accelerated adenosine stress first-pass contrast enhanced CMR perfusion imaging at 1.5T MRI. Absolute stress MBF was derived. Visual analysis of the dynamic perfusion series was undertaken by two expert CMR readers. Diagnostic accuracy was determined on presence of significant CAD as defined by ICA and FFR ≤ 0.80 using Area under the Curve (AUC) from receiver operator characteristic curves.

**Results** At the patient level, there was significantly lower MBF in patients with CAD compared to those without CAD (2.03 [1.82–2.37] vs 2.68 [2.31–2.93] ml/g/min, p<0.001). There was a high diagnostic accuracy for the detection of CAD for quantitative stress MBF with AUC 0.84 (95% confidence interval [CI] 0.68–0.94, p<0.001), and for visual analysis with AUC 0.89 (95% CI: 0.75 – 0.97), p<0.0001). These were not significantly different (p=0.52). The optimal threshold for MBF detection of CAD was ≤2.50 ml/g/min, with sensitivity of 100% (95% CI: 77%-100%) and specificity of 71% (95% CI: 49%-87%).

**Conclusion** High-resolution quantitative near whole-heart myocardial perfusion imaging shows high diagnostic accuracy for detection of significant CAD, with comparable accuracy compared to expert visual analysis. This technique could be considered for automated widespread clinical use without the need for expert analysis of visual dynamic perfusion images.

**Acknowledgements** The authors acknowledge financial support from the Department of Health through the National Institute for Health Research (NIHR) comprehensive Biomedical Research Centre award to Guy’s & St Thomas’ NHS Foundation Trust in partnership with King’s College London and King’s College Hospital NHS Foundation Trust and by the NIHR MedTech Co-operative for Cardiovascular Disease at Guy’s and St Thomas’ NHS Foundation Trust. This paper presents independent research funded by the National Institute for Health Research (NIHR) under its Research for Patient Benefit (RfPB) Programme (Grant Reference Number PB-PG-0416–20008). The work was also supported by the EPSRC (EP/P001099/1, EP/R010933/1, and EP/L015226/1) and the Wellcome/EPSRC Centre for Medical Engineering [WT 203148/Z/16/Z]. MSN was funded by a NIHR Clinical Lectureship [CL-2019-17-001]. SP is funded by a BHF Chair [CH/16/2/32089]. The views expressed are those of the authors and not necessarily those of the BHF, the DoH, the EPSRC, the NHS, the NIHR, or the Wellcome Trust.

5 CORRELATIONS BETWEEN CARDIAC MAGNETIC RESONANCE AND MYOCARDIAL HISTOLOGIC FINDINGS IN FABRY DISEASE

1,2Raffaello Ditaranto, 3Omella Leone, 5Luigi Lovato, 6Giovanna Cenacchi, 7Fabio Niro, 6Valentina Papa, 7Hibba Kurdi, 1Vanda Parisi, 1Frederico Di Nicola, 1Riccardo Baldassarre, 1Ludovica Barile, 6Costantino Catalano, 1Matteo Minnucci, 1Chiara Chii, 1,2,6Nazzareno Galì, 8James C. Moon, 7Elena Biagini. 1Cardiac Unit, Cardiac Thoracic and Vascular Department, IRCCS Azienda Ospedaliero-Universitaria di Bologna; 2European Reference Network for Rare, Low Prevalence and Complex Diseases of the Heart-ERN GUARD-Heart; 3Department of Experimental, Diagnostic and Specialty Medicine, University of Bologna, Bologna, Italy; 4Department of Pathology, Cardiovascular and Cardiac Transplant Pathology Unit, St. Orosio Hospital, IRCCS Azienda Ospedaliero-Universitaria di Bologna; 5CARDIO-thoracic Radiology, St. Orosio Hospital, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy; 6Department of Biomedical and Neuromotor Sciences, University of Bologna, Bologna, Italy; 7Barts Heart Centre, Barts Health NHS Trust, West Smithfield, London, UK; 8Institute of Cardiovascular Science, University College London, London, UK; 9Department of Cardiovascular Imaging, Barts Heart Centre, Barts Health NHS Trust, London, UK

**Introduction** Fabry disease (FD) causes cardiac left ventricular hypertrophy (LVH) thought to be due myocyte lipid storage and compensatory sarcomeric increase. Myocardial T1 in FD by cardiac magnetic resonance (CMR) demonstrates T1 lowering, with T1 falling until overt LVH, then normalizing as further LVH occurs. However no histological validation has been provided to date. Therefore, aim of the study was to correlate CMR myocardial values and histologic findings.

**Materials and Methods** Fifteen FD patients (49 years [IQR39–63], 60% females) undergoing CMR (cines, native T1 mapping, LGE) and either endomyocardial biopsy (EMB, n=11) or septal myectomy (n=4). Tissue specimens were analyzed with light/electron microscopy. Histomorphometric analysis measured myocyte vacuolization either as a percent of myocyte number (%VM) or area (%VMA).

**Results** Histological changes preceded imaging changes: myocyte hypertrophy preceded LVH and fibrosis preceded LGE. % VM and%VMA correlated with LVH either as maximal wall thickness (MWT r=0.780, p<0.001; r=0.859, p<0.0001) or left ventricular mass index (LVMi r=0.823, p<0.001; r=0.847, p<0.0001). LVH patients had high% VM (≥45%) and ≥80% by elevated MWT and LVMi respectively and high% VMA (≥18% and ≥22% respectively). At least 45% of VM and 10% VMA were needed for T1 lowering. In patients without increased LVMi (67%) T1 fell as%VMA increased (r=0.883; p<0.001). In patients with increased LVMi, no clear relationship was reported (r=-0.501; p=0.389).

**Discussion** This study compared CMR with myocardial histology in FD patients focusing on storage (vacuolization), LVH and native T1 values. Main findings were:

1. Histological changes preceded imaging changes: myocyte hypertrophy pre detectable LVH, storage pre detectable T1 lowering and fibrosis LGE.
2. Myocyte size increased with storage and clinical LVH.
3. Significant storage was necessary for both clinical LVH and T1 lowering.
4. The relationships between storage and clinical LVH was non-linear.
5. Native T1 values fell with storage until the presence of overt LVH (i.e. increased LVMi), when the relationship trend was lost.

**Conclusion** In FD, histological changes precede imaging changes. LVH correlated with myocyte storage with 45% vacuolization (10% VMA) needed for detectable LVH. T1 lowering strongly correlates with myocyte vacuolization in early disease but not in advanced disease.

**Acknowledgements** The work reported in this publication was also funded by the Italian Ministry of Health, RC-2022–2773270 project.

6 CMR SERVICE IMPROVEMENT VIA DEPLOYED SERVICE-LEVEL RAPID CMR PROTOCOLS WITH INTEGRATED AI

1Jessica Artico, 1Reem Laymouna, 1Paige Fox, 1Hunaiai Shiwani, 1Hibba Kurdi, 1Adronike Abucion, 1lain Pierce, 1Rhodri Davies, 1Hui Xue, 1Peter Kellman, 1Mark Westwood, 1Charlotte Manisty, 1Thomas Treibel, 1James Moon. 1Barts Heart Centre and University college of London Hospital, UK; 5National Heart, Lung, and Blood Institute, National Institutes of Health Bethesda, USA

**Background** Demand for CMR has been increasing year on year, and has been exacerbated by the pandemic. The need
for rapid, focused protocols to increase through-put, improve cost-effectiveness and reduce waiting lists is now essential. We designed and implemented two new rapid CMR protocols incorporating AI approaches in daily clinical practice and measured their impact.

**Methods** As part of service level improvements, we implemented two protocols:

Protocol 1: rapid Perfusion CMR for ischaemia/viability; Protocol 2: rapid non-contrast CMR for cardiotoxicity. These protocols used inline perfusion mapping with AI analysis, and inline ventricular analysis using the Mycardium AI superhuman analysis approach.

A total of 260 patients were recruited and allocated to either rapid or standard CMR. Scanning times (first to last image timestamp), and image quality (consensus of 2 observers) were assessed.

**Results** Protocol 1: Conventional stress imaging took an average of 36 minutes (range 24–52 minutes, n=80). Rapid perfusion CMR took an average of 23 minutes (range 14 to 31 minutes, n=120), an average saving of 13 minutes (p<0.001).

Protocol 2: Conventional non-contrast CMR took 15.0 minutes (range 11 to 20 minutes). Rapid non-contrast CMR took 9.9 minutes (range 5–13 minutes), including inline analysis, an average saving of 5.1 minutes—but this shorter scan included the inline AI analysis, an additional reporting saving.

For both protocol 1 and 2, the scan quality was considered similar (3/3, good).

**Conclusion** Rapid CMR protocols incorporating AI approaches permit major savings on scan duration without any apparent image quality penalties. Scans can consistently be performed in less than 25 minutes and less than 10 minutes for non-contrast. These can be implemented in NHS clinical services.

**Sequelae** Following this trial, rapid CMR approaches have become routine for ~1/4 patients at our site and booking slots have been reduced to 50 minutes (from 1 hour) on all CMR booking diaries with a daily increase in activity of +3 patients a day with consequent benefits to waiting lists.

**REFERENCES**

