

was 19.0% in the 3rd tertile CIMT ( $\geq 0.83$ mm) group, 12.1% in the 2nd tertile (0.70–0.82mm) group and 4.3% in the 1st tertile ( $\leq 0.69$ mm) group ( $p=0.01$ ) (Fig. 2). After adding CIMT to a model with peak cTnI, net proportion of patients reclassified correctly by CIMT was 28.7% and net classification improvement was 0.56 (95% CI 0.46 to 0.66,  $p < 0.001$ ) (Fig. 3).

**Conclusions:** Carotid plaque and IMT was a strong prognosticator to predict future cardiovascular events in first STEMI patients than was door-to-balloon time or peak cTnI.

## POSTER SESSION 5

### CARDIAC INVOLVEMENT IN SYSTEMIC DISEASES

#### P3813 | BEDSIDE

##### Usefulness of 3D trans-oesophageal echocardiography in aortic atherosclerosis

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**Introduction:** Aortic complex atherosclerotic plaques are a risk factor for stroke. In the present study we evaluated the feasibility and reproducibility of three-dimensional transoesophageal echocardiography (3D-TOE) compared with two-dimensional transoesophageal echocardiography (2D-TOE) in the assessment of aortic atherosclerosis in a population of patients with cardiovascular risk factors.

**Methods:** We prospectively enrolled 41 consecutive patients referred to our centre for TOE (19 for stroke and 22 control patients without previous history of stroke). Aortic atherosclerosis was identified and measured with 2D-TOE and 3D-TOE (Phillips Medical System, IE-33, probe S7-3t). Echocardiography video clips were stored and analysed by 2 different observers, blinded to each other, to assess inter-observer variability.

**Results:** Mean additional time for acquisition of 3D-TOE images was  $26 \pm 12$  seconds. Simple atherosclerotic plaques were found on the descending aorta (DA), the aortic arch (AA) and the ascending aorta (AAo) respectively in 85%, 61% and 12.5% of patients with both methods. Complex plaques were found in 14.6% of patients with 2D-TOE versus 19.5% with 3D-TOE ( $p = 0.5$ ). On Bland-Altman analysis, mean difference between 2- and 3D plaque measurements was  $-0.15$  mm for observer 1 and  $-0.19$  mm for observer 2. On Wilcoxon's test, there was no significant difference in plaques thickness between 2D- and 3D-TOE, despite higher values with 3D-TOE (respectively for observer 1 and 2:  $p=0.085$  and  $p=0.056$  on DA;  $p=0.57$  and  $p=0.17$  on AA;  $p=0.59$  and  $p=0.34$  on AAo). With 3D-TOE, intra- and inter- observer variability was excellent, especially on the descending aorta (Lin's concordance coefficient correlation  $\rho=0.99$  and  $0.98$  respectively) and the aortic arch ( $\rho=0.97$  for both), although the reproducibility of 3D in the ascending aorta was weaker ( $\rho=0.76$  and  $0.83$ , respectively).

**Conclusion:** 3D-TOE is a feasible and highly reproducible method. However, besides the advantage of reproducibility, we found no additional value of 3D compared with 2D for the identification of aortic plaques.

#### P3814 | BEDSIDE

##### Could contrast echocardiography be an alternative to chest CT for pulmonary arteriovenous malformations screening in pediatric hereditary hemorrhagic telangiectasia?

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**Background:** In hereditary hemorrhagic telangiectasia (HHT), assessment of pulmonary arteriovenous malformations (PAVMs) may be difficult in pediatric patients. The aim of this study was to assess the reliability of contrast echocardiography in a pediatric population presenting with HHT.

**Methods:** We prospectively studied 22 pediatric patients presenting with HHT out a screening familial cohort. All patients underwent transthoracic contrast echocardiography (TTCE) and low-dose thoracic computed tomography (CT). Each TTCE examination was performed using second harmonic imaging, allowing to improve the quality of 2-dimensional imaging. The contrast protocol consisted of the injection of agitated 5% glucose solution through an upper extremity vein. We used the classification proposed by Barzilay et al.: grade 0 means no opacification of the left ventricle after the first 3 cardiac cycles following contrast appearance in the right atrium, grade 1 means minimal opacification; grade 2, moderate; grade 3, extensive opacification without outlining the endocardium; and grade 4, extensive opacification with clear endocardial definition. We considered CT as normal when no PAVMs or only one microscopic PAVMs was detected.

**Results:** Mean age of the population was  $11 \pm 5$  years (12 male). A PAVM was detected in 10 patients (45%) by CT. TTCE was feasible in all pediatric patients. Using TTCE, a grade 0 was found in 4 patients, a grade 1 in 7 patients, a grade 2 in 5 patients, a grade 3 in 6 patients and no patient had a grade 4. In case of grade 0 or 1, no patient had a significant PAVMs, whereas for grade 2 and 3, all patients excepted one had PAVMs. The sensibility and specificity of TTCE for the detection of PAVMs was respectively 100% and 92%.

**Conclusion:** Detection of PAVMs by TTCE is feasible in pediatric patients presenting with HHT. The reliability of TTCE is high in this specific population. A low

grade classification could presumably allow to avoid CT irradiation in pediatric patients.

#### P3815 | BEDSIDE

##### Subclinical atherosclerosis, vascular dysfunction and abnormal LV myocardial deformation is similar between patients with psoriasis and no hypertension and patients with untreated hypertension

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Psoriasis has been associated with an increasing risk for atherosclerosis, including coronary artery disease. CAD is an important cause of morbidity and mortality in patients with psoriasis. We investigated whether surrogate markers of subclinical atherosclerosis, vascular dysfunction and LV myocardial dysfunction are impaired in patients with psoriasis.

**Methods:** We compared 59 patients with psoriasis and no hypertension (PS) with 59 patients with untreated hypertension (HYP) and 40 normal subjects (N) with similar age and sex. In all patients and controls we measured a) the carotid-femoral pulse wave velocity using the Complior apparatus (PWVc) and augmentation index (AI) pulse wave velocity (PWVa) and using the oscillometric method (Arteriograph, TensioMed) b) coronary flow reserve of the LAD (CFR) by Doppler echocardiography c) carotid intima-media thickness (IMT) by ultrasonography d) global LV longitudinal strain (GLS) and strain rate (GLSR), using speckle tracking echocardiography. The PASI score an index of the extent of psoriatic lesions, was estimated in patients with psoriasis

**Results:** Patients with psoriasis had higher PWVc, PWVa, AI, IMT, and lower CFR, LGS and GLSR than normals ( $p < 0.05$ ) but similar values of these markers with untreated hypertensives ( $p=ns$ ) (PWVc-m/sec:  $8.6 \pm 1.5$  [N] vs.  $10.5 \pm 1.5$  [HYP] vs.  $10.4 \pm 1.8$  [PS], PWVa- m/sec  $7.3 \pm 1.6$  [N] vs.  $9.5 \pm 1.5$  [HYP] vs.  $9.6 \pm 2.8$  [PS] m/sec, AI -%:  $17 \pm 11$  [N] vs.  $24 \pm 15$  [HYP] vs.  $25 \pm 17$  [PS], CFR:  $3.4 \pm 0.6$  [N] vs.  $2.5 \pm 0.6$  [HYP] vs.  $2.4 \pm 0.1$  [PS] IMT-mm:  $0.7 \pm 0.2$  [N] vs.  $1.2 \pm 0.1$  [HYP] vs.  $0.9 \pm 0.3$  [PS], GLS-%:  $-21.9 \pm 1.6$  [N] vs.  $-18 \pm 1.5$  [HYP] vs.  $-16.2 \pm 4$  [PS] %, GLSR- l/sec:  $-1.2 \pm 0.12$  [N] vs.  $-1.0 \pm 0.2$  [HYP] vs.  $0.85 \pm 0.2$  [PS]). High PASI score as related with increased IMT ( $r=0.67$ ,  $p < 0.01$ ) and increased PWVc and PWVa was associated with decreased CFR ( $r=-0.39$ ,  $r=-0.49$ ,  $p < 0.05$ ) and GLS ( $r=0.33$ ,  $r=0.40$ ,  $p < 0.05$ ). Increased AI was associated with decreased GLS ( $r=0.30$   $p < 0.05$ )

**Conclusions:** Patients with psoriasis have similarly impaired markers of subclinical atherosclerosis, vascular function and LV myocardial deformation with patients with untreated hypertension when compared with healthy subjects. The extent carotid atherosclerosis is related with severity of psoriasis. Increased arterial stiffness is related with abnormal coronary microcirculation and LV deformation in patients with Psoriasis

#### P3816 | BEDSIDE

##### Reference ranges for biventricular volumes and ejection fraction and for left ventricular mass in adult thalassemia intermedia patients without myocardial iron overload

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**Purpose:** Thalassemia intermedia (TI) patients have significantly higher cardiac output and volumes with respect to thalassemia major patients.

This study aimed to establish the ranges for normal biventricular volumes and ejection fraction (EF) and for left ventricular (LV) mass assessed by cardiovascular magnetic resonance (CMR) in TI.

**Methods:** Among the 294 adult TI patients enrolled in the MIOT network, we selected 68 patients with no known risk factors or history of cardiac disease, normal electrocardiogram, no myocardial iron overload or fibrosis. Biventricular parameters were quantitatively evaluated by cine images using MASS<sup>®</sup> software. LV and right ventricular (RV) end-diastolic volume (EDV), end-systolic volume (ESV) and

Table 1

	Males		Females	
	Mean±SD	Normal value	Mean±SD	Normal value
LV EDVI (ml/m <sup>2</sup> )	101.5±22.6	<147	89.4±15.1	<120
LV ESVI (ml/m <sup>2</sup> )	38.1±11.2	<60	32.2±7.9	<48
LV SVI (ml/m <sup>2</sup> )	63.6±13.9	<91	57.4±12.3	<82
LV mass index	69.2±12.6	<94	57.7±10.9	<79
LV EF (%)	62.6±5.6	>57	63.8±5.9	>57.9
RV EDVI (ml/m <sup>2</sup> )	94.7±19.8	<134	83.9±16.1	<116
RV ESVI (ml/m <sup>2</sup> )	33.6±8.1	<50	30.5±9.3	<49
RV SVI (ml/m <sup>2</sup> )	61.1±14.8	<91	52.9±13.6	<80
RV EF (%)	63.9±5.7	>58.2	63.2±7.9	>55.3

stroke volume (SV) were normalized by body surface area (EDVI, ESVI, SVI), as well as the LV mass.

**Results:** The selected patients had a mean age of 36.5±9.2 years and 37 were males.

Biventricular volumes indexes (with the exception of the RV ESVI) and LV mass were significantly larger in males than in females while the EFs were not different. Biventricular parameters are detailed in Table 1 with differentiation for sex. Table 1 reports also the cut-off of normality defined as mean - 2 standard deviation (SD) for the volumes and the LV mass and as mean - 1 SD for the EF (considering the high cardiac output state in anemic patients).

**Conclusions:** Reference ranges for biventricular volumes and function specific to adult TI patients were defined. These new reference ranges are important for avoiding a misdiagnosis of cardiomyopathy in TI patients.

### P3817 | BEDSIDE

#### Right ventricular systolic dysfunction in young adults born preterm

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**Purpose:** Young adults born preterm have increased left ventricular mass, reduced myocardial strain and a unique three-dimensional left ventricular geometry. We have now investigated whether preterm birth also has an impact on the right ventricle.

**Methods:** We studied 102 preterm-born young adults followed prospectively since birth (mean gestational age = 30.3±2.5 weeks and mean birth weight = 1.30±0.29 kilograms) and 132 term-born controls born to uncomplicated pregnancies. We quantified right ventricular structure and function by cardiovascular magnetic resonance on a 1.5T Siemens scanner using Argus and TomTec 2D Cardiac Performance Analysis MR post-processing software.

**Results:** Right ventricular mass was increased in the preterm-born young adults compared to term-born controls (24.5±3.5 vs. 20.4±3.4 g/m<sup>2</sup>, P<0.001) proportional to the changes in the left ventricle. The increase in mass was inversely related to gestational age (r=-0.47, P<0.001) with an incremental elevation in right ventricular mass for each increase in severity of prematurity (i.e. extremely preterm > very preterm > moderate to late preterm, P<0.05). Preterm-born young adults also showed a reduction in end-diastolic volume (79.8±13.2 vs. 88.5±11.8 mL/m<sup>2</sup>, P<0.001) and right ventricular free wall longitudinal peak systolic strain and longitudinal peak systolic strain rate compared to term-born controls (P<0.001). However, the changes in right ventricular function were more severe than observed for the left ventricle with a significant reduction in ejection fraction (57.0±7.6 vs. 60.0±5.3%, P=0.006), related to gestational age (r=0.46, P<0.001) and a proportion having ejection fractions below the normal range. Adjustment for postnatal ventilation accounted for some of this variation but an independent impact of prematurity remained.

**Conclusions:** Young adults born preterm have increased right ventricular mass and significant reductions in right ventricular systolic function. These initial findings, in combination with our previous findings for the left ventricle, indicate myocardial changes in preterm infants are global and relevant to both pulmonary and systemic circulations. The changes are proportional to the degree of prematurity but may be more severe in the right ventricle.

### P3818 | BEDSIDE

#### Pulmonary shunt grading on transthoracic contrast echocardiography predicts the indication for transcatheter embolotherapy of pulmonary arteriovenous malformations

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**Background:** Pulmonary arteriovenous malformations (PAVMs) are associated with severe neurological complications in patients with hereditary haemorrhagic telangiectasia (HHT). Screening for PAVMs is performed with transthoracic contrast echocardiography (TTCE) and confirmed with chest high-resolution computed tomography (HRCT) to evaluate the opportunity for transcatheter embolotherapy.

**Purpose:** We determined whether pulmonary shunt grading on TTCE predicts the indication for transcatheter embolotherapy of PAVMs.

**Methods:** A total of 1020 consecutive persons (mean age 44.4±15.5 years, 58% female), referred for HHT screening between 2004 and 2011 at two specialized HHT clinics, were prospectively included and underwent both TTCE and chest HRCT. A quantitative three-point grading scale was used to classify the pulmonary shunt on TTCE (grade 0, no microbubbles; 1, <30 microbubbles; 2, 30-100 microbubbles; 3, >100 microbubbles). Transcatheter embolotherapy was

performed in all PAVMs judged large enough for endovascular closure based on chest HRCT.

**Results:** TTCE documented a pulmonary shunt in 547 persons (53.6%). The positive predictive value of a pulmonary shunt grade 1, 2 or 3 on TTCE for the presence of PAVMs on chest HRCT was 12%, 45% and 93% respectively. Based on chest HRCT, transcatheter embolotherapy was performed in 39 (26%) and 127 (78%) patients with a pulmonary shunt grade 2 or 3 on TTCE respectively, while none of the 473 and 231 patients with respectively a pulmonary shunt grade 0 or 1 had PAVMs large enough for transcatheter embolotherapy.

**Conclusions:** Pulmonary shunt grading on TTCE predicts the indication for transcatheter embolotherapy of PAVMs. Additional chest HRCT should be withheld in patients with a pulmonary shunt grade 1, since these shunts are too small for transcatheter embolotherapy.

### P3819 | BEDSIDE

#### Acute changes of glucose and insulin levels during oral glucose tolerance test are related to changes in LV myocardial deformation, untwisting and coronary flow reserve

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Increased arterial stiffness caused by insulin resistance may impair LV function. We investigated whether first degree relatives of diabetics have similar changes of coronary microcirculation and myocardial twisting with diabetics during an oral glucose tolerance test (OGTT).

**Methods:** In 76 subjects, we measured glucose, insulin, pulse wave velocity (PWV) and augmentation index (AI) (Arteriograph) at 0, 30, 60, 90 and 120 min of OGTT. At 0 and 120 min, we measured a) E', A' and E'/A' mitral annular velocities using tissue Doppler b) LV longitudinal systolic (LGSr-l/s) and diastolic strain rate (LGSrE), twisting (Tw-deg), twisting (Tw-deg/sec) and untwisting (unTw) velocity using speckle tracking echocardiography c) coronary flow reserve (CFR) using Doppler echocardiography. We assessed insulin resistance using insulin sensitivity index (ISI- includes both insulin and glucose throughout OGTT).

**Results:** Thirty-six subjects who were first degree relatives of diabetics had normal OGTT (relatives), 20 had normal OGTT and no family history of diabetes (normals), and 20 had abnormal OGTT (diabetics). Compared to normals, diabetics and relatives had both higher baseline PWV (9.3±2 vs. 8.1±2 vs. 7.2±1.6), AI (23±9 vs. 24±14, 18±1), insulin (median 14 vs. 15 vs. 10 µU/ml), and lower ISI (50±24 vs. 73±22 vs. 93±17), E'/A' (0.7±0.2 vs. 0.98±0.2 vs. 1.1±0.3) LGSr (-0.95±0.1 vs. -0.94±0.1 vs. -1.1±15) LGSrE (0.98±0.1 vs. 1.±0.1 vs. 1.3±15), Tw (15±7 vs. 13±5 vs. 17±7) and unTw velocity (-95±31 vs. -94±40 vs. 116±36) and lower CFR (2.7±1.1 vs. 2.6±0.9 vs. 3.0±0.6) (p<0.05). Insulin was increased at 120min, to 521% in diabetics, 293% in relatives and 190% in normals (p<0.05). PWV was increased at 120min to 8.9 (10%) in relatives, was reduced to 6.8 (6%) in normals and remained high (9.4±2m/s) in diabetics (p<0.05). Tw and unTw velocity at 120min, was increased to 17 (13%) and -105 (10%) in diabetics, to 15 (15%) and -105 (10%) in relatives and was reduced to 13 (24%) and -87 (25%) in normals (p<0.05). CFR was decreased to 2.4 (14%) in diabetics, 2.3 (12%) in relatives and 2.8 (6%) in normals (p<0.05). ISI, insulin and glucose at 120 min were related with PWV, CFR, LGSr, LGSrE, TW, Tw velocity, unTw velocity and E'/A' and PWV was related with LGSr E, Tw, Tw velocity, unTw velocity and E'/A' (in both diabetics and relatives (p<0.05).

**Conclusions:** Acute hyperglycemia and hyperinsulinemia during OGTT are related with abnormal LV myocardial deformation, twisting and untwisting possibly through increases in arterial stiffness and impairment of coronary microcirculatory function in first degree relatives and diabetics

### P3820 | BEDSIDE

#### The role of transthoracic contrast echocardiography in the clinical diagnosis of hereditary haemorrhagic telangiectasia

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**Background:** Hereditary haemorrhagic telangiectasia (HHT) can be diagnosed according to the four clinical Curaçao criteria, including presence of pulmonary arteriovenous malformations (PAVMs). In the last few years, transthoracic contrast echocardiography (TTCE) replaced chest high-resolution tomography (HRCT) for the screening of PAVMs.

**Purpose:** We evaluated the added value of TTCE to the current clinical Curaçao criteria in diagnosing HHT.

**Methods:** Between 2004 and 2012, a total of 487 first-degree relatives of HHT-causing mutation carriers were included, who underwent both TTCE and chest HRCT. Genetic testing was performed in all persons and considered as gold standard for the presence or absence of HHT. A quantitative three-point grading scale was used to classify the pulmonary shunt on TTCE (grade 0, no microbubbles; 1, <30 microbubbles; 2, 30-100 microbubbles; 3, >100 microbubbles).