TRANSOESOPHAGEAL ECHOCARDIOGRAPHY *Chairman: Mark Monaghan*

Evaluation of right atrial mass lesions using transoesophageal echocardiography.

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The large number of anatomic variants in the right atrium makes differentiation of pathological lesions from normal structures difficult by transthoracic echocardiography (TTE). The improved image resolution of transoesophageal echocardiography (TOE) allows better assessment of the size and characteristics of intracardiac masses. This study investigates the role of TOE in the evaluation of right atrial mass lesions.

TOE was performed in 25 consecutive patients who had an equivocal echogenic structure seen in the right atrium by TTE. Echocardiographic studies were analysed independently by two observers without previous knowledge of the clinical data for individual patients.

A definite diagnosis was made in 23 patients by TOE.

Lesions identified included right atrial thrombus (seven patients); right atrial myxoma (three patients); atrial septal aneurysm (two patients); Chiari network (two patients); and normal anatomic variant (nine patients). Lesion characteristics such as size, morphology and site of attachment to the atrial wall were clearly identified. We conclude that TOE is superior to TTE in the diagnosis of right atrial mass lesions and is useful in guiding appropriate therapy.

Transoesophageal echocardiography is the only diagnostic test required in the management of patients with acute thoracic aortic dissection

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Transoesophageal echocardiography (TE) is an invaluable investigation in the management of patients with thoracic aortic dissection. It is used as the definitive test in our unit and we have reviewed our experience to establish the value and limitations of this approach. From May 90 to May 92, 48 patients were referred with possible acute aortic dissection. 45 (94%) had immediate TE in the cardiac care unit. All received sedation with intravenous midazolam. The ECG was monitored and systolic pressure was kept at <110mmHg with nitroprusside and/or labetalol. There were no complications. Three patients were transferred with CT-diagnosed dissection but were too ill for TE or surgery; all died, and dissections were confirmed at autopsy. 25/48 patients (52%) had confirmed dissection. TE (performed in 22 patients) identified the origin and extent in 21 (96%) patients; in 1 patient it confirmed dissection but did not delineate its extent. 17 patients had type A dissection and 8 type B. Only 1 patient had coronary angiography, and 1 had CT scan in our unit (for chronic dissection). In 16 patients referred with the CT diagnosis of dissection the diagnosis was confirmed by TE in 12, and the site of dissection reclassified by TE in 2 others (specificity of CT 63%). The other 4 had aortic aneurysm with atheroma and intraluminal thrombus. 10 patients (aged 24 to 74 years, mean 52) with type A dissection had surgery. This was immediate in 8, in whom the mean delay between admission and arrival in theatre was 2.8 hours. TE findings were confirmed in all patients, and surgical mortality was 10%. TE is the essential investigation in patients with suspected dissection as it is rapid, accurate and safe. Diagnostic CT scanning prior to referral and coronary angiography prior to surgery increase the preoperative delay and are unnecessary.

TRANSOESOPHAGEAL ECHO IMAGING AND FLOW MEASUREMENTS IN THE PROXIMAL CORONARY ARTERIES: DO MORE PLANES = MORE SUCCESS?

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The improved image quality of transoesophageal echocardiography (TOE) has allowed the imaging of proximal coronary arteries in a proportion of patients. We have prospectively analysed the assessment of proximal coronary arteries in 30 consecutive, unselected patients (mean age 63 years, range 34-81 years) using mono-, bi- and multiplane TOE. Indications for TOE were possible endocarditis (11) or cardiac source of emboli (5), mitral valve disease (9), aortic arch pathology (3) and atrial masses (2). Studies were performed using a 5MHz multiplane transducer. Following the diagnostic studies the coronary arteries were serially assessed in the 3 standard modes. Imaging, colour flow (CF) and spectral Doppler studies of the coronary arteries were attempted.

Results: Successful studies.

	Imaging			Doppler (all planes)	
	Mono	Biplane	Multiplane	CF	Spectral
LM	18/30	18/30	20/30	15/30	0/30
LAD	13/30	13/30	16/30	15/30	13/30
Cx	15/30	15/30	15/30	8/30	4/30
RCA	6/30	6/30	9/30	6/30	0/30

LM=left main artery, LAD=left anterior descending artery (long axis), Cx=circumflex artery, RCA=right coronary artery.

Movement of the coronary arteries was the major limitation in allowing successful spectral Doppler studies. The biplane mode did not improve diagnostic information in any patient. Multiplane mode provided additional information in 16/30 (53%) allowing imaging of the LAD in short axis in 8 patients, LAD in long axis in 3, LM in 2 and RCA in 3. Multiplane TOE is therefore superior to monoplane TOE in the assessment of proximal coronary arteries. However even with these extra imaging planes, successful studies of the proximal coronary arteries was only possible in approximately 50% of patients. Specifically, the difficulty in reliably obtaining adequate spectral Doppler profiles of LAD flow severely limits this technique as a method of studying physiological changes in coronary flow. Previous studies suggesting a high success rate with monoplane TOE may have been over optimistic.

Is magnetic resonance imaging superior to transoesophageal echocardiography in the follow up of patients with thoracic aortic dissection?

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Transoesophageal echocardiography (TOE) is now established as the immediate investigation of choice in patients with acute thoracic aortic dissection. Following either medical or surgical treatment patients with aortic dissection require detailed follow up. Persistence of a false lumen is associated with an increased complication rate and its maintenance is related to tears leading to flow between the lumens. The difficulties of imaging the upper ascending aorta with TOE have led to the suggestion that magnetic resonance imaging (MRI) should be used as the investigation of choice for routine follow up, as it images the whole aorta. To compare the relative values of the TOE and MRI for detailed assessment of the morphology of dissections we have established a prospective comparative study. 10 patients age 24-72 years (mean 58) have been studied at an interval of mean 12 months since the initial diagnosis. 7 patients with type A dissection had been managed surgically and 3 patients with type B have been managed medically. TOE was performed using a biplane or multiplane probe with an HP Sonos 1500 by experienced operators. An IGE MR MAX 0.5 Tesla scanner with ECG and respiratory gating took T1 images in the transverse and parasagittal planes. Studies were performed "blind" and reported independently using a detailed protocol. Patients undergoing TOE received intravenous sedation and both investigations were well tolerated. There were no complications. MRI and TOE gave similar absolute values about the size of the aorta and extent of the dissection. Both detected the presence of flow in the false lumen which occurred in 8/10 patients including 5/7 surgical patients. TOE identified the presence of tears between the false and true lumens in 7 patients (range 1-4 mean 1.7), these were not seen on MRI. TOE also revealed mild aortic regurgitation in 6 patients and evidence of thrombus with spontaneous echo contrast. Both TOE and MRI readily identified the persistence of dissection, but in this study only TOE was able to demonstrate further details of dissection such as the sites of intimal tears. These details are relevant when making decisions about future management and we therefore suggest that TOE should be the initial investigation for routine follow up in these patients.

Echocardiographic assessment of the mitral valve does not predict clinically useful balloon dilatation

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The success of Balloon Mitral Valvotomy (BMV) is usually assessed by changes in mitral valve (MV) area following the procedure. The use of transoesophageal echocardiography (TOE) to "score" the valve morphology has been shown to predict increases in valve area and TOE is therefore used to assess patients suitability for balloon dilatation. To determine whether these increases in valve area are a surrogate for a successful clinical outcome, changes in valve area were compared with changes in both exercise duration and exercise capacity measured as peak oxygen consumption (peak VO₂).

22 patients (age 44-74 mean 58, 21 female) underwent maximal treadmill exercise testing with respiratory gas analysis. All patients were familiarised with the apparatus and performed exercise testing before and mean 10 weeks after BMV. All patients had TTE and TOE prior to the procedure and MV area was measured using Doppler pressure half time. All mitral valves were given an echocardiographic score based on TOE findings by 2 experienced independent observers. BMV was performed using the Inoue technique and there were no significant complications. The range of the TOE echo score was 4 to 11 (mean 6) and there was no significant intra-observer variability. MV area calculated by Doppler was similar to measurement at catheter by Gorlin formula (mean 0.98 ± 0.2 vs $0.9 \pm 0.2 \text{ cm}^2$). There was a significant increase in MV area following BMV ($1.4 \pm 0.4 \text{ cm}^2$ $p < 0.0005$) and at repeat exercise testing both exercise duration (480 ± 230 to $620 \pm 240 \text{ secs}$ $p < 0.0005$) and peak VO₂ (13 ± 5 to 11 ± 4 $p = \text{NS}$) had increased. There was a significant inverse relationship between the echo score and the increase in MV area ($r = -0.59$ $p < 0.01$) but there was no relation between the echo score or the change in valve area and increases in exercise time or peak VO₂.

TOE assessment of the mitral valve before BMV predicts increases in valve area. However, echo scoring does not predict improvements in exercise tolerance and this suggests that patients whose valves are not echocardiographically ideal for dilation, may benefit from BMV.

Significant hypotension in patients given midazolam before transoesophageal echocardiography

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Intravenous benzodiazepines are used commonly as sedation for transoesophageal echocardiography (TOE) although they cause hypotension which may be a particular problem in patients with coronary or valvar heart disease. To determine the incidence of significant hypotension we assessed systolic and diastolic blood pressure (BP) and pulse rate in 30 consecutive patients undergoing routine TOE. With the patient in the left lateral position, BP was recorded using an automatic cuff (Critikon), at baseline and every 2 minutes during the procedure. All patients received intravenous Midazolam (dose $4.4 \text{ mg} \pm 1.7$ mean $\pm$ SD) and topical xylocaine.

BP fell after IV Midazolam in all patients. Systolic BP was reduced from 141 ± 31 to $122 \pm 31 \text{ mmHg}$ and diastolic from 76 ± 14 to $67 \pm 13 \text{ mmHg}$ (both, $p < 0.001$). Probe insertion was not accompanied by a significant change in BP. The hypotension persisted, and often increased throughout the study. The lowest mean systolic pressure was $106 \pm 24 \text{ mmHg}$, 14 minutes after midazolam IV. During TOE, 26% of patients developed a systolic BP of 90 mmHg or below.

In patients with severe coronary artery or valvar disease, hypotension may be deleterious. During stress studies, dipyridamole and dobutamine may also induce hypotension and their interaction with midazolam should be appreciated. A fall in BP reduces systemic afterload and thus decreases cardiac work. This may decrease the likelihood of inducing ischaemia in patients undergoing stress TOE, and hence reduce the sensitivity of the test for the diagnosis of coronary artery disease.

Operators should be aware of the hypotension induced by sedation during routine TOE especially in patients with coronary disease, severe valvar stenosis and in those undergoing stress TOE.

ASSESSMENT OF RHEUMATIC MITRAL VALVES: SINGLE-PLANE VERSUS BIPLANE

TRANSOESOPHAGEAL ECHOCARDIOGRAPHY
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The suitability of rheumatic mitral valves (RMV) for percutaneous balloon valvotomy may be assessed using transoesophageal echocardiography (TOE), but imaging of the sub-valvar apparatus in the horizontal plane may be limited by acoustic shadows from the calcified valve. We investigated whether the addition of the vertical echocardiographic plane in the assessment of such valves gave further information on valve morphology, particularly on the sub-valvar apparatus. The Wilkins scoring system can be used to analyse 4 components of the RMV: leaflet mobility, thickening, calcification and sub-valvar involvement. A score of 1 to 4 is awarded for each component, to give a maximum total of 16. The lower the score, the more suitable the valve for balloon dilatation.

20 patients (16 women, 4 men, mean age 56) referred for assessment of suitability of RMV for balloon valvotomy were included in the study. The valve was first assessed using only the horizontal TOE plane and images recorded on videotape. The valve was then assessed using the vertical plane and the images recorded. The tapes were subsequently reviewed by 2 independent observers who were blinded as to the patient's identity and clinical status. Scoring was first based on the horizontal images alone. 2 weeks later the tapes were analysed by the same observers scoring the valve using both horizontal and vertical planes.

The scores derived using both imaging planes (6.2 ± 1.6 mean $\pm$ SD) were significantly higher than those derived using the horizontal plane alone (5.3 ± 1.8) ($p = 0.001$). Each component of the score was also compared. There was no significant difference between valve mobility, thickness and calcification as scored by each method. Scores for sub-valvar thickening however were significantly higher when both planes were used (2.0 ± 0.9 vs 1.2 ± 0.7 $p = 0.001$). Inter and intra-observer variability were both good ($r = 0.74$ and 0.88 respectively).

We conclude that addition of the vertical imaging plane improves detection of rheumatic involvement of the sub-valvar apparatus. Biplane TOE allows a more comprehensive assessment of rheumatic mitral stenosis, helping patient selection for balloon valvotomy.