**ORAL CONTRIBUTIONS**

**837 Real-Time Three-Dimensional Echocardiography: Novel Clinical Applications**

**Tuesday, March 09, 2004, 10:30 a.m.-Noon**

**Morial Convention Center, La Louisiane A**

**837-1 Live 3-D Echo as an Adjunct During Conventional 2-D Dobutamine Stress Echocardiography**

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**Background:** Live 3-D echocardiography (3-D, Philips Medical Systems) has the potential to enhance diagnostic evaluation of patients undergoing Dobutamine Stress Echocardiography (DSE). However, its application during DSE has not been reported.

**Methods:** One hundred and forty-eight patients, age range 30-89yrs., were studied. All patients underwent conventional 2-D DSE. 3-D biplane and full volume images were obtained in parasternal and apical views at baseline and at peak stress by rapidly switching the transducers between 2-D and 3-D techniques. Cropping planes were used on-line to slice full volume images for visualizing LV/RV in multiple views. Wall motion was assessed in 3-D from serial short axis slices obtained from LV apex to base. 2-D and 3-D images were evaluated for segmental LV wall motion by two different observers.

**Results:** Technically satisfactory 3-D images for comparison with 2-D were obtained in 140 patients. Based on the presence or absence of abnormal LV wall motion at baseline and on the presence or absence of ischemia at peak stress, comparisons between the two techniques showed an agreement of 86.2% at baseline (Kappa = 0.78) and 89.9% at peak DSE (Kappa = 0.84). LV wall motion scores by 2-D and 3-D were 1.06 and 1.05 at baseline, 1.09 and 1.12 at peak stress (p<0.05). Coronary angiograms were available in 57 patients. The sensitivity in detecting coronary artery disease was 76% by 2-D and 88% by 3-D. Out of 6 patients with non-diagnostic studies by 2-D, (no ischemia at sub-maximal heart rate), 3-D detected ischemia in 2 patients.

**Conclusions:** Live 3-D echocardiography is feasible during conventional 2-D DSE. A higher LV wall motion score by 3-D at peak DSE may be due to a better definition of the extent of ischemia. Addition of Live 3-D to conventional 2-D DSE may enhance detection of coronary artery disease.

**837-2 Contrast Improves Endocardial Border Definition Index in Real-Time 3-D Echocardiography**

Statamas Kapetanakis, David S. Mullins, Penelope Giannakopoulou, George Amin, Mark John Mongias, King's College Hospital, London, United Kingdom

**Background:** Real-time three-dimensional echocardiography (RT3DE) is a novel modality. As with 2D echo, endocardial delineation is limited in a substantial proportion of patients. The use of echo contrast has not been specifically evaluated in RT3DE and may enhance endocardial border detection.

**Methods:** 50 patients (60% male, 62.5±11 years). RT3DE was performed with the Sonos 7500 and the X4 transducer. Contrast images were acquired with continuous infusion of Sonovue. Average acquisition time was 6 sec. 3D datasets were cropped to produce 4, 2, and 3 chamber views and a short axis view of the LV. Two cropping methods - thin and thick - produced 800 digital loops. 3 observers reviewed these for image quality and endocardial delineability. The Endocardial Border Definition Index (EBDI) was defined as total score for all segments reviewed divided by that number of segments.

**Results:** With contrast, there was significant improvement in image quality. More loops had adequate (59% of contrast images vs. 36.25%) or excellent (28.2% of contrast images vs. 8.5%) quality. Significantly fewer loops were uninterpretable when enhanced with contrast (0.75% of contrast images vs. 18.3%). There was a significant improvement in EBDI when images were enhanced with contrast (1.87±0.288 for contrast images vs. 1.09±0.56, p<0.001) regardless of cropping.

**Conclusion:** Contrast enhanced RT3DE is feasible and provides rapid, high quality acquisition of 3D images. This technology should be especially valuable during Stress Echocardiography.

**837-3 Real-Time Three-Dimensional Echocardiographic Assessment of Endocardial Surface Can Quantitate the Size of Myocardial Infarction**

Koichi Inoue, Hiroshi Ito, Katsumi Iwakura, Shigeko Kawanu, Atsuo Okumara, Koji Tanaka, Yuya Nishida, Kenshi Fuji, Sakurabashi Watanabe Hospital, Osaka, Japan

It is well known that ischemic myocardial damage is the most severe in the subendocardial layer. Real-time three-dimensional echocardiography (RT3DE) allows us to observe endocardial surface structure. The aims of this study were to characterize the endocardial structure of infarcted myocardium and to assess the potential of RT3DE to quantitate the site and size of myocardial infarction (MI).

**Methods:** We performed RT3DE in 17 patients with Q wave MI and 3 normal subjects with SONOS7500 (Philips). From apical approach, we recorded endocardial surface of ventricular septum, inferior and posterior wall with long-axis view and the other side of left ventricle by changing the direction of transducer.

**Results:** In normal subjects, the endocardial surface has rough folds of trabecularis and they shrink during systole. Surface of the infarcted myocardium is characterized by 1) disarray of folds (smooth surface). 2) (<35% of LV, 0.25% of LV, 0.3% of LV, 3.35% of LV) large from visual inspection. Wall motion score calculated from 2D echo as sum of 17 segmental score (3=akinesia to 0=norality) was well correlated to the average of graded asymmetry area volume (p<0.04, p=0.0001).

**Conclusions:** We observed endocardial surface structure by RT3DE and biopsy of infarcted myocardium have typical features. The distribution and spatial extent of endocardial abnormalities observed by RT3DE is useful to diagnose the site and size of MI.

**837-4 Real-Time Three-Dimensional Echocardiography is Superior to Two-Dimensional Echocardiography and Fluoroscopy in Guidance of Endomyocardial Biopsy**

Miriam E. Amitai, Ingela Schnittger, Judy Chow, Patricia Brown, David H. Liang, Stanford University, School of Medicine, Stanford, CA

**Background:** Endomyocardial biopsy of the right ventricle is the standard method for monitoring rejection in heart transplant recipients. Although the procedure is generally performed under fluoroscopic guidance, acute and chronic complications are not rare. 2D ultrasound can improve localization of the biopuncture site, however this tool still has limitations. The hypothesis of this study was that real time 3D ultrasound would improve the accuracy (identify the location of biopsy). Methods: A total of 38 biopy procedures were performed under usual fluoroscopic guidance and were monitored with 2D and 3D ultrasound on alternate passes of the biopuncture. The operator performing the echocardiogram made a best effort to track the tip of the biopuncture during the biopsy passes. No attempt was made to improve the image quality by positioning the patient or to alter the biopsies based on the echocardiographic information. The echo images were recorded on SVHS videotape and reviewed independently by two level 3 trained echocardiographers. The reviewers scored each biopsy pass for tip visualization and location of the biopsy (outside of the biopsy chamber, in the nidus, or inside the biopsy chamber). A total of 38 biopy attempts were made during the 3D biopsy procedures. The location of the biopsy was determined in 82% of the studies monitored with 3D echo, whereas 2D echo demonstrated the location in only 58% of biopsies (p=0.0001). On a procedure-by-procedure comparison, 3D echo was found to show the tip better in 31/38 vs. 33/38 for 2D echo (p=0.0001). In 3 of 4 biopsies, the 3D method was clearly better. Of the 23 procedures in which both observers scored a preference for one echo method over the other, there was agreement in 21 (91%) as to which was the better technique. When both observers scored the location of the biopsy, there was 88% agreement on the biopsy location and 48% of biopsies were definitely from an unsafe location, resulting in 2 perforations and 1 tamponade.

**Conclusions:** 1) Real time 3D echocardiography improves the ability to see the location of the biopuncture during biopsies. 2) Fluoroscopy alone is inadequate to ensure proper performance of endomyocardial biopsies.

**837-5 Proximal Flow Convergence Region as Assessed by Real-Time 3-D Echocardiography: Challenging the Hemispheric Assumption**

Chaim Yosef, Robert A. Levine, Judy Hung, Massachusetts General Hospital, Boston, MA

**Background:** Traditionally, the proximal flow convergence region (PFCR) is assumed to be a hemisphere when calculating mitral regurgitant (MR) flow and orifice area. This may not be valid given the elliptical configuration of the mitral orifice. Imaging of the PFCR by 2D echo is challenging, and the assumption that the PFCR is a hemisphere when calculating mitral regurgitant flow and orifice area may be a frequent source of error. Results: A total of 38 biopy attempts were made during the 3D biopsy procedures. The location of the biopsy was determined in 82% of the studies monitored with 3D echo, whereas 2D echo demonstrated the location in only 58% of biopsies (p=0.0001). On a procedure-by-procedure comparison, 3D echo was found to show the tip better in 31/38 vs. 33/38 for 2D echo (p=0.0001). In 3 of 4 biopsies, the 3D method was clearly better. Of the 23 procedures in which both observers scored a preference for one echo method over the other, there was agreement in 21 (91%) as to which was the better technique. When both observers scored the location of the biopsy, there was 88% agreement on the biopsy location and 48% of biopsies were definitely from an unsafe location, resulting in 2 perforations and 1 tamponade.

**Conclusions:** 1) Real time 3D echocardiography improves the ability to see the location of the biopuncture during biopsies. 2) Fluoroscopy alone is inadequate to ensure proper performance of endomyocardial biopsies.