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Surface detection and color-encoding applied to real-time three-dimensional echocardiographic images as a basis for automated assessment of left ventricular wall motion  
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Purpose: Color encoding of left ventricular (LV) endocardial motion in 2D echo (2DE) has been shown to improve visual detection of regional wall motion abnormalities (RWMA). Our goals were: 1) to extend this technique to color encode detected LV endocardial surfaces from real-time 3D echo (RT3DE) images; 2) to automatically detect systolic RWMA and test its accuracy against visual interpretation of 2DE images.  
Methods: 1) 19 normal subjects (N), and 14 patients with RWMA (including 7 with global LV dysfunction) underwent RT3DE and 2DE (Philips). 2DE images (apical 2-, 3- and 4-chamber) were reviewed by an expert cardiologist, who graded wall motion (18 segments model) as normal or abnormal (AB). RT3DE datasets were analyzed using custom software: frame-by-frame semi-automated LV surface detection was followed by logical operations applied to each pair of consecutive frames, to track color and encode endocardial motion in 3D. Then, regional fractional volume change (RFVC) in % of regional end-diastolic volume was calculated automatically by colored voxels count, and displayed as stacked color-histograms. In RWMA, RFVCs were compared with regional thresholds, derived from RFVC computed in N and optimized using ROC analysis, for automated classification of wall motion.  
Results: The generation of 3D color-encoded wall-motion and RFVC quantification took <10 sec. In RWMA, 182/252 segments were graded as AB (Figure 1, arrows). The automated technique agreed with the expert reader in 225/252 (89%) segments, with only 8/252 (3%) false positive and 19/252 (8%) false negative detections (sensitivity: 0.91; specificity: 0.80; accuracy: 0.84).  
Conclusions: The proposed technique could improve the visual assessment of wall motion from RT3DE images, and represent the basis for automated detection of RWMA.

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Three dimensional parametric viability assessment during dobutamine stress echocardiography at patients after myocardial infarction before revascularization  
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The aim of the study was to assess 3D quantification used during dobutamine stress echocardiography (DSE 3D) in viability assessment at patients (pts) after myocardial infarction before revascularization.  
Methods: We analyzed 59 patients (pts) referred to viability assessment by DSE before planned revascularization after coronary angiography. Stress echo was done using standard protocol (0-10-20 mcg/min dobutamine if needed in 3-5 min) on Philips IE33 with 3D Qlab advanced software. During base line assessment and maximal dobutamine infusion 2D (DSE 2D) and 3D (DSE 3D) full volume were recorded. First observer described LV contractility using 17 segment model as normo, hipo, akininesis and dyskinesis in 2D. Second observer, using 3D reconstructed 17 segments 3D LV shape. Contractility of each segment was analyzed using following parameters: segment contractility fraction/SCF - change of segment thickness during systole-diastole, segment movement fraction/SMF - inward, systolic movement of segments and synchronicity time/sT - segment-s contraction time. After 6 months at 55 pts the viability was assessed by 2D and 3D rest echocardiography.  
Conclusion: Three dimensional analysis of DSE has better diagnostic value than standard assessment in viability assessment at patients after myocardial infarction before revascularization. The parametric assessment was very helpful in contractility borderline segments (e.g. hipoakinetik) analysis when it was difficult to qualify segments unambiguously.

Table 1 2D vs 3D SE viability comparison

<table>
<thead>
<tr>
<th>Group</th>
<th>3D Sensitivity</th>
<th>3D Specificity</th>
<th>2D PPV</th>
<th>2D NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>92%</td>
<td>92%</td>
<td>92%</td>
<td>92%</td>
</tr>
<tr>
<td>B</td>
<td>89%</td>
<td>90%</td>
<td>90%</td>
<td>86%</td>
</tr>
</tbody>
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3D left atrial volume with real-time 3D echocardiography as a marker of left ventricular diastolic function: A comparison study with the left atrial measurements with 2D echocardiography  
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Purpose: To explore not only the feasibility of 3D left atrial (LA) volume measurement by real-time 3D echocardiography (RT3DE) but also its correlation with conventional echocardiographic parameters representing left ventricular (LV) diastolic function in comparison with the LA measurements by 2D echocardiography (2DE).  
Methods: 2DE and RT3DE were performed in 15 normal subjects (NL) and 31 patients with diastolic dysfunction. The patients group was sub-divided into 3 groups [impaired relaxation (IR): 15, pseudonormal (PN): 7, restrictive physiology (RP): 9] according to the LV diastolic dysfunction that was graded by conventional echocardiographic diastolic parameters (E/A, DT, S/D and E/E'). Full volume images including LA were acquired over 4 cardiac cycles from apical views using Sonos 7500 (Phillips, Co.). 3D LA volume (3DLAV) was calculated by integrating the planimetry of LA contours in 8 rotational planes during end systole with 3D computer software (4D CardioView). Full volume images were analyzed by M-mode 3DE. LA volume (2DLAV) was also calculated by monoplane Simpson’s rule (disc method) on the apical four-chamber view. All measurements were indexed (i) by body surface area (BSA).  
Results: 3DLAV (p<0.05) and 2DLAV revealed significant differences between 4 groups (NL, IR, PN and RP) by ANOVA test, while LAD did not (p>0.05). 3DLAV showed a closer correlation with 2DLAV (r=0.94, p<0.01) than LAD (r=0.79, p<0.05). In patients group, 3DLAV revealed significant correlation (p<0.01) with E/A (r=0.49) and E/E' (r=0.51) showing higher correlation coefficient than 2DLAV (r=0.43, r=0.41, p<0.05) while LAD did not (r=-0.33, r=-0.29, p>0.05).  
Conclusion: 3DLAV assessed with combined use of RT3DE and 3D computer software seems to be a feasible method. 3DLAV showing better correlations with the conventional diastolic parameters seems to be a more useful marker of the LV diastolic function than other LA measurements by 2DE.