Usefulness of Noninvasive Assessment of Coronary Flow Reserve Using Contrast Enhanced Transhoracic Color Doppler Echocardiography for Detecting Left Anterior Descending Stenosis With Comparison of Stress Thallium-201 Single-Photon Emission Computed Tomography

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Background: Transhoracic color Doppler echocardiography (TCDE) using intravenous Levovist™ is a useful and promising tool to assess coronary flow velocity in the left anterior descending coronary artery (LAD) in bedside. We have reported a good correlation of coronary flow reserve (CFR) detected by TCDE in the LAD. Objective of this study was to compare the clinical value of CFR for detecting LAD stenosis between by TCDE and by stress Ti-201 single photon emission computed tomography (SPECT).

Methods: Sixty-eight consecutive patients (mean age 64±10 y.o., 37 male, 31 female) who underwent coronary angiography were enrolled in this study. High frequency transducer, equipped with Sonos 5500 (Philips Medical Systems Inc., USA) was used to detect the color image and the flow velocity of distal LAD. CFR was defined as the ratio of diastolic peak velocity during hyperemia divided by diastolic peak velocity at baseline during adenosine trisphosphate infusion (0.15 mg/kg/min). CFR was measured in the LAD by TCDE with intravenous Levovist™. SPECT and coronary angiography were performed nearly simultaneously.

Fourteen patients had significant LAD stenosis (group S) and 54 patients had normal coronary angiography (group N). Angiographic stenosis was defined as diameter stenosis more than 70%. Results: Adequate spectral Doppler recordings of coronary flow velocity and CFR in the LAD were obtained in 67 of 70 patients (96%). The value of CFR of group S was significantly lower than in group N (1.7±0.8 vs. 2.6±1.0, p=0.002). CFR lower than 2.0 detected by TCDE indicated a significant stenosis in the LAD with sensitivity of 79%, specificity of 75%, and positive predictive value was 42%, negative predictive value was 88%. For detecting LAD stenosis, SPECT provided a lower sensitivity of 67%, specificity of 72%, and positive predictive value was 46%, negative predictive value was 93%

Conclusions: The results demonstrate that with contrast enhanced TCDE appeared to be non-invasive and more beneficial method to detect significant LAD stenosis than SPECT.

Coronary Flow Reserve in the Left Anterior Descending Artery Could Predict Systolic Function Recovery After Primary Angioplasty: A Transhoracic Doppler Echocardiography Study

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Background: Although blood flow is restored in the culprit vessel by primary angioplasty and provides prognostic information that is incremental to clinical data and conventional measures of LV systolic and diastolic function.

Conclusion: Increased LA volume index is a powerful predictor of mortality following AMI, and provides prognostic information that is incremental to clinical data and conventional measures of LV systolic and diastolic function.

Coronary Flow Velocity Reserve Using Transhoracic Color Doppler Echocardiography Is Influenced By Serum High-Density Lipoprotein and Low-Density Lipoprotein Cholesterol Level in Patients With Hyperlipidemia

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Background: Hyperlipidemia (HL) has more events of coronary artery disease, showing lower coronary flow reserve (CFR) by Doppler guide wire. Transhoracic color Doppler echocardiography (TCDE) has used to assess coronary non-invasively. We hypothesized that HL influenced CFR detected by TCDE as well as coronary stenosis.

Method: A 63 patients (60±11 y.o.) undergoing coronary angiography were studied and CFR of the left anterior descending coronary artery was evaluated during adenosine trisphosphate infusion using TCDE. A coronary stenosis was defined as % diameter stenosis ≥ 50%. CFR was defined as the ratio of hyperemic peak velocity divided by baseline. Total cholesterol (TC), high-density lipoprotein (HDL), low-density lipoprotein (LDL) were divided into low or high level groups (mg/dl) respectively.

We evaluated CFR in pts with TC<220 and ≥220 (high, low TC), HDL<40 and ≥40 (high, low LDL) and LDL<120 and ≥120 (high, low LDL).

Results: No significant difference of CFR was noted between high TC and low TC with stenosis. In high HDL, O<25 in patients with stenosis was significantly lower than without (1.4±0.5 vs. 2.8±1.0, p<0.005). In low HDL, CFR was correlated lower regardless of coronary stenosis. In high LDL, CFR in patients with stenosis was significantly lower than without (1.5±0.5 vs. 2.5±0.9, p<0.005).

Conclusions: Our results indicate that HDL, LDL levels influence CFR as well as coronary stenosis. Lower CFR in low HDL suggests possible impairment of coronary microcirculation due to metabolically abnormal lipid in HL.

In Vitro Validation of Angle Corrected Tissue Displacement Imaging

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Background: Tissue displacement imaging with angle-correction is a new generation tissue Doppler method for objective quantification of regional cardiac function. Our objective was to rigorously test the accuracy and reproducibility of this method.

Methods: Our in vitro apparatus consisted of an oscillating metal rod (echo target) in a water-filled chamber controlled by a microstepping motor (resolution of 50,000 steps/revolution). A computer motion system precisely controlled displacement, velocity and the acceleration of the echo target. A 2.5MHz echo probe was fixed parallel to the target (90°) and at 45° as a control in order to determine the accuracy of angle correction. Target excursion varied from 1 to 15 mm at speeds from 60 to 130 cycles/min (2.60 mm/s). Measure was performed in triplicate to test reproducibility. Custom echo software (AphiQ, Toshiba, Corp.) angle-corrected motion (vector motion = vector beam code 9), then integrated and transformed velocity data to quantitative displacement data.

Results: At both 0° and at 45°, tissue displacement imaging data strongly correlated with true displacement over all distances and speeds (r = 0.999, p<0.0001). Reproducibility was excellent with < 2% variability. Bland-Altman analysis revealed very close agreement with a slight underestimation of true displacement by 0.1 mm.

Conclusion: Tissue displacement imaging with Doppler angle correction appears to be an accurate and reliable method which has promise to quantify regional cardiac function.