

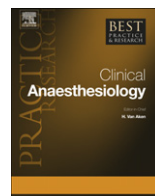


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### Limited transthoracic echocardiography assessment in anaesthesia and critical care

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The use of echocardiography in anaesthesia and critical care started with transoesophageal echocardiography, whereas transthoracic echocardiography was largely the domain of the cardiologist. In recent times, there has been a change in focus towards transthoracic echocardiography owing to the development of small and portable, yet high-fidelity, echocardiography machines. The cost has reduced, thereby increasing the availability of equipment. A parallel development has been the concept of limited transthoracic echocardiography that can be performed by practitioners with limited experience. The basis of these examinations is to provide the practising clinician with immediate information to help guide management with a focus on haemodynamic evaluation, and limited structural (valve) assessment to categorise whether there is a valve disorder that may or may not cause haemodynamic instability.

The limited examination is therefore goal directed. A number of named examinations exist which differ in their scope and views. All of these require a limited knowledge base, and are designed for the clinician to recognise patterns consistent with haemodynamic or anatomical abnormalities. They range from very limited two-dimensional assessments of ventricular function to more complex (yet presently limited) studies such as HEART (haemodynamic echocardiography assessment in real time) scan, which is designed

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to provide haemodynamic state, as well as basic valvular and pericardial assessment. It is suitable for goal-directed examination in the operating theatre, emergency department or intensive care unit (ICU) and for preoperative screening.

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## **Echocardiography in anaesthesia and critical care**

The heart and the circulation are arguably the most critical of the organ systems in critical care. Critical to anaesthesia is the ability to assess a patient's physiological reserve before he or she is anaesthetised or, if the patient is unable to cope with the changes during a procedure, to determine the nature of the problem and a method to solve it. Another challenge is the patient who is unable to exercise for orthopaedic or other reasons and whose physiological reserve cannot be assessed adequately on purely clinical grounds. Shortness of breath can be caused by lung or cardiac pathology or a combination and the part played by each is not always obvious. Clinicians are also challenged with unexplained hypotension or cardiovascular collapse. There are many causes, few of which can be confidently diagnosed by conventional invasive pressure monitoring. The first-line treatment is often based on fluid administration, vasopressor support or establishing inotrope treatment. Rational treatment, however, follows accurate diagnosis, and this is often delayed until diagnostic imaging modalities are employed.

Preoperative assessment of patients is a fundamental part of anaesthesia care. Good preoperative assessment will identify patients with signs or symptoms of potential cardiovascular disorder. While additional tests such as electrocardiogram (ECG) or chest radiograph may offer some additional diagnostic information, they are generally inadequate to identify the type and severity of cardiovascular disorder. Echocardiography is probably the investigation of choice to help differentiate cardiac disorder and risk. A good example is the undiagnosed systolic murmur. It could be mild AS or MR, neither of which carries any increased risk to the anaesthetic; or, it could be severe AS that may require a change in the anaesthetic management approach or delaying the operation pending further investigation and management of the valve disorder.

The scenario of "I wish I had an echo" is repeated even more often in emergency cases where there is no doubt that an echocardiogram would be useful, but the operation cannot be reasonably delayed for more than a short period of time. Few hospitals have a skilled sonographer and/or cardiologist immediately available 24 h a day, 7 days a week for urgent echocardiograms. The total number of cases is small and would not justify an out-of-hours urgent call either. Similar problems are faced by intensivists and emergency physicians with out-of-hours cases where an echocardiogram would be immediately useful.

Over the past 20 years, but more so in the past 5 years, there have been two parallel moves to assist critical care physicians solve the foregoing problems. The first has been the development of point-of-care echocardiography with smaller portable machines taken to the patient's bedside or into the operating rooms. The second has been the development of limited echocardiography where the scanning and the interpretation of the images have been conducted by the critical care physicians themselves. The aim of this article is to outline the parallel changes of point-of-care echocardiography and the evolution of limited transthoracic echocardiography (TTE) examinations.

### **Point-of-care echocardiography**

The majority of today's specialised cardiovascular investigations are dependent on large, relatively expensive equipment that is only suitable for location in a cardiological investigation. Examples include angiography, cardiac computed tomography (CT) and cardiac magnetic resonance imaging (MRI) facilities. Early echocardiography machines were large and heavy and, though cart-based, were predominantly located in a fixed laboratory. However, miniaturisation and increased computing power have seen the development of fully featured echocardiography machines that are laptop sized and

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