events. ^{18}F -NaF PET-CT holds promise as a non-invasive marker of disease severity and future risk in patients with acute aortic syndrome.

Conflict of Interest None

162 MULTI-MODALITY IMAGING IN SURVIVORS OF COVID-19

¹Trisha Singh, ¹Shruti Joshi, ¹Nick Spath, ¹Lucy Kershaw, ¹Andy Baker, ¹Helen Jordan, ²Gaurav Gulsin, ³Michelle Williams, ³Edwin van Beek, ²Jayanth Arnold, ¹Semple Scott, ³David Newby, ¹Marc Dweck, ²Gerry McCann. ¹University of Edinburgh, Edinburgh, UK; ²University of Leicester; ³Centre for Cardiovascular Sciences, University of Edinburgh

10.1136/heartjnl-2021-BCS.159

Background Widespread abnormalities of the myocardium have been reported in patients with COVID-19. However, these patients often have substantial co-morbidities and it is essential to understand whether cardiac abnormalities represent pre-existing disease or are the consequence of COVID-19.

Objective To determine the contribution and cardiac impact of co-morbidities in patients who have recovered from COVID-19.

Methods In a prospective observational study, adult patients hospitalized with confirmed COVID-19 were recruited from the Edinburgh Heart Centre between May and November 2020 and compared to healthy and co-morbidity-matched volunteers. Patients underwent gadolinium and manganese-enhanced magnetic resonance imaging and coronary computed tomography angiography.

Results Twenty-three patients (54 ± 11 years, 20 male) who recovered from COVID-19 were recruited. Half ($n=11$, 48%) required admission to the intensive care unit and a third ($n=7$, 31%) received non-invasive or invasive ventilation. Patients had a high prevalence of known cardiovascular disease

($n=18$, 78%), associated risk factors ($n=11$, 45%) and coronary artery disease ($n=8$, 35%). Compared with younger healthy volunteers ($n=10$), myocardial native T1 values (1202 ± 25 versus 1162 ± 27 ms, $P=0.008$, **figure 1**) and extracellular volume fraction (31.9 ± 1.7 versus 29.8 ± 0.5 %, $P=0.001$, **figure 1**) were higher with no differences in manganese uptake. Compared to co-morbidity-matched volunteers ($n=20$), there were no differences in native T1 values (1202 ± 25 versus 1196 ± 39 ms, $P=0.61$, **figure 1**), extracellular volume fraction (31.9 ± 1.7 versus 31.0 ± 0.5 %, $P=0.11$), presence of late gadolinium enhancement or manganese uptake. These findings remained irrespective of COVID-19 disease severity, presence of concomitant myocardial injury or coronary artery disease.

Conclusions Patients who have recovered following hospitalization with COVID-19 have no evidence of a major excess in myocardial injury or dysfunction compared to co-morbidity-matched volunteers. The presence of co-morbidities likely explains many of the previously reported myocardial abnormalities.

Conflict of Interest None

163 FIRST IN VIVO PRETARGETED PET IMAGING OF ATHEROSCLEROSIS WITH ANTIBODIES AGAINST FORMS OF MODIFIED LIPOPROTEINS

¹Cinzia Marceddu, ¹Adam Hartley, ¹Mikhail Caga-Anan, ¹Samata Pandey, ¹Yasmin Morris, ¹Dorian Haskard, ²Jan Passchier, ^{1,2}Ramzi Khamis. ¹Imperial College London, London, UK; ²Invivo London

10.1136/heartjnl-2021-BCS.160

Atherosclerosis is a cardiovascular disease initiated by the deposition of Low Density Proteins (LDL) within the intima and

Abstract 162 Figure 1

Abstract 163 Figure 1 NIRF tetrazine selectively reacts with LO9-TCO on tissue

The Figure shows a microscopy study on sequential series of atherosclerotic mouse tissue. Panel A shows H&E stain of atherosclerotic mouse tissue (magnified in D). In panel B the tissue was coated with unmodified LO9 and then exposed to the NIRF tetrazine. In panel C the tissue was coated with LO9-TCO and then exposed to the NIRF tetrazine (in red). NIRF tetrazine signal can only be seen on slide coated with LO9-TCO.

their subsequent oxidation to (oxLDL). Currently, there are no available Positron Emission Tomography (PET) tracers for clinical imaging of atherosclerosis. LO1 and LO9 are novel antibodies that target modified low-density lipoprotein, a component of atherosclerotic plaques. Despite their high specificity for their molecular target, the use of full antibodies as PET tracers is limited due to their long circulation time. Pretargeted labelling of antibodies overcomes this limitation by decoupling the antibodies' slow pharmacokinetics from the half-life of the radioisotope, injecting the two components separately and facilitating their use as tracers. The methodology requires a trans-cyclooctene (TCO) conjugation to the antibody, followed by the selective *in vivo* reaction with a radiolabelled tetrazine (Tz) injected after the conjugated antibody has accumulated on target and partially cleared from the blood. The components necessary for the pretargeted PET imaging of atherosclerosis were prepared and characterised. The radiolabelled tetrazine [^{18}F]FpyTz was prepared and purified with a radiochemical yield of 10.5% and a radiochemical purity <99%. In addition, a near-infrared (NIRF) emitting tetrazine Tz-VT was also synthesized to mimic the behavior of the radiolabelled analogues in some *in vitro* and *ex vivo* tests. Conjugation of LO9 and LO1 yielded LO9-TCO and LO1-TCO, respectively. Aortic root sections from LDL-R $^{-/-}$ mice fed a high-fat diet for 14 weeks were exposed to LO9, LO1, LO9-TCO and LO1-TCO respectively, followed by Tz-VT, and examined using fluorescent microscopy. The stained sections exposed to LO9-TCO or LO1-TCO and Tz showed areas of positive signal along the plaque edges a representative example obtained using LO9-TCO is depicted in figure, while control slides exposed to LO9 or LO1 showed no signal. Ldlr $^{-/-}$ mice fed a high-fat diet for 22 weeks were injected with the modified antibodies first and with the radiolabelled tetrazine after 72h. PET/CT studies and *Ex vivo* biodistribution studies were via γ -counter were performed. Additionally, PET/CT and *ex vivo* biodistribution studies were performed with directly labelled antibodies LO1-89Zr and LO9-89Zr to enable comparison.

Animals injected with LO1 and LO9 showed a higher aorta uptake when compared with the control antibody. Analysis of

Abstract 163 Figure 2 PET images of mice injected with pretargeted antibodies

PET images of three Ldlr $^{-/-}$ mice fed a high-fat diet for 22 weeks; animals were injected (from left to right) with LO1-TCO, control-TCO, LO9-TCO then after 72 h, animals received a second injection with [^{18}F]FpyTz. Animals were imaged 5 minutes post-injection. Red arrows indicate areas of positive accumulation corresponding to atherosclerotic plaques.

PET images of pretargeted antibodies showed co-localisation of LO9 and LO1 at bifurcations of the aorta. The first studies of in vivo pretargeted PET detection of atherosclerosis were performed, our studies successfully demonstrated pretargeting of native low-density lipoprotein within atherosclerotic plaques in mice, in-vivo and ex-vivo using plaque specific antibodies.

Conflict of Interest none

164

THE EFFECT OF ENDURANCE EXERCISE ON RIGHT VENTRICULAR MORPHOLOGY IN FEMALE MASTER ATHLETES

¹Uchenna Ozo, ²Stathis Papatheodorou, ³Charlotte Mahoney, ⁴Zephryn Fanton, ⁴Paulo Bulleros, ⁴Michael Papadakis, ⁴Sanjay Sharma. ¹Cardiology Clinical Academic Group, St. George's University Hospitals NHS Foundation Trust, London, UK; ²Unit of Inherited and Rare Cardiovascular Diseases, Onassis Cardiac Surgery Centre, Greece; ³St Mary's Hospital, Manchester University Hospitals NHS Foundation Trust, Manchester Academic Health; ⁴St George's Hospital, London

10.1136/heartjnl-2021-BCS.161

Objectives To investigate the effect of lifelong exercise on right heart size and function in a large group of female master athletes.

Background The benefits of moderate exercise are well known, however several studies have raised concerns about the association between excessive endurance exercise and adverse right ventricular (RV) cardiac remodelling. During exercise the RV undergoes a dramatic increase in preload leading to a 30-fold increase in RV wall stress. Critically, the reduction in pulmonary vascular resistance pales in comparison to that of systemic resistance leading to an exponential increase in pulmonary artery pressure. Subsequently, intensive endurance exercise has been associated with transient RV dilatation and systolic dysfunction. Furthermore, animal studies and several small cohorts of seemingly healthy predominately male endurance athletes have suggested that repetitive intensive exercise leads to an increased prevalence of right ventricular dysfunction. Few large studies have specifically assessed right heart morphology and function in lifelong female master athletes (>40 years old).

Methods 173 apparently healthy and asymptomatic female master athletes (mean age 55.1 ± 7.4 years) underwent echocardiography using conventional planes as recommended by the British Society of Echocardiography. Athletes exercised >6 hours a week for at least 10 consecutive years. The results were compared to 43 sedentary age matched controls who exercised less than 3 hours per week (table 1).

Abstract 164 Table 1 Demographics of female athletes and controls

	Female Athletes N= 173	Controls N = 42	p value
Age (years)	55.1 $\pm$ 7.44	54 $\pm$ 7.32	
BMI	21.6 $\pm$ 2.08	25 $\pm$ 3.89	<0.0001*
Height (cm)	166.7 $\pm$ 6.37	164.3 $\pm$ 7.39	0.037*
Weight (kg)	60.3 $\pm$ 7.5	68.6 $\pm$ 13.6	<0.0001*
Framingham score (%)	2.3 $\pm$ 2.0	3.0 $\pm$ 1.8	0.0065*

Abstract 164 Table 2 Right heart dimensions and function assessed by 2D echocardiography in female master athletes compared to healthy sedentary controls

	Female Athletes N= 173	Controls N = 42	p value
Age (years)	55.1 $\pm$ 7.44	54.0 $\pm$ 7.32	
BMI	21.6 $\pm$ 2.08	25.0 $\pm$ 3.89	<0.0001*
RVOT proximal (mm)	29.8 $\pm$ 4.4	29.4 $\pm$ 3.3	0.6
RVOT distal (mm)	21.6 $\pm$ 3.9	21.3 $\pm$ 3.5	0.7
RVD 1 (mm)	38.4 $\pm$ 4.0	35.9 $\pm$ 3.8	0.0005*
RVD 2 (mm)	26.8 $\pm$ 3.8	25.5 $\pm$ 3.5	0.057
RVD 3 (mm)	78.6 $\pm$ 9.0	74.0 $\pm$ 8.2	0.003*
RV Area diastole indexed (mm/m²)	10.9 $\pm$ 2.4	9.0 $\pm$ 1.6	<0.0001*
RVFAC %	48.0 $\pm$ 9.5	49.7 $\pm$ 7.9	0.186
TAPSE	24.7 $\pm$ 4.5	22.3 $\pm$ 3.1	0.0032*
Right atrial area indexed (mm/m²)	9.9 $\pm$ 1.7	7.6 $\pm$ 1.4	<0.0001*

BMI; Body Mass Index, RVD; right ventricular dimension, RVFAC; right ventricular fractional area change, RVOT; right ventricular outflow tract, TAPSE; tricuspid annular plane systolic excursion.

*Statistically significant