MISCELLANEOUS

619 Intensity of the cell inflammatory response and myocardial perfusion pattern by myocardial contrast echocardiography post acute coronary syndrome

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Background: The intensity of the cell inflammatory response after an acute coronary syndrome (ACS) is a consequence of the extension of the left ventricular (LV) myocardial ischemic area and the area at risk, which can be assessed by myocardial contrast echocardiography (MCE).

Purpose: We studied a population of 36 ACS patients (pts), 52.7% (n=19 pts) STEMI, 25% (n=14 pts) NSTEMI, and 22.2% (n=8 pts) with unstable angina, between the first (D1) and third (D3) days post ACS.

Methods: In each case, we collected blood samples to determine the levels of high sensitivity C-reactive protein (hs-CRP-ng/ml) and cell membrane receptors CD4 and CD40 (n/mm3), and its variation gradients (D= D3 - D1) as an estimation of the intensity of the cell inflammatory response. For each laboratory parameter the increasing A values were graded in 50% MCE study was performed at D3 post ACS with a C256 and 512 Sequoia (Acuson Siemens, Germany) ultrasound machines after intravenous Sonovue® (Bracco, Rov)continuous infusion during 3’, intermittent digital MCE imaging acquisition, Δt=175 ms, Tc imaging condition, and PCl software, with the acquisition of destruction/perfusion sequential images. The MCE pattern was classified in 16 LV wall segments as normal (P0), late filling (P1), heterogeneous (P2) and absence of perfusion (P3), the mean value/pt, percent distribution (%) and the correspondent segmental perfusion index (SPI) were calculated.

Results: We observed a direct relationship between SPI and hs-CRP (r=0.44; p=0.01) and ΔCD40 (r=0.51; p<0.01). Linear regression and multiple correlation analysis were applied between hs-CRP and the different MCE pattern, with P1/pt (r=0.37; p<0.01), P2/pt (r=0.53; p<0.01) and between CD40 and P1/pt (r=0.42; p=0.01) and P2/pt (r=0.56; p<0.01).

Conclusions: In this study we obtained a direct relationship between the intensity of the cell inflammatory response post ACS evaluated by serum markers and the extension of the LV myocardial ischemic area by MCE. This relationship was more significant for the late filling and patchy MCE pattern, revealing the presence of a greater myocardial area at risk post ACS by this new non invasive technique.

CORONARY FLOW

620 Comparison between noninvasive transthoracic coronary flow reserve and contrast cardiac magnetic resonance to identify myocardial recovery after anterir reperfused myocardial infarction

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Previous studies showed that coronary flow reserve (CFR) measurement after recanalization of the infarct-related coronary artery has predictive value of myocardial viability. Gadolinium contrast enhanced cardiac magnetic resonance (GE-MRI) is a non invasive technique able to assess myocardial function and irreversible myocardial damage. Aim of this study was to compare CFR and GE-MRI to assess myocardial viability and to predict myocardial recovery after primary PCI.

Methods: Forthty patients (36 male, aged 60±12 years) with first anterior AMI treated with primary PCI underwent CFR echocardiogram on the left anterior descending coronary artery with adenosine transthoracic echocardiography and GE-MRI 5±3 days after PCI and two-dimensional echocardiography at admission and at 6 month follow-up. A 17-segment model of the left ventricle was used to analyze both wall motion abnormalities and transmural extent of necrosis at GE-MRI as assessed by hyperenhancement (HE) extent. A necrosis score was derived for each segment in the risk area considering HE thickness extent (1: non HE; 2: HE less than 25%; 3: HE grater than 25% - less than 50%; 4: HE greater than 50% - less than 75%; 5: HE transmural greater than 75%). In each patient a wall motion score index (WMSI) and a necrosis score index (NSI) and a trasmurality score index (TSI) were calculated in the risk area. A satisfactory recovery was defined as wall motion improvement in at least two contiguous dysfunctioning segments for >1 grade.

Results: At univariate analysis predictors of recovery of function at follow-up were peak CFPK value (r=0.36, p=0.02), CFR value (r=-0.81, p<0.0001), NSI (r=-0.37, p=0.03) and TSI (r=0.56, p<0.0001), microvascular obstruction at GE-MRI (r=0.38, p<0.02). At multivariate analysis the significant predictor of recovery at 6 month follow-up were TSI at GE-MRI (coefficient 0.51; p=0.006), and CFR value (coefficient 0.48, p=0.001). Using receiver operating characteristics ROC curve analysis the optimal CFR cutoff identified was <2.4, with 73% of sensitivity and 92% of specificity (p=0.0001), in identifying patients with significant recovery at follow-up. Moreover, the optimal TSI cutoff identified was <0.28. Thus TSI cutoff was 73% sensitive and 88% specific (p=0.0001).

Conclusions: CFR and GE-MRI after AMI predict myocardial viability and LV functional recovery at follow-up. Our study showed that noninvasive CFR and GE-MRI have the same sensibility and specificity to assess regional ventricle recovery after AMI.

621 Clinical value of echocardiographic assessment of coronary flow reserve after descending coronary artery stenting in unselected population

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Background: Restenosis after percutaneous coronary stenting still remains a relevant clinical problem. The non-invasive tests in patients with stents are low accurate, particularly when drugs as betablockers cannot be withdrawn and when there is an old anterior myocardial infarction (MI).

Aim of the study: Assess the usefulness of echocardiographic evaluation of coronary flow reserve (CFR) in detecting significant angiographic restenosis after coronary stenting of the left anterior descending (LAD) coronary artery in a non-selected population.

Methods: 223 patients (age 61±10 years; 168 men) treated in the last 9 months with stenting of the middle-proximal tract of the LAD, underwent measurement of CFR by transthoracic Doppler echocardiography in the distal tract of the LAD during adenosine infusion (0.14 mg/kg/min over 90 sec) within 48 hours of control coronary angiography. Drug administration was continued, and patients with old anterior-apical MI were included. Exclusion criteria were atrial fibrillation, second or third degree atio-ventricular block, cardiomyopathy, severe valvular heart disease, and left ventricular ejection fraction <40%. CFR was calculated as the ratio of hyperemic to basal peak
diastolic flow velocity. A >70% stenosis at coronary angiography has been considered significant.

Recurrent restenosis occurred in 49 patients (22%). There was a significant difference in basal coronary flow velocity (23.6 ± 6.8 vs 27.4 ± 9.7; p < 0.002) and CFR (2.7 ± 0.6 vs 1.5 ± 0.5; p < 0.0001) between patients with and without restenosis, respectively. A univariate linear relation was found between coronary narrowing and CFR (r = 0.73; p < 0.0001), which remained significant after adjustment for other variables, such as systolic and diastolic blood pressure and heart rate (r = 0.74; p < 0.0001). A ROC curve showed that a CFR cut-off value of 2 identified significant restenosis with a sensitivity of 88% and a specificity of 88% (AUC = 0.94). In a multivariate logistic regression analysis, anterior MI, diabetes, heart rate and above all coronary stenosis (β = 0.19, p < 0.001, β = 0.16, p < 0.04, β = 0.16, p < 0.003; β = 0.66, p < 0.0001, respectively) were independent predictors of CFR. The inverse correlation between coronary stenosis and CFR persisted in patients with old anterior MI (r = 0.70; p < 0.0001) and in those treated with 8-blockers (r = 0.64; p < 0.0001).

Conclusions: Measurement of CFR is a valuable tool to identify restenosis after LAD stenting, even in unselected patients with previous anterior MI and taking 8-blockers.

622 Noninvasive assessment of coronary flow reserve after elective stenting in patients with previous myocardial infarction: Relation to left ventricular recovery
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Background: Analysis of coronary flow reserve dynamics after reperfusion of infarct related artery (IRA) may provide informations about microvascular integrity and recovery of infarcted region.

Objective: The aim our study was to evaluate the coronary flow reserve (CFR) in the IRA, before and after elective percutaneous coronary intervention (PCI), in relation to left ventricular recovery in patients with previous myocardial infarction.

Methods: Measurement of CFR was performed with transthoracic Doppler Echocardiography (TDE) before stenting, 24h after and three months later, in 39 patients with previous (>1 month) myocardial infarction, during dipyridamole vasodilatation. CFR was defined as the ratio of peak hyperemic to basal averaged peak velocity in the distal part of IRA. Ventricular recovery was determined by improvement in resting WMSI >0.20 at third month follow-up comparing to values before PCI.

Results: According to the improvement in resting WMSI at third month, patients were divided in two groups: group I recovered (n=27) and group II nonrecovered (n=12). Before PCI, no differences were observed in WMSI (1.41 ± 0.22 group I vs 1.50 ± 0.17 group II, p=ns) and in CFR between these two groups (1.56 ± 0.32 in group I and 1.51 ± 0.28 in group II, p=ns). In both groups CFR increased significantly after 24h (2.74 ± 0.78 in group I and 2.33 ± 0.52 in group II, p<0.0001 comparing to CFR before PCI), with no further significant improvement after third month (2.88 ± 0.79, in group I and 2.28 ± 0.66, in group II; p=ns comparing to CFR after 24h). CFR value of 2.46 discriminates patients with LV recovery with sensitivity of 68% and specificity of 78% (CI 95%; 0.61-0.694, p<0.001) as compared to CFR before PCI, with 0.15% decrease at 3 months follow up only in group I (1.19 ± 0.20 vs 1.41 ± 0.22, before PCI, p<0.0001).

Negative correlation was found in Group I between CFR and WMSI after three months, r = -0.52, p<0.05. In group II no improvement was observed in WMSI after 3 months time interval. Follow up was successful in all. Clinical and echocardiographic data at rest, peak and recovery phase of DSE were included to Cox proportional hazards regression models to identify independent predictors of cardiac events (cardiac death, non-fatal myocardial infarction and late revascularization), more than 6 months after testing.

Results: During follow up (mean 36±28 months), 19 patients (10%) died from cardiac causes, 34 (18%) patients suffered non-fatal myocardial infarction and 77 (41%) patients underwent late revascularization. Univariable independent predictors of cardiac events included age (hazard ratio HR 1.01 confidence interval 95% CI 1.00-1.02, p=ns), diabetes (HR 1.4, 95% CI 1.0-1.9), rest WMA (HR 1.4, 95% CI 1.1-1.6), new WMA (HR 1.2, 95% CI 0.9-1.4) at recovery phase of DSE. The best multivariant model to predict cardiac events included new WMA (HR 5.3, 95% CI 1.7-16.6) at recovery phase of DSE, after controlling for clinical and peak DSE data. In fact this model proved to have the best predictive value for late cardiac events (HR 11.2, 95% CI 39.1) as shown in figure 1.

Conclusions: This study illustrates that myocardial ischemia at recovery phase of DSE is an independent predictor of cardiac events and has an incremental value when compared to ischemia at peak.

625 Perfusion assessment by myocardial contrast echocardiography and parametric imaging after primary angioplasty predicts late functional modelling of left ventricle
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Myocardial contrast echocardiography (MCE) allows the assessment of myocardial perfusion and viability, which is associated to microvascular pres-
ery. We aimed to assess the predictive value of quantitative MCE with parametric imaging in late ventricular remodelling in patients with myocardial infarction submitted to primary angioplasty.

**Methods:** We studied 35 patients (pts; 26 men, 53.1±11.9 years-old) with a first myocardial infarction (LAD in 27 and RCA in 8) submitted to primary angioplasty, with akynetic or dyskinetic segments in infarction territory. Exclusion criteria: non-ischaemic rhythm and absence of echocardiographic window. We analysed the following data: angiographic TIMI grade after angioplasty; maximum troponin and CK; end-diastolic (EDV) and end-systolic volumes (ESV) and ejection fraction (EF) by biplane 2D-echo at 7 days and 6 months after intervention; MCE 7 days after angioplasty, MCE; real time perfusion imaging (power pulse inversion, MI.0.18-0.22), flash and systolic trigger at 1:1. During Sonovue® infusion at constant rate. Perfusion was assessed qualitatively (exponential equation: y=A(1-e-Bt)+c (A-blood volume, B-flow velocity, AxB-myocardial flow) and parametric images of perfusion were obtained by a dedicated software (QLab). Perfusion was then classified in 2 degrees as a result of the color-coded parametric analysis: 1-normal or reduced, 2-severely reduced/absent) in 17 ventricular segments. A perfusion index (PI) was calculated from the sum of individual scores/number of segments. Comparing the early and late LV indexes, we considered as criterion for remodelling: increase of EDV or ESV >20% or decrease of EF <20%.

**Results:** All pts had TIMI 3 angiographic flow, maximum CK was 1650±1100, maximum troponin 42±1.53 and mean PI was 1.6±0.3. Late evaluation yielded 11 pts with one or more remodelling criteria. A positive correlation was found between PI and late EDV (p=0.02) and ESV (p=0.001) and negative with EF (p=0.02). A cutoff of 1.4 for PI by ROC curves identified pts with late remodelling with 86% sensitivity and 88% specificity. Multivariate analysis yielded IP as the only independent predictor of remodelling between all the variables of the model (p=0.01).

**Conclusion:** Perfusion assessment by quantitative MCE with parametric imaging in patients submitted to primary angioplasty predicts late remodelling. Parametric imaging allows easier and faster analysis of perfusion and should be used as a routine bedside method for clinical assessment of viability and late remodelling.

**628 Determinants of reverse left ventricular remodelling after acute myocardial infarction**

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After AMI a very early left ventricular (LV) enlargement frequently occurs. In some patients a progressive LV dilation (LV remodelling) may be observed whereas in others LV volumes reduction has been detected (r-LVR, reverse LV remodelling). Main determinants of r-LVR are still under discussion. We hypothesized that the extent of microvascular damage may play a major role.

**Methods:** 54 patients with first STEMI successfully reperfused. After reperfusion, peak CK, ST-segment reduction and TIMI grade were calculated. The extent of microvascular damage was assessed by intravenous magnetic resonance imaging (MCE), a agent, before and 7 days after the infarction. Endocardial length of contrast defect (CDL%) was evaluated on day 1 after reperfusion (T1). The extent of wall motion abnormalities (WMA%), LV end-diastolic volumes indexed by body area surface (EDV/BSA), and ejection fraction (EF%) at T1 and at 3-months follow-up (T2) were also calculated.

R-LVR was defined as >10% reduction of EDV at follow-up.

**Results:** At T2, 54% of patients had r-LVR. At T1, EDV/BSA was similar in patients with r-LVR than in the others. CDL% and WMA% were significantly lower and EF% was significantly higher in patients with r-LVR than the others. At T2, the EDV/BSA decreased in patients with r-LVR and increased in the others, WMA% and EF% improved in patients with r-LVR, while they didn’t change in the others. ROC curves analysis, sensitivity and specificity of different parameters to predict reverse LV remodelling was calculated and the results are listed in the table.

**Conclusion:** R-LVR frequently occurs in patients successfully reperfused after AMI. A contrast defect extent <7% soon after reperfusion is the best predictor of r-LVR at follow-up. Patients with reverse LV have the higher improvement in systolic LV function as compared to the others.

<table>
<thead>
<tr>
<th>Table 1. ROC curves analysis</th>
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<tr>
<td>Sensitivity</td>
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<td>CDL%</td>
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<td>EDV/BSA (m/lmq)</td>
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<td>WMA%</td>
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<td>TIMI grade</td>
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<tr>
<td>ST reduction %</td>
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<td>EF%</td>
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**MYOCARDIAL VELOCITY IMAGING (DMI) – LV FUNCTION**

**627 Assessment of the extent of prior myocardial infarction by echocardiographic strain mapping: validation using magnetic resonance imaging**

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**Purpose:** We examined if strain mapping, a modality of strain imaging, can be used to study the size and transmurality of prior myocardial infarction area.

**Methods:** 26 patients (61±10 years, 5 female) admitted for acute coronary syndrome were included prospectively. All had elevated cardiac isoenzymes and angiographically verified critical stenosis in coronary arteries. Patients underwent echocardiography with strain imaging 6-12 months after the index event. Colour strain cine loops of the left ventricle were acquired for all standard apical views. A score from 0 to 3 was designated to each myocardial segment according to the ASE 16-segment model based on the colour of the segment using two different strain scales. (0= strain values < 10%; 1= 10-20%; 2=20-50% and 3>50%). In addition, end-systolic strain values were measured from each segment using quantitative analysis. Cardiac magnetic resonance imaging (CMR) with late enhancement (LE) with gadolinium for identification of infarcted myocardial segments was performed as validation method 12±7 days apart.

**Results:** The segmental scores yielded by strain mapping had a good correlation with the end-systolic strain values obtained by quantitative strain analysis (r=0.618, p<0.001). LE could be demonstrated in 96 of 381 segments (25%) assessed by CMR. Strain mapping was feasible in 79 of 96 segments (82%) with infarction and in 216 of 274 segments (79%) without infarction. Strain mapping scores in myocardial segments without LE (0.37±0.7) and in segments with LE (1.32±1.2) were significantly different (p<0.001 by Mann-Whitney U test). The average strain mapping score was 0.46±0.6 in myocardial segments with less than 50% extent of LE and 2.6±0.5 in segments with more than 50% extent of LE (p<0.006 by Mann-Whitney U test). Strain mapping scores correlated with the size of the infarction (r=0.605, p<0.002) estimated by CMR.

**Conclusions:** Our results suggest that echocardiographic strain mapping can be used to estimate the size and transmurality of the infarction area. Thus strain mapping may be a clinically applicable method for the estimation of regional myocardial function in post-myocardial infarction patients.

**LV FUNCTION – OTHER**

**628 Radial and circumferential strain estimation from CINE MR sequences**

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**Purpose:** Different techniques have been proposed to compute motion fields in cine MR sequences in short axis (30-60 frames per cycle, basal, mid- and apical) and late enhancement after administration of 0.2 mmol/kg of gadolinium-derived contrast agent. Cine images were processed with proprietary software. Cardiac motion field was obtained for each pixel and Sr and Sc quantified in the 16 standard segments.

**Methods:** We studied 42 patients with chronic myocardial infarction (>6 months from admission, open infarct-related artery, no other significant lesions). Studies included cine MR SSFP sequences in short axis (30-60 frames per cycle, basal, mid- and apical) and late enhancement after administration of 0.2 mmol/kg of gadolinium-derived contrast agent. Cine images were processed with proprietary software. Cardiac motion field was obtained for each pixel and Sr and Sc quantified in the 16 standard segments.

**Results:** Among the segments (S) analysed, 36 were graded as dysfunctional. Mean Sr was 61±19% in normokynetic S and 31±15% in dysfunctional S (p<0.005). Mean Sc was 25±1% in normokynetic S and 16±1% in dysfunctional S. Figure shows the regions selected and the outcome Sr and Sc temporal curves. Significant correlation was found between Sr and % of myocardial thickness showing late enhancement in the same segments (r=0.52, p=0.002).

**Conclusions:** Obtaining Sr and Sc from conventional CINE MR imaging using spatio-temporal non-rigid registration techniques allows quantifying regional myocardial function, overcoming the frame rate limitations of Tagged MR.
629 Validation of real-time 3D echocardiography study protocol in identification of anatomic mitral regurgitant defect in patients with prolapse or flail

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Background: In patients with mitral regurgitation (MR), valve repair is a major incentive to early surgery and is decided on the basis of the mechanisms and anatomic mitral lesions. These lesions can be easily studied with transesophageal echocardiography (TEE). A study protocol of real-time 3D echocardiography (RT3D) for the identifications of the valve defect is not well validated.

Objectives: This study was performed to validate a protocol of RT3D for assessment mitral valve for identification of anatomic valve defect due to prolapse or flail using TEE as gold standard.

Methods: One hundred and nineteen consecutive patients with moderate to severe MR (mean age 64 ± 3.4) were studied with RT3D and TEE to identify the valve defects causing MR and the results were evaluated in blind manner. RT3D study protocol was performed as follows: data were acquired in a zoom mode and in a full-volume mode from apical window. Then, using 3-D Lab software (version 2.0, Philips), a volume rendered en-face view of the mitral valve from the left atrium was reconstructed and guided by this view, a series of longitudinal cutplanes were reconstructed to visualise A1-P1, A2-P2 and A3-P3. Segmental analysis of the valve was evaluated according to American Society of Echocardiography guidelines.

Results: Among 119 patients, 66 had prolapse or flail by TEE. The accuracy of RT3D for prolapse lesion was 97% (p = 0.0001), with a sensitivity and specificity of 96% and 96%, whereas for flail lesion the accuracy was 95% (p = 0.0001) with a sensitivity and specificity of 91% and 97%. The diagnostic accuracy for the individual scallops is reported in Table 1.

Conclusions: RT3D protocol used rendering en-face view and a series of longitudinal cut planes is highly accurate in the identification of anatomic valve defect and its location, particularly showing high specificity values.

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<th>Table 1</th>
<th>Defect location</th>
<th>Agreement</th>
<th>Sensitivity</th>
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<tr>
<td>A1</td>
<td>91%</td>
<td>90%</td>
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<td>P3</td>
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630 Three-dimensional versus two-dimensional echocardiography in mitral valve repair

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Objectives: Our aim was to compare the diagnostic performance of three-dimensional echocardiogram versus two-dimensional in patients with regurgitant mitral valve.

Background: An accurate assessment of morphology and function of the mitral valve is essential for surgical repair. Two-dimensional (2D) transesophageal echocardiography has certain spatial limitations that could be overcome by three-dimensional (3D) imaging.

Methods: Patients undergoing surgical repair due to severe mitral regurgitation. Preoperative 2D and 3D transesophageal echocardiographic studies were compared to surgical findings (standard of reference). 3D images of the MV were obtained unaware of 2D or surgical findings.

Results: Eighty-one consecutive patients underwent surgical repair (2002-2004). Concordance regarding segments affected between the 2- and 3D studies and surgery was high, (2D: 86%-98%, 3D: 89%-100%). An increment of accuracy for 3D imaging was observed in A1 segment defects (p = 0.05) and commissural dysfunction (p = 0.02). 2D study incorrectly classified 22 segments mainly corresponding to complex disease. The three-dimensional study in correctly classified 14 segments, unrelated to complex disease. Five (6%) patients with complex disease, who suffered complex repair surgery, were incorrectly diagnosed with 2D but adequately with 3D echocardiography. A non-expert observer analysis of the 3D images was in accordance (94%, α 0.845) with data of the experienced author.

Conclusions: Three-dimensional echocardiography offers high precision in the evaluation of the mitral valve, and it may complement two-dimensional study in patients with complex valve anatomy where surgical decisions are even more difficult. It provides easily interpretable images and thus a high degree of experience is not required.

631 Comparison of 2DTEE vs 3DTTE in identification of individual scallop prolapse of the mitral valve

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A pre-operative correct assessment of mitral valve (MV) anatomy is essential to surgical design in particular because advances in cardiac surgery extended MV repair also to complex MV prolapse (MVP). 2D transesophageal echocardiography (2DTEE) provides precise informations about leaflets anatomy, but 3 dimensional (3D) echo could increase the understanding of more complex abnormalities. In a previous study of our group 3DTEE and 2DTEE showed similar accuracy in the evaluation of MVP. Aim of this study was to compare the accuracy of the two methods (2DTEE and 3DTEE) in the evaluation of individual scallops involvement in MVP. Sixty patients referred to surgical repair of MVP and selected out of 102 consecutive cases on the basis of good or optimal quality of 3D MV reconstructions (3DLIVE system), underwent 2DTEE intraoperatorively. Individual MV scallops were examined and sensitivity (SENS), specificity (SPEC) and accuracy (ACC) were analysed in comparison with surgical inspection. Intra and interobserver variability was calculated.

Results: Global ACC of 3DTEE (91%) and 2DTEE (88%) were similar. SENS and SPEC of the 2 techniques were similar in the analysis of posterior leaflet (fig. 1), anterolateral commissural scallops and chordal rupture. SENS and ACC in evaluation of posteriomedial commissural scallops (fig. 2) and anterolateral leaflet (fig. 3) involvement were significantly superior for 3DTEE vs 2DTEE. Intraobserver variability was: 3DTEE 68%, 2DTEE 89% and interobserver variability was 3DTEE 68%, 2DTEE 77% respectively. In conclusion both 2DTEE and 3DTEE had similar good concordance with surgery in the evaluation of MV anatomy. 3DTEE was superior in the evaluation of more complex cases of MVP.

632 Assessment of mitral regurgitation mechanism. Three-dimensional transesophageal echocardiographic study

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Mitral regurgitation (MR) is a common surgical pathology and a correct judgement of its mechanism is important for optimal surgical intervention. A good understanding requires complete assessment of the mitral valvular apparatus. Two-dimensional transthoracic (TTE) and transesophageal echocardiography (TEE) requires mental integration of all data about morphology of mitral leaflets. Tridimensional echocardiography (3D) can be a better and a quicker alternative.

We aim to evaluate the accuracy of 3 D transesophageal echocardiographic reconstruction in assessing the mitral valve pathology in patients with significant MR.

Material and methods: A complete echocardiographic study (two-dimensional TTE, TEE and 3D TEE reconstruction) was performed in 50 patients (p) with severe MR caused by pathology of mitral valve, who underwent surgical intervention. The patients with ischemic MR, obstructive hypertrophic cardiomyopathy, MR due to mitral annulus dilation, and also congenital MR were excluded. Five patients had mitral mechanical prosthesis. The 3D study was performed using an ultrasound imaging system Sonos 5500, Agilent
633 Improvement of the comprehensive analysis of mitral regurgitant jet with live three-dimensional color-flow doppler

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Purpose: Live three-dimensional echocardiography (3D echo) improves the comprehensive approach of various cardiac pathologies. We sought to evaluate the potential interest of live 3D color-flow Doppler in the assessment of mitral regurgitant (MR) jets.

Methods: One hundred patients (59±17 years, 49 males) presenting with at least mild MR were prospectively studied using 2D echocardiography and live 3D echo (Sonos Agilent 7500, Philips). Live 3D echo data were analyzed in a blind fashion 3.6±0.9 months after acquisition and subsequently compared with 2D data. The convergence zone and the vena contracta sizes and shapes, the jet origin and the number of jets, the left atrial jet direction and extent were analyzed.

Results: Mitral regurgitation was grade 1-2 in 26% of patients and grade 3-4 in 74% of patients using 2D echocardiography. For each patient, 2-2.5 3D volumes were acquired, including 2.1±1.1 color-flow volumes. Mean time for analysis was 7.0±2.9 min including 2.4±1.1 min for 3D color-flow doppler analysis. The quality of color-flow doppler images was considered as good in 28% of patients, as fair in 51%, and poor in 21%. The color-flow Doppler was analyzable in 95% of patients. Using Kappa statistics, 3D color-flow doppler demonstrated a good agreement with 2D echo in the localization of the main jet origin (Kappa: 0.85; 0.75-0.95). The number of jets was 1.4±0.7 (1 to 4) per patient. The main jet origin was lateral in 5% of patients, central in 62%, mediolateral in 5%, and was extended all along the closure line in 23% of patients.

Live 3D color-flow Doppler was particularly useful for the identification of multiple jets, diffuse regurgitation (all along the closure line), or commissural jet origin. Live 3D color-flow Doppler greatly improves the MR analysis, demonstrating a non hemispheric shape of convergence zone and a non circular vena contracta in up to 44% of patients. The subsequent discrepancy in MR orifice area (between the PISA and the quantitative Doppler methods using 2D echo) had a clinical impact in about 10% of patients (ERO 0.1 vs 0.5-0.8 ml/min i.v.). Image analysis was performed offline on a workstation (GE Vivid 7 Pro, GE Medical Systems, UK) using manual tracing of end diastolic (EDV) and end systolic volumes (ESV) in 3 apical planes registered simultaneously. LV volumes and EF were evaluated on two separate occasions by two independent observers blinded to all clinical data. Intra- and interobserver variability of the results was analysed.

634 Incremental value of contrast-enhanced simplified 3D echocardiography

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Background: Accurate determination of left ventricular (LV) volumes and ejection fraction (EF) is important not only for its prognostic information but also for therapy guidance. Echocardiography is at present the most commonly used method to provide this information and contrast-enhanced imaging has been proven valuable for 2D echocardiography. Whether contrast enhancement also improves the accuracy of 3D echocardiography needs to be further evaluated.

Methods: 23 consecutive patients, subjects to coronary angiography on clinical grounds were evaluated by simplified 3D echocardiography and image acquisition before and then after contrast enhancement (Sonovue®, 0.5-0.8 ml/min i.v.). Image analysis was performed offline on a workstation (GE Vivid 7 Pro, GE Medical Systems, UK) using manual tracing of end diastolic (EDV) and end systolic volumes (ESV) in 3 apical planes registered simultaneously. LV volumes and EF were evaluated on two separate occasions by two independent observers blinded to all clinical data. Intra- and interobserver variability of the results was analysed.

Results: Interindividual variability was consistently lower (see figure) when contrast enhancement was employed (coefficients of variation: EF - 5.66% vs 8.47%, ESV - 4.7% vs 5.48% vs 5.65%). The same was valid for methodological error from double determinations (EF - 6.1% vs 8.7%, ESV - 5.7% vs 11.9%, EDV - 4.5% vs 5.2%). Furthermore EDV was found to be larger when contrast was used.

Conclusion: Contrast enhanced simplified 3D echocardiography improves the accuracy of the LV volume assessment by reducing variability of the results. In addition, the diagnostic use of simplified 3D echocardiography without contrast enhancement appears to result in the underestimation of EDV as could be anticipated from previous preliminary studies.

635 Regional left ventricular systolic function in dilated cardiomyopathy: A real-time three dimensional echocardiographic study

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Background: Evaluation of left ventricular (LV) function provides important diagnostic and prognostic informations particularly Timing of regional LV function (mechanical dysynchrony).

Methods: Eighty patients with dilated cardiomyopathy due to idiopathic (D, n=40), ischemic (I, n=40) and control group (C, n=30) were investigated using Sonos7500 with X4 transducer. Full volume acquisitions from apical position were performed and images were sent to Q lab advanced quantification software for off-line analysis by two investigators blinded to patient data. The following LV parameters were measured: for global function (EDV, ESV and EF) and regional function of the LV 17 segments [standard deviation of time-to-minimum systolic volumes (Tmsv-SD), maximum dispersion (Tmsv-Dif) and SD of Tmsv as a percentage from cardiac cycle (Tmsv-SD%)]. Correlations between global and regional functions were performed.

Results: Tmsv-SD% is the most sensitive parameter that have inverse linear correlation with LV-EF in [DCM (r= -0.78), ICM (r= -0.49) < 0.001], but not for controls (Table). Excellent agreement for inter-observer (0.91) and intra-observer (0.93) were found for Tmsv-SD%.

Conclusion: RT3DE is a sensitive, simple and reproducible tool for quantification of mechanical dysynchrony. It may help in follow up of cardiomyopathy and heart failure patients and in selection of candidates for cardiac resynchronization therapy.

Table 1

<table>
<thead>
<tr>
<th>D (n=40)</th>
<th>I (n=40)</th>
<th>C (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tmsv-SD, %</td>
<td>18.9±4.7*</td>
<td>16.2±3.2*</td>
</tr>
<tr>
<td>Tmsv-SD, ms</td>
<td>73±51</td>
<td>36±27*</td>
</tr>
<tr>
<td>Tmsv-Dif, ms</td>
<td>254±182*</td>
<td>161±87*</td>
</tr>
<tr>
<td>LV-EF, %</td>
<td>25±8*</td>
<td>36±3*</td>
</tr>
<tr>
<td>LV-ESV, ml</td>
<td>165±54*</td>
<td>108±35*</td>
</tr>
<tr>
<td>LV-EDV, ml</td>
<td>219±66*</td>
<td>171±55*</td>
</tr>
<tr>
<td>QRS, ms</td>
<td>169±35*</td>
<td>160±22</td>
</tr>
<tr>
<td>Correlation with LV-EF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tmsv-SD %</td>
<td>-0.78*</td>
<td>-0.61*</td>
</tr>
<tr>
<td>Tmsv-SD, ms</td>
<td>-0.417</td>
<td>-0.24</td>
</tr>
<tr>
<td>Tmsv-Dif, ms</td>
<td>-0.33</td>
<td>-0.20</td>
</tr>
</tbody>
</table>

*P< 0.01 versus control, ? for correlation

636 Assessment of left atrial function: A real-time 3-D Echocardiography study

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Evaluation of left atrial(LA) size and function are important in clinical decision-making. LA volume (LAV) is an accurate index of LA size.

Aim: To compare between (RT3DE) and (2DE) for assessment of LA function.

Methods: One-hundred patients (pts) were investigated using (RT3DE) and (2D TTE). RT3DE studies were performed by Sonos 7500 ® with X4 trans-
Efficient quantification of the left ventricular volume using RT3DE (ml) 22±10 25±11 NS 49±21 64±27 <0.01

Table 1

<table>
<thead>
<tr>
<th>Group I (n=50)</th>
<th>RT3DE 2D TTE P value</th>
<th>Group II (n=50)</th>
<th>RT3DE 2D TTE P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>V max (ml)</td>
<td>35±10 37±12 NS</td>
<td>82±32 86±29 NS</td>
<td></td>
</tr>
<tr>
<td>V min (ml)</td>
<td>16±7 20±8 &lt;0.05</td>
<td>44±22 51±26 &lt;0.01</td>
<td></td>
</tr>
<tr>
<td>V pre A (ml)</td>
<td>22±10 25±11 NS</td>
<td>49±21 64±27 &lt;0.01</td>
<td></td>
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</tbody>
</table>

637 Efficient quantification of the left ventricular volume using 3D-echocardiography

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Background: For quantification of the left ventricular (LV) volume using 3D-echocardiography (3DE) a number of cross-sectional images are extracted from the recorded 3D-dataset and used for endocardial border detection. The goal of this study was to determine the minimum number of long axis images necessary for accurate quantification of the LV volume.

Method: Both MRI and 3DE recordings of the LV were obtained from 15 patients. Quantification of the LV volumes was performed with an initial set of 16 equi-angular long axis images, which were randomly oriented around the imaging axis (IA). Subsequently, subsets of 8, 4, and 2 equi-angular images were used.

Results: A strong correlation was observed between volumes obtained with MRI and 3DE using the full set of 16 images (r=0.99; y=0.96x+3.3 mL; SEE=7.1 mL). Comparison of these results with those from randomly chosen subsets showed a significant difference for volumes obtained with 4 and 2 images (p<0.005). However, when the subsets were selected to coincide with the most eccentric point (MEP) on the endocardial border this was only the case for the subsets of 2 images (p<0.001), see figure 1.

Conclusion: This study demonstrates that accurate LV volume quantification can be performed with as little as 6 equi-angular long axis images. By selecting the correctly oriented image set, the number of images can even be brought down to 4, which will further reduce the analysis time.