HEARTscan is an acronym for the limited transthoracic echocardiography study “Haemodynamic Echocardiography Assessment In Real Time”. It has been developed by the University of Melbourne ultrasound group (see www.heartweb.com). The registered name “H.A.R.T.scan®” refers to the training package developed by the University of Melbourne.

The core concept is that limited transthoracic echocardiography can add additional information to evaluate the cardiovascular state of the patient better than conventional history, examination, and basic investigations. It is a form of “ultrasound-assisted examination”, and promises to be a vital tool in anaesthetic practice in the future.

Figure 1 shows the typical pre-anaesthetic assessment paradigm used today. If patients are unwell, they will typically be seen in either a pre-admission clinic, or just before surgery in the emergency operating room. The anaesthetist will record a history looking for evidence of heart failure or general frailty, perform an examination looking for a murmur, tachycardia, third heart sound, and evaluate whether they have hypoperfusion or shock. Basic investigations such as arterial blood gases, ECG, or chest X-ray may be performed. Typically, however, these processes will identify that a cardiovascular problem exists, but may not specify what the problem is. What the clinician wants to know is what the haemodynamic state is, or whether there is a valve problem that will cause haemodynamic instability, if there are any other unknown causes (such as pericardial effusion).

In Figure 2, the diagnostic and management processes that the clinician will go through are shown. Although low blood pressure is detected as a problem, what is actually treated is the underlying haemodynamic state. For example, both systolic failure and hypovolaemia cause hypotension, but the treatment is very different. Similarly, if there is a valve lesion, will it cause haemodynamic instability or not? The premise of point of care or limited echocardiography is to add a new order of diagnostic information, to facilitate better clinical decision making. Armed with good information, it is easy for clinicians to make a rational judgment and provide consistent management. In fact, limited echocardiography is likely to provide about 90% of important clinical information for perioperative use compared to a comprehensive transthoracic study.

The limited scan and completion of a report should take about 10 min, so as not to unduly interfere with the workflow in clinical practice. An example of the report is shown in Figure 3. What is important is the pictorial and categorical description of findings, which not only focuses on the clinician’s assessment of the patient, but also prioritises the haemodynamic state and basic valve assessment.

A core concept of the HEARTscan study is that it is a transthoracic exam, though the principles can be applied to transoesophageal echocardiography. Haemodynamic state assessment, and limited valvular assessment, using two-dimensional and colour flow Doppler only is performed. Note that qualitative Doppler techniques are not part of the study. It involves a limited report, and utilises all the transthoracic windows except suprasternal. It is important to understand that not all windows are available for good imaging in all patients, and secondly, what is really critical is that once the information is obtained, it is time to move on. Traditionally, the parasternal window is used first as this is what happens in comprehensive transthoracic echocardiography, but this can be adjusted according to the clinical situation. For example, in an arrest situation, the subcostal window is usually used first.
Refresher Course: Practical workshop: HEARTscan

The training course has two major components. Firstly, the knowledge base is delivered to students prior to the course. This consists of four interactive multi-media tutorials and 20 case studies. It is expected that students will complete this work prior to attending a two-day, hands-on workshop. The aim of the workshop is to give students the tools and practice in obtaining images. This is performed in a small group scenario (1:5 tutor:student ratio), and scanning is performed on volunteers. There are a number of rotations where students learn how to perform transthoracic echocardiography and how to get images, followed by haemodynamic state evaluation, valve assessment, and then practising the whole study. In a concurrent station, a facilitator takes those students not actively scanning through multiple cases where pathology is shown and discussed, and students have the opportunity to practise completing the report. Overall, there is approximately 40 hours of knowledge base pre-reading, and a two-day, hands-on workshop. This gives the student enough information to get started. It is expected that they all need to do another 30 studies before they will feel comfortable in performing the study in a timely manner.

Integral to the training course are the concepts of H.A.R.T.scan positive valve lesions, which means that the valve abnormality may cause haemodynamic instability. Generally, this refers to moderate or severe stenosis or regurgitation. Mild aortic stenosis, for example, would be “H.A.R.T.scan negative”. Throughout the course, it is reinforced that limited knowledge base and training equates to limited diagnostic repertoire. This is a similar concept to ATLS, where students are taught patterns and responses to trauma situations. Limited echocardiography is about teaching diagnostic patterns from which clinicians will form predictable responses. Qualitative Doppler is

Figure 1: Flow diagram of traditional pre-anaesthetic assessment

- Unwell Patient
- History
- Examination
- Basic IX
- Problem Exists
- What is the Haemodynamic state
  - Will the valve cause haemodynamic instability
  - Are they any other causes

Figure 2: Diagnostic and management triage diagram

- Normal Hyponaemia
- Hypovolaemia
- Primary diastolic failure
- Systolic failure
- Systolic and diastolic failure
- Vasodilation
- RV failure

- Stable or Unstable
- How urgent is the operation?
  - Defer the operation, or get on and operate, with high risk

- Triage
  - Valve or other
  - Is the valve lesion likely to cause haemodynamic instability?
deliberately not taught, as the knowledge base and experience required to perform it accurately is much greater than can be taught and practised with a limited echocardiography scan. And if abnormal pathology is found, it is a strongly recommended that a full and comprehensive echocardiography study is performed at a later stage.

The limited echocardiography study has very widespread application in critical care medicine. In patients with potential heart disease, the added diagnostic “pickup” rate is actually surprisingly high. The impact on decision-making is considerable. This will apply equally to the emergency department, anaesthesia pre-assessment, intraoperative assessment, or in the intensive care afterwards. It also applies to both emergency, as well as elective patients. Furthermore, it is actually quite easy to perform. Although there is a general fear that transthoracic echocardiography is difficult to accomplish, in fact it is not. One has to accept that with regard to some patients, images will not be obtained, but in the majority, useful diagnostic information can be obtained from at least one window.

Limited transthoracic echocardiography has the potential to revolutionise the way that critical care clinicians evaluate and manage their patients.

References