Automated Echocardiographic Confirmation of Regional Wall Motion Abnormalities: Quantification of Continuous LV Volume

S.J. Fry, P. Hunziker, H. Bosch, H. Reiber, M.H. Picard. Massachusetts General Hospital, Boston, MA, USA

Background: The qualitative assessment of LV regional wall motion abnormalities (WMA) is challenging and subject to high inter-rater variability. Since the temporal sequence of regional wall motion is altered after infarction, we hypothesized that the temporal characteristics of LV volume during systole as determined by automated border detection (ABD) would also be altered and provide a simple, quantitative method of detecting WMA.

Methods: Two-dimensional echocardiograms from 73 patients referred for coronary disease were studied. Wall motion scoring was performed on all images to separate those with resting WMA (+) from normal (-). Cardiac cycles of the apical 4 and 2 chamber views were digitally acquired and transferred to a workstation where LV volume by Simpson's method was calculated for each frame using endocardial borders automatically detected by a minimal cost contour detection algorithm. Log-transformed systolic LV volume was plotted against time yielding step functions which characterized the rate of LV emptying (Δlog V/t) in each patient.

Results: The population consisted of 49 WMA and 24 WMA+. The Δlog V/t derived from ABD volume analysis in both the apical 4 and 2 chamber views achieved statistical significance between the groups (WMA (−) vs. WMA (+): 4 chamber: 1.32 ± 0.59 vs. 0.67 ± 0.30, p < 0.001; 2 chamber: 1.87 ± 0.56 vs. 0.66 ± 0.40, p < 0.001).

Conclusion: The ABD parameter which is easy to derive from digital echocardiograms can identify patients with WMA and thus has the potential to improve confidence in WMA assessment and reduce interobserver variability.

Cardiac Power can be Readily Estimated: Validation of a Simple Index

G. Armstrong, K. Fukamachi, S. Carlier, L. Cardon, J. Thomas, T. Minnick. Cleveland Clinic Foundation, Cleveland, OH, USA

Peak power (PP) measures LV function independent of geometry but requires estimation of central aortic pressure waveform. PP occurs shortly after peak flow, as LV pressure is rising. Seeking a simplified index of PP to be applied non-invasively, we used the product of peak flow and mean arterial pressure.

Methods: In open-chest animals peak aortic flow was measured with an ultrasonic flowmeter (FM) to validate our index; and by PW and CW Doppler epicardial echocardiography (peak velocity × aortic annulus area) to assess clinical applicability. Recordings were made at baseline, during partial aortic cross-clamping, dobutamine infusion, inferior vena cava compression and LV dysfunction.

Results: Correlations with true PP (the instantaneous product of aortic FM and Millar pressure catheter measurements) were: FM PP r = 0.994, p < 0.0001; PW Doppler PP r = 0.980, p < 0.0001 and CW Doppler PP r = 0.904, p = 0.016 (see figs). Because Doppler measures the maximum (central luminal) flow, Doppler PP was greater than FM PP (p < 0.05). PW Doppler had the lowest correlation, probably because of difficulties in matching area measurements with sample volume location.

Conclusion: 1. Peak power can be accurately estimated from measurements easily obtained non-invasively. 2. This may simplify quantitation of contractile reserve in the echocardiography laboratory.
Detection of intravascular thrombus (IVT) is not always easy by conventional ultrasonic imaging. We explored the potential of a new contrast agent targeted to thrombus (MRX408) using a lipid synthesized with an arginine-glycine-aspartic acid analog in the evaluation of in vivo IVT.

Methods: We created intravascular thrombus (IVT) by inserting thrombin-soaked cotton threads through the inferior vena cava (IVC) in 9 dogs. With a commercially available 2-D echocardiographic system, we recorded images of the IVC at baseline with no contrast agent, during continuous infusion of MRX113 (a nontargeted contrast agent as a control) and infusion of targeted agent, MRX408. Videoendoscopy (V1, unitless) and the size of IVT (area) were analyzed blindly. Presence of IVT was verified by autopsy.

Results: In all instances of IVT, efficient binding by the agent MRX408 and visual targeting was noted. VI of IVT was not different between baseline and MRX113 (40.0 ± 14.6 and 73.9 ± 41.3, p = ns) but was higher during MRX408 infusion (105.7 ± 47.8, p < 0.05 vs. Baseline and vs MRX113). The maximum area of IVT was similar during baseline and MRX 113 (p = ns) but was found to be larger during MRX408 infusion by -41 ± 9% and -34 ± 14%, (P < 0.01 for each).

Conclusion: The issue targeted contrast agent, MRX408 enhances the visualization of IVC thrombus. It has the potential to improve the diagnostic power for detecting and delineating intravascular thrombus, even when a conventional ultrasound imaging modality is employed.

**804-4**

**Simultaneously Implanted "Crisscrossing" Stents Provide Excellent Relief for Postoperative Bilateral Proximal Pulmonary Artery Stenoses With Closely Related Ostia**

T.M. Zeller, C.E. Mullins, M.R. Netel, R.G. Grillka, F.F. Ing. Bay College of Medicine and Texas Children's Hospital, Houston, TX, USA

Background: For patients with postoperative pulmonary artery stenoses, expandable intravascular stent placement is the treatment of choice. However, patients with postoperative bilateral proximal pulmonary artery stenoses (PBPPS), with closely related branch ostia, present a specific problem as proximal stent implantation may compromise access to the contralateral pulmonary artery. We hypothesized that simultaneously implanted crisscrossing stents (SIXS) would be safe, would improve hemodynamics and allow future access to both pulmonary arteries.

Methods: Twenty patients (15 M: 8 F; 6.9 y; 5.6 ± 4.2 y post-op) with PBPPS, with (n = 9) and without MPA stenosis, had SIXS between 1993 and 1997. The principal diagnoses were dTGA (7), TOF (7), PA-VSD (4), Truncus (2) and AFO/a procedure (1). We examined the change in RV-FA ratios, PA size and gradients, and branch angle with SIXS.

Results: Hemodynamics and vessel size improved significantly with SIXS (table), but branch angles were not significantly changed.

<table>
<thead>
<tr>
<th>Branch</th>
<th>Gradients (mmHg)</th>
<th>Vessel size (mm)</th>
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</thead>
<tbody>
<tr>
<td>RV FA</td>
<td>MPA-LPA</td>
<td>MPA-RPA</td>
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<tr>
<td>Pre-stent</td>
<td>0.73 ± 0.21</td>
<td>6.4 ± 2.8</td>
</tr>
<tr>
<td>Post-stent</td>
<td>0.59 ± 0.12</td>
<td>6.4 ± 7.1</td>
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Conclusions: SIXS provides excellent relief for postoperative PBPPS while maintaining access to both PAs and should be considered an excellent treatment choice for this problem.

**804-5**

**Application of Endovascular Stents on the Management of Right Ventricular to Pulmonary Artery Conduit Stenosis**

C. Ovetar, C.A. Caldabone, B.W. McNerney, D. Nakaen, R.M. Freedman, L.N. Benson. The Hospital for Sick Children, University of Toronto, Toronto, Canada

Background: Extracardiac conduits between the RV and pulmonary arteries commit patients to multiple reoperations. Endovascular stenting of a stenotic conduit may delay, delay progression of stenosis. Methods: From 7/90 to 5/97, 42 patients underwent transcatheter stent insertion to relieve RV conduit stenoses. Median age at procedure was 5.6 yrs (range: 6 mo-17 yrs), with a median interval from conduit insertion of 2.4 yrs (3 mo-13.9 yrs). Clinical, echo, hemodynamic, anagrhaphic and follow-up data were obtained.

Results: RV systolic pressures decreased from 71 ± 18 mmHg to 48 ± 15 mmHg (p = 0.0001) after stent placement, with an increase in the minimal diameter of the conduit of 51 ± 44% (p = 0.0001). No major complications occurred. Eleven pts had 1 and 2 pts had 2 additional transcatheter interventions to further dilate the stent or add an additional stent. Surgical conduit replacement was required in 17 pts at a mean of 20 ± 16 mo after the stent placement. Of those without surgery, 12 pts have been followed <1 y, the remainder up to 5.4 yrs with 1 late death at 2.8 yrs after stent placement. Freedom from surgical intervention was 62% at 1 yr, 66% at 2 yr and 39% at 3 yr after stenting. There was no effect on freedom from surgery at pt age or duration of conduit at stenting, but higher initial RV pressures predicted decreased palliation, with a trend towards improved early results in the 2nd half of the study.

Conclusions: Transcatheter placement of endovascular stents in stenotic RV conduits significantly delays conduit replacement.

**804-6**

**Management of Pulmonary Artery Trauma due to Balloon Dilatation**

C.M. Baker, F.X. McGowan. J.E. Lock, J.F. Kearse. The Children's Hospital, Boston, Massachusetts, USA

Background: Balloon dilation (BD) of the pulmonary artery (PA) is important in the management of peripheral pulmonary stenoses. Successful BD requires a controlled tear of the PA, however complications ranging from small pseudoaneurysms to PA rupture can occur. We report our experience managing BD associated PA rupture.

Methods: All records (1983-1997) for patients undergoing cardiac catheterization during which BD of a PA was performed were reviewed using a com-