Methods: We enrolled 23 patients [16 male (70%), mean age 59±10 years] with CTRCAO and without stenosis of LAD and 13 [5 male (38%), mean age 62±10 years] age matched control subject without cardiovascular disease. All patients underwent a PCI attempt aiming the opening of the CTRCAO. All patients and control subjects underwent detailed TTDE at the beginning of the study. Patients with successful CTRCAO PCI underwent a repeated DCFV assessment by TTDE. DCFV were assessed by TTDE interrogating the proximal LAD. Peak (PDCVF) and velocity-time integrals (DCFVTI) of the DCFV spectrums were measured.
Results: The mean Rentrop collateral grade was 2.2±0.7 in CTRCAO patients. Both DCFV parameters were significantly higher in CTRCAO patients before PCI compared to control subjects (PDCFV: 74.9±31.9 vs. 45.8±15.6 cm/sec, $p<0.01$; DCFVTI: 21.8±6.3 vs 14.5±7.9 cm/sec, $p<0.05$). The PCI was successful in 18 patients (78%). PDCFV and DCFVTI decreased significantly after successful PCI of CTRCAO when compared to DCFV values measured before interventions (Table).

	Before CTRCAO PCI	After CTRCAO PCI	p value
Peak LAD DCFV (cm/sec)	72.8±31.4	52.2±20.6	$p<0.01$
VTI of LAD DCFV (cm)	22.4±4.1	15.2±7.7	$p<0.05$

Results are expressed as mean ± SD; CTRCAO = chronic total right coronary artery occlusion; DCFV = diastolic coronary flow velocity; VTI = velocity time integral; PCI = percutan coronary artery intervention.

Conclusion: Presence of CTRCAO is accompanied by elevated DCFV profile of the non-diseased LAD coronary artery. Successful PCI of CTRCAO results in significant decrease of LAD DCFV values.

P5248 | BEDSIDE
Variability of thoracic aortic diameters according to gender, age and body surface area: nomograms should replace absolute cut-off values?

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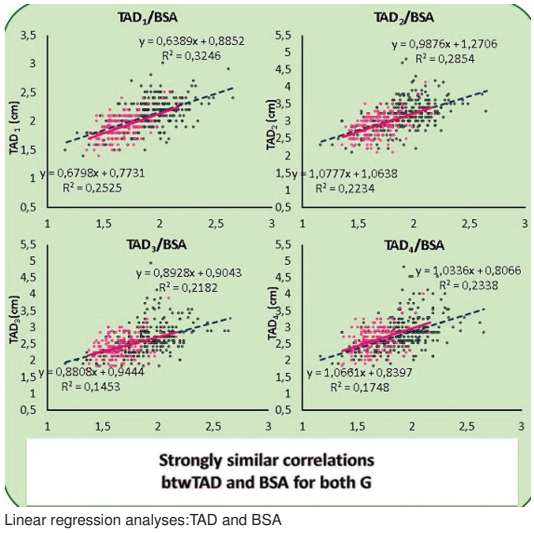
Background: Thoracic aortic (TA) dilatation requires accurate and timely detection to prevent progression to aneurysm or dissection, and 2-D transthoracic echocardiography remains the screening tool. Differences in TA diameters (TAD) according to gender, age and body surface area (BSA) have been previously reported. However, the reported ranges of TAD are limited by small sample size, different measurement sites and heterogeneous cohorts. Moreover, surgery indication for aneurysms is still based mainly on absolute diameters with no reference to gender, age or BSA.
Purpose: We aimed to assess the full spectrum of TAD in both gender and their correlations with age and BSA to obtain reference normograms in healthy adolescents and adults.
Methods: Medical examination and complete color flow/spectral Doppler transthoracic echocardiograms were performed to exclude cardiovascular risk factors, thoracic aorta aneurysm, aortic regurgitation, bicuspid valve, past history of cardiac surgery or personal/familial Marfan/Ehlers-Danlos syndromes. TAD (cm) were assessed according to last recommendations in healthy, ≥14 y/o volunteers at: annulus (TAD1), sinuses of Valsalva (TAD2), sinotubular junction (TAD3), proximal ascending (TAD4), isthmus (TAD5) and proximal descending (TAD6). We used parasternal long axis (TAD1–4) and suprasternal (TAD5&6) views. TAD1 was measured at mid-systole (inner edge method). All other TAD were measured at end-diastole (leading edge method). Data was stratified by G and A (A1: 14–24 y/o, A2: 24–40 y/o, A3: >40 y/o) and indexed to BSA (TADi). Linear regression analyses between dependent (TAD, TADi) and independent (G, A and BSA) variables were conducted with Pearson's least squares method to obtain coefficients of determination (R2) and 95% prediction intervals. Group data was compared with unequal variance T-test for independent samples or Fisher's z transformation for independent correlations, and results are reported as mean±SEM. Significance was set at $P<0.05$.
Results: Pooled data from all patients (n=520; 39% women; 32.8±0.7 y/o; 1.82±0.23 m^2) showed that all TAD increased with age and BSA ($p<0.001$). All TADi were negatively correlated with BSA ($p<0.001$). Every TADi was positively correlated with age ($p<0.001$) except for the annulus diamters (R2=0.0005; p=NS). Gender comparisons showed differences between men and women and TAD, TADi, age and BSA ($p<0.001$), but strongly similar correlations (p=NS). Normograms were obtained for A1, A2 and A3 to predict TAD from BSA with no need of G distinction.
Conclusions: BSA is the strongest predictor of TAD. Similarly, TAD increase with age, except for the aortic annulus which depends more on BSA. Women have smaller TAD due to their lower BSA, but they correlate strongly similar to men. Therefore, we propose nomograms of TAD for different A groups without G distinction. BSA and A must be taken into account when assessing an individual patient.



Linear regression analyses:TAD and BSA

P5249 | BENCH
Fetal cardiac tumor: echocardiography characteristics, clinical manifestations and outcomes

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Objective: The aim of this study is to assess the echocardiography characteristics, clinical manifestations and outcome of fetal cardiac tumors.
Methods: We retrospectively analyzed 21607 fetal echocardiograms from August 2010 to December 2016 in our institution. A total of 54 fetuses were suspected having single or multiple cardiac tumors. The fetal echocardiography characteristics and clinical manifestations were summarized. Follow-up for pregnant women was performed. For terminated pregnancies, fetal umbilical cord and deltoid muscle tissues and parental peripheral blood were obtained. In delivered fetuses, the newborn and parental peripheral blood was also collected, transthoracic echocardiography (TTE) for newborn were performed and clinical data were also collected. Targeted genomic sequencing of TSC1 and TSC2 genetic test were performed.
Results: In 54 fetuses with single or multiple cardiac tumors, the pregnant women age was 29.4±4.7 years (range 19–38 years), and the mean gestation age was 28.1±4.4 weeks (range 21~38 weeks). 37 fetuses were terminated (68.5%), 11 fetuses were lost to follow-up and 7 fetuses were delivered. The ultrasound characteristics are single or multiple hyperechogenic, well demarcated, ovoid hamartomas, located in the interventricular septum, left and right atrial and ventricular myocardium. Color Doppler showed no flow in the tumors.
Fetal echocardiography showed single tumor in 14 fetuses, among them, 4 fetuses were terminated, 9 fetuses were lost to follow-up and 2 fetuses were delivered, one case had TTE study at 2 years old showed a tumor persist without a regression trend and the TSC genetic test showed a negative TSC mutation. Spontaneous tumor regression occurred in one case at a 3 years age confirmed by TTE without a TSC genetic test. The other 40 fetuses showed multiple tumors, 34 fetuses were terminated with 24 fetuses had TSC genetic test that showed familial inherited mutation in 8 cases, de novo mutations in 11 cases, negative TSC mutation in 5 cases. 2 fetuses were lost to follow-up and 5 fetuses were delivered. TTE study was performed in the delivered 5 cases, showed spontaneous tumor regression occurred in 3 cases (latest at 2 years and 3 month), tumor persist in 2 cases (10 month, 2 years respectively). 2 cases had TSC genetic test, one showed a familial inherited mutation with tumor persist at 2 years old; one showed fetal de novo mutation with a spontaneous tumor regression at one year old by TTE and intracranial tubers by CT.
Conclusion: Most prenatal cardiac tumor detected by echocardiography should raise the suspect of tuberous sclerosis especially in fetuses with multiple tumors, TSC1 and TSC2 sequence detect is recommended, the virulence gene mutation is easy to be found in familial cases. The patients require prenatal diagnosis and genetic counseling, which is helpful in establishing antenatal management strategy and management of next pregnancy.

ECHOCARDIOGRAPHY/DOPPLER

P5250 | BEDSIDE
Can 3d-echocardiography challenge cardiac magnetic resonance imaging in the assessment of right ventricular volumes and function in GUCH patients after percutaneous pulmonary valve implantation?

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Background: Cardiac MR (CMR) is the gold standard for the assessment of the volumes and function of the right ventricle (RV). Recently, transthoracic three-dimensional echocardiography (3DE) is becoming increasingly available in the routine clinical practice.
Purpose: To investigate the clinical significance and interchangeability of CMR

versus 3DE for the evaluation of RV in patients with congenital heart disease (CHD), who underwent percutaneous pulmonary valve implantation (PPVI) for RV outflow tract dysfunction.
Materials and methods: 52 patients who underwent PPVI were evaluated with 3DE and CMR to assess the RV. RV volumes and ejection fraction (EF) were measured for both imaging techniques with commercially available softwares (Tomtec-Germany for 3DE and Medimatic-Netherlands for CMR data). Paired t test, Bland-Altman analysis and Pearson's correlation analysis were used where appropriate.
Results: 80% of the patients had adequate image quality on 3DE and was included in the study. 78% had a primary disease of the RV (tetralogy of Fallot, pulmonary atresia, transposition of the great arteries, ...), while 9 patients had a natively normal RV and underwent PPVI after a Ross procedure. No differences were found regarding age, body size and type of valve implanted. Linear regression analysis showed high correlation coefficients between 3DE and CMR ($p<0.001$). Bland-Altman analysis showed limited bias and narrow limits of agreement (LOA) between the two techniques: End Diastolic Volume index (EDVi): bias -2.1 ml, LOA ±22.8 ml; End Systolic Volume index (ESVi): bias -4.1 ml, LOA ±15 ml; EF: bias 4%, LOA: ±16.3. A non-significant trend towards overestimation of volumes by 3DE was observed. The 3DE measurements were found to be highly reproducible in terms of intra-observer variability (EDVi 0.97, ESVi, 0.87, EF 089, $p<0.001$).

Comparison of RV volumes and EF

	CMR	3DE	P*	r
EDVi (ml/m^2)	82.98±23.52	85.12±22.48	0.001	0.873
ESVi (ml/m^2)	37.33±17.60	41.4±15.6	0.001	0.897
EF (%)	56±10.6	52.04±9.89	0.001	0.675

*P value for % difference. CMR: cardiac magnetic resonance; 3DE: 3-dimensional echocardiography; EDVi: End Diastolic Volume index; ESVi: End Systolic Volume index.

Conclusion: The present study supports the applicability of 3DE for the assessment of RV volumes and EF in patients with CHD after PPVI.

P5251 | BEDSIDE
Left atrium appendage: different morphology, same results

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Background: Atrial fibrillation is one of the most common arrhythmias. Left atrium (LA) remodeling plays major role in possible recurrences of atrial fibrillation (AF). On terms of AF recurrences LA morphology has been widely studied, but the role of the left atrial appendage (LAA) is still unknown.
Objective: To describe morphological characteristics of LAA and to analyze their clinical impact in AF patients.
Methods: 167 patients underwent PV isolation for AF. 3D rotational angiography was performed preprocedural in all patients and a 3D model of the whole atrium was analyzed including LAA. Images were post processed with customized software to obtain different morphological parameters of the LAA as volume, ostium maximum and minimum diameter, and surface area. Morphology of the appendage, as well as the number of lobes were analyzed visually by two experts. All patients were followed up for 6 months and AF recurrences were reported.
Results: Basic analysis on our population showed that 75.5% were in paroxysmal AF and 26.2% had AF recurrence. Furthermore, 58% of the patients had CHA2DS2-VASc $\geq$2 and only 2.4% of strokes were reported. Regarding the LAA morphology, there was a highly good concordance between observers with a significant χ^2 analysis showing a LAA type of 14.3% chicken wing, 22.1% wind sock, 24% cactus and, the most common in our population, 39.6% cauliflower. The average number of lobes was 2.3±1.2. Cactus type was characterized by the maximum number of lobes, 2.7±1. We did not find any statistical difference neither on LA or LAA volume, nor on LAA surface area, regarding the different types of LAA. In contrast, a significant difference in the ostium maximum diameter among the different types of LAA was observed. The type of cauliflower was reported with the maximum diameter compared to chicken wing and wind sock type. No difference was found comparing LAA morphology with AF type or recurrences. 3D LA volume was statistically significant higher in persistent AF and the only significant predictor marker of AF recurrences.
Conclusion: Despite the variety of LAA in terms of types, number of lobes and dimensions, we did not find any single parameter to predict AF recurrences or strokes. In agreement with previous studies, 3D LA volume remained the main predictor of AF recurrences.

P5252 | BEDSIDE
Impact of sex, age, and cardiovascular risk factors on myocardial strain

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Introduction: Myocardial deformation imaging is a sensitive and reproducible tool for early discovery of myocardial dysfunction. Several cardiovascular risk factors are known to contribute to the development of heart failure, but their impact on myocardial deformation is unexplored.
Purpose: To determine the individual impact of cardiovascular risk factors on global peak systolic strain (GLPS) as well as on systolic and diastolic strain rate (SR).
Methods: The ongoing STAAB Cohort Study (Characteristics and Course of Heart Failure STAges A/B and Determinants of Progression) recruits participants (30–79 years) free of symptomatic heart failure from a representative sample of the population of Würzburg, Germany, for assessing frequency and determinants of the early heart failure stages A-B. Participants undergo clinical evaluation and transthoracic echocardiography (Vivid S6®, GE). 2D speckle tracking analysis was performed offline (EchoPac®, GE). GLPS as well as systolic and diastolic SR were obtained from three apical standard views in an 18 segment model. Cardiovascular risk factors were defined as: hypertension (RR $\geq$140/90 mmHg), dyslipidemia (LDL $\geq$190 mg/dl), obesity (BMI $>$30 kg/m^2), diabetes mellitus (diabetic medication, HbA1c $>$6.5%, fasting plasma glucose $>$7.0 mmol/l or 2h-plasma glucose $>$11.1 mmol/l), smoking (current or ex-smoker). Reference deformation values were derived from a subsample of apparently healthy participants free of cardiovascular risk factors and cardiovascular disease.
Results: In 1219 of 1818 participants (49% male, 54±12 years) deformation analysis could be performed. In 323 of 543 apparently healthy participants GLPS could be obtained: compared to apparently healthy men, in apparently healthy women GLPS (-18.7±2.2% vs -20.4±2.0%, $p<0.05$) and mean systolic SR (-0.94±0.14/s vs -1.02±0.13/s, $p<0.01$) were more negative, and early diastolic SR was higher (1.17±0.29/s vs. 1.44±0.38/s, $p<0.001$). Late diastolic SR showed no sex difference. With increasing age, GLPS became significantly less negative ($p=0.001$), and early and late diastolic SR significantly less positive ($p<0.001$). Including all risk factors in a general linear model (total cohort, n=1219), GLPS was affected by dyslipidemia ($p=0.003$) in women and by obesity in either sex ($p=0.003$). Systolic SR was influenced by obesity in women ($p<0.001$), and diabetes in men ($p=0.048$). Early diastolic SR was affected by hypertension ($p=0.009$) in women, and obesity in either sex ($p<0.001$). No risk factor influenced late diastolic SR.
Conclusion: In a well characterized population-based cohort, balanced for age and sex, we found in apparently healthy participants that male sex and higher age were associated with worse systolic and diastolic deformation patterns, suggesting the use of sex- and age-specific cut-off values. Further, dyslipidemia, diabetes and obesity had a negative impact on systolic function, whereas diastolic function was mainly affected by hypertension and obesity.
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P5253 | BEDSIDE
Ventricular synchrony is not determined by myocardial perfusion in heart failure: A 13N-ammonia PET study

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Background: An inverse relationship between myocardial perfusion and PET ventricular synchrony has been proposed. Ventricular synchrony has been suggested as a useful marker for the detection of multivessel coronary artery disease. However, the potentially confounding influence of fixed perfusion defects (indicating previous infarction and scar) over the perfusion-synchrony relationship, has not been investigated. In heart failure, ventricular remodelling possibly affects perfusion and synchrony, adding a layer of complexity to this interrelation. The present study aimed to evaluate the relationship between quantitative PET regional myocardial perfusion and ventricular synchrony when accounting for the extent and severity of pre-existing fixed perfusion defects in patients with heart failure.
Methods: 98 patients with chronic heart failure underwent PET perfusion scanning with 13N-ammonia. Gender, age, and modifiable cardiovascular risk factors data was retrieved. Quantitative perfusion was analysed regionally per vessel territory (LAD, LCx and RCA) and a myocardial perfusion reserve (MPR) $<$2.0 was considered abnormal. The summed rest score (SRS) was retrieved as a proxy for the extent and severity of fixed perfusion defects in patients with previous infarction. Rest and stress synchrony was analysed through the histogram bandwidth (BW), standard deviation (SD) and Entropy. Prior comparison of synchrony parameters between patients with 0,1,2 and 3-vessels with abnormal MPR, we performed a stepwise multivariate analysis with stress synchrony (BW, SD and Entropy) as the dependent variable. Clinical data, number of vessel territories with abnormal MPR, history of a previous MI and SRS were input as the independent variables.
Results: An MPR ($<$2.0) was found in 0- (28 patients), 1- (10 patients), 2- (14 patients) and 3-vessels (37 patients). There were no significant differences in synchrony between rest and stress. Between groups, there was a significantly worse stress BW in patients with abnormal MPR in 3 vessels (Diff=28.8°, p=0.015) and only a trend in stress Entropy (Diff=7.23%, p=0.08). Multivariate analysis showed in the first step that the number of vessels with abnormal MPR (p=0.024), dyslipidemia (p=0.036), and sex (p=0.025) were significant predictors of stress synchrony. However, when adding the presence of a previous MI and SRS to the