**ORAL SESSION**

**New modalities of stress echocardiography**

Friday, 8 December 2006, 16:30–18:00

Location: Novak

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### 3-D ECHO

1004

**Three dimensional parametric contractility assessment during dobutamine stress echocardiography at patients suspected of coronary artery disease**

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**Background:** The aim of the study was to assess value of 3D quantification used during diagnostic dobutamine stress echocardiography (dDASE 3D) at patients (pts) suspected of coronary artery disease (CAD).

**Methods:** We analyzed 40 patients (pts) referred to dDASE 3D before planned coronary angiography. Stress echo was done using standard protocol (0-10-20-30-40 - mcg/min dobutamine + atropine if needed in 5-3-3-3 min. intervals) on Philips IE33 with 3D Qlab advanced software. During base assessment and maximal dobutamine infusion 2D (dDASE 2D) and 3D (dDASE 3D) full volume were recorded. First observer described LV contractility using 17 segment model as normo, hipo, akinesy and dyskinesis in 2D. Second independent observer, reconstructed 17 segments 3D LV shape. Contractility of each segment were analyzed by following 3D parameters: segment contractility fraction/SCF - change of segment thickness during systole-diastole, segment movement fraction/SMF - inward, systolic movement of segments and time of contraction, synchronicity time/st - segment’s time contraction. All patients had coronary angiogram, as a significant >=70% occlusion was defined (>50% occlusion in the left main coronary artery).

**Results:** We analyzed diagnostic values of 2D dDASE and dDASE 3D in comparison to results of coronary angiogram.

**Conclusion:** Because of the real 3D analysis DASE 3D has better diagnostic value than standard 2D assessment in identification of patients with coronary artery disease. The parametric assessment was very helpful in border-line segment assessment (e.g. hipoakinetik) when it was difficult to qualify segment unambiguously.

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<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
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<tr>
<td>3D</td>
<td>90%</td>
<td>90%</td>
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<tr>
<td>2D</td>
<td>85%</td>
<td>90%</td>
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1005

**Transathoracic real-time three-dimensional bicycle stress echocardiography: Comparison of this new technique with conventional two-dimensional bicycle stress echo**

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**Purpose:** Two-dimensional bicycle stress echo (2-D-BSE) is a safe and accurate method for diagnosing coronary artery disease (CAD), but adequate image acquisition at peak stress remains a problem due to motion artefacts and hyperventilation. Newly introduced three-dimensional echo allows rapid image acquisition of the entire left ventricle using an apical imaging plane.

The aim of the study was 1) to evaluate the diagnostic accuracy of three-dimensional bicycle stress echo (3-D BSE) and 2) to answer the question if image acquisition is facilitated by this new approach.

**Methods:** 35 consecutive patients (pts) with clinically suspected CAD scheduled for coronary angiography were investigated. In all pts 2-D BSE and 3-D BSE were performed in a randomized order by one experienced investigator; there was a time delay of at least 2 hours between the first and the second BSE. 2-D BSE images were acquired from 2 parasternal and 2 apical image planes, 3-D BSE images from the apical window. Analysis of 3-D BSE was performed from anatomical images by cropping the full volume data sets.

**Results:** Mean time for adequate image acquisition at peak stress was shorter for 3-D BSE than for 2-D BSE (20±6 s compared to 78±9 s, p<0.001). Image quality at rest and peak stress was sufficient to evaluate all three coronary territories in 92% in 3-D BSE and in 96% in 2-D BSE. There was no significant difference regarding sensitivity and specificity of 3-D BSE (89 and 92%) compared with 2-D BSE (92 and 94%), to detect CAD.

**Conclusions:** In bicycle stress echo 3-D image acquisition is rapid and accurate and allows reproducible assessment of myocardial ischemia. The shortening of the acquisition time in stress echocardiography makes this technique a promising and useful tool for daily clinical practice.

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**Real-time three-dimensional dobutamine stress echocardiography in detection of myocardial ischemia - validation with coronary angiography**

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**Objective:** The goal of the present study was to compare real-time three-dimensional (RT3DE) to two-dimensional dobutamine stress echocardiography (2DE) for detection of myocardial ischemia, with angiographic validation of the results.

**Methods:** 56 patients (age 64.5±6.2, 38 males), referred for coronary angiography, were examined by 2DE and RT3DE during the same dobutamine stress protocol with echo-contrast medium infusion for left-ventricle opacification. We compared the regional wall-motion score for the four apical segments at peak stress which was 1.35±0.55 by 2DE and 1.52±0.69 by RT3DE. All patients completed the protocol uneventfully. Mean acquisition time for the necessary views to evaluate all segments was 26.3±2.5 sec for RT3DE and 58.8±3.7 sec for 2DE (p<0.001). At peak stress, RT3DE reported higher wall-motion score index (1.25±0.24 by 2DE, 1.30±0.27 by RT3DE; p=0.014). We compared the regional wall-motion score for the four apical segments at peak stress which was 1.35±0.55 by 2DE and 1.52±0.69 by RT3DE (p=0.003). The diagnostic parameters of 2DE vs RT3DE were: sensitivity 73% vs 78%, specificity 93 vs 89% and overall accuracy 86% vs 85%, respectively. In the LAD territory, in particular, where RT3DE reported higher apical wall-motion scores, it showed a tendency towards higher sensitivity (85% vs 78%), although this difference did not achieve statistical significance.

**Conclusion:** We report that RT3DE identifies more readily wall-motion abnormalities in the apical region than 2DE, which may explain the tendency towards higher sensitivity in the LAD territory. We validate RT3DE results using angiography as reference and our findings indicate diagnostic equivalence to 2DE, with the advantage of significantly shorter acquisition times.
1007
Contrast agent supported real time 3D Stress-Echocardiography for detection of coronary artery disease
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Background: Real time 3D echocardiography provides fast recording of a complete cardiac volume data set and allows new insights into the heart. However, reduced spatial resolution of the 3D matrix transducers led to impaired assessment of left ventricular wall motion (WM). We compared 3D stress echocardiography combined with contrast application (CA) for improved endocardial border detection to conventional 2D echo in order to detect significant coronary artery disease.
Methods: 17 patients with suspected coronary disease underwent dobutamine stress echo. 3D echo was performed in apical view using a 4S Transducer (Sonos 7500, Philips) at low mechanical index (0.5-0.6) with bolus injection of 1.0 ml CA (Sonovue©) at rest and during stress. For 2D echo we used also CA and the conventional mode of 4S transducer. WM of 3D echo was evaluated in off-line mode and c-scan analysis (1 mm slices) and compared to conventional WM analysis in 2D echo. Following echo exam, all patients underwent coronary angiography and stenosis (< or >70%) as well as perfusion territory were determined by an experienced examiner.
Results: Dobutamine stress increased heart rate (69±12 vs 131±21/min, p<0.001) but not blood pressure (96±19 vs 149±37 mm Hg, ns). All 272 segments could be sufficiently evaluated by CA 3D stress echo. Specificity of CA 3D echo was comparable to 2D (97.4% vs 98.7%). However, positive (77.8% vs 70.0%, p<0.001) and negative predictive values were higher in CA 3D echo alone (94.9% vs 85.9%, ns). In particular, detection of ≥70% stenoses in the right and circumflex coronary supplying the inferior and posterior wall could be improved (36.4% abs.).
Conclusion: Contrast agent supported real time 3D stress echo improves detection of coronary artery disease especially of the right and circumflex coronary artery supplying the inferior and posterior segments. However, less sensitivity of 2D echo supposes reduced echogenicity of the 4S transducer used in conventional mode and limits the technique.

CONTRAST ECHO

1008
Comparison of diagnostic value of stress real-time myocardial contrast echocardiography and gated single-photon emission computed tomography in patients with suspected coronary artery disease
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2Chair of Cardiology Medical University, Lodz, Poland
Background: Gated 99mTc-sestamibi SPECT (G-SPECT) is a noninvasive imaging technique widely used in patients with suspected coronary artery disease. The diagnostic potential of stress real-time myocardial contrast echocardiography (MCE) has not yet been fully established.
Aim: To compare the diagnostic value of stress real-time MCE and G-SPECT in detecting significant coronary artery disease (CAD).
Material and methods: 103 patients (pts) (68 male, mean age 58.9±9 years) with suspected stable CAD (mean CCS class 2.2) scheduled for coronary angiography were included in this prospective study. Prior to coronary angiography all pts underwent G-SPECT and rapid high dose dipiridamole (0.84 mg/kg iv over 4 minutes)-atropine (up to 1mg iv) stress real-time MCE (Contrast Pulse Sequencing, Siemens Sequoia 256) using repeated iv boluses of Optison. Perfusion defects in 18 sections of the left ventricle were visually assessed by consensus of 2 investigators. The segments were divided into 3 coronary territories (LAD, Cx, RCA) based on typical coronary flow distribution. The presence of significant CAD (≥70% stenosis or ≥50% stenosis of left main coronary artery) was detected by coronary angiography.
Results: Significant CAD was present in 77% of pts (30 - 1 vessel, 25% - 2 vessels, 21% - 3 vessels). Table 1 presents accuracy (Ac), sensitivity (Se) and specificity (Sp) of analyzed methods in detecting significant CAD and significant stenoses of individual coronary arteries. The differences in diagnostic accuracy between G-SPECT and MCE were not statistically significant with an exception of Cx territory, where sensitivity of G-SPECT was significantly higher than sensitivity of MCE (48% vs 30% respectively, p=0.03).
Conclusions: Stress real-time MCE and G-SPECT provide similar diagnostic accuracy in detecting significant coronary artery disease.

STRESS ECHO

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Rapid atrial and ventricular pacing stress echocardiography in coronary artery disease: an alternative technique of stress testing.
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Aim: The aim of this study was to assess the safety and accuracy of simple, brief echocardiographic stress test protocol based on rapid cardiac pacing in patients with implanted permanent pacemaker for non-invasive diagnosis of ischemic heart disease in patients (pts) with and without left ventricular hypertrophy.
Method: We present the final results of a national multicenter study Pol-RAPSE (Polish study on Rapid Pacing Stress Echocardiography) including 100 pts (mean age 65±5 years, range 45-80) with permanent pacing (27% VI, 10% AAI, 63% DDD) qualified for stress echocardiography. Using external programming system heart rate was stepwise increased to 100 beats for 3 minutes and 85% of age-predicted maximal heart rate for 3 minutes using AAI/DDD if feasible and additionally VVI mode. Results of 149 tests were analyzed - peak stress was obtained in 73 pts using physiological AAI/DDD stimulation and/or in 76 pts by VVI mode. All patients underwent coronary angiography as reference; significant coronary artery stenosis was defined as ≥50% diameter reduction.
Results: Significant coronary disease was detected in angiography in 53 (53%) pts. Mean duration time of RAPSE examination was 9±2 min. No adverse events were observed. The quality of endocardial border visualization was good in every case. Heart rate at rest and at maximal stimulation was 68±8 and 129±11 minute (p<0.0001), systolic blood pressure 130±21 and 128±22 mm Hg (ns), ejection fraction 51±12 and 49±15% (ns), wall motion score index 1.32±0.4 and 1.49±0.5 AAI/DDD and 1.65±0.5 (p<0.0001) respectively. The feasibility of the test was 98% - only 2 AAI pts (treated with betablockers) failed to reach the target heart rate due to low Wencleckheart point. Test specificity was 90%, sensitivity - 91%, accuracy - 95% by AAI mode vs 68%, 91% and 87% respectively by VVI mode (ns). Accuracy values were similar in left ventricular hypertrophy group (92% and 86% for AAI/DDD and VVI, resp.) and in patients receiving beta blockers therapy the accuracy was 81% by AAI mode and 77% by VVI mode (ns).
Conclusions: RAPSE is a rapid, feasible and safe stress protocol allowing efficient diagnosis of ischemic heart disease in pts with both AAI and VVI pacing, including those with left ventricular hypertrophy or beta blockade. Easier interpretation of peak AAI images results in a slight trend towards better accuracy as compared to peak right ventricular pacing.