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Limitations of Valsalva maneuver to detect pseudonormal transmirtal filling pattern: a study of healthy individuals.
S. Cosson 1, J.P. Kervokian 1, P. Beaufils 2. 1Hôpital Lariboisiere, Cardiology, Paris, France; 2Hôpital Lariboisiere, Cardiology, Paris, France

Background: Pseudonormal (PN) mitral filling pattern represents a moderate diastolic dysfunction in which an abnormal relaxation is compensated by an elevated atrial pressure. Inversion of the mitral E/A ratio during Valsalva maneuver (VM) is a method recommended to identify a PN filling pattern. Sparse data are available on the effects of this maneuver in healthy asymptomatic middle-aged individuals in whom baseline E/A ratio is close to 1.

Aim: To evaluate the effects of changes in loading condition with VM on the pattern of Doppler mitral velocity profile in middle-aged healthy individuals.

Methods: We studied 30 (23 men, 50±1 years, 42±6) healthy individuals without any overt cardiovascular disease or vascular risk factor. Peak velocity of early (E) and late (A) mitral waves and their ratios at rest and during VM as well as left ventricular ejection fraction (LVEF) were measured by standard techniques. Early (Ea) and late (Aa) myocardial velocities were obtained by pulsed tissue Doppler imaging (TDI) at the lateral and septal mitral annuli.

Results: Measurements were feasible in all subjects. All had normal LVEF (64±5%).

<table>
<thead>
<tr>
<th>Rest</th>
<th>VM</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate (beats/min)</td>
<td>63 ± 10</td>
<td>73 ± 10</td>
</tr>
<tr>
<td>E (cm/s)</td>
<td>68.5 ± 8.4</td>
<td>73.6 ± 7.1</td>
</tr>
<tr>
<td>A (cm/s)</td>
<td>55.1 ± 6</td>
<td>49.9 ± 6.7</td>
</tr>
<tr>
<td>E/A</td>
<td>1.25 ± 0.14</td>
<td>0.76 ± 0.12</td>
</tr>
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</table>

Nine subjects had an abnormal relaxation filling pattern (E/A < 1), E, A and E/A significantly decreased with VM. Inversion of E/A was observed in 20 (21% (95%) subjects with a baseline E/A > 1, leading to a pseudonormal classification according to VM pattern(table). However, all had Ea > 8 cm/s (E sept 10.5±1.1 cm/s, E lat 15.2±1.9 cm/s) and E/A < 10 (E/A lat 4.6±0.9, E/A sept 6.6±1.4).

Conclusion: Our data suggest that inversion of E/A ratio during VM does not differentiate between normal and pseudonormal LV filling pattern in normal subjects. The use of this single method could lead to misleading results when applied to detect early manifestation of several cardiomypathies.

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Left ventricular diastolic function as routinely reported in a tertiary referral center: analysis of 3227 exams.
P. Barbier, M. Alimento, M.D. Guazzi. Centro Cardiologico Fondazione Monzino, IRCCS, Milan, Italy

Abstracts related to left ventricular (LV) "diastology" (analysis of filling pressures and chamber compliance) presented at scientific meetings have paralleled increased use of the Doppler techniques, but feedback of proposed algorithms to estimate LV diastolic function on the "real world" of clinical diagnosis is unknown.

Aim: to analyse effective use of LV diastolic function analysis during routine echocardiographic outpatient studies in a tertiary referral center.

Methods: We selected 3227 consecutive reports (outpatient studies) generated between October 1999 and 2000 by 6 ASE level 3, 5 level II and 3 level I (respectively 2503, 677, and 47 studies) cardiologists. Each exam included complete M-Mode, LV biplane volumes and ejection fraction, and pulsed Doppler mitral and pulmonary venous flow parameters. We searched the database for frequencies of numerical (mitral E/A peak velocity ratio and E deceleration time, pulmonary venous systo-diastolic velocity-time integral ratio), and text (strings in comments: "diastolic function", "filling pressure", "compliance", "restrictive") descriptions related to LV diastolic assessment.

Results: text descriptions of LV diastolic function were found in 51%, 19% and 43% of reports of level I, II and III operators. In patients with "cardiomyopathy", text descriptions were found in 29%, 64% and 60% of reports of level I, II and III operators. In this same subset, LV biplane end-diastolic volume, mitral E/A ratio and E deceleration time were reported by respectively 86%, 14%, and 14% of level I; 47%, 35% and 40% of level II; and 51%, 32%, and 37% of level III operators. Finally, in patients with reduced ejection fraction (<45%), text descriptions of LV diastolic function were found in 47% of all reports, whereas measurements of LV biplane end-diastolic volume, mitral E/A and E deceleration time were found respectively in 62%, 25% and 30% of all reports.

Conclusion: in the "real world" of diagnostic echocardiography, even expert cardiologists assess simple indexes of LV diastolic function in less than half of the patients in whom they are recommended as mandatory (cardiomyopathy or LV systolic dysfunction). These results suggest that in echocardiographic diastology there exists a feedback gap between research findings and clinical applications of these findings.

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Effect of simvastatine on Doppler indices of left ventricular diastolic function in hypertensive patients with hypercholesterolemia.
W. Kosmala, M. Przewlocka-Kosmala. Medical University, Cardiology, Wroclaw, Poland

No precise data are available whether treatment with statins exerts beneficial effect on left ventricular diastolic function (LVDf) in hypertensive patients.

Aim: To investigate the effect of treatment with simvastatine 20 mg daily on Doppler indices of LVDf in pts with mild essential hypertension.

Material and methods: The population of the study consisted of 26 pts aged 62.6±11.2 years with previously not-treated mild essential hypertension withou other cardiovascular disorders and elevated plasma level of LDL-cholesterol (>160 mg/dl). In all subjects hypotensive therapy with hydrochlorothiazide 12.5 mg daily was introduced. 12 pts remained only on low-cholesterol diet (control group) whereas 14 were additionally treated with simvastatine 20 mg daily. Echo study was performed at baseline and after 3 month of the treatment and included estimation of peak velocity of early (E) and late (A) transmirtal flow, deceleration time of E wave (DT), isovolumic relaxation time (IVRT), total ejection isovolume index (TEI), E (ETT) and A (ATT) wave transit time to the LV outflow tract, flow propagation velocity of E wave (EP).

Results: LDL-cholesterol level decreased in the simvastatine group from 186.4±19.2 to 154.7±20.6 and in the control group from 185.5±17.6 to 176.7±16.4 mg/dl, being significantly lower after treatment in the simvastatine group. Systolic and diastolic blood pressure decreased from 153.7±9.3/94.2±4.8 mmHg to 138.6±5.2/87.5±5.4 mmHg in the simvastatine group and from 154.5±7.8/93.9±3.7 mmHg to 136.9±4.9/86.8±4.7 mmHg in the control group and did not differ between both groups. In the simvastatine group significant increase in EP from 48.2±15.9 to 55.7±16.7 cm/s (p<0.05) and decrease in ETT from 129±26 to 118±25 ms (p<0.05) was demonstrated. None of evaluated Doppler parameters changed significantly in the control group.

Conclusion: In pts with mild hypertension and hypercholesterolemia simvastatine improves left ventricular diastolic function which is indicated by increase in EP and decrease in ETT.

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Correlation of echocardiographic diastolic parameters and exercise tolerance in patients after myocardial infarction.
K. Wierzbowska, J. Drozdz, M. Koziminska-Pakula, J.D. Kasprzak. Medical University of Lodz, Cardiology Dept., Lodz, Poland

Background: Despite the knowledge of connection between left ventricular diastolic function and signs and symptoms of congestive heart failure, the relationship of wide spectrum of echocardiographic parameters with exercise tolerance are not thoroughly investigated.

Purpose: Our aim was to examine the correlation between the classic and novel markers of diastolic function (including mitral filling propagation velocities and tissue Doppler diastolic parameters) and exercise tolerance measured as the duration of symptom-limited treadmill exercise test in patients after myocardial infarction.

Methods: In 60 patients after myocardial infarction (MI) transthoracic echocardiography and treadmill exercise test according to Bruce protocol was performed. In 46 persons the exercise test was stopped because of signs of congestive heart failure: fatigue and dyspnoea (mean age: 60±11, 36 male, mean EF 30±10%).

Results: The strongest relationships with exercise tolerance were detected for the difference between atrial reversal time of pulmonary vein flow and duration of atrial phase of mitral inflow (delta At, correlation coefficient r=0.53, p<0.001), duration and deceleration time of mitral atrial wave (At, r=0.47, Adt, r=0.45, p<0.01), ejection fraction (EF, r=0.43) and duration of atrial reversal time (Act, r=0.38).

Among the novel parameters a significant correlation was found for the ratio of peak early mitral inflow velocity to peak early mitral annulus (m.a.) velocity measured by pulsed tissue Doppler in lateral segment of m.a., (E/E, n=0.48), velocity time integral of atrial phase of m. a. motion (AVd, n=0.45) and early m. a. velocity (E, n=0.44).

Conclusions: In our study the strongest correlation with exercise tolerance was detected mainly for parameters related to elevated end-diastolic pressure in the left ventricle such as atrial reversal parameters from pulmonary vein flow or E/E ratio. In this post-MI group also the left ventricular ejection fraction (but not E/A ratio) showed close relationship with exercise tolerance.

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Utility of new Doppler parameters connected with elevated left ventricle end-diastolic pressure for identification of mitral inflow pseudonormalization.

K. Wierzbowska, J. Drozdz, J.D. Kasprzak, M. Krzeminiska-Pakula. Medical University of Lodz, Cardiology Dept., Lodz, Poland

The occurrence of mitral inflow pseudonormalization imposes some difficulties on classification of diastolic function (DF). Our aim was to assess if a new parameters proposed as a noninvasive measurement of filling pressure, ratios of peak early wave velocity to early propagation velocity (E/Ep) and peak early wave velocity to early diastolic motion of mitral annulus (E/E'), can help in differentiation of normal (N) and pseudonormal (PN) mitral inflow.

Purpose: We compared E/Ep and E/E' ratios and other echocardiographic parameters between patients (pts) with normal (N) and pseudonormal (PN) mitral inflow, performed ROC analysis for detection of optimal cut-off values and assessed diagnostic value of this parameters for detection of pseudonormalization.

Methods: Among 120 pts with coronary artery disease and 60 healthy persons examined by transthoracic echocardiography with assessment of diastolic function we selected the subgroup with E/A ratio between 1 and 2, and divided them into N and PN mitral inflow group according to E wave deceleration time. Propagation velocity was measured by color M-mode and tissue Doppler parameters were assessed in lateral segment of mitral annulus. Than we compared 15 pts with PN (mean age 57.1±11, male) and 54 persons with N pattern (mean age 55.9±Male).

Results: In N group E/Ep and E/E' ratios were lower than in PN group (1,7±0,4 vs 3,5±1,3 for E/Ep and 6,3±2,1 vs 9±3,7 for E/E'; p<0,001).

For cut-off values of Ev/Ep above 2,3 and of E/Ep above 8,2, sensitivity, specificity, positive predictive value, negative predictive value and accuracy for detection of PN were respectively: 87, 91, 72, 96, 90% and 60, 81, 47, 88, 77%.

Purpose: Our aim was to calculate correlations between systolic variables: ejection fraction (EF) and systolic velocity of mitral annulus (m. a.) motion and comprehensive spectrum of diastolic parameters of left ventricle.

Methods: We performed transthoracic echocardiography with assessment of mitral inflow, pulmonary vein flow, propagation of early mitral and atrial wave in color Doppler M-mode and pulsed TDE spectrum of m. a. motion (E/E'v) and assessed correlations between systolic and diastolic parameters.

Results: We found significant positive correlation between EF and early propagation velocity (E/Ep; r=0,68) and systolic velocity of pulmonary vein flow (S; r=0,46).

Negative correlation was observed for early mitral inflow velocity to early propagation ratio (Ev/Ep; r=0,68) and duration of atrial reversal in pulmonary vein (Ar t; r=0,55).

Also average systolic velocity of m. a. correlated significantly with Ep (r=0,42), S (r=0,31) and Ev/Ep (r=0,34).

Conclusions: Both Ev/Ep and E/E' ratios are useful for differentiation of PN and N pattern. In our group of pts diagnostic value of E/E' ratio was highly significant, greater than E/Ep ratio, comparable with enlarged LA diameter and slightly better than value of pulmonary flow parameters.

126 Gender-related differences of diastolic function in normal subjects and patients with coronary artery disease.

K. Wierzbowska, J. Drozdz, J.D. Kasprzak, M. Krzeminiska-Pakula. Medical University of Lodz, Cardiology Dept., Lodz, Poland

Background: Recent studies indicated on some gender-related differences in diastolic filling in hypertension. Wide spectrum of new Doppler methods and parameters encourage the reexamination of impact of gender on left ventricile diastolic performance in other group of patient (pts).

Purpose: Our aim was to study if comprehensive assessment of diastolic function detects any difference between normal male and female subjects and pts with angiographically proved CAD with normal ejection fraction.

Methods: We examined 127 subjects: 70 male (34 healthy and 36 with CAD) and 57 female (33 healthy) by transthoracic echocardiography with assessment of classic mitral and pulmonary veins flow, propagation of mitral waves and tissue Doppler variables of mitral annulus motion (TDE). Male (M) and female (F) group were paired with regard to age, heart rate and medical treatment. We compared separately healthy (34 M: mean age 51±13, and 33 F: mean age 53±11) and CAD group (36 M: mean age 56±10 and 24 F: mean age 60±10).

Results: Among classic diastolic parameters in healthy subjects velocity of early wave of mitral inflow (Ev) and systolic wave of pulmonary vein flow (S) were significantly higher in F: (respectively 77±18 vs 65±19 cm/s and 64±14 vs 57±11 cm/s; p<0,05). Among propagation parameters atrial wave propagation velocity (Ap) was lower in F: (43±12 vs 50±12 cm/s; p<0,05), early propagation to atrial propagation ratio (Ep/Ap) was higher in F: (1,1±0,5 vs 1,3±0,5; p<0,05). Analysis of TDE showed higher values of atrial (A') and systolic (S') velocities of mitral annulus (m. a.) in M: (15±2 vs 12±2 cm/s and 11±2 vs 10±2 cm/s; p<0,05) and higher early inflow velocity to early annulus velocity ratio (E/E') in F: (7,1±2 vs 5,9±1,5; p<0,01) for parameters calculated from six points of m. a. For lateral segment of m. a. only E/E' ratio was higher in F: (6,7±2,6 vs 5,1±1,4; p<0,01).

In CAD pts we observed higher E/A ratio in M: (1,1±0,5 vs 0,8±0,2; p<0,05), atrial inflow velocity (Av) and atrial velocity to atrial propagation ratio (Av/Ap) in F: (78±24 vs 64±17 cm/s; p<0,007 and 1,6±0,5 and 1,3±0,5; p<0,05, respectively).

Conclusions: Our data suggest trend to lower velocities in healthy women and the strongest statistical significance was shown for higher E/E' ratio in F.
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Incremental value of E'/Vp in characterization of systolic-diasstolic dysfunctions in heart failure: a BNP study.
M.V. Luong1, M.O. Benoit2, J.L. Paulu, E. Aebregel3, H. Raffoul3, R. Khedim3, L. Auziere3, H. Diebold1, B. Diebold1, 1Georges Pompidou European Hospital, Cardiology department, Paris, France; 2Hopital Europeen Georges Pompidou, Biochemical department, Paris, France; 3Hopital Europeen Georges Pompidou, Cardiology department, Paris, France

Aim: To evaluate the incremental value of sophisticated evaluation of left-ventricular filling pressure for determining systolic-diasstolic interactions.

Methods: 51 patients underwent echography to evaluate systolic (ejection fraction (EF)), and diastolic functions (mitral Doppler for E/A, deceleration time(DT), E wave flow propagation velocity (Vp), early diastolic velocity of lateral mitral annulus (Ea)) and BNP.

Results: Significant increases of BNP between the 3 tertiles for E/Vp(0.01), E/A(Ea/0.05), DT, EF, PAP(0.001) were obtained. Combination of EF with diastolic indexes provided “echographic severity” profiles associated with elevated BNP(Table) and led to striking differences for EF and E/Vp (p<0.0001)(Picture).

Systolic-diasstolic interactions and BNP

<table>
<thead>
<tr>
<th>Systolic-diasstolic model</th>
<th>Best tertile</th>
<th>Intermediate</th>
<th>Worst tertile</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF/E’/Vp</td>
<td>227 ± 80</td>
<td>490 ± 80</td>
<td>890 ± 81</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>EF/Ea/E’/Vp</td>
<td>244 ± 91</td>
<td>536 ± 86</td>
<td>111 ± 89</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>EF/DT</td>
<td>255 ± 85</td>
<td>522 ± 100</td>
<td>797 ± 81</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>EF/EA</td>
<td>327 ± 75</td>
<td>547 ± 85</td>
<td>953 ± 79</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>EF/E’</td>
<td>296 ± 117</td>
<td>469 ± 91</td>
<td>783 ± 111</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

For each X parameter Best tertile: EF<50 percentile+ X best 50 percentile or non restrictive pattern Worsr tertile: EF>50 percentile+ X worse 50 percentile or restrictive pattern.

Restrictive pattern: E/A > 2 and DT < 150 BNP values are in pg/ml.

Conclusion: In patients suspected of heart failure, BNP levels are related to systolic dysfunction but also by the severity of associated diastolic dysfunction.

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Serum n-terminal pro-brain natriuretic peptide is a sensitive marker of diastolic dysfunction in non-obstructive hypertrophic cardiomyopathy.
A. Araujo, E. Arteaga, R. Rabelo, P. Buck, B. Ianni, C. Mady. Heart Institute - Sao Paulo University, Cardiopatias Gerais, Sao Paulo, Brazil

Background: Amino-terminal pro-brain natriuretic peptide (NT-proBNP) is a marker of ventricular function in heart failure.

Objective: We sought to investigate the diagnostic value of NT-proBNP in patients (pts) with non-obstructive hypertrophic cardiomyopathy (NOHCM) and its utility in determining the degree of LV diastolic dysfunction.

Methods and Results: NT-proBNP was quantified in 40 pts with NOHCM and in 20 normal volunteers (control group). The concentrations differed between pts and normals (mean 1095 pg/ml versus 41 pg/ml, p<0.0001). The maximal serum value in the control group was 115 pg/ml. Assuming this cutoff the test had sensitivity 78%, specificity 100% and accuracy 85%. Among the pts the best overall correlation of NT-proBNP and echocardiographic indexes was with left atrium (LA) diameter (r=0.52). There were no consistent correlations with indexes derived from mitral flow, pulmonary venous flow, tissue doppler imaging and myocardial thickness. Pts with LA > 50mm had a mean value of 2482 pg/ml and those with LA between 41-50mm 732 pg/ml; p<0.0005. Pts with a difference > 30 ms between the durations of pulmonary venous A reverse wave and mitral flow A wave had a mean value of 1773 pg/ml as compared with 567 pg/ml of those pts with a difference < 30ms; p<0.0002. Pts with E/Ea ratio > 10.0 (mitral E wave velocity/Ea mitral annular longitudinal velocity) had a mean NT-proBNP 2420 pg/ml and those with E/Ea < 10.0 54 pg/ml; p<0.001.

Conclusion: We concluded that serum NT-proBNP is a sensitive diagnostic test for NOHCM and a strong predictor of LV diastolic dysfunction in such patients, with potential usefulness for monitoring therapeutic responses.

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Diastolic filling vortex in the normal left ventricle.
T. Ishizu1, T. Ishimitsu2, Y. Seo2, K. Obara2, N. Moriyama2, I. Yamaguchi2, 1University of Tsukuba, Cardiovascular division, Tsukuba, Japan; 2Tsukuba, Japan

Objectives: The aim of this study was to clarify the diastolic filling flow characteristics in the normal left ventricle.

Background: During left ventricular filling, basally oriented velocities are seen in the outflow compartment. These velocities may represent vortex formation at basal level or blood returned from the apical region.

Methods: Left ventricular flow patterns were visualized in 13 healthy individuals (age 33 ± 8 years) with the use of contrast enhanced two-dimensional echocardiography techniques. Intraventricular microbubble traces were identified by frame-by-frame analyses of the apical long axis view (frame rate 86 or 121 Hz).

Results: During early transmirtral flow acceleration, two or three mushroom-shaped fluid components were created in sequence. Around the mitral valve maximum opening and semi-closure, the anterior part of the mushroom-shaped-fluid component, which was at the level of the mid-ventricle, moved toward basally and create the clockwise swirling vortex occupying the outflow compartment behind the anterior mitral leaflet. Other mushroom-shaped fluid components transformed into the several vortices and traveled to the apical region, which represent the apical branches of the E wave on the M-mode color Doppler. During diastasis, vortices breakdown occurred in basal left ventricle.

Conclusion: A common diastolic flow characteristic was identified in the normal left ventricle. The results revealed that the retrograde velocities in the outflow compartment were the part of the filling vortex at the basal left ventricle behind the anterior mitral leaflet. The returned flow from the apical region into the outflow was not observed during early diastole in normal human heart.

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Mitril E- wave velocity to inflow propagation velocity ratio in assessment of left ventricular diastolic function in patients with low ejection fraction.
A. Wojtarowiczc, M. Peregud-Pogorzelska, E. Plofiksa. Department of Cardiology, Szczecin, Poland

Left ventricular (LV) diastolic function is an important diagnostic and prognostic factor in many clinical states. Inflow propagation velocity (Prop) is known as preload independent method in LV diastolic function estimation, however in patients with low LV ejection fraction (EF) with unfavorable restrictive filling pattern (RES) further Prop decrease is not found. The aim of our work was to evaluate of mitral E wave velocity to Prop ratio (E/Prop) as a potentially more sensitive than Prop index in LV diastolic dysfunction estimation.

The studied groups enrolled 134 individuals with EF < 35%, on sinus rhythm and without significant valvular diseases. The patients were divided into three groups: 1) with impaired relaxation (REL) - 39 pts; 2) with pseudonormal pattern (PN) - 53 pts; and 3) with restrictive flow pattern (RES) – 42 pts. The studied groups did not differ significantly regarding age, heart rate and EF values. In control group was 25 healthy persons. Inflow pattern was measured on mitral orifice level by PW-Doppler, and Prop in 4 chamber apical view using M-mode color Doppler.

Results: In control group the values of the studied parameters were as follows: Prop 69±10.8 m/s and E/Prop 0.93±0.23. Maximal value of E/Prop was 1.3. In the studied groups the Prop values were as follows: in RES 39.1±9.0 m/s, in PN 37.7±7.3 m/s, and in REL 33.2±8.8 m/s. The differences between REL and other groups were significant (P<0.01). The E/Prop values were as follows: in the RES group: 2.5 ± 0.6; PN: 2.12 ± 0.7, and REL: 1.45 ± 0.6. The differences between all studied groups was statistically significant (REL vs the remaining groups: P<0.0001, RES vs PN: P<0.01). In all patients in assessed groups Prop was lower, and E/Prop higher, than in healthy individuals.

Conclusions: 1. LV function impairment cause decrease of Prop and increase of E/Prop ratio. 2. In similar LV systolic function impairment, E/Prop ratio is higher in more pronounced diastolic dysfunction.
132 Increased arterial stiffness is associated with left ventricular diastolic dysfunction in patients with Adamantandes-Bechet’s disease.

C. Vagueiro1, 2, 1Hospital de Santa Maria, Cardiology Dept, Lisbon, Portugal; 2St. Imre Hospital, Budapest, Hungary; 2Alexandra General Hospital, Clinical Therapeutics Dept., Athens, Greece; 3Athens Medical Center, Rheumatology, Therapeutics, Athens, Greece; 2Alexandra General Hospital, Athens, Greece

Purpose: To evaluate the usefulness of Tei Index, assessed by transmural Doppler echocardiography, in the estimation of LV diastolic pressures, in patients with ischemic heart disease.

Methods: Thirty-nine patients with coronary artery disease and referred for coronary angiography; all were in sinus rhythm and had no known valvular heart disease or chronic pulmonary disease. After conventional 2-D and Doppler examination, Tei index was calculated as the sum of the isovolumic contraction and relaxation times divided by ejection time. These data were correlated with the values of LV filling pressures obtained during left heart catheterisation.

Results: Tei index was reproducibly measured in all the patients. We found significant correlations of Tei index with LV end-diastolic pressure (r=0.74; p<0.01, chart) and with pre-“a” wave LV diastolic pressure (r=0.66; p<0.01).

In this study, there were 28 patients with normal diastolic filling (E/A >1 and 0.55 differentiates pseudonormal mitral inflow (defined as E/A < or =1 and LV diastolic pressure > 15 mmHg) from normal mitral inflow with high sensitivity (89%), specificity (92%) and accuracy (90%).

Conclusions: In patients with coronary heart disease, Tei index is easily obtainable and useful in the assessment of LV filling pressures and may be used to identify patients with pseudonormal mitral inflow.

135 Left ventricular diastolic dysfunction in unstable angina.

I. Vlasserov1, P. Stougiannos1, A. Kartalis1, D. Syriani1, I. Pylarinos1, A. Katsimichas1, G. Triantafyllou2, I. Kallikazaros1. 1Hippokration Hospital, State Cardiology Clinic, Athens, Greece; 2Galatias-Athens, Greece

Introduction: Coronary artery disease (CAD), in its various clinical presentations, is often associated with systolic as well as diastolic left ventricular dysfunction (LVDD). The purpose of this study is to evaluate the presence of LVDD in patients with unstable angina (UA) using various echocardiographic techniques.

Methods: We studied 52 patients (pts) (39 male, 13 female, 65±12 years old) who were referred in our department during 1 year from UA. They were evaluated for the presence of LVDD, within 3 days from the onset of symptoms, by estimating: i) the E and A waves, as well as the E/A ratio from the transmital diastolic flow, ii) the e and a waves, as well as the e’/a’ ratio, from the pulse- waved tissue Doppler imaging of the mitral annulus and iii) the flow propagation velocity (VP) (cm/sec) from the color M-mode of the diastolic mitral inflow.

Results: The E/A was <1 in 35/52 (67%) pts, the e’/a’ was <1 in 48/52 (92%) pts and the VP was less than 40 in 31/52 (60%) pts. 100% of pts with E/A <1 had e’/a’ <1, while 23/36 (64%) pts had a VP less than 40. Among the pts with e’/a’ <1, 34/48 (71%) had E/A <1, while 19/48 (40%) pts had a VP less than 40.

Conclusions: It seems the LVDD is quite frequent in pts with CAD presenting with symptoms and signs of UA. It is easily detected with various echocardiographic techniques, while the most modern of them seems to be far more sensitive for its detection. Its presence may also be a significant prognostic factor that needs further investigation.

136 Systolic and diastolic left ventricular function in adolescents and young adults with end-stage renal disease. Comparative study before and after hemodialysis.

A. Swiinski1, W. Bobkowski1, J. Zachwieja1, G. Horzga-Kaminska1, B. Mrozinski1, E. Stefaniak2, A. Warzywoda2. 1University of Medical Sciences, Department of Pediatric Nephrology, Poznan, Poland; 2University of Medical Sciences, Department of Pediatric Cardiology, Poznan, Poland

Background: Cardiovascular disease is the leading cause of mortality in patients (pts) with end stage renal disease (ESRD) on maintenance hemodialysis (HD). Congestive heart failure is the most frequent fatal complication. Therefore the diagnosis and treatment of such cardiovascular lesions is very important for improving long-term survival.

Methods: The aims of this study were Doppler echocardiographic quantify LV end-diastolic and end-systolic volume indices (LVEDVI, LSVSVI), LV cardiac index (CI), systemic vascular resistance index (SVRI) and LV diastolic and systolic function in 30 pts with ESRD aged between 14 and 23 (17.3±3.6yrs), before and after HD (bHD; aHD). ECHO parameters were compared with similar variables in 50 healthy adolescents and adults (N). These measurements were performed according to the guidelines of the American Society of Echocardiography.

Results: We found a significant decrease of LVEDVI (cm³/m²: bHD = 138.7±10.4, aHD = 110.8±10.4, N = 67.6±5.39), LSVSVI (cm³/m²: bHD = 70.3±8.2, aHD = 58.7±6.8, N = 67.6±5.39) and CI (l/min/m²: bHD = 7.9±0.9, aHD = 5.0±0.9, N = 3.9±1.1), correlated with weight loss and reduction in preload after HD (r = 0.1285, r = 0.1246, r = 0.1342 respectively; p < 0.05). LVEF, (LV% SF and SVRI were normal and did not change after HD (LVF% : bHD = 64.8±3.8; aHD = 65.3±5.6; N = 61.2±1.29), LVF% : bHD = 37.3±7.5; aHD = 36.6±5.6; N = 34.4±2.9), (SVRI kp/a’; bHD = 196.4±13.6; aHD = 187.6±10.2; N = 188.0±1.0). HD patients had some impairment in LV diastolic function. MV E/A ratio was significantly decreased before and increased after HD, DCT and IVRT prolonged before and significantly decreased after HD (bHD MV E/A = 1.11±0.17, DCT = 198.5±23ms, IVRT = 91.8±6.8ms; aHD MV E/A = 1.47±0.11, DCT = 170.8±25ms, IVRT = 65.5±10ms; N; MV E/A = 1.94±0.14, DCT = 150.3±22ms, IVRT = 71.4±6.2ms).

Conclusions: 1. in adolescents and young adults with ESRD HD trough the reduction in preload change LV function decreases CI, and do not change LV contractility and SVR. 2. Impaired LV diastolic function is reversible after HD in some patients with ESRD.

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Abstracts

137 Lack of association between ACE gene polymorphism and left ventricular systolic function and diastolic filling pattern in patients with systolic heart failure (HS) and non-smokers.

E. Straburszynska-Migai1, E. Chimna2, A. Szyzka1, O. Trojanska1, L. Lastowska1, A. Jabiecka2, A. Cieslinski2, 11st Dept. of Cardiology, Poznan.; 2Univ. School of Med. Sciences, Dept. of Clinical Pharmacology, Poznan.

Relationship have been frequently found between angiotensin-converting enzyme (ACE) genotype and various pathological and physiological cardiovascular outcomes and functions. It is not clear if there is an association between left ventricular systolic function and ACE genotype in patients with idiopathic dilated cardiomyopathy. We did not find any information about relationship between diastolic patterns and ACE genotype. We evaluated the relationship between left ventricular systolic function and diastolic filling pattern and ACE genotype in patients with systolic heart failure due to ischemic heart disease (ICM - 22 pts) and dilated cardiomyopathy (DCM - 39 pts). They were 61 pts with UFEF less or equal to 40%. NYHA class I - IV. The DD, ID and II genotypes were present in 23 pts (38%), 24 pts (39%) and 14 (23%) respectively. The genotype distribution was similar to that of control subjects (23%; 24%; 13%). There was also no significant difference in the distribution of restrictive and nonrestrictive pattern (restrictive - E/A ratio > 2 or between 1 and 2 with E wave deceleration time less or equal to 130 ms). Considering age, duration of symptoms, NYHA class, LVEF, UFEF we have not found significant differences between groups (duration of symptoms in DD, ID, ID II: 45 months, 38 months, and 34 months; p = n.s.,LVEDD, LVET we have not found significant differences between groups. There was no significant difference in the distribution of restrictive pattern between groups (DD, ID, II: groups: 70,3 mm, 74,2 mm, 71,7 mm respectively; p = n.s.; UFEF in DD, ID II: groups: 27,6%, 24,8%, and 25,6% respectively; p = n.s.). There was also no significant difference in the distribution of restrictive pattern between groups (DD, ID, II: groups: 70%, 60% and 40% respectively; p = n.s.). Conclusion: We find no evidence to support an association between ACE genotype and left ventricular systolic function and filling pattern.

138 Does “pure” diastolic dysfunction exist in systemic sclerosis?

C. Stanescu1, D. Dnicu1, G.H.A. Dan1, B. Miltescu1, S. Tanaseanu2, C. Tanaseanu3, 1Bucharest, Romania; 2Colentina University Hospital, Cardiology, Bucharest, Romania; 3Medicover Rombel, Grozovici, Bucharest, Romania

Systemic sclerosis (SS) is an autoimmune disease frequently associated with cardiac involvement, mainly pulmonary hypertension and alteration of myocardial function. The impairment of systolic and diastolic functional abnormalities, mainly in the asymptomatic patient with SS is not well defined. Patients (pts) with SS usually have diastolic dysfunction, as assessed by Doppler transmitral flow, with preserved systolic function, as assessed by ejection fraction. The velocities measured at the mitral annulus by pulsed tissue Doppler imaging (pTDI) are likely to be indexes of global longitudinal function of the left ventricle.

The aim of the study was to evaluate in such pts, by means of pTDI, the longitudinal subendocardial systolic function, which could be altered even in the presence of a normal radial systolic function, expressed by a normal ejection fraction.

Methods: We included 34 pts with SS, 42±6 yrs old, 91.1% female, who had normal ejection fraction, calculated from B-mode images according to Simpson’s rule and an E/A ratio had normal ejection fraction, calculated from B-mode images according to Simpson’s rule and an E/A ratio.<br>Eur J Echocardiography Abstracts Supplement, December 2003

140 Influence of coronary angioplasty and subsequent restenosis on Doppler indices of left ventricular diastolic function in patients with coronary artery disease (CAD) and preserved systolic function.

W. Kosmała, M. Przewlocka-Kosmała. Medical University, Cardiology, Wrocław, Poland

There are conflicting data on the timing of improvement of left ventricular diastolic function (LVDF) after PTCA, as well as which Doppler indices of LVDF are predominantly influenced by restenosis.

Aim: To investigate the effect of PTCA and restenosis on Doppler indices of LVDF in pts with preserved left ventricular systolic performance.

Material and methods: Studied group consisted of 81 pts aged 63.2±10.4 years with typical effort angina, LVEF >50%, and single vessel disease. Angioplasty was performed for elective PTCA. Echo study was performed before and 3 days, 1, 3 and 6 months after PTCA and included estimation of: peak velocity of early (E) and late (A) transmitial flow, duration of E wave, E wave mitral inflow relaxation time (IVRT), duration of A wave (Adur), total ejection isovolumic index (TEI), E/A (ETT) and A/A (ITT) wave transit time to the LV outflow tract, flow propagation velocity of E wave (Ep), peak velocity of systolic (S), diastolic (D) and atrial reversal (AR) pulmonary venous flow, duration of AR wave (Adur).

Results: None of evaluated parameters changed significantly 3 days after PTCA. After 1 month ETT decreased significantly from 134.6±28 at baseline to 120±27 ms (p<0.01). After 3 months significant increase in Ep (46.8±19.3 vs 52.7±19.9 cm/s, p<0.001) and decrease in E/Ep (1.46±0.43 vs 1.26±0.36, p<0.05) was noted. Other Doppler parameters did not alter during observation. Restenosis was confirmed angiographically in 16 pts and was followed by significant increase in ETT and E/A and decrease in Ep compared to the last preceding examination (136.2±24 vs 252±34 ms, p=0.001; 1.16±0.19 vs 1.7±0.01, p=0.003; 46.1±19.8 vs 54.2±2.09 cm/s, p<0.001, respectively).

Conclusion: In conclusion: (1) Significant improvement in LVDF after successful PTCA in patients with preserved left ventricular systolic performance is evidenced the most early by decrease in ETT and later by increase in Ep, E/A, Adur/A and IVRT. (2) ETT, Ep and E/A are the best indicators of worsening of LVDF as a consequence of restenosis of coronary artery.

141 Pulmonary venous inflow shows improved function of left ventricle in young healthy smokers.

B. Lichodziejewska, K. Kurnicka, M. Ciurzyński, J. Malysz, A. Lipińska, D. Liszewska-Pfeiffer. Medical University, Internal Medicine and Cardiology, Poznan, Poland

The impairment of left ventricular diastolic function (LVDF) causing changes of mitral venous flow (MVF) was shown in smoking healthy persons and with IHD or arterial hypertension. The aim of our study was to examine the pulmonary venous flow (PVF) in young healthy smokers.

Material and Methods: The study group (HS) consisted of 30 healthy smokers (16 women,14 men; age 20 - 40, mean 30). BM in both groups was < 25. In ECHO the parameters of LV-DVF was measured. Results: MVF assessment: maximal velocity (Vel max; cm/sec) of early phase (E) was lower in HS group than in C group without statistical significance - NS; Vel max of late phase (A), was higher in HS than C group (NS) so the MV/E ratio was significantly lower in smokers than in control group (1.3 SD 0.2 vs 1.5 SD 0.3; p < 0.02), deceleration time of MVF-E and isovolumic relaxation time did not change significantly. PVF assessment: Vel max of systolic flow (S) was higher in HS group than in C group (NS), Vel max (cm/sec) of diastolic flow (D) was lower in HS than C group (50 SD 9 vs 55 SD 8; p<0.05); so the PVF/S/D ratio was significantly higher in smokers than in control group (1.1 SD 0.2 vs 0.9 SD 0.3; p < 0.02). The changes of MVF/E/A ratio between group C and HS suggest the impairment of LV-DF in smokers, but E/A still remain normal for this age group. The PVF/S/D ratio was significantly higher in smokers with a profile (SD > 1) typical for impaired LV relaxation in this age group. Heart rate and blood pressure did not differ significantly between both groups.

Conclusions: 1. The assessment of pulmonary venous flow is a good method to reflect heart function. Even at young age with normal SVF flow, defects of LV relaxation could be detected by PVF/S/D ratio.

2. The SD ratio of pulmonary venous flow in young healthy smokers shows impairment of LV relaxation, when mitral valve flow is E/A normal.
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Can BNP be a useful tool for predicting severe diastolic dysfunction in patients with chronic heart failure?

Ab. Scardovi, C. Coletta, N. Asspromonte, A. Sestili, T. Di Giacomo, M. Romano, M. Renni, M. Greggi, V. Ceci. 0. Spirito Hospital. Cardiology, Rome, Italy

The assessment of severe diastolic dysfunction (SDD) plays a major role for the prediction of outcome in patients (pts) with chronic heart failure (CHF). In these pts, Doppler echocardiography (DE) remains the first choice non-invasive technique, but other parameters could be alternatively utilized for a wider and cheaper screening of SDD in mildly symptomatic populations. Indeed, we sought to determine the accuracy of BNP, a cardiac neurohormone directly correlated to both left ventricular filling and pulmonary capillary wedge pressure, for predicting SDD.

Methods: One-hundred sixty four consecutive pts (age: 70 ± 11; F:34%; beta-blocker therapy: 53%; ischecmic 52%; NYHA functional class: I: 8%; II: 68%; III: 24%; mean ejection fraction: 41 ± 12%) were considered. BNP plasma level was measured by means of the "Triage System" (Biosite Diagnostic, Triage BNP Test) and BNP plasma levels could be helpful for the first-step assessment of SDD population referred with symptoms of CHF, improving the efficacy of diagnostic flow-chart in the individual patient.

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Correlations between left-ventricular filling pressure echographic parameters and BNP levels in patients suspected of heart failure.

M.V. Luong1, M.O. Berrol2, J.L. Paul3, H. Raffoul4, E. Abergel5, R. Khedim1, O. Nardi1, H. Diebold1, B. Diebold1. 1Cardiology Department. 2Biochemical Department. Georges Pompidou European Hospital, Paris, France

Aim: High levels of B-natriuretic peptide (BNP) were related to systolic and diastolic dysfunctions or elevated systolic pulmonary artery pressure (PAP). We attempted to assess the correlations between BNP levels and combination of systolic and diastolic parameters and PAP in patients suspected of heart failure.

Methods: We studied 51 patients who underwent echocardiography to evaluate ventricular systolic function (ejection fraction [EF]), diastolic function (velocities of E and A waves, mitral waves for E/A ratio, E wave deceleration time (DT), E wave color M-mode Doppler flow propagation velocity (Vp), peak E wave of the lateral annulus velocity by Doppler tissue recordings (Ea)) for Ea/Vp and E/A ratio and BNP blood test 48 hours within echography. Simple linear regression analysis was used to evaluate the correlations between BNP and each parameter. Stepwise regression model was used to determine the best combination of systolic-diastolic model. BNP (536 pg/ml) was included into the group 1 and BNP (75.44 ± 46 pg/ml) reliably discriminated Pts with SDD without SDD (Negative predictive value: 93%).

Conclusions: BNP plasma levels could be helpful for the first-step assessment of SDD population referred with symptoms of CHF, improving the efficacy of diagnostic flow-chart in the individual patient.

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Association of wall motion score index with left ventricular diastolic function and filling pressures.

A.C. Popescu1, B.A. Popescu2, M.S. Feinberg1, V. Guetta1, S. Rath2, M. Eider3, E. Schwammenthal1, 1University Hospital, Cardiology Department. Bucharest, Romania; 2Institute of Cardiology, Bucharest, Romania; 3Heart Institute, Sheba Medical Center, Tel Hashomer, Israel

Background: Coronary artery disease is characterized by regional myocardial dysfunction affecting both contraction and relaxation. Because relaxation is impaired in any myocardial segment with wall motion abnormality, the wall motion score index (WMSI) should not only reflect extent of systolic dysfunction, but also extent of diastolic dysfunction.

Objectives: We therefore hypothesized that WMSI is able to separate patients (pts) with clinical events of pulmonary congestion (elevated filling pressures) from pts without pulmonary congestion and that WMSI correlates with left ventricular end-diastolic pressure (LVEDP).

Methods: The study group consisted of 54 consecutively studied pts, divided into two groups: group A included pts with clinical events of pulmonary congestion (24 pts, 22 men, mean age 64.2 ± 12.3 years) and group B consisted of pts without pulmonary congestion (30 pts, 21 men, mean age 66 ± 10.7 years). In addition, WMSI was assessed in a group of 18 consecutive pts (16 men, mean age 65.4 ± 10 years) who underwent diagnostic cardiac catheterization including measurement of LVEDP.

Results: WMSI was significantly higher in group A than in group B (2.12 ± 0.48 vs 1.25 ± 0.38, p < 0.0001). Analysis of the receiver operating characteristic (ROC) curve showed the best separation between the two groups for a cut-off value of WMSI of 1.75 (sensitivity - 83.3%, specificity - 90% and accuracy - 87%). In pts undergoing catheterization WMSI correlated well with LVEDP (r = 0.75, p < 0.001).

Conclusions: WMSI has a high diagnostic accuracy in separating pts with a clinical event of pulmonary congestion from pts without such an event and correlates well with directly measured LVEDP, which may indicate its association with diastolic dysfunction. WMSI should therefore not simply be regarded as a parameter of systolic ventricular function but rather as an index of extent and severity of overall myocardial segmental dysfunction.
146 Left ventricular stroke volume displaces anteriorly the aortic root through left atrial reservoir expansion.

G. Berra, P. Barbier, M.D. Guazzi. Centro Cardiologico Monzino, IRCCS, Milan, Italy

Extent of aortic root (AR) systolic anterior movement has been explained as determined by left ventricular (LV) ejection and correlated to stroke volume. Further, the AR "sits" on the anterior left atrial (LA) wall and diastolic posterior displacement of AR has been related to LV diastolic filling and LA emptying.

Aim: Because past and recent evidence suggests a reciprocal interaction between LA reservoir function and LV stroke volume, aim of this study was to demonstrate that the AR is directly displaced by extent of LA expansion during reservoir, as a function of LV stroke volume.

Methods: in 20 normal subjects and 80 consecutive patients undergoing diagnostic echocardiography (age 59±15) we analyzed the ability to predict anterior movement of AR, measured in parasternal view with respect to transducer position, of different LA dimensions non contiguous to the AR in the apical 4-chamber (supero-inferior, medio-lateral diameters and area) and 2-chamber (supero-inferior, antero-posterior diameters and area) views. For all dimensions, LA reservoir indexes were calculated as maximum – minimum dimension.

Results: at multiple regression analysis, reservoir expansion of 2-chamber supero-inferior and 4-chamber medio-lateral diameters, and LV biv lobe stroke volume predicted (r=0.022) with decreasing importance anterior movement of AR, independently from BSA, age, heart rate, LA and AR dimensions, LV preload and ejec tion fraction, and heart disease. When LA reservoir function indexes were excluded from analysis, only LV stroke volume predicted (p<0.001) AR movement.

Conclusion: our analysis suggests that LV stroke volume influences indirectly the systolic anterior displacement of the AR through the direct influence of LA reservoir expansion.

147 Is the diastolic velocity decay from the left ventricular inflow tract to the left ventricular outflow tract affected by the systolic function?

C. Tiano 1, J. Rosins pas 1, V. Volberg 2, R. Brunoldo 2, R. Montecchiesi 2, J. Lerman 2, D. Piñeiro 2. 1ING Maschwitz, Argentina; 2Hospital de Clinicas, Hospital, Cardiology Dept., London, United Kingdom; 2Royal Brompton Hospital, IRCCS, Milan, Italy

Results: spectral waveform in 23 p, as well as the Er/E and Ar/A ratios. The IVRT, DT, EPV in the LVOT (Er and Ar), the E deceleration time (DT), the E propagation velocity with the LV elastic recoil reduction could be a possible explanation.

148 Is the slowed left ventricular relaxation or augmented atrial transport function the primary abnormality of filling in mild hypertension?

S. Qirko 1. T. Goda 2. 1University Hospital Center; Department of cardiology, Albania; 2University Hospital Center, Department of Cardiology, Tirana, Albania

Background: The diastolic dysfunction in the early phases of hypertension has been attributed to a primary slowing of LV relaxation, expressed by reduced Doppler E wave. The augmentation of atrial filling, manifested by an increased Doppler A wave, is considered compensatory and secondary. The aim of this study was to evaluate whether the primary abnormality of the LV filling in mild hypertension is the augmented atrial transport or the reduced LV relaxation.

Methods: 35 normotensive (NT) and 45 untreated subjects (HT) were included in the study. They were matched for age. All of them were free of any other type of cardiopathy. LV relaxation was assessed by measuring of doppler E wave velocity and by evaluation of the mitral propagation velocity (Vp) (a load-insensitive method) measured by color M-mode echo. Atrial transport was assessed by Doppler A wave velocity. LV mass index (LVMI, g/m²) and LV shortening fraction (LVSF) were measured and calculated by echo.

Results: E wave velocity, Vp, LVMI and FSh were similar for both groups. Significant difference was observed only in A wave velocity, as shown on the table.

Univariate correlation coefficients

<table>
<thead>
<tr>
<th>A</th>
<th>E</th>
<th>Vp</th>
<th>LVMI</th>
<th>FSh</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>0.14</td>
<td>0.44</td>
<td>0.14</td>
<td>0.43</td>
</tr>
<tr>
<td>BSA</td>
<td>0.22</td>
<td>0.98</td>
<td>0.22</td>
<td>0.98</td>
</tr>
<tr>
<td>SI</td>
<td>0.30</td>
<td>0.8</td>
<td>0.30</td>
<td>0.80</td>
</tr>
<tr>
<td>DT</td>
<td>0.15</td>
<td>0.04</td>
<td>0.15</td>
<td>0.04</td>
</tr>
<tr>
<td>EPV</td>
<td>0.20</td>
<td>0.05</td>
<td>0.20</td>
<td>0.05</td>
</tr>
<tr>
<td>LVMI</td>
<td>0.20</td>
<td>0.05</td>
<td>0.20</td>
<td>0.05</td>
</tr>
<tr>
<td>FSh</td>
<td>0.20</td>
<td>0.05</td>
<td>0.20</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Forward stepwise multivariate regression analysis identifies the LVEF and Dop/Dt as the only factors with significant influence over Er/E and Ar/A.

Conclusion: The data suggest that the diastolic velocity decay from the inflow tract to the LVOT is not established. The effect of acute myocardial infarction (MI) on left ventricular (LV) systolic function?

I.S. Ramzy 1, M. Dancey 1, D. Gibson 1, A. Coats 2, M. Henein 2. 1Central Middlesex University Hospital, Department of Cardiology, Uxbridge, Middlesex, United Kingdom; 2Royal Brompton Hospital, London, United Kingdom

Background: The effect of acute myocardial infarction (MI) on left ventricular (LV) systolic function was investigated. As the only factors with significant influence over Er/E and Ar/A.

Results: in 21 patients with acute MI; 11 anterior (age 52±8 years) and 10 inferior (age 59±16 years) at admission during thrombolysis and 30 days after recovery using ECG and echocardiography. Electromechanical segmental delay was taken from the end of the T wave to the onset of long axis lengthening in early diastole at different sites; anterior, posterior, lateral and septal. ST and T wave durations were compared with corresponding segmental mechanical delay.

Results: in patients with inferior MI the delayed onset of the posterior long axis lengthening, with respect to end ejection, was not different from normal 69±28 ± 65±10 ms (NS), at admission. This delay correlated closely with ST segment (r=0.86, p<0.001) and T wave duration (r=0.79, p<0.001). In contrast, with anterior infarction the onset of anterior long axis lengthening was delayed by 20ms, 80±24 vs 60±9 ms. p<0.001 compared to normal. This delay became only related to ST duration 30 days after MI infarction (r=0.8, p<0.001) but not with T wave.

Conclusion: Patients with inferior MI recover their diastolic electromechanical relationship within days after thrombolysis, however with anterior infarction this relationship becomes apparent 30 days after thrombolysis. These findings suggest a significant ventricular remodelling process after thrombolysis for anterior infarction.

149 Is the slowed left ventricular relaxation or augmented atrial transport function the primary abnormality of filling in mild hypertension? A. Araujo 1, E. Arteaga 1, B. Buck, S. Ianni, C. Mady. Heart Institute - Sao Paulo University, Cardiopatias Geneticas, Sao Paulo, Brazil

Objective: to determine the effects of angiotensin II (Ang II) blockade on left ventricular (LV) diastolic function of patients with hypertension (HCM). Background: Intestinal fibrosis improves LV compliance in HCM. Ang II has profibrotic effects on myocardium that can be influenced by an Ang II receptor antagonist, losartan. Losartan reversed myocardial fibrosis in mice with a transgenic model of human HCM but the effects of Ang II blockade in human HCM is unknown.

Methods: in 12 non-obstructive HCM patients with a septal thickness > 15mm we performed Doppler echocardiographic evaluation of LV diastolic function. The measurements consisted of M-mode left atrium diameter (LAD), mitral peak early (E) and atrial (A) filling velocities, E/A ratio, E/e, IVRT; pulmonary venous peak systolic (S), diastolic (D) and atrial (PVA) velocities, tissue Doppler early longitudinal diastolic velocity of mitral annulus (Ea) and the E/e ratio. The patients received 100mg/day of losartan during a mean period of 177 days. At the end of the treatment the studies were repeated. A paired t-test p<0.05 was considered significant.

Results: all 8 previously symptomatic patients related exercise tolerance improvement. The following parameters significantly improved: LAD diminution, S and PVA lowering, Ea increase and E/e Ea reduction (table). The mean E/A ratio was not significantly altered but patients with E/A > 1 had an inversion to > 1.0 and restrictive patterns of E/A changed to normal ratios.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Baseline</th>
<th>6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA (mm)</td>
<td>42.7</td>
<td>39.1</td>
</tr>
<tr>
<td>S (cm/s)</td>
<td>65.1</td>
<td>56.8</td>
</tr>
<tr>
<td>PVA (cm/s)</td>
<td>37.7</td>
<td>30.9</td>
</tr>
<tr>
<td>Ea (cm/s)</td>
<td>13.2</td>
<td>11.7</td>
</tr>
<tr>
<td>E/e</td>
<td>6.6</td>
<td>5.1</td>
</tr>
</tbody>
</table>

Data expressed as mean values of 5 averaged measurements obtained by 2 observers

Conclusions: in patients with non-obstructive HCM, long term Ang II blockade with losartan caused an improvement in Doppler indexes of LV diastolic dysfunction and an increase in exercise tolerance. These findings support the view that pharmacological interventions targeting myocardial interstitial fibrosis can have salutary effects in human HCM.
151 Improvement of left ventricular diastolic function after successful catheter ablation for lone paroxysmal atrial fibrillation.

P. Reant, S. Lafitte, P. Jaie, V. Le Bouffus, R. Weerasooriya, R. Roudaut, M. Haissaguerre. Hôpital Cardiologique Haut-Leveque, 33, PESSAC, France

Background: We investigated whether lone atrial fibrillation (LAF) was the cause of heart rhythm remodeling using serial transesophageal echocardiographic (TEE) studies.

Methods: 28 pts (mean age 52±9 yrs, 5F) underwent successful ablation of LAF by pulmonary vein isolation in combination with mitral ischaem linear ablation. TTE measurements including parameters from pulsed Doppler, Doppler tissue imaging, acoustic quantification and transimal flow velocity propagation were prospectively acquired before and 1, 3 and 6 months after the ablation procedure.

Results: In all 28 pts, stable sinus rhythm was maintained during follow-up. Mode left ventricular (LV) velocity propagation (Vp) as well as pulmonary A wave velocity and TEI index were significantly improved in the entire group at 3 and 6 months. In 7 pts who had baseline E/A ratio <1, a normal profile was addition ally observed after ablation. Progressive significant reductions of left atrial dimensions from both parasternal and apical views were documented during follow-up. No significant difference was observed before and after treatment for LV dimension (28pts), systolic (28pts) and conventional diastolic parameters (E and A mitral waves)(21pts).

Conclusion: Elimination of LAF is associated with improvement of LV diastolic function and significant reduction of LA dimensions suggesting that the arrhythmia is linked to these abnormalities.

152 A prevalence and determinants of diastolic dysfunction in a general population.

A. Rybakov, T. Kuznetsova, S. Malyutina. Institute of Internal Medicine, Lab. of Cardiology, Novosibirsk, Russian Federation

The incidence of primary diastolic heart failure (DHF) in ageing European populations is remarkably rising. But DHF prognosis and its prevalence in general population is still unclear. Impaired left ventricular (LV) diastolic function plays an important role in such common cardiovascular disorders as hypertension, ischemic heart disease, and congestive heart failure.

The purpose of this investigation was to assess the prevalence of LV diastolic dysfunction according to Doppler criteria, and to analyze its determinants in general population.

Methods: The cross-sectional study was carried out in Novosibirsk, Russia in the frame of WHO MONICA Project. Doppler analysis of LV inflow was performed in general population sample of 346 men aged 35-54 (technically inadequate patients and those with the presence of systolic cardiac failure and aortic regurgitation were excluded). Peak flow velocity in early diastole (peak E), in late diastole (peak A), and the E/A ratio were measured. All measures were compared with healthy reference group (n=68) selected from the same population.

Results: Prevalence of LV diastolic dysfunction was of 24.7% in men under 50 (E/A<1.0) and was of 33.7% in those above 50 (E/A<0.5). In the entire sample peak E, peak A and E/A ratio were, respectively: 49.0±10.4 cm/s, 45.0±6.8 cm/s and 1.13±0.34 cm/s. In the entire sample and healthy group the age, heart rate, systolic blood pressure (SBP) and LV percent fractional shortening by multivariate models were strongly related to early and late diastolic transmitial peak velocities and E/A ratio. Age was negatively associated with E peak (b=0.58, p<0.001) and E/A ratio (b=-0.02, p<0.001) and positively associated with A peak (b=0.23, p<0.001) in both groups, and univariate correlation was not markedly attenuated by adjusting for other factors tested in multivariate model. SBP within normal range in reference group negatively correlated with E/A ratio (b=-0.009, p=0.01), but did not reach significant values for absolute parameters as peak E and A. In the population, mean wall thickness at end-diastole was an independent predictor of E peak (b=-0.68, p<0.05), A peak (b=1.60, p<0.001) and E/A ratio (b=-0.04, p<0.01).

Conclusion: The prevalence of LV diastolic dysfunction in middle-age male population is relatively high: about 29%. In general population Doppler parameters of LV diastolic filling are associated with age, blood pressure, heart rate, LV systolic function and wall thickness.

153 Tissue Doppler imaging (TDI) for estimation of filling pressures validation in patients with primary or secondary mitral regurgitation.

C. Bruch, J. Shlymann, M. Grude, T.H. Wichter, G. Breithardt. WWU Münster, Inner Medizin C, Münster, Germany

Background: Mitral annular velocities derived from tissue Doppler imaging (TDI) complement traditional variables in the evaluation of left ventricular (LV) performance. The mitral E/E’ ratio has been suggested as an estimate of LV filling pressures in selected subsets of patients. However, E/E’ has not been validated in patients with primary or secondary mitral regurgitation (MR).

Methods & Results: 14 patients (pts) with primary MR (prolapse (n=6), flail leaflet (n=8), rheumatic degeneration (n=3)), mean age 49±11 y, PMR group), 26 pts with MR secondary due to ischemic (n=19) or dilated cardiomyopathy (n=7) (mean age 2.7±0.3, age 60±12 y, SMR group) and 29 asymptomatic controls (age 56±11 y, CON group) underwent echocardiographic measurements of mitral annular velocity (E, E’, A’) and mitral inflow velocities (E, A, E/A-ratio). Mitral annular velocities (E’, S’, A’) derived from pulsed TDI were obtained at the septal mitral annulus. In pts., LV end-diastolic pressure (LVEDP) was derived from left heart catheterization.

<table>
<thead>
<tr>
<th>Group</th>
<th>EF (%)</th>
<th>Mitral E/E’ ratio</th>
<th>S’ (cm/s)</th>
<th>E’ (cm/s)</th>
<th>A’ (cm/s)</th>
<th>E/E’</th>
<th>LVEDP (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CON (n=29)</td>
<td>67±8</td>
<td>1.20±0.35</td>
<td>5.8±1.3</td>
<td>11.6±2.5</td>
<td>11.3±2.0</td>
<td>6.5±1.5</td>
<td>81±20</td>
</tr>
<tr>
<td>PMR (n=14)</td>
<td>70±10</td>
<td>1.74±0.64</td>
<td>10.2±2.5</td>
<td>12.3±3.2</td>
<td>11.2±2.1</td>
<td>8.5±3.4</td>
<td>13±6</td>
</tr>
<tr>
<td>SMR (n=26)</td>
<td>30±11</td>
<td>21.2±3.2</td>
<td>4.7±1.1</td>
<td>1.7±1.3</td>
<td>6.3±2.5</td>
<td>16.2±4.5</td>
<td>20±6</td>
</tr>
</tbody>
</table>

Conclusion: Tissue Doppler imaging (TDI) is a reliable estimate of filling pressures. In subjects with primary SV and preserved LV filling pressures, filling pressures are underestimated by E/E’, mainly due to increased E’.

154 Tissue Doppler predicts left ventricular filling pressure better than standard Doppler in patients with mitral valve regurgitation.

E. Agricola 1, M. Galderisi 2, M. Oppizi 1, G. Melisungo 1, F. Airoldi 3, A. Margonato 1, 1Ospedale San Raffele, Division of Non-Invasive Cardiology, Milan, Italy; 2Federico II University, Clinical and Experimental Medicine, Naples, Italy; 3Ospedale San Raffaele, Interventional Cardiology, Milan, Italy

Background: Mitral and pulmonary venous flow measurements are widely used to estimate changes of left ventricular (LV) filling pressure. Mitral regurgitation (MR) induces modifications of both mitral and pulmonary venous flow making these parameters unreliable to assess LV diastolic function.

Objective: To evaluate whether tissue Doppler (TD) diastolic indices measured at the level of LV mitral annulus can predict LV filling pressure in patients with MR.

Methods: Forty patients (age: 55±11 years) with severe MR (ejection fraction 40% - 75%), underwent a complete Doppler echocardiographic examination including TD. Transmitial E and A wave velocities, E wave deceleration time, A wave duration, pulmonary systolic and diastolic velocity, reversal flow duration, the difference between pulmonary and mitral A wave (A’-A), TD-derived Em and Am of LV lateral mitral annulus were measured. LV end-diastolic pressure (LVEDP) was measured invasively.

Results: E peak velocity (r=0.56, p<0.001), E deceleration time (r=0.70, p<0.0001), Em velocity (r=0.78, p<0.0001), Em/Am ratio (r=0.71, p<0.0001), E/Em ratio (r=0.88, p<0.0001), pulmonary venous systolic velocity and systolicdiastolic ratio (r=0.70, p<0.005 and r=0.57, p<0.01, respectively) and A’-A (r=0.55, p<0.01) had univariate relations to LVEDP in the overall population. By a multiple linear regression analysis, Em/Em ratio (b=0.87, p<0.0001) was an independent predictor of LVEDP while standard Doppler transmitial and pulmonary venous flow indexes did not enter the model (R2= 0.74, S.E=E, p<0.0001). An E/Em ratio > 10 detected a mean LVEDP > 15 mmHg with a sensitivity of 90% and a specificity of 83%.

Conclusion: Mitral regurgitation influences the majority of standard Doppler measurements used in the clinical setting to predict LVEDP but not E/Em ratio. Mitral E velocity adjusted for the influence of relaxation (i.e. the E’/Em ratio) may be considered a reliable measurement to estimate accurately LVEDP in patients with MR.

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155 Assessment of Valsalva maneuver as a method for evaluation of patients with pseudonormalized left ventricular filling pattern.


Background: Valsalva maneuver was used to differentiate normal from pseudonormalized mitral flow pattern. Doppler tissue imaging (DTI), differentiates normal from abnormal diastolic function.

Aim of the Work: Assessment of Valsalva maneuver as a mean to differentiate pseudonormal from normal mitral flow pattern (MFP), using pulsed- wave DTI

Patients and Methods: sixty patients with dilated cardiomyopathy (EF<40%), sinus rhythm and pseudonormalized MFP were selected. Transmitral flow velocity curves before and during Valsalva maneuver were recorded. Peak early mitral filling (Em), peak atrial filling (Am) and Em/Am were measured before and during Valsalva. Valsalva patients were classified into two groups. Group I included 24 patients with Em/Am<1 and group II, 36 patients with Em/Am >1.

Conclusions: Pulsed-wave DTI was recorded at septal, lateral, inferior and anterior aspect of the mitral annulus from apical 4 and 2 chamber views. The mean peak early velocity (Ea), peak atrial velocity (Aa), and Ea/Aa of the 4 sites were measured from DTI derived velocity curve for each patient. The results were compared with the MFP.

Results: Valsalva maneuver was able to detect a hidden relaxation abnormality in 40% of patients where Em/Am became<1 with significantly prolonged deceleration time (DT), and isovolumetric relaxation time (IVRT). However, 60% of patients remained normal.

156 Echocardiographic diastolic dysfunction parameters and mitral regurgitation are predictors of pulmonary hypertension in left ventricular dysfunction.

J. Saavedra, P. Talavera, E. García, P. Awamleh, M.T. Alberca, A. Karoni, F.G. Cosio. 1Hospital Universitario de Getafe, Cardiology, Getafe, Spain

Introduction: Pulmonary hypertension (PHT) in patients with left ventricular systolic dysfunction (LVSD) is associated to a worse prognosis.

Objectives: We sought to study the prevalence of PHT in a group of patients with LVSD and its relation to echocardiographic parameters of diastolic function (DF). Methods: We have studied a series of 71 patients, 58 men, middle age 53±14 years with LVSD, mean ejection fraction (EF) 25±7%, 34 of them had coronary disease and 37 had dilated cardiomyopathy. A transthoracic echocardiography was performed measuring: the systolic pulmonary arterial pressure (SPAP), DF parameters in the mitral flow, E and A velocity, E/A ratio, E deceleration time(EDT) and isovolumetric relaxation time (IVRT), and in the right superior pulmonary vein: systemic wave velocity (S), diastolic (D) their areas (ARG and ARD) and their ratio (S/D) and velocity of the atrial retrograde wave (A). Mitral regurgitation and its severity was also assessed. SPAP could be measured in 55 patients (77%). The mean SPAP was 24±18 mmHg. Mean SPAP was 36 mmHg in patients with grade I mitral regurgitation, 45 mmHg in grade II, 55 mmHg in grade III and 63 mmHg in grade IV. p<0.01. SPAP was higher in patients with a more severe diastolic dysfunction, as shown in the table (p<0.01).

Mean PSAP in diastatic filling patterns

<table>
<thead>
<tr>
<th>LV filling pattern</th>
<th>Number of patients</th>
<th>PSAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impaired relaxation</td>
<td>21</td>
<td>31 mmHg</td>
</tr>
<tr>
<td>Pseudonormal</td>
<td>6</td>
<td>41 mmHg</td>
</tr>
<tr>
<td>Restrictive</td>
<td>28</td>
<td>53 mmHg</td>
</tr>
</tbody>
</table>

Conclusions: 1) The severity of PHT is correlated with DF parameters and mitral regurgitation in patients with cardiac failure due to LVSD. 2) Those patients with a more restrictive inflow pattern and more severe mitral regurgitation have a higher SPAP.

157 Prognosis of systolic and diastolic heart failure in the elderly.

M. Lengyel, C.S. Farsangi, A. Zoriadí, 1. Göttschege G. Hung.inst.of Cardiology, Budapest, Hungary; 2St. Imre Hospital, Budapest, Hungary

The results of comparison of prognosis of systolic (S) and diastolic (D) heart failure (HF) has been controversial. The objective of this study was to compare outcomes of SHF and DHF in elderly hospitalized patients.

Methods: Left ventricular ejection fraction (EF), mitral E/A velocity ratio and deceleration time (DT) were measured and calculated by echocardiography. In NYHA class II-IV pts SHF was defined as EF<40% and DHF as EF<25% plus either impaired relaxation (E/A<1.0 and DT<~200 ms) or restrictive function (E/A>2.0 or DT<~140 ms) or atrial fibrillation. Actuarial survival was assessed by Kaplan-Meier analysis. Patients >85 years (28 males and 49 females) were followed for 11.4±6.4 months. 34 pts had DHF and 41 pts (89%) died. 29-74 pts died (48%) in GI and 22 in GI (NS). HF mortality was 3 in GI and 11 in GI (p<0.033). 2 years actuarial survival in the whole group was 30%. There was no difference between survivors and nonsurvivors in age (77±1.6 vs 79±3.7, p=0.46). EF (46±2.18 vs 42±5.2±1.8%, pulmonary artery systolic pressure (43.1±12.9 vs 47.6±15.0 mmHg), but NYHA class was significantly lower (2.9±0.7 vs 3.4±0.8, p=0.05) and pleural effusion by echo was significantly less frequent (27.5 vs 57.1%, p=0.05) in survivors than in nonsurvivors. Actuarial 2 year survival of pts in class IV was significantly worse (10%) compared to NYHA III-IV (41%), p<0.003. There was no difference in the 2 year survival between GI (32%) and GI (27%).

Conclusions: Overall survival with SHF and DHF in the elderly is similar. Prognosis of systolic and diastolic heart failure in the elderly is related to NYHA class. EF and survival was independent of age and EF but it was inversely related to functional class.

158 Suspected isolated diastolic dysfunction occurs in 36% of patients with the clinical diagnosis of congestive heart failure.

M.R. Movahed, M. Ahmadi-Kashani, R. Gim, B. Kasravi, M. Hashemzadeh. UCI Medical Center, Dept. of Medicine/Cardiology, Orange, United States of America

Introduction: The prevalence of diastolic left ventricular (LV) dysfunction in a population presenting with the diagnosis of congestive heart failure (CHF) is controversial. The prevalence of systolic and asymptomatic LV dysfunction in patients with CHF varies considerably in current literature. We evaluated the prevalence of systolic and suspected diastolic dysfunction in a large population presenting with a clinical diagnosis of CHF using echocardiography.

Methods: We retrospectively reviewed 24,380 echocardiograms performed at our institution from 1984 to 1998. We evaluated the prevalence of abnormal LV systolic and diastolic dysfunction in patients with the clinical diagnosis of CHF. Suspected diastolic dysfunction was defined as presence of left atrial enlargement, left ventricular hypertrophy or restrictive filling pattern.

Results: In this cohort, 636 echocardiograms with CHF as the primary diagnosis were reviewed. LV function data were available in 461 patients. Normal LV size and function was found in 238 patients (48%). Isolated suspected diastolic dysfunction was found in 166 patients (36%). Normal systolic and diastolic function was observed in 12% of patients.

Conclusions: Nearly one-half of the echocardiograms with the primary diagnosis of CHF exhibited normal LV size and systolic function. In this cohort, 36% of the patients had suspected echocardiographic evidence of abnormal diastolic dysfunction along with the clinical diagnosis of CHF.

159 Left ventricular longitudinal relaxation velocity; a sensitive index of diastolic dysfunction.

B. Nilsson1, Y. Fornerander2, R. Egerlid3, B. Wandt4, 1Anesthesiology, Karlstad; 2Medical Center, Örebro; 3Sahlgrenska and Örebro University Hosp, Göteborg; 4Örebro University Hospital, Clinical Physiology, Örebro, Sweden

Objective: The aim of the present study was to evaluate maximal longitudinal relaxation velocity of the left ventricle as an index of diastolic dysfunction.

Methods: Sixty-four consecutive patients with known or suspected heart failure, NYHA class II-IV, with or without a history of myocardial infarction, angina pectoris and 11 a history of myocardial infarction were investigated. The long axis movements of the mitral annulus from apical four-chamber view. Pulsed-wave DTI was recorded at septal, lateral, inferior and anterior aspect of the mitral annulus and assessment of diastolic dysfunction in those patients.

Results: According to age-related reference values for the E/A ratio of the mitral inflow and recording of the pulmonary vein flow, the maximal early diastolic velocity were analysed by using the mean value from four sites. The maximal relaxation velocity by M-mode (M-RVm) was measured as the steepest part of the curve in early diastole and the velocities recorded by pulsed tissue Doppler (TD-RVm) were measured from the outer border of the dense part of the spectral curve. The diastolic mitral inflow velocity and pulmonary vein flow were recorded by pulsed Doppler from the apical four-chamber view.

Every case was classified as belonging to the group with normal or to the group with impaired diastolic function with all three methods, M-RVm, TD-RVm and the combination E/A ratio of the mitral inflow and recording of the pulmonary vein flow. Cases with diastolic dysfunction according to the latter method were regarded as true cases when the sensitivity and specificity for M-RVm and TD-RVm were calculated. Previously reported reference values were used for M-RVm and TD-RVm. Results: According to age-related reference values for the E/A ratio of the mitral inflow, and for pulmonary vein flow, 27 of the 64 patients had diastolic dysfunction, of whom 12 had also systolic dysfunction (EF<50% by Simpson’s rule). When diastolic dysfunction was identified by means of the E/A ratio and pulmonary vein flow, M-RVm had a sensitivity of 89% and a specificity of 81%. TD-RVm had a sensitivity of 81% and a specificity of 78%. Fisher’s exact test showed that the M-RVm recorded by either modality can be used to identify diastolic dysfunction (p<0.0001). TD-RVm (mean 86.8 mm/sec) was 29.7% (p<0.001) higher than M-RVm (mean 66.9 mm/sec).

Conclusions: Maximal relaxation velocity in the long axis of the left ventricle, recorded by either M-mode or Doppler can be used for assessment of diastolic dysfunction. Considerably higher velocities are recorded by tissue Doppler than by M-mode. Different age-related reference values must therefore be used.
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Ejercicio no invasivo para evaluar la función diastólica.

W. Kosmala, M. Przewlocka-Kosmala. Medical University, Cardiology, Wroclaw, Poland.

Elevated plasma level of nitric oxide (NO) is common finding in patients (pts) with systolic heart failure. However, the relation of NO to diastolic dysfunction is not well defined.

Aim: The aim of the study was to investigate plasma level of NO in hypertensive pts with pure diastolic heart failure.

Material and Methods: Studied group consisted of 57 pts (26 males, 31 females) mean age 53.5±11.7 with essential hypertension. 26 pts presented symptoms of NYHA class I and 31 NYHA class II. 18 healthy persons mean age 52.2±12.1 served as control group.

Results: Only pts with normal global and regional left ventricular systolic function were enrolled into the study. Systolic and diastolic function of left ventricle was assessed echocardiographically by measurements of left ventricular ejection fraction and velocity of early (E) and late (A) transmural flow, deceleration time of E wave (DT), isovolumic relaxation time (IVRT) and flow propagation velocity of E wave (Vp).

Conclusion: In conclusion, plasma NO level is elevated in hypertensive pts with mild isolated diastolic heart failure and it depends on the severity of heart failure being significantly higher in NYHA class II than in NYHA class I.

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Evaluation of preload dependency of mitral inflow, tissue Doppler and color M-Mode values and time intervals.

M. Klickicap1, S. Turhan1, G. Nergizoglu2, K. Kevem2, U. Rahimov1, N. Duman2, G. Agkem1. 1Ankara University School of Medicine, Cardiology, Ankara, Turkey; 2Ankara University School of Medicine, Nephrology, Ankara, Turkey.

Purpose: Some of the echocardiographic parameters that used in evaluation of left ventricular filling are preload-dependent. In this study we evaluated preload dependency of these criteria.

Method: Forty-one patients undergoing hemodialysis due to chronic renal failure were enrolled to the study. In order to demonstrate preload dependency of the echocardiographic parameters of diastolic function, velocities and time intervals of mitral inflow (E and A wave velocities, E-wave deceleration time, and isovolumic relaxation time), tissue Doppler velocities of mitral lateral annulus (Em and Am) were measured.

Results: Stroke volume and cardiac output were significantly decreased after dialysis. Velocities and time intervals of mitral inflow were found to be preload-dependent. Although tissue Doppler velocities were influenced partially by the change in preload, color M-Mode parameters were found preload-independent (Table 1).

Table 1. Echocardiographic Parameters

<table>
<thead>
<tr>
<th>Before Dialysis</th>
<th>After Dialysis</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke Volume (ml/beat)</td>
<td>97.7 ± 28.4</td>
<td>73.3 ± 20.5</td>
</tr>
<tr>
<td>Cardiac Output (L/min)</td>
<td>6.9 ± 2.1</td>
<td>5.9 ± 2.0</td>
</tr>
<tr>
<td>E (cm/sec)</td>
<td>87.2 ± 18.8</td>
<td>64.0 ± 21.9</td>
</tr>
<tr>
<td>A (cm/sec)</td>
<td>80.5 ± 18.6</td>
<td>73.1 ± 18.8</td>
</tr>
<tr>
<td>Em (cm/sec)</td>
<td>1.13 ± 0.39</td>
<td>0.88 ± 0.38</td>
</tr>
<tr>
<td>Deceleration time (msec)</td>
<td>213.2 ± 30.0</td>
<td>234.4 ± 46.6</td>
</tr>
<tr>
<td>Isovolumic relaxation time (msec)</td>
<td>93.6 ± 18.9</td>
<td>101.4 ± 20.7</td>
</tr>
<tr>
<td>Am (cm/sec)</td>
<td>12.0 ± 3.0</td>
<td>11.6 ± 3.3</td>
</tr>
<tr>
<td>Em/Am</td>
<td>11.6 ± 2.3</td>
<td>10.0 ± 2.3</td>
</tr>
<tr>
<td>Vp (cm/sec)</td>
<td>513.3 ± 15.9</td>
<td>494.8 ± 28.4</td>
</tr>
<tr>
<td>Td (msec)</td>
<td>85.5 ± 29.1</td>
<td>98.7 ± 40.5</td>
</tr>
</tbody>
</table>

Conclusion: Color M-Mode parameters of diastolic function were superior to the other echocardiographic parameters of diastolic function in terms of preload dependency.

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Is color m-mode of mitral inflow a load independent parameter in a clinical setting?

J. Nuñez-Moncillo1, C. Fernandez Palomeque2, J.F. Forteza1, A. Rodriguez1, H. Conde1, A. Bethencourt1. 1Hospital Universitario San Durante, Cardiology, Palma de Mallorca, Spain; 2Hospital Son Dureta - BINUCS, Cardiology, Palma de Mallorca, Spain.

Echo-Doppler is an excellent non-invasive tool for in vivo diastolic assessment. Color M-mode of mitral inflow can determine the rate of flow propagation in the left ventricle (LV). When diastolic function is impaired, wave propagation velocity (Vpe) is slow, even when left atrial (LA) pressure is increased. This “relative” load independence has been previously reported under several conditions.

We analyzed Vpe behavior in the strain phase of the Valsalva maneuver (VM), 23 subjects (10 men, 13 women, aged 56.1±14.5 years) comprised the study group. We used STE analysis in the strain phase of the Valsalva maneuver (VM) and analyzed load independent values.

Results: Comparison between NYHA I, NYHA II and controls as shown in the table. Plasma NO level did not correlate with individual diastatic parameters.

<table>
<thead>
<tr>
<th>NYHA I</th>
<th>NYHA II</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>A [cm/sec]</td>
<td>65.5 ± 8.0</td>
<td>74.8 ± 11.7*</td>
</tr>
<tr>
<td>E/A</td>
<td>0.12 ± 0.26</td>
<td>0.96 ± 0.18</td>
</tr>
<tr>
<td>NO [mcmol/L]</td>
<td>28.1 ± 6.5</td>
<td>41.9 ± 9.3*</td>
</tr>
</tbody>
</table>

*p < 0.05 vs control group; ** p < 0.01 vs control group; # p > 0.04 vs NYHA I

Conclusion: In conclusion, plasma NO level is elevated in hypertensive pts with mild isolated diastolic heart failure and it depends on the severity of heart failure being significantly higher in NYHA class II than in NYHA class I.

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Early to late left ventricular color m-mode flow propagation is related with natriuretic peptides levels in dilated cardiomyopathy.

A.P. Patrianakos1, F.I. Partenakis1, P.G. Tzanakis1, E.A. Papadimitriou1, G.F. Diaikakis1, D.C. Kambouraki1, P.E. Vardas2. 1Heraklion University Hospital, Cardiology Dept, Heraklion, Crete, Greece; 2Heraklion University Hospital, Cardiology, Heraklion, Greece.

Background: In heart failure, the early flow propagation (Ep) has been used as a valuable index of diastolic dysfunction while Atrial (ANP) and Brain (BNP) natriuretic peptides are secreted from atrial and ventricles in response to volume or pressure overload. However data about late flow propagation (Ap) velocity is lacking.

In the present study, we assess the relationship of Ap with natriuretic peptides levels in patients with non-ischemic dilated cardiomyopathy (NIDC).

Methods: We study 43 pts with angiographically proven NIDC, aged 58.1±11.3y, NYHA functional class II-III and LV ejection fraction (EF) 51.2±10.4%.

A complete echocardiography study and color M-Mode Doppler was performed and Ep and Ap were calculated. N-Terminal-Pro ANP and BNp levels were measured in all patients.

Results: Patients were divided into group (I)24 pts) with delayed relaxation pattern (in Early to Late (A) transmural PW-Doppler wave was <1, isovolumetric relaxation time (IVRT) >100msec, DTe was >220 msec and atrial component (AR) of the Pulmonary Vey flow <35 cm/sec and group II with pseudonormal pattern if E/A=1-2, IVRT=100-120msec, DTe=150-200msec and AR=35-30 cm/sec. Six pts with restrictive filling pattern were excluded because of no measurable Ap.

There were no significant differences in age, NYHA class, UFEF, LV ejection and Ap (0.69±0.29 vs 0.54±0.30 vs NS) between the two groups.

Group II patients showed decreased peak systolic PW velocity (Spv) (0.44±0.31 vs 0.52±0.05 m/sec,p=0.02), and increased Ep (0.44±0.21 vs 0.31±0.14 m/sec, p=0.01), and Ep/Ap ratio (1.91±1 vs 0.56±0.41±0.01) compared to group I pts.

Group II pts had also increased ANP (4.2±3.2 vs 2.9±1.5 m/mol/l, p=0.003) and BNP (1.2±0.61 vs 0.77±0.33, p=0.03) levels compared to group I.

A significant correlation was found between Ep/Ap ratio and AR (r=0.44, p=0.04), ANP (r=0.49, p=0.04) and BNP (r=0.82, p=0.001) levels.

Multivariate linear regression analysis showed that the Ep/Ap ratio was the most powerful predictor of BNP levels (p<0.001).

Conclusions: 1-Valsalva maneuver decreases LV inflow velocity propagation in normal subjects and also in those with impaired relaxation. 2-Acute preload reduction could be the cause of these results. 3-Load modifying maneuvers proposed for diastolic assessment need to be re-evaluated and standardized.

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