611 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 (RWMAs). 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: 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 and color 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.

614 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).

Method: 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, D/S 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 planimeteries of LA contours in 8 rotational axial planes during end systole with 3D computer software (4D CardioView, TomTec, Co.). LA dimension (LAD) was measured by M-mode 2DE. LA volume (2DLAV) also was 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.