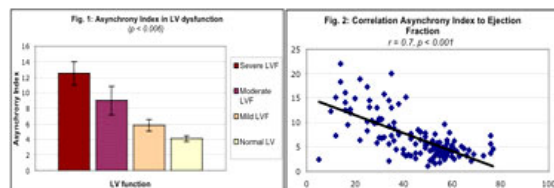


Methods: 141 patients with normal QRS duration (<120 ms) referred for assessment of LV function were investigated. Routine 2D echocardiography was followed immediately by RT3DE using the Philips Sonos 7500 with the X4 transducer. A full volume acquisition (FVA) of the left ventricle was obtained from the apical position. The 3D dataset was analysed offline (4D LV analysis, version 1.2, TomTec) to derive global and regional LV time-volume curves utilising semi-automated endocardial border detection. An asynchrony index (AI) was derived by calculating standard deviation of the time for each of the 16 segments to reach its minimum volume.

Results: The average acquisition time for 3D datasets was 7 sec. 49% had normal LV systolic function, 15.8% had mild, 16.5% moderate and 18.7% severe systolic dysfunction. The asynchrony index was 4.1 ± 1.5 , 5.8 ± 1.8 , 9 ± 4.5 and 12.5 ± 3.9 for each group respectively (fig. 1). There was good negative correlation between ejection fraction and AI ($r = -0.7$, $p < 0.001$, fig. 2).

Conclusion: RT3DE is a sensitive tool for quantifying mechanical LV asynchrony which appears to increase with increasing degrees of systolic dysfunction.



1113-161

Assessment of the Left Atrial Appendage Using Transthoracic Real-Time Three-Dimensional Echocardiography

Eugene Shteerman, Kumiko Hirata, Om Kapoor, Marie-Edouard N. Desvarieux, Todd Pulerwitz, Khady Fall, Frank K. Wanstall, Marco R. Di Tullio, Shunichi Homma, Columbia Presbyterian Medical Center, New York, NY

Background: Imaging of the left atrial appendage (LAA) is important for thrombus detection. Newly developed real-time three-dimensional (RT3-D) ultrasound equipment allows on-line acquisition and rendering of cardiac structures and may provide incremental diagnostic information about LAA morphology compared to conventional 2-D imaging. **Methods:** 40 subjects were studied (24 cardiac patients, 14 men, mean age 53.2 ± 17.9 years and 16 normal controls of younger age, 9 men, mean age 31.6 ± 6.9 years) using transthoracic RT3-D and 2-D imaging (3.5MHz transducer, Philips Sonos 7500). The LAA visualization was attempted in 1) parasternal short axis view, 2) apical two-chamber view, and 3) modified apical five-chamber view, dividing the LAA into two segments: body (proximal portion: anterior and posterior aspect) and tip (distal portion). All images were reviewed by two experienced echocardiographers. **Results:** 20 of 24 patients (83.3%) and 13 of 16 volunteers (81.3%) had adequate 3-D images of the LAA. Comparison results are reported in the table. In five subjects, pectinate muscles were seen by RT3-D, but not by 2-D imaging. **Conclusions:** 1) Transthoracic RT3-D echocardiography adequately visualizes the LAA in the majority of subjects without significant age differences. 2) RT3-D imaging may provide incremental diagnostic information over 2-D imaging on wall morphology, which may be useful in the evaluation of LAA pathology.

Table:

LAA Structures	Patients (n = 20)	Volunteers (n = 13)
Anterior Aspect of Body	18 (90%)	11 (84.6%)
Posterior Aspect of Body	18 (90%)	11 (84.6%)
Tip	10 (50%)	9 (69.2%)

1113-162

Geometric Deformity of the Saddle-Shaped Mitral Annulus in Patients With Ischemic Mitral Regurgitation: Real-Time Three-Dimensional Echocardiographic Study

Nozomi Watanabe, Yasuko Yamaura, Manabu Taniguchi, Takahiro Kawamoto, Yasuo Ogasawara, Takashi Akasaka, Kiyoshi Yoshida, Kawasaki Medical School, Kurashiki, Japan

Objective: We sought to clarify three-dimensional configuration of the mitral annulus in ischemic functional mitral regurgitation.

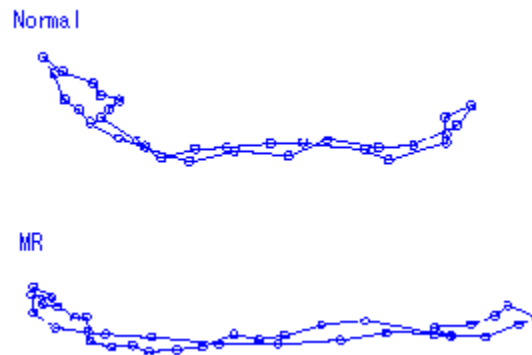
Methods: Twenty-five previous myocardial infarction patients with left ventricular dysfunction (ejection fraction <50%) and ten healthy control subjects were examined. Patients were divided into two groups: ERO0.1cm^2; non-MR group, ERO $\geq 0.1\text{cm}^2</math>; MR group. Utilizing real-time three-dimensional echocardiography (SONOS 7500[®], Philips), mitral annulus configuration was constructed in diastole and systole. Height of the saddle shaped mitral annulus was calibrated (non-planar index).$

Results: In control subjects, mitral annulus configuration was appeared as non-planar 'saddle shape'. Non-planar index was $5.4 \pm 3.6\text{mm}$.

In both non-MR and MR groups, three-dimensional configuration of the mitral annulus was appeared as flat shape, with less dynamic movement during cardiac cycle. In MR group, saddle shape of the mitral annulus was markedly deformed and rather warped. Non-planar index was significantly smaller in MR group, comparing with non-MR group ($-1.52 \pm 4.2\text{mm}$ vs. $1.42 \pm 3.9\text{mm}$, $P < 0.05$).

Conclusions: Saddle shape of the mitral annulus was deformed in patients with

ischemic MR. Changes in three-dimensional configuration of the mitral annulus might play a role as one of the mechanisms in ischemic MR.



1113-163

The Role of Real-Time and Freehand Three-Dimensional Echocardiography in the Evaluation of Rheumatic Mitral Stenosis

Leopoldo Perez de Isla, Lissa Sugeng, Lynn Weinert, Juan Luis Gutierrez Chico, Pedro Cordeiro, Roberto M. Lang, Jose Zamorano, Hospital Clínico San Carlos, Madrid, Spain, University of Chicago, Chicago, IL

Three-dimensional echocardiography allows the visualization of the mitral valve in any desired plane and can be performed using real-time 3D acquisition or freehand scanning. The accuracy of these techniques for the evaluation of mitral stenosis have yet to be established. Our aim was to determine which of the clinically used Echo-Doppler methods correlates best with the mitral valvular area (MVA) acquired invasively using Gorlin's formula. **Methods:** We studied 80 pts with mitral stenosis (age 51 ± 14 yrs). MVA was determined by conventional Echo-Doppler methods (2D planimetry, pressure half time - PHT - and PISA) and by 3D echocardiography (matrix array probe, N=50; and freehand scanning, N=30). The results were compared with MVA determined by the invasive Gorlin method. Average MVA, linear regression (r) and intraclass correlation coefficients (ICC) were computed for each method. Measurements were performed by two independent observers and repeated by one of them to determine the inter- and intra-observer variability. **Results:** Determination of MVA by 3D echo had the best correlation with the Gorlin's method (table). Inter-observer variability was similar for 3D (ICC=0.90) and PHT (ICC=0.95). In addition, intra-observer variability was also similar for RT 3D (ICC=0.96) and PHT (ICC=0.92). **Conclusions:** RT 3D echo is an accurate and highly reproducible technique for assessing MVA in patients with rheumatic mitral valve stenosis. 3D echo showed the best correlation with the invasively estimated MVA.

	Averaged MVA	r	ICC (95% confidence interval)
PHT	1.28 ± 0.39	0.73 ($p < 0.001$)	0.68 (0.39-0.75)
2D	1.39 ± 0.37	0.80 ($p < 0.001$)	0.62 (0.38-0.72)
PISA	1.24 ± 0.39	0.57 ($p < 0.001$)	0.49 (0.24-0.66)
3D	1.26 ± 0.43	0.97 ($p < 0.001$)	0.84 (0.74-0.89)
Gorlin	1.30 ± 0.48		

1113-164

Assessment of the Proximal Aorta by Real-Time Three-Dimensional Echocardiography

Marie-Edouard N. Desvarieux, Kumiko Hirata, Todd Pulerwitz, Eugene Shteerman, Steve Nadelberg, F. Khady Fall, Samira Rivera, Shunichi Homma, Marco R. Di Tullio, Columbia University, New York, NY

Background: Transesophageal echocardiography (TEE) is the most widely used imaging technique to evaluate the aortic arch. However, the proximal portion of the aortic arch is not visualized due to the interposition of the trachea. The more easily performed three-dimensional transthoracic (3D TTE) imaging may provide a noninvasive means of viewing the entire proximal aorta. **Methods:** Real-time 3D TTE with full volume acquisition (Philips SONOS 7500) was performed to image the proximal aorta through a lateral suprasternal or suprasternal window. Twenty-seven patients were imaged (mean age $= 57 \pm 15$ y, 52% male). The thoracic aorta was subdivided into the proximal ascending, distal ascending, proximal aortic arch, distal aortic arch, and proximal descending thoracic aorta. The images were reviewed by two cardiologists to determine the extent of the vessel circumference visualized (not visualized, less than 50%, 50 -75% and greater than 75%). **Results:** See Table. Greater than 75% of the circumference of the proximal arch was visualized in two-thirds of the patients. **Conclusions:** 1) Transthoracic real-time 3D echocardiography with full volume acquisition reliably visualizes most of the proximal aorta. The posterior half of the aortic arch is always visualized while the anterior portion is more difficult to acquire. 2) The proximal arch, which is often not visualized by TEE, is visible in the majority of subjects. 3) Real-time 3D TTE could prove as a useful noninvasive method to assess for aortic arch disease.

Proximal Aorta Circumference Visualized by Real-Time Three-Dimensional Echocardiography

	Not Visualized	<50% of Aortic Circumference Visualized	50-75% of Aortic Circumference Visualized	>75% of Aortic Circumference Visualized
Proximal Ascending	7%	48%	41%	4%
Distal Ascending	7%	30%	56%	7%
Proximal Arch	-	-	33%	67%
Distal Arch	-	-	7%	93%
Proximal Descending	4%	33%	52%	11%

ORAL CONTRIBUTIONS

823 Prognostic Significance of Diastolic Function Abnormalities

Monday, March 08, 2004, 4:00 p.m.-5:30 p.m.
Morial Convention Center, La Louisiane A

4:00 p.m.

823-1 Tissue Doppler Echocardiography and B-Type Natriuretic Peptide in the Prognosis of Congestive Heart Failure

Hisham Dokainish, Eunice Ambriz, William A. Zoghbi, Miguel A. Quinones, Sherif F. Nagueh, Baylor College of Medicine, Houston, TX

Background: B-type natriuretic peptide (BNP) and tissue Doppler (TD) derived E/Ea (transmitral early diastolic velocity/TD annular early diastolic velocity) have not been directly compared in the prognosis of patients with congestive heart failure (CHF).

Methods: Patients admitted to hospital for suspected CHF had simultaneous clinical examination, comprehensive Doppler echocardiography (CDE) and BNP once stable and ready for discharge. CDE evidence of HF was defined as Doppler evidence of elevated left ventricular filling pressures or depressed EF (<50%). The primary endpoint was a combination of death and rehospitalization for CHF.

Results: In the 81 patients studied, the mean time to follow-up was 245.5 ± 40.6 days. There were 28 patients (35%) who reached the primary endpoint (8 deaths, 20 readmissions for CHF). There were no differences in baseline characteristics (age, gender, diabetes, hypertension, smoking) between patients who reached the primary endpoint and those who did not. Univariate predictors of the primary endpoint are shown in Table. In multiple logistic regression including Framingham criteria for CHF, BNP, E/Ea and CDE, CDE was the only significant predictor of outcome (odds ratio=15.9, p=0.019).

Conclusion: BNP and E/Ea both predict prognosis in CHF, but a comprehensive Doppler echocardiogram performed the best overall in this study.

Univariate Predictors of Outcome in CHF

	CHF by Framingham criteria	Ejection Fraction (%)	LA volume index (ml/m ²)	E/A	Mitral Deceleration Time (ms)	Sa-Systolic annular velocity (cm/s)	Aa-Late diastolic velocity (cm/s)	E/Ea	BNP (pg/ml)
Endpoint (N=28)	20/43 (47%)	32.8 ± 13.4	43.5 ± 11.9	1.5 ± 0.7	182.9 ± 68.6	4.2 ± 1.5	5.1 ± 2.6	19.0 ± 7.3	513.6 ± 355.4
No Endpoint (N=53)	8/38 (21%) p=0.03	46.1 ± 20.7 p=0.005	33.6 ± 17.7 p<0.001	1.2 ± 0.8 p=0.04	207.7 ± 46.6 p=0.07	5.1 ± 1.5 p=0.01	6.8 ± 2.2 p=0.006	14.6 ± 6.4 p=0.008	254.5 ± 324.8 p<0.001

4:15 p.m.

823-2 The Ratio of Early Diastolic Mitral Flow Velocity to Early Diastolic Mitral Annular Velocity Predicts Prognosis in Patients With Chronic Congestive Heart Failure

Tayfun Acil, Thomas Wichter, Jörg Stypmann, Frauke Janssen, Matthias Paul, Matthias Grude, Hans H. Scheld, Günter Breithardt, Christian Bruch, Universitätsklinikum Münster, Münster, Germany

Background: The prognostic value of tissue Doppler imaging (TDI) in patients with chronic congestive heart failure (CHF) has not been compared against conventional measures of systolic, diastolic and overall left ventricular LV performance. The aim of this study was to assess the prognostic value of TDI-derived parameters in patients with CHF.

Methods: One hundred thirty-two subjects with chronic CHF [due to ischemic (n=82) or dilated (n=50) cardiomyopathy, 101 males, mean age 57±11 years] underwent conventional two-dimensional/Doppler echocardiography and assessment of the Tei-Index (iso-

volumic contraction time and isovolumic relaxation time divided by ejection time). Systolic, early and late diastolic mitral annular velocities (S', E' and A', respectively) were derived from pulsed TDI. A cardiac event (cardiac death or hospitalization due to decompen- sated CHF) was defined as the combined study endpoint.

Results: The patients were followed for a mean of 224±123 days. Thirty-one patients suffered an event (cardiac death, n=5; hospitalization due to CHF, n=26). In patients with an event, ejection fraction was lower (25±10 vs. 32±9 %), mitral deceleration time was shorter (138±58 vs. 193±72 ms), and the peak mitral early flow to E'-ratio (E/E') (16.1±6.6 vs. 10.6±5.0) was significantly elevated as compared to event-free patients (p<0.001 for all comparisons). Also, in patients with the combined study endpoint, the Tei-Index was elevated (1.09 ± 0.39 vs. 0.86 ± 0.26, p<0.01), and a restrictive mitral filling pattern was more frequent (51.6 vs. 17.5%, p<0.001). However, stepwise multivariate analysis identified the mitral E/E'-ratio (p<0.0001) and the Tei-Index (p=0.019) as the only independent predictors of an event. In patients with mitral E/E'-ratio >12.5 or Tei-Index >0.90, outcome was poor.

Conclusion: In subjects with chronic CHF, the mitral E/E'-ratio is a stronger predictor of future cardiac events than conventional parameters of systolic, diastolic or overall LV performance. The E/E'-ratio may be a useful addition in the routine follow-up of such patients.

4:30 p.m.

823-3 Incremental Prognostic Value of the Doppler Echocardiographic Tei Index After Acute Myocardial Infarction: Comparison With N-Terminal Pro Brain Natriuretic Peptide

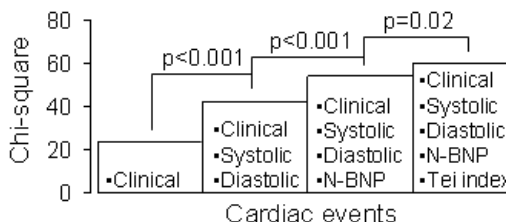
Betina Norager, Mirza Husic, Jacob Moller, Kenneth Egstrup, Svendborg Hospital, Svendborg, Denmark, Odense University Hospital, Odense, Denmark

Background: The prognostic value of N-terminal pro brain natriuretic peptide (N-BNP) in relation to combined systolic and diastolic left ventricular function is unknown. We investigated the prognostic value of the Doppler Tei index of combined systolic and diastolic performance in relation to N-BNP levels after acute myocardial infarction (AMI).

Methods: Doppler echocardiography and N-BNP were assessed in 127 consecutive patients with first AMI in the subacute phase. Tei index was calculated as the sum of isovolumic relaxation and contraction time divided by ejection time. Primary end point was a composite of cardiac death or readmission due to congestive heart failure or reinfarction.

Results: During follow-up of 26 ± 9 months, 14 patients died from cardiac causes, and 18 patients were readmitted due to reinfarction or congestive heart failure. Log N-BNP correlated with Tei index (r = 0.41, p < 0.0001). The incremental value of Tei index in predicting cardiac events was assessed in four modeling steps (Figure). Tei index improved the multivariate model including clinical variables (age, Killip class ≥ II on admission), systolic and diastolic variables (ejection fraction and mitral deceleration time ≤ 140 ms), and log N-BNP (change in chi-square from 54.1 to 59.5, p = 0.02).

Conclusions: Tei index is a potent predictor of cardiac events after AMI and provides prognostic information incremental to conventional measures of left ventricular systolic and diastolic function and N-BNP levels.



4:45 p.m.

823-4 Short Deceleration Time of Mitral Inflow E Velocity: Prognostic Implication With Atrial Fibrillation Versus Sinus Rhythm in Patients With Left Ventricular Systolic Dysfunction

Marcel Peltier, Mohamed Zoubidi, Michel Slama, Christophe Tribouilloy, South Hospital, Amiens, France

Background. Previous studies have demonstrated that a restrictive transmitral flow is strongly related to the prognosis in patients in sinus rhythm (SR) who have a broad spectrum of cardiac diseases. However, the prognostic value of mitral Doppler profile is unknown in patients with atrial fibrillation (AF), particularly in presence of left ventricular (LV) systolic dysfunction. The aim of this prospective study was to evaluate the contribution of an initially short deceleration time of mitral inflow E velocity (EDT) for predicting survival in patients with LV systolic dysfunction in AF and in SR.

Methods. The follow-up outcome of 140 consecutive patients with LV ejection fraction <40% was analyzed. Complete history, physical examination, and echocardiography were performed.

Results. Chronic AF was present in 40 patients (29%). During a mean follow-up of 26 ± 11 months, 54 patients died, 18 in the AF group and 36 in SR group. Mitral Doppler tracings of sufficient quality were obtained in all patients. LV ejection fraction was similar in the 2 groups (33% vs 31%) whereas EDT were shorter in AF group (150 ± 49 ms versus 176 ± 69 ms in SR group; p=0.033). At 2 years, estimated survival rates were similarly in both groups (74% in the AF group vs 75% in the SR group; p=0.89). Survival curves generated for different thresholds of EDT indicated significant worsening of prognosis for short-