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Detection and prognostication of reversible perfusion abnormalities and scar in patients with suspected coronary ischemia: Results from a pilot study comparing stress cardiac magnetic resonance and positron emission tomography

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Introduction

Both cardiac positron emission tomography (PET) and cardiac magnetic resonance (CMR) imaging allow assessment of myocardial perfusion and scar in patients with suspected or previously diagnosed ischemic heart disease. There are no clinical studies that have directly compared these two modalities.

Purpose

In this prospective study, we sought to assess the concordance of CMR and PET in detecting the burden of myocardial ischemia and scar. We also assessed the prognostic association of both modalities with cardiac death or acute myocardial infarction (AMI).

Methods

Consecutive patients who underwent stress PET Rubidium perfusion were prospectively enrolled to undergo stress CMR for assessment of ischemia and infarction. Sum rest and sum stress scores were qualitatively graded using a 16-segment model in both PET and CMR. CMR protocol consisted of cine steady-state free precession imaging for left ventricular function, rest and adenosine-stress first pass perfusion at 0.075 mmol/kg, and late gadolinium enhancement (LGE) imaging for myocardial scar.

Results

Ninety patients were enrolled and underwent CMR within 60 days of the PET. Mean age was 61 years and 60% were male. Thirty-one had a significant reversible perfusion defect(ReVPD)seen on stress CMR. Concordance rate for presence of ReVPD was 71% (see Table 1). For the 26 patients with discordant findings for perfusion, 23 (88%) patients were noted to have a RevPD by CMR. Concordance rate for the presence of myocardial scar was 71% (Table 2). In the 26 patients with discordant findings for scar, 24 (92%) patients were noted to have subendocardial scar by CMR. At a medium follow-up of 3.0 years (IQR 2.2 years), RevPD by both PET and CMR were associated with all major adverse events (PET: HR 2.7, $P = 0.05$; CMR: HR 6.9, $P < 0.001$). With absence of RevPD and absence of scar, PET and CMR were associated with a negative hard-event (cardiac death or acute myocardial infarction) rate of 96% and 99%, respectively. Among the 25 patients with abnormal CMR (reversible defect or scar) but normal PET, there were 3 cardiac deaths and 3 AMIs during the follow-up.

Conclusion

In this pilot study we found moderate concordance between CMR and PET. The absence of RevPD and scar on either modality was associated with a good short term prognosis. Patients who had an abnormal CMR but normal PET had an increased incidence of major cardiac events including AMI and death.

Table 1: Detection of reversible perfusion defects on PET and CMR

	Patients with no reversible perfusion defect on stress CMR	Patients with reversible perfusion defect on stress CMR
Patients with no reversible perfusion defect on PET	56	23
Patients with reversible perfusion defect on PET	3	8

Table 2: Detection of myocardial scar by PET and CMR

	Patients with no scar on CMR	Patients with scar on CMR
Patients with no scar on PET	59	24
Patients with Scar on PET	2	4