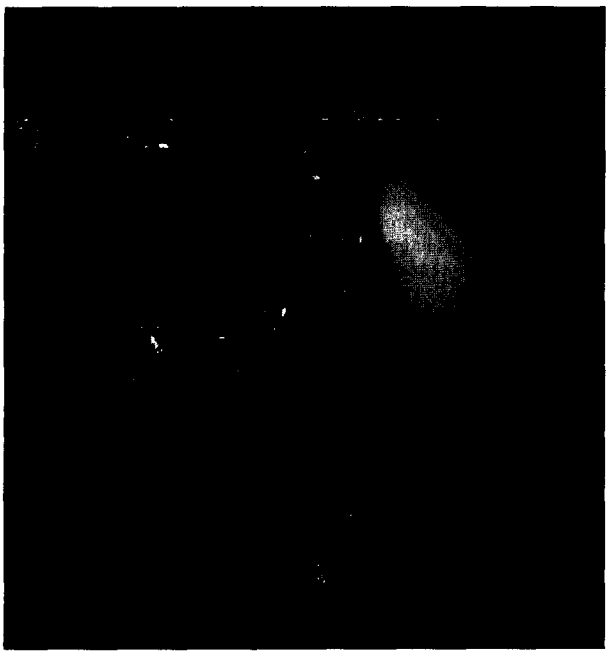
16%). **Conclusions**: Accurate quantitative measurements of instantaneous LV volumes can be obtained using endocardial tracking of contrast biplane echocardiograms.



2:30 p.m.

826-3 **Computerized Eyeballing: A Novel Method for the Assessment of Left Ventricular Function**

Shimon A. Reisner, Peter Lysyansky, Yoram Agmon, Diab Mutlak, Jonathan Lessick, Rambam Medical Center, Haifa, Israel

Background and aim: echocardiographic estimation of left ventricular global and segmental function is subjective and prone to considerable intra and interobserver variability. Our aim was to develop a novel approach for automatic assessment of regional and global left ventricular function from 2-dimensional echocardiographic images.
Methods: The user defines a line within the myocardium along the selected segments. Around this line the computer automatically selects natural acoustic markers moving with the tissue. Frame-by-frame tracking of these markers during the heart cycle yields temporal contractility along the selected region of interest. Quantitative curves of changes in left ventricular volume, local velocity, strain-rate and strain are generated. Longitudinal and transverse tissue velocity is color-coded and presented. Computer derived left ventricular ejection fraction (LVEF) and longitudinal strain per segment were compared with the results obtained by 2 blinded echocardiographers. Thirty echocardiographic apical 4 and 2-chamber loops, 10 from normal subjects and 20 from patients with segmental or global dysfunction, were analyzed. There was a complete agreement between the observers regarding segmental wall motion abnormalities (WMA). The mean estimated LVEF (by eyeballing and modified Simpson) was used for comparison with the computer derived value.
Results: Automatic tracking was adequate in 25 segments (83%). In 2 loops (7%) volume recording was too noisy and estimation of LVEF was impossible. Computer versus echocardiographer (%) LVEF was 51±17 versus 48±20, mean±1SD, respectively, P=not significant, r=0.82). Automatic assessments of longitudinal strain (compared to normal values and adjacent segments) correctly depicted all loops with WMA. There were no false positive cases of WMA in the adequately traced loops.
Conclusions: 1) In the majority of patients a novel computer program enabled automatic assessment of regional and global left ventricular function from 2-dimensional echocardiographic images. 2) Early validation studies are suggestive of a good correlation between the computer program and blinded experienced echocardiographers.

2:45 p.m.

826-4 **Focal Myocardial Lesion Formation Using High Intensity Focused Ultrasound Without Direct Tissue Contact**

David J. Engel, Kumiko Hirata, Kenichi Sugioka, Charles Marboe, Robert Muratore, Ernest Feleppa, Fred Lizzi, Shunichi Homma, Riverside Research Institute, New York, NY, Columbia Presbyterian Medical Center, New York, NY

The potential therapeutic uses of ultrasound in cardiac disease have not been extensively studied. As such, we have developed a means of delivering high intensity focused ultrasound (HIFU) to the myocardium in order to create localized myocardial lesions. There are currently no systems in use to create myocardial lesions with ultrasound, and unlike other methods such as radiofrequecy ablation, HIFU has the advantageous properties of not requiring direct contact with the myocardial tissue as well as the ability to focus energy within a small volume such that an intramyocardial lesion may be formed. **Methods:** The left and right ventricles were sectioned from 3 freshly excised canine hearts and placed in a saline bath with the transducer positioned 9cm from the endocardial surface of the myocardium. Forty lesions (25 RV, 15 LV) were created using HIFU energy delivered for 1 second at a frequency of 4.746 MHz with varying focal region intensities ranging from 25.0-36.1 kW/cm^2. Treated sections were fixed in 10% formalin and processed for histochemistry. **Results:** Using HIFU, we produced focal lesions in the myocardium ranging from approximately 1.2 mm-5.5 mm in length in a dose-dependent manner. The histopathology demonstrated hypereosinophilia of the myocytes due to clumping of cytoplasmic elements, as well as vacuolization within individual myocytes. With adjustment of the HIFU focal length to maximize the delivered energy to 0.5 cm beneath the endocardial surface of the myocardium, focal lesions were created in the mid-myocardial wall that spared both the endocardial and epicardial surfaces. **Conclusion:** HIFU is a novel means to create focal myocardial lesions in a manner that does not require direct tissue contact. This may prove to be useful for non-invasive ablation of intramyocardial lesions such as arrhythmogenic foci and the hypertrophic LV septum in hypertrophic cardiomyopathy.

3:00 p.m.

826-5 **Time Interval Between Onset of Mitral Inflow and Onset of Early Diastolic Velocity by Tissue Doppler: A Novel Index of Left Ventricular Relaxation**

Carlos Rivas-Gotz, Michael Manolios, Sherif F. Nagueh, Baylor College of Medicine, Houston, TX

Background. Tissue Doppler (TD) imaging of the mitral annulus motion provides useful information about myocardial function. So far studies have focused on the measurement of early (Ea) and late diastolic velocities but have not examined the diagnostic utility of the time to onset of Ea in comparison with the time to onset of mitral inflow (QRS to Ea-QRS to E).
Methods. This parameter was examined in 60 consecutive patients, undergoing simultaneous heart catheterization and Doppler echocardiography.
Results. It was significantly longer in patients with impaired relaxation and pseudonormal LV filling patterns in comparison with age-matched controls. Also, it had a significant relation with tau (r=0.83, p<0.001). In a prospective group of 32 consecutive patients, the regression equation from the initial population: (tau=32+0.7xtime interval) was used to predict tau. PCWP was then derived using the equation: $PCWP_{Doppler} = LVes \times e^{-IVRT/tau_{TD}}$, where IVRT is isovolumetric relaxation time and LVes is left ventricular end-systolic pressure calculated as 0.9 x aortic systolic pressure. PCWP Doppler related well to PCWP catheter (r=0.81, p<0.001) with a mean difference of 1.3±3.5 mmHg.
Conclusions. The time interval: (QRS to Ea-QRS to E) is a useful novel index of LV relaxation. It can be used to identify patients with diastolic dysfunction and predict PCWP.

3:15 p.m.

826-6 **Noninvasive Estimation of Diastolic Intraventricular Pressure Gradients From Color M-Mode Echocardiography: Intraoperative Human Validation**

Neil L. Greenberg, Michael S. Firstenberg, Aleksandr Rovner, Mario J. Garcia, Nicholas Smedira, James D. Thomas, The Cleveland Clinic Foundation, Cleveland, OH

Background: Early diastolic intraventricular pressure gradients (IVPG) have been related to diastolic and systolic ventricular functional measures in invasive animal investigations. Although we have previously demonstrated the ability to estimate IVPG using the Euler equation with Color M-mode (CMM) Doppler spatio-temporal velocity distributions in a canine model, the accuracy of this approach has not been examined in across population of human subjects with varying characteristics. Therefore, the aim of this investigation is validation of this noninvasive methodology with invasive correlation.
Methods: 18 patients undergoing surgical procedures (8 CABG and 10 myectomy) were studied by transesophageal echocardiography (Acuson Sequoia). A triple sensor high-fidelity catheter was placed across the mitral valve intra-operatively for simultaneous recording of left atrial, basal and apical LV pressures. IVPG were assessed from the invasive catheter measurements and compared to Doppler-derived gradients using linear regression analysis.
Results: The mean IVPG determined from the color M-mode Doppler data was 2.80 ± 1.03 mmHg, while the mean IVPG determined invasively was 2.77 ± 0.93 mmHg (p = 0.59). A strong correlation between the CMM derived and invasively determined IVPG was observed (r = 0.92, y = 1.03x - 0.04, absolute error = 0.28 ± 0.28 mmHg, p < 0.001). Linear regression analysis of the patient subgroups (revascularization and myectomy) did not demonstrate significant differences in the computed absolute error between the noninvasive and invasive measures.
Conclusions: Noninvasive estimation of IVPG is accurate across different geometries using CMM inflow velocity distributions. This methodology facilitates further investigations where invasive assessment of diastolic function cannot be performed.