1d

How to establish myocardial perfusion imaging in the emergency department

A. Flotats (Barcelona)

Acute coronary syndromes (ACS) are associated with an increased risk of cardiac death and acute myocardial infarction (AMI), especially in patients not hospitalised (twofold risk) [1]. Besides, early detection of ACS is crucial to take advantage of treatment. The inadvertent discharge of patients with ACS may also result in additional and costly emergency department (ED) visits and diagnostic work-ups, and medicolegal adverse consequences for physicians. Accordingly, the majority of patients presenting to the ED with symptoms suggestive of acute cardiac ischaemia are admitted or kept on observation in special units. This strategy results in 55-75 % unnecessary hospitalisations. Even with this overadmission, up to 2.3 % of patients with unstable angina (UA) and 2.1 % of those with AMI are mistakenly released from the ED [1, 2]. Therefore, the triage of patients with suspected ACS in the ED is challenging and faces the difficult task of avoiding inappropriate hospitalisations without any reduction in appropriate admissions.

If one considers the sequence of functional events taking place during myocardial ischaemia (the ischaemic cascade), the alteration of myocardial perfusion precedes the appearance of regional wall motion abnormalities, ECG changes and chest pain. Therefore, myocardial perfusion imaging (MPI) offers potential insight in the identification of acute myocardial ischaemia, especially with the advent of ^{99m}Tc-agents.

^{99m}Tc-agents can be readily available for acute imaging and offer better image quality than ^{201}Tl, with lesser attenuation artefacts, and no significant redistribution once they are taken up by the myocardium. This allows for imaging even several hours after the injection, which facilitates the interrelation between the emergency and nuclear medicine departments and permits the estimation of the extension and severity of myocardial perfusion defects following coronary reperfusion treatment, independently of temporal restraints. This even permits the evaluation of salvaged myocardium when comparing acute rest images with those from a subsequent rest injection after reperfusion.

Resting MPI with ^{99m}Tc-agents in the ED has demonstrated excellent sensitivity (~90 %) and good specificity (~77 %) for acute myocardial ischaemia, and high negative predictive values, either for excluding AMI (>99 %) or future cardiac events during medium-term follow-up (97 %) [3]. Additionally, since the most important predictors of patient outcome in ACS include perfusion defect size, left ventricular ejection fraction and left ventricle volumes, early gated SPECT MPI adds information for initial risk assessment. The accuracy of MPI for detecting ACS is probably related to the timing of injection with respect to the onset of patient's symptoms. Ideally, the tracer would be administered during chest pain, although MPI may remain abnormal for several hours following transient myocardial ischaemia even when normal flow is restored.

Since MPI may show abnormalities both in patients with unstable angina (UA) and AMI, it may detect patients with UA, otherwise overlooked solely by the serum tests. Moreover, although in the setting of AMI >10 g of myocardial tissue must be injured before a perfusion defect can be resolved with MPI, this technique can achieve better sensitivity than the serum tests when both are performed soon after the onset of the event [4]. However, MPI is rarely useful in patients with prior AMI, except in those who had previously undergone a perfusion scintigraphy, which could be compared with the acute resting image of the suspected ACS episode.

Incorporation of MPI in the routine diagnostic algorithm of patients with low-to-moderate risk of ischaemic heart disease and non-diagnostic ECGs influences ED physicians triage decision making, resulting in cost savings (reduce inappropriate hospitalisations) without any reduction in appropriate admissions (maintaining sensitivity), with shorter length of hospital stay and more effective utilisation of invasive diagnosing testing [5].

Physicians reporting MPI for the correct triage of patients with suspected ACS should be aware that interpretation of images needs to be directed to obtain a high sensitivity, sometimes at expenses of

reducing the specificity. Attenuation artefacts may lead to both false positive and negative scan interpretations. Several procedures such as gated SPET acquisition and attenuation correction have been developed to optimise image interpretation and improve diagnostic accuracy.

Due to the high sensitivity and negative predictive value of acute rest MPI it appears reasonable to discharge home low-risk patients relatively quickly and perform an outpatient exercise ECG test, reserving stress MPI for patients unable to exercise. Probably, the cost of rest and outpatient stress MPI combined is inferior to the cost of a stay in a chest pain observation unit. However, the cost savings of the implementation of MPI in ED are in relation with the number of patients attended with symptoms suggestive of ACS.

References

1. Pope JH, Aufderheide TP, Ruzhazer R, et al. Missed diagnosis of acute cardiac ischemia in the emergency department. N Engl J Med 2000; 342: 1163-70.
2. Selker HP, Beshansky JR, Griffith JL, et al. Use of the acute cardiac ischemia time-insensitive predictive instrument (ACI-TIPI) to assist with triage of patients with chest pain or other symptoms suggestive of acute cardiac ischemia: a multicenter, controlled clinical trial. Ann Intern Med 1998; 129: 845-55.
3. Ioannidis JPA, Salem D, Chew PW, Lau J. Accuracy of imaging technologies in the diagnosis of acute cardiac ischemia in the emergency department: a meta-analysis. Ann Emerg Med 2001; 37: 471-77.
4. Wackers FJTh, Brown KA, Heller GV, et al. American Society of Nuclear Cardiology position statement on radionuclide imaging in patients with suspected acute ischemic syndromes in the emergency department or chest pain center. J Nucl Cardiol 2002; 9: 246-50.

   Udelson JE, Beshansky JR, Ballin DS, et al. Myocardial perfusion imaging for evaluation and triage of patients with suspected acute cardiac ischemia. A randomized controlled trial. JAMA 2002; 288: 2693-2700.