

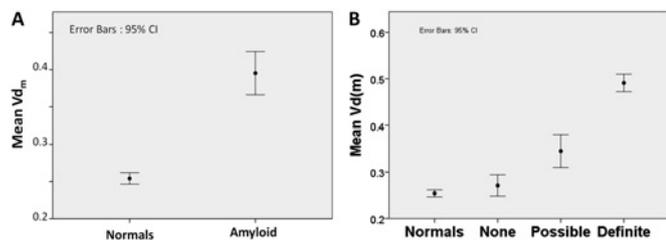
diseases. Further work will build on this study to evaluate the potential role of Vd_m as a clinical biomarker.

093 CARDIAC INVOLVEMENT IN CARDIAC AL AMYLOIDOSIS AS MEASURED BY EQUILIBRIUM CONTRAST CARDIOVASCULAR MAGNETIC RESONANCE

doi:10.1136/heartjnl-2012-301877b.93

¹S M Banyersad,* ¹D Sado, ¹A S Flett, ²S Gibbs, ²J Pinney, ¹V Maestrini, ²A Wechalekar, ²P N Hawkins, ¹J C Moon. ¹The Heart Hospital, London, UK; ²National Amyloidosis Centre, London, UK

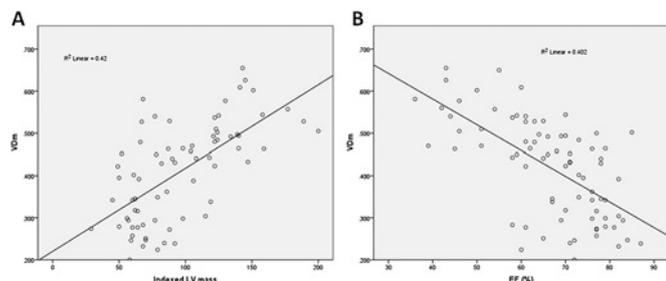
Introduction Cardiac involvement drives prognosis in Systemic AL Amyloidosis, predicting outcome and influencing therapeutic options. Current methods of cardiac assessment do not quantify the myocardial amyloid burden. We used Equilibrium Contrast Cardiovascular Magnetic Resonance (EQ-CMR) to measure the cardiac interstitial compartment, measured as the myocardial contrast volume of distribution, Vd_m , which we hypothesised would reflect the amyloid burden.



Abstract 093 Figure 1

Methods Patients with systemic AL amyloidosis undergoing routine work up at the National Amyloidosis Centre were recruited (n=60, 39 males, 21 females, mean age 63 years) and underwent conventional CMR including late enhancement, EQ-CMR to measure Vd_m and standard cardiac work-up including ECG, echocardiography, biomarkers (BNP, Troponin T) and functional assessment (6-min walk test, 6MWT, where permitted by autonomic neuropathy). Results were compared to normal controls. Conventional assessment ranked cardiac involvement as definite, probable and none.

Results Vd_m was significantly higher in patients than normal controls (0.25 vs 0.40, $p<0.001$) (see Abstract 093 figure 1A). This tracked conventional cardiac assessment (none, probable, definite corresponded with a Vd_m of 0.276 vs 0.342 vs 0.488, $p<0.005$), respectively (see Abstract 093 figure 1B). Vd_m correlated with cardiac parameters by echo (eg, TDI S-wave R^2 0.27, $p<0.001$) and



Abstract 093 Figure 2

conventional CMR (eg, indexed LV mass R^2 0.31, $p<0.001$ —see Abstract 093 figure 2). Significant correlations were also seen with BNP (R^2 0.47, $p<0.001$) and Troponin T (R^2 0.28, $p=0.006$). Vd_m was associated with ECG abnormalities and tracked small QRS voltages (R^2 0.33, $p<0.001$). A higher Vd_m correlated with a lower 6MWT outcome (R^2 0.13, $p=0.03$).

Conclusions The measurement of the myocardial interstitial compartment (Vd_m) using EQ-CMR in systemic AL amyloidosis quantifies the cardiac amyloid burden.

094 THE PREVALENCE OF NON-CALCIFIED PLAQUES IN SYMPTOMATIC PATIENTS WITH ZERO CALCIUM SCORE

doi:10.1136/heartjnl-2012-301877b.94

¹G K Koulaouzidis,* ¹D C Charisopoulou, ²T M McArthur, ²S M Maffrett, ²M T Tighe, ²P J J Jenkins. ¹Heart Centre and Department of Public Health and Clinical Medicine, Umea University, Umea, Sweden; ²European Scanning Centre, London, UK

Introduction Atheromatous plaque rupture is the most common cause of coronary artery thrombosis. Non-calcified plaques, with thin fibrous cap and large thrombogenic lipid core, are predominantly the most susceptible to rupture.

Aims To investigate, with a 640-slice, 320-row CT scanner, the non-calcified coronary artery plaques (NCAP) prevalence and the degree of caused obstruction, in a cohort of symptomatic subjects, without coronary calcification.

Methods and Results Out of 1806 patients, who underwent coronary CT angiography (CTCA), we retrospectively identified 447 symptomatic patients with coronary artery calcification (CAC) score of 0. Standard cardiovascular risk factors were assessed prior to the CTCA study. From the 447 subjects, 400 (89.48%) had a negative CTCA, while in 47 (10.51%) NCAP were depicted on CTCA. Four of these (4/47) had stenosis more than 50%. Mean age of patients with positive CTCA was 56.21 years, significantly higher than those of patients with negative CTCA (50.6 years, $p<0.004$). Additionally, when compared to patients with normal CTCA, those with NCAP were in higher risk of developing CAD, as derived from the pre CTCA assessment (26% vs 34.04%, $p<0.0001$). The Left Anterior Descending artery (LAD), and especially the proximal segment, was the predominant location for the development of NCAP.

Conclusion Absence of coronary calcification does not exclude the presence of atherosclerosis; NCAP is present in up to 10% of patients with CAC score of 0. Symptomatic patients, who older in age, with multiple factors and high probability of CAD, would benefit from CTCA even in the absence of CAC.

095 PLAQUE MAPPING BASED ON CONTRAST RATIOS PERMITS IDENTIFICATION OF UNSTABLE CORONARY PLAQUE AND QUANTIFICATION OF CORONARY ATHEROSCLEROSIS BY CORONARY CT ANGIOGRAPHY

doi:10.1136/heartjnl-2012-301877b.95

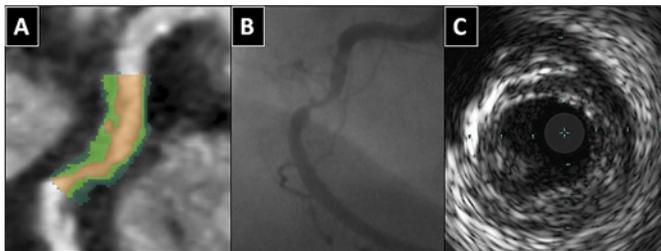
¹D R Obaid,* ¹P A Calvert, ²M Goddard, ²D Gopalan, ¹J H F Rudd, ¹M R Bennett. ¹University of Cambridge, Cambridge, UK; ²Papworth NHS Foundation Trust Hospital, Cambridge, UK

Background Previous attempts to characterise coronary components using CT have relied on fixed Hounsfield unit (HU) ranges which do not correct for the effect of inter-patient variation of contrast intensity on plaque attenuation. We examine the utility of using HU-ranges derived from contrast attenuation ratios.

Methods 57 patients underwent coronary CT and Virtual Histology IVUS examination. Attenuation was sampled in over 1000 plaque

areas co-registered with VH-IVUS and compared to contrast attenuation to create contrast ratios for each plaque component. These ratios were used to create a colour map of the plaque based on the HU of its constituents and used to test: (A) Classification of plaque components against histology in 10 post-mortem human coronary arteries. (B) Quantification of plaque geometry and composition compared with VH-IVUS in 30 coronary segments. (C) Ability to differentiate 63 patients prospectively enrolled with either stable angina or acute coronary syndrome.

Results (A) CT contrast ratio defined HU-colour maps were created for the 10 post-mortem arteries which were then sectioned into eighty-seven 400 μm segments for histological analysis. The maps permitted detection of significant atherosclerosis with sensitivity-92% and specificity-90%, calcified-plaque with sensitivity-80% and specificity-88% and necrotic core sensitivity-55%, specificity-96%. If only necrotic core area $>2\text{ mm}^2$ are considered (above the spatial resolution of CT) there is a significant improvement in sensitivity-75%. (B) Plaque-maps were created for 900 mm of coronary segments and co-registered with VH-IVUS. On average, CT overestimated total plaque area by 44%, vessel volume-33%, lumen-10%, necrotic core-140%, fibrous plaque-70% and calcified plaque-9%. However, correlation between CT and VH-IVUS was highly significant ($p<0.001$) for all measurements: vessel volume ($r=0.86$), lumen ($r=0.74$), necrotic core ($r=0.47$), fibrous plaque ($r=0.74$) and calcified plaque $r=0.69$). (C) Culprit lesions of 31 patients with stable angina and 32 with troponin-positive ACS underwent CT prior to PCI. Features discriminating acute from stable plaque detected using the plaque-maps include: micro-calcification-63% vs 35% ($p=0.03$), distinct necrotic core-56% vs 23% ($p<0.01$) (Abstract 095 figure 1) and positive vessel remodelling-68% vs 26% ($p<0.001$). The percentage of necrotic core (low attenuation plaque) was higher in acute plaques-54% vs 44% ($p<0.01$) while conversely the percentage of calcified plaque (high attenuation plaque) was lower-4% vs 15% ($p<0.01$). Intra-plaque contrast was more common 44% vs 6% ($p<0.001$) with high specificity for acute plaques (94%) and we feel it may represent visualisation of plaque rupture (Abstract 095 figure 1).



Abstract 095 Figure 1 (A) CT image of intra-plaque contrast with colour mapping. (B) Corresponding coronary angiogram. (C) IVUS reveals plaque rupture at this point.

Conclusion Plaque-mapping with contrast ratios allows plaque quantification and may assist diagnosis of acute plaque rupture.

096 A COMPARATIVE STUDY OF STANDARD FILTERED BACK PROJECTION WITH NOVEL ITERATIVE RECONSTRUCTION TECHNIQUES IN CARDIAC CT

doi:10.1136/heartjnl-2012-301877b.96

¹P McKavanagh, * ¹L Lusk, ¹P Ball, ²M Harbinson, ¹T Trinnick, ¹E Duly, ¹G Walls, ¹S McCusker, ¹C L McQuillan, ¹S Shevlin, ¹M Alkhalil, ¹P M Donnelly. ¹Ulster Hospital, Belfast, UK; ²Royal Victoria Hospital, Belfast, UK

Background Iterative reconstruction (IR) is a novel but significant development in CT image acquisition. There have been a number of studies that have reported on the potential of IR in cardiac CT. These retrospectively applied IR in the image domain to images

acquired with standard filtered back projection (FBP) techniques. This study was part of an ongoing randomised control trial [ISRCTN52480460] evaluating the cost effectiveness of cardiac CT.

Methods 250 patients were prospectively enrolled to have a cardiac CT for the investigation of stable chest pain. Written and informed consent was obtained. Data acquisition were performed on a Philips Brilliance 64. The patients were divided into two groups. Cohort A underwent standard FBP imaging, and Cohort B underwent IR with Idose® (Philips, Cleveland, Ohio, USA). Within each cohort the scan parameters (kv, mAs, pitch) and reconstruction protocols (prospective or retrospective) were determined by patient characteristics. Images were assessed for noise and signal quality within regions of interest (ROI) on axial images, and subjectively for image quality by two experienced readers. Noise was defined as the SD of the measured HU, and signal as the HU mean attenuation value. The ROIs were in the ascending aorta, interventricular septum and left ventricular cavity. Subjective image quality was rated blindly using a 5-point Likert scale. Effective radiation dose (ED) of each CTCA was estimated by multiplying the dose-length product by a chest-specific conversion coefficient ($\kappa=0.014\text{ mSv}\times\text{mGy}^{-1}\times\text{cm}^{-1}$).

Results Of the 250 patients enrolled 3 withdrew. 146 of the 247 subjects were male with a mean age of 57.93 (SD 9.93). Cohort A consisted of 124 patients, and cohort B 123, with no significant difference in baseline demographics. The mean dose of all FBP was 6.09 mSv, (SD 3.16) compared to an IR mean of 4.23 mSv, (SD 2.01) which was a dose saving of 1.86 mSv (30.54%). This was a significant dose reduction ($p\text{ value }<0.0001$). Mean image quality score obtained from the IR images was 3.67 (SD 1.04) compared to the FBP images of 3.29 (SD 1.17) $p\text{ value of }0.0067$. There was good agreement between the readers— κ coefficient 0.83. Cohort A consisted of 74 retrospective images and 50 prospective. Cohort B had 116 with retrospective and 7 with prospective. The mean ED for a prospective FBP was 3.50 mSv (SD 1.15), with the IR equivalent being 2.00 mSv (0.72), giving a mean dose saving of 1.50 mSv (42.86%). The mean ED for FBP retrospective studies was 7.85 mSv (SD 2.87), with the IR equivalent being 4.36 mSv (SD 1.99), with a mean dose saving of 3.49 mSv (44.46%). There was no statistical difference in noise or mean attenuation between the IR and FBP images in all three areas of interest Abstract 096 table 1.

Abstract 096 Table 1

Region of interest	Image noise		p Value	Attenuation		p Value
	FBP	IR		FBP	IR	
Ascending aorta	29.76 \pm 32.00	27.33 \pm 10.10	0.42	505.85 \pm 95.64	520.72 \pm 103.07	0.24
Interventricular septum	28.96 \pm 9.63	28.27 \pm 7.53	0.53	154.76 \pm 35.28	153.63 \pm 32.41	0.79
Left ventricle	29.78 \pm 9.36	28.55 \pm 12.39	0.38	464.27 \pm 92.50	484.07 \pm 99.38	0.11

Conclusions To our knowledge this is the first study to prospectively compare FBP with IR. It suggests that cardiac IR protocols confer a substantial radiation dose reduction without a compromise in diagnostic quality.

097 CALCIUM SCORES ARE MORE COST EFFECTIVE FOR RISK STRATIFICATION THAN NICE'S MODIFIED DIAMOND FORRESTER CALCULATOR

doi:10.1136/heartjnl-2012-301877b.97

¹S McCusker, ¹P McKavanagh, * ¹L Lusk, ²A Agus, ¹P Ball, ³M Harbinson, ¹T Trinnick, ¹E Duly, ¹G Walls, ¹S Shevlin, ¹C L McQuillan, ¹M Alkhalil, ¹P Donnelly. ¹Ulster Hospital, Belfast, UK; ²CRSC, Glasgow, UK; ³Royal Victoria Hospital, Belfast, UK

Background In March 2010 NICE published clinical guideline 95 (CG95). This proposed a move to a primary imaging strategy for