

1002-79 TEE Assessment of Papillary Muscle Anatomy and Contraction in Patients With and Without Left Ventricular Hypertrophy

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Extremely few studies of human papillary muscle (PM) structure and function have been done using transthoracic echo, and none by TEE. In a prospective TEE study of 30 patients, 11 with LVH (LV wall thickness > 11 mm and LV mass > 140 g/m²) and 19 with no LVH, normal LV size and wall motion, we made the following transthoracic assessment: In the mid-papillary short axis view, end-diastolic (ED) and end-systolic (ES) cross-sectional area of both PMs were obtained. In the long axis view, ED and ES length of both PMs were obtained. Results are shown in table. Conclusions: 1. Improved quantitative assessment of papillary muscle morphology and function by TEE is feasible. 2. We provide the first TEE data on normal PM length and areas in systole and diastole. 3. In hypertensive hypertrophied LVs, PMs are hypertrophied, with larger cross-sectional areas; while PM length remains unchanged, PM shape changes (thicker) in such hearts. 4. PM area systolic fractional shortening is less in hypertrophied LVs than in normal LVs.

Mean Values of:	LVH (N = 11)		Normals (N = 15)	
	LVH	Normals	LVH	Normals
LV wall thickness (cm)	1.31	1.09**	1.31**	1.09**
LV mass (g/m ²)	178	133**	178	133**
	Anterior PM		Posterior PM	
	LVH	Normals	LVH	Normals
Cross section area, ED (cm ²)	1.79 ± 0.32	1.24 ± 0.30*	1.28 ± 0.33	0.84 ± 0.21*
Cross-section area, ES (cm ²)	2.17 ± 0.31	1.67 ± 0.24*	1.31 ± 0.22	1.09 ± 0.19*
% Increase	16.5 ± 7.2	27.3 ± 6.1*	8.4 ± 6.9	23.4 ± 8.0**
Length (L) ED (cm)	3.71 ± 0.43	3.66 ± 0.42	2.98 ± 0.29	2.81 ± 0.31
Length (L) ES (cm)	2.71 ± 0.45	2.68 ± 0.44	2.49 ± 0.28	2.41 ± 0.30
% Shortening	25.2 ± 8.1	27.1 ± 7.8	15.8 ± 5.6	14.6 ± 5.2
Shape: Area/L ² , ED	0.130 ± 0.03	0.092 ± 0.04	0.144 ± 0.02	0.106 ± 0.02*
Area/L ² , ES	0.295 ± 0.06	0.233 ± 0.05	0.244 ± 0.03	0.181 ± 0.03*

*p value < 0.05, **p value < 0.01

1002-80 Applicability of Transesophageal Imaging of the Flow Convergence Region for Evaluating Patent Ductus Arteriosus

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We imaged flow convergences to aid determination of the site of the aortic inlet of a PDA and as an aid to quantitation. In this study, we used matrix biplane transesophageal echocardiography (TEE) (Aloka 870) in 24 pts with isolated patent ductus arteriosus (PDA) with normal pulmonary artery (PA) pressures, (age: 3 mos-14 yrs; weight: 4-64 kg) during surgical PDA closure. By surgical measurement, the PDA diameters were: small (< 3 mm) in 6 pts; moderate (3-6 mm) in 10 pts; and large (> 6 mm) in 8 pts. In only 10 pts could the length of the ductus connecting to the PA be imaged clearly by TEE. However, for all cases a flow convergence region (FCR) was identified in either transverse (23) or longitudinal (20) plane TEE views while imaging in a leftward direction through the descending aorta toward the left PA and FCR was, thus, a very good marker for PDA. The maximum diameter of the FCR in either plane in the descending aorta in early diastole was less than 2 mm for small PDA's using a low aliasing velocity (AV) of 32 cm/sec; more than 4 mm for large PDA's using a high AV of 64 cm/s; and for the moderate-sized PDA's, the distance was in between (> 2 mm using an AV of 32 cm/s and < 4 mm at an AV of 64 cm/s). In 3 pts, FCR quantitation of volume flow correlated closely with measurements at cardiac catheterization and in another pt, continued flow acceleration after surgical ligation promoted further dissection, division and oversewing of an isolated PDA. Our method should be helpful in surgery, thorascopic ductus clipping and coil embolization under TEE guidance.

1002-81 Transcranial Contrast Doppler Improves Assessment of Significance of Patent Foramen Ovale in Divers With Decompression Sickness

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The presence of a patent foramen ovale (PFO) may contribute to the development of decompression sickness (DCS). The sensitivity of Transesophageal contrast echocardiography (TEE) is such that it might detect both physiologically significant and insignificant right-to-left shunts. We predicted that

transcranial Doppler sonographic monitoring (TCD) would be superior to TEE in detecting PFO associated DCS since TCD would detect a lesser number of insignificant PFO's. Twenty-six divers referred for evaluation of unexplained DCS were studied by contrast transthoracic echocardiography (TTE), TEE and TCD. Hand-agitated saline was injected into the right antecubital vein of patients or age- and sex-matched controls both before and after Valsalva maneuver. Studies were judged positive if 3 to 5 micro-bubbles were detected in the left atrium (TTE and TEE) within 3 cardiac cycles or if any microbubbles were detected in the middle cerebral artery (TCD) within 4 to 6 cardiac cycles. Results were as follows:

	No DCS	DCS	+PV	-PV
TTE	17% (5/30)	31% (8/26)	62%	58%
TEE	47% (14/30)	58% (15/26)	52%	59%
TCD	23% (7/30)	50% (13/26)	65%	67%

(n/n) = number positive/total number; PV = predictive value.

The incidence of PFO by TEE was similar for normal subjects as for divers with DCS. The detection of PFO by TCD, however, was approximately 2 times greater in the group with DCS. TCD had better positive and negative predictive values for detecting PFO's in DCS than TTE or TEE.

1002-82 Impact of Transesophageal Echocardiographic Detection of Intimal Tears on Operative Mortality in Acute Type A Aortic Dissection

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Because of the abrupt and serious progression, immediate diagnosis and adequate treatments including emergent operations are required in patients of acute Stanford type A aortic dissection. Although the usefulness of transesophageal echocardiography (TEE) has been established in patients of aortic dissection, it has limitation for diagnosing the exact location of intimal tear. To investigate the relationship between the sites of intimal tear diagnosed by pre-operative TEE and operative mortality, consecutive 73 patients with acute type A aortic dissection underwent emergent surgery were retrospectively studied. Pre-operative TEE findings were compared with the surgical and/or angiographic findings during or after surgical operation. TEE showed the high sensitivity for diagnosis of type A dissection (99%), however diagnostic sensitivity of the intimal tear was lower, 39% at aortic arch, 79% at ascending and 77% at descending aorta. Undetected tears were located in distal ascending aorta to proximal aortic arch "TEE dead angle" or located in just above the aortic ring and smaller sized (< 10 mm). Mortality was higher in the undetected tear cases, 3 of 9 cases (33%) at ascending aorta and 5 of 11 cases (46%) at aortic arch, compared to the detected cases, 4 of 33 cases (12%) at ascending aorta and one of 7 cases (14%) at aortic arch. In conclusion, prompt and correct diagnosis of intimal tears by pre-operative TEE is an important factor of operative mortality in the treatment of acute type A aortic dissection.

1002-83 Evaluation of Left Atrial Appendage Flow in Patients With Atrial Fibrillation: A Transesophageal Echocardiography Study With Intravenous Albumin-Contrast Agent

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To assess hemostasis in the left atrial appendage (LAA) in patients with atrial fibrillation (Af), we performed biplane transesophageal echocardiography (TEE) with an intravenous albumin-contrast agent (Albunex) in consecutive 57 patients (36 men, 21 women; age 72 ± 11 years). Subjects consisted of 24 patients with Af and 33 patients with sinus rhythm. Based on the degree of opacification in the LAA with Albunex (0.2 ml/kg), patients were classified into three groups. Those with rapid and complete opacification in the LAA with Albunex were classified as Group 1 (G1). Those with delayed and incomplete opacification in the LAA compared with the left atrial (LA) cavity were classified as Group 2 (G2). Those with no opacification in the LAA were classified as Group 3 (G3). Most of the patients with sinus rhythm were in G1 (21/33 [64%]). In contrast, patients with Af were in G2 (8/24 [33%]) or G3 (16/24 [67%]). No patients with Af were classified in G1. The incidence of LA

	G1 (n = 21)	G2 (n = 18)	G3 (n = 18)
LA thrombus	0 (0%)	0 (0%)	11 (61%)***
SEC	0 (0%)	4 (22%)	10 (56%)***
Cerebral embolism	3 (14%)	0 (0%)	10 (56%)***

*p < 0.01, **p < 0.001 vs G1; #p < 0.05, ##p < 0.001 vs G2.

thrombi, LA spontaneous echo contrast (SEC) and cerebral ischemic emboli was very high in G3.

Thus, this method can be used to classify patients with Af into subgroups, and to clarify those with a high risk of thromboembolism. We conclude that the absence of opacification in the LAA after Alburnex administration implies a high risk of LA thrombus and cardiogenic thromboembolism.

1002-84 Influence of Left Atrial Pressure on the Left Atrial Appendage Flow Velocity Pattern

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Transesophageal echocardiography was performed to evaluate the influence of the left atrial (LA) pressure on the atrial systolic forward left atrial appendage flow (LAA-A) velocity in 32 patients (pts) with various myocardial diseases and 30 normal controls. In all of the pts, the maximum LA diameter (LAD) and maximum LAA area (LAAa) correlated positively with mean pulmonary capillary wedge pressure (mPC) ($r = 0.52, p < 0.001$; $r = 0.56, p < 0.001$, respectively), but the amplitude of interatrial septal motion (IASa) and % area change of LAA (LAA-EF) during atrial systole correlated negatively with mPC ($r = -0.71, p < 0.0001$; $r = -0.74, p < 0.001$, respectively). The transmitral flow velocity (TMF) of 12 pts showed "pseudonormalization" pattern, and mPC was 18.1 ± 5.1 mmHg (Gr-A). The TMF of 20 pts showed "relaxation failure" pattern, and mPC was 9.0 ± 3.2 mmHg (Gr-B). The peak LAA-A velocity decreased significantly in Gr-A than in normal controls (33.0 ± 16.3 vs 54.2 ± 12.4 cm/s, $p < 0.0001$), but increased in Gr-B (68.6 ± 20.7 cm/s, $p < 0.01$). LAD and LAAa were significantly larger in Gr-A than in Gr-B. IASa and LAA-EF were significantly smaller in Gr-A than in Gr-B. We conclude that in cases with mild left ventricular diastolic dysfunction, LAA contractility and peak LAA-A flow velocity increased compensatorily, however, in the elevated LA pressure, those parameters decreased with enlarged LA and LAA, and that the stagnated LAA flow has a possibility for thrombus formation in LAA even in the pts with sinus rhythm.

1003 Cardiac Catheterization and Angiography

Wednesday, March 27, 1996, 9:00 a.m.-11:00 a.m.
Orange County Convention Center, Hall E
Presentation Hour: 9:00 a.m.-10:00 a.m.

1003-22 Diffuse Disease & Fractal Properties of Coronary Trees - A 3-Dimensional Study

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As opposed to stenosis evaluation in coronary artery disease, where commercial QCA systems achieve high quality performance, assessment of diffuse disease is still a problem. There is evidence that different measures of size (MS) and branching order of segments of a normal coronary artery are correlated on a logarithmic scale. Diffuse atherosclerosis affecting the epicardial vessels inhomogeneously increases random variance in MS in between segments resulting in a decrease of the logarithmic correlations. To quantify this process accurate 3-dimensional reconstructions of vascular trees from biplane angiograms were analyzed. Each reconstructed coronary (C) was decomposed into a set of subtrees (T) (average 13 T per C). The 'stems' and 'crowns' of the Ts were evaluated as to their diameter (D), length (L) and volume (V). The covariance of these 6 parameters in each C was then evaluated by product moment correlations (r). Sensitivity and specificity of the calculated r's in LCA was tested by variance analysis comparing a control group (N:n = 4), a group with visible b2izarre vessel changes (DCHD;n = 4) and a group with coronary artery disease without gross luminographic changes (CHD;n = 7).

Results table: Mean values and SD of correlations r with D of the stem as dependent variable along with F-values and p-values of a multivariate variance analysis in between groups are presented.

	V 'stem'	V 'crown'	D 'crown'	L 'crown'
N	0.529 ± 0.138	0.584 ± 0.119	0.776 ± 0.101	0.578 ± 0.123
CHD	0.330 ± 0.160	0.423 ± 0.127	0.703 ± 0.200	0.411 ± 0.127
DCHD	0.230 ± 0.161	0.276 ± 0.130	0.557 ± 0.182	0.263 ± 0.114
F-value	3.908	6.035	6.501	1.633
p-value	0.049	0.015	0.012	0.236

Conclusion: Correlation analysis of 3-D reconstructed coronaries in individual patients is able to discriminate controls, patients with moderate and

with severe disease. This technique is suitable to quantify progression of disease and is not restricted to an intraindividual comparison.

1003-23 Thrombin and Platelet Activation by Cardiac Catheterization Despite Aspirin

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The effect of left cardiac catheterization on the coagulation system is not well documented; as a result, heparin administration for this procedure is controversial. We investigated thrombin and platelet activity before and after routine left cardiac catheterization in 10 patients with stable ischemic heart disease (9 male, 50 ± 8 yrs) receiving antiplatelet (oral aspirin: 75-300 mg/day for at least 5 days) but not anticoagulant drugs. The plasma concentrations of prothrombin fragment 1.2 (F1.2, nmol/L), thrombin-antithrombin III (TAT, ug/L), fibrinopeptide A (FPA, ug/L) and the platelet-release product, beta-thromboglobulin (β -TG, ug/L), were measured from clean venipunctures performed before and after 0, 60 and 180 minutes from the end of the procedure. To avoid artifacts, specific antiplatelet and antithrombin agents were used in the sampling tubes. A significant increase in all measured factors was recorded immediately after the procedure, and up to 60 min for F1.2, compared with before or 3 hrs later (medians and interquartiles):

	Before	0 min	60 min	180 min
TAT	1.9 [1.5-2.8]	11* [7.9-17]	5.5 [4.8-6.5]	2.8 [2.1-4]
F1.2	0.7 [0.5-1.1]	1.2* [0.8-1.7]	1.0* [0.8-1.6]	0.6 [0.4-1.1]
FPA	1.1 [0.9-1.7]	2.4* [1.3-3.1]	ND	0.8 [0.6-0.9]
β -TG	ND	178* [87-200]	35 [29-74]	48 [21-85]

*p < 0.02 compared with before or 180 min. ND = not determined.

TAT levels correlated significantly with FPA ($p = 0.0003$), F1.2 ($p = 0.01$) and β -TG levels ($p = 0.04$).

Thus, routine left cardiac catheterization induces a transient, systemically-detectable, activation of coagulation and platelets, despite aspirin therapy. This suggests that thrombin-driven platelet agonism, not inhibited by aspirin, occurs and that prophylactic heparin should be considered.

1003-24 Lossy (15:1) Compression of Digital Coronary Angiograms Does Not Limit Detection of Subtle Morphologic Features

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Introduction: Digital coronary angiography has become increasingly common worldwide, replacing cinefilm in many centers. Lossy data compression allows for more practical storage and transfer of images, but possible degradative effects on detection of subtle angiographic abnormalities has not been explored.

Methods: A consensus panel of 3 angiographers identified abnormalities (coronary stents, dissections, and thrombus) in 50 digital angiographic sequences selected from 31 interventional procedures. Four additional angiographers individually reviewed a random presentation of the sequences both with and without the application of irreversible (lossy) JPEG data compression (15:1).

Results: Agreement of individuals with the consensus panel was high for interpretation of both original (Kappa = 0.75) and compressed (Kappa = 0.76) images, and was similar for identification of each type of abnormality (Kappa = 0.76 each for stent, thrombus, and dissection). Results of individual observer performance demonstrated very good agreement (Kappa = 0.90 for 1200 observations) between compressed and original images.

Conclusion: There is no significant loss in the ability to identify subtle morphologic features using lossy compression at 15:1. These data imply that lossy compression at this level may be applied to digital coronary angiograms to reduce storage and transmission requirements without sacrifice of important diagnostic information.

1003-25 Clinical Site Variability in Radiographic Imaging Parameters and Quality Assurance Standards

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Variability in radiographic imaging parameters among clinical sites may have an important effect on the overall film quality for angiographic restenosis trials. To address this issue we evaluated 46 cardiac catheterization laboratories within the United States and Canada. Using standardized phantoms,

WEDNESDAY POSTER