(15%) showed ISC by DbE, compared with 57% of non-AF pts who died (p = 0.03). The predictive value of negative DbE in AF (86% over 20 m) was less than previously reported.

Conclusion: DbE is safe and feasible in pts with AF, but its prognostic value is limited, despite the apparent adequacy of stress. This likely represents technical difficulties with DbE interpretation.

1153 Echocardiographic Methods

Tuesday, March 31, 1998, 3:00 p.m.–5:00 p.m.
Georgia World Congress Center, West Exhibit Hall Level
Presentation Hour: 3:00 p.m.–4:00 p.m.

1153-137 Non-linear Harmonic Imaging of Tissue: A Superior New Technology for Left Ventricular Border Delineation

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Non-linearly generated harmonic (NLH) imaging of tissue has been reported to improve image resolution by decreasing acoustic clutter and side-lobe artifact. To determine whether this new technology improves sensitivity for delineation of the left ventricular (LV) myocardial/blood interface, a nonselected series of 13 patients (7 females/6 males; mean age 53 years) underwent two-dimensional echocardiography with both standard (STAND) and NLH tissue imaging (Acuson Sequoia). A STAND transducer transmit frequency of 3.5 MHz and harmonic receive frequency of 3.5 MHz were used. LV was divided into 16-wall segments and further classified as anterior (Ant), inferior (Inf), posterior (Post), and lateral (Lat) regions. A quality score of 0 to 4 was assigned to each segment based on a consensus of two readers; 202 segments were compared.

Results: (See Table): NLH yielded significant improvement in each region compared with STAND imaging: mean quality score differences were 0.96 post, 0.89 lat, 0.84 ant, and 0.43 inf. Analyses of individual segments showed significant improvement in all but the basal septum. This improvement resulted from a reduction in the speckle pattern and boundary enhancement.

	Ant	Lat	Post	Inf
STAND	1.44	1.23	1.83	1.95
NLH	2.28	2.12	2.79	2.38
p value	< 0.0001	0.0001	0.0005	0.001

Conclusions: Non-linear tissue harmonic imaging increases sensitivity, compared to standard imaging, for delineation of the left ventricular endocardial border. Benefits extend beyond the apex to virtually all segments of the left ventricle.

1153-138 Omniplane Transthoracic Echocardiography Provides an Easy Method to Estimate Mitral Annulus Size and Shape: Verification by Voxel-based Three-dimensional Echocardiography

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Background: Accurate assessment of mitral annulus (MA) size and shape is important in planning mitral valve repair. Conventional transthoracic 2D echo is limited in this regard.

Methods: To explore the potential of a new method, Omniplane *transthoracic* echocardiography (Omni2DE), we studied 20 pts (16 to 83 yrs), with the Omni2DE probe (3.7/5 MHz, H-P) that steers the imaging array thorough 180°. We imaged from the *parasternal* acoustic window. In addition, voxel-based 3D echo (3DE) was performed using rotational approach (TomTec). In the Omni2DE, we examined 18 planes (10° increment from 0 to 180, with long-axis considered as 0°) and measured MA area (sqcm) from the best plane, as well as maximum (Dmax) and anteroposterior (Dap) diameters (cm), in systole (S) and diastole (D). These were compared to data derived from 3DE.

Results (Mean ± SD): The MA was best defined in the range of 60 to 70°; the comparisons between were:

	3DE	Omni2DE	Regression	r	p
Area D	14 ± 3.6	15 ± 4.3	y = 0.59x + 5.2	0.69	< 0.001
S	8.7 ± 3.4	8.3 ± 3.4	y = 0.84x + 0.97	0.83	< 0.001
Dmax D	4.9 ± 0.7	5.2 ± 0.8	y = 0.43x + 2.7	0.50	< 0.05
S	3.8 ± 0.7	3.7 ± 0.7	y = 0.65x + 1.4	0.70	< 0.001
Dap D	3.4 ± 0.7	3.4 ± 0.8	y = 0.67x + 1.1	0.78	< 0.001
S	2.6 ± 0.7	2.6 ± 0.7	y = 0.56x + 1.1	0.64	< 0.01

Conclusions: Omni2DE allows quantitative assessment of MA size and shape by yielding correct imaging planes to visualize MA. It is an easy method that provides important information in a simple manner.

1153-139 A New Computerized Method for Evaluating Myocardial Left Ventricular Function by Tissue Doppler Imaging

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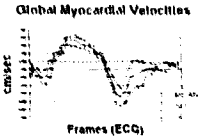
Background: Tissue Doppler Imaging (TDI) is a new non-invasive ultrasound technique that allows the measurement, in real time, of myocardial velocities during the cardiac cycle. However TDI offers only limited possibilities of quantification by positioning a small ROI. Aims of this study were 1) to develop a simple and useful computerized system to quantify regional LV function by TDI analysis 2) to characterize normal pattern of global and regional myocardial velocities 3) to evaluate the possibility of reducing the intra- and inter-observer variability.

Methods: Twelve healthy young volunteers underwent: a) Bi-dimensional echo (2-D ECHO), b) TDI and c) Magnetic Resonance Imaging (MRI), obtaining equivalent and comparable slices (4- and 2-chambers views). After computerized acquisition and loading of 25–38 frames per cardiac cycle, 2-D ECHO and MRI endocardial and epicardial contours were drawn and 100 chords were positioned and measured on each image, obtaining systolic thickening changes (%Th). After TDI velocities scale calibration, the previous saved chords were superimposed on TDI images and colors extracted and converted, having curves of regional and global (Fig) myocardial velocities *during the entire cardiac cycle*.

Results: 1) the waveforms are similar in all cases; 2) there are no significant statistical differences but only minimal regional heterogeneity in the systo-diastolic velocities and time intervals; 3) intra- and inter-observer variability is lower with TDI (1.9% and 3.2%) than with %Th analysis (7.2 and 9.4%).



Conclusion: This new computerized method allows to achieve, by TDI analysis, the normal range of myocardial velocities during the entire cardiac cycle and it reduces intra- and inter-observer variability.

1153-140 Radial Jet Vortical Events Are Better Delineated on 3D Reconstructions of Flow Images Than on 2D Color Doppler: An In Vitro Study With Comparisons to Optical Visualization of Flow Jets

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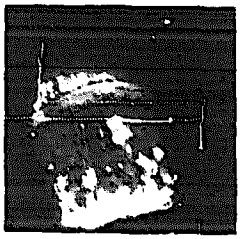
Entrainment and vortical structures are sometimes clearly visualized in longitudinal views of flowing jets by optical visualization methods. These events also occur radially around the direction of propagation. However, vortical events are often poorly visualized on color coded flow maps because of the angle-dependence of color Doppler encoded images in 2D planar views. We performed rotational 3D reconstruction of pulsatile jet flows using a a TomTec™ imaging system, an Interspec ATL™ annular array, and a customized color map to facilitate composite video transfer of subtle *low velocity* color dynamics into the grey scale TomTec™ milieu.



The reconstructed 3D pulsatile flow images from circular and rectangular orifices (areas: 0.24 cm^2) clearly showed radial orientations of vortical entrainment events and, during propagation, also showed axial rotation of the entire jet structure within the flow field when viewed "en face" matching observations by optical visualization. By integrating flows between planes, vortical events

are enhanced such that spatial appreciation of the rotation of the jet flows and the radially oriented vortical events was substantially improved in our dynamic 3D flow images.

1153-141 Transcranial Doppler High-Intensity Transient Signals During Cardiac Catheterization and Angiography

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High-intensity transient signals (HITS) detected by transcranial Doppler ultrasonography (TCD) have been associated with cerebral emboli. To determine the incidence and significance of HITS during cardiac catheterization and angiography, we examined the frequency of HITS in the left middle cerebral artery (MCA) with TCD in thirteen patients (age 70 ± 8 years). HITS were counted by use of criteria recommended by the Consensus Committee of the Ninth International Cerebral Hemodynamics Symposium.

Results: (1) There were no HITS during the baseline recording in any patients. (2) During catheterization, HITS were detected in all patients with an average of 13 (range; 6 to 33) per procedure. Most of these events (98%) were seen shortly after injection of contrast agents or saline. One HITS was detected during catheter manipulation in the ascending aorta. (3) No correlation was found between the number of HITS and age, presence of coronary disease, history of hypertension, diabetes and, smoking. Hemostatic markers, including thrombin antithrombin III, fibrinogen, D-dimmer, plasmin alpha-2-plasmin inhibitor complex, beta- thromboglobulin, apolipoprotein and tissue plasminogen activator did not show any correlation to the frequency of HITS. (4) No patients had angiographic stroke.

Conclusions: HITS are present during cardiac catheterization and angiography, although these events are clinically silent. HITS are generally associated with injection procedure of contrast agents and saline.

1153-142 Power Motion Imaging for Quantification of Heart Wall Motion: An Ultrasound Study in the Rabbit.

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Introduction: Power Motion Imaging (PMI) is a method of echographic two-dimensional imaging (2D) that represents Doppler energy of tissue as a color scale map. Since the Doppler energy signal is known to incorporate information about the nature and motion of the tissue, we hypothesized that PMI could identify different degrees of myocardial contraction.

Methods: We studied fourteen rabbits with an ATL HDI 3000 in PMI and ECG triggering modes. Two to five stages of wall contraction were recorded for each rabbit. Low wall thickening (WT) stages were obtained after intravenous injection (IV) 0.5 ml of Diltiazem and high WT stages with 0.25 ml of Isoprenaline. For each stage, heart rate (HR), myocardial wall slope (S) and wall thickening in septal (SA) and lateral areas (LA) were recorded in M-mode. Five beats were then recorded using 2D PMI mode in the proto-systolic phase. Mean of pixel intensities (Mpi) were calculated on PMI frames in 10 × 10 pixels regions of interest from SA, LA and anterior area (AA). The relative variations in Mpi obtained by HR and M-modes were compared.

Results: Mean ± SD of HR, S, WT and Mpi were respectively 155 ± 49 bpm, 39.1 ± 15.8 degrees, 48 ± 29 % and 119.5 ± 40.8. No correlation was found between relative S and relative Mpi. A weak correlation was found between relative S and relative Mpi ($y = 0.43x - 0.09$, $r = 0.54$). Correlations between relative WT and relative Mpi were better ($y = 0.45x - 0.02$, $r = 0.68$), in particular in SA ($y = 0.38x - 0.1$, $r = 0.79$).

Conclusions: PMI signal is well correlated with wall thickening. This modality can assess myocardial contraction by direct quantification of wall motion. It may thus be of value in clinical viability studies.

1154 Magnetic Resonance Imaging: Coronary Arteries and Ventricular Function

Tuesday, March 31, 1998, 3:00 p.m.–5:00 p.m.
Georgia World Congress Center, West Exhibit Hall Level
Presentation Hour: 3:00 p.m.–4:00 p.m.

1154-143 In Vivo Magnetic Resonance Imaging of Post Angioplasty Coronary Vessel Wall Lesions in Pigs

M. Shinnar, R. Gallo, Z.A. Fayad, J.T. Fallon, A. Padurean, S.N. Konstadt, D. Moskowitz, J. Abela, J.J. Badimon, V. Fuster. *Cardiovascular Institute, Mount Sinai Medical Center, NY, NY, USA*

Background: Previous studies have shown that MRI can characterize plaque in human carotids and rabbit aortas. However, because of the size of the arteries and both cardiac and respiratory motion, coronary vessel lesions have not been imaged in vivo. We show for the first time that such imaging is feasible.

Methods: Ten pigs underwent PTCA of the LAD with an oversized balloon. MRI (GE Signa 1.5T) was done at various times after the PTCA on paralyzed, intubated pigs. The LAD was identified with MRI coronary angiography. Spin echo images were then obtained transversely to the LAD lesion. Image resolution was 500–600 μ, with a slice thickness of 3–5 mm. Pigs were then sacrificed, and the MR images were compared with histopathology.

Results: Good quality images were obtained in 7 pigs. Pathology was obtained in 6 of these pigs. MRI images clearly discriminated among the fibrocellular and thrombotic contributions to the late stenosis process post arterial injury.

Conclusions: We show, for the first time in coronaries, that in vivo MR imaging and tissue characterization of lesions is feasible if motion is adequately suppressed. Resolution is comparable to that reported in the rabbit aorta. MRI characterization of coronary plaques offers a new, noninvasive approach for risk stratification.

1154-144 Improved Differentiation Between Infarcted and Non-infarcted Myocardial Regions by Magnetic Resonance Tagging

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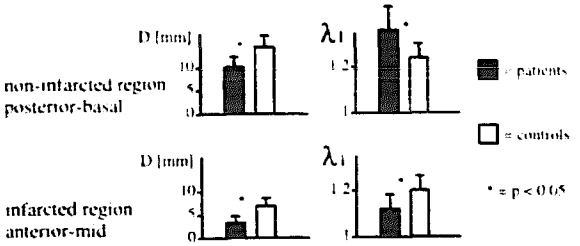
Background: The motion of the heart wall is usually qualified as hypo- or normokinetic. However, myocardial motion is a composite of active deformation (strain) and passive displacement. Our aim was to assess the relevance of separating strain from displacement after infarction.

Methods: Ten patients (age 52 ± 11 yr, males) had an anterior infarction due to an angiographically proven culprit lesion in the LAD coronary artery. Within 8 ± 3 days after infarction, Magnetic Resonance Imaging with tagging (7 mm grid) was performed on the vertical long-axis image plane. The motion of triangular finite elements of myocardium was analyzed between end-diastole and end-systole. Results are the maximum principal strain $\lambda 1$ (1 + greatest systolic stretch), and the rigid-body displacement D of the elements. The anterior and posterior left ventricular walls were subdivided in basal, mid and apical levels. Mean values of $\lambda 1$ and D were obtained for each region. The anterior wall at mid level was an infarcted region, and the posterior wall at basal level a non-infarcted region. Patients were compared to healthy controls (n = 8, age 53 ± 10 yr, males).

Results: D was equally decreased in the infarcted and non-infarcted regions. $\lambda 1$, however, was decreased (less stretching) in the infarcted region, but *not* decreased (rather increased) in the non-infarcted region.



Conclusion: The maximum principal strain of myocardium differentiates better between infarcted and non-infarcted regions, than displacement.

TUESDAY POSTER