Myocardial perfusion scintigraphy: an important step between clinical assessment and coronary angiography in patients with stable chest pain

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Online publish-ahead-of-print 2 November 2005

This editorial refers to 'Potential impact of myocardial perfusion scintigraphy as gatekeeper for invasive examination and treatment in patients with stable angina pectoris: observational study without post-test referral bias'† by P.F. Høilund-Carlsen et al., on page 29

Myocardial perfusion scintigraphy (MPS) is an effective and cost-effective technique in patients presenting with stable chest pain. It provides a reliable assessment of coronary obstruction leading to inducible perfusion abnormalities and of the prognosis of disease. It can therefore be used both for diagnosis and for triage of patients between initial medical therapy and invasive investigation with a view to revascularization. It is recommended as the first-line diagnostic procedure when exercise electrocardiography is difficult or inconclusive, such as when the resting ECG is abnormal, when maximal dynamic exercise is unlikely to be achieved, and in women.† Although comparison between a test of coronary function and coronary anatomy is fraught with difficulties, the sensitivity of MPS for detecting angiographic stenosis is 85–90% and the normal MPS rate in a low likelihood population (normalcy) is 90–95%, depending upon the population studied.‡ As with any diagnostic test, MPS is most useful in patients with an intermediate (25–75%) likelihood of underlying coronary disease, but its prognostic value also makes it helpful in patients with a high likelihood. It is diagnostically least useful in patients with a low likelihood of disease in whom performing any diagnostic test can be questioned, although a normal scan reliably indicates a risk of myocardial infarction or cardiac death below 1% per year for up to 5 or even 10 years depending upon risk factors.

Coronary angiography has historically been used as the gold standard for the diagnosis of coronary disease although as an anatomical test it does not necessarily establish the relationship between coronary disease and presenting symptoms, and advanced coronary atheroma can be present despite a normal coronary lumen. Given the reliability of the current non-invasive functional tests such as MPS and stress echocardiography, the diagnostic role of invasive angiography is significantly reduced, although widespread availability and expertise mean that it is still commonly used, especially when functional imaging is not available. This is however not always an optimal strategy of investigation either for the patient or for the healthcare system that supports the cost of diagnosis and management. When the likelihood of requiring revascularization either to relieve symptoms or to improve prognosis is high then the strategy of direct coronary angiography is highly effective. Unfortunately, many factors such as availability, expertise, and remuneration often lead to intermediate or lower likelihood patients also undergoing angiography without a prior functional test. This approach is both clinically inefficient and expensive. A large body of evidence has demonstrated that MPS can be used as a gatekeeper for coronary angiography, meaning that angiography need only be performed in patients with intractable symptoms or a high-risk perfusion scan.³,4 Furthermore, several studies have shown that initial MPS followed by selective coronary angiography is highly cost-effective when compared with direct angiography.⁵,6

Høilund-Carlsen et al.⁷ demonstrate in a unique study design which is free of post-test referral bias that MPS can be an effective gatekeeper for angiography, and can reduce the number of unnecessary coronary angiograms, and possibly even interventions. Participants presenting for the diagnosis of stable chest pain were recruited at the only medical institution serving a Danish island with a population that is representative of many of our own patients. All patients referred for coronary catheterization were considered, and the decision on whether or not to perform coronary angiography was mainly based on the clinical estimate of likelihood of coronary disease. Five hundred and seven such patients underwent MPS using standard techniques and the results were not made available to the referring physician. Of these, 476 patients underwent coronary angiography. Most patients with angiographically significant coronary stenosis had abnormal perfusion on MPS and were revascularized accordingly. The rest had a normal scan, and approximately 63% (27/43) of them were revascularized either percutaneously or surgically. Most of these "false-negative" scans were observed in patients with typical

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The opinions expressed in this article are not necessarily those of the Editors of the European Heart Journal or of the European Society of Cardiology.

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† doi:10.1093/eurheartj/ehi503

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angina and so this observation is in agreement with the Bayesian model, which states that in patients at high-risk of disease, currently available tests add little incremental diagnostic value to clinical assessment and unexpected findings are more likely to represent false than true results. This emphasizes the importance of requesting and interpreting diagnostic tests in the context of individual clinical characteristics.

Approximately, 40% of patients had normal myocardial perfusion and either normal coronary arteries or angiographically insignificant stenosis (<50% luminal diameter reduction). Thus, had coronary angiography been performed only in patients with abnormal MPS, almost half of angiograms could have been avoided. Previous studies have already shown the high proportion of normal angiograms among patients referred directly to catheterization. This is particularly relevant in women, where the lower prevalence of disease and the complex relationship between coronary atherosclerosis and symptoms leads to a large proportion, up to half in some series, of coronary angiograms being normal.

Another interesting aspect of the study is the assumption that coronary revascularization could have been prevented in some cases on the basis of MPS findings alone. The authors estimated the number of coronary interventions that could have been avoided had the decision to intervene been based on MPS, given that the coronary event rate in patients with a normal scan is as low as in the general population. Although this may be valid for patients with single-vessel disease, concern may arise in the 10% of patients with a normal scan that had significant multivessel disease. Without follow-up data it is difficult to estimate the potential benefit of MPS-guided management in these patients and it is also difficult to determine whether intervention was justified on clinical or prognostic grounds. Although the low event rate in patients with MPS is well-documented the recent study of Hachamovitch et al. showed that this period of warranty may be short-lived in some patients, including diabetic women, patients unable to exercise, and the elderly, presumably because of rapidly progressive disease. A controlled, randomized study looking at the relation between MPS findings and the effect of different therapeutic strategies on symptomatic improvement and clinical outcome would clarify this point.

An important issue alongside the diagnostic value of MPS is its cost-effectiveness. This was beyond the scope of the Danish study but some of its data deserve further discussion. According to the authors, coronary angiography could have been avoided in nearly half of their subjects, but 13% of subjects would have undergone unnecessary coronary angiography had MPS been performed. It seems that although normal angiography cannot be completely avoided, MPS reduces the numbers significantly. Modelling and observational studies have already shown that in patients presenting with stable chest pain, strategies of investigation involving MPS are more cost-effective than those not using the technique. The EMPIRE study in Europe and its counterpart in the United States, the economics of non-invasive diagnosis (END) study, both demonstrated that the adoption of a non-invasive strategy with selective catheterization was associated with substantial savings (up to 30–40%) when compared with a strategy of direct referral to angiography. Both diagnostic and follow-up management costs were significantly lower in the non-invasive arm when compared with the more aggressive approach with no effect on clinical outcome.

Finally, a limitation of the study was the exclusion of high-risk patients, including diabetics and subjects older than 75 years of age. More flexible recruitment would have provided a population even closer to daily clinical practice. Diabetic patients are more likely to benefit from assessment of myocardial perfusion than non-diabetics. They are likely to present with diffuse disease often involving more than one vessel and thus adequate assessment of the extent and severity of myocardial ischaemia is essential. The elderly are another growing group of patients in whom the risk of complications during catheterization is not negligible, and MPS can be particularly useful. Although the restrictions in recruitment are a limitation to generalization, the excluded groups are even more likely to benefit from MPS and so the study’s conclusions should remain valid.

In conclusion, the study of Høilund-Carlsen et al. has elegantly demonstrated the importance of documenting myocardial ischaemia as a prelude to coronary angiography in patients presenting with stable chest pain. The greatest contribution of the study is its unique design and we should consider this study to confirm the essential role of non-invasive functional assessment in such patients.

Conflict of interest: none declared.

References