**Routine Implementation of Biplane Echocardiography in Large Volume Clinical Practice**

Partho P. Sen Gupta, Krishnaswamy Chandrasekharan, Dan Prince, Rebecca Dyke, Bijoy Khandheria, Mayo Clinic, Rochester, MN

**Background:** Utility of multi-dimensional echocardiographic imaging for improved assessment of cardiac geometry and function has been demonstrated in clinical settings. However concerns regarding ease of performance, learning curve, time and quality of imaging, and effects on overall clinical work-flow remain inadequately addressed. We hypothesized that simultaneous acquisition of two echocardiographic views from one acoustic window targeted for either orthogonal or modified component planes, would shorten sonographer’s time for imaging, yet maintain the image quality.

**Methods:** 100 consecutive unselected patients (59±16 yrs, 49 males) referred to echocardiography laboratory of Mayo Clinic were randomized to conventional or biplane imaging without previous knowledge using a broadband S3 and a matrix-array BP-X4 transducer (Phillips, Andover, Mass). Imaging time and variables influencing learning curve were analyzed.

**Results:** Average time for biplane and monoplane imaging showed no difference in the first 24 cases. A significant reduction in average acquisition time occurred in 58 (73.6%) cases (5.6 ± 1.3 vs 6.6 ± 1.6 min, p = 0.0003). No differences were noted with regards to referral pattern, patient’s body habitus, or underlying diagnosis including the number or pattern of cardiac lesions. Prolonged biplane imaging time was noted in 18 (23.6%) cases and resulted from differences arising due to larger size of biplane imaging probe as regards to size of echo-window, different biplane probe-frequency causing a suboptimal opening image quality and reduced size of component image in biplane display. Overall, biplane scanning resulted in 12% reduction in imaging time, while maintaining an optimal image quality in 87% patients. Improvement in software design in later 35 cases further improved the average time gain to 15%.

**Conclusion:** In a high volume echocardiography laboratory, biplane imaging effectively reduces acquisition time while maintaining a diagnostic image quality. The impact on workflow and, efficiency in the era of declining reimbursements could be substantial. Improvement in technology and, transducer size will result in further gains.

**Rebirth of Bedside Cardiovascular Examination Using Hand-Carried Ultrasound**

Sergio L. Kobal, Luca Trento, Simin Bahrami, Kirsten Tolstrup, Tasneem Z. Naqui, Bojan Cercoek, Yoram Neuman, James Mirocha, Saibal Kar, James S. Forrester, Robert J. Siegel, Cedars-Sinai Medical Center, Los Angeles, CA, University of California, Los Angeles, David Geffen School of Medicine, Los Angeles

**Background:** Bedside cardiovascular diagnosis is sub-optimal, even when performed by experts. We compared the accuracy of cardiovascular diagnosis by medical students operating a small, hand-carried cardiac ultrasound (HCU) to that of board certified cardiologists (MD) using standard physical examination.

**Methods:** Sixty-one patients (38% women), age 70 ± 19 yrs, with significant cardiac disease, had a HCU study performed by one of two medical students with 18 hrs training in cardiac ultrasound, and a physical examination by one of five MD. Diagnostic accuracy was validated with standard echocardiography.

**Results:** The students were superior to MD to diagnose valvular and non-valvular lesions as shown in Figure. Students improved their sensitivity when evaluating the most severe cases of left ventricular (LV) dysfunction, LV enlargement and LV hypertrophy (from 59% to 89% for non-severe and severe cases, respectively); MD sensitivity, unrelated to the severity of the findings, was sub-optimal (41% and 54% for non-severe and severe cases, respectively). There were 111 valvular regurgitations and 13 stenoses. Students and MD sensitivity of lesions that cause a systolic murmur was 93% and 62% (p <0.001), and of lesions that produce a diastolic murmur was 75% and 16% (p <0.001), respectively.

**Conclusions:** The diagnostic accuracy of medical students using a HCU device after a brief echocardiographic training is superior to experienced cardiologists performing a cardiac physical examination.

**Use of Real-time Three-dimensional Echocardiography to Measure Ventricular Dyssynchrony and Assess Cardiac Resynchronization in Heart Failure Patients**

Thomas E. Hong, Lisa Sugeng, Lynn Weinert, Victor Mor-Avi, Asem D. Desai, Roberto M. Lang, Bradley P. Knight, University of Chicago, Chicago, IL

In patients with heart failure (HF) and intraventricular conduction delay (IVCD), cardiac resynchronization therapy (CRT) may improve systolic ventricular function by restoring synchronized ventricular contraction. We tested the ability of real-time three-dimensional echocardiography (RT3DE) to quantify ventricular dyssynchrony and assess the degree of resynchronization with CRT.

**Methods:** Ten pts (7M, 3F, 71±5 yrs) with HF (6 ischemic; 4 non-ischemic) and IVCD who were treated with CRT were enrolled. Patients were studied 2.3±3.0 months after device implantation. RT3DE images (Phillips 7500) were obtained with and without CRT. Data were analyzed (TomTec) to obtain LV ejection fraction (EF) and regional volume over time curves for 16 LV segments. The time from the onset to end of ejection was calculated in each segment, and an index of dyssynchrony (DI) was defined as the standard deviation of the mean of all segments. **Results:** The mean baseline DI was 16±5. CRT resulted in a nonsignificant decrease in the mean DI to 13±3. The GRS duration was reduced in 9/10 pts from 178±34 to 154±19 ms. The DI decreased by ≥ 10% in 5 pts (19±3 to 12±3; p<0.001) and was associated with an increase in the EF (30±10 to 35±11%; p<0.01). The DI increased by ≥ 10% in 3 pts and was associated with no significant change in EF.

**Conclusions:** Real-time three-dimensional echocardiography allows the quantification of ventricular dyssynchrony and may aid in the assessment of the degree of resynchronization with CRT.

**3D Echocardiographic Quantification of Left Ventricular Asynchrony in Patients Selected for Cardiac Resynchronization Therapy**

Stam Kapetanakis, Michael Cookin, Ian L. Williams, Mark Kearney, Mark J. Monaghan, Kings College Hospital, London, United Kingdom

**Background:** Real-time transthoracic 3D echocardiography (RT3DE) provides a unique assessment of LV function and quantification of myocardial asynchrony.

**Methods:** 10 patients (68±11 yrs) underwent cardiac resynchronization therapy (CRT) for treatment of NYHA class III/IV heart failure (8 patients with dilated cardiomyopathy and 2 with ischaemic heart disease). The AV delay for the biventricular pacing device was optimised with pulsed Doppler. RT3DE was performed prior to implantation and during optimisation, at each AV delay setting. 3D datasets were analysed offline (LV Analysis 1.2, TomTec), to obtain regional time-volume curves (fig. 1). An asynchrony index (AI) was calculated as the standard deviation of the time for each segment to reach its peak ejection fraction higher AI indicates more severe asynchrony. Optimisation took place 2±1 days post implantation and the patients reported any perceived improvement.

**Results:** 1 patient did not experience improvement. In this patient there was no change in LVEF or AI. In all other patients there was a significant increase in ejection fraction and a decrease in AI. There was a good negative correlation between the increase in LVEF and the decrease in AI (r = -0.62, fig. 2). The lowest AI in 9 cases was achieved at the optimal AV delay defined by pulsed Doppler, confirming mechanical resynchronisation.

**Conclusion:** RT3DE provides an excellent method for quantifying mechanical asynchrony in patients undergoing CRT.

**Tissue Doppler Versus Strain Rate Imaging for Detecting Left Ventricular Aneurysm: Studies in an In Vitro Model of the Myocardium**

Megan E. Healy, Ikuo Hashimoto, Rahul Deb, Julia C. Swanson, Muhammad Ashraf, Xiaokui Li, David J. Sahn, Oregon Health & Science University, Portland, OR

**Background:** We tested a tissue Doppler based method for quantifying left ventricular wall motion in a calibrated pulsatile LV aneurysm model.

**Methods:** Eleven double balloon models were made by coating all but the apex with latex to provide a thinner aneurysm region with exaggerated expandable paradoxical motion