

References

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Stress echocardiography and myocardial contrast echocardiography in viability assessment

See page 771 for the article to which this Editorial refers

The strongest predictor of prognosis in patients with ischaemic heart disease is left ventricular dysfunction which is caused by post-infarction scar or fibrosis as well as by asynergic but still viable myocardium. In the latter case left ventricular dysfunction can be reversible and can improve either spontaneously (stunning) or after coronary revascularization (hibernation). Thus, assessment of myocardial viability becomes an essential step in clinical decision making related to coronary revascularization procedures.

Diagnostic methods capable of predicting myocardial viability have been based on the detection of either metabolic activity or contractile reserve within dysfunctional segments. Myocardial perfusion and preserved metabolic activity are evaluated in the clinical setting by deoxyglucose or 201-thallium scintigraphy. Contractile reserve (usually elicited by dobutamine infusion) is currently detected by echocardiography and, more recently, by MRI or blood pool scintigraphy. Over the past ten years, myocardial contrast echocardiography has been extensively evaluated in experimental and clinical studies and has been proposed as a method to assess myocardial perfusion and, recently, viability. Myocardial opacification, produced by the presence of microbubbles in the coronary microcirculation, has been considered synonymous with preserved microvascular integrity.

Potentially, contractile reserve (by dobutamine echocardiography) and microvascular integrity (by contrast echocardiography) provide

different information regarding functional recovery after coronary revascularization. The inotropic stimulus focuses on the final effect (the recovery of dysfunctional segments), while contrast echocardiography refers to a prerequisite for myocardial viability (microvascular integrity)^[1,2].

Dobutamine echocardiography and myocardial contrast echocardiography also have different intrinsic limitations. In fact, haemodynamic changes induced systemically by dobutamine infusion may potentially alter wall motion and left ventricular function in a way which is independent of viability, thus providing false-positive results. Alternatively, some coronary stenoses may be so severe that the short period of increased contractility, which takes place as expression of viability, may be missed because of the rapid onset of ischaemic asynergy induced by dobutamine, thus generating false-negative results. On the other hand, myocardial opacification might be seen even in islands of viable myocytes surrounded by predominantly fibrotic areas. This phenomenon has been described with 201-thallium imaging and may render perfusion imaging 'too sensitive' to detect viability in segments which are, on the contrary, incapable of functional recovery.

A previous study by De Filippi *et al.*^[3] compared dobutamine stress echocardiography with myocardial contrast echo in predicting the recovery of regional left ventricular function after coronary revascularization in patients with chronic ischaemic heart disease. When dealing with hypokinetic segments, the two techniques were not significantly different in predicting functional recovery. However, when dealing with akinetic segments, dobutamine

echo and contrast echo showed similar sensitivities (89% vs 94%) but dobutamine echo had a higher specificity than contrast echocardiography (92% vs 67%). These results are consistent with the study by Arnese *et al.*^[4], who compared dobutamine echocardiography with thallium scintigraphy in predicting the recovery of left ventricular function after coronary revascularization in patients with left ventricular ejection fraction less than 40%. Also in the same study, dobutamine echocardiography had a higher positive predictive value than 201-thallium scintigraphy (85% vs 33%). These data are also consistent with a recent study by Bolognese *et al.*^[5] who evaluated myocardial viability by dobutamine echo and contrast echo in patients with acute myocardial infarction treated by primary PTCA. Again, although the sensitivity of the two techniques were quite similar (89% vs 96%), dobutamine echocardiography showed a greater specificity than contrast echocardiography (91% vs 18%) in predicting functional recovery.

In the present paper by Agati *et al.*^[6] dobutamine echocardiography was compared with myocardial contrast echocardiography in predicting the recovery of regional left ventricular function in patients with recent myocardial infarction. Although microvascular perfusion did not always imply functional recovery after coronary revascularization, the specificity and positive predictive value of contrast echocardiography (90% and 81%) were higher than those of dobutamine echo (88% and 76%). The superiority of contrast echocardiography in this study, compared to previous results, certainly warrants further investigation. However, the difference between all these results might be explained partly by the different time intervals between myocardial infarction and testing procedures adopted in the various studies.

The enthusiasm generated by recent studies, which show that perfusion by contrast echo can predict recovery of left ventricular function after coronary revascularization, is counterbalanced by the fact that the contrast agents used in these studies had to be delivered via intracoronary injection. Currently, more than ten contrast agents are under intense investigation and appear to be able to image the perfused myocardium after intravenous injection. If

we consider the 'good morning' as a clue for the 'good day', we might be close to contrast agents that can be used at the bedside or in the echo laboratory, where the information by contractile reserve (by dobutamine or even by dipyridamole echo) could be complemented by perfusion imaging, as suggested by Agati's paper.

Finally, if the repeatability of echo contrast injections — in different clinical settings and circumstances — is also taken into account, then it is easy to predict that new contrast agents will contribute to fill the gap between cardiac anatomy and function, i.e. perfusion imaging, an unsolved issue for modern echocardiography.

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