POSTER SESSION 2

THE IMAGING EXAMINATION AND QUALITY ASSESSMENT

P600

Upstream Quality Control of B-line in Stressecho 2020

MC. Scali[1]; Q. Ciampi[2]; A. Zagatina[3]; I. Simova[4]; L. Cortigiani[5]; P. Trambaiolo[6]; MH. Miglioranza[7]; JL. De Castro E Silva Pretto[8]; M. Paterni[9]; M. Dekleva[10]; S. Severino[11]; JE. Perez[12]; J. Celutkiene[13]; C. Carpeggiani[9]; E. Picano[9]
[1]Azienda Ospedaliero-Universitaria Pisana, Cardiology, Pisa, Italy; [2]Fatebenefratelli Hospital, Division of Cardiology, Benevento, Italy; [3]Medika Cardiocenter, Cardiology, Saint Petersburg, Russian Federation; [4]City Clinic, Cardiovascular Center, Sofia, Bulgaria; [5]San Luca Hospital, Cardiology, Lucca, Italy; [6]Sandro Pertini Hospital, Cardiology, Rome, Italy; [7]Federal University of Rio Grande do Sul, Cardiology, Porto Alegre, Brazil; [8]Hospital Sao Vicente, Cardiology, Passo Fundo, Brazil; [9]Institute of Clinical Physiology, CNR, Cardiology, Pisa, Italy; [10]Health Center "Zvezdara", cardiology, Belgrade, Serbia; [11]Vincenzo Monaldi Hospital, Cardiology, Naples, Italy; [12]Washington University School of Medicine, Barnes-Jewish Hospital, Cardiology, washington, United States of America; [13]Vilnius University, Cardiology, Vilnius, Lithuania

On behalf of: Stress Echo 2020 study group

Background: The effectiveness trial "Stress echo (SE) 2020" is at the starting blocks to evaluate novel applications of SE in and beyond coronary artery disease. Besides the assessment of regional wall motion (RWM), the core protocol also includes 4-regions scan of B-lines by lung ultrasound (LUS), which is essential to assess pulmonary congestion and refine prognostic stratification in coronary artery disease and heart failure patients.
Purpose: To provide upstream quality control and harmonize B-lines reading criteria across SE2020 centers.
Methods: One cardiologist-echocardiographer from each of 45 centers from 13 countries (Argentina, Brazil, Bulgaria, Costa Rica, Hungary, Italy, Lithuania, Poland, Portugal, Russia, Serbia, UK, USA) of SE 2020 network read a set of 20 LUS video-clips selected by the core lab. All aspiring centers met the pre-requisite of high volume activity (>100 studies per year) and previous pass of the quality control for regional wall motion abnormalities. The core lab prepared for readers an obligatory web-based learning 2-hours module (http://se2020.altervista.org). Each test clip was scored from 0 (black lung, no B-lines) to 10 (white lung, see Figure). The diagnostic gold standard was the reading of core lab. The answer of the reader was considered correct if concordant with core lab reading ± 1 (for instance, core lab reading of 5 B-lines; correct answer 4, 5, or 6). The a priori determined pass threshold was 18/20 (≥ 90%) with R value >.90.
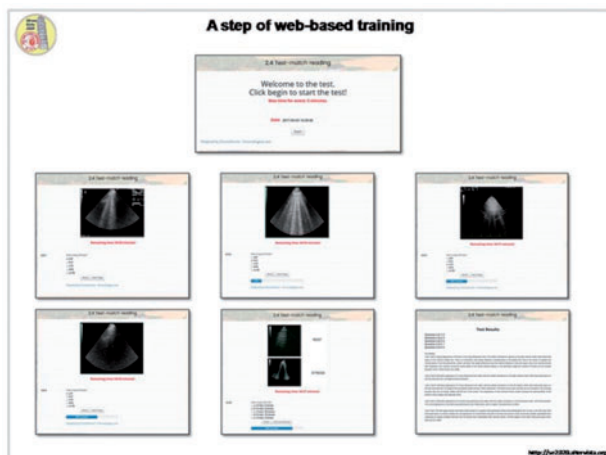
Abstract P600 Figure. Figure

Results: Of the initial 45 readers who started, 7 did not complete the attempt and 38 were successfully accredited, 23 (57%) on first attempt. The average time to completion of test was 14.6 min; 33 readers were B-lines naive (without previous exposure to B-lines). All accredited readers started to use it in everyday routine during physical or pharmacological SE in all-comers enrolled in SE2020 for known or suspected coronary artery disease and/or heart failure and enrolled 903 patients with dual imaging

(regional wall motion and B-lines) as per May 24, 2017. Conclusions: A user-friendly web-based learning is highly effective for training B-lines also in echocardiographers without previous exposure to B-lines. After a limited learning effort, the accuracy of B-lines reading is comparable between very experienced and freshly trained readers. B-lines are becoming an integral part of dual imaging SE adopted as the core protocol in SE2020 for all forms of physical and pharmacological stress

P601

Visual assessment of left ventricular ejection fraction: frequency of use in routine practice in Poland

R. Dankowski; J. Zaprutko; P. Kalmucki; K. Kochman; W. Sacharczuk; A. Szyszka
Poznan University of Medical Sciences, 2nd Department of Cardiology, Poznan, Poland

Background: The recommended method for the echocardiographic assessment of left ventricular ejection fraction (LVEF) is biplane method of disc. Analysis of echocardiographic data from clinical trials on cardiac resynchronization therapy has shown, however, that, contrary to the guidelines, visual assessment of LVEF (ie. eyeball method) is often used.
Aim: We sought to determine the frequency of eyeballing of LVEF.
Methods: We conducted a survey during the Annual Meeting of the Polish Association of Echocardiography. First, seven echocardiographic cine loops was presented (from the same echocardiographic examination); parasternal long axis, three parasternal short axes (basal, middle and apex), apical long axis, four chamber and two chamber views. The audience was asked to assess the LVEF visually. We asked also the questions about the most frequently used method of the estimation of LVEF and two questions about the experience in echocardiography.
Results: 159 surveys has been returned. Calculated LVEF (biplane method of disc) was 48%. LVEF was reported by 109 responders. Mean value of the eyeballing LVEF was 49,2%, median 50% and range was from 25% to 65%.
The majority of respondents declared that they use eyeball estimation of the LVEF most often (87 persons; 54,7%), 37 (23,3%) persons answered that they use biplane method of disc most commonly. 20 (12,6%) responders reported Teicholz method as preferred one, and 9 (5,7%) persons indicated both: eyeball and biplane method.
Conclusion: Despite the obvious limitations the visual assessment is most commonly used method for the estimation of LVEF. Based on the results of our study it should be emphasised that training programmes on echocardiography should include thorough analysis of all potential pitfalls regarding this method.

P602

Agreement of Left ventricular assessment of patients with left bundle branch block using quantitative methods between echocardiography and Magnetic Resonance Imaging

AM. Mistry; N. Natarajan; GM. Mccann
Glenfield Hospital, Leicester, United Kingdom

Funding Acknowledgements: No funding was required

Background: Left ventricular ejection fraction (LVEF) has diagnostic, therapeutic, and prognostic implications. It helps guide the appropriate initiation of heart failure medication and determine when complex implantable devices are used. The preferred method of LV assessment by the British Society of Echocardiography is by Modified Simpson's rule using 2D echocardiogram. The measurement of LVEF can be hindered by the presence of left bundle branch block (LBBB) due to asymmetrical and abnormal sequence of contraction of the left ventricular walls. Cardiac Magnetic Resonance Imaging (MRI) is the gold-standard for measuring ventricular volumes and mass. MRI generates high resolution, reproducible images allowing for accurate assessment of LV dimensions and EF without geometrical assumption and it retains accuracy in segmental disease.
Method: MRI reports that included 'LBBB' or 'Left bundle branch' within either the request or the report were retrospectively obtained from January 2008 – June 2013. The LVEF by MRI was recorded. The echocardiogram data was reviewed and mode of LV assessment with LVEF was recorded. Echocardiograms reported within one year of the MRI were included. These results were then compared with MRI LVEF.
Results: 643 patients underwent cardiac MRI with either 'left bundle branch block' or 'LBBB' mentioned in the requesting information or the MRI report. Mean age of 65 years (+11). In total, 197 patients underwent MRI and echocardiogram within 1 year of each other with a formal report available for review. In these patients, LV function using echocardiography was formally assessed either by Simpsons biplane method (8%), visual assessment (88%), M-mode (0.5%), single plane (1%), or the

method was not stated (4, 2%). Echocardiographic LV assessment overestimated, agreed, and underestimated LV systolic impairment in 41.1%, 44.2%, and 14.7% respectively.

Of the 643 patients, only 33 (5.1%) patients were identified to have had and LVEF assessed using 2D transthoracic echocardiography with Modified Simpson's rule. Of these, 16 had an echocardiogram within the same year. The echo underestimated the EF in 11/16 patients by mean average of 10.1% (range 5.9% to 25%) and overestimated the EF in 5/16 by mean average of 8.8% (range 0.4% to 14.6%). Overall, echocardiographical assessment of LV EF estimated the EF to be -4.2% compared to the MRI derived value. This demonstrates that echo tends to underestimate LVEF even when using Simpsons biplane.

Conclusion: 2D echocardiography underestimated the LVEF in patients with evidence of LBBB leading to potentially unnecessary investigations such as cardiac MRI to further assess the LV dimensions and aetiology of LV impairment. It may also potentially qualify or disqualify them for an implantable cardiac defibrillator or cardiac resynchronisation therapy.

ASSESSMENT OF MORPHOLOGY AND FUNCTION

P603

Reduced LA strain followed by enlarged diameter are the best predictors for recurrent atrial fibrillation after catheter ablation: a systematic review and meta-analysis

G. Bajraktari[1]; P. Ibrahimi[1]; I. Bytyci[1]; E. Haliti[1]; MY. Henein[2]
[1]University Clinical Centre of Kosova (UCC), Service of Cardiology, Pristina, Kosovo Republic of; [2]Heart Centre and Department of Public Health and Clinical Medicine, Umea University, Umea, Sweden

Background and Aim: Left atrial (LA) enlargement is commonly associated with atrial fibrillation (AF) with its known complications. Trans-catheter ablation has become a conventional treatment of AF, but its recurrence remains of significant concern. The aim of this meta-analysis was to determine echocardiographic LA measurements that predict recurrence of AF which should assist in optimizing patient's selection.

Methods: We systematically searched PubMed-Medline, EMBASE, Scopus, Google Scholar and the Cochrane Central Registry, up to January 2017 in order to select clinical trial and observational studies which assessed the predictive role of LA parameters in AF recurrence after catheter-ablation. 16.332 patients from 92 studies with paroxysmal AF (PAF), persistent (PeAF) or long standing persistent AF (L-PeAF) were included.

Results: Three measurements, including LA, diameter, volume (LAVmax) and myocardial strain, were identified as predictors of AF recurrence after ablation. The pooled analysis showed that after a follow-up period of 18.5 ± 7.7 months, patients with AF recurrence had larger LA diameter weighted mean difference (WMD) 0.49 [95% CI 0.39-0.59, P<0.001], larger LAVmax and LAVI, WMD 16.21, [95% CI 11.7-20.7, P<0.0001] and 4.19 [95% CI 2.97-5.42, P<0.0001] and lower LA strain, WMD -7.04%, [95% CI -9.62 to -4.45, P<0.0001] compared with those without AF recurrence. The most powerful predictors of AF recurrence were LA strain <20% [HR: 6.8 (95% CI 2.1-21.4), followed by LA diameter ≥50mm [HR: 4.6, 95% CI 2.6-9.1], LAVmax >150ml [HR: 3.8, 95% CI 1.4-10.4] and to a lesser extent LA diameter ≥45mm [HR: 4.3, 95% CI 2.3-7.9] and LA diameter ≥40mm [HR: 2.96, 95% CI 1.06-8.61].

Conclusions: Based on the available evidence, LA strain <20% is the strongest predictor of AF recurrence after ablation treatment, followed by LA diameter >50 mm. These findings should have clinical impact on optimizing patient's selection.

P604

Disjunction, a separation between the atrial wall-mitral valve junction and the left ventricular attachment

A. Isotani; T. Schau; M. Schoepp; M. Neuss; C. Butter
Brandenburg Heart Center, Bernau bei Berlin, Germany

Purpose: Disjunction was defined as a separation between the atrial wall-mitral valve junction and the left ventricular attachment, which was reported pathologically by Hutchins for the first time in 1986. Little is known about the disjunction of mitral annulus fibrosus. We aimed to review the clinical aspect and morphological features of the disjunction.

Methods: This study included consecutive 251 patients with moderate to severe or severe primary mitral regurgitation (MR), who underwent MC-implantation between March 2009 and April 2014 in our heart center. Disjunction was assessed by transesophageal echocardiography before procedure. A separation between the atrial wall-mitral valve junction and the left ventricular attachment was measured by observing throughout the cardiac cycle. Left and right ventricular geometries and function were measured by transthoracic echocardiography.

Results: Thirty-one patients (12%) had disjunction. In 86 patients with primary MR, 27 (31%) had disjunction while 4 of 165 patients (2%) among patients with secondary MR. All disjunction were observed on posterior mitral leaflets. Forty-nine percent were located on P1, 40 percent were on P3 and 12 percent were on P2. Nine patients had two or more disjunction. Eighty-six patients with primary MR was separated into two groups; patients with disjunction (27) and without disjunction (59). Baseline

characteristics of age, gender, operative risk, severity of heart failure and severity of initial MR were similar between two groups. Left ventricular end-diastolic diameter of disfunction group were significantly smaller than non-disjunction group. On the other hand, mitral annulus diameter of disjunction group were significantly larger than non-disjunction group. The result of MC procedure were similar between two groups.

Conclusions: Disjunction was seen mainly on posterior mitral leaflet. Patients with disjunction had smaller left ventricle, however, they had larger mitral annulus. Clinical impact of disjunction is still uncertain. Further investigation is needed to prepair for future therapy.
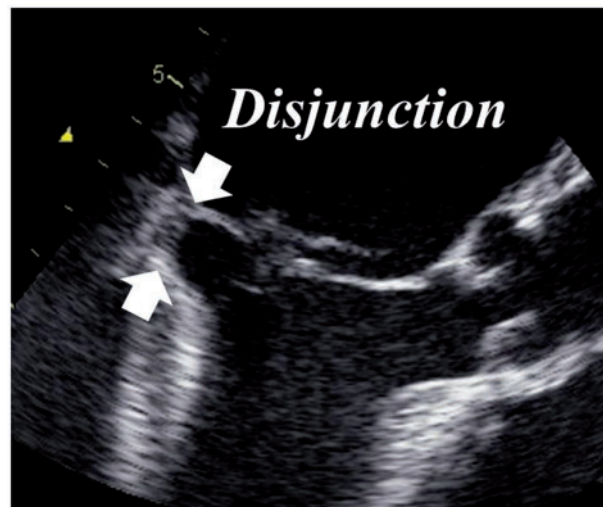
Abstract P604 Figure. Typical disjunction

P605

Role of effective regurgitant orifice area as independent determinant of left atrial peak longitudinal strain

RM. Inciardi; C. Greco; C. Bergamini; G. Benfari; C. Vassanelli; A. Rossi
University of Verona, Division of Cardiology, Department of Medicine., Verona, Italy

Introduction: Peak atrial longitudinal strain (PALS) is becoming a pivotal tool to determine left atrial (LA) function in heart disease such as heart failure, valvular heart disease and cardiomyopathies. Influence of mitral regurgitation (MR) on LA structural remodeling is well known, but less is recognized on functional remodeling

**Purpose:** To determine the influence of MR on PALS

Methods: We enrolled 149 consecutive patients in sinus rhythm (baseline characteristics in Table 1) admitted to our EchoLab. Complete transthoracic echocardiography was performed. MR was estimated with the effective regurgitant orifice area (EROA), determined with the proximal isovelocity surface area method and LA strain analysis was performed with a speckle-tracking software

Results: Ninety-six patients (64.4%) presented MR (91% had mild MR, 8% moderate and 1% severe MR). PALS showed a significant correlation with EROA (r2=0.31; p<0.001; figure 1). After adjustment for LA volume index, end-diastolic volume index, ejection fraction, E/E' and mean of S', EROA resulted independently correlated with PALS (r=-0.28; p=0.001)

Conclusions: PALS analysis is a sensitive tool to detect functional remodeling in patients with MR independently from LA volume and the main systolic and diastolic parameters

Baseline characteristics

Clinical Characteristics	Total (N = 149)
Age (years)	67 ± 14
Women, n (%)	65 (43)
BMI (kg/m²)	24 ± 3
Hypertension, n (%)	103 (69)
Diabetes n (%)	40 (27)
Systolic Blood Pressure (mmHg)	128 ± 20
EF (%)	54 ± 12
EDVi (ml/mq)	71 ± 23
LAVi (ml/mq)	39 ± 16
E/A	1 ± 0.5
E/E'	11 ± 5
PASP (mmHg)	33 ± 11
PALS (%)	31 ± 12
TAPSE (mm)	23 ± 3
EROA (cm²)	0.07 ± 0.09
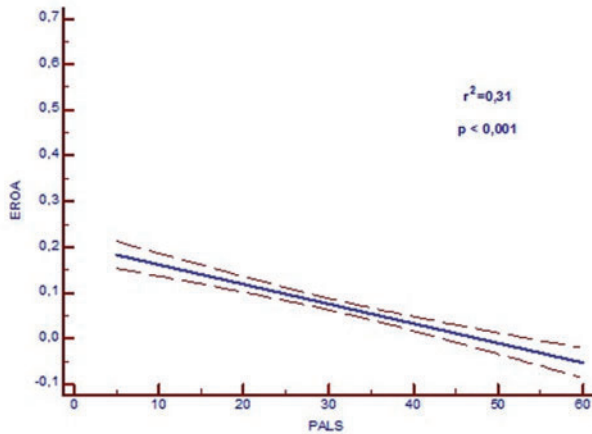
Abstract P605 Figure. Correlation between EROA and PALS

P606

Evaluation of atrial conduction abnormalities in patients with different degree of essential hypertensio arterialis

D. Djikic[1]; B. Dejanovic[2]; N. Mujovic[1]; A. Kocijancic[1]; M. Marinkovic[1]; N. Jankovic[1]; B. Orbovic[1]; V. Kovacevic[1]; S. Lazic[2]; M. Polovina[1]; V. Peric[2]; D. Simic[1]

[1]University Clinical Center of Serbia, Cardiology, Belgrade, Serbia; [2]University Clinical Center, Pristina, Serbia

Objectives: Investigate left and right atrial electromechanical delay (EMD) in patients with different degree of hypertensio arterialis (HTA).

Patients and methods: The study included 75 patients (age 55.4 ± 10.1) with a regulated essential hypertension, 28 patients (age 49.9 ± 10.6) with high normal blood pressure and 46 (51.1 ± 9.7) healthy controls. Patients with arterial hypertension were divided into groups on the basis of the highest measured values of tensio arterialis. Intraleft, intraright and inter atrial EMD were measured by tissue Doppler imaging.

Results: Intra left EMD was significantly higher in the HTA group in relation to control group and significantly increased as belonging to a group with a higher degree of hypertension (5.6 ± 2.4 vs 8.8 ± 4.7 vs 15.4 ± 7.7 vs 23.0 ± 10.3 vs 31.0 ± 7.0). The patients with high normal blood pressure group had significantly higher values of intra left EMD in relation to the patients in the control group. Intra right EMD and inter atrial EMD vas significantly higher in HTA group in relation to control, and significantly increased with a higher degree of hypertension (10.6 ± 3.6 vs 16.2 ± 4.8 vs 20.5 ± 7.7 vs 28.1 ± 8.1 vs 37.4 ± 8.9), (15.6 ± 3.9 vs 25.3 ± 5.9 vs 35.2 ± 13.3 vs 50.2 ± 15.5 vs 67.4 ± 12.7). The patients with high normal blood pressure group had a significantly longer values of these two parameters in relation to control group. ROC curve has shown that intra left EMD 15.5ms separates the patients with arterial hypertension from patients with high normal blood pressure group, with a sensitivity 68% and specificity 99%, 0.89 (0.83-0.94), inter atrial EMD 26.5ms, when the sensitivity is 89%, a specificity of 85%, 0.97 (0.94-0.99), and for intraright EMD value 19.5, when the sensitivity is 76% and the specificity 92%, 0.93 (0.90-0.97). The measured value for the delay of the electrical impulse within the left atrium is higher than 7msec predicts the existence of high normal blood pressure values, with a sensitivity 82%, specificity 83%, 0.93 (0.89-0.97) a value inter atrial EMD greater than 20msec, with a sensitivity 92% and specificity of 93%, 0.92 (0.88-0.96).

Conclusion: Subjects with arterial hypertension even when they are medically regulated have inhomogeneous impulse propagation through both atria and between the two atria. Non-homogeneous propagation of the electrical impulse is dependent on the degree of arterial hypertension.

P607

Whether we should expect for an early response to cardiac resynchronisation therapy

VA. Kuznetsov; AM. Soldatova; DV. Krinochkin; TN. Enina

Tyumen Cardiology Research center, Tyumen, Russian Federation

The aim: was to evaluate clinical, morphological, functional features and mortality in patients with congestive heart failure (CHF) and different time of the best response to cardiac resynchronization therapy (CRT).

Materials and methods: 122 patients (82.8% men) with NYHA functional class III-IV (mean age 54.8 ± 9.6 years). At baseline, 1, 3 months and each 6 months after implantation we evaluated clinical and echocardiographic parameters. In 28 patients the best decrease of left ventricular end-systolic volume (LVESV) was achieved up to 3 months (1.1 ± 0.9 months, I group – «early» response) and in 94 patients – after 3 month (22.6 ± 14.9 months, II group – «late» response). Groups did not differ in clinical characteristics, QRS duration and parameters of mechanical dyssynchrony.

Results: In the II group responders (decrease in LVESV $\geq 15\%$) were identified more frequently (90.4% vs. 60.7%; p = 0.001), all patients with decrease of LVESV $\geq 30\%$ (super-responders, n=53) had «late» response.

During follow-up period (33.2 ± 16.7 months) increase in left ventricular ejection fraction (LVEF) and decrease in LVESV were more evident in patients with «late» response. In Kaplan-Meier analysis mortality in the II group was significantly lower (28.6% vs 3.2%; p=0.001). Cox regression showed that LVESV (HR 1.012; 95% CI 1.004–1.021; P = 0.005) and the time of response (HR 0.131; 95% CI 0.032–0.530; P=0.004) were associated with long-term mortality. Conclusion: Patients with «late» response to CRT demonstrate higher rates of responders and super-responders and better dynamics in LVESV and LVEF compared with patients with «early» response. «Early» response and greater LVESV are associated with higher mortality rate. Thus, early clinical and functional improvement should not be used as a marker of the efficacy of CRT in terms of long-term mortality

P608

Accuracy of the novel semi-automatic 3-dimensional ultrasound analysis system for abdominal aortic aneurysm: Comparison with 2-dimensional ultrasound and aortic CT angiography

IJ. Cho[1]; HJ. Chang[1]; MA. Kim[1]; JY. Lee[2]; J. Park[2]; MK. Kang[3]; N. Chung[1]

[1]Yonsei University College of Medicine, Cardiology Division, Seoul, Korea Republic of; [2]Samsung Medison, Seoul, Korea Republic of; [3]Hallym University, Cardiology division, Chuncheon, Korea Republic of

Background: Accurate measurement of maximum aortic diameter is crucial for patients with abdominal aortic aneurysm (AAA), as the size of aorta is the best criterion to decide intervention. Aortic CT angiography (CTA) is the gold standard for aortic diameter, but CTA has several limitations including contrast usage and radiation hazard. The purpose of the current study was to evaluate accuracy of novel semi-automatic 3-dimensional (3D) ultrasound (US) by comparing it with 2-dimensional (2D) US and with aortic CT angiography (CTA) as a reference.

Methods: We consecutively enrolled 35 patients with AAA. 2D and 3D US imaging was acquired using Samsung Medison Ultrasound system equipped with the single sweep volumetric transducer. Analysis was performed off-line software provided by the manufacturer. Aortic CTA was obtained during index visit. Maximum aortic diameter (ADMAX), maximum vessel area (VAMAX) were measured with 2D US, 3D US, and CTA. Lumen area (LA) and thrombus area (TA) of maximum vessel diameter point were also measured with 2D US, 3D US, and CTA in 22 patients with thrombus in the AAA. Thrombus volume was measured by 3D US and CTA.

Results: ADMAX from 3D US demonstrated a better agreement (r=0.99) with CTA than 2D US(r=0.94). Overall, 2D methods underestimated ADMAX when compared with 3D US (3.7 ± 0.9 cm vs 4.0 ± 1.0 cm). Compared with CTA, Bland-Altman analysis for 3D US showed a good agreement (2 standard deviation [SD]: 0.26 mm) than did 2D US (2 SD: 0.65 mm). VAMAX, LA, and TA all demonstrated a better agreement with CTA than 2D US (r=0.988 vs r=0.961 for MVA, r=0.892 vs r=0.816 for LA, and r=0.977 vs r=0.950, respectively). Thrombus volume assessed with 3D US showed excellent correlation with CTA (r=0.99 and 2SD in Bland-Altman analysis: 13.0 mm3).

Conclusion: 3D US was more accurate than 2D US in measurement of maximum diameter of AAA and vessel areas. Moreover, it accurately provided thrombus volume in the vessel, which was not evaluable in 2D US. The application of novel 3D US may serve a pivotal role for AAA management, by providing accurate maximum vessel diameter as well as thrombus burden in it.
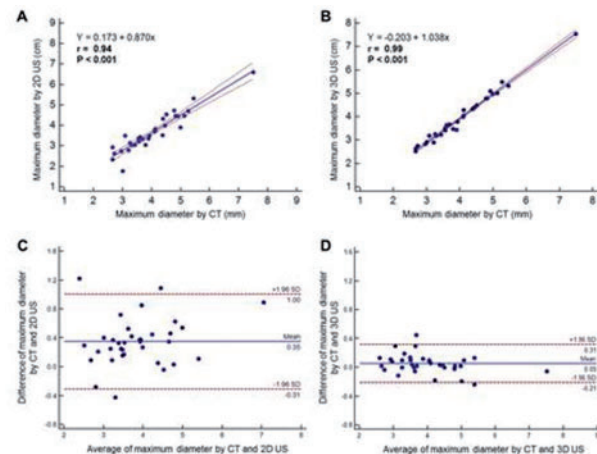
Abstract P608 Figure.

P609

Aortic stiffness is increased in cardiac amyloidosis

A. Nemes; D. Foldeak; P. Domsik; A. Kalapos; A. Kormanyos; Z. Borbenyi; T. Forster

2nd Department of Medicine and Cardiology Center, University of Szeged, Szeged, Hungary

Introduction: Cardiac amyloidosis (CA) has been defined as an infiltrative disorder primarily caused by extracellular tissue deposition of amyloid fibrils in the myocardial

interstitium. The current study was designed to test whether alterations in echocardiographic ascending aortic elastic properties could be detected in CA patients. It was also aimed to compare their results to age-, gender- and risk factor-matched controls.
Methods: The present study comprised of 19 CA patients (mean age: 63.7 ± 9.1 years, 14 males) from which CA proved to be light-chain (AL) amyloidosis in 17 cases and transthyretin (TTR) amyloidosis in 2 cases. Their results were compared to 20 age-, gender and risk factor-matched controls (59.3 ± 4.1 years, 17 males). All patients and healthy subjects had undergone routine transthoracic echocardiography extended with blood pressure measurement. Echocardiographic aortic elastic properties were calculated from systolic and diastolic aortic diameter and blood pressure data.
Results: Significantly thickened interventricular septum (15.1 ± 3.4 mm vs. 9.9 ± 1.1 mm, p<0.0001) and left ventricular (LV) posterior wall (14.2 ± 2.4 mm vs. 9.7 ± 1.0 mm, p<0.0001), reduced mean LV ejection fraction (59.3 ± 11.7% vs. 66.2 ± 6.7%, p=0.03) and increased E/A (1.89 ± 1.15 vs. 0.88 ± 0.21, p=0.0007) suggesting systolic and diastolic dysfunction could be detected in CA patients. Significantly reduced aortic strain (0.054 ± 0.039 vs. 0.080 ± 0.036, p=0.04) and pulsatile change in aortic diameter (1.53 ± 1.08 mm vs. 2.22 ± 1.04 mm, p=0.05) and increased aortic stiffness index (12.6 ± 10.7 vs. 7.5 ± 3.6, p=0.05) could be demonstrated in CA patients as compared to matched controls.
Conclusion: Increased aortic stiffness could be demonstrated in CA as compared to age-, gender- and risk factor-matched controls.

P610

Additional cardiac remodeling of a military special operation forces program in young athletes

PJ. Gomes Dinis[1]; H. Dores[2]; R. Teixeira[1]; L. Moreno[3]; L. Puga[1]; MC. Cachulo[1]; J. Cardoso[3]; L. Goncalves[1]
[1]University Hospitals of Coimbra, Coimbra, Portugal; [2]Armed Force Hospital, Cardiology, Lisbon, Portugal; [3]Coimbra Health Military Center, Coimbra, Portugal

Introduction: Intense and prolonged physical training causes cardiac adaptations. Different types of training results in different adaptations. The aim of this study was to evaluate if a demanding military training program added cardiac remodeling in a population that already trained population.
Methods: Prospective study evaluating 76 military candidates for special operation forces. Of these, 45 were previously athletes, with a history of physical exercise (> 10h / week). Only 17 soldiers, from previously athletes, successfully completed the training program. They were evaluated with a 6 month interval, corresponding to the beginning and the end of the program with a clinical history and a physical exam; blood pressure and heart rate evaluation; anthropometric data and echocardiogram.
Results: The sample consisted of young caucasian males, with a mean age of 21 ± 3 years. There were significant changes from the beginning to the end of the program. We observed a decrease in the percentage of fat mass (19.1 ± 3.3 vs. 13.1 ± 3.5%, P <0.01) and an increase in the percentage of muscle mass (41.3 ± 2.1 vs. 44.4 ± 1.8%, P <0.01). The systolic and diastolic blood pressure, and baseline heart rate decreased. Relatively to cardiac remodeling, there was an increase in left ventricular diameter (49.7 ± 3.2 vs. 52.8 ± 3.4 mm, P <0.01), an increase in left atrial volume (63.4 ± 10.5 vs. 71.1 ± 11.1 mL, P = 0.02), and an increase in left ventricular mass (93.1 ± 7.7 vs. 100.2 ± 11.4g/m2, P <0.01). Functional parameters also changed, with an increase in S ’(15 ± 2 vs. 17 ± 2cm/s, P <0.01) and a slight decrease in left ventricular ejection fraction (LVEF) (60 ± 6% vs. 54 ± 6%, P <0.01). Conclusion: Even in a population of athletes, intense military physical training causes changes with additional cardiac remodeling, both structural and functional.

	Soldiers (N=17)		
	Initial	Final	P
Fat massa (%)	19.1±3.3	13.1±3.5	<0.01
Muscular Mass (%)	41.3±2.1	44.4±1.8	<0.01
LV diastolic diameter (mm)	49,7±3.2	52.8±3.4	<0.01
LV mass (g/m^2)	93.1±7.7	100.2±11.4	<0.01
RWT	0.40±0.05	0.36±0.05	0.05
Left atrium volume (mL)	63.4±10.5	71.2±12.1	0.02
DTI - S' (cm/s)	15±2	17±2	<0.01
LVEF (%)	60±6	54±6	<0.01

P611

Myocardial deformation after acute myocarditis with infarct -like presentation.A 2-D strain follow -up study

M. Campisi; C. De Gregorio; S. Carerj; R. Donato; A. Recupero; C. Zito; R. Costantino; P. Pugliatti; D. Di Nunzio; G. Di Bella
U.O. Polyclinic G. Martino, Messina, Italy

On behalf of: University of Messina

Background: The aim of present study was to assess left ventricular (LV) myocardial deformation and over-time changes in patients with acute myocarditis (AM) with infarct-like presentation.

Methods and Results: 35 male patients with diagnosis of AM with preserved systolic function on the basis of cardiac magnetic resonance imaging (MRI) were enrolled. On admission, echocardiography with measurement of global longitudinal (LS), circumferential (CS) and radial (RS) strains, was performed both at endocardial (ENDO) and epicardial (EPI) levels. Findings were compared to 25 control subjects. Twenty-six patients were also monitored over a 22-month follow-up (FU group). On admission global ENDO-LS was poorer in AM (-19.2±3.1) than in controls (-24.0±1.05) (p<0.0001), whereas EPI-LS was not different (-20.6±3.4 vs -19.7±6, respectively, p=NS). A functional increase in both ENDO-LS (-20.8±5.4, p=NS) and EPI-LS (-22.6±4.6, p=0.02) was found in FU versus AM patients. EPI-CS also improved from -8.9±2.2 to -10.7±2.3 (p<0.0001), as well as ENDO-CS (from -21.4±4.2 to -23.3±4.9, p=0.001), whereas RS remained unchanged. Strain values were chiefly impaired in segments showing late gadolinium enhancement on admission cardiac MRI.
Conclusions: The present study demonstrates a steady ENDO-LS impairment in infarct-like AM during a two-year follow-up period, despite preserved LV ejection fraction. This is more likely in segments showing gadolinium enhancement. On the contrary, EPI-LS, EPI-CS and ENDO-CS tend to improve as potential compensatory mechanisms.

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Myocardial deformation and intensity of exercise in athletes, new overlap between pathology and physiologic

HD. Dores[1]; L. Mendes[2]; P. Dinis[3]; JF. Santos[2]
[1]Hospital Luz, Lisbon, Portugal; [2]Hospital da Luz, Cardiologia, Setúbal, Portugal; [3]Hospital de Santa Cruz, Lisbon, Portugal

Introduction: Regular physical exercise induces several cardiac adaptations that can overlap changes present in several pathological conditions. The myocardial deformation, useful in early detection of myocardial pathology, is less studied in athletes, namely in respect to the relationship with the type and intensity of exercise.
Aim: To characterize the myocardial deformation evaluated by 2D strain in three groups of athletes with different exercise intensities and to compare with a reference population.
Methods and Results: Eighty-one healthy athletes were included (90.1% men; mean age 24±7 years old; 76.5% Caucasian) and subdivided in the groups: Group 1 –athletes of football in national competitive level (N=37); Group 2 – athletes of basketball in regional competitive level (N=17); Group 3 – non-competitive athletes, predominantly involved in dynamic modalities (N=27). A transthoracic echocardiogram (GE^{TM} Healthcare) was performed, including the evaluation of left ventricular Global Longitudinal Strain (GLS). GLS was significantly different between the groups – lower in Group 1, followed by the Group 2 and Group 3 (-16.8±2.8 Vs. -18.3±1.8 Vs. -19.5±2.1%; all p<0.05). Additionally, the GLS of these groups was compared with reference values recommended by the American Society of Echocardiography. The GLS of this control group (-21.5%±2.0%) was significantly higher when compared with the groups evaluated (all p<0.001).
Conclusions: In the studied population, left ventricular myocardial deformation evaluated by GLS was significantly lower in athletes and inversely to intensity/level of exercise. GLS in athletes has similar values to those founded in several pathological conditions, being difficult to differentiate physiology from pathology.

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Impact of longitudinal changes in left ventricular ejection fraction on outcomes of patients with mid-range ejection fraction and reduced ejection fraction

K. Hu; D. Liu; K. Robitzkat; T. Kiwitz; M. Schmidt; S. Herrmann; G. Ertl; S. Frantz; S. Stoerk; P. Nordbeck
Comprehensive Heart Failure Center Wuerzburg, University Hospital Wuerzburg, Department of Internal Medicine I, Wuerzburg, Germany

Background: Association between longitudinal changes in left ventricular ejection fraction (LVEF) and outcomes in heart failure patients with mid-range ejection fraction (EF 40-49%) remains elusive now.
Purpose: This study aimed to determine the impact of longitudinal changes in LVEF on outcomes of HFmrEF and HFrEF (LVEF<40%) patients.
Methods: In total, 286 patients with HFmrEF (mean age 67±12 years, 74.1% male) and 410 patients with HFrEF (mean age 66±12 years, 76.1% male) defined at the first echocardiographic examination were enrolled in this study. All patients underwent ≥ 2 echocardiography examinations and the interval between first and last examinations was no less than 6 months. The endpoint was all-cause mortality or heart transplantation.
Results: Over a median echocardiographic follow-up of 27.5 months, mean LVEF increased by 10.4% (9.1 to 11.7%) in HFrEF patients and by 2.9% (1.8-4.0%) in HFmrEF patients (P<0.05). Patients were further divided into 3 subgroups: worsened LVEF (decrease>5%, n=118), unchanged LVEF (change -5% to 5%, n=260), and improved LVEF (increase >5%, n=418). In HFmrHF patients, coronary artery disease (OR 2.08) and ICD implantation (OR 4.86) were determinants for worsened LVEF. In HFrEF patients, improved LVEF was significantly associated with younger age (OR 0.97), absence of diabetes mellitus (OR 1.64), hyperlipidaemia (OR 1.58), coronary artery disease (OR 2.52), and ICD implantation (OR 2.42).
During the median follow-up period of 130 (90-438) days from the last echocardiography to the endpoints, 48 (12.4%) HFmrEF patients and 69 (16.8%) HFrEF patients died or underwent heart transplantation (p=0.080). Kaplan-Meier curves demonstrated

that overall survival was significantly lower in HFmrEF patients with worsened LVEF than in those with unchanged or improved LVEF (worsened 76.7% vs. unchanged 90.8% vs. improved 89.5%, p=0.001), which was significantly lower in HFrEF patients with worsened or unchanged LVEF as compared to HFrEF patients with improved LVEF (73.3% vs. 77.1% vs. 87.9%, p=0.005).

Cox regression survival analysis showed that the presence of HFrEF at baseline was independent determinant of 2-year overall survival in ischemic HF patients (HR 2.16, p=0.009) but not in non-ischemic HF patients (HR 1.13, p=0.792). In ischemic HF patients, improved LVEF over time was independent determinant of 2-year overall survival in HFrEF patients (HR 0.36, p=0.003), whereas worsened LVEF was independent determinant of 2-year outcomes in HFmrEF patients (HR 2.48, P=0.030).

Conclusions: In patients with HFmrHF, coronary artery disease and ICD implantation are determinants of worsened LVEF. In patients with HFrEF, improved LVEF was significantly associated with younger age, absence of diabetes mellitus/hyperlipidaemia/coronary artery disease/ICD implantation. Assessment of longitudinal changes in LVEF are linked with prognosis in ischemic, but not in non-ischemic HF patients with HFmrEF and HFrEF.

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Cardiovascular remodeling in athletes and militaries: a comparative study

PJ. Gomes Dinis[1]; R. Teixeira[1]; H. Dores[2]; P. Correia[1]; M. Madeira[1]; MC. Cachulo[1]; J. Cardoso[3]; L. Goncalves[1]

[1]University Hospitals of Coimbra, Coimbra, Portugal; [2]Armed Force Hospital, Cardiology, Lisbon, Portugal; [3]Coimbra Health Military Center, Coimbra, Portugal

Introduction: Depending on static or dynamic physical training, the cardiac remodeling will be predominantly of concentric or eccentric pattern, respectively. Special operation forces are subject to heavy physical training loads, which includes static and dynamic components. The objective of this study was to compare the cardiac remodeling of special operation forces and high competition athletes.

Methods: Prospective study that evaluated 17 soldiers (S) who successfully completed the course of special operation forces, and 17 professional basketball players (B). They were evaluated with a 6-month interval, corresponding to the beginning and end of the military training program and beginning and end of the sports season. This evaluation included: clinical history and physical examination; anthropometric evaluation, electrocardiogram (EKG) and transthoracic echocardiogram (TTE).

Results: The two groups had identical mean ages, but presented differences relatively to male gender (S-100% vs. B-47.3%, P <0.01) and caucasian race (S-100% vs. B-64.7%, P <0.01). It was verified that soldiers had an increase in body weight, with gain of muscular mass and decrease of fat mass. TTE revealed different patterns of remodeling. In soldiers it was noted an increase of left cavities and a decrease in relative wall thickness (eccentric hypertrophy). In athletes was observed a tendency for cavities sizes decrease and an increase in relative wall thickness (concentric hypertrophy). The remodeling differences in percentage between the two groups were statistically significant for muscle mass, fat mass, left ventricular diastolic dimension, relative wall thickness and left ventricular ejection fraction (LVEF)(Table 1). These data are equally true with gender and race adjustment.

Conclusion: The soldiers group had a predominantly eccentric pattern, while the group of basketball players had a predominantly concentric pattern. The methodology and training load influence cardiac adaptations.

	Athelets (N=17)	Soldiers (N=17)	P
Δ Muscular mass (%)	2.1 ±2.4	7.7±4.1	<0.01
Δ Fat mass (%)	0.6±14.9	-30.1±15.7	<0.01
Δ Intraventricular septum (%)	12.0±19.7	2.7±10.7	0.1
Δ LV mass (%)	8.6±15.1	10.2±10.8	0.72
Δ RWT (%)	14.1±22.5	-7.0±14.3	<0.01
Δ LV diastolic diameter (%)	-3.0±6.1	6.4±14.3	<0.01
Δ LVEF (%)	5.4±11.8	-11.0±12.8	<0.01

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Is strain analysis ready for prime time? a test retest comparison study under real world conditions

NL. Do Couto Francisco; X. Tang; A. Sell; R. Drew; HG. Lu; A. Palloma; J. Vinoya; I. Schnittger; D. Liang; F. Haddad
Stanford University, Echocardiography Lab, Palo Alto, United States of America

Introduction: Global longitudinal strain (GLS) when performed in careful studies has been shown to be a reliable measure of LV function. Changes of as little as 15% have been determined to be of clinical importance. Most tests on the reproducibility of GLS have used repeated analysis of the same imaging data and do not include the range of variability that would occur in actual practice with varying sonographers, acquisitions and machines. Prior to clinical implementation of a strain protocol, we chose to study real world reproducibility.

Methods: Fifty-four unselected patients undergoing clinical echocardiograms had apical images acquired by two sonographers each using two different ultrasound machines (PHILIPS EPIQ/QLAB 10.2 and GE E95 2.01). Seven sonographers participated in the study. Each was trained on the acquisition and analysis of strain data. Strain was analyzed at the time of acquisition. Bias was measured as the mean of the differences and tested using t-test. Agreement between measures was determined using coefficient of variation (COV). F-test was used to test for significant differences in variation.

Results: The average LVEF was (58 ± 9 %). The mean GLS by GE was (-16.7 ± 3.2%) and by Phillips (-19.0 ±0 3%) (p<0.01). Table 1 summarizes results for the inter-vendor test-retest characteristics and global versus single plane measurements. Although GE had lower quantitative COV than Philips for test-retest, the variance for differences in measurements were not statistically significant (F test p=0.12). GLS had significantly lower variability than single plane measurements (p =0.10). Most importantly 17%(GE) and 22%(Philips) of test-retest comparisons would have reached the 15% criteria for clinical significance.

Conclusion: Variability in strain measurements is significant in "real world". Changes in strain greater than the currently used threshold of 15% may be due to variation in measurement and not a change in patient condition in many cases. Caution must be used in making clinical decisions based solely on strain measurements. If strain is to be used, GLS and consistency in the machine and software are important in reducing spurious results.

Table 1

	Bias	COV (%)	Percent >15% GLSΔ
Philips GLS	-0.11	8.6 (6.8-10.0)	22%
GE GLS	0.14	8.0 (6.4-9.4)	17%
Phillips - 4Ch	0.01	12 (9.6-14)	35%
GE - 4Ch	0.20	10.8 (8.2-12.8)	25%
Phillips - GE GLS Comparison	-2.4	14.8 (11.9-17.2)	47%

GLS - longitudinal strain; Ch-Chambers

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Reproducibility and clinical reliability of new and conventional echocardiographic parameters of left ventricular systolic function

T. Baron[1]; L. Berglund[2]; EM. Hedin[3]; FA. Flachskampf[3]
[1]Uppsala Clinical Research Center, Uppsala University, Department of Medical Sciences, Uppsala, Sweden; [2]Uppsala Clinical Research Center, Uppsala, Sweden; [3]Uppsala University, Dept. of Medical Sciences, Cardiology and Clinical Physiology, Uppsala, Sweden

Background: Inter-observer variability, spontaneous biological variation, and measurement error influence test-retest variability, which is crucial for the clinical reliability of left ventricular (LV) function parameters, since a large variability makes it impossible to distinguish effects of disease from the variability in the measurement technique. Limited data on test-retest variability has been published, mainly in patients with normal LV function.

Purpose: To investigate test-retest variability of LV strain measurements in relation to the conventional functional parameters of LV systolic function.

Methods: In a group of 30 patients with different degrees of impairment of LV ejection fraction (EF), echocardiographic studies of the left ventricle were acquired independently and in a blinded fashion by two different, experienced echocardiographers during the same examination. All studies were then analyzed off-line by two independent, blinded readers. The following measurements were obtained: LV EF, end-diastolic and end-systolic volumes (LV EDV and LV ESV), mitral annular plane systolic excursion (MAPSE) and strain (global longitudinal (GLS) and circumferential (CS) [from mid-papillary short-axis view segments]). Reliability of measurements was measured by the Intraclass Correlation Coefficient (ICC) for single measures, and for each parameter the minimal difference detectable with a less than 5% chance of error was determined.

Results: An excellent reliability was found between all measurements. For ICC, their 95% CI and intra-subject SDs, see table. The smallest detectable change in the studied echo parameters was: 1.7% (corresponding to 8.0% relative to mean normal value) for GLS, 3.5% (17.9% relative change) for CS, 6.6% (10.5% relative change) for LV-EF and 1.1mm (9.1% relative change) for MAPSE.

Conclusion: High test-retest reliability was found for all functional parameters. Surprisingly, reproducibility of volume based measures of LV-function, as well as AV-plane displacement were higher than previously reported and only slightly lower than for GLS. Reproducibility of GLS was higher than of CS.

Variable	ICC	95% CI	Mean intra-subject SD
GLS	0.985	0.978-0.991	0.9 %
CS	0.931	0.902-0.959	1.8 %
LV EF	0.979	0.971-0.988	3 %
LV EDV	0.984	0.977-0.990	11 ml
LV ESV	0.990	0.985-0.994	8 ml
MAPSE	0.980	0.971-0.988	0.6 mm

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Effects of an extensive echocardiographic biventricular pacemaker optimization protocol on the rate of non-responders after cardiac resynchronization therapy

P. Barbier[1]; C. Agalbato[1]; I. Viscone[1]; M. Guglielmo[1]; G. Savioli[2]
[1]Centro Cardiologico Monzino, IRCCS, Cardiovascular Imaging Area, Milano, Italy; [2]Foundation IRCCS Polyclinic San Matteo, Medical Clinic II - University of Pavia, Pavia, Italy

Background: Cardiac resynchronization therapy (CRT) was shown to be effective in patients with advanced heart failure (NYHA III-IV), both in improving prognosis and

quality of life and in triggering reverse remodeling of left ventricular (LV) volumes, geometry and function. Among the factors responsible for lack of clinical improvement or LV reverse remodeling in 30-50% of patients (non-responders to CRT), there is a missing or inadequate biventricular pacemaker (PM-Biv) optimization (OPT) of both the atrio-ventricular (AVd) and inter-ventricular (VVd) time intervals

Purpose: To compare in an echocardiographic observational study the rate of CRT non-responders between patients with and without echocardiographic OPT (OPTe).

Methods: We compared two groups of patients undergoing CRT (guidelines-based indication): Gr 1, 155 patients with intraprocedural AVd and VVd OPT based on QRS duration, or proprietary PM-Biv automated OPT algorithm; Gr.2, 70 patients sent to the echocardiography laboratory (by the attending physician) to perform post-implant additional echocardiographic optimization (algorithm based on modifications of pulsed Doppler velocities of LV inflow and outflow, and the Tei index of LV contractility) and programmed echocardiographic follow-up. Positive response to CRT was defined as LV end-systolic volume reduction > 15% at 6 and 12 months post-implant.

Results: Gr.1 and 2 were comparable for age (69±10 vs 68±11 y.), sex (M= 53 vs 47%), LV biplane end-diastolic volume (107±35 vs 111±37 ml/m2), ejection fraction (31±8 vs 31±9 %), and pulmonary systolic pressure (continuous wave Doppler of tricuspid regurgitation) (37±12 vs 37±20 mmHg). Etiology of dilated cardiopathy was ischemic in 44% of Gr.1 and 56% of Gr.2 patients (p=ns). Echocardiographic follow-up was available at 12 months in 68% of Gr.1 and 73% of Gr.2 patients. In Gr.1, rates of non-responders at 6 and 12 months were 68% and 59%, whereas rates in Gr.2 were 58% and 39% (p= 0.039 vs Gr.1).

Conclusions: Our preliminary data suggest a significant role for OPTe to reduce non-responder rate in CRT, allowing for the logistic burden required by the echocardiographic OPTe. Given the dimensions of heart failure epidemiology, the observed reduction in non-responder rate has a potential significant impact on both patients prognosis and management costs of patients with chronic heart failure.

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Reference ranges for transthoracic echocardiography following heart transplantation

A. Ingvarsson[1]; A. Werther Evaldsson[1]; J. Waktare[2]; J. Nilsson[3]; G. Smith[1]; M. Stagmo[1]; G. Radegran[1]; A. Roijer[1]; C. Meurling[1]
[1]Lund University, Skane University Hospital, Department of Cardiology, Lund, Sweden; [2]Liverpool Heart and Chest Hospital, Liverpool, United Kingdom; [3]Lund University, Skane University Hospital,Department of Cardiothoracic Surgery, Anesthesia, Intensive Care, Lund, Sweden

On behalf of: Lund echocardiographic research network

Background: Heart function following heart transplantation (HTx) is influenced by numerous factors including cause of donor death, allograft ischemic time, cardiac surgery and organ size mismatch. Graft function after HTx can be assessed non-invasively using transthoracic echocardiography but reference values are currently not available in this context.

Purpose: The aims of the present study were to compare echocardiographic measures for chamber size and function in clinically stable HTx patients with healthy subjects, to explore the association of allograft age with chamber size and function, and to derive echocardiographic reference values in HTx patients.

Methods: This single centre study enrolled 124 consecutive HTx patients examined prospectively. Patients underwent a comprehensive examination with 2-dimensional echocardiography according to contemporary guidelines using a Philips iE33 ultrasound system. Exclusion criteria: active rejection, heart failure, arrhythmia and valvular disease. All continuous data conforming to a normal distribution are presented as mean ±SD and 95% confidence interval. Echocardiographic measurements were compared to previously reported reference values from the general population. Findings were considered statistically significant at p<0.05.

Results: Compared to reference values derived from healthy subjects we found larger atrial dimensions in HTx patients, with additional differences depending on surgical technique for atrial anastomosis. Left ventricular (LV) diastolic volume was smaller and LV wall thickness was increased in HTx patients (p<0.001). Regarding LV function, both ejection fraction ((EF) 62±7%, p<0.01) and global longitudinal strain were lower ((GLS) -16.5±3.3%, p<0.001), but no differences were observed for global circumferential strain (GCS). Measures of right ventricular (RV) size were greater than reference values (p<0.001). Conventional function measures as well as strain from the RV lateral free wall (RVfree) were reduced (tricuspid annular plane systolic excursion 15±4 mm, p<0 0001, RV systolic tissue Doppler 10±6 cm/s, p<0.001, fractional area change 40±8%, p<0.0001 and RVfree -16.9±4.2%, p<0.001). No correlations were found between echocardiographic measurements and allograft age during up to 25 years after HTx.

Conclusion: Routinely used echocardiographic measures differ in stable HTx patients as compared to healthy subjects. Assessment of left ventricular function with EF and GCS were normal, but GLS were reduced. Right ventricular size was increased and all RV function parameters were below published reference values. Our finding indicate that speckle tracking derived strain can add information and we suggest it should be included when assessing patients post HTx. Furthermore the observed differences could be clinically relevant in the assessment of this patient group and we suggest that specific reference values should be applied in this context.

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3d strain parameters in relation to brain natriuretic peptide in patients with dilated cardiomyopathy

M. Rady; K. Sveric; RH. Strasser; K. Ibrahim

Dresden University of Technology, Heart Center, Department of Cardiology and intensive care, Dresden, Germany

Purpose: Plasma NT-proBNP correlates with prognosis in patients with heart failure (HF) and is helpful in titrating HF therapy. We hypothesized that left ventricular (LV) global strain parameters from 3D speckle tracking echocardiography (3D-STE) at rest would predict NT-proBNP level in non-ischemic dilated cardiomyopathy (DCM).

Methods: We performed multi-beat 3D-STE in 52 patients (51 ± 2 years, all males) with recently diagnosed DCM (< 3 months). NT-proBNP levels were measured at the same day at rest. 20 matched healthy volunteers served as controls. Analysis of 3D LV volumes was performed on a dedicated wall motion tracking software. LV end-diastolic volume (EDV), end-systolic volume (ESV) and stroke volume (SV) were measured and indexed (I) to body surface area for calculation of LV ejection fraction (EF). Global longitudinal strain (GLS) and global circumferential strain (GCS) were calculated as means of 16 regional LV peak systolic strains.

Results: In all DCM patients GLS correlated best with NT-proBNP (r = 0.54, p< 0.001) followed by LV EF, GCS and EDV (r = 0.426, 0.393, 0.374 and 0.357; p < 0.05), although GLS and LV EF showed high inter-correlation (r = - 0.861, p< 0.001). In stepwise multiple regression only GLS remained the most powerful predictor (beta = 0.486, p = 0.001) of NT-pro BNP compared to EDV or GCS (beta = 0.310 and 0.101, p > 0.03) in the overall model (R = 0.256, p < 0.01). GLS remained best predictor of NT-pro BNP in DCM patients with LV EF <35% (r = 0.491, p< 0.001), while it was not correlated in the subgroup with LV EF > 35% (r = 0.264). As expected DCM patients showed an impaired LV function and higher LV dimensions than healthy controls (Table 1)

Conclusion: We demonstrated the superiority of GLS to predict NT-proBNP levels above LV EF, SV and GLS in male DCM patients. We showed the importance of GLS in the assessment of adverse clinical status in patients with DCM. Further studies are required to evaluate the role of GLS in predicting the prognosis of DCM patients.

Baseline characteristics

	All DCM (n=52)	LVEF<35% (n=34)	LVEF>35% (n=18)	Controls (n=20)	P value
NT-proBNP (pmol/L)	467[172,1703]	525[240,2092]	155[73,635]		0.009
NYHA class I and II n(%)	38(73)	22(64)	16(88)		0.035
EDV-I (ml/m2)	107±37	114±38	180±25	61±8	0.02
ESV-I (ml/m2)	75±31	86±32	107±17	28±5	<0.005
LVEF (%)	31±9	26±6	41±4	55±3	<0.005
GLS (%)	-8.5±3.1	-7.0±2.5	-11.4±2.0	-13.3±2.0	<0.005
GCS (%)	-12.4±4.5	-9.8±2.7	-17.5±2.4	-27.4±2.4	<0.005

Mean with sd; NT-proBNP as median with quartiles [25%,75%]

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Clinical significance of right ventricular longitudinal function parameters after aortic valve replacement

A. Coisne[1]; T. Modine[2]; F. Outteryck[1]; S. Mouton[1]; R. Pilato[1]; H. Ridon[1]; M. Richardson[1]; A. Duva-Pentiah[1]; B. Boutie[1]; M. Jacquelinet[1]; M. Koussa[2]; G. Fayad[2]; P. Lancellotti[3]; D. Montaigne[1]
[1]Cardiology Hospital of Lille, Department of Clinical Physiology and Echocardiography – Heart Valve Clinic, Lille, France; [2]Cardiology Hospital of Lille, Department of Cardiovascular surgery, Lille, France; [3]University Hospital of Liege (CHU), GIGA Cardiovascular Sciences, Departments of Cardiology, Heart Valve Clinic, Liege, Belgium

Background: Parameters of longitudinal systolic function, i.e. tricuspid annular plane systolic excursion (TAPSE) and peak systolic velocity (PSV) of tricuspid annulus, are used to quantify RV function in daily practice. Changes in TAPSE and PSV after cardiac surgery have been described for many years with almost no data regarding their clinical significance.

Purpose: To test whether early post-operative decline in right ventricular (RV) longitudinal function is predictive of long-term outcomes after aortic valve replacement (AVR) in patients with severe aortic stenosis (AS

Methods: Between January 2009 and December 2015, we prospectively explored all consecutive patients referred to our cardiovascular surgery department for AVR presenting with severe AS, normal left ventricular ejection fraction (>50%) and TAPSE (>14mm). TAPSE and PSV were assessed 7 days after cardiac surgery for all patients and 1-year after AVR in a subgroup of 100 patients. Patients were followed for major events (ME), i.e. cardiovascular death, cardiac hospitalization, acute heart failure and stroke.

Results: Among a total of 752 patients, 135 patients presented poor acoustic window precluding reliable post-operative measurement of RV parameters. 617 patients were followed-up for ME. TAPSE and PSV were severely decreased after surgery (p<0.0001) with an incomplete but significant recovery 1-year after AVR. Longer cardio-pulmonary bypass duration was the only independent parameter associated with more important decrease in RV function after AVR. After a mean follow-up of 4 ± 2.3 years, no association was shown between early post-operative alteration in TAPSE and long-term prognosis (p=0.21 by log-rank test for trend for ME). Along the same line, neither PSV at discharge nor TAPSE/SPAP (systolic pulmonary arterial pressure) and PSV/SPAP ratios predicted ME onset.

Conclusion: The early and severe post-operative decline in RV longitudinal function reverses within a year and is not predictive of long-term outcomes after AVR

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Assessment of the temporal right ventricular strain-area relation in pulmonary arterial hypertension

HG. Hulshof[1]; AP. Van Dijk[1]; KP. George[2]; D. Merkus[3]; K. Stam[3]; RWB Van Duin[3]; K. Van Tertholen[1]; MTE Hopman[1]; F. Haddad[4]; DHJ Thijssen[1]; D. Oxborough[1]

[1]Radboud University Medical Centre, Nijmegen, Netherlands; [2]Liverpool John Moores University, Liverpool, United Kingdom; [3]Erasmus Medical Center, Rotterdam, Netherlands; [4]Stanford University, Palo Alto, United States of America

Introduction: Pulmonary arterial hypertension (PAH) is characterised by an increased pulmonary vascular resistance (PVR). The higher workload of the right ventricle (RV) results in ventricular remodelling to normalise wall stress. In this exploratory study we assessed whether a novel echocardiographic technique (strain (å)-area loops): 1. differs between PAH patients vs. controls and 2. relates to incremental levels of PVR in PAH patients.

Methods: To address aim 1 we retrospectively assessed 42 PAH patients and 15 healthy controls. Standard transthoracic echocardiography was used to obtain a modified apical 4 chamber of the RV. Concomitant temporal å values and RV areas were obtained to construct a å-area loop. The å-area relationship was assessed by 1) early systolic strain (å_ES), 2) slope of the linear regression line in systole (Sslope), 3) peak longitudinal å (peak å), and 4) dissociation between early systolic and diastolic å contribution (UNCOUP_ED) and 5) late systolic and diastolic å contribution (UNCOUP_LD). To address aim 2 in 37 PAH patients, echocardiographic and right heart catheterisation data were retrieved. Patients were divided in 3 groups (PVR≤500; 501≤PVR≤700; PVR≥701 (dynes.s.cm-5)) to assess if PVR progressively alters å-area loops. Additionally ROC-curves were used to determine the potential clinical value of these novel å-area loop characteristics in PAH patients.

Results: A rightward shift of å-area loop was present in PAH patients compared to controls (Figure 1A). PAH patients had lower peak å (-15.6±4.0 vs. -21.0±4.0, P<0.01) and a lower Sslope (-1.6±0.5 vs. -2.8±0.7, P<0.01) and showed lower UNCOUP_LD (1.0±2.1 vs. 3.3±3.2, P<0.01) compared to controls. Within PAH patients, higher PVR was associated with a more progressive rightward shift (Figure 1B), a lower peak å (-18.9±3.0 vs. -15.6±2.4 vs. -12.3±4.3, P<0.01) and lower Sslope (-2.1±0.4 vs. -1.6±0.5 vs. -1.2±0.4, P<0.01). Using ROC-curves, å-area loop characteristics (Sslope and Peak å) alone and in combination with traditional measures (RVFAC and TAPSE) showed superior discriminative capacity compared to traditional measures alone to distinguish between controls vs PAH patients, but also between PAH patients with lower versus higher PVR.

Conclusion: Patients with PAH, especially in those with higher PVR, demonstrate distinct RV å-area loop measures compared to healthy controls. Moreover, these characteristics alone show better discriminative power between (clinical) groups than traditional measures. These additional insights in cardiac mechanics in PAH patients may be useful for therapy and patient management.

Figure 1 - Mean ε-area loops in A) healthy controls and PAH patients and B) PAH patients with PVR<500 (n=13, solid lines), with 500<PVR<700 (n=13, long dashed line) and PVR>700 (n=12, short dashed line). The thick lines represent the systolic ε-area relation, the thin lines represent the diastolic ε-area relation.
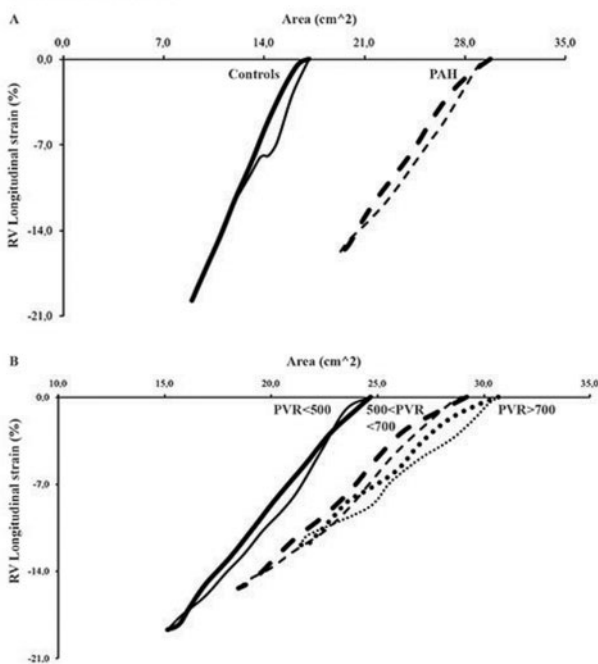
Abstract P621 Figure.

P622

Interest of 3D echocardiography in the assessment of right ventriculo-arterial coupling

R. Aubert; C. Venner; O. Huttin; D. Haine; S. Pinelli; L. Filipetti; CH. Maigrat; J. Vincent; F. Baruffaldi; S. Pierre; A. Guillaumot; Y. Juilliere; F. Chabot; A. Chaouat; C. Selton-Suty
University Hospital of Nancy - Hospital Brabois, Vandoeuvre les Nancy, France

Background: Despite its clinical interest, the analysis of right ventriculo-arterial coupling (RVAC) from pressure-volume loops is not routinely performed. An alternative and simpler method has been derived from the combination of right heart catheterization (RHC) pressure data and CMR-derived RV volumic data. Echocardiography which allows simultaneous pressure estimation and volume measurement by 3D could be another way to estimate RVAC.

Methods: Ninety patients suspect of pulmonary hypertension (PH) underwent RHC, echocardiography including 3D RV acquisition and CMR in a mean delay of 1.4±1.7 days (mean mPAP 37.9 ± 11.3 mmHg, range [15-66]). Complete echo was also performed in 30 normal patients (mPAP 18.4 ± 3.1).

Pulmonary artery effective elastance (Ea) was calculated as mPAP/SV (mmHg/mL), RV maximal end-systolic elastance (Emax) as mPAP/ESV (mmHg/mL), and RVAC as Ea/Emax. RHC measured mean PA pressure (mPAP) and PVR was calculated as (mPAP-PCWP)/CO. mPAP was also estimated from echo using Chemla's formula (mPAP = 0.61 x sPAP + 2mmHg). RV end-systolic volume (ESV), end-diastolic volume (EDV), stroke volume (SV) (mL) and ejection fraction (EF) (%) were obtained both from CMR and from 3D echo (3DE) volumetric analysis (TomTec).

Spearman's correlation coefficients were calculated between 3DE measurements of Ea, Emax and RVAC and RHC-CMR derived measurements. Ea, Emax and RVAC were compared between pts with mPAP< (n=41) or ≥25 mm Hg (n=79), and between 3 groups defined according to the tertiles of PVR among the 90 patients who had RHC.

Results: Among the 90 patients who had RHC-CMR, there were strong correlations between 3DE and RHC-CMR measures for Ea (3DE 1.27 ± 0.94, RHC-CMR 0.71 ± 0.52, r=0.806, p<0.001), Emax (3DE 0.72 ± 0.37, RHC-CMR 0.38 ± 0.19, r=0.798, p<0.001) and RVAC (3DE: 2.01 ± 1.28, RHC-CMR: 2.32 ± 1.77, r=0.826, p<0.001) and concordance (Bland Altman) was good.

3DE-Ea, 3DE-Emax and 3DE-RVAC were significantly lower in pts with mPAP<25 mm Hg than in others (Ea 0.54 ± 0.24 vs 1.34 ± 0.98, p<0.001; Emax 0.69 ± 0.37 vs 0.83 ± 0.29, p=0.04; RVAC 0.66 ± 0.19 vs 2.17 ± 1.28, p<0.001).

3DE-Ea and 3DE-RVAC increased significantly with advancing severity as defined by PVR tertiles (Ea: low tertile: 0.85 ± 0.38, mid-tertile: 1.14 ± 0.39, high-tertile: 1.82 ± 1.39, p<0.001; RVAC low tertile: 1.24 ± 0.76, mid-tertile: 1.89 ± 0.92, high tertile: 2.91 ± 1.46, p<0.001) but Emax did not differ significantly (low tertile: 0.77 ± 0.33; mid-tertile: 0.69 ± 0.29; high-tertile: 0.69 ± 0.47, ns).

Conclusion: Ea, Emax and RVAC derived from 3DE correlated very well with gold-standard RHC-CMR measurements and were significantly different between patients with normal or elevated mPAP, suggesting failure of the RV to increase its contractility and to maintain coupling at high levels of afterload. The echocardiographic assessment of Ea, Emax and RVAC may give further insights in the evaluation of RV response to chronic increased afterload.

P623

3D Right ventricular strain: comparative analysis of Tetralogy of Fallot and atrial septal defect

P. Moceri[1]; M. Sermesant[2]; D. Baudouy[1]; E. Ferrari[1]; N. Duchateau[3]

[1]University Hospital of Nice - Hospital Pasteur, Nice, France; [2]INRIA, Asclepios Research Project, Sophia-Antipolis, France; [3]University Claude Bernard of Lyon, CREATIS, Lyon, France

Background: Right ventricular (RV) function assessment is crucial in CHD patients, especially in atrial septal defect (ASD) and Tetralogy of Fallot (TOF) patients. Indeed, prognosis is very different between TOF patients with pulmonary regurgitation and ASD patients, and only little is known about 3D deformation in RV overload.

Purpose: The aim of our study was to assess RV remodeling differences between ASD, TOF patients and controls.

Methods: We performed a prospective case-control study. We included 10 patients with an ASD (mean age 53.3±21y) and 10 with TOF (mean age 34.9±18y) who were older than 16 years old, and compared them to a control group free from any cardiovascular disease (N=44, mean age 42.5±15y). 3D transthoracic RV echocardiographic sequences were acquired. Myocardial tracking was performed by a semi-automatic commercial software. Output RV meshes included spatial correspondences. They were post-processed to align the data temporally and extract local deformation. Global and local statistics provided deformation patterns for each subgroup of subjects.

Results: Overall, ASD and TOF patients had similar but reduced RV ejection fraction (respectively 44.3±10 and 44.5±12 %) and dilated right ventricles (mean RV EDV 158.3±100 and 115.4±46mL) using 3D analysis. Similar RV global area strain (GAS), global longitudinal strain (GLS) and global circumferential strain (GCS) were observed between the two groups. Compared to controls, ASD patients had lower GAS (-22.2±8 vs -29.4±5%; p=0.01), lower GCS (-12.9±4 vs -17.1±4%; p=0.009) but similar GLS (p=0.07). TOF patients had also lower GAS (-25.1±6%; p=0.03) but lower GLS (-10.0±3%; p=0.01) and similar GCS (-15.5±4%; p=0.4) in comparison with the control group. However, ASD patients had significantly lower CS in the

infundibular, inlet and membranous septum as compared with TOF patients (respectively p=0.02, p=0.05 and p=0.03).

Conclusion: Volume overload in ASD patients seems to impact circumferential strain and preserve longitudinal strain, whereas TOF patients tend to have lower longitudinal strain with preserved circumferential strain, probably because of the combination of RV pressure and volume overload. A larger cohort of patients could help understand the insights of RV remodeling in congenital heart disease using 3D speckle-tracking imaging.
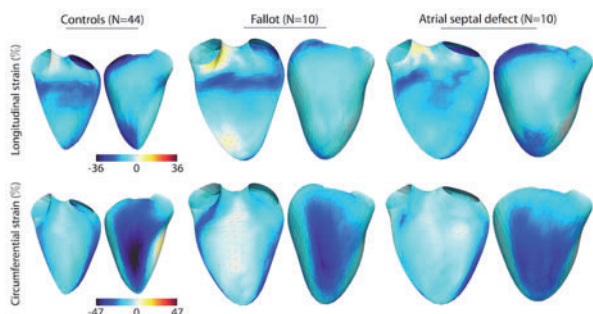
Abstract P623 Figure. RV strain in ASD, TOF and controls

P624

Right coronary artery motion analysis: a novel method to measure right ventricular systolic function by selective coronary angiography

F. Baumann[1]; S. Obeid[1]; T. Gilhofer[1]; P. Siegrist[1]; R. Manka[1]; J. Von Spiczak[1]; J. Alibegovic[1]; F. Tanner[1]; TF. Luescher[1]; RK. Binder[2]
[1]University Hospital Zurich, Department of Cardiology, Zurich, Switzerland; [2]Klinikum Wels-Grieskirchen, Wels, Austria

Background/Introduction: During cardiac catheterization left ventricular systolic function is routinely measured by left ventricular angiography. However, right ventricular systolic function is not routinely assessed in the catheterization laboratory.

Purpose: Therefore, we developed a method to measure right ventricular systolic function during selective coronary angiography by analyzing the systolic translational motion of the right coronary artery thereby reproducing the tricuspid annular plane systolic excursion (TAPSE) as measured by echocardiography.

Methods: In consecutive patients who underwent transthoracic echocardiography and selective coronary angiography, the angiographic motion of the right coronary artery (RCA) in a thirty degree right anterior oblique view was analyzed by two independent operators on two occasions. The motion distance and maximum speed of the mid-portion of the RCA (mid-point between the RCA ostium and the crux cordis) during systole towards the apex was compared to the TAPSE by echocardiography as gold standard (figure 1c).

Results: In 97 patients, the mid-portion of the RCA moved 25.9±9.9 millimeter with a maximum speed of 11.3±4.7 centimeter per second during systole towards the apex. During independent repeat measurements, the reliability of operator A (Cronbach's Alpha) was 94.7 % (95% CI 92.1 – 96.5, p<0.001) and 95.2% (95% CI 92.8 – 96.8, p<0.001) and of operator B 98.1% (95% CI 97.2 – 98.7, p<0.001) and 97.6% (95% CI 96.4 – 98.4, p<0.001) for the RCA motion distance and RCA speed, respectively. Inter-observer variability was excellent for both measurements (Cronbachs's alpha for distance 97.6%, 95% CI 96.4 – 98.4, p<0.001; for speed 96.4%, 95% CI 94.6 – 97.6, p<0.001). The Bland–Altman analysis showed that the 95% limits of agreement between the two operators ranged from -7.84 to 4.17 (figure 1b). There was a significant correlation of the RCA motion distance and RCA maximum speed with the TAPSE measured by echocardiography (Pearson's correlation for RCA distance: r=0.59, p<0.001; for RCA speed: r=0.40, p<0.001) (figure 1a). In patients with a normal right ventricular systolic function measured by echocardiography the RCA motion distance was 27.8±9.2 millimeter and the RCA maximum speed was 12.0±4.4 centimeter per second. The area under the receiver operating curve (ROC) for the RCA motion distance was 0.88 (95% CI 0.80 – 0.96) for discrimination of normal and abnormal right ventricular systolic function (figure 1d).

Conclusion: Analysis of the RCA motion is a reproducible and reliable method to measure right ventricular systolic function during selective coronary angiography. It is a simple and useful tool to asses right ventricular function in the catheterization laboratory and may serve for risk assessment for right ventricular failure.
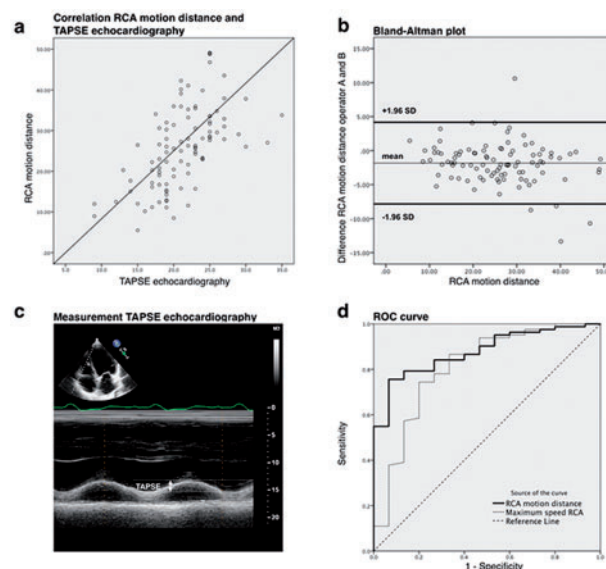
Abstract P624 Figure.a-d

P625

Evaluation of layer strain in right ventricular free wall assessed by two-dimensional speckle tracking echocardiography in patients with pulmonary hypertension

S. Kojima[1]; K. Obase[2]; A. Tsuneto[3]; A. Ide[4]; A. Umihata[1]; N. Kawanami[1]; A. Asada[4]; Y. Kimura[1]; N. Kaku[1]; T. Yoshimuta[3]; T. Minami[3]; S. Ikeda[3]; S. Yamachika[5]; K. Maemura[3]; K. Yanagihara[1]
[1]Nagasaki University Hospital, Laboratory Medicine, Nagasaki, Japan; [2]Nagasaki University Hospital, Cardiovascular Surgery, Nagasaki, Japan; [3]Nagasaki University Hospital, Cardiovascular Medicine, Nagasaki, Japan; [4]Nagasaki University Hospital, Ultrasonic Imaging Center, Nagasaki, Japan; [5]Shunkaikai Inoue Hospital, Cardiovascular Medicine, Nagasaki, Japan

Introduction: Right ventricular (RV) myocardium consists of endocardiac longitudinal muscle and epicardiac circular muscle. It is reported that in left ventricular (LV) hypertrophy with hypertension, the circumferential strain of LV endocardium is lower than that of epicardium even if the LV ejection fraction is preserved.

Purpose: The aim of this study is to identify the difference of endocardiac and epicardiac RV free wall strain in patients with pulmonary hypertension.

Methods: Twenty patients with chronic thromboembolic pulmonary hypertension (CTEPH) (2 men; mean age, 67±13) who underwent two-dimensional speckle tracking echocardiography (2DSTE) and right heart catheterization (RHC) were studied. The peak systolic longitudinal strain (PS) of RV free wall was measured at the endocardial site (Endo-PS) and epicardium site (Epi-PS) by 2DSTE (GE Healthcare EchoPAC version 201), and Epi/Endo was calculated as the ratio of Epi-PS and Endo-PS. The association between 2DSTE parameters and mean pulmonary artery pressure (MPAP), pulmonary vascular resistance (PVR) derived from RHC, six-minute walk distance (6MWD) and NT-proBNP were evaluated.

Results: Absolut value of Endo-PS was higher than the Epi-PS (p<0.001). Endo-PS, Epi-Ps and Epi/Endo were significantly correlated with logarithmic NT-ProBNP (r=0.59, r=0.54, r=0.52). Endo-PS was likely to be correlated with MPAP (r=0.41) and PVR (r=0.43), but Epi-PS was not. Interestingly, Epi/Endo showed significant correlation with MPAP (r=0.60), PVR (r=-0.55) and 6MWD (r=-0.44) as well as logarithmic NT-ProBNP.

Conclusions: In patients with CTEPH, decreased outer layer strain compared with inner in RV free wall was observed. The ratio of these strains correlated with MPAP, PVR, 6MWD and logarithmic NT-ProBNP, suggesting the ratio may have a clinical impact for predicting the severity of pulmonary hypertension. Further studies are needed with large numbers.

Results

	mean±SD	Correlation coefficient (r)			
		MPAP	PVR	6MWD	Log NT-proBNP
Endo-PS	-18.1±5.6%	0.41	0.43	-0.13	0.59**
Epi-PS	-14.9±4.2%	0.30	0.35	-0.10	0.54*
Epi/Endo	0.83±0.06	0.60**	0.55*	-0.44*	0.52*

Correlation between 2STE and clinical parameters
*P<0.05, **P<0.01
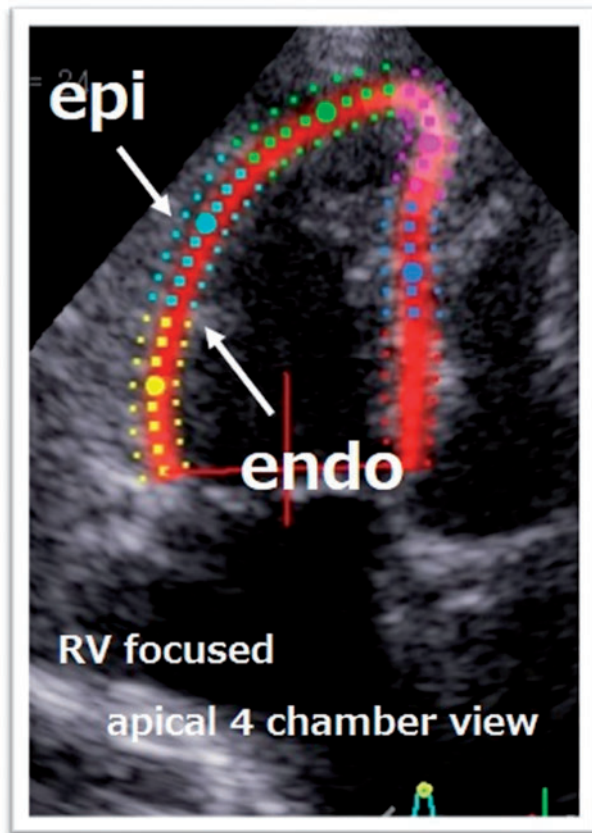
Abstract P625 Figure. Layer longitudinal strain of RV

P626
Tricuspid annular displacement using speckle-tracking 2D echocardiography as a simple index for right ventricular systolic function: comparison with 3D echocardiography

T. Hozumi; N. Maniwa; K. Takemoto; S. Ota; Y. Ozaki; M. Kashiwagi; K. Shimamura; A. Kuroi; T. Kameyama; Y. Matsuo; H. Kitabata; Y. Ino; T. Kubo; A. Tanaka; T. Akasaka
*Wakayama Medical University, Wakayama, Japan*

Background: Right ventricular (RV) function has been identified as prognostic factor in patients with various cardiac diseases. Although TAPSE by M-mode and systolic peak velocity of tricuspid annuls (s') by tissue Doppler echocardiography have been used as indexes for RV systolic function, these are obtained from only the lateral annulus in apical four-chamber view (AP4CV) which may be one of limitations in the estimation of accurate RV systolic function. Application of speckle-tracking technology to the tricuspid annulus provides rapid and easy assessment of tricuspid annular displacement (TAD) of the mid-point of lateral and septal tricuspid annulus in the same view (AP4CV) which may be suitable for RV systolic function.
Purpose: The purpose of this study was to examine whether TAD in AP4CV measured by speckle -tracking 2D echocardiography can be used as a simple index for RV systolic function.
Methods: The study population consists of 50 subjects without segmental wall motion abnormality and arrhythmia [mean age: 50 ± 22 years, 16 with aortic stenosis (AS), 14 with mitral regurgitation (MR), 5 with dilated cardiomyopathy (DCM), 5 with pulmonary hypertension (PH) and 10 without structural heart disease] in whom RVEF was measured by 3D echocardiography (EPIQ and iE33, Philips) with 4D RV-FUNCTION software (TomTec). In 2D echocardiography, AP4CV for the assessment of RV was recorded. Using Philips QLAB10 software, TAD was automatically and quickly evaluated as the base-to-apex displacement of lateral and septal annulus, and mid-point of both annuls as shown in Figure. The percentage of TAD to RV length from the mid-point of tricuspid annuls to the apex at end-diastole (%TAD) was also calculated automatically. The study population was divided into two groups according to RVEF; patients with decreased RV systolic function (RVEF<45%; group-A) and patients without decreased RV systolic function (RVEF >45%; group-B).

Results: %TAD was successfully assessed in 44 (88%) of 50 study subjects. %TAD in group-A was significantly smaller than that in group-B (11.8 ± 2.9 vs 19.5 ± 3.1, p<0.001). There was a good correlation between %TAD and RVEF in all the study subjects (r=0.81, p<0.001). According to ROC analysis, the best cut-off value of %TAD (19.9%) had a sensitivity of 93% and specificity of 96% (AUC=0.98) for the presence of decreased RVEF (<45%).
Conclusions: %TAD in apical four-chamber view using speckle-tracking 2D echocardiography which is rapidly evaluated can be used as a simple index for RV systolic function in the clinical setting.
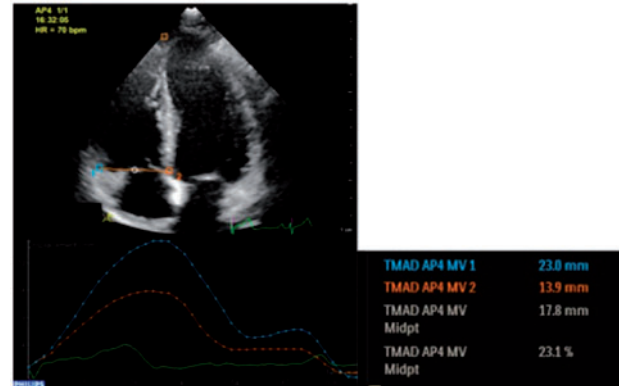
Abstract P626 Figure.

P627
The age-related alterations in diastolic mechanics assessed by speckle-tracking echocardiography in healthy individuals

IW. Seong[1]; BJ. Sun[1]; JH. Park[1]; JH. Lee[2]; MS. Shin[3]; HO. Jung[4]; IS. Sohn[5]; HS. Kim[6]; SM. Park[7]; JH. Choi[8]; HK. Kim[9]; GY. Cho[10]; MR. Lee[11]; KH. Kim[12]; SW. Park[13]
[1]Chungnam National University Hospital, Cardiology, Daejeon, Korea Republic of; [2]Chungbuk National University Hospital, Division of Cardiology, Department of Internal Medicine, Cheongju, Korea Republic of; [3]Gil Hospital, Division of Cardiology, Department of Internal Medicine, Incheon, Korea Republic of; [4]Seoul St. Mary's Hospital, Division of Cardiology, Department of Internal Medicine, Seoul, Korea Republic of; [5]Kyunghee University, Division of Cardiology, Department of Internal Medicine, Seoul, Korea Republic of; [6]Keimyung University Hospital Dongsan Medical Center, Division of Cardiology, Department of Internal Medicine, Daegu, Korea Republic of; [7]Korea University Anam Hospital, Division of Cardiology, Department of Internal Medicine, Seoul, Korea Republic of; [8]Pusan National University School of Medicine, Division of Cardiology, Department of Internal Medicine, Busan, Korea Republic of; [9]Seoul National University College of Medicine, Division of Cardiology, Department of Internal Medicine, Seoul, Korea Republic of; [10]Seoul National University Bundang Hospital, Division of Cardiology, Department of Internal Medicine, Seongnam, Korea Republic of; [11]Samsung Changwon Hospital, Division of Cardiology, Department of Internal Medicine, Changwon, Korea Republic of; [12]Chonnam National University Medical School, Division of Cardiology, Department of Internal Medicine, Gwangju, Korea Republic of; [13]Samsung Medical Center, Division of Cardiology, Department of Internal Medicine, Seoul, Korea Republic of

Background: About the left ventricular (LV) diastolic strain rate, data regarding normal subjects and its physiologic changes are still limited. We aimed to assess the age-related alterations in diastolic mechanics using speckle-tracking echocardiography (STE).
Methods: In a prospective study, we enrolled 447 healthy individuals without history of cardiovascular disease. We analyzed the relationships between age and diastolic parameters of early diastolic strain rate (SRe), late diastolic strain rate (SRa) and the ratio of those (SRa/SRe).
Results: Among total, 213 (48%) were male and the mean age was 48±15 years (figure A). Systemic blood pressures were 120±13 and 72±10 mmHg. The LV mass index was 74 g/m^2 with ejection fraction of 62±4%. Both SRe and SRa showed significant correlations with age, but their age-related trends were opposite (figure B and C). The SRa/SRe ratio was shown as the most relevant parameter with age (R=0.638, p < 0.001, figure D). On multiple linear regression, age showed independent associations with diastolic parameters; increasing age accompanied lower SRe (β=-0.241, p < 0.001) but higher SRa (β=0.531, p < 0.001) and SRe/SRa ratio (β=0.538, p < 0.001).
Conclusion: With increasing age, the early diastolic suction power of LV declines whereas the late diastolic compensatory pulling takes place.
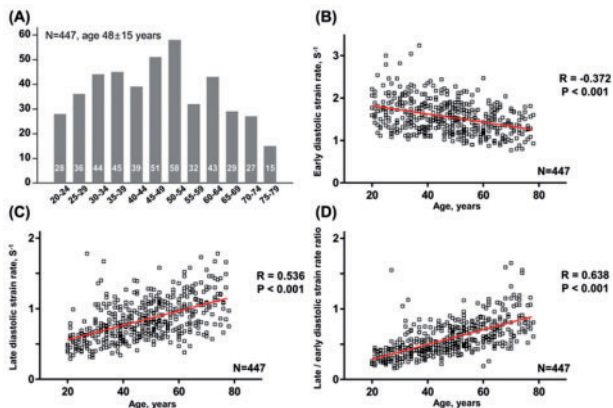
Abstract P627 Figure.

ISCHEMIC HEART DISEASE

P628

Unrecognized left anterior descending ostial lesions can be revealed by transthoracic Doppler visualization
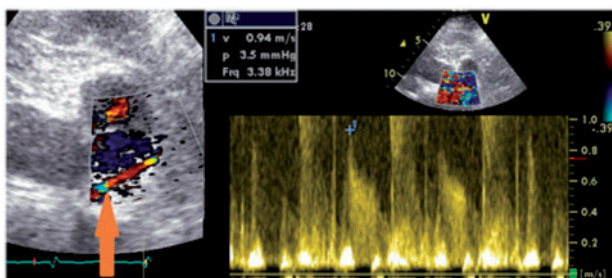
A. Zagatina; N. Zhuravskaya
Cardiocenter Medika, Saint Petersburg, Russian Federation

Stress echocardiography (SE) is a well-established technique for the prognosis of patients with coronary artery disease (CAD). Coronary angiography is an invasive standard for making decisions about treatment strategy. However, stenoses of bifurcation of the arteries can be unrecognized by classical coronary angiography, leading to the severe discrepancy between SE and coronary angiography. The aim was to define the diagnostic value of transthoracic Doppler visualization of left anterior descending (LAD) in cases of severe discrepancy between SE and angiography.
Methods and results: Two hundred and twenty-nine patients, who underwent supine bicycle SE with an additional proximal LAD flow scan, were screened. Eight patients (6 men, 58 y.o., 43-74) had a severe wall motion abnormality in LAD territory with IWMA more than 2.0. They had no stenoses in LAD by coronary angiograms. However, there were aliased coronary flow velocities at rest with high local velocities at LAD ostium, and the average velocity was 103 cm/s (80-150 cm/s). Intravascular ultrasound and/or invasive fractional flow reserves for these patients were performed. All of LAD ostial lesions were defined as being significant.
Conclusion: Additional transthoracic Doppler visualization of LAD can be useful for revealing unrecognized ostial lesions in cases of discrepancy between SE and angiography.

Abstract P628 Figure.

P629

Role of coronary flow velocity in predicting nearest outcome in real clinical practice

A. Zagatina[1]; N. Zhuravskaya[1]; M. Kamenskikh[2]; D. Shmatov[2]; S. Sayganov[3]; F. Rigo[4]
[1]*Cardiocenter Medika, Saint Petersburg, Russian Federation;* [2]*Saint Petersburg State University, Cardiosurgery, Saint Petersburg, Russian Federation;* [3]*Northwestern Medical University n.a. I.I. Mechnikov, St. Petersburg, Russian Federation;* [4]*Dell'Angelo Hospital, Venice, Italy*

Accelerated transthoracic coronary artery flow velocity can be a sign of narrowing these arteries. We sought to assess the prognostic utility of aliased coronary flow velocities at rest (velocity ≥70 cm/s) in left side coronary arteries in consecutive patients who were referred for echocardiography with and without previously documented coronary artery disease, followed for a period of 10 months.

Methods: Three hundred and eight patients, who underwent a echocardiography with an additional LAD and LCx flow scan, were included into the study: 1) Group 1 – 193 persons with high velocities in the proximal part of the arteries; 2) Group 2 – 74 patients with high velocities in the middle parts, 3) 41 persons whose coronary velocities were normal were included as a control group. Death, nonfatal myocardial infarction (MI), pulmonary edema, and/or revascularization were defined as major adverse cardiac events (MACE).
Results: Over a median follow-up of 10 months, there were 149 patients with MACE: 10 deaths, 6 nonfatal MI and 133 patients who underwent revascularization. Deaths occurred in Group 1 only (5% vs. 0% vs. 0%, p<0.03, in Group 1, Group 2, and the control group, respectively). Death/MI occurred in 8% vs. 1% vs. 0%, respectively, p<0.02. MACE were observed in 59% vs. 50% vs. 0%, p<0.0001, respectively. Only maximal proximal velocity proved to be and independent prognostic predictor of death (OR 1.02, CI 1.01–1.03, p<0.006) and death/MI (OR 1.02, CI 1.01–1.03, p<0.002). Male sex (OR 0.45, CI 0.27–0.76, p<0.0009) and proximal maximal velocity (OR 1.01, CI 1.01–1.02, p<0.0001) were independent prognostic predictors of MACE.
The cut-off point for maximal velocity in proximal portions of the arteries for predicting death was 88 cm/s. Sensitivity was 90% and specificity was 55%, with an area under the ROC curve of 0.76, p<0.0007. A cut-off point for maximal velocity of 78 cm/s predicted MACE with sensitivity 83%, specificity 54%, with an area under the ROC curve of 0.72, p<0.0001.
Conclusion: value of coronary flow velocity during routine echocardiography an independent prognostic predictor of MACE.

P630

Measurement of a short-term change in left ventricular global longitudinal strain is useful for the risk stratification in high-risk patients with acute ST-elevation myocardial infarction

R. Hosono[1]; A. Yamada[2]; K. Nakamura[1]; R. Tanaka[1]; S. Jinno[1]; K. Sugimoto[1]; K. Takada[3]; K. Sugimoto[3]; J. Ishii[4]; Y. Ozaki[4]
[1]*Fujita Health University Hospital, Clinical Laboratory, Toyoake, Japan;* [2]*Fujita Health University, Toyoake, Japan;* [3]*Fujita Health University, Faculty of Medical Management and Information Science, Toyoake, Japan;* [4]*Fujita Health University School of Medicine, Department of Cardiology, Toyoake, Japan*

Background: In patients with acute ST-elevation myocardial infarction (STEMI), reduced left ventricular (LV) longitudinal strain (GLS) in the acute stage is shown to be a predictor of poorer prognosis. However, GLS is changeable during hospitalisation and the clinical importance of GLS change remains to be elucidated. The aim of this study was to clarify the short-term change in GLS and its association with cardiac events.
Methods: We studied the consecutive patients who were hospitalised due to first STEMI between 2011 and 2014 in our institution. We performed echocardiography within 48 hours after admission. In addition to the conventional echo data, GLS was measured from apical 3 views (4-, 3- and 2-chamber views) by speckle tracking imaging. According to the reported cutoff value, we selected the patients with GLS < -15.1% as a group at high risk for cardiac events. We excluded those with atrial fibrillation and poor echo image quality for speckle tracking analysis from this study. Follow-up echocardiography was performed within 7 days prior to the discharge, and a change in GLS (delta GLS) was calculated (2nd GLS – 1st GLS). We examined cardiac events (cardiac death, heart failure admission, acute coronary syndrome and myocardial re-infarction) of the study subjects during the term of surveillance.
Results: Fifty-nine patients (mean age 65±13 years, 48 men) were eligible for this study. Mean period between the first and follow-up echo examination was 12±7 days. During a mean follow-up period of 614±594 days, 16 patients experienced cardiac events (3 cases of cardiac death, 4 cases of heart failure admission, 9 cases of ischemic events). At the time of admission, there were no differences in mean age, LV ejection fraction, GLS and peak serum level of creatinine phosphokinase between the patients with events (16 patients) and those without (43 patients). Nevertheless, delta GLS was significantly higher in the patients with events (0.7±1.9 vs -1.1±1.6% p < 0.05), that is, 2nd GLS was more reduced in those patients. Receiver-operating characteristics curve revealed that delta GLS at -0.1% was the optimal cutoff value to predict later cardiac events (AUC 0.75, sensitivity 63%, specificity 72%). Kaplan-Meier analysis showed that patients with delta GLS < -0.1% (37 patients) experienced significantly less cardiac events during the follow-up period (p < 0.0001, log-rank).
Conclusion: Delta GLS was a useful index for the risk stratification in first STEMI patients at high risk. Worsening of 2nd GLS suggested poorer clinical outcome in those patients. Re-estimation of GLS would be highly recommended before discharge.

P631

Can we early identify STEMI patients treated by pPCI at risk to develop heart failure: a speckle tracking echocardiograpic study with one year follow-up?

D. Trifunovic; G. Krljanac; L. Savic; M. Asanin; R. Lasica; D. Matovic; J. Stepanovic; G. Stankovic; I. Mrdovic
Cardiology department, Clinical center of Serbia, Faculty of medicine, University of Belgrade, Belgrade, Serbia

Despite contemporary treatment, significant proportion of STEMI patients (pts) develop heart failure (HF) after primary percutaneous coronary intervention (pPCI). Early identification of those at risk for HF is important. Speckle-tracking echocardiography enables comprehensive evaluation of left ventricular (LV) systolic function, beyond ejection fraction (EF), measuring myocardial deformation by strain and strain rate.

Aim: the study analyzed the relation between LV myocardial mechanics assessed early after pPCI in STEMI patients and development of HF (NYHA class≥2) during the first year after pPCI .

Methods: in 120 consecutive STEMI patients echocardiography was done 5±2 days after pPCI including conventional echo parameters, longitudinal (L), radial (R) and circumferential (C) peak systolic strain (S;%) and peak systolic strain rate (Sr;1/s) on endo-, mid- and epicardial level. Post-systolic shortenings (PSS;%) were calculated for LS and CS on all three layers. In order to analyze predictive power of LV deformation parameters with respect to LV geometry, peak LV systolic strains were indexed over LV end-systolic volume index (LVESVI). Echo studies were done on VIVID 9-GE and EchoPack version 13 was used for speckle tracking analysis.

Results: one year after pPCI 15% of pts developed HF. Compared to non-HF pts, HF patients had LS and CS significantly impaired on all three myocardial layers (LSendo: -9.98±5.14 vs -15.54±5.20 p<0.001; LSmid: -8.08±4.05 vs -12.97±5.11, p<0.001; LSepi: -11.68±3.53 vs -7.67±3.34 p<0.001, CSendo: -13.52±6.14 vs -21.15±5.96, p<0.001; CSmid -9.39±4.31 vs -14.65±4.26, p<0.001; CSepi: -6.72±3.20 vs -10.51±3.34, p<0.001), as well as RS (9.35±4.53 vs 13.22±5.87, p=0.017). As expected, HF pts had lower EF (37.64±12.03 vs 51.11±9.39, <0.001) and higher WMSI (1.42±0.37 vs 1.80±0.33, p<0.001). PSS for LS on all three layers were significantly higher in those who developed HF: endo- (21.33±14.94 vs 9.54±8.32, p<0.001), mid- (23.40±15.41 vs 10.49±8.38, p<0.001 p<0.001) and epicardial level (26.37±16.39 vs 12.00±9.84, p<0.001.

ROC analysis reviled comparable sensitivity (Sn) and specificity (Sp) in HF prediction for EF (ROC 0.810, p<0.001, for 49.5%, Sn 88% Sp 62%) and LS on epicarial level (ROC 0.799; p<0.001; for -11.00%, Sn 88%, Sp 62%). PSS for LS on epicarial level (ROC 0.817, p<0.001; for 17.9%, Sn 81%, Sp 76%) and CS on endocaridal level (ROC 0.822, p<0.001; for 15.92%, Sn 81%, Sp 80%) had better specificity compared to EF. However, the best Sn and very good Sp had LS on epicarial level divided by LVESVI (ROC 0.836, p=0.001, for 0.34, Sn 90%, Sp 73%).

Conclusion: STEMI pts who will develop HF during the first year, have severely impaired not only EF, but longitudinal, circumferential and radial LV myocardial deformation parameters early after pPCI. The best predictor for HF development, more specific and more sensitive than EF, was peak systolic LS on epicarial level indexed by LV systolic volume.

P632

Myocardial infarction with non-obstructive coronary arteries: does age matter?

M. Braga; H. Nascimento; SM. Oliveira; M. Vasconcelos; T. Pinho; RA. Rodrigues; A. Madureira; P. Dias; MJ. Maciel
Sao Joao Hospital, Porto, Portugal

Introduction: Myocardial infarction with non-obstructive coronary arteries (MINOCA) is a heterogeneous disease corresponding to 1-13% of all cases of acute myocardial infarction (AMI). There are several potential aetiologies and the medical approach can be challenge. Although more common in young patients, MINOCA can be diagnosed in all ages.

Purpose: To analyze MINOCA in different age groups, in terms of clinical profile and outcomes.

Methods: We performed a retrospective analysis of a cohort of patients admitted from 2007 to 2014 for AMI suspect and coronariography with non-obstructive coronary arteries (angiographic stenosis <50%). All of them performed a cardiac magnetic resonance (CMR) for further evaluation. Patients were divided in 3 groups according to age: G1: ≤49 years old, G2: 50-64 years old and G3: ≥65 years old. We used Q-square and ANOVA analysis.

Results: Of a total of 108 patients, 48 had ≤49 years old, 30 patients had 50-64 years old and 30 patients had ≥65 years old. Only 23.1% of patients were female in G1, in contrast to 63.3% and 80.0% females in G2 and G3, respectively (p<0.001). Hypertension and dyslipidemia were more frequent in G2 and G3 than G1. In G1 there were more smokers. AMI without ST elevation was the main admission diagnosis in the overall population (G1: 60.4%, G2: 86.7% and G3 76.7%). The most of cases had ST depression or T wave inversion. There were no differences in means of maximal l troponin between groups. Concerning to echocardiographic (echo) findings, severe left ventricular systolic dysfunction was present in 10.4% in G1, 16.7% in G2 and 40.0% in G3 (p=0.005). Regional wall motions abnormality was more frequent in G2 (56.7%) and G3 (60.0%) than G1 (20.8%), p<0.001. Coronariography showed normal arteries in most patients in all groups. Myocardial edema in CMR was more common in G1 (p<0.001). After contrast, epicardial late enhancement was more frequent in G1, while intra-myocardium enhancement was predominant in G2 and G3 groups. In G1 the main final diagnosis was acute myocarditis (72,9% of patients). In contrast, 43.3% of patients in G2 had AMI. Finally, in G3 Takostubo cardiomyopathy (36.7%) and AMI (30.0%) were the leading diagnosis. During follow-up of 3.1±2.0 years, readmissions for MINOCA were more frequent G2, without statistically significance. There were only 3 deaths, all of them in G2.

Conclusions: Unexpectedly, the female sex was not predominant in young group patients. In work-up diagnosis, the most difference observed between groups were in echo and CMR results, focusing the importance of the imaging test in etiologic diagnosis. Acute myocarditis was the leading diagnosis in younger patients, while AMI was predominant in middle-age group. On the other hand, Takotstubo cardiomyopathy and AMI were the major diagnosis in older patients. Further studies of MINOCA are needed to enhance knowledge about this entity and to improve clinical management of this minority of patients.

P633

Right ventricular morphological and functional remodeling one year after first ST elevation myocardial infarction-a prospective three-dimensional echocardiographic study

D. Zamfir[1]; S. Onciul[2]; C. Stefan[1]; D. Cadil[1]; A. Diaconeasa[1]; D. Pitic[1]; G. Tamasescu[1]; R. Onut[1]; M. Stoian[1]; L. Calmac[1]; V. Bataila[1]; M. Dorobantu[2]
[1]*Clinical Emergency Hospital, Department of Cardiology, Bucharest, Romania;*
[2]*University of Medicine and Pharmacy Carol Davila, Bucharest, Romania*

Background: Left ventricular remodeling following acute myocardial infarction has been well described, but right ventricular (RV) volume changes and evolution of RV ejection fraction (RVEF) have been by far less studied in the setting of ST elevation myocardial infarction (STEMI) treated by primary coronary intervention .

Aims: To assess temporal changes of the RV dimensions and systolic function after STEMI with different locations.

Material and methods: We have prospectively analyzed a cohort of 80 consecutive patients presenting with a first STEMI treated successfully by primary percutaneous coronary intervention Patients with a history of cardiac or pulmonary diseases were excluded. Patients were distributed into 3 groups according to the ECG aspect at admission: group A - anterior STEMI (n=45), group B non-anterior STEMI (n=22) and group C concomitant RV necrosis on ECG irrespective of left ventricular infarct location (n=13). Right ventricular indexed end-diastolic (RVEDV) and endsystolic volumes (RVESV) as well as RVEF were measured by three dimensional echocardiography at discharge and 12 months after the initial event.

Results: During follow up, patients in group A encountered a significant increase in RVEF (43.17+/-8.37% to 49.78+/-7.05% ; p=0.014), with a concomitant increase of RVEDV (38.98+/-9.43 ml/m2 vs 54.93+/-8.98 ml/m2) p = 0.041. In group B and C, an ascending trend in RVEF and RV volumes was noted although not statistically significant.. Looking comparative at the evolution of RV volumes and RVEF between groups, patients with RV necrosis showed a significant improvement in systolic function expressed through RVEF and a significant RV dilatation compared to patients without RV necrosis. (p=0.021 for RVEF ; p = 0.036.for RVEDV; p=0.024 for RVESV).

Conclusion: Right ventricular dilatation occurs in the first year in patients with anterior STEMI, concomitant with a significant recovery in RV systolic function in the same group of patients. At comparative assessment between different MI localization, the magnitude of morphological and functional RV changes is significantly greater after associated RV infarction than after isolated LV wall infarction

P634

Impaired left ventricular diastolic function is related with poor long-term clinical outcomes in patients with acute anterior myocardial infarction

IW. Seong; JH. Park; BJ. Sun; JK. Oh; SW. Seong; JH. Lee; SW. Choi; JO. Jeong
Chungnam National University Hospital, Daejeon, Korea Republic of

Background: Left ventricular (LV) systolic dysfunction has been known as a strong negative prognostic factor for in AMI patients. However, the importance of diastolic dysfunction has been still unknown in the prediction of prognosis in these patients. We performed this study to evaluate whether diastolic dysfunction can predict long-term prognosis in anterior AMI patients.

Methods: We retrospectively analyzed all consecutive anterior AMI patients with available echocardiographic images within 1 month from January 2005 to April 2016. After gathering clinical characteristics from their medical records, systolic and diastolic functions were analyzed from digitally stored echocardiographic images.

Results: We included total 1045 patients (748 males, mean age 64 ± 12 years) with anterior AMI, and 494 (47%) were diagnosed as STEMI. Because of insufficient echocardiographic data assessing diastolic function, the presence or the grade of diastolic dysfunction could be assessed in 990 patients (95%). Of total 990 patients, 215 patients had one or more major adverse cardiovascular cerebral events (MACCE, 114 deaths, 26 MIs, 42 cerebrovascular accidents, 34 target vessel revascularization, and 57 hospital admission for heart failure). In the MACCE group, age was higher, higher end-systolic LV dimension, and lower LV ejection fraction (LVEF). Mitral annular velocities were lower and mitral E/E' ratio, an indicator of LV end-diastolic pressure was higher in the MACCE group (15.0±7.4 vs. 11.9±5.5, p,<0.001). The presence of LV diastolic dysfunction [3] 2 was associated with poor long-term survival (HR = 1.583, 95% CI = 1.008 – 2.486, P = 0.046) after the adjustment of age, LVEF and end-systolic LV dimension.

Conclusion: Along with LV systolic dysfunction, LV diastolic dysfunction was also related with future development of MACCEs in patients with anterior AMI.

HEART VALVES

P635

Does left atrial and ventricular peak systolic strain change after exercise in patients with mild rheumatic mitral stenosis?

M. Akbulut; C. Tulunay Kaya; DM. Gerede Uludag; C. Erol
Ankara University, Cardiology, Ankara, Turkey

Introduction: Rheumatic mitral stenosis is a leading cause of morbidity in developing countries. It has adverse hemodynamic effects that may not be completely determined by conventional transthoracic echocardiographic techniques. Symptomatic

patients with mitral valve area>1.5 cm2 comprises a gray zone in management. Therefore, exercise stress testing is recommended in these patients with symptoms discordant with the severity of the stenosis. Left atrial strain analysis with speckle tracking imaging emerges as a promising technique for the evaluation of these hemodynamic effects better. Despite the well-known fact that the left ventricle is spared from the deleterious hemodynamic effects of mitral stenosis, some new research has recently revaled that it might actually be associated with sub-clinical left ventricle dysfunction.

Purpose: We aimed to examine the left atrial and ventricular function both during rest and just after exercise by speckle tracking imaging in patients with mild mitral stenosis and ascertain early hemodynamic deterioration.

Methods: We included 46 patients with mild mitral stenosis. The patients were evaluated with trans-thoracic echocardiography during rest. Left atrial and ventricular peak systolic strain values were calculated. Exercise stress test was then performed by using treadmill with standard Bruce protocol. All of the patients reached the 85% of age predicted maximal heart rate. Immediately after the termination of the test, the echocardiographic examination was repeated.

Results: Both mean trans-mitral gradient and systolic pulmonary artery pressure values were found to be significantly higher following exercise (p<0.001, p=0.001). Exercise did not cause a significant chance in left atrial and ventricular peak systolic strain value (p=0.708, p=0.854). A negative significant correlation was found between the mean trans-mitral gradient and peak systolic left atrial strain following exercise (p=0.039, r=-0.361).

Conclusion: In patients with mitral valve area>1.5 cm2, exercise stress test did not cause a significant change in left atrial and ventricular peak systolic strain.

Hemodynamic variables

	REST	POS-EXERCISE	p
Mean transmitral gradient (mmHg)	4,52±1,84	6,46±3,26	<0.001
Maximum transmitral gradient (mmHg)	11,1±4,20	15,7±6,78	<0.001
GLS-avg/LA	17,1±8,33	16,8±9,10	0.708
SPAP	34±7,01	37,65±10,74	0.001
GLS-avg/LV	-18,19±4,01	-17,98±5,26	0.854

SPAP:systolic pulmonary artery pressure; GLS-avg/LA:global longitudinal strain-mean/left atrium; GLS-avg/LV:global longitudinal strain-average/left ventricle
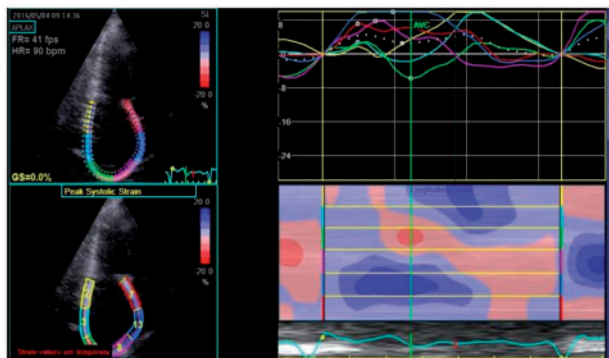
Abstract P635 Figure. Left Atrium Strain Analysis

P636

Stress echocardiohragphy: a safe and useful test in the management of patients with rheumatic mitral stenosis

R. Adelino Recasens[1]; E. Ferrer[1]; G. Junca[1]; A. Teis[1]; S. Serrano[2]; N. Vallejo[1]; E. Bernal[2]; J. Lopez Ayerbe[1]; F. Gual[1]; N. Soto[2]; E. Cascos[2]; J. Serra[2]; A. Bayes Genis[2]
[1]University Hospital Trias i Pujol, Cardiac imaging Unit, Cardioloy, Barcelona, Spain; [2]University Hospital Trias i Pujol, Barcelona, Spain

Background: Current clinical guidelines include stress echocardiography (SE) in the evaluation of patients with rheumatic mitral stenosis (RMS).

Objectives: Our aim was to describe our experience in terms of safety and usefulness of SE practiced in patients with RMS in a our hospital (tertiary center).

Methods: Retrospective analysis of 26 patients with asymptomatic severe RMS or non-severe RMS but with symptoms, who undergo a SE from January 2013 to December 2016.

Results: Basal characteristics in our patients were: age 60 ± 14, 77% women, 42% hypertension, 12% diabetes, mitral mean gradient (MG) 6.7 ± 2.4 mmHg, valve area 1.1 cm2 ± 0.12, pulmonary artery systolic pressure (PASP) 42 ± 10 mmHg, EF 62 ± 7%, degree mitral regurgitation degree(MR) 1.6 ± 0.6. SE was performed in all patients without any complications. The SE was considered positive in 21 patients (80.7%). The criterion for a positive result of SE were: increase > 15 mmHg of MG in 66.6%, dyspnea in 61.9%, PASP > 60 mmHg in 52,2%, and 14.28% by increasing MR degree. SE brought a change in the management or treatment in 80.7% of cases (even though SE was negative). After 12 months of follow-up, no patient with negative

SE result required surgery or percutaneous intervention, while 66% of patients with positive result undergo an intervention. A higher basal mitral MG and basal PASP were the only predictors for positive SE.

Conclusion: SE is a safe and useful test in the evaluation of patients RMS; additionally, it is easy to perform. SE involved a change in the management in a high proportion of patients. SE is also reliable, as no patient with negative SE result required interventionism nor died after 12 months of follow-up.

P637

Diastolic retrograde flow in the descending aorta for quantification of aortic regurgitation - insights from a cardiovascular magnetic resonance imaging study

A. Kammerlander[1]; M. Wiesinger[1]; F. Duca[1]; S. Aschauer[1]; C. Zotter-Tufaro[1]; ML. Schwaiger[1]; R. Badre-Eslam[1]; BA. Marzluf[2]; PE. Bartko[1]; D. Bonderman[1]; J. Mascherbauer[1]
[1]Medical University of Vienna, Department of Internal Medicine II, Division of Cardiology, Vienna, Austria; [2]Otto Wagner Spital, Vienna, Austria

Background: Echocardiography is the standard method for quantification of aortic regurgitation (AR). However, accurate estimation of AR severity by echo may be challenging due to inherent limitations of applied methods. Cardiovascular magnetic resonance imaging (CMR) has recently been advertised as an accurate method for AR quantification and is given a class I recommendation in the current guidelines if echocardiography results are inconclusive. CMR allows quantification of regurtation volumes and fractions, however, exact cut-off values for severity grading are a matter of debate. Recently, presence of holodiastolic retrograde flow (HRF) in the descending aorta by CMR has been proposed as strong indicator for severe AR.

The present prospective study sought to evaluate the usefulness of CMR for the quantification of AR.

Methods: and Results. 232 consecutive patients (33% female, 57±18 years) with varying degrees of AR by echocardiography (90 mild, 59 moderate, and 44 severe, 39 with inconclusive echocardiographic results - "moderate to severe" AR) were invited to undergo CMR within 4 weeks. CMR consisted of standard protocols including phase-contrast velocity-encoded imaging for regurgitant fraction (RegF) at the sinutubular junction and assessment of HRF in the descending aorta.

Severe AR was defined as the presence of HRF in the descending aorta by CMR.

Left ventricular (LV) end-diastolic volumes (EDV) by CMR significantly increased with increasing AR severity by echo (LVEDV: mild: 151±60ml, moderate: 184±71ml, "moderate to severe": 210±93ml, severe: 238±68ml; p<0.001), as did RegF at the sinutubular junction (mild: 7±14%, moderate: 13±14%, "moderate to severe": 22±17%, severe: 35±15%; p<0.001).

Among the 149 patients with non-severe AR by echo, 8% had HRF by CMR, indicating severe AR.

Among the 44 patients with severe AR by echo, 34% did not show HRF by CMR, suggesting overestimation of AR severity in these patients.

In patients with inconclusive echo results, 42% had HRF in the descending aorta, indicative for severe AR.

Presence of HRF by CMR was associated with significantly higher RegF at the sinutubular junction (9±12% versus 38±18%, p<0.001) and more dilated LVs (165±61ml versus 250±85ml, p<0.001).

Conclusion: Quantification of AR by CMR is feasible and highly reproducible. HRF in the descending aorta by CMR is an easily measurable marker that is very helpful for the distinction between severe and non-severe AR, especially when echocardiographic results are inconclusive.
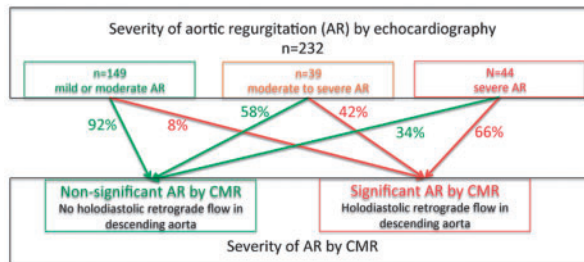
Abstract P637 Figure.

P638

Early changes of left ventricular rotational dynamics and relationship with myocardial deformation in significant chronic aortic regurgitation with normal ejection fraction

R. Verseckaite; V. Mizariene; A. Montvilaite; I. Auguste; R. Jurkevicius
Lithuanian University of Health Sciences, Cardiology, Kaunas, Lithuania

Background: The assessment of myocardial function in the context of chronic aortic regurgitation (AR) remain highly challenging. Quantification of LV rotation deformation seem promising, but the experience in this field remains limited. The aim of this study was to evaluate the complex LV rotational deformation in asymptomatic patients with chronic AR and preserved EF using 2D speckle tracking echocardiography (2D-STE). The relation between LV rotation parameters and global longitudinal (GL), circumferential (GC) strain (S), strain rate (Sr) was also evaluated.

Methods: One hundred-four individuals were prospectively studied: 44 asymptomatic patients with moderate-to-severe or severe AR and 60 age, gender-matched healthy subjects. All subjects underwent standard echocardiography and offline 2D-STE analysis.

Results: In AR patients we found significantly increased peak systolic apical rotation (Ap-Ro), peak systolic Ap-Ro rate, LV twist (LVT) and LVT rate than in controls ($14.0\pm5.9°$ vs. $9.7\pm4.6°$, $89.6\pm32.6°/s$ vs. $74.9\pm27°/s$, $19.3\pm6.2°$ vs. $16.6\pm5.4°$, $162.1\pm44.5°/s$ vs. $145.6\pm34°/s$, resp., $p<0.05$). The basal rotational (Ba-Ro) parameters did not differ between the groups. AR patients had significantly lower LV rotational diastolic parameters as early diastolic Ba-Ro rate and Ap-Ro rate as well as LV untwist rate (-110.7 ± 41.1 vs. $168.7\pm44.3°/s$, $p<0.05$). Patients with AR had more impaired GLS, GCS and peak systolic GLSr compared with controls, but the peak systolic GCSr was comparable between the groups (Table). Peak early diastolic GLSr and GCSr were reduced in AR patients ($p<0.05$). The peak systolic Ap-Ro rate, LVT rate correlated with GCSr ($r=-0.40$; $r=-0.54$, resp., $p<0.05$). LV untwist rate correlated with peak early diastolic GLSr and GCSr ($r=-0.46$, $r=-0.62$, $p<0.05$).

Conclusion: GLS, GCS and GLSr were impaired in asymptomatic patients with significant AR, despite normal EF, but LV apical rotational systolic parameters were increased and GCSr remained unaffected, who may preserve the LV systolic performance. Decrease of LV early diastolic Ba-Ro and Ap-Ro rates and LV untwist rate, which is influenced by impaired peak early diastolic GLSr and GCSr, attenuate LV diastolic performance, producing elevation of LV filling pressures and may detect subclinical LV dysfunction before EF declines.

Myocardial deformation parameters

Variable	AR group	Controls
Global LS (%)	-18.9 ± 2.3*	-20.0 ± 2.1
Global CS (%)	-19.0 ± 2.4*	-20.6 ± 3.1
Global LSr (1/s)	-1.07 ± 0.17*	-1.18 ± 0.15
Global CSr (1/s)	-1.71 ± 0.27	-1.78 ± 0.29

*$P<0.05$
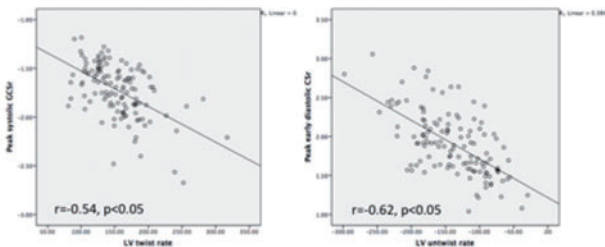
Abstract P638 Figure. Relations between LVT, LVU rates and CSr

P639

Evaluation of the integrative algorithm for aortic regurgitation severity by current ASE recommendations using cardiac magnetic resonance as reference method

O. Bech-Hanssen; SA. Gao; AÅ Johnsson; KM. Lagerstrand; CL. Polte
Sahlgrenska University Hospital, Gothenburg, Sweden

Background: and PURPOSE. The recent recommendations for the echocardiographic evaluation of native valvular regurgitation from the American Society of Echocardiography and Society of Cardiovascular Magnetic Resonance present an integrative algorithm for the grading of aortic regurgitation (AR) severity. The aim of the present study was to evaluate the diagnostic performance of this algorithm using cardiovascular resonance (CMR) as reference.

Methods: This prospective imaging study comprised 45 patients with chronic AR (moderate (n=19), severe with an indication for surgery (n=26)). All patients underwent echocardiography and CMR within 4 hours. Two different CMR thresholds indicating severe regurgitation where evaluated: 1) official guideline threshold (regurgitant volume (RV) $\geq$ 60 ml, regurgitant fraction (RF) $\geq$ 50%) and 2) new CMR-specific threshold (RV > 40 ml, RF >30%)*. Direct flow quantification using phase-contrast velocity imaging was used to obtain the RV-CMR/RF-CMR at the level of the sinotubular junction.

Results: The linear relationships between RV-CMR and the four quantitative parameters including vena contracta, the pressure half-time, the RV-Echo and effective regurgitant orifice area were weak to moderate (R range 0.46 to 0.65). In the first step of the algorithm containing 6 qualitative or semi-quantitative parameters (270 parameters in 45 patients) 212 (79%) were obtained. Fifteen patients (33%) had $\geq$4 criteria indicating severe AR. Twenty-eight (62%) patients had 2-3 criteria and proceeded to the step 2 quantitative Doppler evaluation. This was possible in 21 patients but not in the remaining 7 (16%) patients, of whom 4 had severe AR according to CMR. The overall diagnostic performance of the algorithm assessed in 38 patients was best when using the new CMR-specific thresholds as reference (Table).

Conclusion: The recently proposed integrative algorithm for the echocardiographic grading of AR severity has an acceptable diagnostic performance especially when using lower CMR thresholds indicating severe regurgitation. The moderate relation between individual parameters and RV-CMR underlines the importance of the integrative approach. There is a feasibility problem using quantitative Doppler and, therefore, occasionally a need for CMR as a second line tool.

	Standard thresholds	New CMR thresholds*
Sensitivity, % (95% CI)	95 (75-99)	92 (74-98)
Specificity, % (95% CI)	65 (43-82)	80 (55-93)
Positive likelihood ratio	2.7 (1.5-5)	4.6 (1.7-12.7)
Negative likelihood ratio	0.08 (0.012-0.6)	0.1 (0.03-0.4)

*Polte CL et al. doi: 10.1016/j.amjcard.2017.03.041

P640

Exercise stress echocardiography in asymptomatic patients with severe aortic regurgitation

SY. Lee; SJ. Park; JO. Choi; SA. Chang; SC. Lee; SW. Park
Samsung Medical Center, cardiology, Seoul, Korea Republic of

Background: The management of asymptomatic patients with severe aortic regurgitation (AR) and preserved left ventricular (LV) function has remained controversial.

Purpose: We aimed to evaluate the value of exercise stress echocardiography (ESE) in asymptomatic severe AR with preserved LV function as predicting high risk patients who might benefit from early referral for surgery.

Methods: A retrospective analysis was conducted of 84 asymptomatic patients with severe AR who underwent initial ESE from 2009 to 2016. All subjects underwent a symptom-limited treadmill test using a protocol (Bruce). Post-exercise ejection fraction (EF) increase of >4% was defined as contractile reserve (CR). The primary outcome which was defined as the composite of development of symptoms, deterioration in LV function (EF < 50% in echocardiography) and AV repair or replacement during follow up, was assessed.

Results: During follow up duration of 45 ± 25 months, the primary outcome occurred in 32 (38%). In demographic data, primary outcome group showed higher N terminal prohormone of brain natriuretic peptide (NT-proBNP) level (465 ± 702 pg/dL vs 141 ± 139 pg/dL, p=0.015), poorer exercise capacity (10.8 ± 2.4 METs vs 12.1 ± 2.0 METs, p=0.007) and less contractile reserve (15.6% vs 50%, p=0.002) than primary outcome free group. (Table 1) In multivariate analysis, the absence of CR was significantly associated with primary outcome (odds ratio [OR] 0.13, 95% CI 0.33-0.54, p = 0.005). (Table 2)

Conclusion: In asymptomatic severe AR, the absence of CR in ESE was independent predictors for deterioration of symptoms and need to surgical intervention.

Results of multivariate analysis

Parameter	Odd ratio	95% CI	P value
lnNT-proBNP	1.27	0.62-2.57	0.516
Age	0.99	0.94-1.05	0.867
METs	0.98	0.67-1.46	0.942
RVSP	1.04	0.94-1.16	0.424
Contractile reserve	0.13	0.33-0.54	0.005

P641

Assessing of aortic regurgitation by real time echocardiographic 3D proximal isovelocity surface area (3D-PISA) method: a pilot study

RA. Spampinato[1]; C. Jahnke[2]; I. Paetsch[2]; T. Noack[1]; S. Hilbert[2]; V. Schloma[1]; K. John[1]; F. Bonamigo Thome[1]; S. Loebe[2]; G. Hindricks[2]; M. Borger[1]
[1]University of Leipzig, Heart Center, Department of Cardiac Surgery, Leipzig, Germany; [2]Heart Center of Leipzig, Department of Electrophysiology, Leipzig, Germany

Background: Recent advances in real-time three-dimensional (3D) transthoracic echocardiography (TTE) provide a semi-automated method of the proximal isovelocity surface area (3D-PISA) to derive the measurements of the effective regurgitant orifice

area (3D-EROA) and regurgitant volume (3D-RV). For assessing aortic regurgitation (AR) severity, 3D-TTE has been validated using the evaluation of the vena contracta area (3D-VCA) but not much work has been done with 3D-PISA method. So, we performed a pilot study to evaluate this 3D-TTE method compared with standard 2D-TTE and cardiovascular magnetic resonance (CMR).

Method: We evaluated the 3D-PISA method for assessing AR in 9 patients (54.4±15years; all men; 1, mild; 3 moderate; and 5 severe AR) with available 2D-TTE and CMR data. The 3D-PISA derived quantitative parameters were then compared with all methods.

Results: The regurgitant volume mean values were statistically not different between methods (2D-TTE RV 63.6±28.5ml; CMR RV 49.4±26ml; and 3D-PISA RV 54.8±23.5ml), with a tendency to obtain higher values with 2D-TTE when compared with CMR (2D-TTE vs. CMR: mean difference: 14.2ml; 95% CI -6.6 to 35, p=0.15 and 3D-PISA vs. CMR: mean difference: 5.4ml; 95% CI -10.5 to 21.3, p=0.45). Finally, measurements of 3D-PISA derived quantitative parameters (i.e. 3D-RV and 3D-EROA) showed a good Pearson correlation between 2D-TTE and CMR derived parameters (Figure).

Conclusions: This pilot study suggests that 3D-PISA method for assessing aortic regurgitation could enable an accurate quantification of "quantitative" parameters.
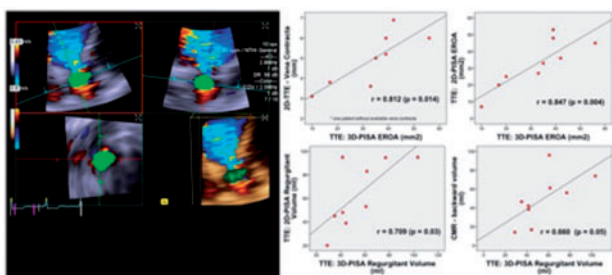
Abstract P641 Figure. Figure

P642

Indexed ring areas of aortic valve complex by body size in patients with aortic regurgitation are larger than that in cases with normal aortic valve function and aortic stenosis

D. Murai; H. Komatsu; D. Tatuta; T. Sato; R. Suzuki; M. Toba; K. Asakawa;
Y. Dannoura; T. Makino; T. Koya
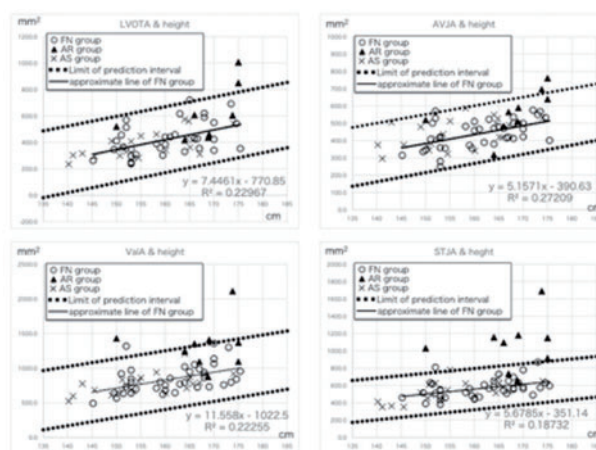*Sapporo City General Hospital, Department of Cardiovascular Medicine, Sapporo, Japan*

Background: Previous study has reported enlargement of dimension of sino-tubular junction (STJ), sinus of Valsaiva (Val) or aorto-ventricular junction (AVJ) in patients with aortic regurgitation (AR). However, each valvular ring area and correlation with body size have not been clear in the patients with aortic valve disease such as AR or aortic stenosis (AS).

Purpose: To clarify the relationships between each valvular ring area and body size, and to compare the ring area indexed by body size in case with AR, AS and functional normal(FN) aortic valve.

Methods: The objects are consecutive 70 cases performed the three dimensional transesophageal echocardiography (3DTEE) in our institution from April 2016 to May 2017 with normal function in aortic valve (FN group, n=39), moderate or severe AR (AR group, n=9) and mild to severe AS (AS group, n=22). We obtained 3D image data of AVC by using EPIQ 7c and X7-2t probe, and analyzed using QLAB software (Philips inc.). We identified the each cross sectional area orthogonal to the blood flow axis of Left ventricular out tract (LVOT), AVJ, Val(decided at level of maximal ring area) and STJ. The ring area of LVOT was measured in mid systolic phase, and others were measured in end-diastolic phase. We analyzed the correlation between ring area and height by Peason's correlation analysis, and compared the relationship among the three groups by analysis of covariance (ANCOVA). The prediction interval of each ring area in FN group were calculated as proportional normal range. Indexed ring area divided by height were compared among three groups by analysis of variance (ANOVA).

Results: There were significant correlation between height and each ring area in FN and AS groups(FN groups: LVOT R=0.48, p<0.01, AVJ R=0.52, p<0.001, Val R=0.46, p<0.05, STJ R=0.42, p<0.01, AS groups: LVOT R=0.66, p<0.01, AVJ R=0.50, p<0.05, Val R=0.6, p<0.01, STJ R=0.65, p<0.001). Whereas, there were no significant correlation in AR (LVOT R=0.53, p=0.17, AVJ R=0.57, p=0.10, Val R=0.07, p=0.84, STJ R=0.19, p=0.62). There were significant difference in relationship between ring area and height among three groups (LVOT p<0.05, AVJ p<0.05, Val p<0.05, STJ p<0.0001 by ANCOVA). The plot of individual cases of three groups and the prediction interval of each ring area were shown in Figure. The indexed ring area were significantly larger in AR than other groups (LVOT: FN vs AR vs AS 263±74 vs 364±114 vs 241±51 m㎡/m, p<0.001, AVJ: 273±46 vs 336±69 vs 279±46 m㎡/m, p<0.01, Val: 521±117 vs 795±203 vs 487±81 m㎡/m, p<0.0001, STJ: 350±62 vs 637±172 vs 341±65 m㎡/m, p<0.0001 by ANOVA).

Conclusion: Each ring area of AVC corrected by hight in AR group ware enlarged comparing FN and AS groups. These non-proportional enlargements of AVC of AR was meybe key mechanism of AR. The functional normal valvular range was thought to be a therapeutic set point in aortic root repair surgery.

Abstract P642 Figure. Figure

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Measurement of height of valvular rings and volume of valsalva sinus in aortic valve complex in patients with aortic valve diseases by using 3D trans esophageal echocardiography

D. Murai; H. Komatsu; D. Tatuta; T. Sato; R. Suzuki; M. Toba; K. Asakawa;
Y. Dannoura; T. Makino; T. Koya
Sapporo City General Hospital, Department of Cardiovascular Medicine, Sapporo, Japan

Background: Previous studies have reported enlargement of sino-tubular junction (STJ) size in patients with aortic regurgitation (AR). However, each valvular ring height in aortic valve complex (AVC) and volume of valsalva sinus (ValV) in the patients with aortic valve disease such as AR or aortic stenosis (AS) have not been exactly clear.

Purpose: To clarify the valvular ring height and ValV in the patients with moderate to severe AR or severe AS.

Methods: The three dimensional transesophageal echocardiography (3DTEE) was performed in consecutive 57 patients: the patients with normal function in aortic valve (FN) (n=35), the patients with moderate or severe AR without organic change in valve cusp (n=8), and the patients with severe AS (n=14). We obtained 3D image data of AVC by using EPIQ 7c and X7-2t probe, and analyzed the 3D data by using QLAB software (Philips inc.). We identified the ring of aorto-ventricular junction (AVJ), valsalva sinus (Val) and STJ. The ring height of Val was decided at the level of maximal ring area. The valvular ring heights from AVJ to STJ (ASH), from AVJ to Val (AVH), and from Val to STJ (VSH) were measured in end-diastolic phase. We also measured ValV calculated by using cross-sectional area and heights at each valvular rings in the AVC. We compared these parameters among the three groups by analysis of variance (ANOVA).

Results: There was no significant difference among three groups in age, sex and body surface area. ASH in AR group was significantly larger than that in FN group, while that in AS group was smaller than FN group (FN vs AR vs AS: 21.6±3.2 vs 28.7±5.3 vs 18.8±3.0 mm, p<0.01 by ANOVA). AVH and VSH in AR group were larger than those in FN group, while those in AS group were tend to be smaller than FN group (AVH: 12.1±2.3 vs 14.9±4.4 vs 10.1±1.3 mm, p<0.05 by ANOVA, VSH: 9.6±2.5 vs 13.8±6.4 vs 8.6±2.4 mm, p<0.01 by ANOVA). ValV in AR group were larger than that in FN, while that in AS were tend to be smaller than FN (15.4±5.5 vs 30.2±9.9 vs 12.1±4.1 cm3, p<0.05 by ANOVA).

Conclusion: AVC in AR group have elongated in the longitudinal direction and enlarged in the volume comparing with FN group. Whereas that in AS group have shortened in height and tended to be smaller in the volume.

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Clinical and echocardiographic follow-up of patients with prosthetic heart valves: a large tertiary centre experience

B. Alaour; C. Menexi; B. Shah
University Hospital Southampton NHS Foundation Trust, Cardiology, Southampton, United Kingdom

Introduction: Patients with prosthetic heart valves (PHV) require lifelong specialist follow up. Although international guidelines exist recommending frequency of follow-up, including utilization of echocardiography, cardiology follow-up regimes of PHV patients vary significantly between different centres and sometimes within the same centre.We conducted a retrospective study to determine follow-up practice and echocardiography utilization in PHV patients in a large tertiary centre in the UK and audited this practice against the ESC guidelines.

Methods: We retrospectively reviewed all patients who underwent surgical valve intervention in our institution, the largest university teaching hospital in south England, during 2008.

We excluded patients who require individualised follow up (e.g. heart failure). Electronic patient records were reviewed. Patterns of follow-up and performance of echocardiography were compared against ESC recommendations.

Results: 93 eligible patients were identified. Baseline characteristics are shown in table 1.

61 patients (65.5 %) did not have any routine clinical or echocardiographic follow up planned and were discharged form outpatient follow up. As of 2017, only 4/61 (2.4%) patients had been re-referred for follow-up from primary care. ESC guidelines state that "Yearly echocardiographic examination is recommended after the fifth year in patients with a bioprosthesis"- thus there were 45 patients (73%) in our study that were not receiving appropriate echocardiography >5 years after bioprosthesis implantation.

32 patients (34.5 %) had routine follow up. There was a remarkable variation and heterogeneity in follow up regimes ranging from "no follow up" to "yearly clinical review and echo". This variation did not correlate with prosthesis type or the grade of assessing clinician.

Conclusion: The follow up of PHV patients - and appropriate utilization of echocardiography - remains highly variable even in large centres and differs from recommendations of published guidelines in most cases. These data support the wider implementation of specialist heart valve clinics, in order to standardize care for patients, regulate utilization of echocardiography and thus improve cost-efficiency.

Table 1

Gender	fenales	32%		
males	68%			
Age Mean (SD)	73 (11)			
Valve intervention	Mechanical valve(s)	Tissue valve(s)	Valve(s) repair	Valve(s) repair+valve(s) replacement
	13%	72%	12%	3%

Baseline characteristics

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Clinical characteristics and mortality predictors of patients with surgically implanted tricuspid bioprosthetic valves

A. Valentim Goncalves; T. Mendonca; L. Moura Branco; AT. Timoteo; A. Galrinho; I. Rodrigues; RI. Moreira; M. Cruz; P. Modas; L. Morais; LC. Miranda; N. Banazol; P. Coelho; J. Fragata; RC. Ferreira
Hospital de Santa Marta, Lisbon, Portugal

Introduction: Tricuspid valve replacement is historically associated with high morbidity and mortality. Recently there has been growing interest in the percutaneous implantation of tricuspid prostheses. This was the reason to try to characterize a population with surgically implanted tricuspid bioprostheses.

Purpose: To analyze the results of surgery with tricuspid bioprosthesis implantation and describe mortality predictors in this population.

Methods: A retrospective study of patients submitted to surgical tricuspid bioprosthesis implantation between 2003 and 2014 in one medical center. Demographic and clinical data were collected and analyzed during the follow-up. The clinical data were collected from the clinical files and from a database of the cardiac department. Mortality during follow-up was collected from a national database. A univariate analysis was performed followed by a multivariate Cox analysis to describe mortality predictors. Values of $p < 0.05$ were considered significant.

Results: 34 patients were included (female 58.8%, mean age 5.9 ± 16 years, mean follow-up time 58.7 52.7 months), all of them submitted to tricuspid bioprosthesis implantation. The etiology was rheumatic in 44.1%, functional in 2.5%, endocarditis in 14.7%, traumatic in 5.9%, congenital in 2.9% and other causes in 8.8%. 20.6% had chronic kidney disease, 5.9% liver disease, 26.5% diabetes mellitus and 14.7% chronic obstructive pulmonary disease.

Annuloplasty rings had been previously implanted in 35.3% and previous bioprosthesis tricuspid implantation had been performed in 11.8% (62% had a previous valvular intervention). The average EUROSCORE II was 7.25%. 87.5% were in NHYA class III/IV before surgery. 74.2% had preserved left ventricular ejection fraction. Other cardiac procedure was made in 44.1% during surgery (mitral intervention – 38.2%; aortic intervention – 20.5%).

During follow-up one patient needed another tricuspid intervention. Postoperative mortality (defined as death in 30 days and/or until hospital release) was 20.6% and 64% had adverse events soon after surgery (defined as total bleeding at 48 hours > 10ml/kg or needing transfusion, mechanical ventilation > 24 hours or re-ventilation required, inotropic support > 48 hours, cardiac arrest, dialysis, coma or stroke). 1 and 5-year survival were 71% and 54.2%, respectively.

Cox analysis revealed that age greater than 75 years (p 0.011) and surgical adverse events (p 0.001) were independent predictors of mortality. For mortality during follow-up both age greater than 75 years (p 0.066) and previous cardiac surgery (p 0.077) revealed a borderline significant trend.

Conclusion: This study verifies the heterogeneity of patients submitted to tricuspid prosthetic valve implantation, maintaining high mortality in the short and long term.

Independent predictors of mortality were age > 75 years and the presence of adverse events shortly after surgery.

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Mortality predictors in patients with tricuspid bioprosthetic valves. The role of echocardiography

A. Valentim Goncalves; T. Mendonca; L. Moura Branco; AT. Timoteo; A. Galrinho; I. Rodrigues; RI. Moreira; M. Cruz; P. Modas; L. Morais; LC. Miranda; N. Banazol; P. Coelho; J. Fragata; RC. Ferreira
Hospital de Santa Marta, Lisbon, Portugal

Introduction: Tricuspid valve replacement is a rare procedure, historically associated with high morbidity and mortality. The recent growing interest in the implantation of percutaneous tricuspid prostheses was the reason to characterize a population with surgically implanted prostheses.

Purpose: To analyze the results of surgery and describe mortality predictors in echocardiograms performed before and after implantation of tricuspid bioprosthesis.

Methods: A retrospective study of patients submitted to tricuspid bioprostheses implantation between 2003 and 2015 in one single medical center, who performed echocardiograms before and after surgery. Demographic and clinic data were collected during follow-up from the clinical files and from a database of the cardiac surgery department. Mortality during follow-up was collected from a national database. A univariate analysis was performed followed by a multivariate Cox analysis to describe mortality predictors.

Results: 20 patients had tricuspid bioprosthetic valves implanted and had echocardiograms 1 to 6 months before surgery (male 55%, mean age 57.9 ± 14 years, mean follow-up time 43.8 ± 35.9 months). 13 repeated the echocardiogram 1 to 3 months after surgery in the same hospital. Postoperative mortality (defined as death in 30 days and/or until hospital release) was 15% and there was 55% mortality during follow-up. Annuloplasty rings and implanted bioprosthesis had been previously implanted in 50% and in 15% respectively. 75% and 45% had previous mitral and aortic intervention respectively. 80% were in NHYA class III/IV before surgery.

In the echocardiograms performed before surgery the left ventricular end-diastolic and end-systolic diameters were 52.8 ± 8mm and 32.4 ± 7mm respectively, with mean ejection fraction of $59.5 \pm 12\%$. PASP was estimated by Doppler to be 48.9 ± 16mmHg and 70% had right ventricular dilatation. In the echocardiogram performed shortly after tricuspid bioprosthesis implantation the left ventricular end-diastolic and end-systolic diameters were similar to previous (53.6 ± 8mm and 31.9 ± 9mm respectively), with mean ejection fraction of $59.6 \pm 10\%$. Mean left atrial diameter was 58.7 ± 8mm and 75% had right ventricular dilatation.

Univariate Cox analysis revealed that left atrial diameter greater than 70mm in the echocardiogram before surgery (p 0.037) and end-diastolic left ventricular diameter superior to 60mm after surgery (p 0.042) were mortality predictors. However multivariate analysis did not detect any independent predictor of mortality.

Conclusion: Patients with tricuspid bioprostheses in this study represent a heterogeneous population with multivalvular disease. The overall mortality was high (15%) and mid-term prognosis is bad (55% mortality). Larger left atrial (> 70mm) and left ventricles (> 60 mm) were associated with increased mortality, although there were no independent predictors of mortality in this small population.

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In-hospital mortality in patients with infective endocarditis: comparison between different scoring systems

D. Trifunovic[1]; B. Obrenovic- Kircanski[1]; B. Ivanovic[1]; D. Kalimanovska-Ostric[1]; J. Petrovic[2]; I. Petrovic[2]; O. Petrovic[2]; I. Jovanovic[2]; S. Matic[2]; V. Tutus[2]; S. Putnik[2]; M. Boricic-Kostic[2]; J. Stepanovic[2]; B. Vujisic-Tesic[1]; M. Petrovic[1]
[1]Clinical Centre of Serbia, Cardiology Clinic, Medical Faculty, Belgrade, Serbia;
[2]Institute for cardiovascular disease, Clinical centre of Serbia, Belgrade, Serbia

Infective endocaridtis (IE) is still a challenging disease with significant in-hospital mortality. Although surgical treatment for IE carries substantial risk, operated patients generally have better outcomes, if indications, timing, and surgery techniques are appropriate. Several risk scores including STS-IE risk score, estimate mortality and outcomes for endocarditis surgery. However just a few focused to predict mortality in IE patients (operated and non-operated) taking into account probability for surgical treatment. Recently, ICE-PCS score weighted for surgical treatment was developed to predict 6 month mortality in IE, but analog risk score for in-hospital mortality is lacking.

This study was aimed to test power of ICE-PCS score and STS-IE score to predict in-hospital mortality and to develop new simplified risk score for in-hospital mortality (SRS-IH) accounting for treatment strategy.

Methods: 267 patients with definitive diagnosis of IE from the single tertiary center were enrolled between 2009-16. Surgery was performed in 61.8% of patients during the index hospitalization. In-hospital mortality was 16.5%: 12.7% in operated group and 22.5% in medically treated group (p=0.036). Univariate predictors of in-hospital mortality in logistic regression were: host factors (age>60 yrs, female gender, DM, acute renal failure, malignancy, previous heart failure), IE complications (sepsis, embolic event, spleen abscess, NYHA 3 or 4), treatment (surgical treatment, emergency operation, urgent operation) and echocardiographic findings (multiple vegetations, perivalvular abscess, EF<40%, right ventricular systolic pressure >40 mmHg and pericardial effusion). In multivariable model independent predictors were: acute renal failure (OR 3.610, 95% CI 1.735 to 10.198, p=0.004), sepsis (OR 3.121, 95% CI 1.028 to 7.689, p=0.015), NYHA class 3 or 4 (OR 8.783, 95% CI 3.855 to 20.800,

p<0.001), surgical treatment (OR 0.408, 95%CI 0.183 to 0.903, p<0.001) and peri-valvular abscess (OR 3.326, 95% CI 1.121 to 9.873, p=0.030). SRS-IH score was defined by weight adjustment of these variables. ROC analysis was performed for SRS-IH score (AUC=0.851, 95% CI 0.785 to 0.916, p<0.0010), ICE-PCS score (AUC=0.729, 95% CI 0.655 to 0.804, p<0.001) and STS-IE score (AUC=0.775, 95%CI 0.699 to 0.850, p<0.001). Comparisons were made between ICE-PCS score ≥ 8, SRS-IH score ≥ 2 and STS-IE score ≥20, regarding sensitivity (76.0% vs 81.4% vs 80.5%) specificity (52.0 % vs 71.4% vs 56.4%), negative predictive value (91.24 vs 95.0% vs 93.3%) and positive predictive value (24.8% vs 36.5% vs 27.7%).

Conclusion: surgically treated IE patients during index hospitalization had lower in-hospital mortality, compared to medically treated patients. Simple scores, based on clinical variables, echocardiographic findings and treatment strategy, can be used to identify patients with high risk for in-hospital mortality, with good sensitivity, moderate specificity and high negative predictive values.

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Clinical use of cardiac imaging in the assessment of infective endocarditis. A single centre experience

F. Panzeri; MC. Ferrara; A. Moreo; B. De Chiara; F. Casadei; F. Musca; F. Spano'; G. Santambrogio; O. Belli; C. Giannattasio
Niguarda Ca' Granda Hospital, Milan, Italy

Background: Infective Endocarditis (IE) is a severe disease, associated with high morbidity and in-hospital mortality. Despite improvements in diagnostic and therapeutic strategies, both the incidence and severity of the disease seem to be unchanged. Echocardiography plays a key role in the assessment of IE. It is useful for the diagnosis, the assessment of the severity of the disease, the prediction of prognosis, and the follow up.

Purpose: We report the experience of our echocardiographic centre in the assessment of IE, by focusing on the role of echocardiography in the diagnosis and the association with nuclear imaging.

Methods: We analyzed 1466 requests of echocardiographic exams, both transthoracic and transesophageal, that were made in our centre from January 2015 to December 2016 in the suspicion of IE. We checked in how many cases echocardiography has been diagnostic; in how many cases, even with a diagnostic echocardiographic exam, nuclear imaging (18F-FDG PET-CT) has been perfomed and in how many cases nuclear imaging has contributed to the diagnosis with uncertain or negative echocardiographic exams.

Results: Out of 27896 echocardiographic exams performed from January 2015 to December 2016, 1466 have been done because of the suspicion of IE. Out of these 1466, the diagnosis of IE has been made in 65 cases. The echocardiography has been conclusive for IE in 52 patients. In 7 of these, even in the presence of diagnostic echocardiographic exam, 18F-FDG PET-CT has been performed: in 6 cases to evaluate the activity of the disease and in 1 case for suspicion of Libman-Sacks disease, diagnosis finally confirmed. In 34 cases, the echocardiographic exam has been defined doubt. In these cases, 18F-FDG PET-CT has been performed with positive result in 8 cases.

Conclusions: Our centre experience, with a high number of requests for the suspicion of IE and of diagnosis of IE, shows how echocardiography is still the cornerstone of the imaging techniques in the assessment of infective endocarditis. Nuclear imaging has been proven to be a valuable and reliable technic when both clinical and echocardiography evaluation do not provide enough evidence to diagnose IE or to definitively exclude it.

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Evolution of patients with acute infective endocarditis rejected for surgery

N. Soto Flores; N. Vallejo; R. Nunez; L. Mateu; A. Vivero; N. Sopena; A. Teis; L. Pedro Botet; R. Adelino; E. Cascos; A. Bayes Genis
Germans Trias i Pujol Hospital, Badalona (Barcelona), Spain

Introduction: Infective endocarditis (IE) is associated with high mortality. It is known that in hospital mortality is around 20% -30%. But less is known about long-term evolution of patients, especially those who are rejected for surgery in acute phase.

Purpose: Our purpose is to know about long-term prognosis of patients diagnosed with IE who have surgical indication, rejected for surgery in the acute phase, compared to patients who are operated and to patients candidates for medical treatment.

Methods: Prospective observational analysis of survival in patients with IE admitted to our center (2003-2016).

Results: We reported 348 cases of IE, 246 (71%) had surgical indication. 82 patients were rejected for surgery and 164 were operated. Rejected patients presented higher Charlson comorbidity score (3.5) and higher EuroSCORE (34.7%) compared to the surgical group (average 2,2 and 21.7 % respectively). The distribution of other characteristics between the groups was not statistically significant. Patients considered unfit for surgery had a higher mortality (69.5%) than those operated (28.7%). This difference is statistically significant (p <0.001).

The difference in mortality between both groups (operated and rejected) is concentrated in the first 2 months of the diagnosis, with no differences observed from 50 days.

Patients rejected for surgery have a higher mortality risk (HR = 1.9; p <0.001) independent of its comorbidity. EuroSCORE showed a significant association with mortality risk (p <0.001). IE complicated with stroke was associated with worse prognosis (HR = 3.98; p = 0.012).

Conclusions: The mortality of patients rejected for surgery is very high and is concentrated mainly in the first two months after the diagnosis. They present higher risk of mortality independent of other clinical characteristics.
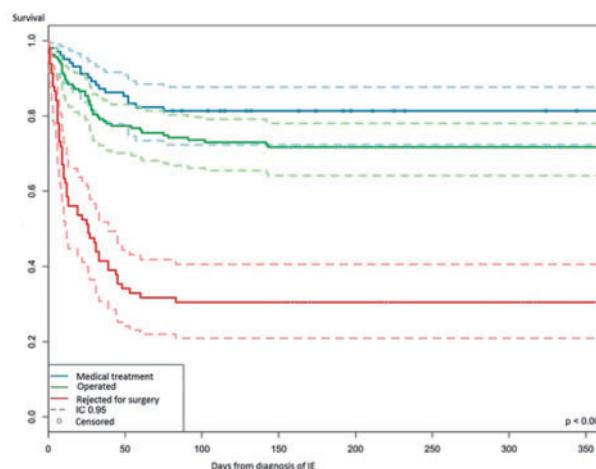
Abstract P649 Figure. Survival of rejected patients

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Direct effect of transcatheter aortic valve implantation on mid-term left ventricular function and remodelling: a speckle-tracking echocardiography study

M. Papafaklis; K. Keramida; N. Tsigaridas; S. Loizos; V. Panoulas; N. Ruparelia; A. Frame; J. Anderson; A. Chukwuemeka; S. Sen; I. Malik; N. Sutaria; G. Mikhail; P. Nihoyannopoulos
Hammersmith Hospital, London, United Kingdom

Background: Transcatheter aortic valve implantation (TAVI) is considered as the standard of care in patients with severe symptomatic aortic stenosis and high peri-operative risk. Previous studies have shown geometric changes and improvement in myocardial function immediately after TAVI. However, they included a broad spectrum patient population with many co-morbidities. There are limited data on the direct effect of TAVI on mid-term left ventricle (LV) function & remodelling.

Purpose: To investigate the mid-term LV function & remodelling after TAVI in a selected patient population without co-morbidities known to have a direct impact on LV remodelling.

Methods: We considered all patients who underwent TAVI at our hospital. After excluding patients with atrial fibrillation and coronary artery disease requiring revascularisation, there were 56 patients with available echocardiographic data at baseline (BL; pre-TAVI) and mid-term follow-up (FU; more than 3 months after TAVI).

Results: Median FU duration was 10.0 months (IQR: 7.9-14.2). Mean patient age was 81.7±8.3 years, 64% were females, and mean logistic EuroScore was 13.5±9.1%. Indices of systolic/diastolic function and tissue Doppler were similar at FU & BL (Table 1). At FU, there was a significant decrease in LV wall thickness and mass (p=0.007). Strain analysis of longitudinal motion was feasible in 41 patients (73%) with adequate data quality. Global longitudinal peak systolic strain was similar at FU & BL.

Conclusion: TAVI results in mid-term reverse LV remodelling characterised by a decrease in LV wall thickness and mass. In this older patient population with preserved LV systolic function at BL, there was no mid-term deterioration or improvement in LV systolic and diastolic function including global longitudinal strain.

Echocardiographic Variables: BL vs FU

Echocardiographic variable	Baseline (pre-TAVI)	Mid-term follow-up (post-TAVI)	P value
Aortic max velocity, m/s	4.49±0.71	2.12±0.64	<0.001
Aortic mean gradient, mmHg	47.71±15.90	9.41±8.03	<0.001
LV ejection fraction, %	58.3±11.3	58.1±10.7	0.871
LV end-diastolic dimension, mm	44.3±6.6	44.5±6.2	0.759
Interventricular septumend-diastolic thickness, mm	12.4±2.1	11.6±2.1	0.007
LV posterior wallend-diastolic thickness, mm	11.4±1.97	10.6±1.9	0.003
LV mass, gr	194.8±55.1	177.1±47.9	0.007
Peak mitral E, m/s	0.85±0.30	0.90±0.28	0.190
Tissue Doppler E', m/s	0.059±0.028	0.058±0.018	0.799
Global longitudinalpeak systolic strain, %	-15.59±7.92	-14.87±7.00	0.460

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Pre-operative annular shape, but not size, predicts functional improvement following percutaneous mitral valve repair

AJ. Barron; S. Chotai; L. Kelly; R. Smith

Harefield Hospital, Cardiology, London, United Kingdom

Background: Percutaneous mitral valve repair leads to symptomatic benefit in many patients with mitral regurgitation not deemed suitable for surgical intervention. However it is unclear if we can predict the patients most likely to benefit. The mitral annulus is a flexible structure, with dynamic function throughout the cardiac cycle. Multiple measurements of the annulus can be made, but it is unknown if these can help predict the improvement in a patient's functional status.

Purpose: To identify how the typical annular mechanics impact symptomatic benefit following percutaneous mitral valve repair.

Methods: 24 patients who had undergone a MitraClip procedure (Abbott Vascular) for MR were assessed. They had a pre-operative trans-esophageal echocardiogram (TEE), and pre-operative and post-operative transthoracic echocardiograms (TTE) within 6 months of the procedure with no worse than mild-moderate residual MR post-procedure. Anteroposterior (AP) and commissural diameters were measured at end-diastole, mid-systole and end-systole from the apical long-axis and the apical 2 chamber views respectively. Ellipsicity index (EI) was calculated as the ratio of the commissural to AP diameter. Symptoms were measured using the New York Heart Association (NYHA) classification system.

Results: Annular area at any time point when measured by TTE, or in end-systole by TOE did not predict the change in NYHA class. However in patients with a more normal annular shape in diastole, as defined by a higher EI, symptom improvement was greater (NYHA class improvement 0.4 in the lowest half vs 1.3 in the upper half, p=0.005). EI during systole did not impact on improvement in symptoms.

Conclusion: Following percutaneous mitral valve repair some patients derive symptomatic benefit whilst others do not. Pre-operative echocardiography is crucial to patient selection and may allow us to identify those most likely to derive benefit. Whilst pre-procedural annular size does not appear to correlate to symptomatic improvement following repair, patients with a more elliptical annulus (as evidenced by a higher EI) appear to gain more functional benefit.

We hypothesize that a low EI, reflecting asymmetric annular remodelling, may derive less benefit because this asymmetrical remodelling may preferentially increase commissural regurgitation, which is difficult to treat by percutaneous repair.

Overall these results suggest that even patients with significant annular dilatation may derive symptomatic benefit from percutaneous mitral valve repair, but most predictably if the dilatation occurs symmetrically.
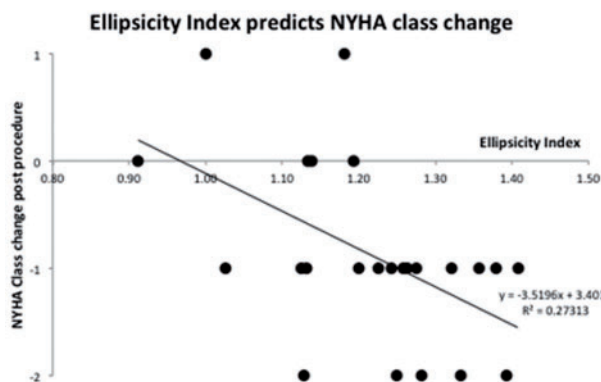
Abstract P651 Figure. EI predicts NYHA Class change

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The typically large reduction in left ventricular ejection fraction seen following surgical correction of mitral regurgitation is not seen following percutaneous mitral valve repair

S. Chotai[1]; L. Kelly[1]; C. Di Mario[2]; R. Smith[1]; AJ. Barron[1]

[1]Harefield Hospital, Cardiology, London, United Kingdom; [2]Royal Brompton Hospital, Cardiology, London, United Kingdom

Background: The presence of significant mitral regurgitation (MR) has the effect of elevating the left ventricular ejection fraction (LVEF), so that it over-represents the true systolic function of the left ventricle. Therefore after cardiac surgery to correct MR the LVEF often drops significantly, as the LVEF in the absence of MR more accurately reflects the true systolic function of the ventricle. However a drop in real systolic function due to operative factors may also contribute. Percutaneous mitral repair offers a unique opportunity to evaluate the contribution from the amelioration of the MR to the change in LVEF without the potential influence from intraoperative factors.

Purpose: To identify the average change in LVEF before and after percutaneous mitral valve repair, and the impact of the degree of residual MR on the change in LVEF.

Methods: 76 patients who had undergone a MitraClip procedure (Abbott Vascular) for MR were assessed. They had a pre-operative echocardiogram and a post-

operative echocardiogram within 6 months of the procedure. MR was graded as none (0), mild (1), mild-moderate (2), moderate-severe (3) or severe (4). LVEF was measured using Simpsons Biplane Method, and graded as 1 - normal ($\geq$55%), 2 - mildly impaired (45-54%), 3 - moderately impaired (30-44%) or 4 - severely impaired (<30%). The pre- and post-procedural MR grade and LVEF were compared using a paired t-test, and then assessed for degree of residual MR. P<0.05 was considered statistically significant.

Results: Mitral regurgitation reduced significantly following percutaneous repair (mean grade pre-procedure 3.9, post-procedure 2.0, p<0.001). The average EF grade pre-procedure was 2.3 and post-procedure was 2.4, with an overall non-significant change in grade of -0.12 (p=0.11). The degree of residual MR did not affect the results, with no significant change in LVEF in those with no worse than mild-moderate residual MR (grades 0-2), or those with moderate-severe residual MR (grades 3-4) (n=55, Δ-0.16, p=0.06 and n=21, Δ-0.00, p=1.00 respectively). The mechanism of MR, divided into either functional or degenerative, did not affect the change in LVEF. An LV outflow tract velocity time integral measurement (LVOT VTI) was made on 61 patients both pre and post procedure, without a significant change between these two time points (15.4 vs 14.9cm, p=0.43).

Conclusion: The typical drop in LVEF resulting from surgical correction of MR is not seen following percutaneous mitral valve repair. A statistically non-significant small drop in systolic function did occur, which would only approximate a reduction in LVEF of 5%. The lack of change of the LVOT VTI supports the hypothesis that cardiac output is maintained, and the larger drop in EF typically seen following cardiac surgery may be a combination of viewing a more representative EF, and new LV dysfunction due to operative factors.

P653

Evaluation on rheumatic mitral stenosis patients: discriminating those in sinus rhythm from atrial fibrillation. A cardiac magnetic resonance preliminary study

CA. Atmadikoesoemah; E. Elen; M. Kasim

Department of Cardiology & Vascular Medicine, Faculty of Medicine, Universitas Indonesia, National Cardiovascular Center Harapan Kita, Jakarta, Indonesia

Introduction: Deteriorating all 3 layers of all cardiac chambers, Rheumatic heart disease provokes atrial fibrillation (AF) that eventually called for catheter ablation. Recent study showed that a shorter post-contrast left ventricular (LV) T1 relaxation time is associated with reduced freedom from AF post catheter ablation.

Purpose: This study was to investigate factors contributed in the occurrence of AF in rheumatic mitral stenosis while comparing the native and post contrast LV T1 relaxation times in those patients with sinus rhythm (SR) and AF.

Methods: The study was carried in the Department of Cardiology and Vascular Medicine, Universitas Indonesia/ National Cardiovascular Center in Januari 2015-March 2016. Based on the ECG findings, 18 patients were divided into two groups: sinus rhythm (6 patients) and AF (12 patients). Routine CMR examinations were carried out, including assessment of native and post contrast LV myocardial T1 relaxation time by Look Locker technique.

Results: Patients in SR group were significantly younger (33.67+6.83 vs 43.75+10.66, p 0.03), have smaller left atrial diameter (48.17+5.04 vs 60.20+12.84, p 0.05), and smaller LV scar volume 13.80+4.51 vs 25.43+16.78, p 0.04) with shorter native T1 relaxation time (860.33+114.20 vs 1395.97+458.85, p 0.02). Further multiple regression study showed that only age and native T1 value were significant in determining the occurrence of AF, F (4, 95) = 8.953, p < .05, R2 = .717. Both groups had no difference regarding the degree of mitral stenosis, LV-RV ejection fraction, LV strain and post contrast T1 value.

Conclusions: In rheumatic MS patients, those in AF have longer native –instead of post contrast- LV T1 relaxation times than those in SR. MRI would help to determine the best cut off value in which these patients will have any benefit of future AF catheter ablation; thus further study is needed.

CARDIOMYOPATHIES

P654

Significance of cardiac magnetic resonance imaging after aborted sudden cardiac death in patients with normal coronary angiography

H. Vago; I. Csecs; CS. Czimbalmos; A. Toth; F. Suhai; ZS. Dohy; L. Szabo; A. Kiss; A. Szucs; D. Becker; B. Merkely

Heart and Vascular Center Senmelweis University, Budapest, Hungary

On behalf of: CMR Working Group Semmelweis University Heart and Vascular Center

Background: The one-year incidence of sudden cardiac death (SCD) is about 8.6/100000 and this condition is responsible for approximately 25-35% of total cardiovascular mortality. Despite the routinely performed medical check-up after aborted SCD including electrocardiogram, echocardiography, coronary angiography, in 50% of the cases the etiology of SCD remains unclear.

Purpose: Our aim was to investigate the role of cardiac magnetic resonance (CMR) in diagnostic workup of aborted SCD with normal coronary angiography and to determine the frequency of the pathological conditions in this patient population.

Methods: During a 7.5-year period (2010 Jan-2017 May) at the Heart and Vascular Center of the Semmelweis University we performed CMR examinations in 71 patients (37.8$\pm$13.4 y, 36 male) after aborted SCD with normal coronary angiography. Among

them 10 were athletes (28.4±10.3 y, 8 male). Left and right ventricular parameters and the presence of myocardial scar were assessed. We examined whether CMR changed the provisional diagnosis.

Results: CMR proved structural myocardial abnormality in 63% of the cases (n=45) as follows: dilated (DCM n=10), mitral valve prolapse (n=4), arrhythmogenic right ventricular cardiomyopathy (ARVC n=3), hypertrophic cardiomyopathy (HCM n=3), myocarditis (n=3), acute myocardial infarction (n=2), subendocardial scar reflecting previous myocardial infarction (n=2), apical ballooning syndrome (n=2), noncompaction cardiomyopathy (n=1), endomyocardial fibrosis (n=1) and aspecific structural alterations (n=14). In the last group myocardial fibrosis with nonischaemic pattern could be identified in 7 pts.

Age-specific incidence rates show that the most common structural heart disease over 35 years was DCM, while ARVC occured only under 35 years in our patient population, and was the most common structural disorder in athletes (n=3). CMR examination changed the provisional diagnosis in 49% of the patients.

Conclusion: CMR provides an improved diagnostic yield in the clarification of the excessively variable etiology of SCD.

P655
Cardiac MRI for a better identification of structural heart disease in patients with ventricular arrhythmia

D. Andreini[1]; S. Mushtaq[2]; E. Conte[2]; S. Zanchi[2]; E. Menotti[2]; V. Ditali[2]; M. Guglielmo[2]; A. Baggiano[2]; A. Santos[2]; F. Fazzari[2]; E. Mancini[2]; G. Pontone[2]; M. Pepi[2]
[1]University of Milan, Foundation Monzino (IRCCS), Center Cardiology, Dpt of Cardiology, Milan, Italy; [2]Cardiology Center Monzino IRCCS, Milan, Italy

Background: Ventricular arrhythmia (VA) is a quite prevalent diagnoses in the general population and the majority of patients have non-repetitive ectopic beats. However in Europe and North America, 50–100/100000 sudden unexpected cardiac deaths occur every year, and about half of these are attributable to VA. Prognostic stratification is the main issue in this setting and the presence of structural heart disease is one of the most important determinants of poor prognosis. Echocardiography is the most commonly used tool to determine the presence or the absence of structural heart disease. Aim of this study is to evaluate whether in patients with VA and normal echocardiography, cardiac MRI may identify patients with structural heart disease whose risk has been underestimated by transthoracic echocardiography.

Material and Methods: From a registry of patients undergoing to cardiac MRI for VA we identified 756 consecutive patients who had an echocardiography performed in our Institute before MRI without abnormal findings. For every patient traditional risk factors and the presence of cardiovascular symptoms (chest pain, syncope, pre-lypotimia, dyspnea, palpitations) were evaluated. Ventricular ectopic beats (VEBs) was graded as follow:>1000 VEBs/24h;>10000 VEBs/24h; non-sustained ventricular tachycardia (NSVT); sustained ventricular tachycardia (SVT) and history of resuscitated cardiac arrest. End-point of the study was the presence of structural heart disease at cardiac MRI.

Results: We enrolled 756 patients (mean age 42±16 years; male n=481; 64%) with VA and normal 3rd level transthoracic echocardiogram who underwent cardiac MRI. Among them, 185 patients (24.5%) were found to have structural heart disease at cardiac MRI. More specifically, 69 (37.3%) patients had a diagnosis of previous myocarditis, 40 (21.6%) of arrhythmogenic right ventricular cardiomyopathy, 36 (19.5%) of dilated cardiomyopathy, 16 (8.6%) of previous myocardial infarction, 8 (4.8%) of congenital heart disease, 8 (3.7%) of hypertrophic cardiomyopathy, 5 (2.7%) of left-dominant arrhythmogenic cardiomyopathy and 3 (1.6%) of left ventricular non-compaction cardiomyopathy. In the entire cohort, 501 (66.3%) reported cardiovascular symptoms; more specifically 78 subjects (10.3%) had syncope and 102 (13.5%) had chest pain. For what concern ventricular arrhythmia, 433 patients (57.3%) had more than 1000 VEBs/24h, 199 (26.3%) had more than 10000 VEBs/24h, 173 (22.9%) had NSVT, 58 (7.7%) had SVT and 11 (1.5%) had resuscitated cardiac arrest. Among clinical variable only previous TVS (OR 2.01 95%CI 1.15-3.52) and reported chest pain (OR 2.7 95%CI 1.78-4.26) are associated with cardiac MRI positive for structural heart disease.

Conclusion: Among patient with ventricular arrhythmia and normal transthoracic echocardiogram almost 25% had cardiac MRI positive for structural heart disease. Of note, among clinical variable previous chest pain and SVT were associated to positive cardiac MRI.

P656
Relaxin as a novel biomarker of cardiac fibrosis and left ventricular diastolic parameters in end-stage heart failure

EG. Gara; J. Simon; GY. Csiko; T. Radovits; G. Foldes; J. Skopal; B. Merkely
Semmelweis University, Heart Center, Budapest, Hungary

Background and Purpose: Relaxin is a pleiotropic hormone with deeply described effects in pregnancy and labor. Furthermore, it has recently emerged as a new therapeutic agent in decompensated heart failure patients. Furthermore, relaxin can also act as a novel biomarker in chronic heart failure. Here we aimed at investigating the role of endogenous, circulating relaxins (RLX-1 and RLX-2) on cardiac remodeling and fibrosis, as well as on the left and right ventricular function.

Methods: Human myocardial samples were collected from consented patients with ischemic - end-stage heart failure (HF) (n=55), serum and explanted myocardial tissue were collected and biobanked during heart transplantation surgery. Medical history, laboratory findings, hemodynamical (cardiac output, PVR, PCWP) and echocardiographic measurements were assessed. Circulating RLX-1 (at least 3 replicates/patient) and RLX-2 was measured by ELISA from serum. Left and right ventricular

wall segments were stained with Picrosirius red and Massons' trichrome. The amount of myocardial fibrosis was quantified with Image J density analyses. For statistical analyses t-tests, Spearman's correlation tests were used, a p-value of ≤ 0.05 was considered to be statistically significant.

Results: Mean levels of RLX-1 from end-stage HF were comparable with those measured in pregnant women. (702±283 pg/ml in vs. 560-1060 pg/ml, respectively). RLX-1 proved to be independent of age, gender, hypertension, diabetes mellitus, BMI or BSA. We found a moderate inverse correlation between serum RLX-1 levels and the extent of ventricular fibrosis (r=-0.493, p=0.0005 in the right ventricle and r=-0.487, p=0.0006 in the left ventricle). In parallel with this, a moderate correlation was found in left ventricular diastolic function parameters (E/A r=0.456, p=0.0025). There were no significant differences in the laboratory results, hemodynamics, and other echocardiography parameters. RLX-1 levels showed moderate correlation with RLX-2 levels (r=0.453, p=0.0003).

Conclusion: In this population of end-stage heart failure patients with ischemic etiology higher endogenous RLX-1 levels were accompanied by significantly lower extent of myocardial fibrosis. This finding suggests the specified biomarker role for RLX-1 and emphasizes its therapeutic use of RLX-1 as an anti-fibrotic drug. Further studies are necessary to fully understand its role in the myocardial function and detailed intracellular mechanisms of action.

P657
Three-dimensional strain echocardiography, vascular ultrasound and cardiac biomarkers in early detection of cardiotoxicity in non-Hodgkin lymphoma patients

D. Mihalcea[1]; R. Bruja[2]; AM. Vladareanu[1]; D. Vinereanu[1]
[1]Carol Davila University of Medicine and Pharmacy, University and Emergency Hospital Bucharest, Cardiology Department, Bucharest, Romania; [2]University Emergency Hospital, Bucharest, Romania

CHOP chemotherapy (cyclophosphamide, doxorubicin, vincristin, prednisone) in non-Hodgkin lymphoma (NHL) has risk of cardiotoxicity, increasing morbidity and mortality.

Aim: To define new parameters of 3D LV deformation, arterial stiffness and biomarkers, for early detection and prediction of cardiotoxicity.

Methods: 100 patients (45men, 59±16years), with NHL, with LVEF >50%, scheduled for CHOP, were assessed at baseline, after 3rd cyle and treatment completion (doxorubicin cumulative dose 382±68mg). 3D echo (3DE) was used to assess LV EF and systolic deformation: longitudinal, radial, circumferential, area strain (LS, RS, CS, AS), Echo-tracking for pulse wave velocity (PWV), augmentation index (AIX) and β index; troponin I and NTproBNP were measured as markers of cardiac injury and high overload. Cardiotoxicity was defined as decrease of LVEF<50%, with >10% from the baseline value.

Results: At the end of CHOP therapy, 21 patients (21%) (group I) developed cardiotoxicity (LVEF=64±2 vs 48±1, p<0.0001), while 79 patients (group II) did not (LVEF=63±3 vs 56±2, p<0.0001). There were a significant reduction of LS, CS AS starting 3rd cycle and increased arterial stiffness, but group I had greater changes than group II (p<0.001) (Table). It was a significant correlation between LVEF reduction and decrease of LS, AS and increased PWV, β index and troponin level after 3rd cycle (r =0.621; r =0.412, r =-0.359, r =-0.413, r=-0.304, all p<0.05). Reduction of LS after 3rd cycle was the best independent predictor for LVEF decrease at the end of treatment (R2=0.394, p=0.001). By ROC analysis, LS decreased with more than 22% after 3rd cycle predicted cardiotoxicity at the end of CHOP therapy (Sb 81%, Sp 79%).

Conclusion: Assessment of 3DE myocardial deformation, arterial stiffness parameters and cardiac biomarkers are able to detect early chemotherapy-induced cardiotoxicity and to predict LVEF further decline in non-Hodgkin lymphoma patientis. Further studies are needed to assess if these parameters can be used in routine clinical practice.

Parameters for cardiotoxicity diagnosis

Parameter	CHOP therapy	Group I	Group II
LS (-%)	Baseline	22.7±1.2	23.3±1.5
	3rd cycle	16.1±1.4†	19.4±1.6†
	Final	11.8±1.3†	17.6±2.2†
CS (-%)	Baseline	23.1±1.2	22.8±1.3
	3rd cycle	17.0±1.4†	19.7±1.2
	Final	14.6±1.2†	16.6±1.8†
AS (-%)	Baseline	44.1±2.8	43.9±3.2
	3rd cycle	37.6±3.5†	39.5±2.2†
	Final	33.7±4.2†	37.5±5.3†
PWV (m/sec)	Baseline	5.4±1.2	5.4±1.4
	3rd cycle	8.3±1.5	6.1±1.4
	Final	9.7±1.4†	7.2±1.6†
β index	Baseline	8.4±1.5	8.4±1.4
	3rd cycle	12.3±1.9†	11.1±1.9
	Final	17.7±1.5†	13.2±1.2†
Tn I (ng/ml)	Baseline	0.006±0.002	0.007±0.0001
	3rd cycle	0.036±0.005	0.011±0.0004
	Final	0.082±0.008†	0.019±0.0009†

† p<0.05; LS - longitudinal strain; CS - circumferential strain; AS - area strain; PWV - pulse wave velocity; Tn I - troponin I

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Ranolazine post-treatment reduces cardiotoxic effects due to Trastuzumab Emtansine: in vitro and in vivo study

N. Maurea[1]; C. Coppola[1]; G. Piscopo[1]; G. Riccio[2]; D. Rea[3]; R. De Vecchis[4]; C. Maurea[1]; G. Sorrentino[1]; C. De Lorenzo[5]; M. De Laurentiis[6]

[1]Istituto Nazionale per lo Studio e la Cura dei Tumori Fondazione Giovanni Pascale - IRCCS, Division of Cardiology, Naples, Italy; [2]Federico II University of Naples, Department of Pharmacy, Naples, Italy; [3]Istituto Nazionale per lo Studio e la Cura dei Tumori Fondazione Giovanni Pascale - IRCCS, Animal Facility, Naples, Italy; [4]Elena d'Aosta Hospital, Department of Cardiology, Naples, Italy; [5]University 'Federico II', Department of Molecular Medicine and Medical Biotechnology, Naples, Italy; [6]Istituto Nazionale per lo Studio e la Cura dei Tumori Fondazione Giovanni Pascale - IRCSS, Department of Breast Surgery and Cancer Prevention, Naples, Italy

Background: Ado trastuzumab emtansine (TDM1) is a novel antibody–drug conjugate consisting of trastuzumab (TRAS) covalently linked to the highly potent microtubule inhibitory agent DM1 via a stable thioether linker. TDM1 is used in metastatic ErbB2 positive breast cancer patients, previously treated with TRAS and taxane. Although, the potential cardiotoxic effects of TDM1 have not yet been fully elucidated, they can include all the mechanisms of TRAS-related cardiotoxicity, such as changes in Ca2+ regulation related to blockade of ErbB2, PI3K-Akt and MAPK pathways. Here, we aim to elucidate whether Ranolazine (RAN), administered after TDM1 treatment, blunts or not cardiotoxicity in vivo and in vitro.

Methods: In vitro, human fetal cardiomyocytes (HFC) were treated with TDM1 for 3 days and then treated in the absence or presence of RAN for 3 days. Cell viability was assessed by cell counting and MTT assay. To evaluate cardiac function in vivo, C57/BL6 mice, 2-4 months old, were daily treated with TDM1 (44.4 mg/kg/day). At day 0 and after 7 days, fractional shortening (FS) and ejection fraction (EF) were measured, by M/B mode echocardiography, and radial and longitudinal strain (RS and LS) were evaluated using 2D speckle-stracking. These measurements were repeated after 5 days of RAN treatment (305 mg/Kg/day), started at the end of TDM1 treatment.

Results: RAN reduces TDM1 toxicity in HFC, as evidenced by the higher percentage of viable cells treated with TDM1+ RAN with respect to the cells treated with TDM1 alone (p<0.01). In in vivo studies: after 7 days with TDM1 administration, FS decreased to 53.6±0.9%, versus 61.0±0.8 % (sham), (p<0.01), and EF decreased to 85.5±3.5 % versus 91.0±0.8% (sham), (p<0.01). Moreover, RS decreased to 20.92±3.2 % versus 42.2±10.1% (sham) (p<0.01), and LS decreased to -15.5±2.8 % versus -23.6±6.7% (sham), (p<0.01).
In mice treated with TDM1 and, successively treated with RAN for 5 days, the indices of cardiac function partially recovered: FS 58±2.4 % (p<0.05), EF 88.8±1.7 %, (p<0.05), RS (35.7±8.2 %, p>0.05), whereas the alteration of LS persists even after treatment with RAN (-17.3±3.7 %, p>0.05)

Conclusions: Here we show that in vivo RAN post-treatment reduces cardiotoxic effects due to TDM1, as demonstrated by the recovery of FS, EF and RS values. As expected, RAN increases cell viability of HFC treated with TDM1

P659

Echocardiographic guided screening for Fabry disease in a metropolitan area not already explored

R. Citro[1]; C. Prota[1]; A. Silverio[1]; M. Bellino[1]; D. Di Vece[1]; D. Ferraioli[1]; I. Radano[1]; P. Bottiglieri[1]; R. Napoletano[1]; R. Ascoli[1]; L. Soriente[1]; A. Gigantino[1]; E. Bossone[2]; F. Piscione[1]

[1]University Hospital San Giovanni di Dio e Ruggi d'Aragona, Department of Cardiology, Salerno, Italy; [2]Cava De' Tirreni-Amalfi Coast Hospital, Division of Cardiology, Cava De' Tirreni, Salerno, Italy

Aim of the study: To perform an echocardiographic screening for left ventricular hypertrophy (LVH) in a metropolitan area not already explored for Fabry disease (FD).

Methods: From August to December 2016, among patients referring to our echo-lab, those with echocardiographic detection of LVH defined as a maximal end-diastolic septal or posterior wall thickness ≥13 mm, in association with at least one of the classical signs and symptoms related to FD (acroparesthesias, anhidrosis/hypohidrosis, angiokeratomas, gastrointestinal problems, renal failure or cerebrovascular complications) were considered eligible for the FD screening program. Exclusion criteria were severe aortic stenosis or LVH of known etiology; whereas patients with arterial hypertension were included. In male patients, α-Gal A activity was measured using dried

blood spot testing, and diagnosis was confirmed by mutation analysis of the GLA gene; in females, mutation analysis was the primary screening tool.

Results: Fifteen patients (7 males; mean age of 60 ± 18.5 yy and mean left ventricular septal diameter of 15.4 ± 2.4 mm) were considered eligible for the screening program. Acroparesthesias, gastrointestinal transit abnormalities and headache were reported in 4 (26.7%), 4 (26.7%) and 2 (13.3%) patients respectively. Most of the study population assessed had a known history of arterial hypertension (9, 60%) and of diabetes mellitus (3, 20%); many patients, moreover, presented renal failure (6, 40%), particularly 2 of them were on a regular dialysis program. Two (13.3%) GLA gene mutations were detected, of note one of them never described in the literature. The characteristics of the two positively screened patients and their relatives affected by FD are shown in Table 1. Of note despite normal ejection fraction global longitudinal strain was slightly reduced (<-19%.) in most of FD patients.

Conclusion: In a metropolitan area not previously investigated, a short clinical and echocardiographic guided screening program revealed a high prevalence of FD (13.3%). Of note a GLA gene mutation never described before was identified.

P660

Comparative effectiveness of torasemide versus furosemide in symptomatic therapy in heart failure patients: results from the TORNADO trial

A. Fojt[1]; R. Glowczynska[1]; P. Balsam Pawel[1]; J. Kochanowski[1]; K. Ozieranski[2]; M. Markulis[1]; A. Tyminska[1]; M. Peller[1]; A. Cacko[1]; E. Bakula[2]; R. Kowalik[1]; Z. Huczek[1]; KJ. Filipiak[1]; G. Opolski[1]; M. Grabowski[1]

[1]Medical University of Warsaw, 1st Chair and Department of Cardiology, Warsaw, Poland; [2]Western Hospital in Grodzisk Mazowiecki, Department of Cardiology, Grodzisk Mazowiecki, Poland

Background: Despite decades of diuretics' history, knowledge about this therapy in heart failure (HF) is unsatisfactory. Furosemide (F) has no positive effect on patients' (pts) outcomes and may even be associated with increased risk for hospitalization and mortality. In contrast, some reports suggest that torasemide (T) may have advantageous influence on clinical outcomes. Even lesser is known on it's influence on the structure and function of the heart described by echocardiographic (ECHO) parameters.

Purpose: To compare the effects of T and F on clinical outcomes including New York Heart Association (NYHA) class and echocardiography findings in pts with chronic HF.

Methods: This analysis included forty-nine pts from the ongoing multicentre, randomized, open, blinded endpoint phase-IV TORNADO trial (NCT01942109). The study is enrolling HF pts in NYHA II-IV class, treated with optimal HF therapy. At the time of enrolment pts are stable, with a fixed-dose of F. Pts are randomized to treatment with F and T (randomization 1:1). After randomization, F continues in its current fixed-dose or is replaced by equipotential dose of T (4:1). On control visits were performed clinical examination and an ECHO, checking following parameters: ejection fraction (EF), left ventricular end diastolic diameter (LVEDD), left atrial area (LA area), left atrium volume (LAVol), mitral regurgitation range (MR range), effective regurgitant orifice (ERO), mitral regurgitant volume (MRvol), tricuspid regurgitation peak gradient (TRPG). Baseline clinical and laboratory parameters were included in the logistic regression model.

Results: Pts were randomized to F (32) and T (17) groups. Pts were followed-up (FU) for a mean of 6-months. Median age of total population was 69 years and 75.5% of pts were male. Most common HF etiology was ischemic heart disease (50%). Pts in the T and F groups were well matched in terms of age, gender, chronic diseases, NYHA class, heart rate, systolic blood pressure, laboratory findings, HF recommended pharmacotherapy and implantable devices. There were no significant differences between echocardiographic parameters at baseline in F and T groups. NYHA class decreased with F patients by 0.38 (±0.65) vs 0.16 (±1.19) with T patients (p=0,035). For the whole group of 49 patients a decrease of MR range after 3 months was observed (p=0.057). After 6 months a decrease of TRPG was also noticeable (p=0.041). In F group the TRPG decreased after 3 months (p=0.074) and after 6 months (p=0.031). A smaller change in LAVol with patients from T group was observed vs F group (p=0.077).

Conclusions: In both F and T groups was observed an improvement in NYHA class, but only in F group it was statistically significant. In comparison to T, F may have more beneficial effects on symptomatic therapy in HF, but without improvement in

Abstract P659 Table 1. Characteristics of FD patients

Index Case	Gender / Age	Max LV Thickness (mm)	Ejection Fraction (%)	Global Longitudinal Strain (%)	Signs & Symptoms of FD	α GAL-A Activity (μmol/l/h)	GLA Mutation	LYSO-GB3 Levels (ng/ml)
1	F/57	14	56	-18	Acroparesthesias, headache, abdominal pain	Normal	c.388A>G (p.Lys130Glu), exon 3	4
2	M/66	17	50	-12	Mild chronic renal failure	<0,8	c.901C>G (p.Arg301Gly), exon 6	5,3
3 (Patient 1 son)	M/25	12	69	-18	Acroparesthesias, abdominal pain	<0,8	c.388A>G (p.Lys130Glu), exon 3	18,1
4 (Patient 2 daughter)	F/41	0,9	60	-20	None	Normal	c.901C>G (p.Arg301Gly), exon 6	Normal
5 (Patient 2 nephew)	M/12	0,6	70	-18	Developmental disability, history of epilepsy, gastrointestinal problems	<0,8	c.901C>G (p.Arg301Gly), exon 6	3,9

LVEDD and EF. There were little differences in other echocardiographic parameters in both F and T groups during follow-up.

P661
Restrictive heart remodeling among breast cancer survivors

N. Maroz-Vadalazhskaya[1]; A. Zakharevich[2]
[1]Scientific and Practical Center of Cardiology, Minsk, Belarus; [2]Republican Scientific-Practical Centre of Sport, Minsk, Belarus

Improved survival in breast cancer patients is often accompanied by treatment related complications, including adverse effects of cancer therapies on the heart. Major findings in those are the worsening of systolic function regarding LVEF calculation and deformational indices. Indeed, same patients demonstrate HF symptoms despite "normal" LVEF, which need to be investigated.
Aim: regular assesment of heart remodeling and function was performed to find a substrate of HF symptoms in patients under anticancer treatment.
Cohort of 40 women (27-58 y.o.) with HER2+ breast cancer were examed every 3 months after initial diagnosis and beginning of treatment. Among them 40 pts had metastatic cancer, 5 - primary breast cancer. Radiotherapy, surgery and chemotherapy were performed from 6 months to 10 years before initiation of trastuzumab treatment. Cardiotoxicity effect (symptomatic falling of LVEF) was revealed in one woman, who was excluded from present study. Nine patients met HF symptoms (NYHA I-II) and were treated.
**Results:** Shortening of long axis and decreasing of volume of both atrial chambers followed by the increasing of sphericity indices of LA and RA in groups. Patients of groups of treatment had negative dynamics of systoilc longitudinal deformation of both ventricles (for both p<0,05). Decreasing of systolic deformation and restrictive chamber remodeling correlated to exercise intolerance and HF symptoms (p<0,02). No patients had decreasing of LVEF (pair t-test, p>0,05).
Conclusion: all patients demonstrated decreasing of atrial chamber short axis and volume. Less dramatic remodeling and HF symptoms were found in patients with monotherapy of trastuzumab. Atrial restrictive remodeling could be a cause of worsening of ventricular systolic deformation as well as HF symptoms.

Echo data during year prospective exams

Treatment	Month f/u	EDD, mm	ESD, mm	LA, mm	RA long axis, mm	RA short axis, mm
Trastuzumab	3 vs 12	46,0 vs 48,8	30,3 vs 30,2	32,5 vs 32,4	45,1 vs 46,6	34,4 vs 42,1
Radiotherapy + trastuzumab	3 vs 12	39,1 vs 49,2	25,1 vs 34,3	30,0 vs 37,3	46,1 vs 46,5	40,3 vs 45,2
Doxorubicin + trastuzumab	3 vs 12	49,3 vs 50,2	31,2 vs 33,3	36,1 vs 30,3*	49,2 vs 38,1*	35,4 vs 42,2*
Radiotherapy+ doxorubicin+ trastuzumab	3 vs 12	47,0 vs 47,6	31,4 vs 33,1	33,8 vs 30,8	46,3 vs 40,8*	38,8 vs 3 vs 36,7

* - p<0,05 between 3 and 12 month of f/u in groups of treatment
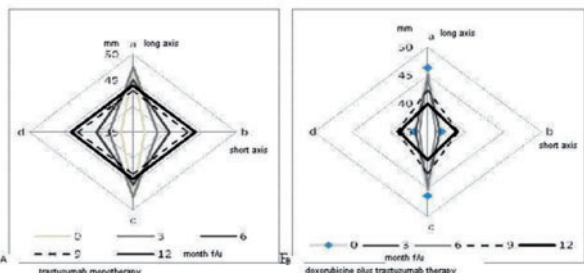
Abstract P661 Figure. Atrial remodeling in HER2+ patients

P662
Prognostic value of renal dysfunction in patients with left ventricular non-compaction cardiomyopathy

SF. Stampfli[1]; L. Erhart[1]; N. Hagenbuch[2]; BE. Stahli[1]; BA. Kaufmann[3]; B. Gencer[4]; P. Haager[5]; H. Muller[4]; L. Held[2]; FC. Tanner[1]
[1]University Heart Center, Cardiology, Zurich, Switzerland; [2]University of Zurich, Department of Biostatistics; Epidemiology, Biostatistics and Prevention Institute, Zurich, Switzerland; [3]University Hospital Basel, Cardiology, Basel, Switzerland; [4]Geneva University Hospitals, Geneva, Switzerland; [5]Cantonal Hospital St. Gallen, St. Gallen, Switzerland

Introduction: Left ventricular non-compaction cardiomyopathy (LVNC) is a potentially life threatening disease, characterized by a thin, compacted epicardial layer and a thick endocardial layer with prominent trabeculations and deep recesses. While renal function has been observed to inversely correlate with clinical outcome in other cardiomyopathies, its prognostic significance in LVNC has not been investigated. The aim of this study was to determine the prognostic value of renal function in patients with LVNC.
Methods: All patients with isolated LVNC as diagnosed by echocardiography and/or magnetic resonance imaging between 1988 and 2016 in 4 Swiss centers were included in a patient registry and analyzed for this study. Values for creatinine, urea, and estimated glomerular filtration rate (eGFR) as assessed by the Modification of Diet in Renal Disease (MDRD) formula were collected and analyzed by a Cox regression model for the occurrence of a composite endpoint of death and heart transplantation.
Results: The median age of the 126 included patients was 47.3 years; median left ventricular ejection fraction was 42%. During the median observation period of 7.4 years 23 patients reached the endpoint. Median values at study entry were: creatinine 87 μmol/l (IQR 74-102), urea 6.1 mmol/l (IQR 4.4-8.1), eGFR 86 ml/m2 (IQR 68-96). Median last values before an event were: creatinine 122 μmol/l (IQR 83-146), urea 6.8 mmol/l (IQR 5.1-9.7), eGFR 68 ml/min (IQR 50-76). The age- and gender-corrected hazard ratio (HR) for death or heart transplantation were: 1.9 (95%-CI 1.4-2.6) for an increase in creatinine of 30 μmol/l (p<0.0001), 1.6 (95%-CI 1.2-2.2) for an increase in urea of 5 mmol/l (p= 0.004), and 3.6 (95%-CI 1.9-6.9) for a decrease in eGFR of 30 ml/min (p=0.0001). The HR (log2) for every doubling of creatinine was 7.7 (95%-CI 3-19.8; p<0.0001), for every doubling of urea 2.5 (95%-CI 1.5-4.3; p= 0.0006), and for every bisection of eGFR 5.3 (95%-CI 2.4-11.6; p<0.0001).
Conclusion: This study provides evidence that a decrease in kidney function as assessed by creatinine, urea, and eGFR is associated with increased risk of death and heart transplantation in patients with LVNC. This finding suggests that kidney function should be included in follow-up and risk assessment of LVNC patients.

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Evaluation of systolic and diastolic left ventricular function in patients with systemic lupus erythematosus by specle tracking echocardiography

ASP Tadeu[1]; O. Azevedo[2]; F. Castro[2]; M. Lourenco[2]; A. Lourenco[2]; I. Tadeu[3]
[1]University of Minho - Life and Health Sciences Research Institute (ICVS), Braga, Portugal; [2]Hospital Guimaraes, Guimaraes, Portugal; [3] Unidade de Cuidados de Saúde Personalizados de Vila Real II, Vila Real, Portugal

Background: Systemic lupus erythematosus (SLE) is an inflammatory autoimmune disease. Heart involvement by SLE is frequent, but insidious in most cases. Myocardial deformation imaging by speckle tracking is a sensitive echocardiographic technique to assess ventricular function. There are few studies evaluating systolic and diastolic ventricular function of SLE patients based on myocardial deformation imaging.
Aim: To evaluate left ventricular (LV) systolic and diastolic function in SLE patients by myocardial deformation analysis using 2D speckle tracking technique.
Methods: Retrospective study including 30 SLE patients, without known cardiovascular comorbidities or complications, and 37 healthy controls. Demographic, clinical and echocardiographic data by conventional echocardiography and tissue Doppler imaging were obtained. LV systolic and diastolic function was evaluated by myocardial deformation analysis using 2D speckle tracking.
Results: SLE patients were mostly women (96.7%), with mean age 41.5±11.3 years, mean duration of disease 8,0±4.7 years and moderate disease activity (median of SLEDAI-2K index 12). SLE patients presented higher ventricular mass (p=0.036), lower ejection fraction (p=0.043) and lower septal S' wave velocity (p=0.038) than controls, although within normal range, without fulfilling any criteria of systolic or diastolic ventricular dysfunction by conventional echocardiography or tissue Doppler imaging. Myocardial deformation analysis revealed that SLE patients had worse values of peak-systolic global longitudinal strain (-20.2±2.4 vs. -21.6±1.7%; p=0.007) and strain rate (-1.19±0.17 vs. -1.29±0.18; p=0.024) than controls. No differences were found between the groups concerning early diastolic longitudinal strain rate (p=0.160) or E/ early diastolic longitudinal strain rate ratio (p=0.624).
Conclusion: SLE patients, without known cardiovascular comorbidities or complications, present subclinical systolic ventricular dysfunction with worsening of both global longitudinal strain and strain rate.

SYSTEMIC DISEASES AND OTHER CONDITIONS

P664
Greater improvement myocardial deformation and endothelial glycocalyx by inhibition of Interleukin-6 activity in patients with rheumatoid arthritis

I. Ikonomidis[1]; G. Pavlidis[2]; P. Katsimbri[3]; H. Triantafyllidi[2]; M. Varoudi[2]; G. Kostelli[2]; D. Vlastos[2]; D. Benas[2]; E. Kalogeris[2]; J. Parissis[2]; J. Lekakis[2]; D. Boumpas[3]; E. Iliodromitis[2]
[1]University of Athens, Athens, Greece; [2]University of Athens Medical School, Attikon Hospital, 2nd Department of Cardiology, Athens, Greece; [3]University of Athens Medical School, Attikon Hospital, 4th Department of Internal Medicine, ATHENS, Greece

Background: Interleukin-6 mediates atherogenesis and coronary vasoreactivity. Tocilizumab, a humanised monoclonal antibody against the human interleukin-6 receptor, is used for the treatment of rheumatoid arthritis.(RA) We investigated the

effects of tocilizumab on arterial function, LV myocardial deformation and endothelial function and glycocalyx in RA patients.

Methods: Forty patients with RA (age: 62±9 years) received tocilizumab 160mg once a week subcutaneous for 3 months. Twenty age and sex matched subjects with similar risk factors served as controls. At baseline and after 3-month treatment we assessed: a) carotid-femoral pulse wave velocity(PWVc - Complior SP ALAM), central systolic blood pressure(cSBP), augmentation index(AI), b)LV longitudinal strain(GLS), systolic(LongSr) and diastolic(LongSrE) strain rate, peak twisting(pTw), peak twisting velocity(pTwVel) and peak untwisting velocity(pUtwVel)using speckle tracking echocardiography. The degree of LV untwisting was calculated as the percentage difference between peak twisting and untwisting at MVO(%dpTw−UtwMVO),at peak(%dpTw-UtwPEF)and end of early LV diastolic filling(%dpTw-UtwEDF) d) perfused boundary region(PBR) of the sublingual arterial microvessels(ranged from 5-25μm) using Sideview Darkfield imaging(Microscan, Glycocheck). Increased PBR is considered an accurate index of reduced endothelial glucocalyx thickness because of a deeper RBC penetration in the glucocalyx e)Flow mediated dilatation(FMD) of the brachial artery and percentage difference of FMD(FMD%)after hyperemia f)coronary flow reserve (CFR) of the LAD using Doppler echocardiography.

Results: Patients with RA had impaired all vascular and LV deformation markers compared to controls (p<0.05). After3-months treatment, subjects who received tocilizumab achieved a reduction of PWV(12.2±3 vs. 10.7±2m/sec),Aix(24±16 vs. 18±15%),PBR(2.11±0.2 vs. 1.95±0.18μm)and pTw(16.7±6 vs. 13.7±7deg) in parallel with an increase of %dpTw-UtwMVO(35±12 vs. 41±11),FMD%(8.9±7 vs. 10.7±7), CFR-VTI(2.6±0.6 vs. 2.8±0.6)(p<0.05 for all comparisons). At baseline FMD% was related with CFR (r=0.45) and CFR was inversely related with %dpTw-UtwMVO(r=-0.42)(p<0.05 for all associations). Post-treatment FMD% was related with PWV(r=0.76),GLS(r=0.88),pUtwVel(r=0.89)and inversely related with pTw(r=-0.71)(p<0.05). The percentage difference of Aix was associated with the percentage difference of pTw(r=0.68) and the percentage difference of PBR was related with the percentage difference of PWV(r=0.40) (p<0.05).

Conclusion: IL-6 inhibition improves endothelial function and glycocalyx integrity resulting to improved coronary, aortic wall function and LV myocardial deformation in RA patients suggesting the important role of IL-6 activity in cardiovasular function and the beneficial effect of its inhibition on cardiovascular system .

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Patients with psoriatic arthritis present greater improvement of left ventricular torsional mechanics than patients with psoriasis after treatment with biological agents

I. Ikonomidis[1]; M. Varoudi[2]; G. Makavos[2]; E. Papadavid[3]; I. Kapniari[3]; K. Theodoropoulos[3]; D. Vlastos[2]; G. Pavlidis[2]; I. Andreadou[4]; G. Kostelli[2]; D. Benas[2]; H. Triantafyllidi[2]; P. Katsimbri[5]; D. Rigopoulos[3]; E. Iliodromitis[2]
[1]University of Athens, Athens, Greece; [2]University of Athens Medical School, Attikon Hospital, 2nd Department of Cardiology, Athens, Greece; [3]University of Athens Medical School, Attikon Hospital, 2nd Department of Dermatology & Venereology, Athens, Greece; [4]University of Athens, Department of Pharmaceutical Chemistry, Athens, Greece; [5]University of Athens Medical School, Attikon Hospital, 4th Department of Internal Medicine, ATHENS, Greece

Psoriasis and psoriatic arthritis have been associated with an increasing risk for atherosclerosis. However psoriatic arthritis is associated with a greater inflammatory burden than psoriasis. We investigated whether there was a greater improvement of surrogate markers of vascular dysfunction and LV myocardial deformation, post - treatment with biological agents in patients with psoriatic arthritis (PSART), compared to patients with psoriasis(PS).

Methods: We compared 100 patients with psoriasis (PS) [50,22± 12yrs,] (psoriasis area and severity index PASI disease activity score: (PASI: 13,15±11,5) with 30 patients with psoriatic arthritis (PSART) [52,9±12yrs and PASI:12,7±11,2) at baseline and after 4 months of treatment with biological agents. We measured: a) the pulse wave velocity (PWVa) by Arteriograph. b) LV longitudinal (GLS -%), strain and strain rate (GLSR), twisting (Tw -deg), peak twisting (Tw-deg/sec) velocity and peak untwisting (unTw) velocity, using speckle tracking echocardiography .c) coronary flow reserve (CFR) of the left anterior descending artery by Doppler echocardiography. Forty normal subjects served as controls.

Results: At baseline PSART had higher, PWV, AI, and lower CFR and GLS than PS, while both PSART and PS had impaired values of these markers compared to normal controls (p<0.05 for all comparisons) .

PWVa=10,50± 2,19 [PS] vs. 11,00 ±1,92 [PSART] m/sec,AI=24,52±22, 41[PS] vs. 31,05±15,85 [PSART], CFR=2,97±1,09[PS] vs.2,69±0,98[PSART], GLS-%:-16,99±4,45[PS] vs-16,00±4,38.[PSART].

Post-treatment there was a greater improvement of torsion and twisting velocity in PSART than in PS patients.(p<0.05 for all comparisons). Torsion=14,94±6,18 [PS] vs.16,40±6,52 [PSART],TwistVel=98,05±44,95 [PS] vs.111,05±23,64. [PSART]. The incidence of traditional atherosclerotic risk factors was similar between the study groups (p=ns).

Conclusions: Psoriatic arthritis patients have a greater impairment of myocardial deformation and vascular function than psoriasis patients and thus they present a greater improvement LV torsional mechanics of post treatment with biological agents, than the patients with psoriasis.

P666

Prevalence of cardiac sarcoidosis in patients with pulmonary sarcoidosis

MP. Huitema[1]; ALM Bakker[1]; MCJ Van Thor[1]; JC. Grutters[2]; MJ. Swaans[1]; BJWM Rensing[1]; MC. Post[1]
[1]St Antonius Hospital, Cardiology, Nieuwegein, Netherlands; [2]St Antonius Hospital, Pulmonology, Nieuwegein, Netherlands

Introduction: The exact prevalence of cardiac sarcoidosis (CS) in sarcoidosis is still unknown. Early recognition of CS is important, since patients are at risk for ventricular arrhythmias. We evaluate the prevalence of CS in sarcoidosis patients newly referred to a tertiary sarcoidosis centre.

Methods: All consecutive patients newly referred to our tertiary centre with (a history of) pulmonary sarcoidosis were screened by echocardiography, electrocardiogram, biomarkers and history taking for the presence of pulmonary hypertension and/or CS. In case of abnormalities, further investigation included MRI and FDG-PET (figure 1). Finally, the diagnosis of CS was made by a multidisciplinary team and based on multi-modality imaging and clinical criteria described in the international consensus statement. Patients were divided in CS, possible CS, no CS, and not further investigated.

Results: In total, 305 patients were screened as depicted in the figure (38.1% female, mean age 48.6 years). In 52.1% of the patients, further screening for CS was performed by MRI and/or FDG PET. Of all patients, 7.2% (22 patients) had CS. Furthermore, 3.6% (11 patients) had possible cardiac sarcoidosis and 126 (41.3%) had no cardiac sarcoidosis. Baseline characteristics of all groups can be found in the table.

Conclusion: CS is estimated to be present in 7.2% of the pulmonary sarcoidosis patients who are newly referred to a tertiary centre. In 3.6% possible CS is diagnosed.

Baseline characteristics

	CS (n=22)	Possible CS (n=11)	No CS (n=126)	Not further investigated (n=146)
Sex (female)	18.2%	54.5%	42.9%	35.6%
Age (years)	55.9±10.4	61.3±15.6	55.1±12.0	54.9±11.2
Troponin T >0.014 ug/l	18.2%	27.3%	7.1%	2.1%
NT-pro BNP (pg/ml)	632.7±580.1	267.4±230.6	166.1±196.8	96.4±68.5
EF normal	68.2%	81.8%	95.2%	99.3%
EF mildly abnormal	18.2%	9.1%	4.8%	0
EF moderately abnormal	4.5%	9.1%	0	0
EF severely abnormal	9.1%	0	0	0

EF normal (male ≥52%, female ≥54%), mildly abnormal (male 41-51%, female 41-53%), moderately abnormal (male and female 30-40%), severely abnormal (male and female <30%)
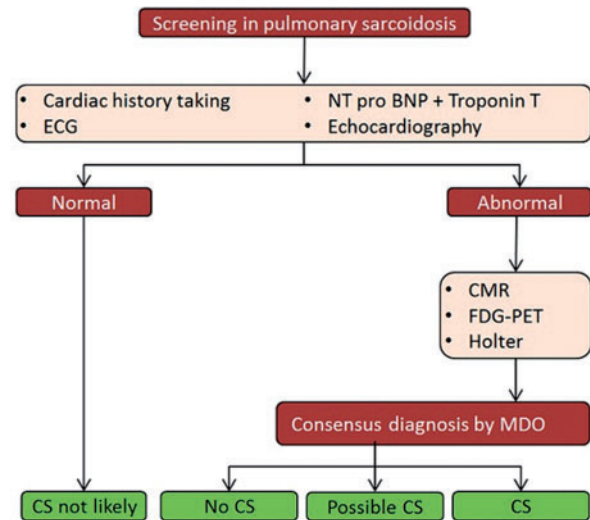
Abstract P666 Figure. Flowchart screening cardiac sarcoidosis

P667

Correlation of ankle brachial index measurement by and for cardiologists: are all the techniques valid?

OG. Perea; M. Corneli; R. Henquin

Cardiovascular Institute of Buenos Aires (ICBA), Cardiovascular Imaging Department, Buenos Aires, Argentina

Summary: Objective: The ankle-brachial index (ABI) is a tool for the diagnosis and management of peripheral arterial disease, and a marker of atherosclerosis. The objective of this study is to determine the correlation of ABI measured by a pocket Doppler device compared to ABI determination at the echo Doppler vascular laboratory.
Methods: We evaluated the ABI in patients referred to the echo Doppler vascular laboratory for an arterial and / or venous lower limb study between March 2014 to December 2014. Resting ABI was determined with a pocket Doppler (continuous Doppler) and then by Doppler at the echo vascular laboratory (pulsed Doppler). All measurements were made by two examiners. Reproducibility was assessed by the use of the reproducibility coefficient and correlation coefficients between measurements.
Results: 310 patients, 69% were men, mean age 58 years were included. The mean resting ABI with pocket Doppler was 1.01 and the ABI registered with pulsed Doppler at the vascular laboratory was 1.04. The reproducibility coefficient showed no significant difference between measurements (p > 0.1) and the correlation coefficient showed high agreement between inter-observer reproducibility (0.79–0.97).The Bland-Altman method was used to demonstrate the correlation between the two measurements. The mean difference between the two measurement methods was 0.003 in the right side (p = 0.1) and in left of 0.002 (p = 0.6) (see Figure 1).
Conclusions: Our study demonstrates that ABI measurements with pocket Doppler and pulsed Doppler at the vascular laboratory are consistent and can be replaced with each other. When used properly, the ABI remains an invaluable tool for assessment not only of peripheral arterial disease, but also a great prognostic marker for cardiovascular disease.

P668

Detection of subclinical myocardial involvement in patients with systemic sclerosis by myocardial 18F-FDG PET/CT and speckle tracking echocardiography

G. Agoston[1]; ZS. Besenyi[2]; R. Hemelein[3]; A. Palinkas[4]; L. Kovacs[3]; L. Pavics[2]; A. Varga[1]

[1]University of Szeged, Department of Family Medicine, Szeged, Hungary; [2]University of Szeged, Department Of Nuclear Medicine, Szeged, Hungary; [3]University of Szeged, Department of Rheumatology and Immunology, Szeged, Hungary; [4]University of Szeged, Csongrád County Hospital, Hódmezovásárhely, Szeged, Hungary

Background: Myocardial involvement is a frequent complication in connective tissue diseases particularly in systemic sclerosis (SSc). In SSc the immuno-inflamatory damage leads to myocardial fibrosis and consequent myocardial dysfunction. The development of overt myocardial involvement is recognized as powerful prognostic factor.
Purpose: To assess the diagnostic utility of cardiac 18F-FDG PET CT in patients with SSc, and to evaluate simultaneously the underlying mechanical changes in the affected myocardium using 2 Dimensional Speckle Tracking Echocardiography (STE).
Methods: 19 patients with connective tissue diseases (14 patients with SSc and 5 patients with suspected giant cell arteritis, age: 56,3±10, 78% female) where enrolled in the prospective study. All patient underwent 18F-FDG PET CT of the myocardium assessing 18-FDG uptake in kBq/cc. Within 24 hours all patients underwent comprehensive echocardiography focusing on left ventricular myocardial mechanics applying STE. The recommended 17 segment model was used to assess the 18F-FDG activity and for the calculation of myocardial strain too. The strain values were measured off-line by available speckle tracking software.
Results: Among 19 patients 6 patients (32%) showed significantly increased 18F-FDG activity (18,02±2,6 kBq/cc vs. 7,8±1,1 kBq/cc, p<0,01, Figure 1). In patients where the 18F-FDG uptake was increased, we measured decreased global left ventricular longitudinal strain values (19,3±0,9% vs. 14,6±1,5%, p<0,01). We found negative correlation between strain and 18-FDG uptake (p<0,01, r=-0,62) In 5 patients where the indication of the 18F-FDG PET CT was arteritis, we didn't observe pathological 18-FDG uptake (4±1 kBq/cc), and left ventricular strain values were also in physiological range (22,3±1%). This observation supports that among connective tissue diseases myocardial involvement mostly affects patients with SSc.
Conclusion: 18F-FDG PET CT is a promising imaging tool to detect active myocardial involvement in patients with SSc. In the active condition of the myocardial involvement STE provides a simple, non-invasive modality to detect subtle mechanical changes in myocardium.
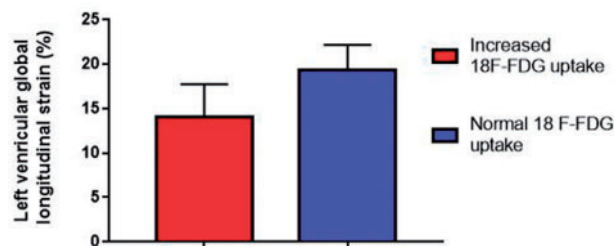
Abstract P668 Figure. LV strain-normal vs increased FDG uptake

P669

Carotid arterial circumferential strain as a subclinical indicator for cardiovascular involvement in patients with ankylosing spondylitis

L. Law; H. Forsblad Delia; P. Lindqvist

Umea University Hospital, Umea, Sweden

Background: Subclinical indicators for cardiovascular disease (CVD) are becoming increasingly important for early prevention and clinical management. Ankylosing spondylitis (AS) is a systemic rheumatic disease known to be associated with increased risk of CVD. The aim of this study was to assess bilateral common carotid arterial (CCA) circumferential strain (CS), and conventional carotid parameters, including intima media thickness (IMT), in an attempt to determine any subclinical indicators of CV involvement in a selection of the AS population.
Material and Methods: Eighty-eight patients with AS (44 with hypertension (HT)), and 39 controls (16 young adults and 23 adults) were investigated. Bilateral carotid arterial ultrasound measurements were carried out on all patients and controls. Common carotid circumferential systolic strain (CCA CS) was measured in a short axis view using TOMTEC system. All image acquisition and analysis was carried out by LL. Inter-observer reliability analysis was carried out by PL.
Results: Conventional and new ultrasound measurements as well as blood pressures are presented in Table 1 and Figure 1. Inter-observer variability coefficient was 11,7%.
Conclusion: CCA CS decreased linearly with increasing age, this behaviour was further exaggerated in AS patients. Age related changes in CCA CS suggest evidence for arterial stiffness, with stiffening further increasing in AS patients with and without HT.

Mean and standard deviation of results

	ASHT	ASnHT	Adult controls	Young controls
AGE (years)	55±9	51±13	50±9	23±3
CCA CS $_{mean}$ (%)	6.5±2.7	8.1±4.0*	9.8±1.8 ¤	11.3±1.8
SBP (mmHg)	135±19	126±18	123±11	115±12
DBP (mmHg)	79±10	77±10	72±7¤	68±8
IMT $_{mean}$ (mm)	0.09±0.06	0.07±0.01	0.07±0.01	0.05±0.003
FAC $_{mean}$ (%)	-13.2±5.7	-17.1±9.1*	-20.4±3.9	-24.1±4.0
EDD $_{mean}$ (mm)	6.0±0.7	5.8±0.7	5.4±0.7¤	5.4±0.3
ESD $_{mean}$ (mm)	6.4±0.7	6.3±0.8	5.9±0.8¤	6.1±0.4
PP (mmHg)	61±19	54±13	51±9.5	47±10

¤ P<0.05 Adult controls versus ASnHT
* P<0.05 ASnHT versus ASHT
^P<0.05 Adult controls versus Young Controls
FAC% (fractional area change), EDD (end diastolic diameter), ESD (end systolic diameter), PP (pulse pressure)
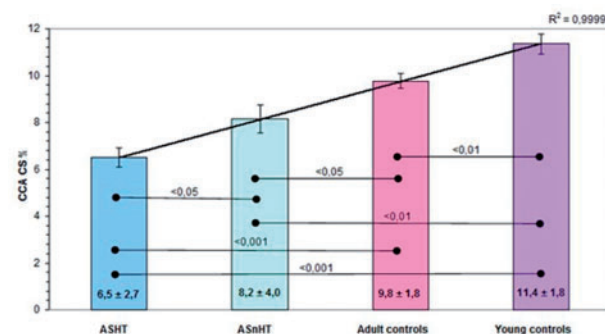
Abstract P669 Figure. CCA CS mean values and significants

P670

Functional and structural cardiac abnormalities in osteogenesis imperfecta

V. Hernandez Jimenez[1]; R. Mata Caballero[2]; L. Molina Blazquez[2]; B. Alcon Duran[2]; J. Gorriz Magana[2]; C. Nava Aguilera[2]; JA. Serrano[2]; I. Pavon De Paz[2]; J. Saavedra Falero[2]
[1]Hospital Rey Juan Carlos, Cardiology, Mostoles, Spain; [2]Hospital Universitario de Getafe, Madrid, Spain

Background: Cardiovascular abnormalities have been reported in patients with Osteogenesis Imperfecta (OI).
Purpose: The aim of our study was to assess the functional and structural cardiac abnormalities in patients with OI in comparison with a control group of healthy people.
Methods: We studied 80 patients with OI and 60 healthy controls, matched regarding sex and age. All of them underwent an echocardiographic study.
Results: The mean age of OI group was $31,3 \pm 15,4$ years and the mean age of control group was $35,1 \pm 17,2$ years. The left ventricular ejection fraction (LVEF) was significantly lower in OI patients. The left atrial dimension adjusted by body surface area (AI/BSA) was significantly higher in OI than in controls. The diastolic and systolic diameters of the left ventricle adjusted by body surface area were significantly higher in OI. The relative wall thickness (RWT) was significantly higher in OI patients than in control. The septal left ventricular wall thickness tended to be greater in OI patients. There were non-significant differences in the posterior left ventricular wall. The left ventricular mass indexed (LVMI) tended to be greater in OI. (Table 1).
Conclusions: According our results, the patients affected by OI suffer changes in geometry and function of heart. These echocardiographic parameters might worsen over time. A careful cardiological assessment of patients affected by OI may be necessary.

Table 1

PARAMETERS	OI GROUP	CONTROL GROUP	p
AI/BSA (mm)	$20,8 \pm 0,59$	$19,2 \pm 0,62$	0,03
Septal wall thickness (mm)	$8,76 \pm 0,22$	$8,33 \pm 0,16$	0,06
Posterior wall thickness (mm)	$8,5 \pm 0,15$	$8,2 \pm 0,17$	0,11
DD/BSA (mm)	$29,77 \pm 1,26$	$26,78 \pm 0,99$	0,03
DS/BSA (mm)	$20,8 \pm 2,34$	$15,7 \pm 0,63$	0,03
RWT	$0,38 \pm 0,09$	$0,36 \pm 0,08$	0,008
LVMI gr/m^2	$91,9 \pm 3,35$	$72,81 \pm 11,9$	0,06
LVEF (%)	$65,7 \pm 0,89$	$68,3 \pm 0,81$	0,03

DD/BSA: diastolic diameter of left ventricle/body surface area.
DS/BSA: sistolic diameter of left ventricle/body surface area

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The role of cardiopulmonary exercise test in the evaluation of patients with ankylosing spondylitis

A. Caglayan Turk[1]; S. Arslan[2]; Y. Karavelioglu[3]; M. Kalcik[3]; M. Yetim[3]; T. Dogan[3]; O. Karaarslan[3]; L. Bekar[3]; I. Ekinozu[3]; C. Alp[3]; Z. Golbasi[3]
[1]Hitit University Çorum Training and Research Hospital, Physical medicine and rehabilitation, Çorum, Turkey; [2]Hitit University Çorum Training and Research Hospital, Chest Disease, çorum, Turkey; [3]Hitit University Çorum Training and Research Hospital, Cardiology, Çorum, Turkey

Background: Ankylosing spondylitis (AS) patients commonly have the complaint of reduced exercise capacity. Pulmonary function impairment, chest wall restriction, weak respiratory muscle performance, peripheral muscle weakness and deconditioning have been reported as the hypotheses for reduced exercise capacity. During early stages of disease, the pulmonary function loss is not obvious.
Purpose: In our study, we aimed to evaluate the pulmonary functions and exercise performance of early stage ankylosing spondylitis patients by cardiopulmonary exercise test (CPET) and spirometry.
Method: Fifty AS patients (mean age: 40.4 ± 11.8; male: 38) were evaluated prospectively by CPET, spirometry, chest X-ray and electrocardiography. Thirty-four healthy subjects (mean age: 49.7 ± 10.3; male: 27) were enrolled as control group. All data entered into a dataset and compared between patient and control groups.
Result: There was no significant difference between demographic parameters of the patient and control groups. Comparison of spirometry results revealed no significant difference between the groups. FEV1 and FVC values were similar between the groups (95.4 ± 11.9 vs. 90.8 ± 14.6,p=0.177 and 91.8 ± 11.2 vs. 87.1 ± 14.1, p=0.153 respectively). There were significant differences in terms of CPET parameters between the groups. The duration of the test and maximum load were significantly lower at patient group (16.1 ± 3.4 vs. 19.4 ± 3.1, p<0.001 and 116.4 ± 36.5 vs. 152.5 ± 31.2, p=0.001 respectively). Whereas no significant difference was found between respiratory exchange ratios (RER) (1.06 ± 0.05 vs 1.08 ± 0.08, p=0.344). VO2max was significantly lower in patient group during maximum exercise [12(11-14) vs 15 (12-17), p<0.001]. There was no significant difference in VE/VCO2 between patient and control groups (34.4 ± 4.1 vs. 35.9 ± 5.3, p=0.192) at maximum effort .
Conclusion: CPET might be a better test to assess the pulmonary function status of ankylosing spondylitis patients especially during early stage of the disease.

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One year echocardiographic follow-up in scleroderma patients on standard therapy

SL. Magda[1]; VD. Bratu[1]; AM. Gheorghiu[2]; RI. Mincu[1]; T. Constantinescu[3]; CM. Mihai[2]; M. Cinteza[4]; D. Vinereanu[1]
[1]University Emergency Hospital, Bucharest, Romania; [2]Clinical Hospital "Dr.I.Cantacuzino", Rheumathology, Bucharest, Romania; [3]"Marius Nasta" Institute Of Pneumology, Bucharest, Romania; [4]Carol Davila University of Medicine and Pharmacy, University and Emergency Hospital Bucharest, Cardiology Department, Bucharest, Romania

Background: Cardiac involvement in scleroderma (SSc) includes pulmonary hypertension, myocardial fibrosis and subclinical systolic dysfunction, but the long term influence of current rheumatological therapies on those features has to be investigated.
Aim: to assess 2D and 4D parameters of systolic function and to determine their evolution under standard therapy in patients with different forms of SSc.
Methods: 53 subjects (54 ± 12 years, 51 women) with SSc, mean time since onset 6.2 ± 6.7 yrs, were studied at baseline. Of those, 41 subjects were reassessed after 1 year of treatment. Standard 2D echo was used to determine LV ejection fraction (2DEF), RV fractional area shortening (FAC), TAPSE and systolic PAP. Tissue Doppler was used for systolic velocities at the tricuspid annulus (S TDI). Speckle tracking was used to determine LV and RV longitudinal strain (2DLS and RVGLS). 4D auto LV quantification echo was used to assess 4D ejection fraction (4DEF), longitudinal (4DLS), circumferential (4DCS), radial (4DRS), and area strain (4DAS).
Results: At baseline, standard echo parameters were normal. As we have already shown, SSc patients have subclinical systolic dysfunction compared to matched controls. After 1 year of treatment, 2D standard, TDI and speckle tracking, as well as 4D echo parameters, were similar to baseline (table), with no correlation to the treatment type.
Conclusion: Patients with SSc have subclinical systolic dysfunction which doesn't seem to be influenced by classical therapy. Cardiovascular screening in these patients should extend beyond pulmonary hypertension.

Parameter	Baseline (N=53)	FU1 (N=41)	P value
2DEF (%)	57.1 ± 6.8	59.4 ± 4.4	NS
2DLS (%)	-16.8 ± 2.7	-17.9 ± 2.2	NS
4DEF (%)	60.6 ± 6.7	63.5 ± 6.8	NS
4DLS (%)	-11.6 ± 4.0	-13.0 ± 3.5	NS
4DAS (%)	-21.2 ± 6.6	-20.4 ± 11.1	NS
FAC (%)	34.4 ± 12.8	39.5 ± 11.2	NS
TAPSE (mm)	22.9 ± 3.5	22.3 ± 4.3	NS
SPAP (mmHg)	25.4 ± 9.1	28.1 ± 11.1	NS
S TDI (cm/s)	13.9 ± 2.9	14.2 ± 2.7	NS
RVGLS (%)	-18.3 ± 8.1	-21.0 ± 9.3	NS

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Subclinical alterations in left ventricular function in patients with psoriasis: compared with the patients with psoriatic arthritis

B. Kilickiran Avci[1]; K. Tascilar[2]; HA. Barman[1]; B. Engin[3]; S. Ugurlu[2]; T. Suren[3]; O. Ozden Tok[1]; B. Ikitimur[1]; S. Serdaroglu[3]; E. Seyahi Kural[2]; E. Aydemir[3]; H. Yuksel[1]
[1]Istanbul University, Cerrahpasa Faculty of Medicine, Department of Cardiology, Istanbul, Turkey; [2]Istanbul University, Cerrahpasa Faculty of Medicine, Department of Internal Medicine, Division of Rheumatology, Istanbul, Turkey; [3]Istanbul University, Cerrahpasa Faculty of Medicine, Department of Dermatology, Istanbul, Turkey

Background: Psoriasis and psoriatic arthritis (PsA) are confer an independent risk for various cardiovascular diseases, including myocardial infarction and new onset heart failure. Although many studies with traditional echocardiography could not show any significant decrease in LV EF, recently few studies showed subclinical impairment in LV systolic function with speckle tracking echocardiography in either psoriasis or PsA patients without overt cardiovascular disease. However, apart from one, these studies did not include a diseased control group and none of them compared psoriatic patients with PsA.
Purposes: We aimed to identify and compare subclinical alterations of left ventricle (LV) function by analyzing longitudinal deformation and by measuring indices of diastolic function by echocardiography in asymptomatic psoriasis patients with/without psoriatic arthritis. Because of subtle abnormalities in LV systolic and diastolic function are common in diabetics and recent study draw attention to alteration in GLS (defined as <-%18) might be an early sign of LV remodeling, we included diabetic patients without overt cardiovascular disease served as a diseased control.
Methods: The study group included 123 patients with psoriasis (53 of them were affected by PsA), 54 with diabetes mellitus, and 64 healthy controls. LV global longitudinal strain (GLS) was assessed with two-dimensional speckle-tracking echocardiography. Alteration in GLS was defined as GLS < -18%. Diastolic function was studied

by conventional and tissue Doppler imaging based indices (medial or lateral annulus e', E/e', pulmonary artery systolic pressure and left atrial volume index).

Results: All indices of diastolic function were similar in patients with psoriasis, PsA and healthy controls. GLS was worse in patients with psoriasis (-20.2 ± 2.8%) and PsA (-20.2 ± 2.0%) than the healthy controls (-22.6 ± 2.5%) (p <0.001 and p <0.001, respectively). Diabetic group had the worst GLS (-18.9 ± 2.3%) value among them (p<0.001). Six (28.6%) patients with psoriasis, 8 (15.1%) with PsA and 25 (46.3%) with diabetes mellitus and none of the healthy controls had alteration in GLS. Linear regression analysis showed that presence of psoriasis independently associated with worse GLS values (B=2.33, 95%CI 1.42 - 3.42, p <0.001) whereas additional arthritis was not.

Conclusions: Although LV diastolic function do not exhibit alteration, GLS alteration detected by speckle tracking echocardiography is not rare in patients with psoriasis with/without PsA without clinically evident cardiovascular disease. The presence of psoriasis was independently associated with worse GLS values regardless of arthritis. However, the alteration in GLS in patients with psoriasis with/without PsA is not comparable to that of individuals with diabetes.

CONGENITAL HEART DISEASE

P674

Pulmonary artery dilation parallels ascending aorta dilation in children with bicuspid aortic valve

DM. Dorobantu[1]; R. Enache[1]; I. Ghiorghiu[2]; R. Badea[1]; C. Ginghina[1]; BA. Popescu[1]
[1]Institute of Cardiovascular Diseases Prof. C.C. Iliescu, Bucharest, Romania; [2]"Prof. Dr. Victor Gomoiu" Children's Hospital, Bucharest, Romania

Background: Bicuspid aortic valve (BAV) is associated with dilated ascending aorta (AAO) and main pulmonary artery (MPA) in adults. It is not clear if this is true in children. Purpose: We aim to identify the presence and pattern of MPA dilation in children with BAV. Methods: We retrospectively identified 27 pediatric patients with BAV and aortic and pulmonary artery measurements at one visit. We randomly selected 27 children with similar gender and age as controls. There were 5 patients with aortic coarctation in the BAV group and they were paired with children having isolated coarctation and normal aortic valve. We calculated the following ratios: AAO/aortic annulus, MPA/pulmonary annulus, AAO/MPA and aortic/pulmonary annulus. Previous studies have shown that the AAO/aortic annulus ratio remains constant irrespective of age, weight or height in normal children, and we assumed that the MPA/pulmonary annulus follows the same pattern. Results: The mean age was 14.6 years. From the BAV group 7 patients (26%) had moderate or severe stenosis and 10 (37%) moderate or severe regurgitation. The main results are summarized in Table. We found that AAO and MPA diameters are larger in the BAV group, but not annulus sizes. Both the AAO/aortic annulus and MPA/pulmonary annulus ratios were higher in the BAV group. Aortic/pulmonary annulus ratio was slightly higher in the BAV group, with AAO/MPA ratio being comparable among the two groups. The analysis was repeated excluding the patients with aortic coarctation, obtaining similar results. Conclusions: In our study, using both absolute values and age-independent ratios, we showed MPA diameters in children with BAV are larger when compared to controls, following a pattern of dilation similar to that of the AOO. Further studies are warranted to prospectively determine the rate of MPA dilation, and whether it can have clinical implications, especially in cases of autograft aortic valve replacements.

Dimensions and rations in BAV vs control

Mean values	BAV	Control	p value
Aortic annulus (mm)	20.7	19.6	0.17
Ascending aorta (AAO) (mm)	27.2	23.4	<0.001
Pulmonary annulus (mm)	20.3	20.3	0.9
Main pulmonary artery (MPA) (mm)	23.3	21.6	0.08
AAO/Aortic annulus	1.31	1.19	0.001
MPA/Pulmonary annulus	1.16	1.07	0.01
AAO/MPA	1.18	1.09	0.11
Aortic/Pulmonary annulus	1.03	0.97	0.08

p values are from student t-test

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Diagnosing ARVC in pediatric patients applying the revised Task Force Criteria: Importance of imaging, 12-lead ECG and genetics

M. Steinmetz[1]; U. Krause[1]; P. Lauerer[1]; F. Konietschke[2]; R. Aguayo[3]; CO. Ritter[4]; A. Schuster[5]; J. Lotz[4]; T. Paul[1]; W. Staab[4]
[1]University Medical Center Gottingen (UMG), Pediatric Cardiology, Gottingen, Germany; [2]University of Texas at Dallas, Mathematical Sciences, Richardson, United States of America; [3]American University of Antigua, College of Medicie, Coolidge, United States of America; [4]University Medical Center Gottingen (UMG), Diagnostic and Interventional Radiology, Gottingen, Germany; [5]University Medical Center Gottingen (UMG), Cardiology and Pneumology, Gottingen, Germany

Background: Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC) is a potentially lethal disease that is well described in adults. In pediatric patients, however, identification of patients at risk of adverse events of ARVC remains a challenge.

Objective: To determine which criteria of the revised Task Force Criteria (rTFC), alone or combined, have an impact on diagnosis of ARVC when compared to disease specific genetic mutations in pediatric patients <18 years.

Methods: Between September 2010 and December 2013, 48 consecutive young patients £ 18 years of age (mean 14,range of 12.9-15.1 years) underwent contrast-enhanced magnetic resonance imaging (CMR), genetic testing and comprehensive clinical work-up for ARVC criteria to test for clinically suspected ARVC. As specified by the rTFC, patients were grouped into 4 categories: "definite", "borderline", "possible" and "none" ARVC.

Results: Of the 48 patients, 12 were found to have gene mutations of either the desmoplakin (9/12) or plakophyllin (3/12) locus. According to rTFC 12/48 patients were considered as "definite" ARVC (25%), while 10/12 (83.3%) had an ARVC specific gene mutation. Of the remaining 36 patients, 6 (12.5%) were grouped as "borderline" ARVC, 7 (14.6%) as "possible" ARVC (including the remaining two genetic mutations) and 22 (45.8%) as "none" ARVC, respectively.
Statistical analysis of ARVC criteria in patients diagnosed with "definite" ARVC revealed high prevalence of positive findings by imaging (CMR and echocardiography) and positive genetics. The positive predictive value to detect "definite" ARVC by genotyping was 83.3%, the negative predictive value was 94%. Logistic regression analyses for different criteria combinations revealed that imaging modalities (echo and CMR combined) and abnormalities of 12-lead ECG were significant markers (p < 0.01). Positive results of endomyocardial biopsies or arrhythmia on ECG or Holter as defined by the rTFC were not significant in this analysis.

Conclusions: The rTFC for ARVC should be used with caution in children and adolescents suspected for ARVC. 12-lead ECG and imaging modalities (CMR and echo) were of major value, positive results should prompt genetic testing.

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Echocardiographic assessment of ventricular contraction and synchrony in children with isolated complete atrioventricular block and epicardial pacing: midterm outcome according to pacing sites

T. Hayashi; N. Shimizu; Y. Misaki; H. Ono
National Center for Child Health and Development, Division of Pediatric Cardiology, Tokyo, Japan

Background: Clinical implications of ventricular pacing sites on cardiac function are still under investigation in children with isolated atrioventricular block who survive free of pacing-induced cardiomyopathy.

Purpose: We aimed to elucidate midterm outcomes of permanent epicardial pacing in children according to ventricular pacing sites inferred from QRS morphology.

Methods: The study included 12 children (6 boys) with permanent epicardial dual-chamber pacemaker due to isolated complete or advanced atrioventricular block, who had a regular follow-up visit at our institution from October 2016 to April 2017. QRS morphology in electrocardiogram was reviewed to determine ventricular pacing sites; right bundle-branch block implies left ventricular (LV) pacing while left bundle-branch block implies right ventricular (RV) pacing. By off-line 2-dimensional speckle tracking analysis using echocardiographic images at the follow-up visit, LV global longitudinal strain (GLS), septal to lateral delay of the time to peak longitudinal strain in four-chamber view (LS delay), and standard deviation of the time to peak radial strain in parasternal short axis view at the mid-papillary level (RS delay) were calculated. RV GLS was also computed. Interventricular dyssynchrony was evaluated with interventricular mechanical delay (IVMD). The data were compared between children with LV pacing and those with RV pacing using the Mann-Whitney U test. A value of p < 0.05 was considered statistically significant.

Results: Patients were 10.0 (range, 6.8 to 15.3) years old at the examination, and the ventricular pacing sites had remained the same for 7.0 (1.6 to 12.3) years. No patient had symptomatic heart failure. There were 3 children with LV pacing and 9 children with RV pacing. The LV pacing group and RV pacing group were comparable in terms of the age at examination, pacing duration, body surface area, and heart rate. Compared with the RV pacing group, the LV pacing group had a better LV contraction (GLS –23% [–24% to –20%] vs –18% [–21% to –13%], p < 0.05). The LV pacing group showed a superior LV mechanical synchrony than the RV pacing group (LS delay 0 [–16 to 15] msec vs 78 [13 to 93] msec, p < 0.05; RS delay 13 [9 to 13] msec vs 31 [13 to 64] msec, p < 0.05). There was no significant difference in RV GLS between the groups (–22 [–26 to –20]% vs –24 [–36 to –15]%, p = 0.71). The LV pacing group had a shorter IVMD than the RV pacing group (7 [4 to 14] msec vs 45 [32 to 66] msec, p < 0.01).

Conclusions: In epicardial pacemaker-treated children at midterm follow-up, LV pacing was associated with a better LV contraction and mechanical synchrony than RV pacing. No difference in RV function was noted. Although pacemaker therapy is clinically well tolerated irrespective of the ventricular pacing sites, those with RV pacing should be meticulously monitored for pathological LV remodelling.

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Associations of vector flow derived diastolic indices with traditional indices of left ventricular function in children and young adults

M. Craft[1]; C. Casey[2]; K. Bisselou[1]; C. Erickson[1]; R. Spicer[1]; D. Danford[1]; S. Kutty[1]
[1]Children's Hospital and Medical Center, omaha, United States of America; [2]Hitachi Healthcares Americas, Twinsburg, OH, United States of America

Background: Vector Flow Mapping (VFM) is an ultrasonic algorithm to demonstrate intracardiac blood flow velocity vectors from extracting and processing color Doppler information.

Purpose: We sought to investigate how VFM derived wall shear stress (WSS) and energy loss (EL) indices relate to (a) subject characteristics, and (b) standard indices of LV systolic and diastolic function in normal children and young adults.

Methods: Echocardiograms were prospectively performed (ProSound F75, 5-MHz transducer, Hitachi). 2D-color Doppler cine loops (average 37 fps) were obtained in apical 3-chamber view. VFM analysis consisted of endocardial border tracking, application of 2D continuity equation to color Doppler data for obtaining velocity components perpendicular to the echo beam line, and calculations of (a) EL and (b) WSS from frame-by-frame velocity vector fields averaged over 3 cardiac cycles. End-diastolic and end-systolic volumes, biplane ejection fraction (EF), E/e', indexed LA volumes (iLA vol), and global longitudinal strain (GLS) were measured, and Pearson correlations explored against VFM derived WSS and EL indices.

Results: In 41 subjects (age 18 ± 9 yrs, BSA 1.7 ± 0.5 m/m2, HR 68 ± 15 bpm) the biplane EF, cardiac index, iLA vol, E/e' and GLS were 62 ± 4 %, 2.4 ± 0.6 l/m/m2, 22.4 ± 6 ml/m2, 4 ± 1.2, and-19 ± 2% respectively. The mean ± SD of diastolic WSS and EL were 0.2± 0.2 Pa, and 26 ± 19 mW/m. Diastolic WSS and EL had significant negative correlation with age and BSA, and positive correlation with heart rate (Table). Among LV functional indices, diastolic WSS and EL correlated best with E/e' while association with EF and GLS were weak (Table).

Conclusion: Vector flow derived left ventricular diastolic indices in children and young adults are heart rate dependent, and predictably associated with E/e'. Correlation of this data with those in disease states is an important next step.

Variable	Diastolic WSS	Diastolic EL
	r/ p	r/ p
Age	-0.568/ 0.0001	-0.520/ 0.0005
BSA	-0.547/ 0.0002	-0.526/ 0.0004
Heart rate	0.448/ 0.0034	0.539/ 0.0003
Cardiac index	0.405/ 0.0086	0.426/ 0.0054
E/e'	0.383/ 0.0135	0.601/ <.0001
Indexed LA vol	-0.128/ 0.4234	-0.184/ 0.2496
GLS	-0.008/ 0.9614	-0.067/ 0.6789

Table 1: Pearson correlation between VFM indices and other covariates

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New predictors of outcome in patients with bicuspid aortic valve by a combined approach of cardiac imaging and biomelecular analysis

L. Longobardo[1]; ML. Carerj[2]; M. Cusma Piccione[1]; S. Carerj[1]; G. Di Bella[1]; L. Oreto[1]; MC. Todaro[1]; L. Alibani[1]; G. D'amico[1]; MP. Calabro[3]; R. Manganaro[1]; G. Oreto[1]; C. Zito[1]

[1]University of Messina, Cardiology and CCU - Department of Clinical and Experimental Medicine, Messina, Italy; [2]University of Messina, Radiology Department, Messina, Italy; [3]University of Messina, Paediatrics - Department of Human Pathology, Messina, Italy

Background: Bicuspid aortic valve (BAV) is often complicated by aortic aneurysms and dissection.

Purpose: To evaluate the prognostic efficacy of new echocardiographic, laboratory and genetic parameters to predict aortic complications.

Methods: We have followed up 30 BAV pts (age 38.3±17 years) for 48±11 months, coming from a cohort of 47pts who had underwent echocardiography with aortic stiffness and 2D longitudinal strain analysis, assessment of ELN G1664A elastin genetic mutation and quantification of elastin soluble fragments (ESF).Surgical treatment of aortic aneurysm or dissection was considered the primary endpoint, the progressive aortic dilatation > 1 mm/year the secondary one.

Results: 20% of population underwent surgical treatment of aortic aneurysm or dissection (primary end-point), 63% showed a progressive aortic dilatation > 1 mm/year (secondary endpoint). 66.7% of homozygous mutation pts (AA) underwent surgical treatment, whereas only 28.6% of wild type (GG) and 16.7% of heterozygous subjects (GA) needed surgical intervention (p=0.048). All AA patients and 87.5% of GA pts showed a progressive aortic dilatation during FU. Pts who underwent surgical treatment had a significantly increased aortic stiffness (14.7±10 vs 7.2±5.4; p=0.004), ESF amount (63.9±4.5 vs 56.3±7.8 ng/mL; p=0.006) and ascending aortic diameter (60±0 vs 37.4±6.3 mm; p= <0.0001) compared with those who did not need the intervention. On the other hand, aortic strain was significantly reduced (25.7±15.4 vs 44.3±17.5; p=0.008). Univariate regression analysis indicated aortic stiffness (p=0.005; HR 1.119; IC 95% 1.03-1.21), aortic strain (p=0.19; HR 0.946; IC 95% 0.903-0.991) and ESF quantity (p=0.003; HR 1.190; IC 95% 1.059-1.337) as variables related to the treatment. GG genotype resulted to be protective of primary endpoint compared with GA (p=0.001; HR 0.042; IC 95% 0.007-0.273) and AA (p=<0.0001; HR 0.028; IC 95% 0.004-0.174) genotypes respectively. Multivariate regression analysis confirmed ESF quantity as strong predictor of surgical treatment (p=0.049; HR 1.373; IC 95% 1.001-1.884) and the protective role of GG genotype compared with GA (p=0.001; HR 0.029; IC 95% 0.004-0.216) and AA (p=<0.0001; HR 0.020; IC 95% 0.003-0.153) respectively. About the secondary endpoint, within the variables indicated by univariate regression analysis, only ESF quantity was statistically significant, according to multivariate regression analysis (p=0.020; HR 1.270; IC 95% 1.039-1.553). ROC analysis showed that 62.3 ng/mL was the best cut-off value of ESF in the serum to predict the need of a surgical treatment, with high sensitivity and specificity (80 and 91.8% respectively, AUC 0.80); moreover, a ESF cut-off value of 53.6 ng/mL showed high sensitivity and specificity (84 and 75% respectively, AUC 0.846) to predict progressive aortic dilatation.

Conclusions: ESF are effective predictors of aortic dilatation and surgical treatment of aortic aneurysm in BAV patients.

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Coexistent bicuspid aortic valve and mitral valve prolapse: epidemiology and importance of the giant anterior mitral leaflet phenotype

R. Padang; SV. Pislaru; JF. Malouf; VT. Nkomo; SV. Mankad; ME. Sarano; HI. Michelena

Mayo Clinic, Department of Cardiovascular Diseases, Rochester, United States of America

Background: Bicuspid aortic valve (BAV) and mitral valve prolapse (MVP) are common heart valve disorders and association between the two conditions has been reported; however, the true prevalence and clinical impact of coexistent conditions are unknown.

Purpose: Determine the prevalence of MVP in BAV disease and evaluate its phenotypic expression and clinical significance.

Methods: Retrospective analysis of all echocardiography studies performed between January 2005 and December 2015 were done in: (1) Local residents to determine the community prevalence of MVP in subjects with BAV and tricuspid aortic valve (TAV); and (2) all comers with BAV to assess for the presence and phenotype of MVP.

Results: Within the community, there was a 2.7% prevalence of MVP in BAV patients, vs 3.4% among those with TAV during the same time-period (p=0.45). And among 5644 consecutive BAV patients undergoing echo at our institution, we identified 130 subjects with coexistent MVP; 105 (81%) male, age 51±16years. Posterior MVP was the most common type (n=50; 38%), followed by anterior and bileaflet MVP (n=40 each; 31%). A large anterior mitral leaflet phenotype (defined as anterior to posterior leaflet length ratio in early systole ≥3:1) was observed in 26 (65%) and 5 (13%) of those with anterior and bileaflet MVP, respectively. Among the 31 patients with BAV and large anterior leaflet prolapse, an extreme phenotype of giant anterior leaflet prolapse (GAP-BAV; defined as a triad of large anterior mitral leaflet, diminutive posterior leaflet, and anterior leaflet reaching the posterior mitral annulus in mid-systole on 2D echo; Figure) was seen in 18 subjects (14% of the 130-patient cohort). Compared to a randomly-selected control group of BAV with normal MV (n=30), those with GAP-BAV were younger at presentation (47±15 vs 55±10years, p<0.0001) and more likely to have right-left cusp fusion (97% vs 73%, p=0.03), larger aortic annulus diameter (27±3mm vs 25±2mm, p=0.002), ≥moderate mitral regurgitation (MR; 47% vs 0%, p=0.0001) and ≥moderate BAV regurgitation (53% vs 23%, p=0.03). Of the 130 patients, MV surgery occurred in 42 (32%), repair in 88% of cases. Seven subjects with GAP-BAV had MV surgery (repair in 5, replacement in 2). After a median follow-up of 5.5 months (range 4-83 months), 4 out of 5 subjects (80%) with GAP-BAV and successful initial MV repair required re-do mitral surgery due to recurrent severe MR. This was notably higher compared to the rate of re-do mitral surgery in those without GAP-BAV (6%, p=0.001).

Conclusion: The community prevalence of MVP in BAV is 2.7%, not higher than the general population. An extreme phenotype of giant anterior mitral leaflet prolapse was present in 14% of those with coexistent BAV and MVP, characterized by high prevalence of mitral and aortic regurgitation, and high failure rate of MV repair, suggesting significantly deficient mitral tissue and the need to explore other surgical techniques for management.
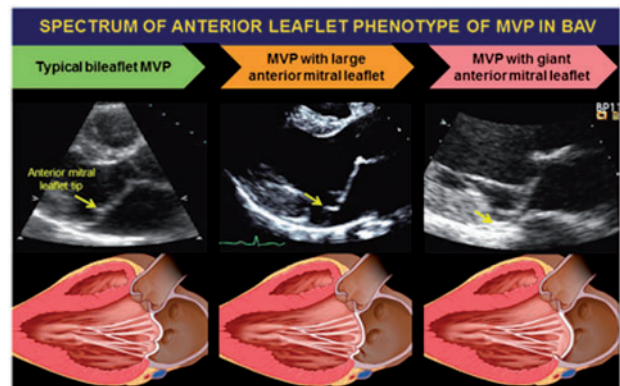
Abstract P679 Figure. Figure

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Geometry of aortic root in bicuspid valve with and without regurgitation - 3D ECHO study

S. Kovalova; J. Necas

St. Anne's University Hospital Brno, Center of Cardiovascular and Transplantation Surgery, Brno, Czech Republic

Introduction: Growing possibilities of valve-sparing surgery in aortic regurgitant lesions raise questions concerning underlying mechanisms causing valvular incompetence. They seem to be important for the surgical approach with long-lasting favourable outcome.

Purpose: of our study was to characterize the differences in the shape of the aortic root of bicuspid valve in patients with and without aortic regurgitation.

Methods: We analysed and compared 2 groups of patients. The first group consisted of 61 individuals (5 women, mean age 43 years) with bicuspid aortic valve referred for surgery with severe aortic regurgitation. The second one included 28 individuals (8 women, mean age 51 years) with competent bicuspid aortic valve. The majority of patients of the latter group were referred for surgery because of dilatation of ascending aorta, but there were some individuals in whom bicuspid aortic valve was accidental finding only.

All patients were examined using Philips system iE33 or Epiq 7C. ECHO examinations performed: 2D TTE - quantification of aortic regurgitation and measurements of ascending aorta and 3D TOE - live acquisition and subsequent muliplanar reconstruction of the aortic root. In all patients the following parameters were quantified: annulus diameter, diameter of aortic root, diameter of ST junction, diameter of ascending aorta, bicommissural dimension and circumference of both cusps separately. Measured parameters of both groups of patients were compared using Students t- test.

Results: In the first group there was a stronger predominance of men and their average age was lower. While the dilatation of ascending aorta was present in majority of patients in the second group, in the first group it was found in 6 patients (11,5%) only. In both groups RL morphology of the aortic valve was more frequent (80,8% and 60% respectively), while RN configuration was found in 11,5% and 15% respectively and purely bicuspid valve in 5,8% and 25% respectively. Average values of described parameters in mm (first and second group) were: annulus 30,9 and 26,5, aortic root 36,5 and 37,3, ST junction 35,7 and 39, ascending aorta 41,1 and 49,1, bicommissural distance 31,4 and 30,6, larger cusp circumference 51 and 49, smaller cusp circumference 43 in both groups. There was statistically significant difference between both groups in aortic annulus and ascending aorta diameters.

Conclusion: Our study identified dilatation of the aortic annulus as the only risk factor for the development of regurgitation in bicuspid aortic valve. Dilatation of ST junction and ascending aorta were not related to the aortic regurgitation. Even if the purely bicuspid valve configuration was more frequent in individuals with competent aortic valve, simple valve asymmetry doesn't seem to be the underlying condition for aortic valve regurgitation.

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Bicuspid aortic valve aortopathy: are there any differences depending on the valvular dysfunction type?

J. Petrovic[1]; S. Krasic[1]; I. Petrovic[1]; O. Petrovic[1]; D. Vasic[1]; D. Trifunovic[2]; M. Boricic Kostic[1]; M. Dragovic[1]; B. Vujisic Tesic[2]; M. Petrovic[2]; B. Ivanovic[2]
[1]Clinical center of Serbia, Clinic for cardiology, Belgrade, Serbia; [2]University Belgrade Medical School, Belgrade, Serbia

Background: Bicuspid aortic valve (BAV) is one of the most common congenital heart defects, frequently accompanied by aortopathy i.e. dilatation or aneurysm of initial aortic parts.

Purpose: To asses the frequency, distribution and degree of aortopathy in BAV patients depending on the valvular dysfunction type.

Methods: The retrospective study included 486 patients with the diagnosis of BAV referred from the Echocardiographic lab, Clinic for Cardiology, Clinical center of Serbia from January 2010 to December 2016. A standard transthoracic color Doppler echocardiographic examination was performed in all of them. Patients with hemodynamically significant valvular dysfunction were divided in two groups depending on predominant valvular dysfunction type, stenosis or insufficiency. Aortic stenosis with MPG ≥ 40mmHg and/or AVA <0.8cm2 and moderate or severe grade of aortic insufficiency were considered hemodynamically significant. Patients with Marfan syndrome, previous aortic valve reconstruction and previous surgery of the ascending aorta were excluded.

Results: There were 440 eligible patients, predominantly males (74.5% vs 25.5%, p<0.001) average age of 46±14 years. About half of them had hemodynamically significant valvular dysfunction (51.8% vs 48.2%, p>0.05). There were significantly more patients with aortic insufficiency (71% vs 29%, p<0.001) and they had more frequent bulbar aortopathy with higher aortic diameters (47.5% vs 30.0%, p>0.05; 39.1±5.8cm vs 36.4±5.6cm, p<0.01), while the frequency of the ascending aortopathy and the ascending aortic diameters were similar in both groups (40.7% vs 39.4%, p>0.05; 42.1±9.3 vs 41.0±7.1, p=0.930). No significant difference in age was observed between the group with BAV insufficiency compared to the group with BAV stenosis (45.3±14.8 vs 48.6±14.1 years, p=0.125).

Conclusion: BAV insufficiency represents more common type of BAV dysfunction which is more frequently associated with bulbar aortopathy and higher aortic diameters in comparison with BAV stenosis.

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Evolution of valve lesion and aortic dilation in patients with bicuspid aortic valve

S. Aguiar Rosa[1]; A. Galrinho[1]; L. Branco[1]; A. Timoteo[1]; A. Agapito[1]; L. Sousa[1]; J. Oliveira[1]; P. Rio[1]; A. Viveiros Monteiro[1]; I. Rodrigues[1]; M. Cruz[1]; R. Moreira[1]; A. Leal[1]; FF. Pinto[2]; R. Cruz Ferreira[1]
[1]Hospital de Santa Marta, Cardiology, Lisbon, Portugal; [2]Hospital de Santa Marta, Pediatric Cardiology, Lisbon, Portugal

Background: Bicuspid aortic valve is frequently associated with aortic valve stenosis (AS) or regurgitation (AR) and proximal aortic dilatation (AD). Disease progression has high interpersonal variability.

Purpose: The aim of the present study is to assess the evolution of valve lesion and AD, and identify factors of disease progression.

Methods: Prospective analysis of echocardiographic evolution of BAV adult patients (P). BAV pattern (right and left cusps fusion [RL], right and noncoronary cusps fusion [RN], left and noncoronary cusps fusion [LN], and two cusps without a raphe [WR]), transaortic gradient, aortic valve regurgitation and aortic diameter were analysed at baseline and during follow up. Aortic stiffness index and distensibility were evaluated at baseline echocardiograms.

Endpoints: a) combined valvular endpoint: worsening of AS (Δ maximum gradient >10mmHg), AR, or need of valve surgery; b) worsening of AD (Δ diameter ≥2mm). Mean follow up period 33.9±15.8 months.

Results: 54 P, 55.1% male, mean age 36.2± 13.5 years, 11P (15.9%) had aortic coarctation and 17 P (24.6%) had hypertension. 30P (43.5%) belonged to RL, 17P (24.6%) to RN, 3P (4.3%) to LN and 4P (5.8%) to WR.

44 P (81.5%) presented combined valvular endpoint, these P tended to be younger (34.0±11.1 vs 45.9±18.8 years, p=0.064) and had lower aorta distensibility (0,00215±0,00173 vs 0,00438±0,00065; p=0.060).

24 P (44.4%) of P presented worsening of AD. At baseline these P presented lower aorta distensibility. (0.00215±0.00136 vs 0.00378±0.00226; p=0.018), stiffnex index (6.13±4.20 vs 9.70±4.91; p=0.016) and lower aortic root diameter (28.3±5.4 vs 32.4±5.5mm; p=0.011).

Conclusion: In a follow up of about 3 years, 81.5 % of BAV P presented progression of valvular disease and 44.4% worsening of AD, being the latter associated with lower aorta distensibility, stiffnex index and aortic root diameter.

DISEASES OF THE AORTA

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Are we forgetting long-term outcomes in the management of aortic intramural hematoma?

A. Valentim Goncalves; T. Mendonca; LM. Branco; A. Galrinho; AT. Timoteo; RI. Moreira; M. Cruz; I. Rodrigues; P. Modas; L. Morais; LC. Miranda; N. Banazol; P. Coelho; J. Fragata; R. Cruz Ferreira
Hospital de Santa Marta, Lisbon, Portugal

Introduction: Aortic intramural hematoma (AIH) is defined as a hematoma confined within the medial layer of the aorta in the absence of a detectable intimal tear and in different series, accounted for 5-20% of patients with symptoms consistent with an aortic dissection (AD). The long-term clinical course of patients with AIH is not clearly known.

Purpose: To analyze short-term and long-term prognosis of patients with AIH and to compare it with the results of AD.

Methods: A retrospective study of patients with the echocardiographic diagnosis of AIH or AD between 2004 and 2015 in one medical center. Demographic and clinical data were collected and analyzed during the follow-up. The clinical data were collected from the clinical files. Mortality during follow-up was collected from a national database. A univariate analysis was performed followed by a multivariate Cox analysis to describe mortality predictors. Values of p < 0.05 were considered significant.

Results: Of 65 patients, 16 (24,6%) had AIH (male 50%, mean age 68,2 years and mean follow-up time 63,8 months) and 49 (75,4%) had AD (male 71,4%, mean age 57,1 years and mean follow-up time 60,8 months). Patients with IMH were older (p 0,003), had more Stanford B classification (75% vs 16,3%; p<0,001) but presented with similar symptoms, such as severe pain (62,5% vs 57,9%), shock (12,5% vs 26,3%) and acute coronary syndrome (5,3% vs 0%). 6,3% and 5,3% were asymptomatic, respectively. Patients with IMH were less likely to present with severe aortic regurgitation (0% vs 10,2%) and had similar pericardial effusion (25% vs 28,6%). Type A IMH (25%) and AD (14,6%) were managed medically infrequently and type B IMH (75%) and AD (62,5%) were more frequently treated medically. Since type B was the main classification in IMH, surgery was more frequent in AD (37,5 vs 77,6%, p 0,003).

Overall in-hospital mortality (defined as death in 30 days and/or until hospital release) was not statistically different for IMH compared to AD (18.8% vs 22,4%) but after hospital release overall mortality were higher with IMH (53,8% vs 21,1%, p 0,025).

Multivariate Cox analysis with the AIH and AD together after hospital release revealed that age (p<0,001), performed surgery (p 0,001) and AIH (p 0,014) were independent predictors of mortality.

Conclusion: Patients with AIH seem not to have better long-term prognosis than patients with AD, since AIH was an independent predictor of mortality after hospital release together with age and performed surgery. It is hoped that increasing recognition of AIH by clinicians would emphasize the potential lethality of the condition.

STRESS ECHO

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Diagnostic accuracy of 2D regional strain analysis in predicting anterior and posterior coronary circulation disease during dobutamine stress echocardiography

M. Abdelwahab; A. Elamragy; D. Elremisy; M. Daoud; W. Ammar; H. Taha
Cairo University Hospitals, Department of Cardiovascular Medicine, Cairo, Egypt., Cairo, Egypt

Background: There is growing evidence for the diagnostic value of the global longitudinal myocardial deformation indices in predicting the presence of significant coronary

artery disease (CAD). However, the significance of regional myocardial deformation analysis is still unknown.

Aim: To study the diagnostic accuracy of 2D speckle tracking echocardiography (STE)-derived regional longitudinal strain and strain rate during dobutamine stress echocardiography (DSE) in predicting the culprit coronary artery territory in patients with moderate pretest probability for CAD.

Methodology: 101 patients suspected to have stable CAD were prospectively studied by DSE, followed by coronary angiography within one month. The 3 standard apical views were acquired at rest and peak stress (average frame rate was 70/sec). Each segment of the 17 segment model was analyzed for the following 2D STE derived indices: longitudinal peak systolic strain (LS), longitudinal peak systolic strain rate (LSRs), longitudinal early diastolic strain rate (LSRd) and post systolic index (PSI). Regional strain was obtained by calculating the mean of strain parameters of all segments supplied by either the left anterior descending artery [10 segments representing the anterior coronary circulation (ACC)] or the right coronary, left circumflex or both arteries [7 segments representing the posterior coronary circulation (PCC)]. Luminal diameter stenosis $\geq$ 70% on coronary angiography was considered significant.

Results: Group 1 (n= 52 patients) had normal or mild CAD while group 2 (n=49 patients) had significant CAD and was further classified into group 2A (n=21, ACC territory disease), and 2B (n=11, PCC territory disease). Those with mixed territory disease (n=17) were excluded from final analysis.

At rest, PSI of ACC segments was marginally higher in group 2A than group 1 (0.015±0.01 vs 0.008±0.01, p:0.05), while LS & LSRs of PCC segments were lower in group 2B than group 1 (-19.4±2.6 vs -21.7±2.5, p:0.007 and -1.23±0.17 vs -1.49±0.33, p: 0.015 respectively).

At peak stress, all strain parameters were significantly different between the two groups regardless of the involved territory. In Receiver Operator Characteristics analysis, peak stress LS in either ACC and PCC territories showed the largest area under the curve: 0.9 (p<0.001) and 0.88 (p<0.001) respectively. In ACC, LS cutoff value of -21% had 90.5% sensitivity and 88.5% specificity for detecting significant ACC disease, while in PCC, LS cutoff value of -20% had 81.8% sensitivity and 79% specificity for detecting significant PCC disease.

Conclusion: Regional strain analysis at rest (LS and LSRs) could detect significant CAD in PCC territory. At peak stress, LS of -21% in ACC segments and -20% in PCC segments can detect significant disease in the corresponding coronary territory with high sensitivity and specificity.

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Detection of true severe stenosis in patients with significant low flow aortic stenosis and preserved ejection fraction. The role of high-dose dobutamine stress

C. Evdoridis; G. Blazakis; P. Tolios; A. Kalafatis; V. Tzamou; A. Trikas
Elpis General Hospital, Athens, Greece

Purpose: Patients with paradoxical low-flow AS (PLFLG-AS) may be at risk for deterioration of hemodynamic status at peak dobutamine stress (DSE) thus a dobutamine incremental dose up to 20 mgr/kgr/min is generally recommended to discriminate true severe from pseudo severe AS. Using this dose not all patients can achieve a normal cardiac output (CO) while the feasibility of peak dobutamine dose (40 mgr/kgr/min +/- atropine) to achieve this target is not fully investigated.

Methods: To investigate this possibility, we performed a DSE (dose 5-40 μgr/kgr/min ± atro-pine) in 24 consecutive patients with PLFLG-AS (aortic valve area- AVA ≤0.6 cm^2/M^2), EF ≥ 50 % and stroke volume index (SVI) ≤ 35 ml/M^2.

Results: During DSE normal cardiac output (SVI > 35 ml/M^2) was achieved in 15 patients (Group A). In 7 patients AVA was not increased or was increased to a value less than 1 cm^2 as opposed to pressure gradient (true severe AS), while in the other 8 patients AVA was increased (pseudo severe AS, Table). In 9 patients (Group B) there was a drop of blood pressure and CO at peak stress (not conclusive DSE). Patients in this group had smaller end diastolic LV dimen-sions (LVED) compared to patients of Group A (LVED volume 29±7 ml/M2 vs 36 ± 5 ml/M2)

Conclusions: 1)High dose DSE can detect true severe stenosis in many patients with PLFLG-AS. 2) Although high dose DSE in PLFLG-AS patients with small LV dimensions may be incon-clusive due to blood pressure drop, it can be safely conducted.

	AVA peak > 1 cm2 (N=8)			AVA peak ≤ 1 cm2 (n=7)		
	Rest	Peak	p	Rest	Peak	p
AVA	0.86 (0.06)	1.38(0.12)	<0.001	0.81 (0.1)	0.84 (0.1)	NS
V max	2.7 (0.1)	3.1 (0.29)	0.05	2.58 (0.14)	3.9 (0.2)	<0.001
SVI	29.1 (1.3)	43.91 (1.4)	<0.001	27.5 (1.1)	48.9 (1.4)	<0.001

P686

Peak exercise left ventricular systolic function predicts exercise capacity in heart failure with preserved ejection fraction

CM. Van De Heyning; C. Franssen; VF. Segers
University of Antwerp Hospital (Edegem), Department of Cardiology, Antwerp, Belgium

Background: Indices of left ventricular (LV) systolic and diastolic function at rest have been related with exercise capacity (peak VO2) in patients with heart failure with preserved ejection fraction (HFpEF), but the role of these parameters during exercise remains understudied. Exercise echocardiography represents the most adequate non-invasive imaging tool to assess LV systolic function, LV filling pressures (E/e') and systolic pulmonary artery pressures (PAPs) during exercise.

Purpose: We sought to investigate the relationship between rest and exercise haemodynamics and peak VO2 in HFpEF.

Methods: Consecutive patients who meet current diagnostic criteria for HFpEF (LVEF>50%, symptoms of heart failure and E/e' >15 or NT-proBNP >220 pg/mL) were included after informed consent. All patients underwent cardiopulmonary exercise testing with assessment of peak VO2, and exercise echocardiography with measurement of tissue Doppler derived systolic velocity at the medial mitral annulus (Med s'), E/e' and PAPs at rest and at peak exercise.

Results: A total of 36 patients were evaluated (73±6 years, 64% female, LVEF 61±8% and peak VO2 16.7±4.0 ml/kg/min). Compared to rest, there was a significant increase in Med s' (6.1±1.1 vs. 7.8±1.9, p<0.001), in E/e' (18.4±5.9 vs. 21.0±6.3, p=0.009) and in PAPs (34±7 vs. 54±10 mmHg, p<0.0001) during exercise. Med s' and E/e' at rest and at peak exercise were strongly related (Pearson's r = 0.533, p<0.002 and Pearson's r = 0.663, p<0.0001 respectively), while there was only a moderate correlation between rest and peak PAPs (Pearson's r = 0.445, p=0.038). Furthermore, at rest there was a moderate correlation between peak VO2 and LVEF (Pearson's r = 0.431, p=0.009) and a moderate inverse association between peak VO2 and E/e' (Pearson's r = -0.390, p=0.019). During peak exercise, we found a strong correlation between peak VO2 and Med s' (Pearson's r = 0.564, p=0.001), but only a moderate inverse relationship between peak VO2 and E/e' (Pearson's r = -0.378, p=0.023). In contrast, there was no significant association between peak VO2 and PAPs at rest or at peak exercise. In multivariate logistic regression analysis, Med s' at peak exercise was the only independent predictor of peak VO2 (p=0.011).

Conclusions: Exercise capacity as assessed by peak VO2 in HFpEF patients correlates with LV systolic and diastolic function at rest and at peak exercise. Moreover, Med s' at peak exercise was an independent predictor of peak VO2. Although we observed a significant increase in LV filling pressures and PAPs during exercise, these parameters do not emerge as important predictors of exercise capacity in HFpEF.

P687

Impaired heart rate recovery after incomplete revascularization for acute myocardial infarction with st elevation in patients without inducible ischemia

N. Boskovic; MT. Petrovic; V. Giga; I. Rakocevic; D. Trifunovic Zamaklar; S. Dedic; A. Vukovic; S. Aleksandric; M. Tesic; M. Dobric; I. Nedeljkovic; B. Beleslin; A. Djordjevic Dikic; J. Stepanovic
School of Medicine, University of Belgrade, Cardiology Clinic, Clinical Center of Serbia, Belgrade, Serbia

Background: Stress echocardiography (SECHO) is important noninvasive tool for the detection of myocardial ischemia. The correlation of prognostic markers of SECHO such as Duke treadmill score, Metabolic Equivalents (METs), achieved target heart rate (THR), heart rate recovery (HRR) and wall motion score index (WMSI) with the angiographic extensity of coronary artery disease (CAD) after primary percutaneous coronary intervention (pPCI) has not been completely clarified.

Purpose: With this study we sought to evaluate the value of Duke treadmill score, METs, achieved THR, WMSI at rest and HRR in prediction of CAD extensity in patients with stable coronary artery disease after successful pPCI.

Methods: Our study comprised of 214 (110, 65.5% male, average age 59±9 years) patients successfully treated with pPCI. All patients performed stress echocardiography according Bruce protocol in order to assess residual ischemia in coronary artery other than treated vessel. Stress echocardiography was considered positive for ischemia in the case of new or worsening of preexisting wall motion abnormalities. Duke treadmill score, MET, as well as HRR in the first minute after exercise were calculated in all patients. Lesion severity of non-culprit coronary arteries was assessed by quantitative coronary angiography.

Results: Out of 214 pts 47 (21.9%) ad positive SECHO test following pPCI and were excluded from the further analysis. The remaining patients were divided in two groups: patients with complete revascularization (91 pts, 54.2%) and patients with incomplete revascularization (one vessel and multi vessels CAD) (76 pts, 45.8%) all with negative stress echocardiography testing following pPCI. Between patients with complete and incomplete revascularization there was no statistically significant difference (p>0.05) in a Duke score, METs, achieved THR and risks factors for CAD (diabetes, hypertension, hyperlipidemia, family history of CAD and smoking). Nevertheless, patients with incomplete revascularization had lower HRR (27.9±11.8 vs 33.1 ± 13.5, p=0.011) and higher WMSI (1.3±0.25 vs 1.21±0.24, p=0.032) comparing to the complete revascularized patients. In the multivariate analysis both the HRR (OR 0.973 [95% CI 0.948-0.999], p=0.044) and WMSI (OR 4.755 [95% CI 1.044-21.663], p=0.044) were related to angiographic extensity of CAD. Area under receiver operating characteristic curve for HRR was 0.619, p=0.008 with cut off value of 29 (Sn 60%, Sp 63%). Also there was significantly higher rate of male patients with incomplete revascularization comparing to complete revascularization (76.6% vs 56%, p=0.008).

Conclusions: Our results suggest that HRR is impaired in incomplete revascularized patients. These patients have higher WMSI in comparison to the complete revascularized patients.

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Echocardiographic evaluation of right ventricular sistolic function and pulmonary hypertension in young patients with pulmonary sarcoidosis

IA. Evsikova; SJ. Bartosh-Zelenaya; TV. Naiden
Northwest state medical university by I.I. Mechnikov, Functional Diagnostic Department, St. Petersburg, Russian Federation

Echocardiographic assessment of right ventricular (RV) contractility and pulmonary artery pressure (PAP) in asymptomatic young patients with sarcoidosis is important for early diagnosis of heart complications.

Purpose: To evaluate RV systolic function and PAP at rest and at the peak of exercise in young patients with pulmonary sarcoidosis (1-2 stage) and compare it with the same parameters in healthy.

Methods: The main group included 15 patients (11 men, 4 women) aged 25-44 years with histologically confirmed asymptomatic pulmonary sarcoidosis (1-2 stage); control group included 10 healthy persons (6 men, 4 women). Groups were comparable by sex and age. Cardiac measurements were performed with an ultrasound system Vivid E9 (GE, USA) using 1.7-4.6 MHz sector transducer. Systolic PAP, global longitudinal RV strain (GLS RV), the tricuspid annular plane systolic excursion (TAPSE) in the M-mode, maximum speed of tricuspid annular motion (S') using tissue doppler imaging were evaluated both at rest and at the peak of exercise (Cardiosoft stress system, GE, «e-Bike», protocol "50x25" per 2 min).

Results: Systolic PAP at rest in patients with sarcoidosis significantly exceeded values in control group (30.1±7.89 and 25.1±4.3 mm Hg, p=0.035). S' values at rest didn't differ significantly (0.16±0.027 and 0.15±0.018 m/s, p=0.6). At the same time TAPSE at rest was significantly higher in patients of main group (26.2±3.38 and 22.7±3.6 mm, p=0.035), whereas GLS RV was initially higher in healthy individuals (-20.5 ± 2.85 and -22.37 ± 0.77%, respectively, p = 0.005).

At the peak of exercise significant increase of PAP from 30.1±7.89 to 47.29±15.9 mm Hg was found in the main group (p=0.0008). In the control group any significant changes of PAP weren't found (p=0.17). Both groups showed a significant increase in TAPSE (p=0.054 and 0.01) and in S' (p=0.0008 and 0.017). In patients with sarcoidosis there was a insignificant decrease in GLS RV from -20.5±2.85 to

-19.69±5.5% (but any statistical differences weren't detected, p=0.6), while in the control group GLS RV increased from -22.37±0.77 to -24.2±3.1%.

Conclusions: In patients with sarcoidosis, PAP at rest is significantly higher compared with healthy and at the peak of exercise increases to pathological values, whereas in healthy it doesn't changes significantly. Measurement of RV basal segments contractility (TAPSE; S') at rest gives conflicting results, whereas evaluation of GLS RV shows a significant reduction in patients with sarcoidosis. So we confirm the need of further studies of GLS RV changes during stress-Echo as an early predictor of systolic function decrease in patients with sarcoidosis.

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The change of ventricular-arterial coupling during stress echocardiography after thoracic endovascular aortic repair: comparison with normal subjects

M. Toki[1]; N. Kagiyama[2]; A. Hayashida[3]; S. Aritaka[1]; K. Yoshida[3]
[1]The Sakakibara Heart Institute of Okayama, Department of Clinical Laboratory, Okayama, Japan; [2]University of Pittsburgh, Pittsburgh, United States of America; [3]The Sakakibara Heart Institute of Okayama, Department Of Cardiology, Okayama, Japan

Background: Thoracic endovascular aortic repair (TEVAR) has been established as a standard therapy for thoracic aortic aneurysm. Because stent graft used in TEVAR is more rigid than native aorta, it may influence afterload on left ventricle (LV) and exacerbate ventricular-arterial coupling (VAC). We thought to compare VAC at rest and its response during exercise between patients after TEVAR and normal subjects.

Method: We reviewed 43 subjects who underwent semi-supine ergometer exercise in our hospital (15 patients after TEVAR and 28 normal subjects). Patients with LV ejection fraction ≤50% and/or previous history of heart failure admission were excluded. LV end-systolic elastance (Ees = mean blood pressure / LV end-systolic volume) as load independent LV contractility, execution aortic elastance (Ea = systolic blood pressure × 0.9 / stroke volume) as total afterload and VAC (Ees / Ea) were calculated at rest and during peak exercise, respectively.

Results: At rest, there were no differences in Ea, Ees and VAC between the two groups. On the other hand, increase of Ees during exercise was significantly less in TEVAR group, while increase of Ea was not significantly different between the two groups. As a result, increase of VAC was significantly less in TEVAR group than normal subjects.

Conclusion: Although there was no significant difference in VAC between TEVAR group and normal subjects at rest, exercise induced VAC increase was significantly less in TEVAR group. TEVAR may have unfavorable influence on VAC. Careful follow-up of LV function after TEVAR may be required.
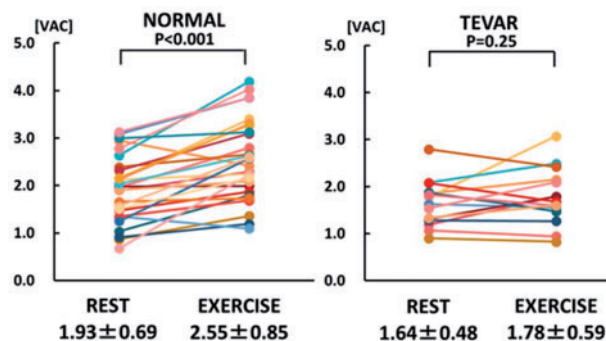
Abstract P689 Figure. The Change of VAC during Exercise

P690

Clinical and echocardiographic characterization of false positive results of stress echocardiography

RA. Guerreiro[1]; P. Fazendas[2]; AR. Pereira[2]; A. Marques[2]; S. Alegria[2]; K. Congo[1]; AC. Gomes[2]; J. Carvalho[1]; G. Morgado[2]; I. Cruz[2]; AR. Almeida[2]; I. Joao[2]; H. Pereira[2]
[1]Hospital Espirito Santo de Evora, Cardiology, Evora, Portugal; [2]Hospital Garcia de Orta, Cardiology, Almada, Portugal

Introduction: According to ESC guidelines of stable coronary artery disease, stress echocardiography has a sensitivity of 72% to 85% and a specificity of 80% to 91%, depending if you use exercise, dobutamine or dipyridamole as stressor. Thus, 9% to 20% of patients who undergo a stress echocardiogram and have a positive result can correspond to a false positive result.

Purpose: The authors pretend to study patients with a false positive stress echocardiogram to evaluate in which extend do these patients differ from those with a true positive stress echocardiogram.

Mehtods: Retrospective observational single-centre study including all patients who underwent a stress echocardiogram (using exercise, dobutamine or dipyridamole) and were submitted during the following 12 months to a coronariography. The diagnosis of coronary artery disease was established when a stenosis greater than 50% was found in any epicardial coronary artery in the coronariography. False positive results of stress echocardiography correspond to patients with a positive stress echocardiogram with no coronary artery disease. Clinical and echocardiographic variables were compared between patients with true and false positive stress echocardiogram.

Results: 219 patients were included in the study [mean age 65 (± 9.1) years, 170 (77.6%) men], of whom 47 (21.46%) had a false positive stress echocardiogram. Similar rates of false positive results were found in stress echocardiography using exercise, dobutamine or dipyridamole. Patients with a false positive stress echocardiogram were less frequently men (woman: 40.4% vs 17.4%, p=0.001), more obese (body mass index: 28.25 vs 24.69, p=0.012) and with less cardiovascular risk factors (arterial hypertension: 34% vs 53.5%, p=0.018; hyperlipidaemia: 29.8% vs 51.2%, p=0.009; diabetes: 8.5% vs 33.1%, p=0.001). Regarding the stress echocardiogram, both groups had a similar difference in the wall motion score index between peak and basal (0.24 vs 0.27, p=NS) and similar left ventricle distribution of wall motion abnormalities. In a multivariate predictive model of true positive stress echocardiogram, men (OR 3.80, 95%CI 1.74 – 8.30), diabetes (OR 5.70, 95%CI 1.85 – 17.58) and number of left ventricle's segments with peak motion abnormalities (OR 1.21, 95%CI 1.07 – 1.37) were positively correlated with a true positive result and body mass index (OR 0.94, 95%CI 0.89 – 0.99) was negatively correlated with a true positive result.

Conclusion: Patients with false positive stress echocardiogram are less frequently men and have less cardiovascular risk factors, namely arterial hypertension, hyperlipidaemia and diabetes. The percentage of false positives (21.46%) of stress echocardiography is in accordance with the specificity reported in the literature, corresponding to a positive predictive value of 78.54%. No specific left ventricle's segments with de novo peak wall motion abnormalities were associated with a false positive stress echocardiogram.

TRANSESOPHAGEAL ECHOCARDIOGRAPHY

P691

Percutaneos closure of left atrial appendage: outcomes of 69 cases

L. Lanzoni; C. Dugo; A. Chiampan; S. Bonapace; A. Cecchetto; L. Albrigi; G. Molon; G. Canali; E. Barbieri
"Sacred Heart" Hospital of Negrar, Department of Cardiology, Negrar-Verona, Italy

Introduction: percutaneous closure of left atrial appendage (LAA) is an evolving therapy that should be taken into consideration in those patients (pts) with non valvular atrial fibrillation(NVAF) and contraindication for OAC. The importance of proper patient selection, the role of TEE echo 2D/3D pre, during and post procedure are essential. Methods: in our center we performed 69 procedure (51 males, mean age 75±4,9),over a period of 4 years. LAA anatomy: chicken wing in 20% of cases, windsock 15%, cauliflower 37% and cactus 28%.Patients were at high risk for stroke with an average CHA2DS2-VASc Score of 3,8±1,5 and HASBLED Score 3,4 ±0,7. In 52 pts we implanted the Watchman device and in 17 pts the Amplatzer device because of a reduced depth of LAA. 2D/3D TEE is a key tool to evaluate the complex anatomy of LAA, to assess its width and depth, to exclude the presence of clots. Even more TEE has a pivotal role to guide the different phases of the procedure, in particular the transseptal puncture and the correct positioning of the device. Results: no deaths nor ictus in the periprocedural period, trivial residual leak (<3mm, 20%); mayor complications: 1 perforation with tamponade, 1 migration of the device, 1 acute thrombus formation. At follow up (mean 27 months): 3 deaths(no cardiac reasons), 3 pts experienced ictus (in only one the presence of clot on the atrial surface of the device was demonstrated), trivial leak in 49%, leak>5 mm in 6%.Conclusion:the LAA closure seems a efficacious strategy for stroke prevention in NVAF pts; the role of TEE in particular 3D TEE is mandatory in every stage of the procedure to minimize the risk, to discover the complications, to asses the results and for monitoring the long term outcome.

Peri procedural phase/ Long term follow up
Deaths:0/ Deaths:3
Leak:20% (<3mm) /Leak:49% (<3 mm)
Ictus/TIA: 0 /Ictus/TIA:3
Cardiac Tamponade:1
Migration of the device:0
Acute clot formation:1/ Evidence of clot at TEE control:3

Results in the perioperative period and at follow up

P692

Can 3D Transesophageal Echo unmask paradoxical low flow low gradient aortic stenosis diagnosed by 2D echo?

OG. Perea; M. Lombardero; R. Henquin

Sanatorio Trinidad de Palermo, Cardiovascular Imaging Department, Buenos Aires, Argentina

Introduction: Paradoxical low-Flow/Low-Gradient (PLF-LG) Aortic Stenosis (AS) by 2D transthoracic echocardiography (TTE) is defined by the calculation of the stroke volume index (SVI) at the left ventricular outflow tract (LVOT). However, SVI assessment by this method assumes inaccurate LVOT dimensions, while 3D transesophageal echocardiography (TEE) does not.
Objective: Determine the number of patients with severe AS judged as LF-LG by both 2D TTE and 3D TEE.
Material and methods: We evaluated prospective 42 patients with severe AS by 2D TTE and 3D TEE. SVI and LVOT area were estimated according to standard techniques, while LVOT area by 3D TEE was obtained using multislice and planimetry at mesosytole. PLF-LG AS was defined: aortic valve area (AVA) < de 1 cm^2, SVI < de 35 ml/m^2, mean gradient (MG) < de 40 mmHg and a left ventricular ejection fraction (LVEF) > de 50%. The degree of concordance between imaging methods was assessed using Bland & Altman and Lin index.
Results: mean age was 75.2 ± 9.3 years old and 56,7% were males. By 2D TTE, the mean LVOT diameter was 2.01±0.28 cm, AVA 0.66±0.21 cm2, MG 38.7±12.8 mmHg and the LVEF 55±12.2%. Eleven patients (26%) had PLF-LG AS by 2D TTE (mean SVI: 26.2 ±5.1 ml/m^2) and nine of them (81%) were reclassified as normal flow following 3D LVOT assessment (Mean SVI 36.9 ±6.0 ml/m^2).
Conclusions: The majority of patients judged as PLF-LG AS by 2D TTE were then reclassified as normal flow by using 3D LVOT measurements.

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Effects of Decreased Annular Height and Annular Saddle-shaped Non-planarity in Degenerative Severe Mitral Regurgitation with Normal LVEF: Real-time 3D Transoesophageal Echocardiography

EJ. Cho[1]; SJ. Park[2]; SA. Chang[2]; JO. Choi[2]; SC. Lee[2]; SW. Park[2]; PW. Park[2]
[1]National Cancer Center, Cardiology, Goyang-si, Korea Republic of; [2]Samsung Medical Center, Sungkyunkwan University, Cardiovascular Center, Seoul, Korea Republic of

Background: The extent of mitral annular (MA) remodeling and dysfunction is correlated with the severity of mitral regurgitation (MR) as well as left atrial (LA) and left ventricular (LV) dilation. MA dysfunction may be a useful prognostic factor for operative timing and MR recurrence after successful mitral valve (MV) repair.

Purpose: The aim of this study was to evaluate additive prognostic factors of MA non-planarity using real-time 3D transoesophageal echocardiography (RT3D-TEE) analysis in patients with chronic severe MR and preserved LV systolic function.
Methods: Forty-six patients with chronic severe MR and preserved LV systolic function scheduled for MV repair were prospectively enrolled.
Echocardiographic studies were performed before surgery and postoperatively within at least 6 months and at least 1 year after surgery. RT3D-TEE was performed before the operation and immediately post-operative.
Results: Mean age was 55.0±14.87 years and 23(50%) were male. Annulus height/body surface area (BSA) obtained via RT3D-TEE was correlated with the degree of postoperative LA remodeling. Patients were divided into two groups by average baseline annulus height/BSA. Patients with normal annular height had a smaller postoperative LV end-diastolic dimension, LV end-systolic dimension and LA volume index than patients with decreased annular height. Preoperative annulus height/BSA values strongly predicted postoperative LA remodeling.
Conclusion: MA height may be a useful prognostic factor for determining the timing of surgery in patients with chronic primary MR. Annulus height/BSA assessed via RT3D-TEE may provide additional information predictive of postoperative LA remodeling after successful MV repair.
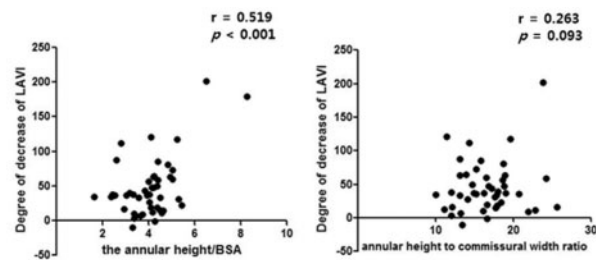
Abstract P693 Figure. Figure

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Intraoperative TEE facilities of application the Impella RSS LP5.0 in patients with acute decompensate heart failure

VI. Skidan[1]; GP. Nartsissova[2]; VY. Bondar[1]
[1]Federal Center of Cardiovacular Surgery, Cardiovascular Imaging, Khabarovsk, Russian Federation; [2]State Research Institute of Circulation Pathology, Cardiovacular Imaging, Novosibirsk, Russian Federation

Background: TEE is useful to rule out anatomic contraindications before implantation Impella RSS LP 5.0, to control of positioning the system andachievingthe maximal performance of the device. The estimations of LV and RV function during procedure provide the prophylaxis of intraoperative complications.
Objective: To determine the protocol of intraoperative TEE associated with circulatory support system Impella RSS 5.0 LP in patients with acute decompensate heart failure that require hemodynamic support.
Methods: The study involved 24 patients; menaged from 57 to 79 years. The majority of patients were with multiple comorbidities, severe LV systolic dysfunction conditionedaneurysm of the apex and anterior wall of the LV, and higher NYHA heart failure class refractory to medication. 3 patients underwent coronary artery bypass surgery, plastics of LV aneurysm, and plastics or prosthesis of AV and MV valves. The Impella RSS LP 5.0 was needed for circulatory support under an extracorporeal bypass control unit for periods up to 2 hours.On the final stage of surgery an intraoperative TEE control was provided the information of correct positioning and evaluation of LV filling necessary to optimize pump performance. Used equipment: Philips ie33 - 3DQA analysis program, Siemens Acuson X300, Siemens Magneton Avanto 1,5 Tesla.
Results: The dilatation and remodeling of the LV were revealed by 3DTTE and MRI using U-test with good correlation between analysis: EDV (ml) 306 ml, p=0, 17; ESV (ml) 199 ml, p=0, 19; EF (%) 27%, p=0, 11. RV function was slightly less than normal TAPSE (mm) 14 mm,p=0,08; FAC% 34 (%), p=0,23. All patients had severe MR and TR. As known EF less than 30% is a predictor of additional mechanical circulatory support. Application of Impella RSS LP 5.0 system in 3 patients helped to reduce the time of aortic occlusion.The best TEE views for positioning the device in the LV is TEE amid-esophageallong axis view TEE at 100-150°. Difficulties of positioning the system offset, if catheter inlet area about 4 cm below the aortic valve; catheter outlet area well above the aortic valve (frequently not visible on TEE -7 cm between aortic valve and aortotomiya); catheter angled toward the left ventricular apex away from the heart wall and not curledup or blocking the mitral valve. Color Doppler was used as an additional method to correct position of device, when a dense mosaic pattern of turbulence appeared above the aortic valve near the outlet area of the catheter.Even in cases of correct positioning inlet obstructiondue to contact with ventricular wallmay occur.During ImpellaRSS LP 5.0 performances all patients had an increase of LVEF up to 30%, the reduction of MR and TR, and unchanged or improved RV function. Thus, an application of intraoperative TEE plays an important role in achieving maximum productivity ofImpella RSS LP 5.0 and reducing intraoperative complications.
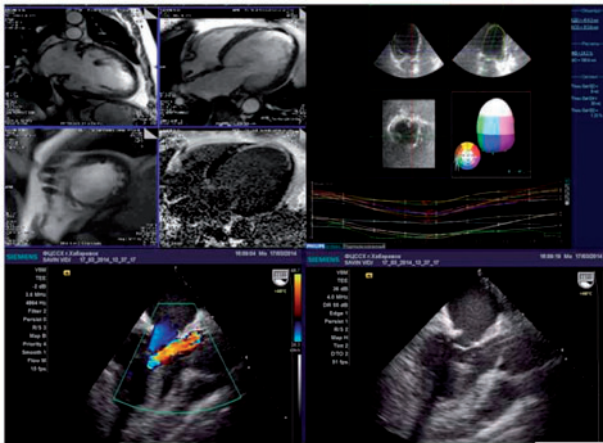
Abstract P694 Figure. LV volume and geometry by 3DTTE and MRI

P695

Evaluation of left atrial appendage function and thrombi in patients with atrial fibrillation: from transthoracic to real time 3D transesophageal echocardiography

I. Dentamaro[1]; C. Girasoli[1]; E. Michelotto[2]; V. Ostuni[2]; C. D'agostino[2]; C. Cadeddu[3]; P. Colonna[2]

[1]Polyclinic Hospital of Bari, Cardiology Department, DETO, Bari, Italy; [2]Polyclinic Hospital of Bari, Cardiology Hospital, Bari, Italy; [3]University of Cagliari, Cardiology Department, Cagliari, Italy

Background: The detection of embolic sources in patients with atrial fibrillation (AF) is an important issue to guide anticoagulant therapy, especially in patients with moderate/high embolic and hemorrhagic risk. Two-dimensional transesophageal echocardiography (2DTEE) is considered the gold standard for the study of left atrial appendage (LAA), but sometimes it makes some false-negative diagnosis. We hypothesized that real time 3D TEE (RT3DTEE) is superior to 2DTEE in detecting and/or excluding LAA thrombi.

Methods: This study included consecutive patients, with non-valvular AF at least 48 hours, referred for cardiovascular evaluation and eventual electric cardioversion. Clinical data, transthoracic, 2D and RT3DTEE (both performed after 24 hours from the first TTE) were all analyzed. We enrolled 93 patients (60 males, age = 67.1 ± 14.2 years, with range = 35-84 years) with non-valvular AF persistent (59) or permanent (34), with an intermediate-high grade of thromboembolic (CHADS2 = 1.7 ± 1.1, CHA2DS2-VASc = 3.1 ± 1.6) and hemorrhagic (HAS-BLED = 2.3 ± 0.9) risk, and with TTE and TEE indication.

Results: Before cardioversion, the emptying velocity of LAA (LAAeV) with TTE was well defined only in 59/93 patients (63%), and 30 patients of these had a dysfunctional LAA evaluated with spectral Doppler tracing. On the contrary a LAAeV with good quality was obtained in all patients with both 2DTEE and RT3DTEE, with an optimum correlation of LAAeV (r = 0.91); 49/93 (53%) patients showed a dysfunctional LAA (LAAeV <40 cm/s) without any discrepancy between 2DTEE and RT3DTEE. A subgroup of 5 patients (7.2% of the 69 undergoing cardioversion) presented a persistent dysfunction even after cardioversion (documented by LAAeV values of <40 cm/s on the TEE post-CV: mean value of 22.8 ± LLAeV = 10.3 cm/s). The mean value of the LAA area was 3.6 ± 1.6 cm^2 with TTE, while the TEE was equal to 4.0 ± 1.6 cm^2. TEE allowed to observe in 1 patient (1.1%) a bilobed shape of the LAA. In addiction with TEE a patent foramen ovale was detected in 25 patients (26.9%), an atrial septal aneurysm in 5 patients (5.4%), an uncomplicated aortic plaques in 49 patients (52.7%) and aortic plaques complicated in 4 patients (4.3%). TEE to pre-CV observed a SEC (in the left atrium, right atrium or LAA) in 81 patients (87.1%), of whom 49 (52.7%) had mild SEC, 19 (20, 4%) of intermediate grade, and 13 (14%) severe. A thrombus was detected with certainty by 2DTEE pre-CV in 8/93 patients (8.6%). In cases of doubt with 2DTEE (5/93 patients: 5.4%), the addition of the RT3DTEE mode allowed to discriminate with certainty the presence of just pectinate muscles in 4 patients and a small apical thrombus in another patient.

Conclusions: The complete analysis of TTE, TEE and RT3DTEE is necessary in patients with AF at risk of embolism. RT3DTEE is feasible, accurate and showed an additional diagnostic capability in the differential diagnosis of selected cases with suspected LAA thrombi.

TISSUE DOPPLER AND SPECKLE TRACKING

P696

Feasibility and reproducibility of left ventricular longitudinal strain measurements in pre term babies using two dimensional speckle tracking echocardiography

TS. Hecker; A. Mcleod; A. Swan; M. Joseph; S. Sinhal; R. Perry
Flinders Medical Centre and Flinders University, Adelaide, Australia

Background: In adults, speckle tracking strain echocardiography (STSE) has shown to be less load dependent, more reproducible and able to better identify subclinical left ventricular (LV) dysfunction than ejection fraction. STSE in the neonatal population has not been as extensively studied as this population has unique challenges such as very high heart rates and difficulty in obtaining a full range of images from the apical window.

Methods: Standard apical 4 chamber, 2 chamber and long axis images were taken at a frame rate of 95 frames per second (fps) and analysed using dedicated STSE software (aCMQ, Philips Medical Systems). Regional and global longitudinal strain (GLS) was determined from each apical view. The ease of acquisition, image quality, intra and inter observer variability were also assessed.

Results: Twenty six neonates (gestation 28.9 ± 5weeks, weight 1.6 ± 1.2kg) had STSE analysis performed. Both the apical 2 chamber and long axis views were more difficult to obtain than the 4 chamber view. Both GLS (-28.1 ± 2.4%) and 4 chamber strain (-28.6 ± 2.8%) were well correlated (intra-class correlation (ICC) 0.89, p<0.0001). There was good intra (ICC 0.88, p<0.0001) and inter (ICC 0.83, p<0.0001) operator reproducibility for STSE measurements.

Conclusion: In the preterm neonate population STSE is a feasible and reliable method of assessing left ventricular strain. The STSE of the Apical 4 chamber is reflective of GLS and may be used in its place in neonates where the other apical views are difficult to obtain.

P697

From electric to mechanic: left ventricle mechanical dispersion as a marker of arrhytmogenic risk in post-MI patients

C. Zito[1]; L. Alibani[1]; G. D' Amico[1]; R. Manganaro[1]; M. Cusma' Piccione[1]; L. Longobardo[1]; ML. Carerj[2]; C. Butta'[1]; R. Citro[3]; A. Nicotera[1]; P. Crea[1]; G. Picciolo[1]; C. Morabito[1]; S. Carerj[1]

[1]University of Messina, Cardiology and CCU - Department of Clinical and Experimental Medicine, Messina, Italy; [2]University of Messina, Department of Radiology, Messina, Italy; [3]AOU S. Giovanni e Ruggi, Department of Cardiology, Salerno, Italy

Background: Currently, left ventricular (LV) ejection fraction (EF) is the main parameter used to select patients for Implantable Cardioverter Defibrillator (ICD) therapy. However, its limits for an appropriate risk stratification of arrhythmia are also well known. After myocardial infarction (MI) the presence of myocardial scar forms the substrate for malignant arrhythmias, due to the consequent electrical dispersion that is a known arrhythmogenic factor .

Purpose: the aim of our study was to investigate whether LV mechanical dispersion was greater in post-MI patients with recorded sustained ventricular arrhythmias than in those without recorded arrhythmias.

Methods: Twenty post-MI patients (mean age 62 ± 12.8 years) who underwent ICD implantation according to current criteria were prospectively enrolled. Global Longitudinal Strain (GLS) was measured by speckle tracking echocardiography and mechanical dispersion was defined as the standard deviation of time to peak negative strain in 17 left ventricular segments. Standard two-dimensional (2D) and three-dimensional (3D) echocardiographic parameters were also measured.

Results: After 1 year of follow-up, 15 patients had no and 5 patients had one or more recorded ventricular arrhythmias requiring appropriate ICD therapy. The EF, both 2D and 3D, did not differ between ICD patients with and without arrhythmias (41±13% vs 38±10%, p=0.4 and 39±12 vs 37±11, p=0,7, respectively). Similarly was obtained for GLS (-12±4% vs 11±5%, p=0,5). In contrast, mechanical dispersion was greater in ICD patients with recorded ventricular arrhythmias compared with those without (108±51 ms vs. 82±31 ms, p=0,04).

Conclusions: Mechanical dispersion was more pronounced in post-MI patients who underwent ventricular arrhythmias. This novel parameter assessed by myocardial strain could be helpful to distinguish patients at high risk who could optimally benefit from ICD therapy, even in the presence of an EF greater than 35%.

P698

Myocardial stretch propagation in late diastole in healthy volunteers

M. Strachinaru[1]; ML. Geleijnse[1]; A. Van Den Bosch[1]; N. De Jong[2]; JG. Bosch[2]; HJ. Vos[2]

[1]Erasmus Medical Center, Cardiology, Rotterdam, Netherlands; [2]Erasmus Medical Center, Biomedical Engineering, Rotterdam, Netherlands

Background: During late diastole the left ventricular (LV) myocardium is quasi-relaxed and reacts to pressure/volume changes like an elastic material. The atrial contraction causes the LV walls to stretch from base to apex, generating a wave-like pattern that propagates towards the apex. The propagation velocity of this myocardial stretch was proposed as a possible measure of myocardial stiffness in late diastole (Basic Res Cardiol 2014). It is however uncertain whether it represents a wave or a progressive stretching of the LV relaxed wall. Reference values in a statistically significant healthy population are lacking.

Purpose: We measured the propagation velocity of the LV myocardial stretch occurring after atrial contraction in a healthy population.

Methods: Forty-five healthy volunteers, 64% males, mean age 34±13 were prospectively recruited and underwent a high frame rate colour tissue Doppler study (mean frame rate=540±26), synchronized to the simultaneous recording of the electrocardiogram and phonocardiogram. The DICOM loops were processed offline using the manufacturer's post-processing software designed for normal clinical applications. The slope of the wave-like front propagating in the interventricular septum after atrial

contraction was computed along a virtual M-mode line. The velocity was averaged over 3 heartbeats for every subject.

Results: Wave-like patterns were visible after atrial contraction, propagating from base to apex. The figure shows one heart cycle, with the mean velocity along a virtual M-mode line in the mid panel, synchronous to the ECG signal (green line) and phonocardiogram (yellow line) in the lower panel. The onset of the myocardial stretch (after the P wave on the ECG) is marked with a vertical line and the slope of the myocardial stretch with a dotted line. The mean propagation velocity in our group was 1.60±0.27m/s, range 1.05 to 2.13 m/s. No significant difference was noted between male and female subjects.

Conclusion: The propagation velocity of the LV myocardial stretch generated by the atrial contraction can be measured with high frame rate ultrasound in normal individuals. The present study provides a reference range for this velocity. Further research is needed in order to establish the exact nature of this wave-like phenomenon.

Category	Normal volunteers N=45	Male N=29	Female N=16	p
Age	34±13	34±14	35±13	0.81
BMI	24±3	24±4	22±2	0.07
Frame rate	540±26	536±23	550±33	0.1
Propagation velocity	1.60±0.27	1.61±0.27	1.59±0.29	0.81
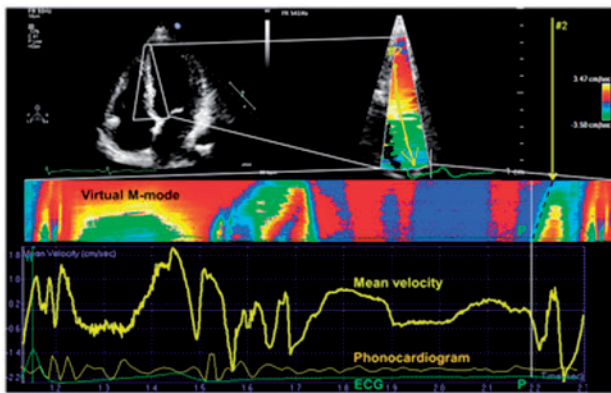
Abstract P698 Figure.

P699

Arterial hypertension as the risk factor of the worse left atrial remodeling in patients undergoing pulmonary vein isolation

J. Wieczorek; K. Mizia-Stec; M. Cichon; P. Wieczorek; A. Hoffmann; S. Nowak; M. Wybraniec; I. Wozniak-Skowerska; A. Wnuk-Wojnar; K. Szydlo
7th Clinical Hospital of Medical University of Silesia, 1st Department of Cardiology, Katowice, Poland

Background: Left atrial (LA) function assessment, using LA wall strains quantification is a new technique which may be useful in evaluation of pulmonary vein isolation (PVI) effectiveness and LA remodeling after procedure in patients with atrial fibrillation (AF).

Purpose: The aim of this study was to determine occurrence of contractility disturbances before and after PVI in patients with AF depending on arterial hypertension (HA) presence.

Methods: Eighty-nine patients with paroxysmal AF were enrolled into the study (age median: 58 (IQR 50-63) y., 65.1% males). The whole group was divided depending on HA presence – group 1 with HA (age median: 59; IQR 54.5-64) and group 2 without HA (age median: 56; IQR 44-62). The main inclusion criterion involved maintained sinus rhythm before PVI and preserved LVEF. The following markers of LA function before and 6 months after PVI (follow-up) using 2D transthoracic echocardiography (TTE) were analyzed: LA global and segmental wall peak longitudinal strains, measured during LA contractile period. We based on five-wall model for LA segmentation, corresponding with six-segment division in apical two- and four-chamber projections.

Results: In the whole group, there were no differences between LA strains (segmental and global), comparing baseline and follow-up data. At the baseline TTE assessment, patients with and without HA were similar, when comparing LA strains. We found significant differences in the follow-up groups: patients with HA have lower (less negative) LA septal wall strains (basal, medial and apical), as well as lower apical segment of lateral wall strain and global 4-chamber strain, comparing to patients without HA (table 1). PVI efficacy was confirmed in 52 (58.4%) patients and was similar in both groups. The Repeated Measures ANOVA analysis showed a significant influence of interaction of HA and time after PVI on 4-chamber (p=0.004) (figure 1), but not 2-chamber (p=0.51) LA global strain. Mean delta value (6-month vs baseline) of 4-chamber global LA strain was 0.6% in subjects with HA and -4% in subjects free from HA (p=0.004).

Conclusion: Arterial hypertension in patients with AF is associated with worse LA function after PVI procedure.

table 1

4-chamber strains in the follow-up	Group 1 With HA Mean±SD	Group 2 Without HA Mean±SD	P
Basal-septal (%)	-14.68±7.4	-19.06±2.7	0.01
Medial-septal (%)	-12.81±8.5	-18.74±3.9	0.006
Apical-septal (%)	-11.33±5.9	-16.40±6.6	0.004
Apical-lateral (%)	-10.25±5.5	-14.98±7.3	0.007
Global LA strain (%)	-11.70±4.3	-15.88±4.2	<0.001
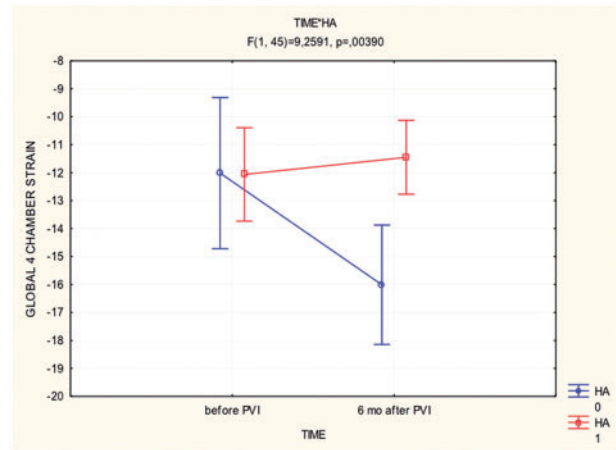
Abstract P699 Figure.

P700

Echocardiographic evaluation of aortic biomechanics in relation to disease activity and central pulse wave velocity in patients with ankylosing spondylitis

D. Ozkaramanli Gur[1]; DN. Ozaltin[2]; AB. Sarifakioglu[3]; A. Akyuz[1]; S. Alpsoy[1]
[1]Namik Kemal University Faculty of Medicine, Cardiology, Tekirdag, Turkey; [2]Namik Kemal University Faculty of Medicine, Cardiovascular Physiology, Tekirdag, Turkey; [3]Namik Kemal University Faculty of Medicine, physical therapy and rehabilitation, Tekirdag, Turkey

Background: Echocardiography is the most useful diagnostic tool to reveal cardiovascular involvement in Ankylosing Spondilitis(AS) which results in aortitis, aortic dilatation, aortic valvular regurgitation and vasculopathy.

Purpose: To determine the echocardiographic indices in early detection of aortic involvement, we examined the mechanical properties of proximal ascending aorta with conventional M Mode and velocity vector imaging (VVI) echocardiography in patients with AS. The association of disease activity and echocardiographic indices of vasculopathy is explored.

Methods: Seventy-five patients with AS were compared with 30 age and sex matched healthy individuals. The linear dimensions of aorta (Aortic root, sinus of valsavla, sinotubular junction and proximal aorta at systole and diastole) were measured by M mode echocardiography and used to calculate aortic strain, distensibility and elastic modulus. The VVI was performed to evaluate the longitudinal displacement(LD), transverse displacement(TD), longitudinal strain(LS) and transverse strain(TS) of the anterior and posterior aortic walls separately. Central pulse wave velocity(cPVW) of subjects was determined by oscillometric method. Disease activity was determined by the Bath AS Disease Activity Index (BASDAI).

Results: When AS patients were compared to the control subjects, the systolic aortic diameter (3.1±0.36 vs 2.94±0.28, p=0.009), the diameter at the level of sinus valsalva (3.2±0.38 vs 3.0±0.31, p=0.019) and the cPWV (5.7(3.5-11) vs 5.2(4.0-7.1), p=0.016) were significantly increased; but TS of both anterior (37.5 (9.82-480.7) vs 103.3(12.7-568.1), p<0.001) and posterior aortic walls(31.7(4.68-432.2) vs 43.7(5.2-446.3), p=0.033) were significantly decreased in patients with AS. The disease activity(BASDAI) was correlated with aortic strain (r=-0.28, p=0.01), aortic compliance(r=-0.33, p=0.005), aortic distensibility(r=-0.28, p=0.01) and elastic modulus(r=0.28, p=0.01). Similarly, cPWV was correlated with aortic diameters (r=0.36, p=0.001 at aortic root; r=0.46, p<0.001 at sinus of valsalva; r=0.35, p=0.002 at sinotubular junction), systolic aortic diameter (r=0.49, p<0.001), diastolic aortic diameter(r=0.55, p<0.001), aortic strain (r=-0.27, p=0.02), aortic compliance (r=-0.27, p=0.02), distensibility (r=-0.39, p=0.001) and elastic modulus (r=0.39, p=0.001). Logistic regression analysis revealed that among all M-Mode and VVI echocardiographic indices; cPWV (p=0.005, OR:3.87), TS of the posterior aortic wall (p=0.021, OR:1.1) and TS of anterior aortic wall (p=0. 001, OR:1.1) were the independent predictors the AS.

Conclusion: Our study showed that although still within the normal range, AS patients have increased aortic diameters and cPWV but impaired TS of anterior and posterior walls; indicating aortic vasculapathy. Determining transverse strain by VVI of the proximal aorta can be an useful tool to reveal occult disease in patients with AS.

P702

Correlation between conventional echocardiography and myocardial deformation imaging in assessment the prognosis in patient with coronary artery aneurism after Kawasaki diseases

R. Marinov[1]; K. Hristova[1]; I. Chakarov[2]; A. Telcharova[3]
[1]Nadezhda Women's Health Hospital, Sofia, Bulgaria; [2]University Hospital Tsaritsa Yoanna, Sofia, Bulgaria; [3]University Hospital Alexandrovska, Sofia, Bulgaria

Kawasaki diseases is the autoimmune process, which characterizes with the engagement of arteries and especially -the coronary arteries of the heart.

The aim of this study was to assess global and regional LV myocardial function and to predict the long-term prognosis of Kawasaki diseases in the poor population treated only with salicylic acid, without any immunomodulators.

Design and method: We analyzed 42 children (mean age 7,4 ±3,9 years), 10 of them with a residual coronary aneurism and 20 healthy children (mean age 9,6 ±4, 8). Apical and basal short axis for 2D images were acquired (65±7 frames/s) in addition to apical four, three and two-chamber views. Global and regional peak systolic strain - longitudinal, radial and circumferential on the LV was derived and the strain curves (εLL, εCC, εRR) were extracted using a commercial software.

Results: In the measurements of LV function, there was a clear tendency toward a decrease in the ejection fraction (65,9 ± 4,1vs. 71,9± 3,2) with a concomitant increase in LV diastolic diameter (LVDD) (z-score 0.7±1,0 vs.-0,3±0,8). Global longitudinal strain measurements of the LV were non-significantly different between the Kawasaki group without an aneurysm and normals (GLS -19,23±1,98% vs -21,73±0.92 %, p=0.03). The regional peak systolic longitudinal strain (LS) were reduced significantly, especially on the basal and middle LV - segments on anteroseptal wall and on inferoseptal wall, as well as the global longitudinal systolic strain. In the group - Kawasaki with an aneurysm was found significantly reduced GLS compared with normal patients -17,94±1,69 % vs -21,73±0.92 %. (p<0,001). In addition, fair correlation of GLS and with LV volume index (r = 0.79) and high sensitivity and specificity was found (area under curve 0.87, p < 0.01)

Conclusion: Decreased segmental GLS values are a sign of regional hypokinesia with a possible local segmental ischemia in the group with coronary aneurysms on coronary artery and are a marker for developing severe LV dysfunction in the future. Missing of significant differences for global longitudinal strain in the group without an aneurysm is associated with still normal and light impaired global LV function and their changes could predict the new onset failure of the ventricle in the future
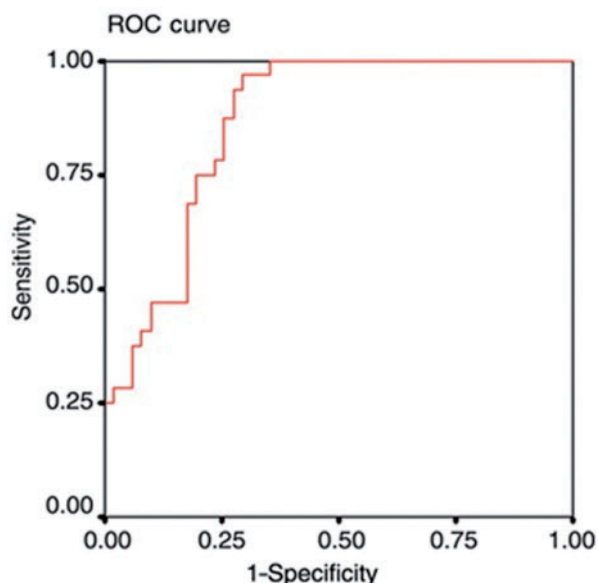

Fig 1. Roc - curve of correlation of GLS and myocardial injuries/ area under curve 0.87, P < 0.01/

Abstract P702 Figure. Roc curve

P703

Rationale and design of the CARDIOBESE study

SM. Snelder[1]; LE. De Laat - De Groot[2]; LE. Biter[3]; M. Castro Cabesas[4]; GJ. Van De Geijn[5]; B. Boxma[6]; E. Birnie[6]; R. Klaasen[7]; F. Zijlstra[8]; BM. Van Dalen[1]
[1]Franciscus Gasthuis, Cardiology, Rotterdam, Netherlands; [2]Maasstad Ziekenhuis, Cardiology, Rotterdam, Netherlands; [3]Franciscus Gasthuis, Surgery, Rotterdam, Netherlands; [4]Franciscus Gasthuis, Internal Medicine, Rotterdam, Netherlands; [5]Franciscus Gasthuis, Clinical chemistry, Rotterdam, Netherlands; [6]Franciscus Gasthuis, Statistics and Education, Rotterdam, Netherlands; [7]Maasstad Ziekenhuis, Surgery, Rotterdam, Netherlands; [8]Erasmus Medical Center, Cardiology, Rotterdam, Netherlands

Background: Obesity is one of the most important public health problems in the Western world. 51.6% of the adult EU's population was overweight (BMI ≥25 kg/m2) in 2014. Also, the prevalence of heart failure is increasing. There were 15 million patients with heart failure among the countries represented by the ESC in 2014. In view of the increasing prevalence of both obesity and heart failure, an important growing overlap of these two clinical entities in the near future is expected. Current knowledge on the role of obesity in causing cardiac dysfunction is insufficient to develop adequate risk stratification, monitoring and treatment strategies for obesity patients.

Purpose: The main objective of the CARdiac Dysfunction In OBesity – Early Signs Evaluation (CARDIOBESE) study is to identify parameters that are able to detect cardiac dysfunction at a very early stage in obesity patients.

Methods: A cross sectional study of 100 obesity patients (BMI ≥35 kg/m2), without known cardiovascular disease, scheduled for bariatric surgery and 50 age and gender matched normal-weight controls (BMI <30 kg/m2) will be performed to quantify the proportion of early signs of cardiac dysfunction in obese patients and to determine if obese patients have an elevated risk of (early signs of) cardiac dysfunction. Conventional and speckle tracking echocardiography will be used to identify early signs of cardiac dysfunction in obesity, focusing on left ventricular diastolic dysfunction, strain and strain rate, and twist/untwist. Also determination of biomarkers in blood/urine samples and holtermonitoring will be performed.

Furthermore, a prospective follow-up study of obesity patients, using the aforementioned diagnostics before and one year after bariatric surgery, will be done to gain insight in the pathophysiology of obesity causing cardiac dysfunction.

Conclusion: The CARDIOBESE study will provide insight in the early signs of cardiac dysfunction in obesity. Echocardiographic parameters that are able to indicate cardiac dysfunction in obesity patients at a very early stage may be identified. Also, combination of the various diagnostics used in this study and using these techniques in obesity patients before and one year after bariatric surgery, may help to gain understanding of the pathophysiology of obesity causing cardiac dysfunction.
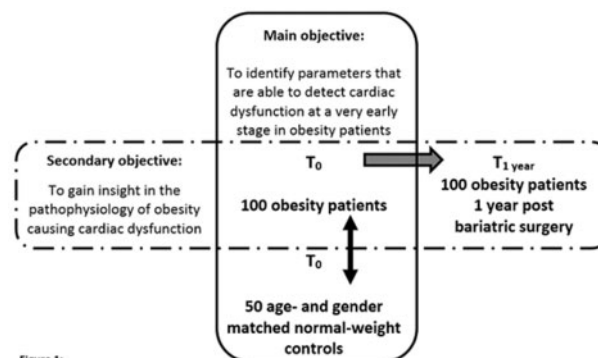

Abstract P703 Figure. Overview of the CARDIOBESE study

P704

Left atrial function in hypertensive patients assessed by 2D speckle tracking echocardiography

T. Ahmed; M. Hassn; A. Mazen; E. Samy
Al-Azhar University, cardiology, Cairo, Egypt

Background: Hypertension is a major health problem throughout the world because of its high prevalence and its association with increased risk of cardiovascular disease. Left atrial (LA) structural remodeling and/or functional impairment might play apart in pathogenesis and development of heart failure. 2D speckle tracking echocardiography (STE) provides more insight into early hypertension induce left atrial dysfunction (LA).

Objective: The aim of our work is to assess LA function as a marker of end organ damage in low risk (for coronary artery disease) hypertensive patients by 2D STE and Its correlation with their functional capacity for early prevention and management of heart failure.

Methods: This work studied 30 consecutive patients with hypertension and low risk for CAD (group 1, mean age 48± 5y, BSA 1.9±1.1) and 15 age and BSA matched healthy subjects as a control group (group 2, mean age 47± 5y, BSA1.8±0.1). All were evaluated with comprehensive 2D and Doppler echocardiography techniques, TDI and 2D STE. Stress myocardial perfusion imaging (MPI) by using treadmill exercise test was done to exclude CAD and to assess functional capacity.

Results: Our results showed a statistically highly significant decrease in the average peak left atrial global longitudinal strain (PALS) in group 1 (group1 = 23.9± 5 Vs 30.7±2.4 in group 2, P< 0.00),also statistically highly significant increase in the E/Em parameter by echo-Doppler and TDI in group 1 (group1= -10.5±2.6 Vs -7±1 in group2, P < 0.000) and a statistically significant decrease in the functional capacity parameter using treadmill METS in group 1 (group1= 6.8±1 Vs 7.9±1 in group2, P < 0.01) in comparison with group2. However, there were no significant differences between the two groups regarding other LA parameters by conventional echo Doppler, TDI and 2D STE.

Conclusion: The 2D STE is a new valuable and promising technique for the detection of early changes in left atrial function. The peak left atrial longitudinal strain assessed by 2D-STE can be used as an early marker of left atrial dysfunction and end organ damage in hypertensive patients. v

P705

Association between myocardial deformation and cystatin c levels in hypertensives without chronic kidney disease

MY. Kolesnyk[1]; MV. Sokolova[1]; OV. Kolesnyk[2]
[1]Zaporizhzhya State Medical University, Zaporizhzhya, Ukraine; [2]Regional clinical hospital 9, Zaporizhzhya, Ukraine

Background: Cystatin C (Cyst C) is a widely used biomarker of kidney function. However, recent studies showed its role in cardiac remodeling. Previous investigations found the relationship of Cyst C to left ventricular mass index (LVMI) and diastolic parameters in hypertensive patients without any renal disease. The association of myocardial deformation with Cyst C levels has not been tested. The purpose of the study was to estimate relationship between left ventricular (LV) deformation with serum Cyst C levels in hypertensive males without chronic kidney disease (CKD).
Methods: The study included 177 untreated males with uncomplicated arterial hypertension (mean age 51±8 years) without CKD. The patients were divided into 4 groups according to the quartile of Cyst C. The LV deformation was assessed by two-dimensional speckle tracking echocardiography. Global longitudinal strain (GLS), systolic (GLSR) and early diastolic strain rate (GLSRe) were averaged from 3 apical views. Circular strain (CS). radial strain (RS) and strain rate were measured on basal and apical LV level. Cyst C concentration was determined in serum by immunoturbidimetric method. The groups were compared by Jonckheere-Terpstra test for trend.
Results: The median and interquartile range of Cyst C were 0.89 (0.78-0.99) mg/L. The patients from group with highest Cyst C quartile were significantly older, had higher LVMI and lower diastolic velocities. The elevation of Cyst C level was associated with progressive deterioration of global longitudinal strain and early diastolic strain rate. The circular strain and strain rate were reduced on basal LV level (Table). There was no significant difference between apical circular and radial deformation among patients from different Cyst C quartiles. The GLS correlated significantly with Cyst C after adjustment for age and LVMI.
Conclusions: Increased Cyst C levels are associated with deterioration of LV longitudinal and circular deformation. Cyst C may reflect adverse cardiac remodeling in hypertensive patients without CKD.

Parameter	1st quartile Cyst C ($<$0.78 mg/L)	2nd quartile Cyst C (0.78-0.89 mg/L)	3d quartile Cyst C (0.9-0.99 mg/L)	4th quartile Cyst C ($>$0.99 mg/L)	p for trend
GLS, %	16.6 (15-17.9)	15.5 (14-16.9)	16.4 (14.7-17.6)	15 (12.6-16.3)	$<$0.05
GLSR, 1/s	0.95 (0.88-1.03)	0.92 (0.84-1.04)	0.96 (0.87-1.08)	0.92 (0.78-0.98)	$>$0,05
GLSRe,1/s	0.93 (0.85-1.16)	0.86 (0,7-1)	0.92 (0.73-1.13)	0.83 (0.64-1.03)	$<$0.05
Basal CS, %	19.7 (17-22.3)	18.3 (15.7-22)	18.2 (16.5-21.3)	17.1 (13.7-20.8)	$<$0.05
Basal CSR, 1/s	1.4 (1.19-1.61)	1.24 (1.08-1.47)	1.31 (1.13-1.48)	1.16 (1.04-1.41)	$<$0.05
Basal RS, %	23.3 (18.1-31.9)	24.3 (18.5-31.9)	26.2 (19.4-31.7)	25.9 (14.3-33)	$>$0.05
Basal RSR, 1/s	2.03 (1.7-2.23)	1.93 (1.56-2.25)	1.85 (1.65-2.08)	1.8 (1.47-2.22)	$>$0.05

Values presented as median and interquartile range

P706

The association between segmental scar burden and late occurrence of post-systolic strain

E. Nestaas[1]; O. Gjesdal[2]; S. Sarvari[2]; E. Hopp[3]; HJ. Smith[2]; KH. Haugaa[1]; T. Edvardsen[1]
[1]University of Oslo, Faculty of Medicine AND Center for Cardiological Innovation, Dept. of Card., Oslo Univ. Hosp, Oslo, Norway; [2]Center for Cardiological Innovation, Dept. of Card., Oslo Univ. Hosp, Oslo, Norway; [3]Dept. of Radiol and Nucl Med and Center for Cardiological Innovation, Dept. of Card., Oslo Univ Hosp, Oslo, Norway

Background: Longitudinal post systolic strain (PSS) is shortening of the myocardium in diastole. PSS has been associated with myocardial viability, scar and ischaemia, but can also be present in normal myocardium. Cardiac resynchronization therapy (CRT) has recently been related to left ventricular (LV) segments with late activation. PSS is therefore of interest when considering lead placement in CRT. Placement of lead in scars is associated with variable conduction and high capture thresholds. It is therefore important to obtain detailed knowledge about the timing of PSS in relation to scars.
**Purpose:** We aimed to explore the association between PSS and scars and hypothesized that PSS is delayed in LV segments with scars.
Methods: We included 33 patients with scars on late-enhancement MRI. All patients had QRS duration $<$150 milliseconds. We performed a standard 16-segment longitudinal strain analysis by speckle tracking echocardiography (2D-strain) and identified the LV segment with the latest PSS. We assessed segmental scar burden by

measuring the scarred volume and total volume of each LV segment by MRI. The Figure shows PSS by echocardiography (4-chamber view) in two LV segments with 100% scar burden (arrows) from a study patient.
Results: All patients had $>$1 LV segments with PSS and in all 33 patients, echocardiography showed PSS in 297 (56%) segments. The median (quartiles) time from aortic valve closure (green line on figure) to the latest PSS (white line on figure) was 120 milliseconds (103, 143). MRI exhibited scars $>$75% in 21/528 (4%) segments and scars of any size in 251/528 (48%) segments. PSS was significantly more frequent in the 21 (4%) segments containing scars $>$75% and in the 251 (48%) segments containing any scars (p$<$0.05). Scars $>$75% occurred more frequently in the segment with the latest PSS (p$<$0.001) and there was a strong trend for more frequently occurrence of any scars in the segment with the latest PSS (p=0.056). In 8 patients containing LV segments with scars $>$75%, PSS was significantly more frequent in the 21 (16%) segments with scars $>$75% (p$<$0.05) and similarly, PSS was significantly more frequent in the 71 (55%) segments with any scars (p$<$0.05).
Conclusions: The latest systolic peak is strongly related to LV segments with scars, and even more pronounced in LV segments with scars $>$75%. This information may be useful in decisions and planning for CRT.
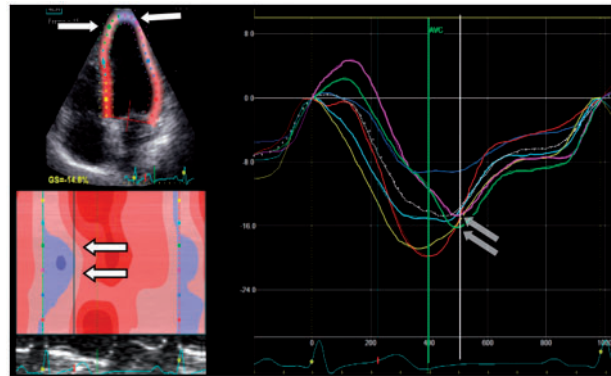
Abstract P706 Figure. Strain analysis from a study patient

P707

Impact of increased aortic transvalvular gradient on myocardial mechanics in patients with mechanical prosthetic aortic valve

B. Pirat; A. Ozyildiz; H. Muderrisoglu
Baskent University, Cardiology, Ankara, Turkey

Background: Myocardial strain imaging and rotation analysis were studied for native aortic valve stenosis, however not for prosthetic aortic valve (PAV) dysfunction. In this study, we aimed to compare left ventricular global longitudinal strain and rotation in patients who had mechanical PAV with and without increased transvalvular gradient.
Methods: The study included 90 subjects; 60 patients with mechanical PAV at least 1 year after surgery and 30 individuals who had no structural heart disease as the control group. Transthoracic echocardiography was performed to all patients including estimation of mean pressure gradient (MPG), indexed effective orifice area (iEOA), ejection time (ET), acceleration time (AT) and Doppler velocity index (DVI). Patients with PAV were divided into 2 groups; MPG $<$ 20 mmHg (27 patients with normal gradient) and $>$ 20 mmHg (33 patients with high gradient). Global peak systolic longitudinal strain (GLS) analyses were performed by speckle tracking method from apical four-chamber, two-chamber and long-axis views. Apical and basal rotation and twist values were determined from short-axis views. Venous blood samples were obtained from each patient, on the same day with echocardiographic examination for brain natriuretic peptide (BNP) analysis.
Results: Mean age of patients and controls were 46 ± 20 and 45 ± 17 years respectively (p=0.8). DVI was lower in high gradient (HG) group compared with normal gradient (NG) group, (p$<$0.001); AT was longer (p=0.001) and ratio of AT to ET was higher (p=0.009) in HG group than NG group. iEOA were lower in HG group compared with NG group (p$<$0.001). Mean GLS was -21.5±2.1% in controls, -20.0±3.5% in NG, and -17.9±2.1% in HG groups, respectively (p$<$0.001). While basal rotation was lower in HG group compared to control group (p=0.048), there was no significant difference between the groups in terms of apical rotation and twist (p=0.452 and p=0.07, respectively). BNP levels were; 17.1 ± 9.6 pg/ml in control group; 24.1 ± 15.6 pg/ml in NG group; and 36.5 ± 42 pg/ml in HG group (p=0.048). There was no significant relationship in the correlation analysis carried out between MPG and GLS or BNP. In the multivariate regression analysis, only DVI was found to be an independent parameter that can estimate the aortic valve MPG.
Conclusions: Left ventricular longitudinal strain is impaired in patients with PAV and high mean gradient suggesting worse left ventricular reverse remodeling in these patients. However, traditional Doppler echocardiography measurements are still indispensable and reliable methods.

P709

Evaluation of left ventricular performance in hypertensive patients by speckle tracking echocardiography: correlation with brain natriuretic peptide

W. Hamed; MF. Noamany; MA. Soliman; M. Abd El-Raouf
Menoufiya University, cardiology, Shebin El-kom, Egypt

Background: Hypertension results in hemodynamic changes ranging from maladaptive left ventricular hypertrophy (LVH) to heart failure. Two dimensional speckle tracking echocardiography (2D-STE) allows rapid and accurate analysis of regional and global left ventricular (LV) systolic and diastolic functions.
Objective: Assessments of LV function in hypertensive patients with apparently preserved LV systolic function using 2D-STE in correlation with plasma brain natriuretic peptide (BNP) levels.
Patients and Methods: Eighty hypertensive patients were enrolled, they were classified into LVH group (group III) and non-LVH group (group II). Twenty sex and age matched healthy individuals were recruited as controls (group I). 2D-STE was done to all subjects to assess LV longitudinal strain, and strain rate (SR). Plasma BNP levels were measured in all subjects.
Results: Global longitudinal systolic strain was significantly reduced in group III compared with group II (P= 0.037) and group I (P = 0.000). Furthermore, group III showed significantly reduced global LV longitudinal systolic SR and early diastolic strain rate compared with group II (P = 0.023 and 0.008 respectively), and group I (P= 0.01 and 0.0001 respectively). On the other hand, the mean values of global SRa were significantly higher in both group II and group III compared to group I (P = 0.0001). A negative correlation was found between BNP level and global peak systolic strain, global systolic strain rate, early diastolic strain rate and late diastolic strain rate in hypertensive patients (groups II & III) in whom BNP level was significantly higher than controls (group I) (P = 0.000).
Conclusion: A substantial impairment of LV systolic and diastolic functions is detected in hypertensive patients with apparently preserved LV systolic function, especially if associated with LVH, as evidenced by two-dimensional speckle tracking echocardiography. Plasma BNP level is elevated in hypertensive patients and shows a significant negative correlation with strain and strain rate values.

P710

Echocardiographic evaluation of right ventricular myocardial dysfunction in patients with arterial hypertension

S. Ivanov; V. Matveev; L. Kuznetsova; I. Dmitrieva
I.M. Sechenov First Moscow State Medical University, Moscow, Russian Federation

Purpose: comparative evaluation of measurement data of right ventricular (RV) deformation and displacement received with the help of echocardiography by using Speckle Tracking (STE) and tissue Doppler imaging (TDI) techniques in patients with arterial hypertension (AH) and healthy individuals.
Methods: the study included a total of 62 consecutive subjects. The control group consisted of 34 healthy controls – 20 men (59%) and 14 women (mean age 43±12 years, systolic blood pressure (SBP) – 114±11 mm Hg, diastolic blood pressure (DBP) – 72±7 mm Hg). The study group included 28 patients with arterial hypertension – 16 men (57%) and 12 women (mean age – 46±13 years, SBP –147±18 mm Hg, DBP – 92±10 mm Hg). Inclusion criteria for the patients in the study group were the diagnosis of essential hypertension stage I and the lack of medical treatment. The study was performed with the expert class ultrasound system. Right ventricle function analysis was conducted using Vector Velocity Imaging application. Transthoracic echocardiography was performed in the apical 4-chamber position. Strain rate (SR) and velocity (V) were measured in three different cardiac cycle phases (S – RV systole, E – early diastolic filling, A – late diastolic filling), regional RV longitudinal strain (S) and displacement (D) – in the moment of maximal myocardial deformation. In this study the mean values of parameters were used for the basal and middle segments only (each value was an average between all segments values). By using TDI early diastolic motion (Ea) and late diastolic motion (Aa) speed of the lateral portion of the tricuspid valve annulus and Ea peak acceleration (AR) rate were received. Ea/Aa ratio was calculated as well.
Results: TDI showed a statistically significant difference in Ea, Aa, Ea/Aa and AR (p<0,05) between the groups. In the control group Ea and Ea/Aa were equal to 0,03±0,14 m/s and 1,22±0,53, in patients of the study group – 0,11±0,03 m/s and 0,84±0,30, respectively. Aa and AR in healthy subjects had values of 0,13±0,04 m/s and 1,31±0,69 m/s^2, in hypertensive patients – 0,15±0,04 m/s and 0,97±0,31 m/s^2, respectively. During analysis of the RV deformation properties a statistically significant reduction in the parameters S and VE (p<0,05) was obtained. Strain from the control group was equal to -22,06±5,12 %, in patients with hypertension – -19,23±6,23 %. VE in the control group was equal to -4,31±1,67 cm/s, and in the study group it was equal to -3,42±1,46 cm/s.
Conclusion: The findings demonstrate that modern techniques such as tissue Doppler imaging and Speckle Tracking echocardiography can reliably detect decrease in the lateral portion of the tricuspid valve annulus motion parameters measured during early diastolic filling and of RV myocardial strain parameters, respectively, in patients with arterial hypertension stage I compared to healthy individuals.

P711

The impact of abnormal circadian bp profile on left atrial function by 2d speckle tracking echocardiography and its effect on functional capacity in hypertensive patients

T. Ahmed; N. Hassan; A. Mazen; E. Samy
Al-Azhar University, cardiology, Cairo, Egypt

Background: The left atrial (LA) function has an important role in hypertension as it is strongly predictive of adverse cardiac events and death, assessing the circadian BP profile is more predictive than assessing the office BP reading in estimating the cardiovascular risk. 2D speckle tracking echocardiography (2D STE) provides more insight into early hypertension induce left atrial dysfunction (LA).
Objective: The aim of our work is to assess the impact of abnormal circadian BP profile on LA function by 2D STE and its effect on functional capacity in hypertensive patient with preserved EF% by conventional Echocardiography.
Methods: This work included 30 consecutive hypertensive patients with preserved EF% by conventional Echocardiography and low risk for CAD (mean age 48± 5y and BSA 1.9±1.1) and were classified into two groups according to data derived from 24h ambulatory BP, group 1: dipper group and included 14 patients (mean age 48±8y and BSA 1.9±0.1) and group 2: non-dipper group and included 16 patients (mean age 50±6y and BSA 1.9±0.09). All were evaluated with comprehensive 2D and Doppler echocardiographic techniques, TDI and 2D STE, and ambulatory BP. Stress myocardial perfusion imaging (MPI) by using treadmill exercise test was done to exclude CAD and to assess functional capacity.
Results: Our results showed a statistically highly significant decrease in the average peak left atrial global longitudinal strain (PALS) in group 2 (the non dipper group) (group1 = 26±4 Vs 20.4±3.5 in group 2, P < 0.00), and a statistically significant decrease in the functional capacity parameter using treadmill METS in group 2 (group1= 7.3±1.4 Vs 6.2±0.8 in group2, P < 0.01) in comparison with group1. Also we found a significant mild positive correlation between the average LA-PALS and the functional capacity assessed by treadmill stress test (r=0.424, P=0.05). There were no other significant differences between the two groups regarding other LA parameters by conventional echo Doppler, TDI and 2D STE.
Conclusion: Abnormal circadian BP profile add more deleterious effect on left atrial function in hypertensive patients as detected by 2D STE that denotes more decrease in functional capacity and worse cardiac events.

P712

Speckle tracking echocardiography of left atrium as an assessment tool in patients with atrial fibrillation

P. Bhardwaj[1]; G. Gleerup Fornitz[1]; J. Roland Petersen[2]
[1]Amager Hospital, Department of Cardiology, Copenhagen, Denmark; [2]Slagelse Hospital, Department of Cardiology, Slagelse, Denmark

Background: Assessment of left atrial (LA) function in patients with atrial fibrillation (AF) is essential when evaluating cardiac function. It is found that functional abnormalities in the left ventricle can cause structural changes in the LA and give AF. The LA diameter and volume are the primary parameters measured in these patients in Denmark by standard echocardiography.
Purpose: To assess LA function in patients with AF with 2D speckle tracking echocardiography (STE).
Methods: 102 patients were referred to a cardiac ambulatory with the purpose of event recording for 7 days, diagnosing first time AF. All patients were offered LA-STE. 54 got both echocardiography and event recording done. AF was valid if one or more events occurred. Abnormal LA-STE was defined by values below 40%.
Results: There was a significant statistic correlation between AF and abnormal LA-STE values (P-value: 0.001). 85% had AF, and out of these 91% had abnormal LA-STE value. Only 15% of the patients did not have AF in the event record, and out of these only 12.5% had abnormal values.
Conclusion: LA-STE as a new parameter of LA function may be a useful assessment tool in finding LA abnormalities and thereby LA dysfunction in patients with AF.
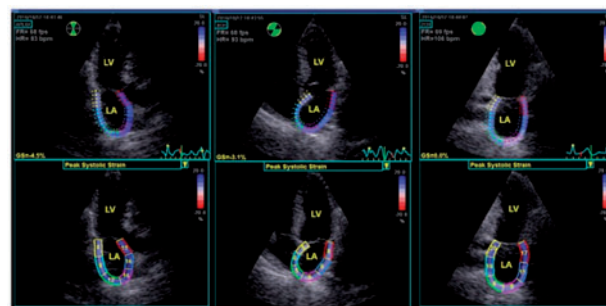
Abstract P712 Figure. LA-STE

P713

Left atrial (LA) strain reliably reflects LA stiffness in heart failure patients with reduced, but not in those with preserved ejection fraction

A. Lundberg[1]; H. Abdulrahim[1]; C. Da Silva[1]; A. Venkateshvaran[1]; C. Lourenco[1]; B. Merkely[2]; LH. Lund[1]; AI. Nagy[2]; A. Manouras[1]
[1]Karolinska University Hospital, Theme of Heart and Vessels, Stockholm, Sweden; [2]Semmelweis University, Heart and Vascular Centre, Budapest, Hungary

Background: Left atrial (LA) strain (LA-GS) is an emerging biomarker in heart failure (HF) with documented prognostic value both in HF with reduced (HFrEF) and with preserved (HFpEF) ejection fraction.

Although LA-GS has been demonstrated to associate with LA stiffness, a number of studies reported that left ventricular (LV) deformation impacts on LA mechanics in a manner that influences its independent prognostic value.

Aim: In this prospective, invasive study we set out to investigate the reliability of LA-GS as an estimate of LA stiffness and pressures in HFrEF and HFpEF, and to study the impact of LV deformation on LA mechanics in these two cohorts.

Methods: 175 HF patients with preserved (n=101) or reduced (n=74) ejection fraction (EF) were enrolled prospectively. All patients underwent right heart catheterisation and simultaneous transthoracic echocardiographic examination. LA-GS was measured by 2D speckle tracking. LA stiffness was calculated as the ratio of maximal systolic LA pressure (LAP) to LA volume indexed to body surface area (LAVi).

Results: In patients with HFrEF, LA-GS significantly correlated with LA stiffness (r=-0.26; p=0.023). It also showed significant association with both the invasively measured pulmonary artery wedge pressure (PAWP) (r=-0.5; p≤0.001) and its non-invasive estimate, the E/e' ratio (r=-0.26; p=0.01), as well as the LV global longitudinal strain (LV-GLS) (r=0.25; p=0.016). Interestingly, in patients with HFpEF, no association between LA-GS and LA stiffness could be observed. A weaker yet significant correlation with PAWP (r=-0.29; p=0.014) and E/e' (r=-0.25; p=0.033) was evident. On the other hand, the association with LV-GLS was significantly stronger (r=0.55; p≤0.001) in this cohort.

In multiple regression analysis, including PCWP, LAVi and LV -GLS, in HFpEF patients LAVi and LV -GLS acted as significant independent determinants of LA-GS (6.8 + 1.1 LV-GLS - 0.1 LAVi; p ≤ 0.001). In HFrEF, PAWP and LAVi demonstrated significant predictive value, whereas LV-GLS was not a significant determinant (27,3 - 0,31 PAWP - 0,13 LAVi; p ≤ 0.001).

Conclusion: Although in HFrEF LA-GS is associated with LA stiffness, this relationship was not evident in HFpEF. In the later cohort LV-GLS acted as an independent determinant of LA-GS.

P714

Left ventricular stiffness estimation in HFpEF patients using 3D echocardiography and tissue Doppler imaging

U. Primessnig; M. Krisper; E. Pieske-Kraigher; D. Morris; B. Pieske; C. Tschoepe
Charité - Universitätsmedizin Berlin, Campus Virchow-Klinikum, Department of Cardiology, Berlin, Germany

Aim: The purpose of this study was to analyze the usefulness and clinical relevance of a novel non-invasive method to evaluate left ventricular (LV) stiffness in patients with heart failure and preserved ejection fraction (HFpEF).

Methods and Results: We included 462 patients with HFpEF based on the ESC guidelines. In these patients, we analyzed the usefulness and clinical relevance of the novel non-invasive method to estimate LV stiffness, the diastolic pressure volume quotient (DPVQ). DPVQ was defined as the ratio of the mitral annular E/e' using PW and tissue Doppler imaging to LV end-diastolic volume using 3D transthoracic echocardiography. Regarding the usefulness of this novel parameter, DPVQ had an adequate diagnostic performance to estimate elevated LV filling pressures (cutoff 0.135; sensitivity 92%, specificity 65%) as well as an execelent correlation with these pressures measured by the mitral E/e' ratio (r = 0.90, p < 0.01). Moreover, concerning the clinical relevance of these findings, we found that a cutoff of DPVQ > 0.135 was significantly linked to worse symptomatic status in these patients (sensitivity 80% and specificity 75% concerning the estimated risk for NYHA class III and IV).

Conclusions: The findings of this study suggest that a non-invasive diastolic pressure volume quotient (DPVQ) using Doppler and 3D echocardiography could be of adequate usefulness and clinical relevance in patients with HFpEF.

P715

Mechanical dyssynchrony in steinert's disease: a three-dimensional speckle tracking evaluation

D. Seabra[1]; R. Pontes Dos Santos[1]; N. Moreno[2]; H. Guedes[1]; L. Marques[1]; J. Azevedo[1]; P. Pinto[1]
[1]Hospital Centre do Tamega e Sousa, Cardiology Department, Penafiel, Portugal;
[2]Hospital Pedro Hispano, Cardiology Department, Matosinhos, Portugal

Introduction: Myotonic dystrophy type 1 (MD1), also known as Steinert's disease, is a multisystemic neuromuscular disorder, with cardiac involvement in about 80% of cases. The major cardiac manifestations include intraventricular conduction disturbances and progressive left ventricular (LV) dysfunction. However, there is little evidence to document mechanical dyssynchrony in this population.

The three-dimensional (3D) speckle tracking strain evaluation has proved to be a useful and accurate tool in the quantification of the degree of LV dyssynchrony, estimating the time of the mechanical activation of the different segments.

Purpose: To appraise the mechanical dyssynchrony in individuals with MD1 in the absence of electrical dyssynchrony.

Methods: Comparative unicentric study of a group of patients with a genetically proven diagnosis of MD1 (MDG) with a control group (CG) of healthy volunteers. Exclusion criteria included the presence of QRS ≥120 msec, pacemaker-dependent rhythm or LV dysfunction. The Artida™ system (Toshiba Medical Systems) was used for the echocardiographic assessment of all patients.

LV dyssynchrony was quantified as maximal opposing wall delay in time-to-peak strain (DOpW) from the mechanical activation of LV segments as well as the standard deviation (SD) of the time until the radial strain peak of the 16 segments.

Result(s): MDG consisted in 16 patients with a mean age of 33.13 ± 13.1 years, with female predominance (59%); CG comprised 16 individuals, with similar demographic characteristics. All patients were in sinus rhythm and there were no significant differences in PR and QRS intervals between the groups.

The 3D speckle tracking analyses reveal a significant higher DOpW in MDG compared to the control group (126 ± 29 vs. 90 ± 20 mseg, p<0.001) as well as SD (44 ± 11 vs. 34 ± 10 ms, p 0.009). The delay between segments was significantly correlated with SD (p 0.029).

There was a significant negative correlation between myocardial twist index and DOpW (p 0.017; attached image).

Conclusion(s): In this cohort of MD1 patients, the presence of mechanical dyssynchrony was observed by 3D speckle tracking analysis in the absence of established electrical dyssynchrony (QRS <120 ms). In addition, myocardial twist, a key element in cardiac mechanics, has been found to correlate negatively with the duration of DOpW in absence of LV failure. Therefore, this method may be useful in the early assessment of cardiac repercussions in patients with myotonic dystrophy in order to prevent or delay the onset of LV dysfunction.
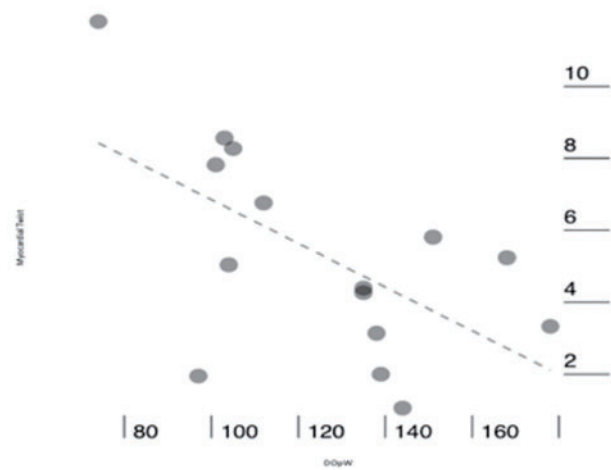
Abstract P715 Figure.

CARDIAC MAGNETIC RESONANCE

P716

Inter-vendor agreement of left and right ventricular cardiovascular magnetic resonance myocardial feature-tracking

RJ. Gertz[1]; T. Lange[1]; JT. Kowallick[2]; SJ. Backhaus[1]; C. Unterberg-Buchwald[1]; M. Steinmetz[3]; W. Staab[2]; S. Kutty[4]; G. Hasenfuss[1]; J. Lotz[2]; A. Schuster[1]
[1]Georg-August-University Göttingen, Department of Cardiology and Pneumology, Göttingen, Germany; [2]Georg-August-University Göttingen, Institute for Diagnostic and Interventional Radiology, Göttingen, Germany; [3]Georg-August-University Göttingen, Department of Paediatric Cardiology and Intensive Care Medicine, Göttingen, Germany; [4]University of Nebraska / Creighton University, Childrens Hospital and Medical Center Joint Division of Pediatric Cardiology, Omaha, United States of America

Aim: To assess inter-vendor agreement of left and right ventricular cardiovascular magnetic resonance feature-tracking (CMR-FT) for quantitative assessments of wall mechanics and strain using two commercially available analysis techniques and to examine the influence of repeated measurements on reproducibility.

Material and methods: CMR-cine long- and short-axis images of 10 patients without significant reduction in left and right ventricular ejection fraction (LVEF: 69.0% ± 3.3%; RVEF: 59.4% ± 7.1%) and 10 patients with a significantly impaired systolic function (LVEF 37.0% ± 9.8%; RVEF 40.0% ± 11.3%) were analyzed using two different types of commercially available feature tracking software. Global left and right ventricular longitudinal strain (LV GLS, RV GLS), global left ventricular circumferential (GCS) and radial strains (GRS) were assessed. Differences in intra- and interobserver variability within and between software types based on single (R1) and repeated measurements [averages of two (R2) and three repetitions (R3)] were evaluated using Bland-Altman analysis, intra-class correlation coefficients (ICC), and coefficient of variation (CoV), respectively. Strain parameters were correlated with LV and RVEF using Pearson correlation coefficients to investigate the relation of global deformation and volumetric indexes of myocardial function.

Results: Agreement between vendors was highest for GCS and LV GLS as well on an intra-observer level as on an inter-observer level. RV GLS and LV GRS both showed lower inter-vendor agreement. Consistently, on an intra-vendor level reproducibility was best for LV GLS and GCS. Albeit inter-vendor agreement for RV GLS was low, intra-vendor agreement for this parameter was high in both types of software (all results are displayed in Table 1).

Correlation between strain parameters and ejection fraction was highest in both vendors between GCS and LVEF (vendor one: r=-0.94, vendor two: r=-0.96). RV GLS and RVEF showed the lowest correlation strength (r=-0.64) using vendor one, which was higher using vendor two (r=-0.85).The impact of repeated measurements on intra-vendor reproducibility was highest for GRS and RV GLS. The effect on inter-vendor agreement for these parameters was, however, less pronounced. Repeated measurements had only little impact on LV GLS and GCS regarding as well intra-vendor reproducibility as inter-vendor agreement.

Conclusion: GCS and LV GLS qualify as the most robust parameters within and between individual software types. Conversely GRS and RV GLS show high inter-vendor variability but acceptable reproducibility within each software type that can be improved applying repeated analyses. Further studies are needed to confirm these findings and to define the incremental clinical value of feature tracking derived quantitative deformation parameters.
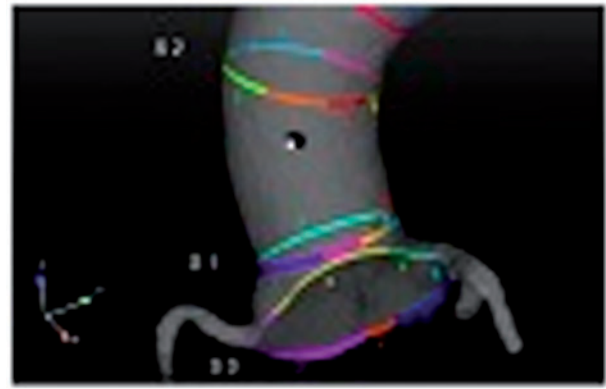
Table 1
Inter-vendor agreement and intra- and inter-observer variablity for global longitudinal, global circumferential and global radial strain based on three averaged measurements (R3)

	vendor one versus vendor two			vendor one			vendor two		
	Mean Difference	ICC (95% CI)	CoV (%)	Mean Difference (SD)	ICC (95% CI)	CoV (%)	Mean Difference (SD)	ICC (95% CI)	CoV (%)
Intra-observer LV GLS %	1.00 (2.23)	0.97 (0.92–0.99)	12.70	-0.15 (0.64)	1.00 (1.00–1.00)	3.79	0.24 (0.87)	1.00 (0.99–1.00)	4.78
GCS %	0.66 (2.73)	0.98 (0.95–1.00)	11.50	-0.49 (0.56)	1.00 (0.99–1.00)	2.41	0.03 (0.74)	1.00 (1.00–1.00)	3.08
GRS %	-12.16 (8.67)	0.62 (0.00–0.88)	34.28	-0.85 (3.00)	0.96 (0.90–0.99)	15.29	-2.45 (4.59)	0.97 (0.90–0.99)	14.07
RV GLS %	2.78 (6.21)	0.80 (0.49–0.92)	32.47	-0.62 (1.14)	0.99 (0.98–1.00)	6.55	0.59 (1.38)	0.99 (0.98–1.00)	6.61
Inter-observer LV GLS %	-0.72 (2.88)	0.96 (0.89–0.98)	16.03	0.52 (0.94)	1.00 (0.98–1.00)	5.41	0.18 (0.72)	1.00 (0.99–1.00)	3.96
GCS %	-0.51 (2.40)	0.99 (0.96–0.99)	10.08	0.17 (1.09)	1.00 (0.99–1.00)	4.64	0.23 (0.91)	1.00 (1.00–1.00)	3.76
GRS %	14.78 (8.72)	0.53 (0.00–0.85)	32.98	0.17 (3.00)	0.96 (0.89–0.98)	15.67	4.51 (6.87)	0.89 (0.64–0.96)	23.59
RV GLS %	0.63 (5.12)	0.86 (0.65–0.95)	28.75	0.40 (1.13)	0.99 (0.98–1.00)	6.30	0.19 (0.80)	1.00 (0.99–1.00)	3.89

SD, standard deviation; Diff., differences; ICC, intra-class correlation coefficient; CoV, coefficient of variation; CI, confidence interval; LV GLS, global left ventricular longitudinal strain; GCS, global left ventricular circumferential strain; GRS, global left ventricular radial strain; RV GLS, global right ventricular longitudinal strain

Abstract P716 Figure.

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Impact of aortic valve disease on ascending aorta shear stresses analyzed by cardiac magnetic resonance and computational fluid dynamics

BIM Igual Munoz[1]; DCD Cuadra-Delgado[2]; FJVM Valera Martinez[3]; AMG Maceira-Gonzalez Alicia[4]; RBF Barbero-Fresno Ruben[2]; AMA Montero-Argudo Anastasio[3]; PGG Garcia- Gonzalez Pilar[4]; RPS Paya Serrano[1]; RSJ Sanchez-Jurado Raul[4]; ASV Sanchez- Vazquez Alejandro[3]; JLPB Perez Bosca[1]; SMC Morell Cabedo[1]
[1]University General Hospital of Valencia, cardiology, Valencia, Spain; [2]ANALISIS DSC, MADRID, Spain; [3]Hospital La Fe, Valencia, Spain; [4]ERESA, valencia, Spain

Computational Fluid Dynamics (CFD) is an evolving technology that may be used witn other imaging modalities, as cardiac magnetic resonance (CMR) allowing evaluation of flow dynamics with high temporal and spatial resolution. Using a previously validated CMR-CFD model, we aim to study the impact of aortic valve disease on ascending aorta (AA) wall stresses.(WSS) .

Methods: DICOM file of a prospectively triggered vascular computed tomography study of healthy control was used to obtain a 3D .STL. file of AA and an unstructured hybrid mesh of finite elements was developed into the model. In addition flow data obtained by magnetic resonance phase- contrast sequences prescribed in a double oblique plane at aortic valve plane were derived using a CFD U-RANS mathematical model for turbulent flow into the 3D file. The systolic peak and average WSS at the vessel wall were analyzed in 4 perpendicular slices at sinus portion, sino-tubular junction, tubular portion and distal AA. as shown in the picture.

Results: Twenty -nine patients with a mean age of 51 ± 23 years, 18 (51%) males, 10 of them (29%) with bicuspid aortic valve, 10 patients with isolated aortic regurgitation (AR), 9 patients with isolated aortic stenosis (AS) and 10 healthy controls were prospectively included. A significant increase in peak and mean WSS at all studied levels and also in global mean WSS (2.2 / 0.9 / 1.05 [pa]) and systolic peak of WSS (7.18 / 3.2 /3.7 [pa]) in patients with AR vs AS and controls respectively were observed.

Conclusions: presence of AR significantily increases WSS compared with controls and patients with AS.

wall shear stresses by valve disease

	WSS mean [pa]				WSS peak [pa]			
wss	SEG0	SEG1	SEG2	SEG3	SEG0	SEG1	SEG2	SEG3
AR N=10	1.9	3.1	1.7	1.5	6.7	13.3	6,12	4.3
AS N=9	0.8	1.4	0.8	0.7	3.15	5.5	2.6	1.8
Controls N=10	0.8	1.4	0.9	0.9	3.6	6.29	2.9	1.3
P	*/NS	*/NS	*/NS	*/NS	**/NS	**/NS	**/NS	**/NS

AR: aortic regurgitation; aortic stenosis; WSS: wall shear stress; (*)=p<0.05;(**)= p <0.001

Abstract P717 Figure. Study planes at the vessel wall

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Incremental value of cardiac deformation analysis in patients severe tricuspid regurgitation and normal right ventricular function: a cardiovascular magnetic resonance imaging study

A. Gonzalez Gomez; R. Hinojar; A. Esteban; MA. Fernandez Mendez; A. Carbonell; A. Garcia; A. Marco; JM. Monteagudo Ruiz; JJ. Jimenez Nacher; JL. Zamorano; C. Fernandez-Golfin
University Hospital Ramon y Cajal, Department of Cardiology, Madrid, Spain

Background: Diagnosis and optimal timing of surgical intervention in tricuspid regurgitation (TR) is challenging and remains controversial. The right ventricle (RV) has an essential role in the decision making of patients with severe TR. Evaluation of dimensions and function should always be conducted, being cardiovascular magnetic resonance (CMR) the preferred method when available. The purpose of our study was to evaluate RV strain parameters by CMR-FT in patients with severe TR and normal RV systolic function.

Methods: 13 asymptomatic patients with severe TR and normal RV systolic function and 10 healthy controls underwent a conventional CMR study. CMR-FT was applied to the right ventricle using standard short and long axis views of cine SSFP sequences (Circle CVI 42, Calgary, Canada). Right ventricular global peak longitudinal, circumferential and radial systolic strain values (GLS, GCS, GRS respectively) were measured in all subjects.

Results: RV function was normal in all controls and severe TR patients (64.5% vs 56.5%, p=0.76). RV diastolic and systolic volumes showed no significant differences between controls and severe TR patients (132.5±27.4 vs 164.82±58.74, p= 0.088 for diastolic volumes, 47.96±17 vs 71.4±38.6; p=0.058 for systolic volumes). Patients with severe TR showed impaired longitudinal and radial systolic RV strain values compared to controls (GLS -13±2, p=0.09; GRS 21±4, p=0.14; GCS, p= -16±4, p=NS).

Conclusions: RV deformation parameters are impaired in patients with severe TR despite normal RV function. CMR-FT appears promising in this particular scenario, due to its potential in identifying patients before RV function declines.

COMPUTED TOMOGRAPHY AND NUCLEAR CARDIOLOGY

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Quantitative versus qualitative evaluation of static stress computed tomographic perfusion to detect hemodinamically significant coronary artery disease in intermediate to high risk patients

M. Guglielmo[1]; AI. Guaricci[2]; A. Baggiano[1]; F. Fazzari[3]; D. Andreini[1]; G. Calligaris[1]; S. Galli[1]; G. Teruzzi[1]; D. Trabattoni[1]; F. Fabbiocchi[1]; A. Lualdi[1]; P. Montorsi[1]; A. Bartorelli[1]; M. Pepi[1]; G. Pontone[4]
[1]Centro Cardiologico Monzino, IRCCS, Milan, Italy; [2]Polyclinic Hospital of Bari, Bari, Italy; [3]University Hospital Paolo Giaccone, Palermo, Italy; [4]University of Milan, Foundation Monzino (IRCCS), Center Cardiology, Dpt of Cardiology, Milan, Italy

Background: Static stress computed tomographic perfusion (CTP) represents a useful tool to improve the detection of hemodinamically significant coronary artery disease (CAD) of coronary computed tomographic angiography (CCTA) in the subset of patients with intermediate to high risk for CAD. Qualitative and quantitative methods were proposed to evaluate a static stress CTP showing both good diagnostic accuracy. A few data are available regarding to the comparison of diagnostic performance of these two approaches.

Purpose: The aim of this study is to perform a head to head intra-patient comparison of qualitative evaluation versus quantitative evaluation of static stress CTP to detect hemodinamically significant CAD in consecutive intermediate to high risk patients scheduled for invasive coronary angiography (ICA) plus clinically indicated invasive fractional flow reserve (FFR).

Methods: Consecutive symptomatic patients [mean age: 65±9 years, male: 49 (64%)] with intermediate to high pre-test probability of CAD and scheduled for

clinically indicated ICA+FFR, were prospectively enrolled. All patients underwent rest-CCA followed by stress-CTP protocol with adenosine (Revolution CT Scanner, GE Healthcare, Milwaukee, WI) with injection of 70 ml of Iodixanol 320 (Visipaque 320 mg/ml, GE Healthcare, Oslo, Norway). In each patient, a qualitative evaluation with visual approach (CTP was defined positive for the presence of subendocardial hypo-enhancement encompassing ≥25% of transmural myocardial thickness within a specific coronary territory) and a quantitative evaluation with transmural perfusion ratio (TPR) (sub-endocardium mean density/sub-epicardium mean density < 0.9) were measured. At ICA, hemodynamically significant CAD was defined by the presence of >50% stenosis on left main coronary artery, severe (>80%) or occlusive stenosis or FFR<0.80. The diagnostic accuracy of qualitative and quantitative stress CTP versus ICA+FFR were compared on a per-vessel basis.

Results: Obstructive CAD was found in 32% (74/228) of vessels and in 61% (46/76) of patients at ICA. According to our endpoint definition, hemodynamically significant CAD was present in 23% (52/228) of vessel and in 42% (32/76) of patients. The mean time for quantitative analysis was significantly higher as compared to qualitative analysis (35±6 min vs. 5±2 min, p<0.01). In a vessel-based model, CTP with qualitative evaluation showed a higher specificity (86% [CI95%:81-91)] vs. 77% [CI95%:71-83)], p<0.05) and similar sensitivity (85% [CI95%:75-85)] vs. 88% [CI95%:80-97)], p:0.56) as compared to quantitative CTP. Similarly, the area under the curve (AUC) of qualitative versus quantitative static CTP was significantly higher (0.81 vs. 0.74, p<0.01).

Conclusions: Static stress CTP qualitative evaluation of perfusion defect is associated with a less time consuming and higher specificity and diagnostic accuracy to detect functionally significant CAD.

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Epicardial fat volume, aortic area and aortic strain measured at computed tomography

G. Staskiewicz[1]; E. Czekajska-Chehab[2]; S. Uhlig[2]; E. Siek[2]; M. Zakoscielna[2]; P. Przybylski[2]; A. Tomaszewski[3]; A. Drop[2]

[1]Medical University of Lublin, Human Anatomy Department, Lublin, Poland; [2]Medical University of Lublin, Department of Radiology, Lublin, Poland; [3]Medical University of Lublin, Department of Cardiology, Lublin, Poland

Background: Association between epicardial fat (EF) and cardiovascular risk factors has been well recognized. Recent studies show, that EF plays important role in regulation of cardiac metabolic processes, as well as progression of atherosclerosis. Computed tomography allows for reliable measurement of epicardial fat volume with simulataneous assessment of coronary arteries and aorta.

Purpose: The purpose of the study was to compare the size of ascending and descending aorta as well as changes of their size throughout cardiac cycle in patients with different amounts of EF.

Methods: Fifty-four ECG-gated computed tomography studies have been included for retrospective analysis. Mean patients' age was 50,1+/-20,5 years, M:F ratio was 36:14. Mean BMI was 26,06+/-3,72. Exclusion criteria were coronary artery disease, signs of atherosclerosis, bicuspid aortic valve and arterial hypertension. Areas of ascending and descending aorta have been measured in all phases of cardiac cycle. EF volume has been measured by manual labelling of epicardial adipose tissue with threshold between -190 and -30 Hounsfield units. Aortic strain has been defined by ratio of (aortic systolic area – diastolic area) * 100/ diastolic area. Standard left ventricular parameters have been measured, e.g. end-systolic and end-diastolic volumes, stroke volume and ejection fraction. Histogram of EF volume has been used to identify two cutpoints of EF volume and identify patients with small, average and large amount of EF (groups 1, 2 and 3 respectively).

Results: Mean EF volume in the study group was 86,17+/-38,32ml (range: 22,39 – 374,2 ml). Age, BMI and body height did not differ significantly between the groups. Body mass has been significantly higher in group 3 as compared with remaining groups (p=0,015). No significant diffferences of LV function parameters have been observed between study groups. Areas of ascending aorta have been significantly larger in group 3 than in group 1: 1062,0+/-189,5mm² vs. 725,3+/-191,7mm² for systolic phase (p=0,002) and 940,5+/-171,6mm² vs. 591,6+/-154,6mm² for diastole (p<0,001). Similar significant differences have been observed for descending aorta with 561,4+/-200,9mm² vs. 351,2+/-57,1mm² in systole and 508,5+/-197,7mm² vs. 300,6+/-59,5mm² in diastole, p=0,008 and 0,006, respectively. Aortic strain measured in ascending aorta in group 3 was 13,1+/-5,44% and was significantly smaller than in group 1 (23,11+/-7,34%, p=0,01).

Conclusions: In the study group, patients with larger amount of EF presented with larger size of aorta and decreased aortic strain, which suggests differences in aortic wall mechanics even without detectable signs of atherosclerosis.

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Mitral annular calcification in patients undergoing percutaneous aortic valve implantation. Cardiac computed tomography evaluation and hemodynamic relevance

E. Pozo Osinalde; C. Morr; F. Islas; A. De Agustin; L. Nombela; A. Bustos; L. Perez De Isla; C. Macaya
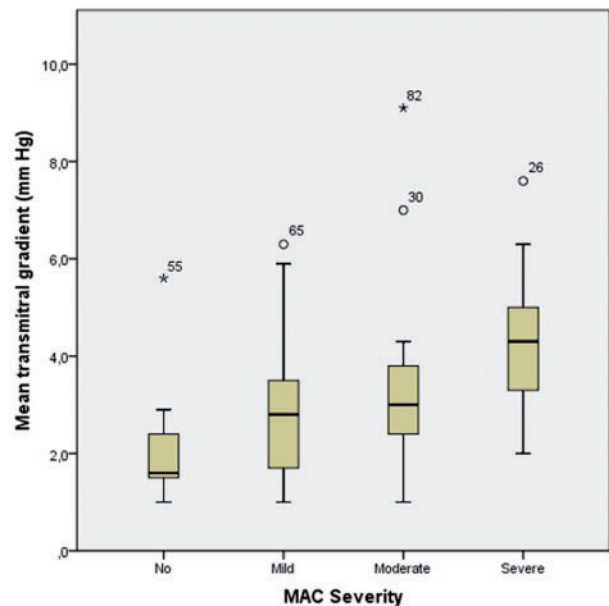
Hospital Clinic San Carlos, Madrid, Spain

Background: Mitral annular calcification is a degenerative process related with atherosclerosis and age. Therefore, its presence among patients referred for transaortic valve implantation (TAVI) may be significant.

Purpose: To evaluate the prevalence and extension of MAC using cardiac computed tomography (CCT) in patients with severe aortic stenosis scheduled for TAVI.

Methods: A cohort of 103 consecutive patients with pre-TAVI study with a 64-slices CCT was evaluated. Calcium deposits extension was visually evaluated using a maximum intensity projection in a double-oblique view, and calcium volume was quantified with a 3D reconstruction software from post-contrast images. Basal transmitral flow was evaluated from echocardiogram with Doppler analysis according to the current guidelines.

Results: From the 103 selected patients, 6 were excluded due to prior mitral valve replacement. We finally analyzed 97 patients (42.3% males, 86±4 years old). The most frequent mitral valve disease was degenerative (95.6%) and only 2.1% of the cases showed a preprocedural mitral valve regurgitation greater than II/IV. CAM was detected in 76.3% of the patients (39.2% mild, 15.5% moderate and 21.6% severe). Calcium was most commonly located in the posterior groove (58.8%), followed by anterior groove (12.4%) and symmetric distribution (5.2%). Among the patients with CAM, the median volume was 350 mm3 [IQR: 120-1818]. No association with age, cardiovascular risk factors or ischemic cardiomyopathy was observed in this population. Not only the mean transmitral gradient (2.2 vs 1.6 mm Hg; p <0.001) but also the indexed volume of the left atrium (43 vs 30 mL/m2; p =0.046) were significantly higher in patients with CAM. Moreover, CAM quantification was correlated with mean transmitral gradient (r= 0.52; p <0.001) and maximum velocity of the E wave (r= 0.41; p <0.001).

Conclusions: CAM is very frequent finding in patients referred for TAVI. Qualitative and quantitative evaluation with post-contrast CCT was significantly associated with transmitral gradients and left atrial size.

Abstract P721 Figure.