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The assessment of reperfusion haemorrhage following acute myocardial infarction by T2 and T2* cardiovascular magnetic resonance

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Introduction

Reperfusion of severely ischaemic myocardium can lead to interstitial haemorrhage due to irreversible vascular injury. Haemorrhagic infarction can be detected in vivo by cardiovascular magnetic resonance (CMR) as hypointense signal on T2-weighted and T2* imaging. However, the clinical implications of myocardial haemorrhage following acute myocardial infarction (AMI) remain undetermined.

Purpose

To assess whether the presence of myocardial haemorrhage, as determined by T2-weighted and T2* CMR, influences infarct size, amount of salvaged myocardium and left ventricular ejection fraction (LVEF) following primary percutaneous coronary intervention (PPCI) for AMI.

Methods

44 patients with first presentation acute ST elevation MI, treated successfully with PPCI, underwent CMR imaging within 72 hours of admission. The CMR protocol was identical for all patients and included cine imaging, T2-weighted and dual-echo T2* sequences and late gadolinium enhancement (LGE). CMR images were analysed by two experienced observers. The area at risk (T2-weighted) and infarcted tissue (LGE) were identified using a semi-automated algorithm highlighting myocardium with a signal intensity >2 SD above that of remote normal myocardium. Myocardial haemorrhage and microvascular obstruction (MO), respectively, were identified as regions of hypoenhancement within these areas of hyperenhancement. Myocardial haemorrhage was confirmed by the presence of hypointense signal on T2* imaging.

Results

21 (48%) patients had evidence of MO on LGE. 13 of these 21 patients had myocardial haemorrhage suggested by T2-weighted imaging. 8 of these 13 patients had myocardial haemorrhage confirmed by T2* imaging. Patients with myocardial haemorrhage had greater %LV scar than patients with MO only and patients without MO (mean (SD) 39.5 (11.3) vs 28.9 (13.1) vs 17.2 (8.8), respectively, overall $p < 0.001$). Myocardial haemorrhage was also associated with smaller %LV-salvaged myocardium (2.6 (3.4) vs 7.9 (5.9) vs 14.1 (13.4), respectively, overall $p = 0.025$) and lower %LVEF (35.2 (6.3) vs 43.7 (5.6) vs 47.1 (8.8), respectively, overall $p = 0.002$) (Figure 1).

Conclusion

Reperfused haemorrhagic myocardial infarction can be detected by CMR and is associated with larger infarct size, diminished myocardial salvage and lower LVEF. Larger studies in this area are required in the future to establish the prognostic implications of these findings.

CMR parameter	No MO or Haemorrhage (n=23)	MO only (n=13)	Myocardial Haemorrhage (n=8)	ANOVA p value
%LV scar	17.2 (8.8)	28.9 (13.1)	39.5 (11.3)†	<0.001
%LV-salvaged	14.1 (13.4)	7.9 (5.9)	2.6 (3.4)*	0.025
%LVEF	47.1 (8.8)	43.7 (5.6)	35.2 (6.3)*	0.002

Paired t tests for comparisons between patients with MO only and myocardial haemorrhage, *p<0.05, †p=0.07.

Figure 1
CMR parameters for 44 patients. Data represented as mean (SD).