Abstracts

Oral presentations

001 WAVE INTENSITY ANALYSIS: INSIGHTS IN HAEMODYNAMIC ABNORMALITIES IN HEART FAILURE

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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. It 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 heart failure (HF). 29 patients with HF were compared to 29 age-matched subjects with normal systolic function (N). An additional 67 subjects with compensated HF were studied to examine possible relationships between ventricular function and wave dispersion. Brachial BP, carotid arterial pressure (P) and flow velocity (U) were measured by sphygmomanometry, tonometry and pulsed wave Doppler respectively. The intensities of forward and backward waves and carotid pulse wave velocity (c) were calculated. Data are means $\pm$ SD, p was calculated by Student's t-test. P was lower in the HF group [129$\pm$21 (N); 120$\pm$24 mmHg (HF); p=0.10]. c did not differ [13.6$\pm$5.5 (N); 13.2$\pm$6.3 ms-1 (HF)]. Peak U was significantly reduced in the heart failure group [0.70$\pm$0.15 (N); 0.56$\pm$0.17 ms-1 (HF), p=0.006]. Ventricular wave power was dramatically reduced in HF [29.2$\pm$9.8 (N); 15.4$\pm$7.7 mWm-2 (HF); p<0.00001], as was wave work [232$\pm$80 (N); 124$\pm$66 Jm-2 (HF); p<0.00001]. Wave reflection from the head [13.3$\pm$7.5 (N); 17.5$\pm$11.7 % (HF), p=0.08] and the body [1.5$\pm$1.7 (N); 5.4$\pm$6.1% (HF), p=0.001] were increased in the HF group. The magnitude of the systolic ventricular power wave correlated with SBP (r=0.49 p<0.001) and age (r=0.29, p=0.009). Heart failure is associated with a dramatic impairment in the ability of the heart to generate pressure waves. 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 and giving additional insights into cardio-vascular pathophysiology.

002 AN AUDIT TO DETERMINE WHETHER ALL PATIENTS ADMITTED WITH HEART FAILURE RECEIVE ROUTINE ECHOCARDIOGRAPHY AND DOES IT ALTER THEIR MANAGEMENT

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One hundred and eight admissions aged 49–92 with a diagnosis of heart failure were retrospectively evaluated. 57% of patients with suspected heart failure were not offered echo on admission however 8% of these patients had been scanned recently. In total 44 patients were referred for echo. Following echocardiography the clinical concept of disease altered in 28% of cases and a treatable cause for heart failure was found in 4.5%. Echo was useful in identifying a cause for heart failure of an unknown aetiology; it was also able to confirm a diagnosis of coronary heart disease.

Echo significantly affected patient treatment with respect to ACE inhibitor prescribing (χ^2=8.17, P<0.005). Echo not only identified those patients with impaired systolic function who would benefit from treatment but also identified significant valve disease, a contraindication for ACE inhibitor treatment. This study identified a number of patients who were receiving sub optimal treatment for heart failure. Despite confirmed impaired systolic function on echo, 13.6% of patients were not prescribed an ACE inhibitor and 50% of patients with severely impaired left ventricular function were not taking Spironolactone.

Referral of patients for echo was not consistent throughout the team of physicians. One physician in particular referred significantly more patients for echocardiography.

This study did find that echo altered management of patients with suspected heart failure. It was also clear that local and NSF guidelines are not being met. Not all patients with heart failure receive echocardiography and not all patients with impaired systolic function are offered ACE inhibitor treatment.

003 CONTRAST ENHANCED REAL-TIME 3D STRESS ECHOCARDIOGRAPHY: IS IT FEASIBLE?

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Real-time 3D echocardiography (RT3DE) is a new modality that allows capture of the entire cardiac volume within one data set. The data set can be cropped to reveal different 3D sections. Any 2D echo imaging plane can also be re-created from the 3D data set. Acquisition can be completed in a few seconds allowing rapid and detailed 3D analysis of LV function. Contrast echo improves 2D echo assessment of LV function. Contrast has not been previously evaluated in combination with RT3DE.

20 unselected patients referred for contrast stress echo were evaluated at baseline using an infusion (1.1 ml/min) of Sonovue (Bracco). RT3DE was performed using a Philips Sonos 7500 system with a Matrix array transducer. Low MI (0.3) harmonic imaging was utilised with processing optimised for contrast. Whole cardiac volume acquisition was performed using an apical window. Average acquisition time was 5 sec. The data set could then be cropped or sliced in multiple planes, re-creating standard 2D echo views. Infinite echo planes can be obtained by adjusting the position of the cropping tool. All 20 unselected patients demonstrated excellent endocardial definition in all segments with good contrast resolution and a frame rate of approx 20 Hz.

Contrast enhanced RT3DE is feasible in patients referred for evaluation of LV function. It provides rapid, high quality acquisition of 3D images allowing creation of any 2D plane during off-line analysis. This technology should be especially valuable during Stress Echo.

004 IMPROVEMENT OF LEFT VENTRICULAR DIASTOLIC FUNCTION AFTER SEPTAL SURGICAL MYECTOMY OR PERCUTANEOUS SEPTAL ALCOHOL ABLATION IN PATIENTS WITH HYPERTROPHIC OBSTRUCTIVE CARDIOMYOPATHY

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Left ventricular outflow tract (LVOT) obstruction and diastolic dysfunction are responsible for dyspnoea in patients with hypertrophic obstructive cardiomyopathy (HOCM). Surgical myectomy and percutaneous septal alcohol ablation are effective treatments to relieve obstruction in these patients. To assess the effect of surgical and percutaneous septal reduction therapy (SRT) on LV diastolic function, 59 HOCM patients were studied at baseline and 3$\pm$4 months after septal myectomy (n=37) or alcohol ablation (n=22).

There was a significant improvement in NYHA class and in peak oxygen consumption after SRT. LVOT pressure gradient was markedly reduced to a similar extend by both procedures. The ratio of early to late peak diastolic LV inflow velocities (E/A) and the ratio of early diastolic LV inflow velocity to lateral mitral annular velocity (E/Ea) significantly decreased after SRT (1.5$\pm$1.6 versus 0.9$\pm$0.8 and 17$\pm$9 versus 10$\pm$5 respectively). At baseline, 54% of patients had delayed relaxation and 35% showed a pseudonormal pattern on transmitral inflow recording. After SRT, 89% of patients showed delayed relaxation. 80% of patients with a restrictive LV filling pattern before SRT had pseudonormal or delayed relaxation after SRT. Left atrial area at end systole decreased form 33$\pm$8 to 26$\pm$6 cm^2, p<0.05. Total area of mitral regurgitant jet also significantly decreased. There was no correlation between the change in diastolic pattern, E/A and E/Ea ratios and the change in mitral regurgitation. There were no significant differences in the changes of LV diastolic function indices between septal myectomy and alcohol ablation patients.

Conclusion: Echocardiographic diastolic function parameters improved after SRT in HOCM patients with similar changes after septal myectomy and septal alcohol ablation. These changes in diastolic parameters were not related to the decrease in mitral regurgitation.

Improvement in LV relaxation and decrease in LA pressure after SRT may contribute to the clinical amelioration of the patients.

005 DOBUTAMINE-INDUCED HAEMODYNAMIC CHANGES ASSESSED BY ECHO: IMPLICATIONS FOR INOTROPE DOSING

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Background: Beta-adrenoceptor agonists are used in patients with severe heart failure. They increase contractility and heart rate and therefore forward cardiac output (CO). However, published data suggest that patient mortality is increased by these drugs. We hypothesize that higher drug doses reduce stroke volume (SV) by shortening diastolic filling times and decreasing end-diastolic volume, contributing to this outcome.

Methods: 92 (Gp A) and 69 (Gp B) patients with normal and ischaemic Dobutamine stress echocardiograms were assessed. Dobutamine was infused at 10 µg/kg/min increments+/−atropine to achieve ⩾85% maximum predicted heart rate. Left ventricular wall motion score index (LV-WMSI) was calculated using the 16-segment/4-grade wall motion model. SV and CO were obtained from LV outflow tract and ECG data. Digitised data from an Enconcert (Philips) archive were analysed offline. Exclusions = atrial fibrillation, mitral regurgitation or obstructive LVOT gradients. Statistical significance = $p<0.05$*.

Results: There was no significant difference in heart rates. Dobutamine induces a biphasic change in SV, with SV falling at higher doses in both groups, but to greater extent in ischaemia.

Abstract 5

Dobutamine stage	Baseline	Low dose	Peak
A – CO (l/min)	4.9±1.2	7.4±2.1	10.5±3.2
B – CO	4.8±1.4	6.7±2.3	8.7±3.3*
A – SV (ml)	68±15	78±19	72±21
B – SV	66±20	72±23	60±23*
A – WMSI	1.03±0.13	1.01±0.02	1.00±0.02
B – WMSI	1.80±0.45*	1.66±0.43*	1.87±0.45*

Conclusions: Maximal forward SV occurs at lower inotrope doses in normal and abnormal hearts. Beyond this SV, any rise in CO becomes rate-dependent, with metabolic implications for the ischaemic heart. Inappropriate dosing can therefore be detrimental and dose optimisation may be helped by echo.

006 THE INFLUENCE OF MECHANICAL DISPERSION ON GLOBAL SYSTOLIC VELOCITY DURING BIVENTRICULAR PACING

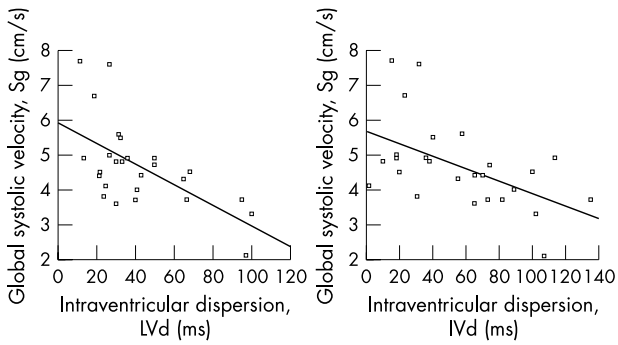
R.E. Lane, A.W.C. Chow, N.S. Peters, D.W. Davies, J. Mayet. *St. Mary's Hospital and Imperial College School of Medicine, London, UK*

Tissue Doppler imaging (TDI) can provide a quantitative measure of both mechanical dyssynchrony and systolic performance and enables assessment of the changes observed in patients with heart failure during biventricular pacing (BVP).

Methods: 17 patients age 72.6±12.3 years, with severe heart failure (NYHA III-IV) and LBBB (QRS 166±23 ms) underwent BVP. TDI from six segments across the LV at the level of the mitral valve annulus and from the RV free wall were recorded. Regional electromechanical delay was calculated as time from start of QRS to onset of systolic contraction. Intraventricular mechanical dispersion (LVd) was calculated as the time between latest and earliest sites of LV contraction. Interventricular mechanical dispersion (IVd) was calculated as the time delay between latest site of LV contraction and RV contraction. Global systolic velocity (Sg) as a measure of LV performance, was calculated as mean left ventricular (LV) systolic velocity. Measurements were made at baseline and during synchronous BVP.

Results: LVd and IVd were significantly reduced from baseline with BVP (78.1±51.0 v 42.3±25.3, p0.011 and 116.8±48.9 v 56.6±36.4, p=0.001) During synchronous BVP, Sg was found to negatively correlate with both LVd and IVd ($r=-0.54$, $p=0.004$ and $r=-0.54$, $p=0.005$ respectively) see graphs.

Conclusion: During BVP, maximal reductions in both IVd and LVd are needed to derive optimal LV performance. These can be quantified using TDI, and may be used as a guide for optimising therapy.



007 FEASIBILITY OF A NEW, COMPUTER BASED ASSESSMENT OF MYOCARDIAL PERFUSION WITH CONTRAST ECHOCARDIOGRAPHY

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Background: Myocardial Contrast Echocardiography (MCE) is a promising technique of assessing myocardial perfusion in patients with Coronary Artery Disease (CAD). Currently, quantitative assessment is performed by manually selecting regions of interest (ROI). We have specially developed a new software, Echofit, that automatically analyses and colour codes the redistribution of contrast bubbles after high impulse destruction.

Methods: Twenty patients with suspected CAD that were referred to our department for stress echocardiogram were studied, 13 men and 7 women, mean age 64±14. All patients underwent coronary angiography. A standard dipyridamole stress test (0.142 mg/kg/min for 4 min) was performed and continuous infusion of Sonazoid® (NC100100) was administered for MCE. We used the HDI 5000 (Philips Medical Systems) with Pulse Inversion and Real Time Perfusion Imaging (RTPI) with low mechanical index (MI) for imaging and high MI for destruction. The 3 standard apical views were digitally acquired and stored, at rest and peak stress. Twelve ROI were evaluated using dedicated standardised commercially available software (Q-lab, Philips Medical Systems), and the alpha and beta values were calculated. The results were compared with the coefficient patterns derived from Echofit which models the behaviour of the myocardial tissues in terms of the micro-bubble intensities over time as alpha(1-exp(-beta*t)), where t is time. Marquardt-Levenberg optimisation method was used to minimise the overall residual error between the optimised and the original intensity curve, resulting in the measurement of alpha and beta. These alpha and beta coefficients at of all image pixels are displayed in a final colour-coded image: the alpha pattern, and the slope pattern with the slope being slope = alpha*beta.

Results: Areas of abnormal perfusion were characterised visually and by the slope and the alpha. Altogether, 180 ROI were studied with both techniques. Overall concordance between the two methods for all regions was 98% for normal versus abnormal myocardial perfusion. Using Echofit areas of subendocardial hypoperfusion were easier identified and studied further. In two patients subendocardial perfusion of the mid septum was noted using Echofit and angiography confirmed 70–80% RCA stenosis.

Conclusion: This new software offers an objective and easy offline assessment of regional myocardial perfusion in patients with CAD using MCE. Additionally, subendocardial hypoperfusion was easily detected.

008 IN CLINICAL PRACTICE TRANSOESOPHAGEAL ECHOCARDIOGRAPHY USUALLY FAILS TO DETECT LARGE PERSISTENT FORAMEN OVALE

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A large persistent foramen ovale (PFO) is a mechanism for paradoxical thromboembolism and decompression illness. Transoesophageal echocardiography (TOE) is the gold standard for detecting a PFO. We have

closed over 120 PFOs in divers who have had shunt-related decompression illness and many cases of paradoxical thromboembolism. In each case the PFO was demonstrated by transthoracic contrast echocardiography. Most were referred for a closure procedure without TOE. 18 divers with a history of shunt-related decompression illness and 2 patients who had stroke as a result of paradoxical embolism had TOE performed at 15 regional cardiology centres in the United Kingdom. The TOEs were by experts. The TOE operators were aware of the results of transthoracic contrast echocardiograms in 18 cases. Cardiac catheterisation was performed in all cases. TOE failed to detect 14 of 20 (70%) clinically relevant PFOs that were detected by transthoracic contrast echocardiography and confirmed by cardiac catheterisation. The PFOs were 7–16 mm diameter (mean 10.6 mm). TOE provided an accurate estimate of PFO size in only 1 of 20 cases. TOE after transcatheter closure failed to detect a large residual shunt in the two patients with a residual shunt. TOE is not an accurate method of detecting a PFO.

009 VASCULAR ALTERATIONS IN AORTIC STENOSIS

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Background: The presence of symptoms is incompletely related to the grade of aortic stenosis and to LV function. It is possible that aortic physiology contributes.

Aims: To determine whether changes occur in aortic/ peripheral vascular haemodynamics in patients with aortic stenosis.

Methods: 36 consecutive asymptomatic patients and 8 with symptoms (Sx), with a mean age of 66 (range 29–82), had echocardiography, sphygmocardiography and photo-plethysmography to measure the augmentation index (AI), the subendocardial viability ratio (SEVR), the ascending aortic systolic and diastolic blood pressure (CSP and CDP), pulse wave velocity (PWV) (aortic compliance) and also peripheral artery tone (RI).

Results: The AI and the PWV were directly related to the grade of AS and the PWV decreased in symptomatic patients. The ascending aortic blood pressure and the SEVR also fell with symptoms.

Abstract 9

	Mild	Moderate	Severe	Sx	P value
EOA cm^2	>1	0.75–1	<0.75	<0.75	
N	14	15	7	8	
Vmax m/s	3.1	3.9	4.2	4.9	
Ai (%)	90	94	112	116	0.003
CSP(mmHg)	117	130	140	122	0.049
CDP(mmHg)	74	79	87	76	0.06
SEVR (%)	157	149	141	111	0.18
PWV (m/s)	9.3	10.4	12.3	9.5	0.02
RI (%)	77	66	76	54	0.047

Conclusions: Peripheral arterial physiology is related to the grade of aortic stenosis and the presence of symptoms.

010 A NEW PROTOCOL FOR LOW POWER CONTRAST IMAGING IN DOBUTAMINE STRESS ECHOCARDIOGRAPHY: PRELIMINARY CLINICAL RESULTS

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Real-time low power imaging has been introduced for myocardial contrast echocardiography. This technique has also been proven to be useful for improved endocardial border definition. It is unknown whether this technique is feasible and useful in Dobutamine stress echocardiography (DSE).

Objective: to test the feasibility of a new protocol for assessment of LV function using power modulation during DSE.

Methods: 89 consecutive patients referred for DSE underwent the established protocol for DSE using tissue harmonic imaging. After acquisition of the peak stress loops, contrast echocardiography was performed using power modulation. In 45 patients 0.3 ml bolus of Optison were given, in 44 patients a continuous infusion of Sono Vue (0.8 ml/min) was started and 3 apical views were acquired. A second contrast study was performed in recovery when images at peak stress did not show normal findings. Endocardial border definition was evaluated by 3 step visual score.

Results: Contrast injections were performed at an average heart rate of 128 bpm. All contrast studies were diagnostic. A total of 1600 segments were analysed. Endocardial border definition increased in 37% of the segments in comparison to the native images- particularly delineation of the apical segments and basal lateral and anterior segments improved.

Conclusion: power modulation is feasible in Dobutamine Contrast Echocardiography and results in significant improvement of the LV border delineation at peak stress.

011 A NEW APPROACH TO CARDIAC RESYNCHRONISATION: MULTISITE RIGHT VENTRICULAR PACING

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Biventricular pacing (BVP) aims to improve systolic function and symptoms in severe heart failure. Left ventricular (LV) lead problems account for the majority of complications and failures of BVP. With the use of tissue Doppler imaging (TDI), we investigated the feasibility of an entirely right-sided pacing configuration: multisite RV pacing (MRVP), as a simpler and safer alternative to BVP in providing cardiac resynchronisation.

Methods: Fourteen patients (mean age 63±11 years, EF <30%, 7 with ischaemic heart disease and all with chronic heart failure and left bundle branch block) underwent temporary MRVP prior to BVP. Quadripolar catheters were positioned in the high right atrium, mid RV inferior wall and on the anterior RV septum and synchronous MRVP commenced. Pulsed wave TDI was used to measure regional electromechanical delay, from which the dispersion of mechanical contraction within the LV (LVd) and between LV and RV (IVd) were calculated. Measurements were made at baseline, during synchronous BVP and MRVP.

Results: For all parameters there were no significant difference between BVP and MRVP except for QRS duration p0.001.

Abstract 11

	QRS (ms)	EF (%)	IVd (ms)	LVd (ms)	ΣIVd+LVd
Baseline	165±26	19±7	87±41	64±28	152±57
BVP	161±27	24±10	46±36	30±10	76±42
P	0.167	0.114	0.016	0.005	0.002
MRVP	189±21	25±7	54±37	44±18	98±45
P	0.006	0.061	0.035	0.009	0.019

(p values compared to baseline).

Conclusion: MRVP significantly reduces mechanical dispersion and improves LV performance comparable with BVP. MRVP may offer an effective and simpler form of cardiac resynchronisation therapy and should be considered as an alternative for patients where BVP is not possible.

012 AN AUDIT OF AN ECHOCARDIOGRAM SERVICE IN A DISTRICT GENERAL HOSPITAL

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We carried out a retrospective, case-note based audit of all in-patient requests for echocardiography during the month of July 2002. The objective of our audit was to improve the quality of referrals for echocardiography and decrease the number of echocardiograms repeated unnecessarily thus improving the efficiency of the service, decreasing the out-patient waiting time.

The total number of requests was 83 with a mean patient age of 72yrs (excluding paediatrics). 25% of requests were for patients over the age of 80.

After submission of the request form the 24% patients had their investigation on the same day. 59% of requests were carried out within 1 day of request, with 72% within 3 days.

40% of requests originated from cardiology and 49% from general medicine. 49% of requests were for assessment of left ventricular function. Clinical information was provided on the request form in 94% of cases but only 59% posed a specific question. One quarter of the

patients had already had an echocardiogram in the last 2 years and a quarter of these had no obvious reason for a repeat scan.

When we reviewed the notes in a sample of the patients in the audit we found that there was no recorded recognition of an echocardiogram having been performed in 42% of cases.

In conclusion, we suggest that improved filing of results, timely access to old notes and subsequent clinical review of these notes, would decrease the number of scans repeated unnecessarily. Improved recording of the result by, for example, introduction of a stamp in the notes would lead to increased awareness that the scan had been performed. Finally, we suggest that more detailed information on the request form, with a specific question posed would enable the sonographer a more focused approach and allow for improved time management.

Moderated poster presentations

013 THE EFFECT OF TIME TO THROMBOLYSIS ON THE LV FUNCTION POST ANTERIOR MI AND THE MOST ACCURATE AND REPRODUCIBLE METHOD OF ASSESSMENT

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Background: Previous clinical trials have demonstrated that there is a reduction in mortality by thrombolytic therapy in acute MI in relation to a shorter time between onset of symptoms and treatment. This study analyses the link between time to thrombolysis and early recovery of LV function. It also assesses the most accurate and reproducible method of assessing the function itself.

Methods: 35 patients with Anterior MI but no previous cardiac history received thrombolysis. These patients had echocardiograms performed 5 days post MI. The LV function was assessed using a visual eyeballing method and the LV function graded as good or showing mild, mild-moderate, moderate, moderate-severe or severe LV dysfunction. An LV ejection fraction was then calculated 3 times per patient using the Modified Simpson's package. Thrombolysis times were compared to LV function as assessed by each method.

Results: Mean call to needle times increased with a more severe degree of LV dysfunction. Mean times were, Severe-254 mins, Moderate-Severe-122 mins, moderate-78 mins, mild-moderate-62 mins, mild-45 mins and good-42 mins. There was poor correlation between Modified Simpson's measurements and thrombolysis times.

Conclusions: LV systolic function was found to be better with a shorter time between symptoms and treatment. The patients with the poorer graded function had mostly had a lengthened call to needle time. The visual eyeballing method was found to be the most accurate and reproducible method of LV assessment, as the Modified Simpson's showed poor correlation and variability.

014 CHARACTERISATION OF A NEWLY DEVELOPED ULTRASONIC CONTRAST AGENT

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Background: The size and composition of commercially available ultrasonic contrast microbubbles are such that when insonated at routinely used diagnostic frequencies (2–7 MHz), the bubbles resonate and strongly scatter ultrasound. Recently there has been increasing interest in imaging and manipulating these microbubbles at higher frequencies (30–40 MHz) for possible applications in targeting microbubble-encapsulated drugs to specific plaque sites in arteries and to image such sites using intravascular ultrasound. Due to commercial sensitivity re shell constituents and manufacture, targeting of specific commercial agents was not possible.

Aim: To produce an ultrasonic contrast microbubble capable of resonating at 30–40 MHz and to use such an agent for targeting specific cell-lines found in the arterial wall.

Method: A lipid-encapsulated nitrogen-filled microbubble was developed in-house. The agent was diluted to various concentrations using saline and blood-mimicking fluid (BMF). Using a ClearView Ultra system, an Atlantis SR intravascular probe was inserted into each solution and one frame of unprocessed ultrasonic data was acquired. The data was downloaded onto a PC. A region-of-interest (ROI) of 128 data points and 9 ultrasonic lines was chosen. Over these ROIs, mean backscatter power was calculated and referenced to data collected from a water-air interface. The ability of the agent to be targeted to specific cells was assessed microscopically by labelling the microbubbles with an antibody (CD54) and then passing these microbubbles over endothelial cells grown on an agar interface.

Results: At concentrations of 25 mg/ml, mean backscatter power was approximately 9 dB less than a commercially available agent (Definity). This level of backscatter is adequate for arterial plaque studies. Under physiological flow conditions the microbubbles were observed (both optically and acoustically) to be attached to the endothelial cells.

015 DIFFERENTIATION OF ISCHAEMIC AND IDIOPATHIC DILATED CARDIOMYOPATHY: TISSUE DOPPLER CHARACTERISTICS IN PATIENTS WITH GLOBAL SYSTOLIC LEFT VENTRICULAR DYSFUNCTION

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Many studies have shown that conventional echocardiographic parameters are unable to distinguish between ischaemic and non-ischaemic aetiologies in patients with global severe left ventricular dysfunction when history of coronary artery disease lacks. A coronary angiogram is usually performed but an ischemic origin is rarely found. The aim of this study was to determine whether colour tissue Doppler imaging and strain could make this distinction. The study cohort comprised 18 controls (53 ± 10y, 9 M), 37 patients, with idiopathic dilated cardiomyopathy (DCM) (62 ± 10y, 28 M, LVEF 30 ± 9 %, LV EDD 6.1 ± 0.4 cm) and 16 patients with ⩾3-vessel coronary artery disease (IHD) (67 ± 11y, 13 M, LVEF 29 ± 10 %, LV EDD 6.4 ± 0.3 cm). Colour tissue Doppler velocities and strain were measured in the left ventricular posterior wall on M-mode recordings. When the posterior wall was akinetic and thin, measurements were performed in the septum. Wall motion score index (2.34 ± 0.39 versus 2.25 ± 0.42) and the number of akinetic LV segments per patient were not significantly different between patients with IHD and those with DCM. During systole, ejection epicardial velocity measured at the time of peak endocardial velocity was higher in DCM than in IHD (21 ± 13 versus 10 ± 9 mm/s, $p=0.04$). The ratio of preejection to ejection endocardial velocity was lower in DCM compared to IHD (25 ± 27 versus 72 ± 44, $p=0.01$). During early diastole, peak endocardial velocity (68 ± 33 versus 42 ± 24, $p=0.03$), peak epicardial velocity (53 ± 31 versus 26 ± 17, $p=0.01$), and endocardial velocity measured at peak epicardial velocity (36 ± 27 versus 10 ± 9, $p=0.003$) were higher in DCM than in IHD. Systolic strain and tissue Doppler derived myocardial velocity gradients were similar in both groups of patients. Conclusion, analysis of colour tissue Doppler echocardiograms in endocardial and epicardial layers may be able to identify those patients with global severe left ventricular dysfunction that have ischaemic heart disease.

016 ROLE OF TWO DIMENSIONAL AND DOPPLER ECHOCARDIOGRAPHY IN PATIENTS WITH DUCHENNE CARDIOMYOPATHY

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Patients (pts) with Duchenne dystrophy (DMD) constitute a population of poor clinical state. DMD cardiomyopathy is one of the main reasons of morbidity and mortality in these pts. In this echocardiographic retrospective study several 2-D and Doppler variables were assessed in asymptomatic (a-DMD) or symptomatic heart failure DMD pts (s-DMD) and in a control group of healthy children. We also focused on Doppler-index (DI), a new, reproducible variable capable to assess the myocardial performance in many clinical settings. We assessed the echocardiograms of 24 normal controls (aged 9 ± 3 yrs) and 58 DMD-patients [(a-DMD,n:35;8 ± 2 yrs) (s-DMD,n:23;16 ± 3 yrs)]. One investigator with no access to any clinical information calculated all the echo variables. The DI was calculated using the sum of isovolumetric contraction plus relaxation time divided by ejection time (ET) [(ICT+IRT)/ET]. The statistics were performed by using unpaired t-test and ANOVA method with Bonferroni's correction. The ROC curve for the DI values was also estimated in an attempt to discriminate the best predicting value between controls and DMD pts.

Results: The LV fractional shortening (FS) of DMD pts in comparison with controls was significantly lower (28 ± 9% vs. 36 ± 6%, $p<0.001$). The peak E to A transmitral velocities ratio and the DI were significantly different too (E/A: 2.2 ± 0.7 vs. 1.6 ± 0.4 $p<0.001$, DI: 0.50 ± 0.15 vs. 0.39 ± 0.06, $p<0.001$). The only differences between a-DMD and

controls were the E/A (1.7±0.4vs.2.2±0.7,p<0.01) and LV ET (256±22 vs.232±15 msecs, p<0.001). The DI between controls and a-DMD was similar (0.39±0.06 vs 0.43±0.09 p: NS). Finally, a DI value of 0.50 was the best cut-off value between normal subjects and DMD pts.

Conclusions: The FS, E/A ratio and DI are useful echocardiographic variables for the assessment of DMD pts. However, from all the measured variables only E/A and ET were different between controls and a-DMD pts.

017 ELECTRICAL OR MECHANICAL DISPERSION: PREDICTOR OF CARDIAC RESYNCHRONISATION THERAPY

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The ECG has been used to identify patients for cardiac resynchronisation therapy (CRT). However, 30% of selected patients fail to derive symptomatic benefit. Tissue Doppler imaging (TDI) can measure the dispersion of mechanical contraction between right and left ventricles (RV and LV) and within the LV, and may be a superior tool for predicting patient response.

Methods: 12 lead ECG, 2D echocardiography and TDI were performed at baseline and during synchronous CRT in 28 patients age 66±12 years with chronic heart failure, ejection fraction (EF) <35% and left bundle branch block. TDI was used to measure regional electro-mechanical delay of the LV and RV. Intraventricular mechanical dispersion (LVd) was calculated as the time between latest and earliest sites of LV contraction. Interventricular mechanical dispersion (IVd) was calculated as the maximal delay between LV and RV contraction. Responders (R) or non-responders (NR) to CRT were classified on the basis of symptomatic and functional improvement.

Results: Baseline QRS was positively correlated with IVd (r=0.5, p0.017) but not with LVd. Following CRT, mean QRS duration was unchanged, EF increased (19±7 to 24±10% p0.01), IVd decreased (103±62 to 61±42 ms p<0.001) and LVd decreased (76±49 to 43±30 ms p0.001). During CRT, IVd was reduced by 54% and 15% in R and NR respectively whilst LVd was reduced by 40% and −2% in R and NR respectively. A 20% reduction in both LVd and IVd had 91% sensitivity and 100% specificity in predicting clinical benefit following CRT.

Abstract 17

	QRS (ms)	IVd (ms)	LVd (ms)
R baseline	175±23	140±74	95±64
R CRT	166±23	67±52	51±36
p	0.3	0.003	0.003
NR baseline	156±26	62±43	34±23
NR CRT	152±10	53±41	35±29
p	0.6	0.2	1.0

Conclusion: QRS duration does not predict clinical response with CRT. TDI can be used to assess dyssynchrony and predict response to CRT. Optimal reductions in both IVd and LVd appear to be important for clinical improvement.

018 CONTRAST AGENT INCREASES DOPPLER VELOCITIES AND IMPROVES REPRODUCIBILITY OF AORTIC VALVE AREA MEASUREMENTS IN PATIENTS WITH AORTIC STENOSIS

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Purpose: Observer variability may limit assessment of aortic stenosis by Doppler echocardiography. The aim of this study was to assess whether echocardiographic contrast agent improves reproducibility of aortic valve area (AVA) measurements in patients with aortic stenosis.

Methods: 20 patients with aortic stenosis (67+/−10 years) underwent non-contrast and contrast Doppler echocardiography, on two occasions, three weeks apart.

Results: Intraobserver and interobserver coefficients of reproducibility were 0.36 and 0.20 cm respectively for left ventricular outflow tract (LVOT) diameter, and 0.38 and 0.24 cm^2 respectively for AVA. Whilst intraobserver reproducibility was unaffected, the use of contrast improved interobserver reproducibility for LVOT diameter (mean of differences −0.02+/−0.07 cm vs 0.01+/−0.10 cm, p<0.05) and AVA (mean of differences 0.02+/−0.10 cm^2 vs 0.07+/−0.12 cm^2, p<0.05). Pre- and post-valve velocities were increased with contrast compared to non-contrast imaging (pre: 1.07+/−0.20 m/s vs 0.94+/−0.19 m/s, p<0.01; post: 3.76+/−0.87 m/s vs 3.47+/−0.78 m/s, p<0.01). Mean AVA was unaltered.

Conclusions: Echocardiographic contrast significantly increases Doppler velocities and produces modest improvements in the reproducibility of LVOT diameter and AVA measurements. We suggest that, when assessing patients with aortic stenosis, contrast agents should be considered in the difficult-to-image patients with poor baseline LVOT images or Doppler studies, or when there appears to be marked variability in sequential echocardiographic studies.

019 CONTINUITY EQUATION AREA IN BILEAFLET PROSTHETIC AORTIC VALVES: VALVE SIZE CANNOT BE SUBSTITUTED FOR LV OUTFLOW TRACT DIAMETER

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Background: The labelled valve size approximates the annulus in which it is implanted. A number of studies have suggested that it is more accurate than measuring LV outflow tract diameter for calculating the continuity equation area.

Objectives: The aims of this study were to compare labelled size with an in vitro model of the LV outflow tract and to measure the orifice size in six designs of bileaflet mechanical heart valve.

Methods: The inflow aspect of each of 29 valves was photographed then digitised and the maximum internal diameter and orifice area calculated. The LV outflow tract was modelled using a series of machined polypropylene blocks.

Results: The modelled LV outflow diameter ranged from 1.0 to 3.0 mm larger than labelled valve size for the intra-annular valves and from 3.5 mm smaller to 1.5 mm larger than labelled size for the supra-annular valves. Using labelled size gave an estimate of LV outflow area from 140 mm^2 smaller to 120 mm^2 larger than the actual area. The internal orifice diameter ranged from 1.6 mm to 4.6 mm less than the manufacturer's labelled size. The geometric orifice area varied widely between 159 and 222 mm^2 for the six size 19 valves and between 316 and 405 mm^2 for the six size 25 valves.

Conclusion: There are major differences between labelled size and actual size in bileaflet mechanical valves. Labelled size should not be used to compare haemodynamic function nor for the calculation of the orifice area using the continuity equation.

020 ATORVASTATIN DOES NOT REDUCE LV MASS OR AFFECT DIASTOLIC FUNCTION AFTER ONE YEAR OF TREATMENT

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Methods: It has been postulated that the statins may have beneficial affects on LV mass in the hypertensive population. We randomised 406 hypertensive patients with normal levels of serum cholesterol (≤6.5 mmol/L) to take either 10 mg of Atorvastatin or placebo. All patients underwent echocardiography after one year of treatment.

Results: Data on LV mass was obtained from 406 patients; with a similar number providing data on transmitral Doppler flow (TMD) and Tissue Doppler Echocardiography (TDE) at the level of the mitral annulus on the lateral wall. Both groups were equivalent in terms of age, sex and BMI.

Conclusion: After one year of treatment Atorvastatin had no significant effect on LV mass or diastolic function. This large cohort of patients does not support preliminary data from small studies that statins have beneficial effects on cardiac structure.

Abstract 20

LV Mass

Treatment	N=	LV Mass (g)
Atorvastatin	217	239.655
Placebo	189	234.900*

Transmitral Doppler

Treatment	N=	E wave (cm/s)	A wave (cm/s)	E/A ratio	E wave decel. time (s)
Atorvastatin	218	60.934	71.810	0.849	0.193
Placebo	190	60.542	71.287	0.849	0.193*

Lateral Wall velocities by TDE (cm/s)

Treatment	N=	S wave	E wave	A wave	E/A ratio
Atorvastatin	207	9.470	9.311	12.168	0.801
Placebo	188	9.586	9.381	11.891	0.842*

*All differences are statistically non-significant.

021 ASSESSMENT OF THE DYNAMIC PERFORMANCE OF NATIVE AND PROSTHETIC AORTIC VALVES

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Background: The assessment of aortic valve (AV) function by pressure gradients has limitations. Such gradients are dependent on flow across the effective AV orifice, which is affected by left ventricular stroke volume, heart rate and afterload. AV performance should therefore be characterised across a range of physiological flow rates. Measures such as the pressure-drop flow regression slope (PDFS) have been described. Due to nonlinear change, PDFS is not always obtainable; we hypothesized that measures of instantaneous AV resistance (mean pressure drop/flow, R) obtained during stress echocardiography could be used to define the performance of native and prosthetic aortic valves.

Methods: 23 patients with AV stenosis (Group A, continuity AV area at baseline <1 cm^2), 29 with AV bioprostheses (B), 18 with AV mechanical prostheses (C) and 92 with no stenosis (D) underwent stress echocardiography. Mean pressure drop and flow was calculated from 2D and Doppler measurements at each stage of Dobutamine stress.

Results: Group A had higher R [$p<0.05$*, all groups compared to A] at baseline and low dose stress; maximal R occurred at baseline and decreased with stress. Prosthetic R increased with stress so that at peak, there was no statistical difference with Group A. Prosthetic R was higher than in group D, but no difference was seen between groups B and C.

Abstract 21

Mean R±SEM	Baseline	Low dose	Peak dose
Group A	0.195±0.023	0.186±0.021	0.106±0.004
Group B	0.056±0.008*	0.069±0.010*	0.066±0.012
Group C	0.053±0.006*	0.085±0.014*	0.082±0.011
Group D	0.006±0.001*	0.008±0.001*	0.008±0.001*

Conclusions: AV stenosis causes a high R but such valves can still accommodate for increasing flow. Prostheses have lower R values but rigid orifices may reduce performance at higher flows.