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CONGENITAL

Friday May 16 | 09:00—13:30 | Group A

1162 (pp01)

CMR Long-Term Follow-up of Patients Treated by Percutaneous Pulmonary Valve Implantation CMR Long-Term Follow-up of Patients Treated by Percutaneous Pulmonary Valve Implantation

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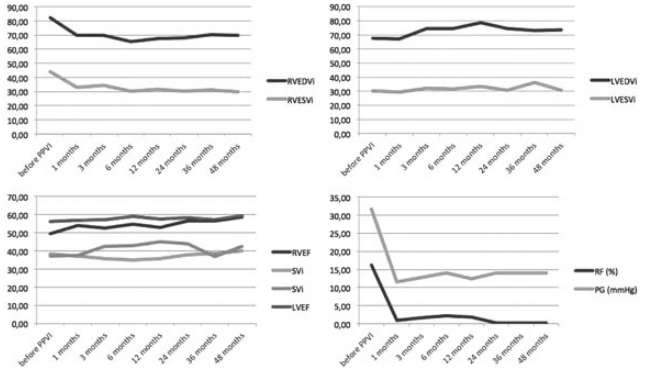
Purpose: In patient with pathology of the right ventricle outflow tract or of the pulmonary valve a right ventricle (RV) -pulmonary artery (PA) conduit is usually implanted. However, the good function of conduits is limited during the life and multiple re-interventions are often required. While a pulmonary percutaneous valve implantation (PPVI) could be a good alternative to surgical repair no data are known regarding the long term follow-up of this approach.
Methods: After IRB approval and informed consent, patients with pulmonary conduit dysfunction were prospectively scheduled cardiac magnetic resonance (CMR) at 1.5-T, before and 1, 3, 6, 12, 36, 48 months after PPVI (Melody, Medtronic). CMR protocol was comprehensive of SSFP cine images to measure bi-ventricular volumes and function and phase contrast images to measure intra-arterial trough-plane flow.
Results: From January 2008 to January 2014, 40 patients were enrolled (21 $\pm$ 8 years old). Two patients were excluded from the study due to complication of percutaneous procedure and subsequent surgical intervention. Trend of end-diastolic volume index (EDVI), end-systolic volume index (ESVI), stroke volume index (SVi) and ejection fraction (EF) of the RV and LV before PPVI and after procedure is showed in Figure 1. A significant reduction of valve regurgitant fraction, pressure gradient, RV volume and LV EDVI as well as a significant improvement of RV function was found.
Conclusions: Four years after PPVI a significant and persistent improvement of biventricular function was detectable. CMR appears to be the ideal tool for longitudinal evaluation of patients treated by PPVI.



1174 (pp02)

Factors influencing image quality with 3D self-navigated whole heart CMR imaging in patients with congenital heart disease

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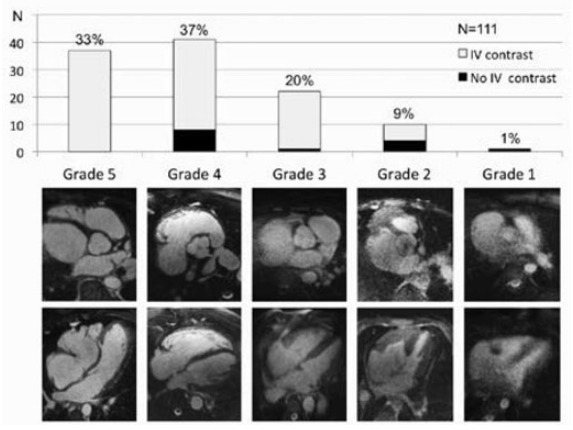
Introduction: For the morphological assessment of complex congenital heart disease (CHD) 3D free-breathing cardiac MR (CMR) is a potential option. A new sequence with direct self-navigation on the heart has recently been developed (Piccini D. Radiology 2014). Our aim was to identify the factors associated with low image quality in order to further improve this sequence.
Methods: All patients with CHD aged $>$2y and referred for clinical CMR were considered for inclusion. On a 1.5T-MRI scanner (Magnetom AERA, Siemens Healthcare) a self-navigated acquisition was performed during free breathing with respiratory navigation in the superior-inferior direction only (12'417-15'050 radial read-outs sampled over 377-953 heartbeats depending on heart rate (HR), all lines accepted for reconstruction) providing isotropic 3D image data with a resolution of 1x1x1mm3. Image quality was graded using a 5-grade scale where 5 = excellent quality, 4 = mild blurring only, 3 = moderate blurring but completely diagnostic dataset, 2 = insufficient quality with marked blurring and only partially diagnostic information and 1 = non-diagnostic dataset. Patients and protocol-related factors associated with insufficient image quality were identified using stepwise multivariate logistic regression.
Results: In 144 consecutive patients the pulse sequence was not applied for logistical reasons (time constraint) in 33 patients resulting in 111 patients (55% male, age 23 $\pm$ 12y) for analysis (44% with complex malformation; 69% with previous surgery). IV contrast (0.2 mmol/kg Gadobutrol) was used in 87%. Scan duration was 9.5 $\pm$ 3.1min, HR was 75 $\pm$ 16bpm. Image quality was graded as given in Figure. Factors significantly associated with poor image quality (grade 1 or 2 vs grades 4 and 5) were younger age (OR 0.89, 95%-CI 0.8-0.99, $p < 0.05$), lower ejection fraction (EF) of the systemic ventricle (OR 1.2x10-10, 95%-CI 2.4x10-17-0.0006, $p < 0.01$), higher HR (OR 1.11, 95%-CI 1.03-1.2, $p < 0.01$) and the absence of contrast injection (OR 0.007, 95%-CI 0.0004-0.15, $p < 0.01$). Overall, a diagnostic quality could be obtained in 94% in the contrast-enhanced 3D acquisitions, of which 77% were of good to excellent quality.
Conclusion: In a consecutive large patient population with CHD, contrast-enhanced 3D self-navigated CMR provided diagnostic datasets in 94% of patients. Further developments should aim to improve respiratory tracking in small infants, in patients with reduced EF, and in those with irregular breathing patterns.



1188 (pp03)

Biventricular heart remodeling after percutaneous and surgical pulmonary valve implantation: a cardiac magnetic resonance study

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Purpose: Percutaneous pulmonary valve implantation (PPVI) is an alternative to surgical pulmonary valve replacement (SPVR) in selected patients with congenital right ventricular outflow tract (RVOT) obstruction. Objective of this study is to evaluate the medium-term impact of PVVI and SPVR on biventricular function as assessed by cardiac magnetic resonance (CMR).
Methods: From 2008 to 2013, 33 patients (20 $\pm$ 8 years) underwent PPVI, while 16 patients (30 $\pm$ 11 years) underwent SPVR. A cono-truncal disease was present in 29/49 patients, previous Ross operation in 9/49. CMR was performed before and after an average of 10 months (range 3-15). Ventricular measurements were made on short-axis SSFP cine images.
Results: Results are summarized in table 1. The right ventricular end-diastolic volume index (RVEDVI) decreased significantly for both procedures. Right ventricular ejection

fraction (RVEF) increased significantly in the SPVR group compared to the PPVI patients. The left ventricular end-diastolic volume index (LVEDVI) increased more significantly after the procedure in the PPVI group; while changes were less evident and delayed in the SPVR patients. Left ventricular stroke volume index (LVSVI) increased in both groups after the procedure. There was an inverse correlation between the RV and LVEDVI: as the RVEDVI decreased in the follow-up, the LVEDVI increased.

Conclusions: Improvement of RVOT function is associated with reduction of RV volume and positive effects on ventricular–ventricular interaction supported by the increased LVSVI after the procedure. In the follow-up LV function improvement is delayed in the SPVR group. Medium-term follow-up shows permanent beneficial effect of pulmonary valve replacement in both groups.

Table 1: Pre and post pulmonary valve raplacement.

	PPVI			Surgical Group		
Variable	Pre	Post	Pvalue	Pre	Post	Pvalue
RVEDVI, ml/m2	81 ± 37	68 ± 16	0.03	142 ± 34	88 ± 21	≤0.01
RVESVI, ml/m2	43 ± 35	32 ± 13	≤0.01	75 ± 29	41 ± 15	≤0.01
RVSVI, ml/m2	36 ± 11	35 ± 9	NS	71 ± 40	47 ± 13	≤0.01
RVEF, %	49 ± 14	53 ± 12	0.109	46 ± 11	53 ± 9	0.03
LVEDV, ml/m2	66 ± 16	74 ± 17	≤0.01	61 ± 7	66 ± 12	≤0.05
LV ESV, ml/m2	28 ± 10	32 ± 12	≤0.01	24 ± 7	25 ± 7	0.2
LV SV, ml/m2	38 ± 12	41 ± 11	0.04	35 ± 10	40 ± 8	≤0.05
LV EF, %	57 ± 10	56 ± 11	0.509	60 ± 9	62 ± 6	0.379

1241 (pp04)

Assessing Relation of Tricuspid Valve Annular Tilt Index with Right Ventricular Enlargement in Patients with Tetralogy of Fallot in Cardiac Magnetic Resonance Imaging

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Objectives: Right ventricular enlargement is an important risk factor for ventricular arrhythmias, right ventricular failure and sudden cardiac death in patients with repaired tetralogy of fallot (TOF). In another word Right ventricular end-diastolic volume index (RVEDVI) based on the body surface area, greater than 150 mL/m^2 is a chief risk factor for sudden death in TOF patients. Because of abnormal geometry, two-dimensional echocardiography is limited to accurately assess of right ventricular end-diastolic volume (RVEDV). Cardiac magnetic resonance imaging (CMRI) is the accepted standard for quantifying RVEDV. There is one study that measured RVEDV enlargement with right ventricular annular tilt (RVAT), but we assess RVEDV enlargement with right ventricular annular tilt index (RVATI) based on the body surface area to reach more accurate results.

Methods: All patients with repaired TOF with an echocardiogram and CMRI were included in this retrospective study (n = 30). The patients were divided into two groups according to RVEDVI: group a, patients with RVEDVI over 150mL/m^2 (n = 15); group b, patients with RVEDVI under 150mL/m^2 (n = 15). The RVEDV measurements were obtained by CMRI and the RVAT was determined by measuring the angle of the tricuspid valve plane relative to the mitral valve plane at end-diastole in the apical 4-chamber view in echocardiographic study (n = 30).

Results: The mean RVEDVI was 151.5 ± 38.8 mL/m^2 in the study groups that 15 patients were over 150mL/m^2 (which considered sever RV enlargement with increased risk of sudden death), and 15 patients were under 150mL/m^2 (considered as lower risk of sudden death). The mean RVATI was 11.0 ± 2.5 degrees/m2 in all patients. Receiver operating characteristic analysis demonstrated an RVATI of 17.1 degrees/m2 as the cutoff for predicting a RVEDVI of greater than 150 mL/m^2 with a sensitivity of 93.3% and specificity of 73.3% (area under the curve = 88.4; confidence interval,75.9 -100.0; P= .0001).

Conclusions: The mean RVATI more than 11.0 ± 2.5 degrees/m2 is associated with an RVEDVI more than 150 mL/m^2. RVATI is a useful echocardiographic technique for detecting increased RVEDVI in patients with TOF and may help discern which patients should undergo RVEDVI quantification by CMRI. For more accuracy and unification we use annular tilt index cutoff value in which RVATI more than 17.1 degrees/m2 considered the same as RVEDVI more than 150mL/m^2.

1252 (pp05)

Long term follow-up of repaired pulmonaray atresia with intact ventricular septum and critical pulmonary valve stenosis by cardiac magnetic resonance imaging

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University Hospital la Timone, Marseille

Long term follow-up of repaired pulmonary atresia with intact ventricular septum (rPAIVS) and critical pulmonary valve stenosis (rCPVS) is not well described. Residual lesions such as atrial septal defect, pulmonary and tricuspid regurgitation (PR and TR) may lead to right ventricle (RV) enlargement. QRS enlargement on electrocardiogram is of prognosis significance in congenital heart diseases.

We sought to determine long term follow-up of patients with rPAIVS or rCPVS.

Methods: We retrospectively studied patients with biventricular rPAIVS or rCPVS attending our centre. Cardiac magnetic resonance (CMR) imaging was performed on a 1.5 T whole-body CMR using standardized protocols. Numbers are expressed as median [interquartile range], Pearson correlation analysis and X2 test were used to assess the relationships between different parameters.

Results: Eleven patients were studied at a median age of 13.2 years [10.3-16.2]. Two patients had previous palliation. Repair was a transannular patch in 4 patients and a percutaneous dilatation in 7. Four patients had atrial septal defect requiring surgery. Age at repair was 10 days [2.5-22.7] and delay between repair and CMR study was 13.1 years [9.9-16.2]. RV was dilated 9 patients 133 ml/m^2 [110-164] of which 6 patients had decrease RV ejection fraction. RV volume, ejection fraction and QRS duration were normal in 2 patients. More than mild TR was present in 7 patients. All but 1 patient had PR (32% [30-39]). Late gadolinium enhancement was found in 3 patients, at infundibular level in 2. All patients had normal left ventricle volume and function. QRS duration was >120 ms in 5 patients with right bundle branch. RV dilatation was associated with age at CMR (r = 0.62, p = 0.04), decrease RV ejection fraction (r = 0.78, p = 0.006), as a trend with TR (r = 0.57, p = 0.06) but not with PR (r = 0.38, p = 0.2) or late gadolinium enhancement (r = -0.26, p = 0,5). QRS duration was not associated with the type of repair, the presence late gadolinium enhancement or RV dilatation (p = 0.8, p = 0.4 and p = 0.5 respectively) but was associated with RV ejection fraction (r = -0.7, p = 0.02).

Conclusions: RV dilatation, decrease RV ejection fraction and QRS enlargement are common in rPAIVS and rCPVS. Mechanisms of RV dilatation and decrease RV function appear to be multifactorial. T1 mapping studies should be performed. Determining the optimal timing for pulmonary valve replacement and tricuspid valve surgery is challenging.

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VALVULAR

Friday May 16 | 09:00—13:30 | Group A

1201 (pp06)

Comparison of Extravascular volume by cardiac MR T1 mapping by conventional look locker versus modified look locker techniques to predict histologically measured fibrosis in valve disease

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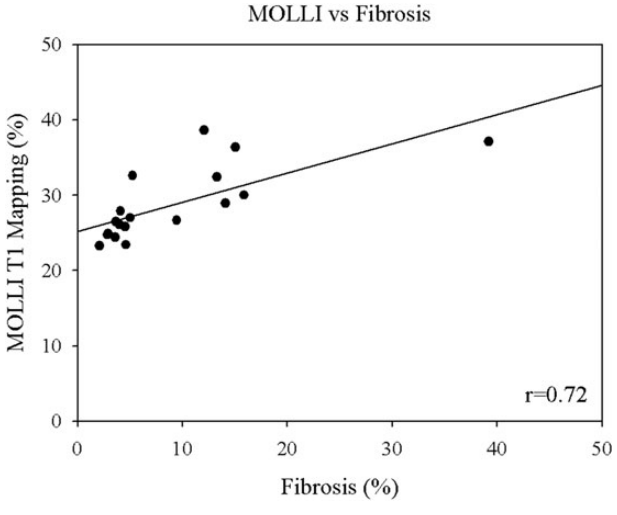
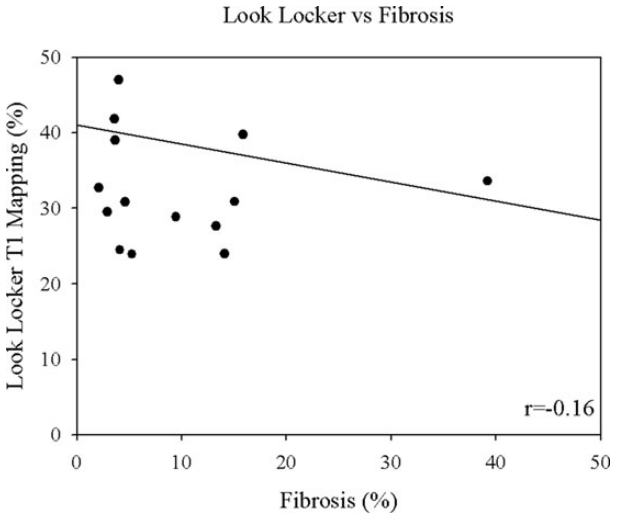
Background: Valvular heart disease is associated with left ventricular hypertrophy, remodeling and development of diffuse interstitial fibrosis. So far, histopathology remains the gold standard for evaluating diffuse myocardial fibrosis. Gadolinium enhanced Cardiac Magnetic Resonance (CMR) T1 mapping is new method which allows to quantify the myocardial extracellular volume (ECV). Look locker and modified look locker (MOLLI) are two techniques to assess ECV. Hence, it was suggested that the two techniques are equivalents. Therefore the aim of this study is to compare these two techniques against histological measurement.

Methods and results: 18 patients (age = 58 ± 14 years, 72% men) with either severe aortic valve disease (stenosis or regurgitation) or severe mitral regurgitation, but without coronary artery disease preoperatively underwent ECV measurement by CMR two beat look locker and MOLLI 3-3-5 single breathhold T1 mapping. LV biopsies were performed at the time of surgery 24 ± 38 days later and stained with Sirius red. The amount of fibrosis quantified by biopsy was 9.0 ± 8.9% [2.1;39.2]. ECV by T1 mapping mesured by look locker normalized to heart rate of 60bpm was 38.7 ± 13.9% [23.9;64.4] and by MOLLI was 28.7 ± 4.8% [23.3;38.6] (values are presented as mean ± SD [min;max]). The two T1 mapping values are significantly different (p = 0,010). There was a good correlation between histologically measured fibrosis and T1 mapping ECV by MOLLI (r = 0.72, p < 0.001, cfr figure) but not by look locker (r = -0.16, p = 0.52) mesurement.





Conclusion: ECV determined by CMR T1 mapping mesured by MOLLI technique closely correlates with histologically determined diffuse interstitial fibrosis. By contrast the look locker method does not provide accurate mesurement of ECV, likely because the shot interval does not allow complete relaxation of T1.

1258 (pp07)

Differences in left ventricular geometry and function between patients with bicuspid and tricuspid aortic valve stenosis

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Department of Cardiovascular Medicine, University of Oxford, Oxford, UK

Background: Aortic valve stenosis (AS) is an increasing healthcare burden (3% over 70 years affected). Bicuspid aortic valves (BAV), although only present in 1-2% of the population, accounts for over 50% of severe aortic valve disease. They may have earlier abnormalities of left ventricular strain because of longer standing effects on the LV. While resting strain abnormalities have been shown in BAV compared to healthy controls, LV geometry and strain has not, to our knowledge, been compared in groups with AS.
Methods: 76 participants (aged 55 to 78 years) with asymptomatic moderate to severe AS (39 BAV; 37 TAV) underwent cardiac MRI (CMR) scanning at 1.5 Tesla. Proprietary feature tracking software was used calculate longitudinal and circumferential peak systolic strain, strain rate and diastolic strain rate. Circumferential strain was measured at the LV base, mid ventricle and apex. LV dimensions, mass, ejection fraction were derived from standard CMR software. The sphericity index is the ratio of LV end-diastolic volume to a sphere with a diameter equal to the LV long axis dimension in diastole; repeated in systole.
Results: Participants with bicuspid aortic valves were slightly younger (BAV 65.5 $\pm$ 5.8 years vs TAV 71.5 $\pm$ 6.3 years). LV end diastolic volumes showed a trend towards being slightly larger in the BAV group (74mls/m2 vs 68.3ml/m^2, p= 0.09). The LV diastolic and systolic sphericity index was higher in the BAV group: diastolic sphericity index 38.5% vs 34.1% in TAV p = 0.03; systolic sphericity index 25.6% vs 18.0%, p= 0.02 .There was no significant difference in LV ejection fraction or LV mass index. Both systolic and diastolic strain values were not significantly different between groups. Global longitudinal strain (-17.4 BAV vs -16.6 TAV, p = 0.44); Peak circumferential strain at Base LV(-26.4 vs -28.0 TAV, p = 0.16); Mid(-25.5 BAV vs -26.4, p = 0.40); Apex(-34.2 BAV vs -34.5, p = 0.86).
Conclusions: Bicuspid aortic stenosis is associated with a more spherical left ventricle than tricuspid aortic valve stenosis; whether this reflects an early adverse change requires further study. There is no difference however, in crude measures of function such as ejection fraction, nor significant differences in strain values. Despite the longer duration of aortic valve disease in the BAV group and altered LV geometry, it appears that the LV adapts well and there are no functional differences compared to a similar group with acquired AS.

1276 (pp08)

Pulse wave velocity measurements by 3T cardiac magnetic resonance – comparison with applanation tonometry

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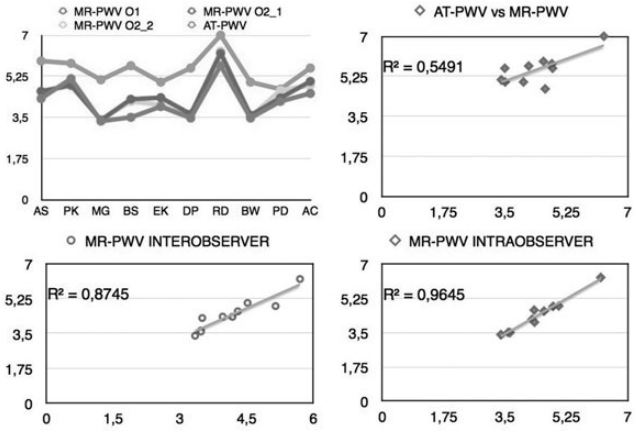
Background: Arterial stiffness is one of the most potent prognostic factors of cardiovascular morbidity and mortality. Its surrogate parameter, pulse wave velocity (PWV), can be assessed by carotid-femoral applanation tonometry (AT), which is currently a gold standard. However, limited availability of the AT equipment prevents its wider application in clinical practice. Cardiac magnetic resonance (CMR) study can include robust arterial stiffness assessment at no extra cost, without significant protocol extension. However, comparison data of these two methods of PWV measurement are limited.
Purpose: To compare AT- and CMR-derived PWV measurements in our initial set of ten consecutive subjects aged 28 $\pm$ 8 (16-44) yrs in whom cardiovascular disease was excluded based on clinical assessment and CMR result.
Methods and results: Ten consecutive subjects underwent CMR as screening for genetic/familial disease. PWV measurements were done with AT by the carotid [C] and femoral [F] applanation pulse wave recording and body surface approximation of the distance travelled (suprasternal notch to [F] - suprasternal notch to [C]), using SphygmoCor, (AtCor Medical, Australia), and with 3T CMR (Philips Achieva 3T TX, Eindhoven, the Netherlands), based on ascending and thoracic aortic flow data and direct aortic length measurements (Segment, Medviso, Sweden). Mean AT-PWV and mean CMR-PWV were 5,54 $\pm$ 0,65 m/s and 4,15 $\pm$ 0,79 m/s, respectively). Good correlation was found between these two methods (R = 0,7; P < 0,05). Interobserver variability of CMR-PWV was very good (R = 0,93; P < 0,05) as was intraobserver variability (R = 0,98; P < 0,05). Determination coefficients [R2] are shown on graphs.
Conclusions: These preliminary results indicate that aortic PWV measurements incorporated in routine 3T CMR examination correlate well with carotid-femoral AT-PWV measurements in individuals without detectable cardiovascular disease. CMR-derived PWV analysis appears to have excellent intraobserver and interobserver variability. Further research is needed in a variety of clinical conditions.



1146 (pp09)

Comparison of magnetic resonance imaging assessment of aortic valve area and severity of stenosis to echocardiogram in patients

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Introduction: In theory, severity of aortic stenosis (AS) are graded based on 3 criteria, which are pressure gradient, blood flow velocity across aortic valve and aortic valve area (AVA). However, in clinical practice, severity of AS is solely based on blood flow velocity determined via transthoracic echocardiogram (TTE). This study aims to compare the aortic valve area (AVA) measured directly from MRI planimetry with those derived from TTE, in order to determine if there is a significant difference between these 2 methods of measuring AVA. The study also aims to find out if the morphology of the valve (bicuspid or trileaflet) affects the difference between the 2 methods of measurement.
Methodology: This is a prospective study, consisting of 45 patients presenting to the Cardiology Department in the Royal Infirmary Edinburgh. The patients are controlled for age, gender, systolic blood pressure, AS severity, end diastolic and systolic volume as well as presence of other comorbidities such as diabetes mellitus, hypertension and coronary artery events. AVA was measured directly from MRI planimetry and compared with TTE derived AVA from equation of continuity, making use of the maximum velocity of blood flow across the aortic valve. Both imaging were done within 2 weeks from each other.
Results: MRI planimetry AVA is found to be significantly larger than TTE derived AVA in 24 BAV patients (p < 0.05, correlation = 0.658). This difference is retained when the 21 trileaflet valve patients are assessed (p < 0.05, correlation = 0.707). Significant difference is noted with the reclassification of AS severity in BAV patients (p = 0.001) but none noted with trileaflets.The results showed that TTE has been consistently overestimating the severity of AS but clinically affects the BAV patients more, in terms of severity reclassification. This could be due to the morphology of the BAV causing a more turbulent blood flow across the valve, resulting in an overestimation of AS severity by TTE.
Conclusion: MRI proves to be a useful, accurate and reproducible tool in cardiac imaging. However, further studies are required to assess its accuracy in comparison to actual area measured post-aortic valve replacement. Accurate measurement of AVA is important to ensure that severity of AS are correctly classified, ensuring that patients are receiving appropriate interventions.

1216 (pp10)

Noninvasive assessment of Aortic incompetence: Flow quantification by CMR using navigator based respiratory motion compensation correlates better with left ventricular enddiastolic volume than echocardiography

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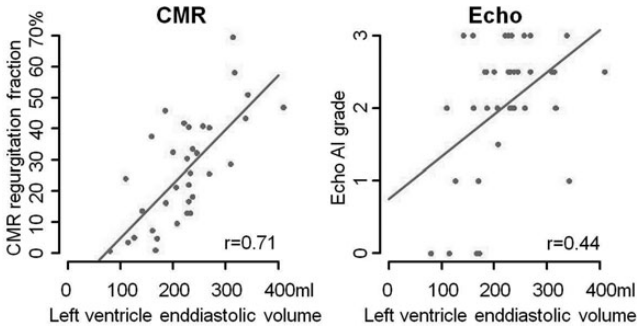
Background: Assessment of aortic incompetence sometimes is challenging. The indication of valve replacement is solely based on imaging, but a clear gold standard is missing since every modality has limitations in certain circumstances. Novel flow quantification using navigator based respiratory motion compensation allows for high temporal resolution without motion artifacts and may improve the quantification of the regurgitation fraction.
Methods: We analyzed 38 patients with various degree of aortic incompetence undergoing both standard echocardiographic assessment and CMR flow quantification using navigator based respiratory motion compensation.
Both modalities were correlated with the left ventricular enddiastolic volume (LVEDDV) assessed by CMR as a surrogate endpoint reflecting left ventricular remodeling caused by the regurgitant blood flow.
Results: Aortic incompetence by Echo ranged from grade 0 to grade 3 (median grade2), regurgitation fraction by CMR ranged from 1% to 70% (median 25%), and LVEDDV ranged from 80 to 409 ml (median 227 ml). Correlation coefficient r for Echo and CMR were 0.44 and 0.71 respectively (both $p < 0.0001$). CMR correlated significantly better with LVEDDV than Echo ($p = 0.02$ for difference).
Conclusion: Flow quantification by CMR using navigator based respiratory motion compensation has a better correlation with pathophysiological changes caused by aortic incompetence than standard assessment by Echo and may serve as an useful additional modality helping to make a desision on valve replacement.



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VENTRICULAR FUNCTION

Friday May 16 | 09:00–13:30 | Group A

1127 (pp11)

Extramedullary hematopoiesis (EMH) is associated with lower cardiac iron loading in regularly polytransfused thalassaemia patients

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Objectives: Extramedullary hematopoiesis (EMH) is an incidental finding in regularly and historically polytransfused thalassaemia patients but no study has evaluated if it is a marker of a peculiar pattern cardiac of iron loading.
Methods: 1266 thalassemia patients (pts) regularly transfused consecutively enrolled in the Myocardial Iron in Thalassemia (MIOT) Network were considered. MRI was used to assess the presence of EMH by SPGR sequences, to quantify cardiac iron overload by a multiecho T2* approach, and to assess cardiac function, volumes, atrial areas and pulmonary diameter by SSFP sequences. Myocardial fibrosis was evaluated by LGE technique.
Results: EMH was detected in 167 pts (13.2%). The Table shows demographic and haematological comparisons between EMH- and EMH+ pts. No significant differences were found in the chelation regimens between the two groups.
EMH+ pts had significant less cardiac iron overload than EMH- pts (13.2 vs 28.3% of pts with global heart T2* < 20 ms; $P = 0.003$) (Figure on the left).
Biventicular volumes, cardiac indexes, ejection fractions, atrial areas and presence of myocardial fibrosis were comparable between the two groups. EMH+ patients had a significantly higher LV mass index (62.3 ± 13.2 vs 58.63 ± 13.19; $P = 0.001$) (Figure on the center) and a significantly higher pulmonary artery diameter (24.7 ± 4.2 vs 23.6 ± 3.8; $P = 0.002$) (Figure on the right). Considering the 482 (38.1%) patients with MRI LIC > 7 mg/g dw, the EMH+ group had a significant lower frequency of global heart T2* < 20 ms (18.4% vs 40.8% $p = 0.007$).
Conclusions: In this large cohort of regularly transfused thalassemia patients, EMH was not rarely observed and was associated to a heart thalassemia intermedia like pattern (reduced cardiac iron loading and stigmata of high cardiac output state) despite the transfusional regimen.

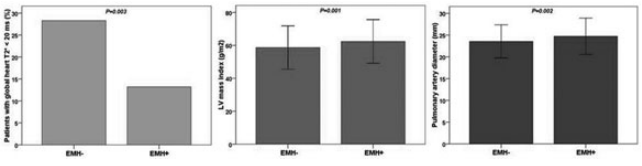

Figure 1:

	EMH- (N=1099)	EMH+ (N=167)	P
Age (yrs)	30.08 ± 8.63	38.93 ± 6.10	<0.0001
Sex (M/F)	520/579	91/76	0.084
Pre-transfusion Hb (g/dl)	9.61 ± 0.72	9.63 ± 0.91	0.900
Age at first transfusion (yrs)	1.52 ± 1.69	2.03 ± 2.05	<0.0001
Regular transfusions starting age (yrs)	1.89 ± 2.52	3.56 ± 6.24	<0.0001
Splenectomy (%)	51.4	73.1	<0.0001
Mean Serum Ferritin (ng/ml)	1562 ± 1476	994 ± 1066	<0.0001
Chelation starting age (yrs)	4.64 ± 3.95	7.71 ± 6.05	<0.0001

1104 (pp12)

Regional Myocardial Contractility In Thalassemia Major By Magnetic Resonance Tagging

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Objectives: Magnetic resonance (MR) tagging analyzed by dedicated tracking algorithms allows very precise measurements of myocardial motion and characterization of regional myocardial function. Our aim was to quantitatively assess for the regional myocardial contractility in thalassemia major (TM) patients and to correlate it with heart iron overload and left ventricular (LV) function.
Methods: Seventy-four TM patients (46 F; 31.8 ± 8.5 yrs) enrolled in the MIOT (Myocardial Iron Overload in Thalassemia) network underwent MR (1.5T). Three short-axis (basal, medial and apical) tagged MR images were analyzed off-line using harmonic phase (HARP) methods (Diagnosoft software) and the circumferential shortening (Ecc) was evaluated for all the 16 myocardial segments. Four main circumferential regions (anterior, septal, inferior, and lateral) were defined. The same axes were acquired by a T2* GRE multiecho technique to assess myocardial iron overload (MIO). LV function parameters were evaluated by cine images.
Results: Segmental ECC values ranged from -9.66 ± 4.17 % (basal anteroseptal segment) to 13.36 ± 4.57 % (mid- anterior segment). No significant circumferential variability was de-tected while a slice-to-slice variability was present (Figure 1).
Compared with previous studied healthy subjects, TM patients showed strain values significantly lower in all the circumferential regions at each level (mean difference from 4 % to 13 %; $P < 0.001$ for all the comparisons) (Table 1). Segmental Ecc values were not significantly correlated with the correspondent T2* values and no correlation was detected considering the global values, averaged over all segmental values. Three groups identified on the basis of cardiac iron distribution: no MIO, heterogenous MIO and homogeneous MIO. The global ECC was comparable among the three groups (-11.56 ± 1.60% vs -11.70 ± 2.43% vs -11.14 ± 1.95%; $P = 0.602$). Global Ecc values were not significantly correlated with age and were comparable between the sexes. Circumferential shortening
Table 1

		Anterior	Septal	Inferior	Lateral
Basal	Healthy	-0.20 ± 0.03	-0.17 ± 0.03	-0.16 ± 0.03	-0.21 ± 0.03
	TM	-0.11 ± 0.04	-0.10 ± 0.03	-0.12 ± 0.04	-0.11 ± 0.03
		Diff = 0.09 P<0.001	Diff = 0.07 P<0.001	Diff = 0.04 P<0.001	Diff = 0.10 P<0.001
Medium	Healthy	-0.23 ± 0.04	-0.16 ± 0.03	-0.16 ± 0.05	-0.22 ± 0.03
	TM	-0.14 ± 0.05	-0.12 ± 0.03	-0.11 ± 0.04	-0.12 ± 0.03
		Diff = 0.09 P<0.001	Diff = 0.04 P<0.001	Diff = 0.05 P<0.001	Diff = 0.10 P<0.001
Apical	Healthy	-0.24 ± 0.06	-0.18 ± 0.03	-0.23 ± 0.04	-0.24 ± 0.04
	TM	-0.12 ± 0.04	-0.13 ± 0.04	-0.12 ± 0.05	-0.11 ± 0.04
		Diff = 0.12 P<0.001	Diff = 0.05 P<0.001	Diff = 0.11 P<0.001	Diff = 0.13 P<0.001

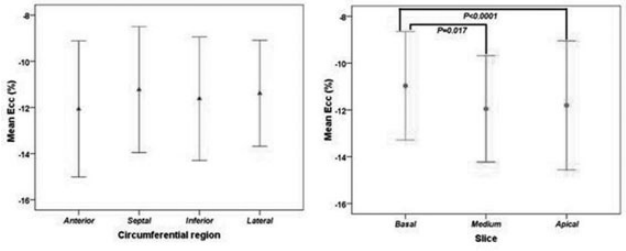

Figure 1:

was not associated to LV volumes and ejection fraction (with a $P > 0.5$ in all the comparisons).
Conclusions: TM patients showed a significantly lower cardiac contractility compared with healthy subjects, but this altered contractility was not related to cardiac iron, volumes and function.

1105 (pp13)
Right ventricular wall motion abnormalities in thalassemia major and intermedia patients

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Objectives: The role of the right ventricle (RV) is gaining ground in thalassemia patients and the magnetic resonance imaging (MRI) is the gold-standard for the study of its anatomy and function. In this study we investigated for the first time the relationship between RV motion abnormalities, volumes and function in both thalassemia major (TM) and thalassemia intermedia (TI) patients.
Methods: CMR was performed in 1369 TM patients (537 males; 30.9 $\pm$ 8.9 years) and 266 TI patients (38.5 $\pm$ 11.5 years) enrolled in the Myocardial Iron Overload in Thalassemia Network. Cine images were acquired to evaluate wall motion and to quantify RV volumes and ejection fraction (EF).
Results: The presence of RV motion abnormalities was comparable between TM and TI patients (3.0% vs 4.5%; $P = 0.201$). Out of the 41 TM patients with abnormal RV motion, 35 were hypokinetic, 5 were dyskinetic and 1 was akynetic. Out of the 12 TI patients with abnormal RV motion, 8 were hypokinetic and 4 were dyskinetic. Table 1 and Table 2 show the comparison between TM patients with normal and abnormal RV motion and between TI patients with normal and abnormal RV motion, respectively. TM patients with abnormal RV motion were older and they were more frequently males. Regarless by the form of thalassemia, right volumes were significantly higher in patients with abnormal RV motion while the EF was significantly lower.
Conclusions: Movement abormalities of the right ventricle are not common in thalassemia and have a comparable frequency between TM and TI patients. In both the forms of thalasemia, movement abormalities of the right ventricle were associated with RV dilation and dysfunction.

Table1. Comparison between TM patients with abnormal and normal RV motion

	Abnormal RV motion	Normal RV motion	P
Age	34.7 ± 5.8	30.9 ± 8.9	0.005
Sex (M/F)	31/10	633/695	<0.0001
RV EDVI (ml/m2)	109.0 ± 45.9	82.7 ± 18.9	<0.0001
RV ESVI (ml/m2)	60.7 ± 28.9	32.1 ± 11.2	<0.0001
RV EF (%)	45.2 ± 10.1	61.5 ± 7.7	<0.0001

Table 2. Comparison between TI patients with abnormal and normal RV motion

	Abnormal RV motion	Normal RV motion	P
Age (years)	41.3 ± 9.2	38.4 ± 11.6	0.307
Sex (M/F)	7/5	128/126	0.591
RV EDVI (ml/m2)	111.6 ± 35.3	83.4 ± 19.2	0.012
RV ESVI (ml/m2)	55.7 ± 32.6	31.5 ± 10.1	<0.0001
RV EF (%)	51.0 ± 14.8	63.9 ± 7.3	0.001

1187 (pp14)
Application of Feature Tracking with Cine Cardiac MR for Semiautomated Prediction of Normal Right Ventricular Systolic Function

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Background: Cardiac Magnetic Resonance Imaging (CMR) has emerged as the gold standard for the evaluation of biventricular systolic function. Semi-automated algorithms for investigating left ventricular function exist but similar methodologies function poorly in the right ventricle (RV) due to its more complex geometry. The purpose of this study was to determine the feasibility of feature tracking using a semi-automated algorithm for assessing the tricuspid annular systolic plane excursion with CMR (MR-TAPSE) compared to TAPSE with transthoracic echocardiography (TTE)(echo-TAPSE) for the prediction of normal RV systolic function.
Methods: IRB-approved retrospective analysis of 64 subjects (43% female, avg 58.7 $\pm$ 19 yrs) referred for CMR who also underwent TTE within 3 months. 4-chamber CMR images were acquired at 1.5T using a breath-held segmented ECG-gated cine steady state free precession sequence (TR/TE 2.8/1.2, 5 segments, in-plane res = 1.5x2.1mm2, 6mm thick). CMR images were analyzed using prototype software evaluating deformation fields to semi-automatically identify and track the tricuspid base plane at the lateral tricuspid insertion. The MR-TAPSE was correlated to CMR-determined RV ejection fraction (RVEF). Echo-TAPSE was obtained and correlated to the RVEF. Differences between MR- and echo-TAPSE were evaluated using a Bland-Altman analysis. RVEF was considered normal if > 40%. ROC analysis was performed to optimize the area under the curve (AUC) for MR-TAPSE prediction of a normal RVEF.
Results: The median RVEF averaged 46% (range 7-69%). Correlation between MR-TAPSE and RVEF ($r = 0.37$, $p = 0.002$) was similar to that between echo-TAPSE and RVEF ($r = 0.41$, $p = 0.004$). Bland-Altman analysis showed good agreement between MR- and echo-TAPSE with a bias of 3.3 $\pm$ 5.7 mm. ROC analysis demonstrated that a MR-TAPSE of $\geq$ 16 mm resulted in an AUC of 0.758 with a sensitivity of 58% and a specificity of 92% ($p = 0.0002$).
Conclusion: MR-TAPSE significantly correlates with RVEF and shows promise for the semi-automated prediction of normal RV systolic function with a high degree of specificity. We are planning a follow-up study validating the MR-TAPSE threshold of $\geq$16 mm in a separate patient cohort.

1208 (pp15)
Analysis of cardiac deformation from MRI: Initial experience of a cine DENSE acquisition at 1.5T compared with feature tracking

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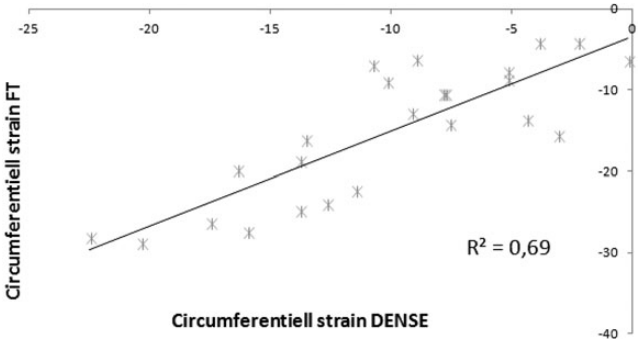
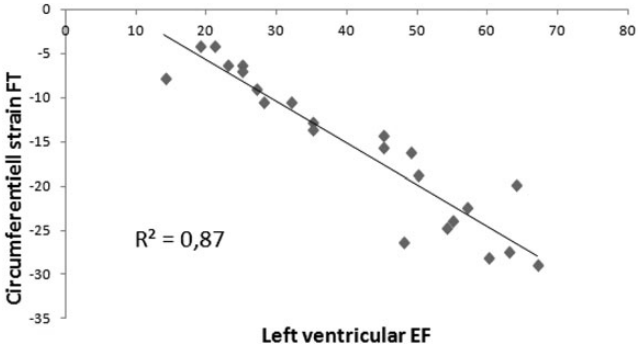
Background: Myocardial deformation can be used for the objective quantification of myocardial contraction. Feature tracking (FT) is a recently introduced technique that uses image processing of cine MRI. DENSE (D), "displacement encoding with stimulated echoes" has high spatial resolution, but was previously available only at a few time points in the cardiac cycle. We applied DENSE to detect peak strain in unselected patients and compared with FT.
Methods: Twenty-four patients were investigated with a Siemens Avanto 1.5T scanner. Mean age of the patients was 51 + /-16 yrs. DENSE was acquired from a midventricular slice as well as cine and scar images. DENSE analysis was performed using "CIM" software, University of Auckland, NZ, and was reported in the circumferential and radial directions. Feature tracking analysis was performed on the corresponding cine slice using commercially available software. Volumes and ejection fraction were obtained with software provided by the vendor.
Results: Mean LV volume was 217 ml, LV mass 165 g and ejection fraction 41%. Image quality was satisfactory in cine allowing FT to be performed in all patients. The DENSE acquisition showed artifacts or fading that negatively affected analysis in 8 of the 24 patients. Circumferential strain D was -10.2% and FT-15.3%, mean difference 5.1 percentage points (pp). Radial strain D was 25.1% and FT 15.8%, mean difference 9.3 pp. Circumferential strain showed a fairly good agreement between D and FT ($R2 = 0.69$, Fig1) while radial strain had low agreement ($R2 = 0.02$) regardless of image quality. In a comparison with ejection fraction as reference, circumferential strain with FT ($R2 = 0.87$, Fig 2) was clearly superior to D ($R2 = 0.61$).
Conclusion: This pilot study in unselected patients referred for cardiac MRI showed that cine DENSE is feasible but needs further refinement in order to lower sensitivity to artifacts. Both DENSE and feature tracking showed low values of radial strain that appear to be lower than expected in light of the status of the patients.





1268 (pp16)

Usefulness of right ventricular trabeculae and papillary muscles on volumes and function assessed by cardiovascular magnetic resonance with a semi-automatic threshold-based segmentation algorithm

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Introduction: The objective of this study was to assess the usefulness of right ventricular (RV) trabeculae and papillary muscles on measured volumes and function assessed by cardiovascular magnetic resonance (CMR) with a novel semi-automatic segmentation algorithm. The new algorithm excludes trabeculae and papillary muscles from the blood pool, while the manual approach includes these objects in the blood pool.
Method: The subject included patients with right heart lesion of the congenital heart diseases. We measured RV end-diastolic volume (RVEDV), end-systolic volume (RVESV), stroke volume (RVSV) and ejection fraction (RVEF) using standard method of manual contour tracing and semi-automatic method. Also, we measured pulmonary artery flow volume (PAFV) as RVSV using phase contrast MR. The MRI imaging was obtained using the Siemens MAGNETOM Sonata 1.5T system. The analyses were performed using a workstation (Medis QMass Enterprise Solution & QFlow).
Results: There was a total of 30 cases (26 tetralogy of Fallow, 2 atrial septal defect with partial anomalous pulmonary venous return, 1 truncus arteriosis and one transposition of the great arteries), with the mean age of 24 +/- 16 years old. Exclusion of trabeculae and papillary muscle in the RV blood volume decreased measured RVEDV by 31 % (from 178 +/- 58 to 122 +/- 65 ml/m^2, $p < 0.01$) compared to inclusion, RVESV by 34 % (from 112 +/- 65 to 74 +/- 44 ml/m^2, $p < 0.01$), RVSV by 23 % (from 61 +/- 27 to 47 +/- 26 ml/m^2, $p < 0.01$) and relatively increased RVEF by 7 % (from 41 +/- 14 to 44 +/- 17 %, $p = 0.01$). RVSV by PAFV (43 +/- 22 ml/m^2) had strong approximation with value measured by semi-automatic method (mean difference = 4.86 ml/m^2, $p = 0.27$) rather than standard method (mean difference = 18.7 ml/m^2, $p < 0.01$). In 22 cases, RVEDV, RVESV and RVSV including trabeculae and papillary muscles on ventriculographies had strong approximation with those measured by standard method rather than semi-automatic method on MRI.
Conclusion: Excluding trabeculae and papillary muscle significantly affect measured RV volumes and function. Semi-automatic threshold-based segmentation software can reliably exclude trabeculae and papillary muscles from the RV blood volume. We highly recommended this novel method for measurement of true right ventricular volumes and function in congenital and acquired heart diseases.

1142 (pp17)

Fast generation of T2* maps in the whole range of clinical interest: application to thalassemia major patients

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Objectives: T2* maps obtained by processing of multiecho MR images are useful in several clinical applications. Fast T2* map generation usually involves the modelling of the signal decay curves as a pure exponential decay, to quickly estimate the T2* value by the linear fitting of the logarithm of the signal. In patients with severe iron overload, where the signal null at later echoes diverging from the pure exponential model, this approach may fail leading to incorrect T2* values. We propose a method for T2* map generation, including automatic background pixels detection and automatic truncation of the curve, to compensate for signal collapse at low T2* values.
Methods: The proposed method (Figure 1) was validated on synthetic images and on 60 thalassemia patients with different levels of myocardial iron overload. As the true value of T2* in patients is unknown, the validation on patients data was conducted by comparing the measurement done with the proposed methodology with the ones performed by a validated software (HIPPO MIOT) that uses a region of interest (ROI)- based approach.
Results: The developed procedure was effective in generating correct T2* maps in the whole T2* range of clinical interest (error below 10%) in a time compatible with on-line image a fully automated myocardial iron uantification.

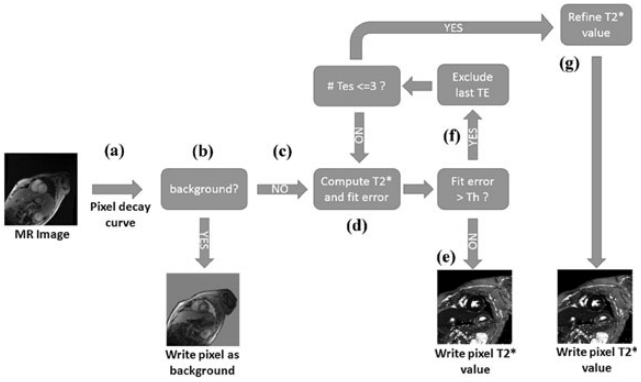

Figure 1: Flow-chart of the map generation algorithm.

Table 1. Performance of the proposed procedure.

Groups	T2* value measurement location		
	Mid Septum	Global	Segmental
Automatic pixel-wise vs manual ROI-based measurements			
Severe MIO	CoV=5.03% (r=0.98, P<0.0001)	CoV=3.37% (r=0.99, P<0.0001)	CoV=6.37% (r=0.98, P<0.0001)
Middle to moderate MIO	CoV=4.32% (r=0.98, P<0.0001)	CoV=3.36% (r=0.98, P<0.0001)	CoV=6.69% (r=0.96, P<0.0001)
No MIO	CoV=2.28% (r=0.99, P<0.0001)	CoV=3.12% (r=0.99, P<0.0001)	CoV=5.85% (r=0.96, P<0.0001)
All patients	CoV=3.29% (r=0.99, P<0.0001)	CoV=3.71% (r=0.99, P<0.0001)	CoV=7.04% (r=0.96, P<0.0001)
Automatic vs manual ROI-based measurements			
Severe MIO	CoV=5.76% (r=0.99, P<0.0001)	CoV=4.13% (r=0.99, P<0.0001)	CoV=6.85% (r=0.96, P<0.001)
Middle to moderate MIO	CoV=3.49% (r=0.98, P<0.0001)	CoV=1.31% (r=0.99, P<0.0001)	CoV=5.40% (r=0.97, P<0.001)
No MIO	CoV=2.96% (r=0.99, P<0.0001)	CoV=1.43% (r=0.99, P<0.0001)	CoV=4.79% (r=0.97, P<0.001)
All patients	CoV=3.77% (r=0.99, P<0.0001)	CoV=1.84% (r=0.99, P<0.0001)	CoV=5.80% (r=0.97, P<0.001)

A good agreement was found between T2* map measurements and ROI-based measurements (Table 1).
In ROI-based analysis, T2* values obtained with manual truncation of decay curve were comparrlable to corresponding T2* values obtained by the proposed automatic procedure (Table 1).
Conclusions: This approach could be easily incorporated into T2* analysis software to spread in the clinical arena the development of of a fully automated myocardial iron quantification.

1108 (pp18)

MRI Survey In Transfusion-Dependent and Non-Transfusion-Dependent MDS Patients

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Objectives: There are few and rather contradictory studies using Magnetic resonance imaging (MRI) in the evaluation of myelodysplastic (MDS) syndromes. We report the baseline MRI findings at the end of the recruitment in the MIOMED (Myocardial Iron Overload in MyElodysplastic Diseases) study. In particular, we investigated myocardial iron overload (MIO), hepatic iron overload and biventricular functional parameters in MDS patients, outlying the differences between transfusion dependent (TD) and non transfusion dependent (non-TD) patients.
Methods: MIOMED is an observational, MRI multicentre study in low and intermediate-1 risk MDS patients who have not received regular iron chelation therapy. 48 patients (71.7 $\pm$ 8.5 years, 17 F) underwent the baseline MRI exam. MIO was assessed using a multislice multiecho T2* approach. Hepatic T2* values were converted into liver iron concentration (LIC).Biventricular function parameters were quantified by cine sequences.
Results: The mean global heart T2* was 38.7 $\pm$ 8.3 ms. Global heart T2* values were not significantly correlated with LIC or serum ferritin levels.
Thirty-two (66.6%) patients were non-TD while 16 patients were TD. The two groups were homogeneous for age, sex and hemoglobin levels but TD patients had significantly higher serum ferritin levels. The percentage of patients with detectable hepatic iron (LIC > 3 mg/g/dw) was significantly higher in the TD group (Fig. 1, left). A significant heart iron (global heart T2* < 20 ms) was found in two patients. One patient was not transfused and he did not show significant hepatic iron while the other one was regularly transfused and he received sporadically chelation treatment with deferoxamine in the 2 years before the MRI. The global heart T2* (Fig. 1, right) and the number of segments with T2* < 20 ms were comparable between the two groups. Biventricular end-diastolic volume index, biventricular ejection fraction and left ventricular mass index were comparable between the two groups.
Conclusions: As expected, regularly transfused MDS patients showed significantly higher levels of hepatic iron overload. MIO is not frequent in MDS patients and it is not correlated with LIC and serum ferritin levels. Conversely, MIO can be present also in non-TD

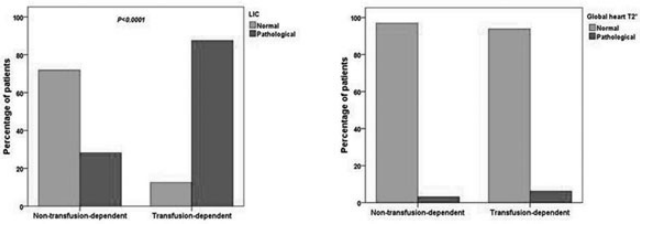

Figure 1:

patients and in absence of detectable hepatic iron. These data remark the importance to check directly for heart iron avoiding to estimate heart iron burden from indirect indicators such as LIC, serum ferritin or transfusion state.

1119 (pp19)

Left Ventricular Global Function Index: Relation with Infarct Characteristics and Left Ventricular Ejection Fraction after ST-Segment Elevation Myocardial Infarction

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Objectives: The left ventricular global function index (LVGFI) is a novel indicator of cardiac performance. In healthy individuals, decreased values are strongly associated with adverse cardiovascular events. Its role in patients after acute myocardial infarction is unknown. We sought to investigate the relationship between the LVGFI and infarct characteristics as well as left ventricular ejection fraction in patients after acute ST-segment elevation myocardial infarction (STEMI).
Materials and methods: 226 patients with first STEMI (mean age 57 $\pm$ 11 years) were enrolled in this observational study. All patients underwent cardiac magnetic resonance (CMR) imaging within the first week after STEMI. Infarct characteristics were determined with the use of late gadolinium enhanced images. Left ventricular dimensions and function were measured by cine true-FISP sequences.
Results: The mean LVGFI was 32 $\pm$ 8 %. Female patients displayed a higher LVGFI than male patients ($p = 0.032$). LVGFI was inversely related with peak creatine kinase ($r = -0.46$), peak cardiac troponin T ($r = -0.45$) and CMR-determined infarct size ($r = -0.42$, all $p < 0.001$). Significantly decreased LVGFI values were also observed in patients with microvascular obstruction and anterior STEMI (all $p < 0.001$). In addition, there was a strong correlation between LVGFI and left ventricular ejection fraction ($r = 0.91$, $p < 0.001$).
Conclusion: This study demonstrates that the LVGFI is strongly associated with infarct characteristics and left ventricular ejection fraction in patients after acute STEMI. LVGFI might be a useful functional parameter of the left ventricle, but its definitive role as a prognostic marker needs to be determined in large outcome trials.

1139 (pp20)

Effect of splenectomy on cardiac iron and function in different transfusion-dependent patients

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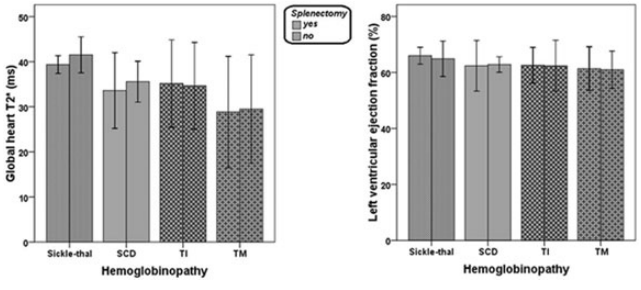
Objectives: The main therapeutic rationale for splenectomy in transfusion-dependent patients with hemoglobinopathies is to decrease blood consumption and transfusion requirement. However, since the spleen is a large physiologic iron depot, splenectomy may have a possible role of in determining extrahepatic iron overload.
This study aimed to observe retrospectively the effect of splenectomy on cardiac iron and function in different groups of transfusion-dependent patients.
Methods: 1735 transfusion-dependent patients enrolled in the Myocardial Iron Overload in Thalassemia (MIOT) Network were considered. 14 patients had sickle-thalassemia, 23 patients had sickle-cell disease (SCD), 179 had thalassemia intermedia (TI) and 1519 had thalassemia major (TM). Cardiac iron was assessed using a multislice multiecho T2* approach. Left ventricular ejection fraction (LV EF) was quantified by cine sequences.
Results: The frequency of splenectomy was: 21.4% in sickle-thalassemia, 65.2% in SCD, 84.9% in TI and 55.1% in TM ($P < 0.0001$). Splenectomized TM patients were older than non-splenectomized patients (34.3 $\pm$ 7.9 yrs vs 27.2 $\pm$ 7.8 yrs; $P < 0.0001$). In each hemoglobinopathy, cardiac T2* and LV EF were comparable between splenectomised and non-splenectomized patients (Figure).
Conclusions: Regardless by the type of hemoglobinopathy, in regularly transfused patients splenectomy was not associated with increased cardiac iron and reduced cardiac function.



1141 (pp21)

Left ventricular global function Index by CMR is more strongly associated to different patterns of myocardial iron overload than the global systolic function

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Objectives: The Cardiovascular Magnetic Resonance by the multislice multiecho T2* technique allows to detect different patterns of myocardial iron overload (MIO). Moreover, the analysis of cine images allows the quantification of the left ventricular global function index (LVGFI) that combines the LV SV, endsystolic and end- diastolic volumes, as well as LV mass. A LVGFI <37% was shown to be strongly predictive of cardiovascular events. We aimed to verify the association between different patterns of MIO and the LVGFI vs the LV ejection fraction (EF) in thalassemia major (TM) patients.
Methods: We considered 812 TM patients (391 M, 30.4 8.6 years), consecutively enrolled in the Myocardial Iron Overload in Thalassemia (MIOT) network. The T2* value in all the 16 cardiac segments was evaluated. LVGFI and LVEF were quantitatively evaluated by SSFP cine images. Heart dysfunction was diagnosed in presence of LVEF < 2 standard deviations (SD) from the mean value normalized to age and gender.
Results: We identified 4 groups of patients: 138 with homogeneous MIO (all segments with T2* < 20 ms), 97 with heterogeneous MIO (some segments with T2* < 20 ms, others with T2* > 20 ms) and significant global heart iron (global heart T2* < 20 ms), 238 with heterogeneous MIO and no significant global heart iron, and 339 with no MIO (all segments with T2* > 20 ms).
The mean LVFGI was significantly different among the 4 groups (Figure 1).
Compared to the group with no MIO, all the other 3 groups were significantly more likely to have a LVGFI <37%, conversely, only the groups with homogeneous MIO and with heterogeneous MIO and significant global heart iron showed a significant higher risk to have LV dysfunction. For all groups the association between different patterns of MIO with a LVGFI <37%, was stronger than the association with a LV dysfunction (Figure 2). Conclusions: LVGFI is a functional parameter integrating structural as well as mechanical behaviour stronger associated to different patterns of MIO than the LVEF. Thus, a LVGFI < 37% could better identify a significant higher risk of adverse cardiovascular events beyond heart failure in iron loaded patients.

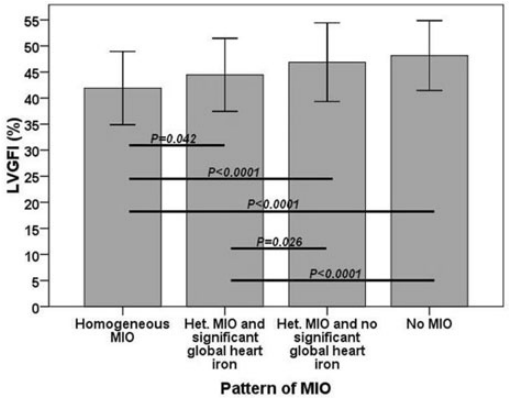

Figure 1:

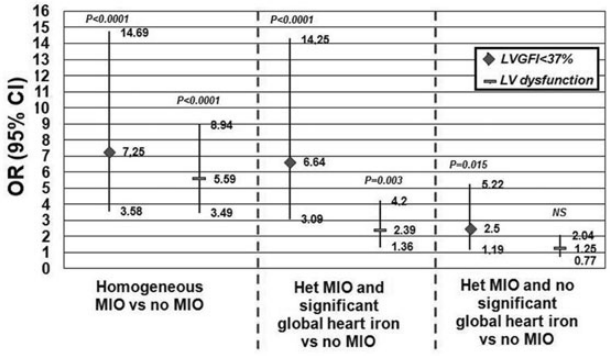

Figure 2:

1149 (pp22)

Accuracy and Reproducibility of RV Volumes and Systolic Function Measurements by CMR using Short-Axis and Long-Axis Four-Chamber views

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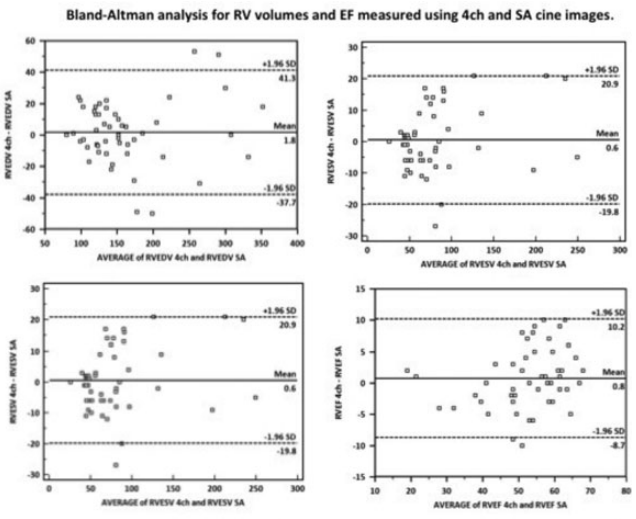
Background: Cardiac magnetic resonance (CMR) is the reference standard for right ventricular (RV) volume and function assessment. A stack of short-axis slices (SA) is routinely used to measure RV volumes but basal slice selection is challenging due to tricuspid

annular plane excursion. Long-axis views offer a clearer view of the tricuspid and pulmonary valve planes, eliminating the need for cross-referencing; yet, there is a significant partial-volume variability due to large areas of tangential subendocardial borders not perpendicilar to the plane. We evaluated the agreement between SA and parallel long-axis slices in a 4-chamber orientation (4ch) for measurements of RV volumes and function.
Methods: RV end-diastolic (EDV) and end-systolic (ESV) volumes were measured with the method of discs, tracing the RV endocardium on stacks of cine CMR slices (8 mm, no gap) in SA and 4ch orientation in consecutive patients referred for clinical CMR. Intra and interobserver agreement was assessed between 2 experienced readers.
Results: Images from 50 patients (mean age 55.8 years, 36% female) were analysed. Less slices were acquired in 4ch (median 14, interquartile range 13-15) than in SA (14, 14-15, $p = 0.01$), and there was a trend toward tracing less slices in 4ch than in SA (11, 10-12 vs. 12, 10-13, $p = 0.057$). By Bland-Altman analysis, mean differences between RV volumes and ejection fraction (EF) were small but limits of agreement were wide (table and figure). No evidence of fixed or proportional bias between 4ch and SA measurements was found by linear regression analysis. Reclassification analysis was done for RV dilatation (EDV $>$ or equal to 110 mL/m^2 for males and $>$ or equal to100 mL/m^2 in females) and dysfunction (RVEF $<$ 45%). Using 4ch instead of SA changed the RV dilatation category for 3 patients (6%) and the RV dysfunction category for 2 patients (4%). Interobserver differences were smaller in SA for EDV ($p = 0.001$) and ESV ($p = 0.03$) but there was no significant interobserver difference in EF ($p = 0.1$). Intraobserver agreement was better in SA for EDV (concordance correlation coefficient $Cb = 0.99$) and EF ($Cb = 0.86$) but was better in 4ch for ESV ($Cb = 0.97$).
Conclusions: Parallel long axis views in a 4-chamber view orientation) provide similar results for RV volumes and function; yet SA has a better intra and interobserver agreement although with large limits of agreement.



	Mean difference	Limits of agreement
RVEDV	1.8 mL	-37.7 – 41.3 mL
RVESV	0.6 mL	-19.8 – 20.9 mL
RVSV	2.1 mL	-28.6 – 32.9 mL
RVEF	0.8 %	-8.7 – 10.2 %
Indexed RVEDV	1.0 mL/m^2	-17.8 – 19.9 mL/m^2
Indexed RVESV	0.2 mL/m^2	-10.3 – 10.8 mL/m^2

1154 (pp23)
A novel ultra fast CMR approach for the assessment of left ventricular volumes and function in one breath-hold

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Background: CMR is generally accepted as the gold standard for left ventricular (LV) volumes and function assessment. However, conventional cine imaging requires several breath-holds to cover the entire LV during 10-15 min. Compressed Sensing (CS) emerged as a means to accelerate data acquisition.
Purpose: to compare a novel prototype CS single breath-hold, multi-slice cine technique with the standard multi-breath-hold technique for the assessment of LV volumes and function.
Materials and methods: Twelve volunteers (75% male, age 33 $\pm$ 8y) and 21 patients (86% male, age 63 $\pm$ 14y) were included in the study. The novel prototype single breath-hold multi-slice CS cine sequence was implemented on a 1.5T MAGNETOM Aera (Siemens) MR System. Three long-axis and 4 short-axis slices were acquired in a single breath-hold of 14 heart beats (temporal/spatial resolution: 30ms/1.5 x 1.5mm2, acceleration factor: 11.0) (Fig.1A). The CS cine data were analyzed by the Argus 4DVF software (Siemens) which is based on a 3D LV-model that takes the motion of the mitral valve plane into account (Fig.1B). For gold standard comparison, a conventional stack of cine SSFP images was acquired (temporal/spatial resolution 40ms/1.2 x 1.6mm 2, slice thickness/gap: 8mm/2mm) and analyzed by the Argus VF software (Siemens). As a reference for the LV stroke volume (LVSV), the aortic flow (AoFlow) was measured by a phase-contrast acquisition (temporal/spatial resolution 40ms/1.8 x 1.8mm2) in 16 subjects (volunteers and patients without mitral insufficiency on echocardiography). The image quality of the CS acquisitions and the intra- and inter-observer reproducibility were assessed.
Results: The CS acquisition was more accurate than conventional approach for LVSV quantification: LVSV overestimation vs AoFlow was 6.4 $\pm$ 6.9ml with CS vs 14.1 $\pm$ 11.2ml with the standard approach ($p = 0.025$) with less variability ($r = 0.91$ vs $r = 0.79$, respectively, Fig.2).The CS acquisitions showed an excellent image quality in 94% of the subjects and maintained quantitative accuracy in LV systolic function (CS-LVEF = 48.5 $\pm$ 15.9% vs standard LVEF = 49.8 $\pm$ 15.8%, $p = 0.11$) with excellent correlation ($r = 0.96$, slope $= 0.97$, $p < 0.00001$). The intra-/inter-observer agreement for all CS parameters was good (slopes: 0.93-1.06, r: 0.90-0.99).
Conclusions: Accurate and reproducible measurements of LV volumes and function can be obtained in "one breath-hold" using this novel prototype multi-slice CS cine sequence with significant reduction of the scan time and potential clinical application.

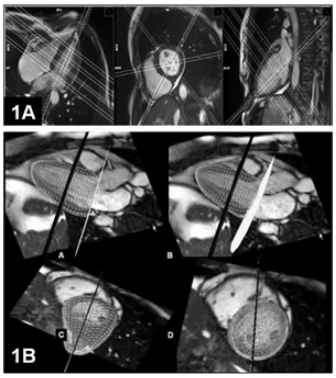

Figure 1: A: Planning of slice position (3 long-axis and 4 short-axis) on the localizers and acquisition in one breath-hold. B: Representative frames of the 3D-cine loop (generated by the Argus 4DVF software, Siemens).

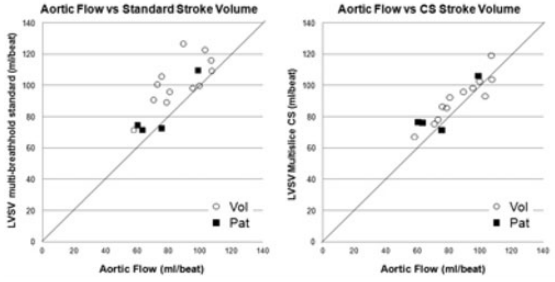

Figure 2: Comparison of single-breathhold CS and standard multi-breathhold CMR for quantification of LVSV (linear regression analysis).

1202 (pp24)
Potential value of cardiac magnetic resonance obtained long-axis right ventricular displacement in the evaluation of patients with pulmonary arterial hypertension

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Purpose: Echocardiographically obtained tricuspid annular plane systolic excursion (echo-TAPSE) is an established non invasive parameter for the evaluation of right ventricular (RV) function in patients with pulmonary arterial hypertension (PAH). There is, however, scarce data on the use of cardiac magnetic resonance (CMR) in the assessment of PAH patients. The aim of our study is to reveal the potential value of CMR in the evaluation of RV dysfunction as expressed by long-axis RV displacement (CMR-TAPSE).
Methods: All patients underwent CMR (Avanto Siemens 1,5T) for the determination of CMR-TAPSE (4chamber view), left ventricular eccentricity index in end-systole (LVSei) and end-diastole (LVDei), interventricular septal curvature ratio (CR) and curvature duration index (CDi, duration of septal curvature configuration x 100 / cardiac cycle duration) (short-axis view), as well as echocardiography for the assessment of echo-TAPSE.
Results: Our study included 16 patients (12 women, mean age 46.3 $\pm$ 12.5 years) with PAH. A direct linear correlation between CMR-TAPSE and echo-TAPSE ($r = 0.625$, $p =$

0.01), CR (r = 0.509 p < 0.05), CDi (r = -0.680 p = 0.004), LVSei (r = -0.732 p = 0.002) and LVDei (r = -0.625 p = 0.01) was observed.
Conclusions: CMR is a useful tool for the non invasive and reproducible evaluation of RV function and pressure overload of PAH patients.

1220 (pp25)
The Diagnostic Value and Safety of Cardiovascular Magnetic Resonance Imaging in Patients with Cardiac Rhythm Devices

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Bristol Heart Institute, Bristol NIHR Cardiovascular Biomedical Research Unit (BRU), Bristol, United Kingdom

Background: Cardiovascular magnetic resonance (CMR) examinations in patients with cardiac rhythm devices are increasingly required in daily clinical practice. Conventional pacemakers and implantable cardioverter-defibrillators (ICD) have always been regarded as a contraindication to magnetic resonance (MR) imaging. However the introduction of MR-conditional systems have significantly improved access to MR examinations. Despite solution of this problem device related artefact remains a significant issue in CMR studies.
Objectives: The aim of this study was to investigate diagnostic accuracy and safety of CMR imaging in patients with MR-conditional pacemakers and implantable loop recorders (ILR).
Methods: Between June 2012 to January 2014 we identified 28 consecutive patients with cardiac rhythm devices who were referred for a CMR examination in our tertiary cardiothoracic centre . All devices were interrogated and reprogrammed pre-CMR and post-CMR to minimize interference with the electromagnetic fields. All scans were performed on 1.5 Tesla scanner.
Results: Among the 28 patients with cardiac devices undergoing a CMR, 11(39%) had pacemakers and 17(61%) ILR . All devices scanned were left sided implants. All pacemakers scanned were MR conditional. In the post-CMR interrogation, there were no significant changes of pacing capture threshold, lead impedance and battery life noted immediately or 3 months after the CMR. 12(43%) patients had stress perfusion study, 16 (57%) was a cardiomyopathy scan. Artefact due to the cardiac device was identified in 17/28 (61%) of the scans, and no artefacts in 11 patients. Artefacts were then categorized in minor artefacts (n = 15) and major artefacts (n = 2), the latter group providing major limitation to the diagnostic accuracy of the CMR scan. Among the 15 devices providing minor artefacts, n = 2 were pacemakers vs n = 13 ILR (p < 0.001). Of those 2 providing major artefact 1 was a pacemaker and 1 was a ILR. Of the devices no causing artefacts (n = 11), 8 were pacemakers and 3 ILR. Overall most common image sequence affected by artefact were cine thereby causing inaccurate volume assessment.
Conclusions: CMR can be performed safely in patients with ILR and MR conditional pacemakers with strictly defined cardiologic and radiologic protocols and monitoring. Most of the devices can cause artefacts but causing minor interference with the diagnostic accuracy of the CMR scan.

1249 (pp26)
Pericardial Constriction Following Coronary Artery Bypass Grafting: A Magnetic Resonance Study

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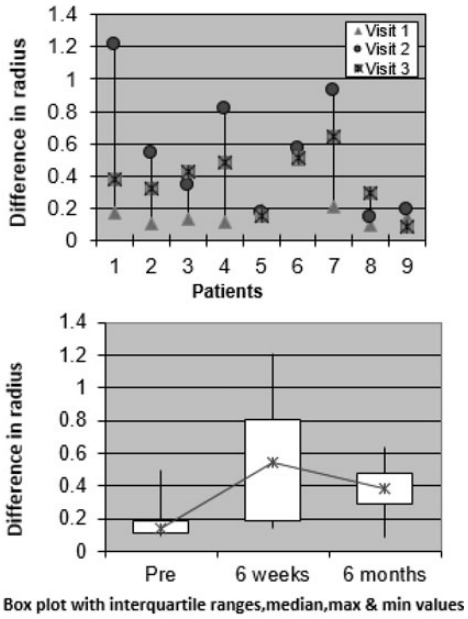
Royal Devon & Exeter Hospital, University of Exeter Medical School, Derriford Cardiothoracic Centre, Musgrove Park Hospital Taunton

Background: Constrictive Pericarditis is a rare but serious complication following Coronary Artery Bypass Grafting (CABG). There are certain characteristics of pericardial constriction which can be identified by Cardiovascular Magnetic Resonance (CMR). These have been studied in a population known or clinically suspected of having pericardial constriction.However, few data are available with regard to CMR features of constrictive physiology (CP) in asymptomatic post CABG patients.It is clinically important to determine the degree to which CMR features of CP is a normal finding post CABG, when considering further intervention on symptomatic patients based on the CMR images.Therefore, the purpose of this study was to investigate the incidence and clinical course of CP observed on post-operative CMR examination in patients who had undergone isolated CABG surgery.
Methods: Patients underwent CMR imaging at baseline,6 weeks and 6 months post CABG. On free breathing short-axis cine MR images, septal motion was assessed, and the septal and left ventricular free wall (LVFW) radii of curvature were quantified and normalized to end systole. Abnormal diastolic septal motion was expressed in terms of the largest difference in normalized radius between the septum and the LVFW. For morphologic evaluation of the pericardium,spin-echo and gradient-echo MR images were analyzed.The pericardial thickness was measured at the atrio-ventricular grooves, the inter-ventricular grooves and along the free wall of the ventricles.
Results: 9 patients were studied. No significant pericardial thickening or pericardial effusion was seen in any of the study patients.Significant septal flattening was noticed in 3 (33%) of the 9 patients on their 6 week post CABG scan (Figure 1).The maximal difference in normalised radius of curvature between the septum and LVFW on the 6 week post CABG scan was significantly higher (Mean 0.54 cm,Standard deviation 0.38, 95% confidence intervals 0.29 -0.79, p < 0.02) as compared to baseline (Mean 0.18 cm, SD 0.13, 95% CI 0.1 - 0.26).The 6 month follow up scan showed a downward trend (Mean 0.36cm,SD 0.18,95% CI 0.24 - 0.48) (Figure 2).
Conclusions: Constrictive physiology as demonstrated by abnormal diastolic septal motion is a frequent phenomenon post CABG in asymptomatic patients. However, the majority of the changes resolves by 6 months without progressing to clinically symptomatic constrictive pericarditis.



Box plot with interquartile ranges,median,max & min values

1250 (pp27)
Cardiovascular magnetic resonance is useful in the assessment of the acute cardiovascular effect of static exercise

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Background: The acute effect of static exercise on the global dynamics of the cardiovascular system is poorly understood. The use of cardiovascular magnetic resonance may be useful for evaluating this effect.
Methods: A total of 12 healthy individuals (10 men, mean age 36 ± 10 years) underwent cardiovascular magnetic resonance at rest and while performing a maximal sustained static exercise (weight elevation with both legs). We analyzed the effects on left and right ventricular function, on ascending aorta dynamics, and on venous return using standard cine and phase-contrast sequences.
Results: The analysis of left ventricular and right ventricular function was feasible in all participants, whereas aortic and superior vena cava flow analysis was feasible in 11 of the 12 participants. We observed an excellent reproducibility in the measurements of the images obtained at rest as well as during static exercise (R coefficient between 0.77-0.99 for the different measurements).
During exercise, we observed reduced left (-35 ± 8%, p < 0.001) and right (-44 ± 9%, p < 0.001) ventricles end-diastolic volumes, reduced left (-35 ± 16%, p < 0.001) and right (-43 ± 8%, p < 0.001) ventricles end-systolic volumes (both with a significant greater reduction in the right ventricle), a reduced superior vena cava cross-sectional area (-20 ± 17 %, p = 0.003), and increased left ventricle wall thickness. We calculated an increase in left ventricle contractility, without any significant increase in left ventricle wall stress. There were no significant changes in the left and right ventricles ejection fraction. During exercise, we noted a tendency toward decreased aortic distensibility and a reduction of ascending aorta systolic expansion.
Conclusions: In healthy individuals, an acute maximum static exercise produced a decreases in the left ventricle, right ventricle, and superior vena cava volumes, and signs of increased aortic stiffness without increasing left ventricular wall stress.
Cardiovascular magnetic resonance is feasible and useful in evaluating the hemodynamic effects of static exercise.

1155 (pp28)
A comparison between Left Ventricular Non-Compaction Disease and Hypertrabeculated Left Ventricle in β -Thalassemia Major

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Aims and objectives: To test the diagnostic accuracy of cardiovascular magnetic resonance (CMR) imaging in differentiating left ventricle non-compaction (LVNC) disease from hypertrabeculated LV of β -thalassemia major (β -TM). CMR is used to differentiate LVNC from other pathological and physiological conditions characterized by prominent LV trabeculae but β -TM, in whom hypertrabeculated LV has also been described, has not been considered so far as a potential differential diagnosis.
Methods & materials: We retrospectively analyzed CMR cine images of 10 patients with previously diagnosed LVNC and 38 patients with β -TM. Two CMR diagnostic criteria were applied at end-diastole: a ratio of non-compacted to compacted myocardium (NC/C ratio) >2.5 at a segmental level and a percentage of trabeculated LV mass >20% of global LV mass.

Results: Fifty percent of β -TM patients had at least 1 positive NC/C segment. Although areas of non-compaction defined by the NC/C ratio were less frequent in β -TM than in LVNC patients (7% vs. 37% of overall myocardial segments, P<0.0001), they had similar distribution within the LV (predominant at the apex and postero-lateral wall, uncommon at the septum) which precluded differential diagnosis. A NC/C ratio of >2.5 showed low specificity (58%) to distinguish LVNC from β -TM whereas a trabeculated LV mass >20% was more accurate (sensitivity 100%, specificity 87%). Best specificity (92%) was obtained with a trabeculated LV mass percentage of >26%.
Conclusions: Differentiation of LVNC from β -TM patients may depend on the selected CMR criterion. In this study population, percentage of trabeculated LV mass showed to be better than NC/C ratio.

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HEART FAILURE

Friday May 16 | 14:30—18:50 | Group B

1117 (pp29)
Association of Aortic Pulse Wave Velocity with NT-pro-BNP levels 12 Months after acute STEMI

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Objectives: We have previously shown that aortic pulse wave velocity (PWV) is associated with biomarkers of myocardial wall stress measured 4 months after acute STEMI. We speculated that vascular-ventricular coupling might be responsible for these results. In the present study, we prospectively investigated the relationship of increased aortic stiffness with N-terminal pro-B-type natriuretic peptide (NT-pro-BNP) levels 12 months after STEMI.
Materials and methods: 50 STEMI patients who were treated with primary coronary angioplasty underwent cardiovascular magnetic resonance (CMR) at baseline and at 12-month follow-up. Aortic PWV was determined by velocity-encoded, phase-contrast CMR. Blood samples were routinely drawn at baseline and follow-up to determine NT-proBNP levels. PWV and NT-pro-BNP levels were log-transformed for correlation analysis to achieve normal distribution.
Results: The mean age of the study population was 57 ± 12 years and median baseline PWV was 7.0 m/s (IQR: 5.8—8.4). After 12 months mean infarct size was 11 ± 6 % of left ventricular mass and mean ejection fraction was 53 ± 11 %. The median NT-proBNP level after 12 months was 169 ng/L (IQR: 97—335). In univariate analysis NT-pro-BNP levels after 12 months correlated with PWV (r: 0.415, p = 0.003), age (r: 0.427, p = 0.002), end-systolic volume (r: 0.291, p = 0.040) and infarct size (r: 0.460, p = 0.001). After multivariate analysis PWV remained an independent predictor of NT-pro-BNP levels 12 months after STEMI (model: r: 0.742, p < 0.001).
Conclusion: Aortic stiffness, as determined by PWV, is associated with NT-pro-BNP levels 12 months after reperfused STEMI. This association remains significant after correction for infarct size, age and end-systolic volume. Our data suggests a role for aortic stiffness in chronic left ventricular remodeling after STEMI.

1171 (pp30)
The right heart in HFpEF, insights from a cardiac magnetic resonance study

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Medical University of Vienna, Department of Internal Medicine II, Division of Cardiology

Background: Cardiovascular magnetic resonance imaging (CMR) is the gold-standard technique for the assessment of right ventricular function. Recent data indicate that right ventricular ejection fraction (RVEF) <45% by CMR is a strong predictor of outcome in patients with dilated cardiomyopathy. However, the prognostic significance of RVEF in heart failure with preserved ejection fraction (HFpEF) is unknown.
Methods and results: Between December 2010 and September 2013 we prospectively enrolled 105 HFpEF patients. At baseline, all patients underwent CMR imaging in addition to invasive and non-invasive testing. Right ventricular systolic dysfunction (RVSD), defined by RV ejection fraction <45%, was present in 27 (25.71%) patients.
Patients were followed for 434 ± 325 days, during which 31 had a cardiac event (hospitalization for heart failure and/or death for cardiac reason).
By univariate Cox analysis RVSD (p = 0.007), NYHA functional class (p = 0.006), 6-minute-walking-distance (p < 0.001), diabetes (p < 0.001), and invasively measured systolic (p < 0.001) and mean pulmonary artery pressures (p < 0.001) were significantly associated with outcome. By multivariable analysis only RVSD (HR 4.852, CI 1.97 - 11.92, p = 0.001) and diabetes (HR 3.99, CI 1.65 - 9.65 p= 0.002) remained significant predictors of cardiac events. In addition, patients with RVSD presented with significantly higher resting heart rate (p= 0.022), more advanced NYHA functional class (p= 0.016) and shorter 6-minute-walking-distance (t-test p= 0.016). By Kaplan Meier analysis, outcome was significantly worse in patients with RVSD (log rank, p = 0.0052).
Conclusions: Although HFpEF is considered a disease of the left ventricle, respective parameters are not related with outcome. In contrast, RVSD has a significant impact on outcome and clinical status in HFpEF patients. Assessment of RVSD by CMR is important for risk-stratification in this patient population.

1173 (pp31)
Massive pulmonary embolism refractory to anticoagulant therapy - CMR revealed pulmonary artery sarcoma

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Background: An 81 years old male patient presented to the Emergency department because of progressive dyspnea on exertion. The complaints had been going on for several weeks but had aggravated on the day of his visit. Clinical examination and chest X-ray were not conclusive. As d-dimer value was elevated the patient underwent computed tomography that showed massive pulmonary embolism (PE) with thrombus formation in the main pulmonary artery (PA) protruding into the left PA. The patient was put on an oral anticoagulant and discharged after clinical improvement. During work up for a possible underlying disease that might have caused the thromboembolic event he finally underwent a FDG-PET scan which showed a hypermetabolic mass in the PA and also in the left parahilar region. Subsequently, the patient was referred to cardiac MRI for further evaluation.
Methods: The exam was performed with a 1.5T Philips, Achieva scanner. The scan protocol contained the following sequences: SSFP cines, cine with tagging, TSE T1 and T2 weighted with/without fat saturation, perfusion study and late enhancement after administration of Gadoteridol.
Findings.: In the cine studies we found a large formation of a polycyclic configurated mass that adhered to the wall of the main PA and partially reached into the left PA. Large parts of this structure were also quite mobile. The size of the mass had not significantly changed since the first CT scan had been performed and anticoagulation had been installed (8 weeks before the MRI). Representing the hypermetabolic spot that was described as located "hilar" in the PET we found another intravascular mass at the bifurcation of the left PA. In T1 weighted images the structure was isointens to the myocardium whereas T2 weighted images signal intensity was hyperintens, even more pronounced with fat saturation. During the perfusion study the mass showed only slow uptake of contrast media. Post-contrast the mass showed a heterogenous late enhancement. The tagging sequence found no certain infiltration of the vascular wall. MRI findings were consistent with a non-thrombotic rather neoplastic mass suspicious of malignancy and surgical removal of the mass after exclusion of a primary extracardiac tumor was recommended. Histopathology revealed an undifferentiated sarcoma.
Conclusions: Pulmonary artery malignancy might mimick pulmonary embolism and CMR is a useful tool to further elucidate the diagnosis and to plan the surgical procedure.

1230 (pp32)
Development of a three-dimensional simulator for surgical planning of left ventricular reconstruction

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Introduction: The surgical reconstruction of the left ventricle (LV) is an effective therapeutic strategy to reduce the LV volume and compensate for LV remodeling secondary to myocardial infarction. Its implementation and outcome are dependent on the specific anatomy of the LV to be treated. While anatomical features can be assessed pre-operatively based on cardiac imaging, no tool is available to quantify in advance the post-operative LV shape, volume and function.
Aim: Developing and preliminarily testing a computational model of the left ventricle (LV) allowing for virtually implementing LV reconstruction procedures, and for predicting their effects on a patient-specific basis and almost in real-time.
Methods: In home software and graphical user interface were developed in Matlab (The Mathworks, Inc.), which allow for:
i. manual detection of LV endocardial and epicardial contours on cardiac magnetic resonance (CMR) cine- sequences (either short- or long-axis);
ii. automatically generating the LV 3D geometry;
iii. quantifying LV volume, shape, local wall thickness; and curvature;
iv. virtually navigating the LV;
v. virtually positioning a sizer in the LV cavity, resecting myocardial tissue, inserting a Dacron patch, and suturing;
vi. computing the associated post-operative LV geometry and function through a mass-spring model, which accounts for the non-linear, anisotropic and almost incompressible mechanical properties of passive myocardial tissue.

The potential of the software was preliminarily tested on three retrospectively selected patients, for whom short-axis cine-CMR sequences were available. Tests were run to assess robustness, usability, and time-efficiency of the software, as well as to qualitatively judge the realism of the computed post-operative LV function.
Results: The software allowed for easily combining resection, plication, and Dacron insertion. Even when complex procedures were simulated, the code was robust and time-efficient; the computation of the post-operative LV configuration required approximately 2 min. In all tests, the post-operative LV shape resembled the one of the sizer positioned into the LV.
Conclusions: Preliminary results are encouraging and provide the basis for subsequent quantitative tests aimed at validating our model through the analysis of ad hoc prospectively enrolled patients, and of in vitro phantoms.

1243 (pp33)
Non-contrast myocardial T1 mapping in pulmonary hypertension: Correlations with cardiac function and right heart hemodynamics

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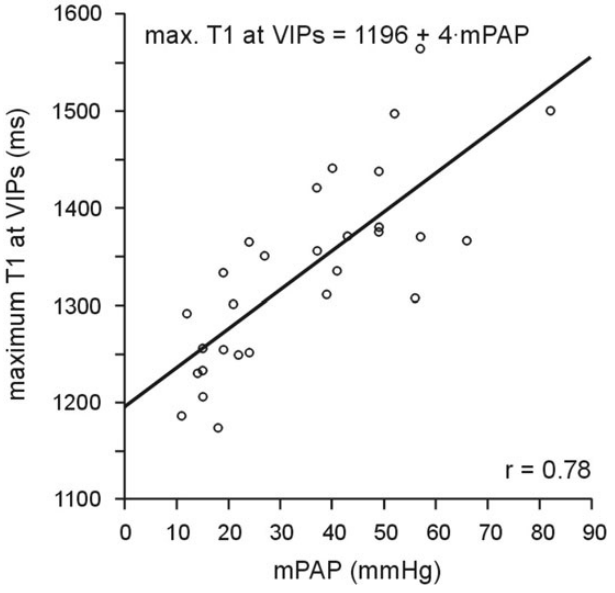
Objectives: Extent of disarrayed myocardium and myocardial fibrosis at the ventricular insertion points (VIP) and interventricular septum has been identified as marker for progression of pulmonary hypertension (PH). As non-contrast T1 relaxation times increase with myocardial collagen volume content, we hypothesized, that T1 maps could depict myocardial alterations in PH patients. Aim of the present study was to assess myocardial and VIP T1 times in patients with normal and elevated mean pulmonary pressure (mPAP) to investigate their correlations with cardiac function, mass and right heart hemodynamic parameters.
Methods: 29 consecutive patients with suspected or known PH (mean mPAP, 36 $\pm$ 20 mmHg; range, 11-82 mmHg) were referred to non-contrast cardiac magnetic resonance imaging at 3T 1 $\pm$ 2 days to right heart catheter. Left (LV) and right ventricular (RV) function and mass were derived from cine real-time imaging. A prototype modified Look-Locker inversion recovery sequence was used to acquire myocardial T1 maps in basal, mid-ventricular and apical short axes images in systole. Ventricular T1 times were evaluated by manual segmentation of RV and LV myocardium. VIP T1 times were defined as maximum T1 time in the VIPs. Myocardial and VIP T1 values for PH and non-PH subjects were compared by t-test, relationship between T1 values and functional as well as hemodynamic parameters were analyzed by correlation analysis.
Results: Global LV T1 times were significantly higher in PH than in non-PH subjects (1219 $\pm$ 54 ms vs. 1180 $\pm$ 39 ms; $p = 0.04$), RV T1 times did not show differences (1249 $\pm$ 35 ms vs. 1239 $\pm$ 40 ms; $p = 0.48$). Correspondingly, weak correlation was found between LV T1 and mPAP ($r = 0.42$, $p = 0.02$), but none between RV T1 values and mPAP. Mean VIP T1 times were significantly higher in PH than non-PH subjects (1399 $\pm$ 72 ms vs. 1257 $\pm$ 55 ms; $p < 0.0001$), and correlated strongest with mPAP ($r = 0.78$, $p < 0.0001$), systolic and diastolic pulmonary arterial pressures ($r = 0.77$ and $r = 0.78$, $p < 0.0001$), LV curvature ratio ($r = -0.75$, $p < 0.0001$), LV eccentricity index ($r = 0.74$, $p < 0.0001$), pulmonary vascular resistance ($r = 0.71$, $p < 0.0001$), RV/LV mass ($r = 0.65$, $p = 0.0002$), RV mass ($r = 0.55$, $p = 0.002$), and RV ejection fraction ($r = -0.5$, $p = 0.006$).
Conclusion: In patients with PH, non-contrast LV T1 times are increased. T1 times at VIPs correlate with ventricular function, mass and right heart hemodynamic indices and might represent a useful quantitative measure for myocardial remodeling in PH.



1172 (pp34)
Myocardial Biopsy for the Validation of Cardiac Magnetic Resonance T1 Mapping for Quantification of Extracellular Matrix

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Background: Diffuse myocardial fibrosis / extracellular matrix expansion is a landmark feature of various cardiac diseases and is associated with an unfavorable prognosis. Recently, cardiac magnetic resonance (CMR) T1-mapping has been proposed for the quantification of extracellular matrix.
Published series mainly used two T1 mapping sequences: 1. Modified Look-Locker Inversion recovery (MOLLI) T1 mapping, allowing the calculation of extracellular volume (ECV), 2. Post-contrast multiple breath-hold T1 mapping. In addition, native (pre-contrast) T1 mapping has gained increasing interest.
Although CMR T1 mapping is a very promising technique and has been advertised as the new "non-invasive myocardial biopsy", validation data, particularly in heart failure patients, are sparse.
Methods: 22 heart failure patients underwent CMR T1 mapping on a 1.5-T scanner (Avanto, Siemens Medical Solutions, Erlangen, Germany) and left ventricular biopsy within 4 weeks. The population consisted of 16 HFpEF (heart failure with preserved ejection fraction) patients, 3 patients suffering from dilated cardiomyopathy and 3 amyloidosis patients. In all patients the 3 T1 mapping sequences were applied.
Left ventricular biopsies were stained with modified Trichrome and Congo-red. Extracellular matrix was quantified with TissueFAXS and HistoQuest© analysis.
Results: Extracellular matrix by TissueFAXS was 43.8 $\pm$ 20.8% of the region of interest, ECV as determined by MOLLI was 33.6 $\pm$ 9.9%. The average post-contrast T1 time by the multiple breath-hold sequence was 407 $\pm$ 85ms and native T1 times were 1000 $\pm$ 61ms. The amount of extracellular matrix by TissueFAXS correlated significantly with MOLLI ECV ($r = 0.583$, $p = 0.011$) and with multiple breath-hold post-contrast T1 times ($r = -0.459$, $p = 0.042$), but not with native T1 times ($r = 0.375$, $p = 0.114$).
Conclusion: In the present series, MOLLI ECV appears to be the most accurate method for the quantification of extracellular matrix expansion when validated against myocardial biopsies. Although multiple breath-hold post-contrast T1 mapping may be influenced by renal function, heart rate, and time of acquisition, it also appears useful for non-invasive measurement of extracellular matrix. Native T1 mapping showed the weakest correlation with extracellular matrix by TissueFAXS, but there was a tendency towards a significant relationship ($r = 0.375$, $p = 0.114$)

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INTERVENTIONAL

Friday May 16 | 14:30—18:50 | Group B

1128 (pp35)
The Coronary Sinus and Thebesian Valve in Cardiac Magnetic Resonance

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Introduction: Cardiac magnetic resonance (CMR) can potentially be useful in visualizing the coronary venous system before cardiac resynchronization. The aim was to evaluate the usefulness of CMR in the evaluation of the coronary sinus including the Thebesian valve (ThebV) - which protects the coronary sinus.
Methods: 63 patients aged 48,6 $\pm$ 17,2 (23 W) were included into the trial. All magnetic resonance examinations were performed by using a GE Optima MR450w 1.5T with GEM Suite with a dedicated cardiac coil GE body 3D small cardiac. A steady state free precession (SSFP; FIESTA/45) sequence was the basis of the visualization and analysis of the coronary sinus as well as Thebesian valve. All data were evaluated by two CMR investigators. The ThebV was analyzed based on the modified CT classification.
Results: We were able to visualize the coronary sinus using the basic SSFP sequence in all of the patients. Average length of the coronary sinus was 37.6 $\pm$ 13.4mm, average diameter was 8.8 $\pm$ 3.7mm and average angle of the entrance coronary sinus into the right atrium was 110.1 $\pm$ 13.1°. The ThebV was found in 24 cases (52.2%). The most frequent variant of the ThebV (37.5%) was the "D" variant in which a significant part of the ostium is covered by the valve. We also found the following types: "A2" - the semi-lunar membrane is visible from the atrium wall and covers more than 50% of the CS ostium (20.8%); "A1" - covers less than 50% of the CS ostium (16.6%); "E" - the membrane is porous so only the border between areas is visible (12.5%) and "C" - the valve is built from two separate parts with a gap between the parts (12.5%).
Conclusions: It is possible to visualize and measure the coronary sinus and the Thebesian valve using cardiac magnetic resonance with SSFP sequences.

1185 (pp36)
Cardiac computed tomography versus cardiac magnetic resonance for characterization of left atrium anatomy before radiofrequency catheter ablation of atrial fibrillation: impact on radiation exposure and outcome

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Background: Radiofrequency catheter ablation (RFCA) of atrial fibrillation (AF) has improved by the integration of left atrium (LA) anatomy evaluated by computed tomography (CT) or magnetic resonance (MR). However, no comparative data between CT and MR have been described. The aim of this study is to compare the procedural characteristics, radiation exposure (ED) and clinical outcomes between RFCA guided by image integration with CT versus CMR.
Methods and materials: Four hundred consecutive patients with drug-refractory paroxysmal or persistent AF were randomized to CT (Group 1; N: 200; mean age 61.6 $\pm$ 10.9 yo; male:155) or MR (Group 2; N: 200; mean age 59.7 $\pm$ 10.4 yo; male:166) for evaluation of LA before RFCA. CT was performed with 64-slices scanner (Discovery CT 750HD, GE

Healthcare, Milwaukee, WI) and MR was performed with 1.5-Tscanner (Discovery MR450, GE Healthcare, Milwaukee, WI) using a non-triggered contrast enhancement magnetic resonance angiography sequence. All patients were subsequently treated by image integration-supported RFCA. Left atrium volume, variant of pulmonary veins anatomy, pulmonary veins ostial dimensions, procedural characteristics, overall radiation exposure and rate of AF recurrence were measured and compared between the two groups.
Results: The two groups were homogeneous in terms of demographic characteristics, cardiovascular risk factors, prevalence of persistent AF, medical therapy and echocardiographic characteristics. The mean follow-up was similar (557 $\pm$ 302 vs. 523 $\pm$ 265 days, respectively, p:0.24). Group 1 showed higher LA volume versus group 2 (117 $\pm$ 46 vs. 101 $\pm$ 40 mL, $p < 0.001$). The procedural characteristics [fluoroscopy time (32.6 $\pm$ 16.0 vs. 35.0 $\pm$ 16.6 min, p:0.15); procedural duration (180.2 $\pm$ 59.0 vs. 182.8 $\pm$ 53.5, p:0.65, pulmonary veins identified (4 $\pm$ 0.1 vs. 3.9 $\pm$ 0.2, p:0.08); pulmonary veins targeted (3.9 $\pm$ 0.4 vs. 3.9 $\pm$ 0.4, p: 053); pulmonary veins isolated (3.9 $\pm$ 0.4 vs. 3.9 $\pm$ 0.4, p:0.9)] and the rate of AF recurrence (29% vs. 26%, p:0.5) were similar between the two groups. Group 1 showed a higher cumulative ED (40.4 $\pm$ 23.7 vs. 32.8 $\pm$ 23.5, $p < 0.005$). and LA volume measured by MR was the most robust independent predictor of AF recurrence at multivariate analysis [(HR: 1.08 (1.01-1.15), p:0.02].
Conclusions: CT and MR provide similar information before RFCA. However, MR integration- supported RFCA procedure seems to be associated with a lower overall cumulative radiation despite similar outcome in comparison with CT-guided RFCA.

1222 (pp37)
Cardiac magnetic resonance imaging assessment of atrial remodelling and cardiac function before and after left atrial ablation for long-standing persistent atrial fibrillation

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Introduction: Atrial fibrillation (AF) is characterized by loss of electromechanical function leading to left atrial (LA) remodeling, particularly in long-standing persistent AF (LSPAF). Atrial remodeling is most accurately estimated by measuring atrial volumes. Cardiovascular magnetic resonance (CMR) is the gold standard technique for measurement of ventricular and atrial dimensions and function. The purpose of this study was to assess cardiac volumes and function in LSPAF patients who have been restored to sinus rhythm (SR) by ablation.
Methods: 45 consecutive patients (mean age 64.4 $\pm$ 10.8 years, 30males) with LSPAF underwent LA ablation via either thoracoscopic surgical ($n = 21$) or percutaneous ($n = 24$) approach. A Siemens MRI scanner (Avanto, 1.5T) was used to analyze atrial and ventricular volumes at baseline and at 3 months post- ablation. 12 patients were excluded due to limited CMR data in the follow-up (2 received non MRI conditional pacemakers, 7 had dyspnea, 1 was lost, 1 was claustrophobic and 1 was excluded due to CABG).
Biplane area-length method was used to measure LA maximum (maxV) and minimum (minV) volumes from the VLA and HLA views acquired using a breath-hold ECG-gated steady state free precision cine sequence (SSFP).
Ventricular volumes were calculated from contiguous short-axis eines from the atrioventricular ring to the apex. All volumes were indexed for BSA.
Atrial function was expressed by ejection fraction (max-min volume/max volume x 100%).
A 7-day cardiac event recorder was used to determine rhythm status at 3 months.
Results: At 3 months post LA ablation SR was documented in 23 of 33 patients (69.6%). This group demonstrated a significant reduction in indexed LA maxV (imaxV baseline 52.9 $\pm$ 17.4 ml, 3 months 46.1 $\pm$ 14.4 ml, $p = 0.01$,) and a significant improvement in the LA EF and LV EF 3 months post ablation (baseline LAEF 20.9 $\pm$ 9.6%, 3months 29 $\pm$ 11%, $p = 0.02$, baseline LV EF 58.3 $\pm$ 10.6%, 3months 64.8 $\pm$ 7.1, $p = 0.005$).
Patients with AF recurrence at 3 months, showed no statistically significant change in both LA EF and LV EF. However, there was a significant reduction of the indexed LA maxV (imaxV baseline 64 $\pm$ 10.3 ml, 3 months 55.4 $\pm$ 13.6 ml, $p = <0.05$).
Conclusions: LA ablation is associated with a significant reduction in LA volume size even in LSPAF. Our data show that this reduction in volume is associated with a significant improvement of LVSEF in those who attain SR, the mechanism of which is likely to represent restoration of LA function.

1261 (pp38)
Cardiac magnetic resonance improves no reflow diagnostic accuracy and prognostic stratification compared to coronary angiography in patients with ST-segment elevation acute myocardial infarction

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Objectives: To assess the no reflow (NR) diagnostic accuracy and prognostic stratification ability of coronary angiography versus cardiac magnetic resonance (CMR) in patients with ST-elevation myocardial infarction (STEMI).
Methods: We enrolled 53 consecutive STEMI patients within 12 hours of symptoms onset who underwent primary percutaneous coronary intervention (PCI). Angiographic NR (ANR) was defined as TIMI flow grade <3 and/or blush grade <2 post PCI. CMR NR (Philips Achieva 1.5 T) was defined as microvascular obstruction (MVO) on early and late T1 IR sequences acquired after injection of 0.2 mmol/kg of Gadobutrol. Patients underwent CMR between 2 and 5 days after STEMI and at 6 months follow-up.
Results: Nineteen patients (36%) had ANR and 35 (66%) showed MVO at CMR. Among patients with ANR, only 2 did not have MVO. Among patients with MVO, 17 had ANR and 18 did not. They had higher troponin T (TnT) peak ($p < 0.0001$) and larger LGE ($p < 0.0001$). Patients with MVO also had significantly lower left ventricular ejection fraction (LVEF) (47.1 $\pm$ 9.3 vs 56.3 $\pm$ 8.3%,$p < 0.001$) and increased LV end sistolic volume (iESV) (40.8 $\pm$ 12.0 vs 33.2 $\pm$ 10.0 ml/sqm,$p = 0.02$). In contrast, despite a definite trend toward larger infarct size in patients with vs without ANR (TnT peak $p = 0.12$), there was not a significant difference between the two groups. A pre-PCI TIMI flow of 0-1 predicted MVO (OR 0.26,$p = 0.05$) but not ANR (OR 0.52,$p = 0.38$) at univariate analysis. The occurrence of ANR predicted the presence of MVO at CMR (OR 7.56,$p = 0.01$) but not the LGE extension (OR 1.01, $p = 0.64$). Conversely, MVO occurrence was related to larger LGE (OR 1.12,$p = 0.002$). TnT peak predicted MVO at univariate analysis (OR 1.742,$p < 0.001$). After multivariate analysis only TnT peak was an independent predictor of MVO (OR 2.10, $p < 0.001$). Mean clinical follow-up was 390 $\pm$ 243 days. Follow-up CMR showed that patients with acute phase MVO had lower LVEF ($p < 0.05$) and higher iEDV ($p < 0.05$) and iESV ($p < 0.01$). Patients with and without ANR did not have significant differences in LVEF, iEDV, iESV and LGE area at follow-up CMR. MACE-free survival was significantly worse in patients with vs without MVO (34% vs 11%, $p = 0.05$), while it was similar among patients with and without ANR (32% vs 28%, $p = 0.53$). Patents with ANR but without MVO did not have any MACE at follow up.
Conclusion: Our data suggest a higher diagnostic efficiency, accuracy and prognostic stratification of CMR vs angiography in STEMI patients.

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ISCHEMIA AND PERFUSION

Friday May 16 | 14:30—18:50 | Group B

1259 (pp39)
Prognostic Role of Cardiac Magnetic Resonance in Patients With Severe ST-Elevation Myocardial Infarction: 12-Month Follow-Up

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Introduction: Cardiovascular disease is the leading cause of death in Latvia that occurs approximately 55 % of all deaths. Patient rehabilitation after myocardial infarction and secondary prevention can decrease coronary heart disease average at 20-30%. Nowadays cardiovascular magnetic resonance (CMR) is the technique of choice for assessing fibrosis after myocardial infarction, characterize myocardial tissue, and analyze left ventricle function. It provides a robust diagnostic yield in patients after STEMI, identifies myocardial viability, detect malignant ventricular arrhythmia substrate.
Aim of the study: To investigate the prognostic value of cardiovascular magnetic resonance (CMR) in patients with severe ST-elevation myocardial infarction (STEMI). To predict the adverse outcomes in patients after STEMI (composite of congestive heart failure, myocardial reinfarction, postinfarction angina, atrial or ventricular arrhythmias, cardiac death).
Material and methods: Eighteen patients from Pauls Stradins Clinical University Hospital after STEMI reperfused by primary coronary intervention within 24 hours after symptom onset. CMR was performed in median 8 months after the event. Clinical follow-up was conducted in median after 12 months.
Results: The results show that the nine patients (50%) had recurrent cardiac hospitalization. Five patients (28%) notes significantly impaired quality of life after acute myocardial infarction. Infarct size measured 15 minutes after gadolinium injection was an average 30% of left ventricular mass. The left ventricle wall motion changes in 15 patients (83%), aneurysms formed in 9 patients (50%) and average left ventricular ejection fraction was 41%.
Conclusion: The results show that the infarct size, left ventricle wall motion, aneurysms was the predictors of adverse outcomes in patients after STEMI. These findings have the potential to bring significant refinement in prescribing ICD therapy, to optimize medical treatment and pay attention in risk factor modification.

1279 (pp40)
Safety and feasibility of dobutamine stress cardiac magnetic resonance for cardiovascular assessment prior to renal transplantation

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Introduction: Coronary artery disease (CAD) is reported to be 20 times higher in those on dialysis than an age matched patient with normal renal function. Current guidelines recommend cardiovascular risk assessment prior to renal transplantation. There is currently no evidence for the role of dobutamine stress cardiovascular magnetic resonance(DSCMR) in this population, despite established evidence base in the non-CKD population. The aim of this study was to determine the feasibility and safety of DSCMR in the risk stratification of end-stage renal failure (ESRF) patients awaiting renal transplantation.
Methods: Consecutive CKD patients ($n = 41$) who were referred for risk stratification prior to renal transplantation underwent DSCMR.27 were male (66%) and 14 women (34%) with a median age of 56 years.19 were on haemodialysis (46%), 10 peritoneal dialysis (24%) and 12 at the pre-dialysis stage (29%) with the main causes of renal failure were diabetes mellitus (29%), hypertension (22%) and glomerulonephritis (22%).Patients were examined using a clinical 1.5T MRI. SSFP cine images were acquired in the short axis stack covering the whole of the left ventricle. Further SSFP cine images were taken at rest and during

a standardized high-dose dobutamine-atropine protocol in the horizontal long axis, vertical long axis, 3 chamber and 3 short axis views. These were repeated at each stage of inotropic stimulation. Dobutamine was infused during 3 minute stages of incremental doses of 5, 10, 20 and 40 μg/kg/min until at least 85% of the age predicted target heart rate (THR) was achieved.
Results: Of the 41 patients, 38 (93%) achieved the end point, being either positive for ischaemia or negative with achieving ≥ 85% of age predicted THR. 2 did not achieve THR despite maximum dose of dobutamine and atropine and 1 was discontinued due to severe headache. Of the 38 which achieved an end point, 34 (90%) were negative for inducible wall motion abnormalities and 4 (10%) were positive. There were no occurrences of myocardial infarction, sustained ventricular arrhythmia or any sustained ventricular arrhythmia or any serious lasting complication.
Conclusions: DSCMR is safe and viable investigation for the cardiovascular risk stratification of high-risk CKD patients prior to renal transplantation. DSCMR already has an established evidence base in the non-CKD population with superiority over other non-invasive techniques. Larger studies with outcome data are now required.

1214 (pp41)
Usefulness of India Ink Artefact in Steady-state Free Precession Pulse Sequences for Detection and Quantification of Intramyocardial Fat

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Background: Cardiac Magnetic Resonance (CMR) with conventional FSE and STIR (FSE/STIR) allows detection of intamyocardial fat in different clinical conditions. In SSFP images acquired with a TR/TE ≈2,, fat is hypertintense and surrounded by a black boundary, called "Indian Ink" artifact that is generated when fat and water coexist in the same voxel. Aim of this study was to compare the SSFP with the FSE/STIR method for the detection of left ventricular fat metaplasia in patients with old myocardial infarction (OMI).
Methods: 200 consecutive patients with OMI (>1000 days) underwent magnetic resonance.
Results: LV intramyocardial fat was detected in SSFP images of 95 patients (47.5%) and in FSE/STIR images of 84 patients (42%). A very good strength of agreement was found using the SSFP technique between investigators, while only a moderate good agreement using the FSE/STIR method. In the 11 patients with LV at detected only by SSFP, the extent of fat was significantly lower than in those with fat detected by both the technique (4.8 ± 2.7% vs 2.01 ± 1.8% of left ventricular mass, $p < 0.001$) suggesting that SSFP allows detection of small areas of fat more between than FSE/STIR.
Conclusions: SSFP sequence with TR/TE = 2 is more accurate then FSE/STIR technique for identifying and quantifying the presence.

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MRA AND CORONARY MRA

Friday May 16 | 14:30—18:50 | Group B

1122 (pp42)
Comparison of an Oscillometric Method with Cardiac Magnetic Resonance for the Analysis of Aortic Pulse Wave Velocity

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Objectives: Pulse wave velocity (PWV) is the proposed gold-standard for the assessment of aortic elastic properties. The aim of this study was to compare aortic PWV determined by an oscillometric device and cardiac magnetic resonance imaging (CMR).
Materials and methods: PWV was assessed in 41 healthy volunteers with the two different methods. The oscillometric method (PWV-OSC) is based on a transfer function from the brachial pressure waves determined by oscillometric blood pressure measurements with a common cuff (Mobil-O-Graph, I.E.M. Stolberg, Germany). CMR was used to determine aortic PWV-CMR with the use of the transit time method based on phase-contrast imaging on the level of the ascending and abdominal aorta on a clinical 1.5 Tesla scanner (Siemens, Erlangen, Germany). Spearman correlation coefficients, coefficients of variation and Bland-Altman plots were used to study methods agreement.
Results: Median age of the study population was 35 years (IQR: 24 - 56 years, 11 females). Both methods showed a very strong correlation with age (PWV-OSC r: 0.886 and PWVCMR r: 0.837; $p < 0.001$) and systolic as well as diastolic blood pressure (r: 0.488 - 0.686, $p < 0.001$). Median PWVOSC was 6.00 m/s (IQR: 5.1—8.2 m/s) and median PWV-CMR was 5.60 (IQR: 4.66 - 7.33 m/s). A good agreement was found between PWV-OSC and PWVCMR (r: 0.776, $p < 0.001$) but the mean difference between both methods was 0.43 m/s ($p = 0.001$). The coefficient of variation between both measurements was 20%.
Conclusion: Both methods showed a strong association with established determinants of PWV. We found a good agreement between PWV-OSC and PWV-CMR, but the measurements differed significantly in absolute values.

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MYOCARDIAL METABOLISM

Friday May 16 | 14:30—18:50 | Group B

1198 (pp43)
Early phenotypes of diabetic cardiomyopathy assessed by multiparametric magnetic resonance imaging and magnetic resonance spectroscopy

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Objectives: Cardiovascular magnetic resonance (CMR) imaging and spectrocopy (MRS) provide a non-invasive assessment of the functional, structural and metabolic status of the heart. The aim of this study was to assess the early manifestations of diabetic cardiomyopathy using multiparametric CMR and MRS in patients with stable, uncomplicated type 2 diabetes (T2DM), having a short duration of disease (<4 years).
Methods: 21 patients (mean age 54 ± 1.65 years) with early-onset (median duration 1.5 [IQR: 0.5-2] years) T2DM and 12 healthy volunteers with moderately elevated body mass index (BMI) (mean age 52 ± 2.3 years) and 15 healthy volunteers with normal BMI (mean age 53 ± 3.5 years) were studied. Patients were either drug naive for diabetic therapy or on metformin monotherapy, HBA1c ≥6.4 and ≤8.8%, with no history of coronary artery disease or uncontrolled hypertension. Myocardial lipid content and PCr/ATP ratios were quantified using 1H- and 31P MRS, respectively. CMR included cine, tagging and native T1 mapping at 3.0 T. LV diastology was characterised using echocardiography.
Results: Diabetic patients were matched with control groups (Table 1) for age and gender; they were weight matched with the elevated BMI control group. Myocardial energetics were impaired in diabetics when compared to controls with elevated and normal BMI (PCr/ATP ratio: 1.50 ± 0.07 vs. 2.01 ± 0.10 vs. 2.06 ± 0.12, $p < 0.001$) and myocardial lipid content was increased (1.09 ± 0.15 vs. 0.52 ± 0.07 vs. 0.51 ± 0.07% respectively, $p = 0.001$). Peak systolic circumferential strain was reduced in diabetics (-15.4 ± 0.9 vs -19 ± 0.7 vs 19 ± 0.6, $p = 0.002$), indicating subtle LV dysfunction and diastolic function was impaired in diabetics (mitral in-flow E/A ratio = 0.93 ± 0.06 vs. 1.13 ± 0.13 vs. 1.24 ± 0.1, $p = 0.03$) respectively, when compared to elevated and normal BMI controls. Despite the metabolic abnormalities observed in diabetics, there was no difference in native T1 values (as a measure of myocardial fibrosis) between diabetic patients and elevated and normal BMI controls (1192 ± 6.5 vs. 1184 ± 7 vs.1198 ± 12 respectively, $p = 0.58$).
Conclusions: Abnormal myocardial energy metabolism, cardiac steatosis, reduced LV strain and diastolic dysfunction are present in uncomplicated T2DM patients with short duration of disease. CMR is a sensitive, non-invasive tool for assessment of myocardial pathophysiology, and is helpful in the comprehensive phenotyping and staging of myocardial involvement in diabetes.

Table1. Baseline characteristics, laboratory features and CMR and MRS findings

	Type 2 Diabetes Mellitus (n=21)	Controls with elevated Body Mass Index (n=12)	Controls with normal Body Mass Index (n=15)	P value
Demographic features and clinical status				
Age, years	54.4 ± 1.65	52 ± 2.6	53 ± 3.5	0.78
Male, n (%)	11 (41)	7 (58)	9 (60)	
Body Mass Index (kg/m^2)	28 ± 1.2	29 ± 0.7	22.3 ± 0.8	<0.001
Systolic BP (mmHg)	129 ± 1.8	128 ± 2.7	121 ± 5	0.17
Diastolic BP (mmHg)	77 ± 1.4	71 ± 1.5	73 ± 2.2	0.08
Heart rate, bpm	68 ± 2.7	63 ± 2.6	61 ± 3.4	0.18
Echocardiographic features				
Mitral in-flow E/A ratio	0.93 ± 0.06	1.13 ± 0.13	1.24 ± 0.1	0.03
Tissue Doppler septal E/E' ratio	8.58 ± 0.65	10.3 ± 0.6	8.4 ± 0.6	0.16
Laboratory results				
HBA1c, %	7.31 ± 0.16	–	–	
Triglyceride, mmol/L	1.63 ± 0.18	1.37 ± 0.21	0.96 ± 0.16	0.04
Non-esterified fatty acids, mmol/L	0.61 ± 0.10	0.28 ± 0.05	0.48 ± 0.10	0.07
Insulin	163 ± 62	175 ± 82	45 ± 20	0.8
CMR and MRS findings				
LVEDV, ml	129 ± 6.3	157 ± 9.7	137 ± 10	0.07
LVESV, ml	38 ± 3.4	45 ± 4.8	44 ± 4.6	0.46
LVEF, %	71 ± 1.85	72 ± 1.6	69 ± 1.5	0.59
LV Mass indexed to BSA, g/m^2	61 ± 3	61 ± 4	52 ± 3.7	0.11
LV Wall thickness, mm	10.5 ± 0.4	10 ± 0.3	8.4 ± 0.5	0.02
Mid short axis peak systolic circumferential strain	-15.4 ± 0.9	-19 ± 0.7	19 ± 0.6	0.002
Peak circumferential diastolic strain rate, s^{-1}	62 ± 6	71 ± 4.3	74 ± 5	0.27
PCr/ATP ratio	1.50 ± 0.07	2.01 ± 0.10	2.06 ± 0.12	<0.001
Myocardial lipid content, %	1.09 ± 0.15	0.53 ± 0.07	0.52 ± 0.07	0.001
Native myocardial T1 value, ms	1192 ± 6.5	1184 ± 7	1198 ± 12	0.58

Continuous data are mean ± standard error, unless otherwise stated.

ATP, adenosine triphosphate; HBA1c, glycated haemoglobin A1c; LV, left ventricle/ventricular; LVEDD, left ventricular end-diastolic dimension; LVEF, left ventricular ejection fraction; LVESD, left ventricular end-systolic dimension; PCr, phosphocreatine

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VIABILITY

Friday May 16 | 14:30–18:50 | Group B

1239 (pp44)

The volume of intraventricular blood demonstrating increased signal in black blood STIR images corresponds with left ventricular thrombus formation early after anterior ST-segment elevation myocardial infarction

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Objectives: To assess cardiac magnetic resonance (CMR) predictors for left ventricular thrombus (LVT) formation early after anterior ST-segment elevation myocardial infarction (STEMI) treated with primary percutaneous coronary intervention (PCI) and dual antiplatelet therapy (DAPT).
Methods: Eighty-three (65 males, 18 females, mean age 59.3 ± 12.5 years) patients, who underwent CMR 3-5 days after first anterior STEMI treated with primary PCI and DAPT were enrolled. Cine, black blood T2-weighted STIR and late gadolinium enhancement (LGE) CMR images were assessed off-line using dedicated software (QMass 7.5, Medis, Leiden, The Netherlands). LVT was defined as intraventricular, adjacent to left ventricular (LV) wall dark mass on LGE images. The volume of intraventricular blood demonstrating increased signal was quantified on short axis black-blood STIR images using a signal intensity threshold of 5 standard deviations above the mean signal intensity of normal appearing black blood within left ventricle. Logistic regression analysis was performed in stepwise forward fashion to determine CMR predictors for LVT formation. The outcomes were expressed by odds ratio (OR) with corresponding 95% confidence interval (CI).
Results: LVT was detected in 18 subjects (21.7%). LVT volume was 5.6 ± 4.8 ml. Comparing subjects with and without LVT 3-5 days after anterior STEMI the former had higher volume of intraventricular blood demonstrating increased signal on black blood STIR images (44 ± 26 versus 18 ± 20 ml; $p < 0.001$). There was no difference in LV ejection fraction (41 ± 7% versus 43 ± 12%; $p = 0.48$), end-diastolic volume index (90 ± 17 versus 84 ± 22 ml/m^2, $p = 0.26$), the extent of LVLGE (40 ± 15% versus 38 ± 16% of LV myocardium; $p = 0.62$), microvascular obstruction (4 ± 4% versus 3 ± 4% of LV myocardium; $p = 0.25$) and area at risk (52 ± 15% versus 59 ± 23% of LV myocardium; $p = 0.24$). Of CMR parameters the volume of intraventricular blood demonstrating increased signal in black blood STIR images was the only independent predictor for LVT (OR = 1.05 per 1 ml, 95%CI: 1.02-1.07; $p = 0.001$).
Conclusion: The volume of intraventricular blood demonstrating increased signal in black blood STIR images corresponds with left ventricular thrombus formation early after anterior STEMI.

1269 (pp45)

Impact of myocardial thickness on viability assessment with late Gadolinium enhancement sequences

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Objectives: Extension of late Gadolinium enhancement (LGE) within the myocardial wall is crucial for viability assessment in patients with coronary artery disease. This study aims to evaluate the relationship between the myocardial wall thickness (MWT) and the extension of LGE through the myocardial wall.
Methods: This is a retrospective study of 50 patients investigated for myocardial viability. All patients underwent CMR with LGE sequences performed in short axis, long axis and 4 chambers plans. Intramural extension of LGE was visually assessed into 3 subtypes: < 25%, between 25 and 75% and > 75%. An average MWT of the involved myocardial wall was measured and divided into 2 groups: MWT > 5mm and MWT <5mm. Several statistical correlations between MWT and LGE were investigated.
Results: Forty percent of our patients had a MWT <5mm (n = 20) versus 60% with a MWT > 5mm (n = 30). Ninety eight percent of them had a LGE (n = 49) and 2% had not (n = 1). The intramural extension of LGE was divided up as following: <25% (n = 13); between 25 and 75% (n = 11) and >75% (n = 36). There was no statistical interaction between the extension of LGE and the MWT when intramural extension is only <25%, whereas an end-diastolic MWT <5mm is correlated to the extension of LGE when LGE's intramural extension is between 25-75% and >75%, separately or in association, (chi-square test = 5, $p = 0.03$) and (chi-square test = 14, $p = 0.003$) respectively. Statistical analysis indicated also that an intramural extension of LGE >75% is an independent predictor of myocardial thinning (chi-square test = 15, $p = 0.01$).
Conclusion: Wall thickness is an important marker of myocardial viability in patients with ischemic cardiomyopathy. A simple measurement of MWT is a valuable adjunct to LGE in the assessment of myocardial viability.

1235 (pp46)

Microvascular obstruction versus infarct size as predictors for left ventricular remodeling

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Background and aims: In reperfused acute myocardial infarction, estimation of hyperenhancement volume and microvascular obstruction (MVO) constitutes a dynamic process after contrast administration. Therefore, the prognostic role of these 2 parameters have diverged in different studies. Thus, our aim was to determine the best predictor and the optimal time after contrast injection to predict left ventricular remodeling.
Methods: Subjects were evaluated using CMR within the first week (n= 60), 3 months and one year after a STEMI percutaneously revascularized. Cine CMR was performed to measure left ventricular function. Additionally, multi-slice inversion-recovery single shot (ss-IR) images were acquired sequentially at 1, 3, 5, 7, 10, 15, 20, and 25 min after bolus contrast administration to measure the hyperenhancement and MVO (hypoenhancement) volumes. Inversion time was set to null normal myocardium.
Results: The presence of delayed hypoperfusion at each time point after contrast administration results in larger hyperenhancement volumes, end systolic volume (ESV), and reduced ejection fraction (EF) (Table). The hyperenhancement and the hypoperfused volumes at all-time points were significant univariate predictors for ESV during the 3 months and at 1 year. However, in multivariate analysis, the volume of hypoperfusion at 15 min was the only predictor for ESV ($r = 0.73$, $p = 0.01$) and EF ($r = -0.75$, $p < 0.001$) at 1 year.
Conclusion: Infarct size and the area of MVO can predict adverse ventricular remodeling; however, the area of MVO 15 min after contrast is the strongest predictor for ESV and EF at one year follow-up.

Table 1: Values are mean ± SD. ESV= End systolic Volume. EF= Ejection Fraction.

	Delayed Hypoperfusion absent			Delayed Hypoperfusion present		
Minutes after contrast	Infarct size	ESV	EF	Infarct Size	ESV	EF
1	15 ± 11 g	75 ± 21 ml	50 ± 10 %	30 ± 16 g	92 ± 32 ml	42 ± 11 %
3	17 ± 14 g	77 ± 26 ml	49 ± 11 %	33 ± 16 g	97 ± 30 ml	42 ± 11 %
5	18 ± 13 g	75 ± 26 ml	49 ± 11 %	18 ± 13 g	100 ± 29 ml	41 ± 11 %
7	18 ± 13 g	76 ± 25 ml	49 ± 10 %	18 ± 13 g	102 ± 30 ml	40 ± 11 %
10	19 ± 13 g	78 ± 28 ml	48 ± 11 %	19 ± 13 g	101 ± 27 ml	41 ± 11 %
15	19 ± 13 g	78 ± 28 ml	48 ± 11 %	19 ± 13 g	101 ± 27 ml	41 ± 11 %
20	20 ± 14 g	79 ± 27 ml	47 ± 11 %	20 ± 14 g	103 ± 29 ml	41 ± 12 %
25	20 ± 14 g	79 ± 28 ml	47 ± 11 %	20 ± 14 g	103 ± 29 ml	40 ± 7 %

1278 (pp47)

Pre Scan Information, Good Communication and Music: The Patient's Perspective to Improving Cardiovascular Magnetic Resonance Tolerability

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Background: There has been an expansion in the availability and use of Cardiovascular Magnetic Resonance (CMR) for improved diagnosis and prognosis assessment. Although CMR is known to be safe we have little data on tolerability of the study from a patient's perspective. We wished to evaluate patient tolerability and possible modifiable factors that may improve the patient experience.
Method: We distributed a short questionnaire to 100 patients scanned in our centre between January and February 2014. Patients completed it after their scan. We collected patient demographics, whether the study involved pharmacological stress, patient tolerability and feedback about ways of improving patient satisfaction.
Results: Of the 100 respondents the majority were male (65%), with a mean age of 54 years (range: 19-85). 90% were outpatients and 65% of the studies were adenosine stress perfusion scans. Most patients (88%) reported that they had been given enough information before the procedure.

Table1. Data are counts recorded per respondent with percentages in brackets. P=0.001, chi square for proportion scans with and without enough information before the test.

Table showing the relationship of scan tolerance with Perceived information level before the scan

			Tolerated scan		
			No	Yes	Total
Enough Information	No	Count	5	5	10
		% within enough information	(50.0%)	(50.0%)	(100.0%)
		% within tolerate scan yes or no	(38.5%)	(6.3%)	(10.8%)
	Yes	Count	8	75	83
		% within enough information	(9.6%)	(90.4%)	(100.0%)
		% within tolerate scan yes or no	(61.5%)	(93.8%)	(89.2%)
Total		Count	13	80	93
		% within enough information	(14.0%)	(86.0%)	(100.0%)
		% within tolerate scan yes or no	(100.0%)	(100.0%)	(100.0%)

Despite being well informed, 24% were extremely or very worried before the test. However, 48% were not worried at all. Eighty-six per cent of the respondents tolerated the scan well with 43% tolerating the scan without any problem and 43% finding the study 'slightly

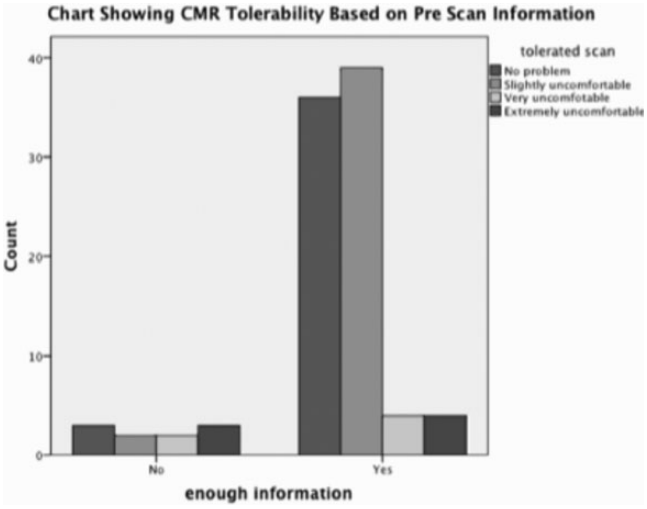

Figure 1: Bar chart showing CMR tolcrability based on whether patient felt they had enough information about the scan.

uncomfortable.' 14% did not tolerate the scan well with 6% finding it 'very uncomfortable' and 8% 'extremely uncomfortable'. The most frequently identified issues were noise (27%) and limited space (30.5 %). Of those who had an adenosine study 30% listed symptoms, such as chest tightness among the most uncomfortable aspects.

When asked whether they would consider having another scan, the majority said 'yes' (81%), 14% answered 'maybe' and only 5% 'never again'.

To improve the tolerability 17% of the patients felt that more communication during the procedure would help and 36% asked for background music.

Patients who felt they had enough information about the test were significantly more likely to tolerate the scan then not tolerate compared to those who did not have enough information (75 of 83 vs 5 of 10 patients respectively, $p = 0.001$).

Conclusion: CMR was generally well tolerated and most of the patients would be willing to repeat the test if indicated. Adequate information about the procedure before the scan and good communication during CMR improves tolerability. Additional background music and good communication during CMR may also be useful in helping them to relax thus enhancing the patient experience.

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INFLAMMATORY DISEASE/CARDIOMYOPATHIES

Saturday May 17 | 08:30—14:00 | Group C

1107 (pp48)

Myocardial Tissue Characterization By Cardiac MR Imaging In Myelodysplastic Syndromes

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Objectives: MRI provides unique insight regarding tissue characterization in the heart. We report the baseline MRI findings at the end of the recruitment in the MIOMED (Myocardial Iron Overload in MyElodysplastic Diseases) study. The iron distribution in the whole left ventricle (LV), the presence of myocardial fibrosis and the association with LV function in patients with myelodysplastic syndromes (MDS) were investigated. No data are available in the literature.

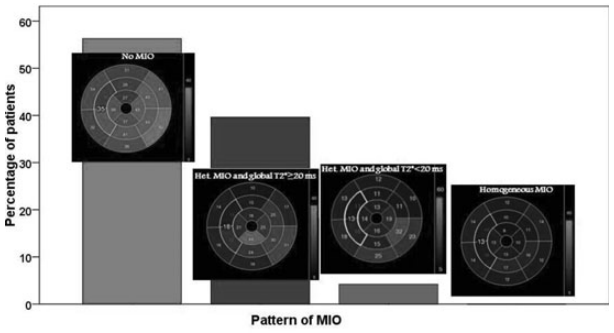
Methods: MIOMED is an observational, multicentre study in low and intermediate-1 risk MDS patients who have not received regular iron chelation. 48 patients (71.7 $\pm$ 8.5 years, 17 F) underwent the baseline MRI exam. Myocardial iron overload (MIO) was assessed using a multislice multiecho T2* approach. Function parameters were quantified by cine sequences. Myocardial fibrosis was evaluated by late gadolinium enhancement acquisitions.

Results: We found 27 (56.3%) patients with no MIO (all 16 segmental T2* values $>$ 20 ms). The remaining patients showed an heterogeneous MIO (some segments with T2* $>$ 20 ms and other segments with T2* $<$ 20 ms) and of them 2 (9.5%) showed a global T2* value $<$20 ms, indicating significant MIO (Figure).

A reduced LV ejection fraction (EF) was found in the 29.5%. There was no association between heart T2* and LV EF.

Myocardial fibrosis was detected in the 35.9% of the patients. Three patients showed an ischemic pattern and only one had a positive history for a previous myocardial infarction. The majority of the patients had two or more foci of fibrosis, involving more frequently the septum. Patients with myocardial fibrosis were significantly older (75.4 $\pm$ 7.9 vs 68.9 $\pm$ 7.6 yrs; $P = 0.019$). Global heart T2* and LV volumes were comparable between patients with and without fibrosis. The LV EF was lower in fibrotic patients but the statistical significance was not reached (58.4 $\pm$ 11.7 vs 64.8 $\pm$ 8.9 %; $P = 0.067$).

Conclusions: Although a significant heart iron was found only in two cases, nearly half the patients had an abnormal T2* value in at least one segment. This finding underlines the importance to use a multislice approach in order to perform an early diagnosis and prevent a more diffuse iron distribution by chelation therapy. This goal could be critical in patients with myocardial fibrosis, a relative common finding. An underlying heart damage as represented by fibrosis could make the hearts of MDS patients more sensitive to lower levels of accumulated iron.



1140 (pp49)

The role of left ventricular global function index for the prediction of cardiac complications in thalassemia major

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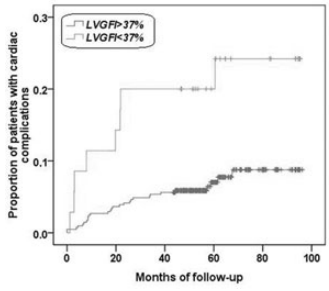
Objectives: Cardiac complications are one of the main causes of death in thalassemia major (TM) patients. Recently, the MESA study showed the strong predictive value of the left ventricular global function index (LVGFI) evaluated by cardiovascular magnetic resonance (CMR) in the prediction of the of cardiovascular events. LVGFI is a functional parameter integrating structural as well as mechanical behaviour derived from the analysis of cine SSFP images. We evaluated the predictive value of LVGFI and other CMR parameters for cardiac complications in thalassemia major (TM).

Methods: We followed prospectively 537 white TM patients enrolled in the MIOT network. Fifty patients were excluded from the analysis because a cardiac complication was present at the time of the first CMR. All prognostic variables associated with the outcome at the univariate Cox model were placed in the multivariate model and were ruled out if they did not significantly improve the adjustment.

Results: At baseline the mean age was 29.5 $\pm$ 9.0 years and 222 patients were males. The mean follow-up time was 58 $\pm$ 18 months. After the first CMR only the 37.8% of the patients did not change the chelation regimen or the frequency/dosage. We recorded 40 cardiac complications: 19 episodes of HF, 19 arrhythmias, all supraventicular hyperhyperkinetic, and 2 pulmonary hypertensions. A LVGFI $<$ 37% was a significant univariate prognosticator of cardiac complications (HR = 3.42, 95%CI = 1.56-7.52, P = 0.002). The other significant univariate prognosticators were heart iron, atrial dilatation, ventricular dysfunction evaluated by the left ventricular ejection fraction (LVEF), and myocardial fibrosis. Serum ferritin and liver iron by T2* MR were not predictive factors for cardiac complications. In the multivariate analysis the independent predictive factors were a LVGFI $<$ 37% (HR = 3.08, 95%CI = 1.32-7.20, P = 0.010), an homogeneous pattern of MIO (compared to no MIO) (HR = 3.95, 95%CI = 1.56-10.04, P = 0.001), and myocardial fibrosis (HR = 3.45, 95%CI = 1.68-7.09, P = 0.001) .

Conclusions: We detected few cardiac events thanks to a CMR-guided, patient-specific adjustment of the chelation therapy. A LVGFI $<$ 37%, severe and homogeneous MIO, and myocardial fibrosis identify patients at high risk of cardiac complications globally considered. Importantly, the dysfunction evaluated by the LVEF lose its predictive value for cardiac complications when included in a multivariate model.



Kaplan–Meier survival curve for the LVGFI

1161 (pp50)

T1-mapping cardiovascular magnetic resonance detects early myocardial and skeletal muscle remodeling in systemic sclerosis

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Objectives: Systemic sclerosis (SSc) may induce cardiac fibrosis and systo-diastolic dysfunction. Cardiovascular magnetic resonance (CMR) can detect gross myocardial fibrosis with late gadolinium enhancement (LGE) and interstitial myocardial fibrosis with T1 mapping techniques. The aim of the study was to detect subclinical cardiac involvement with CMR in paucisymptomatic SSc patients and no previous history of myocardial disease.
Methods: Thirty consecutive SSc patients (mean age 51 $\pm$ 12 years, all women) and 10 healthy controls (mean age 48 $\pm$ 15 years, all women) underwent clinical and biohumoral assessment and CMR. Extracellular volume fraction (ECV) was calculated from pre- and post-contrast T1 values in the myocardium and skeletal muscle, after correction for hematocrit.
Results: Seventeen patients (57%) were in NYHA class I, 13 (43%) in NYHA class II. All patients had normal biventricular volumes and systolic function, while LGE was present in 7 patients (23%). Myocardial ECV was significantly increased in patients with SSc (30 $\pm$ 4%) than controls (28 $\pm$ 4%, $p = 0.03$), as was skeletal muscle ECV (23 $\pm$ 6% vs 18 $\pm$ 4%, $p < 0.01$). There were no differences in myocardial ECV between patients with and without LGE (p = NS). Myocardial ECV showed no significant correlations with clinical data, biventricular volumes, systolic or diastolic function. Overall, myocardial ECV showed a significant correlation with skeletal muscle ECV ($R = 0.58$, $p < 0.001$).
Conclusion: SSc is associated not only with myocardial replacement fibrosis, as detected by LGE, but also characterized by a significant interstitial remodeling either in the myocardial or the skeletal muscle, as detected by an increased ECV also in patients with normal biventricular function.

1170 (pp51)

Assessing the impact of the revision of the taskforce criteria for the diagnosis of Arrhythmogenic Right Ventricular Cardiomyopathy

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Background: Arrhythmogenic right ventricular cardiomyopathy (ARVC) is a genetically determined cardiomyopathy associated with ventricular arrhythmia and sudden cardiac death. In 2010 the criteria used to diagnose the condition were revised. The aim of this study was to investigate the impact of the 2010 revisions on the prevalence of ARVC criteria determined by cardiac magnetic resonance (CMR) imaging in a consecutive series of patients with a clinical suspicion for ARVC.
Methods: Retrospective analysis was performed on the CMR scans of all patients referred with a clinical suspicion of ARVC between 2011 and 2013 at a single regional centre. Presence or absence of major and minor CMR task force criteria (TFC) was determined using both the original and the revised criteria. Patient records were also reviewed to determine the prevalence of non-imaging criteria.
Results: 401 consecutive patients were included (mean age 41.2 $\pm$ 16.8yrs, 55% male). 216 patients (53.9%) satisfied at least one non-imaging criterion for a diagnosis of ARVC. Utilising the original criteria, 16 patients (3.9%) satisfied major CMR criteria compared with 12 patients (3%) with the revised criteria ($p = 0.42$). Of the 16 patients initially classified as having major CMR criteria in the original guidelines 4 (25%) did not fulfil any of the revised TFC. Using the original criteria, 115 patients (28.7%) satisfied minor CMR criteria compared with 18 patients (4.5%) with the revised TFC ($p < 0.001$); 97 patients (84.3%) with minor original TFC did not have any of the revised TFC. This discrepancy was primarily due to the exclusion of regional wall motion abnormalities in the absence RV dilatation as a criterion, in the revised TFC. Application of the revised CMR TFC significantly improved the positive predictive value for combined CMR major and minor criteria in diagnosing ARVC from 8.4% to 40%, calculated based upon the patients final diagnosis using the full TFC. Despite this improvement in specificity, CMR's sensitivity for the diagnosis of ARVC was not significantly reduced (70.6% vs. 84.1%).
Conclusion: CMR plays an important diagnostic role in the evaluation of patients with possible ARVC. The revision of the ARVC task force imaging criteria has improved CMR's accuracy in the diagnosis of the condition.

1193 (pp52)

Improving Diagnosis of LV Non-compaction (LVNC) with Cardiac Magnetic Resonance (CMR)

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Introduction: Left ventricular non-compaction (LVNC) cardiomyopathy has eluded systematic classification due to its genotypic and phenotypic heterogeneity. We aimed to develop a cardiac magnetic resonance (CMR) based semi-automated objective technique for quantification of non-compacted (NC) and compacted (C) masses and to ascertain their relationships to global and regional LV function.
Methods: We analysed CMR data from 31 adults with isolated LVNC and 20 controls. NC and C masses were measured using relative signal intensities (SI) of myocardium and blood pool. Global and regional LVNC mass was calculated and correlated with both global and regional LV systolic function.
Results: In LVNC patients, 7.4 +/- 2 of 17 segments (AHA 17 segment LV model) were non-compacted. LVNC patients had significantly higher end-systolic (ES) and end-diastolic (ED) NC:C ratios compared to controls (ES 26 + /- 12 vs. 16. + /- 5, $p < 0.001$; ED 44 + /-14 vs. 29 +/-18, $p < 0.001$). Elevated NC:C ratio correlated inversely with global ejection fraction, with a stronger correlation for ES (Pearson's $r = -0.58$, $p < 0.001$ in ES vs. $r = -0.29$, $p = 0.03$ in ED). LVNC patients also demonstrated significant elevations in NC:C ratio at apical, mid-ventricular in both cardiac phases compared to controls. Linear regression showed significant inverse correlations between ED and ES apical NC:C ratio and ejection fraction, strongest for ES (ES $r = -0.72$, $p < 0.001$ vs. ED $r = -0.39$, $p = 0.02$). Late gadolinium enhancement was demonstrated in 2 patients and did not correlate with arrhythmia risk.
Conclusions: CMR enables quantification of NC:C ratio of the entire ventricle and improves the ability to detect functionally significant NC compared to previous echocardiographic and CMR techniques.

1205 (pp53)

T1 native as a marker for differentiation of the left ventricular hypertrophy phenotypes of hypertrophic cardiomyopathy and hypertensive cardiomyopathy

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Purpose: The differential diagnosis of hypertrophic phenotype remains challenging in clinical practice, in particular between hypertrophy cardiomyopathy (HCM) and increased left ventricular wall thickness (LVWT) due to systemic hypertension (HTN). Its importance lies in the clinical implications for patients. Diffuse myocardial fibrosis is the characteristic feature in HCM, whereas hypertensive response is underpinned by addition of myofibrils in otherwise normal myocardial tissue. Late gadolinium enhancement (LGE) imaging provided important new way of differentiation between these two entities by separating those cases with evidence of regional fibrosis. Whereas approximately 60% of patients with HCM reveal visually discernable LGE, T1 mapping is highly discriminative, irrespective of the presence of LGE.
Methods: Seventy-nine patients with diagnosis of unequivocally hypertrophic cardiomyopathy and sixty patients with hypertensive cardiomyopathy underwent routine cardiac MRI protocol including assessment of function and scar in addition to T1 mapping (3-Tesla). T1 values were measured conservatively within septal myocardium in midventricular short-axis slice prior to administration of 0.2 mmol/kg of gadobutrol.
Results: HCM group showed higher LV mass and maximum LVWT than the HTN group (HCM vs. HTN: LVmass, g/m2: 98.1 $\pm$ 33.6 vs. 67.2 $\pm$ 22.6; maximum LVWT 19.0 $\pm$ 3.9 vs. 13.2 $\pm$ 1.3, $p < 0.0001$). LGE was present in 20% ($n = 10$, 4 with an ischaemic pattern) of the HTN group and in 82% ($n = 48$, 2 with an ischaemic pattern ($p < 0.001$) of the HCM group). Patients with HCM showed significantly higher T1 values compared to HTN patients (HCM vs. HTN, msec: 1163 $\pm$ 46 vs. 1049 $\pm$ 31, <0.0001). Native T1 values were concordant to LVWT and LV mass ($r = 0.52$ and $r = 0.46$, $p < 0.001$, respectively). T1 native held superior diagnostic accuracy compared to conventional functional parameters and the presence of LGE to discriminate between hypertrophic or hypertensive cardiomyopathy (AUC, T1 native = 0.99, LVmass = 0.82, LVWT= 0.95, LGE= 0.82, $p < 0.001$). T1 native was identified as an independent discriminator between the two conditions.
Conclusion: We demonstrate that native T1 values can reliably discriminate between hypertrophic and hypertensive cardiomyopathy. Given its novelty and ease-of-use nature, T1 native has the immediate potential of clinical translation as a diagnostic marker between these two conditions.

1209 (pp54)

Aortic stiffness in the presence of self-limiting and sustained systemic inflammation: comparison of acute myocarditis and chronic inflammatory diseases

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Background: Aortic stiffness, measured by pulse way velocity (PWV), is an independent predictor of cardiovascular events over and above traditional risk factors. Previous evidence revealed moderately raised PWV in the presence of presence of systemic inflammatory diseases, such as rheumatoid arthritis (RA) and systemic lupus erythematosus (SLE). Changes in aortic stiffness in response to acute systemic inflammation, such as systemic viral myocarditis, remain unknown.
Methods: Ninety-nine subjects with either clinical diagnosis of acute myocarditis ($n = 44$) or chronic systemic inflammatory disease (RA and SLE, $n = 55$) underwent standardized cardiac CMR protocol for the assessment of PWV. Thirty-eight apparently healthy subjects served as control group. Central PWV was obtained by an inplane phase contrast gradient echo sequence with high temporal resolution (120 phases/cardiac cycle) and foot-to-foot measurement.
Results: Groups were well matched for age, gender and cardiovascular risk factors, with no differences in blood pressure or heart rate between groups. Compared to controls, both patients' groups had significantly raised central PWV (control vs. acute myocarditis vs. systemic inflammation, PWV (m/sec): 5.1 $\pm$ 1.0 vs. 8.4 $\pm$ 2.4 vs. 8.5 $\pm$ 2.6, $p < 0.001$, with no significant differences between the two groups of patients on post-hoc analysis. We identified significant relationship between PWV and age (controls, r: 0.56; acute

myocarditis, r: 0.51; and systemic inflammation, r: 0.3 $p < 0.0001$ for all), whereas no other functional index showed significant association.
Conclusion: We demonstrate for the first time that there is increased aortic stiffness in response to self-limiting inflammatory injury, which is comparable in magnitude to sustained systemic inflammation.

1211 (pp55)
Myocardial T2 mapping for improved detection of inflammatory myocardial involvement in acute and chronic myocarditis

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Purpose: Cardiac magnetic resonance (CMR) increasingly adds to clinical conformation of the diagnosis in patients with suspected myocarditis. The proposed Lake Louise Consensus Criteria ("any-two" approach) can separate from chronic forms of myocardial inflammation. However, both global enhancement ratio (GRE) and T2-weighted imaging are underutilized, due to poor reproducibility and high susceptibility to artefacts. T1 and T2 mapping by CMR projects tissue-dependent relaxation times. T2 mapping has been recently proposed as a robust and accurate technique to identify areas of focal myocardial oedema. Our aim was to investigate the value of quantitative T2 values in discrimination between health and disease, and separation between active/acute myocarditis and chronic convalescent stage of the disease.
Methods: Patients with acute presentation of viral myocarditis ($n = 24$) and subjects in clinical convalescence ($n = 23$) were recruited. Thirty-three healthy subjects were served as controls. All subjects underwent CMR study for routine assessment of myocardial oedema, function and scar by at 3-Tesla scanner. T2 values were acquired in midventricular short-axis slice (mSAX) using GraSE sequence. We examined regional T2 values in patients and controls. T2 values are presented as an average of the six segments per mSAX. Secondly we investigated the differences between visually involved and remote myocardium (involved myocardium= areas by LGE, remote= areas with no LGE)
Results: Patients with acute myocarditis and chronic myocarditis showed significantly raised T2 values [controls vs. acute vs. chronic myocarditis, T2 myocardium (msec): 48 ± 3 vs. 59 ± 9 vs. 53 ± 5, $p < 0.0001$). Compared to controls, T2 values in remote myocardium were significantly different for acute myocarditis only (T2, msec: 48 ± 3 vs. 51 ± 5 vs. 49 ± 2, $p < 0.01$), whereas T2 values in involved myocardium differed between all groups (T2, msec: 48 ± 3 vs. 69 ± 13 vs. 57 ± 8, $p < 0.0001$]. T2 values of complete mSAX or involved areas were identified as the independent discriminators between active and chronic myocarditis. T2 values were concordant with T2 edema ratio (T2 involved, $r = 0.42$, $p < 0.001$) and with native T1 ($r = 0.55$, $p < 0.001$). Inter and intra-observer reproducibility of T2 values quantification was excellent (intra: $r = 0.978$; $P < 0.001$; mean difference (MD) $\pm$ SD = -0.05 $\pm$ 1.85; inter: $r = 0.948$, $P < 0.001$; MD $\pm$ SD = 0.01 ± 2.5).
Conclusion: We demonstrate that quantitative T2 values are increased in patients with myocarditis. We furhter demonstrate that average mSAX and involved T2 values can discriminate between acute and chronic stage of the disease.

1221 (pp56)
Disease-specific differences of left ventricular rotational mechanics between cardiac amyloidosis and hypertrophic cardiomyopathy: a feature-tracking magnetic resonance study

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Purpose: Left ventricular twist (LVT) and untwisting (LVUT) rate are global parameters of LV function. Aim of the present study was to investigate the differences in LV rotational mechanics between patients with cardiac amyloidosis (CA) and hypertrophic cardiomyopathy (HCM).
Methods: 20 consecutive patients with CA, 20 consecutive patients with HCM and 20 consecutive subjects without evidence of structural heart disease were included. Cardiac magnetic resonance (CMR) with late gadolinium enhancement (LGE) imaging was performed to evaluate biventricular function, LV mass index and presence/extent of LGE. Feature-tracking analysis was applied to basal and apical short-axis images to determine peak basal and apical rotation, peak LVT, time to peak LVT, peak LVUT rate and time to peak LVUT rate.
Results: Peak LVT in CA patients was significantly impaired compared to control subjects ($11.3 \pm 4.0^\circ$ vs. $15.0 \pm 1.6^\circ$; $p < 0.05$), due to an impairment of peak basal rotation ($-2.9 \pm 2.5^\circ$ vs. $-7.0 \pm 0.7^\circ$; $p < 0.001$). Conversely, peak LVT in HCM patients was significantly higher compared to control subjects ($18.9 \pm 6.7^\circ$ vs. $15.0 \pm 1.6^\circ$; $p < 0.05$), due to an increase in peak apical rotation ($12.9 \pm 5.5^\circ$ vs. $8.3 \pm 1.4^\circ$; $p < 0.01$). Peak LVUT rate was significantly impaired in CA patients compared to control subjects ($-83 \pm 42^\circ$/sec vs.$-112 \pm 26^\circ$/sec; $p < 0.05$), while it was preserved in HCM patients ($-107 \pm 37^\circ$/sec vs. $-112 \pm 26^\circ$/sec; $p > 0.05$). Time to peak LVUT rate was significantly prolonged in both CA and HCM patients compared to control subjects ($146 \pm 30\%$ of LV systole vs. $133 \pm 23\%$ vs. $113 \pm 6\%$; ANOVA $p < 0.001$). At ROC curve analysis, peak basal rotation $> -5.9^\circ$, peak LVT $\leq 13.8^\circ$ and peak LVUT rate $> -81^\circ$/sec had the highest sensitivity and specificity for identification of patients with CA (100% and 83%, 75% and 80% and 55% and 95%, respectively); peak apical rotation $> 11^\circ$ and peak LVT $> 17^\circ$ had the highest sensitivity and specificity for identification of patients with HCM (75% and 83% and 65% and 100%, respectively). At multivariate analysis, age ($p = 0.007$), LV ejection fraction ($p = 0.035$) and extent of LGE ($p < 0.001$) were independently related to peak LVT; LV mass index ($p = 0.015$) and extent of LGE ($p = 0.004$) were independently related to peak LVUT rate, while extent of LGE ($p < 0.001$) was the only variable independently related to time to peak LVUT rate.
Conclusions: CA and HCM have specific behavior of LV rotational mechanics. The extent of LGE significantly influences the LV rotational mechanics.

1224 (pp57)
Right ventricular strain and dyssynchrony assessment in arrhythmogenic right ventricular cardiomyopathy: a cardiac magnetic resonance feature-tracking study

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Purpose: Cardiac magnetic resonance imaging (cMRI) represents the gold-standard imaging technique for assessment of right ventricular (RV) function; however, analysis of regional dysfunction in arrhythmogenic right ventricular cardiomyopathy (ARVC) may be inadequate due to the complex contraction pattern of the RV. Aim of the present study was to determine the utility of RV strain and dyssynchrony assessment using a novel feature-tracking MR software system and its incremental value over conventional cMRI.
Methods: 32 consecutive patients with ARVC diagnosed according to the 2010 Task force criteria (45 ± 13 years, 69% males) referred to cMRI were included. 32 patients with idiopathic right ventricular outflow tract (RVOT) arrhythmias and 32 control subjects, matched for age and gender to the ARVC group, were included for comparison purpose. cMRI was performed to assess biventricular function; feature-tracking analysis was applied to assess regional and global RV strain and RV dyssynchrony from the 4-chamber cine MR images. Longitudinal peak systolic strain (SS) from basal, mid and apical RV free wall segments was measured and averaged to measure global longitudinal strain (GLS). Standard deviation (SD) of time-to-peak strain (TPS) was calculated as a parameter of mechanical dispersion, using a 6 RV segment model.
Results: SS at RV basal ($-22 \pm 11\%$ vs. $-35 \pm 14\%$ vs.$-35 \pm 15\%$; $p < 0.001$), mid ($-15 \pm 8\%$ vs. $-22 \pm 12\%$ vs.$-26 \pm 11\%$; $p < 0.001$) and apical level ($-14 \pm 8\%$ vs. $-22 \pm 12\%$ vs.$-25 \pm 11\%$; $p < 0.001$) and RV GLS ($-17 \pm 5\%$ vs. $-26 \pm 6\%$ vs.$-29 \pm 6\%$; $p < 0.001$) were significantly lower and RV SD-TPS (145 ± 90ms vs. 68 ± 47ms vs. 50 ± 23ms; $p < 0.001$) was significantly higher among ARVC patients compared to RVOT patients and controls. Except for RV basal free wall SS, differences remained significant even when considering only ARVC patients with RV ejection fraction $\geq$50% or RV segments without wall motion abnormalities. At ROC curve analysis, RV GLS $>$-23.19% and RV SD-TPS $>$113.13ms had the highest sensitivity and specificity for identification of patients with ARVC (91% and 75% and 59% and 95%, respectively). According to these cut-off values, RV GLS and RV SD-TPS allowed correct identification of 14 out of 17 (82%) and 11 out of 17 (65%) ARVC patients with RV ejection fraction $\geq$50%, respectively.
Conclusion: Strain analysis by feature-tracking MR objectively quantifies global and regional RV dysfunction and RV dyssynchrony in ARVC patients and provides incremental value over conventional cMRI.

1254 (pp58)
Subclinical focal fibrosis and abnormal left ventricular strain in patients with sarcoidosis without clinical evidence of cardiac disease

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Background: Cardiac involvement in systemic sarcoidosis occurs in 20-25% of patients; and is associated with poor outcome and reduced survival. The identification of cardiac sarcoidosis is challenging in asymptomatic patients using conventional methods including echocardiography. We aimed to assess the role of CMR for detecting subclinical cardiac sarcoidosis in patients with demonstrated pulmonary sarcoidosis and without cardiac symptoms.
Methods: We included consecutive patients with pulmonary sarcoisosi referred for CMR study from a specialized sarcoidosis ambulatory clinic in a tertiary university hospital. Inclusion criterion was the diagnosis of sarcoidosis and absence of clinical signs of cardiovascular disease. Exclusion criteria included the presence of atrial fibrillation, more than mild valvular heart disease, ischemic heart disease and general contra-indications to CMR and/or gadolinium. All patients underwent CMR at 3.0T. CMR study included cine CMR (stack of short-axis and long-axis planes) for LV function, T2-weighed imaging, tagging, late gadolinium enhancement (LGE) with gadobutrol 0.20 mmol/Kg.
Results: 31 patients were included, 50 ± 14 year-old, 16 male. A control group of 11 healthy individuals were assessed by tagging. ECG and conventional echocardiograms were normal in all. LV end-diastolic volume and ejection fraction were normal in all patients (72 ± 11 ml/m^2 and $59 \pm 6\%$ respectively). No myocardial signal changes were found on T2-weighed imaging. Focal LGE was found in 9 patients (29%), predominantly involving the midwall and or subepicardium of the basal septum and lateral myocardial segments. Regarding strain analysis obtained from tagging, patients with sarcoidosis had significantly lower LV peak longitudinal strain than the controls (-15.3 ± 1.9 versus -18.0 ± 1.1, $p = 0.006$). In 18 patients, including 9 patients with focal LGE and other 9 without LGE, strain values were abnormal, with a mean value of -13.5 ± 1.2.
Conclusion: In patients with systemic sarcoidosis and absence of clinical cardiac involvement, CMR showed subclinical involvement in a substantial proportion, with focal LGE

and abnormal longitudinal strain probably due to more widespread myocardial disease. Our group is presently assessing the impact of these findings on the outcome.

1168 (pp59)

Right Ventricular Longitudinal Strain based on Magnetic Resonance Feature Tracking in Patients with Arrhythmogenic Right Ventricular Cardiomyopathy

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Background: Arrhythmogenic right ventricular cardiomyopathy (ARVC) is characterized by dilatation and fibro-fatty substitution of the myocardium in the right ventricle (RV). Cardiovascular magnetic resonance imaging (CMR) is the gold standard for visualization and volume quantification of the RV, but the assessment of wall motion is still based on qualitative "eye-balling". Previous studies have shown the successful application of feature tracking (CMR-FT) to the left ventricle. The aim of this study was to test the feasibility of CMR-FT to assess RV strain in patients (P) with ARVC and in healthy controls(C).
Methods: Thirteen patients fulfilling Task Force Criteria for ARVC and twenty healthy subjects underwent cardiac MRI at 1.5 Tesla. Steady-state free precession cine of six long axis slices was acquired by rotating the cut planes around the long axis of the RV. The 3-, 4- and 2-chamber views of the RV were identified. Segmental longitudinal strain was measured and re-calculated in terms of regional strain for the base (B), mid (M) and apical (A) levels of the RV and for the anterior, inferior, septal and free walls.
Results: RV end systolic volume was significantly higher and ejection fraction lower in patients (104-82 ml, 49- 56%). Longitudinal strain decreased from base to apex in both groups (P:-25%, -22%, -19%, C:-31%, -24%, -20%). In a wall based analysis, the absolute strain values were significantly lower in patient lateral (P-24%, C -32%) and anterior walls (P -22%, C-28 %) but not in inferior (P-26%, C -27%) and septal walls (P -15%, C -18%).
Conclusion: Feature tracking was successfully applied to the RV in this cohort of ARVC patients. Longitudinal absolute strain was lower in the basal segments and in the entire anterior and the free walls compared to controls. This supports previous reports on the uneven regional distribution of ARVC.

Table 1: RV EF and longitudinal strain values

	ARVC	Control	P
EF (%)	49	56	0.01*
Base (%)	-25	-31	0.005*
mid	-22	-24	0.3
apex	-19	-20	0.5
lateral wall (%)	-24	-32	0.02*
anterior	-22	-28	0.01*
Inferior	-26	-27	0.9
septal	-15	-18	0.1

1178 (pp60)

The utility of cardiovascular magnetic resonance imaging in the assessment of cardiac, pericardial and mediastinal masses: a 3 year experience

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Background: Primary cardiac tumours are rare however reliance on cardiac magnetic resonance imaging (CMR) for further assessment of all mass lesions affecting the heart, pericardium and mediastinum following initial identification by other imaging modalities is anecdotally increasing. We aim to review the diagnostic accuracy of CMR in this setting compared with the other imaging modalities.
Methods: We reviewed a series of 49 patients referred to the CMR service for further assessment of an identified mass lesion across a period of 3 consecutive years, 2011-2013 inclusive, at a single centre.
Results: 49 patients (24 male, aged 16-88 years, median 56 $\pm$ 30 years) with suspected cardiac, pericardial or mediastinal masses underwent CMR. Prior imaging consisted of transthoracic echocardiography TTE (63%), computed tomography CT (18%), transoesophageal echocardiography TOE (17%) and magnetic resonance imaging of thorax (2%). In 34 of the referred cases the suspected mass lesion was identified and characterised by CMR. In the remaining 15 cases no mass lesion or other explanation was identified. In 4 of these cases clinical history and further analysis of the initial imaging raised the probability of thrombus with resolution in the interval between. CMR reports identified mass lesions as persisting thrombus (26%), left atrial myxoma (15%), pericardial cyst (12%), prominent anatomical feature such as crista terminalis (10%), metastatic neoplastic disease (8%), fibroelastoma (8%), lipoma (6%), pericardial fibroma (3%), endomyocardial fibrosis (3%), sarcoma (3%) and infiltrative primary chest tumour (3%). The positive predictive values of each imaging modality when diagnoses were confirmed by clinical follow up, response to treatment, imaging follow up or histopathology are as follows: CT (55.6%), TTE (45.2%), TOE (25%). CMR has a positive predictive value of 91% in this series. Left ventricular ejection fraction (range 15-80%) and right ventricular ejection fraction (range 11-77%) did not influence diagnostic accuracy. Cases incorrectly diagnosed by CMR included one case each of atrial myxoma and thrombus and failure to tissue characterise a sarcoma.
Conclusion: CMR has a high positive predictive value in the characterisation of cardiac, pericardial and mediastinal mass lesions. This is reassuring as to the utility of CMR both in the diagnosis and follow up of such lesions.

1181 (pp61)

Septal assessed mitral annular plane systolic excursion is a predictor of stroke and thrombembolism in patients with hypertrophic cardiomyopathy – a cardiovascular magnetic resonance imaging study

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Objectives: Hypertrophic cardiomyopathy (HCM) is a complex genetic heart disease. Thrombembolic complications and stroke are known complications in HCM. We sought to assess the clinical and cardiovascular magnetic resonance (CMR) characteristics of patients with HCM suffering from thrombembolic events and analyzed the predictors of these unfavorable outcomes.
Methods: A total of 121 consecutive patients with HCM were enrolled and underwent late gadolinium enhanced (LGE) CMR.
Results: During the follow-up of 5.5 $\pm$ 3.3 years, the clinical endpoint of systemic embolism, ischemic stroke or transient ischemic attack occurred in 15 (12%). Of the 15 patients with thromboembolic events, 7 (47%) were women. The incidence of severe symptoms (NYHA III/IV) (13 [87%] vs 47 [44%], $p = 0.002$) as well as atrial fibrillation (10 [67%] vs 37 [35%], $p = 0.02$) was more prevalent and the CHA2DS2-VASc (3.1 $\pm$ 1.6 vs 2.4 $\pm$ 1.0, $p = 0.03$) higher in patients with HCM suffering from thromboembolic complications. Among patients who suffered from a thromboembolic endpoint, septal MAPSE was significantly lower (0.7 $\pm$ 0.2 vs 1.0 $\pm$ 0.4, $p = 0.002$), the minimal left atrial (LA) volume was significantly elevated (100.1 $\pm$ 51.1 vs 65.3 $\pm$ 58.5, $p = 0.03$) and the LA ejection fraction was significantly reduced (26.0 $\pm$ 15.8% vs 38.2 $\pm$ 15.5%, $p = 0.005$). The other CMR parameter (left and right ventricular ejection fraction, volumes and dimensions as well as the extent of fibrosis determined by LGE) were not significantly different between patients with thromboembolic events and event-free patients. Univariate analysis revealed only for septal MAPSE (RR 0.11 [0.01-0.91], $p = 0.04$) a statistically significant relationship with the clinical endpoint.
Conclusions: Thrombembolic complications showed a prevalence of 12%. These complications were more common in women, patients with atrial fibrillation and more severe symptoms as well as in those patients with HCM and a higher CHA2DS2-VASc score. Furthermore, the thromboembolic endpoint occurred significantly more often in patients with a lower LA ejection fraction, a higher LA minimal volume and a reduced septal MAPSE. Septal MAPSE was the only significant risk factor for thromboembolic complications in patients with HCM and might therefore be an important early risk marker.

1195 (pp62)

Late gadolinium enhancement in patients meeting cardiovascular magnetic resonance (CMR) criteria for left ventricular non-compaction and its relation to disease severity

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Objective: Late gadolinium enhancement (LGE) is identified frequently in left ventricular non-compaction (LVNC) but its relationship to disease severity is not yet clear. The purpose of this study is to describe the frequency and distribution of LGE in patients meeting CMR criteria for LVNC, and to evaluate its relationship to clinical status and LV systolic function.
Methods: The CMR database of our institution was searched for all patients with a first diagnosis of LVNC using CMR criteria from January 2010 until December 2013. The CMR scans of 42 patients (67% males; mean age, 48 $\pm$ 14 years) were retrospectively evaluated. CMR assessment included both functional and tissue characteristic imaging. The LGE images were analyzed using a 17-segment cardiac model.
Results: Mean number of non-compacted segments per patient was 4.4 $\pm$ 1.7 and the non-compacted (NC) to compacted (C) ratio was 4.0 $\pm$ 1.0. Non-compaction was most commonly noted in the apical segments in all patients, mostly involving the lateral left ventricular wall. LGE was present in 70% of patients, involving the ventricular septum in 56% of the patients. A total of 97 segments were positive for LGE, 11% sub-endocardial, 46% mid-myocardial and 42% transmural. In LGE positive patients there was a mean of 4.1 NC segments compared to 4.8 segments in the LGE negative ($p = 0.16$). There were more LGE positive patients in NYHA 3-4 (88%) versus NYHA 1-2 (62%) however this did not achieve statistical significance ($p = 0.09$). In patients with left ventricular ejection fraction (LVEF) $\leq$30%, 81% were LGE positive compared to 53% in those with LVEF $>$ 30% ($p = 0.08$). Similarly, LGE was more prevalent and extensive in patients with LVEF $<$30% (mean 2.85 segments) compared to patients with LVEF $\geq$30% (1.60 segments, $p = 0.11$).
Conclusions: In patients meeting CMR criteria for LVNC, LGE distribution was heterogeneous. There was a trend towards worse functional class and lower LVEF in LGE positive patients although it did not achieve statistical significance.

1196 (pp63)
Impact of the new task force criteria of Arrhythmogenic Right Ventricular Cardiomyopathy on Its Prevalence by CMR Criteria

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Objective: Arrhythmogenic right ventricular cardiomyopathy (ARVC) is an inherited cardiomyopathy that can lead to sudden cardiac death. The diagnostic criterion has recently been revised to include, amongst others, new cardiovascular magnetic resonance (CMR) criteria to improve the diagnostic sensitivity. The implications of this revision on local clinical decision making are unknown.The purpose of our study was to assess and compare the clinical impact of Original1994 Task Force Criteria (OTF) to the Revised 2010 Task Force Criteria (RTF) on the prevalence of ARVC criteria though the use CMR at our center.
Methods: We retrospectively evaluated the CMR scans of 106 patients (mean age 40 $\pm$ 14, 54% male), referred for clinical suspicion of ARVC between 2011 and 2013, and determined the presence or absence of major and minor CMR criteria using the Original and the Revised Task Force Criteria.
Results: Applying the OTF, 26 patients (25%) had at least one major criterion present compared to 17 patients (16%) with the RTF ($p = 0.17$). Ten (9%) patients with major OTF criteria did not meet any of the RTF criteria, major or minor. Using the OTF, 14 patients (13%) had at least 1 minor criterion versus 3 patients (3%, $p = 0.009$) with the RTF. Using the OTF, 28 patients had CMR criteria for ARVC present: 15 (14%) patients met the full criteria and had definite ARVC, 5 (5%) had borderline, and 8 (8%) had possible ARVC. Using the RTF, 17 patients had CMR criteria for ARVC present: 12 (11%) patients had definite, 1(1%) had borderline, and 4(4%) had possible ARVC. Therefore, upon reclassification with the RTF, 11 of these 28 patients did not meet any CMR criteria for ARVC ($p = 0.09$).
Conclusions: In our experience, the revision of the ARVC task force imaging criteria reduced the overall prevalence of major and minor criteria. However, apart from the minor criteria, this reduction was not statistically significant. Further studies are required using histopathology as a gold standard.

1199 (pp64)
Utility of Cardiovascular Magnetic Resonance for Cardiac Structural Abnormalities Detection in Patients Presenting with Ventricular Arrhythmia and Normal Echocardiography

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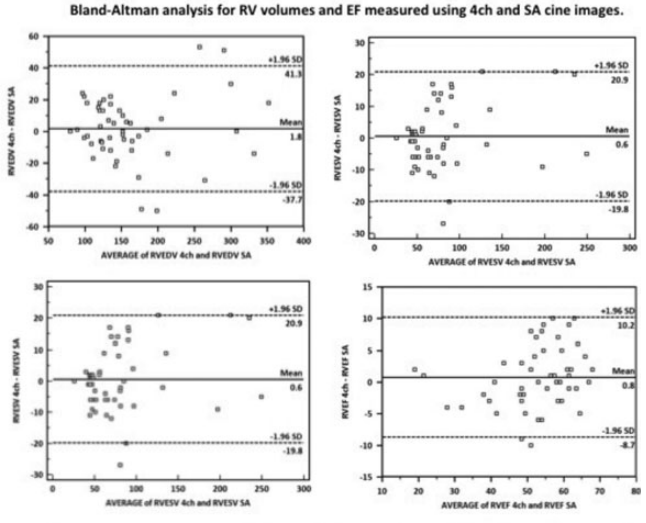
Objective: To evaluate whether cardiovascular magnetic resonance imaging (MRI) provides additional information for cardiac structural abnormalities in patients presenting with ventricular arrhythmia and normal echocardiography findings.
Methods: Patients who presented with ventricular arrhythmia, either premature ventricular complex (PVC), ventricular tachycardia (VT), palpitation or syncope from suspected ventricular arrhythmia were recruited. All of the patients had normal echocardiography reports. Cardiac MRI was performed under 1.5 T magnetic resonance scanner (Philips Achieva release 3.2). Resting ventricular systolic function was acquired using steady-state free precession sequence in short-axis and axial view. All patients were given either Gadopentetate dimeglumine or Gadobenate demeglumine (total 0.2 mmol/kg) for late gadolinium enhancement sequence. Images were analyzed using Extended MR WorkSpace release 2.6. Impaired left and right ventricular function was defined as left ventricular ejection fraction (LVEF) and right ventricular ejection fraction (RVEF) less than 50% and 40% respectively. Wall motion abnormalities were observed in both ventricles. Arrhythmogenic right ventricular dysplasia (ARVD) was diagnosed using a modified ARVD/C taskforce criteria. Myocardial scar was defined as hyper-enhanced area within myocardium. Statistical analysis was done by SPSS.
Results: Total 75 patients were included (age 44 $+$ 16; male 45.3%; 41 patients with PVC, 15 patients with VT, 9 patients with syncope, 10 patients with palpitation). 11 patients (14.7%) had cardiac structural abnormalities detected by cardiac MRI. ARVD is the most common abnormal findings (7 patients fulfilled 1 major criteria and 1 patients fulfilled 1 minor criteria) whereas 4 patients had non-ischemic myocardial enhancement. Among the arrhythmic problems, 7 from 15 patients (46.7%) who presented with VT had cardiac abnormalities detected by MRI whereas 2 from 41 patients (4.9%) who presented with PVC had cardiac abnormalities.
Conclusions: Despite of normal echocardiography, cardiac MRI provides relevant additional cardiac abnormalities information especially in patients who presented with ventricular tachycardia.



	Mean difference	Limits of agreement
RVEDV	1.8 mL	-37.7 – 41.3 mL
RVESV	0.6 mL	-19.8 – 20.9 mL
RVSV	2.1 mL	-28.6 – 32.9 mL
RVEF	0.8 %	-8.7 – 10.2 %
Indexed RVEDV	1.0 mL/m^2	-17.8 – 19.9 mL/m^2
Indexed RVESV	0.2 mL/m^2	-10.3 – 10.8 mL/m^2

Figure 1: a 70 year old man presented with non-sustained VT, normal ventricular function by echocardiography and normal coronary artery but delayed enhancement revealed extensive mid-wall enhancement in left ventricle.

1210 (pp66)
Native T1 and T2 values by cardiovascular magnetic resonance imaging in patients with systemic inflammatory conditions

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Purpose: Patients with systemic inflammatory diseases (SID) are at risk of heart failure due to sustained systemic inflammation leading to diffuse myocardial injury and left ventricular remodelling. Because native T1 and T2 values are raised in the presence of diffuse fibrosis and edema, T1 and T2 mapping by cardiac magnetic resonance (CMR) are emerging as potential tools to assess diffuse myocardial involvement. In this study, we examined native T1 and T2 values in patients with SID.
Methods: 79 patients with a clinical diagnosis of SID (systemic lupus erythematosus (SLE, $n = 46$), rheumatoid arthritis (RA, $n = 17$), systemic sclerosis (SS, $n = 9$) and Wegener's granulomatosis (WG, $n = 7$) underwent CMR study for assessment of oedema, function and scar at 3-Tesla scanner. 36 healthy subjects served as controls. Native T1 values were measured conservatively within septal myocardium of midventricular short-axis slice (mSAX). T2 values were recorded from T2 maps based on GraSE sequence. We compared regional T2 values between patients and controls, and assessed associations with native T1 values.
Results: Patients showed impaired global LV systolic function compared to controls (control vs. SLE vs. RA vs. SS vs. WG, % = 62 $\pm$ 5 vs. 54 $\pm$ 12 vs. 60 $\pm$ 8 vs. 53 $\pm$ 8 vs. 56, $p = 0.02$). The presence of LGE was variable in the groups (SLE: $n = 19$ (41%); RA: $n = 2$ (12%); SS:$n = 5$(56%); WG: $n = 4$ (57%), which was of non-ischaemic pattern in presentation. Edema ratio was raised in all SID. Patients showed higher T1 and T2 values compared to controls (controls vs. SLE vs. RA vs. SS Vs. WG, native T1 (msec):1048 $\pm$ 26 vs. 1170 $\pm$ 52 vs. 1118 $\pm$ 52 vs. 1199 $\pm$ 81 vs. 1151 $\pm$ 57, $p < 0.001$ and T2 (msec-average of all segments per mSAX): 48 $\pm$ 3 vs. 58 $\pm$ 7 vs. 54 $\pm$ 5 vs. 53 $\pm$ 3 vs. 57 $\pm$ 8, $p<0.001$). Whereas there were no T2 regional variations in controls ($p>0.05$ for all segments), patients showed regional differences in T2 values (range of T2 values within mSAX, maximum vs. minimum (msec): SLE: 61 $\pm$ 6 vs 54 $\pm$ 8; RA: 58 $\pm$ 6 vs. 49 $\pm$ 3, SS: 59 $\pm$ 3 vs 51 $\pm$ 3, $p < 0.01$). There was a linear relationship between native T1 and average T2 ($r = 0.63$, $p < 0.001$). Quantitative native T1 and T2 values were concordant with edema ratio ($r = 0.56$ and $r = 0.52$ respectively, $p < 0.001$) and the presence of LGE ($r = 0.28$ and $r = 0.34$ respectively, $p < 0.01$).
Conclusion: We demonstrate that native T1 and T2 values are increased in patients with systemic inflammation compared to controls. We also demonstrate that T2 values have regional differences in the presence of diffuse involvement. Native T1 and T2 values may serve as an early marker of myocardial injury due to diffuse fibrosis and low grade of edema.

1219 (pp67)
Prevalence and Prognostic Value of Concealed Structural Abnormalities in Patients with Apparently Idiopathic Ventricular Arrhythmias of Left Versus Right Ventricular Origin

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Background: Routine diagnostic work-up occasionally does not identify any abnormality among patients with monomorphic ventricular arrhythmias of left ventricular origin (VAs-LV). Aim of the present study was to investigate the value of cardiac magnetic resonance imaging (cMRI) for the diagnostic work-up and prognostication of these patients.
Methods: 46 consecutive patients (65% males, mean age 44 $\pm$ 15 years) with monomorphic VAs-LV and negative routine diagnostic work-up were included. 74 consecutive patients (60% males, mean age 40 $\pm$ 17 years) with apparently idiopathic monomorphic

VAs of right ventricular origin (VAs-RV) served as control group. Both groups of patients were referred to cardiac MRI to assess LV and RV function, myocardial fatty replacement, myocardial edema and necrosis/fibrosis. Patients were followed-up for 23 ± 20 months. The outcome event was an arrhythmic composite end-point of sudden cardiac death (SCD) or nonfatal episode of ventricular fibrillation or sustained ventricular tachycardia requiring external cardioversion or appropriate intracardiac defibrillator therapy.
Results: The 2 groups of patients did not differ in age ($p = 0.14$) and gender ($p = 0.57$). No significant difference was observed between patients with VAs-LV and VAs-RV regarding biventricular volumes and systolic function (LVEDVi 79 ± 19 ml/m^2 vs. 74 ± 12 ml/m^2, $p = 0.16$; LVEF 65 ± 10% vs. 66 ± 7%, $p = 0.84$; RVEDVi 70 ± 15 ml/m^2 vs. 71 ± 13 ml/m^2; $p = 0.77$; RVEF 70 ± 7% vs. 69 ± 7%, $p = 0.42$) . Cardiac MRI demonstrated myocardial structural abnormalities in 19 (41%) patients with VAs-LV vs. 4 (5%) patients with VAs-RV ($p < 0.001$). At multivariate analysis, age ≥40 years (OR = 6.1; $p = 0.021$), male gender (OR = 9.5; $p = 0.014$), family history of sudden cardiac death and/or cardiomyopathy (OR = 4.1; $p = 0.050$) and VAs with right bundle branch block morphology and superior QRS axis were significantly and independently related to the presence of myocardial structural abnormalities. The outcome event occurred in 9 patients; myocardial structural abnormalities on cMRI were significantly and independently related to the outcome event (HR 28.9; $p = 0.002$).
Conclusions: Myocardial structural changes are detected by cMRI in a non-negligible proportion of patients with apparently idiopathic monomorphic VAs-LV and are associated with worse outcome. Cardiac MRI should be implemented in the routine diagnostic work-up of these patients, to better characterize the pathogenic substrate of VAs and tailor specific therapy.

1228 (pp68)
Correlation of electrocardiographic changes and late gadolinium enhancement detected by cardiac magnetic resonance imaging in patients with acute myocarditis

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Introduction: Acute myocarditis (MC) may occasionally have an infarct-like presentation. We aimed to assess the relationship between electrocardiographic (ECG) findings and late gadolinium enhancement (LGE) evaluated by cardiac magnetic resonance (CMR) in such patients (pts).
Methods: We retrospectively reviewed 72 pts who were admitted with diagnoses of MC between 2007 and 2013 at our institution. CMR was performed during hospitalization for MC diagnosis. ST elevation (STE) in mm was registered in every ECG lead. In every myocardial segment the presence of LGE was registered.
Results: The mean age of pts was 33 ± 10 years and 56 (78%) of pts were males. STE was found in 65% of the patients, with the inferolateral region being the most frequently affected (45%). CMR showed LGE in 92% of pts. Topographic agreement between the inferolateral localization of STE and LGE was 68% ($k = 0.41$, $p = 0.01$).
Conclusion: Analysis of the site of STE underestimates the extent of myocardial injury among pts with infarct-like MC. There was a correlation between the localization of STE and LGE only in the inferolateral localization. LGE localization based on the STE localization cannot be inferred, neither vice versa in another localization different from the inferolateral.

1267 (pp69)
Cardiac magnetic resonance imaging in systemic sclerosis: correlations between morphological and functional parameters

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Background: Cardiac impairment in systemic sclerosis (SSc) is often clinically silent until the late stages of the disease and is associated with a poor prognosis. Cardiac magnetic resonance imaging (CMRI) may be a reliable method for diagnosing heart disease before symptom onset, thusly improving prognosis.
Aims: In this study, we sought to identify myocardial abnormalities in SSc patients using CMRI and to determine whether late gadolinium enhancement cardiac magnetic resonance imaging (LGE-CMRI) is an independent predictor of cardiovascular events.
Methods: Fifty-eight consecutive patients (35 women and 24 men, mean age 49 ± 13 years) with SScs were included in the study and compared with fifty-eight healthy volunteers with similar demographic characteristics. All patients underwent standard clinical and CMRI evaluation to obtain morphological and functional parameters in order to assess the presence, localization and pattern of LGE-CMRI.
Results: 44 (75%) patients with SSc had at least one CMRI abnormality, such as LGE-CMRI (29.3%), valvular anomalies (46.5%) or pericardial abnormalities (48.2%). Left and right ventricle ejection fractions were considerably lower in test group patients ($p = 0.003$ and $p < 0.001$, respectively), as was the tricuspid annular plane systolic excursion ($p < 0.001$). The LGE-CMRI was obvious in 17 SSc patients, particularly in the left ventricle (15 patients) and was associated with larger left ventricle volumes and poorer ejection fraction. During a 60-month median follow-up, 19% (11 patients) of SSc patients experienced an adverse outcome ($p = 0.02$ for Kaplan-Meier survival curves). The presence of right atrium enlargement yielded a hazard ratio of 5.0 for all cardiovascular events ($p = 0.007$ for Kaplan-Meier survival curves).
Conclusions: CMRI is a useful technique for identifying cardiac abnormalities in SSc patients without cardiovascular symptoms. LGE-CMRI and right atrium dilatation in SSc patients strongly predicts adverse cardiac outcomes. The role of LGE-CMR for risk stratification in SSc patients requires further investigation.

1270 (pp70)
Restrictive cardiomyopathy versus constrictive pericarditis: Challenges of CMR diagnosis

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Objectives: The differentiation of chronic constrictive pericarditis (CCP) from restrictive cardiomyopathy (RCM) is often difficult. The aim of this study is to determine the clinical utility of CMR for distinguishing both these disorders.
Methods: This is a retrospective study of 16 patients investigated for clinical suspicion of RCM (n = 9), CCP (n = 4) or clinical and ultrasonography features that does not allow a diagnostic orientation in favor of CPC or RCM (n = 3). Clinical history and ultrasonography features were reviewed for all patients. CMR was performed on 1.5 T scanner with retrospective cardiac gating. Bright blood Cine bSSFP and late Gadolinium enhancement (LGE) sequences were performed in all patients. Dark blood sequences were only performed in 11 patients with T2 (n = 8) and T1 (n = 6). All MR examinations were reviewed for kinetic, pericardial and LGE anomalies.
Results: Anomalies of cardiac kinetic (n = 12) associated with features of severe diastolic dysfunction (n = 7) and ventricular interdependence (n = 6) were found. Left ventricular hypertrophy was found in 3 patients. Pericardial effusion (n = 11) with pericardial thickening (n = 3) were noticed. Non ischemic myocardial LGE was found in 4 patients, with typical features of amyloidosis in one. The final diagnosis was CCP in 2 patients, RCM in 6 patients, a mixed CCP with RCM in 2 patients. In 5 patients, neither CCP nor RCM was retained and in one patient CMR was inconclusive but rather more in favor of the diagnosis of CCP.
Conclusion: Differential diagnosis of CCP versus RCM is one of the most complicated diagnostic problems in cardiology practice. In addition of clinical suspicion, ultrasonography and hemodynamic findings, MRI can provide arguments in favor of a diagnosis and sometimes even completely redirect the diagnostic suspicion thanks to its ability to explore the heart muscle and its enhancement.

1277 (pp71)
Atrio-Ventricular block in young and middle aged adults and the diagnotic role of Cardiac MRI in identifying the underlying aetiology

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Background: Atrio-ventricular (AV) block is a fairly common brady-arrhythmia seen in the elderly. High-grade AV conduction abnormalities are uncommon in young or middle-aged adults, but when identified pose a dilemma. Patients are often submitted to pacemaker (PPM) implantation without further investigation. Approximately 3-5% of all the patients undergoing pacemaker implantation for AV block are aged 18-55years. The underlying aetiology influences both the treatment strategies and the prognosis of AV block.
Cardiovascular magnetic resonance (CMR) has the potential to identify an underlying aetiology for AV block.
Aim: To determine the diagnostic role of CMR in young and middle aged adults (18-55years) with AV block.
Methods: This retrospective observational study was performed at a tertiary centre in the South-West of England. Data were collected on consecutive AV block patients (18-55yrs) who were referred for CMR between Sep 2012 to Feb 2014. A comprehensive CMR protocol was used (including long and short axis cines, and late gadolinium enhancement). Each scan was reported by a consultant with >10yrs experience.
Results: We identified 19 patients with AV block (13 male, 6 female) with a mean age of 42.0 ± 11.3years. CMR identified the underlying aetiology in 6/19 (32%) patients (1 dilated cardiomyopathy with septal fibrosis, 1 old myocardial infarction, 1 cardiac sarcoidosis, 1 aortic regurgitation, 1 constrictive pericarditis and 1 athlete's heart). In 13/19 patients (68%) there were no abnormalities detected by CMR. The diagnosis led to a change in management in each of the 6 patients. In comparison the transthoracic echocardiogram was inconclusive in all the 19 patients.
Conclusion: CMR has identified an underlying diagnosis in 1/3 of patients with AV block (secondary AV block), whilst in 2/3 of the patients CMR was normal suggesting idiopathic AV block. These findings have implications for appropriate and tailored treatment strategies.

1281 (pp72)
Left ventricular non-compaction cardiomyopathy: insights from cardiac magnetic resonance imaging

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Introduction: Left ventricle non-compaction (LVNC) cardiomyopathy has been considered as a well-defined individual entity. However recent data reveal a broad spectrum of clinical and pathophysiological findings. We aimed to study our population of patients (pts) with LVNC diagnosis based on echocardiographic criteria published by Jenni et al.
Methods: We analyzed 20 pts who performed cardiac magnetic resonance (CMR) at our institution.

Results: The majority of pts were male (60%), with a mean age of 50 ± 8 years. We found 3 cases of preserved LV function (>55%), one of them with LV dilatation. In the total population the mean LV telediastolic volume (TDV) was 133 ± 65 ml/m^2 and telesystolic volume (TSV) was 86 ± 58 ml/m^2. LV systolic dysfunction was noted (39 ± 19%), together with low left atrium ejection fraction (40 ± 18%). Concerning right ventricle (RV) there were 2 cases of systolic dysfunction (mean RV ejection fraction 53 ± 8%), but all pts had normal RV volumes (mean TDV 73 ± 20 ml/m^2; mean TSV 35 ± 13 ml/m^2). Hypertrabeculation was confirmed in the entire population, with a mean of 6 ± 2 segments (including apex). A diastolic ratio of non-compaction /compaction >2.3 was identified in 5 ± 2 segments with predominance of apical segments (maximum ratio 4.1 ± 0.8 in apical lateral segment). At mid segments we observed this ratio in 11 pts (55%; ranging from one segment in 4 pts to three segments in 2 pts), with extension in one case to basal segments. There was no correlation of number of hypertrabeculated segments with LV volumes or ejection fraction. Late gadolinium enhancement (LGE) was evaluated in 17 pts. Forty-five percent of the population had LGE, in 4 cases with an ischemic pattern and the remaining with mid-wall (3 cases) and subepicardial enhancement (1 case).
Conclusions: The advances in cardiovascular imaging contributes to improved accuracy in diagnosis of LVNC. However these heterogeneity data demonstrate the need to obtain more stringent criteria in order to accept this phenotype as a distinct cardiomyopathy.

1135 (pp73)
Early diagnosis of Fabry cardiomyopathy is challenging

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Aim: to determine specific clinical, ECG, echocardiography and cardiac magnetic resonance imaging (CMR) features of fabry disease cardiomyopathy (FCM) in comparison to FD patients without cardiac involvement (N-FCM).
Methods: we retrospectively included sixty height subjects, thirty-four patients with FD and thirty-four normal (N) subjects between 2004 and 2013. In this study FCM was considered present in subjects with left ventricular hypertrophy based on echocardiography measurement and or the presence of at least two of the following criteria : inverted T waves, Sa velocity at lateral mitral annulus <8 m/sec, global longitudinal strain <18%.
Results: The age was 39 [31.5-54.5] years. Higher ECG conduction abnormalities (44.1% vs 14.7%, p = 0.02), shorter PR (20.6% vs 0%, p = 0.01), and higher frequency of inverted T waves (29.4 % vs 0%, p < 0.001) in FD vs N. Higher left ventricular mass (LVM) (187.8 [165.9-213] vs 131 [106.1-158], p < 0.001), diastolic left ventricular diameter (98 [82-110] vs 75.5 [70-81], p = 0.006) and E/Ea (6 [6-7.9] vs 6 [5-6.1], p = 0.02), cardiac index (3.25 [2.5-4.4] vs 2.72 [2.4-2.9], p = 0.01), left atrium diameter (19 [17.6-21] vs 15 [13.8-18], p < 0.001), diastolic right ventricular diameter (9.4 [7.9-10.2] vs 8.1 [7.2-8.8], p= 0.02) in FD. In FD, there was (70.1%) cardiac (FCM), (55.9%) renal, (61.8%) neurological, (64.7%) dermatological, (76.5%) ORL, (82.4%) ophthalmologic, (11.8%), pulmonary involvements. 79.4% was under treatment, duration treatment was 35.2 [9-81] months. No difference regards treatment between FCM and N-FCM. No difference in cardiovascular clinical symptoms between FCM and N-FCM. No difference in all organs involvements between FCM and N-FCM. No difference in ECG features except for inverted T waves (FCM 5 (20.8%) vs (0%) in N-FCM, p= 0.02). Higher echocardiography LVMI (117 [97.7-126.8] vs 86 [65-98], p < 0.001), a lower E wave velocity in FCM as compared to N-FCM (79 [66.3-92] vs 99 [85.4-105], p= 0.02). In FCM, the LVMI was correlated with age (r = 0.6, p = 0.0015), and inversely correlated to E/A (r = -0.5, p = 0.019). In contrast, LVMI was not correlated to inverted T waves on ECG (r = 0.17, p = 0.41). In cardiac MRI myocardial fibrosis was present in 4 (16.6%) in FCM.
Conclusion: The diagnosis of early stage FCM is still challenging. There are no specific clinical features of FCM. The inverted T waves could be useful in the diagnosis of early stage of FCM even without the presence of LVH.

1215 (pp74)
Abnormal T2-STIR Magnetic Resonance in Hypertrophic Cardiomyopathy: a Marker of Advanced Disease and Electric Myocardial Instability

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Background: Myocardial hyperintensity at T2-STIR (HyT2) cardiac magnetic resonance (CMR) imaging was demonstrated in patients with hypertrophic cardiomyopathy (HCM) and it was considered a sign of acute damage. The aim of the current study was to evaluate the association between HyT2, clinical and CMR parameters, and markers of ventricular electrical instability.
Methods: Sixty-five patients underwent a thorough clinical examination, 24-hour ECG recording, and CMR examination including functional evaluation, T2-STIR images and LGE.
Results: HyT2 was detected in 27 patients (42%). Subjects with HyT2 showed greater left ventricle (LV) mass index (p < 0.001), lower LV ejection fraction (p = 0.05) and a greater extent of LGE (p < 0.001) than those without. Twenty-two subjects (34%) presented non sustained ventricular tachycardia (NSVT) at 24-hour ECG recording, 21 (95%) presenting HyT2. By logistic regression analysis, HyT2 (odds ratio — OR: 165, 11-2455, p < 0.001) and the percent LGE extent (1.1, 1.0-1.3, p < 0.001) were independent predictors of NSVT, while the mere presence of LGE was not associated with NSVT occurrence (p =0.49). The presence of HyT2 was associated with lower heart rate variability (p = 0.006) and an higher arrhythmic risk score (p < 0.001).
Conclusions: In HCM patients, HyT2 at CMR is associated to more advanced disease, and increased arrhythmic burden.

1134 (pp75)
What are the specific features of Faby cardiomyopathy in comparison amyloidosis cardiomyopathy ?

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Aim: to determine specific clinical, ECG, echocardiography and cardiac magnetic resonance imaging (CMR) features of fabry disease cardiomyopathy (FCM) in comparison to amyloisis cardiomyopathy (ACM).
Methods: we retrospectively included forty six patients, twenty-four patients with FCM, twenty-two with ACM between 2004 and 2013. Detailed demographic, clinical, any organ involvement, ECG, echocardiogray and CMR features were recorded.
Results: FCM were younger than ACM (41 [34.49-56] vs 76.5 [67-82.1] years, p < 0.0001). Lower frequency of left ventricular (LV) heart failure in FCM (4.2% vs 86.4%, p < 0.0001) and lower heart frequency in FCM vs ACM (66 [62-76.1] vs 8 [68.6-85.6] beats/min, p = 0.04). Higher ventricular ectopic beats in FCM vs ACM (45.8% vs 13.6%, p = 0.025). Using echocardiography, Lower LVMI in FCM vs ACM (117 [97.7-126.8], 165 [134-198.6], p = 0.0006). Higher left ventricular ejection fraction (LVEF) and cardiac index in FCM (68.5 [63.7-70]%, 61 [54.1-65.3], p = 0.005, 3.5 [2.1-4.6], 1.65 [1.3-2.23] ml/min/m2, p = 0.02 respectively). Lower E/Ea in FCM (6 [6-8], 14.5 [11-19.2], p < 0.0001). Higher S wave DTI at lateral mitral annulus and S wave DTI at lateral tricuspid annulus in FCM vs ACM (10.15 [8-11.7], 5.5 [4-8], p = 0.0009), (13.6 [11.8-15.2], 10.25 [9-12.4], p = 0.02) respectively. Lower left atrium diameter in FCM (20 [18-21], 26 [21-31.6], p = 0.002).
No difference in right ventricular systolic function between the groups FCM 46 [38-56] vs ACM 39.5% [37.9-48.1], p = 0.21) but decreased TAPSE (40.9% vs 0%, p = 0.001) and higher pulmonary systolic pressure in ACM vs FCM (42.5 [38-45] vs 25 [21-28.2], p < 0.0001). In MRI, lower myocardial fibrosis (16.7% vs 95.5 %, p < 0.00001) and pericardial effusion (4.5% vs 28.6% in p = 0.009) in FCM vs ACM.
Conclusion: FCM appears to be less severe than ACM with a lower frequency of heart failure, regional and global left ventricular dysfunction and lower left ventricular myocardial fibrosis. Furthermore, there is lower regional right ventricular abnormalities in FCM.

1217 (pp76)
Native T1 values discriminate between health and disease in acute and convalescent stage of disease in clinically suspected myocarditis

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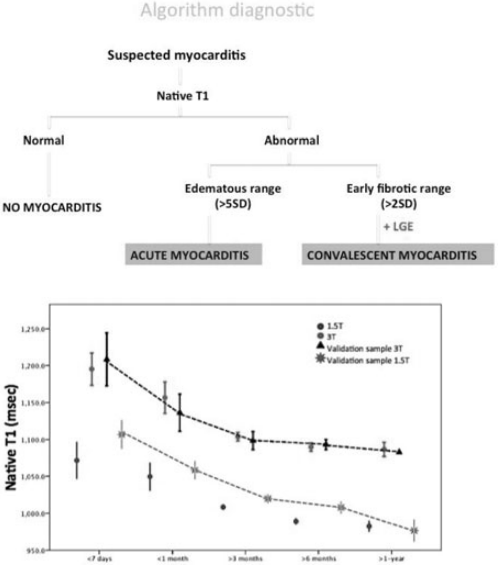
Background: Myocarditis is an important cause of cardiac morbidity and mortality. Characterised by a wide spectrum of clinical presentation, detection of disease can be challenging and clinical management pathway uncertain. T1 mapping by cardiovascular magnetic resonance (CMR) may reflect evolution of disease and support clinical diagnosis independently of the stage of disease.



Methods and results: Patients with clinical diagnosis of viral myocarditis (n = 165) underwent CMR (1.5 and 3 Tesla) for T2 imaging, late gadolinium enhancement (LGE) and T1 mapping prior to and >20 minutes after administration of 0.2 mmol/kg of gadobutrol.

Compared to controls (n = 40), T1-indices were increased in patients with acute symptoms (n = 61) and in convalescence (n = 67). A cohort of patients (n = 37) underwent serial scans (acute presentation and convalescence) and showed similar values to the two groups of independent subjects at respective stages. Native T1 can discriminate between health and disease independently of the stage of disease as well as between the two stages of myocarditis. Using predefined cut-off values for normal ranges, acute myocarditis was independently discriminated by native T1. The convalescent stage was best defined by a combination of LGE and native T1 (figure 1). In the present dataset, acute myocarditis was identified using 5SD above normal range. The convalescent stage was identified by either positive native T1 (>2SD) and/or presence of LGE. T1 native values showed gradual reduction of values over the course of the disease (figure2).
Conclusions: Native T1 can reliably discriminate between health and disease when myocarditis is clinically suspected. Based on our findings, we propose a novel algorithm for diagnosis of myocarditis irrespective of the clinical disease stage.

1225 (pp77)
Epidemiology, management and outcome in acute myocarditis: single experience in a tertiary center

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Introduction: The true incidence of acute myocarditis (MC) is unknown. Most patients will recover without sequelae, but a subset of patients will progress to chronic inflammatory and dilated cardiomyopathy. To better understand the clinical features and outcome of MC, we analysed the data of consecutive MC pts admitted to our department.

Methods: We retrospectively reviewed 72 pts who were admitted with diagnoses of MC between 2007 and 2013 at our institution. Cardiac magnetic resonance (CMR) was performed during hospitalization for MC diagnosis. Medical records were reviewed to abstract the demographic data, clinical presentation, evaluation, treatment, and follow-up outcomes.
Results: The mean age of pts was 33 ± 10 years and 56 (78%) of pts were males. 69% of pts had a short viral prodrome. Acute chest pain was the main inaugural symptom (92%) and fever at admission was detected in 44 (71%). Troponin I elevation was found in all patients (mean peak level of 22 ± 33ng/ml). Mean BNP, C-reactive protein values at admission were 176 ± 336 pg/ml and 79 ± 76 mg/dl, respectively. An abnormal ECG was present in 54 (75%) pts. Moderate to severe left ventricular (LV) systolic dysfunction (ejection fraction <45%) was present at admission in 13 pts (18%). CMR was displayed at 4 ± 2 days after admission and mean LV systolic function was (59 ± 8%), myocardial oedema was present in 58% and late gadolinium enhancement (LGE) in 92%. Mean hospitalization time was 9 ± 5 days. 53 (74%) pts were prescribed on non-steroidal inflammatory drugs (NSAIDs) during 2 ± 1 weeks after discharge. After a mean follow-up of 3 ± 2years no deaths occurred and 8 (14%) pts had the second episode of MC: all of them occurred in the first year (mean 8 ± 3months) of inaugural diagnosis. Only10 pts (of 13) had normalization of LV function.
In multivariate analysis a normal ECG (OR 14, 95%CI 1.91-105.2) and presence of oedema in T2 weight imaging (OR 11.48, 95%CI 1.54-87.98) were independent predictors of MC recurrence. On the oher hand, the only determinat of persistent LV dysfunction was the LV dysfunction at baseline (OR 1.2; CI 1.12-2.03, p = 0.032).
Conclusion: Despite the favorable outcome, some pts do not fully recover LV function and others had recurrence of MC. Further studies are needed to evaluate the long-term prognosis for such pts.