Dynamic Diastolic Stress Echocardiography With Minimal Exercise Enables Prediction of Exercise Tolerance in Patients With Congestive Heart Failure

Takashi Yamaura, Yuuki Otsubo, Yu Takayama, Kenichi Nakashita, Kuninori Takasawa, Yoshihisa Noguchi, Naoko Mizukami, Toshihiro Morita, Tsuyoshi Fukudome, Chuwa Tei, Kagoshima University School of Medicine, Kagoshima, Japan

Background: The most important factor to determine quality of life is exercise tolerance. It can be quantified with peak VO2 by analyzing patients’ expired gas during carefully performed moderate or more exercise by skilled examiners. The purpose of this study is to investigate whether minimal exercise stress echocardiography allows noninvasive prediction of peak VO2 or not.

Methods: Subjects consisted of 10 patients with congestive heart failure of grade 2 to 3 of New York Heart Association’s classification and 4 normal controls. Anaerobic threshold (AT) and peak VO2 was measured conventionally by analyzing expired gas during multiple step ergometer exercise. By minimal stress echocardiography, peak VO2 was measured by keeping DcT and E velocity on baseline value was evaluated by pulsed Doppler echo (E velocity, E/E' ratio) and by intravenous volume loading. The peak VO2 by DcT shortening by LL in hypertensive patients with diabetes was significantly greater than in those without diabetes. These findings suggest that LL maneuver can be useful as a simple preloading test and that this test may unveil the latent LV diastolic dysfunction in diabetic hypertensives, because a great shortening in DcT by LL is shown to reflect the restrictive (more severe) diastolic dysfunction.

Results: 1) The shortening of the deceleration time of the E wave (DcT) by LL was strongly correlated with peak VO2 (r=0.88, a<0.0001). Study 2) The DcT shortening by LL in diabetic group (236 ± 47 to 189 ± 34 msec) was significantly greater than in non-diabetic group (222 ± 38 to 202 ± 34 msec). Furthermore, the presence of diabetes was an independent predictor for the DcT shortening. There was no independency as a predictive factor in other clinical and echocardiographic parameters.

Conclusions: 1) In the present study, we showed a strong correlation between changes in DcT by passive LL maneuver and by intravenous volume loading. 2) This study also showed that DcT shortening by LL in hypertensive patients with diabetes was significantly greater than in those without diabetes. 3) These findings suggest that LL maneuver can be useful as a simple preloading test and that this test may unveil the latent LV diastolic dysfunction in diabetic hypertensives, because a great shortening in DcT by LL is shown to reflect the restrictive (more severe) diastolic dysfunction.

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Multislice Computed Tomography for Noninvasive Coronary Angiography: Diagnostic Accuracy of Volume Rendering Versus Maximum Intensity Projection Reconstructions.

Annachiara Ackroyd, Egidio Traversi, Giancarlo Barazzoni, Giuseppe Bertoli, Maurizia Baldi, Roberto Travaini, IRCSS Salvatore Maugeri Foundation, Pavia, Italy.

Background: Contrast multislice computed tomography (MSCT) with retrospective ECG-gated image reconstruction is a new challenging technique for noninvasive visualization of coronary artery. High spatial resolution MSCT images are reconstructed by different algorithms. We investigated the accuracy of sliding thin slab maximum intensity projections (MIP) and 3-D volume rendered reconstruction (VR) in the detection of significant (>50%) coronary artery stenosis in comparison with coronary angiography (CA).

Methods: We studied 26 symptomatic patients with MSCT who underwent CA within 5 days. Images were obtained using a 16-detector scanner (LightSpeed Ultra, GE, USA) with a 120 ml intravenous bolus of non-ionic contrast agent during a single breath-hold. Mean heart rate was 62 ± 6 bpm. From 0.5-1.2 mm thickness slices, retrospective ECG-gating was used to reconstruct images during the diastolic phase of cardiac cycle. MIP and VR reconstructions were analyzed by two operators unaware of CA results. We considered 13 coronary segments: RCA: proximal, middle, distal and posterior descending; LM: LAD: proximal, middle, distal; LCX: marginal branch.

Results: Of 352 coronary segments, 250 (71.1%) were adequately visualized with MIP and 246 (69.8%) with VR. Motion artifacts were the most frequent reason for uninterpretable segments. The MIP, proximal and middle LAD were always visualized by both methods. The overall sensitivity was 76.9% for MIP and 72.3% for VR, with a specificity of 76.5% and 75% respectively (positive predictive value 54.3% for MIP and 53.4% for VR; negative predictive value 86.6% for MIP and 87.2% for VR). Evaluation based on both MIP and VR showed a sensitivity of 80% and specificity of 76.5%, with a positive predictive value of 57.6% and a negative predictive value of 90.7%. Considering only main branches (LM, LAD, RCA, L CX) the sensitivity and specificity were 77.5% and 76.4% for MIP and 96.0% and 80.1% for VR respectively.

Conclusions: MIP and VR showed similar diagnostic accuracy in identification of coronary artery stenoses and their combination allows a slight increase in diagnostic value of MSCT.

The Accuracy of Multislice Spiral Computed Tomography Using a Novel ECG-Gated Image Reconstruction Method for the Assessment of Coronary Artery Stenosis.

Toshiyuki Horio, Yuchi Sato, Masahiko Kato, Fumio Itooue, Takao Imazeki, Akhiro Yoshimura, Naoya Matsu moto, Motohiro Takahashi, Katsuo Kanmatsuse, Nihon University Surugadai Hospital, Tokyo, Japan.

We investigated the accuracy of multislice, spiral computed tomography (MSCT) to detect coronary artery disease in comparison with coronary angiography (CA) using a new retrospective ECG-gated reconstruction method which minimizes cardiac motion artifact.

Method: 40 consecutive patients undergoing MSCT and CAG entered the study. MSCT was performed using a Somatom Zoom (Siemens, Germany) with collimation 1.0mm, pitch 1.5 and gantry rotation time 500ms. Metoprolol (20-60mg) was administered orally one hour prior to MSCT imaging in order to achieve the heart rate less than 64/min. The retrospective ECG-gated image reconstruction was performed with a data acquisition window (250ms) positioned immediately before atrial contraction in order to minimize motion artifacts caused by the abrupt diastolic ventricular movement during the rapid filling and atrial contraction periods. Following inspection of volume rendering images, muraipan reconstruction images of the left main trunk (LM), the left anterior descending artery (LAD), the left circumflex artery (LCX) and the right coronary artery (RCA) were obtained and evaluated for luminal narrowing semiquantitatively. The results were compared to those obtained by CAG.

Results: 152 (80%) out of 196 coronary arteries were free from motion artifact and eligible for evaluation. The remaining 44 arteries were excluded from the analysis because of severe calcification (n=4) and difficulty in breathhold (n=4). The sensitivity to detect coronary luminal narrowing greater than 50% was 100% for the LMT, 92% for the LAD, 85% for the LCX and 83% for the RCA. The specificity to define luminal narrowing less than 50% was 100% for the LMT, 92% for the LAD, 85% for the LCX and 83 % for the RCA. The overall sensitivity and specificity was 96% and 93%, respectively. Conclusion: Using a retrospective ECG-gated reconstruction technique which minimizes cardiac motion artifacts, MSCT provides excellent sensitivity and specificity for detecting coronary artery disease.