Br Heart J 1988;**60**:1–3

Editorial

Oesophageal echocardiography

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The image quality of standard precordial echocardiograms can be unsatisfactory for various reasons. These include chronic pulmonary disease, obesity, chest deformities, and changes in the chest wall with age. In such patients important diagnostic information can more readily be obtained by oesophageal echocardiography.[1] Furthermore, even in patients with apparently excellent precordial imaging the oesophageal approach improves the signal to noise ratio because it circumvents the chest wall. This permits both better detection of poorly echo reflective structures such as thrombi and allows the use of higher frequency transducers, which give more detailed imaging of cardiac structure. In addition, some structures that are poorly displayed by the standard precordial approach are better visualised by the oesophageal approach. These include large areas of the atrial cavities, the left main coronary artery (and its proximal branches), and the thoracic aorta.[2–4]

Intraoperative applications

This new approach gives useful new information in several clinical situations and cardiac conditions. For example, in patients at high risk of cardiovascular complications the oesophageal probe can be used to monitor left ventricular function during anaesthesia without interfering with the surgical procedure.[5,6]

Oesophageal monitoring of left ventricular wall motion during operation permits the early detection of ischaemia and intervention to prevent myocardial infarction.[7–9] Oesophageal echocardiography was a more accurate predictor of changes in left ventricular filling than flow directed wedge catheters[7] (currently the accepted intraoperative technique for monitoring of left ventricular function). The immediate effects of coronary revascularisation can be studied by oesophageal echocardiography[10] and the technique can be used to monitor intracardiac air and other emboli passing through the heart.[11–14] The method opens a new area of research into the cardiovascular effects of anaesthetic drugs and interventions.[15,16] As with gastrointestinal endoscopy there is a risk of oesophageal perforation. Over three thousand cardiac studies have now been reported with no episode of perforation. The introduction of transducers without optical fibres seems to be as safe as the introduction of transducers with optical fibres. We believe that oesophageal echocardiography is safe when carried out by cardiologists and anaesthetists who are trained in the introduction of gastroscopes. Although the technique is valuable for intraoperative monitoring, oesophageal echocardiography will perhaps have its greatest impact when applied to intraoperative diagnosis. Oesophageal imaging combined with colour flow studies may be able to give the surgeon an intraoperative angiographic assessment of any surgical repair or valve replacement that lies in a plane accessible to the echo beam.[17] With modern cardioplegia, bypass time is no longer a limiting factor in surgical repair. Such immediate intraoperative evaluation of the repair should permit more precise and effective operations because bypass can be extended for further surgery if imaging shows that this is necessary.

Emergency and outpatient applications

Oesophageal echocardiography can also be used to assess the critically ill patient in whom an underlying acute cardiac event is suspected.[18] This technique is especially suitable for ventilated patients in the emergency room or in the intensive care unit when precordial echocardiography does not give sufficient

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information and in whom other diagnostic methods are not applicable.

It is likely that transoesophageal echocardiography will find an important place in the outpatient assessment of patients with suspected cardiac disease.

Before oesophageal echocardiography the patient must fast for about four hours. Usually patients do not need premedication if they are given a full explanation of both the reason for the study and the procedure. But some may need standard endoscopy premedication. Lignocaine (10%) is sprayed on to the hypopharynx and patients are studied in the left lateral decubitus position. The gastroscope is introduced in the standard manner with or without fibreoptic imaging. Rotation and angulation of the gastroscope give different views of the heart. The probe must be advanced to the fundus of the stomach to record all the available cross sectional views of the heart. Most of the clinically useful information is usually obtained within ten minutes. An experienced operator will obtain images of high quality in almost all patients. Relative contraindications to oesophageal echocardiography are difficulty with swallowing, a history of oesophageal disease, and preexisting radiation treatment. If these features are present a gastroenterologist should be consulted about the feasibility of the examination.

Oesophageal imaging gives fewer section planes than the precordial approach. But in the structurally normal heart it gives excellent visualisation of the left atrium, mitral valve, and left ventricular outflow tract. The aortic valve can only be visualised in an oblique section. The aortic root and left main coronary artery and its proximal branches are also well displayed. The technique is rapidly being adopted as the investigation of choice for aortic dissection because it gives good images of the descending thoracic aorta.[4 19 20] Aortic dissection can be diagnosed within 10 minutes of clinical suspicion. The mortality rate in type I aortic dissection is approximately 5% in the first hour. Computed tomography takes longer than oesophageal echocardiography and in our experience earlier emergency surgery may reduce overall mortality in this group of patients. Patients with chest trauma and acute aortic injury may also benefit from oesophageal echocardiography.

Image quality

Wall motion abnormalities in the proximal and mid ventricular walls are well defined, but the apex of the left ventricle remains a relatively uncharted area. The right heart is not well imaged but may be clearly seen in patients with cardiac rotation or right heart dilatation or both. The interatrial septum and right atrial appendage are consistently imaged as are the superior and inferior caval veins. The right ventricular outflow tract is not visualised in the normal heart and the pulmonary valve is seen only infrequently. The main pulmonary artery distal to the valve and its bifurcation into left and right pulmonary arteries is seen in over 50% of patients. Ultimately, these relatively poorly visualised areas may become accessible to more flexible and better steered transducers.

Because some areas are particularly well visualised from the oesophagus, the technique is most informative about abnormalities of the aorto mitral valve,[4 21] left atrium (including appendage thrombi), [2-4 22] interatrial septum,[23] left ventricular outflow tract, aortic root, and proximal left coronary artery and in the assessment of function of the proximal/mid portions of the ventricular myocardium. In combination with colour flow mapping techniques, oesophageal echocardiography is more sensitive than the precordial approach for detecting regurgitant jets in the left atrium in patients with both acquired mitral valve disease and valve prostheses. Investigation of mitral regurgitant jets by the precordial approach is limited by both the decline in the amplitude of Doppler signals over distance and the poor sound penetration to the area of interest. "Flow masking" behind the mechanical prosthesis is very common[24] and reduces the usefulness of assessment of mitral prosthetic regurgitation by the precordial approach. This is not a problem with oesophageal echocardiography because the transducer is placed immediately behind the left atrium.

At present, the transducers that are used for oesophageal echocardiography are too large for neonates or infants. But they can be used in older children and adolescents. We believe that oesophageal echocardiography will give additional information in the assessment of complex atrioventricular connections, Fontan circulation, the success of atrial baffle operation, and complex pulmonary atresia.

Conclusion

Oesophageal echocardiography is a logical extension of standard precordial echocardiography and is a major advance in the care of patients with cardiovascular disease. It provides diagnostic information essential for clinical decision making in patients with inadequate precordial studies. Its superior image resolution and increased sensitivity allow cardiac structure and function to be visualised in great detail. The method has proved to be a valuable means of intraoperative and perioperative monitoring of left ventricular performance in high risk patients and promises to be invaluable in critically ill patients. It

will undoubtedly become the principal method for analysis of both acute and chronic disease of the thoracic aorta, which cannot be seen from the precordial windows. In addition, oesophageal echocardiography is a major diagnostic advance in the evaluation of patients with suspected intracardiac emboli and dysfunction of a mitral valve prosthesis.

We believe that at present oesophageal studies should be performed only by cardiologists at centres with an extensive experience of the application of all routine diagnostic modes of cardiac ultrasound and an experienced gasteroenterological department. Cardiologists intending to use oesophageal echocardiography must be trained by an experienced gasteroenterologist.

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