108 STREAMLINING ASSESSMENT OF CORONARY ARTERY DISEASE USING FFRCT: REAL WORLD EXPERIENCE FROM A LARGE DISTRICT GENERAL HOSPITAL

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Introduction CT coronary angiography (CTCA) is recommended by NICE [CG95] for diagnosis of coronary artery disease (CAD) in patients with stable chest pain. HeartFlow FFRCT utilises a standard CTCA data set to provide a non-invasive fractional flow reserve (FFR) estimate by computational fluid dynamics. Analysis of FFRCT demonstrated a high level of diagnostic accuracy & FFRCT has been advocated by NICE [MTG32]. Adoption of FFRCT should streamline assessment of CAD, ensuring limited invasive resources are used in patients more likely to need revascularisation. We evaluated introduction of FFRCT in a large district general hospital and its impact on clinical assessment of CAD.

Methods CTCA studies were performed as per local guidelines. Studies with coronary stenoses between 30 & 90% were forwarded to HeartFlow for FFRCT analysis. The referring cardiologist viewed both anatomical & functional data before deciding on treatment. Demographic & outcome data were analysed for the first 15 months by scrutinising electronic patient records. An FFRCT ≤0.80 was considered to demonstrate significant obstructive CAD.

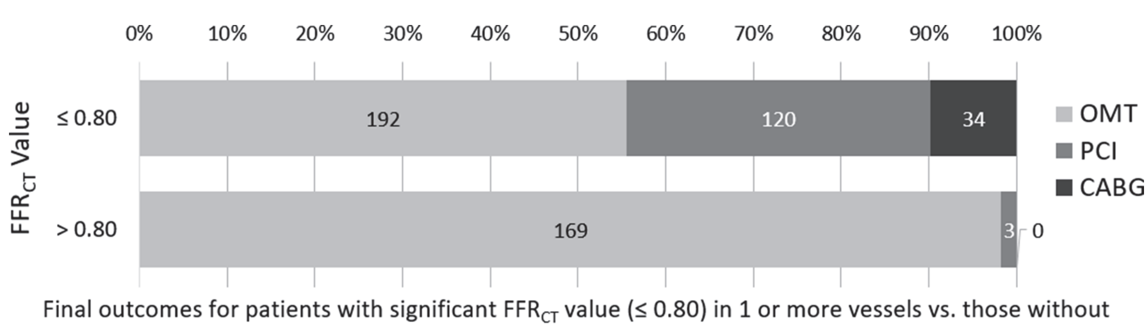
Results A total of 1938 CTCA studies were undertaken over 15 months. 584 (30.1%) met criteria for HeartFlow FFRCT analysis. 66 studies (11.3%) were rejected due to quality. FFRCT analysis was received for 518 patients (mean age 66.1 ±9.7 years; 62.2% male; hypertension 69.1%; hyperlipidaemia 64.5%; diabetes 21.0%; smoking history 67.0%; family history CAD 43.8%). Median time to CTCA was 43±26 days.

346 patients (66.8%) had one or more vessels with an FFRCT result of ≤0.80. 167 patients (32.3%) had 2 or 3 vessels with FFRCT values ≤0.80. Of patients with FFRCT ≤0.80, 201 (58.1%) were investigated further by invasive coronary angiography (median time to angiogram after CTCA 43 ±56 days). 62 (17.9%) had invasive FFR assessment, with good correlation to the FFRCT result. Of the 346 patients with FFRCT lesions ≤0.80, 154 (44.5%) required either percutaneous coronary intervention (PCI – 120; 34.7%) or coronary artery bypass grafting (CABG – 34; 9.8%). The other 192 patients (55.5%) were managed with optimal medical therapy (OMT).

Of 172 patients (33.2%) without FFRCT positive lesions (i.e. all lesions >0.80), the majority (98.3%) received OMT. Only 8 patients (4.7%) required subsequent invasive angiography, with 3 patients (1.7%) needing PCI (all of whom had invasive FFR studies).

Conclusion Less than half of the patients sent for FFRCT required invasive angiographic assessment. An FFRCT >0.80 safely identified patients that could be managed with OMT. As clinicians became more confident of the accuracy of FFRCT, less invasive FFR was undertaken; and clinicians increasingly deferred invasive angiography after identification of FFRCT lesions ≤0.80 located in the distal coronary circulation. FFRCT allows streamlining of management of CAD by identifying patients who would best benefit from invasive treatment, freeing up limited resources.

Conflict of Interest None



Abstract 108 Figure 1 Correlation of final outcomes and presence of FFRCT coronary lesions ≤ 0.80

109 FEASIBILITY AND POTENTIAL CLINICAL UTILITY OF BIVENTRICULAR FUNCTION, AORTIC AND PULMONARY FLOW ASSESSMENT USING COMPRESSED SENSE DURING CONTINUOUS EXERCISE CARDIOVASCULAR MAGNETIC RESONANCE (EX-CMR)

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Background Biventricular volume, aortic and pulmonary flow assessment by cardiovascular magnetic resonance (CMR) allows accurate direct quantification of aortic and pulmonary flow and indirect quantification of mitral and tricuspid regurgitation. Exercise cardiovascular magnetic resonance (Ex-CMR) combines the preferred method of exercise stress with the diagnostic capabilities of CMR. Compressed SENSE (CS) is a novel parallel imaging technique, robust to respiratory motion that has not previously been used in Ex-CMR. This study aims to demonstrate the feasibility and utility of performing biventricular function and flow assessment during continuous in-scanner exercise, using vendor supplied CS sequences and commercial analysis software (Circle cvi42).

Methods 12 healthy volunteers (8 male, age 35±10 years) had CMR imaging (1.5T Philips Ingenia) using a novel free breathing CS protocol at rest and during continuous in-scanner supine cycle exercise (Lode BV) to low and moderate exercise intensities. Target heart rates (THR) were individually prescribed using heart rate reserve (HRR) and an age predicted maximal heart rate model. Participants exercised with no resistance for 1 minute then at an increase of 25W every 2 minutes until target heart rate (THR) were achieved at low (30-39% HRR) and moderate (40-59% HRR) exercise.

At rest, the novel CS protocol was validated against our institute's standard clinical breath-held (BH) sequences (SENSE 2, bSSFP multi-phase, multi-slice SA cines & aortic and pulmonary 2D flow).

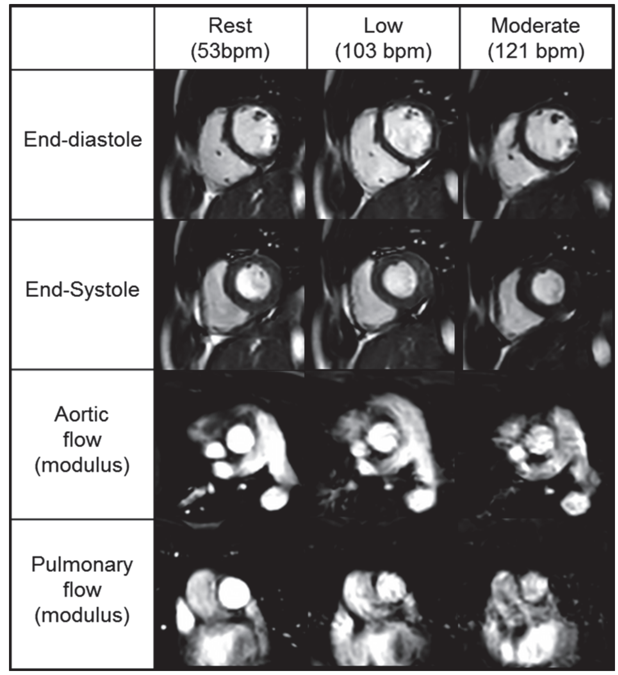
The Ex-CMR protocol involved:

- Biventricular volume assessment - free breathing, Compressed SENSE acceleration x 3 (CS3), bSSFP, respiratory navigated, retrospectively gated short axis cine imaging.
- Flow acquisition - free breathing CS3 aortic and pulmonary through-plane phase contrast imaging.

Results Resting biventricular volumes, aortic and pulmonary flows from CS3 sequences demonstrated very strong correlation with clinical breath held sequences (all correlations r >0.93, p<0.01). Participant's heart rates remained within the prescribed exercise intensities for each stage (table 1). Examples of exercise image quality are presented in figure 1. Biventricular end-diastolic volumes (EDV) remained unchanged with increasing exercise (with the exception of a drop in right ventricular EDV at moderate exercise), with an increase in stroke volumes (SV) driven by a fall in end systolic volumes (table 2). Aortic and pulmonary stroke volumes similarly rose with increasing exercise intensities, strongly correlating at all exercise intensities with the corresponding stroke volumes acquired from biventricular SA cine imaging (all correlations: r >0.88, p <0.01).

Conclusion This is the first study to demonstrate feasibility of biventricular function, aortic and pulmonary flow assessment during continuous Ex-CMR using vendor provided sequences and commercially available analysis software. The developed Compressed SENSE Ex-CMR protocol could easily be adopted across a wide number of centres, potentially allowing assessment of the haemodynamic response to a wide range of cardiovascular diseases, therefore increasing the clinical utility of Ex-CMR.

Conflict of Interest N/A



Abstract 109 Figure 1 Consecitive free breathing short axis and flow images acquired in the same patient at rest and during continuous exercise to low and moderate exercise intensities

Abstract 109 Table 1 Physiological response to supine bicycle Ex-CMR

Exercise intensity	Rest	Low	Moderate
Heart rate reserve (%) of maximal heart rate	N/A	30-39%	40-59%
Heart rate (beats per minute)	58±6	102±5	119±5
Systolic blood pressure *	119±10	143±15	160±24
Diastolic blood pressure *	71±8	76±13	75±13
Borg rate of perceived exertion	6±0	9.6±1.8	13.7±2.4
Mean work rate (Watts)	0	52±26	84±24

* n=10, 2 blood pressures un-recordable at moderate exercise intensity.

Abstract 109 Table 2 Cardiac haemodynamic response to supine bicycle Ex-CMR

Exercise intensity	Rest		Low	Moderate
Image Sequence	Clinical breath held	Compressed SENSE 3 free breathing		
LVEDV (indexed) ml/m^2	89±16	89±16	88±15	86±14
LVSV (indexed) ml/m^2	50±7	50±7	57±8*	60±7*
LVEF (%)	57±6	57±6	66±7*	70±8*
Aortic stroke volume (indexed) ml/m^2	48±7	48±7	55±8*	57±8*
RVEDV (indexed) ml/m^2	89±16	90±15	87±15	85±14**
RVSV (indexed) ml/m^2	49±8	49±7	56±7*	59±7*
RVEF (%)	55±7	56±6	65±7*	70±6*
Pulmonary stroke volume (indexed) ml/m^2	49±6	48±8	54±7*	55±7*

* p< 0.01, **p<0.05 for differences between exercise stage and rest (CS3 sequence).

110 MYOCARDIAL TISSUE CHARACTERISATION IN HEART FAILURE PATIENTS WITH AND WITHOUT LEFT BUNDLE BRANCH BLOCK

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Background Heart failure patients with left bundle branch (LBBB) have worse outcomes than their counterparts with narrow QRS across the range of ejection fraction. We aimed to investigate whether patients with LBBB have different patterns of fibrosis and perfusion.

Method We prospectively recruited 177 patients with new diagnosis of left ventricular systolic dysfunction (LVSD) of unknown aetiology. Exclusion criteria included presence of angina symptoms or previous known ischaemic heart disease. Surface 12 lead electrocardiogram was reviewed in all patients to diagnose LBBB. All patients underwent cardiovascular magnetic resonance (CMR) on a Siemens 3.0T Prisma system with a protocol that included cine imaging for volumetric analysis, pre and post contrast T1 mapping and free breathing quantitative inline perfusion mapping. Pharmacological stress was achieved via adenosine administration at 140mcg/kg/min increased up to a maximum of 210mcg/kg/