Specific of Myocardial Perfusion Scintigraphy Compared to Invasive Coronary Angiography

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Abstract: *Purpose:* The NICE guidance has placed non-invasive ischaemia testing as the primary role for assessing patients with moderate pre test probability for obstructive coronary artery disease. Functional tests like MPI, have led to a reduced role for invasive coronary angiography (ICA) in initial patient assessment. Aim of our audit was to assess the specificity of our nuclear service compared with ICA retrospectively. The standard was set at a false positive rate of no more than 73%.

Methods: A search was conducted (between Aug2012-Feb2013). MPIs were reported by a radiologist and a cardiologist. A standard 17-segment model was used for MPI interpretation. Coronary angiograms were interpreted for the absence/presence of epicardial luminal narrowing >50% by referencing the clinical report on the patient electronic record. The cases which were positive enough to warrant recommendation for ICA the true positive and false positive rate was determined.

Results: This cross –sectional study included 51 cases.33 had a stenosis in a major coronary artery of>50% giving a true positive rate of 65%. There were18 false positive studies (35%). 5 cases were regarded as having evidence of transient ischaemic dilatation (TID), all of which had a subsequent negative angiogram.3 studies had notable artefact due to patient body habitus, or inability to position the patient optimally. The percentage of myocardium defects was determined for each case at stress. The average percentage in the true positive studies was 17%, in the false positive studies it was7%, excluding those regarding as having TID.

Conclusions: MPI studies deemed sufficiently abnormal to justify a coronary angiogram have a moderate likelihood of predicting a significant stenosis being present on ICA. False positive scans are frequent when only TID and significant artefacts are present. It is likely that CT calcium scoring with MPI will increase the specifity of this imaging. It will also allow CT coronary angiography to be used in cases where artefact is present and the calcified atheroma burden is low.

The audit standard was not met. Suggested changes in practice. 1. Greater caution in recommending ICA for cases where the only evidence for ischaemia is transient ischaemic cardiomyopathy. 2. Increased use of CT to determine cases where significant reversible ischaemia is present in the context of none or low burden of coronary calcification.

Clinical Relevance/Application: MPI assesses myocardial perfusion by using radiotracers injected under stress/rest conditions.

INTRODUCTION

Radionuclide myocardial perfusion imaging (MPI) assesses myocardialperfusion by using intravenous radiotracers injected under stress conditions and if required at rest. Myocardial perfusion defects seen at stress are determined as fixed or reversible depending on whether they are also present on rest images. Technetiumlabelled synthetic compounds, sestamibi and tetrofosminare used as they yield high quality images [1, 2]. Stress is induced using either exercise or by increase coronary blood flow through vasodilatation by pharmacologicological means (adenosine or regadenoson)

Although CT coronary angiography is becoming more established, invasive coronary angiography remains the gold standard for diagnosing obstructive

coronary artery disease Exercise MPI and pharmacological MPI have been shown to have high sensitivity but lower specificity for obstructive coronary artery disease diagnosis determined by invasive coronary angiography [3]. A noninvasive alternative to stress MPI could be stress first-pass contrast enhanced MRI [10]. When MPI and (graded exercise ECG tests) GTX used together, if both test are positive there is a high likelihood that a significant coronary artery obstructive disease is present and if both are negative the disease is absent [9].

The recent NICE guidance has placed non- invasive ischemia testing as the primary role for assessing patients with moderate pretest probability for obstructive coronary artery disease. As a result these functional tests like MPI, stress perfusion MRI and stress echocardiography have led to a reduced role for invasive diagnostic coronary angiography in initial patient assessment [4]. The aim of our audit was to assess the specificity of our nuclear service compared with the invasive coronary angiographyretrospectively.

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The standard was set at a false positive rate of no more than 73% [11].

METHODS

It is standard practice for the two individuals who report MPI studies to use the term "invasive" in a phase to indicate that the study is positive and justifies invasive coronary angiography. Using this a search for the word "invasive" was conducted of the radiology information system for the period August 2010 to February 2010. It was accepted that this would not necessarily capture all positive studies but would gather a cohort of positive MPIs in order to determine true and false positive rate.

For MPI: Studies were performed with technetium tetrofosmin initially on a standard gamma camera. Later studies were performed on a T16 combined gamma camera and CT machine which produced CT calcium score studies. Stress was induced with exercise if possible to achieve 85% of the maximum predicted heart rate for age. If this was not possible pharmocoloigcal stress was induced with adenosine or regadenoson following previously published guidance [1].

MPIs were reported by a radiologist and a cardiologist with greater than 6 and 12 years experience respectively. A standard 17-segment model used for MPI interpretation with number of segments involved and where applicable the percentage of myocardium affected. Coronary angiograms were interpreted for the absence or presence of epicardial occlusion>50% my referencing the clinical report on the patient electronic record.

Of the cases which were positive enough to warrant recommendation for invasive angiography the true positive and false positive rate was determined.

RESULTS

100 studies where identified with the search. 31 cases were excluded as either they were known or it was subsequently discovered they has coronary artery disease on angiography, or had had stenting or bypass grafting in the past. 4 cases were excluded due to incomplete data or that the angiogram was not performed within 6 months of the MPI. In 14 studies abnormalities were seen that were either regarded as equivocal, mild or fixed and no invasive angiogram was advised. This left a cohort of 51 cases of studies that were sufficiently positive to result in a recommendation for coronary invasive angiography.

Of the 51 cases, 33 had a stenosis in a major coronary artery of >50% giving a true positive rate of 65%. There were 18 false positive studies (35%). 5 cases were regarded as having evidence of transient ischaemic dilatation, all of which had a subsequent negative angiogram. 3 studies had notable artefact due to patient body habitus, or inability to position the patient optimally.

The percentage of myocardium defects was determined for each case at stress. The average percentage in the true positive studies was 17%, in the false positive studies it was 7%, excluding those regarding as having transient ischaemic dilatation.

CONCLUSIONS

MPI studies deemed sufficiently abnormal to justify a coronary angiogram have a moderate likelihood of predicting a significant stenosis being present on invasive coronary angiography. False positive scans are frequent when only transient ischaemic dilatation and significant artefacts are present. A single center study showed in symptomatic patients CT coronary angiography could detect the obstructive coronary vessels probably more accurate than MPI [8]. So it is likely that the introduction of CT calcium scoring with myocardial perfusion scanning will increase the specifity of this imaging. It will also allow CT coronary angiography to be sued in cases where artefact is present and the calcified atheroma burden is low.

The standard was unmet.

Suggested Changes in Practice:

1. Greater caution in recommending invasive angiography for cases where the only evidence for ischaemia is transient ischaemic cardiomyopathy.

2. Increased use of CT to determine cases where significant reversible ischaemia is present in the context of none or low burden of coronary calcification.

Planned for re audit in 5 years time.

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