Background The success of emergency coronary reperfusion therapy in ST-elevation myocardial infarction (STEMI) is commonly limited by failed tissue perfusion.
Purpose To assess the clinical significance of myocardial haemorrhage using cardiac magnetic resonance (CMR) in survivors of acute STEMI and assess the temporal evolution of intramyocardial haemorrhage (IMH) versus microvascular obstruction (MVO) in a serial imaging subset.
Methods 286 reperfused STEMI patients underwent CMR 2-days and 6-months post-MI. IMH was taken to represent a hypointense infarct core with a T2* value <20 ms. 30 STEMI patients underwent serial CMR at 4 time points: 4–12 h, 3-days, 10-days and 6–7 months post reperfusion. Cardiovascular death or heart failure hospitalisation (CVD/HF) was independently assessed during follow-up.
Results 245 STEMI patients had evaluable T2* data and 101 (41%) patients had IMH. 133 (51%) patients had MVO. All of the patients with IMH had MVO. IMH was multivariably associated with adverse remodelling, independent of baseline LVEDV (OR (95% CI): 2.64 (1.07, 6.49); p = 0.035). IMH was also multivariably associated with CVD/HF post-discharge (HR (95% CI): 12.9 (1.6, 100.8); p = 0.015).

In the serial imaging subgroup, IMH occurred in 7(23%), 13(43%), 11(33%), and 4(13%) patients at 4–12 h, 3-days, 10-days and 7-months, respectively. The amount of MVO was greatest 4–12 h post-reperfusion, then fell progressively over time. In contrast, the amount of IMH increased dynamically from 4–12 h with a peak at 3 days. MVO resolved by day 10 in 8 patients (44%), 2 (25%) of whom had IMH. Whereas MVO persisted in 10 patients (56%), all (100%) of whom had IMH.
Conclusion IMH is independently associated with adverse remodelling and ACD/HF post-discharge. T2* imaging differentiates persistent, structural microvascular destruction from functional, potentially reversible MVO. IMH is a biomarker with potential to reflect the efficacy of therapeutic interventions in STEMI patients.

9 SEX DIFFERENCES IN CIRCUMFERENTIAL AND LONGITUDINAL STRAIN ASSESSED USING STRAIN ENCODED CARDIAC MAGNETIC RESONANCE AT 3.0T

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Background Displacement encoding with stimulated echoes (DENSE) encodes myocardial tissue displacement into the phase of the MRI image, thus allowing direct quantification of myocardial displacement at multiple cardiac phases. Strain-encoded CMR with DENSE has high spatial (3.2 mm × 3.2 mm × 8 mm) and temporal resolution (TR= 27.34 ms). We aimed to measure myocardial strain values with DENSE in healthy adults across a broad age range at 3.0 Tesla.
Methods Healthy volunteers with no prior medical history or treatment were enrolled and underwent CMR at 3.0T (Magnetom Verio, Siemens healthcare, Erlangen, Germany). Mid-left ventricular short axis and horizontal long axis DENSE sequences were acquired and analysed using CIM_DENSE2D software (University of Auckland, New Zealand and Siemens Healthcare). Segmental and global myocardial circumferential (Ecc) and longitudinal (Ell) strain were obtained.
Results Ecc and Ell were analysed in 77 volunteers (mean age 45 ± 18 years, 49% male) (Table 1). Mean Ecc strain was greater in women than in men. These sex-differences were mainly related to strain values in the anterior and antero-lateral LV segments. There is no difference for Ell.
Conclusion Left ventricular circumferential contractility differs between men and women, and the differences were regionalised to the antero-lateral myocardial regions where LV displacement is greatest.
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Abstract 9 Table 1 Gender differences in Circumferential and Longitudinal Strain at 3T

	Men	Women	p-value
Ecc (%)*	(n = 38)	(n = 39)	
Mean	18.19 ± 1.5	19.42 ± 2.8	0.020
Anterior	19.03 ± 3.4	21.29 ± 3.7	0.008
Antero-septal	17.13 ± 2.9	18.05 ± 3.7	0.235
Infero-septal	15.43 ± 2.9	16.48 ± 3.7	0.178
Inferior	19.56 ± 3.2	20.57 ± 4.2	0.241
Infero-lateral	21.06 ± 3.1	21.33 ± 4.2	0.760
Antero-lateral	19.56 ± 3.0	21.66 ± 3.9	0.01
Ell (%)*			
Mean	10.53 ± 2.4	11.66 ± 2.6	0.052
Basal-septal	8.79 ± 4.10	10.54 ± 4.6	0.083
Mid-septal	12.20 ± 3.6	11.83 ± 4.4	0.687
Apico-septal	14.53 ± 5.0	16.98 ± 4.2	0.024
Basal-lateral	12.83 ± 4.5	15.29 ± 4.7	0.021
Mid-lateral	12.55 ± 4.1	12.56 ± 4.3	0.992
Apico-lateral	13.55 ± 4.3	13.40 ± 4.4	0.801

*Values expressed as mean ± standard deviation

10 SEX DIFFERENCES IN CIRCUMFERENTIAL AND LONGITUDINAL STRAIN REVEALED BY STRAIN-ENCODED CARDIAC MAGNETIC RESONANCE IN HEALTHY VOLUNTEERS AT 1.5T

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Background Displacement encoding with stimulated echoes (DENSE) encodes myocardial tissue displacement into the phase of the MRI image, thus allowing direct quantification of myocardial displacement at multiple cardiac phases. Strain-encoded CMR with DENSE has high spatial (3.2 × 3.2 × 8 mm) and temporal resolution (32.5 ms phase). We aimed to measure myocardial strain values with DENSE in healthy adults across a broad age range at 1.5 Tesla.
Methods Healthy volunteers with no prior medical history (including cardiovascular health problems or medication) were enrolled and underwent CMR at 1.5T (Magnetom Avanto, Siemens Healthcare, Erlangen, Germany). Mid-left ventricular short axis and horizontal long axis DENSE sequences were

obtained, and analysed using CIM_DENSE2D software (University of Auckland, New Zealand and Siemens Healthcare). Segmental and global myocardial circumferential and longitudinal strain were obtained.

Results LV dimensions and circumferential strain were available for 75 volunteers (mean age 44.12 ± 17.7 years old, 48% male) (Table 1). Longitudinal strain was acquired in a subset of participants (n = 20). Mean global circumferential (Ecc) and longitudinal (Ell) strain were greater in women than in men. These differences were mainly related to strain values in the inferior, infero-lateral and antero-lateral LV segments for the circumferential strain and the apico-lateral segment for the longitudinal strain where LV displacement is greatest.

Conclusion Strain-encoded CMR with DENSE has revealed sex differences in myocardial contractility in healthy adults.

Funding Medical Research Scotland project grant. Professor Berry was supported by a Senior Clinical Fellowship from the Scottish Funding Council.

Abstract 10 Table 1 Gender differences in Circumferential and Longitudinal Strain at 1.5T

	Male	Female	p-value
Ecc* (%)	(n = 36)	(n = 39)	
LVEF	65.44 ± 4.0	67.19 ± 3.6	0.129
LVEDV	168.63 ± 26.6	135.72 ± 22.6	<0.001
LVESV	58.39 ± 12.1	44.66 ± 10.8	<0.001
Global	18.59 ± 2.4	20.00 ± 2.6	0.017
Anterior	20.39 ± 3.6	21.39 ± 4.2	0.272
Antero-septal	18.29 ± 3.9	18.07 ± 3.3	0.791
Infero-septal	15.97 ± 3.8	17.41 ± 3.0	0.074
Inferior	18.40 ± 3.3	20.68 ± 3.6	0.006
Infero-lateral	20.68 ± 2.7	22.37 ± 3.7	0.028
Antero-lateral	20.53 ± 3.4	22.27 ± 3.3	0.027
Ell* (%)	(n = 8)	(n = 12)	
Mean	8.83 ± 3.5	13.56 ± 2.9	0.007
Basal-septal	15.68 ± 5.4	10.47 ± 5.2	0.069
Mid-septal	12.34 ± 2.6	12.44 ± 4.8	0.951
Apico-septal	12.16 ± 5.3	15.99 ± 5.5	0.139
Basal-lateral	12.38 ± 2.9	15.69 ± 4.5	0.062
Mid-lateral	11.29 ± 4.9	15.68 ± 3.8	0.053
Apico-lateral	13.47 ± 2.5	16.24 ± 2.8	0.033

*Values expressed as mean ± standard deviation

11 THE IMPACT OF CARDIAC MAGNETIC RESONANCE VIABILITY ASSESSMENT ON THE MANAGEMENT OF PATIENTS WITH ISCHAEMIC HEART DISEASE AND LEFT VENTRICULAR DYSFUNCTION

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Background Identifying patients with ischaemic left ventricular dysfunction that would benefit from revascularisation is challenging. The aim of this study was to investigate the role of cardiovascular magnetic resonance (CMR) imaging in the decision making process in patients being considered for revascularisation.

Methods All patients referred for CMR viability assessment at a regional centre were identified retrospectively between January 2011 and March 2013. Patient records were reviewed to determine the revascularisation strategy and patient outcomes.

Results 324 consecutive patients were identified, of which 256 were being considered for revascularisation. The remainder were undergoing viability assessment for other reasons. Of the patients being considered for revascularisation, 38 (14%) had preserved left ventricular (LV) systolic function, 33 (17%) mild LV dysfunction, 77 (28%) moderate LV dysfunction and 108 (40%) severe LV dysfunction. Of the patients with severe LV dysfunction 22 subsequently underwent coronary artery bypass grafting (CABG), 30 had percutaneous coronary intervention (PCI) and the remaining 56 patients were managed medically. Patient characteristics and outcomes at the end of the follow-up period (median, 28 months) are detailed in Table 1. Death from any cause occurred in 3 (14%) patients in the CABG group, 4 (13%) in the PCI group and 14 (25%) in the medical-therapy group (p = 0.32). Hospitalisation for cardiac causes occurred in 1 patient (5%) in the CABG group, 1 (3%) in the PCI group and 28 (50%) in the medical-therapy group (p < 0.001). Increased cardiac hospitalisation in the medical therapy group was primarily related to admissions with heart failure (73%).

Conclusions Patients undergoing surgical revascularisation had significantly less adverse remodelling than those managed with PCI or medical therapy. Patients undergoing CABG with viability prior to revascularisation demonstrated good outcomes, similar to those undergoing PCI. The medical therapy group had a significantly higher number of non-viable segments and outcome was poor.

Abstract 11 Table 1 Demographics, CMR characteristics and patient outcomes

	CABG (n = 22)	PCI (n = 30)	Medical therapy (n = 56)	P value
Age (yrs)	67.0 ± 9.4	70.5 ± 8.9	69.5 ± 13.0	0.53
Gender (% m)	73	87	86	0.33
Left Ventricular Ejection fraction	28.3 ± 4.6	27.4 ± 5.3	25.8 ± 6.0	0.16
Left Ventricular End Diastolic Volume indexed (mls/m^2)	128.0 ± 29.9	139.8 ± 30.1	139.7 ± 29.5	0.26
Left Ventricular End Systolic Volume indexed (mls/m^2)	87.3 ± 25.9	101.5 ± 23.6	102.5 ± 25.9	0.049
No. of viable segments	13.1 ± 2.78	12.2 ± 3.0	10.5 ± 3.8	0.005
All cause mortality, no. (%)	3 (13.6)	4 (13.3)	14 (25.0)	0.32
Cardiac hospitalisation, no. (%)	1 (4.5)	1 (3.3)	28 (50.0)	<0.001
Major Adverse Cardiac Events, no. (%)	3 (13.6)	6 (20.0)	16 (28.6)	0.33