Cell Lymphomas (TCL); however, disease relapses remain the major cause of treatment failure. Advancements in conditioning regimens, including total marrow and lymphoid irradiation (TMLI) aim to minimize off target toxicity while reducing disease burden prior to HCT. The addition of total skin radiation such as total skin electron therapy (TSET) controls skin disease in a subset of TCL: i.e. cutaneous TCL (CTCL). In this study, we describe the safety, feasibility and efficacy of TMLI and total skin radiation prior to HCT in patients with TCL.

Materials/Methods: We retrospectively analyzed TCL patients who were treated with radiation prior to HCT at City of Hope between February 2012 and September 2024. The primary endpoint was overall survival (OS), and secondary endpoint was local control. Adverse events were assessed using CTCAE v5.0 criteria.

Results: 21 patients (median age 56 [range 24-77] years) with TCL (PTCL, peripheral T cell lymphoma, n=14; CTCL, n=7) were treated with radiation (median 12 Gy [range 2-20Gy]) prior to HCT. Patients received focal radiation (median 12 Gy; n=2), TBI (median 2 Gy; n=2), TMLI (median 12 Gy; n=11), TSET (median 12 Gy; n=2), or a combination of TMLI and total skin radiation (median 12 Gy each, n=4). All transplants were matched donors. Graft-versus-host disease (GVHD) prophylaxis was tacrolimus and sirolimus (n=8) or tacrolimus, mycophenolate mofetil, and post-transplant cyclophosphamide (n=13). Median follow up was 20 months (range 1.3-83.7). All patients engrafted. Median OS was 7 years (95% CI, 3.1 years – not reached [NR]) for all patients. All patients treated with TMLI, and total skin radiation (n=4) remain alive (median follow up 2.4 years [range 0.4-4.8]), while 73% (8/11) of patients treated with TMLI alone are still alive (median follow up 1.6 years [range 0.02-7.0]). Six patients (2 CTCL, 4 PTCL) passed away at a median of 8.5 months (range 1.5-90.8) post-transplant from disease progression (n=5) and lung infection (n=1). No grade 3 radiation-related adverse events occurred. 8 patients had post-transplant infections. 10 patients had mild acute or chronic GVHD. Of the CTCL patients, 4/7 had TMLI & total skin irradiation. All 4 remain alive. 3 of those 4 relapsed (in the skin) and remain alive with salvage systemic treatment and focal skin radiation. 2/7 had TSET alone; 1 relapsed in the skin and remains alive with salvage therapy and 1 died from disease in the bone marrow. 1/7 received focal RT alone and died from disease progression.

Conclusion: TMLI is well tolerated with an acceptable toxicity profile for high-risk TCL patients. The addition of low dose total skin radiation to myeloablative TMLI resulted in no additional toxicity and shows promise for disease control in CTCL patients. The optimal TSET dose for CTCL transplant patients warrants further investigation.

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Detection of Anomalous Patterns in Cancer Patient Undergoing Radiotherapy Using Wearable Sensors: A Proof of Principle Machine Learning Analysis

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Purpose/Objective(s): Radiation Therapy (RT) may cause side effects, many of which are subjectively reported by patients. Previous studies showed the possibility to relate subjective symptoms such as fatigue, with data acquired by wearable sensors such as fitness activity trackers (FT) in a breast cancer patients group. Heart Rate (HR) and Activity Level (AL) emerged as good factors to measure fatigue in an objective fashion. On such a basis, our hypothesis is creating a synergy between a machine learning (ML) approach on the data collected via FT and the related Patient Reported Outcome (PRO), it is possible to better define the patient global status of performance during RT. To this intent, the intra-patient HR and AL patterns were analyzed with ML approach, to label them as "regular" or "anomalous."

Materials/Methods: In this study, a dataset comprising HR and AL data from 20 cancer patients undergoing RT was utilized. Patients were monitored using commercially available FTs to collect the mentioned data, which was sampled at 10-minute intervals over a 50-day period to account for individual daily rhythms. The study applied a data-driven approach to detect deviations from average activity patterns that may indicate physiological distress, e.g., elevated HR while AL is low. The implementation of the Change Point Detection (CPD) algorithm made it possible to identify activity windows for each patient and their subsequent categorization into three (i.e., relax, light-activity, and heavy-activity). Subsequently, unsupervised ML models, founded upon Anomaly Detection Algorithms (ADAs) such as Isolation Forest and One-Class SVM, were deployed to identify patient-specific situations. The integration of these data with statistics derived from the sensors' data allowed to label activity windows within each group as either "regular" or "anomalous."

Results: Data from one prostate cancer patient was analyzed at first. The ADAs identified "anomalous" patterns on 40% of the samples collected during the monitoring period, 24% of which exhibited a clear mismatch between HR and AL. CPD detected 231 activity windows (80 relax, 144 light-activity, and 7 heavy-activity) within the entire observation period. Subsequent analysis of the activity windows within the selected group revealed that 4% of windows could be labeled as "anomalous" (7 relaxing, 3 light-activity and 0 heavy-activity). Confirmation of labeling validity was obtained via patient-reported questionnaires administered during the monitoring period.

Conclusion: Study's first results suggest that analyzing wearable sensor data via ML techniques enhances interpretability of the data collected during patient monitoring throughout RT. This allows for more straightforward comprehension of the underlying patterns exhibited by the collected data. Subsequent research activities will center not only on patients' behavioral analysis, but also on setting a predictive model along with the validation of their clinical applicability across all the population.

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Synthetic Contrast-Enhanced CT Generation Based on Generative Adversarial Networks for Lymph Node Delineation in Nasopharyngeal Carcinoma

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Purpose/Objective(s): Compared with non-enhanced CT (NECT), contrast-enhanced CT (CECT) can more accurately delineate the lymph nodes gross tumor volume (GTVnd) of nasopharyngeal carcinoma (NPC) due to the obvious contrast enhancement of blood vessels. However, contrast agents carry risks of allergic reactions in susceptible patients and additional radiation dose, and only NECT scans are typically performed in adaptive radiotherapy (ART) which pose challenges to the efficiency and accuracy of delineation. This study investigated the feasibility of synthetic contrast-enhanced CT (sCECT) from NECT using generative adversarial networks