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Meeting abstract

2012 Non-invasive assessment of coronary artery disease: a comparison of adenosine stress, studied with contrast echocardiography and 3 Tesla cardiovascular magnetic resonance

Jayanth R Arnold*[1], Theodoros D Karamitsos[1], Jane M Francis[1], Tammy J Pegg[1], Nick Searle[2], Stefan Neubauer[1], Harald Becher[3] and Joseph B Selvanayagam[1]

Address: [1]OCMR, University of Oxford, Oxford, UK, [2]Department of Cardiology, John Radcliffe Hospital, Oxford, UK and [3]University Department of Cardiovascular Medicine, John Radcliffe Hospital, Oxford, UK

* Corresponding author

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Introduction

Several modalities are available for the non-invasive assessment of cardiac disease, but MRI and Echocardiography benefit from the absence of ionizing radiation. Myocardial stress perfusion imaging with cardiovascular magnetic resonance (CMR) is now well established in the assessment of coronary artery disease (CAD). It has been demonstrated that a multiparametric approach combining perfusion and infarction imaging further augments the diagnostic performance of CMR [1]. Recent studies indicate that 3 Tesla is the preferred field strength, with increased signal-to-noise and contrast-to-noise ratios compared with 1.5 Tesla [2]. Despite the widespread use of dobutamine stress echocardiography in clinical practice, adenosine stress echocardiography is not routinely used owing to reduced accuracy when wall motion assessment alone is used to evaluate ischaemia. However, the recent advent of second-generation contrast agents now enables a multiparametric approach for echocardiography, involving simultaneous myocardial perfusion and wall motion analysis. We sought to compare two optimized diagnostic strategies in patients with suspected CAD: 1) a combined perfusion and infarct imaging algorithm by CMR at 3 Tesla and 2) combined perfusion and wall motion analysis by adenosine stress echocardiography (SE).

Methods

Subjects scheduled for elective diagnostic angiography for investigation of exertional chest pain were studied prior to angiography with both SE and CMR. For CMR, patients were studied with first-pass perfusion at 3 Tesla (Trio, Siemens Medical Solutions), at stress (140 mcg/kg/min intravenous adenosine) and at rest. Four short-axis images were acquired every heartbeat using a saturation recovery fast gradient echo sequence and 0.05 mmol/kg contrast agent (Gadodiamide, Omniscan™, GE Healthcare) bolus injection. Perfusion images were acquired every cardiac cycle during the first pass of contrast, using a T_1-weighted fast gradient echo sequence (echo time 1.04 ms, repetition time 2 ms, voxel size 2.1 × 2.6 × 8 mm^3). After rest perfusion, following a further bolus of Gadodiamide (0.045 mmol/kg), delayed enhancement CMR was performed with a T1-weighted segmented inversion-recovery turbo fast low-angle shot (FLASH) sequence (echo time 4.8 ms, voxel size 1.4 × 2.4 × 8 mm, flip angle 20°). For the SE study, 2-, 3- and 4-chamber long-axis images were acquired during short breath holds at stress (140 mcg/kg/min intravenous adenosine) and at rest, with continuous intravenous infusion of Sonovue (Bracco Diagnostics Inc, Italy). CMR and SE images were interpreted visually by two observers blinded to clinical and angiographic data. Quantitative coronary angiography, performed by a third

operator blinded to CMR and SE results, served as the reference standard. Significant CAD was defined angiographically as the presence of ≥ 1 stenosis of ≥ 50% diameter in any of the main epicardial coronary arteries or their branches with a diameter of ≥ 2 mm.

Results

Thirty-two subjects were prospectively recruited. One individual did not complete the CMR examination owing to claustrophobia, so 31 subjects were included in the final analysis. The prevalence of CAD was 71%. All CMR and SE images were visually interpretable. Compared to SE, CMR provided higher diagnostic accuracy (94% vs. 81%) and sensitivity (96% vs. 78%), but similar specificity (82% vs. 82%) for detection of significant CAD. CMR also identified disease location with greater sensitivity (LAD 88% vs. 76%, LCx 75% vs. 63%, RCA 100% vs. 62%) but similar specificity (LAD 93% vs. 86%, LCx 96% vs. 100%, RCA 89% vs. 100%). However, there was no significant difference in the overall detection of CAD (area under ROC curve: 0.83 ± 0.08 SE vs. 0.92 ± 0.05 CMR; p = 0.32, Figure 1).

Conclusion

Whereas the specificity of both techniques is comparable, CMR perfusion imaging provides higher sensitivity by virtue of its high spatial resolution.

References

1. Klem I, *et al.*: *J Am Coll Cardiol* 2006, **47:**1630-8.
2. Cheng ASH, *et al.*: *J Am Coll Cardiol* 2007, **49:**2440-9.

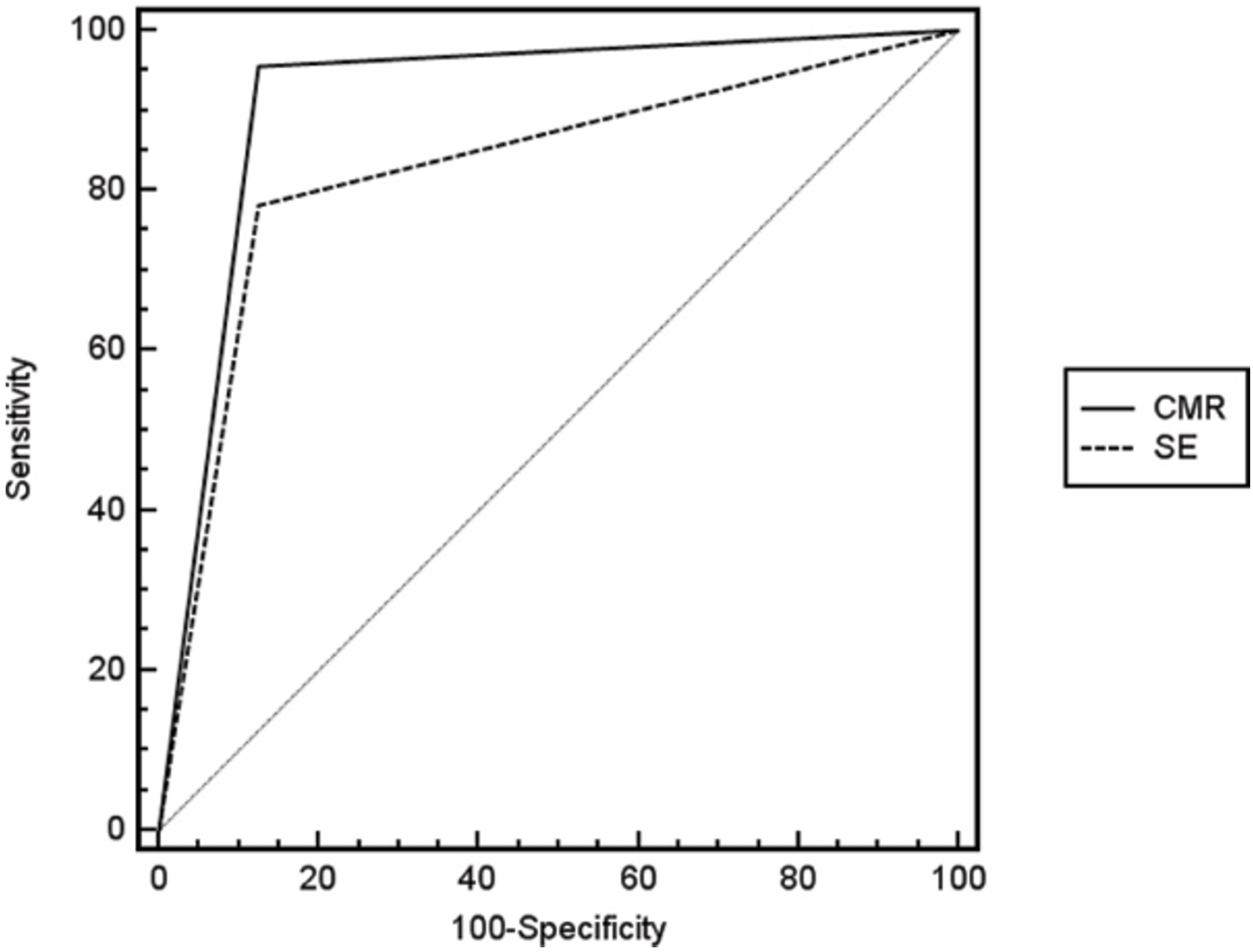

Figure 1
ROC curves for CMR and SE for the overall detection of CAD.