



## Short title: Perioperative diagnostic POCUS

**Keyword list:** Ultrasound, Point-of-care ultrasound, POCUS, Cardiac, Lung, Gastric, Airway

### 1. Purpose

The purpose of this document is to provide recommendations for training, maintenance of competency, and for clinical practice in perioperative diagnostic point-of-care ultrasound (POCUS) to aid clinical assessment.

### 2. Scope

This document applies to all anaesthetists providing perioperative diagnostic POCUS examinations or undertaking training and/or supervision of such procedures.

This guideline is restricted to the use of ultrasound in aiding diagnostic assessment rather than for procedural-based ultrasound techniques (procedural POCUS), for example vascular access and regional anaesthesia, unless otherwise stated. For the purpose of this document the term POCUS will refer specifically to diagnostic POCUS unless otherwise indicated. Diagnostic POCUS studies are conducted to aid clinical diagnosis and assist with clinical management decisions in a range of perioperative environments.

Transoesophageal echocardiography is not included in this guideline and is instead included in PG46.

In this document POCUS modalities are divided into 'core' and 'additional' POCUS studies. Core POCUS examinations (cardiac, lung, gastric and upper airway POCUS) are to varying extents already established in perioperative practice and supported by published recommendations from societies and other professional bodies.<sup>1</sup> 'Additional' POCUS examinations, such as musculoskeletal/soft tissue, ocular and transcranial Doppler ultrasound for neurosurgery or vascular surgery, genitourinary ultrasound and ultrasound for deep venous thrombosis diagnosis are less established in the perioperative setting at this time. Training for use of ultrasound in the trauma patient, including Extended Focused Assessment with Sonography in Trauma (EFAST), is well described for clinicians practicing emergency medicine and thus is not included in this perioperative document.<sup>2</sup>

Paediatric and neonatal POCUS is rapidly developing and gaining popularity as a useful tool for bedside decision making in paediatric anaesthetic care. Paediatric POCUS examinations differ to their adult counterparts in terms of sonographic appearance and formulae required for image interpretation. Consensus guidelines for the initial assessment of paediatric POCUS competence and the subsequent maintenance of these skills in clinical practice are currently in development. This contrasts to POCUS guidelines within adult medicine which are at a more advanced stage of development. This document is a reflection of the current evidence and guidelines as they pertain to adult POCUS practice. It is expected that paediatric POCUS guidelines will continue to develop, and this document will come to reflect emerging standards, guidelines and recommendations with time.

### 3. Background / Introduction

The use of ultrasound to assist clinical diagnosis continues to expand, driven by several factors including the decrease in cost and increase in portability of ultrasound devices, the growing body of evidence demonstrating the value of ultrasound for multiple clinical applications, and the publication of guidelines supporting the use of POCUS by clinicians, as detailed in the Background Paper. As the components and concepts for training and maintaining competence of different POCUS anatomical regions are similar, this document considers the

general principles that should apply to all forms of diagnostic POCUS. More detail is described for the guidance for the individual core POCUS examinations.

### 3.1 Definitions

**Comprehensive ultrasound examinations** assess the entire anatomical region of interest, often following a recognised protocol utilising quantitative assessment with the full range of ultrasound modalities such as spectral Doppler and, in some modalities, 3-dimensional techniques. Comprehensive studies are usually performed by a practitioner with extensive training and certification in diagnostic ultrasound. Echocardiography is an example of a comprehensive ultrasound examination.

**Limited ultrasound** is an examination performed using the skills and equipment required for a comprehensive examination but without undertaking the full protocol of a comprehensive examination. Limited studies are used to complete a detailed assessment of specific aspects of an anatomical region usually for the purposes of a specific diagnosis. An example for cardiac echocardiography is a bubble-study for identification of an interatrial septal defect or quantification of the severity of a cardiac valvular lesion. A limited study is performed by a practitioner with the demonstrated competencies required for a comprehensive ultrasound examination.<sup>3</sup>

**Point of care ultrasound (POCUS)** is the acquisition, interpretation, and immediate clinical integration of ultrasonographic imaging performed by a treating clinician at the patient's bedside.<sup>4</sup> Unlike comprehensive ultrasound, POCUS examinations are typically used to aid in answering specific clinical questions, are often restricted in anatomical coverage and detail, and therefore have lower requirements for training. Ultrasound modalities for POCUS examinations are usually limited to 2-dimensional and in some instances colour flow Doppler, and do not typically use spectral Doppler or 3-dimensional ultrasound.

**Procedural POCUS (ultrasound for procedural guidance)** – ultrasound performed to assist percutaneous and other interventions such as vascular access or regional anaesthesia.

**POCUS Trainee** - For the purposes of this document is a practitioner who is undertaking training to gain knowledge and skills to enable independent practice in POCUS.

**Cardiac POCUS** refers to surface ultrasound imaging of the heart and great vessels. Examples of other terms used include transthoracic focused cardiac ultrasound.

**Lung POCUS** refers to surface imaging of the lungs, pleura and pleural space via the transthoracic route. Examples of other used terms include respiratory and thoracic ultrasound.

**Gastric POCUS** refers to surface ultrasound of the stomach to assess gastric volume and content.

## 4. General Principles

- 4.1 Only clinicians who have completed or are undertaking training in accordance with the relevant components of this document should perform POCUS on patients. It is acknowledged that for each modality, prior training in POCUS imaging may reduce the number of cases required for a new modality.
- 4.2 POCUS examinations should include views recommended by published guidelines where available and relevant to the perioperative setting.
- 4.3 Clinical assessment may be improved using more than one POCUS modality, such as combined cardiac and lung POCUS for the assessment of circulatory instability or respiratory failure.
- 4.4 While the recommended essential views should be attempted whenever feasible, their acquisition may be hindered by limited patient accessibility (e.g., positioning limitations as may exist during CPR or laparotomy) or technical challenges (e.g., morbid obesity or hyperinflated lungs). In such circumstances, it is important to acknowledge these limitations in the report.
- 4.5 POCUS may be considered an extension of clinical examination<sup>5</sup> but should not be relied on as the sole determinant for clinical diagnosis and management.

## **5. Conduct of the POCUS study**

### **5.1 Consent and environment**

Prior to the procedure, where possible, the health practitioner performing the procedure should provide the patient with information about the nature and risks of the procedure, preparation instructions and what to expect during and after the procedure.

The procedure should be performed in a clinical environment that takes into consideration patient privacy, gender, psychosocial and cultural requirements.

Assistance for patient positioning and monitoring should be available if required.

### **5.2 Equipment**

The healthcare facility should ensure ultrasound equipment is functional and appropriately serviced.

Clinicians should understand the capability and limitations of ultrasound equipment for the type of POCUS being performed. Clinicians should be competent in the operation of the available ultrasound equipment prior to use.

Infection control requirements should be clearly outlined, understood and adhered to (see *PG28 Infection prevention and control*).

### **5.3 Image storage**

POCUS images should ideally be stored and archived as an electronic record of the study to facilitate training, clinical care, and audit. Storage of images is important when diagnostic POCUS changes clinical management, particularly for cardiac POCUS. Storage should be compliant with relevant privacy and data security requirements. Where an electronic archive is not available, the clinician performing POCUS should, where possible, store the images in an alternative secure location that is accessible to the patient's treating team(s).

It is acknowledged that image acquisition and storage may not be possible in urgent clinical situations such as cardiac arrest or haemodynamic instability.

### **5.4 Reporting**

A POCUS report should be completed and included in the patient's medical or anaesthetic record when feasible. The minimum requirement for a report includes:

- 5.4.1 Type of POCUS
- 5.4.2 The date and time of the examination.
- 5.4.3 Patient identification.
- 5.4.4 Indications for the study.
- 5.4.5 The name(s) and signature (or e-signature) of those conducting and reporting the examination and findings (including supervisor if relevant).
- 5.4.6 Important findings (typically presence or absence of conditions specific to the POCUS modality and specific clinical questions).
- 5.4.7 Quality of the imaging and any resulting limitations (e.g. views unobtainable) of the interpretation.
- 5.4.8 Recommendations if required, for example referral for a more definitive imaging referral such as comprehensive ultrasound or computed tomography.

## **6. Training**

Performing POCUS requires specific knowledge as well as practical and cognitive skills to perform, interpret and integrate POCUS findings into clinical assessment and management.

It is recommended that POCUS trainees attend a formal comprehensive course that will provide both a knowledge base and assist in the development of procedural skills.

All training requirements for the relevant modality should be met prior to independent practice of POCUS.

Clinicians trained in POCUS are encouraged to seek opinions from other similarly trained clinicians where the new diagnostic information changes patient management significantly or uncertainty exists

## **6.1 Curriculum**

The curriculum of a formal program of training should support the acquisition of:

- 6.1.1 Knowledge of indications for, limitations and risks of each type of POCUS examination
- 6.1.2 Understanding of the physics of ultrasound and its application to sonography
- 6.1.3 A sound knowledge base of sono-anatomy and pathophysiology
- 6.1.4 Sonographic (image acquisition) skills.
- 6.1.5 Sound skills in image interpretation
- 6.1.6 Understanding of the specific objectives of a particular POCUS modality
- 6.1.7 Experience and competence in reporting studies.

## **6.2 Development of skills**

Whilst knowledge acquisition can be achieved via in-person and on-line tuition, development of clinical skills requires “hands on” exposure to clinical cases, live models or simulation mannequins.

- 6.2.1 It is recommended that POCUS trainees participate in at least one face-to-face training session or workshop.
- 6.2.2 The number of clinical cases required to achieve competence will vary according to the POCUS trainee’s prior experience with sonography and the complexity of the type of POCUS. Recommendations for the minimum case numbers are included for each POCUS modality.
- 6.2.3 Clinical studies, simulator studies and pre-recorded cases must include common pathology or clinical conditions relevant to the POCUS modality being learned.
- 6.2.4 Cases performed as part of a course or workshop may be counted towards these case numbers if approved by the course or workshop supervisor
- 6.2.5 Attendance at audit meetings, particularly for cardiac POCUS, forms an important part of training.

## **6.3 Training documentation and assessment**

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

- The number and case mix of the examinations performed and/or reviewed, including date, type, setting, major findings, and level of supervision (direct that is, in room, or indirect).
- The POCUS trainee’s level of involvement with each study (for example, observer, part participant, primary operator, report author, case audit).
- Case review/audit sessions attended.
- Training courses attended.
- The logbook should be available for review by the supervisor

6.3.2 Assessment

- The form of assessment for the development and maintenance of competency in POCUS will depend on the pathway undertaken by the POCUS trainee. This may be external certification, or a formative assessment made by the supervisor(s) of the training course or program. The college does not take responsibility for credentialing beyond recommending compliance with the parameters outlined in this document.
- In any training program, the supervisor should make ongoing formative assessments with feedback on the performance of the POCUS trainee from direct observation or reviewing

recorded images and videos. At the end of the training period, the supervisor may sign-off the POCUS trainee as competent or recommend further steps for skill acquisition

#### **6.4 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, there will be experienced practitioners for whom it is unnecessary to fulfill the training process outlined here. However, continuing professional development activities must still be maintained.

It is recognised that prior experience in ultrasound knowledge and skills (eg in echocardiography or regional anaesthesia) may reduce the number of studies required to gain initial expertise in a particular new ultrasound modality. This should be assessed on an individual basis.

#### **6.5 Supervision**

- 6.5.1 Supervision of POCUS training should be provided by experienced practitioners, in the relevant modality, who have met the requirements outlined in this document
- 6.5.2 Supervision should be in real-time where feasible (preferably in-person however may be remote)
- 6.5.3 Supervision may be off-line for a limited number of lower acuity procedures.
- 6.5.4 In modalities where remote supervision may be appropriate, a satisfactory formative direct observation of procedural skills assessment should be undertaken.
- 6.5.5 Prior to the completion of POCUS training, unsupervised diagnostic information should be used only with caution and only when the POCUS trainee's supervisor considers the reporting of such information to third parties to be within the POCUS trainee's scope of practice.

#### **7. Continuing professional development**

Clinicians trained in POCUS are required to maintain relevant continuing professional development, consistent with ANZCA's continuing professional development policy and standards, as in all other aspects of their practice.

The following is the recommended minimum:

- 7.1 Participation in regular audit and peer review of POCUS studies.
- 7.2 Performance of a minimum of half of the of the minimum number of patient or volunteer studies required for training annually for each core POCUS modality practised. Participation in continuing medical education dedicated to POCUS.

#### **8. Credentialing**

Clinicians need to ensure they are practicing within their scope of practice and credentialled where necessary.

The College does not take responsibility for credentialing, certification or competency beyond recommending compliance with the parameters outlined in this document.

#### **9. Cardiac POCUS examination**

The examination should utilise a framework of the relevant views following published guidelines (see Background Paper).

It is recommended that during the training period, cardiac POCUS trainees obtain at least a formal specialist certificate-level qualification in cardiac POCUS or undertake a fellowship in cardiac anaesthesia which includes formal cardiac POCUS training.

## **9.1 Training - knowledge**

Whichever examination guideline is used, a complete cardiac POCUS examination should include the following:

- 9.1.1 Left and right ventricular assessment for volume, systolic function, and afterload, all used to assist in the categorisation of the primary haemodynamic state (for example hypo/hypervolaemia, left and/or right systolic dysfunction or failure).
- 9.1.2 Valvular assessment for clinically significant pathology. All patients with observed valvular pathology should be referred for further comprehensive echocardiography assessment.
- 9.1.3 Assessment of other potentially significant disorders such as pericardial and pleural effusions and massive pulmonary embolus.

## **9.2 Training - development of skills**

In addition to the requirements detailed under general considerations, during the training period the POCUS trainee should perform at least 90 complete studies, comprising:

- 9.2.1 20 supervised studies on patient or volunteer subjects.
- 9.2.2 20 additional unsupervised studies on subjects, with full review by a supervisor.
- 9.2.3 25 additional studies on either subjects or hands-on simulators.
- 9.2.4 review of 25 pre-recorded cases.

Simulator studies and pre-recorded cases must include common pathology including abnormal left and right ventricular size and systolic function, valvular stenosis and regurgitation, and pericardial effusion.

## **10. Lung POCUS examination**

The examination should utilise a framework of the relevant views following published guidelines (see Background Paper). The number of views recommended varies between published guidelines and on occasions patient and procedural factors will limit accessibility. Nevertheless, an attempt should be made to acquire all views of a published guideline and at least two views with acceptable image quality of each structure of interest should be obtained.

### **10.1 Training - knowledge**

Whichever examination guideline is used lung POCUS should include assessment for the following:

- 10.1.1 Confirmation and distribution of ventilation
- 10.1.2 Lung consolidation and atelectasis
- 10.1.3 Pleural effusion including qualitative estimation of size
- 10.1.4 Pneumothorax including anatomical location and qualitative estimation of size.
- 10.1.5 Alveolar interstitial syndromes including the pattern (oedema or non-oedema) and qualitative assessment of severity.

It is recommended that during the training period, POCUS trainees obtain a thorough knowledge of lung ultrasound principles, and images relating to lung and thoracic pathology. This should be achieved by attending a workshop with suitable didactic content as part of a formal course in POCUS which includes lung ultrasound, or by obtaining a specialist certificate, or equivalent, in lung POCUS.

### **10.2 Training - development of skills**

During the training period the POCUS trainee should perform at least 50 studies, comprising:

- 10.2.1 20 supervised studies.
- 10.2.2 20 additional unsupervised studies, with full review by a supervisor <sup>1</sup> on either patients or hands-on simulators.
- 10.2.3 review of 10 pre-recorded cases.

Simulator studies and pre-recorded cases must include several examples of the pathologies listed above.

## **11. Gastric POCUS**

Gastric POCUS is generally qualitative and assists in classifying the patient as low-risk or high-risk for aspiration. Quantitative components are limited to estimating clear fluid volume. It may be used to assess the effects of an intervention for example, the administration of a prokinetic drug or extending fasting time. It can also be used to confirm placement of a gastric tube.

Published guidelines are in general agreement regarding the conduct of gastric point-of-care ultrasound (see PG47 Background Paper).

### **11.1 Gastric POCUS examination**

All gastric POCUS studies should assess the gastric antrum with the probe in the sagittal or parasagittal position, just inferior to the xiphisternum. Accurate probe position can be confirmed when the liver and aorta are in view. An empty stomach can be diagnosed only when scanning is performed in the right lateral decubitus position.

### **11.2 Training – Knowledge and skill development**

In addition to the requirements detailed under general considerations, a gastric POCUS training program should include

- 11.2.1 Knowledge-based content from reviewing relevant literature or attending a workshop with a didactic component
- 11.2.2 Hands-on training with scans of various gastric states (empty, clear fluids, suspension, solids) on either patients or volunteers
- 11.2.3 Formal image interpretation or reporting of 20 cases (need not be personally performed)
- 11.2.4 A further number of studies under direct or remote supervision, depending on previous experience with ultrasound
  - a. 30 supervised studies for POCUS trainees with basic ultrasound competence <sup>1</sup>
  - b. 15 studies for POCUS trainees with experience in ultrasound-guided regional anaesthesia or cardiac POCUS, as evidenced by a fellowship, formal qualification, or current credentialing. <sup>6</sup>
  - c. Cases may be directly supervised or supervised remotely by the designated training supervisor reviewing recorded images and videos

## **12. Upper airway and neck POCUS**

As a diagnostic tool ultrasound can be used to assess upper airway anatomy and thus assist in prediction of a difficult intubation.<sup>7</sup> It has been used to measure airway dimensions, assess laryngeal oedema and assess the risk of post-extubation stridor.<sup>8</sup> Although ultrasound can be used to confirm tracheal placement of an endotracheal tube <sup>9, 10</sup>, capnography remains the gold standard and use of ultrasound must therefore be limited to situations where capnography is unreliable (eg cardiac arrest) or not available and where the clinician is highly skilled and ultrasound equipment immediately available. From a procedural perspective, ultrasound can be used to identify the cricothyroid membrane in situations where front of neck access may be required such as the “can’t intubate, can’t oxygenate” scenario.

### **12.1 Training**

Training in upper airway sonography should enable identification of the trachea and oesophagus, tongue, epiglottis, vocal cords, hyoid, cricoid and thyroid cartilages, cricothyroid membrane and tracheal rings.<sup>11</sup>

As the risks of misdiagnosis of upper airway anatomy can have profound clinical implications, POCUS trainees should have a clear understanding of:

- the relevant anatomy including normal and pathological variation
- the limitations of the examination

Training case requirements for competency have not been specified by various bodies. Pre-existing ultrasonography skill may influence case requirements but in general terms 20 studies should be personally performed and interpreted with particular emphasis on anatomical variation and pathology.

**This document is accompanied by a background paper (PG47BP) which provides more detailed information regarding the rationale and interpretation of the Guideline.**

### **Further reading**

NSW ACI Emergency Care Institute <https://aci.health.nsw.gov.au/networks/eci/clinical/clinical-tools/ultrasound-in-the-ed/pocus---where-do-i-begin> Accessed 16 July 2024.

Point of care ultrasound Certification Academy. Point-of-Care Ultrasound (POCUS) Certification Guide. Available from: <https://www.pocus.org/pocus-guide/> Accessed 16 July 2024.

Via G, Hussain A, Wells M, et al. International evidence-based recommendations for focused cardiac ultrasound. *J Am Soc Echocardiogr* 2014; 27(683): e1-33.

Cormack CJ, Childs J, Kent K. Point-of-Care Ultrasound Educational Development in Australasia: A Scoping Review. *Ultrasound in Medicine & Biology* 49 (2023) 1375–1384

### **References** (Please see PG47BP for additional references)

1. Bronshteyn YS, Anderson TA, Badakhsh O, Boublik J, Brady MBW, Charnin JE, et al. Diagnostic Point-of-Care Ultrasound: Recommendations From an Expert Panel. *J Cardiothorac Vasc Anesth*. 2022;36(1):22-9.
2. Australasian College of Emergency Medicine. P21 The use of focused ultrasound in emergency medicine 2022 Available from: [https://acem.org.au/getmedia/000b84ee-378f-4b65-a9a7-c174651c2542/Policy\\_on\\_the\\_Use\\_of\\_Focused\\_Ultrasound\\_in\\_Emergency\\_Medicine](https://acem.org.au/getmedia/000b84ee-378f-4b65-a9a7-c174651c2542/Policy_on_the_Use_of_Focused_Ultrasound_in_Emergency_Medicine). Accessed: 16 July 2024
3. Spencer KT, Kimura BJ, Korcarz CE, Pellikka PA, Rahko PS, Siegel RJ. Focused cardiac ultrasound: recommendations from the American Society of Echocardiography. *J Am Soc Echocardiogr*. 2013;26(6):567-81.
4. Diaz-Gomez JL, Mayo PH, Koenig SJ. Point-of-Care Ultrasonography. *N Engl J Med*. 2021;385(17):1593-602.
5. Royse CF, Canty DJ, Faris J, Haji DL, Veltman M, Royse A. Core review: physician-performed ultrasound: the time has come for routine use in acute care medicine. *Anesth Analg*. 2012;115(5):1007-28.
6. Tankul R, Halilamien P, Tangwiwat S, Dejarkom S, Pangthipumpai P. Qualitative and quantitative gastric ultrasound assessment in highly skilled regional anesthesiologists. *BMC Anesthesiol*. 2022;22(1):5.
7. Lin J, Bellinger R, Shedd A, Wolfshohl J, Walker J, Healy J, et al. Point-of-Care Ultrasound in Airway Evaluation and Management: A Comprehensive Review. *Diagnostics (Basel)*. 2023;13(9).
8. Mikaeili H, Yazdchi M, Tarzarni MK, Ansarin K, Ghasemzadeh M. Laryngeal ultrasonography versus cuff leak test in predicting postextubation stridor. *J Cardiovasc Thorac Res*. 2014;6(1):25-8.
9. Sahu AK, Bhoi S, Aggarwal P, Mathew R, Nayer J, T AV, et al. Endotracheal Tube Placement Confirmation by Ultrasonography: A Systematic Review and Meta-Analysis of more than 2500 Patients. *J Emerg Med*. 2020;59(2):254-64.
10. Soar J, Berg KM, Andersen LW, Bottiger BW, Cacciola S, Callaway CW, et al. Adult Advanced Life Support: 2020 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations. *Resuscitation*. 2020;156:A80-A119.
11. Jain K, Yadav M, Gupta N, Thulkar S, Bhatnagar S. Ultrasonographic assessment of airway. *J Anaesthesiol Clin Pharmacol*. 2020;36(1):5-12.



*Professional documents of the Australian and New Zealand College of Anaesthetists (ANZCA) are intended to apply wherever anaesthesia is administered and perioperative medicine practised within Australia and New Zealand. It is the responsibility of each practitioner to have express regard to the particular circumstances of each case, and the application of these ANZCA documents in each case. It is recognised that there may be exceptional situations (for example, some emergencies) in which the interests of patients override the requirement for compliance with some or all of these ANZCA documents. Each document is prepared in the context of the entire body of the college's professional documents, and should be interpreted in this way.*

*ANZCA professional documents are reviewed from time to time, and it is the responsibility of each practitioner to ensure that he or she has obtained the current version which is available from the college website ([www.anzca.edu.au](http://www.anzca.edu.au)). The professional documents have been prepared having regard to the information available at the time of their preparation, and practitioners should therefore take into account any information that may have been published or has become available subsequently.*

*While ANZCA endeavours to ensure that its professional documents are as current as possible at the time of their preparation, it takes no responsibility for matters arising from changed circumstances or information or material which may have become available subsequently.*

Promulgated: 2024  
Reviewed:  
Date of current document: Nov 2024

© Copyright 2024 – Australian and New Zealand College of Anaesthetists. All rights reserved.

*This work is copyright. Apart from any use as permitted under the Copyright Act 1968, no part may be reproduced by any process without prior written permission from ANZCA. Requests and inquiries concerning reproduction and rights should be addressed to the Chief Executive Officer, Australian and New Zealand College of Anaesthetists, 630 St Kilda Road, Melbourne, Victoria 3004, Australia. Email: [ceoanzca@anzca.edu.au](mailto:ceoanzca@anzca.edu.au)*

ANZCA website: [www.anzca.edu.au](http://www.anzca.edu.au)