Abstracts

Correlations	RV EDVI	RV ESVI	RV SVI	RV EF	RA area	mPAP
SV/ESV						
r value	−0.407	−0.712	0.250	0.847	−0.231	−0.301
p value	<0.001	<0.001	.022	<0.001	.042	.014
Global FD						
r value	.319	.303	.130	−.203	.280	.290
p value	<0.005	.005	.238	.064	.013	.018
Maximal Basal FD						
r value	.389	.350	.226	−.196	.296	.267
p value	<0.001	<0.005	.039	.073	.008	.030
Mean Basal FD						
r value	.401	.373	.179	−.215	.350	.297
p value	<0.001	<0.001	.102	.050	<0.005	.016

BSA: body surface area; ILD: Interstitial lung disease; LVEDVi or RVEDVi: indexed left ventricular or right ventricular end-diastolic volume; LVESVi or RVESVi: indexed LV or RV end systolic volume; LV StVi or RV StVi: indexed LV or RV stroke volume; LVEF or RVEF: LV or RV ejection fraction; LGE: late gadolinium enhancement; FD: fractal dimension; HR: hazard ratio; CI: confidence interval, SEM/IQR: standard error of mean/interquartile range)

unclear what key metrics are most clinically relevant. The purpose of this study was to assess the clinical relevance of both RV trabecular complexity and adequacy of RV functional adaptation to increased afterload as assessed by CMR in patients undergoing lung transplant assessment.

Methods Between 2013 and 2018, 84 consecutive patients underwent lung transplant assessment with echocardiography and CMR (1.5T - Siemens Aera) to assess biventricular volumes and function as well as late gadolinium enhancement (LGE). RV trabecular complexity was assessed by its fractal dimension (FD) on CMR, using freely available code (FracAnalyse). RV functional adaptation to increased afterload was assessed with the RV-pulmonary arterial (PA) coupling index (stroke volume(SV)/end-systolic volume(ESV) ratio). Survival was analyzed using the Cox proportional hazard ratio with the primary outcome of time to death.

Results In total 84 patients (median age 53 ± 16 years, 54% male) were included in analysis. Median follow up period was 19.3 ± 17.2 months. Underlying lung disease was recorded in 98% of the study population. Tricuspid regurgitation was echo-detected in 66 patients; 77% (51pts) had echo-calculated pulmonary hypertension (PH) with an estimated RV systolic pressure >35 mmHg and estimated mean PA pressure of 30 ± 10 mmHg. 78.4%, 15.7%, and 5.9% of PH patients were categorized to Groups 3, 5 and 1 of WHO PH classification respectively. Mean LV and RV ejection fraction were $62\% \pm 1.07\%$ and $51\% \pm 18\%$ respectively.

Both SV/ESV and RV FD correlated to mPAP, CMR-derived right atrial area, RVEDVi and RVESVi (table 1). RV FD did not differ significantly in patients with PH. Survival was predicted by SV/ESV ratio, RVEF, indexed RV end-diastolic volume (EDVi), RV end-systolic volume (ESVi), and mPAP on univariate analysis (table 1; SV/ESV carried a hazard ratio of 0.12, $p < 0.005$).

Conclusions In patients with underlying lung disease referred for lung transplant assessment, RV functional adaptation to afterload assessed by CMR seems to predict survival. Fractal analysis of RV trabecular complexity correlated with metrics influencing RV remodelling and contractility, although not survival. Assessment in a larger cohort is required to determine utility of these metrics.

16 MYOCARDIAL EXTRACELLULAR VOLUME IN PATIENTS WITH AORTIC STENOSIS UNDERGOING VALVE INTERVENTION: A MULTICENTRE T1 MAPPING STUDY

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Background Diffuse myocardial fibrosis is a key decompensation mechanism in advanced aortic stenosis (AS) and can be quantified using CMR T1 mapping techniques.

Purpose To assess T1 mapping measures of fibrosis in patients with severe AS referred for aortic valve replacement, and determine their associations with clinical characteristics, disease severity and clinical outcome.

Methods In this international prospective cohort study, patients with severe AS underwent CMR at 1.5T and 3T (Siemens/Philips) with T1 mapping prior to AVR. Image analysis was performed (CVI42, Circle) by a single core laboratory for three T1 mapping measures (native T1, extracellular volume fraction [ECV%] and indexed extracellular volume [iECV=LVMi*ECV%]).

Results Four-hundred patients (70 ± 10 years, 60% male) from nine international centres (Canada/Germany/Korea/USA/UK) were enrolled (including 144 patients from BSCMR AS700 study). AVR was performed (SAVR: $n=342$, TAVI: $n=58$) 19 [4-61] days following CMR, with median of 3.8 [1.7-4.5] years follow-up and 40 deaths recorded.

Abstract 16 Figure 1

As expected, native T1 was higher at 3T than 1.5T (1213 ± 57 versus 1050 ± 48 ms, $p < 0.001$); ECV% did not vary by scanner manufacturer, field strength or T1 mapping sequence (all $p > 0.30$); therefore, only ECV-based measures were analysed.

ECV% correlated with increasing age, Society of Thoracic Surgeons Predicted Risk of Mortality score, known coronary artery disease, lower aortic valve peak velocity, increased LV mass, presence of late gadolinium enhancement (LGE) and reduced LVEF ($p < 0.05$ for all). Following adjustment for demographic and clinical variables, ECV% remained associated with both LVEF ($p < 0.001$) and mass index ($p = 0.043$). Similar associations were seen with iECV.

A progressive increase in all-cause mortality was seen across tertiles of ECV% (14.0, 28.5 and 53.7 deaths per 1000 patient-years; log-rank test, $p = 0.003$). ECV% was independently associated with all-cause mortality following adjustment for age, sex, peak velocity, impaired LVEF and presence of LGE (HR per% increase in ECV%: 1.13, 95% 1.04–1.24, $p = 0.006$). iECV was associated with all-cause mortality following adjustment for age and sex (HR 1.03 95% 1.00–1.06, $p = 0.04$) but not after adjustment for the above clinical variables.

Conclusion In patients with severe AS scheduled for AVR, extracellular volume-based T1 mapping measures are robust, track with LV decompensation, and independently predict late all-cause mortality.

17 FAT WATER IMAGING FOR SUB-EPICARDIAL GADOLINIUM: ENHANCING THE DIAGNOSIS OF MYOCARDITIS

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Background Conventional bright-blood late gadolinium enhancement (BB LGE) provides excellent contrast between areas of LGE and normal myocardium. Conversely, contrast between LGE and epicardial fat is frequently poor making the detection of sub-epicardial LGE difficult. Sub-epicardial LGE is a sensitive and specific pattern of LGE classically described in myocarditis. However, in practice, patients with a clinical presentation consistent with myocarditis often have no evidence of LGE. Fat water phase sensitive inversion recovery (PSIR) LGE (FW PSIR LGE) is a novel sequence that enables delineation of pericardial fat and may have a role in improving detection of sub-epicardial LGE.

Objective To compare the diagnostic utility of the FW PSIR LGE sequence to standard BB LGE in patients with suspected myocarditis.

Methods Thirty-one patients referred for clinical CMR for suspected myocarditis were studied. A full left ventricle short axis stack was performed using both techniques. Two experienced observers analyzed all BB LGE and FW PSIR LGE stacks. A scoring system was devised to quantify the presence and extent of gadolinium enhancement.

Results All patients (mean age 43 ± 20 years) presented with chest pain and raised troponin (median high sensitivity troponin T 706 ng/L, interquartile range 104–1185 ng/L) and a normal coronary angiogram or very low probability of coronary artery disease. A total of 496 LV segments were analysed. Significantly more segments demonstrated sub-epicardial LGE using FW PSIR LGE compared to BB LGE (122/496 (25%) vs 44/496 (9%), $p < 0.01$). Twelve patients (39%) with no BB LGE (classified as no myocarditis) were found to have sub-epicardial LGE on FW PSIR LGE (therefore reclassified as positive for myocarditis). There was good agreement between the two observers using both sequences (BB LGE: global agreement 80%, kappa 0.72; FW PSIR LGE: global agreement 80%, kappa 0.78, both $p < 0.001$).

Abstract 17 Figure 1 Conventional bright blood late gadolinium enhancement images (left panels) and corresponding separated fat water PSIR LGE and fusion imaging (left panels) of 2 different patients showing no definite evidence of subepicardial enhancement in conventional imaging and evidence of subepicardial LGE in separated fat water LGE (red arrows)