Diagnostic Accuracy of Adenosine Myocardial Perfusion Tomography in Patients With a Right Ventricular Pacemaker

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Background: Patients (pts) with a left bundle branch block (LBBB) or a right ventricular pacemaker (RVP) often have perfusion defects during exercise SPECT. Pharmacologic stress has been proposed as an alternative to exercise in pts with LBBB. RVP is not a contraindication to RVP in pts with a RVP is not a known. Objective: We investigated the diagnostic performance of adenosine SPECT for the diagnosis of coronary artery disease (CAD) in pts with RVP.

Methods: Ninety-six pts (63 males, 33 females, mean age 72±8 years), with a RVP and/or left anterior descending artery (140 mg/kg/min for 6 minutes) SPECT and coronary angiography within 30 days of each other. Results: During stress, 75 pts remained in ventricular paced rhythm (VPR) and 21 pts were in non-paced rhythm (NPR). The sensitivity and specificity of adenosine SPECT were 82% and 43% overall, but rose to 84% and 100% during NPR and fell to 81% and 33% during VPR (p<0.03). The accuracy for detection of coronary perfusion abnormalities caused by prolonged ventricular pacing, presence of a cardiomyopathy or high-grade mitral regurgitation was 72% during VPR and 93% during NPR (p=0.03). Among the 12 false-positive tests, all occurred in pts with VPR throughout the study. The false-positive rate is high in this elderly cohort of pts with VPR. This may be due to cardiac abnormalities caused by prolonged ventricular pacing, presence of a cardiomyopathy or changes in myocardial perfusion secondary to abnormal ventricular activation.

The Utility of Stress Myocardial Perfusion Imaging Performed Prior to Electrophysiological Testing

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Background: Prior to the attempted induction of ventricular tachycardia (VT) by programmed electrical stimulation (PES), pts are often first referred for stress SPECT myocardial perfusion imaging (MPI) to identify candidates for revascularization (REVASC). Methods: To assess the utility of this approach, all pts who underwent MPI followed within 30 days (mean 4.9 days) by PES between 1/97 and 6/00 were studied. The stress MPI was performed in 36%, adenosine in 60% and dobutamine in 4%.

Results: As defined as sustained monomorphic VT. Results: There were 251 pts, 60% male, age 71±11 yrs. History included MI in 42%, prior REVASC in 26% and idiopathic myopathy in 6%. Indications for PES were arrhythmia in 64% (usually nonsustained VT) and syncopy in 36%. The table shows the relationship between MPI results and IND. Normal MPI or IND with isolated ischemia (ISC) were associated with low rates of IND. No pt had an ischemic complication associated with PES even though 51% had MPI ISC and 33% had multiple ischemic regions. REVASC was performed between the MRI and PES in only 12 pts; IND remained high (63%) and was associated with prior infarct. Conclusions: A small proportion of pts undergo REVASC after MPI and before PES, but this is not necessary to ensure the safety of PES. MPI is appropriate with a high rate of IND even after successful REVASC. Further study is required to determine whether the very low rate of IND with normal MPI or isolated IND MSC can obviate the need for PES in select pts.

Insulin-Sensitizing Thiazolidinedione Improves Coronary Endothelial Dysfunction in Insulin Resistance by PET Measurements of Myocardial Blood Flow

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Coronary endothelial dysfunction, by intracoronary acetylcholine (ACH), predicts long-term atherosclerosis progression and cardiac events. Closely correlated normal and abnormal coronary flow responses to intracoronary ACH and to cold pressor testing (CPT), proportionate responses in rate pressure product (RPP) and in coronary flows to CPT and an abnormal CPT flow response as a predictor of cardiac events, but its accuracy as a means for probing endothelial function. Based on PET-measured myocardial blood flow (MBF) responses to CPT, we demonstrated previously an abnormal coronary vaso- motion in healthy, non-diabetic Mexican-Americans with insulin resistance (IR). We now postulate that thiazolidinedione-induced redistribution of the cardiac blood flow and dose-dependent anti-inflammatory properties of IR. MBF was measured at rest, after dipyridamole (DIP; integrated coronary vaso- motion and during CPT in 11 IR subjects (10 F; 32±3 years) at baseline (BL), after 3 months of rosiglitazone treatment, (ROS; 8 mg/day), and in 12 age-matched normals. ROS improved body glucose disposal rates from BL (2.57±0.63 to 3.89±0.80 mg/min/kg; p<0.0002) and lowered fasting plasma glucose from 91±9 to 94±9 mg/dl (p<0.05). At BL, MBF in IR at rest and during DIP were similar to normals (0.7 vs. 0.72±0.11 ml/min/g; NS) and were not modified by ROS. CPT in normals produced a 44±5% increase in RPP and a proportionate 43±30% increase in MBF. In the IR, MBF failed to increase significantly at BL (19±16; NS) with DIP compared to normal RPP increase (35±21% vs NS; normal). The RPP response to CPT did not change after 3 months of ROS (42±26%), while, importantly, MBF now increased significantly (36±28%) and in proportion to RPP, which no longer differed from normals. CPT significantly raised MBF from IR to DIP (0.8±0.5 vs. 1.0±0.5 ml/min/g; p=0.001 vs 0.9±0.20 in normals NS). Coronary resistances (mean blood pressure/MBF) declined from BL to ROS at rest (100±24 vs 95±26; p<0.05) and during CPT (126±41 vs 99±31; p<0.01), but did not change during DIP (36±2 vs 41±18). In conclusion, PET MBF measurements confirm the presence of endothelial dysfunction in IR and indicate that thiazo- lndiones sensitize restore endothelial function.

The Echo Assessment of Left Ventricular Function

Tuesday, March 19, 2002, Noon-2:00 p.m. Georgia World Congress Center, Hall G Presentation Hour: 1:00 p.m.-2:00 p.m.

Which Echo/Doppler Index Is Most Predictive of Adverse Outcome in Patients With Severe Heart Failure Referred for Transplantation?


Background: Although it is critical to identify severe heart failure (HF) patients who are at the highest risk for poor outcomes awaiting transplant (TX), this remains unclear. The objective was to test the prognostic value of a multitude of echo/Doppler variables to predict event-free survival in this specific group of patients. Methods: Eighty-five patients with NYHA class III-IV HF and EF< 35% referred for TX were studied by quantitative 2D/Doppler echo. End-diastolic diameters, bipapapal ejection fraction (EF) using Simpson's rule, mitral and tricuspid valve descent, mitral EDV celeration time, degree of mitral regurgitation (semi-quantitative color Doppler), and Tel index (inoue contraction time+isovolumic relaxation time/ejection time) were measured. Patients were followed for end points of death or left ventricular assist device (LVAD). Patients with TX had follow-up truncated at that time. Results: Mean follow-up was 14.6 months. Twelve patients (14%) died (12%); 10 (12%) required LVAD. TX was received. Of the above 2D echo/Doppler parameters, only biplane EF with a cutoff of 20% was significantly predictive of event-free survival (p<0.01). No other previously reported echo/Doppler index was predictive of outcome. Conclusion: Echocardiographic EF remains the singular most important predictor of death or LVAD placement in patients with severe HF referred for TX. No other resting echo/Doppler measure was prognostically significant in this high risk subset of HF patients.

Dependence of Flow Propagation Velocity on Cardiac Size: Observations From Patients With Dilated Cardiomyopathy and Hypertrophic Cardiomyopathy

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Background: Tissue Doppler at the mitral annulus (EA) and flow propagation velocity (FPV) are new indices of myocardial relaxation, which, combined with mitral E velocity, can improve the prediction of filling pressures. Since these indices are dependent on ventricular size is presently not known.

Methods: Patients with hypertrophic cardiomyopathy (HCM, n = 22) and dilated cardiomyopathy (DCM, n = 17), which represent clinical conditions with impaired relaxation yet with different ventricular sizes, were investigated. Comprehensive diastolic function, calculations of end-systolic and end-diastolic volumes (EDV) and ejection fraction were performed. Left atrial pressure (LAP) was estimated from Ea and FPV using previously validated and published equations.

Results: Myocardial relaxation was impaired (Ea<10 cm/s) in all patients. Ea was slightly higher in DCM compared to HCM (7.0±1.6 vs. 5.8±1.5 cm/s; p = 0.02). In contrast, using FPV, more marked differences in the opposite direction were observed (FPV in DCM = 22.9±6.6 cm/s vs. 35.5±12.4 cm/s in HCM; p = 0.001). In DCM, EDV was higher compared to HCM (237±42 vs. 100±21 ml; p < 0.001) and ejection fraction was lower (20.4±6% vs. 73±6%; p<0.001). A weak relation was observed between EA and EDV (r =

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The Relationship Between Strain Rate Values in Orthogonal Directions

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Background: Tissue deformation occurs simultaneously in 3D space during relaxation or contraction. However, current TDI based methods for strain rates (SR) imaging allow SR to be measured mainly parallel to scanlines. We evaluated the relationship between the two orthogonal SR measurements in a 2D plane to see if one estimate in one direction can predict the other SR values.

Methods: A strip of marbled beef (2x3x9cm) was longitudinally extended at 50-100 times/second with an amplitude of 5, 10 and 15mm to model the septum or 4-chamber LV wall. On a 4-channel RSI, 3 signals were used for each of the orthogonal SR (TI, TDI0) to calculate echocardiographic left ventricular (LV) mass, compared with fundamental imaging (FI), considered to be the reference method.

Results: For each observer, LV mass measured with FI was significantly higher than LV mass by the mean of over three measures (both ASE and Penn conventions were used) by 2 independent blinded observers (O1 and O2). LV mass was calculated and indexed by perpendicular to the extension were measured every 100msec from the B-mode 2D image and used for reference SR values. We compared both these SR values scanned from 0° and 90° to the direction of motion to test accuracy of the primary direction SR and the predictability of the orthogonal direction SR data from each scan angle perpendicular to the extension were measured every 100msec from the B-mode 2D image and used for reference SR values. We compared both these SR values scanned from 0° and 90° to the direction of motion to test accuracy of the primary direction SR and the predictability of the orthogonal direction SR data from each scan angle to the direction of motion (r = 0.99, p<0.0001 in both directions). Also, for either direction of scanning, there was an inverse but good correlation between SR values in the parallel and those of the transverse direction, 90° (r = -0.44x - 3.4, r = -0.94, p<0.0001) verified by B-mode results. Lastly, SR in one direction correctly predicted the orthogonal SR values (y = 0.43x + 0.02, r = -0.93, p<0.0001).

Conclusion: Our data clearly indicate that LV mass measurements should not be performed using TDI because of overestimation of LV mass. However, the remarkably high correlations of SR measurements may aid in the validation and quantification of M-mode based methods for assessing LV mass. The orthogonal SR measurements may have clinical value as well as potential for improving the validity and reliability of SR imaging.

Assessment of Echocardiographic Left Ventricular Mass Using Second Harmonic Imaging


The aim of this prospective study was to assess the validity of second harmonic imaging (SHI) to calculate echocardiographic left ventricular (LV) mass, compared with fundamental imaging (FI), considered to be the reference method.

Methods: We evaluated 46 consecutive patients (mean age 54 years, 39% women) with suitable M-mode LV tracing. For each patient, 3 M-mode LV tracings were recorded using FI and SHI. At the end of the study, the calculation of M-mode end-diastolic parameters (interventricular septum, posterior wall and LV diameter) was performed in SHI and FI by the mean of over three measures (both ASE and Penn conventions were used) by 2 independent blinded observers (O1 and O2). LV mass was calculated and indexed by body surface area. LV hypotrophy (LVH) was present when LV mass was higher than 106 g/m² (woman) and 111 g/m² (man).

Results: LV mass measured with SHI was significantly higher than LV mass measured with FI (p<0.008 and p<0.004 with Penn and ASE, respectively) (Table). Seven patients (15.2%) were classified as LVH using SHI, while LV mass was normal using FI. Interobserver reproducibility of LV mass measurement was similar with SHI (p<0.01 with Penn and ASE conventions), but not with FI (p<0.0001 in Penn and ASE conventions).

Conclusion: Our data clearly indicate that LV mass measurements should not be performed using SHI because of overestimation of LV mass. However, the remarkably high correlations of SHI measurements may aid in the validation and quantification of M-mode based methods for assessing LV mass. The orthogonal SR measurements may have clinical value as well as potential for improving the validity and reliability of SR imaging.

Pulmonary Venous Atrial Systolic Flow Reversal Velocity During Ventricular Systole Predicts Left Atrial Elastance: A New Method for Assessing Atrial Systolic Function in an Animal Model

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Background: Pulmonary venous atrial systolic flow reversal (PVA) has been used for evaluating left ventricular and atrial (LA) function. However, the relationship between the PVA and LA elastance has not been elucidated. We hypothesized that when atrial contractile function occurs during ventricular systole (isovolumic LA contraction), PVA will be quantitatively related to LA end-systolic elastance.

Methods: Five anesthetized open chest dogs were studied. LA pressure-area loops were generated using high fidelity LA pressures and automatic border detection and quantification. The loops were obtained at baseline and during inferior caval occlusion. A linear regression analysis was applied to nonisochronal pressure-area points at left atrial end-systole, and the slope of the linear fit was defined as LA elastance (Ees). Periodic premature ventricular stimuli (PVCs) were introduced to achieve isovolumic LA contraction, and the PAs during these beats were measured using Doppler echocardiography. All variables were acquired at baseline and during the intravenous administration of dobutamine.

Results: Peak PVA velocity during PVC was significantly larger than during ordinary atrial systole at both baseline and during dobutamine administration (p<0.01, respectively, Figure). There was a significant positive correlation between Ees and peak PVA velocity during systole (p<0.05).

Conclusion: Isovolumic atrial contraction produces a large PVA, and the peak PVA velocity may be used to predict LA elastance.