Abstracts

Oral presentations

1 NON-COMPACTION OF VENTRICULAR MYOCARDIUM, CLINICAL AND ECHOCARDIOGRAPHIC FEATURES OF 8 CASES
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Non-compaction of the ventricular myocardium (NVM) is a rare cardiomyopathy characterized by prominent trabeculations and deep intertrabecular recesses. In this study 8 cases of NVM were evaluated prospectively. The age of presentation ranged from birth to 10 months. Male to female ratio was 1:3. Clinical presentation was variable; one asymptomatic infant (patient 1) was identified incidentally because of associated patent ductus arteriosus. One infant (patient 2) presented with mild congestive heart failure attributed to associated multiple ventricular septal defects and three patients with isolated NVM (patients 3, 4 and 5) presented with heart failure. In a further three patients (patients 6, 7 and 8) NVM was associated with complex cyanotic congenital heart disease. In all patients diagnosis was confirmed echocardiographically by calculating a ratio of non-compacted to compacted layer thickness of 2 or more. In patients 1 and 2 the ventricular function was normal while it was impaired in the others. Short-term outcome reflected the heterogeneous nature of the disease; patient 1 is doing well with a normal ventricular function, patient 2 showed clinical improvement of congestive heart failure. Patient 3 died with severe myocardial dysfunction at the age of 7 days. Patients 4 and 5 are alive with severely impaired function. Patient 6 died with ventricular arrhythmia following a Blalock-Taussing shunt insertion. Patients 7 and 8 are alive with impaired myocardial function.

NVM may not be as rare as is thought. It should be considered in infants presenting with either congenital heart disease or cardiomyopathy in whom the echocardiographic features suggest excessively prominent trabeculations with or without left ventricular dysfunctio.

2 PREDICTION OF SYMPTOM ONSET IN AORTIC STENOSIS: BASELINE AND SERIAL ECHOCARDIOGRAPHY IN 97 PATIENTS
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Background: It remains unclear which echocardiographic variables are of prognostic significance in asymptomatic aortic stenosis (AS). This prospective study aimed to identify variables from baseline and serial echocardiography that differed in patients who subsequently develop symptoms.

Methods: 97 patients aged 65 years (range 27–81) were studied. All denied symptoms and had normal left ventricular systolic function. A transthoracic echocardiographic study was made at baseline and during BVP. Temporary BVP from RV and 2 different LV lead positions (TDI) was used to assess the effects of different LV lead positions and interventricular pacing interval (IPI) have yet to be established. Tissue Doppler imaging (TDI) was used to assess the effects of different LV lead positions and IPIs on regional LV systolic function.

Methods: 9 patients (age 74±7 years; 4 with ischaemic heart disease and 5 with dilated cardiomyopathy) with chronic HF (NYHA III–IV, LVEF <30%) and LBBB (QRS 169±22ms) were studied. Pulsed wave TDI were measured at the level of the mitral valve annulus at baseline and during BVP. Temporary BVP from RV and 2 different LV positions at 5 IPIs were examined: RV-LV intervals were set at +80, +40, 0, –40 and –80ms with reference to RV pacing. LV pacing was performed from the lateral (n=9) and the inferoposterior walls (n=7).

Results: Mean follow up was 20 months (range 3–50). 80 patients had 2 or more echocardiograms. 24 patients developed symptoms and 73 remained asymptomatic. Peak aortic velocity and mean resistance were significantly greater for patients developing symptoms whilst EOA and left ventricular long axis excursion (LAE) were lower. There were no differences in rate of change of peak aortic velocity or EOA.

Conclusion: Baseline effective orifice area, peak aortic velocity, mean resistance and left ventricular long axis function were significantly different in patients with AS who became symptomatic. However, the rate of change of peak velocity and EOA did not have prognostic significance.

3 CARDIAC CAVITY SIZE INDEX TO DIAMETER OF THE SUBAORTIC ANNULUS
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Introduction: The aortic velocity integral remains constant during growth in childhood. This suggests that the aorta grows to accommodate the change in cardiac output necessary for the metabolic demands of the body. It may be logical to use the size of the aorta as a physiological index in place of body surface area.

Methods: We therefore assessed aortic size and left ventricular structure in 215 healthy children (112 boys and 103 girls), aged between 8 and 9 years. Echocardiograms were performed with an Acuson 128 XP system using a 3.5 MHz probe. Cavity dimensions were averaged over 5 consecutive cardiac cycles using the ASE convention.

Results: There were wide differences in height (115–157 cm) and weight (20.0–55.8 kg). Left atrial diameter ranged between (LA 1.60–3.09 cm) and left ventricular diastolic diameter between (LVDd 3.35–4.83 cm). Both left atrial and left ventricular diameters were correlated with body surface area: LA (r=0.502, p=0.001), LVDd (r=0.632, p<0.001). These were similar correlation with subaortic annulus diameter: LA (r=0.365, p<0.001), LVDd (r=0.530, p<0.001). The correlations with body surface area were no longer apparent after indexing the raw dimension to subaortic annulus diameter: LA/annulus (r=0.109, p=0.10), LVDd/annulus (r=0.144, p=0.05).

Conclusion: Indexing to subaortic annulus diameter is a simple and convenient method of adjusting cardiac chambers for body size during childhood and this may be a clinically useful alternative to indexing to body surface area.

4 BIVENTRICULAR PACING: THE EFFECTS OF LEAD POSITION AND PACING INTERVALS ON CARDIAC PERFORMANCE
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Introduction: In patients with heart failure (HF) and left bundle branch block (LBBB), left ventricular (LV) asynchrony contributes to systolic impairment. Biventricular pacing (BVP) is now an established treatment, however, the optimal LV lead position and interventricular pacing interval (IPI) have yet to be established. Tissue Doppler imaging (TDI) was used to assess the effects of different LV lead positions and IPIs on regional LV systolic function.

Methods: 9 patients (age 74±7 years; 4 with ischaemic heart disease and 5 with dilated cardiomyopathy) with chronic HF (NYHA III–IV, LVEF <30%) and LBBB (QRS 169±22ms) were studied. Pulsed wave TDI were measured at the level of the mitral valve annulus at baseline and during BVP. Temporary BVP from RV and 2 different LV positions at 5 IPIs were examined: RV-LV intervals were set at +80, +40, 0, –40 and –80ms with reference to RV pacing. LV pacing was performed from the lateral (n=9) and the inferoposterior walls (n=7).
**Echocardiographic Characteristics of Moderate or Severe Aortic Stenosis? Dobutamine Stress Echocardiography**

**Background:** Routine echo can detect mechanical evidence of interventricular, atriointerventricular and LV evidence of dyssynchrony associated with LBBB.

**Methods:** Dobutamine stress echocardiography (DSE) is a routine investigation to assess for the presence of reversible myocardial ischaemia. However, there are instances where the patient’s symptoms are reproduced despite the absence of any wall motion abnormality. It is in this subgroup of patients that left ventricular cavity dynamics were further assessed in response to stress. 59 patients had a DSE over a 5-month period, utilising a graded DSE protocol. 18 were positive and 41 negative for wall motion abnormalities. In 5 out of 20 patients with reproduction of their symptoms but normal wall motion, marked systolic cavity obliteration was noted at peak stress. In these patients, continuous wave Doppler (CW) was performed to evaluate intracavity gradients (ICG) or for left ventricular outflow tract obstruction (LVOTO). CW monitoring was also continued during recovery. Baseline characteristics of these 5 patients: 2 male, 3 female, av. age 54 (range 35-65), LVEF-normal [average (LVEF)] 46±5%, LVH and the development or degree of any ICG or LVOTO. We recommend the monitoring such left ventricular dynamics in these patients.

**Results:** Systolic velocities for septum at RV-LV 0, −40 and −80ms and posterior wall at −80ms were significantly reduced from baseline with both LV pacing sites. Neither LV pacing site nor IPI significantly altered lateral or RV wall systolic velocities.

**Conclusion:** During DVP, septal and posterior wall systolic velocities are increased irrespective of LV pacing site. Greatest improvement in LV systolic function occurs when LV precedes RV pacing.

**Echocardiographic Characteristics of Dyssynchrony Caused by Left Bundle Branch Block in Patients Undergoing Cardiac Resynchronisation Pacing**

**Background:** There is convincing evidence that cardiac resynchronisation pacing (CRT) reduces morbidity in patients with class III/IV heart failure, left ventricular ejection (LVEF) ≤35% and significantly worse WMSI, LVEF and CO than group B. In these CRT patients, interventricular dyssynchrony was detected as left sided pre-ejection delays of 50±23 ms. Atrioventricular dyssynchrony was manifest as presystolic mitral regurgitation in 56% and as a uniphasic mitral Doppler inflow due to e/a fusion in 50%. LV dyssynchrony was seen with an average of 6.7±3.7 LV segments showing paradoxical contraction, particularly in the 4 and 3 chamber views. 14/16 group A patients, compared to 3/15 group B patients exhibited significant paradoxical LV contraction.

**Conclusion:** Routine echo can detect mechanical evidence of interventricular, atriointerventricular and LV evidence of dyssynchrony associated with LBBB.

**Detection of Symptomatic Left Ventricular Intracavity Gradients During Dobutamine Stress Echocardiography**

**Background:** Distinguishing moderate from severe aortic stenosis (AS) in patients with mild symptoms can be difficult. Previous studies suggested that dobutamine stress echocardiography could help identify severe AS. We compared resting measures and the mean pressure drop/flow slope (PFS) to surgical findings.

**Methods:** Dobutamine was infused in increments of 5 mcg/kg/min to a maximum of 40 mcg/kg/min. Doppler studies were repeated at each stage. Transaortic flow at each stage was plotted against mean pressure drop and the PFS derived from the linear regression equation. The anatomic degree of stenosis that may account for the patient’s symptoms if wall motion is normal. In 25% of patients (i.e. 5 out of 20) with a negative but symptomatic DSE, these haemodynamic anomalies were identified. There appeared to be no correlation between the presence and degree of LVEF and the development or degree of any ICG or LVOTO. We recommend the monitoring such left ventricular dynamics in these patients.

**Results:** Group A patients had mean LV diastolic diameters of 6.4±3.1 cm and significantly worse WMSI, LVEF and CO than group B. In these CRT patients, interventricular dyssynchrony was detected as left sided pre-ejection delays of 50±23 ms. Atrioventricular dyssynchrony was manifest as presystolic mitral regurgitation in 56% and as a uniphasic mitral Doppler inflow due to e/a fusion in 50%. LV dyssynchrony was seen with an average of 6.7±3.7 LV segments showing paradoxical contraction, particularly in the 4 and 3 chamber
BRAIN NATRIURETIC PEPTIDE IS A USEFUL MARKER OF LEFT VENTRICULAR DYSFUNCTION FOLLOWING MITRAL VALVE REPAIR

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Background: Following successful mitral valve repair surgery, even mild left ventricular (LV) dysfunction carries a poor prognosis. One of the most powerful predictors of this is reduced pre-operative ejection fraction (EF). We assessed the role of baseline Brain Natriuretic Peptide (BNP) as an additional marker of LV dysfunction 6 months following mitral repair.

Methods: 33 patients had pre-operative N-terminal pro-BNP measured using a commercial enzyme-linked immunosorbent assay. All patients had severe mitral regurgitation (Regurgitant fraction >55%) due to degenerative valve disease. Patients with hypertension, previous myocardial infarction, renal or hepatic disease were excluded. Patients who had peri-operative infection or unsuccessful repair as evaluated by a pre-discharge echocardiogram were also excluded. LV EF was calculated by biplane method of discs immediately prior to surgery and repeated after 6 months. An EF of <50% was considered significant.

Results: Baseline patient data was as follows: mean (SD) age 62 (13) years, 73% sinus rhythm and 3 patients with concomitant coronary disease. Mean (SD) BNP was 255 (236) fmol/ml. Post-operative EF was significantly less than at baseline (mean [SD] 60[8]% vs 52[11]% respectively; p<0.001). At 6 month follow-up 1 patient died and 11 had an EF<50%. In the post-operative LV dysfunction group, baseline BNP concentration was significantly greater and pre-operative EF was significantly lower (mean [SD] 420 (298) vs 169 (148) fmol/ml for BNP, p=0.021 and 62(1)% vs 55(3)% for EF, p=0.039). Log(BNP) was inversely associated with post-operative EF, independent of age and baseline EF in a multiple regression model (R²=0.468, p=0.047).

Conclusion: BNP has incremental value in the prediction of LV dysfunction following successful mitral repair surgery for degenerative valve disease.

OBJECTIVE ASSESSMENT OF PULMONARY REGURGITATION IN REPAIRED TETRALOGY OF FALLOT PATIENTS

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Introduction: The presence and severity of pulmonary regurgitation (PR) in repaired tetralogy of fallot (rTOF) patients has been shown to be a factor in the reduced exercise performance experienced by these patients. Patients with restrictive right ventricular (RV) physiology have reduced PR therefore improved exercise haemodynamics. Apart from MIRI there is no easily accessible non-invasive method of assessing the severity. We therefore looked at a group of adult rTOF patients with a view to defining a simple measurement to assess severity.

Methods: All patients underwent echocardiography prior to cardio-pulmonary exercise testing. Images were digitally stored & analysed off line. Peak PR velocity (v), acceleration time (ac.t), deceleration time (dt), deceleration slope [dv/dt] and pressure half time [p1/2t] were measured & averaged from 3 cardiac cycles. Restrictive (R-) RV physiology was defined as antegrade flow in the pulmonary artery coinciding with atrial systole.

Results: As expressed mean (±SD). 26 rTOF subjects (31.08±9.42yrs) were investigated of which 13 had R-RV physiology. Peak PR v was reduced in the R-RV group [1.60±0.59 m/s, 1.98±0.33 m/s, p<0.04]. There was no significant difference in dt, dv/dt or p1/2t between the groups. Peak PR v correlated with peak oxygen consumption [VO2] (r=−0.4, p<0.04) & cardiac reserve (r=−0.5, p<0.02). dv/dt correlated with exercise time (r=−0.5, p<0.01), peak VO2 (r=−0.5, p<0.02), peak cardiac output (r=−0.6, p<0.01) & cardiac output reserve (r=−0.7, p<0.01). dt correlated with peak cardiac output (r=0.4, p<0.05) and p1/2t with rest & percentage predicted heart rate (r=−0.6, p<0.01 & r=−0.4, p<0.05 respectively.

Conclusion: The reduction in peak PR v along with the negative correlation with peak VO2 & cardiac reserve confirm the superior exercise haemodynamics experienced by the restrictive group. Deceleration slope and pressure halftime are independent of RV diastolic physiology yet both correlate significantly with exercise haemodynamics. This may prove an invaluable measurement in the continual assessment of these patients.

THE IMPACT OF DOBUTAMINE STRESS ECHOCARDIOGRAPHY (DSE) RESULTS ON PATIENT MANAGEMENT: DOES A POSITIVE DSE LEAD TO SUBSEQUENT INTERVENTION?

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DSE is a well-established technique for detecting reversible ischaemia and viable myocardium. However, the impact of a DSE result on patient management is less well documented. We performed a retrospective analysis of all patients undergoing a DSE over a 14-month period (April 2000-June 2001) at our institution. This was facilitated by utilising the Enconcert digital echocardiography storage system coupled with the search program Crystal Reports. In all patients undergoing a DSE, a search of the angiography database was also performed. In those not having angiography after a positive DSE, case notes were reviewed. 114 DSE were performed. 55 positive, 59 negative. Of the 55 positive DSE, 44 had angiography – 10 were part of a PMR trial and not included in this analysis. The DSE correctly predicted the territory of significant angiographic stenosis in 21/34. A positive DSE led to percutaneous intervention on the correctly identified lesion in 16/21 (76%). Of the remaining 13 positive DSE, there was discordance between the DSE predicted territory and angiographic findings in 8 and 5 (14.7%) had a normal angiogram. 9 had a negative DSE with subsequent angiography – 5 were normal, 4 had significant single vessel disease (SVD) but no intervention was performed in light of the DSE result. A positive DSE led to revascularisation (PCI or CABG) in 19/34 (56%). Of the remainder most lesions were considered inappropriate for intervention or no longer clinically indicated. In conclusion, a positive DSE had a significant impact on patient management leading to revascularisation in just over half the cases. Conversely, where the DSE did not detect significant SVD, the result dictated that no intervention was undertaken. Finally, in three quarters of the cases where the DSE confirmed the physiological presence of a lesion, intervention was undertaken to that lesion.

HOW DO AGE AND HEART RATE AFFECT REGIONAL SYSTOLIC AND DIASTOLIC MYOCARDIAL FUNCTION?

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Background: Tissue Doppler echocardiography (TDE) allows the non-invasive and objective assessment of regional left and right ventricular systolic and diastolic function, enabling subtle changes to be measured. Global left ventricular diastolic function, classically measured by transmital pulsed wave Doppler flow, reduces with increasing age. It is not known whether this occurs uniformly across different myocardial territories. Systolic velocities are not thought to be normally influenced by the ageing process but do increase with heart rate.

Methods: 60 volunteers aged 20 to 80 were studied. All had normal ECGs and 2D echocardiograms and were not on any medications. Pulsed wave TDE images were obtained from the apical echocardiographic window and systolic (S) and early diastolic (E) myocardial velocities were measured at the septal (sep), lateral (lat) and inferior (inf) aspects of the mitral valve annulus and the free wall of the tricuspid annulus (RV).

Results: Heart rates varied between 55 and 100 beats per minute. Correlation coefficients (r) for the relationship between S and E velocities with age: sep(S) r=−0.40, p=0.003; sep(E) r=−0.73, p<0.0001; lat(S) r=−0.26, p=0.06; lat(E) r=−0.71, p<0.0001; inf(S) r=−0.25, p=0.06; inf(E) r=−0.79, p<0.0001; RV(S) r=0.10, p=0.5; RV(E) r=−0.38, p=0.0039. Correlation coefficients (r) for regional velocities as a function of heart rate in normals: sep(S) r=0.5, p<0.0001; sep(E) r=0.60, p=0.6; lat(S) r=0.21, p=0.1; lat(E) r=0.13, p=0.3; inf(S) r=0.25, p=0.06; inf(E) r=0.07, p=0.6; RV(S) r=0.42, p=0.001; RV(E) r=0.2, p=0.2.

Conclusions: In contrast to current thinking, left ventricular systolic function does in fact subtly decrease with normal ageing. This reduction is not apparent in the right ventricle. Hence, in the assessment of regional systolic function, both age and heart rate must be taken into account. Normal heart rate variation does not influence regional diastolic velocities and the changes seen with age appear to occur in a uniform fashion.
12 DISTURBANCE OF CARDIAC AND LARGE ARTERY FUNCTION IN HEART FAILURE.

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It has been proposed that altered pressure wave reflection, due to abnormalities of large artery function, could contribute to impaired cardiac function in heart failure (HF). Wave intensity analysis (WIA) is a recently described non-invasive technique that provides information on the working state of the heart, wave reflections and arterio-ventricular interaction. Wave intensity is a measure of the energy carried by a wave and is the product of instantaneous changes in pressure and flow velocity at any arterial site. We used WIA to investigate the possibility of altered wave reflection and to further understand the haemodynamic changes that occur in HF. 29 patients with HF (NYHA class II-III, mean EF 35%) were compared to 29 age-matched subjects (60±19yrs) with normal systolic function (N). Brachial blood pressure, carotid arterial pressure (P) and flow velocity (U) were measured by sphygmomanometry, tonometry and pulse contour analysis respectively. The intensities of forward and backward waves and carotid pulse wave velocity (c) were calculated. Data are means ± SD, p was calculated by Student’s t-test. P was lower in the HF group [129±21 (N); 120±24mmHg (HF); p=0.10]. c did not differ [13.6±5.5 (N); 13.2±5.3ms-1 (HF)], suggesting that the elastic properties of the artery were unchanged. Peak U was significantly reduced in the heart failure group [0.70±0.15 (N); 0.56±0.17ms-1 (HF); p=0.006]. Ventricular wave power was dramatically reduced in HF [29.2±8.9 (N); 15.4±7.7Wm2 (HF); p=0.00001], as were wave work [323±80 (N); 124±66Jm-2 (HF); p<0.0001]. Wave reflection from the head [15.3±7.5 (N); 17.5±11.7% (HF); p=0.08] and the body [1.5±1.7 (N); 5.4±1.6% (HF), p=0.001] were increased in the HF group. Heart failure is associated with a dramatic impairment in the ability of the heart to generate pressure waves. In addition wave reflection is increased, consistent with widespread vasoconstriction. This places an additional load on the ventricle that may further impair its function. WIA is a novel, simple way of providing important haemodynamic information in heart failure.

13 TRANSCRANIAL DOPPLER OR TRANSOESOPHAGEAL ECHOCARDIOGRAPHY FOR THE DETECTION OF VENOUS-TO-ARTERIAL CIRCULATION SHUNTS

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Background: Contrast transcranial Doppler ultrasound (TCD) is simple, non-invasive and detects both cardiac and pulmonary veno-arterial circulatory shunts (v-aCS). We compared the TCD detection of v-aCS with transcranial Doppler echocardiography (TOE) for patent foramen ovale (PFO).

Methods: We studied 39 patients aged 15–39 following ischaemic stroke (33) or myocardial infarction (6). Standardised TCD was performed 2 weeks before “simultaneous” TCD and TOE. Agitated saline contrast was injected intravenously twice at rest and twice each with cough and Valsalva provocation. In standardised TCD, the patient sat up and the Valsalva manoeuvre was to a pressure of 40 mmHg for five seconds immediately after contrast injection. During the “simultaneous” TCD and TOE the patient was in the left lateral position, coughing was difficult and Valsalva was by epigastric pressure.

Results: On TOE, 16 of the 39 patients had a PFO, all also having more than 15 microbubble emboli on TCD within 12 cardiac cycles of intravenous contrast injection. In 14 of the 16, paradoxical embolisation was spontaneous and did not need provocation on standardised TCD. The number of microbubble emboli, at a median IQR of 20 (3–135) on standardised TCD was uniformly higher than / (1–43) on simultaneous TCD and 13 (4–221) on TOE, perhaps due to sedation, the lying position or inadequate provocation. The size of the PFO on TOE correlated closely with the number of microbubble emboli on standardised TCD (r=0.83, [0.70, 0.91]).

Conclusions: TOE is relatively insensitive to v-aCS as it is difficult to achieve adequate cough or Valsalva provocation. Standardised TCD is sensitive to the detection of v-aCS and PFO with more than 15 microbubble emboli within 12 cardiac cycles universally detecting PFO.

14 REPAIRED TOF PATIENTS HAVE NORMAL RV BUT ABNORMAL LV DEFORMATION

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Introduction: Strain imaging provides information on local myocardial deformation. Global left (LV) & right (RV) ventricular function is impaired to varying degrees in surgically repaired tetralogy of Fallot (rTOF) patients. Using strain imaging we assessed the local deformation characteristics of different regions of the LV+RV.

Method: rTOF patients were compared to normal controls. All subjects were imaged in the apical 2+4-chamber views superimposed with tissue Doppler imaging data. Longitudinal strain was calculated off line by placing the sample volume in the mid-ventricular and basal segments of the lateral, septal, inferior & anterior walls of the LV & the free wall of the RV. The results were averaged from 3 cardiac cycles. Results are expressed as mean ±SD. 24 rTOF patients were compared to 15 age matched normal controls (31.38±10.38yrs v 32.07±9.87yrs, p=NS). There was no significant difference in strain between the basal+mid regions of the LV or RV in the normal population. Addition wave group, strain was greatest at the base of the heart compared to the mid region in the RV (24.10±10.41% vs 17.3±9.05%, p=0.03), septum (25.7±8.32% vs 17.0±6.56%, p<0.001), lateral (19.9±6.73% vs 15.0±7.93%, p=0.04), inferior (20.7±7.44% vs 15.8±6±3.1%, p=0.05) & anterior (22.3±8.56% vs 16.6±5.38%, p=0.03) walls of the LV. Basal strain of the LV was similar in both groups. However mid-/septal (16.5±5.26% vs 24.0±7.10%, p=0.02), mid-lateral (14.9±7.06% vs 21.1±5.36%, p<0.01), mid-inferior (15.9±5.46% vs 21.5±6.92, p<0.02) & mid-anterior (16.3±5.58% vs 20.7±5±5.50, p=0.04) strain were significantly less. RV strain was similar to that of the normal population at both the basal & mid regions [24.6±10.31% vs 29.93 ±13.43%, p=NS and 16.99±9.14% vs 22.27±11.74%, p=NS, respectively].

Conclusion: Myocardial deformation of the RV is normal in rTOF subjects. However LV deformation is reduced. The pattern of abnormal deformation of the LV is regional suggesting this may be the result of ischaemic injury at the time of repair.

15 BENEFITS OF ANGIOTENSIN CONVERTING ENZYME INHIBITION IN CARDIAC FAILURE

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Wave intensity analysis (WIA) is a novel non-invasive technique that measures the working state of the heart, pressure wave reflection and arterio-ventricular interaction. WIA allows forward and backward waves to be distinguished, where wave intensity (dI) is a measure of the energy carried by a wave. Angiotensin converting enzyme inhibition (ACEI) is beneficial in heart failure and has been shown to reduce peripheral resistance, wave speed (c), augmentation index (AI) and wave reflection. WIA was used to investigate the haemodynamic effects of ACEI. 15 patients with heart failure (NYHA class II-III) were studied on two occasions with and without ACEI. In addition to brachial blood pressure (BP) and ejection fraction (EF), carotid arterial pressure (P) and flow were measured by tonometry and pulsed wave Doppler respectively. Forward and backward wave intensities, forward and backward pressures, carotid c, and AI were calculated. Data are means±SD, p was calculated by a paired Student’s t-test and data were log transformed where appropriate*. ACEI significantly reduced BP from 131±19/74±16 to 119±17/67±12 mmHg (p<0.001 systolic and p=0.02 diastolic). ACEI also caused a reduction in AI (ACEI=26.3±3.07, +ACEI=21.7±13.7 %; p=0.09*) and c (ACEI=15.2±8.4, +ACEI=11.8±5.5 ms–1; p=0.07). Wave reflections from the body (ACEI=3±1.5, +ACEI=3±4.8; NS) and head (ACEI=17±10.8, +ACEI=18±9.9; NS) were not affected by ACEI. ACEI significantly increased AI (ACEI=0.59±0.20, +ACEI=0.66±0.17 ms–1; p=0.03). Ejection fractions also increased with ACEI from 32±20% to 39±16% (p=0.001), without an increase in early forward wave intensity (di+c) (ACEI=22.6±13.9 mWm–2; +ACEI=24.4±17.4 mWm–2; NS) indicating that relatively more cardiac power is invested in achieving ejection than increasing pressure. These data suggest that the major haemodynamic effect of ACEI is to decrease peripheral resistance and to enhance the heart’s function as a flow source.

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THE IMPACT OF HAND CARRIED ULTRASOUND DEVICES (HCU) IN THE CARDIAC OUTPATIENT CLINIC UPON THE REFERRAL PATTERNS TO THE ECHO DEPARTMENT

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Small, portable, low cost, easy to use HCU devices are now freely available. The aim of this study was to evaluate the potential role of these devices in the cardiac outpatient setting and to assess how their use influences referral patterns to the echo department. Over a 5-month period, 75 patients in the cardiac clinic underwent a targeted study using the Philips Optigo HCU device. For each assessment, a proforma was completed, detailing: reason for echo, chamber size, systolic function, colour Doppler findings, presence of pericardial effusion, duration of study and outcome of examination.

In 55 out of 75 patients (73%), the results obtained from the Philips Optigo HCU device prevented a formal referral to the echo department. In 12 cases, the HCU findings confirmed the clinician’s judgement for requesting a formal echo. In only 7 cases (9%) was it utilised when an echo would not normally be done. This is a brief examination (av. 1.9 mins) with a HCU device in the outpatient clinic can have a significant impact on referral patterns and hence workload, to the echo department, both by preventing a significant number of formal studies altogether and by detecting an abnormality needing further assessment, confirming the need for a formal study.

VENTRICULAR REMODELING FOLLOWING MITRAL VALVE REPAIR

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Background: There is limited information on the timescale of changes in left ventricular (LV) dimensions, volumes and systolic function in patients following mitral valve repair surgery.

Methods: We examined serial transthoracic echo studies of 40 consecutive patients with chronic severe mitral regurgitation (MR) 1 day prior to valve repair, then at 1 week and 6 months postsurgery. LV end-diastolic diameter (LVEDD), volume (EDV), ejection fraction (EF) and regurgitant fraction (RF) were measured. The majority (35 patients) had degenerative disease.

Results: Baseline patient characteristics were: mean (SD) age 63 (13) years, 60% were male, 73% in sinus rhythm, 45% with EF>60% and 43% in NYHA grade III/IV. During follow-up 1 patient died and 2 had recurrence of severe MR (RF>55%). After 6 months EF was still significantly lower compared with baseline (mean (SD) EF 59 (8)% at baseline vs 50 (13)% at follow-up). There was an immediate reduction in LV EDV but a more gradual change in LV EDD as shown in the bar graph. The pattern of change was different in age, pre-operative cavity size, EF, NYHA status or presence of coronary disease.

Conclusions: Following successful mitral repair there is an abrupt fall in end-diastolic volume but a gradual drop in mid-cavity diameter implying continuous ventricular remodelling over several months.

MATERIAL CARDFUNCTION IN TWIN PREGNANCIES: A MODEL FOR PREECLAMPSIA?

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The prevalence of pregnancy induced hypertension (PIH) and pre-eclampsia (PET) is increased in multiple pregnancies. Previous studies have demonstrated that PIH and PET are characterised by a hyperdynamic maternal circulation. It is possible that these changes also occur in normal twin pregnancies, but this has not been investigated before.

Methods: Echocardiography was performed in 125 singleton and 110 twin pregnancies at 10-42 weeks gestation. Mitral flow output (CO) was the product of stroke volume and heart rate. Ejection fraction (EF) and fractional shortening (FS) reflected LV systolic function in the circumferential axis. The measurement of the displacement of the mitral annulus (MAD) towards the LV apex during contraction reflected LV systolic function in the longitudinal axis. Fourteen twin and 3 singleton pregnancies developed PIH or PET and were excluded from the analysis.

Results: The prevalence of hypertensive disorders was higher in twin compared to singleton pregnancies (11 % vs 2.3%, p<0.01). CO was significantly lower compared with baseline (mean (SD) EF 59 (8)% at mid-cavity diameter, NYHA grade III/IV. During follow-up 1 patient died and 2 patients following mitral valve repair surgery.

In 55 out of 75 patients (73%), the results obtained from the Philips Optigo HCU device prevented a formal referral to the echo department. In 12 cases, the HCU findings confirmed the clinician’s judgement for requesting a formal echo. In only 7 cases (9%) was it utilised when an echo would not normally be done. This is a brief examination (av. 1.9 mins) with a HCU device in the outpatient clinic can have a significant impact on referral patterns and hence workload, to the echo department, both by preventing a significant number of formal studies altogether and by detecting an abnormality needing further assessment, confirming the need for a formal study.

VENTRICULAR REMODELING FOLLOWING MITRAL VALVE REPAIR

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Background: There is limited information on the timescale of changes in left ventricular (LV) dimensions, volumes and systolic function in patients following mitral valve repair surgery.

Methods: We examined serial transthoracic echo studies of 40 consecutive patients with chronic severe mitral regurgitation (MR) 1 day prior to valve repair, then at 1 week and 6 months postsurgery. LV end-diastolic diameter (LVEDD), volume (EDV), ejection fraction (EF) and regurgitant fraction (RF) were measured. The majority (35 patients) had degenerative disease.

Results: Baseline patient characteristics were: mean (SD) age 63 (13) years, 60% were male, 73% in sinus rhythm, 45% with EF>60% and 43% in NYHA grade III/IV. During follow-up 1 patient died and 2 had recurrence of severe MR (RF>55%). After 6 months EF was still significantly lower compared with baseline (mean (SD) EF 59 (8)% at baseline vs 50 (13)% at follow-up). There was an immediate reduction in LV EDV but a more gradual change in LV EDD as shown in the bar graph. The pattern of change was different in age, pre-operative cavity size, EF, NYHA status or presence of coronary disease.

Conclusions: Following successful mitral repair there is an abrupt fall in end-diastolic volume but a gradual drop in mid-cavity diameter implying continuous ventricular remodelling over several months.

MATERIAL CARDFUNCTION IN TWIN PREGNANCIES: A MODEL FOR PREECLAMPSIA?

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TISSUE DOPPLER ECHOCARDIOGRAPHY AS AN ADJUNCT TO ASSESSING DIASTOLIC FUNCTION IN ESSENTIAL HYPERTENSION

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**Background:** The traditional assessment of diastolic function is limited by the way transmitral flow patterns vary as diastolic dysfunction becomes increasingly severe. It can be a challenge to easily separate normal from pseudonormal patterns.

**Methods:** In order to assess the prevalence of pseudonormal transmitral patterns in patients with uncomplicated essential hypertension we performed standard 2D and tissue Doppler echocardiography (TDE) in 127 patients. Using age matched normal data, we defined an E/A transmitral ratio of >1 coupled with a normal e wave deceleration time and a lateral wall E wave velocity below the 95% confidence interval as a pseudonormal picture.

**Conclusion:** Of the 32 patients who on traditional transmitral Doppler appeared to have normal diastolic function, five were found on TDE to have a significantly reduced E wave velocity, suggesting a pseudonormal picture. These patients have severe diastolic dysfunction. TDE velocities are easy to measure and are a useful adjunct in assessing diastolic function.

GLOBAL LV FUNCTION CAN BE ASSESSED USING ONLY ONE VIEW

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Peak mitral annular descent velocity using tissue Doppler imaging (TDI) provides an accurate assessment of left ventricular (LV) systolic and diastolic function. For assessment of global LV function, analyses of 4 walls (lateral, septum, anterior and posterior) is required. However this is time consuming. We feel this is a major reason why this modality is not used in routine clinical practice. We sought to see if 2-site sampling (lateral & septal) from the apical 4-chamber view, which is considerably less time consuming, would provide the same information.

**Method:** All subjects underwent TDI of the apical 2 & 4-chamber views with the sample volume placed over the lateral, septal, inferior and superior aspect of the mitral annulus. Peak systolic (S), early (E) and late (A) diastolic velocities were measured and averaged from 3 cardiac cycles. 2-site measurements were recorded as S2, E2 and A2 and 4-site as S4, E4 and A4. Images digitally stored & analysed offline. Measurements were averaged from 3 cardiac cycles.

**Results** are expressed as mean (±SD). 72 consecutive subjects, aged 45±18.32yrs, attending for routine echocardiography were scanned. There was no significant difference between measurements taken at 2 or 4-sites for peak S (6.28±2.11 cm/s vs 6.32±2.08 cm/s, p=NS), E (8.16±3.39 cm/s vs 8.08±3.19 cm/s, p=NS), A velocity (6.75±2.60 cm/s vs 7.06±2.66 cm/s, p=NS), or E/A ratio (1.35±0.70 vs 1.29±0.69, p=NS). Excellent correlation was demonstrated between 2 & 4-site sampling in all patients for peak S (r=0.98, p<0.001), E (r=0.97, p<0.001), A velocity (r=0.95, p<0.001) and E/A ratio (r=0.96, p<0.001).

**Conclusion:** Apical 2-site sampling correlates significantly with 4-site sampling in patients with varying degrees of LV impairment. This method is considerably less time consuming. Apical 2-site sampling can be used to assess global LV function.