

and follow-up. Clinical and electrocardiographic markers of MI severity are predictors of interstitial expansion in the infarct zone in STEMI patients.

6 SEGMENTAL VARIATION IN MYOCARDIAL EXTRACELLULAR VOLUME IN HEALTHY MID-LIFE ADULTS

¹J Carberry*, ^{1,2}D Carrick, ³C Haig, ¹SM Rauhalampi, ¹K Mangion, ¹D Corcoran, ¹A Radjenovic, ^{1,2}C Berry. ¹BHF Glasgow Cardiovascular Research Center, Institute of Cardiovascular and Medical Sciences, University of Glasgow, Glasgow, UK; ²West of Scotland Heart and Lung Center, Golden Jubilee National Hospital, Dumbartonshire, UK; ³Robertson Center for Biostatistics, University of Glasgow, Glasgow, UK

10.1136/heartjnl-2015-307845.6

Background Myocardial extracellular volume (ECV) can be estimated by cardiac magnetic resonance imaging (CMR) using pre- and post-contrast T1 MOLLI maps. The age and sex associations with myocardial ECV in healthy mid-life adults are uncertain.

Methods Healthy adults without any history of cardiovascular disease or treatment underwent contrast-enhanced CMR at 1.5 Tesla (Siemens MAGNETOM Avanto). T1 mapping with MOLLI was performed before and 15 min after contrast (0.15 mmol/kg gadoterate meglumine). ECV was estimated in regions (AHA 16-segment LV model) and for the whole left ventricular (LV) myocardium (all regions). ECV was calculated as the difference in relaxation rate ($R1=1/T1$) for myocardium and LV blood pool before vs. after gadolinium contrast administration, corrected for haematocrit (HCT). LV segments which were not evaluable due to artefact were excluded from analysis.

Results 114 segments were assessed from 19 subjects (mean age 61 ± 12 years; 10 (53%) male). 21 (18%) segments were excluded due to blood pool artefact or signal drop-out in the pre-contrast T1 MOLLI scan. All segments were evaluable in the post-contrast T1 MOLLI scans. The remaining segments for each subject were averaged to give an overall ECV (global LV). The mean ECV for all subjects was $25.6 \pm 2.9\%$. There was no overall segmental variation in ECV. ECV in females was higher than in males ($27.6 \pm 3.1\%$ vs. $23.9 \pm 1.3\%$; $P = 0.003$). The percentage difference was 14.5%. ECV was higher in septal segments in females (anteroseptal: $28.0 \pm 3.3\%$ vs. $24.2 \pm 1.5\%$; $P = 0.004$; inferoseptal: $27.3 \pm 3.8\%$ vs. $23.5 \pm 1.6\%$; $P = 0.011$), whereas no differences were observed for other segments (Table 1).

Abstract 6 Table 1 Sex and segmental variation in ECV. ECV presented as Mean \pm SD

ECV (%) per Segment	All subjects (n = 19)	Male (n = 10)	Female (n = 9)	P
Anteroseptal	26.0 \pm 3.1	24.2 \pm 1.5	28.0 \pm 3.3	0.004
Anterior	24.5 \pm 3.9	22.6 \pm 1.6	26.0 \pm 4.6	0.063
Anterolateral	24.8 \pm 3.2	24.2 \pm 1.8	25.7 \pm 4.5	0.407
Inferolateral	26.0 \pm 3.7	24.6 \pm 1.9	27.6 \pm 4.6	0.112
Inferior	25.5 \pm 4.4	23.6 \pm 2.4	27.4 \pm 5.2	0.087
Inferoseptal	25.3 \pm 3.4	23.5 \pm 1.6	27.3 \pm 3.8	0.011
Average	25.6 \pm 2.9	23.9 \pm 1.3	27.6 \pm 3.1	0.003

Conclusion In this preliminary analysis, myocardial ECV was higher in women than in men, which was attributable to higher ECV in the septum in females. This sex difference merits further study. If these results are confirmed by other studies, then sex-specific reference ranges for ECV would seem appropriate.

7 DIAGNOSTIC ACCURACY OF 12 LEAD ECG Q-WAVES AS A MARKER OF MYOCARDIAL SCAR: VALIDATION WITH CMR

Alexander Carpenter, Amardeep Ghosh Dastidar, Catherine Wilson, Jonathan Rodrigues, Anna Baritussio, Chris Lawton, Alberto Palazzuoli, Nauman Ahmed, Mandie Townsend, Andreas Baumbach, Angus Nightingale, Chiara Bucciarelli-Ducci. NIHR Bristol Cardiovascular Biomedical Research Unit, Bristol Heart Institute, Bristol, UK

10.1136/heartjnl-2015-307845.7

Background Traditionally, the presence of Q-waves on 12 lead ECG is considered a marker of a large and/or transmural myocardial infarction (MI). Late gadolinium enhancement (LGE) cardiovascular magnetic resonance (CMR) accurately identifies the presence and extent of myocardial infarction and has become the gold standard for the assessment of myocardial viability.

Aim To determine the diagnostic accuracy of Q-waves on 12 lead ECG to identify myocardial scarring as compared with CMR.

Methods Data was collected on 631 consecutive patients referred for a stress CMR with suspected ischaemic heart disease (April 2013 to Mar 2014). A 12-lead ECG was recorded. Pathological Q-waves – deflection amplitude of $>25\%$ of the subsequent R wave, or being >0.04 s (40 ms) in width and >2 mm in amplitude in >1 corresponding lead. A comprehensive CMR protocol was used. Transmural infarction was defined as $>50\%$ LGE.

Results 498 patients were included (mean age of 64 ± 12 years, 71% males). 290 patients demonstrated MI of whom 157 were transmural and 133 sub-endocardial based on CMR LGE. 126 had pathological Q-waves on 12 lead ECG. The sensitivity, specificity, positive, negative predictive value and accuracy of 12 lead ECG Q-wave as a marker of transmural MI was 36%, 80%, 45%, 73% with moderate overall diagnostic accuracy (66%). The diagnostic accuracy of Q waves as a predictor of previous MI (composite of sub-endocardial and transmural) was 55% (Table 1).

Conclusion Our study demonstrates that the presence of pathological Q-waves on 12 lead ECG is not only a poor marker of myocardial scarring, but also a poor predictor of viability when compared to CMR. In their clinical decision making process, clinicians needs to be aware of the limitation of ECG Q-waves.

Abstract 7 Table 1 Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of ECG Q-waves vs LGE myocardial infarction scar

	Sensitivity (%)	Specificity (%)	Positive Predictive value (%)	Negative Predictive value (%)	Accuracy (%)
Q waves vs transmural MI	36.3	79.8	45.3	73.1	66.1
Q waves vs any MI	32.8	85.1	75.4	47.6	54.6

8 MYOCARDIAL HAEMORRHAGE AFTER ACUTE REPERFUSED ST-ELEVATION MYOCARDIAL INFARCTION: TEMPORAL EVOLUTION, RELATION TO MICROVASCULAR OBSTRUCTION AND PROGNOSTIC SIGNIFICANCE

¹DJA Carrick, ²C Haig, ¹N Ahmed, ³H Eteiba, ³M McEntegart, ³S Watkins, ³M Lindsay, ¹A Radjenovic, ¹KG Oldroyd, ¹C Berry. ¹Cardiovascular Research Centre of Glasgow, Institute of Cardiovascular and Medical Sciences, Glasgow, UK; ²University of Glasgow, Robertson Centre for Biostatistics, Glasgow, UK; ³Golden Jubilee National Hospital, Cardiology, Glasgow, UK

10.1136/heartjnl-2015-307845.8

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

^{1,2}G Clerfond, ^{1,2}K Mangion, ^{1,2}D Carrick, ¹SM Rauhalammi, ^{1,2}D Corcoran, ¹P Hall Barrientos, ¹C McComb, ¹J McClure, ¹A Radjenovic, ^{1,2}C Berry. ¹BHF Glasgow Cardiovascular Research Centre, University of Glasgow, UK; ²West of Scotland Heart and Lung Centre, Golden Jubilee National Hospital, Clydebank, UK

10.1136/heartjnl-2015-307845.9

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.

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

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

^{1,2}G Clerfond, ^{1,2}K Mangion, ^{1,2}D Carrick, ¹SM Rauhalammi, ^{1,2}D Corcoran, ¹P Hall Barrientos, ¹C McComb, ¹J McClure, ¹A Radjenovic, ^{1,2}C Berry. ¹BHF Glasgow Cardiovascular Research Centre, University of Glasgow, UK; ²West of Scotland Heart and Lung Centre, Golden Jubilee National Hospital, Clydebank, UK

10.1136/heartjnl-2015-307845.10

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