

## POSTER SESSION 5

### THE IMAGING EXAMINATION AND QUALITY ASSESSMENT

#### P1064

##### The natural course of heart failure with preserved ejection fraction (HFpEF) - insights from an exploratory echocardiographic registry

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**Background:** Despite recent approaches, a profound understanding of pathophysiological abnormalities in heart failure with preserved ejection fraction (HFpEF) is still lacking.

**Purpose:** Echocardiography provides the method of choice for diagnosis as well as progression assessment in patients with suspected HFpEF. Thus, the purpose of this exploratory study is to investigate long-term outcomes regarding echocardiographic and clinical parameters aiming to further characterize this barely described condition.

**Methods:** A total number of 115 HFpEF patients (mean age  $70.6 \pm 8.9$  years, 66.1% females) were consecutively enrolled: medical history, physical examination, New York Heart Association (NYHA) functional class, 6-minute walking distance and routine blood tests including serum NT-proBNP measurement were evaluated at baseline and follow-up visits. Furthermore, comprehensive transthoracic echocardiography (TTE) was performed at baseline and at mean  $23.9 \pm 15.5$  months of follow-up.

**Results:** The present analysis suggests that HFpEF patients featured significant improvement in NYHA functional class ( $\geq$ III: 72.2% vs. 55.7%,  $p < 0.001$ ) as well as a minor increase in 6-minute walking distance (mean  $325.4 \pm 120.6$  vs.  $355.1 \pm 123.5$  meters,  $p = 0.756$ ) at follow-up, whereas serum NT-proBNP levels (mean  $2026.7 \pm 3301.5$  vs.  $2242.0 \pm 3976.9$  pg/mL,  $p = 0.265$ ) remained consistent. Notably, TTE revealed global, yet not significant, enlargement of atrial and ventricular size over time (left atrium, LA: mean  $61.8$  vs.  $63.0$  mm,  $p = 0.021$ ; left ventricle, LV: mean  $43.8$  vs.  $44.2$  mm,  $p = 0.444$ ; right atrium, RA: mean  $62.5$  vs.  $62.8$  mm,  $p = 0.723$ ; right ventricle, RV:  $37.7$  vs.  $38.0$  mm,  $p = 0.496$ ). LV systolic function assessment by biplane Simpson's method indicated a slight decrease of LV ejection fraction (mean  $58.4 \pm 6.4$  vs.  $55.0 \pm 6.8$  %,  $p = 0.038$ ). E/E' ratio derived from Tissue Doppler measurement strongly correlates with LV filling pressures and was generally elevated in the HFpEF population throughout our investigation (mean  $16.1 \pm 8.2$  vs.  $15.6 \pm 7.6$ ,  $p = 0.835$ ). In addition, RV systolic function tended to significantly deteriorate (moderately to severely abnormal; 15.7% vs. 24.3%,  $p < 0.002$ ) alongside with evidence of tricuspid regurgitation worsening (moderate to severe; 54.8% vs. 67.0%,  $p < 0.001$ ) compared to baseline examination.

**Conclusions:** Our work demonstrates deterioration of right ventricular function and worsening of tricuspid regurgitation over time. Although HFpEF is generally regarded as disease of the left ventricle, recent investigations provide strong evidence of right ventricular contribution to the overall impairment and mortality of these patients.

#### P1065

##### Epicardial fat and effectiveness of catheter radiofrequency ablation in patients with atrial fibrillation and metabolic syndrome

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**Background:** Metabolic syndrome (MetS) increases the risk of atrial fibrillation (AF). The detection of factors which can impact on the effectiveness of radiofrequency ablation (RFA) may be useful in clinical practice. Visceral adipose tissue has proinflammatory and profibrogenic effects on cardiovascular system and may influence upon remodeling of the heart.

**Purpose:** Study objective - to evaluate the epicardial fat thickness (EFT) and to reveal the possible relationship of this parameter with effectiveness of radiofrequency ablation in patients with AF and MetS.

**Design and methods:** 58 patients 35-65 years old (20 women) with MetS (IDF, 2005) with paroxysmal and persistent AF were examined. The control groups were 50 persons with AF and without MetS. Groups did not differ significantly by gender and age ( $p > 0.05$ ). The examination includes: medical history, anthropometry, echocardiography. The EFT was measured with transthoracic echocardiography over the free wall of the right ventricle. After radiofrequency ablation with vein isolation with non-fluoroscopic system of 3D electroanatomical mapping (CARTO3) we analyzed the clinical data and the effectiveness of therapy, which is considered effective if there were no reported paroxysms of AF during follow-up (12 month).

**Results:** EFT in patients with persistent AF was greater than in patients with paroxysmal AF ( $5.2 \pm 1.5$  and  $4.2 \pm 1.1$  mm,  $p = 0.02$ ). Correlation analysis was showed a strong positive correlation between EFT, diameter and volume of the left atrium ( $r = 0.64$ ,  $r = 0.61$ ,  $p < 0.001$ ). After prospective study we registered recurrent paroxysms of AF in 29 patients. In patients with MetS recurrent paroxysms of AF was more often detected (63%) than in patients without MetS (37%). The size of the left atrium in patients with effectiveness of radiofrequency ablation and in patients without effect of this therapy did not differ significantly ( $44.6 \pm 5.4$  and  $42.8 \pm 4.5$  mm,  $p > 0.05$ ). But EFT was greater more than 1,6 folds in patients with recurrent paroxysms of AF than in patients without paroxysms of AF ( $4.5 \pm 1.5$  and  $2.8 \pm 1.5$  mm,  $p = 0.001$ ). The multivariate regression analysis demonstrated that EFT is an independent predictor of non-effective of radiofrequency ablation therapy of AF (OR=1,47, 95% CI 1,02-2,04,  $p = 0,014$ ).

**Conclusions:** Epicardial fat in patients with non effectiveness of radiofrequency ablation is thicker than in patients with effect of this therapy. Greater thickness of epicardial fat is associated with higher risk of non effectiveness of radiofrequency ablation. Epicardial fat can influence on remodeling of the heart, that's why in patients with metabolic syndrome recurrent paroxysms of atrial fibrillation were detected more often than in patients with atrial fibrillation and without metabolic syndrome.

#### P1066

##### Systematic disinfection of echocardiographic probe after each examination to reduce the persistence of pathogens as a potential source of nosocomial infections

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**Introduction:** Carriage of antimicrobial-resistant pathogens (AP) favors patient to patient spread of nosocomial infections (NI). NI have been shown to be associated with increased attributable mortality, length of stay and health care costs. Subsequent prevention may potentially decrease NI.

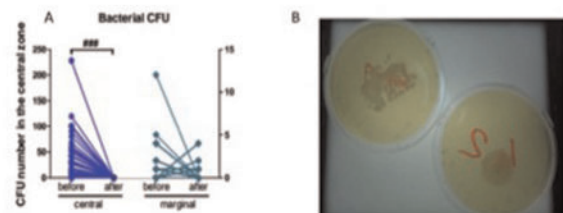
**Purpose:** We hypothesized that transthoracic echocardiographic probes may be an important cause of AP spreading and we aimed to compare the standard of care with systematic probe disinfection after each examination.

**Methods:** We enrolled 48 consecutive patients undergoing a transthoracic echocardiography (mean age: 69 years old, 26 males). The following confounding factors were taken into account: antibiotics administration, oestrogenic medication/pregnancy, corticotherapy, diabetes, alcoholism, auto-immune diseases immunosuppression, chronic dialysis, regular use of skin antiseptics, obesity, dermatitis or parasitic diseases and previous cardiothoracic surgery. After examination, ultrasound probe was cleaned up and was vertically applied on a Tryptic Soy Agar (TSA) contact plate (bioMérieux). Contact time between transducer surface and agar plates was 30 seconds. The probe was disinfected with one wipe (Umonium38<sup>®</sup> Medical Tissues, Huckert's) and hold in contact with another TSA contact plate. Contamination status was then determined by TSA plates that were kept in ventilated position till the end of the day, then incubated at 37°C for 24h and blindly enumerated. The presence of moulds was determined.

**Results:** After standard cleaning, a mean of 16 AP spots (0-228) was detected vs. 1 (0-12) ( $p < 0.001$ ) after systematic disinfection (Fig1A). The difference was independent of the confounding factors. An individual example is shown in Fig1B.

**Conclusions:** A systematic disinfection of transthoracic probe after each examination reduced the persistence of AP. This may decrease the patient to patient spreading of AP and the subsequent nosocomial infections. A systematic protocol of probe disinfection should be developed in every echo laboratory.

Figure 1AB



Abstract P1066 Figure.

## ASSESSMENT OF MORPHOLOGY AND FUNCTION

## P1067

## Left atrial mechanical function assessed by two-dimensional echocardiography in hypertensive patients

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## AIM:

To compare left atrial (LA) mechanical function, assessed by two-dimensional echocardiography, in patients with essential hypertension with healthy controls.

**Methods:** LA volumes were measured echocardiographically in 50 hypertensive patients and 50 age-matched healthy controls using biplane Simpson method. LA volume measurements were done at the time of mitral valve opening (V<sub>max</sub>), at the onset of atrial systole (p wave at the electrocardiogram=V<sub>p</sub>) and at mitral valve closure (V<sub>min</sub>). All volumes were indexed for body surface area, and the following left atrial emptying functions were calculated: LA passive emptying volume=V<sub>max</sub>-V<sub>p</sub>, LA passive emptying fraction=LA passive emptying volume/V<sub>max</sub>, conduit volume=left ventricular stroke volume-(V<sub>max</sub>-V<sub>min</sub>), LA active emptying volume=V<sub>p</sub>-V<sub>min</sub>, LA active emptying fraction=LA active emptying volume/V<sub>p</sub>, LA total emptying volume=(V<sub>max</sub>-V<sub>min</sub>), LA total emptying fraction=LA total emptying volume/V<sub>max</sub>.

**Results:** Hypertension was associated with an increase of all LA volumes: V<sub>max</sub> (p<0.001), V<sub>p</sub> (p<0.001) and V<sub>min</sub> (p<0.004). LA booster pump function was significantly greater in hypertensive patients than in controls with an increase of LA active emptying fraction (35±12% versus 30±12% respectively; p=0.032). The increase of LA booster pump function was found to be greater in hypertensive patients with impaired diastolic function compared to those with normal diastolic function (p=0.029). LA conduct function assessed by LA passive emptying fraction was found to be significantly greater in control group than in hypertensives (32±11% versus 22±12% respectively; p<0.001). There was a negative correlation between left ventricular mass index and LA passive emptying fraction (r=-0.37; p=0.007). LA reservoir function evaluated by LA total emptying fraction was similar in both groups while LA total emptying volume was greater in hypertensives than in control group (p=0.03).

**Conclusion:** Hypertension was associated with a decrease in left atrial passive emptying function, and an increase of systolic pump function. Left ventricular hypertrophy and diastolic dysfunction probably played a major role in these modifications.

## P1068

## Real live applications of three-dimensional echocardiographic quantification of the left ventricular volumes and function using an automated adaptive analytics algorithm

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**Introduction** and purpose: Three-dimensional echocardiographic (3DE) is the most accurate method to quantify cardiac chambers and the option of choice according to current clinical guidelines. Existing 3DE softwares rely on extensive user input, making it time consuming. As a result, 3DE is poorly integrated into the routine clinical work in most centers. Heart model (HM, Philips Medical Systems) is a novel fully automated approach for left-heart chamber quantification that has shown to be accurate and reproducible in a single center setting. Our aim is to study the feasibility of HM to quantify left ventricular (LV) volumes and function in a real clinical scenario of patients and to compare it to conventional 2D measures.

**Methods:** Consecutive 77 patients undergoing a clinically indicated echocardiogram were included to ensure a wide range of chamber size and function. Imaging was performed using the EPIQ system (Philips Medical Systems, Andover, Massachusetts). LV boundaries were traced manually in 2- and 4-chamber views to obtain LV end-diastolic (EDV), end-systolic (ESV) volumes and calculate LVEF using the biplane method of disks. For 3D images a wide-angled "full-volume" 3DE datasets of one cardiac cycle was acquired from the apical position and images were analysed using the automated HM software with endocardial border correction when necessary. Test-retest variability of the automated technique was assessed in a subgroup of 23 patients.

**Results:** Four patients were excluded due to very poor quality images. A total of 73 studies were included in the study (mean age 61±17, 52% were male). 78% of the patients were on sinus rhythm and 63% of the studies have good quality (37% fair or poor). Global editing or regional editing was necessary in 14 patients (19,2%). LV-EDV, LV-ESV and LVEF measured with 2D-biplane method and with 3DE-HM showed a strong correlation (r=0,74, r=0,86, r=0,76, p<0,001 for all). While 2D volumes were infra estimated compared to 3D measures (EDV, MD±SD: 34±25, ESV, MD±SD: 17±12, p<0,001 for both), 2D LVEF was overestimated compared to 3D-HM LVEF (MD 3,9 ± 6,3, p<0,001). Acquisition and imaging post-processing for 3D images required less than 2 minutes in all cases. The test-retest agreement for EDV, ESV and LVEF was high with low coefficient of variation (CoV) (CoV and intraclass

coefficient of correlation [r] for EDV, CoV: 10%, r=0,96, ESV: CoV:12%, r=0,97 and LVEF: CoV: 6%, r=97, p<0,001)r

**Conclusions:** Automated volumetric analysis of LV volumes and LVEF is an accurate, easy and fast alternative to conventional manual methodology. This technique may contribute towards full integration of 3DE quantification into clinical routine.

## P1069

## 3D echocardiographic left ventricular dyssynchrony indices in end stage kidney disease: associations and outcomes

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**Introduction:** Left ventricular (LV) mechanical dyssynchrony is associated with coronary artery disease, left ventricular hypertrophy and abnormal loading conditions. This study aimed to characterize LV mechanical dyssynchrony, measured by 3D transthoracic echocardiography, in patients undergoing hemodialysis (HD). Factors associated with an abnormal LV dyssynchrony and its association with outcomes were explored.

**Methods:** Maintenance HD patients had 3D transthoracic echocardiography performed on a non-dialysis day. Unpaired T tests and Chi-squared tests were utilised to identify differences between baseline characteristics of patients with and without LV mechanical dyssynchrony, defined as a standard deviation (SD) of time to minimum systolic volume corrected to heart rate (Tmsv-16 SD) of >3%. Cox regression analysis was applied to assess the predictive value of LV dyssynchrony to all-cause mortality, cardiac events, and heart failure hospitalizations.

**Results:** Ninety-seven patients had adequate images for analysis (67% male, median age 63 [25th-75th centile, 50-72] years). 94% had preserved LV ejection fraction (LVEF) >50%. Mean Tmsv-16 SD was 3.35 (3.30)%, and 39 patients (40%) had LV mechanical dyssynchrony. There was no difference between patients with and without LV dyssynchrony in any clinical parameter; LVEF (59.6% vs 63.3%, p=0.067); LVMI/HT2.7 (58.7 g/m2.7 vs 54.1 g/m2.7, p=0.229); QRS duration (98.7ms vs 95.8ms, p=0.540). Follow up time was for a median of 27.6 months (17.9 - 30.8 months), Tmsv-16 SD >3% was not predictive of all-cause mortality (adjusted HR 2.16, 95% CI 0.96-4.89, p=0.063) or cardiac events (adjusted HR 2.06, 95% CI 0.85-4.97, p=0.110). However, it was associated with heart failure hospitalization (adjusted HR 1.03, 95% CI 1.00-1.06, p=0.046).

**Conclusions:** 40% of HD patients, the majority with preserved LVEF, had LV mechanical dyssynchrony on a non-dialysis day. In this study, LV dyssynchrony was associated with a higher event rate for heart failure hospitalization.

**Funding Acknowledgements:** Kidney Research UK.

## P1070

## Relative contribution of right ventricular longitudinal shortening and radial displacement to global pump function in healthy volunteers

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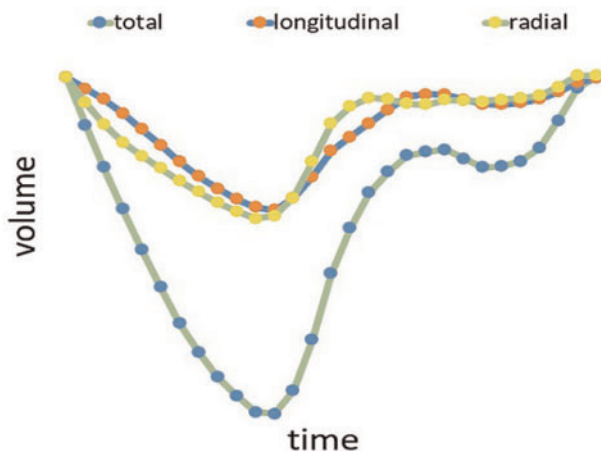
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Traditionally, longitudinal shortening is considered to be the most important mechanism determining global right ventricular (RV) pump function. However, the RV free wall has a small but significant displacement in the radial direction („bellows” effect) also. Despite the fact that the latter is often neglected, due to the large area of the RV free wall, it may significantly contribute to global RV pump function. However, the relative contribution of longitudinal shortening and radial displacement to RV pump function remains to be quantified.

Accordingly, we used three-dimensional echocardiography to acquire full-volume multibeat data sets (mean temporal resolution 35 vps) of the RV in 42 healthy volunteers (mean age 54±8 years, 29 women). Using a commercially available software package a dynamic 3D beutel model of the RV was created. Using our prototype custom software, in addition to RV end-diastolic volume (EDV) and total ejection fraction (TEF), we measured longitudinal (LEF) and radial ejection fraction (REF) by decomposing the motion of each vertex of the reconstructed 3D beutel model along three orthogonal axes and considering the relative contribution of the displacements along a single axis.

Left and RV TEF were normal (64±4 and 52±6%, respectively). RV EDV was 130±31 ml. Conventional measures of RV function were within normal range as well (tricuspid annular plane systolic excursion: 22±3mm, fractional area change: 45±5%). LEF and REF were similar (23±5% and 25±5%, p=0.13) and there was no difference in their ratio to TEF (LEF/TEF: 45±8%, REF/TEF: 49±7%, p=0.07) suggesting equal contribution of the two displacements to global RV pump function (Figure).

Our results suggest that, in healthy volunteers the radial displacement of the RV wall contributes as much as the longitudinal shortening to global RV pump function. The possibility to selectively assess the two components of RV mechanics may help to better understand the development of RV dysfunction in pathological conditions.



Abstract P1070 Figure.

**P1071****ECHO-parameters, associated with short-term mortality and long-term complications in patients with pulmonary embolism of high and intermediate risk**

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**Introduction:** Despite of recent findings in diagnosis and treatment, pulmonary embolism (PE) remains a major cause of mortality in Europe. Prognostic markers of poor outcome is important direction to investigate in PE.

**Purpose:** Our aim is to investigate ECHO parameters as risk factors of short-term mortality and long-term complications in PE.

**Methods:** 112 patients (40 men, 72 women, mean age 66,4±1,5 y.o.) with confirmed by CT PE of high and intermediate risk were divided into 2 groups with complicated or uncomplicated course of PE during 30 days and 12 months follow-up period. On admission ECHO-signs of right ventricle (RV) dysfunction (RV and right atrium (RA) diameters, RV/LV index, systolic blood pressure in PA, shift of intraventricular septum (IVS), hypokinesis of RV free wall) and LV ejection fraction were evaluated.

**Results:** 24 patients (21.4%) died during 30 days (30-days mortality) and 52 patients (46%) had differ long-term complications (death, need of resuscitation, thrombolysis, obstructive shock/hypertension, recurrent VTE).

After 30-days FU period there the rate of mortality was higher in patients only with hypokinesis of free RV wall (58% vs 10% OR 4.5 CI 95% 1.7-11.9 p=0.01). Other ECHO-signs of RV dysfunction (RV diameter 4.1±0.1 vs 3.9±0.1 cm; RA diameter 4.7±0.2 vs 4.8±0.1 cm; RV/LV index 0.8±0.03 vs 0.9±0.02; systolic blood pressure in PA 55.2±3.2 vs 57.0±1.9 mmHg, shift of IVS 25% vs 19% and LV ejection fraction 51.2±4.3 vs 61.2±1.2 %) did not differ significantly (p>0.05) between the groups.

After 12 months FU period there were no significant differs (p>0.05) in two groups: hypokinesis of free RV wall 27% vs 23%; RV diameter 4.1±0.1 vs 3.9±0.1 cm; RA diameter 4.8±0.1 vs 4.7±0.1 cm; RV/LV index 0.91±0.02 vs 0.89±0.03; systolic blood pressure in PA 59.3±2.1 vs 54.5±2.2 mmHg, shift of IVS 33% vs 37% and LV ejection fraction 54.9±2.1 vs 62.6±1.3%

**Conclusion:** Risk factor of 30-days mortality in PE among ECHO-parameters is hypokinesis of RV free wall. There were no significant differs in 2 groups after 12 months FU period.

**P1072****Increased epicardial fat is an independent marker of heart failure with preserved ejection fraction.**

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**Background:** Epicardial fat (EPIFAT) has garnered great interest as an indicator of visceral adiposity and metabolic abnormalities and a predictor of coronary disease and cardiac events. Beyond being simply a marker of global and visceral adiposity, EPIFAT may be implicated in the pathogenesis of cardiovascular disease by modulating myocardial function through paracrine or endocrine effects. EPIFAT thickness can be easily assessed by echo but its clinical value is unknown. Global longitudinal strain (GLS) is a proven marker of subclinical cardiac dysfunction and a predictor of future heart failure (HF) in various cardiopathies. The goal of this study was to identify a link between EPIFAT and whether or not EPIFAT could be associated also to HF.

**Methods and Results:** We first reviewed 86 echocardiograms of patients with a normal left ventricle ejection fraction (mean LVEF 65±4%, age 47±13y, BMI

26±3kg/m<sup>2</sup>, 43% female, 24% hypertension, 6% diabetes) and no significant valvular disease, cardiomyopathy or history of clinical heart failure. All measurements were performed offline on an Echopac system (BT12, General Electric). We measured EPIFAT thickness in the parasternal long axis view, perpendicular to right ventricular outflow tract in end diastole. A GLS > -19% was considered as abnormal. Using a ROC curve analysis, an EPIFAT thickness>5.6mm was found to be significantly associated with an abnormal GLS (AUC 0.727, CI [0.621-0.818], P=0.0006) with a sensitivity and specificity of 53% and 88%, respectively.

Secondly, we reviewed a second independent population of 195 consecutive patients with a normal LVEF (mean LVEF 61±5%, age 63±14y, BMI 26±3kg/m<sup>2</sup>, 48% female, 45% hypertension, 24% diabetes) and no significant valvular disease or definite cardiomyopathy. Documented heart failure occurred in 17% of these patients within the year around the echocardiogram. When divided into 2 groups according to an EPIFAT thickness threshold of 5.6mm, 22% of the patients above 5.6mm had versus 4% in the other group (P=0.001). In multivariate analysis, only hypertension (OR 2.742, CI [1.176-6.394], P=0.02) and EPIFAT thickness (OR 1.381, CI [1.159-1.644], P=0.003) were independently associated with HF in a model including also age, sex, diabetes.

**Conclusion:** EFT is easily measured by echocardiography. Increased EFT is an independent risk factor for the development of heart failure with preserved ejection fraction even after adjusting for other factors.

**P1073****Influence of optimized beta-blocker therapy on diastolic dysfunction determined echocardiographically in heart failure patients**

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**Background.** About half of patients with heart failure (HF) have the normal left ventricle ejection fraction (LVEF) or "heart failure with preserved EF" (HFpEF). The assessment of LV diastolic function using echocardiography is of paramount clinical importance to distinguish this syndrome from other diseases, to assess prognosis, and to identify underlying cardiac disease and its best treatment. However, we do not have the firm guidelines for treatment of those patients, and the role of beta-blockers is still controversial in this setting. The CIBIS-ELD trial comprised of 875 patients with stable HF. The dose of beta-blocker was up-titrated to maximally tolerated one, during 12 weeks.

**Aims and methods.** The aim of this sub-study was to determine the influence of optimization of beta-blocker therapy in patients with HFpEF. We measured, beside LVEF and end-diastolic volume, flow propagation time, deceleration time and isovolumic relaxation time (IVRT) before and at the end of the study. The grade of diastolic dysfunction was determined using the A and E waves of transmitral flow. Growth differentiation factor-15 (GDF-15) and N-terminal prohormone of brain natriuretic peptide (NT-proBNP) were measured before and at the end of the study.

**Results.** Among patients included in the study, 226 had HFpEF, (age 73.4±5.9 years, 65.6% women) and 167 (73.9%) had impaired relaxation, 46 (20.4%) had moderate diastolic dysfunction (pseudonormal filling) and 5 (2.2%) had the restrictive ventricular filling (impaired left ventricle compliance). In 8 patients atrial fibrillation interfered with the gradation of diastolic dysfunction. No significant changes were observed in end-diastolic LV volume and LVEF (47.65±7.5 vs. 47.87±6.3 mm; 57.76±7.4 vs 54.60±16.67%, p=n.s.) after 12 weeks. Flow propagation time and deceleration time were not significantly changed after the end of the study (49.9±35.4 vs. 52.73±54.75 cm/s; 218.9±75.3 vs. 217.4±66.45 ms, p=n.s.). However, IVRT was significantly decreased (102.60±32.60 vs. 97.05±27.62 ms, p=0.027). No significant changes were observed in NT-pro BNP and GDF-15 before and at the end of the study (1662.3±802.47 vs. 1692.82±780.41 ng/L; 445.48±967.01 vs. 523.61±688.35 pg/mL, p=n.s.).

**Conclusion.** Beta-blockers decrease heart rate and prolong the isovolumic relaxation time. Therefore, they could improve diastolic function in patients with HFpEF. However, we did not find significant changes in other echocardiographic parameters of LV function or in concentrations of biomarkers which reflect the function of a left ventricle. More studies regarding this issue are needed.

**On behalf of:** CIBIS ELD.

**P1074****Early diastolic mitral flow velocity/ annular velocity ratio is a sensitive marker of elevated filling pressure in left ventricular dyssynchrony**

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**Introduction:** Current clinical practice guidelines recommend the ratio between peak early diastolic mitral flow velocity and mitral annular velocity (E/e') as a marker of elevated LV filling pressure. In patients with LV dyssynchrony due to electrical conduction delay, however, it is postulated that the E/e' ratio may not reflect elevated filling pressure.

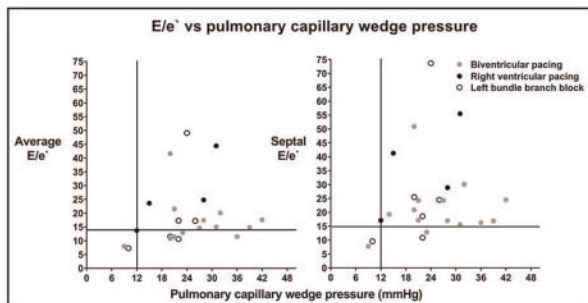
**Purpose:** To clarify whether E/e' can be used to detect elevated LV filling pressure in patients with electrical LV dyssynchrony.

**Methods:** In 24 patients with electrical LV dyssynchrony (6 with left bundle branch block, 4 with right ventricular pacing and 14 with biventricular pacing) we performed simultaneous echocardiography and measurement of pulmonary capillary wedge pressure (PCWP) as an indirect measure of LV filling pressure. Septal and lateral  $e'$  were measured and  $E/e'$  calculated using both septal ( $n=24$ ) and average ( $n=23$ )  $e'$ . Using a cutoff for average  $E/e'$  of 14 and septal  $E/e'$  of 15, patients were classified as having either normal ( $\leq 12$  mmHg) or elevated ( $>12$  mmHg) LV filling pressure.

**Results:** Mean PCWP in the population was  $24 \pm 9$  ( $\pm$ SD) mmHg. Average  $E/e'$  above 14 detected elevated LV filling pressure with a sensitivity of 70% (95% CI: 46-88), whereas septal  $E/e'$  above 15 detected elevated filling pressure with a sensitivity of 91% (70-99).

**Conclusions:**  $E/e'$  seems to be a sensitive marker of elevated LV filling pressure in patients with electrical dyssynchrony. If confirmed in a larger population, this finding indicates that  $E/e'$  can be used the same way in this population as in patients with narrow QRS.

**Funding Acknowledgements:** South-Eastern Norway Regional Health Authority.



Abstract P1074 Figure.

### P1075

#### Left ventricular diastolic function in STEMI patients receiving early and late reperfusion by percutaneous coronary intervention

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**Background** Left ventricular (LV) diastolic dysfunction is seen on patients with acute myocardial infarction (MI) even after successful percutaneous coronary intervention. Previous studies showed the majority of diastolic function post MI recovered slowly than systolic function after revascularization. In this study, we prospectively observed the LV diastolic function change in patients with ST-elevation MI and determined if early reopening of the occluded coronary artery made a better recovery of diastolic function than late reopening during the acute phase of MI. Methods 45 consecutive patients ( $61.20 \pm 11.37$  years, 8 Females) presenting with acute STEMI and treated with coronary intervention were prospectively enrolled in this study. The important inclusion criteria were first acute coronary syndrome episode and LV ejection fraction exceeded 45% on echocardiography. The patients were divided to two different groups by total ischemia time according to the newest ESC guideline on myocardial revascularization. Total ischemic time consisted of prehospital patient delay time and first medical contact (FMC) to balloon time. Transthoracic echocardiography were performed within the first week after coronary intervention and data were compared between early reperfusion (total ischemia time  $< 6$  hours) and late reperfusion group (total ischemia time  $\geq 6$  h). The mitral inflow velocity was obtained from spectral pulse-wave Doppler and mitral annulus propagation velocity (MvP) was measured by color M-mode. The mean of the septal, lateral, anterior, posterior  $e'$  velocity from tissue Doppler was used for calculation of  $E/e'$ . Blood samples were collected to test the cardiac enzymes, pro BNP, lipid cholesterol etc. Results A normal diastolic filling pattern on Doppler echocardiography is seen in only 9 patients in the acute phase of MI. The other 80% patients had abnormal filling patterns: 16 impaired relaxation, 14 pseudonormal, 6 restrictive filling patterns. The baseline age, systolic and diastolic blood pressure, heart rate, body mass index and serum creatinine were not significantly different between two groups ( $P$  all  $> 0.05$ ). The septal  $e'$  velocity was lower in early reperfusion group compared to late reperfusion group ( $5.52 \pm 1.67$  cm/s v.s  $7.11 \pm 2.14$  cm/s,  $P < 0.05$ ), but no statistical difference was found in  $E/e'$  average ( $11.99 \pm 4.30$  v.s  $9.85 \pm 3.47$ ,  $P > 0.05$ ). There was also no statistical difference for left atrial volume index and mitral annulus propagation velocity between early and late reperfusion groups. Conclusion Left ventricular diastolic dysfunction was present in most of acute MI patients even after successful coronary interventions. It seemed MI patients receiving early myocardial reperfusion had no better LV diastolic functions within the acute phase compared to late-reperfusion patients.

**Funding Acknowledgements:** National Natural Science Foundation of China (NO.81400266).

### P1076

#### Could anatomical and functional features predict cerebrovascular events in patients with patent foramen ovale?

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**Background.** PFO has been controversially associated with cryptogenic stroke (CS). Recently, it has been shown that a complex anatomy of PFO could enhance its embolic potential. We investigated which type of PFO morphology could be at major risk. Methods. Between March 2013 and January 2016, we prospectively enrolled 370 pts with PFO (mean age:  $44.3 \pm 15.1$ ; 30% men), identified by contrast-transcranial Doppler and transesophageal echocardiography performed with the following indications: CS (42%), migraine (27%), nonspecific neurological symptoms, in the remaining cases. We analyzed the PFO anatomical features, the presence of shunt at rest and the shunt severity, classifying all the PFOs according to the current recommendations. Results. A complex lesion was found in the following cases: PFOs  $> 4$  mm (40%), severe shunt (41.5%), shunt at rest (60%), tunnel-like morphology (32%), with a tunnel length  $> 8$  mm in 28% of cases), ASA (80%), Chiari's network or Eustachian valve (31%). In the Table 1, the results of a chi-square analysis comparing pts with CS vs. those without CS are displayed. A tunnel-like morphology was significantly more frequent in patients with CS (77.6%) than in those without CS (55.6%,  $p=0.04$ ). On logistic regression analysis, only a tunnel-like morphology was associated to a major risk of CS [OR=0.36 (0.13-0.99)  $p = 0.04$ ]. Conclusions The pathophysiological link between CS and PFO is contradictory. Nevertheless a careful evaluation of anatomical factors could be useful for ensuring a more tailored pts management.

	Pts with CS	Pts without CS	p (Chi-square)
Tunnel-like PFO	77.6%	55.6%	0.04
Severe shunt	41.8%	50.0%	0.38
Tunnel-like PFO + severe shunt	38.5%	33.3%	0.72
ASA	32.1%	41.5%	0.26
Chiari's network/Eustachian valve	16.7%	11.8%	0.54
Tunnel length $> 8$ mm	41.3%	34.6%	0.57
Shunt at rest	28.2%	20.8%	0.44
PFO $> 4$ mm	36.2%	38.2%	0.84
ASA + tunnel-like PFO	26.7%	16%	0.30
ASA + tunnel-length $> 8$ mm	18.2%	11.5%	0.46
ASA + Chiari's network/Eustachian valve	7.7%	0%	0.11
ASA + Shunt at rest	12.9%	14.3%	0.83
ASA + PFO $> 4$ mm	15.6%	25.8%	0.27

## ISCHEMIC HEART DISEASE

### P1077

#### Efficacy of endarterectomy of the left anterior descending artery: evaluation by adenosine echocardiography?

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**Introduction:** Transthoracic Doppler –Echo coronary flow velocity reserve (FR) of the left anterior descending artery (LAD) defined as the ratio of diastolic flow pre over post adenosine infusion has been used to estimate vasodilation of the LAD vascular bed following left internal mammary artery (LIMA) to LAD implantation.

**AIM:** The effect of surgical LAD endarterectomy (END) on LAD FR during CABG has not been elucidated.

**Methods:** 64 patients aged  $68 \pm 9$  years who underwent CABG LIMA to LAD implantation were followed for 58(36-84) months. Of them 45 had coronary angiographic and surgical indication for END ie diffuse highly atheromatous with no or low flow LAD while the remaining 20 had LIMA to LAD without the need of END.

All patients had a complete echo study ( $> 3$  months post surgery) with LVEF measurement and LAD territory contractility evaluation followed by localization of the distal LAD flow by color Doppler. Adenosine (AD) was infused at a rate of 140mg/Kg/min for 4 min. Diastolic peak Velocity PV and time Velocity integral were recorded and the ratio of AD to rest Values was calculated (FR). Patients who doubled their flow velocity with AD were considered to have normal FR.

The median (IQR) value of FR for the whole study population was 2.5 (2.0-3.0). END patients (N=45). The 45 patients with previous END had FR 2.5 (2.1-3.0) while those without previous END 2.4 (1.7-3.0) (p=0.949). Postoperative LVEF was 50% (45-55) for the END pts and 50% (45-55) for the non END patients (p=0.489). LAD territory contractility score was also similar (p=0.268). There were no differences in patients with normal FR between the two groups. Moreover the RF was similar between the two groups when only patients with normal RF were considered. Additionally, END was not proved to be significant prognostic factor for RF (p=0.065). In conclusion, Patients with advanced LAD disease treated by END demonstrate END in patients with angiographic and surgical indications, results in satisfactory functional improvement in terms of vasoreactivity of the LAD vascular bed, overall LVEF, and anterior wall contractility. These echocardiographic indices were similar in pts receiving LIMA-LAD without not in need for END. Outcome of the 2 subgroups is also similar. Transthoracic AD echo provides a useful clinical tool to evaluate post surgical END patients .

**P1078**  
**Left ventricular diastolic dysfunction after acute myocardial infarction with preserved ejection fraction is related to lower exercise capacity**

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**Background:** Low exercise capacity (EC) after myocardial infarction (MI) is connected with worse prognosis. Mechanisms leading to low EC in that group are not fully understood. One of them is diastolic dysfunction.

**Aim:** To assess EC in patients with acute MI according to diastolic function.  
**Methods:** We evaluated prospectively patients with first inferior MI with ST segment elevation treated by primary percutaneous coronary intervention (pPCI) and preserved LV systolic function (LV EF ≥45%). ECHO was performed before discharge within 7 days after MI. Diastolic dysfunction was assessed in Tissue Doppler Echocardiography (TDE) using early lateral diastolic velocity (e'). Patients were divided into two groups with e' < and ≥ 10 cm/s. NT-proBNP plasma concentration was measured in the first 48 hours after pPCI with Roche immunoassay. Cardiopulmonary exercise test (CPET) was done on day 14 ±10 after acute MI. Exercise duration and peak VO2 were assessed as EC parameters. None of the patients had exercise limiting factors other than dyspnoe and/or fatigue.

**Results:** Patients (n=90, 73% males, mean age 61± 9 years) were divided into two groups according to e' lateral wall velocities. The group with e' < 10 cm/s comprised 50 patients and the group with e' ≥ 10 cm/s 40 patients. No significant differences in LV EF and right ventricular (RV) longitudinal systolic function (S') were noticed between groups. The group with LV impaired relaxation had significantly lower EC parameters (Table).

**Conclusion:** In patients after acute inferior MI with preserved systolic function, impaired left ventricular relaxation can be responsible for low exercise capacity.

EC in relation to LV diastolic function

Variable (mean ± SD)	Diastolic dysfunction		P =
	Yes n=50	No n=40	
LV EF (%)	60 ± 9	61 ± 6	NS
RV S' (cm/s)	12.2 ± 2.7	12.5 ± 2.1	NS
NT proBNP (pg/ml)	1460 ± 859	873 ± 512	0.001
Time of exercise (min)	7.45 ± 2.43	9.12 ± 2.13	0.001
Peak VO2 (L/min)	1.46 ± 0.48	1.80 ± 0.50	0.01
Peak VO2 (ml/kg/min)	18 ± 5	22 ± 5	0.001

**P1079**  
**Potentially predictors of ventricular arrhythmia during six months follow up in STEMI patients**

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Potential pathological substrate of worse prognosis and incidence of ventricular arrhythmia in STEMI pts treated with pPCI is distorted myocardial mechanic. Aim: To determine echocardiographic parameters as predictors of worse prognosis and incidence of ventricular arrhythmias during 6 month follow up (FU). We studied conventional echo parameters and parameters of myocardial mechanics: strain (S), strain rate (Sr), index of myocardial dispersion (IMD), rotation (ROT) and torsion for all 18 LV segments and all three myocardial layers. Method: We prospectively studied 99 consecutive STEMI pts treated with pPCI who monitoring in follow up (FU). Echo examination performed on day 4±2 (VIVID 9GE, EchoPAC Ver 113). Malignant ventricular arrhythmias (sustained/non-sustained VT and/or VF) were registered during 6 month FU. Results: 14/85 (14.1%) of all pts had arrhythmic events. The patients were divided in two groups of patients with and without arrhythmias. There were no differences in mortality, re-infarction, re-hospitalization, emergency revascularization, heart failure, stroke, and syntax score (p=NS) between groups. Conventional echo parameters (EF, WMSI, LA vol index) were similar. From parameters of myocardial mechanics, global IMD of longitudinal S (p=0.038) and circumferential S (p=0.044) were

significantly different between groups, as well as peak global base ROT (p=0.012), and peak LV torsion in early diastole (p=0.013). The best predictor of arrhythmia was IMD LS (p=0.037). Cut off was 76.27ms (70% sens and 64.3% spec). Conclusion: During 6 month FU post pPCI period the parameter of ventricular arrhythmia could be IMD longitudinal and circumferential strain, as well as global base rotation and early diastolic torsion. The larger studies are needed to define the best parameter of myocardial deformation as predictor of ventricular arrhythmia.

Parameters of myocardial mechanics

	Pts without arrhythmia (n=85)	Pts with arrhythmia (n=14)	p
IMD SL (ms)	41.73±38.8	68.16±50.96	0.038
IMD CS (ms)	71.35±27.21	91.91±37.18	0.044
G ROT base (°)	-4.74±3.5	-1.73±2.54	0.012
Early diastolic torsion (°)	6.63±3.41	3.31±4.29	0.013

HEART VALVES

**P1080**  
**Association between left atrial dilatation and invasive haemodynamics at rest and during exercise in asymptomatic aortic stenosis**

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**Background:** The transition from an asymptomatic to symptomatic state in severe aortic stenosis (AS) is often difficult to assess. Therefore, identification of a morphological sign of increased hemodynamic load may be important in asymptomatic AS to identify patients at risk.

**Purpose:** The purpose of the present study was to determine whether LA volume in asymptomatic patients with severe AS reflects the haemodynamic burden at rest and during exercise.

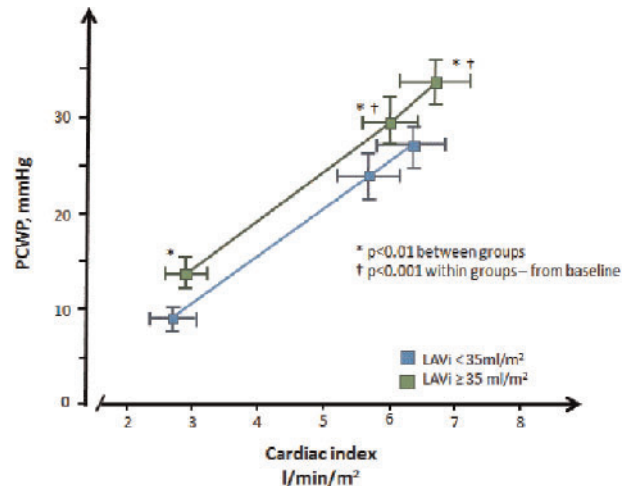
**Methods:** In a prospective study 39 patients (age 73±7, 77% men) with asymptomatic severe aortic stenosis (EF ≥ 50%, aortic valve area (AVA) < 1 cm<sup>2</sup> and aortic peak jet velocity >3.5 m/s) were enrolled. Patients underwent supine bicycle exercise testing with simultaneous invasive haemodynamic monitoring using a Swan-Ganz catheter and Doppler echocardiography. At rest and during exercise cardiac index (CI), pulmonary artery pressures (PAP) and pulmonary capillary wedge pressure (PCWP) was recorded. Patients were stratified into 2 groups according to LA volume index (LAVi) ≥ 35 mL/m<sup>2</sup>.

**Results:** In 25 patients (64%) LAVi was ≥ 35 mL/m<sup>2</sup>. AVA was similar between groups (0.81±0.15 vs 0.84±0.18 cm<sup>2</sup>, p=0.58). PCWP was higher at rest and during exercise in patients with LAVi ≥ 35 mL/m<sup>2</sup> (p<0.01), despite similar cardiac index, figure 1. At rest, PCWP < 12mmHg was found in 11 patients with LA dilatation (44%) whereas PCWP < 25mmHg only was found in 1 patient (4%) with exercise. LAVi and E/e' predicted exercise PCWP > 30mmHg with areas under the receiver-operating curve of 0.75 and 0.84 respectively. LAVi at rest (r=0.64, p<0.001) and E/e'septal at rest (r=0.65, p<0.001) was significantly associated with PCWP at peak exercise.

**Conclusion:** LA size reflects hemodynamic burden in patients with asymptomatic severe AS. Simple quantitative measurements of LA and diastolic function are associated with LV filling pressures with exercise and could be used to identify asymptomatic patients with increased hemodynamic burden.

**Funding Acknowledgements:** The Danish Heart Association, Region of Southern Denmark Research Funds, University of Southern Denmark.

**On behalf of:** Department of Cardiology Odense University Hospital.



Abstract P1080 Figure.

## P1081

**Cardiac amyloidosis and aortic stenosis - the convergence of two aging processes and its association with outcomes**

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**Background:** Wild-type transthyretin or senile systemic amyloidosis (SSA) commonly presents with cardiac involvement. Once thought to be a rare disease, it has now been frequently diagnosed with advances in non-invasive imaging including cardiac MRI (CMR). Recent autopsy series in octogenarians with severe aortic stenosis (AS) who received transcatheter aortic valve replacement reported prevalence up to 30%.

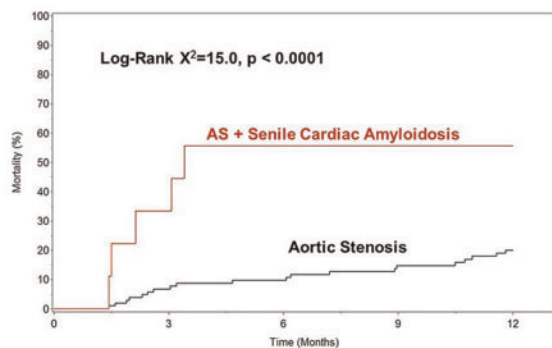
**Purpose:** To evaluate the prevalence of SSA detected by CMR in patients with confirmed moderately-severe AS and its association with clinical outcomes.

**Methods:** 113 consecutive AS patients (85% with severe AS) who underwent clinical CMR study (1.5T Siemens Magnetom Espree) and echocardiogram within 15 days (median 6 days, IQR 0-15) were included in the analysis. Society of Thoracic Surgery predicted risk of mortality (STS-PROM) was calculated for each patient using over 40 clinical parameters. SSA was identified when characteristic pattern involving either subendocardial or diffuse myocardial LGE was observed. Cox-proportional hazards model performed after adjusting for potential confounders to evaluate the independent prognostic role of AS+SSA.

**Results:** A total of 9 patients (8 males) had AS+SSA. Patients with AS+SSA were older than those with only AS ( $88 \pm 6$  vs.  $70 \pm 14$  years,  $p < 0.001$ ) and had higher STS-PROM ( $6.9 \pm 4.2$  vs.  $3.8 \pm 3.7$ ,  $p = 0.02$ ). 9/36 (25%) of patients age >80 years were positive for SSA. Over median follow-up of 18 months (IQR: 11-30 months), there were 59 AVRs (42 surgical and 17 transcatheter) and 40 deaths (35%). AS+SSA patients were similarly likely to receive AVR (44%) as patients with isolated AS (53%). The 1-year mortality of AS+SSA was substantially higher than for isolated AS patients (56% vs. 20%,  $p < 0.0001$ ) (Figure 1). Despite adjustment for AVR, STS-PROM, LVEF, the presence of AS+SSA diagnosed by CMR with LGE imaging remained an independent predictor of all-cause mortality (HR=2.92, 95% CI=1.09-7.86,  $p = 0.03$ ).

**Conclusion:** SSA is very common in AS patients, especially males and octogenarians. The diagnosis of concomitant SSA, using CMR with LGE imaging, is prognostically important identifying a subgroup of AS patients with markedly increased 1-year all-cause mortality. Recognition of SSA in patients with AS may inform medical decision making and improve patient stratification for future therapeutic interventions.

**Figure 1. Kaplan-Meier Curves Comparing All-Cause Mortality in AS vs. AS+SCA Patients**



Abstract P1081 Figure.

## P1082

**Prognostic impact of initial left ventricular dysfunction and mean gradient after transcatheter aortic valve implantation**

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**Background:** Outcomes for different subtypes of aortic stenosis after transcatheter aortic valve implantation are not well known.

**Purpose:** The aim of the study was to evaluate the prognostic impact of the initial left ventricular ejection fraction (LVEF) and aortic mean gradient on survival and on left ventricular function after transcatheter aortic valve implantation (TAVI).

**Patients and Methods:** From 2008, to 2014.12.31. TAVI was performed in 130 cases (55 men, 75 women, mean age  $79.5 \pm 5.6$  years) with severe (aortic valve area  $< 1.0$  cm<sup>2</sup>) symptomatic aortic stenosis (AS) and contraindication or extreme high risk for surgery. Median time for follow-up was 19 (0-86) months, Echocardiography was performed before and 12 months after TAVI. Patients were divided into four groups

according to LVEF and aortic mean gradient NEF-HG: EF $\geq$ 50% and Gr $\geq$ 40 mmHg (n=79) LEF-HG : EF<50% and Gr $\geq$ 40 mmHg (n=17) LEF-LG : EF<50% and Gr<40 mmHg (n=26) PNEF-LG : EF $\geq$ 50% and Gr<40 mmHg (n=8) Primary study endpoint was 30-day and 1-year all-cause mortality, secondary endpoint was the change in LVEF after 12 months in the survivors.

**Results:** All-cause 30-day mortality was 3,8%, 1-year mortality was 17,7% in the whole patient group.

Mortality was low in the high gradient groups ( 30-day: NEF-HG 1,2%, LEF-HG 0%, 1-year: NEF-HG 11,4%, LEF-HG 11,8%) , intermediate in the PNEF-LG ( 30-day 0%, 1-year 25%) and high in LEF-LG ( 30-day 15,4%,  $p = 0,04$ , 1-year 38,5%  $p = 0,01$ ). Patients with LEF-LG AS and LVEF<30% (n=11) had the highest 1-year mortality (63,8%,  $p < 0,001$ ).

In the survivors the mean gradient decreased in all cases (baseline  $50,9 \pm 17,6$  mmHg vs.  $9,1 \pm 4,5$  mmHg,  $p < 0,001$ ) at 1 year. The LVEF didn't change in the NEF-HG ( $63,6 \pm 8,2\%$  vs.  $63,7 \pm 10,6\%$ ) and PNEF-LG groups, ( $66,3 \pm 8,1\%$  vs.  $68,0 \pm 6,2\%$ ), but it improved in the LEF-HG ( $33,4 \pm 9,4\%$  vs.  $56,1 \pm 11,4\%$   $p < 0,001$ ) and LEF-LG groups ( $30,7 \pm 8,2\%$  vs  $43,6 \pm 17,6\%$ ,  $p = 0,007$ ).

**Conclusions:** Aortic stenosis with low gradient and reduced LVEF is associated with worse prognosis after TAVI, compared to AS with high gradient and/or preserved LVEF, but in the survivors the recovery of left ventricular systolic function can be expected. Patients with LEF-LG AS need detailed risk stratification before TAVI. The prognosis of LEF-HG AS and NEF-HG AS are equally good.

## P1083

**Distribution and prognostic significance of left ventricular global longitudinal strain in asymptomatic significant aortic stenosis: an individual participant data meta-analysis**

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**Background:** There is growing evidence suggesting the potential prognostic role of left ventricular (LV) global longitudinal strain (GLS), in asymptomatic patients with aortic stenosis (AS). However, the available data are mainly derived from relatively small sample size and single centre studies. Our objective was therefore to perform an individual participant data meta-analysis in order to (1) describe the distribution, (2) identify the most predictive cut-off values, and (3) assess the impact of LV GLS on prognosis in asymptomatic patients with significant AS.

**Methods:** A literature search was performed in PubMed for studies published between 2005 and 2015 according to the following criteria: "aortic stenosis" AND "strain". The following inclusion criteria were applied to the 237 studies initially identified: (1) asymptomatic patients, (2) LV ejection fraction  $\geq 50\%$ , (3)  $\geq$  moderate AS and (4) outcome data available. A total of 8 studies were eligible for the meta-analysis and all authors were contacted to share the individual data of their studies. All the authors accepted to participate. The primary end-point of the study was mortality and the secondary end-point was combined, considering death and cardiac-related hospitalization.

**Results:** Among the 8 studies included, 879 patients ( $74 \pm 9$  years, 56% men, indexed aortic valve area:  $0.49 \pm 0.14$  cm<sup>2</sup>/m<sup>2</sup>) were analysed. The average LV GLS was  $-16 \pm 4\%$  (median  $-16.2\%$ , 25-75 percentiles:  $-18.4\%$ ;  $-13.5\%$ ). There was no significant difference between LV GLS values among the 8 studies, except for 1 reporting significantly lower LV GLS ( $p < 0.0001$ ). During a mean follow-up of  $2.1 \pm 1.6$  years, 63 deaths and 362 events occurred. Areas under the ROC curve for the prediction of death or combined events using LV GLS were 0.71 and 0.70, respectively. The best predictive cut-off values were  $-12.9\%$  (sensitivity=54%, specificity=80%) for death, and  $-16.2\%$  (sensitivity=68%, specificity=63%) for combined events. Using these cut-off values, patients with impaired LV GLS had significant reductions in both survival and event-free survival (at 5 years:  $57 \pm 7\%$  vs.  $86 \pm 3\%$ ,  $p < 0.0001$ ;  $25 \pm 3\%$  vs.  $51 \pm 5\%$ ,  $p < 0.0001$ , respectively). The hazard-ratios were 4.6 (95% confidence interval [CI]: 2.8-7.6), and 2.2 (95%CI: 1.8-2.8), respectively. Using LV GLS as continuous variable (i.e. without cut-off value), there were strong significant relationships with both mortality and with the combined event (both  $p < 0.0001$ ). For each 1% of worsening in LV GLS, the risk of death increased by 26% (95%CI: 17%-37%), and the risk of the combined event by 14% (95%CI: 11%-17%). Conclusion: The present individual participant data meta-analysis demonstrates that in asymptomatic patients with significant AS and normal LV ejection fraction, LV GLS is a powerful marker of poor outcome. These data emphasize the usefulness of LV GLS for the risk stratification and the management of these patients and may promote the presence of LV GLS in future guidelines.

**On behalf of:** EACVI Research & Innovation Committee.

## P1084

**Discrepancies between echocardiographic and invasive assessment of aortic stenosis in multimorbid elderly patients**

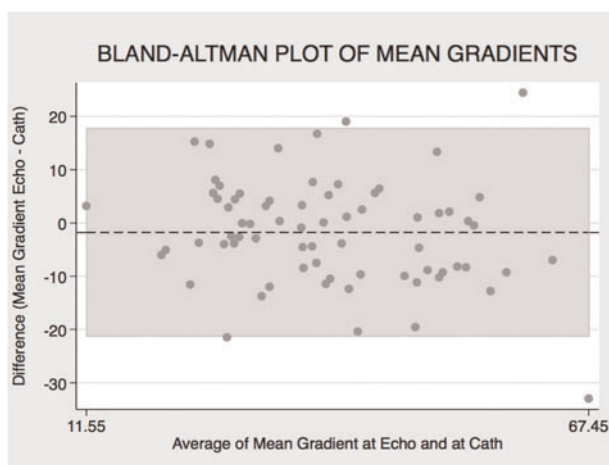
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**Introduction:** Discrepancies between echocardiographic and invasive assessment of aortic stenosis have been recently reported in the elderly. We sought to investigate the amplitude of these discrepancies in a real-world setting.

**Methods:** We examined data from 71 consecutive patients (mean age  $84 \pm 6$  years; 54% women) with moderate or severe aortic stenosis (mean aortic valve area at echocardiography  $0.75 \text{ cm}^2$ , range  $0.41$  to  $1.29 \text{ cm}^2$ ) who underwent both transthoracic echocardiogram and right-and-left heart catheterization within an interval of  $8 \pm 12$  days. All patients were evaluated by our institution's Heart Team and clinical decision-making was based upon these data along with symptomatic status.

**Results:** There were no significant differences in mean arterial pressures ( $94 \pm 16$  vs.  $96 \pm 17$  mmHg,  $p=0.37$ ) and heart rates ( $74 \pm 14$  vs.  $76 \pm 13$  bpm,  $p=0.15$ ) between the two examinations. Mean transaortic gradients were not statistically different using the two methods, albeit with broad limits of agreement (ICC=0.69, bias  $-1.8$  mmHg, LOA  $-21.7$  to  $18.1$  mmHg,  $p=0.14$ ), only 31 patients (44%) having a mean gradient difference  $<5$  mmHg. We found a modest correlation between aortic valve area at echocardiography and at catheterization using directly measured oxygen consumption with a small overall bias but wide, clinically relevant limits of agreement (ICC=0.47, bias  $0.06 \text{ cm}^2$ , LOA  $-0.32$  to  $0.44 \text{ cm}^2$ ,  $p=0.01$ ). In addition, stroke volume index, valvuloarterial impedance, systemic arterial compliance and systemic vascular resistance showed poor correlation between the two methods (ICC between 0.20 and 0.31).

**Conclusion:** In a real-world setting and among multimorbid elderly patients, discrepancies between echocardiographic and hemodynamic measurements are of clinical importance. Thus, the two methods cannot be used interchangeably in this population.



Abstract P1084 Figure.

## P1085

**Echocardiographic determinants and outcome of patients with low-gradient moderate and severe aortic valve stenosis: implications for aortic valve replacement**

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**Background:** Low-dose dobutamine stress echocardiography (DSE) plays an important role in differentiation of patients with low-gradient moderate aortic stenosis (LGMAS) or severe aortic stenosis (LGSAS).

**Purpose:** The objective of this study was to explore the echocardiographic determinants and outcome of patients with LGMAS or LGSAS underwent DSE with or without aortic valve replacement (AVR).

**Methods:** This study comprised consecutive 109 symptomatic patients (67 male, mean age  $77 \pm 8$  years) with low-gradient AS undergoing standard echocardiography and DSE. Simplified projected aortic valve area (AVA<sub>Proj</sub>) was calculated by DSE data. Patients were divided into LGSAS (AVA<sub>Proj</sub> $<1.0 \text{ cm}^2$ ,  $n=57$ ) and LGMAS (AVA<sub>Proj</sub> $\geq 1.0 \text{ cm}^2$ ,  $n=52$ ). All patients completed at least one-year clinical follow-up after DSE (median 638, quartiles 428-974 days).

**Results:** Septal mitral annular plane excursion (MAPSE) was significantly lower and systolic pulmonary artery pressure (SPAP) was significantly higher in LGSAS patients than in LGMAS patients (both  $P<0.05$ ). Regression analysis indicated that higher SPAP (OR 1.03, 95% CI: 1.01-1.06,  $P=0.022$ ) and lower septal MAPSE (OR 0.81, 95% CI: 0.69-0.95,  $P=0.008$ ) are independent determinants for LGSAS. There were 20 (18.3%) cardiac deaths during follow-up. Fifty-three (48.6%) patients (34 LGSAS and 19 LGMAS) underwent conventional AVR surgery ( $n=29$ ) or transcatheter aortic valve implantation ( $n=24$ ) after DSE. Non-AVR was associated with an increased risk of cardiac death in the total cohort (survival: non-AVR 75% vs. AVR 88.7%,  $P=0.037$ ). For patients with preserved left ventricular ejection fraction (LVEF), survival was similar in LGMAS patients with (100%) and without AVR (100%), slightly higher in LGSAS patients with (84.2%) compared those without AVR (77.8%,  $P=0.689$ ). AVR significantly improved survival in both LGSAS (80% vs. 57.1%) and LGMAS (100% vs. 64.7%) patients with reduced LV-EF.

**Conclusions:** Reduced longitudinal LV function (MAPSE), and increased trans-tricuspid pressure gradient (SPAP) are echocardiographic determinants of low-gradient severe AS. AVR significantly improves survival not only in LGSAS but also in LGMAS patients with reduced LVEF in this patient cohort.

## P1086

**Atrial deformation correlated with functional capacity in mitral stenosis**

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**Background:** Severity of the mitral valve stenosis (MS) can be graded by echocardiography, however, the heart failure symptoms are not correlated with echocardiographic parameters well.

**Aim:** This study aimed at searching for determinants of function class in MS patient and investigated the relationship between left atrial (LA) deformation by two-dimensional speckle tracking and heart failure symptoms.

**Methods:** This study included 69 consecutive patients with MS (20 men, age  $61 \pm 14$  years) from out-patient clinics. Functional capacity of patients were assessed by NYHA functional class. LA deformation parameters, including peak LA strain (LAS), peak strain rate in reservoir phase (LASRr) and peak strain rate in conduit phase (LASRc), were assessed by speckle tracking echocardiography. LA emptying fraction (LAEF) was measured by biplane area-length method and left ventricular ejection fraction (LVEF) by biplane Simpson's method. Severity of MS was assessed by mitral valve area (MVA) derived from standard pressure half time method, planimetry and mean trans-mitral valve pressure gradient.

**Results:** There were 15 (22%) patients in functional class I, 42 (61%) in functional class II, and 12 (17%) in functional class III. Comparing all factors between MS patients from functional class I to III, only LAS ( $14.3 \pm 6.6$ ,  $10.6 \pm 5.0$ ,  $8.7 \pm 4.0$  %;  $p = 0.018$ ), LASRr ( $1.6 \pm 0.5$ ,  $1.3 \pm 0.4$ ,  $1.1 \pm 0.4$  s<sup>-1</sup>;  $p = 0.012$ ), and the use of diuretics (7, 73, 67%,  $p < 0.001$ ) were significant factors in determining the severity of heart failure symptoms. There were no differences in mitral valve area, pressure gradient, pulmonary artery pressure, LAEF, and LVEF between functional classes. In multivariate analysis controlling diuretics usage, LAS ( $\beta = -0.233$ ,  $p = 0.045$ ) and LASRr ( $\beta = -0.277$ ,  $p = 0.014$ ) were still independent factors in determining heart failure functional class.

**Conclusion:** In stable MS patients, the NYHA functional class was correlated with LAS and LASRr independently. LA deformation contributed to heart failure symptoms in MS patients.

## P1087

**Net atrioventricular compliance can predict reduction of pulmonary artery pressure after percutaneous mitral balloon commissurotomy**

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**Background:** Pulmonary hypertension is a common complication of rheumatic mitral stenosis (MS). Net atrioventricular compliance (Cn) was found to play an important role in the development of pulmonary hypertension.

**Objectives:** to test the value of Cn in prediction of pulmonary artery pressure reduction after percutaneous mitral balloon commissurotomy (PMBC).

**Patients and Methods:** 80 patients with severe MS were included. We excluded patients with contraindication to PMBC, atrial fibrillation, failure of PMBC, restenosis, and non adherence to follow-up from the study. All patients had undergone full history taking and clinical examination, complete 12-leads electrocardiography, echocardiography, and PMBC.

**Results:** Patients were divided into two groups: Group I: Cn  $< 4 \text{ mL/mmHg}$ , Group II: Cn  $\geq 4 \text{ mL/mmHg}$ . Group I patients had significantly higher SPAP, and lower SPAP reduction. Sensitivity of Cn  $\geq 4 \text{ mL/mmHg}$  in prediction of SPAP reduction  $> 35$  % was 90.7 %, specificity was 83.8 %.

There was a significant negative correlation between Cn and basal SPAP ( $r = -0.349$ ,  $p = 0.0015$ ), and a significant positive between Cn and the percent of SPAP reduction ( $r = 0.617$ ,  $p < 0.00001$ ).

**Conclusion:** Measuring Cn can predict reduction of SPAP in MS patients after PMBC.

**P1088**

**Match and mismatch between opening area and resistance in mild and moderate rheumatic mitral stenosis**

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**Background:** Mitral valve resistance (MVR) is a hemodynamic consequence of mitral stenosis but it has no clear threshold and it has a shortage of data to be reliable.

**Purpose:** is to investigate match and mismatch between opening area and resistance especially in patients with moderate and mild mitral stenosis.

**Materials:** This cross section case control study comprised 88 patients with moderate and mild rheumatic mitral stenosis. Transthoracic echocardiographic study estimated: mitral valve area (MVA) both by planimetry (2D) and pressure half time (PHT), mitral valve score (MVS), mean transmitral pressure gradient (MPG), diastolic filling time(DFT), left ventricular out flow tract diameter (LVOTd) and velocity time integral (LVOT vti) , the MVR was calculated as: MPG/aortic flow ratio [(LVOTd) (LVOTvti)/DFT] in dynes.sec/cm5, NYHA function class of all patients was estimated. We classified our patients into 2 groups, group 1 (51 patients) with matched MVR and group 2 (37 patients) with unmatched MVR (unexpected high MVR in relation to valve area).

**Methods:** Patients with moderate mitral stenosis have MVR less than 105 dynes.sec/cm5, while patient with mild mitral stenosis have MVR less than 76 dynes.sec/cm5 this is in the matched group, but there are patients with unmatched higher MVR. Group 2 compared to group 1; had higher NYHA function class (1.4±0.6 vs. 1.2±0.4, P < 0.05), MVS (8.1±1.8 vs 7±0.9, P < 0.05), MPG (11,3±3.7 vs.7.8±2.5 mmHg, P < 0.01) and higher MVR (122.37±29.87 vs. 67.18±20.12 dynes.sec/cm5 , P < 0.01), MVR showed positive correlation with MVS (r=0.5, P < 0.05), Step wise logistic regression analysis showed that MVS is the only independent predictor of the MVR severity in the mismatched (unexpected high) group , so the higher the MVS the higher the expected MVR whatever the MVA is ; (B±SE=6.997±2.826, t=2.476, 95% CI 1.241±12.752 with an odds ratio=0.412, P < 0.05).

**Conclusion:** It would make much more sense to investigate match and mismatch between opening area and resistance in rheumatic mitral stenosis, the only independent predictor of mismatch is the mitral valve score.

**P1089**

**When should cardiovascular magnetic resonance imaging be considered in patients with chronic aortic or mitral regurgitation?**

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**Background:** Grading of chronic aortic (AR) and mitral regurgitation (MR) by echocardiography (ECHO) is challenging and based on several parameters. Cardiovascular magnetic resonance (CMR) is a second line diagnostic tool when ECHO is inconclusive. At present, no consensus is reached regarding when CMR should be performed.

**Purpose:** We investigated the relation between ECHO and CMR findings in patients with chronic AR or MR to elucidate when CMR should be considered.

**Methods:** Patients with single chronic AR (n=45) or MR (n=49) were investigated using both modalities within 4 hours. ECHO grading was based on established guideline parameters plus an additional threshold for the left ventricular end-diastolic volume index indicating severe AR (> 87 ml/m2) or MR (> 69 ml/m2). The regurgitant volume index by CMR (RVI CMR) was assessed using current standard methods and thresholds indicating severe AR or MR were > 20 ml/m2 or > 32 ml/m2, respectively.

**Results:** Fifty-one percent of AR patients had a bicuspid valve and all MR patients had degenerative valve disease. The linear relations between the RVI CMR and ECHO parameters were moderate (Table). The relation between the RVI CMR and the number of achieved ECHO threshold values for severe regurgitation was strong in AR (R=0.84, P < 0.001) and moderate in MR patients (R=0.71, P < 0.001). All AR patients achieving ≥ 3 ECHO threshold values for severe regurgitation had severe regurgitation based on CMR. In patients with 1-2 or no positive ECHO threshold values the percentages were 43% and 11%, respectively. The corresponding in MR were 96% for patients achieving ≥ 3, 50% for those with 1-2 and 25% for those achieving no positive ECHO threshold values.

**Conclusion:** CMR should be considered in patients with clinically suspected significant chronic AR or MR achieving ≤ 2 ECHO threshold values for severe regurgitation.

**Funding Acknowledgements:** This study was funded by a project grant from the Health & Medical Care Committee of the Regional Executive Board, Västra Götaland Region, Sweden.

Table - Correlation analysis

Aortic regurgitation						
	VC	EDV	PHT	EROA	RV	EDVI
RVI CMR	0.65	0.77	-0.58	0.80	0.78	0.79
Mitral regurgitation						
	VC	E-velocity	TVI-ratio	EROA	RV	EDVI
RVI CMR	0.72	0.68	0.66	0.73	0.61	0.78

Data are presented as the Spearman's rank correlation coefficient. EDV, end-diastolic velocity; EDVI, end-diastolic volume index; EROA, effective regurgitant orifice area; E-velocity, mitral early inflow peak velocity; PHT, pressure half-time; RV, regurgitant volume; TVI-ratio, mitral to aortic time-velocity integral ratio; VC, vena contracta.

**P1090**

**Echocardiographic characteristics of aortic valve fenestration with aortic regurgitation for aortic valve repair**

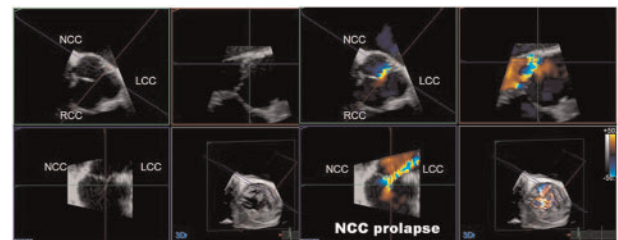
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**introduction:** Aortic valve repair requires a tailored surgical approach determined by the leaflet and aortic root characteristics. Fenestration of aortic valve is a common malformation, but sometimes causes significant aortic valve regurgitation (AR). We sought to improve the identification of aortic valve fenestration that requires patch closure for aortic valve repair using three-dimensional (3D) transesophageal echocardiography (TEE)

**methods:** We investigated consecutive 118 patients who underwent aortic valve plasty for aortic valve regurgitation in our institution from January 2012 to December 2015. We excluded 54 patients of them due to bicuspid aortic valve, aortic dissection, infective endocarditis, aortic valve injury after cardiac operation. Finally, 64 patients were available for analysis. Pre-operative 3D TEE and transthoracic echocardiography (TTE) were conducted for all study subjects within 3 months before surgery. We compare the pre-operative characteristics in patients who had fenestration required autologous patch closure (fenestration group: n = 8) with those in patients who had not (control group: n = 56).

**results:** There were no significant differences in severity of aortic regurgitation between fenestration group and control group by TTE (regurgitant volume 65.1 ± 28.5 ml vs 58.6 ± 19.2 ml: p=0.70, regurgitant fraction 44.6 ± 9.9 % vs 46.4 ± 11.4 % : p=0.72 , effective regurgitant orifice 0.25 ± 0.09 cm2 vs 0.26 ± 0.12 cm2 : p=0.95) . Diameter of sinus of Valsalva (SOV) and sino-tubular junction (STJ) in fenestration group was larger than control group (median diameter of SOV was 39.5 ± 4.7 mm vs 49.7 ± 9.3 mm : p=0.003 , median diameter of STJ was 33.3 ± 4.3 mm vs 44.2 ± 9.7 mm : p=0.002) in 3D TEE. Four patients had fenestration at right coronary cusp, two had at non-coronary cusp, and one had at left. Only one patient had fenestration at left and non-coronary cusps. Regurgitant orifices located at commissure lesion in 6 patients (75%) of fenestration group in contrast to 9 patients (16%) of control group (p=0.0008). There were eccentric regurgitant jet in all of fenestration group and 29 patients (52%) of control group (p=0.002).

**conclusions:** Aortic valve fenestrations required autologous patch closure were frequently located at both commissures lesions of right coronary cusp. We should consider the presence of fenestration when we find aortic regurgitation jet from commissure lesion, especially without aortic root dilatation. 3D TEE could visualize aortic valve fenestration by careful observation of commissures. 3D TEE is essential in the operative assessment of aortic valve regurgitation because accurate determination of origin, lesion localization, and mechanisms is required to determine the surgical techniques.



Abstract P1090 Figure.

**P1091**

**Aortic regurgitation assessment by 3D transesophageal echocardiography vena contracta area: usefulness and comparison with 2D methods.**

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**Background:** Quantitative assessment of aortic regurgitation (AR) using two dimensional (2D) echocardiography remains challenging. Three-dimensional (3D) echocardiography can directly measure the vena contracta area (VCA) without geometric assumptions.

**Purpose:** evaluate the use of 3D transesophageal VCA and compare it with 2D methods in the assessment of AR severity quantification.

**Methods:** Forty-eight patients (64% women) with a diagnosis of AR by transesophageal echocardiography (TEE) between March 2014 and December 2015 were included. Mean age was 62.3 years. Current 2D echocardiography AR quantification methods: 2D vena contracta (VC), AR jet/left ventricle outflow tract (LVOT) relation, AR jet density, pressure half-time, diastolic flow reversal in the descending and abdominal aorta, and 3D VCA were studied.

**Results:** Thirty-eight patients were included in the final study, 14.3% had bicuspid aortic valve (AV). Degenerative AR was present in 38.8% of patients, and 22.4% had a prolapsing AV. 3D VCA was acquired using high volume rate in 53.1% of studies. In case of central AR jets, a moderate correlation was seen between 2D VC and 3D

VCA for grading AR severity (Tau-b 0.33; p 0.016). In case of eccentric jets (13 patients) no correlation was seen between these parameters (p=0.53). A 3D VCA > 0.41 cm2 and the presence of diastolic flow reversal in the descending aorta was the best combination for grading severe AR.

**Conclusions:** Quantification of AR is challenging. 2D VC and 3D VCA are useful parameters for AR quantification, showing moderate correlation in case of central jets. 3D VCA is preferred in case of eccentric jets. The use of 3D VCA and the presence of diastolic flow reversal in the descending aorta was the best combination for grading severe AR.

**P1092**

**Characterising cardiomyopathy in mitral regurgitation due to barlow disease: role of CMR**

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**Background** - Previous studies have raised the possibility that primary degenerative mitral regurgitation (MR) due to Barlow's disease (BD) is associated with a cardiomyopathy, which may be responsible for the increased risk of sudden cardiac death. This study aims to characterise the differences in ventricular structure, function and tissue characterisation between BD and fibroelastic deficiency (FED).

**Methods** - A concordant diagnosis of FED v BD was made following independent, blinded review by 2 experienced observers on echocardiography in 29 patients with moderate-severe primary degenerative MR and normal coronary angiography. All patients underwent comprehensive left (LV) and right ventricular (RV) assessment with cardiac MRI.

**Results** - 15 cases were diagnosed as FED, 14 as BD. The two groups were well matched for age (BD 61.9±13.6yrs v FED 67.8±11.6yrs, P=0.18), BSA, hypertension history, and baseline bloods (eGFR BD 71±17 v FED 71±14, P=0.92). Subjects were asymptomatic on cardiopulmonary exercise tests (mean O2 uptake at 98% predicted). There were no differences in severity of MR, NT-proBNP, LA volume, or standard measures of LV or RV size and function. Segmental LV analysis (Figure 1) demonstrated significantly thinner LV wall measurements in the majority of LV segments in BD patients. This was associated with significantly lower indexed LV mass in BD compared to FED (P=0.03). There were no differences in GCS, GLS, or strain rate, between the two groups. T1 mapping by ShMOLLI and ECV by MOLLI were similar.

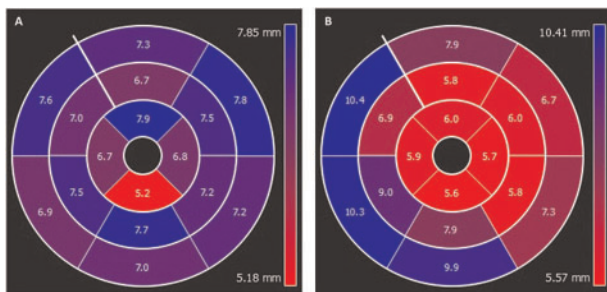
**Conclusion** - BD is associated with thinning of the myocardium and lower indexed LV mass compared to FED despite equivalent severity of MR, exercise performance, and biomarker measures of ventricular stress. Although there were no differences in terms of ventricular size, function or tissue characterisation, these findings suggest that the myocardial response to regurgitant volume in BD is different to that in FED.

**Funding Acknowledgements:** British Heart Foundation Project Grant PG/14/74/31056.

Table 1. MRI comparison of BD v FED

	Barlow's disease	Fibroelastic dysplasia	P Value
LVEDVi (ml/m <sup>2</sup> )	92±22	95±23	0.71
LVESVi (ml/m <sup>2</sup> )	25±12	28±12	0.46
LVEF (%)	73±7	71±8	0.34
Indexed LV mass (g/m <sup>2</sup> )	62.9±11.8	72.8±12.8	0.03
Global circumferential strain (GCS)	-18.7±2	-17.6±3.4	0.28
Global longitudinal strain (GLS)	-16.1±2.9	-14.7±3.1	0.17
ShMOLLI global T1 (ms)	964±26	952±24	0.22
Extracellular volume (%)	30±0.1	30±0.1	0.84

Values are given as mean ± SD.



Abstract P1092 Figure.

**P1093**

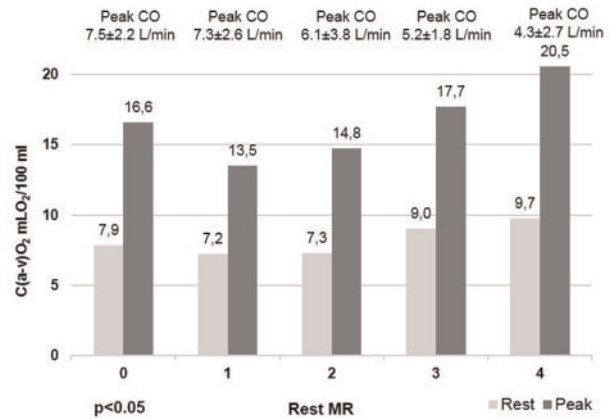
**Compensatory peripheral increase in artero-venous o2 difference to severe functional mitral regurgitation in heart failure**

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**Background:** in heart failure (HF) mitral regurgitation (MR) presence and severity is of indisputable clinical and prognostic relevant. Cardiopulmonary exercise testing

(CPET) allows evaluating functional capacity and provides indexes for HF risk stratification, such as peak oxygen consumption (VO2) and ventilatory efficiency parameters (VE/VCO2). Since MR determines a severity-related backward flow to left atrium, it may result in an unfavourable central blood flow exercise redistribution that is physiologically relevant to VO2 increase. Aim: To evaluate the cardiac output (CO) and VO2 exercise-response according to MR severity in a population of HF reduced ejection fraction (HFrEF) patients. Methods: 104 HFrEF patients (mean age 64±11 y, male 72%, ischemic etiology 68%, mean LVEF 34±9%) underwent a maximal CPET (incremental ramp protocol) combined with exercise-echo. Peripheral extraction (C(a-v)O2) was estimated by the ratio of peak VO2/CO (non-invasively estimated by echo). Results: HFrEF population was studied according to functional MR severity using a four degree scale (0= no\_MR, 1=mild MR, 2=mild-to-moderate MR, 3=moderate-to-severe MR, 4=severe MR). We observed a progressive decrease in functional capacity (lower peak VO2: 0=15.4±3.6; 1=13.2±3; 2=11.7±3.3; 3=11.6±3.2; 4=11.1±2.3 ml/Kg/min, p<0.05) and in ventilatory efficiency (higher VE/VCO2: 0=29.1±4.3; 1=32.4±8.2; 2=33.5±8.1; 3=38.4±36.9; 4=51.6±15, p<0.05) with the increase of MR severity. A more severe MR was also related to a blunted exercise-induced increase in CO and with a compensatory higher peak exercise C(a-v)O2 (Figure). Compared to no MR subjects, a lower O2 estimated extraction in mild to moderate MR stages and a higher than normal increase observed in moderate to severe MR, emphasizes the relevance of a progressive compensatory peripheral adaptation to the central limitation. Conclusions: Severe MR and consequent partial abnormal CO redistribution to the pulmonary circulation is a sort of new and relevant pathophysiological mechanisms that limits overall exercise performance in HFrEF. In the subset of patients at highest risk peripheral compensation in O2 extraction provides a background for a thorough exercise phenotyping of patient with similar clinical condition but different underlying pathways



Abstract P1093 Figure.

**P1094**

**Prognostic impact of concomitant atrioventricular valve regurgitation in patients undergoing transcatheter aortic valve implantation**

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**Background:** The impact of pre-procedural atrioventricular valve regurgitation on prognosis of patients receiving transcatheter aortic valve (TAVI) has been questioned. Moreover, whether these patients exhibit clinical benefits, with amelioration of heart failure symptoms has not been extensively investigated.

**Purpose:** We sought to investigate the prognostic impact of significant pre-procedural mitral regurgitation (MR) and/or tricuspid regurgitation (TR) in patients undergoing TAVI with a self-expandable valve.

**Methods:** Patients with severe and symptomatic aortic stenosis [effective orifice area (EOA) ≤1 cm<sup>2</sup>] who were scheduled for TAVI with a self-expanding valve at our institution were consecutively enrolled. Prospectively collected echocardiographic data before and after TAVI were retrospectively analyzed in all patients. Patients were stratified into two groups according to the severity of MR and TR accordingly: ≥grade 3 were classified as significant and ≤grade 2 as non-significant. Change in MR and TR severity and New York Heart Association functional status (NYHA) were assessed at 30 days. The primary clinical end-point was all-cause mortality defined according to the criteria proposed by the Valve Academic Research Consortium-2.

**Results:** We included 174 patients (mean age: 80.0±6.8 years) in the study; 24.7% of patients (43/174) had significant MR, 17.8% (31/174) had significant TR and 9.1% (16/174) had significant MR and TR. The primary clinical end point occurred in 42 patients (23.6%) during a follow-up period of 24.8±20.4 months. At 30 days, heart failure symptoms were significantly reduced regardless of the extent of atrioventricular valve regurgitation. Patients with significant pre-procedural MR displayed greater mortality during follow-up (37.2% versus 20.0%, p=0.03). Accordingly, significant pre-procedural TR was associated with greater mortality during follow-up (48.4% versus 18.9%, p<0.01). Significant TR was independently associated with mortality [(OR 4.384, (95% CI 1.744-11.022, p=0.02)].

**Conclusions:** All-cause mortality after TAVI in the subgroup of patients with pre-procedural aortic valve regurgitation was significantly higher. It seems though, that patients still benefit by improving heart failure symptoms.

### P1095

#### Morphological characterization of vegetations by real-time three-dimensional transesophageal echocardiography in infective endocarditis: prognostic impact

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**Background:** Vegetation size, determined by two-dimensional transesophageal echocardiography (2DTEE) is a prognostic factor in infective endocarditis (IE). However, in some scenarios, 2DTEE may underestimate the real dimensions of vegetations.

**Purpose:** Our aim was to evaluate the role of real-time three-dimensional transesophageal echocardiography (RT3DTEE) on diagnosis and morphological characterization of vegetations, and its potential prognostic impact.

**Methods:** we analyzed 200 episodes of IE prospectively recruited in a tertiary care centre (2009-2016), of which 65 episodes had both 2DTEE and RT3DTEE assessment of vegetations. Vegetation major and minor diameters, and area were measured. 2DTEE and RT3DTEE data were analyzed blindly.

**Results:** mean age of our population (n=65) was 69 (15) years, and 62% were male. 88% were left-sided IE. Incidence of systemic embolisms was 40%. Regarding vegetation morphology, 37 were filiforms, and 28 were raceme-like vegetations. Vegetation size and area were larger by RT3DTEE (p<0.001), and RT3DTEE was especially relevant in the characterization of the latter (Table 1).

Considering systemic embolisms in left-sided IE as the dependent variable, and vegetation dimension as the independent variable, area under the ROC curve was superior with RT3DTEE (0.72 vs 0.67; p=0.150), although it did not reach statistical significance. The best cut-off point to predict embolisms with RT3DTEE was 17 mm (PPV 70.6%, accuracy 72%), and with 2DTEE was 15 mm (PPV 60%, accuracy 64%). Odds ratio for a RT3DTEE maximum vegetation size  $\geq 17$  mm was 4.98, (IC95%: 1.44-17.15; p=0.011). The association between 2DTEE vegetation size and systemic embolisms was not significant.

**Conclusions:** RT3DTEE enables a more accurate characterization of vegetations, particularly those with a raceme-like shape. In addition, quantification of vegetation size by RT3DTEE might increase the predictive accuracy of embolic risk evaluation in patients with IE.

	RT3DTEE	2DTEE	Difference	p
Major diameter (mm)				
Total (n=65)	15.0 (13.3-16.7)	12.4 (10.8-14.1)	2.57 (1.70-3.45)	<0.001
Filiforms (n=37)	16.8 (14.4-19.2)	14.2 (11.8-16.6)	2.60 (1.55-3.61)	<0.001
Raceme-like (n=28)	12.6 (10.4-14.9)	10.1 (8.3-11.8)	2.56 (0.98-4.15)	0.003
Area (cm <sup>2</sup> )				
Total (n=65)	0.95 (0.70-1.20)	0.64 (0.47-0.82)	0.30 (0.14-0.47)	<0.001
Filiforms (n=37)	0.89 (0.58-1.18)	0.70 (0.42-0.99)	0.18 (0.07-0.29)	0.002
Raceme-like (n=28)	0.85 (0.59-1.11)	0.55 (0.35-0.75)	0.30 (0.13-0.47)	<0.001

### P1096

#### Relation between causative pathogen and echocardiographic findings in patients with infective endocarditis: is there an association and is it clinically relevant?

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**Background:** Causative organisms of infective endocarditis (IE) have different potential for tissue destruction and different propensity to cause extensive and severe heart lesions. Echocardiography is essential for the diagnosis of IE, identification of lesions specific for IE, their extensiveness, severity and haemodynamic consequences. Data regarding the relation between causative pathogen and echocardiographic findings in IE are sparse.

**Aim:** of the study was to investigate the relations between causative organism of IE and type and severity of echocardiographic lesions.

**Methods:** 206 definitive cases of IE diagnosed with the use of modified Duke criteria were included in retrospective, case-by-case, single-center study, between 1st of January 2009 and 31st of December 2015. Echocardiographic lesions specific for IE were defined according to ESC guidelines. Independent predictors for each lesion were identified in multivariable models. In order to quantify the extent and severity of cardiac lesions in toto in each patient, EchoIE Score was calculated as a sum of analyzed lesions (each lesion carries one point + one point for vegetation > 15mm + one point for multivalvular IE).

**Results:** 81% of pts were male, mediana of age was 57 (44-67), 89% had native valve IE, 41.7% on aortic and 36.4% on mitral position, and 11.3% had bivalvular IE. Staphylococcus was predictor of large vegetation (> 15mm) (OR 2.657; 95% CI 1.161-6.077; p= 0.021), leaflet abscess or aneurysm (OR 4.807; 95% CI 1.346-17.171; p=0.016), and pseudoaneurysm (OR 5.883; 95% CI 1.138-30.423; p=0.035). Gram negative rods were predictors of large vegetation (OR 3.943; 95%CI 1.120-13.886; p=0.033), perivalvular abscess (OR 8.565; 95% CI 1.770-41.431; p=0.008) and perivalvular pseudoaneurysm (OR 8.082; 95%CI 1.028-63.518; p=0.047). Patients with HACEK IE and non-HACEK Gram-negative IE had the highest EchoIE Score (Chi-square=14.600, p=0.041). In multivariable analysis, adjusted for DM, haemodialysis, i.v. drug abusers, time from symptom to diagnosis > 1 month, age and predisposing cardiac conditions (high-, intermediated- and low/no-risk for IE) significant predictors of higher EchoIE Score remained: staphylococcus ( $\beta$ = 0.269, p<0.001), Gram negative bacteria (as mono- and in polymicrobial infection) ( $\beta$ = 0.251, p=0.001), carcinoma ( $\beta$ =-0.201, p=0.005) and health-care acquired IE ( $\beta$ = 0.199, p=0.005).

**Conclusion:** despite some overlap, there is a significant association between causative microorganism of IE and echocardiographic lesions, that persisted even after adjustment for other variables known to affect IE prognosis. Staphylococcus and Gram-negative bacteria are associated with more destructive heart changes. These results might be clinically important for risk stratification and treatment decision with more aggressive patient management as soon as causative microorganism is identified.

### P1097

#### Aortic and mitral valve infective endocarditis: different clinical and echocardiographic features and peculiar complication rates

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**Background:** Despite medical and surgical advances, infective endocarditis (IE) is associated with substantial morbidity and mortality. Left-sided cardiac valves are more commonly involved and usually related to worse prognosis.

**Purpose:** To compare aortic IE (AIE) and mitral IE (MIE) characteristics in a population of patients (pts) diagnosed with IE.

**Methods:** Retrospective study that included pts diagnosed with IE who underwent transoesophageal echocardiogram (TOE) in a tertiary hospital centre between 2006 and 2014. Demographic, clinical, echocardiographic, therapeutic and prognostic data were collected and AIE and MIE were compared. A subanalysis of prosthetic valve endocarditis (PVE) was performed. Complications were considered: heart failure (HF), perivalvular extension and cerebral and peripheral embolism.

**Results:** 222 pts diagnosed with IE were evaluated, from whom 206 (92.8%) presented left-sided cardiac valves involvement. In the latter group (68.4% male, average age 63.65  $\pm$  15.11 years, mean follow up 28.92  $\pm$  31.45 months), 55.8% had AIE. The most common echocardiographic finding was vegetation (90.8%) and there was a significant number of abscesses and pseudoaneurysms (22.3%). Staphylococcus spp. was the microorganism more frequently isolated (27.4%). The clinical course was complicated in 71.8% of pts, with heart failure being the most common complication (39.5%). 37.7% of the pts underwent surgical treatment. PVE accounted for 42.2% of all cases (49.4% < 1 year after surgery and 47.3% on biological prosthesis), from which 59.3% were in aortic position. In-hospital mortality was 16.9% and long-term mortality of survivors was 18.4%. Comparing AIE and MIE, there were no differences in demographics and comorbidities, except higher frequency of arterial hypertension (61.7% vs. 41.2%; p=0.005) and coronary disease (22.6% vs. 4.7%; p<0.001) in AIE. AIE was more often complicated by perivalvular extension (38.4% vs. 16.7%; p=0.002), while cerebral emboli were most often associated with MIE (35.3% vs. 18.3%; p 0.014). AIE required surgical treatment more often (43.0% vs. 30.0%; p=0.057). Evaluating the subgroup of PVE, aortic valve was affected earlier (61.7% vs. 32.4%; p=0.009), was more associated with biological prostheses (68.5% vs 16.2%; p<0,001) and had less periprosthetic leaks detected by TOE (16.7% vs. 40.5%; p=0.011). There were no differences in in-hospital and long-term mortality on the different analysis.

**Conclusion:** In the studied group, complication rate of IE was high. AIE was associated with more perivalvular extension and required surgical treatment more often. MIE was complicated more frequently by cerebral emboli, although there were no differences in short and long-term mortality. In the subanalysis of PVE, aortic valve was associated with earlier IE, more biological prostheses and less periprosthetic leaks.

### P1098

#### Vegetation size relevance and impact on prognosis in patients with infective endocarditis

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**Background:** Despite effective antibacterial therapy and better diagnostic facilities with the use of transoesophageal echocardiography, infective endocarditis (IE) is still associated with high mortality and devastating complications. The significance of vegetations' size has been a subject of discussion for many years.

**Purpose:** To analyse vegetations' size in relation to the clinical presentation and outcome in patients (pts) with IE.

**Methods:** Retrospective study which included pts with IE who underwent transoesophageal echocardiography in a tertiary hospital centre from 2006 to 2014. Large

vegetations were considered > 10 mm and very large vegetations > 20 mm. A review was done of clinical and echocardiographic data (affected valves, vegetation size, valve regurgitation) and prognostic factors. Complications were considered: heart failure, perivalvular extension, cerebral and peripheral embolism.

**Results:** A total of 193 pts were evaluated (mean age  $63.1 \pm 15.4$  years, 69.4% male, follow up  $28.5 \pm 30.9$  months). Aortic and mitral valve were the valves most frequently affected (54.4% and 39.4%, respectively). 37.3% were prosthetic valve endocarditis. The most common microorganism isolated was *Staphylococcus* spp. (30.2%). Surgery was required in 31.7% of pts. Complication rate was high (63.3%) and in-hospital mortality was 13.8%. Large vegetations were present in 48.7% and very large vegetations were found in 13.6%. Male gender and tobacco use were associated with larger vegetations ( $p$  0.006 and  $p$  0.001, respectively). IE affecting tricuspid valve presented more often large vegetations ( $p$  0.011) and very large vegetations were more frequent in mitral valve IE ( $p$  0.045). Congenital heart disease was associated with very large vegetations ( $p$  0.004). Blood culture-negative IE presented smaller vegetations ( $p$  0.005) compared to blood culture-positive IE. Valvular regurgitation was more frequent in pts with large vegetations ( $p$  < 0.001). Vegetations > 10 mm were associated with higher rate of surgery (40.2% vs. 23.7%,  $p$  0.015). Vegetation size had a prognostic impact. Large vegetations were associated with clinical course complicated by peripheral embolism (21.3% vs. 8.1%,  $p$  0.022). Patients with very large vegetations (>20 mm) had significantly increased risk of in-hospital mortality (26.9% vs. 11.8%,  $p$  0.039). No differences were found regarding long-term mortality but pts with large vegetations had higher rate of recurrence (11.6% vs. 3.4%,  $p$  0.037).

**Conclusion:** Our results indicate that larger vegetations are associated with male gender, positive blood cultures, congenital heart disease, valve regurgitation, tricuspid and mitral valve IE. Vegetations' size has a prognostic impact in the clinical course of infective endocarditis, associated with higher embolic rate and recurrence when large and when very large to higher in-hospital mortality. Pts with larger vegetations should be closely monitored and aggressively treated.

### P1099

#### Causes of death on the valvular heart disease surveillance list- a 5 year audit

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**Background:** Cardiac disease is responsible for 30% of deaths in the UK. 40% of this a consequence of valvular heart disease (VHD). Due to an ageing population VHD prevalence is set to rise.

It's preponderance in the elderly complicates diagnosis and difficult decisions need to be made regarding high risk surgery as a consequence of multiple co-morbidities. The European Society of Cardiology and European Association for Cardio-thoracic Surgery suggest guidelines recommending surveillance of all VHD patients to ensure optimal management. These guidelines needed structure, however, can be difficult to implement given the current strains on the National Health Service.

The consequences can be catastrophic. In Wales, average time from referral to surgery was over 1 year in 2014. In 2014 the Princess of Wales Hospital had 1300 patients in the surveillance clinic. Given local restraints some patients had to wait over the recommended review interval. Some died while waiting follow up.

**Purpose:** We aimed to investigate cause of death of those who died on the surveillance list to determine if they were preventable deaths or the result of non-cardiac comorbidities in an ageing population.

**Methods:** We ascertained cause of death in all patients who died on the VHD clinic waiting list between 2009 and 2014. For those with a cardiac cause of death the notes were further reviewed.

**Results:** 106 patients on the waiting list had died since 2009. Mean age of death was 78 (range 67-91). Cause of death was considered cardiac or potentially cardiac in 77. 15 patients were excluded as case notes revealed they had already had cardiac surgery. The impact of VHD was considered in the remaining 62 patients and was considered a major contributing factor to death in 14; their reasons for not having surgery were reviewed.

**Conclusion:** 73% of deaths were considered cardiac or potentially cardiac, the latter including conditions such as ischaemic bowel, multi organ failure and stroke. 14 deaths were considered a direct result of VHD, only half of these patients were not referred to surgeons. In 1 of these 14, delay in planned follow up was identified. As services struggle to meet demands, there is growing concern regarding long waiting lists and difficulty adhering to guidelines. This data does not support clinic delay as a cause of death. We suggest sonographer lead clinics as an initiative to reduce waiting times for low risk patients. We question whether we need a better way of identifying those patients that may progress rapidly in order to allow us to ensure timely optimisation of their medical management or more prompt access to surgery.

## CARDIOMYOPATHIES

### P1100

#### Left ventricular non-compaction and idiopathic dilated cardiomyopathy: the significant diagnostic value of longitudinal strain

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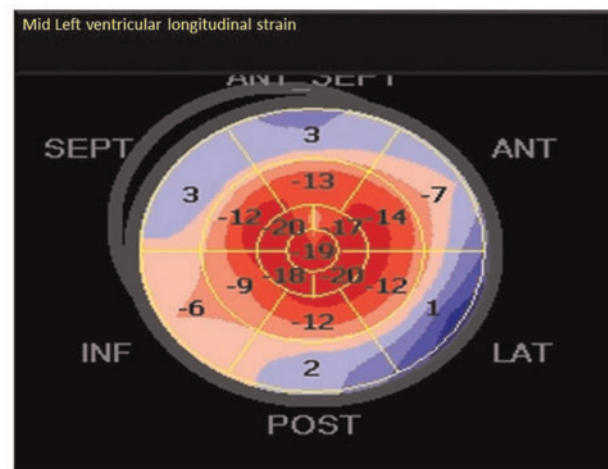
**Background:** Left ventricular non-compaction (LVNC) is characterized by abnormal trabeculations that are mainly at the apex. Distinction between LVNC and non-specific

dilated cardiomyopathies (DCMs) remains often challenging. We sought to find additive tools comparing the longitudinal strain characteristics of LVNC versus idiopathic DCM in a cohort of patients.

**Methods:** Forty-eight cases of LVNC were compared with forty-five cases of DCM. Global and regional multi-layer (sub-endocardial, mid-wall, and sub-epicardial) longitudinal strain analysis was performed. Results were compared to define the best tool for distinguishing LVNC from DCM. A validation cohort (forty-one LVNC patients) was then used to assess the performance of the proposed diagnostic tools.

**Results:** In the derivation cohort, longitudinal strain components were higher in LVNC than in DCM patients. In LVNC, strain values were higher in the non-compacted segments than in the compacted ones. A base-apex gradient mid-strain (AUC = 0.83) with a cut-off of -0.23% had 88.4% sensitivity and 66.7% specificity in distinguishing LVNC from DCM. In a multivariable model, the base-apex mid-gradient in an apical 4-chamber view was the only echocardiographic criteria (OR = 0.76, CI 95% [0.66; 0.90],  $p$  = 0.0010) independently allowing the distinction between LVNC and DCM. In the validation cohort, the base-apex mid-gradient had 88.4% sensitivity, 85.7% negative predictive values for the diagnosis of LVNC.

**Conclusion:** Longitudinal strain, especially the base-apex sub-endocardial longitudinal strain gradient, appears as an additive valuable tool for distinguishing LVNC from DCM. This functional approach could aid in differentiating difficult anatomical cases.



Abstract P1100 Figure.

### P1101

#### The role of echocardiography in the management of diuretics withdrawal in patients with chronic heart failure and severely reduced ejection fraction: a prospective cohort study

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**Introduction.** Diuretic therapy in patients with heart failure with reduced ejection fraction (HFrEF) portends potentially harmful effects and can be probably suspended in selected, HFrEF.

**Purpose.** Our Aim was to identify predictors of safe diuretics withdrawal (DW).

**Methods.** One hundred and ninety patients with HFrEF were enrolled. Clinical evaluation, natriuretic peptide (NT-proBNP) and standard echocardiogram were performed every six months for a median follow-up period of  $20 \pm 10$ . Patients for which DW was not recommended were included in the Non-Withdrawal group, N = 169 (78%), while patients where DW was considered safe were included in the withdrawal group, N = 21 (12%).

**Results.** Patient with NT-proBNP <550 pg/ml, left ventricular end-diastolic diameter <60mm (LVEDD) (OR 0.18;  $p$ <0.0005), left ventricular end-diastolic indexed volume < 80ml/m<sup>2</sup> (OR 1.03;  $p$ <0.005), left atrial indexed volume <34ml/mq (OR 0.28;  $p$ < 0.009), tricuspid annular plane systolic excursion  $\geq 20$  mm (TAPSE) (OR 0.17;  $p$ <0.001) had more chance to DW. In a multivariable analysis TAPSE  $\geq 20$ mm (OR 0.15, 95%CI 0.04-0.45,  $p$ =0.0005) and LVEDD <60mm (OR 0.17, 95%CI 0.06-0.47,  $p$ =0.0007) (AUC for both= 0.78) were independent predictors of DW. At follow up no patients required diuretic resumption and no episode of acute HF occurred.

**Conclusions.** Echocardiography can play a pivotal role in DW in HFrEF after medical treatment has been optimized. TAPSE >20, and LVEDD <60mm were independently predictive of DW.

## P1102

## Outcomes in paediatric new onset left ventricle dysfunction and dilatation: differences between post-myocarditis and DCM

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DCM is the most common form of cardiomyopathy in children and the first indication for heart transplant in infants and children beyond 5 years. Etiology is important, since marked disparity have been shown between idiopathic and post-myocarditic paediatric DCM, in terms of higher rates of reverse remodelling and of transplant free survival for myocarditis. However, the diagnosis of myocarditis is challenging and parameters for reliable risk stratification are lacking.

We aimed at comparing basal data and outcomes of children with primary dilated cardiomyopathy and myocarditis. The primary endpoints were the combined outcome of death or transplantation, or the detection of recovery to normal LV function and dimensions. Data were retrospectively obtained from medical records. All patients (0-18 yrs) referred in 2000-2016 to a single University Hospital for LV dysfunction (LVEF < 55%), and/or dilation (LVEDD > 2 Z scores for BSA) were classified as: certain, probable, possible or unlikely myocarditis

**Results:** 32/72 were classified as having myocarditis (M), whereas in 40/72 myocarditis was unlikely (DCM). 11/32 patients had definite, 8/32 probable and 13/32 possible myocarditis. In both groups a similar significant proportion of patients (14/32 vs 21/40 p=0,4) presented in the 1 year of life, with a 3:1 male to female ratio. Admittance to ICU and inotropes use were similar (16/32 and 14/32 M vs 13/40 and 10/40 DCM) (p= 0,1 and 0,3 respectively), as was the need for ECMO or VADs (6/32 M vs 4/40 DCM p= 0,3). LVEF at onset was significantly lower (p=0,01) for M patients (29,6% vs 39,1%) while mean LVEDDz was comparable (4,1± 2,1 M vs 3,5±2,6 DCM p= 0,3). 4 patients were lost to follow-up. 6/30 patients in the M group and 8/38 in the DCM group reached the primary end point of death or transplant (p= 0,21). LVEF was significantly lower in patients progressing to this primary endpoint in both groups (32±11,7 vs 17±8 p= 0,09 for M, and 44,8 ± 17 vs 25±9 p= 0,07 for DCM), independently on the LVEDDz score (3,6±2 vs 5,8 ± 1 p=0,6 for M, and 3,5±2,3 vs 5,4±2,1 p=0,2 for DCM). Onset below 2 years of age was associated with this primary end-point in the DCM group only (7/22 vs 1/18 p= 0,02 vs 3/18 vs 3/14 p=0,5). Recovery to normal LV was observed in 17/68 patients, with a non significant trend (p= 0,18) for better outcomes in the M group (10/30 vs 7/38). Higher LVEF at diagnosis was associated with a higher chance of recovery in the M group (29,6±14 vs 41,7± 6,9 p= 0,008 in M, 26 ± 11,8 vs 38,9±9,7 p=0,11 in DCM).

Myocarditis accounts for a frequent cause of paediatric new onset LV dilation or dysfunction, often requiring advanced support. Death or transplant occurred similarly in both our groups, with lower LVEF at onset being the most important risk factor. Recovery to normal function occurred in 30% of M patients vs. 18% of DCM ones, a non significant difference. Hence, it is not possible to confirm a strikingly better outcome for paediatric M patients.

## P1103

## De novo mitral regurgitation as a cause of heart failure exacerbation in hypertrophic cardiomyopathy

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**Introduction:** The development of de Novo mitral regurgitation (MR) due to associated intrinsic mitral valve disease (IMVD) in patients with hypertrophic cardiomyopathy (HCM) has been sporadically described. **Purpose:** To evaluate the etiology, prevalence and factors associated with prognosis in this association. **Methods:** 389 HCM patients with complete clinical and echocardiographic follow-up were evaluated. de Novo MR due to associated IMVD was diagnosed by echocardiography (TTE and TEE) by the presence of an anatomically abnormal MV leading to a new MR jet not related to the systolic anterior motion of the MV. **Results:** Sixteen patients (4.0%) with IMVD and de Novo MR causing severe heart failure were identified. Their clinical and echocardiographic characteristics were compared to the overall HCM population (table). Ten patients had a flail leaflet, 4 had severe prolapse, 8 mitral annular calcification, 9 calcified leaflets. Fourteen patients were operated (2 denied surgery). Pathology showed Myxomatous changes in all valves. On multivariable age adjusted analysis LVOT obstruction (HR=4.92) and greater than mild MR at baseline (HR=6.79) significantly and independently predicted the development of de Novo MR. **Conclusions:** With careful echocardiographic evaluation IMVD causing severe MR was found in 4% of our HCM patients. LVOT obstruction and greater than mild MR at baseline predicted the development of de Novo MR. This etiology needs to be considered as a cause of heart failure exacerbation because mitral valve surgery is often required.

## Baseline Characteristics

	No de Novo MR (N=381)	de Novo MR (n=16)	p
Male	262 (72%)	8 (50%)	0.01
Age at Diagnosis (years)	38±18	51±20	0.03
Obstructive HCM	164 (43%)	10 (65%)	0.008
LVEF (%)	62±9	67±8	0.003
LVEDD (mm)	46±6	47±5	0.43
LVESD (mm)	27±5	28±4	0.54
Maximal wall thickness (mm)	19±5	21±5	0.9
LA Diameter (mm)	43±7	52±19	0.003
MR > mild	99 (26%)	14 (88%)	0.001
RV systolic pressure (mmHg)	36±11	45±13	0.005

LVEF, left ventricular ejection fraction; LVEDD, left ventricular end-diastolic diameter; LVESD, left ventricular end-systolic diameter; LA, left atrium, RV, right ventricle.

## P1104

## Correlation of conventional and new echocardiographic parameters with sudden cardiac death risk score in patients with hypertrophic cardiomyopathy

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**Background:** In patients with hypertrophic cardiomyopathy (HCM), left ventricular global longitudinal strain (LV-GLS) is decreased because of left ventricular fibrosis. Ventricular tachyarrhythmias probably arise from the substrate of differentiation in left ventricular histology and physiology that induce electrical instability.

**Purpose:** The aim of our study was to evaluate the prognostic value of conventional and new echocardiographic parameters in these patients.

**Methods:** Echocardiographic examinations were performed in 64 patients with HCM. All patients' sudden cardiac death risk score (HCM-Risk-SCD) calculated with formula that defined in 2014 European Society of Cardiology guideline on diagnosis and management of HCM. Patients were divided into two groups according to HCM-Risk-SCD score.

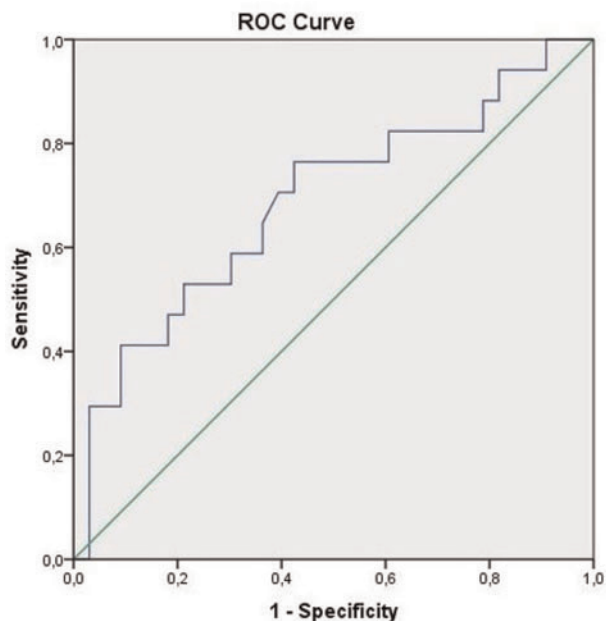
**Results:** Comparison of admission echocardiographic parameters of 64 patients are shown in Table 1. Patients whose HCM-Risk-SCD ≥ 4% have, higher three-dimensional maximal left atrial volume, three-dimensional minimal left atrial volume and lower LV-GLS, mitral A-wave velocity, and posteromedial papillary muscle free-strain (PMPM-S). In binary logistic regression analysis, PMPM-S is an independent predictor for HCM-Risk-SCD score greater than 4% (HR: 1.3 (CI: 0.99-1.72), p=0,016). Receiver operating characteristic analyses for HCM-Risk-SCD ≥ 4% showed that PMPM-S had area under the curve of 0.69 (p=0.032), with an optimal cutoff of -19%, yielding a sensitivity of 82% and a specificity of 70% (Figure 2).

**Conclusions:** LV-GLS and PMPM-S were decreased in patients with HCM but only PMPM-S was an independent predictor of HCM-Risk-SCD score greater than 4%. Additional prospective studies required to confirm this finding.

Table 1

	HCM-Risk-SCD <4%	HCM-Risk-SCD ≥4%	p-value
LVEDD, mm	43.7±5.6	41.9±5.4	NS
LVESD, mm	24.6±5	22.7±3.5	NS
Mitral E-wave, m/s	0.77±0.2	0.84±0.2	NS
Mitral A-wave, m/s	0.77±0.2	0.61±0.2	0.021
Mitral-Septal-Em, cm/s	5.2±1.6	5.4±1.6	NS
Mitral-Lateral-Em, cm/s	8.3±3.3	8.6±3.2	NS
3D-LAV-Max, mL	68.6±21.5	90.1±36.7	0.033
3D-LAV-Min, mL	37.8±15.1	57.2±34.2	0.033
LV-GLS, %	-11.97±2.61	-9.75±2.73	0.003
ALPM-S, %	-16.54±5.34	-15.37±5.06	NS
PMPM-S, %	-18.02±5.68	-14.54±4.78	0.028

Comparison of two groups



Abstract P1104 Figure.

**P1105****Inverse correlation between myocardial fibrosis and left ventricular function in rheumatic mitral stenosis: a preliminary study with cardiac magnetic resonance**

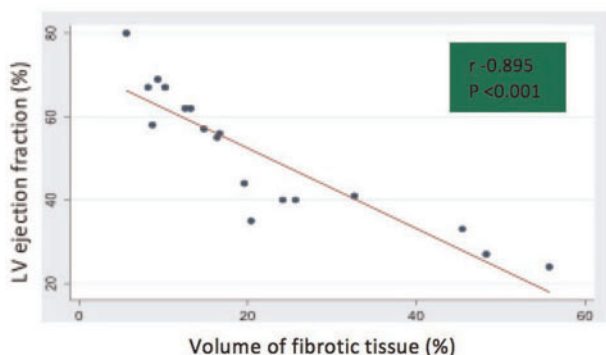
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**Background:** Left ventricular (LV) dysfunction was frequently found in rheumatic mitral stenosis. Many theories were proposed as the causes of the LV dysfunction. Myocardial fibrosis had been revealed in rheumatic heart disease and could be associated with LV dysfunction in rheumatic mitral stenosis.

**Purpose:** To evaluate myocardial fibrosis profile related to left ventricular (LV) function in rheumatic mitral stenosis with cardiac magnetic resonance (CMR) examination.  
**Methods:** Eighteen patients with rheumatic mitral stenosis without history of coronary artery disease or its risk factors underwent CMR examination. Left ventricular ejection fraction (LVEF) and right ventricular ejection fraction (RVEF) were quantified with cine CMR. Fibrotic tissue was evaluated with contrast-enhanced CMR, including its location and volume. Other hemodynamic data was derived from echocardiography results.

**Results:** These patients (40.4±10.5 years old, 72.2% female, 66.7% atrial fibrillation) had mitral valve area of 0.7±0.2 cm<sup>2</sup>, mean mitral valve gradient of 12.6±4.1 mmHg, LVEF of 50.9±3.8%, and RVEF of 37.7±3.3%. Severe pulmonary hypertension was observed in 66.7% patients. Fibrotic tissue was found in all patients with distribution as follows: at basal and mid segments 100%, at apical segments 55.6%. Fibrotic tissue at apical segments was observed more in patients with LVEF < 50% (p 0.02). Fibrotic tissue was found at anterior 77.8%, septal 88.9%, lateral 88.9%, and inferior 94.4%, with predilection at inferior and anterior LV-RV junction. Volume of fibrotic tissue in these patients were 16.6 (5.5-55.8%). In multivariate analysis, volume of fibrotic tissue had negative correlation with LVEF (r -0.89, p<0.001). Fibrotic tissue of 1% was associated with LVEF reduction of 0.96% (95% CI 0.71% to 1.21%).

**Conclusion:** The extent of myocardial fibrosis had strong negative correlation with LV function in rheumatic mitral stenosis.



Abstract P1105 Figure.

**P1106****Left ventricular diastolic dysfunction and cardiac sympathetic derangement in patients with Anderson-Fabry disease: a 2D speckle tracking echocardiography and cardiac 123I-MIBG study**

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**Purpose.** Anderson-Fabry disease (AFD) related cardiomyopathy is thought to be characterized by cardiac hypertrophy, preserved left ventricular (LV) systolic function and impaired diastolic function. Data about cardiac sympathetic nervous function are scant. We aimed to investigate the relationship between LV function and cardiac sympathetic nervous function in patients with AFD.

**Methods** Twenty-eight patients (13 men, mean age 44±12 years) with genetically proved AFD and preserved LV ejection fraction and ten age and gender-matched control subjects underwent speckle tracking echocardiography and 123I-meta-iodobenzylguanidine (MIBG) imaging from which early and late heart to mediastinum (H/M) ratios and myocardial washout rate values were calculated.

**Results** In AFD patients, a significant correlation between late H/M ratio and LV mass index (r=-.62, p=0.001), left atrial volume (r=-0.72, p<0.001), systolic pulmonary artery pressure (r=-0.75, p<0.001), and early diastolic untwisting rate (r=-0.66, p<0.001) was found. Ten AFD patients exhibited a late H/M ratio below two-fold standard deviation of control subjects (≤1.75). Patients showing late H/M ratio≤1.75 had significantly higher LV mass index, relative wall thickness, left atrial volume and systolic pulmonary artery pressure, lower systolic longitudinal strain and an early diastolic untwisting rate compared to patients with late H/M ratio>1.75. At multivariable linear regression analysis, early diastolic untwisting rate was the only independent predictor of late H/M ratio≤1.75 (odds ratio 1.15, 95% confidence interval 1.07-1.31, p<0.05).

**Conclusion.** A cardiac sympathetic derangement was found in this cohort of AFD patients with preserved LV ejection fraction. The present findings, by demonstrating the link between the impairment in diastolic LV rotational mechanics and cardiac sympathetic derangement, support the clinical significance of diastolic dysfunction in AFD patients.

**P1107****Left ventricular hypertrophy and mild cognitive impairment as markers for target organ damage in hypertensive patients with multiple risk factors**

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**Background:** There is a potential correlation between hypertensive damage of various target organs. It is still unclear to what extent the changes in one organ correspond to the in the others and whether we can think of the damage of one organ by assessing the others. The best way to assess hypertensive brain damage is by neuroimaging, which is difficult if should be used in the everyday practice as a screening tool for mild cognitive impairment (MCI).

**Purpose:** to assess the correlation between target organ damage – MCI and left ventricular hypertrophy (LVH). To answer the question can we use echocardiography and neuropsychological testing to screen hypertensive patients for brain target organ damage – MCI.

**Methods:** A prospective study of 263 hypertensive patients. Mean age was 67.551±9.05 years. The follow-up period was mean 12 months (6-20 months). All were on combination medical therapy. The patients underwent full medical history, physical examination, laboratory screening, ECG, echocardiography - assessment of LVH, home and office blood pressure measurement, ambulatory blood pressure monitoring (ABPM), cardio-vascular risk assessment. The neuropsychological screening for MCI was conducted via Montreal Cognitive Assessment (MoCA) and Mini Mental State Examination (MMSE). Geriatric depression scale (GDS) and the 4IADL were also applied. SPSS19 was used for the statistical analysis.

**Results:** The group of patients with left ventricular hypertrophy had significantly (p<0.001) lower neuropsychological tests' results from MoCA and MMSE both on inclusion and during the follow-up visit. Their blood pressure was also significantly higher than the other group (p<0.05).

**Conclusions:** mild cognitive impairment as an early clinical manifestation of target organ damage corresponds to left ventricular hypertrophy in hypertensive patients. Hypertensive patients with left ventricular hypertrophy should be screened for MCI. Deterioration of cognitive functioning may be a prerequisite for poor compliance to treatment and further deterioration of hypertension control and cognitive functioning.

**P1108****Subclinical left ventricular dysfunction in asymptomatic type 1 diabetic children**

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**Introduction:** Diabetic cardiomyopathy (DCM) is a distinct new entity. Pathophysiological mechanisms are not well known. It's defined as the presence of

abnormal myocardial performance or abnormal structure in the absence of epicardial coronary artery disease, hypertension and significant valvular disease. Application of a new echocardiographic tool, the 2D Strain is being evaluated. The aims of our study were to investigate the global longitudinal Strain (GLS) of the left ventricle (LV) and of the right ventricle (RV) and to determine the correlations between GLS and metabolic control evaluated by HbA1c.

**Methods:** It was a retrospective study of 24 children with type 1 diabetes. The conventional echocardiographic parameters and GLS were studied. These data were compared to the measured parameters in 20 healthy children matched for age and sex.

**Results:** The mean age was 11.13 years ± 0.54. The T1D children and control group were comparable with respect to age, gender and heart rate. Diabetic children were asymptomatic and had normal physical examination. The mean duration of diabetes was 7 ± 0.54 years. The mean HbA1c was 8.79% ± 0.25. LVEDD was 41.8 ± 0.84 mm and LVESD was 26.33 ± 0.73 mm. LVEF was preserved with an average of 67.88 ± 1.18%. The left atrial area was 10.78 ± 0.33 and the volume was 24.35 ± 1.72 ml. For diastolic function, in the diabetic group, E wave was 1.07 ± 0.03cm/s, A wave was 0.58 ± 0.04cm/s and E/A ratio was 4.4 ± 2.08. The TDE was significantly shorter in the diabetic group 146.54 ± 3.69 ms Vs 161.42 ms ± 2.38 for the control group, with p = 0.005. The E / E' ratio was significantly higher in the diabetic group compared to the control group (6.72 ± 0.33 vs. 5.21 ± 0.15, p = 0.0011). RV function was preserved in the diabetic group: TAPSE was 20.33 ± 0.26 mm and S' Wave was 14 cm / s ± 0.002. The study of myocardial deformation showed a significant decrease in the GLS of diabetic patients compared to healthy subjects (-18,53% ± 0,5 Vs -25,52% ± 0,37, respectively; p < 0,001). RV longitudinal strain was preserved (-26,31% ± 0,51). No correlation was found between the GLS of the LV and the HbA1c (r = 152, p = 0,477).

**Conclusion:** Myocardial deformation analysis by Strain 2D can detect subclinical impairment of LV systolic function. It is an early marker of diabetic cardiomyopathy. It has a contributive value for screening early cases and for optimizing therapeutic management and consequently codifying the subsequent monitoring strategy.

**P1109**

**Minimal differences shown by echocardiography and NT-proBNP level distinguishing cardiotoxic effect related to breast cancer therapy in patients with or without HER2 expression.**

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**Background:** Current antineoplastic therapies (AT) provide beneficial treatment strategy in patients (PTS) with cancer but may also be associated with cardiovascular side effects. The application of biochemical and imaging diagnostic modalities to detect cardiotoxicity dependent on AT remains challenging.

**Purpose:** The aim of the study was to evaluate an approach using echocardiography and biochemical markers for detection of cardiac injury related to AT in PTS with breast cancer.

**Methods:** 50 female PTS (mean age 57 + 12 years) with new diagnosis of breast cancer were studied. Echocardiographic imaging was performed at baseline and after 12-months of follow-up as well as N-terminal pro-B type natriuretic peptide (NT proBNP) tests. PTS with LVEF < 50% and significant valvular disease were excluded.

**Results:** All PTS received standard AT with anthracyclines. Combination with taxane (docetaxel 15%; paclitaxel 20%) and after that with trastuzumab was given in a subset of 20 PTS with HER2 expression [HER2(+)], while in remaining 30 HER2(-) PTS several were treated with docetaxel (46,6%) or paclitaxel (26,6%). Baseline LVEF was normal in all PTS showing no significant difference at follow-up: 60.5% + 4.3% and 59.4% + 3.7%, respectively. However, baseline NT-proBNP level mean value of 103 + 74 pg/ml increased slightly after AT to 132 + 97 pg/ml (p=0.02). In detailed analysis, significant but subtle differences indicating cardiotoxicity following AT were only observed among HER2(-) PTS (table). Echocardiographic E to Eprime ratio (E/e') remained stable despite variations of LVEF and NT-proBNP.

**Conclusions:** Subtle reduction of LVEF within normal range accompanied by minimal increase of NT-proBNP level exceeding upper limit may indicate cardiotoxicity at one year follow-up in PTS who were given antineoplastic therapy. Surprisingly, addition of trastuzumab in HER2-positive breast cancer treatment appears to generate no cardiac injury as opposite to standard anthracycline strategy in PTS without HER2 expression.

	HER2(+), 20 PTS			HER2(-), 30 PTS		
	baseline	12 months	p	baseline	12 months	p
LVEF (%)	58.8 + 4.1	59.1 + 4.4	NS	61.6 + 4.2	59.5 + 3.2	0.04
NT-proBNP (pg/ml)	108 + 97	109 + 106	NS	99 + 55	148 + 88	0.003
E/e'	9.8 + 3.8	9.4 + 3.7	NS	7.8 + 2.4	7.9 + 2.1	NS

**P1110**

**Speed of recovery of left ventricular function is not related to the prognosis of takotsubo cardiomyopathy - a portuguese multicenter study**

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**Introduction:** Takotsubo cardiomyopathy (TC) is characterized by a transient left ventricular (LV) dysfunction. The speed of recovery of LV function is variable. The impact of the rate of LV function recovery on prognosis of TC is currently unknown.

**Aim:** To determine whether patients diagnosed with TC who have a faster recovery of LV function have better medium term prognosis.

**Methods:** A multicenter study involving 11 hospital centers and including all patients diagnosed with TC in the last 10 years. Echocardiography was analyzed at admission, discharge and follow-up of patients. Complete recovery was defined as the normalization of the segmental motility abnormalities present in the initial echocardiogram. The timing of discharge was defined as a cut-off point for the determination of recovery of LV function. We evaluated whether patients with a faster recovery of LV function had better medium term prognosis.

**Results:** We included 205 patients with TC. Full recovery of LV function was observed in 46% of patients at discharge. A mean follow up of 47 ± 31 months was performed.

Complete recovery of LV function during hospitalization was not associated with a lower incidence of death (3.4% vs 2.6%, p = 0.704) or stroke / TIA (1.1% vs 3.9%, p = 0.209) or lower recurrence of TC (3.3% vs 3.8%, p = 0.884) in the follow-up.

In the multivariate analysis, a faster recovery of LV function was not an independent predictor of cardiovascular events in the medium term follow-up.

**Conclusion:** In this Portuguese multicenter study, patients with TC that present a faster recovery of LV function do not have a better medium term prognosis. However, the low rate of complications in the follow-up may have limited the study results.

**P1111**

**Myocardial dysfunction in Takotsubo cardiomyopathy - more than meets the eye?**

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**Background / Purpose:** Takotsubo cardiomyopathy (TTC) is characterized by reversible left ventricular (LV) systolic dysfunction typically affecting the mid and apical segments, generally presenting in a manner similar to an anterior wall ST-segment elevation myocardial infarction (MI). Myocardial deformation evaluation with speckle tracking echocardiography (STE) has higher sensitivity to detect lesser degrees of dysfunction and is already entering routine clinical practice in fields such as cardiology. We aimed to further characterize myocardial dysfunction in a TTC population using STE and compare these results with those in MI.

**Methods:** 17 patients (pts) with TTC and 20 pts with no prior history of coronary heart disease admitted for anterior wall MI were included. Demographic and clinical information was collected; two-dimensional echocardiography exams within 48h from symptom onset were reviewed, standard parameters calculated and STE strain analysis of global (average of 4-, 2- and 3-chamber views) and regional longitudinal strain (LS) was performed. LV was divided into 3 slices – basal, mid and apical. The mean peak systolic LS of all segments was calculated for each slice.

**Results:** All of the 17 TTC pts identified were female, with a mean age of 64 years (33 to 84 years) and mean left ventricular ejection fraction (LVEF) 38±6%; from the anterior MI population, 20 pts (19 male) were sampled, with a mean age of 57 years (37 to 76 years) and mean LVEF 37±7%.

Global LS was impaired in both samples compared to reference values. However, no statistically significant differences were found between both entities (-10.3±2.9 in TTC vs -10.1±3.7% in MI, p=0.9). As expected, global LS was highly correlated with LVEF in both groups (p=0.006).

Regarding the LV slices, no differences were found between TTC and MI in apical and mid peak systolic LS (-8.4±5.2 vs -6.0±4.3%, p=0.134, and -8.9±2.8 vs -9.9±3.1%, p=0.328, respectively). However, TTC presented significantly worse basal slice LS (-9.8±2.9 vs -12.4±3.1%, p=0.010). Furthermore, the ratio between basal and apical slices LS was significantly lower in this population as well (1.51±0.86 vs 2.94±1.88, p=0.006).

**Conclusions:** LV dysfunction is a key feature in both TTC and MI. Despite what meets the eye, on assessment by deformation analysis TTC presents a more generalized myocardial dysfunction: when compared to MI pts, TTC pts show worse LS across basal segments and also a lower basal/apical LS ratio. This concept of a smaller "dysfunction gradient" in TTS pts changes our understanding of this entity, from a very localized dysfunction to a global LV impairment, with possible implications in the research into pathophysiologic mechanisms.

## SYSTEMIC DISEASES AND OTHER CONDITIONS

## P1112

## Obstructive sleep apnea and echocardiographic parameters

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Obstructive sleep apnea (OSA) is a respiratory disorder associated with recurrent complete or partial obstruction of upper airways with intermittent hypoxemia and reactive waking reactions during sleep. Individuals with OSA are at increased risk of cardiovascular diseases such as heart failure (HF), arterial hypertension, stroke and pulmonary hypertension. Severe OSA with high apnoea-hypopnea index (AHI) may contribute to cardiovascular remodelling and ventricular diastolic dysfunction, and may be helpful in predicting cardiac dysfunction. The aim of this study was to investigate detailed relationship between OSA and HF echocardiographic parameters.

We retrospectively analyzed 1270 patients who were treated in our outpatient sleep apnea clinic. All patients underwent polysomnography. 193 patients with OSA and detailed data obtained from transthoracic echocardiography (TTE) were included in further analysis. TTE was performed using Philips IE-33 or EPIQ Phillips device. Local ethics committee gave consent to conduct the study.

In our study population mean age was 61.2±10.9 years, 74.1% were male, 62.8% were smokers, 70.8% were obese, 83.9% had hypertension, 87.1% had hyperlipidemia, 66.0% reported snoring. Average left ventricular ejection fraction (LVEF) was 61.0±7.4%, average left ventricular diastolic diameter (LVDD), right ventricular diastolic diameter (RVDD) and intraventricular septum at diastole (IVSD) were 44.6±17.9mm, 25.2±10.9mm, 9.4±4.1mm respectively. We identified statistically significant correlations ( $\rho$ -Spearman's rank correlation coefficient) between total number of central apnea and LVDD ( $\rho=0.184$ ,  $p=0.013$ ), number of mixed apnea per hour and LVDD and RVDD ( $\rho_1=0.182$ ,  $p_1=0.014$  and  $\rho_2=0.172$ ,  $p_2=0.021$  respectively). Also we found significant correlation ( $\rho$ -Spearman's rank correlation coefficient) between mean duration of obstructive apnea and almost all major TTE parameters: LVEF, LVDD, RVDD, LAD, IVSD ( $\rho_1=-0.155$ ),  $p_1=0.034$ ;  $\rho_2=0.194$ ,  $p_2=0.009$ ;  $\rho_3=0.212$ ,  $p_3=0.004$ ;  $\rho_4=0.196$ ,  $p_4=0.007$ ;  $\rho_5=0.192$ ,  $p_5=0.009$  respectively). Relationship between OSA and HF is currently a vigorously studied field, since early diagnosis and adequate treatment of OSA may prevent further development of HF. In our study we were able to prove presence of statistically significant correlations between TTE parameters and OSA progression parameters. Though, further studies on larger patients' cohorts are needed to assess the importance of those findings.

## P1113

## Relationship between left atrium and hypertensive retinopathy in patients with systemic hypertension: a real-time three-dimensional echocardiography-based study

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**Background:** The fundoscopic examination of hypertensive patients, which is an established hypertension-related target organ damage (TOD), tends to be underutilized in clinical practice. We sought to investigate the relationship between retinal alterations and left atrium (LA) volumes by means of real-time, three-dimensional echocardiography (RT3DE), which is the most pivotal predictor of diastolic dysfunction.

**Methods:** Our population consisted of 88 consecutive essential hypertensive patients (age 59.2 ± 1.2 years, 53 females) without overt cardiovascular disease. All subjects underwent a funduscopy examination and were distributed into five groups according to the Keith-Wagener-Barker (KWB) classification. Comprehensive transthoracic echocardiographic and RT3DE measurements were performed to assess LA volumes and phasic functions.

**Results:** The four groups (KWB grades 0-4: including 26, 20, 26, and 16 patients, respectively) did not differ with regards to age, gender, or metabolic profile. There were no significant differences between groups with regards to parameters reflecting left ventricle (LV) systolic function and diastolic dysfunctions in conventional echocardiography, except isovolumic relaxation time (IVRT) and deceleration time (DT). Nevertheless, patients in the higher KWB category had higher values of LA volumes (LA maximal volume, LA minimal volume, preatrial contraction volume, LA total stroke volume, LA active stroke volume,  $p < 0.001$ ) regarding RT3DE (table 1). There is also a significant relationship between preatrial contraction volume and duration of HT (r: 0.67,  $p < 0.001$ ).

**Conclusion:** Patients with arterial hypertension were found to have increased LA volume and impaired atrial compliance and contractility. Moreover, RT3DE identifies early functional LA changes in these patients better than conventional echocardiography. Assessment of the hypertensive patient by using RT3DE atrial volume analysis may facilitate early recognition of TOD, which is such a crucial determinant of cardiovascular mortality and morbidity in patients with systemic hypertension.

## P1114

## Detection of early left ventricular systolic dysfunction in hypertensive patients with preserved ejection fraction using deformation imaging

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**Introduction:** Peculiar methods for analysis of myocardial strain using deformation imaging may detect subclinical cardiac involvement in hypertensive patients which is crucial for risk stratification. **Aim:** this study aimed at detection of early left ventricular (LV) systolic dysfunction in hypertensive patients with preserved ejection fraction (EF) using deformation imaging including tissue Doppler imaging (TDI) derived strain and speckle tracking echocardiography (STE) derived strain. **Methods:** we compared 25 hypertensive asymptomatic patients with preserved EF to 15-age matched healthy participants. A comprehensive 2D and Doppler echocardiography including TDI were obtained. LV global longitudinal strain (LV GLS) was obtained by 2-D STE in the apical two-chamber, three-chamber, and four-chamber views. **Results:** LV GLS was significantly reduced in hypertensive patients compared to control group (-14.3±3.1% vs. -18±2.9%,  $p < 0.001$ ). No significant differences were found between both groups regarding TDI-derived global peak systolic strain (PSS) and averaged systolic velocities from 6 annular sites (Av. Sa) obtained by TDI. We observed smaller LV diastolic and systolic internal dimensions (LVEDD and LVESD) in hypertensive patients compared to control group (table 1). **Conclusion:** hypertensive patients with preserved ejection fraction have subtle impairment in LV systolic function. STE derived strain can detect early left ventricular systolic dysfunction in these patients and it is superior to TDI derived strain in identifying this subtle impairment of LV systolic function.

Table (1):

Echocardiographic parameters	HTN (n=25)	Control (n=15)	p Value
IVST (cm)	1.5±0.2	0.9±0.1	<0.0001
PWT (cm)	1.4±0.2	0.9±0.1	<0.0001
LVEDD (cm)	4.4±0.6	5.0±0.4	0.001
LVESD (cm)	2.7±0.5	3.0±0.4	<0.05
M-mode EF (%)	0.69±0.1	0.7±0.1	NS
2D EF (%)	0.66±0.1	0.69±0.1	NS
Av. Sa (cm/s)	5.26±0.91	5.86±0.95	NS
PSS (%)	19.10±4.00	22.32±3.78	NS
GLS (%)	14.3±3.1	18±2.9	0.001

Comparison of echocardiographic parameters between hypertensive patients and control group

## P1115

## Left ventricular strain in systemic sclerosis with and without pulmonary hypertension; a cardiac magnetic resonance study

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**Background:** Systemic sclerosis (SSc) is the autoimmune disease with the highest mortality. Pulmonary arterial hypertension (PAH) is increasingly a reason for death in SSc. Patients with PAH due to SSc (SSc-PAH) have worse prognosis than PAH due to other causes. In all cause PAH, right ventricle (RV) free wall global longitudinal strain (RVFW GLS) is lower (less negative) with echocardiography, and left ventricular (LV) longitudinal contribution to stroke volume is lower despite preserved LV ejection fraction (LVEF) with cardiac magnetic resonance (CMR).

**Purpose:** The aim is to evaluate if LV global longitudinal strain (LV GLS) and RVFW GLS differ in patients with SSc, SSc-PAH and in healthy controls using cardiac magnetic resonance imaging (CMR) and tissue tracking.

**Methods:** 86 subjects were examined with CMR. 40 patients with SSc (57±12 years, 88% female), 19 with SSc-PAH (64±13 years, 68% female) and 27 healthy controls matched by gender and age to the extent possible (34±12 years, 59% female). Patients were examined with right heart catheterization on clinical indication. Patients with SSc and SSc-PAH had mPAP 19±5 and 40±11mmHg with PAWP 7±3 and 5±4mmHg, respectively. Endocardial and epicardial borders were delineated in end diastole for RV in 4-chamber view and for LV in 2-, 3- and 4-chamber long axis views and in end diastole and end systole in short axis stack. GLS was computed in LV from all longaxis views and in the free wall of the RV.

**Results:** There was no significant difference in peak LV GLS among the three groups (ns). LVEF differed in all groups ( $p < 0.05$  for all) (Table 1). Peak RVFW GLS was significantly lower in SSc-PAH compared to the two other groups ( $p < 0.05$ ) with no significant difference in peak RVFW GLS between the control and SSc group (ns) (Figure 1). The SSc group (90%) had significantly more Raynaud's phenomenon compared to the SSc-PAH group (58%,  $p=0.004$ ).

**Conclusion:** Peak LV GLS did not differ among the groups of SSc, SSc-PAH and healthy controls. On the other hand, we found lower RVFW GLS in the SSc-PAH group compared to SSc and healthy controls. The lower incidence of Raynaud's phenomenon in SSc-PAH might indicate that patients with SSc have a different phenotype.



## LV dimension and function parameters

Parameters	pPE-group n=50	Control-group n=20	p value
LVmass, g	133 ± 26	91 ± 14	<0.05
LV mass index, g/m <sup>2</sup>	78 ± 11	53 ± 6	<0.05
LVEF, %	49 ± 6	59 ± 5	<0.05
s', cm/s	6.6 ± 1.1	7.7 ± 1.0	ns
GL strain, %	15 ± 3	21 ± 1	<0.05
Heart rate, bpm	63 ± 9	64 ± 6	ns
Stroke volume, mL	71 ± 12	70 ± 1	ns
LV Cardiac Index, L/min/m <sup>2</sup>	2.7 ± 0.6	2.9 ± 0.4	ns
MV E velocity, cm/s	69 ± 11	71 ± 8	ns
MV E/A ratio	1.37 ± 0.28	1.73 ± 0.55	ns
e', cm/s	11.3 ± 2.2	14.3 ± 1.4	<0.05
E/e' ratio	6.5 ± 1.5	5.6 ± 1.7	ns
LA volume index, mL/m <sup>2</sup>	32 ± 7	28 ± 5	ns

LV= left ventricular, EF=ejection fraction, GL= global longitudinal, MV = mitral valve, LA = left atrial.

## P1119

## Preload dependent changes of left ventricular twisting and torsion during pregnancy: a three-dimensional strain study

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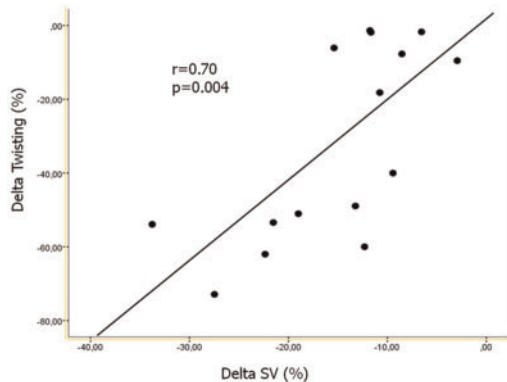
**Background:** Changes of cardiac hemodynamics and loading conditions during healthy pregnancy have been previously investigated. Little is known about variations of left ventricular (LV) myocardial deformation occurring at term pregnancy (TP) and soon after partum (AP).

**Purpose:** We sought to investigate modifications in strain components at TP and AP, by using 3D speckle tracking echocardiography (STE).

**Methods:** Fifteen women (age = 31.7 ± 5.6 years) underwent real-time transthoracic 3D echocardiography (RT3DE), including volumetric and strain quantification, at TP (i.e., at or beyond 37 weeks of gestation) and soon AP (within 7 days from delivery). Fifteen age-matched healthy, no pregnant women were the control group. Overt heart failure, coronary artery disease, primary cardiomyopathies, more than mild valvular heart disease, atrial fibrillation and gestosis were exclusion criteria. RT3DE recordings with virtual apex scanning were obtained using multi-beat reconstruction from 6 consecutive cardiac cycles. LV mass index (LVMI), LV end-diastolic and end-systolic volumes, ejection fraction (EF) and stroke volume (SV) were determined by 3D volumetric analysis. Global longitudinal strain (GLS, %), global circumferential strain (GCS, %), global area strain (GAS, %), global radial strain (GRS, %), LV twisting (°) and torsion (°/cm) were quantified by 3D STE.

**Results:** Body mass index (BMI) and heart rate (HR) were significantly lower at AP than at TP, whereas systolic and diastolic blood pressure did not differ significantly. LV end-diastolic volume (p=0.003), EF (p=0.003) and SV (75.1 ± 14.5 ml at TP and 63.4 ± 12.4 ml AP, p<0.0001) were reduced at AP, without changes of LV end-systolic volume and LVMI. Among strain components, GLS, GCS and GAS did not differ between TP and AP. GRS was marginally reduced at AP (48.5 ± 8.8% at TP versus 47.1 ± 8.2% at AP, p<0.02). LV twisting (6.0 ± 2.6° versus 3.8 ± 1.7°, p=0.003) and torsion (1.3 ± 0.4°/cm versus 1.1 ± 0.3°/cm, p<0.02) were both reduced at AP. SV (p=0.006), twisting (p<0.05) and torsion (p<0.05) of healthy non pregnant controls were all lower in comparison with TP women, but did not differ significantly in comparison with AP condition. Univariate relations of per cent reduction of SV were found with both per cent reduction of LV twisting (r=0.70, p=0.004) (Figure) and torsion (and r=0.52, p=0.04) from TP to AP state. These relations remained significant even after controlling for BMI and HR (partial r = 0.79, p<0.001 and 0.61, p<0.02 respectively).

**Conclusion:** Modifications of myocardial deformation properties are detectable in end-term pregnant women when compared with both early post-partum and healthy, non pregnant state. These changes involve LV radial strain and most importantly twisting and torsion. The latter changes are driven by preload changes, as shown by the relationships of LV twisting and torsion with SV.



Abstract P1119 Figure.

## P1120

## Pre-procedural renal resistive index predicts contrast-induced acute kidney injury following coronary angiography

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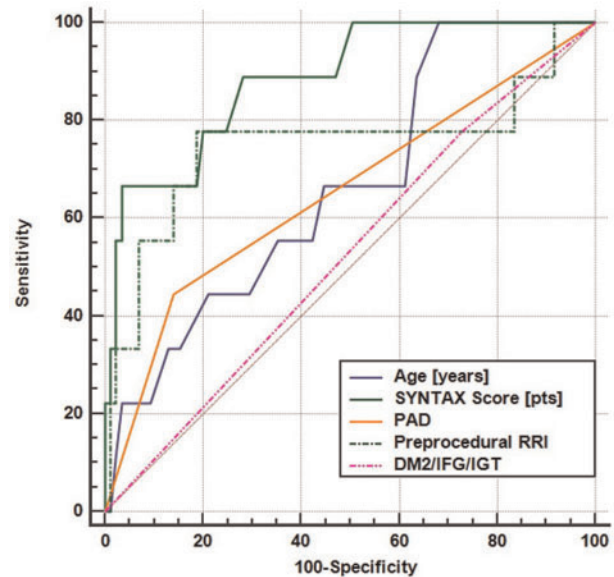
**Background:** The aim of the study was to evaluate clinical, laboratory and ultrasonographic predictors of contrast-induced acute kidney injury (CI-AKI) following coronary angiography/percutaneous coronary interventions (CA/PCI).

**Methods:** This prospective observational study covered 95 consecutive patients (69.5% men; median age 65 (59; 71)) with either stable angina (43.2%), or non-ST-elevation acute coronary syndrome (56.8%) who underwent coronary angiography (44.2% referred for direct PCI and 14.7% for surgical revascularization). Data regarding 128 demographic, clinical, laboratory and procedural variables were collected in all study participants. Ultrasonographic parameters of renal blood flow in arcuate/interlobular arteries, including renal resistive index (RRI) and pulsatility index (RPI), were acquired directly before the procedure. CI-AKI was defined as ≥50% relative or ≥ 0.3 mg/dl absolute increase of serum creatinine concentration at 48 hours after procedure.

**Results:** CI-AKI was confirmed in 9 patients (9.5%). Patients diagnosed with CI-AKI were non-significantly older (p=0.1), had higher SYNTAX score (p=0.0002), higher rate of left main disease (p<0.00001) and peripheral artery disease (PAD; p=0.02) and coronary artery anomaly (p=0.017), more frequently were referred for surgical revascularization (p=0.0003), had greater intima- (p=0.004) and extra-medial thickness (p=0.001), received a higher dose of contrast media (p=0.049), more often overused non-steroidal anti-inflammatory drugs (p=0.001) and had substantially higher pre-procedural RRI (0.69 vs. 0.62; p=0.005) and RPI values (1.54 vs. 1.36; p=0.017). Logistic regression analysis (Figure) confirmed that age (OR=1.19 per 1 year), SYNTAX score (OR=1.19 per 1 pt), presence of PAD (OR=14.3), diabetes mellitus (OR=20.5) and pre-procedural RRI (OR=1.26 per 0.01) were independent predictors of CI-AKI (AUC=0.95, p<0.0001). Pre-procedural RRI >0.69 had sensitivity of 78% and specificity of 81% in CI-AKI prediction.

**Conclusions:** High pre-procedural RRI is associated with the onset of CI-AKI following coronary angiography.

**Funding Acknowledgements:** Grant for scientific research in the field of cardiology funded by Adamed Group under the auspices of Polish Society of Cardiology.



Abstract P1120 Figure.

## P1121

## Simplified 10 point ultrasound in diagnosis of pulmonary congestion in heart failure

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Pulmonary edema (PE), due to fluid retention and redistribution is the cardinal manifestations of heart failure (HF). The aim of this investigation was to study the effectiveness of simplified thoracic sonography in diagnosis of PE

**Material and Methods:** 400 patients with II-IV NYHA functional class HF were evaluated (105 patients with diastolic and 295 with systolic HF). The control group consisted of 160 patients with different heart diseases (CHD, Hypertension, Aortic valve diseases), but without HF. Sonographic examination of a lung was done with 2,0-4,0

MgHz convex or sector probe, from 10 points on thoracic wall (cross points of midclavicular line with II, IV and V intercostal spaces and anterior axillary line with IV and V intercostal spaces), which corresponded to the projection of lower, middle and upper lobes of right lung and upper and lower lobes of left lung.

**Results.** During ultrasound examination 94.5% of patients with HF had "Comet tail phenomenon" (CTPh), which was registered only in 35.5% patients without HF ( $p < 0.001$ ). In DHF group CTPH was registered in 90.5% and in systolic HF group in 95.9% patients. In 91% of patients with HF CTPH was registered from 3 and more registration points. In control group CTPH was registered from more than 3 points only in 2 (1.3%) patients. The best results in diagnosis of DHF can be achieved if we take "3 and more registration points" as a reference point for diagnosis of pulmonary congestion (sensitivity - 0.911, specificity - 0.942, positive predictive value 0.975). The time of examination by simplified method for evaluation of CTPH and pleural space took 3-4 minutes. Conclusion. In patients with HF during pulmonary ultrasound examination significantly often was registered CTPH. The count of registration points from the thoracic wall of CTPH 3 and  $>$  is sensitive and specific sign of HF. The simplified thoracic ultrasound is highly effective in diagnosis of PE in patients with HF

## CONGENITAL HEART DISEASE

### P1122

#### Pulmonary and systemic vascular resistance during graded exercise in patients with ventricular septal defect repair versus healthy controls

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**Background:** The evolution of pulmonary vascular resistance (PVR) during exercise in patients after ventricular septal defect (VSD) repair appears to be different from healthy controls. The question remains whether this is a local phenomenon of altered pulmonary hemodynamics (resulting from damage to the pulmonary circulation following the left-to-right shunt in the past) or the reflection of overall vascular dysfunction.

**Purpose:** This study evaluated PVR and systemic vascular resistance (SVR) at rest and during exercise in patients after VSD repair.

**Methods:** Patients with VSD repair ( $n=22$ ) were consecutively enrolled in the outpatient Congenital Heart Disease clinic of a tertiary university hospital. An age- and gender-matched control group ( $n=15$ ) was implemented. Participants underwent echocardiography at rest and during graded semi-supine bicycle exercise. Patients started cycling at an initial workload of 25W, which was increased by 25W every 2 min, until the maximal tolerated workload. Total SVR was calculated as mean arterial pressure (MAP) divided by cardiac output (CO), total PVR as mean pulmonary artery pressure (mPAP) over CO. The slopes of the MAP-CO and mPAP-CO plots were obtained using linear regression analysis of the measurement points of all workloads. The predicted maximal oxygen uptake was calculated using the Wasserman formula.

**Results:** Twenty-two patients with VSD repair (age  $32 \pm 8$  years, 68% male) were analysed. VSD was perimembranous in 19, outlet type in 2 and muscular in 1. Median VSD defect size before repair was 10 (7-13) mm, median Qp/Qs ratio 2.0 (1.6-3.1). Median age at repair was 3 (1-5) years.

VSD patients and controls had similar baseline and resting echocardiographic characteristics, except for TAPSE which was lower in patients ( $18 \pm 2$  versus  $25 \pm 4$  mm,  $p < 0.001$ ). VSD patients reached lower peak workload ( $156 \pm 48$  versus  $207 \pm 50$  Watt,  $p = 0.004$ ) and peak CO ( $15 \pm 4$  versus  $17 \pm 3$  L/min,  $p = 0.027$ ), but mPAP at peak exercise was comparable to controls ( $36 \pm 6$  versus  $37 \pm 4$  mmHg,  $p = 0.835$ ). In contrast, the predicted maximal oxygen uptake was similar for both groups ( $37 \pm 5$  versus  $40 \pm 9$  mL/kg/min,  $p = 0.133$ ).

Total SVR at rest and at peak exercise was comparable for both groups (rest  $19.2 \pm 4.1$  versus  $21.7 \pm 2.9$  mmHg/L/min,  $p = 0.051$ ; peak  $8.2$  (7.1-11.2) versus  $8.3$  (6.8-9.4) mmHg/L/min,  $p = 0.636$ ). Total PVR at rest was similar ( $3.4$  (2.8-4.0) versus  $3.4$  (2.8-3.9) mmHg/L/min,  $p = 0.725$ ), but total PVR at peak exercise was higher in VSD patients ( $2.6 \pm 0.7$  versus  $2.2 \pm 0.3$  mmHg/L/min,  $p = 0.011$ ). The median slope of the MAP-CO plot was not different ( $3.7$  (2.6-5.3) versus  $3.2$  (2.5-4.2) mmHg/L/min,  $p = 0.453$ ). The mean slope of the mPAP-CO plot was higher in the VSD group ( $2.1 \pm 0.7$  versus  $1.7 \pm 0.3$  mmHg/L/min,  $p = 0.022$ ).

**Conclusion:** The present study results suggest a local phenomenon of altered pulmonary hemodynamics during exercise in patients after VSD repair and emphasize the importance of exercise testing.

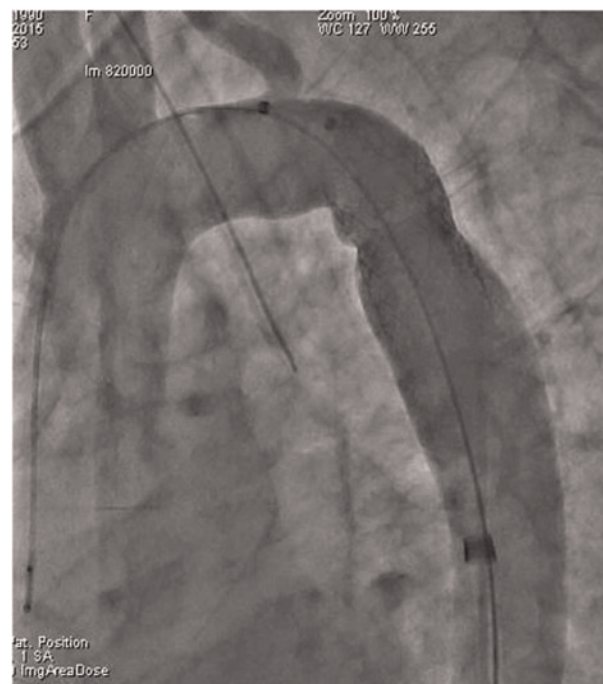
### P1123

#### Effect of percutaneous stent implantation on arterial hypertension and aortic flow dynamics in patients with aortic coarctation: identification of responders and non responders

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**Introduction:** Arterial hypertension (HT) is a common complication after successfully repaired aortic coarctation and involves complex mechanisms. Moderate to severe recoarctation or late diagnosed native coarctation are accessible to endovascular treatment but the effect of aortic stenting on HT is variable. We sought to identify the

factors contributing to persistent abnormal aortic flow dynamics and hypertension despite optimal endovascular treatment. **METHODS:** 30 consecutive patients (median age 18.5 years, range 9 to 58 years, 76.7 % male) who underwent aortic stenting for coarctation (17 native, 13 recoarctations) between 2007 and 2015 were retrospectively enrolled. Optimal treatment was defined by hemodynamic peak-to-peak gradient of less than 10 mmHg after stent implantation. HT was defined according to current recommendations. Aortic arch shape (gothic, crenel or normal) and aortic arch hypoplasia were identified. All patients underwent exercise echocardiography and ambulatory blood pressure monitoring with QKD assessment 6 months after the procedure. Multivariate analysis was performed. **RESULTS:** Arm-leg pressure gradient ( $22$  vs  $0.5$  mmHg,  $p < 0.01$ ), systolic arterial pressure ( $138$  vs  $124.5$  mmHg,  $p < 0.01$ ), hemodynamic peak-to-peak gradient ( $20$  mmHg vs  $4$  mmHg,  $p < 0.01$ ), aortic isthmus maximal velocity at rest ( $3.3$  m/s vs  $2.45$  m/s,  $p < 0.01$ ) and at exercise ( $5.3$  m/s vs  $3.79$  m/s,  $p < 0.01$ ) were significantly decreased after optimal endovascular treatment. 14 patients had persistent HT (46.7 %) and 12 had exercise-induced HT (40 %). Persistent HT at rest was associated with higher body mass index ( $p = 0.043$ ), smoking ( $p = 0.043$ ), and the length of the implanted stent ( $p = 0.017$ ). Normal shape of the aortic arch was associated with the absence of persistent HT ( $p = 0.029$ ). Exercise-Induced HT was associated with aortic arch hypoplasia ( $p = 0.01$ ). Arterial distensibility assessed by QKD measurement seems to be lower in hypertension patients but not statistically significant ( $p = 0.054$ ). Aortic isthmus maximal velocity at stress was not associated with HT nor with an abnormal QKD. **CONCLUSIONS:** Identifying clinical, hemodynamic and anatomic parameters associated with residual hypertension can help to define the non responders after stent implantation. The QKD is a non invasive useful tool in the follow up of corrected aortic coarctation.



Abstract P1123 Figure.

## DISEASES OF THE AORTA

### P1124

#### The use of vitamin k antagonists is associated with increased levels of vascular calcification in low-risk patients with atrial fibrillation

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**Background** – Vitamin K antagonists (VKA) are among the most frequently used drugs to prevent thrombo-embolic events in patients with atrial fibrillation (AF). However, VKA use is associated with increased vascular calcification in high-risk populations.

**Purpose** – To investigate the contribution of VKA-use to vascular calcification of the aortic valve (AoV) and the aorta in low-risk AF patients.

**Methods** – Standardized calcium scoring on multislice computed tomography (MSCT) was performed in 157 AF patients without significant cardiovascular disease. Patients were divided in two groups depending on present/absent VKA treatment. Two observers

performed calcium scoring of the AoV, ascending and descending aorta independently. Propensity score adjusted logistic regression analyses were performed to assess the association between VKA-use and calcification. Potential confounders for VKA treatment were identified by univariable logistic regression. The propensity score of the variables showing a significant difference on VKA treatment (sex, body mass index, rhythm control, left atrial diameter) was estimated and integrated in the logistic regression model as a covariate. Additionally, patients treated with VKA were matched with patients who received no VKA (using propensity score, Greedy method, caliper <5%). The Mann-Whitney U test was performed to assess differences of calcium score of the AoV, ascending and descending aorta in the propensity score matched treatment groups.

**Results** – A total of 69% of the population were male and mean±SD age was 57±9 years. 71 (45%) patients were treated with VKA with a mean duration of 35 months. Logistic regression analyses, adjusted for propensity score, revealed that VKA use was associated with a significantly higher calcium score of the ascending (OR=2.22, 95% CI 1.12-4.40, p=0.023) and descending aorta (OR=2.30, 95% CI 1.17-4.49, p=0.015) and showed a trend towards a higher calcium score of the AoV (OR=1.86, 95% CI 0.94-3.66, p=0.074). After the matching procedure, 61 subjects per group were eligible for analysis. Clinical characteristics between the groups with or without VKA treatment were not significantly different. Again, the calcium score (median(IQR)) of the ascending (no VKA 0(0.0-0.2), VKA 0(0.0-4.4), p=0.008) and descending aorta (no VKA 0(0.0-1.7), VKA 0(0.0-66.1), p=0.002) was significantly higher in the VKA treated group and showed a trend towards a higher calcium score of the AoV (no VKA median (IQR) 0(0.0-1.1), VKA 0(0.0-10.5), p=0.066).

**Conclusion** – Even in patients with a low cardiovascular risk VKA seems to induce - potentially untoward - aortic calcification.

## STRESS ECHO

### P1125

#### Stress echo positivity predicts cancer death

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**Background:** Cardiovascular disease and cancer are the two leading causes of death worldwide, sharing many risk factors (e.g., obesity and diabetes) and biology (e.g., chronic inflammation). Stress echocardiography (SE) has a recognized capability of predicting subsequent cardiac death. An increasing share of patients initially evaluated for coronary artery disease eventually die of cancer.

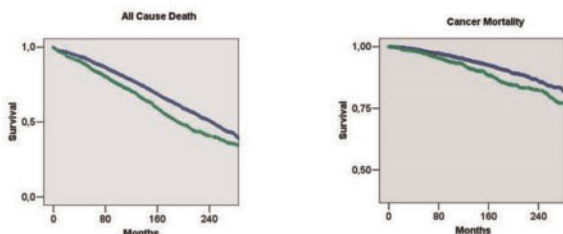
**Purpose.** To assess whether SE positivity predicts cancer death.

**Methods:** In a retrospective analysis of prospectively acquired single center, observational data, we evaluated 4673 consecutive in-hospital patients (age = 62±11 years, 3394 males), 2548 with normal resting function (Wall Motion Score Index = 1 with 2-D echocardiography), who underwent SE from 1983 to 2009. SE was performed with dipyridamole (n=3337), dobutamine (n= 560) or exercise (n= 1056). SE positivity was based on regional wall motion abnormalities (involving > 2 segments in 16 segment model of the left ventricle). All patients were followed-up for a median of 131 months (interquartile range 134). We separately analyzed predetermined end-points: overall mortality; cardiac death; cancer death.

**Results:** SE was positive in 1757 and negative in 2916 patients. During the follow-up there were 761 cardiac, 418 cancer, and 733 non-cardiac non-cancer deaths. The top 6 cancer sites were: lung (24 % of all cancer deaths); prostate (12 % in men); colon (9%); bone marrow (3 %) and breast (8 % in women). The 20-year mortality was higher in subjects with SE positivity than in those with SE negativity, considering the overall mortality (80 % vs. 70%; p < 0.0001), cardiac mortality (31% vs. 27%; p < 0.02), cancer mortality (37% vs. 22%; p < 0.0001: see figure ). At multivariable analysis for cancer mortality SE positivity (hazard ratio [HR]: 1.50; 95% confidence interval [CI]: 1.16 to 1.93; p < 0.02), was independent predictor of cancer mortality.

**Conclusion:** SE results predict overall mortality, cardiac death but also cancer death. This might reflect common epidemiological and biological roots between atherosclerosis and cancer, or the possibility of pro-cancer effects of treatment in ischemic heart disease.

## Stress Echo Mortality Prediction



Abstract P1125 Figure.

### P1126

#### Assessment of the agreement between instantaneous wave-free ratio (iFR) and dobutamine stress echo in real world stable angina patients

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**Introduction:** instantaneous wave-free ratio (the iFR modality) is a novel method used to assess the haemodynamic significance of coronary lesions without the need to induce hyperaemia. Dobutamine stress echocardiography (DSE) is one of the main non-invasive modalities used for the functional assessment of reversible ischemia in patients with angina. We sought to investigate the correlation between DSE and iFR in patients with stable coronary artery disease (CAD).

**Methods:** We studied 84 stable angina patients, who underwent DSE and subsequently diagnostic coronary angiogram with iFR. The optimal iFR cut-off value for predicting a positive DSE was estimated using receiver operator curve analysis (ROC curve). Agreement was estimated using diagnostic accuracy, sensitivity, specificity, positive predictive and negative predictive values.

**Results:** The mean age of the study population was 65.5±11.5 years and 35 (42.9%) were females. In 59 (70.2%) the pressure wire study was performed in the LAD whereas in 25 (29.8%) in the LCx or RCA territories.

The area under the curve for predicting positive DSE using iFR was 0.747, (p=0.001), whereas the optimal cut-off was calculated at 0.9. Overall, the diagnostic accuracy between iFR and DSE was 70.2% (59/84 patients). Sensitivity was 68.2%, specificity 71%, positive predictive value 45.5% and negative predictive value 86.3%.

When assessing the LAD territory alone, sensitivity improved at 77.8% whereas specificity declined to 65.9%. When assessing RCA or LCx territories, sensitivity was only 25% with a specificity of 81%.

Overall there was suboptimal agreement with DSE (kappa 0.337, p<0.001), which was marginally better when assessing the LAD territory (kappa 0.377, p=0.002). There was no significant agreement when assessing non-LAD territories (kappa 0.054, p=0.785).

**Conclusion:** In patients referred for evaluation of stable CAD, there was a fair agreement between DSE and iFR for assessing the LAD but suboptimal correlation for non-LAD territories.

### P1127

#### Impact of AVAproj on severity reclassification of LFLG AS with persistent area - gradient discordance

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Dobutamine stress echocardiography (DSE) has emerged as a powerful, yet imperfect, diagnostic tool aiding in the distinction between patients with true severe aortic stenosis (TS-AS) and those with pseudo-severe AS (PS-AS). However, in many patients the aortic valve area - gradient discordance observed at rest may persist during the DSE, precluding a definite conclusion about stenosis severity. The aim of the present study is to characterize the hemodynamic behavior of low left ventricular ejection fraction low flow low gradient (LFLG) AS with persistence of valve area - gradient discordance (P-AG-D) on DSE.

**Methods:** Retrospective observational study that included all patients with LFLG AS (AVA ≤ 1,0 cm<sup>2</sup> and Vmax < 4 m/s or Gmean < 40 mmHg and LVEF < 50%) referred for DSE evaluation between September/2011 and November/2015 at a single institution. After completing the DSE, patients were further reclassified in terms of severity of the stenosis into 3 groups, using the 2014 AHA/ACC Valvular Heart Disease Guidelines criteria: 1) TS-AS; 2) P-AG-D and 3) PS-AS.

**Results:** 22 patients (15 men, median age 75) were included. 8 patients (5 men, median age 73) were classified as TS-AS, 11 patients (7 men, median age 75) had P-AG-D and only 3 patients (all men, median age 63) had PS-AS, according to 2014 AHA/ACC Guidelines. Patients with P-AG-D did not significantly differ from TS AS patients in terms of basal flow rate (p= 0,840) or basal AVAi (p=0,310). However, patients with P-AG-D achieved a lower peak flow rate [median 204 (173 – 240)] than patients with TS [median 257 (236 – 316)], p= 0,007. Only 2 (18%) patients with P-AG-D achieved criteria for contractile reserve. An additional 4 patients in this group had a Δ Flow > |15| %, enabling the calculation of the simplified projected aortic valve area at 250 ml/s (AVAproj) in a total of 6 patients. Remarkably all these patients had AVAproj < 1,0 cm<sup>2</sup> suggestive of true severe stenosis.

**Conclusion:** The calculation of AVAproj permitted the reclassification of 55% of patients with P-AG-D into the TS-AS category, even in patients without contractile reserve.

### P1128

#### The prognostic value of rest and exercise- induced B-lines in heart failure patients

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**Background.** B-lines are a sign of extra-vascular lung water accumulation detected by lung ultrasound (LUS) at rest and, even more, during stress. Whether they add

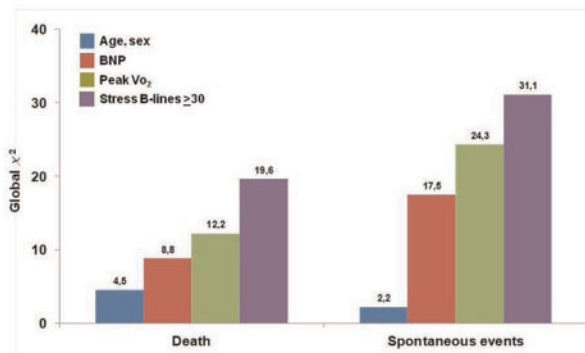
prognostic value to a risk stratification with other established biomarker such as plasma natriuretic peptides or cardiopulmonary testing in heart failure patients with reduced ejection fraction (HF-REF) remains unknown.

**Aim:** To assess the relative prognostic value of exercise-induced B-lines, BNP and cardiopulmonary testing in HF-REF.

**Methods:** We performed standard transthoracic and LUS evaluation at rest (as a part of a standard TTE) and at peak semi-supine exercise stress echo (ESE) in 103 NYHA class I-III HF patients (76 males; age  $64 \pm 12$  years) with depressed left ventricular ejection fraction ( $35 \pm 8\%$ ). B-lines were measured by scanning 28 intercostal spaces on anterior chest, both at rest and peak stress. During admission, all patients also underwent a venous sample for BNP assay and cardiopulmonary testing exercise testing measuring peak oxygen uptake (VO<sub>2</sub>) normalized for body weight (mL O<sub>2</sub> Kg<sup>-1</sup> min<sup>-1</sup>). All patients were followed-up for a median of 8 months (first quartile, 6; third quartile, 11).

**Results:** The overall B-lines number increased from 5, 0- 10 (median, interquartile range) to 12, 0-45 (peak stress,  $p < 0.0001$  vs. rest). Resting BNP values were 150, 73 – 411 pg/mL. Peak VO<sub>2</sub> was  $16.2 \pm 4.8$ . During follow-up, 37 events occurred: 10 cardiac deaths, 23 re-hospitalizations for acute heart failure, 4 nonfatal myocardial infarctions. At multivariable analysis for all events, clinical status (age and gender), BNP, peak VO<sub>2</sub> and stress B-lines  $\geq 30$  (best cut-off identified by receiver-operating curve) were independent and significant predictors (see figure) of both cardiac death (left panel) and all events (right panel).

**Conclusion:** B-lines are easy to obtain, frequent in HF patients and often increase during ESE. Their prognostic value is independent and partially additive over established prognostic predictors such as age and sex, cardiac natriuretic peptides and peak oxygen consumption during cardiopulmonary testing.



Abstract P1128 Figure.

### P1129

#### Stress-induced worsening of left ventricular diastolic function as a new marker of myocardial ischemia: a retrospective observational study

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#### Aims

Echocardiography has been the subject of interest in diagnosing diastolic dysfunction (DD) and estimating left ventricular (LV) filling pressures. Our study is set to estimate the correlation between the worsening of diastolic parameters and the evidence of inducible ischemia during a stress exercise echocardiography in comparison with the results of coronary computed tomographic angiogram (CCTA).

#### Methods and results

191 consecutive patients from the executive screening program were included. Resting heart rate and blood pressure as well as demographic parameters were analyzed. Resting and stress echocardiogram were done followed by CCTA. Standard 2-D and tissue Doppler imaging parameters were added and DD grading was also applied at rest and exercise. Diastolic function worsening by  $\geq 1$  grade was also included for the analysis. Patients with worsening diastolic function had higher stress LV filling pressures ( $E/e' = 11.7 \pm 2.7$  vs.  $E/e' 8.0 \pm 2.0$ ;  $P < 0.0001$ ) and more  $E/e'$  change  $> 25\%$  ( $48\%$  vs.  $22\%$ ,  $P = 0.012$ ). Nevertheless, patients who had worsening of diastolic function by  $\geq 1$  grade had abnormal stress echocardiogram. In addition, patients who had worsening of diastolic function were more likely to have obstructive coronary artery disease (CAD) on CCTA ( $23.8\%$  vs.  $9.2\%$ ;  $P = 0.045$ ). A change in  $E/e' > 25\%$  (stress-rest) was highly associated with positive stress test and abnormal CCTA result.

**Conclusion:** A change in  $E/e' > 25\%$  (stress-rest) and worsening of diastolic function were not only highly associated with abnormal stress echocardiogram and positive stress test but also with obstructive CAD when compared to CCTA results.

### P1130

#### Prediction and management of stable angina in senior population

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**Background:** Prevalence of cardiovascular disease is high in elderly population and diagnostic accuracy of exercise testing is limited. Aim: The aim of our study was to assess in the patients over 70 years old, with stable angina, feasibility of exercise echocardiography (SEHO) and the management of coronary artery disease and stable angina according to the test results. Methods: Our study population included 202 patients (mean age  $74.3 \pm 3.5$  years, 66.8 % male), in whom we have performed SEHO test on the treadmill (Bruce protocol). Test was positive if the new or worsening of pre-existing wall motion abnormality appears. Patients were followed for revascularization, myocardial infarction (MI), hospitalization and cardiac death. Median follow-up period was  $28.5 \pm 20$  months. Results: Test was feasible in 86.63 % of the patients. SEHO test was positive in 37.6% patients. There were no statistical difference ( $p=ns$ ) between SEHO positive and negative patients in regard to previous myocardial infarction, CABG, diabetes mellitus, hypertension and hypercholesterolemia. Events were present in 86.8% SEHO (+) and 45.2% SEHO (-) patients ( $p < 0.001$ ). In SEHO (+) patients, percutaneous coronary intervention was done in 33 (43.4% versus 19% in SEHO (-) group,  $p < 0.001$ ). Although more frequent in SEHO (+) group, there was no statistical difference for myocardial infarction (5.3% vs. 1.6 %,  $p=ns$ ), CABG (15.8% vs. 0.8%,  $p=ns$ ), cardiac death (6.6% vs. 5.6%,  $p=ns$ ), and hospitalization (14.5% vs. 17.5%  $p=ns$ ), respectively. By multivariate analysis, most powerful predictor for occurrence of events was SEHO result (OR 7.14,  $\beta=1.966$ ,  $p < 0.001$ ), and slow heart rate recovery (OR 3.31  $\beta=1.197$ ,  $p=0.013$ ). In addition, by Kaplan-Meier analysis event free time survival was 11.4 months in SEHO (+) group and 45.7 months in SEHO (-) group ( $p < 0.001$ ). Conclusion: SEHO test is feasible in senior population. Positive SEHO test strongly influence further therapeutic strategy towards more invasive, consequently minimizing risk of further hard events. Negative SEHO test carries a good long term prognosis.

### P1131

#### Risk assessment of coronary heart disease in men before revascularization of non-coronary arteries

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**Purpose:** To evaluate the degree of coronary risk (CR) in male patients before surgical revascularization of non-coronary arteries (NCA).

**Methods:** In current study 64 patients with significant (over 50%) atherosclerotic lesion of NCA (extracranial and/or abdominal aorta and lower limb arteries) and high pre-test probability of coronary artery disease (CAD), according to clinical, laboratory and instrumental examination, were included. The mean age of patients was  $54 \pm 5.6$  years. Exclusion criteria were chronic arterial insufficiency of the IV stage (by Fontaine-Pokrovsky classification, 1979), arterial hypertension with systolic blood pressure over 220 mm Hg and diastolic blood pressure over 130 mm Hg, history of stroke or myocardial infarction at last 6 months, severe cardiac arrhythmias, acute arterial and venous thrombosis, oncological and autoimmune diseases.

Risk assessment of cardiovascular events (cardiac death, myocardial infarction, MI) was based on the results of non-invasive diagnostic tests in accordance to recommendations of the ACCF/AHA (2012), using stress-echocardiography (stress-echo). Then groups of high risk (risk of coronary death or MI  $> 3\%$  per year) and medium risk (incidence of cardiovascular events - 1-3% per year), in accordance to current guidelines (ESC/ESA, 2014), were formed for proceeding coronary angiography (CAG).

**Results.** According to the data of stress-echo, group of high CR included 28 patients (44%), group of middle CR - 23 patients (36%), whereas 13 men (20%) had low degree of CR. During CAG (total number - 51 men, 80%), hemodynamically significant stenosis ( $>50\%$ ) of one coronary artery (CA) was detected in 15 patients (23%), two-vessel lesion - in 9 (14%) p, three-vessel disease was diagnosed in 23 men (36%). Significant coronary artery lesion was absent in 4 patients (7%), according to CAG. Comparability of data of stress-echo and CAG in detection of CA involvement was present in 87% of cases in patients with one-vessel disease, in 89% of cases - in two-vessels disease and 91% of cases in men with three-vessels disease.

**Conclusions.** Noninvasive assessment of coronary risk in men before vascular surgery using stress-echo allows to identify patients with high coronary risk in 80% of cases. We would mention, that about 40% of cases in our group were patients with multivessel CAD, which determines high coronary risk and should be considered while planning surgery on the non-coronary arteries. In detecting of coronary artery involvement the data of stress-echo were comparable with data of invasive angiography in 87-91% of cases.

## TRANSESOPHAGEAL ECHOCARDIOGRAPHY

## P1132

**Relation of elevated C-reactive protein level to left atrial size and left atrial thrombus in patients with valvular and non-valvular atrial fibrillation**

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**Purpose:** to detect the relation between (atrial fibrillation and elevated hs-CRP) and evaluating the associations of it to left atrial diameter and presence of SEC or thrombus in different AF etiologies.

**Methods:** 40 patients with AF (20 had valvular AF and 20 had non valvular AF) and 20 control patients with sinus rhythm and no history of AF. All patients underwent transthoracic and transesophageal echocardiography. hs-CRP level were detected.

**Results:** hs-CRP levels are remarkably higher in the AF groups in comparison with control group. The mean hs-CRP in the valvular group was  $9.9 \pm 2.7$  mg/dl and in the non valvular group  $8.4 \pm 3.6$  mg/dl with the control group the mean hs-CRP level was  $3.4 \pm 2.5$  mg/dl ( $p < 0.001$ ) and there was significant positive correlation ( $p$ -value  $< 0.05$ ) between hs-CRP and left atrial diameter, which indicates increase in hs-CRP level when increase in LAD among study groups. there is statistically significant difference with  $p$ -value  $< 0.05$  between different left atrial thrombus groups as regards to hs-CRP level with high mean among patients had left atrial thrombus.

**Conclusions:** hs-CRP may be a prognostic factor for atrial fibrillation. hs-CRP and left atrial diameter are independent risk factors for patients with atrial fibrillation. that inflammation may involve the formation of thrombosis.

**On behalf of:** cardiology department.

Variable	valvular AF (Mean±SD)	non valvular AF (Mean±SD)	control (Mean ±SD)	P-value	sig.
Age (y)	39.5±14.4	57.8±16.8	51.8±16.5	0.002	S
Echo. findings					
EF(%)	58.5±6.2	50.8±16	55.8±13.7	0.2	NS
LVED(cm)	5.3±0.65	5.7±.82	5.7±1.2	0.3	NS
LAD(cm)	5.5±0.67	4.4±0.42	4.1±0.48	0.001	HS
CRP					
hs-CRP	9.9±2.7	8.4±3.6	3.4±2.5	0.001	HS
LA thrombus	hs-CRP		P-value	Sig.	
	Mean	SD			
no(n=54) 70%	6.8	4.1	0.01	S	
yes(n=6) 30%	11	0.36			

## P1133

**Transesophageal echocardiographic assessment of left atrial appendage function as a cardioembolic source in atrial fibrillation**

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**Background:** Atrial fibrillation (AF) a common arrhythmia encountered in clinical practice. Left atrial appendage (LAA) dysfunction leads to thrombus formation resulting in potentially devastating embolic complications. We aimed to study the role of transesophageal echocardiography (TEE) in assessment of left atrial appendage function as a cardioembolic source in atrial fibrillation via measures of LAA Doppler flow velocities and tissue Doppler velocities.

**Methods:** The study comprised 59 patients (pts) referred for TEE. Cases included 30 pts (group I) having non valvular AF & 29 age-matched pts (group II) having sinus rhythm (SR). Group I included 5 AF pts with stroke (Group IA) and 25 AF pts without stroke (group IB). Group II included 10 SR pts with stroke (group II A) and 19 SR pts without stroke (group II B). Patients undergone clinical evaluation and transthoracic echocardiography followed by multiplane TEE examination of LAA for evaluation of LAA ejection fraction (LAA EF), presence and grading of spontaneous echo-contrast (SEC) and/or LAA thrombus. Flow velocity measures included LAA emptying and filling velocities (LAA-E & LAA-F). Tissue Doppler measures obtained from offline analysis and included LAA contraction velocities during early and late diastole (LAAcV1 & LAAcV2) and LAA relaxation velocity (LAA rv) during systole.

**Results:** Stroke AF Patients (group IA) had significantly lower LAAcV2 ( $p=0.01$ ) compared to non-stroke AF pts (group IB). There weren't significant difference between group IA & group IB in respect to other tested parameters. Stroke SR Patients (group IIA) had significantly lower LAA-E and LAA rv ( $p=0.01$  &  $0.02$  respectively) compared to non-stroke SR pts (group IIB). Group IA showed significant reduction of LAA EF, LAA-E, LAA-F and LAAcV2 compared to group IIA (table 1). Cardioembolic stroke presence was positively associated with the presence of SEC ( $p=0.02$ ). There was negative correlation between SEC grade and LAAcV2 ( $r=0.618$  &  $p<0.001$ ).

**Conclusion:** Transesophageal echocardiography is mandatory for assessment of LAA function in suspected cardioembolic stroke patients. Evaluation of LAA by flow velocity & tissue velocity imaging should be considered in the routine work-up of stroke patients whatever in sinus rhythm or in atrial fibrillation.

Variable	Group IA	Group IIA	P value
LAA EF (%)	48.4±7.3	76.5±11.9	0.00
LAA-E (cm/s)	26.9±7.8	52.7±17.4	0.00
LAA-F (cm/s)	27.9±13.3	45.9±13.1	0.04
LAAcV2 (cm/s)	3.50±1.2	5.9±1.3	0.01

table 1: Comparison between G IA & G IIA of LAA measures.

## P1134

**Correlations of three-dimensional mitral valve geometry with chronic ischemic mitral regurgitation severity in compliance with tethering phenotypes**

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**Introduction:** Asymmetric tethering phenotype is associated with unfavourable outcomes in patients with chronic ischemic mitral regurgitation (MR).

**Purpose:** to analyze the correlations between three-dimensional (3D) mitral valve (MV) geometry parameters and MR severity, left ventricular (LV) remodeling in patients with asymmetric and symmetric phenotypes of chronic ischemic MR.

**Methods:** 43 patients (26 men and 17 women) with moderate ( $n=22$ ; mean age  $63.0 \pm 7.2$  years) and severe ( $n=21$ ; mean age  $66.3 \pm 10.6$  years) MR were underwent 3D transesophageal echocardiography (TEE), 2D transthoracic (TTE) and 2D TEE. Non-parametric Kruskal-Wallis test (k-w) and Pearson correlation were used for statistical analysis.

**Results:** Asymmetric tethering phenotype was identified in 21 patients and symmetric phenotype in 22 patients. In asymmetric tethering 3D Tenting Area (TA) was higher ( $2.5 \pm 1.1$  cm<sup>2</sup>) in comparison with symmetric one ( $2.0 \pm 0.3$  cm<sup>2</sup>; k-w:  $\chi^2=3.6$ ;  $p<0.05$ ), and Tenting Volume (TV) to the contrary was lower ( $4.0 \pm 1.5$  cm<sup>3</sup> versus  $4.6 \pm 1.4$  cm<sup>3</sup>; k-w:  $\chi^2=3.2$ ;  $p<0.05$ ; among them in severe asymmetric –  $4.6 \pm 1.8$  cm<sup>3</sup> versus  $5.5 \pm 2.4$  cm<sup>3</sup>; k-w:  $\chi^2=2.8$ ;  $p<0.05$ , respectively).

In asymmetric MR regurgitant Volume ([RVol],  $97.4 \pm 62.2$  ml versus  $75.2 \pm 27.0$ ; k-w:  $\chi^2=3.4$ ;  $p<0.05$ ), TA in apical 4-chamber view ( $2.2 \pm 0.5$  cm<sup>2</sup> versus  $2.0 \pm 0.5$  cm<sup>2</sup>; k-w:  $\chi^2=3.2$ ;  $p<0.05$ ) and apical displacement of the posteromedial papillary muscle ([AD PMPM],  $5.3 \pm 0.7$  cm versus  $5.0 \pm 0.8$  cm; k-w:  $\chi^2=3.4$ ;  $p<0.05$ ) were higher than in symmetric MR.

In symmetric phenotype 3D TV, TA and Tenting Height (TH) correlated with the MR severity, interpapillary distance (IPD) and LV end-systolic dimension ( $r=0.7$ ;  $p<0.004$ ). 3D Posterolateral Angle (PLA) had associations neither with 3D TV, TA, TH, nor with MR severity. The rate and degree of correlations between 3D and 2D parameters in asymmetric MR were lower in comparison with symmetric MR with exception of 3D TV which had multiple correlations with 2D parameters of MR severity and AD PMPM. As opposed to the symmetric in the asymmetric MR 3D PLA had positive correlations with 3D TV ( $r=0.7$ ;  $p<0.001$ ), MR severity (EROA:  $r=0.6$ ;  $p=0.004$ ; RVol:  $r=0.5$ ;  $p=0.02$ ) and AD PMPM ( $r=0.5$ ;  $p=0.01$ ). 2D PLA correlated with 3D PLA ( $r=0.9$ ;  $p<0.001$ ) and other parameters of 3D MV geometry.

**Conclusion(s):** In asymmetric MR phenotype the inverse correlation of TH and TA is revealed, which reflects the loss of the MV saddle-shape. 3D MV geometry has strong multiple correlations with 2D TEE and 2D TTE values. 3D MV parameters are associated with the MR severity. 3D TV has the maximum number of correlations with quantitative criteria of MR severity, 2D MV geometry and LV remodeling. 3D TV is associated with MR severity regardless of the tethering phenotype whereas the association of other 3D/2D MV geometry parameters with MR severity depends on the tethering phenotype. In asymmetric MR posterior leaflet angle and tethering of MV posterior leaflet are correlated with MR severity.

## P1135

**Aortic root physiology in patients with aortic valvulopathy**

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**Introduction:** Some groups studied the anatomy of aortic annulus in patients with aortic stenosis (AS) undergoing transcatheter aortic valve implantation (TAVI). However there are few studies focused on pulsatile changes of the entire structure during cardiac cycle, many of these done only in aortic stenosis with computed tomography (CT).

**Purpose:** Aim of our study was to evaluate dynamic changes of aortic annulus, sinus of Valsalva (SoV) and sinotubular junction (STJ) in patients with aortic stenosis and aortic regurgitation, compared with patients without aortic valvulopathy, using an automated software that detects and tracks aortic root components during cardiac cycle, on three-dimensional (3D) transesophageal echocardiography (TOE) images.

**Methods:** We analyzed three groups of patients with severe aortic stenosis (Group 1, N=86), with at least moderate aortic regurgitation (AR) (Group 2, N=37) and without aortic valvulopathy (Group 3, N=31), referred to our centre for a transesophageal echocardiogram. 3D images were processed by a software that automatically detects and tracks all components of aortic root during the cardiac cycle. We selected for our study the maximum and the minimum value of aortic annulus area and perimeter, sinus of Valsalva and sinotubular junction area. Of each one we calculated its

fractional change, by resting the minimum value to the maximum, dividing for the maximum and expressing the result in percentage.

**Results:** A total of 154 patients (mean age  $73 \pm 15$  years; 54% male gender) were included. Fractional area change (FAC) and fractional perimeter change (FPC) of the annulus were significantly lower in patients with aortic stenosis (Table 1) without differences between groups 2 and 3. Fractional area change of sinus of Valsalva (FAC SoV) was significantly higher in patients with aortic regurgitation versus group 1 and 3. We didn't find significant differences in FAC of sinotubular junction (FAC STJ).

**Conclusions:** Our results demonstrate that normal aortic annulus physiology is altered in patients with aortic stenosis, with reduction of dynamic parameters. On the other hand, in patients with aortic regurgitation sinus of Valsalva show higher systolic excursions.

Table 1

	AS	AR	Controles	p
FAC	15,84±4,09	25,89±9,06	24,72±6,03	0,000
FPC	9,32±3,34	14,64±6,33	13,19±3,78	0,000
FAC SoV	15,14±5,36	18,75±9,67	15,37±8,10	0,035
FAC STJ	20,63±9,29	21,26±8,30	18,33±9,08	0,369

## TISSUE DOPPLER AND SPECKLE TRACKING

### P1136

#### Comparison of layer-specific strain to other contemporary deformation parameters for coronary artery disease prediction in patients with non-ST-segment elevation acute coronary syndrome

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**Objective.** To compare diagnostic impact of layer-specific speckle tracking echocardiography to contemporary deformation parameters for prediction of significant coronary artery disease (CAD) in patients with non-ST-segment elevation acute coronary syndrome (NSTEMI-ACS).

**Background.** Strain analysis is a recent tool allowing assessment of 3 myocardial layers.

**Methods.** 307 consecutive patients admitted for NSTEMI-ACS were prospectively assessed in a single coronary center. Patients were excluded if they had a history of myocardial infarction, or any heart disease. Trans-thoracic echocardiography (TTE) was performed before endovascular treatment and within 72 hours after chest pain. An endocardial, epicardial and a transmural value of global longitudinal strain (GLS) were obtained from 2D speckle tracking acquisition. For each coronary artery, a longitudinal territorial strain (TLS) was calculated, based on the perfusion of the 17 segments of the myocardium.

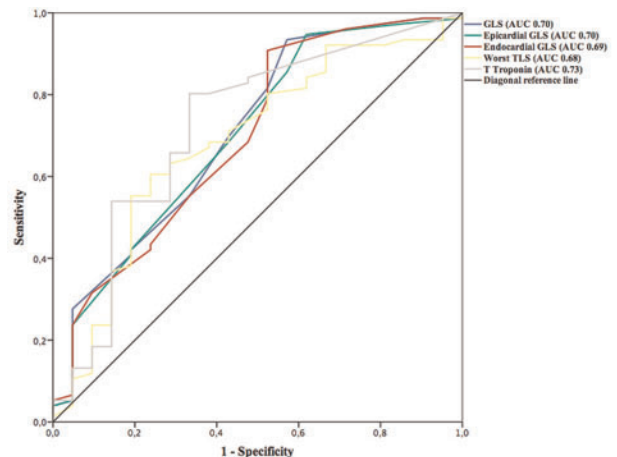
**Results.** Between November 2014 and May 2015, 97 patients were included. 76 (78.3%) had significant CAD. Each value of endocardial ( $-19.8 \pm 3.2$  % vs.  $-22.1 \pm 2.8$ %;  $p = 0.09$ ), epicardial ( $-15.1 \pm 2.4$  % vs.  $-16.9 \pm 2.5$ %;  $p = 0.008$ ) and transmural longitudinal strain ( $-17.0 \pm 2.8$  % vs.  $-19.0 \pm 2.8$ ;  $p = 0.006$ ) was significantly altered in CAD group. The same results were observed for circumferential strain. Receiver-operating characteristic (ROC) curves demonstrate that GLS had the best echocardiographic AUC for diagnosis of CAD (0.70). Specific ROC TLS analysis for CAD detection of each artery showed excellent AUC at 0.85 for circumflex and 0.75 for right coronary artery. GLS, average strain of basal segments and TLS were also predictive of multi-vessel CAD (AUC 0.64, 0.68 and 0.66 respectively).

**Conclusion.** Multi-layer strain wasn't more accurate than global strain to identify CAD in patients admitted for first episode of NSTEMI-ACS. GLS was better than 2D and 3D LVEF, or WMSI to predict significant CAD.

Echocardiographic measures.

	CAD (n = 76)	No CAD (n = 21)	p value
LVEF, %	58.8 ± 6.1	59.1 ± 5.6	0.838
Wall Motion Score Index	1.09 (1.00-1.18)	1.00 (1.00-1.12)	0.135
GLS, %	-17.0 ± 2.8	-19.0 ± 2.8	0.006
Endocardial GLS, %	-19.8 ± 3.2	-22.1 ± 3.3	0.009
Epicardial GLS, %	-15.1 ± 2.4	-16.9 ± 2.5	0.008
Worst TLS, %	-13.4 ± 3.8	-15.6 ± 3.7	0.019

Values are mean±SD, n (%), median (interquartile range). GLS = global longitudinal strain; LVEDVi = left ventricular end-diastolic volume index; LVEF = left ventricular ejection fraction; TLS = territorial longitudinal strain.



Abstract P1136 Figure.

### P1137

#### Machine-learning based diagnosis of heart failure with preserved ejection fraction: how much do we agree with the guidelines?

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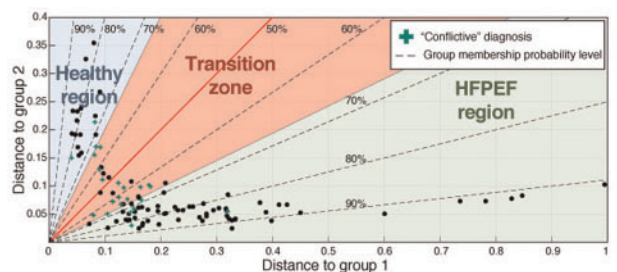
**Purpose:** Current diagnosis of heart failure with preserved ejection fraction (HFPEF) is suboptimal since it oversimplifies abnormalities by only considering "simple" key markers of disease. We investigate whether a comprehensive analysis of multiple myocardial velocity profiles, acquired during a stress echocardiography protocol, can identify characteristic patterns of cardiac (dys-)function and aid in better staging of HFPEF patients.

**Methods:** Velocity profiles were extracted at the basal septum and lateral wall of the left ventricle from rest and exercise tissue Doppler acquisitions. The population consisted of 33 healthy subjects ( $67 \pm 4$  years) and 72 HFPEF ( $72 \pm 6$  years, diagnosed with the current guidelines). Each cardiac phase was identified and used to temporally align the velocity profiles. An unsupervised machine learning algorithm (multiple kernel learning) was used to fuse the heterogeneous input data and to reduce their complexity. Agglomerative hierarchical clustering was performed on this set to identify different groupings within the population and position each subject with regard to all the others according to their similarity.

**Results:** The identified groups substantially differed for the parameters classically used for diagnosis ( $E/e'$  ratio and  $6MWT$ :  $p < 0.03$ ; NT-proBNP:  $p = 0.052$ ) and correlated with the clinical diagnosis (sens=88.9%, spec=54.6%). The probability of membership to each group revealed a healthy and a HFPEF region (sens=92.9%, spec=87.5%) and a transition zone where most of the "conflictive" diagnosis cases were lying (figure).

**Conclusion:** Our method reduced the complexity of myocardial motion descriptors towards a representation where patients can be staged into clinically-relevant regions. The transition zone suggested "conflictive" cases where so called healthy subjects showed hypertensive remodeling, which may evolve into HFPEF and need closer follow up.

**Funding Acknowledgements:** EU FP7 VP2HF (no 611823), EU FP7 MEDIA (no 261409), Spanish Ministry of Economy and Competitiveness (TIN2012-35874), "La Caixa" banking foundation.



Abstract P1137 Figure.

## P1138

## Cardiac shear wave velocity in healthy individuals

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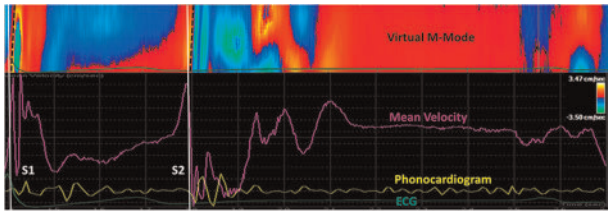
**Background:** The closure of the valves generates shear waves in the heart walls. The propagation velocity of shear waves relates to stiffness. This could potentially be used to estimate the stiffness of the myocardium, with huge potential implications in pathologies characterized by a deterioration of the diastolic properties of the left ventricle. In an earlier phantom study we already validated shear wave tracking with a clinical ultrasound system in cardiac mode.

**Purpose:** In this study we aimed to measure the shear waves velocity in normal individuals.

**Methods:** 12 healthy volunteers, mean age=37±10, 33% females, were investigated using a clinical scanner (Philips iE33), equipped with a S5-1 probe, using a clinical tissue Doppler (TDI) application. ECG and phonocardiogram (PCG) were synchronously recorded. We achieved a TDI frame rate of >500Hz by carefully tuning normal system settings. Data were processed offline in Philips Qlab 8 to extract tissue velocity along a virtual M-mode line in the basal third of the interventricular septum, in parasternal long axis view. This tissue velocity showed a propagating wave pattern after closure of the valves. The slope of the wave front velocity in a space-time panel was measured to obtain the shear wave propagation velocity. The velocity of the shear waves induced by the closure of the mitral valve (1st heart sound) and aortic valve (2nd heart sound) was averaged over 4 heartbeats for every subject.

**Results:** Shear waves were visible after each closure of the heart valves, synchronous to the heart sounds. The figure shows one heart cycle of a subject, with the mean velocity along a virtual M-mode line in the upper panel, synchronous to the ECG signal (green line) and phonocardiogram (yellow line) in the lower panel. The slope of the shear waves is marked with dotted lines and the onset of the heart sounds with white lines. In our healthy volunteer group the mean velocity of the shear wave induced by mitral valve closure was 4.8±0.7m/s, standard error of 0.14 m/s. The mean velocity after aortic valve closure was 3.4±0.5m/s, standard error of 0.09 m/s. We consistently found that for any subject the velocity after mitral valve closure was higher than after aortic valve closure.

**Conclusion:** The velocity of the shear waves generated by the closure of the heart valves can be measured in normal individuals using a clinical TDI application. The shear wave induced after mitral valve closure was consistently faster than after aortic valve closure.



Abstract P1138 Figure.

## P1139

## Do still we need E/E prime ratio in predicting left ventricular filling pressures in heart failure with reduced ejection fraction?

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The recommended indexes to estimate left ventricular filling pressure (LVFP) in patients with reduced ejection fraction (HFrEF) have significant limitations, specifically in some cardiac disorders such as abnormal cardiac structure, valve disease, atrial arrhythmias and cardiac devices which modify the relationship between indices of diastolic function and LVFP.

**Aims:** To test additional role of 2 dimensional speckle tracking strain in association with traditional 2-D and standard Doppler echocardiographic parameters in assessing LVFP in a population of unselected patients with HFrEF, seen in the real life setting and referred to right heart catheterization.

**Methods and Results:** twenty-three unselected HFrEF patients referred to right heart catheterization were enrolled, and a trans-thoracic echocardiogram was performed the same day.

Among standard indices of diastolic dysfunction: left atrial volume and early mitral inflow velocity (E) wave velocity had a significant correlation with pulmonary capillary wedge pressure (PCWP) and mean pulmonary artery pressure (mPAP). The ratio of E to peak atrial longitudinal strain (PALS), the ratio of (E) to global diastolic strain rate (E'sr) and the ratio of peak diastolic (D) pulmonary vein flow to PALS outperformed the ratio of E to early diastolic mitral annular velocity (E') in predicting both PCWP and mPAP (table).

**Conclusions.** In unselected patients with HFrEF the E/PALS, D/PALS and E/E'sr were useful parameter and were stronger than E/E' ratio in predicting PCWP and mPAP.

Variables	Mean ± SD	HF with Reduced EF (n=23)	
		Pulm. Capill. Wedge Press.	mean Pulm. Art. Pressure
Age	51.74 ± 13.83	-0.035 (0.885)	0.076 (0.758)
BMI	26.63 ± 4.26	0.264 (0.275)	0.344 (0.163)
NT - pro Brain Natriuretic Peptide (pg/mL)	2047.35 ± 1660.95	0.522 (0.026)	0.448 (0.071)
Pulm. Capillary Wedge Pressure (mmHg)	17.6 ± 5.7	1 (< 0.001)	0.95 (< 0.001)
Mean Pulmonary Artery Pressure (mmHg)	28.16 ± 12.72	0.95 (< 0.001)	1 (< 0.001)
LV - Ejection Fraction (%)	27.7 ± 6	-0.15 (0.575)	-0.138 (0.616)
LV - End Diastolic Volume Index (mL/cm <sup>2</sup> )	129.38 ± 59.49	0.184 (0.438)	0.202 (0.407)
Left Atrial Volume (mL)	120 ± 45.06	0.704 (0.001)	0.728 (0.001)
E Wave Velocity (mt/sec)	0.86 ± 0.29	0.744 (< 0.001)	0.618 (0.005)
A Wave Velocity (mt/sec)	0.5 ± 0.25	-0.346 (0.195)	-0.328 (0.231)
E / A Ratio	2.48 ± 1.85	0.592 (0.008)	0.537 (0.022)
E / E' Ratio	21.51 ± 14.11	0.617 (0.004)	0.565 (0.012)
LV Global Systolic Strain (%)	-8.91 ± 5.96	-0.005 (0.985)	0.045 (0.872)
LV Global Early Diastolic Strain Rate (%/sec)	0.78 ± 0.21	-0.328 (0.202)	-0.341 (0.2)
LV Global Late Diastolic Strain Rate (%/sec)	0.52 ± 0.24	-0.259 (0.302)	-0.242 (0.346)
Left Atrium Strain (Conduit Phase, QRS Sync)	4.04 ± 3.22	-0.625 (0.04)	-0.675 (0.04)
Peak Atrial Longitudinal Strain (QRS sync)	10.37 ± 7.23	-0.566 (0.051)	-0.609 (0.047)
E / E' LV Global Strain Rate Ratio	1.2 ± 0.57	0.686 (0.001)	0.617 (0.005)
E / LA Conduit syst. Strain	0.48 ± 0.55	0.49 (0.03)	0.48 (0.06)
E / PALS	0.13 ± 0.1	0.70 (0.001)	0.746 (< 0.001)
Pulm. Veins D Wave Vel / PALS	0.09 ± 0.07	0.69 (0.001)	0.73 (0.001)
Systolic LV Torsion (deg)	5.75 ± 7.19	0.022 (0.927)	-0.972 (0.428)
De-Torsion Rate Early Diastole (deg/sec)	-48.03 ± 34.73	0.161 (0.509)	0.23 (0.358)

Abstract P1139 Figure.

## P1140

## Evaluation of myocardial dysfunction in children with Beta Thalassemia major

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**Background:** The new parameters of cardiac function, derived from two-dimensional speckle-tracking echocardiography could be useful for an early diagnosis of cardiac involvement in patients with thalassemia major. Aim: to assess the effect of iron load on the myocardium in beta Thalassemia using speckle tracking echocardiography in reference to T2 star cardiac MRI, and to correlated those parameters with the efficacy of iron chelation and other risk factors.

**Methods:** Thirty transfusion dependent β-TM patients were recruited. A detailed medical history was gathered from the medical records. Laboratory investigations (CBC, liver function tests, markers of hemolysis) were collected and the mean serum ferritin in last 2years was calculated. Echocardiography (m-mode and Speckle Tracking) and Holter monitoring were done to all patients, while MRI T2\* was performed for patients with abnormal speckle echocardiography.

**Results:** Cardiac affection by speckle tracking (longitudinal strain < 11%) was found in 33.3% of BTM patients. There were no significant differences between βTM patients with mean serum ferritin ≥2500 µg/L and those with serum ferritin <2500 µg/L as regard M mode echocardiographic parameters. Patients with mean serum ferritin > 2500 ng/mL in the last 2 years prior evaluation showed a significantly lower global longitudinal strain (GLP/LAX) (p=0.043) which was significantly negative correlation with the mean serum ferritin (p=.002). There were no significant differences between both splenectomized and non splenectomized patients nor between patients on mono and combined chelation therapy as regard echocardiographic data. When evaluating the cardiac MRIT2\* of the 10 patients with decreased GLP/LAX, 9 out of 10 patients had low cardiac MRIT2\* less than 20 ms and 3 out of 10 patients had low ejection fraction below 60 % .

**Conclusion:** decreased GLP/LAX with a significant negative correlation with mean serum ferritin; was observed among BTM patients. CMRIT2\* technique is still considered the reference standard in myocardial iron overload, yet speckle tracking echo techniques might be considered as an alternative effective method to detect early myocardial disease before evident systolic dysfunction.

## P1141

## Association of left ventricular size and septal mechanics with right ventricular function and transplant-free survival in infants with hypoplastic left heart syndrome

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**Background:** In hypoplastic left heart syndrome (HLHS), RV dysfunction is associated with poor outcomes. However, the interaction between RV dysfunction and the varying size of the hypoplastic LV has been controversial.

**Purpose:** To study the impact of septal mechanics and LV-RV interaction on RV function and clinical outcomes in infants with HLHS.

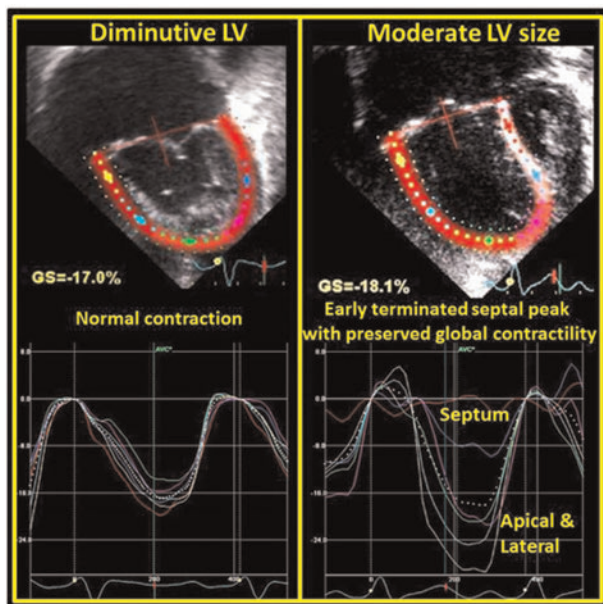
**Methods:** Twenty newborns (0-7 days) with HLHS had pre-Norwood echocardiograms prospectively protocolled for strain analysis of the apical 4-chamber view. RV longitudinal peak systolic strain (LPSS) was measured in six septal/RV segments (non-tracking segments were excluded). LV size was classified as diminutive (LV length < 8mm) or moderately hypoplastic (LV length 8-24mm). The LV of the moderately hypoplastic group extended at least through the basal septal segment and into the mid-septal segment. Clinical outcome was reported as alive vs death or transplant (D-TP). Continuous measures are reported as mean ± standard deviation.

Groups were compared with an unpaired Student or Fischer's Exact T-test,  $p < 0.05$  considered significant.

**Results:** Global RV LPSS for the group was normal ( $-18.7 \pm 4.2\%$ ), but basal septal segmental strain was moderate-severely reduced ( $-8.2 \pm 7.1\%$ ). Infants with a diminutive LV (7/20, 35%) vs a moderately hypoplastic LV (13/20, 65%) did not have significantly global RV LPSS ( $-18.4 \pm 2.6\%$  vs  $-18.8 \pm 3.2\%$ ;  $p=0.83$ ). However, basal septal strain was diminished in the moderately hypoplastic LV group vs the diminutive LV group ( $-14.7 \pm 3.3\%$  vs  $-4.4 \pm 6.0\%$ ;  $p < 0.005$ ). There was with early termination of peak contraction in about half (7/13) of the moderately hypoplastic group (see figure). For clinical outcomes, there was no D-TP in the diminutive LV group (0/7), but D-TP was present in 6/13 infants with a moderately hypoplastic LV ( $p=0.05$ ). In those with poor outcomes, death (4/6, 66%) or transplant (2/6, 33%) occurred between Norwood and Fontan. The most significant basal septal dysfunction (LPSS  $< -3\%$ ) was present in 5/6 of the moderate LV size group with poor outcomes, and in 3/7 of the moderate LV group with good outcome.

**Conclusions:** In these infants with HLHS studied prior to Norwood, septal contractility was diminished in those with a moderately sized LV despite overall good global RV systolic function. This diminished septal contractility and abnormal septal mechanics may be associated with poor outcomes (D-TP).

**Funding Acknowledgements:** The primary author is supported by a Medtronic research grant.



Abstract P1141 Figure.

#### P1142

##### Predictive value of speckle tracking of chronic rejection in middle-aged heart transplant patients

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**Background and Aim:** speckle tracking echocardiography (STE) is highly sensitive technique for evaluating early ventricular systolic and diastolic dysfunction. Abnormal rest STE parameters are related to acute rejection in recipients of heart transplantation. The aim of this study is to assess whether rest and stress STE parameters predict chronic rejection in a cohort of middle-aged heart transplant patients.

**Methods:** Inclusion criteria: patients older than 40 years old with a graft at least 12 months old. Exclusion criteria: previous diagnosis of rejection. All patients underwent stress/rest transthoracic echocardiogram followed by myocardial biopsy after a mean of 14 days. The following echocardiogram parameters were recorded: end-diastolic volume (EDV), end-systolic volume (ESV) stroke volume (SV), ejection fraction (EF), global longitudinal strain (GLS), global circumferential strain (GCS), radial strain (RS), twist and torsion.

**Results:** 52 consecutive patients with orthotopic cardiac transplantation were enrolled in the study. Mean age was 59 ( $\pm 9$ ) years and 21% were male. There were no statistically significant differences in cardiovascular therapy among enrolled patients. Twenty-one patients showed signs of chronic rejection at myocardial biopsy. Patients were stratified according to presence/absence of rejection. Statistical analysis showed no significant difference in Rest echocardiogram parameters apart from ESV ( $p=0.038$ ). By contrast, rejections patients presented lower EF and RS (both  $p < 0.001$ ) and lower GLS and GCS ( $p=0.03$  and  $p < 0.0001$  respectively) at stress echocardiography. Logistic

regression showed that stress GLS and GCS were predictors of rejection (OR 3.43, 95% CI 1.48-7.94 and 1.47, 95% CI 1.03-2.09, respectively).

**Conclusion:** Reduced GCS GLS predict chronic rejection in middle-aged heart transplant patients. These preliminary findings need to be confirmed on a larger scale.

#### P1143

##### Determinants of the left atrial stiffness in systemic sclerosis

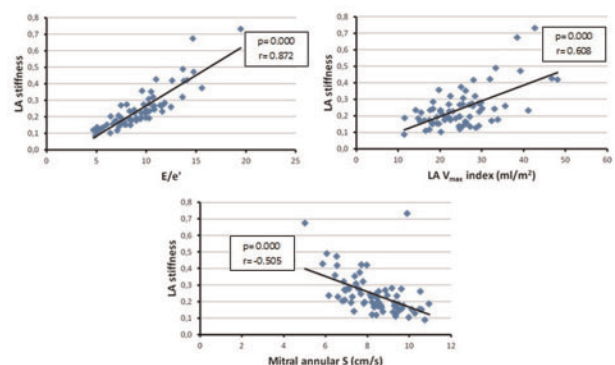
A. Porpacz<sup>1</sup>; A. Nogradi<sup>1</sup>; M. Strenner<sup>1</sup>; T. Minier<sup>2</sup>; L. Czirjak<sup>2</sup>; A. Komocsi<sup>1</sup>; R. Faludi<sup>1</sup>  
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Systemic sclerosis (SSc) is a connective tissue disease characterized by vasculopathy and progressive fibrosis of the skin and certain internal organs. Subclinical myocardial involvement is common in SSc, and is associated with poor prognosis. Less is known, however, about the left atrial (LA) mechanics in this disease. Tissue Doppler imaging and 2D speckle tracking based LA stiffness has been reported as a promising, non-invasive marker of the atrial structural remodeling. Our aim was to investigate the LA stiffness in SSc patients in comparison to healthy volunteers. Echocardiographic determinants of the LA stiffness were also investigated.

Patients, methods: 72 SSc patients (age:  $57 \pm 11$  years, 66 female, 33 limited cutaneous form) were investigated. Their results were compared with the parameters of 30 gender- and age-matching healthy volunteers. Patients with pulmonary arterial hypertension, atrial fibrillation, reduced LV ejection fraction ( $< 55\%$ ) or significant left sided valvular disease were excluded. LV ejection fraction was measured by biplane Simpson's method. LV mass was calculated according to the Devereux formula and indexed for body surface area (LVM index). The following Doppler data were collected: mitral E and A, mitral annular myocardial systolic (S), early- (e') and late- (a') diastolic velocities at the lateral and septal mitral annulus. Lateral and septal myocardial velocities were averaged. E/A and E/e' ratios were calculated. Non-foreshortened, LA-focused apical four- and two-chamber view loops were stored digitally for further off-line analysis. LA reservoir strain was measured with a special software by a single investigator. LA stiffness was calculated as ratio of E/e' to LA reservoir strain. Maximal LA volume was measured with the same software and indexed for body surface area (Vmax index).

**Results:** In SSc patients significantly higher LA stiffness values were found compared to healthy persons ( $0.24 \pm 0.12$  vs.  $0.15 \pm 0.04$ ,  $p=0.000$ ). LA stiffness showed significant correlation with the grade of the mitral regurgitation ( $r=-0.601$ ;  $p=0.000$ ), LV mass index ( $r=0.398$ ;  $p=0.001$ ), mitral annular e' ( $r=-0.633$ ;  $p=0.000$ ), mitral E/e' ( $r=0.872$ ;  $p=0.000$ ), mitral annular S ( $r=-0.505$ ;  $p=0.000$ ) and with LA Vmax index ( $r=0.608$ ;  $p=0.000$ ). In stepwise multiple linear regression analysis E/e', mitral annular S and LA Vmax index became independent predictors of LA stiffness (multiple  $r = 0.911$ ;  $p=0.000$ ;  $F = 108.911$ ).

**Conclusion:** LA stiffness is significantly elevated in SSc patients compared with matched controls. Our data suggest that in this disease the main determinants of the LA stiffness are LV filling pressure, LV longitudinal systolic function and the maximal LA volume.



Abstract P1143 Figure.

#### P1144

##### Could right atrial peak global longitudinal strain be useful in assessment of right heart function in pulmonary arterial hypertension?

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Dysfunction of the right atrium (RA) is one of the most important predictive factors in pulmonary hypertension (PH). Novel echocardiographic parameter - peak right atrial global longitudinal strain (RAGLS) derived from 2D speckle-tracking echocardiography can be useful in assessment of RA function.

The aim of the study was to assess correlation between peak RAGLS with conventional echocardiographic parameters: right ventricular systolic pressure (RVSP), acceleration time (AcT), S' velocity of the right ventricular free wall, tricuspid annulus plane systolic excursion (TAPSE), right ventricular peak global longitudinal systolic

strain (RVGLS) and area of RA. Also correlation between peak RAGLS and NT-proBNP was examined.

**Material and methods:** 25 patients in the mean age  $56 \pm 16,18$  years (23 women, 2 men) were enrolled into the study. In 5 patients IPAH, in 5 patients pulmonary arterial hypertension due to congenital heart defects, in 13 patients pulmonary hypertension due to connective tissue disease and in 2 chronic thromboembolic PH were diagnosed. In all patients echocardiography was performed to assess right ventricular and right atrial function. Echocardiography was performed with Philips EPIQ7 ultrasound system. The peak RAGLS and peak RVGLS were analysed by 2D-STE. In all patients NT-proBNP level was examined.

**Results:** In all patients parameters describing right heart function were impaired: RVSP  $100,37 \pm 28,00$  mmHg, AcT  $75,15 \pm 13,64$  ms, S' velocity  $11,12 \pm 3,4$  cm/s, RA area  $30,97 \pm 9,2$  cm<sup>2</sup>, TAPSE  $16,13 \pm 5,6$  mm. RVGLS in the cohort of patients with PH was  $-12,55 \pm 4,75$  and RAGLS was  $18,16 \pm 9,03$ . Mean NT-proBNP level was  $2666,66 \pm 2177,33$  pg/ml. Strong correlation between peak systolic RAGLS and TAPSE, S' velocity of the right ventricular free wall, RVSP were found. Weak correlation between NT-proBNP and peak RAGLS was observed.

**Conclusion:** Peak RAGLS is a new promising parameter, which correlates with conventional echocardiographic parameters describing severity of right heart dysfunction in PH.

tab.1

Parameter	Value	r
RVSP (mmHg)	$100,37 \pm 28,00$	-0,58
AcT (ms)	$75,15 \pm 13,64$	-0,25
RA area (cm <sup>2</sup> )	$30,97 \pm 9,2$	-0,57
S' velocity (cm/s)	$11,12 \pm 3,4$	0,65
TAPSE (mm)	$16,1 \pm 5,6$	0,81
NT- pro BNP (pg/ml)	$2666,66 \pm 2177,33$	-0,12

Correlation between RAGLS and conventional echocardiographic parameters. r - Pearson correlation index.

**P1145**

**Utility of speckle tracked strain assessment of the right ventricle following lung resection**

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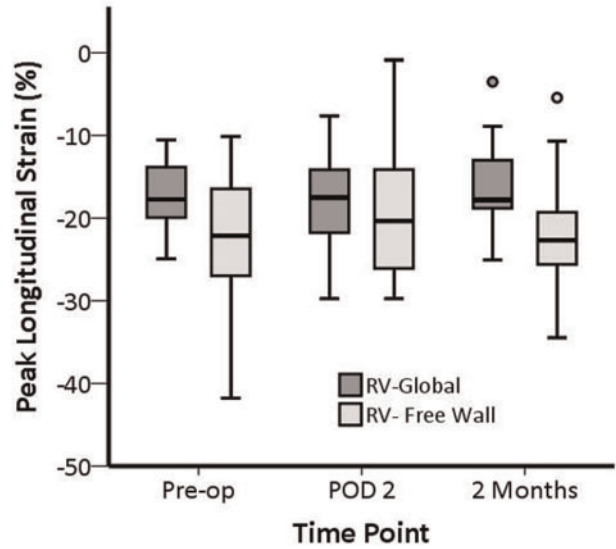
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Existing studies indicate that right ventricular (RV) dysfunction occurs following lung resection, predisposing patient to post-operative complications and prolonged critical care stay. Although widely hypothesised to result from increased afterload, the mechanisms and extent of dysfunction remain incompletely understood. Trans thoracic echocardiographic (TTE) assessment of the RV is challenging in this population, with the difficulties of RV imaging compounded following thoracic surgery. Many of the parameters used correlate poorly with each other and lack validation in this patient group. To further investigate the RV response to lung resection we performed a prospective observational cohort study using cardiac magnetic resonance (CMR) imaging and speckle tracked echocardiography.

With ethics approval and informed consent, 27 patients undergoing lobectomy by thoracotomy underwent serial TTE and CMR; pre-op, on post-operative day 2 (POD 2) and at 2-month follow-up. Global and RV free wall speckle tracked peak longitudinal strain (RV-GPLS and RV-FPLS respectively) were determined offline from randomised and anonymised images (Echopac, GE Healthcare). RV ejection fraction (RVEF) was calculated offline by dual reported analysis of randomised and anonymised CMR images (Argus, Siemens). All correlations were assessed using Pearson's correlation coefficient.

Twenty-six patients had TTE performed on POD 2 with 22 (84.62%) having RVPLS and GPLS calculated. POD 2 RV-GPLS and RV-FPLS (Fig 1.) were unchanged from pre-op values ( $p = 0.69$  and  $0.09$  respectively, Wilcoxon Signed Rank, Fig. 1). RVEF by CMR, POD 2 RV-GPLS and RV-FPLS correlated with the duration of critical care stay ( $r = -0.61$ ,  $r = 0.60$  and  $r = 0.52$  respectively,  $p < 0.01$  for all). RV-GPLS and RV-FPLS correlated moderately with RVEF by CMR at all peri-operative time points ( $r = -0.41$ ,  $-0.54$ ,  $-0.52$  for RV-GPLS and  $r = -0.53$ ,  $-0.51$ ,  $-0.55$  for RV-FPLS,  $p < 0.05$  for all).

This study suggests that speckle tracked strain assessment of the RV may have utility in patients following lung resection. Although there was no significant change in RV strain over time, there is an association with RV function on POD 2 and the duration of critical care stay. Importantly RV strain correlates with a gold standard method of assessing RV function, this offers a non-invasive and bedside method of measuring RV function in this patient group.



Abstract P1145 Figure.

**P1146**

**Edge-to-edge-repair in patients with dilated cardiomyopathy and secondary mitral regurgitation: effect on myocardial function as assessed by echocardiographic speckle tracking analysis**

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**Objective:** To evaluate the effect of catheter-based edge-to-edge mitral valve repair (MVR) with the Mitraclip-System on left ventricular (LV) systolic function as measured by echocardiographic speckle tracking analysis (STA) in addition to standard parameters.

**Background and Methods:** STA is a relatively novel method to quantitatively assess global and regional systolic LV function (LVF). In addition to standard measures of LVF like fractional shortening (FS) and ejection fraction (EF), global longitudinal strain (GLS) and regional peak systolic longitudinal strain were evaluated by STA in 48 patients (pts.; age:  $71.1 \pm 9.3$  years) with severe LV dysfunction and secondary mitral regurgitation (sMR) before and after MVR.

**Results:** Following  $4.5 \pm 5.0$  (range: 0.3-24.0) months after MVR, exercise tolerance and all quantification parameters concerning sMR severity significantly improved (see table). However, LA and LV size remained largely unchanged, as well as both conventional and STA-based measures of LV function.

**Conclusions:** MVR improved exercise tolerance and MR severity in this severely compromised population. However, during the observation period, reduction of the low impedance leak by MVR did not lead to significant reverse LV remodelling.

Variable	baseline	follow-up	p value
NYHA functional class	$3.3 \pm 0.4$	$2.6 \pm 0.7$	0.0001
Maximum workload (w)	$35 \pm 43$	$47 \pm 46$	0.04
MR PISA zone radius (mm)	$8.2 \pm 2.3$	$3.0 \pm 2.1$	0.0001
4 chamber view MR jet area / LA area (%)	$44.4 \pm 12.8$	$15.6 \pm 7.2$	0.001
Overall MR grade (1-3)	$2.6 \pm 0.4$	$1.4 \pm 0.5$	0.0001
LA diameter (mm)	$55.5 \pm 7.2$	$56.1 \pm 8.4$	0.8
LV enddiastolic diameter (mm)	$67.8 \pm 8.8$	$67.5 \pm 9.9$	0.7
LV ejection fraction (%)	$29.1 \pm 10.1$	$29.1 \pm 11.0$	0.9
LV GLS (%)	$7.7 \pm 3.6$	$6.9 \pm 3.5$	0.04

**P1147**

**Decongestion, arterial stiffness and ventricular-arterial coupling in AHF**

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**Background:** congestion and fluid overload are the hallmarks of heart failure (HF). Arterial stiffness and ventricular-arterial coupling (VAC) are independent prognostic factors in HF patients. No studies to date have investigated the role of decongestion with continuous iv furosemide regarding these parameters.

**Purpose:** we aimed at evaluating arterial stiffness and VAC at admission and discharge in patients hospitalized for acute HF (AHF).

**Methods:** 32 patients hospitalized for AHF were enrolled. Before the administration of iv furosemide and at discharge they underwent radial artery applanation tonometry to evaluate central blood pressures and augmentation index (Alx@75), and transthoracic echocardiography to assess aortic elastance (Ea), end-systolic left ventricular elastance (Ees) and their ratio, namely VAC.

**Results:** mean age was 77±9 years. 12 (37.5%) were male. LVEF at admission was 37±10%. Hemodynamic parameters are reported in Table 1. After iv furosemide there was a great improvement in central pressure and Ea. On the other hand, no effects were seen on Alx@75, Ees and VAC. These results are independent from LVEF. Only changes in Ees correlated with weight loss.

**Conclusion:** in patients hospitalized for AHF iv furosemide is associated to an improvement in central pressure, with no effects on VAC. The surprising arterial stiffening in parallel with decongestion can be probably linked to a reduced shear stress due to fluid unloading or to neurohormonal activation. Considering the prognostic role of arterial stiffness in patients with HF, our results are contrasting and need further analysis.

Table 1

Variable	Admission	Discharge	p
Aortic SBP (mmHg)	109±16	102±12	0.024
Aortic DBP (mmHg)	76±6	70±7	<0.001
Aortic MAP (mmHg)	90±10	83±8	0.001
Aortic PP (mmHg)	32±15	32±11	1.000
Alx@75 (%)	24±13	27±11	0.221
Stroke volume (mL)	50±16	57±30	0.102
Ea (mmHg/mL)	2.3±0.8	2.1±0.8	0.036
Ees (mmHg/mL)	2.8±1.1	2.8±1.3	0.668
VAC	0.9±0.2	0.8±0.2	0.303

SBP=systolic blood pressure; DBP=diastolic blood pressure; MAP=mean arterial pressure; PP=pulse pressure; Alx@75=augmentation index corrected for 75 bpm; Ea=aortic elastance; Ees=left ventricular end-systolic elastance; VAC=ventricular-arterial coupling

**P1148**

**Myocardial dysfunction in Anderson-Fabry disease (AFD) without left ventricular hypertrophy**

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**Background.** AFD is a rare X-linked genetic lysosomal storage disorder with an absent or reduced enzymatic activity of the α-galactosidase A (GLA) and progressive intralysosomal accumulation of glycosphingolipids. Cardiac involvement in Fabry disease is very common and more than 50% of patients develops a concentric non-obstructive left ventricular (LV) hypertrophy.

Aim of study was to identify early signs of myocardial involvement in patients with Fabry disease without LV hypertrophy, using 2D Speckle Tracking Echocardiography (STE) to evaluate the LV longitudinal strain (GLS).

**Methods.** 21 patients (7 males, 14 females) with diagnosis of AFD were evaluated. Echo examination was performed using equipment GE Vivid 7 and analyzed by Echo PAC ver. 113.0.0. For this study we reported the values of the LV mass indexed by body surface area (LVMI), E wave of mitral flow, the systolic myocardial velocity (S') and early diastolic velocity (E') of tissue Doppler at mitral annulus, E/E' ratio and the LV longitudinal strain (GLS).

**Patients were grouped according to the presence or absence of left ventricular hypertrophy in two groups:** with LVMI >115 g/m<sup>2</sup> (LVH) and with LVMI ≤115 g/m<sup>2</sup> (noLVH); the data were compared to normal group (N) (91 normal healthy subjects: 48M-43F) matched for age and BSA.

**Results.** LVH pts (2M-3F, age 53±9y) showed: Enzyme activity 1,54±1,98; LVMI g/m<sup>2</sup> 150±23,6; E cm/s 70,4±23,7(vs. N 80,9±17,3 p<0,196); S'cm/s 5,4±1,1 (vs. N 9,4±1,7 p<0,001); E' 5,2±2,7(vs. N 13,3±3,5 p<0,001); E/E' 16,96±11,8 (vs. N 6,3±1,2 p<0,0005); GLS% -11,7±5,4.

NoLVH pts (5M-11F, age 33±19y) showed: Enzyme activity 3,43±3,03; LVMI g/m<sup>2</sup> 70±16,4 (vs. N 66±17,8 p<0,719); E cm/s 82,1±29,6 (vs. N 80,9±17,3 p<0,807); S'cm/s 7,2±1,6 (vs. N 9,4±1,7 p<0,001); E' 12±4,1 (vs. N 13,3±3,5 p<0,204); E/E' 8±3 (vs. N 6,3±1,2 p<0,0005); GLS% -18,4±2,8 (vs. N -21,6±5,5 p<0,02).

**Conclusion.** Our study show that even in patients without hypertrophy, and then in the pre-clinical stage, the longitudinal left ventricular function, expressed by GLS is already precociously altered.

**P1149**

**Assessment of left ventricular twist-untwist mechanics in cardiac amyloidosis using three-dimensional speckle-tracking echocardiography**

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**Background.** Cardiac amyloidosis (CA) is an infiltrative disease primarily caused by extracellular tissue deposition of amyloid fibrils in the myocardial interstitium. Over half of affected patients show cardiac involvement at diagnosis, and this condition is the most important prognostic factor in the natural progression of the disease. The aim of the present study was to examine left ventricular (LV) rotational mechanics in biopsy-proven CA by three-dimensional speckle-tracking echocardiography (3DSTE).

**Methods.** Ten patients (67.9±10.3 years) with CA, 10 patients (68.6±11.7 years) with systemic arterial hypertension (HTN), 10 patients (59.9±13.8 years) with hypertrophic cardiomyopathy (HCM), and 10 age-matched normal controls were studied by conventional echocardiography and 3DSTE. LV longitudinal strain and systolic and diastolic strain rate were obtained in the basal, mid and apical segments of septal and lateral walls in apical 4-chamber view. Circumferential and radial strain and averaged LV rotation and rotational velocities from the base and apex were also determined.

**Results.** LV longitudinal and circumferential strain were reduced in CA patients compared to controls (-14.6% vs -19.7%, p =.005, and -16.9% vs -27.1%, p =.013, respectively) with the most prominent impairment at the basal segments. Peak basal rotation (-5.1±1.4 vs -6.8±2.2degree, p =.001), peak apical rotation (8.7±3.1 vs 10.8±3.4degree, p <.05), and peak untwisting rate (64.3±11 vs 79.3±14degree/s, p =.02) were significantly lower compared to controls. Significant impairment of peak basal rotation was shown in CA patients compared to HTN (p<.05) and HCM patients (p<.01). Comparison of ROC curves for detecting CA showed that the AUC using basal rotation was significantly larger than the other echocardiographic parameters used for diagnosing CA (AUC 0.95, 95% CI 0.87-0.98).

**Conclusions.** Different aspects of LV rotational mechanics are shown in CA, with significant basal hyporotation being the most frequent pattern. This pattern could identify early cardiac involvement and help to differentiate patients with CA from patients with other causes of increased LV wall thickness.

**P1150**

**Three-dimensional principal strain analysis for the dependency of preload changes**

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**Purpose:** Strain analysis along the direction of strongest systolic compression, which is referred as principal strain, showed its usefulness in detecting subclinical cardiac dysfunction. In this study, we investigated three-dimensional principal strain analysis is affected by acute changes of preload or not.

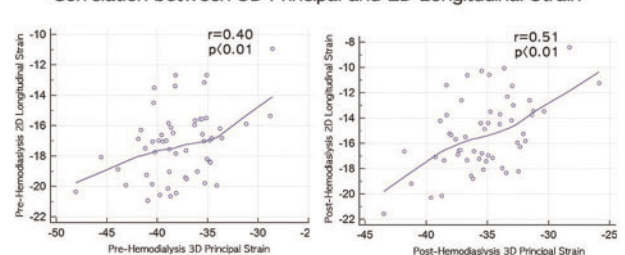
**Methods:** 58 subjects who underwent transthoracic echocardiography including 4D full volume image acquisition of left ventricle before and after hemodialysis were enrolled. Peak systolic principal, longitudinal, circumferential and radial strain values were obtained from left ventricular 4D full volume image along the endocardial border.

**Conclusion:** The values of principal strain could be easily obtained from commercially available software with other functional parameters. They also showed good correlation with 2-dimensional strain values. However, they are not preload-independent just like other more conventional strain parameters.

	Pre-Haemodialysis	Post-Haemodialysis	P values
Principal strain	-37.84±3.54	-35.29±3.22	<0.01
Longitudinal Strain	-24.34±2.93	-21.41±2.11	<0.01
Circumferential Strain	-33.24±3.48	-30.88±3.22	<0.01
Radial strain	47.45±4.61	42.87±3.65	<0.01

Differences in 3-dimensional Strain Values according to Preload Changes

**Correlation between 3D Principal and 2D Longitudinal Strain**



Abstract P1150 Figure.