P2-82 - Moderated Session 5

Ventriculoarterial Coupling in Severe Aortic Stenosis with Heart Failure

Ricardo A. Migliore, Maria E. Adaniya, Miguel Barranco, Guillermo Miramont, Florencio T. Guerrero, Horacio Tamagusuku. Hospital Eva Perón, San Martín, Pcia de Buenos Aires, Argentina

Background: LV function is determined by the couple of LV end-systolic elastance (E_{max}) and effective arterial elastance (E_a). In patients with aortic stenosis (AS) the characteristics of arterial vasculature can impact LV function specially in patients with heart failure. **Objective**: To evaluate the ventriculoarterial coupling in severe AS with heart failure. **Methods**: We studied 67 patients, age average 70 ± 11 years, 37 men, with severe AS (AVA < 1 cm^2) with Doppler echocardiography. E_{max} was estimated by the method of Senzaki et al.. E_a was calculated as end-systolic pressure divided by stroke volume. End-systolic pressure was obtained from calibrated carotid pulse. E_{max}/ E_a ratio was used to assess ventriculoarterial coupling. EF was estimated by biplane method. Patients were divided in two groups: group 1, AS with heart failure (NYHA III-IV) (n = 22) and group 2, AS without heart failure (n = 45). **Results:** mean ± standard deviation

	Group 1	Group 2	P
E_{max} (mmHg/ml)	1.47 ± 0.88	1.87 ± 0.67	N.S.
E_a (mmHg/ml)	2.22 ± 0.74 *	1.70 ± 0.64	*<0.01
E_{max}/ E_a ratio	0.79 ± 0.51	1.45 ± 0.68	*<0.01

Conclusions: E_{max}/ E_a ratio is reduced in patients with severe AS and heart failure due to a increase in E_a. The pathophysiology of heart failure in AS appear related to the characteristics of arterial vasculature.

POSTER SESSION 3
Tuesday, June 9, 2009
Presented 8:30 am-4 pm

Posters

Miscellaneous (Including Interventional and Experimental Echocardiography, and Miscellaneous Diseases)
Posters P3-01 through P3-13

Pediatric Cardiovascular and Adult Congenital Heart Disease – Basic Science in Congenital Heart Disease
Posters P3-14 through P3-16

Quality, Appropriateness, Lab Accreditation, Ergonomics and Outcomes Research
Posters P3-17 through P3-29

Systemic Diseases (Hypertension, Obesity, Metabolic Syndrome, Diabetes, etc.
Posters P3-30 through P3-48

Pediatric Cardiovascular and Adult Congenital Heart Disease – Medical Management of Congenital Heart Disease
Posters P3-49 and P3-50

Pediatric Cardiovascular and Adult Congenital Heart Disease – Post-op Congenital Heart Disease
Posters P3-51 and P3-52

Intraoperative Echocardiography
Posters P3-53 through P3-55

Valvular Heart Disease
Posters P3-56 through P3-71

Pediatric Cardiovascular and Adult Congenital Heart Disease – Hemodynamics/Miscellaneous
Posters P3-72 through P3-75

Moderated Session 6: Presented 12:30 pm-1:30 pm
Theatre 1: Miscellaneous (Including Interventional and Experimental Echocardiography, and Miscellaneous Diseases)
Posters P3-01 through P3-06

Theatre 2: Quality, Appropriateness, Lab Accreditation, Ergonomics and Outcomes Research
Posters P3-17 through P3-22

Moderated Session 7: Presented 2 pm-3 pm
Theatre 1: Systemic Diseases (Hypertension, Obesity, Metabolic Syndrome, Diabetes, etc.)
Posters P3-30 through P3-35

Theatre 2: Valvular Heart Disease
Posters P3-56 through P3-61

P3-01 - Moderated Session 6

Ultrasound-Based Delivery of Cell Therapy for Accelerated Vascular Endothelialization-a Proof-of-Concept Study

Catalin Toma, Andrew Fisher, Jianjun Wang, Xucai Chen, William R. Wagner, Flordeliza S. Villanueva. UPMC, Pittsburgh, PA

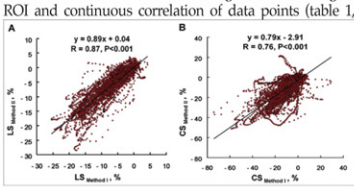
Background: Restoration of a functional endothelial barrier is a critical element in preventing late stent thrombosis; furthermore, intact endothelium protects against progression of the atherosclerotic plaque. We are proposing a novel method for delivering progenitor cell therapy to the coronary wall, based on the acoustic radiation force (RF) applied via ultrasound. The RF is exerted on microbubbles in an ultrasound field due to non-linear oscillation of the bubble, resulting in the displacement of the bubble away from the energy source. We proposed that by specifically conjugating microbubbles to mesenchymal stem cells (MSCs) the cells can be selectively displaced to the arterial wall when passing by a locally delivered ultrasound field. **Methods:** We used an *in vitro* vascular model consisting of a PVC tube placed under the objective of an upright microscope. An external 5 MHz transducer was placed perpendicular to the flow direction, with the ultrasound energy focused at the optical focus. Fluorescently labeled rat mesenchymal stem cells (MSCs, zeta potential -23.2 mV) were exposed in suspension to cationic lipid microbubbles (zeta +55.2 mV) or negatively charged control bubbles (zeta -10 mV), to enable cell-microbubble attachment via charge interactions. The bubble-cell suspensions or cells alone (control) were advanced through the vessel phantom at shear rates corresponding to systolic and diastolic coronary flow. Acoustic RF was applied to the phantom (5 MHz, 1.2 MPa, 20% duty cycle) for 5 seconds. **Results:** Cell:bubble interaction was quantified by flow cytometry based on the increased side-scatter of cells associated with microbubbles, and verified by microscopy. When MSCs were mixed with bubbles at a 1:40 ratio cells:bubbles, 100% of cells associated with bubbles vs. less than 5% attachment for control bubbles (n=3). When RF was applied on MSCs passing through the vessel phantom, arrest of 25.6±5.2% (low flow) and 0.4±0.1% (high flow) of passing MSCs was observed when cationic microbubbles were used (n=4). No cell marginalization was observed when the phantom was perfused with cells pre-mixed with negatively charged control bubbles. **Conclusions:** These data indicate that acoustic RF can be used to control cell delivery under physiologic flow conditions, and provide foundation for in vivo testing of RF-induced re-endothelization of injured vascular segments.

P3-02 - Moderated Session 6

Standardization of Region of Interest for Speckle Tracking Techniques Improves the Accuracy of Two-Dimensional Strain Measurements

Eun Joo Cho, Giuseppe Caracciolo, Scipione Carerj, Marek Belohlavek, Steven Lester, Krishnaswamy Chandrasekaran, Bijoy K. Khandheria, Partho P. Sengupta. Mayo Clinic, Scottsdale, AZ

Background: 2-D speckle tracking echocardiography is a novel non-invasive approach to measure left ventricular (LV) deformation. However, variations in tracking algorithms and lack of standardization in data interpretation may produce marked variability of results. We hypothesized that variability in LV strain measurement seen in different tracking algorithms are due to sampling inaccuracies and can be reduced by standardizing the region of interest (ROI). **Methods:** A total of 14,172 LV strain curves were obtained from 74 subjects, including: 19 healthy controls (46±18 yrs, 9 male), 17 patients with infiltrative cardiomyopathy (62±9 yrs, 8 male) and 38 patients with cardiac transplantation (57±9 yrs, 26 male). LV strains in longitudinal (LS), radial (RS) and circumferential (CS) directions were analyzed using 2 image analysis platforms (Method I, EchoPAC, GE Healthcare and Methods II, 2D Cardiac Performance Analysis, TomTec respectively). Strain curves obtained by both methods were correlated continuously for the entire cardiac cycle or selectively for peak strains using different ROI (full thickness, selective subendocardium and subepicardium respectively). **Results:** There were weak correlations for strain values when ROI were dissimilar (table 1). Correlations and limits of agreement were significantly improved with similar thickness ROI and continuous correlation of data points (table 1, Figure). Analysis of 2D strain curves revealed that the poor correlations resulted from marked variability of data in 33 patients. Higher strains were recorded for ROI restricted to LV subendocardium in comparison with full thickness measurements (-14.2±4.8 vs. -13.6±4.4 %, P=0.05 for LS and -15.0± 5.9 vs. -11.7±3.2 %, P<0.001 for CS at the mitral valve level).



Correlation coefficients between two methods

	Peak value Full vs. endo	Full frame Full vs. endo	Full frame Endo vs. endo
LS	0.656	0.871	0.873
MV CS	0.355	0.762	0.781
AP CS	0.607	0.733	0.743

P<0.002. Full, full thickness; endo, endocardium; LS, longitudinal strain;CS, circumferential strain; MV, mitral valve level of short axis view; AP, apical level of short axis view

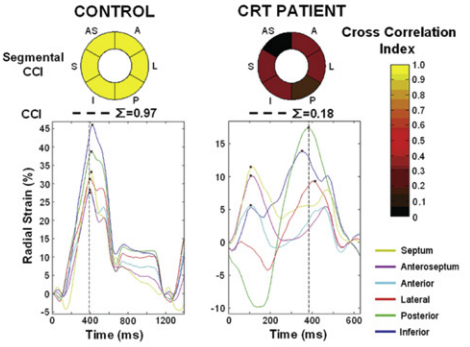
Conclusions: Transmural heterogeneity of myocardial mechanics results in generation of nonuniform strain waveforms. Standardization of ROI in speckle tracking algorithms is a key prerequisite for reducing variability of 2-D strain measurements.

P3-03 - Moderated Session 6

A Novel Automated Speckle Tracking Cross-Correlation Dyssynchrony Analysis to Predict Response to Cardiac Resynchronization Therapy

Han-Na Kim, Hideyuki Hara, Matthew Suffoletto, Hidekazu Tanaka, Lauren Johnson, David Schwartzman, Sanjeev Shroff, John Gorcsan, III. University of Pittsburgh, Pittsburgh, PA

Background: Manual interpretation of echocardiographic strain curves is technically demanding for quantifying dyssynchrony. Our objective was to test a novel automated strain curve analysis method using cross-correlation to predict response to cardiac resynchronization therapy (CRT). **Methods:** We studied 67 subjects; 57 heart failure patients referred for CRT with ejection fraction (EF) 17+11% and QRS duration 159+27ms and 10 normal subjects. Radial dyssynchrony was assessed by speckle-tracking radial strain from 6 standard short-axis segments. Dyssynchrony was first determined manually as peak strain delay (maximum to minimum); then by an automated computer program that used pair-wise correlation of 6 radial strain curves to determine a cross-correlation index (CCI), with perfect synchrony = 1. Response to CRT was defined as ≥15% increase in EF at 7±5 months. **Results:** Normal subjects reproducibly had no dyssynchrony; manual peak strain delay of 20±23ms and CCI of 0.99 ± 0.01. Overall, CRT patients had significant dyssynchrony; peak strain delay of 213±146ms and CCI = 0.54±0.38. Manual peak strain delay with a cut-off of ≥130 ms predicted EF response to CRT with 78% sensitivity and 75% specificity. When added to manual results, automated CCI identified an additional 14% of responders and was highly reproducible. **Conclusions:** A novel automated cross-correlation strain analysis system may contribute to predicting response to CRT, is highly reproducible, and has potential for clinical applications.

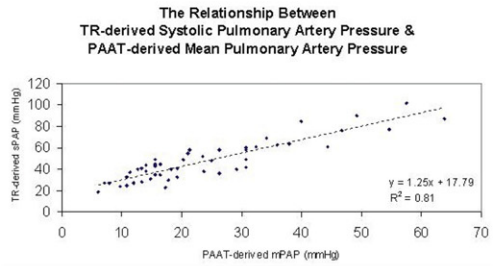


P3-04 - Moderated Session 6

The Relationship between Tricuspid Regurgitant-Derived and Pulmonary Artery Acceleration Time-Derived Pulmonary Arterial Pressures

Peter Noseworthy, Kibar Yared, Michael H. Picard, Arthur E. Weyman, Aaron L. Baggish. Massachusetts General Hospital, Boston, MA

Background: Echocardiographic assessment of systolic pulmonary arterial pressure (sPAP) is conventionally calculated from the velocity of the tricuspid regurgitation (TR) jet. However, there is insufficient TR to estimate sPAP in a significant number of patients. A method of calculating mean pulmonary artery pressure from measurement of Doppler-derived pulmonary artery acceleration time (PAAT) has previously been reported. To date, the relationships between PAAT and TR-derived estimates of PAP have not been examined. **Methods:** We reviewed 50 clinically indicated echocardiograms among patients without tricuspid or pulmonic valvular stenosis. Continuous wave Doppler was used to measure the peak velocity of tricuspid regurgitation. sPAP was calculated as: 4 x peak trans-tricuspid velocity^2 + 10 mmHg (to account for right atrial pressure). PAAT, right ventricular ejection time, and peak pulmonary artery systolic velocity were measured in the proximal pulmonary artery using pulse-wave Doppler. Mean pulmonary artery pressure (mPAP) was calculated as: $\log_{10}$ (mPAP) = -0.0068 x (PAAT) + 2.1 **Results:** Interobserver variability for PAAT was 0.97. PAAT (mean = 114 ± 35 ms) correlated strongly with the peak systolic regurgitant tricuspid velocity (300 ± 80 cm/s, r^2 = 0.77), peak trans-tricuspid gradient (38 ± 19 mmHg, r^2 = 0.75), and the log of the peak trans-tricuspid gradient (1.5 ± 0.2, r^2 = 0.75). TR-derived sPAP was tightly correlated with PAAT-derived mPAP (r^2 = 0.81) as shown below. **Conclusion:** PAAT and PAAT-derived mPAP correlate closely with estimate of sPAP derived from conventional measurement of tricuspid regurgitant flow. This alternative technique appears to be an accurate method for the quantification of PAP when sufficient tricuspid regurgitation is absent.



P3-05 - Moderated Session 6

Natural History of Left Atrial Appendage "Sludge" by Transesophageal Echocardiography in Patients with Atrial Fibrillation

Sheldon Y. Freeberg, Brandon Varr, Sarinya Puwanant, Ruvin S. Gabriel, Wilson W. H. Tang, Oussama M. Wazni, Bruce D. Lindsay, Allan L. Klein. Cleveland Clinic, Cleveland, OH

Background: The transesophageal echocardiography (TEE) risk factor "sludge," regarded as a precursor to thrombus, has been shown to be associated with high rates of stroke/death in patients with atrial fibrillation (AF); however, management of these patients is not well defined. We sought to characterize the natural history of patients with sludge and address whether direct cardioversion (DCC) leads to maintenance of sinus rhythm and resolution of sludge. **Methods**: From the Cleveland Clinic TEE database, we identified 214 AF patients (age 66 ± 12 years, 70% male, EF 41%, LA area 28.33 ± 7.96 cm^2) of which 107 (50%) had independently verified left atrial appendage (LAA) sludge compared to controls (n=107). Sludge was defined as a dynamic, layered echodensity during the cardiac cycle in the LAA. Echocardiography findings, DCC rate, and rhythm at 6 months were analyzed. A cohort of sludge patients (n= 29) were identified with serial TEEs and evaluated based on resolution of sludge in follow-up. **Results**: Patients with sludge had a lower LVEF as well as greater LA diameter and area when compared to controls. Fewer sludge patients remained in sinus rhythm (31.6% sludge vs. 62.8%). In patients with sludge and serial TEEs (median follow-up 155 days), there was resolution to spontaneous echo contrast in 13 (44.8%), persistence in 13 (44.8%) and progression to thrombus in 3 (10.3%) with therapeutic anticoagulation (AC). **Conclusions**: Patients with sludge on TEE have a lower LV ejection fraction and larger left atrium compared to a control group. Despite DCC and therapeutic AC, there are low rates of sinus rhythm and resolution of sludge in serial follow-up with 10% progressing to thrombus. Our findings suggest that the presence of sludge on TEE in AF patients could be considered a relative contraindication to DCC.

Table 1: Echocardiography characteristics and clinical outcomes.	AF-control (n=107)	Sludge (n=107)	p-value
LV Ejection Fraction	49.6 ± 11.7	33.2 ± 16.8	<0.05
LA diameter (cm)	4.4 ± 0.8	5.1 ± 0.8	<0.05
LA area (cm2)	24.6 ± 6.1	31.9 ± 7.9	<0.05
AF at TEE	107/107 (100%)	92/92 (100 %)	NS
Number of DCC	63/107 (58.9 %)	53/92 (57.6%)	NS
Sinus at 6 mo f/u	54/86 (62.8%)	24/76 (31.6%)	<0.005
Serial TEE sludge n=29			
Sludge resolved to SEC		13/29 (44.8%)	
Sludge persists		13/29 (44.8%)	
Sludge progressed to thrombus		3/29 (10.3%)	

NS=not statistically significant