

POSTER SESSION 2

THE IMAGING EXAMINATION AND QUALITY ASSESSMENT

P520

Benefit of early basic transthoracic echocardiography (TTE) in emergency patients performed by physicians with low to intermediate TTE experience

M. Brand; M. Christ; J. Roeing; S. Amirie; M. Grett; M. Beko; I. Breker; R. Wennemann; H.-J. Trappe
University Hospital St. Mary's Hospital Herne, Cardiology and Angiology, Herne, Germany

Purpose: In current guidelines of resuscitation the priority of early transthoracic echocardiography (TTE) is emphasized. The aim of this current prospective study was to evaluate the benefit of early (<45min after admission) basic TTE in all patients admitted to our emergency department with chest pain, dyspnea, unclear syncope and ecg-changes, if performed by physicians with less than one year of TTE experience.

Methods: We performed an analysis of all patients (n = 21) admitted to our emergency department in a 5 months period (01.11.15 – 01.03.16) with new onset of chest pain, dyspnoea, unclear syncope and new ecg-changes, such as LBB, RBB, T-wave inversions, loss of R-waves in the precordial leads and dysrhythmia. Patients with ongoing CPR or after CPR were excluded. Furthermore patients with fever and significant elevated inflammatory markers in the point-of-care laboratory testing were excluded. Patients admitted after 8pm or at the week-end were also excluded to rule out potential bias due to limited resources. All TTEs were performed by physicians with less than one year of TTE experience. The duration of TTE examinations was analysed as well as change in initial suspected diagnosis and early prevention of a likely complicated clinical course. Furthermore the length of hospital and ICU-stay was noted, but was so far not statistically analysed.

Results: 604 patients (73.6%) received a basic TTE ad admission in the emergency department. In 75 patients (12.4%) only subcostal views were obtained due to severe dyspnea or impossible positioning of the patient. The median examination time was 212 seconds (IQR, 107-317). The suspected diagnosis was changed in 143 patients (23.7%). Especially severe pulmonary embolisms, aortic valve stenoses and progressed left ventricular dysfunctions could be excluded (n=92, 64.3%) or included (n=41, 28.7%). In 10 patients (7.0%) the result of the TTE led to immediate intervention in case of obvious myocardial akinesia (n=6, 4.1%), aortic dissection (Stanford Typ A, n=2; 1.4%) and pericardial effusion after surgical valve replacement (n=1; 0.7%).

Conclusions: Routine transthoracic echocardiography in the emergency department – even if performed by physicians with basic experience and in a heterogenous patient collective - is a quick and effective tool for reevaluation and early change of the suspected diagnosis and has the potential to avoid fatal outcomes.

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Appropriateness criteria in echocardiography. A contemporary necessity in clinical practice

A. Stefanidis; S. Lagoudakou; K. Vintzilaos; N. Mokadem; J. Vlachou; E. Komatanou; P. Korkou; A. Kakkavas; K. Komninos; A. Kranidis
General Hospital of Nikea, 1st Department of Cardiology, Piraeus, Greece

Aim: The widespread use of echocardiography determines the technique as irreplaceable for the diagnostic approach of several clinical scenarios. However, only few Scientific Societies have developed appropriate use criteria for its use and as a consequence the real life indications of echo studies are commonly arbitrary. The present study investigated the stratification of the referrals for echo studies according to the appropriateness criteria of the American Society Echocardiography (2011).

Materials and methods: We consecutively gathered and assessed all referrals for echocardiography in a time duration of 6 months in a particular echo lab of a tertiary district Hospital. The referrals were stratified according to a) their suitability (appropriate, uncertain and inappropriate), b) referral physician's specialty (Cardiologist or not), c) type of echo modality referred to (Transthoracic -TTE, Transoesophageal-TOE and stress echo) and d) the clinical scenario investigated.

Results: Referrals for echocardiography are commonly based on arbitrary criteria affecting the level of quality of patients' management and the adequacy of resources availability. Table shows that a significant number of referrals were inappropriate or of uncertain value. The worse performance of inconsistency was associated with non-cardiologists' referrals for TTE modality.

Conclusion: The first step of a high-quality echocardiography service is to satisfy appropriate patient selection in order to provide a rational and cost-effective imaging

study that will lead to clinical benefit. The development of appropriateness criteria from National or International scientific Associations or Societies is considered necessary.

TTE (850 referrals)	Appropriate (%)	Uncertain (%)	Inappropriate (%)
Cardiologists	63	24	13
Non-Cardiologists	32	23	45
TOE (71 referrals)			
Cardiologists	78	12	10
Non-Cardiologists	50	27	23
Stress Echo (20 referrals)			
Cardiologists	80	10	10

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Interobserver variability in 2d transthoracic echocardiography impact of scanning and reading on total variability results from the STAAB cohort study quality control

C. Morbach¹; G. Gelbrich²; J. Simon¹; M. Cramer¹; F. Knobloch¹; T. Tiffe²; M. Wagner²; PU. Heuschmann²; S. Stoerk¹

¹University Hospital Wuerzburg, Comprehensive Heart Failure Center and Dept. of Medicine I, Wuerzburg, Germany; ²University of Wuerzburg, Institute of Clinical Epidemiology and Biometry and Comprehensive Heart Failure Center, Wuerzburg, Germany

Background: Transthoracic echocardiography is a widespread tool to assess cardiac dimensions and function. Careful scan and image-analysis are prerequisites for valid and reliable information. Quality control usually consists of double readings of the same set of images, but there is little data on the impact of different scanners on inter-observer variability.

Purpose: To evaluate the impact of scanning and reading on total inter-observer variability in 2D echo measures. We present results from the echo control program of the population-based STAAB cohort study (Characteristics and Course of Heart Failure Stages A-B and Determinants of Progression).

Methods: Duplicate echocardiographic recordings were performed in 43 subjects by a cardiologist and 3 trained echo technicians, respectively. Inter-observer difference (IOD), inter-scanner difference (ISD), and inter-reader difference (IRD) were assessed comparing self-readings of own scans (n=86) and cross-readings of the other observers scans (n=86), respectively.

Results: The table shows the 95% range of two measurements for IOD, ISD, and IRD of defined parameters. IOD was largest for all echo parameters. ISD was larger than IRD for end-diastolic interventricular septum and posterior wall thickness, whereas IRD was prominent in left ventricular end-diastolic diameter, late diastolic mitral inflow velocity, and the systolic gradient over the tricuspid valve.

Conclusion: Trained echo technicians are able to acquire and read reliable data on cardiac dimensions and function on the population level, which can be used for epidemiological studies. To prevent underestimation of the variability of echo parameters, assessment of real inter-observer variability should be preferred to inter-reader variability as quality measure in clinical and scientific settings.

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components of inter-observer variability

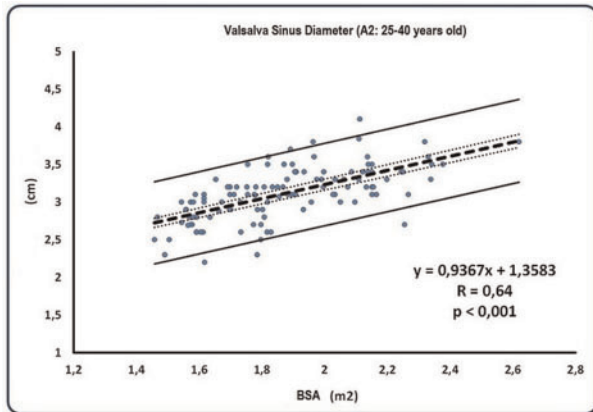
	IOD	ISD	IRD
IVSes (mm)	1.71	1.08	0.89
PWEd (mm)	1.74	1.71	1.63
LVDed (mm)	6.42	3.24	5.60
MVA (m/s)	0.24	0.12	0.20
sPAP (mmHg)	5.88	3.99	5.07

95th percentile of absolute differences of 2 measurements as measure for inter-observer difference (IOD), inter-scanner difference (ISD), and inter-reader difference (IRD). IVSed=interventricular septum end-diastolic, PWEd=posterior wall end-diastolic, LVDed=left ventricular diameter end-diastolic, MVA=mitral inflow velocity late diastolic, sPAP=systolic tricuspid valve pressure gradient

($p < 0.001$). All TADi were negatively correlated with BSA ($p < 0.001$). Every TADi was positively correlated with A ($p < 0.001$) except for TADi1 ($R^2 = 0.0005$; $p = NS$). Gender comparisons showed group differences between TAD, TADi, A and BSA ($p < 0.001$), but strongly similar correlations ($p = NS$). Nomograms were obtained for A1, A2 and A3 to predict TAD from BSA with no need of G distinction.

Conclusions: In our cohort, BSA was the strongest predictor of TAD. TAD increased with A, except for the aortic annulus which depended more on BSA. Women had smaller TAD due to their lower BSA, but they correlated strongly similar to men.

We propose nomograms of TAD for different A groups without G distinction. Our study provides applicable reference prediction values for TA dilatation screening purposes and treatment decision making. BSA and A must be taken into account when assessing an individual patient.



Abstract P526 Figure.

P527

The association of left ventricular outflow tract velocity time integral to all-cause mortality in elderly patients with heart failure

Q. Almodares¹; C. Wallentin Guron¹; A. Thurin¹; M. Fu²; S. Kontogeorgos³; E. Thunstrom²; MC. Johansson¹

¹Sahlgrenska Academy, Clinical Physiology, Gothenburg, Sweden; ²Sahlgrenska Academy, Cardiology, Gothenburg, Sweden; ³Angered Hospital, Cardiology, Gothenburg, Sweden

Background: Prognostic assessment of patients with overt heart failure (HF) is important to discriminate low and high risk individuals within this complex syndrome. Left ventricular ejection fraction (LVEF) is of prognostic value in large cohorts of heart failure patients but it loses strength when applied to elderly patients and those with LVEF above 45%. Left ventricular outflow tract velocity time integral (LVOT VTI) is a simple and robust method to approximate left ventricular stroke volume by Doppler echocardiography. The aim of the present study is to test the association of LVOT VTI to all-cause mortality in elderly patients with HF.

Methods: 289 patients above 65 years hospitalized for HF between April 2007 and April 2008, and who went through an echocardiographic exam were retrospectively enrolled. All-cause mortality was registered during a follow-up of at least 56 months. Among baseline echocardiographic parameters measured or estimated were left ventricular diastolic diameter, left ventricular mass, LVEF, left atrial volume, mitral E-wave deceleration time, E/e' and systolic pulmonary arterial pressure (SPAP) in addition to LVOT VTI.

Results: Univariate analysis in this population showed that a lower LVOT VTI was associated with all-cause mortality (hazard ratio of 0.94, 95% confidence interval: 0.91 - 0.96, $p < 0.001$). This association remained after adjusting for age, heart rate, LVEF, left ventricular mass, left atrial volume and SPAP (hazard ratio of 0.95, 95% confidence interval: 0.92 - 0.99, $p = 0.02$).

Conclusion: A low LVOT VTI is independently associated with increased all-cause mortality in elderly patients with heart failure and may be better than LVEF for risk-stratification in this patient group.

Multivariate analysis

N= 217	HR (95% CI)	P
Age	1,04 (1,02 - 1,07)	0,001
Heart rate	1,00 (0,99 - 1,01)	0,82
LVEF	0,99 (0,98 - 1,01)	0,36
LVMi	1,00 (1,00 - 1,01)	0,80
LAVi	1,00 (0,99 - 1,01)	0,80
SPAP	1,03 (1,01 - 1,04)	< 0,001
LVOT VTI	0,95 (0,92 - 0,99)	0,02

LVMi= left ventricular mass index, LAVi= left atrial volume index, SPAP= systolic pulmonary arterial pressure, VTI= velocity time integral, LVOT= left ventricular outflow tract, HR= hazard ratio, CI = confidence interval. Left ventricular mass and left atrial volume are indexed for the body surface area.

P528

Left ventricular myocardial performance and atrioventricular coupling in patients with primary arterial hypertension

H. Abdulrahim¹; C. Da Silva¹; A. Venkateshvaran¹; AI. Nagy²; LH. Lund³; A. Manouras³
¹Karolinska University Hospital, Department of cardiology, Stockholm, Sweden;
²Semmelweis University Heart Center, Department of cardiology, Budapest, Hungary;
³Karolinska Institute, Department of medicine, Stockholm, Sweden

Introduction: Primary arterial hypertension (PAH) is characterized by pulmonary vascular remodeling yielding right ventricular (RV) failure due to elevated RV loading. However, the left ventricular (LV) performance in PAH is not well characterized. Recently, 2D strain has demonstrated depressed LV function in this cohort, and ascribed this to the effect of interventricular interaction. We sought to investigate the LV performance in these patients using load independent non-invasive metrics of contractility.

Methods: 32 patients with PAH (age: 59 ± 16 years) were consecutively enrolled. Transthoracic echocardiography (TTE) and right heart catheterization (RHC) was performed. Myocardial and LV function was assessed using myocardial mid-wall fractional shortening (LV-FSmw) and single-beat LV elastance (Ees). Systemic arterial afterload was assessed by arterial elastance (Ea) measurements. LV diastolic stiffness was measured by the single-beat method.

Results: Mean pulmonary arterial pressure was elevated in all subjects (PAPm= 43 ± 11 mmHg). Indices of LV arterio-ventricular coupling were normal (Ees/Ea: 1.1 ± 0.3) as was the LV-longitudinal strain ($-17.8 \pm 3.3\%$) whereas the myocardial contractility was slightly elevated (LV-FSmw= 152 ± 76 kdynes/cm2). Although there was an inverse correlation between pulmonary vascular resistance (PVR) and LV-strain ($r = -0.45$, $p = 0.045$), no association between PVR and LV-FSmw or LV stiffness ($p > 0.05$) was observed. Conversely, RV diastolic pressure was significantly associated with LV-stiffness ($r = -0.6$, $p < 0.001$).

Conclusion: Employing load-independent indices, we show that PAH patients are characterized by normal arterio-ventricular coupling and myocardial contractility, contrary to earlier reports that demonstrate depressed LV myocardial function. Furthermore, we show that the effect of interventricular interaction is mainly confined to diastole.

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Interest of a combinatory approach based on traditional left ventricular dyssynchrony parameters and cardiac work estimated by pressure-strain loop curves for the prediction of cardiac resynchronization

E. Gallit¹; C. Leclercq¹; M. Fournet¹; A. Bernard²; P. Mabo¹; E. Samset³; A. Hernandez⁴; E. Donal¹

¹University Hospital of Rennes, Cardiology, Rennes, France; ²University Hospital of Tours, Tours, France; ³University of Oslo, Oslo, Norway; ⁴Laboratory Signal Processing and Image, Rennes, France

Background: Cardiac resynchronization therapy (CRT) in heart failure is limited by still too many non-responders. Purpose of the present study is to evaluate if the use of an approach combining traditional dyssynchrony parameters and the estimation of LV performance by pressure-strain loops (PSLs) can be useful for the prediction of CRT response (CRT+).

Methods: 2D-echocardiography and speckle tracking echocardiography (STE) were performed in 97 (age 65 ± 10 years) patients before CRT implantation. Conventional dyssynchrony parameters were estimated and PSLs were used to estimate LV positive work (posW) and negative work (negW). After a 6-month follow-up, positive response to CRT (CRT+) was defined as $\geq 15\%$ reduction in LV end-systolic volume.

Results: FU, CRT+ was observed in 63 (65%) patients. The main cut-off value able to predict CRT+ was 1057 for PosW (AUC 72%, $p < 0.0001$) and -384 (AUC 0.67, $p < 0.005$) for NegW. As shown in Table 1, the use of a combinatory approach including the concomitant presence of atrio-ventricular dyssynchrony (AV), interventricular dyssynchrony (IV), septal flash (SF), $posW > 1057$ mmHg%, and $negW > -384$ mmHg% showed the great accuracy (97%), sensibility (98%), and positive predictive value (98%) for the prediction of CRT+.

Conclusions: the estimation of cardiac performance by PSL curves in combination with more conventional parameters of LV dyssynchrony might provide a valuable tool for the identification of CRT responders. Further studies on larger series should be designed to confirm these results.

Table 1	Sensibility	Specificity	PPV	NPV	Accuracy
AV	0.32	0.79	0.37	0.75	0.66
IV	0.68	0.62	0.71	0.59	0.66
SF	0.81	0.35	0.69	0.51	0.64
PosW >1057 mmHg%	0.55	0.85	0.72	0.73	0.73
NegW >-384 mmHg%	0.40	0.94	0.72	0.80	0.79
AV+IV+SF+ PosW >1057+ NegW >-384	0.98	0.27	0.98	0.22	0.97

AV, atrio-ventricular dyssynchrony; IV, inter-ventricular dyssynchrony; NPV, negative predictive value; PPV, positive predictive value; SF, septal flash

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The evaluation of cardiac performance by pressure-strain loops: a useful tool for the identification of cardiac resynchronization therapy responders

E. Galli¹; C. Cleclercq¹; M. Fournet¹; A. Bernard²; P. Mabo¹; E. Samset³; A. Hernandez⁴; E. Donal¹

¹University Hospital of Rennes, Cardiology, Rennes, France; ²University Hospital of Tours, Tours, France; ³University of Oslo, Oslo, Norway; ⁴Laboratory Signal Processing and Image, Rennes, France

Background: Cardiac resynchronization therapy (CRT) in heart failure is limited by still too many non-responders.

Purpose of the present study is to evaluate if the estimation of cardiac performance by pressure-strain loops (PSLs) is useful for the selection of CRT candidates.

Methods: 2D-echocardiography and speckle tracking echocardiography (STE) were performed in 97 (age: 65±10 years) patients before CRT implantation. Conventional dyssynchrony parameters were estimated and PSLs were used to estimate LV positive work (posW), negative work (negW), and work efficiency (WE). Positive response to CRT (CRT+) was defined as ≥ 15% reduction in LV end-systolic volume at 6-month follow-up (FU).

Results: CRT+ was observed in 63 (65%) patients.

Table 1 shows the main predictors of CRT+ at logistic regression analysis. The best cut-off value of PosW and NegW for the prediction of CRT+ were: 1057 (AUC 72%, p<0.0001) and -384 (AUC 0.67, p<0.005), respectively.

When these cut-offs were inserted in the multivariable regression analysis, PosW>1057 mm Hg/% (OR 8.26, CI 95%: 2.03-33.57, p=0.003), NegW> -384 mmHg/% (OR 13.26 CI 1.95-90.43, p= 0.008) and SF (OR 7.42, CI 95%: 1.90-28.97, p=0.004) remained the only significant predictors of CRT+.

Conclusions: the estimation of cardiac performance by PSL curves appears to be a novel and very promising tool to identify CRT responders. Further studies on larger series should be designed to confirm these results.

Table 1	OR (95% CI)	p-value	OR 95% (CI)	p-value
LV EDD, per mm	0.93 (0.88-0.98)	0.01	1.02 (0.88-1.19)	0.77
LV ESD, per mm	0.93 (0.89-0.99)	0.001	0.25 (0.81-1.06)	0.41
LV EF, per %	0.63 (0.92-1.05)	0.98		
Ischemic etiology	0.27 (0.11-0.65)	0.004	0.94 (0.82-1.09)	0.11
QRS width, per ms	0.36 (0.12-1.13)	0.08		
QRS width >150 msec	2.92 (0.92-9.28)	0.07		
LBBB	2.20 (0.77-6.26)	0.14		
Atrio-ventricular dyssynchrony	1.79 (0.67-4.81)	0.25		
Interventricular dyssynchrony	3.47 (1.45-8.30)	0.005	1.81 (0.58-5.69)	0.31
Intra-ventricular dyssynchrony	0.51 (0.15-1.72)	0.45		
Septal flash	7.29 (2.82-18.83)	0.0001	4.57 (1.42-14.72)	0.01
PosW, per mmHg%	1.00 (1.00-1.01)	0.03	1.01 (1.00-1.01)	0.02
NegW, per mmHg%	0.99 (0.98-1.00)	0.004	0.99 (0.99-1.00)	0.03
WE, per %	0.09 (0.45-1.03)	0.69		

P531

Left ventricle cardiac function by 2D-speckle tracking echocardiography in diabetes mellitus population: sub-clinical systolic dysfunction study

J. Moreno¹; CML Martinez Lugo²; JZD Zuniga Sedano³; EAR Alexanderson⁴; JC. Camilletti⁵

¹Hospital Country 2000, Imagen Cardiovascular, Guadalajara, Mexico; ²University Hospital of Guadalajara, Guadalajara, Spain; ³Hospital Angeles del Carmen, Cardiology, Guadalajara, Mexico; ⁴National Institute of Cardiology Ignacio Chavez, Nuclear Cardiology, Mexico City, Mexico; ⁵Italian Hospital of La Plata, Nuclear Cardiology, La Plata, Argentina

Aim of the study is to evaluate Left Ventricle systolic function with 2D-speckle tracking to establish an association between hyperglycemia and cardiac sub-clinical dysfunction.

Methodology: 40 diabetic patients and 20 normal subjects as control group were included in the study; Global Longitudinal Strain of the left ventricle in 4, 2 and 3 chamber view (GLSLV), Left Ventricle Ejection fraction (LVEF), Glycosylated Hemoglobin (GH), and Fasting glucose were evaluate in all patients. Exclusion criteria: heart valve disease, known coronary artery disease, Abnormal LVEF. Diabetic patients were divided in 2 groups. Group 1) GH > 7% Group 2) GH < 7%.

Results: see table.

Conclusions: Although LV diastolic volume and ejection fractions were not significantly different, abnormal Glycosylated Hemoglobin seems to be associated with decrease in GLS% of the left ventricle suggesting this data sub-clinical systolic dysfunction as an early stage of heart failure.

Results

	Group 3 (20 pts)	Group 1) GH > 7 (22pts)	Group 2) GH <7 (18pts)	P group 2 vs. 1
GLSLV (%)	-23.3 +/- 2.43	-16.4 +/- 2.19	-21.3 +/- 3.47	P 0.03
LVEF (%)	62.3 +/-4.22	-61.9 +/- 3.2	63.6 +/- 5.4	Not significant
Fasting Glucosa mg/dl	80.2 +/-9.1	250.2 +/-27.4	110 +/-4.3	P 0.005
Glycosylated Hemoglobin %	4.8 +/-2.3	11.1 +/-1.2	5.1 +/-1.9	P 0.003
LV VOLUME mls	107.9 +/- 22	115.4 +/-25	111.3 +/-19	Not significant

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Biphasic tissue doppler mitral annular isovolumic contraction velocities are associated with left ventricular function, isovolumic relaxation, and pulmonary wedge pressure in heart failure patients

P. Lerena Saenz¹; M. Ahmed Abdelrahman²; H. Raslan³; C. Ruisanchez Villar⁴; JM. Cuesta Cosgalla¹; J. Zarauza Navarro⁴; G. Veiga Fernandez⁴; O. Rifaie²; AMS Omar³

¹Hospitales de Sierrallana y Tres mares, Cardiology, Santander, Spain; ²Ain Shams University Hospital, Department of Cardiology, Cairo, Egypt; ³National Research Centre, Medical Division, Department of Internal Medicine, Cairo, Egypt; ⁴Hospital Universitario Marques de Valdecilla, Cardiology, Santander, Spain

Background: Tissue Doppler (TDI) mitral annular isovolumic contraction (IC) and relaxation (IR) are biphasic positive/negative signals (ICp-ICn; and IRp-IRn). Biphasic IC is related to longitudinal endocardial shortening and epicardial stretch, keeping IC within isovolumic constraint. Reportedly, ICp predicts pulmonary capillary wedge pressure (PCWP) in heart failure (HF) with reduced ejection fraction (EF). Aim: Study the relative magnitudes of the biphasic IC and IR velocities, their changes and effect on PCWP in HF patients. Methods: We studied 56 HF patients [56±8 years, 18(32%) females, all sinus rhythm, EF: 54±13, 33(59%); ≥55% and 23 (41%) <55%], and 13 normal controls. TDI velocities averaged from the septal and lateral mitral annulus, and the ratio of mitral flow to mitral annular early diastolic velocity (E/e') were calculated. PCWP was invasively measured in patients simultaneous to echocardiography. Results: Predominantly positive IC (ICp>ICn) and negative IR (IRn>IRp) were found in all controls. This coupled positive IC-negative IR was found in only 28 HF patients and was more frequent in EF≥55% than <55% [20 vs. 8 cases, p= 0.05]. 8 patients had predominantly negative IC [2 EF≥55%, 6 EF<55%, p=0.03 vs. controls] and 26 patients had predominantly positive IR [11 EF≥55%, 15 EF<55% p<0.001 vs. controls]. Compared to controls, ICp and IRn velocities were not different in EF≥55% and were lower in EF<55%, while the ratios ICp/ICn and IRn/IRp were lower in EF≥55% and lowest in EF<55%. ICp correlated with PCWP in EF<55% and not ≥55% (r=-0.67, P<0.001), while ICn correlated in EF ≥55% and not in <55% (r=0.57, P<0.001). The ratio ICp/ICn correlated with PCWP overall, EF≥55% and <55% (r=-0.75, r=-0.8, r=-0.7, respectively, all p<0.001), and was comparable to E/e' ratio (r=0.8, r=0.65, r=0.79, respectively, all p<0.001). The ratio IRn/IRp correlated only in EF<55% (r=-0.48, p=0.02). E/e' and ICn/ICp kept their correlations with PCWP when E/e' was <8 or >15, while when E/e' fell between 8 to 15, correlation lost significance for E/e' and was kept for ICp/ICn (r= 0.4, -0.72, p=0.06, <0.001, respectively). By receiver operator characteristic-curve, ICp/ICn predicted PCWP>13 mmHg better than E/e' (AUC= 0.91, and 0.83, respectively). Finally, ICp correlated with IRn in Controls as well as patients (r=0.8, 0.67, all p=0.001). Compared to controls, this correlation was weaker in EF≥55%, and weakest in EF<55% (r=0.59, 0.49, p<0.001, 0.02). Conclusions: In normal controls, IC is predominantly positive coupled with predominantly negative IR. In HF, this pattern was associated with preserved EF and, regardless of EF, ICp/ICn ratio predicts PCWP, with an advantage when E/e' falls between 8 to 15. The correlation between ICp and IRn suggests that longitudinal IC endocardial shortening is stored by myocytes throughout ejection and released during IR, assisting diastolic relaxation. Depressed ICp may attenuate relaxation in the IR causing increased PCWP.

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Abnormal left atrial volumes and strains are associated with increased arterial stiffness in patients with cryptogenic stroke: a novel pathophysiological path

I. Ikonomidis¹; D. Vlastos²; A. Frogoudaki²; AR. Vrettou²; S. Vlachos²; M. Varoudi²; H. Triantafyllidi²; J. Parissis²; G. Tsvigoulis²; J. Lekakis²

¹University of Athens, Athens, Greece; ²University of Athens Medical School, Attikon Hospital, 2nd Department of Cardiology, Athens, Greece

Background: Approximately 30-40% of ischemic strokes remain without a clearly defined cause after extensive workup and are described as cryptogenic. Impaired arterial hemodynamic properties, endothelial dysfunction, and embolic phenomena of cardiac origin could shed light into the pathogenesis of these cerebrovascular accidents. In this respect, we investigated the arterial stiffness, glycocalyx integrity, and left ventricular diastolic and systolic function in patients with cryptogenic stroke.

Methods: We assessed a) the aortic PWV (PWV), central systolic blood pressure (cSBP), central pulse pressure (cPP), and augmentation index (cAix) by Arteriograph and Complior; b) the perfusion boundary region (PBR) of the sublingual arterial microvessels, a valid marker of endothelial glycocalyx thickness, and thus of endothelial integrity, using Sideview, Darkfield imaging (Glycocheck); and c) left atrial volume/m²(LAVol), relative wall thickness (RWT), left ventricular mass (LV mass) by 2D echocardiography, d) global systolic left ventricular strain (GLSLV), left atrial strain at atrial contraction (LA strain), and left atrial peak strain (LA peak strain) by 2D speckle tracking imaging in 50 patients with cryptogenic stroke and 40 healthy controls (mean age 44,3 years).

Results: PWV, cSBP, cPP, Aix, PBR 2-25 and PBR 5-9 were higher in patients with cryptogenic stroke compared to healthy controls (PWV: 11.8 ± 0.8 vs 9 ± 0.9 , $p = 0.001$, cSBP: 137 ± 3.7 vs 117 ± 4.6 , $p = 0.002$, cPP: 52.7 ± 2.1 vs 40.4 ± 2.8 , $p = 0.004$, cAix 33.1 ± 2.3 vs 20 ± 3.2 , $p = 0.005$, PBR 5-25: 2.07 ± 0.2 vs 1.9 ± 0.2 , $p < 0.04$, PBR 5-9: 1.29 ± 0.02 vs 1.13 ± 0.02 , $p < 0.001$, and PBR 20-25: 2.6 ± 0.2 vs 2.4 ± 0.2 , $p = 0.03$). There was a positive correlation of glycocalyx thickness and central BP with PWV ($p = 0.036$ and < 0.001 , respectively). Patients with stroke exhibited higher left ventricular mass (LV mass = 149.1 ± 56 vs 108 ± 22 g) and left atrial volume (LA vol = 56.3 ± 21.1 vs 30 ± 15 mL), and lower global systolic left ventricular strain (GLSLV = -16 ± 8 vs -21 ± 2 %), left atrial strain at atrial contraction (LA strain = 10 ± 4 vs 25 ± 5 %), and left atrial peak strain (LA peak strain = 20 ± 8 vs 40 ± 10 %) than normal controls ($p < 0.05$), while their relative wall thickness (RWT = 0.43 ± 0.08) was suggestive of concentric hypertrophy. PWV, Aix, and central BP were significantly positively correlated with LA volume, LA strain, LV mass, and RWT ($p < 0.001$ for all comparisons). In addition, LA volume was negatively associated with and LA peak strain ($p < 0.05$), and positively associated with LV mass, IVS, and PW thickness ($p = 0.001$). Finally, GLSLV was positively associated with LA strain ($p = 0.04$).

Conclusions: Abnormal arterial elastic properties are associated with LV hypertrophy, as well as LV diastolic dysfunction. LA dysfunction could provide the substrate of paroxysmal atrial fibrillation and/or blood stagnation and microthrombi formation as a cause of cryptogenic strokes.

ISCHEMIC HEART DISEASE

P534

Detection of coronary microvascular disease using two-dimensional speckle-tracking echocardiography

OM. Galuszka; D. Steffens; J. Friebel; U. Rauch-Krohnert; U. Landmesser; M. Kasner Charite - Campus Benjamin Franklin, Department of Cardiology, Berlin, Germany

Background: Coronary microvascular disease (MVD) is manifested by an angina-like chest pain with a positive response to exercise stress testing and normal coronary angiographic findings. The development of new imaging modalities, such as two-dimensional speckle tracking echocardiography (2D STE), provides a method for the non-invasive assessment of global and local LV function. Previous studies have indicated that 2D STE is more sensitive than conventional echocardiography parameters for detecting subclinical ventricular dysfunction in various clinical disorders.

Aim: The aim of this study was to evaluate the role of left ventricular (LV) systolic strain assessed by two-dimensional speckle-tracking echocardiography for the early detection of myocardial dysfunction in patients with stable angina and proven coronary microvascular disease.

Methods: We compared 45 patients with angiographically documented normal coronary arteries with coronary microvascular disease defined by reduced coronary flow-velocity reserve (CFVR < 2 , assessed by Doppler echocardiography) with 32 healthy persons as a control group (CFVR > 2). Exclusion criteria for both groups were valvular heart disease, cardiomyopathies, inflammatory diseases, myocarditis, vasculitis, arthropathies, Tietze's syndrome, gastrointestinal diseases, aortic diseases, arrhythmias, liver diseases, and alcohol use. All subjects underwent conventional echocardiography including speckle-tracking analysis to assess resting LV function. STE measures were taken from all 16 wall segments. Student's t-test, Mann-Whitney U test, and chi-square test were used to statistically analyze data.

Results: LV systolic function assessed by means of LV ejection fraction (LVEF) was similar for both groups (62.7 vs. 60.6%). Patients with MVD had significantly impaired diastolic function compared with healthy individuals (E/E' 9.5 ± 2.7 vs. 7.7 ± 2.9 , $p < 0.05$). Moreover, global longitudinal strain (GLS): -15.8 ± 2.8 % vs. -17.6 ± 2.5 %; $p < 0.001$) was significantly lower in patients with MVD than in healthy control patients. On the other hand, patients with arterial hypertension presenting with stable angina showed no significant impairment in microvascular (n=16) LV function assessed by means of 2D STE (-17.2 ± 2.7 % vs. -17.6 ± 2.4 %; $p = 0.82$).

Conclusions: Despite normal LVEF significant impairment of LV longitudinal myocardial systolic function was detected with STE in patients with MVD. Therefore, atherosclerosis of small coronary arteries and microvascular dysfunction affects myocardial longitudinal strain which may contribute to patient clinical outcome.

P535

Predictive value of a bi-dimensional transthoracic echocardiographic sign of "

binary image" to identify the anomalous origin of the left circumflex coronary artery from the right coronary sinus

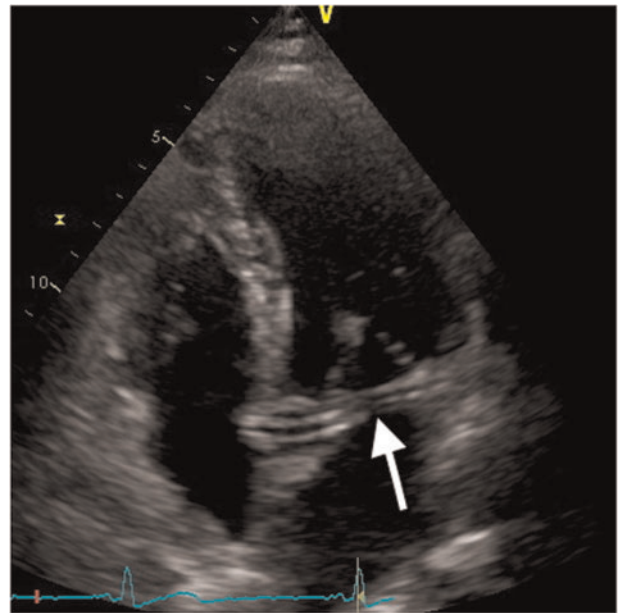
S. Bonapace¹; E. Adamo¹; F. Valbusa¹; C. Ciccio²; A. Rossi³; L. Lanzoni¹; A. Chiampan¹; A. Cecchetto¹; G. Canali¹; E. Barbieri¹

¹Ospedale Sacro Cuore Don Calabria, Division of Cardiology, Negrar, Verona, Italy;

²Ospedale Sacro Cuore Don Calabria, Department of Diagnostic Imaging, Negrar, Italy;

³University of Verona, Department of Biomedical and Surgical Sciences, Section of Cardiology, Verona, Italy

Background: it has been reported a "binary image" projecting into the left atrium above the mitral annulus (Figure) in two-dimensional transthoracic echocardiographic (TTE) 4-chamber view corresponding to an anomalous left circumflex coronary artery (aLCX) originating from the right coronary sinus or the right coronary artery with retro-aortic course. This anomaly has a prevalence of 0.18 to 0.67% and is usually considered a "benign" variant. However, rarely, these patients may develop symptoms due to kinking, narrowing or compression due to its retro-aortic course and a case of sudden death was also described. To date there are no prospective data of the accuracy of this sign in predicting the presence of this anomaly. Purpose: to determine the sensibility, specificity, positive (PPV), negative (NPV) predictive value of this TTE sign in diagnosing the aLCX. Coronary angiography (CA) was used as diagnostic referenced method. Methods: we prospectively enrolled all consecutive patients (aged > 18 years) undergoing CA from November 2014 until April 2016 for various pathological conditions. They underwent a complete TTE before CA. Results: 1372 adult patients were studied. The aLCX was found in 9 patients on CA (prevalence 0.65%). The "binary image" was present in 8 subjects on TTE and in all these patients the diagnosis was confirmed by CA. The only patient in which TTE failed to reveal the sign had a very poor acoustic window in the apical projections. The sensibility, specificity, PPV and NPV of this echocardiographic sign were 90%, 100%, 100% and 99.9% respectively with a diagnostic accuracy of 99.9%. Conclusion: This prospective study demonstrates for the first time that the presence of this TTE sign is typical for this anatomic variant of LCX and shows a high diagnostic accuracy.



Abstract P535 Figure.

P536

Systematic review and meta-analysis of screening for coronary artery disease in asymptomatic diabetic patients

OF. Clerc; TA. Fuchs; J. Stehli; DC. Benz; C. Graeni; RR. Buechel; PA. Kaufmann; O. Gaemperli

University Hospital Zurich, Zurich, Switzerland

Background: Coronary artery disease (CAD) is a major cause of morbidity and mortality in patients with diabetes mellitus, who may be asymptomatic even with advanced CAD. However, the benefit of CAD screening in asymptomatic diabetic patients remains controversial.

Purpose: To perform a systematic review and meta-analysis of prospective randomized controlled trials (RCT) comparing cardiac outcomes in asymptomatic diabetic patients without known CAD randomized to non-invasive CAD screening versus no screening.

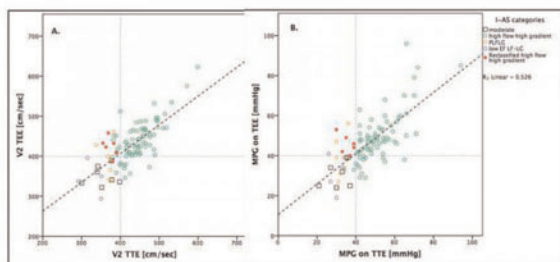
Methods: We performed a systematic search of online databases (PubMed, MEDLINE, EMBASE, Cochrane Library, Scopus, Web of Science) and of reference

Conclusions: Our study demonstrates added value for TEE integrated with TTE in detection severe AS, particularly in patients with moderate AS criteria by TTE but with a DVI ratio ≤ 0.24 .

AS parameters on TTE vs TEE

	TTE	TEE	P value
LVOTD [cm]	2 (1.82-2.1)	2.1 (2-2.2)	<0.001*
AVAi [cm ² /m ²]	0.36±0.09	0.37±0.01	0.38
Highest MPG [mm Hg]	46 (39-54)	46 (39-51)	0.33
V2 [cm/sec]	426±55	425±54	0.85
VTI2 [cm]	109±17.4	106±17.8	0.027*
DVI (VTI1/VTI2)	0.21±0.05	0.2±0.05	<0.001*
Velocity ratio (V1/V2)	0.21±0.04	0.2±0.04	<0.001*

AS-related parameters compared between consecutive TTE and TEE studies of the 100 study patients



Abstract P543 Figure.

P544

The importance of contractile reserve when assessing asymptomatic patients with aortic stenosis

JJ. Van Zalen¹; S. Badiani¹; L. Hart¹; A. Marshall¹; N. Patel¹; G. Lloyd²
¹Eastbourne District General Hospital, Eastbourne, United Kingdom; ²Barts Health NHS Trust, Barts Heart Centre, London, United Kingdom

Asymptomatic patients may exhibit symptoms during objective exercise testing, but whether symptoms are due to the obstructively of the valve (typified by the mean gradient) or underlying ventricular function remains unknown. While the mean gradient is an easy parameter to measure no consensus about the measurement of contractile reserve exists. Longitudinal abnormalities may occur in the presence of a normal ejection fraction and the augmentation of these parameters is poorly described. To obtain an objective regarding patients exercise ability is best determined using cardiopulmonary exercise testing. We therefore examined echocardiographic predictors of exercise ability during cardiopulmonary exercise testing.

24 asymptomatic patients with moderate to severe or severe aortic stenosis and preserved ejection fraction underwent stress echocardiography with simultaneous cardiopulmonary exercise testing. The primary assessment of exercise ability was the VO₂peak and OUES. Echocardiography was measured at rest and during maximal exercise (defined as RER > 1)

OUES and VO₂peak showed a poor relationship with conventional parameters of severity including peak and mean gradients, AVA and dimensionless index, resting systolic function (by EF and TDI). During exercise systolic augmentation had a good relationship with exercise ability but the exercise mean gradient and exercise LVEF did not. Longitudinal systolic function and particularly systolic augmentation is the strongest predictor of exercise ability when compared to conventional measures of severity.

	VO ₂ peak	OUES
S' exercise	Rho=0.69 (p=0.001)	R= 0.71 (p=0.001)
S' rest	Rho=0.52 (p=0.01)	R= 0.44 (p=ns)
Rest AV max V	Rho= 0.09 (p=ns)	R= -0.08 (p=ns)
Rest AV mean PG	Rho= 0.34 (p=ns)	R= -0.10 (p=ns)
Exercise AV max V	Rho=0.43 (p=0.05)	R=0.23 (p=ns)
Exercise AVmean PG	Rho= 0.51 (p=0.001)	R=0.26 (p=ns)
Rest AVA	Rho=0.40 (p=ns)	Rho=0.46 (p=0.04)
Dimensionless index	Rho=0.15 (p=ns)	R=0.13 (p=ns)
LVEF rest	Rho=-0.18 (p=ns)	R=-0.32 (p=ns)
LVEF exercise	Rho=0.18 (p=ns)	R=0.17 (p=ns)

S' - systolic velocity; V - velocity; AV - aortic valve; AVA- aortic valve area; LVEF - left ventricular ejection fraction

P545

Determinants of secondary mitral regurgitation in patients with aortic stenosis and preserved ejection fraction

JM. Bantu-Bimbi¹; L. Jahjah²; D. Schulze²; T. Tran²; T. Peppersack²; JL. Vandenbossche²; P. Unger²
¹ULB-Erasme Hospital, Brussels, Belgium; ²ULB-CHU Saint-Pierre, Brussels, Belgium

Background: Secondary mitral regurgitation (SMR) is common in patients with aortic stenosis (AS) and reduced left ventricular ejection fraction (LVEF). We aimed to assess its prevalence and mechanisms in patients with preserved LVEF.

Methods: Patients presenting a maximal aortic velocity ≥ 2.5 m/s and a LVEF $\geq 50\%$ were assessed by echocardiography. Primary MR, \geq moderate aortic regurgitation, previous aortic or mitral valve surgery, left ventricular outflow tract obstruction, and unfeasible proximal isovelocity surface area method for MR quantification were considered as exclusion criteria.

Results: Sixty patients were included, including 36 (60%) with SMR (mean mitral effective regurgitant orifice (ERO) 9 ± 5 mm², range 3-23 mm²). Only 2 patients had an ERO >20 mm². As compared to patients without MR, larger left atrial (LA) volume, larger mitral E/A and E/e' ratio, lower mitral annular S wave and larger mitral annulus diameter were observed in patients with SMR (Table 1). By contrast, LVEF, maximal aortic velocity and valve area, and longitudinal strain parameters were similar in the 2 groups. By univariable analysis, significant associations were observed between mitral annular diameter, E/e' ratio, LA volume and ERO, and between mitral annular diameter, LV mass, E/A, E/e' ratio, mitral annular septal S wave, LA volume and mitral regurgitant volume. By multivariable analysis, E/e' ratio was associated with ERO (p = 0.003), and mitral annular diameter with regurgitant volume (p = 0.046).

Conclusions: Severe SMR is infrequent in this setting. The associations between the magnitude of SMR and both E/e' ratio and mitral annular diameter reflect the haemodynamic load of SMR but are also consistent with a scenario in which LA dilatation resulting from increased LV filling pressures dilates mitral annulus, thereby increasing SMR which further dilates LA and mitral annulus. This vicious circle, where SMR begets SMR, should be further validated using longitudinal studies.

Table 1

Parameter	SMR+ n=36	SMR- n=24	p value
Left atrial volume (ml/m ²)	45±15	37±18	0.03
LVEF (%)	62±8	62±7	0.87
LV end-diastolic volume (ml)	85±26	80±29	0.50
Maximal aortic velocity	3.74±0.72	3.73±0.79	0.85
Mitral annular diameter (cm)	3.28±0.25	3.12±0.33	0.04
Mitral E/A	0.93±0.44	0.80±0.50	0.03
Mitral E/e'	17.8±6.5	12.8±5.6	0.005

Echo-Doppler values in patients with and without secondary mitral regurgitation

P546

Exercise physiology in patients with mitral annular calcification

G. Pressman¹; Y. Topilsky²; E. Donal³
¹Albert Einstein Medical Center, Philadelphia, United States of America; ²Tel Aviv Sourasky Medical Center, Tel Aviv, Israel; ³University Hospital of Rennes, Rennes, France

Background: Mitral annular calcification (MAC) is frequently encountered on echocardiography, particularly in older subjects and those with chronic kidney disease. It is often associated with a small resting gradient across the mitral valve (MV), but the clinical significance of this gradient is uncertain.

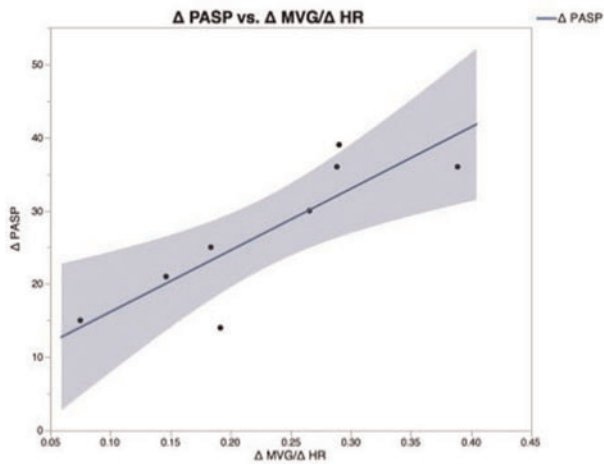
Purpose: To test whether, among patients with MAC, a resting MV gradient (MVG) is associated with exercise limitation and pulmonary hypertension.

Methods: Ten patients (68±12 years, 8 female) with moderate-severe MAC and a resting mean MVG (range 2-17 mm Hg) underwent symptom limited bicycle exercise (25 Watt increments; 2 minutes/stage) with continuous echocardiographic monitoring.

Results: Mean MVG was 7.4 ± 4.2 mm Hg at rest, increasing to 17.0 ± 6.5 mm Hg at peak exercise. Mean pulmonary artery systolic pressure (PASP) was 40 ± 17 mm Hg at rest, and 71 ± 12 mm Hg at peak exercise. Left atrial volume index was

positively correlated with mean resting MVG ($p=0.002$). Rise in PASP with exercise was positively correlated with change in mean MVG normalized to change in heart rate ($\Delta\text{MVG}/\Delta\text{HR}$; $p=0.007$ – see graph).

Conclusions: Among patients with moderate-severe MAC a resting gradient across the MV is correlated with indexed left atrial volume. Change in MVG during exercise is correlated with change in PASP. Thus MAC may be a cause of exercise-related symptoms and reduced exercise tolerance.



Abstract P546 Figure.

P547

Evaluation of left atrial strain in patients with rheumatic mitral stenosis

FA. Castro; O. Azevedo; M. Lourenco; M. Fernandes; I. Oliveira; A. Lourenco; G. Santos
Hospital Senhora da Oliveira, Serviço de Cardiologia, Guimarães, Portugal

Introduction: Rheumatic mitral stenosis (MS) causes left atrial (LA) geometrical changes, due to an increase in LA pressure and volume, and consequently deterioration of its systolic function. LA strain analysis by speckle tracking emerges as a gold standard for evaluation of atrial myocardial deformation.

Aim: To evaluate LA function with strain analysis by speckle tracking in patients with rheumatic MS.

Methods: We included 31 patients with mild to severe rheumatic MS, in sinus rhythm, and 21 healthy controls. All subjects underwent transthoracic echocardiogram, including evaluation of LA diameter and volume and strain analysis by speckle tracking. Peak atrial longitudinal strain (PALS) was measured at the end of the reservoir phase and peak atrial contraction strain (PACS) was measured just before the start of the active atrial contractile phase. The average of PALS and PACS was obtained from the 12 LA segments at apical 4 and 2-chamber views. The LA contraction strain index (CSI) (ratio PACS/PALS x100) was also calculated. SPSS 20.0 was used for statistical analysis.

Results: Patients with rheumatic MS were predominantly female (84%). Mean age was 61 ± 12 , significantly older than healthy controls ($p=0.002$). Patients with rheumatic MS had significantly higher LA diameter (27 ± 5 vs. 20 ± 2 mm/m²; $p<0.001$) and volume (52 ± 19 vs. 22 ± 4 ml/m²; $p<0.001$).

Patients with rheumatic MS had significantly lower PALS (16.1 ± 6.0 vs. 43.6 ± 9.3 , $p<0.001$) and PACS (8.5 ± 4.3 vs. 22.3 ± 5.7 , $p<0.001$). The LA CSI was not significantly different between patients with rheumatic MS and controls (52.2 ± 19.2 vs. $51.9 \pm 10.6\%$, $p=0.944$).

Conclusion: PALS and PACS are significantly decreased in patients with rheumatic MS. Additional studies are required to evaluate the impact of these indices on the risk for development of atrial fibrillation and hence prognosis in patients with rheumatic MS.

P548

Impact of mitral regurgitation on impaired alveolar-capillary membrane diffusion in heart failure with reduced ejection fraction

D. Fina¹; V. Labate¹; A. Gasperetti¹; PL. Laforgia¹; F. Bandera²; E. Alfonzetti²; M. Guazzi¹
¹University of Milan, Heart Failure Unit, IRCCS Policlinico San Donato, Milan, Italy;
²IRCCS, Policlinico San Donato, Heart Failure Unit, San Donato Milanese, Italy

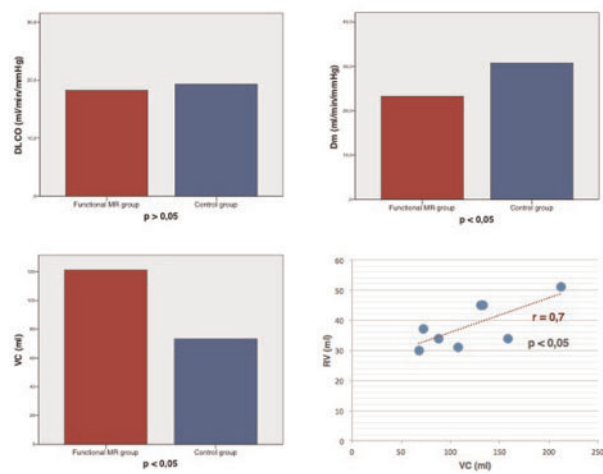
Background: In heart failure (HF) patients, an altered gas diffusing capacity for carbon monoxide (DLCO) is a marker of lung capillary injury that bears relevant clinical and prognostic information. It is unknown whether mitral regurgitation (MR) could play a role in the pathophysiological process of pulmonary microvascular remodeling responsible for an impaired gas diffusion, typical of HF.

Purpose: We aimed at describing the role of an increased capillary volume overload in DLCO impairment in HF patients with functional MR.

Methods: A population of 16 HF patients (mean age 60 ± 10 ; 75% male; mean BMI 27.6 ± 5.3 ; NYHA class I-III; mean left ventricular ejection fraction (LVEF) $32 \pm 8\%$) underwent DLCO measurements with assessment of membrane component (Dm) and capillary blood volume (Vc) and underwent to maximal cardiopulmonary exercise testing (CPET, tilt-ergometer, personalized ramp protocol) combined with Echo-Doppler. Two groups were compared: a functional MR group (8 patients with effective regurgitant orifice area (EROA) > 0.2 cm² and regurgitant volume (RV) > 30 ml) and a control group (8 patients with HF with reduced ejection fraction (HFrEF) with no or mild MR defined by EROA < 0.2 cm² and RV < 30 ml).

Results: No differences were found between the groups in terms of age, BMI, blood haemoglobin, left and right ventricular systolic function, pulmonary systolic pressure and CPET performance. The two groups exhibited similar mild reduced DLCO but MR group showed increased Vc and reduced Dm. A direct correlation between Vc and RV was observed.

Conclusions: In HF patients with functional MR a chronic volume overload determines a proportional increase in Vc. The analysis of the two DLCO components provides relevant clues about the pulmonary microvascular remodeling (reduced Dm) irrespective of increased Vc. For similar degrees of left ventricular remodeling and dysfunction, MR phenotype is detrimental for gas exchange, which appears as an additional demanding therapeutic target.



Abstract P548 Figure.

P549

Edge-to-edge-repair in patients with dilated cardiomyopathy and secondary mitral regurgitation: acute effect on annular geometry

L. Faber¹; W. Scholtz¹; A. Graw¹; N. Bogunovic¹; Z. Dimitriadis¹; S. Scholtz¹; J. Boergemann²; J. Gummer²; D. Horstkotte¹
¹Clinic for Cardiology, Herz- und Diabeteszentrum NRW, Ruhr-Universität Bochum, Bad Oeynhausen, Germany; ²Clinic for Thoracic and Cardiovasc Surgery, Herz- und Diabeteszentrum NRW, Ruhr-Universität Bochum, Bad Oeynhausen, Germany

Objective: To evaluate the effect of catheter-based edge-to-edge mitral valve repair (MVR) with the Mitraclip-System on the geometry of the mitral annulus (MA).

Background and Methods: Restrictive annuloplasty is a surgical approach for severe secondary mitral regurgitation (sMR) in patients (pts.) with left ventricular (LV) dysfunction (LVD). Catheter-based MVR is increasingly used in this population. By intra-procedural 3-dimensional transoesophageal echocardiography (3DE) we analysed whether there is an acute effect of MVR also on MA geometry.

Results: Baseline total ejection fraction was $29.1 \pm 10.1\%$ in 48 pts. with LVD and sMR, 20 of them (42%) under resynchronisation therapy (CRT). In 25 pts. LVD was of ischaemic, and in 23 of non-ischaemic origin. Baseline mitral leaflet tenting height was 8.6 ± 2.6 mm, and maximum MR jet width 17.6 ± 5.4 mm.

After the MVR procedure, all markers of sMR severity decreased after placement of 1-4 (1.7±0.7) clips. In addition, there was a significant reduction of the antero-posterior MA diameter, both measured directly and indirectly, i. e. from the base of the posterior mitral leaflet (PML) to the base of the aortic valve a coronary cusp (ACC) (as clearly defined anatomical landmarks). MA intercommissural diameter did not change (see table).

Conclusions: Catheter-based MVR in sMR not only adapts the mitral leaflets but has an additional and acute remodelling effect on MA geometry by reducing its antero-posterior size. Longer follow-up will determine whether this MA reshaping effect impacts on the degree of sMR reduction.

Variable	baseline	acutely after MVR	p value
MR PISA zone radius (mm)	8.8±2.4	2.1±1.8	0.0001
MR vena contracta width (mm)	7.2±1.5	2.6±1.2	0.0001
MA intercommissural size (mm)	37.8±5.3	38.4±6.0	0.4
MA anterior-posterior size (mm)	33.4±6.1	31.2±6.1	0.0001
MA size PML base to ACC base (mm)	39.8±5.9	34.1±5.9	0.0001

P550

Changes in the management of functional mitral regurgitation in the last 8 years in a tertiary referral hospital

M. Ruiz Ortiz; D. Mesa; M. Delgado; G. Gutierrez Ballesteros; C. Aristizabal Duque; J. Fernandez Cabeza; E. Duran; C. Ferreira; J. Sanchez Fernandez; J. Suarez De Lezo
 Cardiology Department. University Hospital Reina Sofia, Cordoba, Spain

Background and objectives: Management of patients with functional mitral regurgitation (FMR) is not clearly established, and recent interventional procedures, as the percutaneous mitral valve clip repair (MitraClip) has emerged as a promising therapy for these patients in the last years. Our aim was to assess changes in FMR management in the last 8 years in our institution, a tertiary referral hospital in Spain. **Methods:** We prospectively included all echocardiographic studies performed in our institution with the diagnosis of FMR of at least moderate severity in two periods of time: from October 2006 to February 2008 (group 2007) and from January to June 2015 (group 2015). A comparative study of baseline features and subsequent management in the following 6 months was performed. **Results:** A total of 137 patients were included (65 group 2007, 72 group 2015), with a mean age of 64 ± 17 years, 64% male. We observed a lower mean percentage of echocardiograms with FMR diagnosis by month in group 2007 (0.63 ± 0.43 /month) than in group 2015 (1.54 ± 0.14 /month), $p < 0.0005$, and the proportion of first diagnosis versus follow-up studies was different in the two groups (63%/37% in group 2007 versus 29%/71% in group 2015, $p < 0.0005$). We did not find any significant differences in age (64 ± 16 versus 65 ± 18 years), the proportion of females (34% versus 38%), atrial fibrillation (27% versus 35%) or severe FMR (44% versus 50%). Left ventricular (LV) ejection fraction was also similar (0.32 ± 0.14 versus 0.35 ± 0.15), but LV diastolic diameter was smaller (68 ± 9 mm versus 64 ± 12 mm, $p = 0.046$) and systolic pulmonary artery pressure was lower (43 ± 17 mmHg versus 36 ± 13 mm, $p = 0.03$) in group 2015. The rate of transesophageal echocardiogram in the following 6 months was higher in group 2015 (3% versus 10%) although non-significant ($p = 0.10$). We found small numerical differences in management (only medical 86% versus 79%, resynchronization therapy 6% versus 6%, MitraClip implantation 0% versus 7%, heart transplantation 5% versus 7%, and conventional surgery 3% versus 1% in group 2007 versus 2015) but all of them were non-significant. These findings did not change after restricting the analysis only to severe FMR. **Conclusion:** In the last 8 years, we have found in the echocardiography laboratory of our institution a higher mean percentage of echocardiograms with FMR diagnosis by month, a higher proportion of follow up echocardiograms among these patients and a trend towards higher use of transesophageal echocardiogram in this population. Moreover, the echocardiographic data suggest a less advanced stage of the disease at the moment of the diagnostic procedure. These findings may reflect a higher interest of physicians for this entity, as a consequence of the availability of new therapeutic alternatives.

P551

Percutaneous closure of periprosthetic paravalvular leaks under echocardiographic guidance: establishing an alternative to reoperation?

A.I. Azevedo; P. Braga; A. Rodrigues; L. Santos; B. Melica; J. Ribeiro; F. Sampaio; R. Fontes-Carvalho; A. Dias; V. Gama Ribeiro
 Hospital Center Vila Nova Gaia, Porto, Portugal

Introduction: Paravalvular leaks (PVL) are a possible complication after prosthetic valve implantation. Some can cause significant symptoms, namely congestive heart failure and/or haemolysis. Medical therapy is palliative and reoperation has a high mortality rate. Percutaneous transcatheter closure is a promising alternative for symptomatic patients at high surgical risk. We aim to review the efficacy and safety of percutaneous closure of PVL in a consecutive series of patients referred to our Centre.

Methods: Retrospective analysis of clinical and technical procedural data of patients referred to our Centre for percutaneous PVL closure from January 2009 to November 2015. Planning, orientation and evaluation of the procedure was achieved by 3D-echocardiography (Figure 1).

Results: 20 procedures were performed in 18 patients under general anaesthesia, transoesophageal echocardiography and radiographic guidance. 14 mitral PVL were treated in 13 patients and one aortic PVL in one patient. The majority (8) of the PVL were closed in mitral bioprosthesis. Two patients underwent a second intervention, which was technically successful in one of them. Technical success was achieved in 75% (15) of the procedures. At discharge, median NYHA functional class decreased 1 class and haemolytic anaemia decreased from 7 (38.9%) to 2 (11.1%). Two patients had minor bleeding through the femoral vascular access. Survival rates at 6, 12 and 24 months were 77.8%, 77.8% and 61.1%, respectively.

Conclusions: Our experience was globally efficient and safe. The procedure is complex, time-consuming and a second intervention may be necessary. Percutaneous PVL closure may be a feasible alternative for selected symptomatic patients at high surgical risk, not adequately palliated by medical therapy.

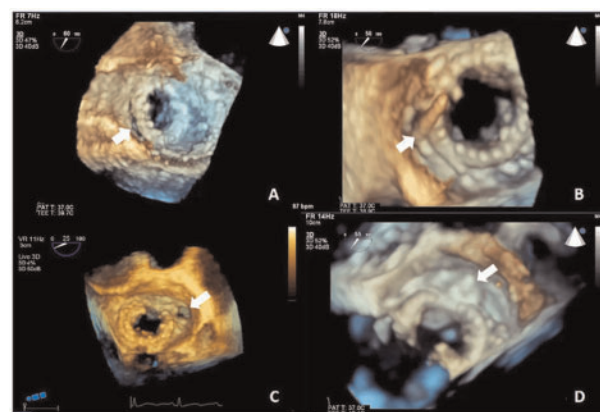
Figure 1. 3D-transesophageal echocardiographic evaluation.

Panel A: a cleft-shaped PVL (white arrow).

Panel B: guidewire positioned in the PVL (white arrow).

Panel C: a circular PVL (white arrow).

Panel D: closure device correctly positioned at the PVL (white arrow).



Abstract P551 Figure.

P552

Clinical profile and predictors of mortality in infective endocarditis with neurologic complications

M. Braga; H. Nascimento; L. Flores; V. Ribeiro; F. Melao; C. Sousa; F. Macedo; P. Dias; M.J. Maciel
 Sao Joao Hospital, Porto, Portugal

Introduction: Infective endocarditis (IE) is complicated by neurologic events in 15-30% of the cases, including ischemic and haemorrhagic stroke, brain abscess, meningitis and infectious aneurysms. Neurologic complications (NC) may difficult the surgical decision-making for cardiac disease and it is associated with excess mortality.

Purpose: Our aim was to describe the clinical profile of patients with IE and NC and evaluate the predictors of in-hospital mortality in these patients.

Methods: We performed a retrospective analysis of 177 consecutive patients admitted in a tertiary hospital with the diagnosis of IE (using Duke criteria) from July 2011 and July 2014 and included 34 patients with IE and NC. Clinical data was collected and inserted in a registry base.

Results: In this cohort, the mean age of patients was 60.7 ± 15.3 years-old, 58.8% males. Regarding to comorbidities, 29.4% of patients had diabetes, 14.7% had chronic obstructive pulmonary disease and 2 patients had end-stage kidney disease in haemodialysis. Fifteen patients had predisposing heart condition for IE. Ischaemic stroke was the clinical presentation of IE in 35.3% of the cases. Brain abscess or mycotic aneurysms were rare. Almost all cases were left IE (50.0% with isolated mitral valve infection and 29.4% with isolated aortic valve infection). Prosthetic valve IE was present in 41.2% of patients. Nearly one third of cases were health-care associated IE. The main causative microorganisms were *Staphylococcus* spp. (38.2%, most of them were methicillin-sensitive *Staphylococcus aureus*), followed by *Enterococcus* spp (20.6%) and *Streptococcus* spp. (14.7%). Echocardiographic images showed abscess formation and/or fistulae in 35.3% of cases and new valvular regurgitation in 50.0% of cases. Six patients (17.6%) had large vegetations (>10mm) and 13 patients (38.2%) had multiple vegetations. From lab analysis, we found that anaemia (mean haemoglobin 10.6 ± 2.2 g/dl) was frequent in these patients. Concerning to IE complications, 9 patients presented acute heart failure (HF), 16 patients had septic embolic events involving other organs (e.g. spleen) and 7 patients had septic shock. In-hospital mortality was 23.5%. No clinical or echocardiographic findings studied were predictors of in-hospital mortality. Health-care associated IE (OR 12.0, $p = 0.009$), lower haemoglobin (OR 0.55, $p = 0.032$), acute HF (OR 8.3, $p = 0.020$) and septic shock (OR 19.2, $p = 0.004$) were predictors of in-hospital mortality.

Conclusions: IE with NC is a serious condition and its management remains challenging, given the scarce literature. This study highlights the patients' main characteristics at baseline and clinical scenario of IE. We found independent predictors of poor prognosis that may help to optimize clinical approach to these patients.

P553

TAVI, arterial stiffness and ventricular-arterial coupling

E. Sciatti; E. Vizzardi; I. Bonadei; F. Platto; M. Metra
 University of Brescia, Cardiology, Department of Medical and Surgical Specialties, Radiological Sciences and Public Health, Brescia, Italy

Background: transcatheter aortic valve implantation (TAVI) is a percutaneous intervention for patients affected by severe aortic stenosis not suitable for cardiac surgery, typically the eldest. The ageing process itself is responsible of vascular and ventricular stiffening. Arterial stiffness and ventricular-arterial coupling (VAC) are independent prognostic factors in patients suffering from heart failure (HF).

Purpose: we aimed at evaluating arterial stiffness and VAC before and early after TAVI.

Methods: 30 patients scheduled for TAVI were enrolled. Within 3 day before and at least 3 day after the procedure they underwent radial artery applanation tonometry to

evaluate, central blood pressures, augmentation pressure (AP) and augmentation index (Alx@75), and transthoracic echocardiography to calculate the aortic elastance (Ea), the end-systolic left ventricular elastance (Ees) and their ratio, namely VAC.

Results: mean age was 81±7 years. 15 (50.0%) were male. Functional aortic valve area was 0.7±0.2 cm², peak gradient 84±28 mmHg and mean gradient 51±18 mmHg. Hemodynamic parameters are reported in Table 1. After TAVI there was a great improvement in Alx@75 and central blood pressure. Moreover, a tendency to amelioration was found for stroke volume and VAC, without statistical significance.

Conclusion: TAVI is associated to an early improvement in arterial stiffness and central hemodynamics. This may be due to a normalization of blood flow through the ascending aorta. Considering the prognostic role of these factors in patients with HF, TAVI is of growing importance under different points of view.

Table 1

Variable	Before TAVI	After TAVI	p
Aortic SBP (mmHg)	121±21	114±18	0.069
Aortic DBP (mmHg)	71±13	65±10	0.012
Aortic MAP (mmHg)	90±15	83±12	0.013
Aortic PP (mmHg)	50±17	49±13	0.652
Alx@75 (%)	32±13	22±11	<0.001
Stroke volume (mL)	75±18	84±28	0.071
Ea (mmHg/mL)	1.7±0.6	1.5±0.5	0.196
Ees (mmHg/mL)	2.1±0.9	2.0±0.8	0.645
VAC	0.9±0.4	0.9±0.3	0.442

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

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Low contrast media CT angiography prior to transcatheter aortic valve implantation procedure

A. Annoni; A. Formenti; ME. Mancini; G. Pontone; D. Andreini; L. Fusini; M. Muratori; S. Mushtaq; M. Guglielmo; M. Peçi
Cardiology Center Monzino (IRCCS), Department of Cardiovascular Sciences, University of Milan, Milan, Italy

Purpose: To evaluate feasibility, image quality and accuracy of a reduced contrast volume protocol for pre-procedural CT imaging in transcatheter aortic valve implantation (TAVI).

Methods: Fourty consecutive patients (23F, mean age 81.5±5.2y, mean BMI 25.6±4.6) referred for TAVI were examined with wide-array novel CT scan with a combined scan protocol: retrospective ECG-gated axial CTA of the heart and thoracic aorta followed by a high-pitch spiral CTA for abdominal aorta and iliac-femoral arteries. A total amount of 50 ml contrast agent was used. Image quality was graded on a visual scale (4-1). Contrast attenuation values (HU) and contrast-to-noise ratio (CNR) were measured at the level of the aortic root, ascending/descending aorta, subrenal aorta and at the level of right and left common femoral arteries. Aortic annulus measurements were compared with final procedural results. Patients creatinine was monitored at the baseline and 72h after procedure.

Results: No exams were classified as not diagnostic. Mean quality score was 3.4±0.8. Mean HU and CNR at the aortic root, ascending/descending aorta subrenal aorta and at the level of right and left common femoral arteries were: 576.4±56.5, 581.2±78.4, 551.1±93.4, 515.2±77.6, 509.7±113.4, 495.3±113.09 HU respectively and 13.8±2.3, 15.7±1.7, 14.9±3.1, 15.8±4.7, 21.3±9.9, 21.8±7.9 respectively. 39 out 40 pts underwent TAVI procedure. In 37 pts (95%) CT measurements were comparable to the size of the implanted valve prosthesis. No patients had severe aortic regurgitation. Mean creatinine before CT and 72h after procedure were 1.16±0.42 and 1.14±0.39 mg/dl. Mean DLP was 462.4±121.2 mGy/cm.

Conclusions: CT with low contrast volume is feasible and clinically useful, allowing accurate pre-procedural TAVI planning and reducing the risk of contrast induced nephropathy.

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Hemodynamic and prognostic impact of permanent pacemaker implantation following transcatheter aortic valve implantation

M. Drakopoulou; K. Toutouzias; K. Stathogiannis; A. Michelongona; G. Latsios; A. Synetos; G. Trantalos; S. Sideris; G. Lazaros; D. Tousoulis
University of Athens Medical School, 1st Department of Cardiology, Athens, Greece

Background: Transcatheter aortic valve implantation (TAVI) may lead to post-procedural conduction system abnormalities and permanent pacemaker (PPM) implantation. Right ventricular pacing in turn may lead to desynchronization and reduced left ventricular ejection fraction (LVEF).

Purpose: We evaluated the hemodynamic and prognostic impact of PPM after TAVI.
Methods: Patients with severe and symptomatic aortic stenosis (effective orifice area [EOA]≤1cm²), who were scheduled for TAVI with a self-expanding valve at our institution, were consecutively enrolled. Prospectively collected clinical and echocardiographic data before and after TAVI were retrospectively analyzed in all patients. Echocardiographic parameters included left ventricular ejection fraction (LVEF), systolic pulmonary artery pressure (SPAP), and aortic, mitral, and tricuspid regurgitation grades. The primary clinical end-point was cumulative 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. The primary clinical end point occurred in 42 patients (23.6%) during a follow-up period of 24.8±20.4 months. PPM was required in 77 patients (43.2%). Patients that did not receive PPM demonstrated significant improvement in LVEF (preLVEF: 49.8±9.1% versus postLVEF: 51.0±8.5%, p<0.01) and SPAP (preSPAP: 45.7±13.3mmHg versus postSPAP: 42.3±9.6mmHg, p<0.01) after TAVI. Patients that received PPM demonstrated attenuated improvement in LVEF (preLVEF: 52.1±8.7% versus postLVEF: 52.7±7.6%, p=0.21) and SPAP (preSPAP: 41.6±10.5mmHg versus postSPAP: 40.0±8.8mmHg, p=0.13). The differences in post-TAVI aortic, mitral, and tricuspid regurgitation grades were insignificant. The mortality rate did not differ between patients that received PPM (20/77) and patients that did not (22/97) (25.9% versus 22.6%, p=0.72)

Conclusions: PPM implantation after TAVI is associated with attenuated improvement in LVEF. However, this unfavourable hemodynamic response does not affect the clinical outcome.

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Impact of transfemoral aortic valve implantation or surgical aortic valve replacement on right ventricular function in the early postprocedural phase

A. Mas-Stachurska; M. Cladellas; M. Ble; B. Vaquerizo; N. Farre; L. Molina; M. Gomez; R. Millan; J. Marti
Hospital del Mar, Cardiology, Barcelona, Spain

purpose: The postoperative right ventricular (RV) dysfunction is linked to adverse outcomes after surgical replacement of the aortic valve (SAVR). The objective of this study was to assess RV function in the early postoperative period (first 2 weeks) after SAVR and transfemoral aortic valve implantation (TAVI) using standard and advanced echocardiographic measures (Speckle Tracking Strain and Tissue Doppler) in order to gain further insight into the changes of RV performance in patient undergoing SAVR or TAVI. **METHODS:** We performed echocardiographic evaluation in 22 patients: 12 undergoing SAVR and 10 undergoing TAVI. Both groups show no differences in mean age: 81.17 vs 82.6 years, sex: 50% male, 50% female, left ventricle ejection fraction (LVEF): 62% vs 60.4% and body surface: 1.74 m² vs 1.56m², (respectively, p>0.05). Echocardiographic measurements included: RV free wall longitudinal strain (RV strain), tricuspid annular plane systolic excursion by M mode (TAPSE), pulsed Doppler systolic velocity at the tricuspid annulus (S' TD), RV diastolic and systolic area (DA, SA), RV fractional area change (FAC) and also parameters related to the pulmonary pressure: tricuspid regurgitation peak velocity (TRV), right atrium area (RA area) and systolic pulmonary artery pressure (SPAP). **RESULTS:** Although the TAVI group had worse baseline characteristics, RV function improved in this group (TAPSE, S' TD, RA area, SPAP) whereas significant deterioration of RV function was observed in patients undergoing SAVR (RV strain, TAPSE and S' TD, p<0,05). Table 1. **CONCLUSION:** While RV function experiences immediate improvement after TAVI it deteriorates significantly after SAVR. These data suggest that high risk patients with pre-existing RV dysfunction may benefit from TAVI.

Table 1.

	RV Strain (%)	TAPSE (mm)	S' TD (cm/s)	RV DA (cm2)	RV SA (cm2)	FAC (%)	RA area (cm2)	TRV (m/s)	RV/RA gradient (mmHg)	SPAP (mmHg)
SAVR Pre	30,11	21,7	12,05	15,86	7,63	52,18	15,61	2,84	34,16	40,04
SAVR Post	19,16	16,14	9,8	16,8	8,45	49,44	15,63	2,65	28,75	35,83
P*	0,004	<0,001	0,001	0,178	0,113	0,187	0,983	0,179	0,106	0,161
TAVI Pre	24,7	18,07	8,99	21,4	11,88	44,27	20,4	3,2	41,53	49,24
TAVI Post	28,93	20,07	10,6	18,54	9,33	47,41	17,3	2,7	29,33	35,04
P*	0,002	0,002	0,051	0,017	0,006	0,316	0,006	0,011	0,014	0,004

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Effects of atrial fibrillation in patients undergoing mitral valve repair with the mitraclip system:one-year outcomes from the GRASP registry

AM. Caggegi; S. Scandura; P. Capranzano; S. Mangiafico; G. Ronsivalle; M. Chiaranda; S. Giaquinta; A. Popolo Rubbio; S. Farruggio; S. Buccheri; S. Imme; G. Castania; ME. Di Salvo; D. Capodanno; C. Tamburino
Ferrarotto Hospital - Institute for Cardiology, Department of Cardiovascular, Catania, Italy

Purpose – Atrial fibrillation (AF) is common in patients with mitral regurgitation (MR) referred for therapy, being often associated with more advanced valvular disease and non cardiac comorbidities. However, specific data on the impact of this condition on the outcomes after percutaneous mitral valve repair are limited. The aim of this prospective, observational study was to characterize one-year outcomes of MitraClip therapy in high surgical risk patients with moderate-to-severe or severe MR with or without AF.

Methods – Patients enrolled in the prospective Getting Reduction of Mitral Insufficiency by Percutaneous Clip Implantation (GRASP) who were eligible at one-year follow-up were included in the present analysis. The primary efficacy endpoint was the composite of death, surgery for mitral valve dysfunction and grade 3+ or 4+ MR at one-year follow-up. Secondary endpoints were the components of the primary endpoint, re-hospitalization rates and functional NYHA class. Also echocardiographic parameters at baseline and one-year follow-up were assessed.

Results – A total of 259 patients were included: 153 (59.1%) without AF and 106 (40.9%) with AF. Forty-seven patients (18.1%) presented with degenerative MR and 212 patients (81.9%) with functional MR. Comparable clinical and echocardiographic baseline characteristics were observed between the two groups except for age, STS

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score and left atrial (LA) volume (worst in the AF group). All patients had a post-procedural residual MR \leq 2+. At one-year follow-up, no significant differences were reported in terms of primary end-point (17.4% in patients with AF versus 17.6% in patients without AF, p= 0.626). Secondary endpoints rates concerning the two groups are reported in Table 1. No statistically significant differences were observed. At one-year follow-up, a significant reduction in left ventricular volumes was observed regardless of AF; no relevant changes were reported in LA volumes.

Conclusions – The MitraClip procedure was associated with low rates of adverse events in patients with AF, reporting one-year outcomes comparable to patients without AF.

Table 1. One-year outcomes in patients w

	No AF	AF	p
Death	13.5%	16.3%	0.661
Surgery for mitral valve	-	-	-
MR grade \geq 3+	5.0%	8.3%	0.154
Re-hospitalization	7.5%	18.4%	0.063
NYHA functional class \leq 2	91.2%	85.2%	0.396

AF, atrial fibrillation; MR, mitral regurgitation; NYHA, New York Heart Association.

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Who will not benefit from cardioversion

M. Leitman; V. Tyomkin; E. Peleg; T. Fuchs; Z. Gabara; Z. Vered
Assaf Harofeh Medical Center, Zerifin, Israel

Background. During last years cardioversion of atrial fibrillation has become routine procedure and often brings symptomatic and functional improvement. Nevertheless, there is a group of patients, that have a complicated course after the cardioversion. Identification of these individuals is important before decision about management. In this work we attempt to characterize those patients that do not benefit from cardioversion.

Methods. 186 episodes of cardioversion in 163 patients with atrial fibrillation admitted in the department of Cardiology during 2008-2013 were analyzed retrospectively regarding the clinical and echocardiographic data. Patients were divided into 2 groups: uncomplicated cardioversion and patients with complicated course.

Results. Of 186 patients 112 were men [60%] and 74 were women [40%], p<0.00001. 25 patients had a complicated course [13%]. Patients with complications after cardioversion were older [72 vs 65, p<0.01], more often died [48% vs. 16%], were more often diabetic 52% vs. 27%, p=0.005, more often underwent urgent cardioversion 64% vs. 40%, p=0.01. Patients with complications more often had left ventricular hypertrophy: left ventricular mass 260 vs. 218 g, p=0.01 and larger left atrium: left atrial volume: 128 vs 102 ml, p<0.009. They more often had significant mitral regurgitation 20% vs. 4%, p=0.03, and higher pulmonary artery pressure 50 vs. 42 mm Hg, p<0.02.

Conclusions. People with complications after cardioversion are older, are more often diabetic and more often have severe mitral regurgitation. In these older diabetic patients with severe mitral regurgitation, enlarged left atrium and pulmonary hypertension, the decision about cardioversion should be weighted on thoroughly.

	Sev Reg	PAH+SO	DM	Age \geq 59	Urgent	EF<40	IV<1.4	LA>32	LV<120	LA>120
Sev Reg	25% p<0.0001									26% p=0.003
PAH+SO	21% p<0.0001	31% p<0.0001	19% p=0.001	22% p=0.0001	30% p<0.0001	40% p<0.0001	23% p=0.003	25% p=0.001	23% p=0.0001	
DM	31% p<0.0001				20% p=0.002	25% p=0.0003			18% p=0.000	
Age \geq 59	19% p=0.0041						15% p=0.02			15% p=0.001
Urgent	22% p<0.0001				17% p=0.001	14% p=0.02	21% p=0.001			
EF<40	30% p<0.0001	20% p=0.002			17% p=0.001		17% p=0.006	16% p=0.01	17% p=0.001	
IV<1.4	40% p<0.0001	25% p=0.0003			14% p=0.003		13% p=0.02		17% p=0.001	
LA>32	23% p=0.0003		15% p=0.02	21% p=0.001	17% p=0.001		11% p=0.03			
LV<120	25% p<0.0001		18% p=0.004			16% p=0.01				
LA>120	26% p=0.002	23% p=0.001	15% p=0.008		17% p=0.01	17% p=0.01				10% p=0.01

Sev Reg - Severe Mitral or Aortic Regurgitation, PAH - pulmonary artery pressure, DM - diabetes mellitus
EF - ejection fraction, IV - interventricular septum, LA - left atrial area, LV - left ventricular mass, g.
LA - left atrial volume, ml. *EF<40+DM+Urgent predicts mortality 27% p<0.00001
EF<40+DM+Urgent+PAH predicts death 35%, p<0.00001, *PAH+SO: Vmax>30g/urgent predicts death 30%, p<0.00001

Abstract P558 Figure.

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Is there residual mechanical dyssynchrony after initial IEGM optimization in cardiac resynchronization patients?

J. Ljubas Macek¹; V. Reskovic Luksic¹; M. Pasalic¹; B. Pezo Nikolic¹; M. Brestovac¹; J. Separovic Hanzevacki²

¹University Hospital Centre Zagreb, Department of cardiovascular diseases, Zagreb, Croatia; ²University of Zagreb School of Medicine, and University Hospital Centre Zagreb, Dpt. of cardiovascular diseases, Zagreb, Croatia

Background: After cardiac resynchronization therapy (CRT), AV delay is usually set by "out of box" value while optimal VV interval is set using intracardiac electrocardiogram method (IEGM) according to the narrowest QRS width, regardless of the actual mechanical response of the left ventricle (LV). Purpose: Our aim was to assess the presence of residual mechanical dyssynchrony after IEGM device optimization using echocardiographic parameters and to define functional response of the LV. Methods: 34 CRT patients (Pts), with native LBBB and in sinus rhythm, were included in the study. Early post implantation IEGM device optimization was performed followed by „zero“ echocardiography-based optimization prior to discharge. LV preexcitation (in sequential 10 ms intervals) was modified according to the presence of early presystolic septal motion („septal flash“), LV ejection fraction (LVEF) and global longitudinal strain (GLS). Results: Mean biventricular paced QRS duration was 143±35 ms, mean IEGM VV delay 19 ms. After IEGM optimization 55.8% (N=19) of Pts still had the presence of septal flash, 62% (N=22) had prolonged septal-to-posterior wall mechanical delay (\geq 130 ms) and 59% (N=14) prolonged tissue-doppler septal-to-lateral delay (SL delay \geq 60 ms). Mean LVEF was 28.7±1.5%, GLS -7.6±0.6, mean LV outflow-tract (LVOT) VTI was also reduced (13.2±1.0 cm) as well as LVOT velocity (0.7±0.1 m/s), mean LV ejection time 247.7±7.5 ms. Early after implantation diastolic dysfunction was mostly grade 1 (77% Pts, N=27), with grade 2 present only in 11.7% (N=4) and grade 3 in 8.8% (N=3). Mean E/e' ratio was 14 with diastolic filling time corrected for RR interval 43.1±1.6 %. Interventricular mechanical delay (by PW Doppler) of 37.7±7.2 ms ruled out the presence of interventricular dyssynchrony. IEGM AV delay was consequently modified in 35% of Pts (N=22) for average of 12 ms and VV delay in 80% (N=27) for average of 22 ms. Conclusion: After IEGM-based device optimization significant number of patients still has the presence of septal flash and its unfavourable consequences of intraventricular mechanics, resulting in generally reduced LV performance in spite of narrowest paced QRS duration and satisfying diastolic filling. Residual septal-to-posterior mechanical delay was also found in more than half of the Pts. In one third of patients AV delay was modified while the majority needed VV optimization. In spite of optimal paced QRS, majority of the patients still have unsatisfactory mechanical response that could be improved by echocardiography-based CRT optimization immediately after implantation.

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Left ventricular reverse remodeling in dilated cardiomyopathy- maintained subclinical myocardial systolic and diastolic dysfunction

S M R Amorim¹; J. Rodrigues¹; M. Campelo¹; B. Moura²; E. Martins¹; F. Macedo¹; J. Silva-Cardoso¹; M.J. Maciel¹

¹Sao Joao Hospital, Porto, Portugal; ²Military Hospital, Porto, Portugal

Introduction: Left ventricular reverse remodeling (LVRR) is characterized by decrease of left ventricular dimensions, normalization of left ventricular shape and improvement of systolic function. In idiopathic dilated cardiomyopathy (DCM), myocardial deformational parameters and their relationships remain incompletely characterized, so we measured those parameters in pts with DCM, comparing the results after optimal pharmacologic therapy, particularly in pts with LVRR.

Methods: Prospective study of 50 DCM pts (28 men, aged 59±10 years, in sinus rhythm, followed for 39±22 months), with left ventricular ejection fraction (EF) < 40%. During follow-up, RR was defined as an increase of 10 units of EF and decrease of diastolic left ventricular diameter (LVD) in the absence of resynchronization therapy. We performed morphological analysis, myocardial performance quantification with LV and RV Tei indexes and LV averaged peak systolic longitudinal (SSlong) strain and circumferential strain (SScirc).

Results: At baseline, mean EF was 25.4±9.8%, LVDD was 62.4±7.4mm, LVD/BSA of 34.2± 4.5 mm/m² and 34 % had MR grade > II/IV. RR occurred in 34% of patients within 17.6±15.6 months and was associated to lower BNP (143.5±137.5 vs 36.9±34.3, p<0.01 and a reduced rate of death or HF hospitalization (5.9 % vs 33.3; p=0.03). Patients with RR had a final EF of 48.9 ±7.9% (Δ LV EF of - 22.4 %), and was significant decrease (p<0.05) in: LVD/BSA, LV systolic diameter/BSA, LV diastolic volume, LV systolic volume, LV mass; an increase (p<0.05) in sphericity index and only 5.9 % had a final MR \geq grade II/IV. However, measures of diastolic function were not significantly different from baseline: LA dimension, LA volume/BSA, evelocity and E/e'ratio. There weren't significant changes in LV Tei index from baseline (basal: 0.82±0.38 to 0.74±0.23, p=0.45). This was also true for RV Tei index. Additionally, final strain values were not different from basal: SSR circumferential: -8.48±2.85 % vs -4.80±4.02 % (p=0.31), SSR longitudinal: - 10.27±3.77 % vs - 13.06±2.90 % (p=0.08). In the group of patients who improved EF> 50% (n=10), SSR circumferential was inferior to normal (- 10.0 ±4.1%) and SSR long was inferior, although close to normal values (- 13.1±3.5%).

Conclusion: Improvement in EF occurred in 34% of DCM pts and was associated with a decrease of BNP and major cardiac events. There was a decrease in diastolic and systolic dimensions and volumes and in sphericity index, confirming truly LV

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Left atrial volume and not diameter is the main determinant of atrial fibrillation in patients with hypertrophic cardiomyopathy

M. Rosca; L. Mandes; A. Calin; CC. Beladan; R. Enache; A. Mateescu; C. Baicus; C. Ginghina; BA. Popescu

"Carol Davila" University of Medicine and Pharmacy, Eurocolab, Bucharest, Romania

Background: The outcome of patients (pts) with hypertrophic cardiomyopathy (HCM) is adversely affected when atrial fibrillation (AF) occurs. Left atrial (LA) remodeling is an important determinant of AF in pts with HCM. The ESC 2014 guidelines on HCM recommend LA diameter as the main LA parameter to evaluate the risk of AF.

Purpose: To assess the relationship between LA remodeling (size, function) and the presence of paroxysmal AF and to identify predictors of persistent or permanent AF occurrence in pts with HCM.

Methods: A comprehensive echocardiogram was performed in 91 consecutive pts with HCM in sinus rhythm (52 ± 17 years, 42 men). The LA antero-posterior diameter and maximal volume were measured and indexed to BSA (LADi, LAVi). Left ventricular (LV) filling pressures were assessed using the E/e' ratio (e' average). LA function was assessed with speckle tracking echocardiography: LA reservoir function by peak systolic strain (ϵ) (LA ϵ); LA conduit function by early diastolic strain rate (Sr) (ESr); and LA pump function by late diastolic Sr (ASr). Global longitudinal LV strain (GLS) was also measured. These pts were followed for 3.9 ± 1.9 years, recording the occurrence of persistent or permanent AF.

Results: Twenty four pts had documented paroxysmal AF at the time of inclusion in the study. Patients with paroxysmal AF were older ($p=0.01$), had higher values of LAVi ($p=0.001$), and lower values of LA ϵ ($p=0.002$), ESr ($p=0.03$) and ASr ($p=0.001$) compared to pts without paroxysmal AF. There were no significant differences between pts with and without paroxysmal AF with respect to LADi, GLS, E/e', mitral regurgitation (MR) severity, presence or severity of LV outflow tract obstruction ($p>0.05$ for all). Receiver operating characteristic curve analysis showed that ASr, LAVi and age have a good discriminative value in distinguishing pts with those without paroxysmal AF (AUC = 0.72, 0.71, 0.68 respectively, $p<0.007$ for all). In multivariate analysis, only age ($p=0.01$) and LAVi ($p=0.04$) were independently correlated with the presence of paroxysmal AF. Sixteen pts developed persistent or permanent AF during follow-up. These pts had higher values of LV mass ($p=0.04$), LADi ($p=0.002$) and LAVi ($p<0.001$), lower values of LA ϵ ($p=0.005$) and ASr ($p=0.001$), and tended to be older ($p=0.07$) and with more severe degree of MR ($p=0.07$). In multivariate analysis only LAVi ($p=0.003$) and age ($p=0.01$) were independently correlated with the occurrence of persistent or permanent AF during follow-up. Of note, eleven pts with paroxysmal AF (46%) and 6 pts with persistent or permanent AF (37%) had LAD <45 mm.

Conclusions: In patients with HCM, age and LA volume and not LA diameter correlated independently with the presence of paroxysmal AF and with the occurrence of persistent or permanent AF. LA volume might be a better parameter than LA diameter for assessing the risk of AF in HCM and it should be measured and followed in these pts.

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Assessment of papillary muscle mass, apical displacement and mitral valve function in children and young adults with hypertrophic cardiomyopathy using three dimensional echocardiography

N. Joseph¹; L. Li¹; M. Craft¹; L. Milil²; C. Erickson²; S. Kutty¹

¹University of Nebraska Medical Center, Paediatric Cardiology, Omaha, United States of America; ²Children's Hospital and Medical Center, Paediatric Cardiology, Omaha, United States of America

Background/Introduction

It has been suggested that papillary muscle (PM) and mitral valve (MV) abnormalities may appear earlier than manifest left ventricular (LV) hypertrophy in the clinical presentation of hypertrophic cardiomyopathy (HCM). Hypertrophied PMs and abnormal anterior PM fusion to the LV walls can promote systolic anterior motion of MV and LV outflow tract obstruction. Little is known about PM and MV changes in young patients with HCM, particularly in earlier stages of disease. We hypothesized that increased PM mass and apical displacement are present in younger patients with mild and moderate HCM, and investigated PM and MV structure and function using real-time three-dimensional echocardiography (3DE).

Methods: Transthoracic research 3DE was performed in HCM patients and age and gender matched controls (iE33; X7-2t; Philips). Anterolateral and posteromedial PM mass, and apical displacement of anterolateral PM were measured (4 D Cardioview 3.0) and indexed to body surface area. The MV annulus structure and function was analyzed (4D MV 2.0, TomTec). Individual PMs were manually planimeted by tracing the endocardial borders on each mid systole frame, taking care to distinguish PMs as distinct from the LV wall. Apical displacement of the PM was expressed as ratio of the distance between the apex and the base of the anterolateral PM to the entire length of the LV lateral wall (APM ratio).

Results: Twenty-six subjects were studied, including 13 HCM patients (age 20.5 ± 12.9 years, 10 male and 3 female), and 13 controls (20.6 ± 13.0 years, 10 male and 3 female). The indexed LV mass in HCM was 100 ± 46 compared to 58 ± 20 in controls ($p < 0.01$). The anterolateral and combined PM mass were 3.8 ± 1.5 g/m² and 5.7 ± 1.8 g/m² in HCM, and differed from respective measurements of 2.1 ± 0.6 g/m² ($p < 0.01$) and 4.4 ± 0.7 g/m² in controls ($p < 0.05$). The posteromedial PM mass in HCM (2.0 ± 0.9 g/m²) was not statistically different from controls (2.3 ± 0.6 g/m², $p=0.153$). The mitral valve annular parameters (annulus circumference, height

and area) in HCM also did not show significant difference from controls. The APM ratio in HCM was lower (0.4 ± 0.1 vs. 0.5 ± 0.05 in controls, $p < 0.01$).

Conclusion: It is feasible to assess PM size and function in children and young adults with HCM using 3DE. The APM ratio is decreased in HCM from apically displaced anterolateral PM. This data suggests that morphologic and functional changes of anterolateral PM may precede the mitral valve annulus changes. Associations of PM indices with clinical outcomes in HCM need to be explored.

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Combining tissue Doppler-derived Tei index and two-dimensional speckle tracking imaging derived longitudinal strain to predict outcome of patients with light-chain cardiac amyloidosis

D. Liu¹; K. Hu¹; S. Herrmann¹; M. Cikes²; G. Ertl¹; F. Weidemann³; S. Stoerk¹; P. Nordbeck¹

¹University of Wuerzburg, Department of Internal Medicine I, Comprehensive Heart Failure Center, Wuerzburg, Germany; ²University Hospital Center Zagreb and School of Medicine, University of Zagreb, Department for Cardiovascular Diseases, Zagreb, Croatia; ³Katharinen-Hospital, Medical Clinic II, Unna, Germany

Background: Light-chain cardiac amyloidosis (AL-CA) is related to a poor prognosis. Speckle tracking imaging (STI) derived longitudinal systolic and diastolic deformation parameters and Doppler-derived left ventricular (LV) Tei index are valuable predictors for outcome of AL-CA patients. We compared the incremental prognostic values of Tei index and deformation parameters in AL-CA patients.

Methods: LV systolic and diastolic function including tissue-Doppler derived LV Tei index and STI derived deformation parameters were evaluated by echocardiography in 58 consecutive AL-CA patients (age 64 ± 10 years, 53.4% male). All patients completed one-year clinical follow-up (median 365, quartiles 121-365 days). The primary end point was all-cause mortality.

Results: Nineteen (32.8%) patients died during follow-up. Tei index (0.89 ± 0.29 vs. 0.61 ± 0.16 , $p < 0.001$) and E to global early diastolic strain rate ratio (E/GLSRdias) were higher while global systolic strain (GLSsys) was lower in non-survivors than in survivors (all $p < 0.05$). Multivariable Cox regression analysis showed that Tei index, NYHA functional class, GLSsys and E/GLSRdias were independent predictors of all-cause mortality risk, with Tei index ≥ 0.9 representing the best utility of a poor outcome (HR 7.01, 95%CI 2.43-20.21, $p < 0.001$). Prediction performance (c-statistic) for one-year mortality was 0.85 for Tei index, 0.77 for GLSsys, and 0.72 for E/GLSRdias. Combined analysis with Tei index ≥ 0.9 and GLSsys absolute value $\leq 13\%$ yielded excellent specificity for all-cause death (100%) and survival (95%).

Conclusions: One-year mortality risk in AL-CA patients can be reliably predicted by deformation markers and Tei index. Their combination has additional prognostic yield that should be confirmed in future prospective follow-up studies.

P567

Left and right ventricular dysfunction in patients submitted to chemotherapy with anthracyclines - predictive value of myocardial deformation imaging

AC. Gomes; LR. Lopes; LR. Lopes; M. Correia; AG. Ferreira; H. Mansinho; M. Correia; H. Mansinho; H. Pereira; H. Pereira

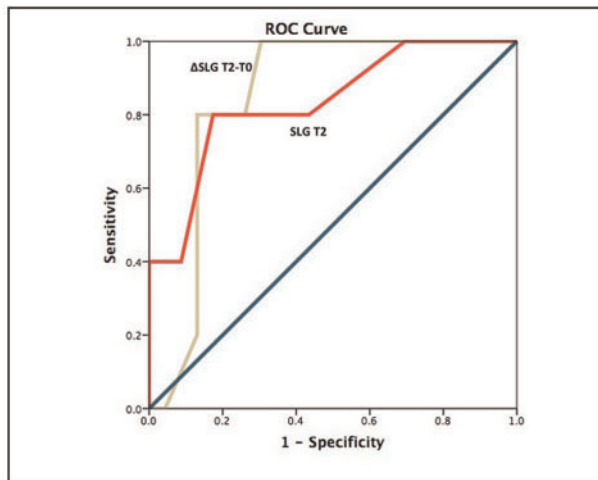
Hospital Garcia de Orta, Cardiology, Almada, Portugal

Introduction: Cardiotoxicity can be a side effect of chemotherapy (CT) with anthracyclines and other drugs. Echocardiographic monitoring to detect early left ventricular dysfunction is mandatory in patients (pts) undergoing these drugs.

Methods: Prospective echocardiographic study of a cohort of pts referred to CT with anthracyclines. The echocardiographic evaluation was performed one week before the beginning of treatment (T0), 1 week after the first cycle (T1), one week after the third cycle (T2), one week after the end of CT (6 to 8 cycles - T3) and one-one and a half years after the end of treatment (T4). In each moment, a conventional echocardiogram was performed, including evaluation of the left and right ventricular dimensions, systolic and diastolic function as well as 2D-speckle tracking assessment of the left ventricle (LV).

Results: 83 pts (breast cancer, $n = 54$, 12 (22%) c-erbB2-positive - submitted to trastuzumab; lymphoma, $n=20$; gastric, $n=9$). Treated with doxorubicin, $n=38$ (252.9 ± 97.3 mg/m²) and epirubicin $n=44$ (313.0 ± 199.5 mg/m²). Age 51.8 ± 12.7 years; 65 (78.3%) females. A progressive and significant reduction in global longitudinal strain (GLS) during CT was observed: T0 ($-20.4 \pm 5.8\%$), T1 ($-19.6 \pm 2.7\%$), T2 ($-19.1 \pm 2.4\%$), T3 ($-17.3 \pm 5.3\%$), $p < 0.0005$ with subsequent stabilization at T4: $-18.3 \pm 2.4\%$, $p=0.199$ vs T3. The LV ejection fraction (LVEF) also decreased significantly during treatment: T0 ($65.0 \pm 4.2\%$), T1 ($63.0 \pm 3.6\%$), T2 ($62.3 \pm 2.7\%$), T3 ($60.2 \pm 5.0\%$), $p < 0.0005$, and stabilized after the last cycle: T4 ($62.2 \pm 5.0\%$, $p=0.122$ vs T3). In T3, the GLS was $\geq -15\%$ in 22% pts; 8% had a LVEF $\leq 55\%$ and in 16% a $\geq 10\%$ LVEF decrease between T0 and T3 was noticed. GLS at T2 $\geq -17.5\%$ had an 80% sensitivity and 87% specificity to predict a $\geq 10\%$ LVEF reduction between T0 and T3 (AUC 0.85, $p=0.016$) (ROC curve). A reduction in GLS between T0-T2 $\geq 4.5\%$ had an 80% sensitivity and 83% specificity to predict the same endpoint (AUC 0.84, $p=0.021$) (ROC curve). The relative percentage of GLS reduction in T1 was related to cumulative doses ($60 \pm 9\%$ if >300 mg/m² vs $39 \pm 19\%$, $p=0.045$); in pts submitted to trastuzumab in addition to anthracyclines, there was no additional systolic dysfunction. The systolic function of the right ventricle assessed by TAPSE also decreased significantly: T0 (22.8 ± 2.9 mm), T1 (22.3 ± 3.6 mm), T2 (22.2 ± 3.7 mm), T3 (21.7 ± 3.4 mm), $p=0.024$.

Conclusion: Chemotherapy with anthracyclines was associated with progressive and significant left ventricular dysfunction, starting as early as the first cycle. The GLS is a sensitive and early predictor of myocardial dysfunction and is also reduced in long-term follow-up. Right ventricular function was also reduced during CT.



Abstract P567 Figure.

P568

Echocardiography outcome monitoring of hypertensive patients with diastolic dysfunction under doxorubicin therapy

AL. Pop-Moldovan¹; M. Trofenciu¹; DA. Darabantiu¹; M. Puschita¹; RM. Christodorescu²

¹Vasile Goldis Western University, Arad, Romania; ²University of Medicine Victor Babes, Timisoara, Romania

Premises and objectives: Potential life-threatening cardiac toxicity limits the dose of doxorubicin. Echocardiography is the standard noninvasive method for monitoring the patients on chemotherapy. The purpose of this study was to assess the outcome in hypertensive oncological patients with diastolic dysfunction and to identify potential risk factors associated with early induced doxorubicin cardiotoxicity.

Material and method: The study group consisted of 50 consecutive hypertensive patients (P) with oncological pathology on doxorubicin chemotherapy and 25 control hypertensive P. A Siemens Acuson X300 unit was used for echocardiographic measurements. The data recorded included: demographics, clinical and echocardiographic measurements, (Table 1). In all 50 P data collection and follow-up were done in out-patient and cardiology department prior to treatment, 6 w after initiation of treatment and at 6 m. Statistical analysis was made using paired t test for patient data and unpaired t test for comparison between the control and study group.

Results: There were no significant differences between control and study P regarding demographic parameters. The study P had a poorer hypertension control, LV hypertrophy and diastolic dysfunction and at 6 weeks and 6 months showed an decrease in EF and deterioration of diastolic function, without reaching statistical significance (Table 1).

Conclusions. The hypertensive P treated with doxorubicin have a good cardiovascular prognosis at 6 months. There is, however, a tendency of deterioration in diastolic and probably in systolic LV function. Therefore a more intensive additional echocardiographic follow-up at 3 months would be more appropriate.

Funding Acknowledgements: Nothing to declare.

Table 1

Parameters	Control (n=25)	Baseline (n=50)	6 weeks (n=50)	6 weeks (n=50)	P value
Age (years)	55.0±7.9	56.9±11.9	56.9±11.9	56.9±11.9	0.396
Males (n)	13 (52%)	23 (46%)	23 (46%)	23 (46%)	0.478
SBP (mmHg)	138.9±12.9	147.0±24.7	149.0±12.6 (0.5)	151.0±11.2(0.2)	0.003*
DBP (mmHg)	78.6±10.3	89.4±12.3	91.2±9.7(0.3)	92.8±11.2(0.1)	0.0004*
EF (%)	66.8±12.9	58.6±14.5	57.3±12.5(0.7)	54.7±13.2(0.1)	0.001*
E/A	1.3±0.4	0.98±1.21	0.97±1.11(0.9)	0.95±2.3(0.9)	0.001*
IVRT (ms)	79.9±17.4	100.8±27.9	101.2±22.4(0.8)	102.0±25.9(0.7)	0.001*
LVMi (g/m ²)	64.4±19.0	86.4±36.1	87.2±28.2(0.9)	88.3±37.8(0.8)	0.006*

* Statistically Significant; SBP - Systolic blood pressure; DBP - diastolic blood pressure; EF - ejection fraction; IVRT - isovolumic relaxation time; LVMi - left ventricular mass index. Data are expressed as mean followed by "±" mean standard deviation (SD).

SYSTEMIC DISEASES AND OTHER CONDITIONS

P569

Diastolic dyssynchrony is associated with exercise intolerance in hypertensive patients with left ventricular hypertrophy

IH. Jung¹; HS. Seo²; MJ. Kim³

¹Inje University, Seoul, Korea Republic of; ²Soonchunhyang University, Bucheon, Korea Republic of; ³St.Mary's Hospital, Cardiology, Incheon, Korea Republic of

Background: Left ventricular hypertrophy (LVH) is associated with intra-ventricular dyssynchrony at systolic phase during exercise in hypertensive patients. However, dyspnea on exertion is much more correlated with diastolic phase. We investigated whether LVH is associated with diastolic dyssynchrony during exercise in patients with hypertension.

Methods: Ninety hypertensive patients with exertional dyspnea and 30 control individuals were enrolled. Exercise stress echocardiography was performed using a symptom limited, multistage supine bicycle test. To evaluate the diastolic dyssynchrony of LV, we calculated the standard deviation (SD) of the averaged time from Q wave to myocardial early diastolic velocity in 12 segments. (TPE-SD, ms). Therefore, diastolic dyssynchrony index was SD of TPe. And also, we applied modified SD (SD/heart rate).

Results: There was no significant difference in systolic blood pressure (BP) and heart rate between the two groups. TPe-SD was significantly higher in patients with LVH at rest (27 ± 11.0 vs. 18.7 ± 7.4 ms, $p < 0.005$) with exaggeration of the degree at peak exercise (42.0 ± 10.6 vs. 30.6 ± 12.4 ms, $p < 0.001$). When applying modified SD, the difference is much more increased (80.0 ± 17.6 vs. 49.0 ± 21.3 ms, $p < 0.001$). Multiple regression analysis showed LV mass index ($\beta = 0.515$, $P = 0.001$) and E/E' at peak exercise ($\beta = -0.253$, $P = 0.025$) were independently associated with LV dyssynchrony during diastolic phase when controlled for age, sex, and systolic BP at peak exercise.

Conclusion: Intra-ventricular diastolic dyssynchrony during exercise is significantly associated with exercise duration in hypertensive patients with LVH. And this result could explain that the patients with exertional dyspnea are more common in LVH group.

Univariate and multivariate analysis for

	Univariate Analysis		Multivariate Analysis	
	β	p value	β	p value
Age	-0.288	*0.037	-0.355	*0.001
Sex	0.161	*0.020	0.250	*0.034
LVMi (g/m ²)	-0.787	*0.008	-0.515	*0.001
LAVI (mL)	-0.440	0.065	-0.175	0.075
E' at peak ex.	0.216	0.589		
Diastolic dyssynchrony	-0.725	*0.030	-0.253	*0.025
S' at peak ex.	0.710	0.073		

LVMi, left ventricular mass index; LAVI, left atrium volume index; E, early diastolic mitral inflow velocity; E', early diastolic longitudinal tissue velocity; S', early systolic longitudinal tissue velocity.

P570

Echocardiographic pattern of acute pulmonary embolism, analysis of consecutive 511 patients

K. Kurnicka¹; B. Lichodziejewska¹; S. Golsiszek¹; O. Dzikowska-Diduch¹; O. Zdonczyk¹; M. Kozłowska¹; M. Kostrubiec¹; M. Ciurzynski¹; P. Palczewski²; P. Pruszczyk¹

¹Dept of Internal Medicine and Cardiology, Medical University of Warsaw, Warsaw, Poland; ²Medical University of Warsaw, Dept of Radiology, Warsaw, Poland

Background: Since there is no comprehensive analysis of transthoracic echocardiographic (TTE) findings of acute pulmonary embolism (PE).

Purpose: To assess the frequency of right ventricular dysfunction (RVD), more typical echocardiographic signs (TES) of PE and potentially misleading echocardiographic abnormalities.

Methods: 511 consecutive patients (281 females, aged 64.0 ± 18.6 years) with confirmed PE underwent standardized TTE. Sixteen of them (3.1%) pts were hemodynamically unstable at admission.

Results: Right ventricular (RV) enlargement was found in 27.4% of patients, RV free wall hypokinesis in 26.6% of patients, interventricular septum flattening in 18.4% of cases, tricuspid regurgitation peak gradient (TRPG) >30 mmHg in 46.6% of subjects, pulmonary ejection acceleration time (AcT) <80 ms in 37.2% of patients and distended inferior vena cava in 12.9% patients. RVD (RV free wall hypokinesis with right ventricular to left ventricular end diastolic ratio [RV/LV] >0.9) was observed in 20.0% of patients. Normal RV morphology and function was present in 33.4% of patients, while the remaining 46.6% subjects presented only mild signs of RV overload. TES defined as McConnell sign, "60/60" sign with mid-systolic "notch" in the pulmonary outflow Doppler profile or right heart thrombi were found in 19.8%, 12.9%, and in 1.8% subjects, respectively. All 16 hemodynamically unstable PE patients presented enlarged hypokinetic RV and showed at least one TES. However, in 3 of them RV/LV was <0.9 due to the presence of an enlarged left ventricle. Interestingly incidental echocardiographic findings (i.e. significant valvular lesions (AS, AR, MR) or LVEF $\leq 35\%$) were found in 9.0% of all studied patients and were detected in 9.6% of 364 non-high-risk PE patients without RVD and TES.

Conclusions: Transthoracic echocardiography can show no significant abnormalities suggestive of PE in 71% of patients with confirmed acute PE. Moreover, in approximately 10% of them TTE can reveal potentially incidental findings. All hemodynamically unstable PE patients presented enlarged hypokinetic RV with at least one typical for PE echocardiographic finding, but some of them did not meet the RV/LV>0.9. The coexistence of an enlarged hypokinetic RV, McConnell sign and "60/60" sign at Doppler assessment seems to be the most useful echocardiographic RVD criterion.

P571
Clinical significance of ventricular interdependence and left ventricular function in patients with pulmonary hypertension receiving specific vasodilator therapy

R. Enache¹; E. Popa¹; IM. Coman¹; R. Badea²; P. Platon²; A. Calin¹; CC. Beladan¹; M. Rosca¹; C. Ghingina¹; BA. Popescu¹; R. Jurcut¹
¹University of Medicine and Pharmacy Carol Davila, Bucharest, Romania; ²Institute of Cardiovascular Diseases "Prof. Dr. CC Iliescu", Bucharest, Romania

In patients with pulmonary hypertension (PH), besides pulmonary artery hemodynamics, right ventricular (RV) function is also impaired. Moreover, right ventricular-arterial coupling (RVAC) seems to be altered. Due to ventricular interdependence, left ventricular (LV) function is also altered in PH patients, but data regarding the clinical impact of LV function in this setting are scarce. Purpose. To assess the LV function and ventricular interdependence parameters in patients with PH using 2D and 3D echocardiography (2DE and 3DE). Methods. Thirty-two patients (40±13 years, 27 women) with arterial PH and 25 controls of similar age and gender (37±9 years, 18 women) were studied. Clinical parameters, BNP, 2DE and 3DE parameters of RV function (RV ejection fraction - EF by 3DE) and 2DE parameters of ventricular interdependence and LV function [systolic (syst.) and diastolic (diast.) eccentricity index (EC), LVEF, E/A ratio, LV global longitudinal strain (LVGLS), TDI-derived lateral (lat.) and septal S- and e'-wave, E/septal e', E/average e', time-velocity integral of left ventricular outflow tract (VTI-LVOT)] were assessed. RV global longitudinal strain (RVGLS) was measured from the apical 4-chamber view as the average of six segments by speckle-tracking echocardiography. A parameter of RVAC- the arterial elastance to RV elastance ratio (Ea/Ees) was assessed as RV end-systolic volume (ESV) to stroke volume ratio. Results. All parameters of LV function and ventricular interdependence, except for lateral S, were significantly impaired in patients compared to controls (all p<0.05). RVGLS, RVEF and RVESV/SV significantly correlated with ventricular interdependence and LV function parameters (Table 1). Furthermore, some of the parameters of ventricular interdependence and LV function significantly correlated with BNP levels (lnBNP): syst EC (r=0.45, p=0.01), diast EC (r=0.42, p=0.015) and lateral e' (r=-0.42, p=0.042). Conclusions. RV function parameters and RVAC have a significant correlation with parameters of LV function and ventricular interdependence. LV function and ventricular interdependence impact BNP levels, suggesting a clinical significance of these findings.

Table 1

Parameter	Syst. EC		Diast. EC		LVEF	E/A ratio	LVGLS	Lat. S	Lat. e c	E/Septal e c ratio	E/average e c ratio	VTI-LVOT
	EC	EC	EC	EC								
RVGLS	0.74	0.76	-0.42	-0.44	0.78	-0.32	-0.69	0.56	0.40	-0.54		
RVEF	-0.67	-0.41	NS	0.43	-0.52	0.42	0.44	-0.40	NS	0.41		
RVESV/SV	0.72	0.40	-0.36	-0.38	0.48	-0.43	-0.44	0.50	0.39	-0.38		

Correlations of RV function and RV ventricular-arterial coupling with parameters of ventricular interdependence and LV function (r values are displayed, all p<0.05); NS, nonsignificant.

P572
Haemodynamic characteristics and ventricular mechanics in post-capillary and combined pre- and post-capillary pulmonary hypertension

AI. Nagy¹; AI. Venkateshvaran²; SC. Sola²; SC. Govind²; PK. Dash²; L. Lund³; AI. Manouras³; B. Merkely¹
¹Semmelweis University, Heart Center, Budapest, Hungary; ²Sri Sathya Sai Institute of Higher Medical Sciences, Cardiology, Bangalore, India; ³Karolinska Institute, Department of Medicine, Solna, Stockholm, Sweden

Background: The development of pulmonary hypertension (PH) in left heart disease carries a poor prognosis. Initially, elevated left ventricular (LV) filling pressures cause a passive increase in the pulmonary venous pressure (passive PH - pPH). In some patients with chronically elevated filling pressures, functional and structural reactive changes in the pulmonary vessels occur, resulting in combined pre- and post-capillary PH (cPH), characterized by increased resistance in the pulmonary vasculature, associated with adverse outcome. A detectable secondary disruption of the LV performance has been related to increased mortality in this cohort. Despite the prognostic relevance of distinguishing pPH from cPH, the haemodynamic profiles of these distinct PH cohorts have not been thoroughly described. Using rheumatic mitral stenosis (MS) as a model we aimed to investigate the differential alterations in inter-ventricular interaction and ventriculo-arterial coupling in these two distinct forms of PH.

Methods: Invasive haemodynamic and echocardiographic data of 94 patients with MS-derived PH along with echocardiograms of 40 age-matched healthy controls were analyzed.

Results: cPH patients displayed greater elevation in right ventricular (RV) pressures and more pronounced RV dysfunction compared to the pPH group. Interestingly, PH

patients also demonstrated increased LV contractility and afterload along with impaired LV diastolic function, and these derangements were more evident in the cPH group.

Conclusions: Our results provide novel insight into the pathophysiology of altered LV and RV mechanics in PH suggesting that additionally to a direct interaction between the two ventricles, an abnormal ventriculo-arterial coupling contributes to the altered LV mechanics associated with adverse prognosis in cPH.

P573
Relationship between hematological response and echocardiographic features in patients with light chains systemic amyloidosis

E. Martins; J. Magne; V. Abovans; C. Boulogne; D. Lavergne; A. Jaccard; D. Mohty
University Hospital of Limoges - Hospital Dupuytren, Limoges, France

Introduction: in patients with systemic light chains amyloidosis, cardiac involvement has major impact on prognosis. The efficacy of treatment is usually assessed by the hematological response, in addition to organ response. However, the relationship between hematological response and post-treatment echocardiographic features remains poorly investigated.

Aim: We aimed to analyze the morphological, functional and hemodynamic echocardiographic parameters changes in confirmed AL patients according to their hematological response at the end of chemotherapy.

Methods and results: 64 patients with both baseline and post-treatment (i.e. end of the chemotherapy) TTE were included in our study. The hematological response was defined according to the current recommendation using the degree of free light chains ratio changes. Patients with complete response or very good partial response were pooled and analyzed as responders and were compared to the non-responders. Among the 64 included patients (age=62±11 years, 50 % of males), 38 patients (59%) were responders and 26 were considered as non-responders. Responders had significantly lower E/A ratio than non-responders (p=0.03, Table). There was no other statistical difference between the 2 groups regarding baseline clinical, demographic and TTE parameters. At follow-up and after hematological treatment (16.5±15.6 months), responders showed significantly lower E/e' ratio and systolic pulmonary arterial pressure (p=0.017 and p=0.016, respectively) as compared to non-responders.

There was a trend for weak improvement in 2D left ventricular global longitudinal strain (LV-GLS) between baseline and follow-up (p=0.09, Table) in responders whereas the non-responders significantly impaired LV-GLS from baseline to follow-up (p=0.02). There was no other significant difference between the 2 groups with regard to follow-up or changes from baseline echocardiographic data (Table).

Conclusion: in patients with AL, hematological response is associated with improvement in estimated LV filling pressure and systolic pulmonary arterial pressure. Furthermore, the impairment of LV longitudinal myocardial function may be used as surrogate marker of absence of hematological response in these patients. Nevertheless, further studies with longer follow-up and larger sample size are required in order to confirm these findings.

Variables	Non-Responders		Responders		p [§]
	Baseline	FU	Baseline	FU	
IVS, mm	14.0±2.9	14.1±3.6	15.2±3.1	14.7±4.1	0.527
LA diameter, mm	41.0±7.2	40.6±6.7	42.2±6.7	41.6±7.0	0.825
LA surf, cm ²	20.5±6.0	21.7±6.1	20.5±5.5	19.4±6.0	0.086
LA Vmax, mL	50.5±8.4	52.1±20.3	73.1±23.9	41.0±14.4	0.541
LVEF SBP, %	57.3±13.7	55±15.1	63.7±10.1	57.6±10.8	0.571
LVEF (%)	60.4±13.0	56.8±19.6	61.9±9.2**	55.5±11.8**	0.121
E wave, cm/s	92.5±27.5	94.7±41.0	81.9±29.4	80.9±27.3	0.551
E/A	2.1±1.3	2.3±1.5	1.4±0.8	1.6±1.5	0.594
E/Ea lat	18.6±5.6	20.9±10.6	17.4±9.6	14.7±5.8	0.028
E Deceleration Time, ms	169.6±57.5	176.2±52.9	207.7±84.9	215.1±66.7	0.721
2D longitudinal strain, %	-12.5±4.3*	-10.0±4.4*	-12.1±4.3	-14.6±6.2	0.090
sPAP, mmHg	37.8±15.0	41.6±18.4	33.6±10.5	31.1±9.4	0.040
T Troponin, µg/L	0.1±0.3	0.2±0.4	0.07±0.1	0.07±0.1	0.833
NT-proBNP, ng/L	5690.3±6187.7	5692.8±8249.2	4621.6±4366.8	3194.3±5232.8	0.245

IVS: Interventricular septum; LA: Left Atrial; LVEF: Left Ventricular Ejection Fraction; SBP: Simpson Biplane; sPAP: Systolic Pulmonary Arterial Pressure
*Baseline vs FU in non responders, p<0.05
**Baseline vs FU in responders, p<0.05
§ comparison of delta (Baseline-FU) between non-responders and responders

Abstract P573 Figure.

P574
Myocardial changes in patients with anorexia nervosa

A. Cereda¹; F. Casadei¹; F. Spano¹; G. Santambrogio¹; F. Musca¹; O. Belli¹; B. De Chiara¹; D. Bokor¹; C. Giannattasio¹; E. Corradi²; CA. Colombo²; A. Moreo¹; ML. Vicario¹
¹Niguarda Ca' Granda Hospital, Cardiology, Milan, Italy; ²Niguarda Ca' Granda Hospital, Division of Clinical Nutrition, Milan, Italy

Background: Cachexia is a multifactorial syndrome characterized by loss of body weight due to an involuntarily wasting of skeletal muscle and adipose tissue mass as a result of an imbalance between catabolic and anabolic processes. Cachexia frequently develops in advanced stages of various chronic diseases such as heart

failure, renal disease and cancer. Anorexia nervosa (AN), an eating disorder characterized by an abnormal eating behavior with disturbances of attitudes towards body weight and shape, is a model of cachexia associated with an high rate of cardiovascular mortality due to electrolyte disorders, hypotension, bradycardia and QTc prolongation. Structurally, the heart of these patients is atrophic with a low ventricular mass (LVMI), pericardial effusion (PE) and a normal EF.

Purpose: Our study was aimed at studying AN as a model of starvation-induced cachexia and understanding the electrographic, echocardiographic and endocrine related changes.

Methods: We studied 31 patients with AN at baseline. All patients were evaluated for anthropometric parameters (BMI, basal metabolism, weight loss), hormonal factors (FT3, FT4, IGF1, GH, DHEA, estrogens), nutritional factors, 24h Holter, basal Echocardiogram and GL-Strain analysis. A BMI of 14.5 (index of AN severity) was used as cut-off to compare patients.

Results: The mean age was 20.2 ± 5.2 years, the mean weight was 38.2 ± 4 Kg with a mean BMI of 14.6 ± 0.7 Kg/m². There was a low BP profile (PAS 92.4 ± 11 , PAD 57 ± 11 mmHg) with bradycardia (Mean HR 58 ± 12 , HR min 41.2 ± 6 bpm). EF was normal ($59 \pm 3\%$) with a normal GLS ($-22.3 \pm 3\%$) and a low LVMI (45.6 ± 9.9 g/m², IVST 5.9 ± 0.8 mm), 11/31 had a pericardial effusion. GLS but not EF was related to IGF-1 (R 0.52, p 0.02), EF and GLS were significantly related to FT3 and FT4 (R 0.25, p<0.05). LVMI was related to IGF1 (R 0.4, p 0.039) and DHEA (R 0.49, p 0.006). Patients with a BMI < 14.5 Kg/m² do not differ for EF and GLS but had a thinner IVST (6.1 ± 0.7 vs. 5.6 ± 0.5 , p 0.05). The presence of a pericardial effusion (11/31) was related to a greater weight loss (15.7 ± 3.7 VS. 9.9 ± 6.1 Kg, p 0.03), to IGF1 (105 ± 42 vs 205 ± 75 ng/ml, p 0.001) and FT3 levels (1.9 ± 0.4 vs. 2.4 ± 0.6 pmol/L, p 0.025), lower septal and tricuspid S' values (S'sept 7.78 ± 0.9 vs. 8.5 ± 0.9 p 0.05, S'tric 11.8 ± 1.2 vs. 13.4 ± 1.2 p 0.005), lower BMI (14.1 ± 0.7 vs. 14.99 ± 0.5 , p 0.001) and to the lowest HR recorded on 24h-Holter (37.8 ± 3.8 vs. 44.6 ± 5.0 , p 0.01)

Conclusion: Structurally, the heart of AN patients is characterized by the presence of a thin IVST and a low LVMI. EF and GLS were within the normal range and slightly related to IGF (insulin-like growth factor) and thyroid hormones. The presence of pericardial effusion identifies a subset of AN patients characterized by a greater weight loss, lower ventricular longitudinal function and a lower minimum 24-hour heart-rate.

P575

Giant cell arteritis presenting as fever of unknown origin: role of clinical history, early positron emission tomography and ultrasound screening

G. Vitiello¹; S. Castellani¹; D. Cammelli²; C. Gallini³; L. Needleman⁴; BK. Cruz²; E. Maggi¹; N. Marchionni¹

¹University of Florence, Experimental and Clinical Medicine Dept., Florence, Italy; ²Careggi University Hospital (AOUC), Rheumatology Section / Immunology Unit, Florence, Italy; ³Careggi University Hospital (AOUC), Nuclear Medicine Unit, Florence, Italy; ⁴Thomas Jefferson University, Philadelphia, United States of America; ⁵University of Alaska/WWAMI Medical School, Anatomy Dept., Anchorage, United States of America

Introduction. Giant cell arteritis (GCA) generally presents with a sudden onset headache. However, in 15% of patients it presents as a fever of unknown origin (FUO). Conversely, GCA is the cause of FUO in 16% of patients older than 65. Jaw claudication (JC) is present in 30-48% of patients and it is considered the most specific GCA associated symptom. Color Doppler sonography of the temporal arteries (TA-CDS) can be the first non-invasive imaging technique employed to demonstrate GCA with an 87% sensitivity and up to 96% specificity.

Purpose. To perform a retrospective analysis of a cohort of patients admitted to our hospital for a FUO and to assess the diagnostic yield achieved by the integration of a directed clinical history (CH) and an early resort to total body positron emission tomography (PET) and TA-CDS in the diagnostic work-up of GCA.

Methods. The study encompassed 13 patients (8M and 5F, 70.23±10 years) hospitalized between 2005 and 2014 for evaluation of FUO in whom infections and malignancies were excluded. During the CH, special attention was paid to presence of JC. In all patients serum acute phase proteins (APP) were tested (erythrocyte sedimentation rate, C-reactive protein). TA-CDS (Sequoia Paragon 512 Ultrasound System, 9-4 MHz linear probe) was performed in 3 of the 4 patients with JC and in 3 of the 9 patients without JC. CDS results were considered positive when imaging demonstrated 1 mm thick hypochoic halo surrounding the main temporal arteries or one of their branches. Nine out of 13 patients underwent PET to detect Large Vessels Vasculitis (LVV).

Results. All patients showed an elevation of at least one APP. CH revealed the presence of JC in 4/13 patients (31%); PET revealed LVV in 4/4 (100%); in all 3 patients with JC and positive PET, TA-CDS revealed an active vasculitic process. In 8/9 patients (89%) without JC, PET scan was positive for LVV; in the only PET negative patient, TA-CDS resulted positive. In 5 patients GCA diagnosis was based only on CDS. Subsequently, GCA was diagnosed in all cases and steroids were readily started.

Conclusions. After excluding infections and malignancies, a vasculitic disorder should be suspected in all patients with FUO. In the early phase of the disease, clinical attention should be mainly focused at demonstrating the presence of GCA by carefully collecting the CH. JC has proved to be specifically helpful for an early correct diagnostic orientation. Early PET and TA-CDS have shown to be crucial as well, showing high sensitivity and specificity when performed before steroid treatment, and our results are in keeping with previous reports. Indeed, TA-CDS has been positive even in patients with negative PET. Therefore TA-CDS should always be performed,

even after a negative PET, before steroid treatment is started. In the presence of FUO, particularly when GCA is suspected because of JC or typical history, PET can also detect the signs of LVV. TA-CDS is complementary to PET.

P576

Subclinical systolic dysfunction in systemic sclerosis is not influenced by standard rheumatologic therapy - a 4D echocardiographic study

SL. Magda¹; VD. Bratu¹; RI. Mincu¹; CM. Miha²; AM. Gherghel²; M. Florescu³; M. Cinteza³; D. Vinereanu³

¹University Emergency Hospital, Bucharest, Romania; ²Clinical Hospital "Dr.I.Cantacuzino", Bucharest, Romania; ³University of Medicine and Pharmacy Carol Davila, Bucharest, Romania

Background. Systemic sclerosis (SSc) is an autoimmune disease, characterized by microvascular occlusive disease and various patterns of cutaneous and parenchymal fibrosis. Cardiac involvement includes pulmonary hypertension, myocardial fibrosis, and systolic dysfunction, but the influence of current rheumatological therapies on these features is insufficiently studied. Aim. To assess 2D and 4D echo parameters of LV systolic function, and to determine their changes under standard therapy, in patients with different forms of SSc. Methods. 40 subjects (53±12 years, 38 women) with SSc (65% limited and 35% generalized forms, mean time since onset 8±7 years) were compared to age, sex and cardiovascular risk factors matched normal (data already presented). 20 subjects were reassessed after 1 year of treatment (25% on Methotrexate or Azathioprine, 56% on Bosentan for digital ulcerations, 63% on Calcium-channel blockers, no patient on corticosteroids). LV systolic function was assessed by standard 2D echo (ejection fraction - 2DEF), speckle tracking (2D longitudinal - 2DLS, circumferential, and radial strain), and 4D auto LV quantification echo (LV geometry, 4D ejection fraction - 4DEF, and systolic deformation as longitudinal - 4DLS, circumferential - 4DCS, radial - 4DRS, and area - 4DAS strain). Results. At baseline, standard echo parameters were normal. As already shown, SSc patients had subclinical LV systolic dysfunction compared to matched normals (by 4D echo parameters). After 1 year of treatment, there were no significant changes of any of the echo parameters (table). Conclusion. Patients with SSc have LV subclinical systolic dysfunction, which is not influenced by standard therapy, suggesting that cardiovascular screening of these patients should be extended beyond pulmonary hypertension. Longer follow-up and extended cohorts are needed.

Funding Acknowledgements: grant 112/2011 and 188/2014.

Parameter	Baseline (N=40)	Follow-up (N=20)	P value
2DLS (%)	-17.6 ± 2.9	-19.2 ± 1.7	NS
2DEF (%)	57.3 ± 7.7	57.2 ± 7.2	NS
4DEF (%)	61.6 ± 6.9	62.6 ± 7.2	NS
4DLS (%)	-12.8 ± 2.9	-13.9 ± 3.6	NS
4DCS (%)	-13.4 ± 3.9	-14.3 ± 3.5	NS
4DRS (%)	36.3 ± 11.1	36.9 ± 9.8	NS
4DAS (%)	-23.6 ± 4.8	-24.3 ± 6.9	NS
SPAP (mmHg)	25.4 ± 9.1	28.1 ± 11.1	NS

SPAP = systolic pulmonary artery pressure

P577

Cardiac index correlates with the degree of hepatic steatosis in obese patients with obstructive sleep apnea

G. Styczynski¹; P. Sobieraj¹; P. Bielicki²; R. Krenke²; CA. Szmigielski¹
¹Medical University of Warsaw, Department of Internal Medicine, Hypertension & Vascular Diseases, Warsaw, Poland; ²Medical University of Warsaw, Department of Internal Medicine, Pneumology and Allergology, Warsaw, Poland

Purpose: Patients with obstructive sleep apnea syndrome (OSAS) have increased morbidity and mortality from cardiovascular disease. However, many patients (pts) with OSAS are also obese and they have non-alcoholic fatty liver disease (NAFLD), which is also a potential significant independent risk factor for cardiovascular episodes. The mechanism by which NAFLD and OSAS interact and increase cardiovascular mortality is complex and not fully known. Severe hepatic steatosis may lead to hepatic inflammation and fibrosis (NASH) and in consequence to hepatic cirrhosis. We decided to check if signs of hyperkinetic circulation typical for hepatic cirrhosis are already present in population with severe steatosis.

Methods: In obese (BMI>30) patients with OSAS (apnea-hypopnea index, AHI>5), we analyzed the degree of hepatic steatosis, based on the difference of echogenicity between liver parenchyma and renal cortex (DIFF), measured using tissue intensity analysis software. Patients with low echogenicity (DIFF < 10dB) were considered to have no or mild steatosis (L-DIFF) and pts with high echogenicity (DIFF ≥ 10dB) were considered to have severe steatosis (H-DIFF). During echocardiography cardiac index (CI), stroke volume (SV), cardiac output (CO), and pulse wave velocity (PWV) were measured.

Results: In 74 obese patients with OSAS, 55 males, 19 females, mean age 54.5±/10.8 years, mean BMI 37.1±/5.7, high echogenicity (H-DIFF) was found in 31 patients and low echogenicity (L-DIFF) in 43 pts. Both groups significantly differed according to CI (2.8 ± 0.3 vs 3.4 ± 0.6 ; p<0.0001); SV (95.3 ± 19.3 vs 105.7 ± 18.0 ; p=0.015), SV/BSA (41.3 ± 6.5 vs 45.7 ± 8.2 ; p=0.028), CO (6.4 ± 1.0 vs 7.9 ± 1.6 ; p<0.0001), CO/BMI (0.175 ± 0.028 vs 0.213 ± 0.043 ; p<0.0001). The groups did not

differ according to age (55.3±11.9 vs 53.5±9.1, NS), weight (111.7±23.5 vs 112.4±16.9, NS), height (173.3±9.9 vs 173.6±9.9, NS), BSA (2.3±0.3 vs 2.3±0.2, NS), BMI (37.0±6.4 vs 37.2±4.6, NS), LVMI (101.5±25.8 vs 95.4±19.8, NS), RWT (0.50±0.06 vs 0.50±0.06, NS), PWV (7.5±1.6 vs 7.3±1.4, NS). Spearman correlation (R) was significant (p<0.05) for DIFF and CI (0.469), as well as CO (0.454) and CO/BMI (0.409). Correlation was not significant for age, weight, height, BSA, BMI, LVMI, RWT, PWV.

Conclusions: Severe liver steatosis is associated with increased cardiac index in obese patients with obstructive sleep apnea.

P578

Myocardial mechanics in top-level endurance athletes: a three-dimensional speckle tracking study

F. Lo Iudice; M. Pettito; M. Ferrone; R. Esposito; A. Vaccaro; A. Buonauro; B. Trimarco; M. Galderisi
University Hospital Federico II, Naples, Italy

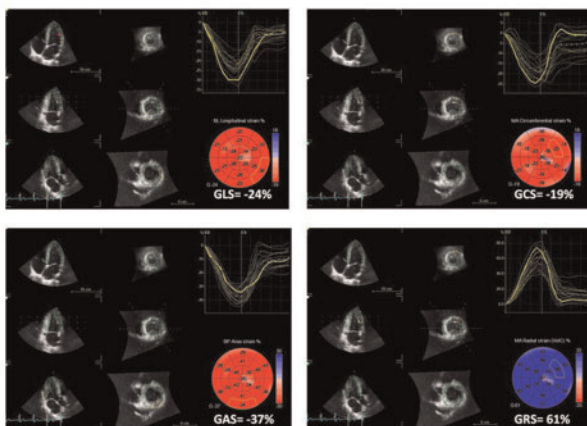
Background: In the trained heart, determinants of left ventricular (LV) performance have been previously investigated, showing how systolic function could be dependent on preload, afterload as well as on LV mass and sinus bradycardia. Determinants of LV myocardial deformation properties in the athlete's heart are poorly known. This issue can be evaluated by using real-time three-dimensional (3D) speckle tracking echocardiography (STE). This technique has the advantage to assess LV deformation inside a volumetric image rather than into bidimensional sections, and to calculate all the strain components within the same heart beat, i.e., at the same heart rate and under the same loading conditions.

Purpose: Aim of our study was to assess the contributors of left ventricular (LV) strain components, using 3D STE in endurance athletes compared with a healthy sedentary group.

Methods: Thirty-six top-level male endurance athletes (AT) (age = 27±5.6 years) and 36 age matched sedentary normal controls (NC) underwent standard and real-time 3D echocardiography. Global longitudinal strain (GLS), global circumferential strain (GCS), global area strain (GAS) and global radial strain (GRS) were assessed using 3D STE. Values of GLS, GCS, and GAS were considered as 'positive' (sign +) to build the independent associations of multivariate models in order to homogenize the results of analyses and strengthen their clinical meaning: the higher the values, the better was the strain deformation.

Results: AT had higher GLS (-22.1±4.4 vs -18.4±3.5%, p<0.0001), GCS (-17.9±2.4 vs -16.0±3.2%, p=0.006) and GAS (-35.5±6.7 vs -30.2±4.9%, p<0.0001), while GRS did not differ significantly with NC (Figure shows bull's eye representation of 3D-STE derived strain components in an endurance AT [rower] from our case series). In separate multiple linear regression analyses, heart rate emerged as independent predictor of GLS (β=-0.37, p<0.002), GCS (β=-0.32, p=0.007), GAS (β=-0.37, p<0.001) and GRS (β=-0.29, p=0.019); LV mass was independently associated with GLS (β=0.34, p=0.009), GAS (β=0.41, p<0.001) but not with GCS and GRS, while diastolic blood pressure predicted GCS (β=-0.46, p<0.0001), GAS (β=-0.28; p=0.006) and GRS (β=-0.42, p<0.001). No independent correlations were found with body surface area and stroke volume. By replacing LV mass with end-diastolic volume, the latter showed independent association with GCS (β=-0.65, p=0.028) and with GRS (β=-0.60, p<0.05).

Conclusion: AT have an increased myocardial function at rest as compared to NC, this being elicited mainly by the deformation of subendocardial and midwall fibers. Sinus bradycardia, LV geometry and afterload are independent determinants of super-normal myocardial deformation at rest.



Abstract P578 Figure.

P579

The athlete heart: what happens to myocardial deformation in physiological adaptation to sports

H. De Barros Viegas; L. Mendes; H. Dores; I. Melo; V. Madeira; J. Patinha; C. Encarnacao; J. Ferreira Santos
Hospital da Luz - Setúbal, Cardiologia, Setúbal, Portugal

Introduction: Sports heart's physiological adaptation is well known, but sometimes difficult to distinguish from myocardiopathies. On the other hand the deformation analysis has shown to be useful in diagnosis of early stage myocardial disease.

Purpose: To analyse myocardial deformation in healthy athletes by 2D strain and compare it with a reference population.

Methods: 35 male athletes (average age 27±9 year; 80% Caucasian) were submitted to a pre-competitive evaluation: Group 1 - 25 competitive athletes (professional soccer >20h/week); Group 2 - 10 recreational level amateur athletes (mostly dynamic exercise, 7±2h/week). Transthoracic echocardiography was performed according to the latest guidelines to quantify cavities dimensions, tissue velocity and global longitudinal strain (GLS). The two groups were compared. Additionally the GLS of the left ventricle (LV) of both groups was compared with a reference male population described in the literature (control group).

Results: As expected there was cardiac structural remodeling in the athletes with: higher LV telediastolic volumes, higher left atrium volumes and inferior average E/e' (see table). In the deformation analysis, LV GLS was significantly inferior in group 1 compared with group 2 (-15,2±1,7 vs. -17,8±1,0%; p<0,001). Both study groups had significant lower GLS compared to the control group (Group 1: -15,2 ± 1,6 vs Control: -21,5±2; p <0,0001) (Group 2: -17,8 ± 1 vs Control: -21,5±2; p <0,0001). In group 1 only 1 athlete (4%) had a GLS in the normal range, that happened in 6 athletes (60%) in group 2.

Conclusion: Sports and physical exercise translates into a physiological cardiac adaptation related with the intensity of training. The myocardial deformity assessed by GLS is significantly lower in athletes and should be used wisely in the differential diagnosis of myocardial disease vs physiological adaptations.

EcoCardiographic Parameter	Group 1 (n= 25)	Group 2 (n = 10)	Control (n = 247)	p value
LV mass (g/m ²)	95±18	93±15	72±18	ns
LA Vol Index. (ml/m ²)	42±6	32±6	25±6	<0,05
RA Vol (ml)	61±15	37±13	23±6	<0,05
E/e'	5,1±1,4	6,6±2,7	6,9±1,5	<0,05
TDV (ml)	164±25	140±23	110±27	<0,05
TSV (ml)	63±17	54±12	41±12	ns
LVEF (%)	62±7	62±6	63±5	ns
LV GLS (%)	15,2±1,7	17,8±1,0	21,5±2	<0,05

P580

Association between left ventricle intrinsic function and urine protein-creatinine ratio in preeclampsia before and after delivery

F. Shahab¹; F. Habib¹; AM. Soesanto¹; J. Sedyawan¹; G. Abdurrazak²
¹National Cardiovascular Center Harapan Kita, Department of Cardiology and Vascular Medicine Universitas Indonesia, Jakarta, Indonesia; ²Harapan Kita Hospital, Department of Obstetrics and Gynecology, Jakarta, Indonesia

Background. One of the manifestation of endothelial dysfunction in preeclampsia (PE) is glomerular endotheliosis that manifested by proteinuria. In this study, the parameter for proteinuria is an urine protein-creatinine ratio (UPCR). The cardiac manifestation of endothelial dysfunction in PE is a subclinical left ventricle dysfunction.

Purpose. To study the correlation between left ventricle intrinsic function and urine protein-creatinine ratio in preeclampsia.

Methods. This prospective study was to evaluate the correlation between global longitudinal strain (GLS) by speckle tracking echocardiography and UPCR in PE patients. The echocardiography was performed 3 times; prior to delivery, 48-72 hours after delivery and 40-60 days after delivery. The UPCR was measured twice; prior to delivery and 40-60 days after delivery. The GLS was analyzed offline.

Results. Thirty patients were enrolled in this study. Mean ages was 28±6.4 years old. Left ventricle intrinsic function after parturition had improved. GLS before delivery was -17.65±2.59% and after parturition was -18.75±2.44%. Bivariate analysis showed there was a positive correlation between GLS prior to delivery with UPCR prior to delivery (r=0.445 p=0.014). Multivariate analysis showed a positive correlation between GLS prior to delivery with UPCR prior to delivery (r=0.426 p=0.011).

Conclusion. There was a moderate correlation between left ventricle intrinsic function (GLS) prior to delivery and urine protein-creatinine ratio prior to delivery.

Baseline characteristic

Variable	n=30
Age (year)	28.5±6.4
Gestational age (week)	36 (20-40)
Systolic before delivery (mmHg)	160 (135-205)
Diastolic before delivery (mmHg)	100±14.6
Systolic 48-72 hours after delivery	141.3±12.2
Diastolic 48-72 hours after delivery	90 (70-105)
Systolic 40-60 days after delivery	130 (115-180)
Diastolic 40-60 days after delivery	85 (70-110)
GLS before delivery (%)	-17.65±2.59
GLS 48-72 hours after delivery (%)	-17.46±2.53
GLS 40-60 days after delivery (%)	-18.75±2.44
UPCR before delivery	3.87 (0.16-16.68)
UPCR 40-60 days after delivery	0.27 (0.08-2.06)

Data are mean±SD, median (min-max), or number (%).

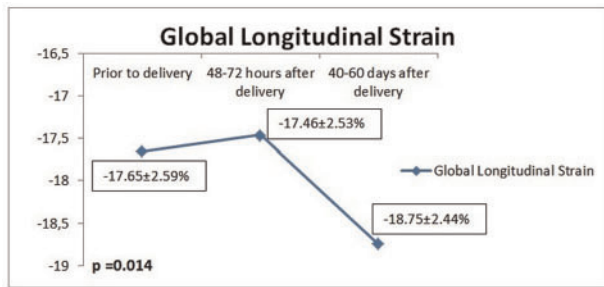


Figure 1. Global longitudinal strain (GLS) speckle tracking echocardiography

p=0.701 : GLS prior to delivery and 48-72 hours after delivery
 p=0.024 : GLS prior to delivery and 40-60 days after delivery
 p=0.002 : GLS 48-72 hours after delivery and 40-60 days after delivery

Abstract P580 Figure.

CONGENITAL HEART DISEASE

P581

Dilatation of the aorta in children with bicuspid aortic valve

I. Trunina¹; A. Sharykin²; NE. Popova²; EV. Karelina¹; ND. Telezhnikova¹
¹Z.A. Bashlayeva City Children's Hospital, cardiology, Moscow, Russian Federation;
²Pirogov Russian National Research Medical University, Moscow, Russian Federation

Background: Obligatory TTE screening in children population is followed by the growing number of asymptomatic heart defects, one of them is bicuspid aortic valve (BAV). Structural changes of the aortic wall, such as dilatation and forming aneurisms because of low elasticity, is a frequent problem that follows valve dysfunction.

Methods: we examined 105 children with BAV from 3 months of age till 18 years: 80 males and 25 females. Mild Aortic stenosis was diagnosed if systolic gradient LV/Ao was 13-40 mm Hg, moderate – if gradient exceeds 40 mm Hg. We took into account regurgitation higher than 1,5 stage. Aortic root was measured in systole between inner walls at several levels: diameter of the Aortic valve (AV), Valsalva sinus (SV), sinotubular junction (STJ), ascending aorta (AscAo) and aortic arch (AA). Dilatation was considered if structural size exceeded 2 z-score for personal BSA. 37 children were examined at follow up study after 18 and 36 months.

Results: Aortic stenosis was evaluated in 47 children (44,8%), among them 44 children had mild Aortic stenosis (AS), only 3 had moderate AS. 22 children (21%) had significant regurgitation and 13 (12,2%) had stenotic and regurgitant valve. In 23 children (22%) no valve dysfunction was found. 58% of children had dilated Aorta (n=61), in which 11% had no signs of valve disfunction and 47% had AS. Dilatation on SV level was in 31 children (29,5%), on STJ – in 21 (20%), 77 (73,3%) had dilated ascending Aorta and in 21 (20%) Aortic arch was affected. In 18 cases (17%) dilatation involved 2 zones, in 7 (6,7%) – 3 zones. Aortic root size augmented relatively proportionally: correlation in between AV-SV-STJ was 0,62-0,68, p<0,05. Ascending Aorta diameter correlated mostly with Aortic arch diameter (r=0,49, p<0,05).

No correlation was observed between aortic diameter and BSA, physical activity did not influence dilatation of the aorta, as well as Arterial pressure level. 5 from 11 children under 3 years of age had dilated Aorta, the youngest patient with aneurism dilatation of ascending Aorta (z-score 2,87) was 9 months old. Follow up examinations of 37 children showed unpredictable dynamic of aortic size: in 8 cases the degree of dilatation has not changed, in 23 it has reduced. In other 24 cases we found progression of increasing aortic diameters, including 12 children with appearance of dilatation exceeding 2 z-scores.

Conclusion: In children with BAV dilatation of the aorta (at least in one of its segments) was observed in 58%, more often it was the ascending aorta. Dilatation is not

caused by hemodynamic changes in BAV, but is an independent disease. Examining patients with BAV is very important to measure Aortic diameter on 4 levels and to evaluate it using z-score.

P582

Cardiovascular functional abnormalities in patients with osteogenesis imperfecta

R. Mata Caballero¹; V. Hernandez Jimenez²; J. Saavedra¹; L. Molina¹; MT. Alberca¹; J. Gorriz¹; J. L Pais¹; I. Pavon¹; C. Navea¹; JJ. Alonso¹
¹University Hospital of Getafe, Cardiology, Getafe, Spain; ²Universitary Hospital Rey Juan Carlos, Mostoles, Spain

Background and Objective: Osteogenesis imperfecta (OI) is a rare inherited connective tissue disease that causes a decrease in collagen type 1; this represents approximately 75% of total collagen in the adult myocardium. The purpose of our study was to assess the functional abnormalities among patients with OI.

Methods: The study included 79 patients with OI and 44 healthy controls, matched regarding sex and age. All of them underwent an echocardiographic study. The systolic myocardial function was evaluated by ejection fraction of the left ventricle (LVEF) and the diastolic function by left atrial (LA) dimension and E/A ratio of the mitral valve with pulse-wave Doppler evaluation. We classified the diastolic function in three patterns: Normal (E/A ratio ≥1 and LA dimension ≤42 mm), grade 1 diastolic dysfunction (E/A ratio <1) and grade 2 or pseudonormalized filling pattern (E/A ratio >1 and LA dimension >42 mm).

Results: There were non-significant differences in age (OI: 32.9 ± 12.8 versus 31.8 ± 9.6 years in the control group, p=0.7). The prevalence of hypertension was similar between both groups (OI: 9 vs 8 % in controls, p=0.8). OI patients had significantly smaller body surface area than controls (1.61 ±0.23 versus 1.81 ±0.27 m², p<0.001). The LVEF was normal in both groups and without significant difference (OI: 65.8 ±7.5 versus 67.2 ±5.8% in healthy group, p=0.15). The E/A ratio tended to be higher in OI (OI: 1.51±0.5 vs 1.37 ± 0.3 in controls, p=0.05). Respect to diastolic function, 25.3% of OI patients had abnormal filling pattern compared to 11.4% healthy patients (p=0.04). Most of the OI patients with diastolic dysfunction had pseudonormalized filling pattern (Table) with elevated atrial pressures. LA diameter was larger in the OI group when indexed for BSA (20.8 ±4.59 versus 19.21 ±5.38 mm/m², p=0.05) and OI patients had significantly higher pulmonary artery systolic pressure (23.35 ±3.52 versus 15.62 ±7.42 mmHg, p<0.001).

Conclusions: According to our results: 1. Patients affected by OI have a normal systolic myocardial function similar to controls. 2. OI patients have more prevalence of diastolic dysfunction than controls. 3. It could possibly be due to a decrease in cardiac elasticity as a consequence of underlying collagen structure abnormality. These findings indicate the need for an echocardiographic assessment and follow-up of affected people.

Diastolic Filling Pattern	OI Group (N= 79)	Control Group (N= 44)
Normal, no (%)	59 (74.7)	39 (88.6)
Grade 1 Diastolic Dysfunction, no (%)	6 (7.6)	4 (9.1)
Grade 2 Diastolic Dysfunction, no (%)	14 (17.7)	1 (2.3)

OI, osteogenesis imperfecta.

STRESS ECHO

P583

Dobutamine stress test fast protocol: diagnostic accuracy and security

H. De Barros Viegas; L. Mendes; S. Sonia; V. Madeira; C. Encarnacao; J. Patinha; I. Melo; J. Ferreira Santos
 Hospital da Luz - Setúbal, Cardiologia, Setúbal, Portugal

Background: Pharmacologic stress test is a well-known validated tool to determine ischemia.

Aims: To evaluate in a prospective away a fast dobutamine protocol (FDP), testing security and achieving sensibility and specificity.

Methods: We studied prospectively every patient that performed FDP since 2012 and had a follow-up superior to 6 months. The FDP has 3 minutes stages with progressive increment of dobutamine doses (10, 20, 30, 40 ug/Kg/min), and 0,5 mg of atropine at minute 6, 7, 8 and 9. It was evaluated the median duration of the exam, the rates of minor complications (supraventricular premature beats and isolated ventricular premature beats) and the major complications (arrhythmic, mechanical and ischemic) imposing exam suspension. It was considered an event: obstructive coronary disease diagnosed by anatomical test, any revascularization type, angina and acute coronary syndrome. In the sensibility and specificity we excluded the follow up dropouts and the exams with doubtful conclusions.

Results: 430 patients (50,6% men) were included, mean age 63±9 years, 33 patients were lost. The mean follow-up was 595±425 days. The mean duration of the exam was 12,5±3,4 minutes. The minor complications were observed in 35,4% of the exams and the major in 5,8% (1 NSVT, 1 frequent premature beats, 11 atrial fibrillation (2,6%), 10 Bezold Jarish response (2,3%), 2 empty left ventricle syndrome with symptoms). Electrical cardioversion was only needed in one patient. The exams were

positive to detect ischemia in 16.5%, not conclusive in 12.8% and negative in 70.7%. The events were registered in 39 patients (9.8%). The FDP sensibility was 60.6% (95%CI; 75-98%) and the specificity was 89.4% (95% CI: 85.5-92.5%), with a negative predictive value of 98.96%.

Conclusions: The FDP was as safe as the classical dobutamine protocol, with similar results (sensitivity and specificity) with reduced time of dobutamine perfusion.

P584

Prognostic value of non-positive exercise echocardiography in the patients submitted to percutaneous coronary intervention

A. Marques; I. Cruz; I. Joao; AC. Gomes; D. Caldeira; L. Lopes; P. Fazendas; H. Pereira
Hospital Garcia de Orta, Cardiology, Almada, Portugal

Introduction: Exercise echocardiography (EE) is a valuable non invasive method in diagnostic and prognostic assess of ischemic cardiac disease. It improves diagnostic accuracy in cases of inconclusive exercise ECG, especially when basal electrocardiographic changes are present.

Purpose: Ascertain prognostic value of non-positive treadmill EE in the patients (pts) previously submitted to percutaneous coronary intervention (PCI). Correlate cardiovascular risk factors (CVRF) with adverse events occurrence.

Methods: We reviewed all EE performed at our centre between 1/2008 and 03/2015 and selected those from pts previously submitted to PCI and that were not positive for myocardial ischemia. Then we evaluated the presence of CVRF, the occurrence of adverse events, and possible correlation. The statistic analysis was made with univariate analysis using chi-square test. For survival analysis we used the Kaplan-Meier method.

Results: We analyzed 3487 treadmill EE of those 648 were performed in pts with previous PCI. Then we studied 295 pts whose EE were negative (220) or inconclusive (75) for myocardial ischemia: 247 (83.7%) men, mean age 61 ± 9 years. 199 pts (67.5%) had complete revascularization. The indication for EE performance was: follow-up in 212 pts (71.9%), atypical chest pain in 33 pts (11.2%), angina pectoris in 19 pts (6.4%), fatigue in 19 pts (6.4%), and other in 8 pts (2.7%). In the mean follow-up of 795 ± 485 days there was 2 (0.7%) non-cardiovascular death and there wasn't cardiovascular death. We note the following events: 13 (4.4%) stable angina, 7 (2.4%) unstable angina, 6 (2%) non-ST-segment-elevation myocardial infarctions, 1 (0.3%) acute myocardial infarction with ST segment elevation, 8 (2.7%) heart failure and 8 (2.7%) pts with positive exercise ECG. These events occurred 805 ± 504 days after EE. Nineteen (6.4%) pts were submitted to PCI and 1 (0.3%) was submitted to surgical revascularization. In univariate analysis we didn't find significant statistical difference between the EE result (inconclusive or negative) and events occurrence ($p=0.562$).

Relative to CVRF we recorded 212 (71.9%) hypertensive pts (HT), 198 (67.1%) with dyslipidemia, 160 (54.2%) smokers or ex-smokers, 76 (25.8%) diabetic pts (DM), 42 (14.2%) obese and 10 (3.4%) with chronic renal disease (CRD). Hypertension ($p=0.016$), dislipidemia ($p=0.046$) and diabetes ($p=0.045$) were predictors of adverse events occurrence.

Conclusions: A non-positive EE pos PCI has a negative predictive value of 84.7%. There was no statistical significant difference between the test result (negative or inconclusive) and adverse events occurrence. Hypertension, dislipidemia and diabetes were predictors of adverse events. One year free-events survival rate was 97.7%. In a patient with previous PCI a treadmill EE without evidence of myocardial ischemia appears to have good prognostic value in medium-term follow-up, with low events incidence.

P585

The use of myocardial strain imaging in the detection of coronary artery disease during stress echocardiography

S. Shimoni; O. Edri; O. Edri; N. Schneider; N. Schneider; N. Abaye; N. Abaye; J. Goerge; J. Goerge; G. Gandelman; G. Gandelman
Kaplan Medical Center, Rehovot, Israel

Background: Myocardial deformation imaging allows quantifying myocardial function far beyond what can be done with sole visual assessment. The aim of our study is to determine whether post-ischemic impairment of regional LV function occurring after exercise could be detected by quantifying territorial longitudinal strain/strain-rate changes in patients with coronary artery disease (CAD).

Methods: Eighty nine consecutive patients with suspected CAD underwent stress echocardiography. Peak systolic strain was measured at rest, peak stress and 5 and 10 min after stress. Bull's eye of strain and strain rate maps were done and compared with coronary angiography results.

Results: There is a significant increase in Peak Systolic strain during exercise and 5 min post exercise with patients without CAD ($p<0.001$). In patients with CAD there is no significant change in PSS values at rest, peak stress and 5 and 10 min after exercise ($p=0.9$). Post systolic shortening index (PSI) is significantly higher at rest in patients with CAD ($P=0.001$). There is no significant change in PSI index during or after exercise in patients with CAD, however in patients with no CAD PSI increases with exercise ($p=0.014$). Peak exercise PSS (AUC 0.745) and rest, peak exercise and 5min post exercise PSI (AUC 0.77, 0.74 and 0.72m respectively) had the best accuracy for detecting CAD at rest, stress and 5 and 10 min post exercise.

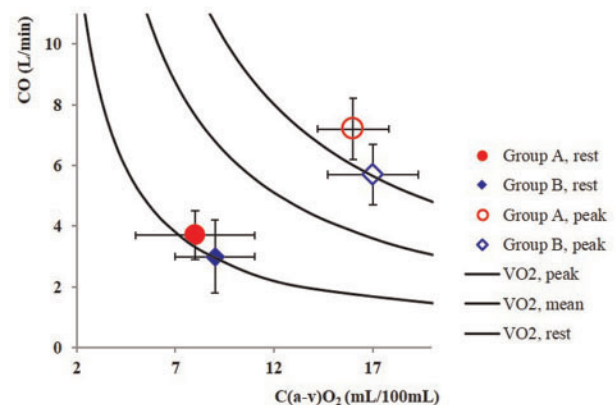
Conclusions: Regional myocardial dysfunction that probably developed during rest and exercise can be detected by the strain method in patients with stable effort angina and CAD. We observed that the various indexes change differently during and after exercise and this is altered when CAD is present. PSS at peak stress and PSI index at rest, peak stress and 5 min post stress are the best parameters for detecting CAD at rest and exercise.

P586

Preserved O₂ extraction exercise response in heart failure patients with chronotropic insufficiency: evidence for a central cardiac rather than peripheral oxygen uptake limitation

G. Generati; F. Bandera; E. Alfonzetti; M. Guazzi
IRCCS, Policlinico San Donato, Heart Failure Unit, San Donato Milanese, Italy

Background: chronotropic incompetence is responsible for exercise limitation in heart failure (HF) patients, and the heart rate (HR) response to exercise has also a strong predictive role in this population. Chronotropic response, evaluated using the chronotropic index ($CI = \frac{\text{maximum HR} - \text{rest HR}}{(220 - \text{age}) - \text{rest HR}}$) can be assessed during maximal cardiopulmonary exercise testing (CPET) in addition to the comprehensive array of exercise capacity parameters provided by the test. Aim: to study the cardiac and functional phenotype related to the heart rate exercise response in a population of HF reduced ejection fraction (HFrEF) patients. Methods: 116 HFrEF patients (mean age 63 ± 11 y, male 70%, ischemic etiology 69%, mean LVEF $33 \pm 9\%$) underwent a maximal CPET (incremental ramp protocol) combined with exercise-echo. Peripheral extraction ($C(a-v)O_2$) was non-invasively estimated by dividing CPET measured VO_2 and echo-derived CO. Study population was divided into 2 groups according to chronotropic response to exercise, assessed using median population value of CI (0.62): Group A with preserved chronotropic response ($n=59$, $CI > 0.62$) and B with impaired HR response ($n=57$, $CI < 0.62$). Results: despite similar baseline characteristics, such as cardiac output (CO, A vs B 3.7 ± 1.3 vs 3 ± 1 L/min, $p=ns$) and VO_2 (0.28 ± 0.06 vs 0.27 ± 0.07 L/min, $ps=ns$), an impaired HR response was related to worse exercise performance (lower peak VO_2 , 1.06 ± 0.33 vs 0.91 ± 0.33 , $p=0.015$) and cardiac response (lower peak CO, 7.2 ± 2.7 vs 5.7 ± 2 L/min, $p=0.001$). Non-invasively assessed peripheral extraction was similar and maximal between groups both at rest and at peak exercise ($C(a-v)O_2$ rest 8 ± 2 vs 9 ± 4 mL/100mL; peak 16 ± 4 vs 17 ± 6 mL/100mL, $p=ns$). Conclusions: in HFrEF an inadequate HR response to maximal exercise is related to an impaired cardiac exercise adaptation that limits exercise capacity, even with preserved peripheral O₂ extraction at rest and maximalized at peak exercise.



Abstract P586 Figure.

P587

Major determinant of O₂ artero-venous difference at peak exercise in heart failure and healthy subjects

G. Generati¹; F. Bandera¹; S. Villani²; O. Ferraro²; E. Alfonzetti¹; M. Guazzi¹
¹IRCCS, Policlinico San Donato, Heart Failure Unit, San Donato Milanese, Italy;
²University of Pavia, Unit of biostatistics and clinical epidemiology, Pavia, Italy

Background: the oxygen uptake (VO_2) response to exercise, measured during cardiopulmonary exercise testing (CPET), is an important prognostic factor in heart failure (HF) patients. The increase in VO_2 is due to the combined increase in cardiac output (CO) and arterial-mixed venous oxygen content difference ($C(a-v)O_2$). Purpose: To investigate the specific determinants of peak exercise VO_2/CO ratio, as estimation of peripheral extraction exercise response ($C(a-v)O_2$), in a population of HF with reduced ejection fraction (HFrEF) and in control group without HF. Methods: 117 HFrEF patients (mean age 63 ± 11 y, male 70%, ischemic etiology 69%, mean LVEF

Two echocardiographic tethering phenotypes were identified: symmetric and asymmetric. TV in asymmetric MR was lower ($4.0 \pm 1.5 \text{ cm}^3$) than in symmetric ($4.6 \pm 1.4 \text{ cm}^3$; $k-w: \chi^2=3.2$; $p<0.05$). The correlation patterns of 3D MV geometry parameters with the MR severity and LV global and regional remodelling was strongly affected by tethering phenotype.
Conclusion(s): 3D TEE provides detailed information on MV deformation. Tenting volume is the main integral criteria of MV geometry correlating with the MR severity, parameters of LV global and local remodeling. Phenotype of MR determines the variation of the correlations.

P591

Left atrial appendage closure. Multimodality imaging in device size selection

C. Fernandez-Golfín; L. Salido Tahoces; C. Izurieta; G. Villareal; A. Esteban; A. Urena Vacas; A. Ayala; J.J. Jimenez Nacher; R. Hinojar Baydes; A. Gonzalez Gomez; A. Garcia; J.L. Mestre; R. Hernandez Antolin; J.J. Zamorano Gomez
University Hospital Ramon y Cajal de Madrid, Madrid, Spain

Background: Transcatheter left atrial appendage (LAA) occlusion is a feasible alternative to long-term anticoagulation therapy for stroke prevention in patients with atrial fibrillation (AF) and high risk of bleeding. Currently, implantation of device is planned and guided by transesophageal echocardiography (TEE) and angiography. However, the implications of sizing the LAA with 3D imaging techniques, such as 3D TEE and multi-detector computed tomography (MDCT) are unknown.

Methods: Retrospective analysis of 30 consecutive patients after LAA closure using the Amplatzer Cardiac Plug ($n=14$) or the Amplatzer Amulet ($n=16$) between march/2012 and November/2015. 2DTEE, 3DTEE and angiography were performed in all patients and MDCT in 10 patients (33.3%) before the LAA closure device implantation. Measurements were performed in a cross-sectional plane orthogonal to the long axis of the LAA at the level of the left circumflex coronary artery and 3D reconstruction of LAA was preoperatively made by MDCT. The device size was chosen oversizing 3-4 mm in relation to the largest angiographic and 3DTEE measurements.

Results: We report 30 consecutive patients who underwent LAA closure (Amplatzer Cardiac Plug ($n=14$) or the Amplatzer Amulet ($n=16$). Median age was 73.1 ± 8.9 years. 54.8% were males. Median CHADS2 and HASBLED scores were 4 (3-5) and 3 (3-4). LAA closure was successfully performed in 28 patients (one failed despite testing three devices and another had a pericardial effusion after transeptal puncture). Mean maximal diameter measurements were 18.9 ± 4.9 mm with 2DTEE, 20.9 ± 4.8 mm angiography, 22.3 ± 5.2 mm 3DTEE, and 24.8 ± 4.3 mm MDCT; We found a good correlation between the measurements analyzed by these techniques; R value 0.82 angiography/2DTEE, 0.83 angiography/3DTEE, 0.67 angiography/MDCT, 0.91 3DTEE/MDCT, 0.90 3DTEE/2DTEE, 0.92 2DTEE/MDCT. Regarding the device size implanted, angiography and 2DTEE trends toward undermeasured and 3DTEE and MDCT overmeasured. 3D reconstruction by MDCT provided useful information to plan the device implantation. There was no blood leakage around the device by TEE examination at 1 month follow up post procedure.

Conclusions: There was a good correlation between the measurements analyzed by different imaging techniques. However, 2D underestimate the size of the left atrial appendage compared to 3D. The use of 3D echo images in combination with angiographic evaluation to select device size leads to excellent results and supports the use of 3D images over 2D in this procedure.

P592

Contributions of three-dimensional transesophageal echocardiography in the evaluation of aortic atherosclerotic plaques

MC. Corneli; G. Perea; Y. Covelli; R. Henquín; R. Ronderos
Instituto Cardiovascular de Buenos Aires, Ciudad Autónoma de Buenos Aires, Argentina

Aims: Complex aortic atherosclerotic plaques (CAAP) are associated with a high risk of embolism. Currently, two-dimensional transesophageal echocardiography (2DTEE) is the main diagnostic tool of CAAP. The data provided by three-dimensional echocardiography (3DTEE) could improve spatial assessment and characterization of aortic atherosclerotic plaques (AAP) identifying a larger number of CAAP. The aim of this study is to compare the prevalence of CAAP evaluated by 2DTEE and 3DTEE.

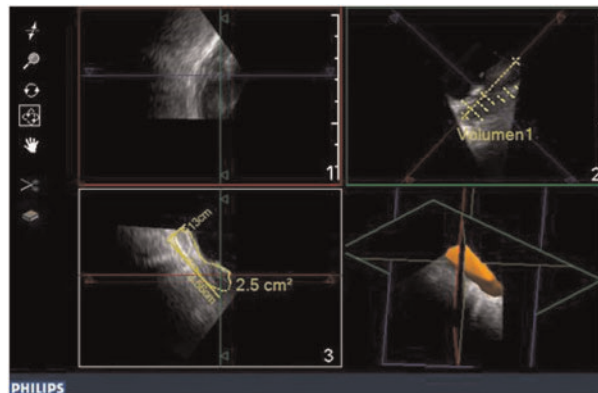
Methods and Results: 27 PAA were found in a population of 20 patients (age 73.4 ± 14 years), which were performed on a scheduled transesophageal echocardiography study. The aorta was evaluated using X-Plane mode. AAP were identified by 2DTEE, and then a 3D volume at that level was acquired. The volume was post-processing in a Q-lab workstation and characteristics of the AAP were determined. It was considered as CAAP a plaque having a thickness ≥ 4 mm. A greater number of CAAP were identified through 3DTEE (64.7% 3D images vs. 17.6% 2D images; $P = 0.01$).

Conclusion: Through the valuation of AAP with 3DTEE a significant difference in spatial assessment and characterization of AAP in relation to 2DTEE it was found. Complementing two-dimensional information, three-dimensional evaluation identifies a greater number of CAAP, and thus improve the diagnosis of patients at high risk of an embolic event.

PAA 2D vs 3D

	2D Image	3D Image	p
Medium thickness, mm (Interquartile range)	3 (2-3)	4.2 (3.5-7)	$P=0.0001$
Number of irregular plaques, n (%)	8 (23.5)	24 (70.6)	$P=0.01$
Plaques > 4 mm, n (%)	6 (17.6)	22 (64.7)	$P=0.01$

Differences in characterization of AAP compared 2D vs 3D



Abstract P592 Figure.

CONTRAST ECHOCARDIOGRAPHY

P593

Agitated blood-saline is superior to agitated air-saline for echocardiographic shunt studies

M. Ali; M.J. Hepinstall; CS. Cassidy; PA. Pellikka; SV. Pislaru; G. Kane
Mayo Clinic, Rochester, United States of America

Introduction: Sterile saline agitated with a small amount of air is used in echocardiography for the detection of intracardiac shunts. However, use in patients with large right-to-left shunts confers a risk of stroke due to embolization of microbubbles. We observed that using a mixture of blood and saline without the addition of air produces excellent quality echocardiographic contrast, and significantly reduces the amount of air introduced to the circulation. The purpose of this study was to test the feasibility of an agitated blood-saline mixture in echocardiographic shunt studies and to compare its efficacy against the standard agitated air-saline mixture in opacification of cardiac chambers.

Methods: In a prospective clinical trial we recruited patients scheduled for a clinically indicated echocardiographic shunt study (TTE, N=50; TEE, N=50). Each patient had at least 2 contrast injections, 1 with the standard agitated air-saline injection (0.5 ml air vigorously mixed with 10ml saline) and 1 with the blood-saline mixture (0.5-1 ml of patients' blood mixed vigorously with 9 ml saline). Digitally stored images were reviewed side-by-side by two independent echocardiographers blinded to the nature of contrast administered. The quality of contrast opacification was rated on the following scale: (poor=1; adequate=2; excellent=3) for right atrial opacification. Scores were then averaged and compared.

Results: Of the 100 patients recruited, 9 were excluded (difficulty withdrawing blood, n=7 or a cancelled shunt study n=2). The remaining 91 patients were analyzed (TTE: n=45; TEE: n=46). Overall administration of blood-saline resulted in fewer studies of poor quality (3 vs 10, $p=0.04$) and overall as many excellent quality studies (45 vs 38, $p=0.17$). The number of excellent quality TTE studies were nearly twice as likely with blood-saline (22, 49%) than with air-saline (12, 27%; $p=0.02$).

Conclusions: Use of agitated blood-saline without air is feasible in most (93%) and tends to provide better quality images compared to agitated air-saline, particularly for transthoracic images. As this approach minimizes the amount of air introduced into the circulation during shunt studies, agitated blood-saline should be considered the default method for contrast opacification during echocardiographic shunt studies where feasible.

P594

Contrast transthoracic echocardiography as a gatekeeper for patent foramen ovale closure

M. Muratori; G. Italiano; E. Innocenti; L. Fusini; M. Mapelli; G. Tamborini; S. Ghulam Ali; P. Gripari; A. Maltagliati; F. Celeste; M. Pepi
Centro Cardiologico Monzino IRCCS, Milan, Italy

Background. The presence of patent foramen ovale (PFO) has been linked to many illnesses, including cryptogenic stroke, transient ischemic attack, migraine, platypnea-orthodoxia syndrome and decompression sickness in scuba divers. Transesophageal echocardiography is the gold standard technique for the visualization of atrial septal anatomy, but it is a secondary level exam, not always available, with additional associated costs

and not completely free from procedural risks. Standard transthoracic echocardiography (TTE) has a too low sensitivity for PFO screening.

Purpose. The aim of the study was to assess the role of TTE associated with agitated saline contrast injection (contrast-TTE) as a gatekeeper for the identification of PFO in a large cohort of patients undergoing selection for percutaneous closure.

Methods. A total of 200 patients undergoing a diagnostic work-up for the identification of PFO was imaged by contrast-TTE at rest and after provocative maneuvers (PM: Valsalva in all cases). Contrast TTE was graded from 0 to 4 on the bases of bubbles counting (0: no bubbles; 1: < 10 bubbles; 2: 10-30 bubbles; 3: >30 bubbles; 4: complete LV opacification). PFO closure was performed after a consensual clinical decision by the cardiologist and the neurologist taking into account comprehensive imaging, clinical evaluation and thrombophilia screening. PFO closure was always monitored by intracardiac echocardiography.

Results. At baseline contrast TTE was positive (≥ 2) in 34 patients (17%) while contrast TTE with PM was positive in 94 cases (47%). 27 out of 200 patients (14%) had an interatrial septal aneurysms. PFO closure was performed in 34 cases (17%). All of these had severe right-to-left shunting (≥ 3) at contrast TTE and 9 cases had also an interatrial septal aneurysms. The procedure was aborted in only 1 patient due to a complex defect anatomy.

Conclusion. Contrast TTE with PM may be not only considered an accurate tool for the detection of PFO but may be also inserted in the diagnostic work-up as a primary gatekeeper for percutaneous closure. Severe shunting at contrast TTE influences final decision making in a large cohort of cases undergoing screening for PFO closure.

TISSUE DOPPLER AND SPECKLE TRACKING

P595

Mitral annular displacement in apical four-chamber view by speckle-tracking echocardiography as a simple index for left ventricular longitudinal systolic function

T. Hozumi; H. Emori; K. Takemoto; K. Terada; M. Orii; K. Ohkochi; T. Kameyama; Y. Ozaki; A. Kuroi; T. Tanimoto; Y. Matsuo; Y. Ino; T. Kubo; A. Tanaka; T. Akasaka
Wakayama Medical University, Wakayama, Japan

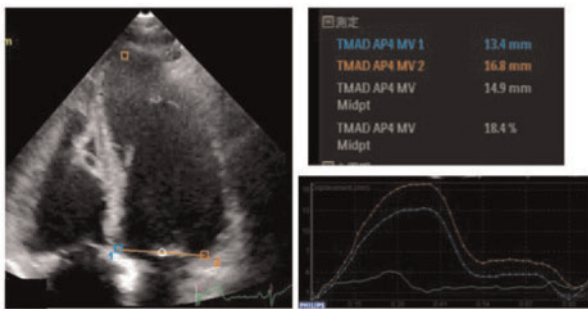
Background. Left ventricular (LV) global longitudinal strain (GLS) from three apical cross-sections using speckle-tracking echocardiography has been used for the evaluation of LV longitudinal systolic function. Application of speckle-tracking technology to the mitral annulus provides rapid and easy assessment of mitral annular displacement (MAD) in apical 4-chamber (AP4) view or 2-chamber view (AP2).

Purpose. The purpose of this study was to examine whether MAD measurements from single apical view by speckle-tracking echocardiography can be used as an alternative index of standard GLS in the clinical setting.

Methods. The study population consists of 83 subjects without segmental wall motion abnormality and arrhythmia [21 with aortic stenosis (AS), 26 with mitral regurgitation, 7 with dilated cardiomyopathy (DCM), and 29 without structural heart disease] in whom GLS was assessed by speckle-tracking echocardiography. Assessment of GLS was performed from apical long-axis view, AP4, and AP2 with QLAB software (ver.10, Philips Medical Systems). Using the same software, MAD was automatically and quickly evaluated as the base-to-apex displacement of mid-point of both septal and lateral annuli in AP4. The percentage of MAD to LV length from the mid-point of mitral annulus to the apex at end-diastole (%MAD) was calculated (Figure). We also evaluated %MAD as the base-to-apex displacement of mid-point of both posterior and anterior annuli in AP2, and the average of % MAD from AP4 and AP2. We compared %MAD evaluated from three ways with GLS in the study subjects.

Results. %MAD was successfully assessed in 81 in AP4 (98%) and 67 in AP2 (81%) of 83 study subjects. There were good correlations between GLS and %MAD in AP4 ($r = -0.85$, $p < 0.01$), %MAD AP2 ($r = -0.80$, $p < 0.01$), and average of %MAD in AP4 and AP2 ($r = -0.87$, $p < 0.01$). Both LVG and %MAD in AP4 in the subjects with AS and DCM were lower than those in normal subjects [GLS: AS -17.7 ± 4.5 , DCM -11.1 ± 3.2 , vs normal -21.0 ± 2.4 , $p < 0.01$, %MAD: AS 10.7 ± 3.9 , DCM 6.6 ± 2.8 vs normal 15.8 ± 2.1 , $p < 0.01$].

Conclusions. %MAD in single AP4 estimated with higher success rate compared with AP2 by speckle-tracking echocardiography correlated well with standard GLS from three apical cross-sections. %MAD in only AP4 which is rapidly evaluated in the clinical setting may be used as an alternative index of GLS for LV longitudinal systolic function.



Abstract P595 Figure.

P596

Impact of chronic glycemic control on left ventricular myocardial function in young patients with type 1 diabetes mellitus

C. Ruisanchez Villar; F.J. Gonzalez Vilchez; M. Piedra Leon; M. Marigomez Estrada; C. Pesquera Gonzalez; J. Ruano Calvo; J. Zarauza Navarro; R. Martin Duran; JA. Amado Senaris
University Hospital Marques de Valdecilla, Santander, Spain

Background. Our aim was to study the utility of novel sensitive echocardiographic techniques to detect subclinical myocardial dysfunction in asymptomatic type 1 diabetes mellitus and whether the metabolic status is of influence.

Methods. 70 asymptomatic type 1 diabetes mellitus patients were compared with 81 healthy volunteers. The groups were age and gender matched (45% vs. 43% women, mean age 37 vs. 36.6 years). Patients and volunteers were normotensive and had a normal lipid profile. The absence of significant coronary artery disease was assumed in the presence of normal maximal exercise echocardiogram. All participants underwent a full conventional echocardiographic study including spectral tissue Doppler. Left ventricular ejection fraction (LVEF) was evaluated on two-dimensional (2D) and 3D echocardiogram. We used 2D-speckle tracking to analyse LV global longitudinal myocardial strain (GLS) as a surrogate of LV systolic function, and peak early global diastolic strain rate (ESR) to assess diastolic performance. A possible correlation was examined for diabetes duration, chronic glycaemic control, expressed by mean 1 year glycated haemoglobin (HbA1C), and microvascular complications.

Results. There were no significant differences in body mass index, blood pressure and lipid profile in the diabetic and control group. Both groups had similar left ventricular (LV) global systolic function by 2D and 3D echocardiography. Patients with type 1 diabetes showed normal diastolic function compared with controls on conventional and TDI echocardiography, evidenced by no significant differences in mitral inflow early diastolic velocity-E wave (80.7 ± 17 cm/s vs. 82.0 ± 16 cm/s, $p = 0.56$), lateral peak mitral annular velocity-Ea wave (13.9 ± 2.9 cm/s vs. 14.1 ± 2.2 cm/s, $p = 0.17$) and in the subrogate E/Ea ratio (5.9 ± 1.3 vs. 5.71 ± 1.2 , $p = 0.11$). Nevertheless, both LV GLS ($-20.3 \pm 1.9\%$ vs. $-21.9 \pm 1.7\%$, $p < 0.001$) and ESR (1.56 ± 0.25 s $^{-1}$ vs. 1.76 ± 0.2 s $^{-1}$, $p < 0.001$) were significantly lower in the diabetic group compared with healthy volunteers.

In the diabetic group, we found a significant association between HbA1C and GLS ($r = 0.4$; $p = 0.01$), and ESR ($r = -0.45$; $p = 0.001$). On multivariate regression analysis HbA1C was the strongest contributor to a decreased LV GLS ($\beta = -0.29$; $p = 0.01$) and LV ESR ($\beta = -0.40$; $p = 0.001$). Diabetes duration and the presence of microalbuminuria were not independent factors associated with GLS ($p = 0.65$; $p = 0.77$) and E SR ($p = 0.58$; $p = 0.67$).

Conclusions. Novel, highly sensitive echocardiographic techniques based on myocardial velocities and deformation appear to be able to detect early stages of myocardial affection in type 1 asymptomatic diabetic patients, even in the presence of apparently normal conventional echocardiographic parameters. A poor glycaemic control may negatively affect this sensitive parameters of LV myocardial function.

P597

Association of left atrial function echocardiographic parameters with fibrosis assessed invasively in patients with sinus rhythm and atrial fibrillation undergoing ablation for atrial fibrillation

E. Pilichowska; J. Baran; P. Kulakowski; B. Zaborska
Grochowski Hospital, Postgraduate Medical School, Department of Cardiology, Warsaw, Poland

Purpose: Electromorphological remodeling and fibrosis of the left atrium (LA) play important role in pathogenesis of atrial fibrillation (AF) and may predict poor catheter ablation (CA) outcome. LA fibrosis may be assessed invasively using electroanatomical mapping (EAM) during electrophysiological study. We have previously shown that the extent of LA fibrosis may be assessed non-invasively by speckle tracking echocardiography (STE), however the effects of underlying cardiac rhythm (sinus or AF) on the accuracy of analysis have not yet been examined.

The aim was to assess the relationship between LA function derived from echocardiography (TTE) and LA fibrosis using EAM in patients with AF and sinus rhythm (SR).

Methods: Patients (pts) n=66 (64% males, mean age 56 ± 10) with non-valvular AF treated with first CA were studied. LA volume using biplane area-length method was calculated. In STE global peak atrial longitudinal strain (PALS) was obtained by averaging values in all LA segments in 4- and 2-chamber views. E/E' and LA stiffness index - the ratio of E/E' to PALS were assessed.

The EAM of LA was build using Carto System before CA. Low amplitude potentials area (LAPA) was quantitatively analysed and expressed as a percentage of LA surface using the range 0.5-0.05 mV to detect potential sites of fibrosis.

Results: 48 (72%) pts were in SR, 18 (28%) pts in AF during the analysis. Pearson correlation analysis showed a significant correlation between LAPA and TTE parameters only in pts with SR not in AF subgroup (table).

Conclusion: Assessment of LA function by TTE with STE correlates well with the extent of LA fibrosis assessed by EAM only in SR. Thus, STE may be useful in non-invasive assessment of LA fibrosis and proper selection of candidates for CA in SR, but may not be applicable during AF rhythm. These preliminary findings warrant further examinations.

TTE parameters	SR LAPA		AF LAPA	
	r	p-value	r	p-value
PALS global	-0.538	<0.001	-0.163	0.518
LA stiffness	0.655	<0.001	0.121	0.656
E/E'	0.559	<0.001	0.432	0.095
LA volume	0.446	0.002	0.222	0.395

P598
Mitral annular calcification decreases diastolic tissue Doppler velocity(E') in regions affected with calcifications

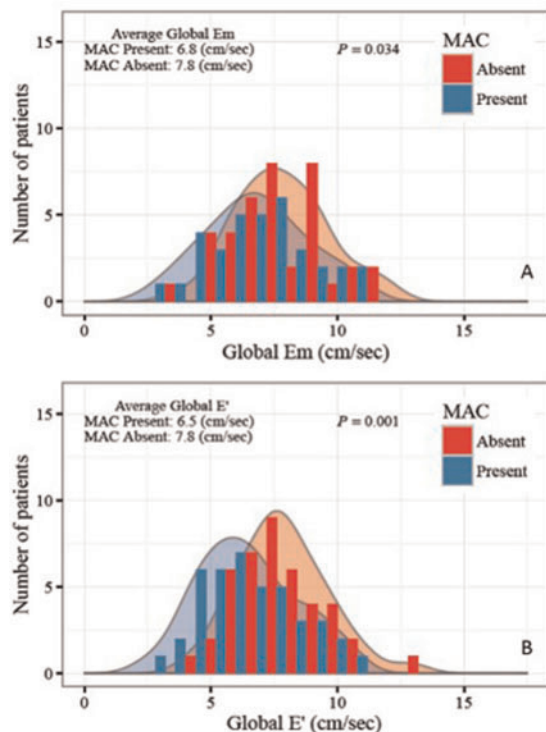
L. Chebrolu; R. Schutt; D. Maragiannis; M. Abudiah; A. Sunkara; P. Alvarez; S. Nagueh; WA. Zoghbi
The Methodist Hospital, Cardiology, Houston, United States of America

Background. Tissue Doppler (TD) diastolic mitral annular velocity (E') is an index of left ventricular (LV) relaxation. Normally, there is a progressive increase in TD velocity from the LV muscle (Em) to annulus (E') in apical views. Whether mitral annular calcification (MAC) affects the mobility of the annulus and diminishes E' in areas with MAC is not known.

Methods. In 138 patients (67 with MAC), TD velocities were obtained from apical views (Apical long, 4 and 2 chamber views) at 6 annular sites (E') and adjacent LV muscle regions (Em, just 1 cm apical to the annulus). The 6 regions were grouped in 2: mostly affected by MAC (Inferolateral/ posterior/inferior), and not affected by MAC (anterior/anterior septum/inferior septum). Atrial fibrillation, LVEF (Ejection Fraction) < 50%, wall motion abnormality and mitral regurgitation were excluded. Data was analyzed in an age-matched sub-population (n = 96).

Results. There were 48 patients with MAC and 48 age-matched patients without MAC. The groups were similar in age (66 ± 11 vs. 64 ± 10 yrs), systolic blood pressure (Range: 114-152 vs 127-149 mm Hg) and LVEF (Mean 74% vs 73%; all p = NS). Average E' and Em were lower in patients with MAC (Figure 1-Graphs A&B depict lower global Em and E' in patients with MAC when compared to controls). Importantly, MAC altered the normal increase of TD velocity from LV muscle to annulus regionally, in the area of calcifications: in calcified regions, velocity was lower in the calcified annulus compared to the adjacent LV muscle (Em - E' = 0.3 ± 0.9 cm/s; % change 6.6 ± 1 %). The reverse (normal progression) was seen in patients without MAC, with E' being higher than Em (Em - E' = - 0.2 ± 1.4 cm/s, % change of - 2.1 ± 16.0%). In the non-calcified annular regions of patients with MAC, the progression in TD velocity from muscle to annulus was similar to the patients without MAC.

Conclusions. Mitral annular calcifications lower TD annular velocity in areas affected with calcification. Thus, caution is needed in applying E' as an index of diastolic function in the presence of MAC.



Abstract P598 Figure.

P599
2D longitudinal LV speckle tracking strain pattern in breast cancer survivors: sports activity vs exercise as prescription model

L. Stefani¹; GP. Pedrizzetti²; BT. Tosi¹; SP. Pedri³; GG. Galanti¹
¹University of Florence, Florence, Italy; ²Engineering and Architectural Department-University of Trieste, Engineering and Architectural Department-University of Trieste, Trieste, Italy; ³Esaote-Italy, Florence, Italy

Introduction: Cardiotoxicity is the second leading cause of long-term morbidity and mortality in cancer. Prevention and management strategies are important to optimize cancer's care and to maintain cardiovascular health. Regular exercise program and sport are normally proposed to maintain myocardial performance. However, no data is available about actual myocardial benefits when different levels of physical exercise are allowed. The purpose of this retrospective observational study is to report clinical and cardiac outcomes, by the 2D Speckle tracking (ST) analysis, in order to reveal the eventual differences between trained group and not trained control group and to support the fact that sports activity and exercise is an effective prescription model to protect patients survived to breast cancer.

Methods: From a large cohort of 55 previous cancer patients, a group of 23 subjects trained in competitive sports activity Dragon Boat Athletes (DBA) for at least 5 yrs, were selected. They were regularly submitted to a complete echo exam including LV Longitudinal Strain (S_l) assessment (XStrain - Esaote). They were matched with a group of 23 previous cancer patients and were compared with two groups of healthy subjects: 20 athletes (HA) from different kinds of non competitive sports, and 20 volunteers. Results: All data, expressed as mean ± SD, were compared by T-Student test. EF and S_l resulted significantly higher only in healthy subjects, both athletes and volunteers. Despite this, the S_l values were within the normal range for all. Particularly, -S_l did not show any significant differences in patients practicing exercise as prescription when compared to the DBA competitive trained group.

Conclusions: appropriate cardiac management by ST method can improve the supervision of the intensity of exercise. More than EF, 2D STE analysis can complete the exercise as prescription therapy. Regular 2D ST pattern revision can optimize and improve cancer therapy supporting and creating efficiencies within the health system. In addition 2D Longitudinal Strain (S_l) confirms that exercise as prescription therapy contributes in maintaining normal heart function at the same level of Dragon Boat Athletes.

Groups	LV Global S _l % (GLS)	LV S _l Medium%	LV S _l Bas Lat %	LV S _l Bas Sept%	LV S _l Lat Apex %	LV S _l Sept Apex%	EF %
Dragon Boat Athletes	-21.87±5.3	-20.02±5	-19.14±7.9	-19.29±5.3	-18.0±5.8	-24.0±5.9	57.2±5.5
Healthy Athletes	-25.4±2.1*	-24.1±2.1*	-25.0±4.1*	-23.5±5.5*	-23.8±5.5*	-25.9±3.8*	64.8±5.1*
Patients submitted to Exercise as Prescription	-19.93±4	-19.21±4.4	-20.81±5.9	-17.89±5.7	-17.64±5.3	-20.52±7.2	59.95±7.3
Healthy subjects submitted to Exercise as prescription	-22.19±4.4	-21.87±3.8	-22.0±6.7	-19.22±4.9	-21.59±5.8	-24.35±6.8	61.39±5.4

P600
Catheter related atrial fibrillation is associated with left atrial deformation in patients with paroxysmal supraventricular tachycardia: a study of two-dimensional speckle tracking echocardiography

M. Akcakoyun; H. Eren; A. Avci; S. Demir; M. Evlice; A. Guner; M. Tabakci; C. Toprak; M. Inanir; R. Kargin
Kartal Kosuyolu Heart Education and Research Hospital, Istanbul, Turkey

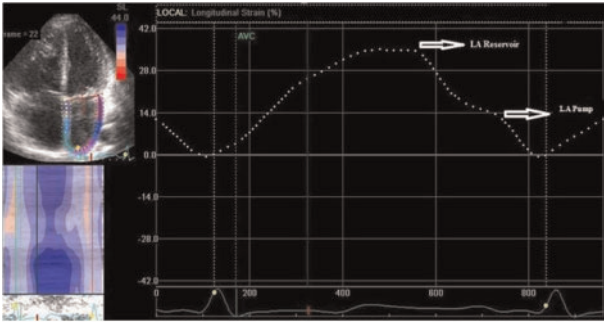
Introduction: the mechanisms of atrial fibrillation (AF) in paroxysmal supraventricular tachycardia (PSVT) are unclear. We studied left atrial (LA) deformation parameters by speckle tracking echocardiography in patients with atrioventricular nodal reentrant tachycardia (AVNRT) those experienced transient AF due to catheter manipulations (catheter related AF) during electrophysiological study (EPS).

Methods: A total of 100 patients who underwent EPS for AVNRT were included. 48 of them were the patients those experienced catheter related AF during EPS. Catheter related AF defined as the AF lasting at least 1 minute due to catheter manipulations during EPS.

Results: LA diameter, LA volum indexmax, LA volum indexmin, E/A ratio and deceleration time were statistically different between the groups (p<0.001, p=0.001, p<0.001, p=0.026, p=0.002, respectively). Peak atrial longitudinal strain (PALS) and LA late diastolic strain (LASa) were impaired in patients with catheter related AF in comparison with the patients without catheter related AF during EPS (35.89±2.42 vs 41.38±3.1; p<0.001 and 14.75±0.99 vs 16.93±1.25, p<0.001, respectively). The patients with catheter related AF had significantly lower LA systolic strain rate, early diastolic strain rate, and late diastolic strain rate than the patients without catheter related AF (1.46 ± 0.10 vs 1.61 ± 0.12; p<0.001, 1.28 ± 0.08 vs 1.4 ± 0.11; p<0.001, and 1.14 ± 0.08 vs 1.26 ± 0.07; p<0.001, respectively). LA diameter and PALS were independently associated with catheter related AF (OR:3.462, p=0.014, and OR:0.228, p=0.003, respectively).

Conclusion: Catheter related AF during EPS is associated with LA deformation in patients with PSVT.

Keywords: Speckle Tracking Echocardiography, Atrial Fibrillation, Supraventricular Tachycardia



Abstract P600 Figure.

P601**Early radiotherapy-induced ECG changes and their comparison with echocardiography in breast cancer patients**

KT. Keski-Pukkila¹; S. Tuohinen¹; T. Skytta²; H. Huhtala³; V. Virtanen¹; P-L Kellokumpu-Lehtinen²; P. Raatikainen⁴; K. Nikus¹

¹Tampere University Hospital, Heart Center, Tampere, Finland; ²Tampere University Hospital, Department of Oncology, Tampere, Finland; ³University of Tampere, School of Health Sciences, Tampere, Finland; ⁴Jyväskylä Central Hospital, Department of Medicine, Jyväskylä, Finland

Background: Adjuvant breast cancer radiotherapy (RT) increases risk for late cardiac complications. The distribution, mechanisms and correlated factors of early electrocardiogram (ECG) changes are unknown. The aim of this study was to explore the early RT-induced ECG changes and their possible mechanisms by comparing them with concurrent changes in echocardiography.

Methods: Sixty eligible patients with left-sided and 20 with right-sided breast cancer were evaluated before and after RT without chemotherapy. Each visit included a comprehensive echocardiography study, laboratory tests and an ECG.

Results: RT-induced ECG changes in the anterior and inferior leads corresponded to the RT fields. A decline in T-wave amplitude was observed in 63 (80%) and T-wave inversions in 44 (55%) patients. T-wave decline ($p < 0.001$) and T-wave inversion ($p = 0.003$) were more frequent in left- than in right-sided breast cancer patients. In multivariable analysis younger age ($\beta = -0.245$, $p = 0.005$), mean heart radiation dose ($\beta = 1.252$, $p = 0.001$) and STE global systolic strain rate change ($\beta = 7.943$, $p = 0.002$) were independently associated with T-wave decline. Active smoking ($\beta = 4.268$, $p = 0.017$), mean heart RT dose ($\beta = 2.135$, $p = 0.004$), septal and posterior tissue reflectivity changes ($\beta = 0.346$, $p = 0.030$) and ($\beta = -0.392$, $p = 0.014$) and GLS change ($\beta = -0.784$, $p = 0.010$) were independently associated with T-wave inversion.

Conclusions: ECG changes were prevalent in the early phase after breast cancer RT. They were associated with several functional and structural changes in echocardiography and with higher cardiac radiation doses. More importantly, the high frequency of the ECG changes after thoracic RT should be kept in mind while evaluating these patients in the clinical setting.

P602**Renal function is a major determinant of decreased sub-epicardial longitudinal strain in hypertension**

W-H Li; Y. Liu; W-C Tsai

National Cheng Kung University Hospital, Cardiovascular division, internal medicine department, Tainan, Taiwan ROC

Background: Our previous study showed sub-epicardial longitudinal strain (EpiLS) was an independent prognostic factor for worse outcome in regularly treated hypertension but not global longitudinal strain (GLS) and sub-endocardial longitudinal strain (EndLS). However, determinants of decreased EpiLS have not been well studied.

Purpose

The aim of this study was to investigate the major determinants of decreased EpiLS in hypertension.

Methods: This study included 95 patients (57 men, age 65 ± 12 years) with uncomplicated hypertension who have been regularly treated for more than 1 year. Speckle tracking echocardiography was used for measurement of longitudinal deformation from 3 apical views of left ventricle. GLS was measured by automated function imaging (AFI). We further divided into sub-endocardial and sub-epicardial myocardium and measured their longitudinal strain by manual click-and-draw method and averaged from 3 apical views. Based on our previous study, we used -17.6% as a cut-off point for decreased EpiLS, which has been proved to be an independent prognostic factor for cardiovascular outcome in hypertension.

Results: Among clinical characteristics, men (62% vs. 32%, $p = 0.011$) were more in decreased EpiLS group but not age, body mass index, systolic and diastolic blood pressure. Left ventricular geometry including diameter and left ventricular mass index were similar between groups. Biochemistry examination showed serum creatinine (0.81 ± 0.22 vs. 1.00 ± 0.28 mg/dl, $p = 0.001$) was significant higher in decreased EpiLS group but not lipid profile or blood glucose. Multivariate analysis controlling

gender and serum creatinine showed only serum creatinine (OR: 13.092, 95%CI 1.178 – 164.082, $p = 0.037$) was an independent factor for decreased EpiLS.

Conclusions Serum creatinine was an independent factor for decreased EpiLS in hypertension.

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P603**Evaluation of left atrial function in patients with non valvular atrial fibrillation post cardioversion: speckle tracking echocardiography**

W. Khailil

zagazig university, cardiology, zagazig, Egypt

Background: Recent advances in electrophysiology and pathophysiology of AF have much interest in PAF due to disturbed left atrial global and segmental mechanical function. Speckle-tracking echocardiography is noninvasive imaging technique allows for an objective and quantitative assessment of global and segmental myocardial function independently from the angle of insonation and cardiac translational movements. Aim to: 1-Evaluate the difference between LA function in patients with AF and in normal individuals. 2- Determine relation between the disturbance in left atrial function and development of paroxysmal AF. 3- Early detection of left atrial remodeling post cardioversion. Patients and Methods: The study conducted in Zagazig Cardiology Department. The patients divided into two groups: each group was 36 patients the first group with recent onset AF& the second group: control group (normal). Inclusion criteria: recent onset AF started within 48h before admission and converted to normal sinus rhythm either spontaneous or by cardioversion. Exclusion criteria: Patients with valvular AF, cardiomyopathy, cardiothoracic surgery, Diabetic, hypertension and congenital heart disease. All patients were subjected to: Trans Thoracic Echocardiography to evaluate: Longitudinal and Transverse left atrial diameter measured at the end of systole, E/A ratio by Trans mitral pulsed Doppler. Speckle tracking echocardiography (STE) used to study LA myocardial function From the apical 4-chamber view, global, septal and lateral and segmental longitudinal LA strain (S) was analyzed utilizing the commercially off-line software. Result: statistical difference observed between cases and control group in LA longitudinal diameter, E velocity and E/A ratio ($P < 0.001$). No difference between them in LA transverse diameter or A velocity. Also statistical significant difference between cases and control group in Global strain %, septal rear, lateral annular, lateral mid and lateral rear. No difference between them in septal annular and septal mid strain. Negative significant correlation between E/A velocity and global strain, septal annular, mid, rear and lateral annular and mid strain. Conclusion: In paroxysmal atrial fibrillation, left atrial systolic function is suppressed. LA functional remodeling began to take place in patients with PAF prior to LA enlargement. left atrial systolic function assessment and early recognition of left atrial remodeling by STE prevent thromboembolic complications post cardioversion.

Funding Acknowledgements: zagazig university.

P604**Myocardial dysfunction in ANCA vasculitis measured by two-dimensional speckle tracking echocardiography**

A. Bajrangee; S. Mahabir; G. King; S. Cuddy; C. Feigherty; AO. Maree; N. Conlon; RT. Murphy

St James Hospital, Cardiology, Dublin, Ireland

Aim

Myocardial involvement in patients with systemic vasculitis portends a poorer prognosis. We sought to determine the extent of myocardial dysfunction in Granulomatosis with polyangiitis and Churg Strauss disease using speckle tracking and strain imaging. **Methods:** 20 patients and 22 controls with no prior cardiac history were recruited from December 2015 to April 2016. Baseline demographics recorded included age, sex, cardiovascular risk factors, time since diagnosis, immunosuppressive therapy and vasculitis damage index score (VDI). We performed transthoracic echocardiography using Vivid 7 GE machine along with twelve lead electrocardiograms (ECG) and biochemical analysis at the study visit. A single blinded operator utilizing Echo Pac 11 software performed offline analysis of strain and speckle tracking measurements.

Results: Mean age of the vasculitis group was 56 ± 10 years with 50% being male, while mean age of controls was 53 ± 9 years with 55% male. There were no significant differences between groups in age, incidence of hypertension ($p = 0.3$) or diabetes ($p = 0.6$).

Radial strain was significantly reduced in the vasculitis cohort ($P = 0.05$). The vasculitis cohort also showed a non-significant reduction in longitudinal strain and abnormal diastology as reflected in a reduction in tissue Doppler E' velocities, decreased transmitral E/A ratio and increased E/E' ratio when compared to controls (Table 1).

There were negative correlations between increasing VDI score and reduction in mitral inflow velocities $r = -0.5$ ($p = 0.02$), number of clinical relapses and tissue Doppler E' $r = -0.6$ ($p = 0.009$) and length of cyclophosphamide use with tissue Doppler E' $r = -0.5$ ($p = 0.02$).

Conclusion: This is one of the largest studies investigating myocardial dysfunction in ANCA positive vasculitis. Patients demonstrated a reduction in radial strain and evidence of abnormal left ventricular relaxation. This may be indicative of underlying cardiac involvement

Funding Acknowledgements: No external sources of funding.

Echocardiographic Data

Measurement	Control	ANCA positive group	P Value
Ejection Fraction (Simpsons)	71 ± 7	70 ± 7	0.8
Mitral Inflow E/A (m/s)	1.2 ± 0.43	1.1 ± 0.44	0.4
Tissue Doppler E' (cm/s)	12.6 ± 3.9	11.5 ± 2.9	0.2
E/E'	6.0 ± 1	6.5 ± 2.0	0.4
Peak Radial Strain (% change)	54 ± 17.7	42.5 ± 17.8	0.05
Peak longitudinal strain (% change)	20.5 ± 3.8	18.9 ± 3.2	0.1

P605

CRT, arterial stiffness and ventricular-arterial coupling in HFrefr

E. Sciatti; E. Vizzardi; I. Bonadei; F. Platto; M. Metra
 University of Brescia, Cardiology, Department of Medical and Surgical Specialties, Radiological Sciences and Public Health, Brescia, Italy

Background: cardiac resynchronization therapy (CRT) is indicated for patients with heart failure HF and left ventricular ejection fraction (LVEF) <35% in sinus rhythm and wide QRS. It can improve LVEF and reduce mortality. Arterial stiffness and ventricular-arterial coupling (VAC) are independent prognostic factors in HF patients. No studies to date have investigated the role of CRT regarding these parameters.

Purpose: we aimed at evaluating arterial stiffness and VAC before and early after CRT.

Methods: 30 patients scheduled for CRT were enrolled. Within 3 day before and at least 3 day after the procedure they underwent radial artery applanation tonometry to evaluate central blood pressures and augmentation index (Alx@75), and transthoracic echocardiography to calculate the aortic elastance (Ea), the end-systolic left ventricular elastance (Ees) and their ratio, namely VAC.

Results: mean age was 72±10 years. 22 (73.3%) were male. LVEF was 32±16%. Hemodynamic parameters are reported in Table 1. After CRT there was a great improvement in central pressure and Ea. On the other hand, no effects were seen on left Alx@75, Ees or VAC. These results are independent from LVEF.

Conclusion: CRT is associated to an early improvement in central pressure and Ea, without effects on VAC or peripheral arterial stiffness. This may be due to a regularization of blood flow through the ascending aorta. Considering the prognostic role of these factors in patients with HF, CRT is of growing importance under different points of view.

Table 1

Variable	Before CRT	After CRT	p
Aortic SBP (mmHg)	111±14	105±12	0.012
Aortic DBP (mmHg)	75±10	72±9	0.153
Aortic MAP (mmHg)	89±11	85±9	0.042
Aortic PP (mmHg)	36±13	32±11	0.052
Alx@75 (%)	23±14	20±13	0.391
Stroke volume (mL)	55±18	63±23	0.081
Ea (mmHg/mL)	2.1±0.7	1.8±0.6	0.026
Ees (mmHg/mL)	2.6±1.0	2.3±1.0	0.184
VAC	0.9±0.4	0.9±0.4	0.729

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

P606

Mitral annular morphology and function in cardiac amyloidosis as assessed by three-dimensional speckle tracking echocardiography

A. Nemes; D. Foldeak; P. Domsik; A. Kalapos; Z. Borbenyi; R. Sepp; T. Forster
 2nd Department of Medicine and Cardiology Center, University of Szeged, Szeged, Hungary

Introduction. Myocardial involvement with interstitial deposition of protein-derived fibrils is seen in cardiac amyloidosis (CA). Three-dimensional speckle-tracking echocardiography (3DSTE) was found to be a suitable tool for quantitative volumetric and functional assessment of ventricles and atria by strain analysis. 3DSTE could be used for 'en-face' analysis of valvular annuli, as well. Regarding to recent studies it could be said that alterations of mitral annular (MA) morphology and function are frequently associated with different clinical scenarios. The present study was designed to compare 3DSTE-derived MA dimensions and functional properties in CA with matched healthy controls.

Methods. The study comprised 10 CA patients (mean age: 65.3 ± 11.6 years, 4 males). The diagnosis of CA was suggested by echocardiography and confirmed by biopsy in all cases. CA proved to be AL amyloidosis in 8 cases and transthyretin amyloidosis in 2 cases. Their results were compared to 18 age- and gender-matched healthy controls (mean age: 60.0 ± 5.29 years, 7 males). Complete two-dimensional Doppler echocardiography and 3DSTE have been performed in all cases.

Results. Significantly enlarged end-diastolic MA diameter and area (3.27 ± 0.44 mm vs. 2.73 ± 0.35 mm², p <0.0001 and 12.07 ± 2.84 mm vs. 9.73 ± 1.93 mm²,

p<0.0001) and end-systolic MA diameter and area (2.97 ± 0.54 mm vs. 2.01 ± 0.36 mm², p <0.0001 and 9.80 ± 2.43 mm vs. 5.17 ± 0.86 mm², p <0.0001) could be demonstrated in CA patients as compared to matched controls. CA was found to be associated with significantly diminished MA fractional area change (18.64 ± 12.43% vs. 44.03 ± 22.07%, p <0.0001) and MA fractional shortening (9.28 ± 6.18% vs. 30.5 ± 8.86%, p <0.0001).

Conclusions. CA is associated with significantly enlarged MA dimensions and decreased MA function as demonstrated by 3DSTE.

COMPUTED TOMOGRAPHY AND NUCLEAR CARDIOLOGY

P607

Coronary plaque characterization in Egyptian metabolic syndrome patients using 64-MDCT

EHAB Selim; SALAH El Tahan; M. Loutfi; EMAN El Sharkawy
 International Cardiac Center Hospital, Cardiology Department, Alexandria, Egypt

The term "metabolic syndrome" encompasses many risk factors for coronary atherosclerosis, including obesity, hypertension, insulin resistance, and dyslipidemia.

Individuals with metabolic syndrome are at increased risk for CHD. Data from recent meta-analysis indicate that people with MetS have a 2-fold increase in CV outcomes and 1.5-fold increase in all-cause mortality. Regarding to pathogenesis of ischemic heart disease of the coronary arteries is almost always due to atheroma and its complication, particularly thrombosis. Recently, MDCT has become a clinically established tool for the diagnosis of significant coronary artery disease. In addition, MDCT permits the assessment of coronary atherosclerotic plaque morphology and composition in good agreement with intravascular ultrasound.

The study was designed to assess the relation between metabolic syndrome and the type of coronary plaques and their components by 64-MDCT in comparison with non-metabolic syndrome group.

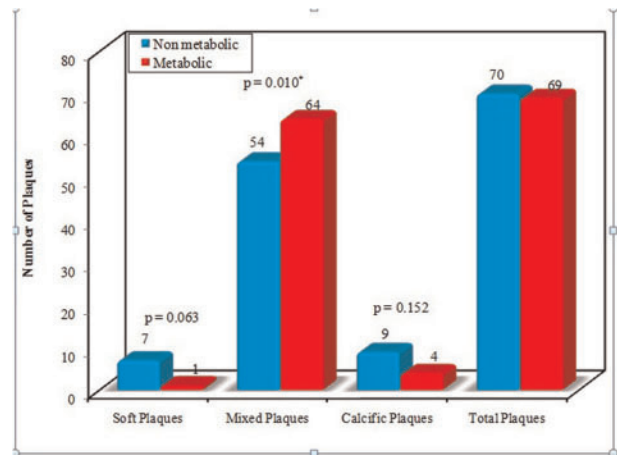
This study included 2 groups (30 MetS vs 30 non-MetS) with low/intermediate pre-test likelihood of CAD who were screened with 64-MDCT between July 2012 and July 2013 at our Centre in Egypt.

All coronary arteries were evaluated for the presence and composition of any plaque in axial and multiplanar reconstructions using Toshiba Medical Systems. Using Color Code Plaque the volume of each component of coronary plaque within the region of interest (ROI) was measured automatically, based on the stratified CT density, plaque analyzed accordingly (soft, mixed or calcified). Lumen, vessel and total plaque volumes were also calculated. Finally, it was determined whether the lesion was obstructive or not, using a threshold of 50% luminal narrowing for the existence of significant stenosis.

There is high statistically significance for each component of MetS in metabolic syndrome group as they are its risk factors. The most common plaque in both groups was mixed plaque with statistically significance higher number in MetS group. With increasing the number of metabolic components in MetS group (3,4 and 5), there were associated increase in the number of mixed plaques.

MetS had more mixed plaques than non-MetS with statistical significance. We observed that patients with MetS had increasing number and percentage of mixed plaques with increasing the number of metabolic components.

MetS is a highly risk condition having more mixed plaques with significance in this study, so it may be reported that mixed plaques are more dangerous and risky than other types of plaques.



Abstract P607 Figure.