

How transoesophageal echocardiography can assist cardiac surgery in adults

After its development and clinical application in the early 1980s transoesophageal echocardiography was rapidly recognised as providing a unique perspective from which to view the heart. Transoesophageal echocardiography is now widely applied in cardiology and is particularly useful in cardiac surgery, allowing continuous intraoperative monitoring without transgressing the sterile field. In addition, in the early postoperative period traditional transthoracic imaging is often unsatisfactory for various reasons including the presence of air and tubes in the mediastinum. Transoesophageal echocardiography can resolve clinical problems encountered in adult and paediatric cardiac surgery. Its applications in paediatric surgery are described by Weintraub et al.

General applications
During routine operations for myocardial revascularisation, transoesophageal echocardiography gives a non-invasive measure of global ventricular function and it can identify regional wall motion abnormalities as possible markers of hypoperfusion both before and immediately after bypass. The question whether transoesophageal echocardiography should be used in all revascularisation procedures is unresolved. Though cardiac output and other haemodynamic data can be derived from transoesophageal echocardiography most cardiac surgical groups continue to rely on thermodilution techniques. Intracardiac air can be visualised easily and de-airing can be continued until transoesophageal echocardiography no longer detects microbubbles. The relation between embolisation of microbubbles and neuropsychological outcome is not clearly defined. Nevertheless, neuropsychological deficit after cardiac surgery is sufficiently common to justify every effort to reduce intraoperative air embolism. Intra-aortic balloon pump insertion can be guided by transoesophageal echocardiography, allowing visualisation of the descending aorta to detect severe atheroma and avoid potential complications.

Transoesophageal echocardiography is the best method of imaging the heart in the early postoperative period. It aids not only the diagnosis of tamponade, but also the diagnosis of other causes of postoperative hypotension and in some situations, such as suspected atypical tamponade, may prompt or even spare a patient repeat thoracotomy. Daily transoesophageal echocardiography has been used to monitor the recovery of myocardial function in patients who needed assist devices after cardiotomy. The results were used to predict successful weaning from such devices.

Aortic surgery
The increasing number of older patients with severe atheromatous disease has focused research interest on the rational management of severe atheroma of the ascending aorta and aortic arch and the attendant risk of neurologic complications resulting from potential intraoperative embolisation. Simple palpation of the aorta at operation underestimates the degree of disease and therefore intraoperative imaging provides unique information, which in many patients may alter the conduct of the operation. There is, however, some doubt whether transoesophageal echocardiography is as sensitive in detecting atheroma of the ascending aorta as direct imaging with an epivascular probe. Though the correct approach to such patients is not yet clear this new information has stimulated some to apply radical surgical approaches to the severely diseased ascending aorta in an attempt to reduce the incidence of neurological complications. These approaches include its prosthetic replacement or the direct removal of pedunculated atheromas, which have been shown to have a high embolic potential.

Transoesophageal echocardiography is a safe, accurate, and rapid method of diagnosing aortic dissection. It has several clear advantages over other imaging techniques and can be used at the bedside to allow emergency surgery to proceed expeditiously. It can show the precise site of the intimal tear and also give functional data on aortic regurgitation and flow within the false lumen to guide surgical intervention. Biplane and omniplane probes and other technical refinements have also improved the visualisation of the ascending aorta and have increased specificity. During surgical repair, transoesophageal echocardiography can be used to confirm satisfactory retrograde flow to the great vessels after institution of cardiopulmonary bypass and aortic valve competence after re suspension. This allows prompt surgical revision if significant aortic regurgitation persists.

Valve surgery
It might be anticipated that the accuracy of transoesophageal echocardiography in the assessment of valve dysfunction could improve strategies in valve surgery. Currently the role of aortic valve repair is limited, though assessment of lesser degrees of aortic valve regurgitation may dictate alteration in the technique of myocardial preservation. Transoesophageal echocardiography gives excellent images of the structures around the aortic root and the technique may be of particular value in the surgery of aortic endocarditis, both in identifying the sites of abscess cavities and intracardiac fistulas and in confirming surgical closure. It also allows homograft sizing and confirmation of satisfactory function of the homograft or prosthetic valve after bypass and gives useful data during pulmonary autograft aortic valve replacement.

The potential role for transoesophageal echocardiography is greater in mitral valve surgery. The anatomy of function and dysfunction of the mitral valve can be clearly defined by transoesophageal echocardiography, particularly in mitral regurgitation, where satisfactory valve repair gives the best short and long term results and decisions made at the time of operation may affect both early and late survival and the need for reoperation. Pre-bypass imaging can prompt or discourage mitral valve surgery and unsatisfactory post-bypass images can lead to further surgical intervention to repair or replace the mitral valve in up to 10% of cases.


Furthermore, residual mitral regurgitation detected by transesophageal echocardiography has been shown to predict poor early and late outcomes.13 34 In hypertrophic obstructive cardiomyopathy, a related but different area of surgery, transesophageal echocardiography has been useful in intraoperative assessment, particularly for assessing the relative importance of muscular septal hypertrophy and systolic anterior motion of the mitral valve leaflet in left ventricular outflow tract obstruction, which dictates whether the patient needs septal myectomy alone or additional mitral valve surgery.

Limitations and reservations

There are reservations about the widespread use of transesophageal echocardiography as an intraoperative aid to monitoring. It is expensive and complex. Until now surgeons and anaesthetists have had little or no training in basic ultrasound techniques. Overall supervision by experienced observers is required, at least initially, to maximise the potential benefits to patient care. The realisation by surgeons and anaesthetists that a better understanding of the basic principles of ultrasound and Doppler would facilitate the effective use of these techniques prompted a recent review.25 In addition, the effects of prolonged intraoperative oesophageal intubation with synchronous endotracheal intubation on oesophageal and pharyngeal function has not been fully assessed. The imaging of certain structures is still suboptimal. The apex of the left ventricle, the right ventricular outflow tract, and the portion of the ascending aorta anterior to the trachea are the principal areas where satisfactory images are often unobtainable. This will improve as biplane and multipane imaging probes develop.

Transesophageal echocardiography has already been used widely both intraoperatively and postoperatively in cardiac surgery patients. It provides new information not previously available to surgeons and anaesthetists that assists decision making. We urge all surgeons to take advantage of the information it provides and we believe that as the technique becomes more widely used not only will its potential applications become more clearly defined but also other uses of usefulness will be identified.

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