**THE RIGHT HEART**

**855 Incremental prognostic value of right ventricular E/Em index in patients with non-terminal idiopathic pulmonary fibrosis**

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**Introduction:** The prevalence of subclinical pulmonary hypertension (PH) and right ventricular (RV) dysfunction in patients with non-end stage idiopathic pulmonary fibrosis (IPF) stands of significant importance for the early detection of the disease. Tissue Doppler Imaging (TDI) derived E/Em index has emerged as an important indicator of filling pressures and serves as an independent risk factor in several cardiovascular diseases. The aim of the present study was to evaluate the association of the same index-obtained for the RV- with survival in a population of clinically stable IPF patients.

**Methods:** Twenty-two clinically stable patients (mean age 65±9.15 males) with the diagnosis of IPF having mild to moderate PH, comprised the study population. Peak pulmonary systolic pressure (PASP) was measured using tricuspid regurgitation Doppler recordings. Standard Doppler echocardiography was performed to obtain early transtricuspid filling velocity (E wave). Early tricuspid annulus velocities (Em) were obtained using TDI and further assessment of RV E/Em index was performed. Patients were followed for a mean period of 19.2±4.4 months and the incidence of death was recorded. A Kaplan-Mayer survival analysis was used in order to assess RV E/Em as an independent prognostic marker.

**Results:** A significant negative correlation was observed between RV E/Em index and PASP \((\text{R=}–0.536, p=0.01)\). Clinical follow-up revealed that mortality was significantly higher in those with an RV E/Em value <4.7 \((\text{log-rank statistic 3.62, } p=0.05)\). \((\text{fig 1})\)

**Conclusions:** Early RV E/Em index is a powerful predictor of mortality in patients with non-terminal IPF. This easily accessible index should be routinely used for the risk stratification of such patients.

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**856 Assessment of right ventricular systolic function with tissue Doppler in patients with cirrhosis**

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**Background:** Assessment of right ventricular (RV) systolic function is challenging due to its complex geometry. Recently, tissue Doppler signals, including systolic ejection velocity (Sa) and myocardial acceleration rate during isovolumic contraction (IVC) have been introduced as parameters for myocardioc systolic function. The aim of this study was to evaluate the usefulness of systolic and isovolumic signals by tissue Doppler for the assessment of RV systolic function in patients with cirrhosis.

**Methods:** Fifty-eight patients with chronic liver disease (44 male, mean age 46±12 years) and 23 age- and sex-matched healthy controls were studied prospectively. Standard echocardiography and pulsed-wave Doppler tissue imaging of the tricuspid annulus at the RV free wall were performed. RV volumes, areas and ejection fraction (EF) were obtained. Systolic RV pressure was estimated by maximal tricuspid regurgitation (TR) velocity. Peak \((\text{+})\text{dP/dt}\) was measured from the continuous wave Doppler-derived TR profile. By using tissue Doppler imaging, Sa was recorded and IVC was calculated as the peak isovolumic contraction velocity divided by the time interval from baseline to peak.

**Results:** Groups were similar with respects to body surface area and mean blood pressures. There were no differences between left and RV EFs among the groups; however, RV end-diastolic and end-systolic volumes, RV systolic pressure and RV wall thickness were increased in patients with cirrhosis when compared with the control group \((\text{all } p<0.05)\). Peak \((\text{+})\text{dP/dt}\) was similar between the groups. Sa of the tricuspid annulus was significantly higher in cirrhotic patients than control group \((23.1±4.5 \text{ vs } 19.2±3.8 \text{ cm/sec}, p=0.001)\). No difference was demonstrated with regards to IVC between the groups \((\text{7.0±2.2 vs } 6.7±1.1 \text{ m/s²}, p>0.05)\).

**Conclusion:** Both preload and afterload of the RV is increased in patients with cirrhosis. Systolic ejection velocity is increased as a result of high preload. However, RV contractility seems to be unchanged since the relatively load independent tissue Doppler parameter IVC, remains similar with the control group.

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**857 Biventricular myocardial adaptation to different training protocols in master athletes**

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**Background:** In competitive athletes, left ventricular (LV) hypertrophy often mimics pathological conditions, and the distinction may have important implications, particularly in adulthood practising regular physical activity. In addition, conflicting data have been reported about the nature (physiologic vs pathologic) of LV hypertrophy in master athletes and veterans.

** Aim of the study:** To analyze LV and right ventricular (RV) myocardial function in master athletes with LV hypertrophy induced by either endurance or strength training.

**Methods:** Standard Doppler echo, ECG ergometric test and colour Doppler Myocardial Imaging (DMI) of LV and of RV basal lateral walls were performed in 35 competitive master (>45 years) endurance athletes (ATE), in 20 strength-trained master athletes (ATS), and in 20 sedentary healthy subjects, all males.
### THE RIGHT HEART

#### 859

**Right ventricular diastolic function in arterial hypertension complicated with heart failure**

M. Tsvetara, D. Tsvetara; T. Chachukashvili

**Purpose:** The aim of this research was to study the changes of right ventricular (RV) diastolic function and pulmonary artery pressure (PAP) in patients with arterial hypertension (AH) complicated with heart failure (HF).

**Methods:** 759 patients with AH without signs of myocardial infarction, were examined by echocardiography. 211 patients (I group), had congestive HF (108 female, 103 male). 54 patients had I, II, VI, III, IV, V I heart failure, according to the NYHA classification. 548 patients (II group) had uncomplicated AH (258 female and 290 male). All patients examined by standard EchoCG. Right ventricular (RV) diastolic function was studied by PW tricuspid flow Dopplerography and Tissue Doppler Imaging (DTI). Mean pulmonary arterial pressure (PAP) was estimated by pulmonary arterial flow acceleration time.

**Results:** PAP, RV wall and cavity dimensions in diastole, was significantly greater in patients with HF. Tricuspid flow E wave velocity (40.52±11.9 vs 45.02±10.5) and E/A ratio (0.97±0.43 vs 1.15±0.34) was significantly lower, tricuspid flow A wave velocity (45.64±14.01 vs 41.39±11.67) was significantly greater and RV early tricuspid deceleration time (DT) shorter in patients with HF. The parameters of RV DTI did not show any difference between groups. 96% of patients with HF and 67.9% without HF had LV diastolic dysfunction (p<0.01). RV diastolic dysfunction was registered frequently in I group (in II group (64.3% vs 29.6%). Restrictive filling pattern was found in 5.9% of HF patients with RV diastolic dysfunction. It was significant gradual increase in PAP (p<0.001) and decrease DT (<0.005) with increase of HF functional class. It was tendency of gradual increase of late and decrease of early tricuspid flow velocity with increase of HF functional class. The correlation between RV and LV filling parameters was pure.

**Conclusion:** The patients with AH complicated with HF have significant changes of EchoCG parameters of RV diastolic function. RV hypotrophy, elevated PAP and RV diastolic dysfunction is frequently observed in patients with AH complicated with CHF than in patients without this complication.

#### 860

**Differenciation between acute and chronic cor pulmonales with midventricular systolic strain of the right ventricle**


**Background:** Cor pulmonale (CP) is defined as the structural and functional alternation of the right ventricle (RV) caused by primary disorders of the respiratory system. We aimed to differentiate acute CP complicated with pulmonary thromboembolism (PTE) from chronic form due to obstructive pulmonary disease (COPD) with strain analysis of RV.

**Patients and methods:** From March 2005 to April 2006, total 49 patients, 24 consecutive patients with acute CP (10 males, mean 68±14 years) and 25 consecutive patients with chronic CP associated with severe COPD (20 males, mean 61±14 years), were included. Echocardiographic data and strain analyses were obtained with GE Vivid 7.

**Results:** There was no statistical difference in age, fractional area change of RV, TR Vmax, and Tei index in both groups. However, males were more included in the chronic group. Midventricular systolic strain of RV was significantly decreased in patients with acute CP. Regarding the midventricular systolic strain in the detection of acute CP by the receiver operating curve, the best sensitivity and specificity were obtained when -12.6% was applied as the criterion (less than -12.6% for predicting an acute CP, the sensitivity, specificity and accuracy were 79.2%, 80.0% and 79.6%, respectively).

**Conclusions:** Midventricular systolic strain of RV can be used in the differentiation between acute and chronic cor pulmonales.

**Table 1. Echocardiographic data**

<table>
<thead>
<tr>
<th>Acute cor pulmonale (n=24)</th>
<th>Chronic cor pulmonale (n=25)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR Vmax (m/sec)</td>
<td>3.6±0.6</td>
<td>3.9±0.7</td>
</tr>
<tr>
<td>RV fractional area change (%)</td>
<td>20.9±11.5</td>
<td>23.4±7.5</td>
</tr>
<tr>
<td>RV Tei index</td>
<td>0.97±0.28</td>
<td>0.67±0.17</td>
</tr>
<tr>
<td>Systolic strain of RV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>-23.5±15.2</td>
<td>-21.3±9.0</td>
</tr>
<tr>
<td>Midventricle</td>
<td>-1.1±19.1</td>
<td>-19.0±8.8</td>
</tr>
<tr>
<td>Apex</td>
<td>-10.8±7.9</td>
<td>-10.0±9.9</td>
</tr>
</tbody>
</table>

**TR Vmax:** maximal velocity of tricuspid regurgitation; **RV:** right ventricle

#### 861

**Systolic tricuspid annular motions in various types of right ventricular overload**

M. Djukic, I. Jovanovic, V. Parezanovic, J. Kalaric, Lj. Sulovic, I. Stefanovic, G. Vukomanovic

**Background:** Systolic tricuspid annular motion was studied in patients with tricuspid regurgitation (TR) using two-dimensional (2D) echocardiography.

**Patients and methods:** 114 consecutive patients with moderate-severe tricuspid regurgitation (TR). Group I: 47 pts with mitral annular disease and TR. Group II: 43 pts with mitral valve repair and TR. Group III: 24 pts with mitral valve stenosis and TR. Group IV: 10 pts with atrial septal defect and TR.

**Conclusions:** The mean annular motion (MAM) was significantly greater in patients with mitral valve disease and mitral valve repair compared to mitral valve stenosis and atrial septal defect.

**Table 1.**

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean MAM (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>7.5±2.0</td>
</tr>
<tr>
<td>Group II</td>
<td>6.7±1.8</td>
</tr>
<tr>
<td>Group III</td>
<td>5.9±1.3</td>
</tr>
<tr>
<td>Group IV</td>
<td>4.8±1.2</td>
</tr>
</tbody>
</table>

**MAM:** mean annular motion; **TR:** tricuspid regurgitation; **MI:** mitral valve; **MVr:** mitral valve repair; **MVs:** mitral valve stenosis; **ASD:** atrial septal defect.
obtained by Tissue Doppler Imaging and by amplitude of tricuspid annular motions (TAPSE) obtained by M-mode Echocardiography.

Results: Group I control Group II ASD Group III PS Group IV Post TOF Sm cm/s 15.1±2.3 18.8±3.6 12.1±3.0 10.4±1.9 p-value <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 TAPSE (mm) 22.1±3.4 31.4±4.3 17.4±3.7 13.1±2.9 p-value <0.0001 <0.0001 <0.0001

Conclusions: Children suffering from CHD with systolic and combined RV overload had damaged RV systolic function, but pts with RV volume overload had increased systolic RV function.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Group I</th>
<th>Control</th>
<th>Group II</th>
<th>ASD</th>
<th>Group III</th>
<th>PS</th>
<th>Group IV</th>
<th>Post TOF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sm (cm/s)</td>
<td>15.1±2.3</td>
<td>18.8±3.6</td>
<td>12.1±3.0</td>
<td>10.4±1.9</td>
<td>p-value</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>TAPSE (mm)</td>
<td>22.1±3.4</td>
<td>31.4±4.3</td>
<td>17.4±3.7</td>
<td>13.1±2.9</td>
<td>p-value</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

862 Right Ventricular Tei index obtained by tissue Doppler imaging is impaired in patients with Human Immunodeficiency Virus

N. Hammad1; S. Ederby1; E. DiAngelantonio1; G. Dufall1; F. Raoux1; F. Bogaty1; P.M. Girard1; A. Cohen1; Saint Antoine hospital, Cardiology Dept., Paris, France

Background: Conflicting results have been reported regarding myocardial involvement in Human Immunodeficiency Virus patients (HIV pts). This might be due to the variety of parameters studied or to methodological limitations. Tei index is an non invasive measurement for assessing systolic and diastolic function of both ventricles. It can be determined by the pulsed wave Doppler (pD) method and by tissue Doppler imaging (TDI).

Objective: The aim of our study was to investigate right ventricular (RV) and left ventricular (LV) functions in HIV pts using Tei index measured by pD and by TDI.

Methods: Using a case-control design, 44 consecutive HIV pts (mean age 42.0±9.2 years, 32 men) and 44 age and sex-matched healthy subjects were prospectively studied. From pulsed TDI at the tricuspid and mitral annular planes, the tricuspid and mitral closure to opening time (A), RV and LV ejection time (ET) intervals for calculating the RV and LV Tei index (according to [A-ET]/ET) were measured using the same Doppler curve. With pD method, A and ET were measured from different cardiac cycles: A was measured from tricuspid and mitral inflows (Ti and Mi respectively), LVET was measured from aortic flow (Af), RVET was measured from pulmonaty flow (PF). Heart rate variability between pD Ti and PT curves was evaluated by measuring RR intervals.

Results: Whereas pD RV Tei index was not significantly different in HIV pts and controls, TDI RV Tei index was significantly higher in HIV pts. These RV Tei index discrepancies could be due to variability in RR intervals between pD Ti and PT curves (ms: 904.1 and 878.3, p=0.002). We found no significant difference with regard to LV Tei index measured using both methods.

Conclusions: Using TDI Tei index as a myocardial performance index, our study suggests that RV function is impaired in HIV pts, while LV performance is not affected at this stage. Since TDI Tei index is measured within one cardiac cycle, it is less affected by heart rate variability.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>HIV(n=44)</th>
<th>Controls (n=44)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDI RV Tei index</td>
<td>0.32 (0.13)</td>
<td>0.25 (0.09)</td>
<td>0.003</td>
</tr>
<tr>
<td>pD RV Tei index</td>
<td>0.25 (0.11)</td>
<td>0.23 (0.10)</td>
<td>0.266</td>
</tr>
<tr>
<td>TDI LV Tei index</td>
<td>0.49 (0.09)</td>
<td>0.49 (0.09)</td>
<td>0.909</td>
</tr>
<tr>
<td>pD LV Tei index</td>
<td>0.41 (0.10)</td>
<td>0.39 (0.11)</td>
<td>0.296</td>
</tr>
</tbody>
</table>

863 A tissue Doppler assessment of right ventricle systolic function in chronic mitral regurgitation

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Introduction: Right ventricle (RV) systolic function is known to be altered in chronic mitral regurgitation (MR). Changes in RV regional deformation are known to be heterogeneous in response to pressure overload. Tissue Doppler imaging can quantify regional RV longitudinal function.

Methods: Patients with chronic primary MR underwent echocardiography. Peak longitudinal systolic strain rate (SR), and end-systolic strain (ESS), were obtained from apical, mid and basal segment of the RV free wall from apex view. Patients were further subdivided into Group 1 if they had a compensated left ventricle (LV), and into Group 2 if they had one or more of the following symptons: End-systolic diameter >4.5 cm, or LV EF ≤60%. Differences between groups were analysed using ANOVA.

Results: 39 MR subjects (17 in Group 1 and 22 in Group 2), age 64.1±12.7 yrs, and 30 healthy age matched controls were included. Equal proportion of patients had tricuspid regurgitation in controls, Group 1 and Group 2, and RV acceleration time and peak tricuspid regurgitation velocity were similar in all 3 groups. In apical segment, there was no significant difference between the groups in SR (p=0.15) and ESS (p=0.25). In mid segment, SR was increased in Group 1 compared to controls, but then decreased to control values in Group 2. ESS in mid segment increased in Group 1 and remained elevated in Group 2. In basal segment, SR and ESS were decreased in both Group 1 and Group 2 (figure). In MR, tricuspid annular systolic velocity correlated best with mid segment SR and ESS, r=−0.42, p=0.009, and r=−0.40, p=0.013.

Conclusions: RV regional deformation responds heterogeneously to the presence of chronic MR, and the change depends on the level of LV compensation. These changes occur despite normal pulmonary arterial pressures.

864 The impact of etiology of heart failure on the right ventricular function

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1Silesian Center For Heart Disease, 1St Dept. Of Cardiology, Zabrze, Poland

Background: The chronic heart failure results in the impairment of function of both ventricles. In respect to the right ventricle (RV) it can be secondary to the pulmonary hypertensión. The pathomechanism of nonischemic dilated cardiomyopathy suggests that RV muscle can be primarily effected by the disease.

Aim: Comparison of RV global and regional systolic and diastolic function in heart failure patients with ischemic (ICM) and nonischemic cardiomyopathy (NICM).

Material: 38 patients (gr. I – 25 with NICM and gr. II – 13 with ICM) in NYHA II class were included to the study. Both groups did not differ in regard to LV parameters: LVH (70.8±5.7 vs 69±4.8 mm; p=NS), LV (57.6±5.9 mm; p=NS), ESV (178.7±48.6 vs 166.7±52 ml; p=NS) EDV (252±46 vs 224±4.6 ml; p=NS), LVEF (29±6.6 vs 25.7±6.2%); p=NS), NT-proBNP concentration (1605±1569 vs 1178±711 pg/ml; p=NS). Standard and tissue Doppler imaging studies were performed to evaluate the following parameters: RV dimension, RV diastolic volume (RV-EDV), RV systolic volume (RV-ESV), RV ejection fraction (RV-EF), tricuspid annulus plane systolic excursion (TAPSE), peak systolic velocity, strain and strain rate of RV free wall (respectively: VELs, Ss, Srs), tricuspid E’ and A’ wave. Results: Both groups did not differ in regard to RV/EDV (29±9.4±2.2 vs 29.8±5.6 mm). However the significant differences were found regarding RV-EDV (53.1±18 vs 39.5±9.9 ml; p=0.04), RVEF (34±4.15 vs 19±8.8 ml; p=0.007), TAPSE (7.2±0.4 vs 5.4±0.3 cm; p=0.004), peak tricuspid E’ velocity (0.076±0.02 vs 0.033±0.01 m/s; p<0.01) and peak A’ velocity (0.078±0.02 vs 0.046±0.01 m/s; p<0.01). The analysis of regional deformation of RV free wall did not reveal any significant differences.

Conclusions: Despite the similar NYHA class and LV function indexes, NICM patients manifested better preserved RV systolic and diastolic function.

865 Persistence of right ventricular dysfunction during dobutamine stress testing following successful coronary artery bypass grafting

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Background: Right ventricular (RV) function after coronary artery bypass surgery (CABG) carries prognostic significance. RV systolic dysfunction at rest is a recognised consequence of CABG, but RV response to stress after successful revascularisation has not been studied.

Aim: To investigate RV response to dobutamine stress in patients with 3-vessel CAD following successful CABG.

Methods: Twenty unselected patients with 3-vessel CAD (including significant R-CAD) were studied with dobutamine stress 1-month before and 3-months using stress strain rate (TAPSE) and end-systolic strain (ESS), were compared with 15 normals. RV long axis function was determined by (i) delay in the onset of shortening (RV-QQS: time between q wave of the ECG to onset of long axis shortening), (ii) amplitude of PES, and (iii) RV systolic amplitude (RV-SA: total amplitude minus PES). LV function was determined by wall motion score index (WMSI).

Results: Control subjects: RV-QQS shortened with stress (79.5±9 ms to 34±12 ms; p<0.001). PES was absent at rest and did not appear with stress, and RV-SA increased (24±1 mm to 30±2 mm; p<0.001). Patients before CABG:
Patients after CABG: RV-SA at rest was 50% lower after CABG (p<0.001). No patient developed chest pain or ST depression, and although LV-WMSI fell with stress after CABG (1.47±0.22 to 1.35±0.28, p<0.001), the RV response was similar to that before CABG. RV-qQS lengthened (93.4±3.4 ms to 115.8±5.6 ms) RV-PES increased (0.50±0.0 mm to 1.5±0.6 mm), and RV-SA fell (21.1±1 mm to 17.1±1 mm, p<0.001).

Conclusions: Successful CABG eliminates stress-induced ischaemic symptoms and ECG changes, and results in significant improvement of pre-operative LV myocardial dysfunction. Despite this, post-CABG RV function is impaired at rest and there is persistent RV long axis incoordination at peak stress. The exact nature of such subendocardial "ischaemia like" RV dysfunction with stress requires further study to elucidate underlying mechanisms.

866 Right ventricular dysfunction in asymptomatic diabetic patients

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Right ventricular (RV) function has been recognized to be clinically and prognostically significant in various pathological settings, such as heart failure due to primary amyloidosis and myocardial infarction and, consequently, it might be relevant in diabetes as well. Contrary to the left ventricle, data regarding RV function in diabetic patients are still incomplete. The aim of the study was to evaluate the preclinical effects of diabetes on regional RV systolic and diastolic function and, symptomatic diabetic subjects using echocardiographic strain/strain rate technique.

Material and methods: Studied groups consisted of 33 patients with diabetes only (DM) (57.3±12.9 yrs) and 40 subjects with coexisting diabetes and hypertension (DMHT) (57.1±12.5 yrs). 36 healthy age-matched persons served as controls (CG).

In each patient echocardiographic study with strain/strain rate imaging was performed. Analysis of RV deformation data included assessment of systolic strain (Ss), peak systolic strain rate (SRs) and peak early diastolic strain rate (SRe) obtained from the basal and apical segments of RV free wall.

Results: Significantly lower values of Ss and SRs in the basal and apical segment of RV free wall in DM and DMHT groups than in controls were indicative of the impairment of RV systolic function. Similarly, decreased SRe in diabetic patients in both evaluated segments reflected abnormalities of RV diastolic performance. The systolic defects were more pronounced in the apical than in the basal segment which might be related to regional inhomogeneity of RV. Both diabetic groups did not differ in all evaluated parameters.

Conclusion: Diabetes mellitus induces subclinical RV systolic and diastolic dysfunction, regardless of coexisting hypertension.

| Table 1
<table>
<thead>
<tr>
<th>Control</th>
<th>LHV (−) hypertension</th>
<th>LHV (+) hypertension</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>20</td>
<td>117</td>
<td>68</td>
</tr>
<tr>
<td>Age (years)</td>
<td>54±2.8</td>
<td>56±2.8</td>
<td>57±2.8</td>
</tr>
<tr>
<td>Women (%)</td>
<td>13(65)</td>
<td>55(47)</td>
<td>40(59)</td>
</tr>
<tr>
<td>E/A ratio</td>
<td>1.3±0.2</td>
<td>0.9±0.2</td>
<td>0.9±0.2</td>
</tr>
<tr>
<td>E/Em</td>
<td>9.0±2.1</td>
<td>11.2±3.1</td>
<td>12.8±4.5</td>
</tr>
<tr>
<td>RV MPI</td>
<td>0.38±0.06</td>
<td>0.44±0.09</td>
<td>0.46±0.09</td>
</tr>
<tr>
<td>RV MPI</td>
<td>0.30±0.06</td>
<td>0.36±0.08</td>
<td>0.39±0.09</td>
</tr>
</tbody>
</table>

867 Right ventricular dysfunction in the hypertensives with left ventricular hypertrophy: the Doppler echocardiographic study using myocardial performance index

M. Esmaeilzadeh 1; A. Fazlinezhad 2; M. Maleki 2; S.Z.M. Ojaghi Haghighi 2; A. Sadeghpour 2; N. Samiei 2; F. Noohi 2

Objectives: Systemic hypertension imparts a chronic augmentation of workload on the left ventricle (LV) and is the most common reason for LV hypertrophy (LVH), which increases the risk of adverse cardiovascular events in patients with hypertension. Whether the hypertensive patients with LVH have right ventricular (RV) dysfunction has not been well assessed because of the complicated geometry of the RV. The myocardial performance index (MPI), obtained from the Doppler time intervals, allows noninvasive and noninvasive estimation of global ventricular function. Therefore, this study was designed to assess RV function for the hypertensive patients with LVH using RV MPI.

Design and methods: Study patients consisted of 185 consecutive patients with hypertension without ischemic heart disease or significant valvular heart disease and 20 age- & sex-matched control subjects. Patients were classified as LHV (−) (n=117) or LHV (+) (n=68) on the basis of echocardiographic LV mass index less than 125 g/m² (men), 110 g/m² (women) or >125 g/m² (men), >110 g/m² (women). RV MPI was obtained from tricuspid and pulmonary Doppler flow velocity.

Results: RV MPI was significantly increased in patients with LHV (+) (0.39±0.08 vs 0.36±0.08 in LHV (−), p=0.30±0.06 in control, p<0.001). RV MPI was correlated well with LV MPI (r=0.52, p<0.001).

Conclusions: The hypertensive patients with LVH have RV dysfunction measured by RV MPI compared with those without LVH. Clinical implications and prognostic significance of these RV dysfunction should be studied further in prospective design.
TDI can be useful to detect subclinical dysfunction even in smokers.

Conclusions: This study demonstrates that RAA functional parameters are as similar as those of LAA. Smoker pattern is associated with a significant decline in ejection velocity for both the RAA (29.3 ± 42.9 cm/sec, p = 0.000) and LAA (30.3 ± 52.8 cm/sec, p = 0.007).

870 Tissue Doppler Imaging derived indexes for right ventricular function evaluation in chronic cigarette smokers

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Background: Delerious effects of chronic cigarette smoking on endothelial function, myocardial stiffness, systemic, coronary and pulmonary circulation are known. There are few data about effect of chronic cigarette smoking on right ventricular (RV) function. Standard echocardiographic evaluation of RV can be difficult or unsatisfactory; recently tissue Doppler Imaging (TDI) has been introduced for the study of systolic and diastolic function of both ventricles, showing load independency and a favourable signal noise relation-ship and permitting the derivation of strain, a specific-parameter. We tested TDI for RV function evaluation in smokers.

Material and methods: We studied 20 patients (10 males, age 36.2 ± 6.5) smokers (>20 cigarettes/die, >5 years) compared to 20 healthy volunteers age-matched. Everyone had normal resting ECG and clinical examination; standard echocardiography was performed in every subject by a single examiner with a Vivid 7 GE Vingmed echo-machine: left ventricular normal dimension and function and no more than ‘trace’ tricuspid regurgitation were criteria for selection. From standard apical view we calculated RV ejec-tion fraction (RVEF, %, area-length monoplane method); three cardiac cycles were then recorded using Color TDI at high frame rate (>120 frame per second); myocardial systolic velocity (Sm, cm/sec), early diastolic velocity (Em, cm/sec), peak myocardial strain (Sr %) and peak strain rate (SR, 1/s) of RV free wall were then obtained. We compared data by Student’s T test.

Results: Data are expressed as mean ± standard deviation and are reported in Table 1. RV Sm, Sm and Em were similar in both groups, peak strain and strain rate were reduced in smokers.

Conclusions: Chronic cigarettes smoking seems to influence RV function. TDI can be useful to detect subclinical dysfunction even in smokers subjects; further study should investigate if any prognostic impact is warranted.

871 Prevalence of prominent eustachian valve on TEE examination

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Eustachian valve (EV) is a structure that can be noted in right atrium in some individuals. In normal embryo, a membrane exists which courses from inferior vena cava to coronary sinus, redirecting the blood flow from inferior vena cava (IVC) through foramen ovale. Just a small remnant usually persists in adults, being considered as a normal variant. In some people this structure is prominent and could be visualized on echo as a mobile membrane in right atrium. The length could be up to several cms. Complications associated with RV EV comprises formation of IVC, infective endocarditis or thrombo-sis. If a patent foramen ovale coexists, EV may be also a risk factor for paradoxical embolization. The prevalence of EV in normal population is not known. In literature, there are some smaller sets of patients with brain embolization, where the prevalence of EV is increased in comparison with a control group.

Purpose: to set the prevalence of prominent EV in unselected patients ex-aired by echo for various reasons.

Material and methods: 1000 consecutive patients examined by transesophageal echo (TEE) was classified as ‘prominent EV’ if there was a mobile membrane longer than 1 cm in typical location, not filling the criteria of Chiarli network.

Results: Forty six patients with prominent EV were identified among these 1000 pts (4.6%).

Discussion: Most of the patients analysed in this study were patients with various types of cardiopathy. Substantial portion of them were examined because of stroke in their history. In a general population, the prevalence of prominent EV would be probably lower.

872 Right ventricular diastolic dysfunction in ischemic end idiopathic dilated cardiomyopathy

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Background: Right ventricular (RV) diastolic dysfunction (DD) is observed in advanced heart failure (HF). Decreased tricuspid annulus early diastolic velocity is the marker of RV DD. There is little data connecting RV DD with etiology of HF.

Aim: To assess differences in RV DD parameters in patients with dilated and ischemic cardiomyopathy.

Material and methods: We studied 34 symptomatic HF patients (PTS) (25 males, mean age 58) divided in 2 groups: ICM (n=19, 15 males, mean age 62) with ischemic cardiomyopathy and IDCM (n=15, 11 males, mean age 55) with idiopathic dilated cardiomyopathy. 18 PTS (12 males, mean age 64) without signs of HF served as the control group. Tricuspid flow early (E) and atrial (A) velocities, E wave deceleration time (DT), E/A index were measured. Velocities of tricuspid annulus early diastolic (E) and atrial (A), E’/A’ index were determined. RV myocardial performance index (RV MPI) described by Tei was calculated.

Results: Tricuspid flow parameters did not differ between groups. Tricuspid annulus early diastolic velocities were decreased in ICM and IDCM groups compared to the control. Tricuspid A’ velocity was lower in IDCM group than in the control. RV MPI was elevated in PTS with cardiomyopathies. There were no differences between ICM and IDCM groups.

Conclusion: Tricuspid flow parameters are not affected in patients with is-chemic and idiopathic dilated cardiomyopathy. Right ventricular diastolic dysfunction detected by decreased E’ and elevated RV MPI exists in both ischemic and idiopathic dilated cardiomyopathy.

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873 Global right ventricular function is impaired in young non-smokers with diabetes mellitus type 1

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Young patients suffered from diabetes mellitus have abnormal left ventricular filling pattern typical for impaired relaxation. The assessment of right ventricu-lar function in diabetics is still inadequate. Aim of our study was to evalu-ate right ventricular (RV) function in young non-smokers with diabetes mel-litus type 1 (DM1).

Material and method: The study group (S) consisted of 55 patients (28 M, 27 F, mean age 26.9 yrs) with DM1, non-smokers, without evidence of cardiac and pulmonary disease, with mean DM1 duration 14.7 yrs. 30 healthy non-smokers (17 M, 13 F, mean age 27.1 yrs) completed control group (C).

In conventional Doppler echocardiography the assessment of RV systolic, diastolic and RV global function was performed.

Results: Mean values of BNP, heart rate, RV diameter, tricuspid valve (TV) regurgitation peak gradient and pulmonary valve ejection acceleration time did not differ between groups. RV systolic function expressed by M-mode tricuspid annulus movement (TAPSE) was normal in both groups. In the assessment of RV diastolic function TV E/A ratio was significantly lower (1.2 ± 0.2 vs 1.4 ± 0.3; p < 0.01) in group S than in C. TV E/A < 1, suggesting RV diastolic dysfunction was observed in 25% of diabetics. The RV myocardial performance index (MPI) defined as the sum of RV isovolumetric relaxation and contraction time divided by RV ejection time, which express global RV func-tion was significantly higher (0.36 ± 0.05 vs 0.28 ± 0.08; p < 0.01) in diabe-tics than in controls, what indicate the alterations in myocardial per-formance. There was no correlation between Doppler parameters and diabetes duration.

Conclusions: 1. The results of Doppler evaluation confirm the impairment of global RV function in young non-smoking type 1 diabetic patients, with or without symptoms of cardiac and pulmonary disease. 2. MPI assessment is helpful in detection of RV dysfunction in this group, but further studies are needed to estimate its prognostic value.
The assessment of right and left ventricular asynchrony in patients with chronic pulmonary thromboembolism prior and post surgical trombendarterectomy

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Background: The pressure overload of the right ventricle (RV) in patients with pulmonary hypertension in the course of chronic pulmonary thromboembolism (CTEPH) alters the mechanical properties of the RV and may result in dysynchronous work of both ventricles.

Aim: The assessment of changes in synchrony of both ventricles prior and post thrombendarterectomy.

Methods: The study group consisted of 7 patients (mean age 50±13 years, 3 male, 4 female) with a diagnosis of CTEPH confirmed by angiography, who had undergone surgical thrombendarterectomy. The intraventricular conduction disturbances were not detected neither before nor post operation. Follow up data were collected 1 month post operation: RV diastolic dimension, RV Dd, RV-FV, RV ejection fraction (EF), PV-AcT, ForQ/RV, RVEF and for L/V (LV lat-IVS delay; RVwall-IVS delay) peak of velocity profile of RV free wall by TDI (respectively RVwall-time to onset, RVwall-time to peak), interventricular septum (IVS-time to onset, IVS-time to peak) and lateral LV wall (LV lat-time to onset, LV lat-time to peak). The intra-ventricular delay for RV and LV (LV lat-IVS delay; RVwall-IVS delay) and inter-ventricular delay (LV//RV lat-IVS delay) were calculated.

Results: After the endarterectomy NYHA class has changed from 3.2±0.7 to 1.1±0.7, p<0.001, mean pulmonary artery pressure from 51.3±11.7 vs 25.3±5.1 mm Hg, p<0.001; total pulmonary resistance from 890±413 to 202±64 dyn/cm5/s, p<0.001; Inter- and intra-ventricular delays are shown in the table.

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tricuspid lateral annular TD velocities before dialysis were 13.05±2.49, 8.78±2.86, 17.47±6.74 cm/s, and after dialysis were 12.45±3.29, 6.92±1.78, 16.66±6.30 cm/s. Myocardial early diastolic velocity decreased marginally by 1.86±2.14 (p=0.044), but systolic and late diastolic velocities did not change significantly (p=0.313 and p=0.531, respectively). In our study population there was no statistically significant correlation between RV TD velocities and LV systolic function.

Conclusion: TDI assessment allows a quantitative evaluation of both systolic and diastolic RV function. Moreover, tricuspid annular velocities were not or only minimally affected by preload reduction in hemodialysis patients.

879 Transesophageal echocardiography for evaluation of right atrial appendage function in comparison with left atrial appendage

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Objectives: We sought to define right atrial appendage (RAA) functional parameters and to compare these measures with those of left atrial appendage (LAA) and to assess the relationship between RAA contraction velocity and atrial and ventricular echo contrast or thrombus in right atrium (RA) and RAA among patients in sinus rhythm.

Methods: In a consecutive series of 154 patients (76 men; mean age of 45 years) who were referred for transesophageal echocardiography, RAA and LAA ejection and filling velocities were measured at 110 and 90 degrees respectively. The left ventricular (LV) right ventricular (RV) size and function, RA size, tricuspid regurgitation severity, RV systolic pressure (by TR peak gradient) were measured using transthoracic echocardiography.

Results: There was no difference between RAA and LAA ejection velocity in normal subjects (42±17.5 versus 49±25 cm/sec, p=0.00). RAA velocity decreased in patients with RV and LV dysfunction (p=0.00), pulmonary arterial hypertension (p=0.05), and RA enlargement (p=0.05) but no significant correlation was found between RAA ejection velocity with RV size and TR severity. Smokey pattern was associated with a significant decline in ejection velocity for both the RAA (29.3±42.9 cm/sec, p=0.00) and LAA (30.3±42.9 cm/sec, p=0.007). Conclusion: This study demonstrates that RAA functional parameters are as similar as those of LAA. Smokey pattern is associated with a significant decline in ejection velocity for both the RAA and LAA, but the substantially lower prevalence of RAA thrombus may be secondary to the anatomical variability between RAA and LAA (larger RAA width).

880 Right ventricular hibernation in acute inferior myocardial infarction

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Background: Right Ventricular (RV) ischaemia is known to occur in 50% of patients with inferior myocardial infarction (MI). The extent of such involvement has never been determined in detail, nor its recovery following conventional therapy of MI.

Aim: To assess RV function in patients with inferior MI and to observe changes following thrombolysis.

Methods: We studied 31 patients with acute inferior MI (age 56±12 years), on the day of admission, day 7 and day 30 post thrombolysis. No patient had clinical signs of right sided heart failure. RV function was assessed from RV free wall long axis amplitude using M-mode echocardiography and total isovolumic time (t-IVT), and Tei index from filling velocities and LV systolic function.

Results: Overall RV performance was impaired demonstrated by prolonged t-IVT (6.6±3.4 s/m, p<0.01), and Tei index (0.4±0.2, p<0.01) normalised on the day of admission, day 7 and day 30 post thrombolysis. There was no significant change in RV inflow diameter (3.1±0.3 vs 2.8±0.4 cm, NS) or severity of tricuspid regurgitation between admission and day 30.

Conclusion: In patients with inferior MI right ventricular segmental and overall function is impaired during the acute attack. Following thrombolysis right ventricular function recovers despite the small percentage of patients who remain with subnormal values. In the absence of evidence for RV infarction these findings may suggest an evidence for hibernating myocardium that may demonstrate delayed recovery.

881 Right ventricular systolic function is not the only determinant of the tricuspid annular velocity. A tissue Doppler study in comparison to cardiac magnetic resonance imaging

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Purpose: Tricuspid annular velocity is a helpful parameter to estimate right ventricular function. We sought to investigate whether left ventricle has any influence on the tricuspid annular velocities.

Methods: We measured tricuspid annulus systolic (S) and isovolumic contraction (IVC) velocities and their durations in a heterogeneous group of 30 patients (mean age 55±20 years) by pulse wave Doppler. Results were compared to cardiac magnetic resonance imaging (CMR) derived right and left ventricular ejection fractions (RVEF, LVEF).

Results: Tricuspid annulus S and IVC velocities correlated significantly with both RVEF (S: r=0.84, IVC: r=0.62) and LVEF (S: r=0.63, IVC: r=0.58) (p<0.001 for all). Groups were defined as: group I with both normal RVEF and LVEF, group II with normal RVEF but LVEF<45%, group III with RV<45% but normal LVEF, group IV with RV<45% and LVEF<45%. S and IVC velocities were highest in group I and lowest in group IV, however either RV or LV dysfunction were associated with similarly reduced S and IVC velocities, intermediate between group I and group IV (figure).

Conclusion: Tricuspid annular velocities are not only determined by right ventricular systolic function but also by left ventricular systolic function. This finding has implications on the estimation of RVEF from the tricuspid annular velocities.

882 Can pulsed wave Doppler tissue velocities consistently detect haemodynamic changes in the normal neonatal heart?

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1University of Sao Paulo, Heart Institute, Sao Paulo, Brazil; 2Maternidade Hilda Brandao, Belo Horizonte, Brazil; 3St George’s Hospital, London, United Kingdom

Background: Pulsed wave Doppler tissue velocities (PWDV) can be used to analyse the short and long axis function of both ventricles. Strain rate (SR) and strain (S) have been proposed as new ultrasound indices for quantifying regional wall deformation. The aim of this study was to analyse if PWDV parameters can change in accordance with variations in SR/S between the early and late neonatal period.

Methods: Data were obtained in 55 healthy neonates, 29 male (mean age 20.14±14 h), being called Group I (GI) and a second examination was done 31.9±2.8 days of age (30 neonates), Group II (GII). Apical and parasternal views were used and a sample volume was put in septal (S), posterior (P), lateral (L), anterior (A) and inferior (I) walls (base, mid and apical segments) of the LV and LV wall of RV. Peak systolic (Sm), peak early diastolic (Em), peak atrial (Am) motion velocities and Em/Am ratio were measured and compared. At least 3 consecutive cardiac cycles with 300 fps were stored for offline analysis to measure peak systolic and peak early and late diastolic SR/ S. A paired samples t test was done comparing the 2 groups and a nonparametric Spearman correlation test was used to compare Sm with systolic SR/S.

Results: In GI, PWDV RV velocities, as SR/S measurements were higher than those of the LV. All components of SR/S were higher in radial (R) direction when compared to the longitudinal (LON) ones (systolic SR 2.99±0.78 S and 8.78±2.6, 17.47±6.74 cm/s, and after dialysis were 12.45±3.29, 6.92±1.78, 16.66±6.30 cm/s. Myocardial early diastolic velocity decreased marginally by 1.86±2.14 (p=0.044), but systolic and late diastolic velocities did not change significantly (p=0.313 and p=0.531, respectively). In our study population there was no statistically significant correlation between RV TD velocities and LV systolic function.

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MYOCARDIAL VELOCITY IMAGING (DMI) – OTHER

Abstracts S145

Eur J Echocardiography Abstracts Supplement, December 2006
seems that PWDVT can’t monitor physiological sequential circulatory changes in early and late neonatal period.

THE RIGHT HEART

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Absolute right atrial and right ventricle measurements in follow up of children after secundum atrial septal defect closure with amplatz septal occluder

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Aim: The goal of the study was to evaluate the right atrial (RA) and right ventricular (RV) size after Atrial Septal Defect (ASD II) closure with Amplatz Septal Occluder (ASO).

Material and methods: In 42 children (study group - SG) aged 4.5-18 years, body weight 16-97 kg transthoracic echo was performed prior ASD implantation and after 24 hours, 1, 3 months, 1, 2, 3, 4 years. In the apical four-chamber view RA longitudinal diameter (RAD), transverse diameter (RADT) and RA area (RAA) were measured as well as RV dimensions: (RVD) and (RVD) in four chamber view, (RVD) in short axis and (RVD) in M-mode were obtained and presented as an absolute values. The comparison of RA and RV measurements obtained prior to closure to the values after the closure as well as post-closure values to previous examination measurements were performed. The control group (CG) consisted of 40 healthy children.

Results: The comparison of RA and RV pre and 24 hours post closure dimensions in study group revealed significant reduction (p<0.0001) of RAD, RADT, RAA as well as significant reduction (p<0.0001) of RVD, RVD, RVD. Significant reduction of all RV absolute values occurred also at 1 month and further significant reduction of RVD (p<0.0005), RVD, (p<0.0001), and RVD (p<0.0005) was observed at 3 months, however afterwards there was no significant reduction of RV measurements at 1, 2, 3, 4 years after procedure. There were no significant differences (p>0.05) between values from SG and CG at 24h for RVD, at 1 month for RVD and RVD, at 1 year for RVD. No significant changes of RA absolute values occurred at 1 month. A further significant reduction at 3 months and 1 year were observed for RAD (p<0.0001; p<0.01) and for RAA (p<0.05) however afterwards there were no significant changes of RA measurements. No significant differences (p>0.05) between values from SG and CG occurred: at 24 h for RAA, at 3 months for RAD, and at 1 year for RAD.

Conclusions: 1. Significant decrease of RA and RV absolute values was observed during the first 24 hours after procedure closure of ASDII. 2. Resolution of RV size enlargement occurred during the first year after procedure. 3. RA size evaluation in children with ASD II and after percutaneous closure is of a great clinical value regarding the occurrence of arrhythmia.

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Can ultrasonic tissue indices be helpful in the assessment of pulmonary regurgitation in patients after repair of tetralogy of Fallot?

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Background: Pulmonary valve regurgitation (PR) is the most common residual finding in patients after repair of tetralogy of Fallot (TOF). We sought to assess whether ultrasonic tissue indices can be helpful in the detection of significant PR and indicate the deleterious effect of PR on the right ventricular (RV) regional myocardial function in adults reoperated after total correction of TOF.

Methods: 19 patients (11 F, 8 M) (mean age 35.5±15.6 y) with TOF operated in childhood and reoperated in the further years were evaluated by conventional echo parameters: RV diameters, fractional area change (FAC) and myocardial performance index (MPI). The duration of PR (PR time) and the color Doppler pulmonary regurgitant jet width (PR width) were also assessed. The ratio between PR width and pulmonary trunk diameter was defined as pulmonary regurgitation index (PRI). To calculate regional longitudinal systolic and diastolic Strain Rate (SR) and maximal strain (S), GE Echopac 2D was applied. The data were averaged from three consecutive heart beats.

Results: We found a very strong correlation between PR width (mean value 4.07 mm) and systolic basal RV S and systolic mid RV S (r=-0.85 and r=-0.87, respectively; p<0.05). Similarly, PRI correlated with basal and mid RV S (r=-0.83 and r=-0.85 respectively; p<0.05). Moreover, PR and PRI were reflected by the value of early and late diastolic SR in the mid RV segments (Fig 1). The degree of deformation in apical RV segments was non-contributory in respect to PR characterization.

Conclusion: The severity of PR in adults reoperated after total TOF repair can be described by increased longitudinal strain in the basal and mid RV segments as well as by augmented diastolic SR values in the mid RV segments.

CONGENITAL HEART DISEASE

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Aortic dilation and dissection in patient after aortic valve replacement because of a bicuspid aortic valve

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Background: Bicuspid aortic valve (BAV) is the most frequent congenital heart disease with a prevalence of 1.2%. Most patients have aortic valve replacement (AVR) sooner or later, because of aortic stenosis or aortic regurgitation. It is well known that BAV is associated with aortic dilation and aortic dissection before AVR. However, little research is done for this association after AVR.

Methods: We identified all patients operated for BAV in the Academic Medical Centre (AMC) in Amsterdam during the period 1992-2000 (n=288, group A) and we analysed whether these people had a dissection and a significant gradient and performed a contrast echocardiography examination at the time of AVR as well as at follow up of 26 patients to determine aortic progression. We also identified all patients operated for an acute dissection of the ascending aorta in the AMC during the period 1992-2000 (n=48, group B) and we reviewed whether these patients were known with BAV.

Results: In group A we found five acute aortic dissections before AVR and one after AVR. Also, eight sudden cardiac deaths after AVR were identified. After AVR, the sinus of Valsalva progressed with 0.35±0.13 mm per year (p<0.02). The proximal ascending aorta progressed with 0.66±0.19 mm per year (p<0.01). In group B we found three patients with a native BAV, while zero patients with a BAV that had AVR were identified. We did not find any significant association of aortic growth with blood pressure or anti-hypertensive medication.

Conclusions: The incidence of aortic dissection in patients with BAV after AVR seems very small (<0.5%). However, sudden cardiac deaths could actually be due to an acute aortic dissection. Although aortic diameters of patients with a BAV are significantly larger than those of the normal population, dilatation rates after AVR are small. However, if dilatation rates are stable over the years aortic dilation could become relevant over the years.

3-D ECHO

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Three-dimensional (3D) echocardiography in evaluation of PDA before and after percutaneous closure

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Objective: The purpose of this study was to assess the ability of three-dimensional (3D) echocardiography in accurately viewing anatomic details in patients with persistent ductus arteriosus.

Methods: 21 cases were analyzed. In ten of them, size and morphological data of the ductus were described by 2D and 3D echocardiography. In the others one, 3D echocardiography was performed after percutaneous closure of the ductus.

Results: In the first group, measurements, gradients and type of duct were obtained by 2D and 3D echocardiography. All the conducts, except one, were type A of Kirchenko classification; the other one was type E. In the second group, measures and gradients of the duct were studied by 2D echocardiography initially. Later, measurements, gradients and pulmonary pressures were obtained by hemodynamics studies. One duct was classified as type E and the rest as type A. Immediately after the closure procedure 6 trivial residual defects were detected. Amplater devices were used in 10 patients and a Nito Occlud device in one of them. The control 3D-echocardiogram reported no residual defects. Two of them were protruding into left branch of the pulmonary artery, three of them into the aorta, and two of them into both arteries. Only one device protruding to the left branch had a significant gradient.

Conclusions: 3D echocardiography is an useful complementary method for the evaluation of patients with patent ductus arteriosus before and after percutaneous closure. This method allows a more detailed characterization of the duct morphology and a better visualization of the closure device in-
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Right ventricular diastolic functions in pediatric patients with isolated pulmonary valve regurgitation
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Purpose: Diastolic dysfunction is an early sign of many different cardiac disorders before the clinical symptoms appear. This study was planned to evaluate right ventricular diastolic functions in patients with isolated pulmonary valve regurgitation.

Methods: The right ventricular diastolic functions of 13 patients aged between 5 to 16 years (mean 10.6 ± 3.47 years) (3 female, 10 male patients) with asymptomatic isolated pulmonary valve regurgitation more than or equal to 1.5 m/sec (Group I) and 27 healthy children aged between 6 to 19 years (mean 12.4 ± 4.06 years) (15 female, 12 male) (Group II) were evaluated echocardiographically. Data were analyzed by using SPSS for windows 10. Data are reported as percentages, mean value ± standard deviation. Mann-Whitney U test was used to assess differences of means between groups. The correlations between data were determined by using the Spearman correlation analysis.

Results: There was statistically a significant difference in peak early diastolic flow velocity (E) between group I and II. There was no statistically significant difference in peak late diastolic flow velocity (A) between groups. The E/A ratio was significantly decreased in group I when compared with group II. Isovolumic relaxation time (IVRT) was prolonged in group I when compared with group II but it was not statistically significantly different between groups. When compared between groups; in group I the E velocity time integral (VTI_E) was decreased, A velocity time integral was (VTI_A) was unchanged and VTI E/A was decreased. There was no significant correlation between pulmonary valve regurgitation flow rate and right ventricular diastolic function parameters.

Conclusions: This study showed that a deterioration occurs in right ventricular diastolic functions in isolated pulmonary valve regurgitation that generally accepted as a benign condition. Therefore we believe that diastolic functions of right ventricle can be a valuable laboratory parameter to follow up patients with isolated pulmonary valve regurgitation for diagnosis and treatment of incoming arrhythmias and cardiac failure. Further studies with large subject groups are needed.

3-D ECHO

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Real time 3D echo allows improved decision making for either catheter intervention or surgery for secundum type ASD (ASD II)
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Background: Usually, the indication for either catheter intervention or surgery of ASD II has been based on transthoracic echo (TTE) or transesophageal echo (TEE). In children the former is less precise, the latter more often accepted as a benign condition. Therefore the aim was to see whether transthoracic real time 3D echo can provide equal diagnostic quality without being as “invasive” as TEE.

Methods: Findings of 2D echo (TTE and TEE) and 3D echo were compared in all 36 children who were hospitalised for closure of ASD within the last year, i.e. since introduction of 3D echo in this institution. Particular emphasis was placed on the morphology of the postero-inferior rim and thus on the subsequent decision for either surgical or interventional approach. The diagnostic findings were compared with the catheter findings and intraoperative findings, resp.

Results: Twenty-five defects were closed interventionally. Eleven were closed surgically, among them 3 had sinus venous type defects, 2 were too large for intervention and 6 did not have a sufficient rim.

Conclusion: Evaluations of 3D echo and TEE were in accordance in doubtful cases. This is also true for the evaluation of the postero-inferior rim. Therefore, we now use real time 3D echo for decision making and do no longer perform TEE to define the differential indication for surgical or interventional closure of ASD II.

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Hypoplastic left heart syndrome: the role of cardiac STIC in prenatal diagnosis
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Hypoplastic left heart syndrome (HLHS) is a complex congenital cardiovascular abnormality that is increasingly diagnosed in utero. Highly restrictive or intact atrial septum in the setting of this cardiac disease occurs in approximately 6% to 11% and it can be part of its etiology. Restrictive foramen ovale is also associated with poor short and medium-term outcomes. New technologies allow nowadays to improve the prenatal diagnosis and physiology in their details. We studied the anatomy of atrial septum in 20 normal fetuses in the second trimester of pregnancy (18-22 gestational week) with cardiac STIC and 3D 4D acquisition with a GE Volusion 730 Expert machine. With the same technique we studied the presence of restrictive or intact atrial septum in 5 cases of HLHS (17-23 gestational week). In all cases we were able to define the anatomy of atrial septum and in four cases we found a highly restrictive foramen ovale. The acquisition of cardiac STIC improved our ability to identify this peculiar anatomic characteristic of HLHS as such to establish more accurately an increased risk of survival of these fetuses. HLHS with restrictive foramen ovale is associated with significantly increased mortality.

3D 4D technique with cardiac STIC can improve our ability of studying atrial septum anatomy in fetuses with this cardiac anomaly affecting perinatal management decision as well as parental counseling.

CONGENITAL HEART DISEASE

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Prediction of isolated aortic coarctation in the foetus
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Objective: Prenatal diagnosis of isolated coarctation of the aorta (CoA) is difficult. Fetal diagnosis depends on recognizing disproportion on four chamber view in mid-trimester and arch hypoplasia. The latter is subjective and the former is a normal finding later in pregnancy and the combination generates a significant proportion of false positive diagnoses. From morphological data, the diameter of the aortic isthmus immediately proximal to insertion of the arterial duct is the optimal site for consistent and accurate measurement by ultrasound. We test the utility of our reference ranges and Z scores for the normal fetal aortic arch isthmus retrospectively in archived data from cases of suspected coarctation.

Methods: Z scores for diameter of the isthmus were created using natural logs (ln) relating the aortic isthmus to femoral length in a prospective cross-sectional study of 243 fetuses without congenital heart disease. Data was stored digitally and measured offline. Measurements were repeated 3 times by a single investigator and averaged. A second investigator measured 50 cases at random. Bland-Altman analysis was used to assess interobserver reproducibility. Archived digital data of fetuses with suspected CoA was examined by a single observer, blind to the outcome. Z scores for the isthmus were compared with normal charts and its predictive nature assessed.

Results: The isthmal Z scores were created for fetuses between 15 and 40 weeks from 225/243 (93%) scans that were of sufficient quality. Inter-observer mean difference was -0.04 mm (95% confidence interval -0.8, 0.71). Z scores of isthmal measurements in fetuses with suspected CoA were created. All measurements resulted in negative Z scores (range -1.5 to -4.5) but there was poor correlation between the lowest Z scores and need for surgery after delivery and no clear cut-off value at any gestational age.

Conclusions: Isthmal Z scores appear unable to refine the antenatal diagnosis of isolated CoA in those suspected of the malformation based on visual impression of four chamber disproportion and arch hypoplasia.

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Spectrum of associated Congenital Heart Disease (CHD) in 35 pediatric patients with Anomalous Left Coronary Artery from Pulmonary Artery (ALCAPA)
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Introduction: (ALCAPA) in infants and children can be isolated or associated with CHD. Complete diagnosis of this malformation is essential for myocardial function recovery and patient outcome of this operable/treatable anomaly.

Objective: To assess the spectrum of associated (CHD) in pediatric patients with (ALCAPA).

Material and methods: Retrospective evaluation of associated CHD lesions diagnosed by echocardiography in all pediatric patients diagnosed with ALCAPA at a tertiary cardiac care center.

Results: 35 pediatric patients were diagnosed to have ALCAPA during the period January 1985 - May 2006. 8 Patients (23%) had additional associated CHD lesions as summarized in (Table 1).
Conclusions: 1. Significant number of Pediatric patients with ALCAPA has associated CHD. 2. Diagnosis of ALCAPA when associated with CHD is usually delayed. CHD distract cardiologists from diagnosing ALCAPA inspite of early CHD presentation and validity of echocardiography. 3. Utilization of detailed high quality echocardiography imaging improves the outcome by accurately and completely diagnosing coexistence of ALCAPA and CHD without delay. 

Results: HRV parameters in study group and control group are presented in table 1. LVM in Study group was significantly higher (p<0.05) than in Control group, the mean values of LVM in Study group was 92.58±28.64 g/m² and 68.92±16.42 g/m². Mean value of PG in children with SA was 56.65 mm Hg (from 25 to 130 mm Hg): Strong correlation between PG and LVM (r=0.56) was found. The values of r coefficient between LVM and HRV parameters varied from 0.1 to 0.4 and between PG and HRV parameters from 0.17 to 0.35. Arrhythmia was diagnosed in 12 children with SA: single ventricular ectopic beats in 11 patients and ventricular run in 1 child. 

Conclusion: 1. Decreased values of HRV parameters in children with SA suggest increased activity of sympathetic system which could lead to arrhythmia. 2. Increased left ventricular mass and transvalvular gradient poorly correlate with heart rate variability in children with congenital aortic valve stenosis. 

Table 1. Characters of patients

<table>
<thead>
<tr>
<th>Patients</th>
<th>Age (months)</th>
<th>Sex</th>
<th>Associated CHD lesions</th>
<th>ALCAPA diagnosis delay</th>
<th>Other Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>0.04 M</td>
<td></td>
<td>Patent Ductus Antenotous (PDA)</td>
<td>No</td>
<td>Prematurity</td>
</tr>
<tr>
<td>#2</td>
<td>1 M</td>
<td></td>
<td>PDA</td>
<td>No Prematurity/</td>
<td>Warding</td>
</tr>
<tr>
<td>#3</td>
<td>6 F</td>
<td></td>
<td>Contratiotomy/ scimitar syndrome</td>
<td>Yes</td>
<td>—</td>
</tr>
<tr>
<td>#4</td>
<td>8 M</td>
<td></td>
<td>Tetralogy of Fallot</td>
<td>Yes</td>
<td>—</td>
</tr>
<tr>
<td>#5</td>
<td>12 F</td>
<td></td>
<td>Partial anomalous venous drainage</td>
<td>Yes</td>
<td>—</td>
</tr>
<tr>
<td>#6</td>
<td>24 M</td>
<td></td>
<td>Ventricular (VSD)</td>
<td>Yes</td>
<td>—</td>
</tr>
<tr>
<td>#7</td>
<td>30 F</td>
<td></td>
<td>Double outlet right ventricle/PDA</td>
<td>Yes</td>
<td>—</td>
</tr>
<tr>
<td>#8</td>
<td>36 F</td>
<td></td>
<td>VSD</td>
<td>Yes</td>
<td>—</td>
</tr>
</tbody>
</table>

892 
Echocardiographic follow-up in congenital valvular aortic stenosis during childhood
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Introduction: In the present era patients with congenital valvular aortic stenosis are diagnosed and are being followed primarily by echocardiography. Heart catheterization is usually reserved for intervention by balloon valvuloplasty. Optimal timing to intervene remains, however, unclear. Since the rate of progression of aortic stenosis as assessed by echocardiography, and possible risk factors are largely unknown, we performed a retrospective review of our patients with congenital aortic valvular stenosis. 

Methods: Retrospective review of all echocardiograms and clinical variables of patients with isolated congenital valvular aortic stenosis were obtained. Echocardiograms consisted of left ventricular mass and peak aortic systolic flow. Progression of the peak systolic aortic flow over time was established. Events were defined as intervention (surgical or balloon valvuloplasty) or death. Event-free survival and overall survival were calculated by the Kaplan- Meier method. Risk factors for intervention or death were determined by means of the logrank tests. 

Results: The population consisted of 245 patients: 30 neonates (<1 month of age), 56 infants (<1 year of age) and 159 patients with an age above 1 year. Severe stenosis (>4 m/sec) was present in 42 patients (17%), moderate stenosis (3-4 m/sec) in 56 patients (23%), and mild stenosis (<3 m/sec) in 147 (60%). Interventions were performed in 73 patients (30%). The intervention-free survival was significantly longer in the older patients and those with only mild stenosis. After the first intervention 50% of the patients needed an intervention within 10 years of follow-up. Five-year overall survival was significantly influenced by age at diagnosis. Neonates had a 27% mortality, 1.5% mortality until 1 year of age and 0.4 mortality beyond the neonatal age. Mortality was significantly reduced if reintervention was performed within 10 years of follow-up. 

Conclusion: 1. Decreased values of HRV parameters in children with SA are significantly associated with aortic valve stenosis. 

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Effect of endovascular stenting of aortic coarctation on biventricular function in adults
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Objective: We sought to investigate the effect of endovascular stenting of aortic coarctation on biventricular function. 

Background: Limited data is available regarding biventricular function in adults receiving endovascular stenting of aortic coarctation.

Methods: We prospeictively studied 21 patients (age 30+10 years) before and 14+2 months after coarctation stenting from year 2003-2005. Measurements of biventricular function and blood pressures were made. The post-stenting results were compared with pre-stenting values (group 1), with 22 age and sex- matched post-surgical repair patients (group 2) and 30 normal controls (group 3). 

Results: The peak systolic gradient across coarctation site fell from 55±15 mm Hg to 18±8 mm Hg after stenting (p<0.001). LV mass decreased (257.6±117.8 g to 212.2±70.9 g; p<0.05), LV long axis function improved (LV lateral and septal systolic velocities: LSm, 6.5±1.4 cm/s to 7.9±1.7 cm/s; SSm, 5.8±2.1 cm/s to 7.3±1.6 cm/s; TCI early septal diastolic velocities: SEM 6.7±1.5 cm/s to 7.8±1.9 cm/s; septal E/A ratio: 4.8±5.3 to 11.8±3.9; p<0.05 for all) and blood pressure control, regression of LV mass and improvement in LV long axis function that may provide insight into long-term outcome of the stented patients. We support aortic stenting in anatomically suitable defects given additional potential benefit on RV function preservation. The clinical significance of subclinical myocardial dysfunction in patients with stented or repaired coarctation warrants further studies. 

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Restrictive right ventricular physiology complicating pulmonary vascular stenosis
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Objective: To assess diastolic restrictive right ventricular (RV) physiology (antegrade pulmonary artery flow in late diastole) in patients with moderate to severe isolated pulmonary valvular stenosis (PS). 

Background: The clinical relevance of restrictive RV physiology in PS patients remains understated.
Methods: 38 consecutive patients (age 37 ± 10 years) with moderate to severe isolated PS referred to Royal Brompton Hospital from year 2002-2005 were retrospectively studied. Presence of symptoms and measurements of RV long axis function by M-mode and spectral PW tissue Doppler imaging (TDI) were recorded. Restrictive RV physiology was assessed by CW Doppler echocardiography.

Results: 18 patients (47%) had restrictive RV physiology. These patients had more severe pulmonary stenosis (68 ± 13 mm Hg vs 50 ± 11 mm Hg, p < 0.001), were more symptomatic (72% vs 32%, p = 0.026), and had poorer TDI RV long axis systolic and diastolic function (Sm 7.7 ± 2.2 vs 10.1 ± 2.6 cm/s, p < 0.001; Em 7.1 ± 2.0 vs 8.1 ± 2.6 cm/s, p = 0.04) compared to other PS patients without restrictive RV physiology. No significant difference in conventional RV diastolic measurements (E, A, E/A ratio, iVRT and DT) or RV myocardial performance indices was found between 2 groups.

Conclusions: Development of symptoms and functional impairment were more evident in patients with restrictive RV physiology complicating pulmonary stenosis. The development of restrictive RV physiology may guide clinical decision in patients with moderate degree of pulmonary stenosis and equivocal symptoms.

896 Is device closure of secundum atrial septal defect safe and effective in comparison to surgery?

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Transcatheter closure of secundum atrial septal defect [ASD] using Amplatzer occluder is widely accepted treatment method with extremely rare complications [1,2]. We evaluated the advantages, safety and complication incidence we evaluated in prospective/retrospective manner a study group of 272 adult patients (pts) with ASD closed transvenously by Amplatzer occluder [AO] [138pts] and surgically [SURG] [134pts].

We compared pre-, early and late postprocedural echocardiography, complication incidence, cardiopulmonary performance (ergospirometry, pulmonary function [PF]), duration of hospital stay and disability in both groups.

Results were analyzed: 1. Comparable ECHO results of closure by both methods, higher incidence (p < 0.01) of minor mitral regurgitation in AO group after closure. 2. High significant lower incidence of early minor complications (p < 0.001) in the AO group, but comparable incidence of late and major complications: AO - 1 hemopericardium due to device erosion of atrial wall requiring operation, 1 mitral valve regurgitation due to interference with oversized device, SURG: 2 redefects (leak of suture) requiring 1 resurgery, 1 closure by Amplatzer occluder. 3. Immediately after closure significant improvement of functional status, earlier improvement (3 vs 6 months) of ergospirometric parameters, lower duration of hospital stay (p < 0.005) in the AO group. 4. Substantial decrease (p < 0.001) of PF parameters in the SURG group up to 6 month postoperatively, in the AO group PF unchanged. In conclusion, despite the ASD closure by Amplatzer occluder is considered in the vast majority of cases as a safe method, severe complications like hemo-pericardium or mitral valve sequelae can occur. Attention should be paid to proper device selection and to oversizing of device like in our AO group. Both methods are equally effective, but the transcatheter closure is advantageous in: a) lower early morbidity b) immediate functional improvement, earlier upturn of cardiopulmonary performance c) less time spent in the hospital, earlier work ability and better cosmetic effect.

897 Coronary anomaly: potential problem during ASD closure

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Case report: A 39-year-old man presented with a history of gradually progressing exertional dyspnea. He had 2/6 systolic murmur in the second left intercostal space. ECG revealed signs of right ventricle hypertrophy. Transthoracic echocardiography showed ostium secundum atrial septal defect (ASD) with pulmonic to systemic flow ratio of 2.5. The patient was referred for transesophageal echocardiography (TEE) prior to planned closure of the ASD with an Amplatzer occluder. TEE confirmed the presence of ASD II. The size of the defect assessed with 3D reconstruction was 2×3 cm. Although there was no aortic rim of the septum, the anatomy of interseptal septum was considered suitable for Amplatzer implantation. However, atypical linear echo-free tubular space was noted by aortic root next to the ASD- most probably compressing RCA causing myocardial ischemia or even infarction. Such complication was previously described in the literature. The patient was referred for surgical ASD closure.

Conclusions: 1. Physicians performing TEE evaluation in ASD patients should be able to detect this very rare but dangerous coronary anomaly. 2. MSCT can clearly visualize and confirm this finding.

898 Left ventricular-to-right atrial shunts in adults with congenital heart disease

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Background: Left ventricular-to-right atrial (LV-RA) communications are considered to be rare congenital heart defects (CHD) that share the pathophysiology of right and left ventricular volume overload with atrial septal defect (ASD) and ventricular septal defect (VSD), respectively. Color Doppler twodimensional echocardiography (2D) is essential in the diagnosis of the defect.

Methods: Among 2,668 adults with CHD in whom CD had been performed we identified those with LV-RA shunt in order to analyse prevalence, underlying defects, mechanisms of shunt, hemodynamic derangement and clinical profile.

Results: LV-RA shunt was detected in 30 patients (1.1%). Mean age was 29 ± 10 years (range 17-54 years; 15 females). Main diagnosis was VSD in 14; partial atrioventricular septal defect in 11; tetralogy of Falot in 4; and bicuspid aortic valve in 1. Previous surgical repair had been performed in 11 patients and the mechanism of LV-RA shunts in this group was partial dehiscence of ventricular path in 9 cases, and postoperative complication of atrioventricular valve replacement in 2. In the 19 non operated patients, mechanism of LV-RA shunt were: antral valve regurgitation into RA that took place through an ostium primum defect with a left side deviation of the atrial septum (partial double outlet RA) in 10 cases; perimembranous VSD partially closed by aneurysmal transformation of the bicuspid leaflets in 7; and perimembranous VSD with Ebstein anomaly in 2. Congenital defects in the atroventricular portion of membranous septum were not found. Pulmonary pressure was normal in all patients except two, but 10 out of 19 non operated patients (53%) required surgery during adult life for a significant shunt with right and left ventricular enlargement.

Conclusions: Left ventricular-to-right atrial shunts are not uncommon in adults with CHD. The mechanisms can be diverse in both unoperated and previously repaired patients. Despite no development of pulmonary hypertension, surgical repair during adult life is frequently required due to the magnitude of the shunt.

Early diastolic dysfunction in congenital aortic valve stenosis

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Introduction: Severe obstruction in patients with congenital valvular aortic stenosis may lead to complaints and ventricular dysfunction. Systolic as well as diastolic dysfunction have been described. It is not clear whether mild to moderate aortic stenosis already may induce changes in left ventricular function. We therefore compared a group of 37 patients with mild to moderate aortic stenosis and no complaints with a group of normal controls.

Methods: The study population consisted of 37 patients with congenital valvular aortic stenosis who were followed on an outpatient basis (mean gradient 35 mm Hg). Twenty-two patients had a peak systolic flow of 2-3 m/sec (group A) and 15 had a peak systolic flow of 3-4 m/sec. Patients with additional cardiac defects or those who had more than mild aortic insufficiency were excluded. Patients were compared with 100 age-matched normal controls. The echocardiographic data were obtained in a standard manner by a Philips Sonos 5500 (Philips Medical Systems, Best, The Netherlands). Echocardiography and obtained M-mode measurement of left ventricular wall and septum, and mitral inflow parameters.

Results: Patients and controls were age matched (10.6 ± 2.7 versus 10.5 ± 1.4 years) and had similar body weight (42.0 ± 15.5 versus 38.8 ± 10.0 kg) and length (148.7 ± 16.3 versus 147.5 ± 10.5 cm). No differences were found for left ventricular-end systolic and end-diastolic dimensions and shortening fraction. Thickness of both interventricular septum (8.1 ± 1.8 versus 8.5 ± 1.3 mm; p = 0.001) and posterior wall (7.2 ± 1.8 versus 5.8 ± 1.3 mm; p = 0.001) as well as left ventricular mass (79.4 ± 20.0 versus 66.5 ± 13.0 g/m2; p = 0.001) were increased in the patients. These variables were significantly larger in group with severe aortic valve disease compared to group with mild aortic valve disease. However, there were no differences in myocardial performance indices or New York Heart Association functional class. The analysis revealed: 1. Comparable ECHO results of closure by both methods, higher incidence (p < 0.01) of minor mitral regurgitation in AO group as compared to SURG group. Mitral deceleration time was increased in the patients. These variables were significantly larger in group with severe aortic valve disease compared to group with mild aortic valve disease. However, there were no differences in myocardial performance indices or New York Heart Association functional class.

Conclusions: Left ventricular end-diastolic volume index and end-systolic volume index were larger in young persons with severe isolated PS referred to our (group B) patients as compared to group A. Mitral deceleration time was increased in the patients. These variables were significantly larger in group with severe aortic valve disease compared to group with mild aortic valve disease. However, there were no differences in myocardial performance indices or New York Heart Association functional class.

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HEART FAILURE – RESYNCHRONISATION

902 Normal values for ventricular synchrony measured by tissue Doppler imaging and tissue Doppler synchronization imaging in structurally normal hearts

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Background: Resynchronization therapy has been an attractive option for the treatment of heart failure (HF) patients, and LV ejection fraction (LVEF) is the most important factor in patient selection. The mechanism of LV remodelling in bundle branch block (BBB) is still a topic of discussion. LBBB frequently found in patients with left bundle branch block (LBBB). This study investigates mechanical consequences of conduction delays by echocardiographic Strain Imaging as its potential mechanism.

Methods: In 19 patients with non-ischaemic LBBB (QRS 170±21 ms), 15 patients with right bundle branch block (RBBB) (QRS 156±16 ms) and 15 healthy volunteers (NORM) (QRS 91±6 ms) we acquired longitudinal tissue Doppler data of three consecutive heart cycles from an apical four- and three-chamber view. Digital data were post-processed off-line by custom made research software. Timing of valve opening and closure was assessed from spectral Doppler traces. Onset of left ventricular segmental shortening (OS) was measured relative to mitral valve closure (MVC). Segmental strain during ejection time (SET) served as a marker of regional function. Segments were divided into three groups; basal, mid-segmental, and apical segments. We compared the two methods regarding to diagnose PFO.

Results: The group of 17 patients (13 female, mean age 35.6, range 19-61, 4 male, mean age 43.7, range 35-57) who underwent surgery for PAVC between 1989 and 2005 was examined. 11 patients underwent mitral valve repair. Left ventricular dimensions and systolic function were assessed from parasternal and apical 2D views. The severity of MR was assessed qualitatively with a 4 plus scale and quantitatively with the measurements of the (PISA), the effective regurgitant orifice (ERO) and the mitral regurgitant volume (MR vol).

Results: MR was classified quantitatively as mild (<0.2) in 9 patients, moderate (0.2-0.4) in 5 and severe (>0.4) in 3 patients. Using CD flow mapping in 4 plus scale the MR was mild (<0) in 3 patients, mild to moderate (+/−) in 12 and severe (++++) in 2 cases. Qualitative and quantitative method of assessment were concordant in 3 patients with mild MR, in 5 patients moderate MR, and in 2 patients with severe MR. Qualitative assessment tended to underestimate the regurgitation severity in 1 patients and overestimate the regurgitation severity in 5 patients.

Conclusion: Qualitative estimation of mitral regurgitation in patients with PAVC frequently overestimates its severity, compared to quantitative assessment, which should be used routinely in this subgroup of patients to evaluate the outcome of surgery.
segments and occurred 68 ms after MVC in lateral and posterior segments (p < 0.05 vs NORM and LBBB). In NORM, SET ranged from -10% to -17%, in RBBB, from -12% to -17%, respectively. In LBBB, however, both septal and anteroseptal SET were markedly reduced (both -6%, both p < 0.01 vs NORM and RBBB) while lateral and posterior SET showed no significant difference (-9% and -11%, resp., both n.s.).

Conclusion: Despite a significant interventricular delay, intra-LV segmental onset of shortening and ejection time strain are distributed similarly in RBBB and NORM. Left-sided pre-excitation in LBBB, however, shifts onset of shortening in septal and anteroseptal segments towards the pre-ejection period, reducing their load and contribution to global ejection. Ejection is then mainly due to shortening of lateral and posterior segments. Our data suggest, that asymmetric LV remodelling in LBBB is caused by regional loading inhomogeneity.

LV FUNCTION – OTHER

904

Interventricular and intraventricular synchrony in the left bundle branch block. Relation with baseline cardiomyopathy

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Purpose: Evaluate the interventricular and left intraventricular synchrony in left bundle branch block (LBBB) and its relation with the baseline cardiomyopathy.

Material and methods: 58 patients (35 women) with a mean age of 72 years, diagnosed as isolated LBBB were included. Echocardiography was performed to all patients. The interventricular asynchrony was considered when the difference between the aortic and pulmonary pre-ejection time interval was >40 ms, by CW-Doppler. The LV synchrony was studied using two methods. First, the difference, in M-mode, between the systolic peaks of the septum and posterior wall, in short-axis. A difference >130 ms was considered asynchrony; second, the difference between the shortest and longest time interval Q-tele-systolic movement of the four basal walls, using Tissue-Doppler. The factors significantly associated (p < 0.05) with left intraventricular asynchrony; second, the difference between the shortest and longest time interval Q-tele-systolic movement of the four basal walls, using Tissue-Doppler, and posterior wall, in short-axis. A difference >130 ms was considered asynchrony.

Results: The mean QRS width was 148 ms. The mean LVEF was 53%, and the EDLV diameter was 58 mm. 70% of the patients showed interventricular asynchrony, 24% left intraventricular asynchrony by Tissue-Doppler, and 30% by M-mode. The factors significantly associated (p < 0.05) with left intraventricular asynchrony were the QRS width, the EDLV diameter and LVEF. In contrast, no independent predictive factors were found for interventricular asynchrony.

Conclusions: The presence of LBBB is not indicative of asynchrony. The left intraventricular asynchrony was significantly related with wider QRS, severe dilated LV or systolic dysfunction. On the contrary, patients with normal LV showed more frequently synchrony despite LBBB.

Table 1. Factors associated with asynchrony

<table>
<thead>
<tr>
<th>Tissue-Doppler Asynchrony</th>
<th>YES</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean QRS (msec)</td>
<td>143.9</td>
<td>163.8</td>
</tr>
<tr>
<td>Mean EDLV (mm)</td>
<td>55.6</td>
<td>67.7</td>
</tr>
<tr>
<td>Mean LVEF (%)</td>
<td>58.7</td>
<td>38.2</td>
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<tr>
<td>M-Mode Asynchrony</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Mean QRS (msec)</td>
<td>144.2</td>
<td>157.25</td>
</tr>
<tr>
<td>Mean EDLV (mm)</td>
<td>55.2</td>
<td>65.7</td>
</tr>
<tr>
<td>Mean LVEF (%)</td>
<td>59.9</td>
<td>40.74</td>
</tr>
</tbody>
</table>

EDLV = End-diastolic left ventricular diameter. LVEF = left ventricular ejection fraction

MYOCARDIAL VELOCITY IMAGING (DMI) – OTHER

905

Early relaxation E Wave by DTI and high risk of CHF in LBBB

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Background: Left bundle branch block (LBBB) is characterized by a significant reduction of the segmental and global left ventricular (LV) function and, in such cases, LV failure (LVF) is a frequent clinical manifestation in the course of the natural evolution of this entity.

Objective: Our proposal was to study LV segmental function by pulsed Doppler tissue imaging (DTI) in a population of 44 patients (pts), 54.5% (24/44) male gender, mean age 59 ± 10 yrs, (37-71 yrs), with LBBB pattern on the ECG, of non ischemic etiology, without mitral regurgitation ≥ grade II, without significant regional wall motion abnormalities, and to establish its value in the identification of increased risk for LVF. Material and methods: In each case by conventional MM and 2D-echocardiography, we calculated left atrial diameter (LA-mm), LV end-systolic (ESD-mm) and enddiastolic (EDD-mm)

diameters, LV end-systolic (ESV-mm) and enddiastolic (DV-mm) volumes, LV % fractional shortening (FS-%), LV % ejection fraction (EF-%), LV global mass (LVM-g), LVM index (LVMi g/m²), and the LV segmental contractility index (SCI). By pulsed DTI, obtained at the level of mitral vavular ring in 2 orthogonal planes, we calculated the maximal (Vmax-cm/s) and mean (Vmean-cm/sec) velocities of the systolic contraction wave (v’), early (e’) and late (a’) diastolic relaxation waves, and the correspondent diastolic e/a’ velocity ratio. According to the occurrence of major clinical events and in-hospital admittance for LVF during follow-up, our population was divided in groups LVF: (n=24 pts; 54.5%) and LVF + (n=20 pts; 45.4%).

Results: No significant differences were found between these groups, concerning the majority of the analysed parameters, including LVM and LVEF. Significant differences were found between these groups for EDV (p=0.03), Vmax DTI e’ wave (11±4 vs 6.3 cm/s, p<0.01) and for the diastolic e/a’ ratio (0.5±0.2 vs 0.8±0.3; p<0.01).

Conclusions: Pulsed DTI study can give important clinical information in cases of LBBB. Our data showed that the reduction of the active LV myocardial e’ wave by pulsed DTI was the fundamental factor responsible for LVF, implicating LV segmental diastolic dysfunction as the etiopathogenic factor in this particular group of LBBB patients.

3-D ECHO

906

Serial evaluation of global left ventricular function and mechanical dyssynchrony in patients with an isolated left bundle branch block using real-time 3D echocardiography

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Introduction: Experimental studies in animals showed that formation of a left bundle branch block (LBBB) acutely causes irreversible global left ventricular (LV) dysfunction and subsequently increase in LV volumes. In humans, a LBBB is associated with increased morbidity and mortality, however, there is no serial information of global LV dysfunction and mechanical dyssynchrony in patients with an isolated LBBB. Real-time 3D echocardiography (RT3DE) provides accurate information about global LV function and mechanical dyssynchrony.

Methods: RT3DE (Sonos 7500, Philips Medical Systems) was performed in 14 patients with a LBBB, without signs and symptoms of heart failure and/or underlying cardiac disease. LV ejection fraction (EF), LV end-diastolic and end-systolic volumes were measured. Furthermore, LV mechanical dyssynchrony was evaluated with specially designed software (4D LV-Analysis CRT 1.2, TomTec Imaging Systems) by the systolic dyssynchrony index (SDI): standard deviation of the mean time to end-systole (after mitral valve closure) of 12 separate segments of the LV corrected for RR-interval; and the maximum time difference of end-systole between latest and earliest contracting LV segment (LE).

Results: We studied 14 patients (5 male, age 69±7 years) at baseline and after 18±4 months. All patients remained free of signs and symptoms of heart failure. See table 1.

Conclusion: RT3DE evaluation of patients with an isolated LBBB showed an increase in LV mechanical dyssynchrony. QRS-duration and global LV function remained unchanged during serial evaluation. Therefore, we conclude that a LBBB is a slowly progressive disorder that increases LV mechanical dyssynchrony prior to LV dilatation and global LV dysfunction.

Table 1. Baseline (n=14) vs Follow-up (n=14)

<table>
<thead>
<tr>
<th>QRS-duration, msec</th>
<th>144±11</th>
<th>148±11</th>
<th>0.079</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF, %</td>
<td>42±9</td>
<td>42±13</td>
<td>0.900</td>
</tr>
<tr>
<td>EDV, ml</td>
<td>149±48</td>
<td>142±55</td>
<td>0.206</td>
</tr>
<tr>
<td>ESV, ml</td>
<td>90±40</td>
<td>88±51</td>
<td>0.643</td>
</tr>
<tr>
<td>SDI, %</td>
<td>7±6.4</td>
<td>9±3.8</td>
<td>0.007*</td>
</tr>
<tr>
<td>LE, %</td>
<td>23±4±12.8</td>
<td>27±10.6</td>
<td>0.074</td>
</tr>
</tbody>
</table>

*Statistically significant

MYOCARDIAL VELOCITY IMAGING (DMI) – OTHER

907

Left bundle branch block versus continuous right ventricular apex pacing: comparison of diastolic and systolic synchronicity

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Background: Left bundle branch block (LBBB) and continuous right ventricular (RVP) increase the risk for heart failure and cardiac death, especially in patients (pts) with already compromised function.

Aim: To quantify systolic and diastolic asynchrony of LV in pts with LBBB and in pts with chronic continuous RV pacing and to compare indexes of systolic and diastolic function and synchronicity of left ventricle between pts with LBBB and pts with chronic RVP.

Eur J Echocardiography Abstracts Supplement, December 2006
Methods: All pts in sinus rhythm with LBBB and all pts, in any atrial rhythm presenting with RVP, referred for echocardiographic examination, were consecutively enrolled. Pts were divided in two groups according to the presence of RVP or LBBB and underwent a standard echocardiographic examination including the evaluation of ventricular asynchrony by TDI. To assess LV systolic and diastolic synchrony, standard deviation of time to peak systolic velocity (TS) and of time to peak early diastolic velocity (TE) from the 12 LV myocardial segments in each patient were calculated, and the values of 32.6 ms and 30.1 ms used as cut-off for systolic and diastolic asynchrony respectively.

Results: Sixty-two pts were enrolled (31 LBBB/31 RVP). Seven pts (22%) with continuous RVP had permanent atrial fibrillation. The duration of RVP was in all pts longer than 1 year. Pts with LBBB had significantly higher prevalence of dilated cardiomyopathy (p<0.05). There was no significant difference in the demographic characteristics of the two groups in terms of sex, age and drug’s prescription.

Pts with continuous RVP had significantly longer QRS duration (184±34 vs 151±24 ms, p<0.001). There was no significant difference in the prevalence of left intraventricular systolic and diastolic asynchrony. The mean time intervals TS and TE of the 12 LV segments, were statistically greater in the RVP group than in LBBB one (256±53 vs 229±44 ms and 622±51 vs 590±50 ms respectively, p<0.05). RVP pts showed a consistently shorter LV filling time (413±136 vs 510±168 ms, p<0.03) and higher LV EF (41±16 vs 32±16%, p<0.05). Mean heart rate during examination was not statistically different between groups. RVP pts, divided according to QRS width (<180 ms vs >180 ms), showed different degree of diastolic asynchrony, being more asynchronous when QRS is wider.

Conclusions: Pts with RVP and pts with LBBB show the same extent of mechanical asynchrony. RVP pts have greater impairment of diastolic function as expressed by reduced filling time, and show longer electromechanical activation times. This could be an additive mechanism for the development of heart failure.

Elderly patients, despite preserved left ventricular (LV) systolic function, may have LV diastolic dysfunction, which is associated with worse outcome. However, asynchronous ventricular (VV) pacing is often the preferred option in aged patients for atrioventricular (AV) block. The echocardiographic Tissue Doppler Imaging (TDI) and Color M-Mode (CMM) techniques, and the B-type natriuretic peptide (BNP) are valuable in the assessment of the LV systolic and diastolic function. We determined relationships between BNP responses and echocardiographic parameters of LV function following short-term VVI pacing in dual-chamber pacemaker recipients with normal LV systolic function.

Methods: We examined 58 clinically stable patients (mean age 79±8 years) without organic heart disease and normal LV systolic function. Baseline TDI and CMM data, and BNP (median [IQR]) levels during AV pacing in two patient-groups with underlying permanent heart rhythm either intrinsic normal ventricular activation or permanent atrial synchronous ventricular pacing were obtained and compared with those echocardiographic data during VV pacing and BNP responses following a 30-minute continuous VV pacing period.

Results: VV pacing significantly decreased the echocardiographic systolic parameters in both patient groups, whereby patients with intrinsic ventricular activation, as compared to patients with ventricular pacing, showed higher BNP levels in atrial fraction (9.6±5% vs 7.5±4%, respectively; p<0.05) and stroke volume (24.8±10% vs 19±4±10%, respectively; p<0.01). Among the indices of diastolic function, there were in both patient groups significant reductions in E/A (8.9±5% vs 12.1±10%, respectively; p<0.05) and stroke volume (24.8±1% vs 19±4±10%, respectively; p<0.01). Among the indices of diastolic function, there were in both patient groups significant reductions in E/A (8.9±5% vs 12.1±10%, respectively; p<0.05) and stroke volume (24.8±1% vs 19±4±10%, respectively; p<0.01). Among the indices of diastolic function, there were in both patient groups significant reductions in E/A (8.9±5% vs 12.1±10%, respectively; p<0.05) and stroke volume (24.8±1% vs 19±4±10%, respectively; p<0.01).

Conclusions: Short-term VVI pacing in elderly patients for AV block seems to worsen LV systolic and diastolic function and to induce significant BNP increases. Optimal pacemaker selection in elderly patients may include implantation assessment based on signs of LV diastolic dysfunction.

### LV FUNCTION – OTHER

#### 910

Acute effects of VVI pacing on left ventricular function in elderly patients with normal left ventricular systolic function.

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Background: Elderly patients, despite preserved left ventricular (LV) systolic function, may have LV diastolic dysfunction, which is associated with worse outcome. However, asynchronous ventricular (VV) pacing is often the preferred option in aged patients for atrioventricular (AV) block. The echocardiographic Tissue Doppler Imaging (TDI) and Color M-Mode (CMM) techniques, and the B-type natriuretic peptide (BNP) are valuable in the assessment of the LV systolic and diastolic function. We determined relationships between BNP responses and echocardiographic parameters of LV function following short-term VVI pacing in dual-chamber pacemaker recipients with normal LV systolic function.

Methods: We examined 58 clinically stable patients (mean age 79±8 years) without organic heart disease and normal LV systolic function. Baseline TDI and CMM data, and BNP (median [IQR]) levels during AV pacing in two patient-groups with underlying permanent heart rhythm either intrinsic normal ventricular activation or permanent atrial synchronous ventricular pacing were obtained and compared with those echocardiographic data during VV pacing and BNP responses following a 30-minute continuous VV pacing period.

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Conclusions: Short-term VVI pacing in elderly patients for AV block seems to worsen LV systolic and diastolic function and to induce significant BNP increases. Optimal pacemaker selection in elderly patients may include implantation assessment based on signs of LV diastolic dysfunction.

### MYOCARDIAL VELOCITY IMAGING (OMI) – LV FUNCTION

#### 911

Beneficial effect of the right ventricular outflow tract pacing on cardiac function and coronary circulation in comparison with the right ventricular apex pacing.

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Backgrounds: It is unclear that the right ventricular outflow tract pacing (RVOT) pacing might be more suitable for permanent pacing in patients than the right ventricular apex (RVA) pacing and the increase of coronary blood flow might be related to improvement of left ventricular (LV) dysfunction.

Objective: The purpose of this study was to investigate the efficacy of RVOT pacing on cardiac function and coronary circulation in comparison with that of RVA pacing.

Eur J Echocardiography Abstracts Supplement, December 2006
Methods: Twenty consecutive subjects underwent electro-physiological study due to arrhythmia were enrolled. The regional cardiac synchronicity assessed by Two-Dimensional Tissue Tracking (2DTT) machine (Eur-8500, HITACHI Medical Corporation), and the coronary flow in the left anterior descending artery (LAD) measured by a Doppler guide wire were compared between RVOT pacing and RVA pacing at 100 bpm.

Results: QR5 duration during RVOT pacing than RVA pacing (124±15 ms vs 162±15 ms, p<0.01) and there were no significant differences in aortic blood pressure between RVOT pacing and RVA pacing. Intraventricular contraction delay measured between septal and lateral wall assessed by 2DTT machine during RVOT pacing was shorter than that during RVA pacing (99±9 ms vs 142±11 ms, p<0.01). Averaged peak velocity (APV) of coronary flow during RVOT pacing was greater than that during RVA pacing in hyperemia (54.2±18 cm/sec vs 47.7±17 cm/sec, p<0.05) and rest (24±10 cm/sec vs 21±10 cm/sec, p<0.05), but there were no significant differences in coronary flow reserve between RVOT pacing and RVA pacing (2.5±0.8 vs 2.4±0.6). LV stroke volume assessed by echocardiography during RVOT pacing was greater than that during RVA pacing (42.9±7.3 ml vs 38.8±7.2 ml, p<0.05). Besides, microvascular resistance index (which was calculated as the blood pressure at hyperemia divided by the hyperemic APV) during RVOT pacing was lower than that during RVA pacing (2.0±0.8 vs 2.4±1.1, p<0.05).

Conclusions: RVOT pacing could improve dyssynchrony and coronary flow during RVOT pacing could be greater than that during RVA pacing. The increase of coronary blood flow might be related to the increase of LV output and the decrease of microvascular resistance by improvement of LV dyssynchrony.

HEART FAILURE – RESYNCHRONISATION

912 How many patients with long-term right ventricular apical pacing are eligible to upgrading to biventricular pacing?

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Deleterious effects of right ventricular apical (RVA) pacing favoured by abnormal LV activation sequence are reported. Biventricular pacing (BVP) may be a method to reverse these effects. The aim of the study was to evaluate how often the systolic dyssynchrony and indications to BVP are present in patients with permanent RVA pacing and to find out which baseline parameters suggest the need of upgrading to BVP system.

Methods: We screened 176 consecutive, RVA-paced patients admitted to our department for elective pacemaker replacement from June to September 2005 for eligibility for BVP (heart failure NYHA class III or IV despite optimal medical treatment, LVEF ≤ 35% and echo-evaluated systolic dyssynchrony). Fifty-five (34%) of them were pacemaker (PM) dependent, (age 43-88 yrs, first implantation 9.9±1.4 yrs ago, PM type: 30 VVI/VVI-R, 30 DDD/DDD-R, 1 VVIR). Of these, intra-LV dyssynchrony defined as the difference between left and right ventricular systolic function achieved through VP-70 is associated with over-22%. Of the patients only 14 (25%) had normal LV filling (overlap contraction-filling) was observed in 35 (54%) pts. Interventricular dyssynchrony defined as the difference between left and right pre-ejection intervals exceeding 40 ms was present in 40 (62%) pts. LVEF ≤ 35% combined with NYHA III or IV and dyssynchrony was present in 9 pts (14%). Clinical profile of these patients reveals intraventricular conduction disorders (7 pts), LVEF ≤ 50% (7 pts) and non-physiological mode of pacing (6 pts) at first implantation and chronic atrial fibrillation (7 pts) at replacement. Among 87 non-PM dependent patients 2 (3.3%) met the criteria for BVP.

Conclusion: Indications for upgrading to BVP at elective replacement were present in 14% of pts with long-term permanent RVA pacing and in only 2.3% non-PM-dependent pts.

LV FUNCTION – OTHER

913 Heart rate regularity through by permanent ventricular pacing in patients with chronic atrial fibrillation unfavorably affects the ventricular function compared to irregular intrinsic conduction

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Background: In atrial fibrillation (AF), the irregular ventricular response itself contributes to the unfavorable effects of the arrhythmia. One possible option to achieve rate regularization is by means of overdrive right ventricular pacing. However, any benefits may be countered by the adverse effects of the pacing-induced ventricular dyssynchrony.

Objective: We investigated the impact of rate regularization through permanent pacing on the net cardiac function in patients with chronic AF and normal left ventricular systolic function assigned to stable rate control pharmacologic strategy.

Methods: We examined 21 patients (mean age 73±9 years) with chronic AF and narrow QRS complexes, who were implanted with a conventional VVIR pacemaker for bradycardia support. Cardiac function was determined by conventional Doppler, tissue Doppler (TD) and color M-Mode (CMM) echocardiographic studies, and B-type natriuretic peptide (BNP) measurements. Baseline echocardiographic data and BNP [log mean 95% CI] levels were obtained during underlying AF (mean heart rate 58±5 beats/minute) with the pacemaker programmed to ventricular back-up pacing. After programming the pacemaker to continuous ventricular pacing at a rate of 70 beats/min (VP-70), ensuring >90% permanent ventricular pacing at rest, the baseline data were compared with corresponding measurements, acutely, after 2 hours, and in mid-term, following a minimum two-week pacing period.

Results: On average, percent ventricular pacing over the two-week VP-70 period was 74±8% (range, 65% to 89%). VP-70, compared to irregular AF, reduced cardiac index (p<0.05), increased isovolumetric relaxation time (p<0.05), and induced TD-derived decreases of peak systolic mitral velocity and diastolic right ventricular velocity (both p<0.05). The Doppler-derived E/A and E'/vP ratios indicative of left ventricular filling pressures did not change significantly. The BNP levels following mid-term VP-70 increased by 22% ([147 (102-210) pg/ml vs 179 (135-238) pg/ml, p=0.01].

Conclusions: Heart rate regularization in patients with AF and normal left ventricular systolic function achieved through VP-70 is associated with overall inferior echocardiographic features and higher BNP levels compared to those during irregular intrinsic conduction.

MYOCARDIAL VELOCITY IMAGING (DMI) – LV FUNCTION

914 Apical transversal motion display- A novel tool to assess ventricular asynchrony

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2University Erlangen, Medical Clinic II, Erlangen, Germany

Currently, left ventricular (LV) asynchrony is expressed as time-delay of regional velocities, independent of the remaining myocardial function. We hypothesize, that apical transversal motion (ATM) is an integrative parameter reflecting regional function. In this study we investigated this new parameter in different conduction delays.

Methods: We examined 59 persons, 11 patients with post-infarct LBBB, QRS 155±19 ms) and 20 patients with non-ischaemic left bundle branch block (LBBB, QRS 167±19 ms), 11 patients with right bundle branch block (RBBB, QRS 150±13 ms) and 16 healthy volunteers (NORM, QRS 98±9 ms). Colour tissue Doppler data of 3 heart cycles were acquired from an apical 2-, 3-, and 4-chamber view. An ATM trace was calculated from apical motion curves of the six LV walls and displayed in a polar coordinate system by custom made research software. Main direction and amplitude of the ATM trace was compared among the groups.

Results: Mean QRS width was not sign., different between BBB groups, but sign. higher than in NORM (p<0.01). Mean ATM was 1.7±0.7 mm in NORM, 1.3±0.4 mm in RBBB (ns), 2.6±1.7 in LBBB (ns) and 4.2±1.8 mm in LBBBn (p<0.001 vs NORM and RBBB, p<0.05 vs LBBB). ATM of BBB patients did not correlate with QRS width or ejection fraction. Patients with LBBBn were clearly identified by a typical ATM pattern. A cut-off of 3 mm motion amplitude separated LBBBn from all other groups with a sensitivity of 98% and specificity of 88% and resp.

Conclusion: Assessing LV asynchrony by ATM is feasible. ATM considers the amplitude of asynchrony in myocardial motion and, thus, reflects remaining function. ATM may therefore serve as a new parameter of LV asynchrony, e.g. in the context of resynchronization therapy. Further studies are needed to evaluate its clinical potential.
MYOCARDIAL VELOCITY IMAGING (DMI) – OTHER

915 The second regional systolic shortening found in LV lateral wall motion is due to ventricular interaction and should not be used to infer late contraction in this wall when studying LV dysynchrony.

M. Marcinik 1; A. Bijnens 1; A. Marcinik 1; A. Baltabaeva 1; C. Parisi 1; J. Mooring 1; J. Mont 1; B. Vidal 1; M. Sitges 1; V. Delgado 1; J. M. Tolosana 1; M. Azqueta 1; S. Rumolo 1; E. Celentano 1; C. Muto 1; G. Carreras 1; B. Tuccillo 1
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Variations in regional systolic velocity profiles (SVP) have been widely used to assess cardiac dysynchrony. However, regional longitudinal SVP have a non-uniform pattern in the septum (SEP) and anterior wall are similar being mono-phasic with an early systolic peak. In contrast, SVP in the anterior (ANT) and lateral (LAT) walls differ, being bi-phasic with two systolic peaks. Thus when assessing the timing of delayed contraction in the ANT and LAT walls it is important to know which each peak represents. Ventricular interaction could be responsible for the early deceleration of the first peak in ANT and LAT wall motion and could explain the bi-phasic systolic pattern. We postulated that early cessation of the first systolic motion and appearance of a second shortening motion in the LAT wall may be due either to a combination of cardiac twisting around the long axis of the heart and interaction with right ventricle (RV) contractility rather than local myocardial shortening. As regional strain rates (SR) but not velocities (VEL) reflect myocardial contractile function we investigated the relationship between regional peak systolic SR and SVP in the RV free wall, SEP and LAT wall.

Methods: In 23 normals (age 45.5±2.2) long axis regional SVP and SR were obtained from the basal segments of RV, SEP and LAT wall. Time to max decel- eration of the first peak was measured in the LAT and its relationship to RV peak SVP determined. In addition the time to peak VEL and SR in all walls was calculated.

Results: The timing of peak SVP in the RV corresponded to the end of deceleration of the first peak in the LAT SVP (0.199±0.03 vs 0.197±0.03 s, p=NS). There was a consistent and significant difference between the time to peak systolic VEL in LAT vs RV (0.130±0.02 vs 0.103±0.03 s, p<0.001) with the SEP peak systolic VEL in an intermediate position at 0.154±0.03 s (p:NS vs RV and LAT). Systolic SR in all walls had a single peak which occurred in early sys- tole with no significant difference between cardiac walls (0.100±0.02; 0.103±0.02; and 0.105±0.02 s in SEP, LAT and RV respectively). The sec- ond systolic peak in the LAT wall was not associated with any measurable deformation on the SR curve.

Conclusions: This study showed that the early cessation of the first peak systolic VEL and second VEL peak in the LV wall is due to motion induced by RV contraction and does not represent LV contractile function. Further- more, first rather second peak in LAT corresponds to peak systolic SR, which reflects true myocardial contraction. Therefore measurement of cardiac syn- chronization should not be based on SVP but rather on SR profiles.

HEART FAILURE – RESYNCHRONISATION

916 Interventricular delay optimization in cardiac resynchronization therapy: Comparison of two echocardiographic methods.

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Background: There is no consensus on which is the best methodology to optimise cardiac resynchronization devices. The aim of our study was to compare 2 echocardiographic methods to optimise LV programming.

Methods: Thirty patients (p) with severe left ventricular (LV) systolic dysfunc- tion and LBBB received CRT. Three VV intervals (LV preactivation at -30 ms, simultaneous biventricular pacing at 0 ms, or right ventricular preactivation at +30 ms) were tested evaluating their effect on LV ejection (by aortic velocity time integral (VTI) measurement) and on LV synchrony evaluated with Tissue Doppler Imaging (TDI). Aortic VTI was evaluated with PW Doppler and the VV interval that induced the greatest aortic VTI was considered as the optimum by this method. This was compared to the optimum VV interval chosen by LV synchrony analysis assessing it as the one that yielded the most superposi- tion of the curves of displacement of 2 opposite LV walls evaluated by TDI.

Results: In eighteen p (60%), LV preactivation at -30 ms was chosen as the best VV interval using any of the optimization methods. The Table shows the distribution of the optimum VV intervals according to both echocardiographic methods. There was a good agreement between them (kappa=0.66, p<0.01).

Conclusions: 1. When programming VV intervals in CRT devices, the best intraventricular synchrony results in the best hemodynamic performance in most patients. 2. Both methods could be equally useful to optimise CRT devices.

Table 1

<table>
<thead>
<tr>
<th>Optimal VV obtained with aortic VTI</th>
<th>+30 ms</th>
<th>0 ms</th>
<th>-30 ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV synchrony assessment</td>
<td>+30 ms</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0 ms</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>-30 ms</td>
<td>17</td>
<td>1</td>
</tr>
</tbody>
</table>

Optimal VV chosen by

917 Concordance of different echocardiographic methods to assess left ventricular asynchrony.

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Background: Different echocardiographic methods have been proposed to quantify the presence of left ventricular (LV) dyssynchrony; however, few studies have compared them side by side, so there is no consensus on which, if any, is best. Our aim was to compare 4 methods to describe the presence of LV asynchrony.

Methods: Twenty-one patients with LV dysfunction and LBBB (mean QRS 175±23 ms) were studied with Doppler echocardiography. A septal to posterior wall delay >130 ms measured from M-mode scans in the parasternal short axis view was considered as a criterion of LV asynchrony. From 2 and 4-chamber apical views, other parameters derived from Doppler Tissue Imaging (DTI) were also measured and considered indicative of LV asynchrony: the presence of a) a maximum delay to peak tissue velocity >60 ms in a four segments model (DTI velocities), b) the non superposition of the curves of displacement of the lateral and septal walls and/or the anterior and inferior walls (DTI displacement), c) the non superposition of the curves of strain (with post-systolic contraction) of the lateral and septal walls and/or the anterior and inferior walls (DTI derived strain).

Results: Feasibility was 57% for M-mode, 81% for strain and 90% for both velocity and displacement measurements. Prevalence of LV asynchrony was 24% according to M-mode, 57% to DTI velocities, 62% with DTI-displacement and 76% with strain. The best concordance was observed between DTI-velocities and displacement with 16 (76%) coincidences (Kappa 0.56 p<0.01). Concordance between the other methods was not significant due to the small number of concordant pairs in each group.

Conclusions: M-mode was the least feasible and sensitive method to detect LV asynchrony. DTI-derived parameters were all useful, being DTI-veloci- ties and displacement more feasible with similar diagnostic ability. Further technological improvements may increase the feasibility of strain which ap- pears to be the most sensitive method to detect LV asynchrony.
919  
Assessment of LV regional dysynchrony: comparison between Real-time 3D echocardiography and Tissue Doppler analysis
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1Hospital Israelita Albert Einstein, Echocardiography Dept., Sao Paulo, Brazil

Background and objective: LV regional dysynchrony can be well analyzed by Real-time 3D echocardiography as well as by Tissue Doppler Imaging (DTI). There is paucity of information concerning comparative dysynchrony evaluation by both methods. We sought to compare 3D echo and Tissue Doppler dysynchrony assessment.

Methods: We studied 44 patients (28 males, age 47±9 yrs). In the echo-cardiographic evaluation, the patients underwent 3D real-time echo-cardiographic quantification of LVEF and LV regional dysynchrony (LV dysynchrony index of 6 and 12 segments, relative to basal and basal plus restial segments). By DTI we measured LV QS electromechanical interval in the basal segment of the mitral valve annulus of the septum, anterior and inferior walls, as well as DTI dysynchrony index, defined as the standard deviation of the mean QS electromechanical interval of the LV basal segments. Also we measured ECG duration; 3D echo and DTI data were compared by correlation coefficient of determination-Spearman (r), 95% CI, p<0.05, linear regression equation and Bland & Altman test.

Results: 3D 6 segment dysynchrony index (DI) ranged from 0.25 to 6.65 (1.15±1.15)%; 3D 12 segment DI ranged from 0.2 to 20.38 (2.04±3.63)%; DTI DI ranged from 0.26 to 4.32 (0.98±0.87)%; ECG duration ranged from 60 to 200 (80+29.5) ms; 3D LVEF ranged from 0.43 to 0.74 (0.59±0.10). DTI DI ranged from 0.26 to 4.32 (0.98±0.87)%; linear regression equation and Bland & Altman test.

Conclusion: In this small series we observed good correlation between 3D echocardiography and DTI LV dysynchrony assessment. Further studies should be undertaken with larger series of patients with increased ECG duration and decreased LVEF.

920  
Echocardiographic cardiac remodelling in patients with atrial fibrillation and cardiac resynchronization therapy
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Introduction: Cardiac resynchronization therapy (CRT) has shown to reduce morbidity and mortality in selected patients with heart failure, and to promote left ventricular and atrial positive remodelling in patients with sinus rhythm. However there is few information about the impact of CRT in patients with atrial fibrillation.

Objective: To study left ventricular and atrial remodelling in patients with atrial fibrillation (AF) treated with CRT.

Material and methods: Out of 170 patients treated with CRT, 26 (15%) patients presented with AF, of which 10 patients with paroxysmal AF, 6 with persistent AF and 10 with permanent AF (6 patients with previous chronic right ventricular pacing). 24 patients were male, the mean age was 69±9 years, 10 patients had coronary artery disease and the mean ejection fraction was 31±10%, 21 patients had an ICD and 5 patients had pacemakers. The mean time of the follow up was 17±1.5 years. An echocardiogram (Philips Sonos® 5500) was performed to assess the left ventricular and atrial topology (Simpson method) and left atrial volume with the area-length method (area 4C x area 2C x 0.85/L).

Results: Shown in the table. The left ventricular function improved in the three groups of patients. The left atrial volume reduction was appreciated in all groups, but patients with persistent and permanent AF experiment significant reductions.

Conclusion: Patients with AF treated with CRT present positive left ventricular and atrial remodelling with left ventricular function improvement and decrease in left atrial volume.

Table 1

<table>
<thead>
<tr>
<th>R=26</th>
<th>LVEDD (mm)</th>
<th>LVEDV (mL)</th>
<th>E' (cm/s)</th>
<th>EF (%)</th>
<th>LA Vol (mL)</th>
<th>LA Vol (mL)</th>
<th>MR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal</td>
<td>68.31</td>
<td>214.14</td>
<td>143.67</td>
<td>31.37</td>
<td>106.9</td>
<td>107.67</td>
<td>1.48</td>
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<tr>
<td>Post</td>
<td>62.87</td>
<td>155.70</td>
<td>90.32</td>
<td>41.7</td>
<td>98.91</td>
<td>101.59</td>
<td>0.96</td>
</tr>
<tr>
<td>p</td>
<td>.008</td>
<td>.007</td>
<td>.006</td>
<td>.002</td>
<td>.064</td>
<td>.033</td>
<td>.007</td>
</tr>
</tbody>
</table>


921  
Differential effects on systolic and diastolic function after temporary suspension of long-term cardiac resynchronization therapy
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Background: Cardiac resynchronization therapy (CRT) is a promising nonpharmacologic treatment modality for symptomatic patients with chronic left ventricular systolic dysfunction and intraventricular conduction delay. Clinical studies have shown short-term improvement in contractile function and mid-term improvement in clinical status with CRT. The aim of this study was to evaluate the hemodynamic consequences of temporary interruption of CRT after long-term stimulation.

Methods: Twenty patients (16 men, 4 women) in NYHA class III or IV heart failure despite optimal medical therapy and a QRS interval of ≥120 ms received a transvenous biventricular pacing system at the age of 64±7 years. Patients were studied 449±219 days after continuous CRT and again 72 hours after cessation of biventricular pacing keeping all medications constant. The maximal rate of left ventricular systolic pressure rise (dp/dt) was estimated by measuring the time interval between 1 and 3 ms on the mitral regurgitation continuous-wave Doppler spectrum. Parameters of diastolic function were obtained by pulsed-wave Doppler echocardiography.

Results: Withdrawal of CRT was associated with a significant decrease in systolic blood pressure (122±17 vs 106±23 mm Hg, p<0.01), Doppler-derived echocardiographic indexes of systolic and diastolic function are listed in the table.

Conclusion: While temporary cessation of long-term CRT resulted in a significant decline in left ventricular systolic performance, parameters of diastolic function did not change with the exception of diastolic filling time. These results indicate a sustained efficacy of CRT after long-term treatment.

Table 1. Doppler-derived indexes

<table>
<thead>
<tr>
<th>CRT</th>
<th>Off</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dp/dt (mm Hg/s)</td>
<td>747±261</td>
<td>480±142</td>
</tr>
<tr>
<td>Diastolic filling time (msec)</td>
<td>428±67</td>
<td>394±65</td>
</tr>
<tr>
<td>Mitral E/A ratio</td>
<td>0.99±0.92</td>
<td>1.04±1.19</td>
</tr>
<tr>
<td>Mitral deceleration time (msec)</td>
<td>193±66</td>
<td>204±53</td>
</tr>
<tr>
<td>Isovolumic relaxation time (msec)</td>
<td>106±35</td>
<td>104±44</td>
</tr>
<tr>
<td>Pulmonary vein syst./diast. velocity ratio</td>
<td>1.04±0.83</td>
<td>1.04±0.84</td>
</tr>
</tbody>
</table>

NS, not significant.
923 The acute hemodynamic response to optimization is diminished in patients with non-responsive intraventricular dyssynchrony after biventricular device implantation

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1Massachusetts General Hospital, Cardiac Echo Laboratory, Boston, United States of America

Introduction: This study examined whether the presence of mechanical dyssynchrony (MDS) after BIV PPM implantation influences the acute response to optimization (OPT).

Methods: Thirty-six patients (age 68±11 yrs, 10 ischemic cardiomyopathy, 9 men) had echo-guided OPT 1 month after BIP PPM implantation. The AV delay was increased based on the VV VTI varying the delay by 20 ms increments, from a maximum delay preserving ventricular capture to a minimum of 80 ms. The VV delay was then based on the maximal LV VTI while varying the delay by 20 ms increments, from RV to LV pre-excitation by 40 ms. Inter-

ventricular dyssynchrony (IVD) was defined as the difference in pulmonic and aortic pre-ejection times. The maximal time delay (MTD) and standard deviation of time to peak systolic velocity (Ts-SD) in 12 LV segments were determined.

Results: The AV delay was changed in 10 patients (106±8 ms to 167±27 ms, p<0.001) and the VV delay was changed in 7. Compared to baseline, the LV VTI was significantly earlier by 32±11 ms in 2. LV VTI increased after OPT (18.7±20.2 cm, p=0.05), but IVD, MTD and Ts-SD did not change significantly. The % LV VTI change correlated negatively with pre-

OPT MTD (r=−0.62, p=0.03) and Ts-SD (r=−0.64, p=0.02) but not IVD (r=−0.11, p=0.71), suggesting that the degree of intraventricular dyssynchrony present after BIV PPM implantation may influence the acute response to OPT.

Conclusions: Our data suggest that 1) acute increases in LV VTI with OPT may not correlate with acute changes in MDS and 2) the acute response to OPT appears diminished in patients with significant intraventricular dyssynchrony after implantation.

925 Two-dimensional tissue tracking technique can evaluate left ventricular dyssynchrony

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Background: Cardiac resynchronization therapy (CRT) is an established therapy for patients in heart failure with left ventricular dyssynchrony. Although there has been much interest in developing more specific methods of detecting mechanical dyssynchrony, it has not fully elucidated. Recently, two-dimensional tissue tracking (2DTT) technique which can trace regional myocardial tissue using pattern matching method has been developed and expected to be a useful tool in the assessment of LV dyssynchrony. Therefore we estimate the technique for the evaluation LV dyssynchrony.

Method: 20 healthy volunteers and 12 patients who has complete left bundle branch block (CLBBB) were performed 2D echocardiography. In 16 LV segments of standard 5 view (LAX, SAX, 4C, 3C, 2C), we assessed the change of LV wall thickness using 2DTT. LV dyssynchrony is defined as the maximum variation of the time to peak myocardial systolic contraction (maxD) >110 ms or its standard deviation >32 ms as reported previously.

Results: The QRS duration in patients with CLBBB was significantly longer than that in normal volunteers (137±12 vs 97±12 ms, p<0.05). In LAX, SAX and 4C view, maxD was significantly longer in CLBBB than that in healthy volunteers (LAX 110±40 vs 54±28 ms p<0.01, SAX 140±28 vs 63±20 ms p<0.01, 4C 113±35 vs 80±44 ms p<0.05). On the other hand, In LAX, SAX and 4C view in CLBBB, TS-SD was not significantly larger than that in healthy volunteers (LAX 57±20 vs 26±14 ms p<0.05, SAX 58±13 vs 25±7 ms p>0.01, 4C 46±17 vs 32±18 ms p>0.05). The sensitivity and specificity in the diagnosis of LV dyssynchrony were superior in SAX (92 and 85%) compared with those in LAX (83, 80%), 4C (83, 60%), 3C (56, 60%), and 2C view (42, 65%).

Conclusion: In using 2DTT, we could evaluate LV dyssynchrony. SAX is the most useful view for the evaluation of LV dyssynchrony. Direct assessment of systolic synchrony by 2DTT might be a novel technique to identify the patients who respond to CRT.

926 Asynchrony of left ventricular systolic performance after the first acute myocardial infarction in patients with narrow QRS complexes - doppler tissue imaging study

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1Shebin Elkom, Egypt; 2Cardiology Dept., Banha, Egypt; 3Cardiology Dept., Cairo, Egypt

Background: Cardiac resynchronization therapy (CRT) is an established therapy for patients in heart failure with left ventricular dyssynchrony. Doppler tissue imaging (DTI) is now established for detecting regional contractile abnormalities and asynchrony in the LV. Myocardial tissue using pattern matching method has been developed and could be expected to be a useful tool in the assessment of LV dyssynchrony.

Methods: DTI is now established for detecting regional contractile abnormalities and asynchrony in the LV. Myocardial tissue using pattern matching method has been developed and could be expected to be a useful tool in the assessment of LV dyssynchrony.

Objectives: The aim of the study was to assess the degree of LV asynchrony after the first acute myocardial infarction (AMI) in patients with a narrow QRS complex using DTI and correlate this with the site and extent of the infarc-

ion.

Methods: Echocardiography with DTI was performed within one week of AMI in 155 patients and compared with 50 age and sex-matched healthy volunteers. Regional myocardial velocities were assessed at the four midlateral and midanterior sites, and the corresponding systolic velocity (Sm), early diastolic velocity (Em), as well as the time to peak Sm (Ts) and time to peak Em (Te) were measured. To assess LV synchrony, Standard Deviations of Ts (TS-

SD) and Te (Te-SD) of all the four midlateral annular sites were computed. Location and size of infarct were confirmed by echocardiographic wall motion score index (WMSI) .

Results: QRS complex duration was normal in all patients. WMSI was significantly higher in patients with anterior than inferior AMI (2.02±0.34 vs 1.52±0.21, p<0.001). TS-SD was significantly higher in patients group than control group, and in patients with anterior than inferior AMI (38.21±7.259 ms vs 21.0±6.522 ms & 43.18±3.773 ms vs 33.24±1.4 ms respectively, p<0.001 for each). While Te-SD did not differ significantly among these groups (20.35±1.777 ms vs 16.17±1.14 ms, 21.6±1.35 ms vs 19.1±1.11 ms respectively, p>0.05 for each). A strong positive correlation was detected between LV systolic asynchrony (TS-SD) and each of WMSI (r=.77), LV mass (r=.67), LVEFSD (r=.65), LVEFDD (r=.5). The correlation was negative with LVEF (r=-.70), Sm (-.6). The correlation was weak with Em (r=-.33), p<0.001 for all. In multivariate logistic regression analysis, infarct size was found to be the most independent predictor for systolic asynchrony (Odds ratio 3.59, 95% CI [1.43,9.33], p<0.001).

Conclusion: AMI has a significant impact on regional myocardial contractil-

ity and LV systolic (but not the diastolic) synchronicity early in the course of AMI. The degree of LV systolic asynchrony is greater with anterior than inferior AMI and mainly determined by infarct size.
Conclusions: there is a strong correlation between RT3DE derived parameters of LV asynchrony (SD-TTP dispersion of time to peak systole) and LVEF (r=-0.84, p<0.0001) and SDI and SD-TTP (r=0.80, p<0.05). There was a strong correlation between IVS and apex (r=-0.84, p<0.0001) and between IVS and apex (r=0.80, p<0.05). Difference in IVS vs apex were not significant (p=0,12), although it is possible to see a positive trend of apex location in the direction of the lateral and posterior wall of the LV and RV wall.

Results: Middle values of ICT differences between native and pacemaker impulse in particular walls in ms are presented in the table below. Differences in values RVOT vs apex and RVOT vs IVS were statistically significant (p<0.05). Difference in IVS vs apex was not significant (p=0.15), although it is possible to see a positive trend of apex location in the direction of the lateral and posterior wall of the LV and RV wall.

Conclusion: 1. Location of the lead has influence on time of distribution of electric impulses in the myocardium. 2. RVOT can be the most optimal location of the pacemaker lead. 3. What is very surprising is that apex location seems to be a better alternative than RV for pacing.

Table 1. Differences in ICT time*:

<table>
<thead>
<tr>
<th>LEAD LOCALIZATION</th>
<th>RV WALL</th>
<th>IVS</th>
<th>LATERAL ANTERIOR</th>
<th>POSTERIOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>RVOT1</td>
<td>12.1 ms</td>
<td>29.3 ms</td>
<td>23.6 ms</td>
<td>12.9 ms</td>
</tr>
<tr>
<td>IVS</td>
<td>47.5 ms</td>
<td>41.7 ms</td>
<td>50.9 ms</td>
<td>42.5 ms</td>
</tr>
<tr>
<td>APEX</td>
<td>36.0 ms</td>
<td>39.9 ms</td>
<td>41.0 ms</td>
<td>47.0 ms</td>
</tr>
</tbody>
</table>

* ICT=Isovolumetric Contraction Time. 1-IVS=Interventricular Septum 2-RVOT=RV outflow tract

3-D ECHO

928

Real-time three-dimensional echocardiography and tissue Doppler imaging in the quantification of left ventricular dyssynchrony in patients with asymptomatic left ventricular systolic dysfunction

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3-D ECHO

929

Role of real-time 3D echocardiography in the evaluation of the effects of cardiac resynchronization therapy in left ventricular function and remodeling

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Background: Cardiac Resynchronization Therapy (CRT) is an established adjuvant treatment for medical refractory severe heart failure. It has been found that with the current selection criteria, which require a wide QRS complex, a significant number of patients fail to respond. The importance of mechanical dyssynchrony has emerged and the role of echocardiographic modalities (2D, TDI) in its assessment has been established. Our goal in this study was to assess the effects of CRT on the Left ventricle (LV) using several echo parameters measured by Real Time 3D Echocardiography (RT3DE). We also aimed to investigate whether the 3D Systolic Dyssynchrony Index (SDI), defined as the SD of the time it takes each of the 16 segments of the LV to reach their minimum volume, can be used effectively in the identification of patients that are likely to respond to CRT.

Methods: 25 patients underwent CRT. 2D, Tissue Doppler and RT3DE data were obtained both before and 6 months after the device implant. EF, LV volumes and LV mass were calculated.

Results: In 6 months, 17 patients had improved with an average decrease of one NYHA class, 5 had deteriorated and 2 reported no change. All the responders presented with a significant reduction in the DI (16.5±4.9 pre, 7±3.2 post CRT) and increase in the EF (43.4±2 pre, 29.3±3.1 post CRT). In most responders a reduction of the end-systolic of more than 15% was observed (Reverse Remodeling). Using this parameter as primary outcome, ROC curve analysis demonstrated that DI was far more sensitive and specific in predicting RR than QRS or 2D echo parameters.

Conclusions: RT3DE is a robust modality that can be used efficiently to assess the effects of CRT on LV volumes, mass and function, relying on its superior spatial resolution. Although further validation is required, it could also play a vital role in the successful identification of the responders to CRT.

930

Assessment of left ventricular mechanical dyssynchrony with real-time 3D-echocardiography

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Background: Different current echocardiographic methods have been proposed to evaluate left ventricular mechanical dyssynchrony (LVMD) and to identify potential responders to cardiac resynchronization therapy (CRT). Our aim was to study the value of real-time 3D-echocardiography (RT3DE) to assess LVMD.

Methods: 41 patients (pts) were studied: 10 healthy volunteers and 31 pts with different severity of left ventricular dysfunction (16 pts with a ST-segment elevation acute myocardial infarction (STEAMI) and 15 with different etiology dilated cardiomyopathy (DCM)). Full left ventricular volumes were obtained with RT3DE and were divided into 16 segments. The dispersion of the time to minimum regional volume for all 16 segments was used to provide a systolic dyssynchrony index (SDI).

Results: The 10 healthy pts and 16 STEAMI pts (11 with anterior location and 5 with interposterior) had a QRS wide less than 120 ms, whereas pts with DCM had a QRS wider than 135 ms and left bundle branch block morphology. Echocardiographic characteristics are shown in the table. Segmental dyssynchrony was of apical distribution in STEAMI pts, concordant with dicrotic areas, and different from DCM pts, who had a mild basal segmental distribution. All DCM pts underwent CRT, demonstrating an acute improvement of the LV ejection fraction (EF) (21.9±10.5% to 30.4±10.2%; p<0.05) and a reduction of SDI (15.4±8.6% to 9±5%; p<0.05). This achievement was maintained offline.

Conclusions: RT3DE is an useful technique for assessing LVMD and locate the dyssynchronic ventricular segments. This emerging method could provide useful information in the selection and follow-up of suitable pts for CRT.

Table 1

<table>
<thead>
<tr>
<th>Healthy (n=10)</th>
<th>STEAMI (n=16)</th>
<th>DCM (n=15)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVEF (%)</td>
<td>61.7±4</td>
<td>43.1±8.3</td>
<td>21.9±10.5</td>
</tr>
<tr>
<td>LVEDV (ml)</td>
<td>94.6±17.5</td>
<td>109.1±25.8</td>
<td>192.1±75.4</td>
</tr>
<tr>
<td>LVESV (ml)</td>
<td>35.7±5</td>
<td>61.7±16.6</td>
<td>153.1±70.5</td>
</tr>
<tr>
<td>SDI (%)</td>
<td>1.5±0.7</td>
<td>9.5±7.5</td>
<td>15.4±6.7</td>
</tr>
</tbody>
</table>

3D ECHOCARDIOGRAPHY: A new tool to automatically assess left ventricular asynchrony

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Until now, several methods have been used to evaluate left ventricular (LV) asynchrony but there is no gold standard method to define it. The Dysyn-
chrony Index (DI), obtained from 3D echo, has been proposed as a global, accurate and useful parameter. We sought to determine the correlation between currently used parameters of LV dyssynchrony with the DI in patients with systolic dysfunction.

Methods: 45 consecutive pts with a LV Ejection Fraction <40% were included. LV dyssynchrony was defined as a septal-to-posterior wall motion delay (SPWMD) >130 msec, a septal-to-lateral delay >60 msec, the presence of Post-systolic contraction >50 msec of the LV ejection time or an intra-LV electromechanical delay >40 msec. From the 3D derived time-volume-curves, the DI, defined as the standard deviation of the time for all the 16 segments to reach their minimum volumes was obtained. Correlation was assessed between the DI and conventional parameters of dyssynchrony.

Results: Mean age was 65±13 years. The presence of LV dyssynchrony was observed in 29, 47, 32, and 82.4% of patients using the SPWMD, the septal-to-lateral delay, the presence of p-ost-systolic contraction and the intra-LV electromechanical asynchrony respectively. Average DI was 8.5±4%.

Conclusions: The prevalence of LV dyssynchrony is variable depending on the method used. There is no correlation between the parameters of LV dyssynchrony and the DI. This variability should be considered when applying specific echo-Doppler criteria in cardiac resynchronization.

Table 1. DI correlations

| SPWMD | 0.016 |
| Septal-to lateral delay >60 ms | 0.015 |
| Post-systolic contraction | 0.015 |
| Intra LV electromechanical delay | 0.016 |

934

Feasibility and accuracy of single-beat three-dimensional tissue synchronization imaging (TSI) in comparison with two-dimensional TSI in heart failure patients

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A. O. S Maria della Misericordia, Chief Echo.Lab., Cardiovascular Sciences Dept., Udine, Italy

Left ventricular mechanical dyssynchrony (LVMD) has emerged as a therapeutic target with the advent of cardiac resynchronization therapy (CRT). 2D tissue synchronisation imaging (TSI) is an emerging technology to assess LVMD whose ability to identify CRT responders has been proved. However, 2D TSI requires calculation of LVMD in LV views obtained at different times and it is not feasible in patients with unstable cardiac rhythm or atrial fibrillation. The aim of our study was to test whether single-beat real time 3D echo (RT3DE) TSI can be used to objectively quantify LVMD in heart failure pts in comparison to 2D TSI. We studied 79 heart failure pts (66±13 years, 70% M), LV ejection fraction >29±7%, QRS duration =162±38 ms, and NYHA II-IV=37%, 68% patients showed QRS duration >120 msec, and 53% a left bundle branch block. Apical 4-, 2-chamber and long-axis LV views were acquired from all patients with both 2D and RT3D (Vivid 7-Dimension, GE Healthcare, Horten, Norway). Intra-ventricular synchronicity was assessed by TSI using the time to regional peak systolic velocity measured in ejection phase (Ts), and a 6-basal-6-mid-segment model of LV. RT3DTSI was feasible in all pts (feasibility=100%). Time spent to assess LVMD with 2D and RT3DE TSI is summarized in the Table. The standard deviation of Ts (Ts-SD) was significantly wider when calculated with RT3DE than with 2D modality (58±35 vs 48±20 msec; p=0.007). Despite a low correlation between Ts-SDs calculated using the 2 techniques (R²=0.31), they showed high concordance (k=0.86; p 34 msec), and the most delayed LV wall (k=0.83; p<0.0001). RT3D TSI is feasible in heart failure pts with severe LV dyssynchrony. The technique provided quick qualitative and quantitative assessment of LVMD in a single R-R interval, which showed high concordance with standard 2D TSI. Our data may represent the basis to use RT3DE to assess LV synchronicity in patients with unstable hemodynamics, or with atrial arrhythmias or other cardiac arrhythmias.

Table 1

<table>
<thead>
<tr>
<th>Echo-Modality</th>
<th>Acquisition Time (s)</th>
<th>Measurement Time (s)</th>
<th>Overall Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2D - TSI</td>
<td>142±60</td>
<td>43±5</td>
<td>185±29</td>
</tr>
<tr>
<td>RT3DE - TSI</td>
<td>94±74</td>
<td>29±7</td>
<td>123±60</td>
</tr>
</tbody>
</table>

Comparison of time needed to assess LV synchronicity in heart failure patients using 2D and 3D Tissue Synchronization imaging

935

Systolic dyssynchrony index at real time 3D echocardiography correlates with left ventricular ejection fraction in patients with persistent postcardiac infarction and controls

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Background: Mechanical asynchrony (MA) is a major observation in patients with heart failure and is a therapeutic target in resynchronisation therapy. Real time 3D Echocardiography (RT3D) is a novel technique which provides qualitative and quantitative assessment of MA by measuring the Systolic Dyssynchrony Index (SDI), which is defined as the standard deviation of the time for the 16 segments to reach their minimum. No data exist on the relation between MA at 3D echo and EF in patients with previous myocardial infarction.

Purpose: To investigate in patients with previous myocardial infarction and in controls correlation between mechanical asynchrony expressed as SDI at Real time 3D Echocardiography and left ventricular ejection fraction (LVEF) at rest.

Methods: 48 consecutive pts were recruited, 18 with previous myocardial infarction (group 1) mean age 68±10 and 30 controls with normal LV function, (group 2), mean age 60±12. RT3D scanning was performed using the Philips ie 33 and analyzed offline with QLAB to produce time-volume-curves. Systolic dyssynchrony index was derived from the dispersion of time to minimum regional volume for all 16 segments.

Results: Mechanical asynchrony was found to correlate negatively with LVEF. There was a negative correlation between EF and the SDI (p=0.04, r=-0.57), either in patients with previous IMA (p=0.03, r=-0.61, n=18), either in controls (p=0.006, r=-0.74 n=30). The SDI was significantly higher in pts with previous MI 8.1±9 vs 1.2±4 in controls, p<0.01. There was a significant difference in LVEF in the two groups, 36±13 in group 1 vs 58±4 in group 2, p<0.00. An SDI >9 identified patients with EF <35%, p<0.001.

Conclusions: Our findings show the correlation between Mechanical asynchrony expressed as SDI at three dimensional echocardiography and LVEF. SDI is correlated with systolic function in all patients either in patients with LVEF dysfunction or in controls.

936

Measurement of basal asynchrony in real time 3D long axis echocardiography

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Background: In patients with dilated left ventricle (LV) cavities and LV disease, the presence of ventricular asynchrony may be a target for resynchronisation therapy. Current methods to assess synchrony LV function have their known limitations. Doppler Tissue Imaging (DTI) requires up to 12 acquisitions and long axis M-mode requires three acquisitions. Real-time 3D (RT3D) echo assessing LV asynchrony has been proposed, but current methods require statistical evaluation of 16 cavity segments.

Methods: We investigated a novel method of quantifying intersegmental LV asynchrony by measuring 3D long axis at four points on the mitral ring in a single acquisition using a Philips Sonos 7500 RT3D and Tomtec LV Analysis 1.2 software. The timing of local distance from four basal segments (septal, lateral, anterior, inferior) to the mean centre of 3D LV cavity was measured with respect to end of ejection, indicated by aortic valve closure. Seventeen patients with LV disease and dilated cavity (LVEFS=5.1±1.1 cm; LVEDD=6.6±0.88 cm, FS=23±9.8%) were compared to 11 normal controls (LVEFS=3.1±0.29 cm; LVEDD=4.6±0.4 cm; FS=33±5.4%).

Results: Mean LV volumes by RT3D correlated significantly with 2D cavity measurements in patients (LVESV=129±85 ml, r=0.768; LVEDV=186±93 ml, r=0.615, all p<0.05). Mean LV EF correlated well with 2D EF (Teich) (3D EF=35±12%, r=0.636, p<0.05). Intergroup volume ratio at basal sites in patients versus controls was (58±55 vs ms 21±27 ms, p<0.005), suggesting a cut-off value for basal asynchrony of 75 ms.

Conclusion: Basal intersegmental delay by 3D echo may be a useful indication of significant LV asynchrony, allowing clinically relevant assessment in a single acquisition compared to existing DTI or RT3D techniques.

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Left ventricular asynchrony in dilated cardiomyopathy patients and normal subjects with and without left bundle branch block: A three-dimensional echocardiography study

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Background: Cardiac resynchronization therapy (CRT) has been indicated in patients with congestive heart failure based on left ventricular function and the width of the QRS. However, patients (pts) with CHF and narrow QRS have been shown to also have LVA. Three-dimensional echocardiography (3DE) is a new method for measuring LVA of the entire LV rather than based on a segmental approach. The aim of this study was to compare the degree of LVA in pts with normal (NL) function and dilated cardiomyopathy (DCM), with and without (w/o) LLBB using real-time 3DE (RT3DE).

Eur J Echocardiography Abstracts Supplement, December 2006
Methods: 38 pts (13 males/25 females) were studied with DCM and LBBB (group 1, N=11), DCM w/o LBBB (group 2, N=11), NL pts w/o LBBB (group 3, N=8) and NL pts w/o LBBB (group 4, N=8). Full-volume datasets of the left ventricle were obtained using a fully-sampled matrix array probe (Philips, Sonos 7500) and analyzed with 4D LV-analysis software (TomTec, Germany) to derive an asymmetry index (ASI), calculated from the dispersion of time to minimal regional volume for all 16 LV segments.

Results: Data acquisition and analysis was feasible in all pts. In the DCM groups (1 and 2) the ASI was not statistically different regardless of the presence of LBBB (group 1, see Table). In group 1, 18% did not have LVA whereas, in group 2, 55% of pts had an elevated ASI (>7.1%). The ASI correlated negatively with EF regardless of QRS duration (R = 0.83 and R = -0.72, Group 1 and 2, respectively). In pts with NL function and LBBB, the ASI was significantly higher though still within normal limits (WNL) and lower than that measured in DCM pts w/o LBBB.

Conclusion: ASI should be measured in all pts with DCM pts who are candidates for CRT, irrespective of QRS width. RT3DE provides a rapid assessment of LV of the entire ventricle, QRS width should not be used as a criterion for CRT indication, since DCM pts w/o LBBB have elevated ASI in 55% of cases.

Table 1

<table>
<thead>
<tr>
<th>Patient Groups (%)</th>
<th>ASI (%)</th>
<th>EF (%)</th>
<th>QRS (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1 (11) DCM w/ LBBB</td>
<td>9.2±4.5</td>
<td>25±20</td>
<td>166±52*</td>
</tr>
<tr>
<td>Group 2 (11) DCM w/o LBBB</td>
<td>9.0±4.8</td>
<td>22±20</td>
<td>101±30</td>
</tr>
<tr>
<td>Group 3 (8) NL w/ LBBB</td>
<td>4.7±3.8</td>
<td>53±6</td>
<td>145±26</td>
</tr>
<tr>
<td>Group 4 (8) NL w/o LBBB</td>
<td>3.5±2.4</td>
<td>55±6</td>
<td>74±40</td>
</tr>
</tbody>
</table>

* = p<0.05: DCM w/ LBBB vs DCM; † = p<0.05: NL w/ LBBB vs NL

HEART FAILURE – RESYNCHRONISATION

936 Throes failed heart sleeps better? Sleep disordered breathing in patients during cardiac resynchronization therapy

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1Silesian Center For Heart Disease, 1St Dept. Of Cardiology, Zabrze, Poland

The problem of sleep disordered breathing (SDB) and its criteria in chronic heart failure (CHF) patients (pts) is widely discussed. However, there is little data available on SDB in pts during biventricular pacing (BVP).

The aim: To compare the dynamic function of heart in two groups of BIV pts divided according to the rate of SDB.

Methods: We studied 27 pts (aged 52.5±8.4; M:F - 3.5:1) with CHF (ischemic - 47.6%, non-ischemic dilated cardiomyopathy), NYHA 3-4; 25% with preserved LV function (EF > 40%), QRS duration > 130 ms. Two groups were divided according to the rate of SDB for 7 hours sleep period was assessed based on digital Holter monitoring (ResLab). In Group 1 pts with SDB (ASA ≥ 9.5) in 70% of NREM sleep, in Group 2 pts without SDB ASA was ≤ 9.5 in 70% of NREM sleep. ASA was derived from the dispersion of time to minimal regional volume for all 16 LV segments, had the “rocking heart” appearance on the apical 4 chamber view. They had no measurable long axis regional velocity profile dysynchrony due to the pulling effect of radial RV fibers inserted on the LV free wall. However, when analysing radial motion 86% of pre-CRT pts (n=18) had abnormally superimposed systolic velocity profiles instead of the mirrored velocity profiles found in normals. In addition a significant delay was observed in 100% of pre-CRT pts between QRS onset to the end of the first systolic peak velocity in the septum (136±80 msec) and the lateral wall (387±120 msec; p<0.001). Moreover, in these pts the peak septal radial velocity occurred during the isovolumic contraction period. 11 CRT pts (50%) also demonstrated a post systolic ending of the lateral wall radial systolic velocity profile.

Conclusions: In heart failure patients fulfilling the current clinical criteria for CRT, radial velocity parameters (as opposed to long axis data) can detect dyssynchrony in “rocking” hearts with preserved RV long axis function. In failing hearts the use of radial velocity profile data may provide an alternative to regional deformation assessment (strain/SR imaging), the latter being technically challenging in such thin walled hearts.

LV FUNCTION – OTHER

937 Could regional left ventricular radial systolic velocity parameters better describe dysynchrony in the failing heart?

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1St George’s Hospital, Cardiology Dept., London, United Kingdom

Currently, the timing of long axis systolic events (regional motion or deformation) is used to evaluate patients for resynchronization therapy (CRT). However, cardiac rotation or left ventricular (LV) displacement induced by preserved right ventricular long axis shortening may induce higher LV peak systolic velocity profiles than those induced by intrinsic LV contractile function and thus negate long axis systolic velocity index (strain) markers. To determine if radial velocity parameters (theoretically not influenced by cardiac rotation) may offer a better approach, the following study was performed. Data from 21 pts (pre-CRT, 61±12 years, ejection fraction (EF) 28±8%, QRS duration >130 msec) was compared to data obtained from 30 normals (47±11 years, EF >60%, QRS duration <130 msec). Radial Tissue Doppler velocity profiles were obtained from the septum and inferolateral walls at mid-ventricular level using short axis views. 10 CRT pts (47% with preserved RV long axis function, had the “rocking heart” appearance on the apical 4 chamber view. They had no measurable long axis regional velocity profile dys synchrony due to the pulling effect of radial RV fibers inserted on the LV free wall. However, when analysing radial motion 88% of pre-CRT pts (n=18) had abnormally superimposed systolic velocity profiles instead of the mirrored velocity profiles found in normals. In addition a significant delay was observed in 100% of pre-CRT pts between QRS onset to the end of the first systolic peak velocity in the septum (136±80 msec) and the lateral wall (387±120 msec; p<0.001). Moreover, in these pts the peak septal radial velocity occurred during the isovolumic contraction period. 11 CRT pts (50%) also demonstrated a post systolic ending of the lateral wall radial systolic velocity profile.

Conclusions: In heart failure patients fulfilling the current clinical criteria for CRT, radial velocity parameters (as opposed to long axis data) can detect dyssynchrony in “rocking” hearts with preserved RV long axis function. In failing hearts the use of radial velocity profile data may provide an alternative to regional deformation assessment (strain/SR imaging), the latter being technically challenging in such thin walled hearts.

Table 1. Summary of the results

<table>
<thead>
<tr>
<th>Radial deformation</th>
<th>Before CRT</th>
<th>After CRT</th>
<th>p</th>
<th>AVRT Before</th>
<th>Before p</th>
<th>AVRT Before p</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARVF (mmHg)</td>
<td>494±77</td>
<td>511±79</td>
<td>&lt;0.01</td>
<td>497±77</td>
<td>516±81</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>ICT (mmHg)</td>
<td>26.6±12</td>
<td>27.3±13</td>
<td>NS</td>
<td>29.9±13</td>
<td>28.8±12</td>
<td>NS</td>
</tr>
<tr>
<td>RVF (mmHg)</td>
<td>276±32</td>
<td>244±41</td>
<td>&lt;0.05</td>
<td>287±32</td>
<td>240±35</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>AVRT (mmHg)</td>
<td>80±16</td>
<td>78±18</td>
<td>NS</td>
<td>80±15</td>
<td>82±15</td>
<td>NS</td>
</tr>
<tr>
<td>MPI</td>
<td>0.37±0.01</td>
<td>0.42±0.02</td>
<td>&lt;0.05</td>
<td>0.36±0.2</td>
<td>0.41±0.1</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

AVRT: Atrioventricular reentrant tachycardia, DFT: Diastolic filling time, ICT: Isovolumic contraction time, ET: Left ventricular ejection time, VR: Isovolumic relaxation time, MPI: Myocardial performance index. All data were expressed as mean ± SD.
HEART FAILURE – RESYNCHRONISATION

939 Analysis of phase by velocity vector imaging can predict reverse left ventricular remodelling post resynchronization therapy
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1Monaldi Hospital, Cardiology Dept., Naples, Italy; 2S.S. Annunziata Hospital, Naples, Italy; 3S.S. Annunziata Hospital, Cardiology Dept., Salerno, Italy

Background: Cardiac resynchronization therapy (CRT) has been shown to reverse left ventricular remodeling (LVR) in patients with congestive heart failure (CHF). Axius Velocity Vector Imaging-Siemens (VVI) is a novel image analysis approach that analyse the heart mechanics displaying and quantifying the 2D velocity vector field of the regional wall movements from digitally stored black and white echo loops. Phase is a more numerically stable way of comparing the delay of one waveform relative to another and incorporates information from the entire cardiac cycle (systole and diastole), not just systole. We tested the hypothesis that this sophisticated method can accurately predict LVR using phase’s analysis.

Methods: 30 CHF pts (60±10 ys, 23 male) implanted with CRT device were studied. VVI was carried out in the A4C view to evaluate 19 non ischemic (NO ISCH) pts with LBBB and 11 ischemic (ISCH) pts with LBBB. Longitudinal and radial displacement of left septum (LS) and lateral wall(LW) were studied. Patients were divided in responders (R) and non-responders (NR) as defined by the LV reverse remodeling criteria. Baseline characteristics were comparable between the two groups. In addition, the value of TSI to predict response to cardiac resynchronization therapy (CRT) was evaluated.

Results: The reversal of unfavorable left ventricular (LV) remodeling has been already well documented in heart failure patients post biventricular pacemaker (BIV) implantation. The time course of the functional capacity improvement and the reversal of LV remodeling in heart failure patients treated with biventricular pacing. One year follow up

941 Myocardial viability predicts reverse remodelling after cardiac resynchronization therapy (CRT): a 2D strain echocardiography (2DSE) study
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1S. Maria di Loreto Hospital, Division of Cardiology, Naples, Italy

C. R. has been used as a useful therapeutic option for patients with severe heart failure (HF). However 20% to 30% of patients do not respond to this form of therapy undergoing the need for additional selection criteria to identify potential responders (R). The aim of this study was to investigate the value of myocardial viability (MV) to predict reverse remodeling (R) after CRT and its mechanical effects on septal and lateral wall.

Methods: We studied 49 pts (88% M, 12% F), aged 66 ±8 yrs with left ventricular ejection fraction (EF) <35% in NYHA class III-IV and with QRS duration >120 msec. All patients underwent conventional echocardiographic examination including left ventricular volumes, EF. A 2-level scale was used to define MV in each myocardial segment: 1 = myocardial thickness >6 mm, 2 = myocardial thickness ≤6 mm, >6. A vitality score index (VSI) using a 16-segments model was then calculated as the sum of MV in the 16-segments divided by sixteen. Longitudinal (L) and transverse (T) strain were evaluated before and 6 months after CRT; delta value (D) between 6-months and baseline was calculated for basal (B) and mid (M) segments of both septum and lateral wall.

Results: RR, defined by a 15% reduction of LVEFS after 6 months of CRT was significantly related to VSI (LC- 0.537 p<0.001). A VSI >1.25 showed a sensitivity and a specificity respectively of 74% and 87% to identify non responders (NR) (AUC: 0.80-95% CI 0.66-0.93; p<0.0001). TD and LD strain of septum were significantly different between pts with and without VSI>1.25 while only LD strain of lateral wall showed significant difference between the two groups of patients (tab. 1).

Conclusion: Our results show that VSI evaluated by rest 2D echocardiography is a useful tool to predict RR after CRT. In patients with a VSI >1.25 CRT fails to improve both T and L strain while in patients with a VSI<1.25 CRT improves T and L strain of septum but only L strain of lateral wall.

Table 1

| Group | Basal Segment | Mid Segment | LV End diastolic volume | LV End systolic volume | Cardiac output | Peak VO2
|-------|---------------|-------------|------------------------|----------------------|---------------|-------|
| VSI<1.25 | 11.3±1.4 | 11.9±1.4 | 101±15 | 65±10 | 3.8±0.5 | 0.8±0.1
| VSI>1.25 | 11.6±1.7 | 16.4±1.7 | 83±12 | 58±12 | 3.7±0.5 | 0.8±0.1

942 Time course of the functional capacity improvement and the reversal of LV remodeling in heart failure patients treated with biventricular pacing. One year follow up

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1Silesian Center For Heart Disease, TSI Dept. Of Cardiology, Zabrze, Poland; 2Silesian Center For Heart Diseases, Zabrze, Poland

The reversal of unfavorable left ventricular (LV) remodeling has been already well documented in heart failure patients post biventricular pacemaker (BIV) implantation. However, little data is available on the relation between changes in LV geometry and improvement in functional capacity. Aim of the study: To assess the dynamics of changes in LV morphology and functional capacity in the 12 months following BIV.

Material and methods: 30 patients (age - 54±10 y; M:K - 3:1) with diastolic non-ischemic cardiomyopathy (biplane EF - 24.5±8%; ESV - 210±67 ml; EDV - 275±71 ml; NYHA III/IV, QRS - 180±26 ms; septal-lateral intra-LV dysynchrony - 116±76 ms; LV/RV dysynchrony 64±27 ms) were studied during baseline, during pacemaker optimization (OPT), 1, 3, 6, and 12 months post BIV implantation using conventional and tissue Doppler echocardiography and VO2 stress testing.

Results: Significant EF improvement was found early post implantation, at OPT and 1 month (27.8±7 vs 22.7±7 and 29±6 vs 22±7; p=0.03 and p=0.005 respectively). End systolic volume [ESV], end-diastolic volume [EDV] were reduced significantly at 1 month post implantation (197.3±7 vs 218±6 ml at invasive OPT, p=0.004; 217.4±10 vs 209±8 ml at OPT, p=0.03) maximal left ventricular volume reduction was observed at 6 months post implantation (EDV: 216±98 vs 277±86 ml at baseline, p=0.17; ESV: 216±98 vs 277±86 ml at baseline, p=0.09). VO2 increased from 15.2±0.2 vs 18±3±0.03 ml/kg/m² (p=0.048) and remained nearly constant up to 12 months post BIV implantation (see figure 1).

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Conclusion: Solid improvement in EF, EDV, VO2 was found early at 1 month follow up, however at 12 months no persistent improvement was observed. Oxygen consumption does not parallel the alterations in LV geometry.

943 Impact of underlying cardiopathy on left ventricular remodelling after cardiac resynchronization therapy

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Background: Left ventricle remodelling (LVR) has been demonstrated after cardiac resynchronization therapy (CRT) in many studies. However, scarce information exists about the relationship between the evolution of the cardiopathy and the extent of LVR.

Aim: To analyze if LVR depends on the etiology of the underlying cardiopathy.

Methods: Sixty-four patients (70±8 y.o, 52 (81%) men with LV systolic dysfunction (LV EF 23±6%) and LBBB received CRT and were followed-up during 12 months. An echo-Doppler scan was performed at baseline to measure LV diameters with M mode and volume and EF with the Simpson’s method. Mitral regurgitation (MR) was also quantified with the PISA’s method and possible, pulmonary artery pressure (PAP) was determined.

The same study was performed at follow-up.

Results: At 12 months follow-up an overall LVR was observed with a significant reduction of LV diameters and volumes, an improvement of LV EF (from 24±5% to 32±10%, p<0.05). When patients were separately analyzed according to the etiology of their cardiopathy, both groups presented a significant LVR as well (see table).

Patients with IDC had a LV EDV mean reduction of 6%, a LV ESV reduction of 16% and a LV EF increment of 40%. In p with IC the values were 0.5%, 9% y 34% respectively.

Conclusions: At 12 months follow up patients with severe LV systolic dysfunction and LBBB treated with CRT presented LVR independently of the etiology of their cardiopathy, although the extent of LVR was slightly smaller in patients with IC.

Table 1

<table>
<thead>
<tr>
<th>Cardiopathy Type</th>
<th>Ischemic Cardiomyopathy (IC) (n=25)</th>
<th>Idiopathic Dilated Cardiomyopathy (IDC) (n=39)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV EDV (ml)</td>
<td>226±71</td>
<td>201±69</td>
</tr>
<tr>
<td>LV ESV (ml)</td>
<td>176±63</td>
<td>228±71</td>
</tr>
<tr>
<td>LV EF (%)</td>
<td>77±63</td>
<td>83±63</td>
</tr>
<tr>
<td>LV EF (%)</td>
<td>61±12</td>
<td>63±12</td>
</tr>
<tr>
<td>PAP (mm Hg)</td>
<td>38±19</td>
<td>35±19</td>
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</tbody>
</table>
| EDV: end diastolic volume, ESV: end systolic volume, EDD: end diastolic diameter, ESD: end systolic diameter, ROA: mitral regurgitant orifice area.

LV FUNCTION – OTHER

944 Racial differences in left ventricular structure and performance in healthy young adults

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The goal of this study was to evaluate the racial difference in left ventricular performance and geometry in healthy young black and white males subjects. We examined 44 healthy young subjects, 20 black males (mean age 27.6±4.4 years) and 22 white males (mean age 29.7±9.2 years). All subjects underwent clinical visit and conventional and Doppler tissue echocardiography (DTE) for the study of the morphology and kinetics of left ventricle. DTE-determined velocities were taken from apical 4-chamber view analyzing the excursion of mitral annulus at the lateral and posteroseptal sites. Myocardial wall velocities were sampled during systolic ejection (S) and diastole (D) with different filling and atrial (A) contraction. Besides, we evaluated myocardial performance index (MPI), defined as the sum of isovolumic contraction time (ICT) and isovolumic relaxation time (IRT) divided by ventricular ejection time (ET). Black subjects showed a significant increase in body mass index (25.1±3.1 vs 23.1±1.6 kg/m², p<0.02), in the office diastolic blood pressure (83.0±6.2 vs 77.5±7.5 mm Hg, p<0.008) and heart rate (76.1±14.0 vs 66.3±9.7 bpm, p<0.02). No differences were found in left ventricular diameters, volumes, mass, meridional and circumferential end-systolic stress, total peripheral resistance, stroke volume and cardiac output. The relative wall thickness (RWT) was significantly increase in black (0.6±0.4 vs 0.36±0.05, p<0.0001), suggesting a tendency to a concentric remodelling. The left systolic function estimated by conventional parameters was unchanged. Doppler analysis of tissue kinetics showed a significant increase in black subjects of septal S and E waves, as peak velocity (p) and time velocity integral (ivl), when compared with white subjects. The MPI in black subjects was significantly increase (0.46±0.05 vs 0.39±0.05, p<0.0003), due to a significant prolongation of ICT (62.1±19.1 vs 51.4±9.9 msec). A significant correlation between MPI and RWT (r=0.54, p<0.001) and left ventricular mass (r=0.54, p<0.001) respectively were demonstrated. Besides, MPI correlate with Spv (r=0.55, p<0.000) and Svi (r=0.38, p<0.001) waves. In conclusion our data confirm that MPI is increase in black healthy subject and is geometry-dependent, in contrast with current literature. Besides, we found correlations between MPI and systolic indexes derived from DTE. These findings also suggest that racial differences in left ventricular performance and systolic function exist even in absence of other conventional echocardiographic changes.

MYOCARDIAL VELOCITY IMAGING (DMI) – LV FUNCTION

945 Hypercholesterolemia and myocardial function: an experimental ultrasonic strain and strain rate study

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Background: Despite changes in lifestyle and the use of new pharmacologic approaches to lower plasma cholesterol concentration, cardiovascular disease continues to be the principal cause of death in the developed world. Major classic risk factors for cardiovascular diseases include hyperlipidemia, diabetes, smoking, hypertension and obesity. This study aimed to assess whether myocardial function is affected by a diet rich in saturated fat.

Aim of the study: We evaluated the changes in myocardial deformation properties in cholesterol-fed rabbits.

Methods: Male New Zealand White rabbits (n=6) aged 9 wk and weighing 1.91 kg were studied. Rabbits were housed individually in standard stainless-steel cages at 24°C with a 12-h light: dark cycle (lights on, 0630-1830 h). Rabbits had free access to food and tap water. All experiments were performed in accordance with the protocol approved by the Institutional Committee. Baseline and every two weeks for a study period of 6 months. At the end of the experiment, all rabbits underwent normal diet with high cholesterol (2%). Rabbits underwent standard echocardiographic study and ultrasonic derived one-dimensional strain and strain rate analysis. The echocardiographic examination was performed on a 12.5 MHz transducer (Philips, Netherlands), in all the rabbits, the same diet was used at baseline. The same day, all rabbits underwent standard echocardiographic study and ultrasonic derived one-dimensional strain and strain rate analysis. The echocardiographic examination was performed baseline and every two weeks for a study period of 45 days. At the end of experiment, all rabbits were deprived of food overnight and killed under anesthesia. Blood was collected by heart puncture. Whole blood and serum were prepared for laboratory analysis. The major organs and aorta of each rabbit were harvested, washed with ice-cold isotonic saline and weighed. Serum and tissue samples were stored at -20°C until used for analysis.

Results: After 2 weeks of diet rabbits showed a significant increase in total cholesterol, in LCAT, while apolipoprotein was significantly reduced. Standard echocardiographic parameters did not change significantly when compared to baseline for the whole study period. After 45 days of diet both systolic and diastolic myocardial deformation properties were significantly worsened compared to baseline (Systolic Strain: Baseline =35±10%; 45 days =18±8%, p<0.05). Systolic Strain Rate was significantly correlated with total cholesterol (r=0.31, R=0.61).

Conclusion: This study demonstrated that Strain and Strain Rate is feasible in rabbits and is able to detect earlier than standard echocardiography hypercholesterolemia-induced cardiac contractile dysfunction.

LV FUNCTION – OTHER

946 Early abnormalities of left ventricular myocardial characteristics associated with subclinical hyperthyroidism

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Background: If cardiovascular abnormalities are well known in overt hyperthyroidism; the involvement of cardiovascular system in subclinical hyperthyroidism (sHT) is still debated.
Aim: Aim of the present study was to analyze heart function in Subclinical Hypertrophied Heart (SH) in otherwise cardiovascular healthy subjects both by conventional and by new methods using echocardiographic ultrasound techniques.

Material and methods: Twenty-four newly diagnosed and untested SH patients (20 women, mean age: 46 years) and 24 sex- and age-matched healthy volunteers were studied. All subjects were submitted to conventional 2D Doppler Echocardiography, by Radial Pulsed Doppler Tissue Flow Imaging (PWTDI) for the analysis of diastolic function, to Color Doppler Myocardial Imaging (CDMI) for the analysis of regional strain and strain rate (SR) expression of regional myocardial deformability, and to Integrated Backscatter (IBS) for the evaluation of intrinsic contractility and tissue characterization.

Results: Regional myocardial systolic strain findings were significantly higher in SH patients when compared with controls (p<0.001). Considering diastolic SR, the early phase of diastolic SR was compromised in SH subjects as compared to controls (p<0.001). Myocardial Inhibition Index (CIVI), expression of intrinsic contractility, was significantly higher in SH subjects in comparison with controls (p<0.0001). IBS values, were comparable between the 2 study groups.

Conclusions: In conclusion, data of present study suggest that in young patients with SH are present early left ventricular systolic hyperdeformability and hypercontractility and impairment of both active and passive phases of diastole but not ventricular hypertrophy or other structural alterations. To our knowledge, it is the first evidence that in SH patients these functional modifications are present at the same time both in systolic and diastolic phases of the cardiac cycle. The intramyocardial ultrasound techniques CDMI and IBS revealed an early sensitivity in order to detect early functional cardiac abnormalities in SH patients in comparison with conventional 2D-Doppler Echocardiography.

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Mean longitudinal strain and strain rate: an index of assessing subclinical left ventricular dysfunction in hypertension

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Background: Quantification of myocardial function remains a challenge in clinical cardiology. Traditional methods of evaluation of regional myocardial dysfunction, using echocardiographic techniques, are subjective and only partially quantitative. Strain and strain rate parameters seem to be promising in the quantitative evaluation of left ventricular function. LV hypertrophy and diastolic dysfunction are known to be associated with longitudinal LV dysfunction.

Aim: To assess the clinical application longitudinal mean strain and strain rate, in estimating changes of systolic function and if these, correlate with parameters of LV remodeling.

Material and methods: We studied 55 consecutive hypertensive patients and 25 controls, matched for age (49.7±5.7 vs 45.5±4.1 yrs), with normal EF (66.25±2.65 vs 64.3±3.3%). All the subjects had a standard 2D transthoracic echocardiographic examination and colour doppler myocardial imaging of basal and mid LV segments (12) in the longitudinal axis, with a frame rate 156±5.1 fr/s and <15° angle deviation from the beam direction. Mean longitudinal strain (S) and strain rate (SR) were calculated, adding the value of the walls interrogated and dividing with the number of segments assessed. LVmass index (LVMII), wall thickness (WT), relative wall thickness (RWT), systolic and diastolic BP, pulse pressure (PP), mean arterial pressure (MAP), DT, IVRT, E and A wave and E/A ratio were estimated.

Conclusion: Our results demonstrated the ability of peak systolic strain rate to detect early subclinical abnormalities in patients with moderate-severe MR. The accuracy of peak systolic strain rate was high at detecting asymptomatic patients (area under the ROC curve 0.92), but the diagnostic accuracy was lower (area under the ROC curve 0.74) in detecting symptomatic patients with severe MR. We conclude that peak systolic strain rate may be a useful non-invasive tool to detect asymptomatic MR patients with moderate-severe MR.

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Subclinical impairment of LV function by tissue doppler imaging in patients with osteogenesis imperfecta

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Background: Osteogenesis imperfecta (OI) is a genetic connective tissue disorder associated with congenital heart defects, particularly conduction system abnormalities. This study evaluated LV contractility by Color Doppler tissue imaging (CDTI) in OI patients.

Methods: A cross-sectional study of 85 subjects with suspected OSA who had their first overnight polysomnography (PSG) and a complete transthoracic echocardiographic study performed during 2 months of the PSG with no use of continuous positive airway pressure, no previous history of CHF and an EF >45%. Subjects were divided according to the apnea hypopnea index (AHI) in <5, 5-14 and >15 and by the mean oxygen saturation in PSG in >92% and <92%. We calculated the left ventricular cardiac performance index (MPI) using the Doppler signal as (isovolumic contraction time + isovolumic relaxation time)/aortic ejection time. EF was calculated by 2-D. All analyses were performed by the same observer, blinded to the PSG results.

Results: We excluded a total of 35 patients due to suboptimal Doppler signals, EF <45% and previous history of CHF. The mean age was 64±13 years and 25% were women. Results adjusted for age, gender, body mass index, heart rate, status of hypertension, diabetes mellitus and coronary artery disease were shown in the table. Intraobserver and interobserver variability was 4.4% and 2.1% for the MPI respectively.

Conclusion: Global left ventricular performance measured by MPI is impaired in patients with OSA and normal EF. The mechanism seems to be related to the frequency of the apneic episodes rather than the severity of hypoxia.
and since the new Tissue Doppler imaging (TDI) technique has shown to unmistakable systolic dysfunction in other groups of patients, i.e. diabetes and aortic stenosis, we wanted to investigate if OI patients also had impaired systolic function by TDI.

Methods: 28 patients, 47±10 (SD) years of age, from the Norwegian Survey of Adults with Osteogenesis Imperfecta, were included and compared to 28 sex and age matched healthy individuals, 47±10 years (p=ns), with normal LV function. Standard and TDI echocardiography were performed. From the TDI images peak systolic and diastolic tissue velocities were measured in basal segments of septal- and lateral-walls and averaged. Peak systolic strain, reflecting LV systolic tissue deformation and thus LV contractility, was derived from the tissue velocity data. All echocardiographic data was blinded prior to measurements.

Results: By standard 2-D echocardiography LV EF was similar in patients with OI and controls, 57.7±5 vs 58.7±2% (p=ns), as was the transmitial pulsed Doppler early (E) and atrial (A) filling waves, and the ratio between E and A as a measure for LV diastolic function. Peak systolic- tissue velocity and strain, however, were decreased in patients with OI as compared to controls, 4.4±1.0 vs 5.7±1.4 cm/s (p<0.001) and 18.6±3.1 vs 21.0±3.2% (p<0.01), respectively. Moreover, early diastolic peak tissue velocity (E') was also decreased in the OI group as compared to the controls, 6.2±1.9 vs 7.6±2.7 cm/s (p<0.05). Atrial diastolic peak tissue velocity (A') and the ratio between E' and A', however, were similar between the two groups.

Conclusion: Patients with OI seem to have reduced LV systolic function as measured by TVI and strain. The reduction of E' in these patients might indicate an additional impairment of LV relaxation.

951 Tissue doppler and deformation imaging may detect latent left ventricular systolic dysfunction in b-thalassemia patients

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Cardiac hemochromatosis leads to myocardial dysfunction and regional wall motion abnormalities may represent an early sign of cardiac disease. Chronic anemia in b-thalassemia patients with b-thalassemia major (A) and high output state leads usually to LV systolic function overestimation and myocardial contractility misinterpretation. Tissue velocity and especially deformation indexes overcome this limitation being less load dependent.

This study was designed to study regional LV myocardial systolic function in b-thal patients with "normal" LV Ejection function.

Material and methods: The study population included 25 b-thal patients (without heart failure and LV ejection fraction >50%) and 15 healthy controls (group C) with similar age. An echocardiographic system GE Vivid 7 was used. Following a thorough echocardiographic, Doppler and pulsed Tissue Doppler study, color Tissue Doppler loops were digitally stored for off line analysis using the EchoPac software. Tissue systolic velocities (S), strain, strain rate (SR) and strain (s) values were derived as the average of measurements in 3 adjacent sites at the basal parts of LV lateral wall (lat) and interventricular septum (ivs). Blood samples were also collected from all for NT pro BNP levels measurements. Patients were further divided in group A (1 pts younger than 20 years old) and group B (14 pts older than 20 years).

Results: No difference was detected in LV ejection fraction between b-thal and controls. Systolic tissue velocities were decreased in b-thal, especially in older patients, both in lateral wall (lat: C: 11.1±1.9, B: 7.0±2.1 vs B: 7.3±2.1 cm/sec, Anova p: 0.02, C vs A p>0.05, C vs B p<0.01) and high output state leads usually to LV systolic function overestimation and myocardial contractility misinterpretation. Tissue velocity and especially deformation indexes overcome this limitation being less load dependent.

Conclusions: Patients with OI seem to have reduced LV systolic function as measured by TVI and strain. The reduction of E' in these patients might indicate an additional impairment of LV relaxation.

952 Tissue Doppler Imaging in Non Cardiac Patients

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Purpose: Several pathological and clinical studies have described the occurrence of human immunodeficiency virus (HIV) associated cardiac abnormalities. Doppler imaging (TDI) is a useful tool for the detection of subtle abnormalities in the systolic function. The purpose of this study was to investigate left ventricular (LV) systolic function in HIV infected patients, both, with conventional echocardiography and TDI in the era of highly active antiretroviral therapy (HAART).

Methods: We studied 35 HIV infected pts (aged 37.6±7.3 years, 26 men - Group A) all receiving HAART, and 30 (36.5±6.1 years, 20 men - Group B) apparently healthy controls subjects. CD4 lymphocyte count and quantitativa measurement of plasma viral load (VL) were obtained in all HIV-infected pts. All pts underwent simultaneous, 2D echocardiography and TDI. The ejection fraction (EF) was calculated with 2D echocardiography by applying Simpson’s rule. Long axis systolic function were measured from the apical 4-chamber view with DTD, by positioning the sample volume just apical to the SM and lateral (SII) mitral annulus. Pts with a history of ischemic, hypertrophic, dilated congenital, or rheumatic cardiomyopathy, ethanol abuse (>50 g/day), hypertension, significant valvular disease, and atrial fibrillation were excluded. All medications that might possibly interfere with LV contractility were discontinued for at least two days before the examination.

Results: Conventional echocardiography did not show any difference between the 2 groups concerning EF (63.6±3.8 in group A vs 64.6±4.8 in group B, p=ns). When TDI was performed a statistical difference was found for both SM and SII between the groups studied (Sm: 8.2±1.1 cm/sec in group A vs 9.7±1.1 in group B, p=0.04 and, SI. 10.6±1.3 cm/sec in group A and 13.1±1.4 in group B, p=0.02). Furthermore, in HIV infected pts a positive correlation was found between myocardial velocities and CD4 lymphocyte count (for Sm: r=0.39, p=0.01 and for SII: r=0.57, p=0.01).

Conclusions: TDI reveals impairment in the long-axis LV contractile function in HIV infected pts. TDI study should be expanded even in the asymptomatic pts aiming at an early identification, and treatment, of heart muscle involvement.
We sought to analyze myocardial relaxation using CDMI in acromegalic patients (pts.) without LHV or diastolic dysfunction according to PWE and in pts with initial changes in these parameters.

Material nd methods: 32 pts. with acromegaly (49.5±10.5 years) with normal systolic function were distributed in 2 groups according to disease activity. Group A: 12 pts. in remission after pituitary adenectomy; Group B: 20 pts. with active disease. All had LVEF >50% with no prior history of cardiac disease. Sixty-five age and sex matched controls were also studied. All underwent a standard cross sectional transthoracic echocardiogram with tissue Doppler Imaging (TDI). Peak long axis velocity (Sm) was determined for averaging the values from the septal and lateral sites of the mitral annulus. Strain and strain rate data were collected from the basal, mid and apical segments of the anterior and inferior walls.

Results: Mean LVEF and LV end systolic diameter (LVESD) were similar in the 2 groups. Mean Sm was significantly lower in patients with ESRD compared to controls (7.4 cm/sec vs 9.8 cm/sec, p=0.02). Averaged mean myocardial deformation indices were significantly lower in patients with ESRD compared to controls (Strain: 39±18 vs 54±20, p=0.03; Strain rate: -1.1 vs -1.9, p=0.02). Longitudinal strain and strain rate were significantly lower in all LV segments of the inferior and anterior walls for patients with ESRD compared to controls. Myocardial strain correlated with LV mass (r=0.49, p=0.03) but not LVESD in patients with ESRD.

Conclusions: Subclinical changes in LV function can be detected in patients with ESRD and normal LVEF at the onset of dialysis therapy. TDI may be useful in the future for predicting LV function in this patient group before the ventricle starts to fail irreversibly.

MYOCARDIAL VELOCITY IMAGING (DMI) – OTHER

955

Echo-TDI evaluation of left atrial function in patients with major thorassessa
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Hernosclerosis is the main cause of cardiac dysfunction, which is revealed by heart failure and arrhythmias, in patients with thorassessa major (TM). Heart disease conditions the prognosis, so it’s very important to identify early markers for a specific therapy. New echocardiographyc techniques, as Tissue Doppler Imaging (Echo-TDI), concour to study the regional ventricular and atrial systolic dysfunction. Recent studies underscores that the first represents the ratio between the protodiastolic velocity of the transmitral flow (E) and the velocity of the protodiastolic movement of the mitral annulus (Em). The latter is considered as well related with the left ventricular (LV) telediastolic pressure. Aim of the study was to identify, with TDI, some differences of the atrial function in pts with TM and previous episodes of supraventricular arrhythmias. We examined 24 pts (14 M and 10 F, TAL group), divided on the basis of the presence (TAL1, 11 pts) or absence (TAL2, 13 pts) of supraventricular arrhythmias and 12 healthy people (NORM, 9 M and 3 F). All pts underwent Echo-TDI evaluation of morphological (LVIDd, LVIDs, LAD, LAarea), systolic (LVEF) and diastolic function (PVE, PVA, E/A) and derived from TDI parameters, as the velocity at the mitral annulus (Sm, Em, Am, E/Em), the maximal strain rate (SR peak) during systole (S), early filling (E) and atrial contraction and their relative time of peak (SR time) for the LV at the basal septum (SV) and free cardiac wall (PLV) and for the atria at the distal interatrial septum (SAI) and free atrial wall (PAL). We executed a statistic analysis among the groups using Student’s t-test for comparison. We found significant differences comparing E/Em at the distal interatrial septum (SIA) and free atrial wall (PAL). Peak (SR time) for the LV at the basal septum (SIV) and free cardiac wall (PLV)

Table 1. Results

<table>
<thead>
<tr>
<th>Age</th>
<th>LV mass index (g/m²)</th>
<th>E/A</th>
<th>PVA/E</th>
<th>MVAdur</th>
<th>E</th>
<th>E’A</th>
</tr>
</thead>
<tbody>
<tr>
<td>control group</td>
<td>39.41</td>
<td>94.91</td>
<td>1.33</td>
<td>0.66</td>
<td>-11.92</td>
<td>1.79</td>
</tr>
<tr>
<td>remission</td>
<td>45.25</td>
<td>99.46</td>
<td>1.13</td>
<td>0.88</td>
<td>-7.94</td>
<td>1.16</td>
</tr>
<tr>
<td>active disease</td>
<td>52.10#</td>
<td>110.19#</td>
<td>1.02*</td>
<td>0.68</td>
<td>-6.42*</td>
<td>0.80#</td>
</tr>
</tbody>
</table>

Values expressed as mean value. * p<0.03 vs control group, # p=0.03 vs control group, p=0.21 vs group A

LV FUNCTION – OTHER

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Relationship of left ventricular dysfunction and inflammation in acute coronary syndromes
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Background and aim: Inflammatory markers are widely investigated as prognostic factors in acute coronary syndromes (ACS). The aim of the study was to assess the relationship of initial levels of interleukin (IL) 6, high sensitivity C - reactove protein (Hs CRP) and fibrinogen as well as monocytes and white blood cells (WBC) with cardiac diastolic function and strain rate data were collected from the basal, mid and apical segments of the anterior and inferior walls.

Results: We sought to analyze myocardial relaxation using CDMI in acromegalic patients (pts.) without LHV or diastolic dysfunction according to PWE and in pts with initial changes in these parameters.

Purpose: The most common feature of myocardial involvement in acromegaly is left ventricular hypertrophy (LHV) which is often accompanied by diastolic dysfunction (DD). By measuring myocardial velocities with Color Doppler Myocardial Imaging (CDMI) we can detect changes in myocardial function more accurately than by conventional echocardiography (PWE).

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Is color Doppler myocardial imaging superior to conventional echocardiography in early detection of myocardial dysfunction in acromegaly?
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Introduction: Tissue Doppler Imaging (TDI) has been proposed for the differentiation between physiological and pathological left ventricular hypertrophy (LHV). Normal or even supernormal diastolic TDI velocities have been assessed in patients with major thorassessa.

Methods: Eighty patients with ESRD (mean age 54±11 years, 67 male, mean creatinine 610 ± 198 µmol/L) were enrolled immediately prior to the initiation of dialysis therapy. All had LVEF >50% with no prior history of cardiac disease. Sixty-five age and sex matched controls were also studied. All underwent a standard cross sectional transthoracic echocardiogram with tissue Doppler Imaging (TDI). Peak long axis velocity (Sm) was determined for averaging the values from the septal and lateral sites of the mitral annulus. Strain and strain rate data were collected from the basal, mid and apical segments of the anterior and inferior walls.

Results: Mean LVEF and LV end systolic diameter (LVESD) were similar in the 2 groups. Mean Sm was significantly lower in patients with ESRD compared to controls (7.4 cm/sec vs 9.8 cm/sec, p=0.02). Averaged mean myocardial deformation indices were significantly lower in patients with ESRD compared to controls (Strain: 39±18 vs 54±20, p=0.03; Strain rate: -1.1 vs -1.9, p=0.02). Longitudinal strain and strain rate were significantly lower in all LV segments of the inferior and anterior walls for patients with ESRD compared to controls. Myocardial strain correlated with LV mass (r=0.49, p=0.03) but not LVESD in patients with ESRD.

Conclusions: Subclinical changes in LV function can be detected in patients with ESRD and normal LVEF at the onset of dialysis therapy. TDI may be useful in the future for predicting LV function in this patient group before the ventricle starts to fail irreversibly.
Methods: We studied 108 consecutive athletes by echocardiography according to the ASE guidelines. Diastolic function was assessed by flow Doppler analysis of LV filling and by pulsed TDI of MA motion.

Results: Systolic function was found normal in all athletes and structural heart disease was excluded by echocardiography. Mean LV enddiastolic index was 27±3 cm²/m² (>30 cm²/m² in 14 athletes). Mean enddiastolic thickness of septum (10±2 mm; >12 mm in 14 athletes (13%) and posterior wall (9±2 mm) was normal. Peak oxygen consumption during treadmill testing was 55±7 ml/min/kg. Mean early diastolic velocity E' was 16±4.3 cm/s at the posterior wall and 28±3 cm/s at the septal MA. An early diastolic velocity E' < -14 cm/s at the posterior MA was found in 19 of the 108 athletes (17%) and an E' < -13 cm/s at the septal MA was found in 46 athletes (43%). A mean E/E' ratio of 5.2±1.2 (left lateral MA) and of 6.6±1.6 (septal MA) was calculated.

Conclusion: TDI analysis showed (supra-)normal diastolic velocities of the MA in the majority of athletes. However, the proposed cut-off-values are challenged by our data.

LV FUNCTION – OTHER

Tissue doppler imaging can distinguish pathological from physiological left ventricular hypertrophy in master athletes with mild hypertension

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Background and objective: Left ventricular wall thicknesses at transthoracic echocardiography are often increased in master athletes, a growing population of trained people observed in Sport Medicine. The observed Left Ventricular Hypertrophy (LVH) may be a physiological remodeling induced by physical training or the expression of a pathological hypertrophy because of the mild hypertension observed in this middle-aged population. The conventional Pulsed Wave (PW) Doppler analysis of diastolic function, always affected in pathological LVH, is poorly useful to distinguish between physiological and pathological LVH. Aim of this study is to evaluate the role of pulsed wave Tissue Doppler Imaging (TDI) in differentiating pathological from physiological LVH in middle-aged population.

Methods: We have selected a group of 80 master athletes with mild hypertensive state and a group of 80 sedentary subjects suffering from essential hypertension but with a normal diastolic function on standard echo-tensive state and a group of 80 sedentary subjects suffering from essential hypertension but with a normal diastolic function on standard echo-tensive state and hypertrophic cardiomyopathy (HCM). The aim of our study was to analyse peak diastolic MA Doppler velocity in top level athletes (German national handball league). The observed LV hypertrophic segments to coronary arteries in PFP (-11.3±4.8% vs -15.8±2.4%, p<0.01). Finally, no strain apex-base gradient was observed in HCM whereas it was found in PFP and CTL. Inter and intra-observer variabilities ranged between 9 and 13%.

Conclusion: 2D strain can identify specific patterns of myocardial deformation in PPF, CTL and HCM, particularly for pathological segments. The feasibility and reproducibility of the technique make it a clinically applicable method to distinguish between athlete’s heart and HCM.

Table 1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>PFP</th>
<th>CTL</th>
<th>HCM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal</td>
<td>-16.9±4</td>
<td>-20.3±5.6</td>
<td>-14.9±7.7</td>
</tr>
<tr>
<td>Transverse</td>
<td>34.7±4</td>
<td>27.3±14.9</td>
<td>23.5±17.6</td>
</tr>
<tr>
<td>Circumferential</td>
<td>-19.1±5.7</td>
<td>-19.8±8.2</td>
<td>-18.6±9.8</td>
</tr>
<tr>
<td>Radial</td>
<td>39.3±16.2</td>
<td>36.6±18.2</td>
<td>25.1±13.9</td>
</tr>
</tbody>
</table>

Eur J Echocardiography Abstracts Supplement, December 2006
Results: Heart rate was 71±7 bpm before and 72±8 bpm after apnoea (change: +3±13%, p<NS). Systolic and diastolic BP were 123±12 mm Hg and 78±7 mm Hg before, and 118±15 mm Hg (<4.9%, p<NS) and 78±10 mm Hg (+11±14%, p<NS) after apnoea. Main echocardiographic findings are reported in table underneath.

Conclusions: Findings from the present study suggest that breath-hold submersion in professional sea divers induces mild but statistically significant diastolic dilatation of the left ventricle with weak reduction of systolic diameter, likely due to increased systolic function. In fact, septal and infero/lateral wall motion improve, as well as circumferential fractional shortening, irrespective of significant changes in BP. The most likely explanation is a transient blood shift phenomenon, as already demonstrated in deepest submersion activities.

### Table 1

<table>
<thead>
<tr>
<th>Index</th>
<th>Study group (n=90)</th>
<th>Control group (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV EF.</td>
<td>56.4±8.2</td>
<td>62.8±4.3*</td>
</tr>
<tr>
<td>?, cm/s</td>
<td>-9.24±0.78</td>
<td>-11.73±0.56*</td>
</tr>
<tr>
<td>?, cm/s</td>
<td>-12.03±0.56</td>
<td>-14.23±0.48*</td>
</tr>
<tr>
<td>?, cm/s</td>
<td>0.65±0.02</td>
<td>0.89±0.08*</td>
</tr>
<tr>
<td>?, cm/s</td>
<td>7.64±0.42</td>
<td>8.47±1.22*</td>
</tr>
<tr>
<td>?, m/sec</td>
<td>84±4.48</td>
<td>62±2.54*</td>
</tr>
<tr>
<td>DT, msec</td>
<td>124.4±3.3</td>
<td>112.3±3.81*</td>
</tr>
<tr>
<td>IVCT</td>
<td>40.5±2.75</td>
<td>60.3±3.14*</td>
</tr>
<tr>
<td>IVRT</td>
<td>92.4±4.56</td>
<td>82.2±5.62*</td>
</tr>
</tbody>
</table>


### MYOCARDIAL VELOCITY IMAGING (DMI) – LV FUNCTION

#### 963

**Left ventricular myocardial function in hypertensive patients with combined diabetes mellitus according to pulsed wave tissue doppler imaging**

**S.V. Potashyev; M.N. Dolzhenko; N.A. Perepelchenko**

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2. National Medical Academy Of Postgraduate Educ, Cardiology and Functional Diagnosis Dept., Kyiv, Ukraine

Combination of hypertension with diabetes mellitus (DM) significantly worsens the prognosis in such category of patients. Left ventricle (LV) velocity and time indices abnormalities by tissue Doppler imaging (TDI) as a sign of LV remodeling are associated with heart failure development and is a sensitive marker of adverse outcome. The objective of the study was evaluation of mitral annulus motion indices in the patients with hypertension combined with DM type II. We studied 30 patients with hypertension combined with DM type II (mean age 62.3±10.1 years). All patients received conventional treatment: ACE inhibitors, beta-blockers and thiazide diuretics, peroral hypoglycemic agents. Control group included 30 hypertensive patients without DM. All patients underwent EchCo with pulsed wave (PW) TDI of mitral annulus motion evaluation. Regional contractility abnormalities was a criterium for exclusion from the study. TDI velocity and time indices of mitral annulus septal segment were studied (view Table: M±SD, *p<0.05*).

In the patients with hypertension combined with DM type II PW TDI revealed significant worsening of systolic and diastolic LV myocardial function compared to those without DM, which suggests the presence of more “aggressive” blood pressure and serum glucose control in this specific group of patients.

#### Table 1

<table>
<thead>
<tr>
<th>Index</th>
<th>Study group (n=30)</th>
<th>Control group (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV EF.</td>
<td>56.4±8.2</td>
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</tbody>
</table>

### MYOCARDIAL VELOCITY IMAGING (DMI) – LV FUNCTION

#### 964

**Left ventricular diastolic functional abnormalities in asymptomatic patients with type II diabetes mellitus. Its relation with aortic elastic properties**

**E. Seyfeli; M. Duru; H. Saglam; F. Akgul; F. Yalcin; H. Kaya**

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2. Mustafa Kemal University, Hatay, Turkey; Akyon Kocatepe University, Akyonka, Isparta, Turkey

**Objectives:** The aim of this study was to investigate the association between aortic elastic properties and left ventricular diastolic function measured by tissue Doppler echocardiography (TDE) in asymptomatic type 2 diabetes mellitus.

**Methods:** 57 asymptomatic patients with type 2 diabetes without clinical coronary artery disease (33 women, 24 men, mean age: 49±6 years) and 25 healthy control subjects (19 women, 6 men, mean age: 46±7 years) were included in present study. Diastolic filling indices were measured by conventional (CE) and tissue Doppler echocardiography. Aortic elastic properties were measured as follows; Aortic root distensibility (cm²/dyn/103) = 2x (AoS-AoD)/(PpXAoD); Aortic stiffness index (ASI) = ln( SBP/DBP)/(AoS-AoD)/ AoD; Aortic strain (%): AoS-AoD/AoDx100; where; AoS, Aort systolic diameter (mm); AoD, Aort diastolic diameter (mm); Pp, pulse pressure; SBP, systolic blood pressure; DBP, diastolic blood pressure.

**Results:** Compared to control subjects, the ratio of LV diastolic abnormalities measured by CE and TDE were found higher in patients with type 2 diabetes (36% and 73.6%, p<0.001, respectively, and 52%, and 89.4%, p<0.001, for septal annulus; 48%, and 89.4%, p<0.001 for septal basal, respectively). The aortic stiffness index was significantly higher (p=0.001), aortic distensibility and aortic strain were also significantly lower in patients with type 2 diabetes than control subjects (p<0.001 and p<0.001, respectively).

In the multivariate linear regression analysis, Aa distensibility was correlated with age (β=0.310, p=0.006), septal basal Em/Aa ratio (β=0.406, p<0.001). ASI was also correlated with the presence of diabetes mellitus (β=0.395, p=0.005) and lateral basal Em/Aa ratio (β=0.443, p<0.001).

**Conclusions:** Aortic elastic function is impaired in asymptomatic patients with type 2 diabetes. Increased ASI and decreased Aa distensibility are closely associated with diastolic filling indices measured by TDE.

### LV FUNCTION – OTHER

#### 965

**Impact of leptin upon cardiac systolic, diastolic, global myocardial and autonomic function in patients with noninsulin dependent diabetes**

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1. National Medical Academy Of Postgraduate Educ, Cardiology and Functional Diagnosis Dept., Cairo, Egypt
2. Suez Canal University, Cardiology Dept., Ismailia, Egypt

**Purpose:** The increased cardiovascular burden, associated with diabetes mellitus (DM), is due to structural or functional abnormalities induced by DM only or by hyperinsulinemia and insulin resistance associated with metabolic disorders. Recent studies have shown that leptin increases in insulin-resistant states, such as obesity and hypertension. On the basis of evidence of plasma leptin effects on cardiovascular system, we assessed possible impact of leptin upon cardiac function whether systolic or diastolic, also the impact upon global myocardial function assessed by a Doppler-derived myocardial performance index (Tei index) as well as cardiac autonomic function (CANN) in type 2 diabetic patients.

**Methods:** Twenty four type 2 diabetic patients aged 51.1±7.2 years with LV functional changes defined as fasting plasma glucose ≥126 mg/dl without hypertension. Twenty four type 2 diabetic patients without LV functional changes, aged 47.6±9.0 years, were the controls. ECG was performed and QTc dispersion (QTCd) was calculated for detection of CAN. Ejection fraction (EF), fractional shortening (FS), E velocity, A/A ratio, iso-volumetric relaxation time (IRT), iso-volumetric contraction time (ICT), ejection time (ET), and the combined index of myocardial performance (Tei index=IRT+ICT/ET), were calculated by echocardiography Doppler.FAST serum leptin and insulin were assessed. Fasting blood sugar (FBS) and glycosylated hemoglobin (HbA1c) were also assessed. The correlations of leptin to QTCd, EF, FS, E/A ratio and Tei index were statistically analyzed.

**Results:** BMI, FBS, fasting serum leptin and insulin were significantly greater in the cases than in the controls. QTCd, EF and FS showed non-significant differences between groups. There were statistically significant differences between groups in E/A ratio and Tei index. In the case group, leptin was significantly correlated with FBS and fasting serum insulin. Leptin was not significantly correlated with QTCd. Leptin was negatively correlated with E/A ratio and positively correlated with Tei index in the case group.

**Conclusion:** It can be concluded that in conjunction with hyperglycemia, increased free fatty acids, insulin resistance and cardiac autonomic neuropathy, serum leptin is another risk factor associated with the development of diabetic cardiomyopathy.

**Key words:** Leptin, diabetes mellitus, Left ventricular diastolic function, Tei index

### MYOCARDIAL VELOCITY IMAGING (DMI) – LV FUNCTION

#### 966

**Microalbuminuria does not cause additional left ventricular dysfunction in patients with type 2 diabetes. Results of the Myocardial Doppler in Diabetes (MYDID) Study III**

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2. Bangalore, India
3. Stockholm, Sweden

**Background:** Microalbuminuria (MA) has long been known as a risk factor for macrovascular disease in patients with type 2 diabetes. It is however not known whether MA causes left ventricular (LV) regional systolic and diastolic dysfunction.
diastolic dysfunction over and beyond of what is caused by DM alone. The aim of the present study was to investigate whether MA causes additional myocardial functional disturbances in patients with DM.

Methods: 39 non-consecutive, age-matched, human subjects (14 DM without MA, Group; 15 DM with MA, Group 2; 10 normal controls, Group 3) underwent tissue Doppler echo-Doppler (TVE) -enhanced dobutamine stress echocardiography. The DM subjects had no prior history of cardiac events and were asymptomatic. Biochemical data along with HbA1c (%) and urinary microalbumin (UA, µg/L) were obtained using standard methods. Stress images were post-processed on Echopac software (GE) to obtain the TVE variables viz., peak systolic (PSV) & early (E) diastolic velocities (cm/s). Isovolumetric contraction (IVC), relaxation (IVRT) and ejection (ET) times (msec) were measured to obtain Tei index using the formula (IVC+IVRT)/ET in order to assess global myocardial performance. The TVE data were obtained from 4 LV bases. ANOVA followed by Tukey Honest test was performed to compare the groups while unpaired t test was performed to compare the DM groups. p<0.05 was considered statistically significant.

Results: Average age of the patients were 50±6 years. All DM subjects were on oral medications. Fasting plasma glucose, mg/dl (184±13 vs 203±11), and HbA1c (8.0±0.7 vs 8.1±0.6) did not differ between Group 1 &2. UA (µg/L) was significantly higher in Group 2 (100±10) compared with Group 1 (67±2.5; p<0.001). PSV (cm/s) at rest in the LV lateral wall was lowest in Group 2 (4.7±1.1) that differed both from Group 1 (5.6±1.2) and Group 2 (5.8±1.4) (all p<0.05). At peak stress PSV was significantly higher in septum in Group 3 (13.8±2.1) compared with Group 1 (11.1±1.6) and Group 2 (10.0±1.5) (all p<0.001), without any difference between Group 1 & 2. Similar PSV response to stress was also noted in other LV walls. E velocity was significantly lower in the DM groups in all LV walls both at rest as well as during peak stress, without any difference between the DM subjects. Tei index was significantly higher in Group 1 (0.92±0.1 vs 0.40±0.2; p<0.05) compared with Group 3, without any difference in DM subjects.

Conclusions: TVE-defined LV dysfunctions are common in subjects with DM irrespective of the presence of microalbuminuria.

967 Impaired glucose tolerance and insulin resistance significantly affect left ventricular systolic function in patients with STEMI

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1Wroclaw Medical University, Cardiology Dept., Wroclaw, Poland; 2Wroclaw Medical University, Wroclaw, Poland

Aim: to investigate the association of glucometabolic disturbances and insulin resistance (IR) with tissue Doppler imaging (TDI) indices of left ventricular (LV) systolic function in patients with ST elevation myocardial infarction (STEMI).

Methods: studied group consisted of 30 consecutive pts, 19 male (63%), aged 57±11.2 yrs with first in-life STEMI, treated with primary percutaneous coronary intervention, including 14 pts with anterior and 16 with inferior STEMI. Single-vessel disease was diagnosed in 22 pts whereas multivessel disease in 8. Impaired glucose tolerance (IGT), diabetes mellitus (DM) and IR were diagnosed based on HOMA IR index and glucose and insulin profile during oral glucose tolerance test (OGTT) performed before discharge. Echo studies with TDI were performed 7 days and 6 months after STEMI. The analysis of TDI curves comprised the parameters expressed as their mean values obtained from the six LV basal segments: peak systolic velocity (Sm), peak early (Em) and late (Am) diastolic velocity, peak velocity during isovolumic contraction (ICV) and velocity acceleration during isovolumic contraction (ICA).

Results: IGT, DM and IR were diagnosed in 9, 8 and 13 pts, respectively. The presence of IGT and IR (based on insulin profile during OGTT) strongly correlated with alterations of LV systolic function as expressed by significant decrease in Sm, ICV and ICA between both echo studies (table). These relations in case of IGT were confirmed in multivariate analyses including age, gender, localisation of STEMI, extension of atherosclerosis in coronary arteries and peak plasma levels of troponin I, high sensitive C-reactive Protein, interleukin-6, interleukin-10, fibrinogen and N-Terminal pro-Brain Natriuretic Peptide.

Conclusions: in patients with STEMI: (1) both IGT and IR may significantly contribute to the impairment of LV contractile function; (2) not only fasting examination, but also OGTT with simultaneous post-load insulin evaluation may be recommended to identify high-risk pts.

<table>
<thead>
<tr>
<th>delta Sm</th>
<th>delta ICV</th>
<th>delta ICA</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGT (+)</td>
<td>R=0.42, p&lt;0.01</td>
<td>R=0.38, p&lt;0.03</td>
</tr>
<tr>
<td>DM (+)</td>
<td>R=0.24, NS</td>
<td>R=0.31, NS</td>
</tr>
<tr>
<td>HOMA (mg% x µU/mL)</td>
<td>R=0.06, NS</td>
<td>R=0.25, NS</td>
</tr>
<tr>
<td>IR (+)</td>
<td>R=0.34, p&lt;0.04</td>
<td>R=0.28, NS</td>
</tr>
</tbody>
</table>

968 Correlation between left ventricular geometry and right ventricular structural and functional changes in hypertensive patients

Y.A. Yasuk1; A.B. Hadzegova1; S.V. Ivanova1; N.I. Gerasimova1; I.M. Amirbegiyou1; P.V. Krikunov2; Y.N. Yushnik1
1Moscow State Univ. Of Medicine And Dentistry, Moscow, Russian Federation

Objectives: To assess structural and functional changes of the right ventricle (RV) depending on left ventricular (LV) geometry in hypertensive patients.

Patients: We examined 138 hypertensive patients (43 men, 95 women, mean age 50.4±6.1) and 24 sex- and age-matched healthy volunteers (control group). Patients with coronary artery disease, obstructive lung disease, diabetes mellitus and other chronic diseases were not included.

According to echocardiographic findings (39.1%) hypertensives had normal LV geometry, 27 (19.6%) - concentric LV remodeling, and 57 (41.3%) - concentric LV hypertrophy.

Methods: 24-hour ambulatory blood pressure monitoring, treadmill-test, transthoracic echocardiography, Doppler echocardiography (DE) of transmural and transcruspid blood flow and tissue Doppler imaging (TDI) of tricuspid annulus above RV free wall.

Results: In hypertensives compared to controls concentric LV hypertrophy was accompanied by greater RV internal diameter (3.0±0.3 vs 2.8±0.5 cm, p=0.04) and RV free wall thickness (0.50±0.13 vs 0.36±0.08 cm, p<0.001). In concentric LV remodeling group only RV free wall thickness was greater (0.52±0.11 vs 0.36±0.08 cm, p<0.001), meanwhile there was no significant difference between normal geometry group and controls. According to DE, peak velocities ratio of transcruspidal flow (E/A) was decreased in concentric LV hypertrophy (1.1±0.2 vs 1.4±0.3, p<0.001) and concentric remodeling group (1.1±0.3 vs 1.4±0.3, p=0.006) compared to controls.

TDI of tricuspid annulus above RV free wall revealed the decrease of peak velocities ratio Em/Am in hypertensives with concentric LV hypertrophy (1.0±0.3 vs 0.8±0.2, p<0.001), concentric LV remodeling (1.03±0.3 vs 0.9±0.2, p=0.01) and normal LV geometry (1.03±0.3 vs 0.9±0.2, p=0.02) compared to controls. In hypertensives with concentric LV hypertrophy regional isovolumic relaxation time was also greater than in controls (41.9±29.4 vs 23.7±30.5 ms, p=0.01).

Conclusion: In hypertensive patients LV remodeling is accompanied by RV structural changes, which are more severe in concentric LV hypertrophy patients. DE assessment of transcruspid blood flow reveals the impairment of RV diastolic function in LV concentric hypertrophy and concentric remodeling group, whereas TDI of tricuspid annulus above RV free wall can reveal these changes on the stage of normal LV geometry.

969 Impact of diabetes on global and diastolic function of left ventricle in hypertensives

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1Kyunghee East-West Neo Medical Center, Cardiovascular Center Dept., Seoul, Republic of Korea; 2Kyunghee Medical Center, Cardiology Dept., Seoul, Republic of Korea

Background: Both hypertensives and diabetes are at high risk for cardiovascular morbidity and mortality. Compared with patients with essential hypertension without diabetes (HTN), patients with both hypertension and diabetes (HTN DM) may be at higher risk for future cardiovascular complication. Thus, we hypothesized that HTN DM have more depressed left ventricular (LV) function than HTN.

Methods: Echocardiography including 2D and tissue Doppler imaging (TDI) was taken in HTN (n=149) and HTN DM (n=96) with normal systolic function, sinus rhythm on ECG, and without history of ischemic heart disease or significant valvular heart disease.

Results: Both group had similar age, body mass index, LV mass, and ejection fraction, relative wall thickness, and myocardial performance index (MPI) as a predictor of global LV function. Prevalence of LV geometric patterns such as concentric remodeling, eccentric hypertrophy, concentric hypertrophy were similar in both group. On Doppler study, early diastolic mitral annulus velocity by TDI (Ea) was significantly lower in HTN DM (5.6±1.9 vs 6.17±1.78, p<0.05), and the ratio of peak early mitral inflow velocity (E) to Ea was significantly higher in HTN DM group than HTN (13.46±4.12 vs 12.05±3.73, p<0.01).

Conclusions: Diastolic function on TDI were more depressed in HTN DM than HTN despite of similar global LV function and geometry. Its clinical relevance should be assessed further in detail.
Table 1. Doppler parameters of subjects

<table>
<thead>
<tr>
<th></th>
<th>HTN</th>
<th>HTN DM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early mitral inflow (E)/cm/s</td>
<td>70.2±17.1</td>
<td>71.4±16.8</td>
</tr>
<tr>
<td>Dd (msec)</td>
<td>215.0±42.4</td>
<td>219.8±45.9</td>
</tr>
<tr>
<td>IVRT (msec)</td>
<td>108.6±19.8</td>
<td>110.6±22.8</td>
</tr>
<tr>
<td>Ea (cm/s), septal annulus</td>
<td>6.17±1.78</td>
<td>5.65±1.97</td>
</tr>
<tr>
<td>E/Ea, septal annulus</td>
<td>12.0±3.75</td>
<td>13.4±4.12</td>
</tr>
<tr>
<td>Ea (cm/s), lateral annulus</td>
<td>7.87±2.12</td>
<td>7.12±2.38</td>
</tr>
<tr>
<td>E/Ea, lateral annulus</td>
<td>9.5±3.48</td>
<td>10.89±3.67</td>
</tr>
<tr>
<td>LV MPI</td>
<td>0.47±0.1</td>
<td>0.47±0.11</td>
</tr>
</tbody>
</table>

tp<0.05, tp<0.01 vs HTN

970
Myocardial performance index in hypertensive patients with isolated diastolic dysfunction: Comparison between conventional pulse wave Doppler and tissue Doppler

J.M.G. Fernandes 1; B.O. Romao 1; I.R. Rivera 1; M.A. Mendonca 1; V.A. Moises 1
1Universidade Federal de Alagoas, UnCar, Maceio, Arapiraca, Brazil;
2Universidade Federal de Alagoas, Cardiologia Dept., Maceio, Brazil;
3Universidade Federal de Sao Paulo, Cardiologia Dept., Sao Paulo, Brazil

Background: The Doppler derived Myocardial Performance Index (MPI) that combines systolic and diastolic time intervals, is measured conventionally by pulsed-wave Doppler (PWD-MPI). Recently some investigators have obtained this index with tissue Doppler imaging (TDI-MPI) that enables to measure these intervals simultaneously. Although PWD-MPI has been demonstrated to be an indicator of global cardiac function it is unknown whether such results can also be applied to the TDI-MPI. The purpose of the study was to determine the diagnosis accuracy and the degree of agreement between PWD-MPI and TDI-MPI in hypertensive patients with mild diastolic dysfunction (DD) and normal ejection fraction.

Methods: We studied 56 consecutive health adults (control) with normal echocardiogram (28 male, 39±11 years) and 49 subjects with DD (19 male, 66±10 years) defined as E/Ea ratio <1.0 and two of the following criteria: deceleration time >220 ms; early diastolic velocity on the septal annulus (Em)<8 cm/s; and ratio of mitral velocity to Em (E/Em)>8.

Results: PWD-MPI and TDI-MPI were significantly higher in patients with DD than in control subjects. The increase was caused by the prolongation of IRT without a significant variation of isovolumic contraction time and ejection time. The limits of agreement between both methods, according to the Bland-Altman method, range from -0.23 to 0.19 in group control and -0.28 to 0.24 in DD group. PWD-MPI>0.40 and TDI-MPI>0.41 as cutoff point (derived from ROC curves analysis) identified DD subjects with a sensitivity of 65% and 71% and a specificity of 63% and 62% respectively.

Conclusions: PWD-MPI and TDI-MPI showed an acceptable clinical agreement and were increased in hypertensive patients with isolated mild diastolic dysfunction.

Table 1. Time intervals measured by PWD and TDI

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>PWD</th>
<th>TDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET (ms)</td>
<td>307±24</td>
<td>306±28</td>
<td>8.9</td>
</tr>
<tr>
<td>IRT (msec)</td>
<td>196±22</td>
<td>&lt;0.001 80.2±20</td>
<td>111±25</td>
</tr>
<tr>
<td>ICT (ms)</td>
<td>34±15</td>
<td>32±19</td>
<td>0.60</td>
</tr>
<tr>
<td>ICT/ET</td>
<td>0.11±0.05</td>
<td>0.10±0.064</td>
<td>0.16</td>
</tr>
<tr>
<td>MPI</td>
<td>0.38±0.01</td>
<td>0.4±0.12</td>
<td>0.03</td>
</tr>
</tbody>
</table>

ET: ejection time, ICT: isovolumic contraction time, IRT: isovolumic relaxation time

971
Cardiovascular manifestations in relation to the degree of renal disease

E. Linder Klungsell 1; K. Caldahti 1; U. Hahn-Lundstrom 2; B. Hylander 2; S.H. Jacobson 3; A. Pagels 2; K. Jensen-Urstad 1; M.J. Eriksson 1
1Karolinska Institutet, Molecular Medicine and Surgery Dept., Stockholm, Sweden; 2Karolinska University Hospital, Nephrology Dept., Stockholm, Sweden

Background: Advanced renal insufficiency has been recognized as an important risk factor for cardiovascular disease (CVD). However, the mechanisms underlying this association are still incompletely understood. Increased left ventricular mass mediated through increased arterial stiffness may be one of the pathways linking even mild decline in glomerular filtration (GFR) to CVD. Therefore we studied vascular and cardiac function in patients with different degree of renal disease.

Methods: The study population consisted of 44 patients with GFR 50-70 ml/min (Group III), 30 patients with GFR<20 ml/min (Group IV) and 21 healthy age-matched controls with GFR>70 ml/min (Group I). Mean age was 50±10.5 years (19-64). None of the patients was on dialysis. All study subjects underwent blood pressure measurements, echocardiography and carotid ultrasound for estimation of arterial stiffness.

Results: There were no differences between the groups with regard to BMI, BSA, age or gender distribution.

Table 1. Doppler parameters of subjects

<table>
<thead>
<tr>
<th></th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV EF (m%)</td>
<td>&gt;50</td>
<td>&gt;70</td>
<td>50-70</td>
</tr>
<tr>
<td>(n=20)</td>
<td>(n=44)</td>
<td>(n=30)</td>
<td></td>
</tr>
<tr>
<td>Systolic blood pressure (mm Hg)</td>
<td>006 (05)</td>
<td>024 (06)</td>
<td>035 (06)</td>
</tr>
<tr>
<td>Diastolic blood pressure (mm Hg)</td>
<td>73 (00)</td>
<td>79 (00)</td>
<td>79 (00)</td>
</tr>
<tr>
<td>Arterial stiffness</td>
<td>5.3 (0.9)</td>
<td>5.2 (0.7)</td>
<td>7.0 (3.0)</td>
</tr>
<tr>
<td>Intima-media thickness (mm)</td>
<td>0.66 (0.2)</td>
<td>0.64 (0.0)</td>
<td>0.62 (0.0)</td>
</tr>
<tr>
<td>LV mass (g)</td>
<td>225 (54)</td>
<td>245 (87)</td>
<td>278 (87)</td>
</tr>
<tr>
<td>LV mass index (g/m²)</td>
<td>005 (24)</td>
<td>028 (36)</td>
<td>040 (34)</td>
</tr>
<tr>
<td>LV EF</td>
<td>63 (9)</td>
<td>62 (8)</td>
<td>62 (8)</td>
</tr>
<tr>
<td>E/A</td>
<td>0.5 (0.4)</td>
<td>0.3 (0.4)</td>
<td>0.2 (0.4)</td>
</tr>
<tr>
<td>E/E</td>
<td>5.6 (4.0)</td>
<td>6.4 (2.7)</td>
<td>7.6 (2.6)</td>
</tr>
</tbody>
</table>

†p<0.05, ‡p<0.01 vs HTN

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Impact of persistence of arteriovenous fistula after kidney transplantation on left and right ventricular function and motion as studied by tissue Doppler imaging

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Purpose: Maintaining arteriovenous fistula after kidney transplantation is often debated as its presence has been reported to induce high-output cardiac failure.

Methods: In order to evaluate the cardiac impact of persistence of arteriovenous fistula after kidney transplantation, we compared 16 pts with AVF (gr 1: 11M/5F, mean age 51±6 yrs, mean BP: 134/82 mm Hg) to 18 pts (gr 2: 12M/6F, mean age 52±9 yrs, mean BP: 132/80 mm Hg, ns) who either never had AVF or whose AVF had been closed. Each patient underwent complete standard echocardiogram including the measurement of tricuspid annular plane systolic excursion (TAPSE). We calculated global myocardial performance index for both LV (LV MPI) and RV (RV MPI) from the sum of isovolumic contraction and relaxation times divided by ejection times. Moreover, from apical 4C view, we recorded longitudinal myocardial motion within the basal septal (sep), RV (RV) and LV (LV) free walls with pulsed tissue Doppler imaging (TDI). We measured maximal velocity (S max) and time-velocity integral (S TIv) of S systolic wave, and maximal velocities of diastolic E and A waves.

Results: Mean duration of renal transplantation (5.4±2.2 yrs) and of previous hemodialysis (22±20 vs 23±38 months) were similar in the two groups. LV end-diastolic and end-systolic diameters, LV posterior and septal wall thickness, LV mass index, Simpson LV EF were similar in the two groups. Right and left atria areas measured from apical 4-chambers were higher in gr 1 than in gr 2 (LA: 20.5±5.0 vs 16.5±4.2 cm², p=0.02; RA: 17.9±5.1 vs 14.5±3.2 cm², p<0.001). Cardiac index was higher in gr 1 than in gr 2 (2.84±0.61 vs 2.38±0.59 l/min/m², p=0.03). Mitral E/A, mitral deceleration time and mitral flow propagation velocity, systolic pulmonary artery pressure, TAPSE and LV and RV MPI were similar in the two groups as were all TDI parameters.

Conclusion: Our study showed no significant differences among various echocardiographic parameters in kidney transplanted patients with or without persistent FAV. Neither left and right ventricular morphology nor LV or RV systolic and diastolic function or motion seemed to be affected by the extracardiac shunt. The only significant differences were the larger areas of right and left atria, and a slightly higher cardiac index in patients with FAV. This suggests a good chronic cardiac tolerance of FAV in kidney transplanted patients.

MYOCARDIAL VELOCITY IMAGING (DMI) – OTHER

S168 Abstracts

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973 Strain by tissue Doppler imaging associated with regression of cardiac remodeling and fibrosis by combination therapy of candesartan and spironolactone in patients with chronic heart failure

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Background: It is not known if strain by tissue Doppler imaging provides useful information on myocardial fibrosis in chronic heart failure receiving candesartan or in combination with spironolactone therapy.

Methods: 48 chronic heart failure patients with left ventricular ejection fraction (LVEF) <40% on standard therapy including ACEI for more than six months were randomized to candesartan 8 mg daily plus spironolactone 25 mg daily (C+S group, N=23) or candesartan 8mg daily alone (C group, N=25) for one year. Cardiac MRI and echocardiography with TDI were done at baseline, 6 and 12 months. Mean systolic and diastolic myocardial velocities of six-LV basal segments were measured by TDI (Sm, Em). Mean strain of six-basal segments, cyclic variation of integrated backscatter (CVIB) and standard deviation of time to peak systolic myocardial systolic velocity of 12 segments (Ts-SD) were assessed.

Results: The 2 groups had comparable demographic data, LVEF by MRI and echo variables at baseline. LVEF by MRI significantly improved in the C+S group compared to C group (D 5.4±19% vs D 9±5%: p=0.01), LVEF by MRI significantly reduced in the C group, but increased in the C+S group D+1±4% vs D-7±4%, p=0.002) at one year. Meanwhile, the C+S group showed a significant increase in strain (13.1±3% vs 16±1%, p<0.005), Sm (3.4±0.2 vs 4.0±0.3 cm/s, p<0.05), CVIB (11±0.7 vs 13±1, p<0.05), and decreased in diastolic filling pressure E/Em (33.5±5 vs 20.2; p=0.01) from baseline to one year. Ts-SD trended to decrease in C+S group (43±3 vs 37±4 ms, p=0.05). However, there was no change in the C group for strain, Sm, CVIB, E/Em and Ts-SD from baseline to one year follow-up.

Conclusion: Strain by TDI provides useful information in improving LV contractile function and reversing LV remodeling in combination therapy of candesartan and spironolactone with chronic heart failure patients. It probably associates with reduction of myocardial fibrosis verified by CVIB.

974 The role of cardiopulmonary exercise testing in the evaluation of functional capacity after treatment of lymphomas in adults

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Purpose: The authors conducted a study to assess parameters of the cardiac function in patients after a treatment for non-Hodgkin’s and Hodgkin’s disease and to determine the influence of these parameters on patient’s performance status.

Patients and methods: The authors examined 106 patients (66 male and 40 female) aged 40±15 years 1 year after the treatment. The patients were examined by means of rest and post-exercise ejection fraction (EF), patient’s performance status. The rest and post-exercise ejection fraction (EF), patient’s performance status.

Results: In late postoperative period the mean LVEF decreased from 71±1.46 cm to 54±1.21 cm (p<0.01) and mean LV EF did not change significantly (p=0.05). However, there was a significant reduction of LV wall-thickness could be seen only in the C+S group, but increased in the C group D 54±19% vs D 9±5% p=0.01), LV mass (48±5 vs 56±5 g, p=0.05), and left atrial diameter (LA, 47±8 vs 49±9 cm) markedly increased in both groups (p=0.01). Moreover, LV EF correlated with diastolic function, 14 (13%) decreased pVO2<20 ml/kg/min, and 15 (14%) the pVO2 exhibited clinical signs of heart failure. Apart from 3 patients with rest EF<50%

Conclusion: The diastolic dysfunction was the most affected parameter of cardiac function in cancer survivors. This parameter negatively influenced cardiopulmonary performance and significantly correlated with the cumulative dose of doxorubicin given and radiotherapy on mediastinum. Despite a number of patients who experienced fatigue, the study demonstrates that only a relatively small number of patients showed a depressed pVO2 on cardiopulmonary stress test and other cardiac abnormalities.

975 Echocardiographic evaluation of valvular cardiomyopathy using tissue doppler imaging in chronic severe aortic regurgitation

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Background: Postoperative prognosis of patients with severe aortic regurgitation (AR) is favorable if LV contractility is preserved. But in some cases the irreversible changes develop despite of normal preoperative LV EF and lack of symptoms. The aim of this study was to reveal non-stress echo-cardiographic indexes predicting possible postoperative LV dysfunction using TDI technique.

Material and methods: 28 pts (21 men, 7 women, aged 48±5.4) with severe chronic AR and LV EF >55% and LV EDD <55 mm have been examined. Differences between 2 pts LV EF became lower than 50% despite of LV size normalization. These 9 pts created the group B. Results: In late postoperative period the mean LVEF increased from 71±1.46 cm to 54±1.21 cm (p<0.01) and mean LV EF did not change significantly (p=0.05). However, there was a significant reduction of LV wall-thickness could be seen only in the C+S group, but increased in the C group D 54±19% vs D 9±5% p=0.01), LV mass (48±5 vs 56±5 g, p=0.05), and left atrial diameter (LA, 47±8 vs 49±9 cm) markedly increased in both groups (p=0.01). Moreover, LV EF correlated with diastolic function, 14 (13%) decreased pVO2<20 ml/kg/min, and 15 (14%) the pVO2 exhibited clinical signs of heart failure. Apart from 3 patients with rest EF<50%

Conclusion: Longitudinal LV contractility indexes obtained by TDI could be reliably used for prediction of postoperative LV dysfunction in pts with severe chronic AR.

Table 1. Preoperative Echo-parameters

| Age (%) | % in NYHA class II | LVEF (%) | LV EF (%) | Sm (cm/s) | PCTm (ms) | Ctm (ms) | PCTm/Ctm
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<tbody>
<tr>
<td>Group A</td>
<td>56±2.4</td>
<td>22</td>
<td>7.3±2.0</td>
<td>60±4.0</td>
<td>8.5±0.2</td>
<td>99±6.0</td>
<td>224±4.8</td>
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<tr>
<td>Group B</td>
<td>44±1.9</td>
<td>95</td>
<td>7.0±1.7</td>
<td>63±3.5</td>
<td>12±6.4</td>
<td>79±4.8</td>
<td>201±3.8</td>
</tr>
<tr>
<td>P value</td>
<td>&lt;0.01</td>
<td>&lt;0.05</td>
<td>NS</td>
<td>&lt;0.001</td>
<td>&lt;0.05</td>
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</table>

976 Changes of regional myocardial function and myocardial hypertrophy in patients with severe aortic stenoses during long term follow-up after aortic valve replacement

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The purpose of this study was to investigate the change in left ventricular (LV) hypertrophy and regional myocardial function in patients with severe aortic valve stenoses at baseline and during follow-up after aortic valve replacement (AVR).

Methods: 17 patients with severe aortic stenoses were studied by conventional echocardiography and strain imaging before (baseline), 2 weeks, 9 months and 9 years after AVR. Radial myocardial function was assessed in paraster nal long axis views from the posterior wall. By the use of apical four chamber views longitudinal myocardial function was assessed in the septal and lateral wall. In each wall peak systolic and early diastolic strain rates (SR) were measured. In addition, end-diastolic wall-thickness, LV diameter (LVEDD) and ejection fraction (EF) were examined.

Results: For radial function a significant increase of systolic SR could be seen already after 2 weeks (baseline = 1.2±0.3 s-1; 2 weeks = 1.7±0.5 s-1; 9 months = 1.7±0.5 s-1). In contrast, systolic longitudinal SR increased only after 9 months significantly (Figure). For diastolic SR no change in the follow-up period could be documented. Parallel to the change of longitudinal systolic SR a significant reduction of LV wall-thickness could be seen only after 9 months (Figure). LVEDD and EF were normal at baseline and remained constant.

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Conclusions: These data implicate that in patients after AVR the initial increase in radial function can be due to the reduction of afterload. However, the long term remodeling after 9 months expressed as a reduction of wall thickness seems to be associated with an increase of longitudinal contractile function.

977 Quantitative assessment of myocardial contractile reserve during exercise in patients with mitral valve prolapse

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Background: Although the actual trends is toward early surgery in patients with asymptomatic severe organic mitral regurgitation (MR), some of them might already have latent ventricular (LV) dysfunction. This study sought to examine whether tissue Doppler imaging measurement of longitudinal function could be used to identify contractile reserve (CR) during exercise in NYHA II patients with MR due to mitral valve prolapse.

Methods: Forty-seven patients underwent quantitative off-line assessment of longitudinal function by averaging peak mitral annular velocities (PSv) obtained at rest and during semi-supine exercise test.

Results: During test, CR defined by ≥4% improvement in ejection fraction was present in 25 patients. As compared to patients with CR, the degree of MR at rest (effective regurgitant orifice (ERO): 43±18 vs 24±14 mm²; p=0.0048) and at peak exercise (ERO 46±22 vs 23±19 mm², p=0.0049) was greater in the absence of CR whereas ejection fraction was similar (69±6 vs 66±6%, p=ns). The increase in PSv (11±1.9 vs 8±2.5 cm/s; p=0.00029) and changes in LV end-systolic volume (+14.7 vs 4.4±12 ml p=0.0029) during exercise were higher in the CR group. In multivariate analysis, exercise-induced changes in LV end-systolic volume and in PSv independently predicted the presence of CR. An increase in PSv by ≥2 cm/s yielded a sensitivity of 88% and a specificity of 82% to identify positive CR.

Conclusions: Latent LV dysfunction in patients with mitral valve prolapse could be reliably identified using tissue Doppler imaging.

LV FUNCTION – OTHER

978 Surgical ventricular restoration with mitral valve repair/left ventricular shape and function one year after surgery

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The aim of the study was to compare left ventricular (LV) shape and function changes one year following surgical ventricular restoration (SVR) with mitral valve repair (MVR) in patients (pts) with different localisation of ventricular aneurysm.

Methods: The study group consisted of 72 pts who underwent CABG with SVR and MVR during 2000-2005 yrs: 48 pts underwent LV anterior aneurysm reconstrucion (I group), 24 pts - posterior aneurysm reconstruction (II group). The study protocol included evaluation of LV end diastolic and systolic volume indices, LV sphericity, ejection fraction and mitral regurgitation (MR) grade preoperatively, 10-14 days and 1 year after surgery.

Results: Table 1.

Conclusions: SVR with MVR induces improvement in pump function significant reduction in LV volumes and MR which is sustained during one year. Favorable changes in LV sphericity were associated with LV posterior wall aneurysm reconstruction combined with MVR.

Table 1. Main results

<table>
<thead>
<tr>
<th></th>
<th>I group</th>
<th>II group</th>
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<tr>
<td>age (%)</td>
<td>54±9</td>
<td>52±9</td>
<td>LV EF (%)</td>
<td>39±5</td>
</tr>
<tr>
<td>mitral annulus diameter (mm)</td>
<td>101±6</td>
<td>92±3</td>
<td>mitral regurg volume</td>
<td>20±4</td>
</tr>
<tr>
<td>Longitudinal strain (%)</td>
<td>107±4</td>
<td>95±3</td>
<td>Longitudinal strain rate (s-1)</td>
<td>14±4</td>
</tr>
<tr>
<td>MR valve tenting height (mm)</td>
<td>26±1</td>
<td>22±1</td>
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MR ≥2/4 n=49 66±26 39.5±45 3.9±20.1+0.37±14.4+ n=52 66±26 39.1±45 3.9±20.1+0.37±14.4+ n=2/4 n=49 64±26 39.7±34 5.8±20.8+0.41±7.8+ n=52 66±26 39.5±34 5.8±20.1+0.37±14.4+ n=49 64±26 39.7±34 5.8±20.8+0.41±7.8+ n=52 66±26 39.5±34 5.8±20.1+0.37±14.4+

*p<0.05 between pre-op and post-op; #p<0.05 between pre-op and 1 yr. post-op.