ABSTRACTS IN ECHOCARDIOGRAPHY

HAEMODYNAMIC FUNCTION OF THE CARBOMEDICS BILEAFLET HEART VALVE PROSTHESIS
J Roxburgh, RA Cooke, P Deverall, J Chambers.
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There may be major differences in haemodynamics between the various designs of replacement valve. The echocardiographic appearances of every new type must therefore be learned. As yet, there is little published data for the Carbomedics valve. To date we have studied 164 prostheses as part of a larger clinical follow up. There were 107 prostheses in the aortic and 57 in the mitral position in 142 patients aged 58 (30-84 years). All valves were clinically normal and the patients in NYHA class I or II. We measured peak velocity, pressure half-time, stroke volume and effective orifice area using the continuity equation.

Aortic valves

<table>
<thead>
<tr>
<th>Diameter (cm)</th>
<th>Peak velocity (m/s)</th>
<th>Stroke volume (ml)</th>
<th>Measured orifice area (cm^2)</th>
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Effective orifice area (cm^2)

- 1.5
- 1.7
- 2.1
- 2.4

For the mitral valves, there were no significant difference between the annulus diameters for any calculated parameter. For the aortic valve there were significant differences in peak velocity (p<0.003 by ANOVA) and in effective orifice area (p<0.001). There were two or more washing jets from each pivotal point and these were more prominent than in any mechanical valve design. The effective orifice area was comparable with other bioprosthetic and mechanical biological valves and are larger than for stitling disk and porcine biological valves. We conclude that the forward haemodynamics of this new bileaflet valve are favourable. There are obvious physiological regurgitant jets which should not be misdiagnosed as paraprosthetic.

THE VALUE OF INTRAPROCEDURAL ECHOCARDIOGRAPHY DURING BALLOON MITRAL VALVULOPLASTY
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Transcatheter Echocardiography (TEE) is regarded as essential for patient selection prior to Balloon Mitral Valvuloplasty (BMV) and for subsequent long-term follow-up. The value of TTE during the procedure however, is less well defined. The aim of this study was to assess the contribution of TEE, rather than invasive measurements, to procedural and management decisions taken during BMV.

TEE, consisting of transthoracic 2D images and spectral and colour Doppler, was performed during the BMV in 95 consecutive patients (65 female, mean age 57 years). TTE was performed after each balloon inflation to assess planimetered mitral valve area (MVA), the degree of commissural separation, the development of mitral regurgitation (MR) and to exclude any unusual structural sequelae. Right and left heart pressures were measured before and after BMV. Significant images were obtained in 93 patients. Of these achievement of a satisfactory MVA (an increase of >25% and a final MVA >1.5 cm^2) led to the cessation of BMV in 75 (80.6%) patients. This decision was taken prior to invasive measurements and correlated with a final trans-mitral gradient of <6 mmHg in 94% of cases. In 14 (15.1%) patients additional dilatation was performed after achieving a satisfactory MVA to produce complete separation of at least one commissure. The procedure was terminated after TEE detection of eccentric commissural MR in 13 (14.0%) patients, severe MR in 4 (4.3%) patients and a ruptured papillary muscle in 1 (1.1%) patient.

The serial assessment of MVA assisted the choice of final inflated balloon size in all cases and determined the end of the procedure in 75 (80.6%) cases. TTE detection of eccentric or severe MR led to termination of the procedure in 18 (19.4%) patients.

Therefore, TTE performed repeatedly during BMV guides subsequent management decisions and makes repeat ventriculography and pressure measurements after each balloon inflation superfluous.

DOPPLER ECHOCARDIOGRAPHIC ASSESSMENT OF CHANGES IN DIASTOLIC FUNCTION AFTER AORTIC VALVE REPLACEMENT FOR AORTIC STENOSIS: A 10 YEAR FOLLOW UP STUDY
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To evaluate diastolic function after aortic valve replacement (AVR) for aortic stenosis (AS), 36 patients with isolated AS were studied. Each patient underwent 2-D echocardiography and Doppler examination of the left ventricular (LV) inflow and outflow before and after AVR. LV inflow recordings were performed 2 months before (±2.1 months) and 2 weeks after (±2.1 months) AVR. Twenty four patients had a follow up (FU) study 4 years after (±1.6 months) AVR. Twenty four had mechanical and 12 had bioprostheses. Eight patients with mechanical (34%) and 5 with bioprostheses (41%) were found to have additional coronary artery disease (CAD) and had one or more by-pass grafts. The mean age of patients with bioprostheses was higher than that of patients with mechanical AVR (73±9 vs 61±9 years). All patients had sinus rhythm, good systolic function, were class II NYHA and on diuretics prior to AVR. The mean size of aortic prosthesis was similar between patients with mechanical and bioprostheses (3.9±1.7 vs 2.9±1.7 mm, p=NS).

The following indices were estimated from Doppler recordings: isovolumic relaxation time (IVRT), E/A ratio, acceleration time (AT) and rate (AR), deceleration time (DT) and rate (DR) of the LV early filling, and mean transaortic gradient (MPG). LV mass was similar in the pre- and post-operative studies and decreased in the FU study in all patients equally (p>0.01). Fraction shortening was decreased in the post-operative and increased in the FU study (p<0.05) in patients with mechanical AVR all diastolic indices were similar in the pre- and post-operative study. However, IVRT was shortened in the FU study (82±14 vs 75±15 m/sec, p<0.05). Conversely, in patients with bioprostheses, IVRT and AT decreased and DR increased in the post-operative and the FU study (IVRT:111±15 vs 77±18 and 89±16 m/sec, p<0.01; AT: 62±12 vs 60±12 and 62±10 m/sec, p<0.01; DR:3±2 vs 5±2 and 5±2, p<0.05). MPG was increased in the FU study in comparison to the post-operative study (p<0.05). Patients with mechanical AVR had higher MPG than patients with bioprostheses in the post-operative study (21±8 vs 2±4 m/sec, p<0.01). We concluded that, after AVR myocardial relaxation is improved. This improvement is presented earlier after AVR with bioprostheses despite the older patients age, possibly due to the lower residual gradient post-operatively.
Effect of diastolic filling time and R-R interval on pressure half time in patients with mitral stenosis and atrial fibrillation.


Department of Medicine, Clinical Cardiology, Hammersmith Hospital, London.

In patients with mitral stenosis (MS) and atrial fibrillation (AF), pressure half time (P1/2) values are affected by the length of the corresponding R-R interval on the ECG. The aim of the study was to relate diastolic filling time (DFT) to pressure half time (P1/2) b) to define the range of DFT and R-R interval where the corresponding P1/2 values presented the least variability. Twenty patients with MS and AF underwent continuous wave Doppler examination of the left ventricular inflow (LVI) tract. Thirty consecutive Doppler LVI velocity waveforms were recorded in each patient and the pressure half time, the diastolic filling time and R-R interval were measured. None of the patients had significant mitral or aortic regurgitation on colour flow imaging and all had good left ventricular function. P1/2 values were plotted against the corresponding DFT and R-R interval in DFT and in 17 patients (p<0.05). The range of DFT and RR where the corresponding P1/2 values presented the least variability were seen between 300 and 500 msec and 600 and 900 msec, respectively. The mean of all calculated P1/2 values was compared to the mean of P1/2 values from waveforms with DFT between 300-500 msec, <300, >900 and with RR interval between 600-900 msec, <600, >9000, respectively, in each patient. The coefficient of variation of P1/2 values with corresponding DFT between 300-500 msec and with RR interval between 600-900 msec was compared to the coefficient of variation of P1/2 values corresponding DFT between 300-500 msec and with RR interval between 600-900 msec.

The coefficient of variation of P1/2 values with corresponding DFT between 300-500 msec was lower than that of P1/2 values with corresponding RR between 600-900 msec (p<0.05). We concluded that in patients with MS and AF, P1/2 is related to RR and DFT and is measured more accurately on Doppler LVI velocity waveforms with DFT and R-R values between 300 and 500 msec and between 600 and 900 msec, respectively. DFT should be preferred to RR because it is related with less P1/2 variability and is often easier to measure.

ASSESSMENT OF AORTIC WALL DISTENSIBILITY BY TRANSESOPHAGEAL ECHOCARDIOGRAPHY IN PATIENTS WITH Atherosomatous PLAQUES IN THE THORACIC AORTA


Clinical Cardiology, Hammersmith Hospital, RPMS, London.

The purpose of this study was to evaluate the aortic wall distensibility in the presence of atherosomatous plaques in the thoracic aorta as assessed by transesophageal echocardiography (TOE). Methods: Fifty-two consecutive patients (31 males and 21 females, mean age 57±14 years) with various pathologies were studied by TOE. Patients with aortic wall pathology other than atherosclerosis were excluded from the study. M-mode echocardiographic tracing of the descending thoracic aorta at the level of 3 cm from incisors was performed during TOE and the amplitude of motion of the posterior aortic wall (Dd) through the cardiac cycle was calculated. Systolic, diastolic and pulse blood pressure (PP) estimated as the difference between systolic and diastolic blood pressure, were measured simultaneously from the brachial artery by sphygmomanometer. Aortic distensibility was calculated as the ratio Dd/PP. Results: Twenty-eight patients were found to have atherosomatous plaques in the thoracic aorta (Group A) and 24 had no evidence of aortic atheromas (Group B). The age in both groups was similar (61±16 vs 54±11 years). The motion of the posterior aortic wall was less prominent in Group A with significant difference in Dd (0.9±2 vs 1.1±0.6 mm, p<0.001) compared to Group B. The area of the plaque was calculated by measuring the difference between systolic and diastolic blood pressure, were measured simultaneously from the brachial artery by sphygmomanometer. Aortic distensibility was calculated as the ratio Dd/PP. Results: Twenty-eight patients were found to have atherosomatous plaques in the thoracic aorta this and can be detected during routine TOE.

PLANIMETRY OF COLOUR FLOW ACCELERATION SIGNAL PROXIMAL TO THE LEAKING ORIFICE FOR ASSESSMENT OF PROSTHETIC MITRAL VALVE REGURGITATION


Department of Medicine, Clinical Cardiology, Hammersmith Hospital, Royal Postgraduate Medical School, London.

In prosthetic mitral regurgitation transthoracic colour Doppler echocardiography sometimes fails to demonstrate or underestimate the regurgitant jet within the left atrium because of the acoustic shadowing of the prosthesis. To overcome this limitation we assessed the usefulness of acceleration flow signal (AFS), by colour Doppler imaging, for evaluation of the severity of prosthetic mitral regurgitation (PMR). AFS is located immediately upstream of the regurgitant orifice, in the left ventricle. Its location between the transducer and the prosthetic valve permits a better visualization without influence of prosthetic pathology. Methods: Forty-six patients (pts) aged 59±11 years with mechanical prosthetic mitral valve were studied. Apical four-chamber, apical and parasternal long views were obtained in all pts. AFS area was measured by planimetry at the onset of systole. The values of three and five measurements were averaged in pts with sinus rhythm and atrial fibrillation respectively. Severity of PMR (no PMR, mild, moderate or moderate-severe or severe PMR) was documented by transesophageal echocardiography (TOE). Results: Age and heart rate was similar between pts with different severity of PMR.No difference in heart rate between transthoracic and transesophageal echocardiography was significant (76±14 vs 78±16 beats/min, p>NS). No AFS was detected in any patient without PMR (specificity 100%) while it was demonstrated in 30 of the 35 pts with PMR by TOE (sensitivity 85%). The 5 pts without AFS had mild PMR by TOE. The 35 pts with mild PMR was 21.25±5.57mm², in moderate PMR was 48.78±15.62mm² and in severe PMR was 123.65±54.94mm². There was a significant difference in AFS area between mild and moderate (p<0.001), moderate and severe (p<0.001) and mild and severe PMR (p<0.001). Conclusion: The detection and estimation of acceleration flow signals proximal to the regurgitant orifice by colour Doppler transthoracic echocardiography is useful in assessing the severity of mechanical mitral valve regurgitation.

Abstracts in echocardiography
Abstracts in echocardiography

TRANSSEOPHAGEAL DOPPLER ECHOCARDIOGRAPHY MEASUREMENTS OF CARDIAC OUTPUT IN CARDIAC SURGICAL PATIENTS
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Transesophageal echocardiography is becoming increasingly popular as a method of intraoperative monitoring because it can be continuous, does not transgress the sterile operative field, and provides data with regard to valve function, ventricular volumes and contractility. It has been suggested that it can be used to measure cardiac output, however, controversy remains regarding its accuracy. Cardiac output data were measured simultaneously by transesophageal echocardiography (5MHz pulse wave Doppler, single plane viewing probe) and by thermodilution method in twenty one patients undergoing open heart surgery. Comparisons of cardiac output measurements by thermodilution with transesophageal Doppler values derived from left ventricular cross sectional area correlated poorly (r=0.45) and the mean difference between methods was 0.2±2.2 (SD) l/min. Giving limits of agreement of -3.9 to 4.8 l/min. Comparisons of cardiac output measurements by thermodilution with transesophageal Doppler values derived from pulmonary artery flow velocity showed good correlation (r=0.95) with mean difference 0.1±0.45 l/min and narrow limits of agreement of -0.8 to +1.0 l/min. This range is narrow enough to justify the conclusion that the two methods of measurement compare well. Mean difference of repeated determinations through the pulmonary artery in the same patient (reproducibility) was 0.007±2.0 l/min giving limits of agreement of -0.4 to +0.4 l/min. This compares very well with that of the thermodilution method: mean difference 0.004±0.2 l/min, and limits of agreement -0.3 to +0.3 l/min.

Transesophageal Doppler echocardiographic determination of cardiac output using pulmonary artery flow measurement can provide accurate haemodynamic data in patients undergoing cardiac surgery.


To evaluate the pulmonary venous flow patterns by transesophageal pulsed Doppler echocardiography in left atrial tumors seven patients (pts) (3 male and 4 female, aged 57 ± 5.4 years) with left atrial tumors (Group A) and 20 normal controls of similar age (Group B) were studied. All pts had good baseline left ventricular function. Six pts had myxoma and one had extraskeletal mesenchymal chondrosarcoma as confirmed by histopathological examination. Tumors' dimensions were measured after surgical removal. Tumor prolapse through the mitral valve in diastole was observed in four pts. Mitral regurgitation (MR) and flow of the left upper pulmonary vein at 0.5m from the entry point were evaluated by transesophageal echocardiography. The following pulmonary venous flow parameters were measured: Systolic forward peak velocity (S), reversal systolic peak velocity (revS), diastolic forward peak velocity (D), retrograde peak velocity due to atrial contraction (A) and the corresponding velocity-time integrals (SVI, revSVI, total SVI=revSVI+SVI, DVI, AVI). Left atrial size was increased in Group A (40.1±9 vs 31.6±mm, p<0.05). Tumor size was correlated well with left atrial diameter (r=0.82, p<0.02). Group A pts had decreased S (38.8±10.03 vs 55±9.1 mm/s, p<0.001), decreased total SVI (44.3±3.87 vs 92.2±4 mm, p<0.05), increased D (48.8±21.15 vs 30.12±11.1 mm/s, p<0.05), increased DVI (10.67±6.2 vs 5.2±3.1 mm, p<0.05) while there was no difference in A and AVI when compared with Group B. Total SVI was more decreased in prolapsing than in non-prolapsing tumors (2.0±0.94 vs 7.67±0.08 mm, p<0.05). Preferential systolic flow was observed in two pts with the larger prolapsing tumors though moderate or severe MR was not demonstrated. Conclusions: Pulmonary venous flow in left atrial tumors is characterized by a decrease in forward systolic flow which is more significant in prolapsing tumors, an increase in forward diastolic flow and normal retrograde flow due to atrial contraction, perhaps secondary to space occupying lesion.

INTRAVASCULAR ULTRASOUND ACCURACY AND ARTEFACTS
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AIM : To assess the accuracy and artefacts associated with intravascular ultrasound (IVUS) transducers and imaging systems.

METHODS : 5 IVUS systems were analysed using 2 mechanical and 3 phased array transducers. 20 Phantom models were constructed including cylinders and other geometric shapes in artificial tissue. The material used simulates the echogenic properties of human tissue. Measurements were taken of the spatial resolution, geometric accuracy and reproducibility of results. Manipulations of catheters comparable to those experienced in clinical use were undertaken to try and induce artefacts.

RESULTS : The best spatial resolution was obtained with a 30 MHz mechanical transducer (lateral response width 0.65mm, axial response width 0.25mm). Measurements were reproducible +/- 2.5% (95% CI; SD 0.1). A range of artefacts occurred including rotational distortion, halo artefacts, asymmetry off-centre imaging, edge distortion, bubble artefacts and angular distortion. The images with mechanical transducers were more accurate than phased array systems, but distortion artefacts were more common. Distortion from off centre imaging was also more dramatic with the mechanical transducers. Artefacts could be minimised by careful catheter preparation, avoiding catheter torque, adjusting machine settings and central imaging.

CONCLUSIONS : The clinical use of intravascular ultrasound imaging needs to take account of the accuracy and potential artefacts produced by mechanical and phased array transducers. Interpretation of IVUS image requires careful avoidance of situations resulting in artefacts.

MEASUREMENT OF BLOOD FLOW IN LEFT INTERNAL MAMMARY ARTERY TO CORONARY ARTERY BYPASS GRAFTS USING TRANSTHORACIC ECHOCARDIOGRAPHY
JJ Crowley, LM Shapiro. Regional Cardiac Unit, Papworth Hospital, Cambridge, UK

Trans thoracic high frequency (5MHz) combined two dimensional and Doppler echocardiography allows visualisation of the distal left internal mammary artery (LIMA) anatomy and blood velocity profile when imaged using a modified left parasternal approach. In this study we assessed this technique for the measurement of LIMA graft blood flow in patients with previous coronary artery bypass surgery. A total of 29 consecutive patients (23 males and 6 females, mean age 67 ± 6 years) admitted for coronary angiography were studied. All patients had coronary artery bypass graft surgery 8 ± 2 years prior to admission using the LIMA graft to the left anterior descending coronary artery. In all patients the LIMA graft was patent at angiography. In a further 19 patients without grafts the ungrafted LIMA was imaged also.

RESULTS

<table>
<thead>
<tr>
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<th>Systolic/diastolic peak velocity ratio</th>
<th>Mean diameter (cm)</th>
<th>Blood Flow (ml/min)</th>
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<tr>
<td>Grafted LIMA</td>
<td>0.55 ± 0.15</td>
<td>0.23 ± 0.05</td>
<td>59 ± 37</td>
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<tr>
<td>Ungrafted LIMA</td>
<td>3.77 ± 1.12</td>
<td>0.22 ± 0.04</td>
<td>65 ± 23</td>
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</table>

The LIMA graft and its blood velocity profile were visualised in 21 (72%) of the 29 grafted patients. In these patients a biphasic diastolic predominant flow velocity pattern was seen. In contrast, a blood velocity pattern with systolic predominance and low diastolic blood velocities was seen in the ungrafted group. Vessel diameter was measured in 18 of the 29 LIMA grafts and 14 of the 19 ungrafted LIMAs. There was no significant difference in LIMA diameter or blood flow between the two groups. We conclude that Doppler echocardiography provides a noninvasive means of measuring LIMA graft blood flow. This technique may be useful for noninvasive studies of the physiology and pharmacology of coronary artery blood flow.
THE INTER AND INTRA TECHNICIAN VARIATION OF ACOUSTIC QUANTIFICATION ECHOCARDIOGRAPHY (AQ Echo) IN NORMAL VOLTERRA

Dr M A Khan, D Taylor, S Southern, Dr R D Levy. Regional Cardiographic Centre, Weythenshaw Hospital, Manchester.

The non-invasive assessment of left ventricular volume and function is of immense clinical importance and largely remains subjective. AQ Echo provides an objective assessment of end diastolic volume (EDV, ml), end systolic volume (ESV, ml) and ejection fraction (EF, %). The peak filling rate (PFR, EDV/s), time to peak filling rate (TPFR, msec) and peak emptying rate (PER, EDV/s) and is now available in many centres. Two cardiology technicians (Tech) were used to assess the intra and inter-tech variation in normal volunteers. Volunteers (N=105) were screened and 85 normal volunteers were recruited and 20 volunteers were excluded (7 abnormal, 2 with poor echo pictures, 4 with poor AQ pictures and 7 volunteers failed to reattend). AQ echo's were performed by Tech X or Y on day 1 and repeated by both techs on day 2 using Hewlett Packard sonos 1500. Analysis of paired data was performed using t-test.

Intra-Tech variation

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<th>Tech</th>
<th>DAY 1</th>
<th>DAY 2</th>
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<tr>
<td>Mean</td>
<td>Mean</td>
<td>CI</td>
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<tr>
<td>EDV</td>
<td>77.9</td>
<td>75.9</td>
</tr>
<tr>
<td>ESV</td>
<td>35.4</td>
<td>35.7</td>
</tr>
<tr>
<td>EF</td>
<td>53.3</td>
<td>52.5</td>
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<tr>
<td>PFR</td>
<td>3.9</td>
<td>4.1</td>
</tr>
<tr>
<td>TPFR</td>
<td>131.9</td>
<td>121.3</td>
</tr>
<tr>
<td>PER</td>
<td>3.4</td>
<td>3.8</td>
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</table>

Conclusion: There was no statistically significant difference in the intra and inter-tech variation in the assessment of EDV, ESV, EF and TPFR. However the 95% confidence intervals were wide and may limit the clinical use of this tool. An important problem was noted with the electrocardiographic gating and would account for the statistically significant difference in PFR and PER.

Left ventricular filling profile in cardiac amyloidosis.

Doppler echocardiography study.


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To examine the relation between two-dimensional (2-D) Doppler echocardiographic features and Doppler indices of left ventricular function in cardiac amyloidosis, we studied 46 patients (pts) (age 59±12 years) with biopsy proven systemic amyloidosis. 30pts (Group I) showed 2-D echocardiographic evidence of heart amyloid infiltration and 16pts (Group II) showed no evidence of amyloid infiltration. Group I pts were classified into 2 subgroups, with interventricular septal thickness 11-14mm (Group IA-16pts) and >14mm (Group IB-14pts). Mean age was not different between Group IA (61±10years), Group IB (55±14years) and Group II (63±10years,p=NS). LV end-diastolic diameter was similar between Group IA (46±5mm), Group IB (42±5mm) and Group II (44±5mm,p=NS). LV systolic function as expressed by fractional shortening (%)) was impaired both in Group IA (25±8%) and Group IB (24±10%) compared with Group II (37±4%,p<0.05). Left atrial diameter was greater in Group IA (43±6mm) and Group IB (44±6mm) compared to Group II (35±10mm,p=NS). LV outflow tract velocity was also decreased in Group IA (75±16cm/s) compared to Group II (83±19cm/s,p<0.05) and Group II (90±16cm/s,p<0.01). The greatest of early to late transmitral flow velocity was seen in Group IB (2.5±1.2) compared with Group IA (1.5±0.7,p<0.05) and Group II (1.6±0.3,p<0.01). Deceleration time of early filling was significantly shorter in Group IB (126±27ms) compared to Group IA (160±30ms,p<0.05) and Group II (197±29,p<0.01). Isovolumic relaxation time appeared to be 'normalized' in Group IB (66±18ms) demonstrating severe systolic dysfunction. In Group IA (90±25ms,p<0.01) and Group II (95±14ms,p<0.01) where it appeared to be prolonged. We concluded: 1) in cardiac amyloidosis a restrictive LV filling pattern is associated with significant septal thickening and impaired LV systolic function 2) systolic amyloidosis LV relaxation can be abnormal even without 2-D evidence of cardiac amyloid infiltration.

INTRA-CORONARY CONTRAST ECHOCARDIOGRAPHY PREDICTS MYOCARDIAL VIABILITY PRIOR TO PTCA

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A rapid method for predicting myocardial viability prior to revascularisation remains elusive. Intra-coronary contrast echocardiography (ICE) evaluates myocardial perfusion and may have a role in predicting myocardial viability by demonstrating antegrade or collateral flow at a microvascular level. ICE was performed before PTCA in 14 patients who had a significant wall motion abnormality associated with the index artery (LAD=11 RCA=3). There were 10 men and 4 women with a mean age of 63 years (range 54-74yrs). Echo derived wall motion score and global ejection fraction were calculated before PTCA and again at 1 month. Linear ultrasound contrast echo data was digitally stored on optical disc and quantified using a specially developed software package. Measured parameters were peak contrast effect (P), area under the contrast echo curve (A), time to peak contrast effect, contrast half-time and mean transit time. Contrast effect in the myocardial bed of the index coronary artery (i) was also compared with that in a reference bed supplied by a normal coronary artery (r). Nineteen patients ("viable") group) had an improvement in echo score at 1 month while 5 patients ("non-viable") group had no improvement. The "viable" patients had an improvement in ejection fraction (52.1±5.5% to 53.9±4.0%) as well as wall motion index score (1.4±1.1, p<0.04) while the "non-viable" patients had no significant improvement in either parameter (49.0±4.2% to 1.5±1.6). Contrast data for peak value and areas were:

<table>
<thead>
<tr>
<th>P</th>
<th>A</th>
<th>AO(A/O)</th>
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<tbody>
<tr>
<td>Viable</td>
<td>0.84</td>
<td>0.54</td>
</tr>
<tr>
<td>Non-viable</td>
<td>0.64</td>
<td>0.22</td>
</tr>
</tbody>
</table>

p value <0.04 P<0.01 P<0.02 p<0.05.

P and A were significantly greater in the index myocardial bed in the "viable" group compared to the "non-viable" group. The ratio of these parameters in the index compared to a reference bed was also significantly greater in the viable group. Despite a patent epicardial index coronary artery, 45% patients in the "non-viable" group demonstrated minimal contrast effect in the index myocardial segment. These initial results suggest that ICE prior to PTCA may be rapidly used to predict improvement in both regional and global left ventricular function. The contrast data is additive to prediction of the myocardial segment. Diagnostic accuracy of an index myocardial bed "watershed" value should enable a valuable echo predictor of myocardial viability.

LOW DOSE DOBUTAMINE ECHOCARDIOGRAPHY ACCURATELY IDENTIFIES HIBERNATING MYOCARDIUM IN PATIENTS WITH SEVERE CHRONIC ISCHEMIC LEFT VENTRICULAR DYSFUNCTION

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Myocardial thallium-201 uptake (TI-201) has been shown to be an indicator of myocardial viability. However, low dose dobutamine (DOB) induced wall thickening on echo (DOB echo) has not been compared to TI-201 for detection of viable myocardium. In 34 pts with severe chronic ischemic left ventricular dysfunction (ejection fraction<30% in patients with predilection of non-dysnoea, 74MBq of TI-201 was injected at rest after sublingual nitroglycerin and planar imaging was performed at 1 and 4 hours. Low dose (5-10mg/kg/min) DOB was infused and wall thickening on echo was assessed. Echo was repeated without DOB in 11 pts, 3 months after revascularisation. TI-201 and Echo imaging were interpreted blind by two independent observers, using the 13 segment model for both TI-201 uptake was scored semiquantitatively from grade 1-4 according to decreasing uptake with a segmental score of ≤3 being considered viable. Myocardial viability on Echo was considered to be present when there was an increase in wall thickening in dysynergic segments.

TI-201 (n=207 dysynergic segments)

<table>
<thead>
<tr>
<th>Viabile</th>
<th>Non-viable</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOB Viable</td>
<td>131</td>
</tr>
<tr>
<td>Echo Non-viable</td>
<td>28</td>
</tr>
</tbody>
</table>

Concordance = 81% (k=0.52)

DOB Echo showed improvement in 70 out of the 76 segments (92%) which improved after revascularisation; of the 24 segments which did not improve after revascularisation, Dob Echo detected 18 segments as non-viable (75%). Detection of viable myocardium by Dob Echo has a high concordance with TI-201 imaging and predicts mechanical improvement of dysynergic segments after revascularisation with a high degree of accuracy.
ECHOCARDIOGRAPHIC ABNORMALITIES IN CHILDREN REFERRED TO A SPECIALIST MARFAN CLINIC

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Methods: Children with suspected Marfan syndrome (MFS) were referred to a regional specialist clinic and underwent clinical examination, echocardiography, and echocardiogram, including cross-sectional imaging, Doppler and M-mode examination. Detailed measurements of the aortic root and ascending aorta were made in the parasternal long-axis view in the manner described by Roman et al. 

Results: 40 children were reviewed (age 4 days - 19 years; median 7.2 years, male 24, female 16). 24/40 fulfilled diagnostic criteria for MFS. 11/24 had known MFS at referral; 13/24 were diagnosed at clinic review. 8/24 with MFS had abnormal cardiac symptoms/signs (supraventricular tachycardia, 1; systolic murmur, 7; ejection click, 5). 18/24 had echocardiographic abnormalities, including aortic root dilatation >97th centile (15), aortic regurgitation (7), mitral valve prolapse (6), mitral regurgitation (6). Aortic root dilatation was localised (sinuses of Valsalva) in 13/15, and was generalised (sinuses + supra-aortic ridge/ascending aorta) in 2/15. Serial measurements in patients with dilatation revealed progressive dilatation in 2. In the 13 patients with newly-diagnosed MFS, echocardiographic findings provided useful diagnostic information in 9. Interventions included β-blockade (5) and surgical referral (2).

Conclusions: Echocardiography is a valuable tool in assessing children at risk of MFS. It provides diagnostic information and can identify significant cardiac pathology. Relating aortic root dimensions to body surface area allows detection of progressively enlarging lesions and may facilitate early intervention.


MOBILE ECHOCARDIOGRAPHY - A USEFUL SERVICE IN A DISTRICT GENERAL HOSPITAL

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Echocardiography is now an integral part of the cardiac services provided by the great majority of District General Hospitals. Requests for mobile echocardiograms are increasing. However, they are time consuming, produce lesser quality images and risk damage to equipment. We audited mobile echocardiograms to assess their value in patient management and to examine the need for an on-call echo service and a dedicated portable machine. 30 consecutive mobile echocardiograms were analysed (over a 3 month period, representing 7% of studies). The reason for request and the indication for a mobile study was recorded, as were the findings. The impact of the study in terms of patient care was graded into 'no effect,' 'confirming current management,' 'redirecting management'. 26/50 of scans took place on the day of request. The common reason for a mobile request was the patient's condition and the most frequent request was to assess left ventricular function in patients with a clinical diagnosis of cardiac failure. There were 3 requests to look for vegetations and 2 to exclude aortic root dissections. 7 scans were of inadequate quality to answer the question posed and in the remainder no new relevant findings were detected. The scan confirmed current management in 85% of cases. Patients with a clinical diagnosis of severe cardiac failure merely had their diagnosis confirmed and endocarditis could not be confirmed or excluded from the images obtained. In no patient was the treatment plan altered by the echo findings. In conclusion, mobile echocardiograms did not alter management of patients. The allocation of extra resources to set up an on-call service and purchase a mobile scanner cannot be justified on the basis of this audit.

WELSH FETAL CARDIAC SERVICE - THE FIRST 3 YEARS

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Since June 1991 413 pregnancies have been scanned. The median (mode) gestational age was 20 (18) weeks. Reason for scanning included family history of congenital heart disease (CHD) in 33% (33), maternal diabetes (21%), maternal CHD (11%), CHD in relatives (9%), abnormal 4 chamber view (7%), fetal anomaly (6%), arrhythmia (4%), paternal CHD (1%), teratogen exposure (1%). 89 repeat scans were for inadequate 1st scan (43%), re-evaluation of anomaly (30%), rhythm abnormalities (16%), exclusion of late anomaly (11%). 21 abnormalities were detected at a median (range) gestation of 22 (17-36) weeks: 8 hypoplastic left heart syndrome (HLHLS), 2 tricuspid atresia, 2 supraventricular tachycardia, 2 double outlet ventricle, 2 pulmonary atresia (PA) & 1 of truncus arteriosus, ischemic cardiomyopathy, atrial septal defect & critical aortic stenosis. 15 abnormalities were identified out of 27 referred for an abnormal 4 chamber view, 2 from 138 referred for history of CHD in a sibling, 3 from 23 referred for fetal anomaly & 1 from 15 for rhythm abnormality. 8 pregnancies were terminated & 3 fetuses died in utero. Of those born 3 died without intervention (2 HLHLS & 1 PA), 3 underwent surgery with 2 late deaths & 4 have not required intervention. Post mortem or surgical information on 11/17 was available & confirmed the scan diagnosis except 1 diagnosed as HLHLS had situs inversus & PA with diminutive RV. 5 anomalies are known to have been "missed". Reasons were inadequate images (1), observer error (1) & minor lesion (3) detected after routine postnatal scanning of 43 infants as part of quality control. 2 following surgery are well, the minor lesions (small VSD [2], mild coartation [1]) are asymptomatic. The poor outcome of fetuses identified with cardiac disease is not unexpected given the severity of their anomalies. However the service correctly identified 91% of fetuses referred who had significant risk.

CHANGING TRENDS IN AN ECHOCARDIOGRAPHIC SERVICE: A FIVE YEAR RETROSPECTIVE AUDIT

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Recent improvements in echo technology include the introduction of colour flow imaging, and the development of sophisticated left ventricular function analysis software. These innovations, and the results of a number of clinical studies emphasizing the need for formal assessment of cardiac function, may have implications for the provision of an echo service and contribute to the continuously changing trend in the indications for echocardiography. To assess the alterations in the pattern of echocardiographic workload of a busy cardiology department in a combined secondary and tertiary referral centre, we carried out a retrospective audit of adult echocardiograms in 1989 and 1994. During this period, the number of examinations performed per annum increased by 45% (1820 studies in 1989, to 2670 (projected) in 1994). Approximately 10% of requests from each year were audited. There was no alteration in the average age (58 ± 16.3 yrs versus 63 ± 16.5 yrs), sex ratio (52% male in both years) or pattern of referring team (63% cardiology in both years). A direct access service for general practitioners was introduced in 1993 and accounted for 5% of requests in 1994. The indications for study were as follows:

- Assessment of LV function: 1989 (%) 1994 (%) P
  - post MI (1) (7) <0.01
  - Murmur 7 cause 29 15 <0.05
  - Follow-up of known valve disease 14 14 NS
  - Bacterial endocarditis 7 5 NS
  - Intra-tricuspid thrombus 5 5 NS
  - Hypertension 3 6 NS
  - Cardiomyopathy 1 3 NS
  - Aortic dissection <1 <1 NS
  - Congenital, pericardial disease, etc. 15 18 NS

Approximately 25% of studies were normal in both years, unexpected findings were encountered in 32% of patients. Imaging was difficult in 12% & 10% of patients respectively. In spite of this, the question posed was answered in excess of 95% of studies. Interpretation was impossible in <1% of patients. In conclusion, the majority of studies in both years provided the information requested with a significant incidence of additional pathology identified. There has been a significant rise in demands for echo examinations over the last 5 years. Requests for assessment of left ventricular function have increased in both real and percentage terms. It seems likely that these trends will continue in the medium term and this has important implications for future planning of echo service provision.
A PROSPECTIVE EVALUATION OF ECHOCARDIOGRAPHIC TECHNIQUES INCLUDING SVC FLOW VELOCITY FOR THE DIAGNOSIS OF ACUTE CARDIAC ALLOGRAFT REJECTION

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Endomyocardial biopsy remains the gold standard in the diagnosis of cardiac allograft rejection. To determine whether echocardiographic measures correlate with biopsy proven rejection (and can thus reduce the number of biopsies required) we prospectively studied twenty orthotopic heart transplant recipients for three months after transplantation. Within 24 hours of each biopsy (beginning with the first on day 7) each patient had a twelve lead ECG and underwent echocardiography. Nineteen patients survived three months and the mean number of biopsies performed was 10.2 per patient. Parameters measured included superior vena cava (SVC) forward systolic flow (SVC-s), fractional shortening (FS), early mitral inflow velocity (MV), isovolumic relaxation time (IVRT) and summed ECG voltage in leads I, II, III, V1 and V6. Biopsies were graded using the International Society of Heart and Lung Transplantation criteria. There were no significant changes in MV or IVRT during rejection. Using criteria of a 50% decrease in SVC-S, 10% decrease in FS or 10% loss of ECG voltage, the sensitivity and specificity were as follows:

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>1B REJECTION</th>
<th>3A REJECTION</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Sensitivity</td>
<td>Specificity</td>
</tr>
<tr>
<td>SVC-s</td>
<td>61%</td>
<td>91%</td>
</tr>
<tr>
<td>FS</td>
<td>42%</td>
<td>89%</td>
</tr>
<tr>
<td>ECG</td>
<td>38%</td>
<td>82%</td>
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These data indicate that changes in the velocity of SVC forward systolic flow is a superior method for the non-invasive diagnosis of rejection to M-mode echocardiography, summed surface ECG voltage, mitral inflow velocity or isovolumic relaxation time.