# PG46 Guideline on training and practice of perioperative echocardiography in adults 2025

## Short title: Perioperative echocardiography

*Keyword list:*

*Echocardiography, Cardiac ultrasound, Transoesophageal Echocardiography (TOE), Transthoracic Echocardiography (TTE), comprehensive echocardiography study, basic transoesophageal echocardiography*

### 1. Purpose

The purpose of this document is to provide clear recommendations for training, maintenance of competency, and for clinical practice in perioperative echocardiography to support high standards of patient care.

### 2. Scope

This document applies to all anaesthetists providing perioperative echocardiography services as described below to adult patients or those undertaking training and/or supervision of such procedures.

This document applies to transoesophageal echocardiography (basic and comprehensive) and comprehensive transthoracic echocardiography. Point-of-care transthoracic cardiac ultrasound is less comprehensive, requires less training, and is therefore considered elsewhere (see *PG47 Perioperative diagnostic POCUS*) (see also definitions below – Section 4).

### 3. Background

Ultrasound imaging of the heart and its surrounding structures is a means of providing additional diagnostic and monitoring information that enhances safe periprocedural care, including in emergency situations.

The term 'perioperative echocardiography' refers to comprehensive or basic transoesophageal echocardiography (TOE) and comprehensive transthoracic echocardiography (TTE) as diagnostic assessments. Not covered here is point-of-care transthoracic cardiac ultrasound, which addresses specific clinical questions related to hemodynamic instability or cardiac murmurs as part of a broader point-of-care ultrasound examination (see *PG47 Perioperative diagnostic POCUS*).

The advantages of having timely access to cardiac imaging in the perioperative environment, whether in real time or not, are widely recognised. This accessibility is made possible by suitably qualified practitioners and high-quality imaging equipment. However, due to varying clinical contexts and patient requirements, echocardiography studies may differ in their indications, complexity, and duration. It is essential that all echocardiography examinations be conducted by a qualified practitioner or under their supervision.

Perioperative echocardiography, performed by an anaesthetist (or another clinician), assists cardiac surgeons and cardiologists during open-heart or percutaneous cardiac procedures. It may also be used in other settings, such as pre-anaesthesia evaluation (TTE) and haemodynamic diagnosis and management (TOE and TTE). TOE may be useful in a number of non-cardiac surgical procedures including liver transplantation.

Comprehensive echocardiography (both TOE and TTE) is equivalent to the diagnostic services provided by cardiology echocardiography departments. It involves a systematic, detailed examination of the heart's structure and function, documented in a formal report.

There are risks, benefits and cost associated with the performance, interpretation and reporting of echocardiography, so this document has been developed to provide guidance for those wishing to train and practice in perioperative echocardiography to maximise effective and safe practice.

The guideline recognises that different skills and levels of competency are relevant for transoesophageal and transthoracic approaches, and within TOE for basic and comprehensive studies. and those involving structural cardiology.

Fulfilment of the requirements outlined in this document does not bestow formal credentialing or certification but may be used to guide credentialing and accreditation for scope of practice by appropriate authorities in individual institutions.

## 4. Definitions

4.1 **Echocardiography**: A cardiac ultrasound study which is conducted to examine the heart and surrounding structures and provide a written report to guide practice including that by another clinician. It may be conducted via transthoracic (TTE) or transoesophageal (TOE) routes. TOE studies are classified into comprehensive (including interventional echocardiography), limited and basic. Echocardiography employs modalities such as M-mode, 2D imaging, Doppler, and colour Doppler to evaluate heart chambers, valves, and surrounding structures, with advanced techniques including strain imaging and 3D echocardiography, enhancing its clinical utility.

4.2 **Transoesophageal echocardiography (TOE)**: An echocardiography study conducted via the transoesophageal approach to examine the heart and surrounding structures. It provides a qualitative and quantitative assessment to monitor a patient, diagnose a condition, or aid clinical decision-making. These studies utilise multiple imaging modalities.

4.3 **Transthoracic Echocardiography (TTE)**: An echocardiography study conducted via the transthoracic approach to examine the heart and surrounding structures. It provides a qualitative and quantitative assessment to diagnose a condition or aid clinical decision-making.

4.4 **Comprehensive echocardiography study**: A complete echocardiography examination that provides detailed quantitative and qualitative assessment of the heart and surrounding structures, using multiple modalities, to diagnose a condition and/or to aid clinical decision making. It may be conducted via transthoracic (TTE) or transoesophageal (TOE) routes.

4.5 **Interventional echocardiography (IE)**: Describes the role of echocardiography where interactive guidance during real-time cardiac interventions such as structural heart or electrophysiological procedures, usually performed by an interventional cardiologist, is undertaken. This is usually TOE, but occasionally may be TTE e.g. when TOE is not possible. IE may be either a comprehensive or limited study (below) depending on the procedure and clinical circumstances.

4.6 **Limited transoesophageal study:** A TOE examination which is targeted at one particular anatomical region for the purposes of a specific diagnostic assessment or for facilitating a specific procedure, such as a structural heart procedure.[1] A limited study is performed by a practitioner with training and competency in comprehensive TOE.

4.7 **Basic transoesophageal study:** A TOE examination conducted via the transoesophageal approach to examine the heart and surrounding structures. It provides a qualitative and quantitative assessment to diagnose a condition or aid clinical decision-making. Basic TOE utilises 2D and

colour flow Doppler but not typically spectral Doppler or 3D modalities and is generally less detailed and less quantitative than comprehensive studies.

4.8 **Point-of-care transthoracic cardiac ultrasound (POCUS)**: A transthoracic cardiac ultrasound study for the acquisition, interpretation, and immediate clinical integration of findings performed by a treating clinician at the patient's bedside. [2] Other terms used may include goal-directed or focused (see also *PG47 Perioperative diagnostic POCUS*). It is not a comprehensive study. The term "echocardiography" is for comprehensive studies and should not be used with point-of-care studies.

4.9 **Echocardiography trainee:** A practitioner who is training under supervision to gain knowledge and skills to enable independent practice in echocardiography.

4.10 **Echocardiography supervisor**: A practitioner who has fulfilled the requirements for training and maintenance of training in echocardiography and who has accepted the responsibility of supervision of an echocardiography trainee.

## 5. Echocardiography studies

Only medical practitioners who have completed or are undertaking supervised echocardiography training in accordance with this document should perform echocardiography. Echocardiography trainees must be cautious in applying information obtained from echocardiography information that they obtain, to alter clinical management. Echocardiography trainees should verify their findings with their supervisor (or an experienced practitioner) before communicating them to another clinician.

Only practitioners who meet the relevant requirements outlined in this guideline may supervise echocardiography trainees and issue formal reports. Competence in TOE does not automatically qualify a practitioner to supervise TTE training or independent practice (and vice-versa), as each modality, despite shared principles, requires distinct training and assessment.

This guideline and background paper utilised the published indications [3] and practice guidelines for basic TOE,[4] comprehensive TOE and TTE [3, 5, 6] and IE.[7, 8]

5.1 **Basic TOE studies** [4]

5.1.1 The primary purpose of most basic TOE studies is to identify the cause(s) of haemodynamic instability and to monitor and guide haemodynamic management in patients undergoing a procedure or resuscitation.

5.1.2 A complete basic examination should be performed on each patient as a standard examination. It is recognised that circumstances (clinical or logistic) may require limiting the study to specific clinical question(s), however a complete examination should be undertaken when possible.

5.1.3 The complete basic study should include (where possible) the standard views of the guidelines published by the American Society of Echocardiography and Society of Cardiovascular Anesthesiologists, [4] or an equivalent body.

5.1.4 Basic studies Include 2D and colour flow Doppler imaging and measurements but not typically spectral Doppler (with the exception of estimation of cardiac output) or 3D modalities.

5.2 **Comprehensive echocardiography studies (TOE and TTE)**

Comprehensive echocardiography includes TOE and TTE. Specific indications have been published, and in general, studies are indicated when detailed quantitative and qualitative assessment of the heart and surrounding structures is required, using multiple modalities, to diagnose a condition and/or to aid clinical decision making. [3, 5, 6, 9]

Comprehensive studies have the following requirements:

5.2.1 A complete comprehensive study should aim to include all standard views, with the exception of limited studies such as IE for structural heart interventions[8] (e.g. mitral valve evaluation prior to mitral valve intervention in the cardiac catheter laboratory). However, it is recognised that performance of all views may not be achievable in every case due to patient factors or clinical circumstances.

5.2.2 Comprehensive TOE examinations should follow the guidelines published by the American Society of Echocardiography.[3, 5]

5.2.3 Comprehensive TTE examinations should follow the guidelines published by the American Society of Echocardiography.[9]

5.2.4 When echocardiography is performed to assist in a procedure (such as cardiac surgery or cardiac catheter intervention), an echocardiography study should be performed both before and after the procedure.

### 5.3 Storage of echocardiography images and reporting (all examinations)

5.3.1 Echocardiography images from clinical studies, whether TOE (comprehensive, IE, limited or basic) or TTE, should be stored to allow access from a patient's treating team(s) for clinical and audit purposes.

5.3.2 Storage of images should adhere to the institution policies (including security and privacy).

5.3.3 The record of study images should include identification of the patient and echocardiographer(s), date, time, indication and type of examination.

An electronic record of the study images should be stored and archived. This record should be in a digital format, include patient identification, date, time, and type of echocardiography examination (TOE or TTE) to allow a full review for both clinical and audit purposes.

5.3.4 A formal report should be produced that follows published recommendations [10] and include at a minimum:

i. Type of echocardiography (TOE or TTE).
ii. The date and time of the examination.
iii. Patient identification.
iv. Indications for the study.
v. The name(s) and signature (or e-signature/name) of those conducting and reporting the examination and findings (including supervisor if relevant).
vi. Detailed findings.
vii. Quality of the imaging and any resulting limitations affecting interpretation (eg. views unobtainable).
viii. Recommendations (if any).

5.3.5 The formal report should be available:

i. In the patient records.
ii. For archival review.

## 5.4 Safety

While acknowledging clinical benefits, both TOE and TTE have the potential to cause patient harm. The indications and contraindications for each modality must be carefully considered in each case.

### 5.4.1 TOE

#### 5.4.1.1 Indications for TOE

TOE should only be performed when clinically indicated as it is a semi-invasive procedure with rare but potentially lethal complications. Clinical indications have been provided for TOE covering diagnostic, cardiac surgical, cardiology catheter-based procedures and emergencies.[3] More specific indications for structural cardiology interventions [8], critical care settings[11], liver transplantation, and the use of TOE in emergency 'rescue' situations are also described.[12]

#### 5.4.1.2 Contraindications for TOE and safe conduct

Contraindications and recommendations for the safe practice of TOE are based on expert recommendations, case series and retrospective studies [13, 14]. Recommended procedures for safe placement and manipulation of TOE probe should be followed to reduce the risk of injury to the patient or damage to the probe.[3, 13] The TOE probe should be inspected after use for signs of potential patient injury (eg blood contamination. A knowledge of actions to take in response to suspected patient injury is necessary.

#### 5.4.1.3 Assistance

If the patient's anaesthetist performs intraoperative TOE, an experienced anaesthetic assistant may be required to assist in monitoring the patient's clinical condition. This is particularly the case when there is the combination of a very unstable clinical situation and when complex TOE interpretation is required.

An experienced assistant should be available when TOE is performed by the anaesthetist in some structural heart interventions (eg. placement of a Mitraclip) [7]. Alternatively, a separate clinician competent in intraoperative TOE should perform the study whilst the primary anaesthetist manages the patient.

### 5.4.2 TTE

#### 5.4.2.1 Indications for TTE

Although considered non-invasive, risks include interpretive error, patient discomfort and occasionally pressure or thermal-related injury. Therefore, clinical indications should be followed, or when studies are conducted for training then consent from the patient or volunteer should be obtained. Indications have been published.[9]

#### 5.4.2.2 Contraindications for TTE

There are few absolute contraindications for TTE. However, consideration should be given to access, chest wall integrity and patient comfort when performing a study. In addition, the ability to of TTE to provide the desired clinical information, compared to alternative modalities must be taken into account.

#### 5.4.2.3 Assistance

As for TOE, if the TTE investigation is performed during anaesthesia by the anaesthetist then factors described in 5.4.1.3 need to be taken into consideration.

5.4.3 Disinfection and sterilisation.

There must always be adequate facilities and staff to decontaminate and clean the TOE and TTE probe and echocardiography machine surface after use.

TTE probes that do not contact blood or body fluids are considered non-critical and require low-level disinfection and cleaning. If there is a risk of a TTE probe being contaminated with blood or body fluids, then a sterile disposable probe cover should be used, which, provided it remains intact, will enable the TTE probe to be managed as a non-critical device (refer to *PG28 Infection prevention and control*).

TOE probes are considered semi-critical and require high level disinfection or sterilisation between patients. Institutional infection control policies for decontamination and cleaning TOE probes must be followed and logged for tracking and to record compliance (refer to *PG28 Infection prevention and control*).

## 6 Echocardiography Training

### 6.1 Training overview:

It is recognised that there is a continuum in the progression of training from beginner to advanced. However, a fundamental requirement in the conduct of all studies is a thorough understanding of the safe and optimal use of ultrasound equipment. Additionally, it is crucial to be aware of one's limitations in skill and the variations in imaging quality related to patients. This awareness should prompt the practitioner to seek a review from a suitably skilled peer when necessary.

A formal program of training should enable attainment (by examination or other means of assessment) of:

6.1.1 knowledge of cardiac anatomy (including anatomical variations) and pathophysiology
6.1.2 skill in sonographic image acquisition and interpretation
6.1.3 experience and competence in reporting studies
6.1.4 experience and competence in integrating the echocardiography information in clinical management
6.1.5 understanding the importance and process of maintaining competence

The formal training program, including skills development, must be completed within a continuous period of 24 months to ensure currency of experience.

### 6.2 Development of skills

6.2.1 **Basic and comprehensive TOE probe use**
Supervised training is required in the safe handling, insertion, and manipulation of the TOE probe to minimise patient injury. The minimum requirements include:

6.2.1.1 the demonstration of knowledge of indications, contraindications, complications, insertion and safe manipulation of the TOE probe [15]
6.2.1.2 a minimum of performance of 30 directly supervised probe insertions
6.2.1.3 knowledge and experience in the methods of decontamination of TOE probes and the documentation required (see section 5.4.3).

6.2.2 **Basic TOE minimum number of case studies and training/review sessions**

The minimum requirements for basic TOE include performance of at least 100 studies, comprising:

i. An initial 30 studies on patients under direct supervision.
ii. 20 additional unsupervised or supervised studies on patients, with full review by a supervisor.
iii. 25 additional studies with review by a supervisor as required, on either patients or hands-on simulators.
iv. review of 25 pre-recorded clinical cases.

6.2.2.2 Workshops - participation in at least one practical training/workshops.

6.2.2.3 Audit meetings - attendance at a minimum of two echocardiography peer review/audit meetings per year during training.

6.2.3 **Comprehensive TOE or TTE minimum number of case studies and training/review sessions**

Training for comprehensive studies can be in either a single modality (TOE or TTE), or in both combined.

6.2.3.1 The minimum requirements for either modality include performance of at least 200 studies, comprising:

i. 50 studies on patients under direct supervision.
ii. 50 additional studies unsupervised or supervised, with full review by a supervisor.
iii. 100 additional unsupervised studies, with supervisor review if deemed necessary by the echocardiography trainee.

6.2.3.2 The minimum requirements for combined (concurrent training) TTE and TOE include the performance of at least 240 studies, comprising:

i. an initial 60 studies on patients under direct supervision (30 TTE and 30 TOE).
ii. 60 additional studies (30 TTE and 30 TOE), unsupervised or supervised, with full review by a supervisor.
iii. 120 additional unsupervised studies (60 TTE and 60 TOE), with supervisor review if deemed necessary by the echocardiography trainee.

6.2.3.3 For TOE:

i. at least 50 TOE studies should be performed in the operating theatre or cardiac catheter laboratory
ii. Interventional echocardiography training requires additional specific training [6-8]

6.2.3.4 For TOE and TTE, studies performed using simulation (hands-on simulator) and/or pre-recorded studies may account for up to 50 of the additional unsupervised studies (items (iii) in the sections above).

6.2.3.5 For TOE and TTE: Workshops - participation in at least one practical training/workshop.

6.2.3.6 For TOE and TTE: Audit meetings - attendance at a minimum of four echocardiography peer review/audit meetings per year during training.

## 6.3 Knowledge base

### 6.3.1 For Basic TOE training

It is recommended for Basic TOE training that trainees obtain a qualification in echocardiography at an Australian or New Zealand University specialist certificate level or higher (certificate or diploma), or equivalent, completed during the echocardiography training period.

6.3.1.1 For examples of training programs refer to Appendix 1.

6.3.1.2 The formal training program should include:

i. An understanding of physics of ultrasound, including artefacts, and its application to sonography.
ii. An understanding of relevant sonographic anatomy, including variations.
iii. Qualitative assessment of left and right ventricular preload, afterload, contractility and regional wall motion abnormalities, valve stenosis and regurgitation (detailed mechanism not required).
iv. Assessment of other cardiac or pulmonary causes of haemodynamic instability such as cardiac tamponade, pleural effusion and massive pulmonary embolus.
v. Writing a formal report
vi. Integrating echocardiography findings to clinical management

### 6.3.2 For comprehensive TOE or TTE training

6.3.2.1 It is recommended that for comprehensive echocardiography, trainees obtain ONE of the qualifications listed in Appendix 1, section 3 (or equivalent) during the training period.

6.3.2.2 The formal training program should include, but not be limited to:

i. An understanding of physics of ultrasound, including artefacts, and its application to sonography
ii. A comprehensive understanding of cardiac sonographic anatomy, including variations
iii. A wide exposure to normal anatomy and cardiac pathology encountered in anaesthetic practice.
iv. Quantitative assessment of the ventricles, valves, pericardium and great vessels
v. Training in effective interpretation, communication and documentation of ultrasound findings.
vi. Writing a structured report
vii. Integrating echocardiography findings to clinical management

## 6.4 Training documentation and assessment

6.4.1 Echocardiography training documentation

A logbook or equivalent database should be maintained during the training period to record:

6.4.1.1 The number and case mix of the examinations performed and/or reviewed, including: date, type, setting, major findings, and level of supervision (direct or indirect).

6.4.1.2 The echocardiography trainee's level of involvement with each study (for example, observer, part participant, primary operator, report author, case audit).

6.4.1.3 Case review/audit sessions attended.
6.4.1.4 Training courses attended.

The logbook should be available for review by the supervisor both during and on completion of training.

6.4.2 Assessment criteria

The form of assessment for the development and maintenance of competency in echocardiography will depend on the pathway undertaken by the trainee. This may be external certification, or a formative assessment made by the supervisor(s) of the echocardiography training program.

6.4.3 Credentialing

The College does not take responsibility for credentialing beyond recommending compliance with the parameters outlined in this document. The meeting of requirements for credentialling in echocardiography (scope of practice) are the responsibility of the health institution in which practice is to be performed.

### 6.5 Summary Table for Skills Training Requirements

| Training Level | Minimum Cases (total) † | Direct Supervision Requirements | Additional with full review | Additional with optional review | Additional Requirements |
|---|---|---|---|---|---|
| **Basic TOE** | 100 | Initial 30 directly supervised including TOE insertions | 20 | 50* | Workshop; 2 audit meetings/year |
| **Comprehensive TOE** | 200 | 50 direct supervision | 50 | 100* | Workshop; 4 audit meetings/year |
| **Combined TTE/TOE** | 240 | 60 direct supervision (30 each) including 30 directly supervised TOE insertions | 60 (30 each) | 120* (60 each) | As above |

† Number of cases personally performed and reported over 24 months

* Simulation or pre-recorded cases may comprise up to half of these

## 7 Recognition of prior experience

It is acknowledged that because of training and cumulative experience achieved prior to the ratification of the ANZCA guidelines for the relevant modality and scope, many experienced practitioners will exist for whom it is unnecessary to require the training process outlined here. However, continuing professional development activities (see Section 9) must still be maintained.

## 8 Supervision

Supervision of echocardiography training should only be provided by practitioners who have met the requirements in section 6 (or 7) and 9 of this document for the modality (comprehensive TTE/TOE or basic TOE) and scope of practice being supervised.

During training, an echocardiography trainee should have real-time access to their supervisor (or another practitioner suitably qualified in the echocardiography modality.

Prior to the completion of echocardiography training, unsupervised diagnostic information should be used only with extreme caution and only when the echocardiography trainee's supervisor considers the echocardiography trainee is competent in communicating or reporting such information to third parties.[5]

## 9 Continuing professional development

Fellows who are practising echocardiography are required to maintain relevant continuing professional development, consistent with ANZCA's continuing professional development mandatory compliance policy and standards, as in all other aspects of their practice. For practitioners who hold independent certification in comprehensive echocardiography, additional requirements including recertification, as deemed necessary by their certifying body, should be fulfilled.

For practitioners wishing for further guidance, the following is the recommended minimum:

9.1 Participation in regular audit and peer review of echocardiography studies.

9.2 Annual performance of at least 25 cases, with review of at least 25 additional studies . This may be averaged over 24 months in situations of interruptions to clinical practice

9.3 Participation in continuing medical education dedicated to echocardiography.

**This document is accompanied by a background paper (PG46BP) which provides more detailed information regarding the rationale and interpretation of the Guideline.**

**Related ANZCA documents**

ANZCA Continuing professional development standards

ANZCA Continuing professional development mandatory compliance policy

PG28 Guideline on infection prevention and control in anaesthesia

PG47 Guideline on training and practice of perioperative diagnostic point-of-care ultrasound (POCUS)

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## Appendix 1 – Training resources

1. Purpose

   To assist those planning training, examples of echocardiography training and certification programs that provide either knowledge components or certification that are considered equivalent to meet some or all of the requirements listed in PG46, are listed. This list is not exhaustive and may be updated from time-to-time.

   ANZCA does not endorse individual training courses in TOE or TTE. It is up to the echocardiography trainee and their supervisor to satisfy themselves that course organisers and sponsors (eg a society or university) have a curriculum which reflects the principles and points listed in PG46.

2. Basic TOE training. Examples of training programs include (but are not limited to):

   i. Australia - University of Melbourne Specialist Certificate in Clinical Ultrasound (Transoesophageal Echocardiography) [16]
   ii. USA
   National Board of Echocardiography Examination in Basic TEE,
   American Society of Anaesthesiologists Basic Perioperative TEE Program,
   Society of Cardiovascular Anesthesiologists On-CUE Level-1 (Basic) TEE
   iii. UK - Association of Anaesthetists Focused Transoesophageal Echo Accreditation (fTOE)[17]

3. **Comprehensive TOE or TTE training.** Examples of training programs include (but are not limited to):

   It is recommended that for comprehensive echocardiography, trainees obtain ONE of the following qualifications (or equivalent) during the training period:

   i. An Australian or New Zealand university qualification in echocardiography at diploma level or higher, or equivalent

   ii. A pass in a board examination in echocardiography from the US National Board of Echocardiography (Examination of Special Competence in Adult Echocardiography, Examination of Special Competence in Advanced Perioperative Transesophageal Echocardiography), or equivalent,

   iii. A pass in an examination in echocardiography from the British Society of Echocardiography and Association of Cardiothoracic Anaesthetists; or

   iv. A pass from the European Association of Echocardiography and European Association of Cardiothoracic Anaesthesiologists, or equivalent, or

   v. A diploma in diagnostic ultrasound focused on echocardiography from the Australasian Society for Ultrasound in Medicine, or equivalent