**T132-161**  
Electrocardiographic Type of Intraventricular Conduction Disturbances Does Not Predict Mechanical Dyssynchrony Assessed by Tissue Synchronization Imaging  
Takuya Yasogawa, Satoshi Nakatani, Takeshi Maruo, Yoshiro Yasumura, Masakazu Yamagishi, Masafumi Kitakaze, Kurio Miyake, National Cardiovascular Center, Suita, Osaka, Japan

**Background:** The presence of non-responders has become a major limitation in cardiac resynchronization therapy for patients with congestive heart failure and bundle-branch block. This is partly due to the discordance of electrical and mechanical dysynchrony. Recently tissue Doppler technique enables to visualize delayed contraction areas (tissue synchronization imaging, TSI). With TSI, areas of synchronous contraction are colored green and those with delayed contraction are colored red based on the time delay of contraction from the QRS complex.

**Methods:** We investigated if the ECG type of intraventricular conduction disturbances could identify the areas of delayed contraction using TSI. 41 patients with dilated cardiomyopathy (18 with left bundle-branch block, LBBB; 5 with right bundle-branch block, RBBB; 11 with undefined intraventricular conduction disturbances, IVCD and 7 with normal ECG) and 6 normals were studied.

**Results:** All segments in normals showed homogeneously green, suggesting synchronous wall motion. However, the color distribution in patients was inhomogeneous and did not relate with the ECG pattern. There was only a weak correlation between the QRS width and the time delay (r=0.35, p=0.08).

**Conclusions:** ECG could not predict the areas of delayed contraction. Even in patients with normal ECG, mechanical dysynchrony was demonstrated. The indication of cardiac resynchronization therapy should be determined not by the ECG criteria but by the location of delayed contraction.

**T132-162**  
Prediction of Functional Capacity in Chronic Heart Failure Patients Using Myocardial Tissue Doppler  
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**Background:** Exercise therapy improves functional capacity in CHF, but selection and individualization of training would be helped by a simple non-invasive marker of peak VO2. Peak VO2 in these pts is difficult to predict without direct measurement, and LV ejection fraction is a poor predictor. Myocardial tissue velocities are less load-dependent, and may be predictive of the exercise response in CHF pts. We sought to use tissue velocity as a predictor of peak VO2 in CHF pts.

**Methods:** Resting 2D-echo cardiography and tissue Doppler imaging were performed in 182 CHF pts (159 male, age 62±10 years) before and after metabolic exercise testing. The majority of these patients (129, 71%) had ischemic cardiomyopathy, with resting EF of 35±13% and a peak VO2 of 13.6±4.7 ml/min/kg. Results. Neither resting EF (r=0.15) nor peak EF (r=0.18, both p=NS) were correlated with peak VO2. However, peak VO2 correlated with peak systolic velocity in septal (Vss, r=0.31) and lateral walls (Vsl, r=0.26, both p<0.01). In a general linear model (F = 0.25), peak VO2 was calculated from the following equation: 9.6 + 0.68*Vss - 0.06*age + 0.06*maximum HR. This model proved to be a superior predictor of peak VO2 (r=0.51, p<0.001) than the standard prediction equations of Wasserman (r= -0.12, p=0.01).

**Conclusions:** Resting tissue Doppler, age and maximum heart rate may be used to predict functional capacity in CHF patients. This may be of use in selecting and following the response to therapy, including for exercise training.

**T132-163**  
Ventricular Synchrony as Determined by Phase Analysis Correlates With Ejection Fraction  
Susheel K. Kodali, Syed N. Ahmed, Lei Sui, Diane S. Paine, Mary A. Whooley, Nelson B. Schiller, University of California, San Francisco, San Francisco, CA

**Background:** Parametric imaging (Echocardiographic Phase Imaging (EPI)) is an automated means of quantifying the sequence and amplitude of regional wall motion. We sought to apply this technique to the problem of recognizing the severity of incoordination in left bundle branch block (LBBB). We hypothesized that severity of incoordination would correlate with exercise times on a Bruce protocol.

**Methods:** The Heart and Soul database of over 1,000 patients with coronary disease was used to identify 39 with LBBB. The digitally stored images were reevaluated using EPI. In order to characterize incoordination, we devised a 4 point scale termed the Coordination Score (CS). A score of 1 was assigned when the lateral wall and septum were in-phase. Scores 2, 3, and 4 were assigned when the septum was < 30%, 30-60%, and > 60% out-of-phase with the lateral wall.

**Results:** Among the 39 with LBBB, 33 were suitable for analysis. The coordination score did not correlate with exercise time or mitral valve E/A, but did inversely correlate with left ventricular ejection fraction (EF). [r= -0.635, p<0.0001]

**Conclusion:** Although the original hypothesis regarding severity of incoordination and exercise time was not supported, the coordination score, as determined by automated EPI, correlates with EF. Therefore, it appears that diminished EF in LBBB is closely linked with incoordination and EPI may provide both a tool and a target for further investigation of the influence of resynchronization on LV function.

**T132-164**  
Echocardiographic Phase Analysis: Timing of the Cardiac Cycle Using Left Atrial Motion  
Susheel K. Kodali, Syed N. Ahmed, Lei Sui, Diane S. Paine, Mary A. Whooley, Nelson B. Schiller, University of California, San Francisco, San Francisco, CA

**Background:** Parametric imaging (Echocardiographic Phase Imaging, EPI) is an automated means of quantifying the sequence and amplitude of regional wall motion during the cardiac cycle. Typically, the peak of the R wave is designated as the start of the cardiac cycle. Using this point as the zero phase angle, wall motion is plotted over 360 degrees. We used this technique to test the hypothesis that left atrial (LA) wall motion is an ideal reference point for defining the zero degree phase angle of the cardiac cycle in patients with a normal QRS and as well as those with left bundle branch block (LBBB).

**Methods:** The Heart & Soul database of over 1,000 patients with coronary disease was used to identify 39 patients with LBBB of which 33 had images suitable for analysis. A second group of 31 patients were identified with normal ECGs, negative stress tests and normal echocardiograms for age. Phase analysis with the EPI program was then performed using both the onset of atrial motion and the peak R wave as the reference point for time zero of the cardiac cycle.

**Results:** In patients without conduction abnormalities, a tight relationship was seen between the onset of outward atrial motion and the R wave on the ECG. In 94% of normals (29 of 31), phase analysis using atrial motion as time zero was similar to using the
R wave. For LBBB patients, however, there was substantial variability. In 45% of the cases (15 of 33), the R wave did not coincide with onset of atrial motion.

**Conclusion:** In patients with a normal ECG, the onset of atrial motion has a predictable relation with the R wave. In LBBB, this relationship is variable owing to QRS morphology and electromechanical heterogeneity. In LBBB, atrial motion can be used to determine time/degree zero because its union with the onset of systole is obligatory and because EPI can reliably detect it. Setting the onset of the cardiac cycle to an "atrio-phasic" reference standard should prove useful in situations where the ECG is an unsatisfactory timing signal.

**POSTER SESSION**

**1133 Blood Flow Velocity, Coronary Angiography, and Myocardial Perfusion by Magnetic Resonance Imaging**

Tuesday, March 09, 2004, 9:00 a.m.-11:00 a.m.
Morial Convention Center, Hall G
Presentation Hour: 10:00 a.m.-11:00 a.m.

**T1133-154**

**Coronary Artery Magnetic Resonance Angiography Comparison of High Field Magnetic Resonance Imaging at 1.5 and 3 Tesla**

Henning Steen, Joao A. C. Lima, Evangelos Giannitsis, Hugo A. Katus, Matthias Stuber, Johns Hopkins Hospital, Baltimore, MD, Universitätsklinikum, Klinik III, Heidelberg, Germany

**Background:** Cardiovascular MRI examinations are currently performed at 1.5T. Yet, 3T MRI systems have recently been approved for human use by the FDA. We compared objective and subjective parameters for coronary MRA image performance at both 1.5T and 3T.

**Methods:** Twelve healthy adult subjects were scanned within one week on both a 1.5 and 3T whole body scanner (Phillips Intera) with an ECG and navigator gated fat suppressed T2 prep 3D gradient coronary MRA (TR=6.2ms; TE=2.4ms, FOV=360; 512 matrix, 20 slices a 1.5mm, voxel-size= 0.71/0.33 mm) sequence. LAD and RCA vessel sharpness / diameters were measured semi-automatically. Fat saturation, image quality and motion artefacts were assessed via consensus reading (1= poor to excellent image quality) and evaluated using a two-tailed paired Student’s t-test.

**Results:** On both scanners LAD and RCA coronary MRA could be successfully obtained. Vessel sharpness was significantly improved at 3T (RCA: 63.2±4.02 vs. 40.7±0.04; LAD: 42.1±5.08 vs. 33.2±5.0; 0.05) with significant difference in diameter comparison (RCA 1.5T=2.85±0.24mm vs. 2.94±0.26 at the 3T; LAD at 1.5T=2.96±0.27 vs. 2.81±0.25 at 3T). Fat saturation, image quality and motion artefacts were not significantly different.

**Discussion:** Three Tesla Coronary MRA results in an objectively improved vessel sharpness and diameter assessment when compared to 1.5T, while subjective parameters as navigator artefacts were not affected by using higher magnetic field strength.

**Figure 1. Left and right coronary arterial system obtained at 1.5 (A) and 3T (B, D) in the same subjects. From the improved visual vessel delineation with more anatomical detail information (closer arrows) obtained at the higher field-strength. In E, an example right coronary system obtained at 3T is displayed.**

**T1133-155**

**Phase Velocity Mapping by Cardiac Magnetic Resonance Imaging is a Valuable Noninvasive Tool in the Assessment of Patients With Pulmonary Hypertension**

Paola Kuschnir, Rafael Salguero, Javier Sanz, Teresa Ruiz, Rosana Súlica, Valentín Fuster, Michael Poon, Mount Sinai School of Medicine, New York, NY

**Background:** Advanced pulmonary hypertension is a disease with very poor prognosis. Right heart catheterization (RHC) is currently the gold standard for its diagnosis. Phase velocity mapping (PVM) by cardiac magnetic resonance (CMR) is a well-established method to quantify pulmonary artery (PA) flow velocities. The purpose of our study was to assess the correlation between hemodynamic data obtained by PVM with RHC.

**Methods:** 20 consecutive patients were referred for pulmonary hypertension evaluation with CMR. Right ventricle ejection fraction was assessed by prospective triggered fast imaging with steadystate precession (FISP) sequence. PVM of PA was acquired with a 3D steady-state gradient-echo fast low-angle shot pulse sequence with retrospective cardiac gating. All patients underwent RHC within one week to assess mean PA pressure (MPAP, mmHg), right atrium pressure, PA saturation, PA vascular resistance index and cardiac output by thermodilution. Correlations between PVM and RHC data were performed with Pearson’s linear coefficient. Cardiac output results were compared with paired t-test.

**Results:** Average PA flow velocity (APV, cm/s) by PVM showed very good correlation with MPAP (r=-0.86), APV values over 15 were found in all patients with MPAP under 25 (n=5). APV/MAP results between 10-15 were observed in those (n=6) with MPAP between 25-45 except with an APV of 9.85. APV values under 10 were found in all patients (n=9) with MPAP>45 except in one with an APV of 10.03. APV value also showed good correlation with PA vascular resistance index (r=-0.87), right ejection fraction (r=0.83) and PA saturation (r=0.61). No significant correlations were observed for peak PA flow velocity and forward volume with PVM with RHC. Cardiac output (L/min) assessed by PVM (5.34±1.50) was significantly lower than by RHC (6.28±2.13±) (p=0.047, r=0.45). The use of background suppression does not affect the results significantly.

**Conclusions:** PVM can be clinical useful in the initial and follow-up evaluation of patients with pulmonary hypertension. APV as assessed by PVM shows good correlation with most RHC data and may be used as a non-invasive parameter in these patients.

**T1133-156**

**Results of Four Multicenter, Phase III, Magnetic Resonance Angiography (MRA) Trials With MS-325, a Blood Pool Contrast Agent, for the Detection of Vascular Disease in the Aortoiliac, Renal, and Pedal Regions**


**Background:** To evaluate the safety and efficacy of MS-325 for contrast enhanced (CE) MRA in the Aortoiliac, Renal, and Pedal arteries as compared to contrast-2D TOF MRA, using catheter angiography (XRA) as the standard of reference (SOR) in adult patients with known or suspected arterial occlusive disease.

**Methods:** Patients received a 0.03 mmol/kg iv bolus of MS-325, an investigational MRI blood pool contrast agent. In each study, two independent blinded readers interpreted all XRA images for the presence of clinically significant (≥50%) stenosis, with a third reader independently reading in case of disagreement, in order to establish the SOR. Three independent blinded readers separately interpreted 2D-TOF and CE-MRA image sets. Sensitivity, specificity, and accuracy of diagnosis were evaluated for each blinded reader. Vessels deemed uninterpretable in MRA were considered inaccurate. Inter-reader XRA agreement was estimated by comparing the results of the two XRA readers. Patient safety parameters were monitored for 72-96 hours post injection.

**Results:** Over the four trials, 641 patients and 3404 vessels were evaluated. On average, MRA readers showed absolute improvements in sensitivity, specificity, and accuracy of 16.4%, 14.6%, and 13.9%, respectively with the application of MS-325. Each reader showed improvement in accuracy; these improvements were statistically significant in 11/12 readers. MS-325 gave significant improvements in specificity in all readers; the renal and aortoiliac readers also showed significant sensitivity improvements. These values for MS-325-enhanced MRA were comparable to that of XRA inter-reader agreement. Rates of uninterpretable vessels were 1.6% in CE-MRA, 1.6% in TOF-MRA, and were 14.1% for XRA. Studies yielded consistent safety results: overall AE rate possibly or probably related to MS-325 was 21%, of those, the majority (96%) were mild or moderate in severity. No adverse trends in lab chemistries or ECG results were observed.

**Conclusion:** In 4 Phase III studies, MS-325 was demonstrated to be safe and effective for the MRA assessment of vascular disease in multiple vascular territories.

**T1133-157**

**Effect of Serum Cholesterol Levels on Coronary Vasoreactivity in Patients With Type II Diabetes Mellitus**

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**Introduction:** Coronary endothelial function is often impaired in patients with diabetes mellitus (DM). However the determinants of endothelial function in patients with DM have not been clearly defined, a assessed the magnitude and determinants of myocardial blood flow response to coldpressor testing (CPT) using first-pass contrast-enhanced MRI.

**Methods:** Twelve patients (5 females, mean age 59 ± 9 with DM but without overt CAD, underwent MRI first-pass perfusion study at rest and following CPT). Imaging was performed on a 1.5 T Siemens Sonata scanner (Siemens Medical Solutions, Malvern, PA), using TurboFLASH sequence with the following parameters TR/TE/TI/FA/contrast dose/data matrix/spatial resolution = 2.9ms/1.3ms/90ms/6/0.05 mmol/kg/128x70/3.5x1.9x8mm3. Using MEDIS software (Medis Imaging Systems Inc, The Netherlands), the steepness of the first pass myocardial signal intensity curve’s upslope, normalized to blood pool upslope (relative upslope) with CPT was divided by corresponding baseline measurement to calculate myocardial perfusion reserve index (MPRI). In addition the following serum assays were measured: total cholesterol (T chol), triglycerides (trig), HDL cholesterol (HDL), LDL cholesterol (LDL), Fasting blood glucose (FBG), Reactive protein (CRP), insulin, hemoglobin A1c (H-A1c), and Von-Willebrand factor (VWF). Urinary microalbumin level (uAlb), weight (W) and waist circumference (WC) were also measured.

**Results:** Mean weight 163 ± 55 lbs, uAlb= 23 ± 32 mg/dl, WC= 106 ± 9 cm, Tchol= 192 ± 41, Trig = 177 ± 107 mg/dl, HDL= 42 ± 11 mg/dl, LDL= 114 ± 32 mg/dl, FBG = 148 ± 43