

surgical strategy in newborns with multiple left heart obstructive lesions. Particularly patients with moderate hypoplasia of the left ventricle and antegrade blood flow in the ascending aorta might have the opportunity to get biventricular repair after some months.

1059-34

**Transthoracic Echocardiography Is Superior to Transesophageal Imaging for Detection of Right to Left Atrial Shunting**

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**Background:** Agitated saline contrast echocardiography can be carried out either with transesophageal (TEE) or transthoracic (TTE) echocardiography for detection of right to left atrial shunting due to atrial septal defects (ASD) or patent foramen ovale (PFO). TEE is considered to be superior, and therefore to obviate the need for TTE for this purpose, but direct comparative studies are scarce.

**Methods:** Echocardiograms of 94 patients (38 Men; 56 Women; Age 18 - 84 Years; Mean Age 45 Years) who underwent a saline contrast study with both TEE and TTE during an 18-month study period were reviewed. TEE and TTE were performed less than 24 hours apart in 87 patients, and within a month in seven patients. All the studies were done both at rest and following the Valsalva maneuver. In 78 patients the studies were performed to exclude shunts in the setting of transient ischemic attack, strokes, or peripheral embolic events. In seven patients saline contrast was done to exclude shunt secondary to pulmonary hypertension. In the remaining nine patients the study was done due to right heart enlargement or based on clinical suspicion for right to left shunt.

**Results:** In 42 patients a right to left shunt was demonstrated on either TEE, TTE or both (35 had PFO, 5 had secundum ASD and 2 had sinus venosus ASD). In 19 patients both TEE and TTE disclosed right to left shunt, whereas in 21 patients a shunt was noted on TTE only (16/21 demonstrated atrial shunt only after a Valsalva maneuver) while two patients had shunt by TEE only. Both TEE and TTE identified shunts in all patients with ASD. Detection of PFO was better with TTE (33/35 or 91%) than with TEE (only 12/35 or 34 %). In 52 of 94 patients there was no evidence of right to left shunt either by TEE or TTE.

**Conclusion:** A TTE is the preferred approach for detection of right to left atrial shunt related to PFO as compared to a TEE, and both techniques are comparable in detection of shunting due to ASD. Inability to perform an effective Valsalva maneuver during TEE and relatively lower right heart pressures related to sedation and fasting state prior to TEE may explain the differences.

1059-35

**Echocardiographic Characteristics of Unrecognized Myocardial Infarctions in a Population Based Study**

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**Background:** Unrecognized Myocardial Infarction (UMI), in patients who do not seek medical attention, is commonly diagnosed by a surveillance ECG, and has not been studied by echocardiography. UMI has been shown to have a similar prognosis to recognized myocardial infarction (RMI). Therefore we examined the hypothesis that UMI and RMI patients would exhibit similar degrees of structural ventricular damage as assessed by echocardiography.

**Methods:** A population based random sample of 2042 Olmsted County residents, age  $\geq$  45 years, were studied by chart abstraction, ECG and echocardiogram. UMI (n=80) were diagnosed if ECG-MI criteria were met without the history of a documented myocardial infarction. RMI (n=101) were diagnosed if Gillum criteria were met. Echocardiographic data included Left Ventricular End Diastolic Dimension (LVEDD), Left Atrial Dimension (LAD), Left Ventricular Mass (LVMass), LV enlargement (LVE), Right Ventricular Enlargement (RVE), Ejection Fraction (EF), Regional Wall Motion Abnormalities (RWMA), Diastolic Dysfunction (DD) and echocardiographic significant Valvular Heart Disease (VHD).

**Results:** In bivariate analyses, RMI was markedly different from controls in terms of having higher LVEDD (5.4cm vs 4.9cm), LAD (4.4 cm), LVMass (222 g vs 182 g), lower mean EF (55 vs 63; O.R for EF  $<$ 40=11), higher prevalence of DD (O.R.4), RWMA (O.R. 29), VHD (O.R.4), LVE (O.R. 10) and RVE (p $<$ 0.0001 for all). By contrast, UMI was different from controls only in terms of having larger LAD (4.3 cm vs 3.9cm) and lower mean EF (60 vs 63) at p $<$ 0.05. After multivariable adjustment for age, sex, obesity, diabetes, hypertension and smoking, UMI patients were not significantly different from controls whereas RMI group continued to exhibit more abnormalities in LVE, EF, RWMA and LVMass (p $<$ 0.0001).

**Conclusion:** Whereas RMI patients manifest widespread structural abnormalities, UMI patients show only small differences from controls. These findings support the concept that non-recognition may be related to lesser degrees of ventricular injury. The similar prognosis after UMI and RMI cannot be explained by similar degrees of ventricular damage. Other explanatory factors will need to be identified.

1059-36

**Quantitative Regional and Global Right Ventricular Geometry in Health and Disease by Real-Time 3-D Echocardiography**

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**Background:** RV shape has been limited by 2-D methods, temporal and spatial artifacts in reconstructive data and the lack of quantitative regional and global measures of geometry. We describe an approach to quantify 3-D regional and global RV shape by using a shape-fitting algorithm. **Methods:** Real-Time TTE 3-D (SONOS 7500) was done in 43 patients with hypertensive RV disease and 22 individuals with normal RV. A full-volume

1059-32

**Failure to Rise Stroke Volume in Patients With Transposition of the Great Arteries After Atrial Switch Operation Is Due to Fixed Venous Return**

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**Background:** Patients with transposition of the great arteries after atrial switch operation lack the ability to rise stroke volume during exercise. It is unclear whether this is due to a failure of the right ventricular myocardium that life long has to tolerate systemic ventricular load, or whether this is due to the fixed venous return through the non-compliant surgical baffles in the atrium.

**Patients and Methods:** Twelve patients (age  $21.1 \pm 3.8$  years, 3 females) after atrial switch operation (TGA) were compared to 8 patients (age  $34.5 \pm 17.4$  years, 2 females) with congenitally corrected transposition of the great arteries (CCTGA) who have the burden of a systemic load on the right ventricle in the absence of atrial baffles. Both groups did not differ significantly concerning age, weight, length, body mass index, peak oxygen uptake in a cardiopulmonary exercise test, and quality of life scales obtained from the SF-36 questionnaire did not differ significantly.

In all patients stroke volume was measured in the aorta with velocity encoded cine magnetic resonance imaging both at rest and with  $10 \mu\text{g/kg/min}$  dobutamine. Right ventricular end-systolic and end-diastolic volume was measured from ECG triggered balanced fast field echo sequences.

**Results:** Although both groups increase cardiac output with dobutamine similarly, CCTGA patients could raise aortic stroke volume by a factor of  $1.25 \pm 0.30$ , whereas TGA patients failed to do so (factor  $1.00 \pm 0.15$ , p = 0.047). TGA patients had to increase heart rate more than those with CCTGA (factor  $1.52 \pm 0.26$  versus  $1.23 \pm 0.20$ , p = 0.020). This failure to rise stroke volume in TGA patients was due to a decrease in end-diastolic right ventricular volume (p=0.012), despite an increase of right ventricular ejection fraction (p=0.010). In contrast CCTGA had no change in end-diastolic volume (p=0.327) and also an increase in ejection fraction (0.036).

There were no differences between Mustard or Senning repair in the TGA group. **Conclusion:** The well known inability of patients after atrial switch operation to raise their stroke volume during stress is due to a fixed venous return through the surgically created atrial baffle and not due to right ventricular muscle failure.

1059-33

**Left Atrial Enlargement as a Marker for Cardiac Disease: Teaching One Simple Measure for Point-of-Care Ultrasound Screening**

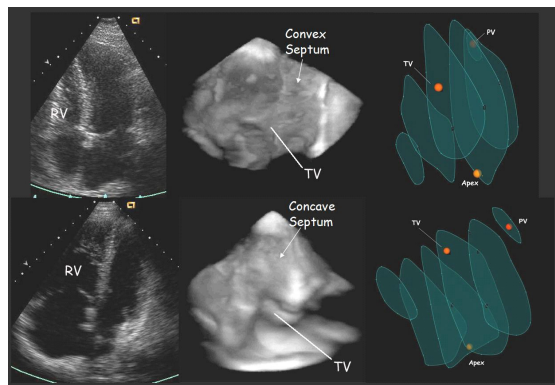
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**BACKGROUND:** Left atrial(LA) enlargement is associated with many cardiac disorders, is readily detectable by "point-of-care" ultrasound examination, and could identify those patients who require further evaluation. To better understand the potential of this single measurement for screening, we first evaluated LA size and its relation to the presence of any significant echo finding and then assessed a simple method to teach physicians unfamiliar with echo to detect LA enlargement. **METHODS:** We analyzed 500 consecutive outpt echo studies for LA dimension (by parasternal M-mode) and whether the echo contained any significant finding. The prevalence of, and likelihood ratios(LR) for, an abnormal echo were calculated at increasing thresholds of LA size. Subsequently, the ability of resident physicians (n=26) to use a 40mm circular marker to assess the LA size was tested on video-looped parasternal images from 13 pts. **RESULTS:** Of 500 echo studies, LA size ranged 24-69mm, median 38mm. Prevalence of an abnormal echo was 43% overall and higher when LA>40mm v. LA<=40mm (69% v. 29%, p<0.05). In the 13 test cases, resident sensitivity, specificity, and accuracy was 65%, 96% and 79% for LA sizes >40mm. For LA size subgroups of 30-40mm (n=6), 41-50mm(n=4) and 51-61mm (n=3), accuracy was 96%, 47%, and 87%. **CONCLUSION:** The likelihood of a cardiac abnormality increases with LA size. Noncardiologists can be easily taught to discriminate LA sizes of clinical value using a simple instructional method.

LA Size Thresholds and Likelihood of Abnormal Echo

Threshold	LA<=30mm	LA<=40mm	LA>40mm	LA>50mm
N= (500)	56	322	178	30
%abnl echo	11%	29%	69%	97%
LR	0.16	0.55	2.9	4000

data of the RV was acquired from an apical transducer position. The data were analyzed offline utilizing full volume algorithms (TomTec). The RV was planimetered in coronal, sagittal and transverse planes at end-diastole. A relative "cast" was constructed of the RV and analyzed for shape (ref: Marcus et al. JASE 2000;13:186): **global descriptors** - spatial distances between the TV, free wall, AP and PV, **regional descriptors** - average curvature (avC) of contours in orthogonal planes. **Results:** Global shape of abnormal RV showed significant (p<0.0001, vs normal RV) elongations of the TV-free wall and PV-AP distances (coronal plane, Fig.), increase in the angulation of the PV-AP relationship (sagittal plane, Fig.) and an increase in the SAX area (transverse plane); avC of the apex (coronal plane) and the RV inflow (transverse plane) was significantly different from the normal RV (p<0.0001). *Detailed measures will be presented.* **Conclusions:** Real-time global and regional RV shape can be measured by 3-D Echo, which may be a better approach for the diagnosis and monitoring of RV deformity and dysfunction .



Noon

**1059-37 Prognostic Role of Transesophageal Echocardiography in Acute Type A Aortic Dissection**

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**Background:** The prognostic role of transesophageal echocardiography (TEE) beyond that provided by clinical risk factors in acute type A aortic dissection (AAD) patients (pts) is not known. **Methods:** We studied 675 AAD pts enrolled in the International Registry of Acute Aortic Dissection. Multivariate logistic regression analysis was used to identify independent associations of in-hospital mortality first using clinical variables found to have marginal association with death on univariate testing (Model 1). The TEE information was then added to build a final model (Model 2). **Results:** In-hospital death occurred in 28.7% of pts. TEE evidence of pericardial effusion (p=0.04), tamponade (p<0.01), peri-aortic hematoma (p=0.02) and patent false lumen (p=0.08) were more frequent in pts who died than those who lived. In contrast, the presence on TEE of dilated ascending aorta (p=0.03), dissection localized to ascending aorta (p=0.02) and thrombosed false lumen (p=0.08) was less common in pts who died. Model 1 identified age ≥70 years, pulse deficit, renal failure, and hypotension/shock as independent predictors of death (with abrupt onset of pain and abnormal ECG showing a trend). Model 2 identified pericardial tamponade to be independently associated with death (OR 2.7, 95% CI 1.1-6.5), while dissection flap confined to ascending aorta (OR 0.2, 95% CI 0.1-0.6) and complete thrombosis of false lumen (OR 0.15, 95% CI 0.03-0.86) were protective. Age, renal failure and abnormal ECG lost their predictive significance for death in Model 2. Addition of TEE information improved the discriminatory power of the prediction model (c-index Model 1=0.74 and Model 2=0.78). **Conclusion:** In addition to confirming the diagnosis and location of AAD, TEE provides prognostic information above and beyond that provided by the clinical risk variables.

Noon

**1059-38 Polar Map Visualization of Left Ventricular Electromechanical Asynchrony**

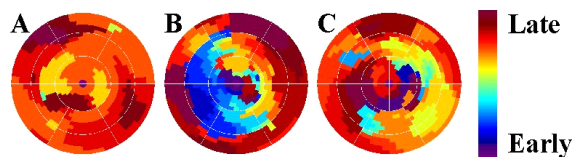
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**Background:** Recent attention for asynchronous left ventricular (LV) contraction in left bundle branch block (LBBB) generates the need for synchrony assessment. A system is described for quantitation of electromechanical LV contraction synchrony by three-dimensional echo-cardiography (3DE) and semi-automatic endocardial contour detection. **Methods:** Eighteen consecutive patients (age 64 ± 15 yrs, 8 female, ejection fraction 38 ± 17%, QRS duration 134 ± 40 ms) underwent transoesophageal, rotational 3DE using an HP SONOS 5500 with built-in 3D acquisition software. Using offline TomTec 4DLV analysis™ software with semi-automatic contour detection, 3D endocardial surfaces were reconstructed. Regional distances to the end-diastolic LV center of gravity were calculated throughout the cardiac cycle. Timing was defined as time between electrocardiographic R-wave and moment of minimal distance for each LV surface point. Dispersion, a

measure of asynchrony, was defined as standard deviation of timing. Polar maps were generated to visualise synchrony by homo- or heterogeneity of their colors. Measurements were repeated to assess reproducibility.

**Results:** See figures. A, normal; B, LBBB; C, Biventricular pacing. Bland-Altman intra-observer variability: timing: -4 ± 130 ms; dispersion: 21 ± 50 ms (mean ± 2SD, segmental level).

**Conclusions:** The combination of 3DE with semi-automatic contour detection enables accurate quantitation and visualisation of LV electromechanical contraction synchrony.



Noon

**1059-39 Mastering Cardiac Auscultation: The Power of Repetition**

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**Background**  
The ability of medical students and residents to recognize heart sounds is poor (~21%) and does not improve with lecture interventions. We tested the hypothesis that cardiac auscultation is a technical skill that requires repetition for mastery. Using a computer program with simulated heart sounds, we studied the efficacy of 400 repetitions of 6 heart sounds and murmurs on the ability of medical students to recognize these sounds.

**Methods:**  
A total of 42 third year medical students was included in this study. Simulated heart sounds were digitally enhanced to optimize clarity and recorded onto a compact disc (CD) which the subjects listened to twice. Subjects listened to a total of 400 repetitions of each of 4 basic cardiac murmurs of left sided valvular lesions (AS, MR, AR, MS) and 2 extra heart sounds (S3, S4). Two tests of auscultatory proficiency were administered: a pretest before the intervention and a posttest after the intervention. At both tests, subjects listened to prerecorded heart sounds in a randomized sequence and wrote the name of the sound on blank answer sheets.

**Results:**  
The baseline proficiency score was 30.7 ± 17.3% (Mean ±SD) and increased significantly to 76.7 ± 18.4 % on the posttest (p<0.001). The average improvement was 46.4 ± 25.5 points.

**Conclusions:**  
Four hundred repetitions of simulated heart sounds significantly improved cardiac auscultation proficiency in medical students. The use of intensive repetition of simulated heart sounds can produce dramatic improvement in this neglected clinical skill. These results suggest that cardiac auscultation is, in part, a technical skill that requires intensive repetition for mastery. This concept has not been applied to the traditional teaching of cardiac auscultation.

Noon

**1059-40 Women in Cardiology: Bridging the Gender Gap**

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Women are significantly under-represented in cardiology (cardiol). Although recently, the number (#) of female med school grads has increased substantially, no prior study has determined whether the # of women entering cardiol training has shown a similar change.

**Methods:** To address this issue, subgroup analyses of the American Medical Association database on postgrad medical education from 1992 to 2001 were performed. The pattern of growth of women in cardiol was assessed and compared to that of other fields and the entire group.

**Results:** See table. Although 28 fields were studied, results are displayed only for the entire group, cardiol and fields with the largest absolute # women or largest growth in the % women. From 1992-2001 the % women in cardiol training rose from 9.8 to 15.5 % ( 59 % increase). The pattern (linear) and rate of rise did not differ significantly from those for the entire group. However the rate of rise lagged behind many other groups especially ob-gyn, family practice and neurology. Further, even in 2001 the % women in cardiol training was << all other medical and most surgical subspecialties.

**Conclusions:** There has been substantial growth in the % women in cardiol training which parallels the overall increase in women in postgrad medical training. However, cardiol lags significantly behind other disciplines especially ob-gyn, and remains one of the areas with the lowest % women. These results have implications for professional initiatives designed to ensure an adequate cardiology workforce.