

POSTER SESSION

1024 Strain and Strain Rate Imaging

Sunday, March 06, 2005, 9:00 a.m.-12:30 p.m.
Orange County Convention Center, Hall E1
Presentation Hour: 9:00 a.m.-10:00 a.m.

1024-63 A New Phase Analysis Method for Evaluating Abnormal Wall Motion From Myocardial Ischemia and Desynchronization Generated by Pacing

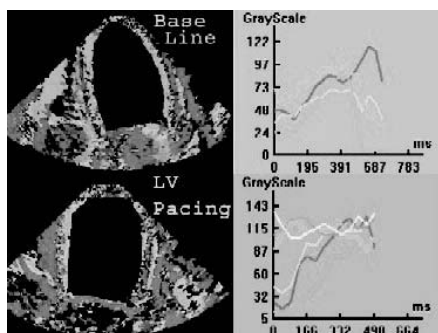
Xiaokui Li, Lei Sui, Helene Houle, James Pemberton, Jian-Feng Chen, Patrick von Behren, Robert I. Lowe, Timothy Thigpen, Michael Jerosch-Herold, David J. Sahn, Oregon Health & Science University, Portland, OR, Siemens Ultrasound, Mountain View, CA

Background: We tested a simple rapid wall motion phase analysis software program running on 2D DICOM echo images to evaluate myocardial wall motion and ventricular synchronization.

Methods: 4 pigs were underwent an open chest procedure for multiple site pacing [left circumflex (LCX), LV Septum (S), LV posterior wall (LV P) and right ventricle (RV)] to create desynchronize rhythm and occlusion (proximal, middle or lower LAD and LCX) to create ischemia simultaneously. An ACUSON Sequoia™ echocardiography system (5MHz) (SIEMENS Ultrasound) was used for scanning at each state analyzed for systolic phase delay (SPD) relative to the R-wave. SPD = [(initial time ÷ R-R duration) x 360°] and the standard deviation (SD) on peak contraction as an indicator of synchrony.

Results: For all base line states: SPD < 180°, mean = 119.76 ± 38.85. During pacing (LCX, LVP, LVS, RV and RVP) without ischemia, SPD was still < 180° but averaged mean and SD was raised to 152.43 ± 53.05. All occluded (OCC) segments' SPD > 180° averaged mean and SD = 219.2 ± 91.6 for OCC with pacing and 216.71 ± 72.92.64 for OCC with no pacing and 215.83 ± 54.70 for released OCC. Color codes Parametric color maps of phase showed the delay allowed rapid, efficient, visualization of abnormal phase delay.

Conclusions: This new method is feasible and fast for future detection of abnormal heart motion and cardiac desynchronization.



1024-64 Two-Dimensional Strain Imaging Echocardiography for the Evaluation of Global Left Ventricular Function: Early Validation Studies

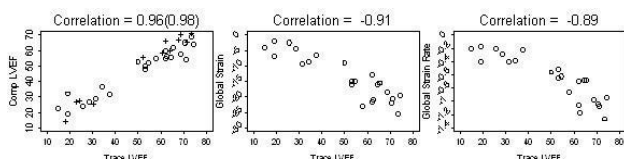
Christian S. Lopez, Rush University Medical Center, Chicago, IL

Background: Novel computer software (General Electric Ultrasound, Milwaukee, WI) is capable of automatic frame-by-frame tracking of natural acoustic markers during the heart cycle, yielding objective measures of contractility.

Methods: Computer generated left ventricular ejection fraction (LVEF), global longitudinal strain (GLS), and GLS rate (GLSR) were calculated from 20 normal and 23 abnormal apical 2, 3, and 4-chamber loops and compared to manual endocardial tracing LVEF.

Results: Mean ± 1SD and significance of difference between normal and abnormal loops:

Loops	n	Tracing LVEF (%)	Computer LVEF (%)	GLS (%)	GLSR (%/second)
All	43	50.7±20.3	46.9±16.6	-13.7±7.4	-0.66±0.36
Normal	20	67.8± 5.7	60.1± 6.5	-20.2±3.0	-0.98±0.19
Abnormal	23	35.9±16.3	35.5±13.9	- 8.1±5.1	-0.37±0.19
#statistic		6.4&	5.3&	7.0&	7.1&



Opison® (+ in the left figure) n=12, r=0.98.

Conclusion: early validation studies suggest excellent correlation between computer-generated global systolic parameters and traditionally traced LVEF.

1024-65 Altered Diastolic Function in Asymptomatic Patients Who Were Newly Diagnosed With Hereditary Hemochromatosis: Utilization of Strain Rate Imaging

Yukitaka Shizukuda, Charles D. Bolan, Dorothy J. Tripodi, Vandana Sachdev, Tammy Nguyen, Ernst Inez, Yu Ying Yau, Susan F. Leitman, Douglas R. Rosing, NHLBI/NIH, Bethesda, MD

Background: Abnormal diastolic function has been reported in patients with hereditary hemochromatosis (HH), particularly advanced stage patients; however, little is known when the abnormalities begin. We hypothesized that diastolic functional alteration develops at the early stages of iron overload.

Methods: Through an NHLBI-sponsored "Heart study of hemochromatosis" protocol, we recruited 11 consecutive newly diagnosed HH patients (ND, aged 49±11, 2 female, mean±SD) and 9 normal controls without any known mutations of HH (aged 45±6, 4 female). All HH patients had confirmed C282Y homozygosity and documented iron overload. All subjects were NYHA Functional Class I. Left ventricular (LV) diastolic function was comprehensively assessed by echocardiography using conventional Doppler measurements (CD), pulsed wave tissue Doppler (PW), and strain rate imaging by the Vivid 7 system (SRI) in the apical views prior to the third phlebotomy therapy.

Results: The serum ferritin (1348±1008 vs 51±39 µg/L, P=0.0016) and transferrin saturation (72±20 vs 22±8%, P<0.0001) were significantly higher in ND compared to controls. Echocardiographically measured LV mass (136±38 vs 118±30g, P=NS) and systolic function by strain imaging were comparable between the two groups. No subjects had more than mild mitral regurgitation. CD detected altered diastolic LV filling demonstrated by significantly lower mitral inflow propagation slope (54±17 vs 75±13 cm/sec², P=0.005), increased pulmonary vein systolic and diastolic peak velocity ratio (1.2±0.2 vs 1.0±0.1, P<0.05), and increased differences in duration of pulmonary vein atrial (A) filling to mitral inflow A filling (-38±39 vs -7±15 msec, P<0.05) in ND. SRI demonstrated increased peak diastolic A strain rate in both the basal septum (1.9±0.6 vs 1.2±0.4 sec⁻¹, P<0.01) and lateral wall (1.3±0.5 vs 0.8±0.3 sec⁻¹, P<0.05) without showing significant differences in early filling strain rate. PW failed to detect any changes of diastolic function in ND.

Conclusions: Our results suggest that altered LV diastolic filling including changes in active atrial filling mechanics is present in newly diagnosed HH patients.

1024-66 Longitudinal and Radial Regional Strain Obtained From Gray-Scale Conventional Echocardiography

María Jesus Ledesma-Carbayo, Andres Santos, Patricia Mahía, Miguel Angel García Fernández, Jan Kubic, Norberto Malpica, Esther Pérez David, Manuel Desco, Hospital General Universitario Gregorio Marañón, Madrid, Spain

Background: Strain measurements using echocardiography are obtained as the spatial gradient of Doppler velocities, inheriting its limitations due to the angular dependency. Our work presents a preliminary validation of a new method to compute the longitudinal (Sl) and axial (Sr) strain components from conventional gray scale echocardiographic images using non-rigid spatio-temporal registration based on semilocal parametric models of the deformation.

Methods: A total number of 46 echocardiographic basal and mid segments from the septum and inferior wall were analysed. These segments were qualitatively classified into three different contractility patterns. Cardiac motion field was obtained for each pixel in the regions of interest extracting Sr and Sl. Results were assessed by means of a one-way analysis of variance (ANOVA) with Sheffé post-hoc correction for multiple comparisons.

Results: Strain components Slong and Sax showed significant differences (p<0.05) between segments with normal contractility and hypokinetic and akinetic ones. Slong showed also significant differences between akinetic and hypokinetic segments.

Conclusion: Obtaining Sr and Sl from echocardiographic conventional imaging using spatio-temporal non-rigid registration techniques allows to quantify regional systolic function, overcoming the limitations of the Doppler based techniques.

m±SD	Normal (n=24)	Hypokinetic (n=9)	Akinetic (n=13)
Sr	55.8 ±21.8 %	20.8±8.7 %	13.9±10.7 %
Sl	-15.2±6.0 %	-8.5±6.8%	-0.5±7.6%

POSTER SESSION

1025 Tissue Velocity and Strain in Ischemic Disease

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1025-87 Detection of Significant Stenotic Lesion in the Left Anterior Descending Coronary Artery using Adenosine Triphosphate Stress Strain Imaging: Comparison with Coronary Flow Velocity Reserve Measurement using Transthoracic Doppler Echocardiography

Tsutomu Takagi, Junichi Yoshikawa, Takagi Cardiology Clinic, Kyoto, Japan, Osaka City University, Osaka, Japan

Background: Usefulness of adenosine triphosphate (ATP) stress strain imaging in diagnosis of coronary artery disease remains unclear.

Methods: To evaluate the usefulness of ATP stress strain imaging in diagnosis of coronary artery disease, 25 patients were studied; 8 patients had significant stenotic