Accuracy of Fully Quantitative CMR Myocardial Perfusion in Detection of Coronary Disease as Measured by Quantitative Coronary Angiography

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Abstract:

Background:

Qualitative assessment of perfusion MRI introduces subjective factors that could be minimized by objective or quantitative measures.

Purpose: to determine the sensitivity, specificity, and accuracy of a fully quantitative stress perfusion method versus quantitative coronary angiography (QCA).

Methods:

Patients (n=67) with known or suspected coronary artery disease underwent dipyridamole stress dual bolus first pass perfusion imaging. Endocardial perfusion was quantified using Fermi function deconvolution (ml/min/g, 12 radial sectors/slice). Qualitative analysis was performed with our standard clinical protocol which utilizes cine, delayed enhancement (DE), and perfusion imaging. A second qualitative analysis was performed using the Duke University algorithm which utilizes DE and perfusion imaging. QCA was performed by a cardiologist blinded to the MRI results.

Results:

Patients averaged 60+/-11 years and 45 were men (67%). Thirty six patients (54%) had coronary stenoses >60% in diameter: 5 had 3-vessel disease (VD), 6 had 2-VD, and 25 had 1-VD. Standard qualitative clinical interpretation yielded a sensitivity of 81% and specificity of 84%. The qualitative Duke algorithm had a sensitivity of 89% but a specificity of only 71%. Quantitative analysis yielded a sensitivity and specificity of 81% and 81%. The accuracy of all three methods ranged from 81-82%.

Receiver operator curve analysis found that the optimal threshold for abnormal perfusion was a 20% or greater flow reduction. This agreed well with coefficient of variation analysis in subjects with no significant stenosis. In normal segments, myocardial blood flow averaged 2.70 +/- 0.76 ml/min/g while true positive perfusion defects averaged 1.51 +/- 0.65 ml/min/g (p<0.001). Intrasubject perfusion was best distinguished by the ratio of ischemic to normal (remote) flow which averaged 0.57 +/- 0.17.

Conclusions:

Quantitative stress perfusion imaging independently has the same diagnostic accuracy as qualitative methods that incorporate cine, rest perfusion, and delayed enhancement imaging.