



**College of Intensive Care Medicine
of Australia and New Zealand**
ABN: 16 134 292 103

FOCUSED CARDIAC ULTRASOUND IN INTENSIVE CARE

NEW CICM TRAINING COMPETENCY

AIMS

1. To train all CICM trainees from 2014 onwards in Focused Cardiac Ultrasound with the aim of answering specific clinical questions, recognizing life threatening and grossly abnormal cardiac pathology as well as to understand the limitations and pitfalls of interpretation of the scan.
2. To create a robust, systematic and achievable training pathway for CICM trainees to allow acquiring this competency during their training.
3. To build the framework enabling a staged introduction of other relevant competencies in General Critical Care Ultrasound (such as lung, pleura, limited abdominal and vascular and procedural ultrasound) into the CICM Curriculum.

BACKGROUND

Ultrasound provides a rapid non-invasive diagnostic and monitoring tool and helps facilitate procedural safety and efficacy. Ultrasound has no evidenced side effects when used at diagnostic imaging intensities, is portable, allows easy serial investigation and gives instantaneous results with trained operators. In addition, focused cardiac ultrasound may allow detection of certain clinical pathology more accurately than physical examination (1), and is therefore a very useful adjunct. With a relatively short period of training and hands-on practice valuable information can be gained, which if integrated appropriately with other methods of examination and imaging will lead to better patient care (1). Affordable, smaller and portable systems are becoming more widespread and it is increasingly being advocated that ICU specialists should have the skills to perform procedural ultrasound and a focused cardiac echo.

As with other imaging modalities there are pitfalls and limitations, however ultrasound has the added complexity due to the interpretation as well as the acquisition of images both relying on the operator. To this end simply attending a course or reading appropriate texts is not sufficient. Adequate hands-on experience and mentorship during training is an essential requirement for education.

EVIDENCE

Many studies have documented the benefits of Focused Cardiac Ultrasound in critically ill patients both in the Intensive Care Unit and other acute care areas (3-5). However, these studies are predominantly based on modest or small numbers. Recommendations for imaging and training in focused cardiac ultrasound are based mainly on expert consensus statements (1) and round-table discussions (6,7). Recently there have been comments and statements Internationally calling for the implementation of Focused Cardiac Ultrasound into the training of a specialist caring for the critically ill. (8-10)

Evidence regarding the number of scans needed for competence is sparse (11,12). An expert round table meeting suggested 30 scans are the minimum number to achieve competence. Flexibility for individual learning curves should be endorsed and for some students further training may be required.

ADMINISTRATION AND COURSE DEVELOPMENT

The CICM Focused Cardiac Ultrasound curriculum and training pathway was a joint development between the CICM Curriculum Review Committee and the CICM Critical Care Ultrasound Group, which includes invited members with recognized qualifications and experience in advanced general critical care ultrasound and echocardiography (eg: Diploma of Diagnostic Ultrasound in Critical Care, Australasian Society of Ultrasound in Medicine). International consensus documents (1,6) and recommendations were reviewed and recognized leading experts in the Australasian Intensive Care community also provided advice and support during the process. Ongoing development and administration will be provided by the CICM Critical Care Ultrasound Group. The CICM Focused Cardiac Ultrasound curriculum and training will be reviewed regularly with oversight provided by the CICM Curriculum Review Committee. Any comments and suggestions from fellows and trainees are welcomed.

SUMMARY OF REQUIREMENTS TO ACHIEVE COMPETENCY

1. Attend an approved echocardiography course meeting the CICM Focused Cardiac Ultrasound requirements
2. Perform and report 30 Focused Cardiac Ultrasound cases, assessed as satisfactory by a CICM approved Assessor. Assessment can be retrospective. At least two cases each of severe left ventricular dysfunction, severe right ventricular dysfunction, pericardial tamponade and gross hypovolaemia should be included.
3. Complete a short on-line MCQ style exam, accessed via the CICM website
4. Perform and report 2 Focused Cardiac Ultrasound examinations directly supervised by an approved Assessor at a satisfactory competence level.

CURRICULUM – THE FOCUSED CARDIAC ULTRASOUND

Trainees learning competency in Focused Cardiac Ultrasound need to be familiar with the below key elements and concepts. (Detailed information can be found in the Syllabus – Appendix 2)

I, Preparation for Focused Cardiac Ultrasound Examination

- The role of Focused Cardiac Ultrasound in clinical practice
- Informed consent
- Recording and entering patient particulars
- Machine setup, basic safety and infection control, patient positioning
- Image acquisition and optimization
- Storage and archiving requirements, including privacy and confidentiality

2, Image acquisition from standard acoustic windows

- Parasternal long axis view
- Parasternal short axis view
- Apical 4 chamber (+/- Apical 2 chamber)
- Subcostal view (including IVC view)

NB: An understanding of how to obtain the apical 2 chamber views should be known, but image acquisition is not essential for competence. Colour or spectral Doppler assessment is not part of the focused cardiac ultrasound scan.

3, Reporting on specific findings

1. Is the LV significantly impaired?
2. Is the LV dilated?
3. Is RV function grossly abnormal?
4. Is the RV dilated?
5. Is there any pericardial fluid / is there pericardial tamponade?
6. Is the patient significantly hypovolaemic?
7. Conclusion addressing the relevant clinical question

4, Interpretation and integration into clinical practice

1. The limitations of Focused Cardiac Ultrasound
2. Integrating findings into clinical practice
3. Scope of practice

COURSES AND ACCREDITATION

CICM does not provide its own course or mandate a particular course. Trainees may choose from a list of available courses that have been approved for CICM purposes. The practice of accrediting various courses is not a unique one and has been based on the well-established practice adopted by the Australasian Society for Ultrasound in Medicine for their CCPU (Certificate in Clinician Performed Ultrasound) process. Although courses are expected to differ slightly in content and delivery, as long as the fundamentals are covered this will be sufficient. Although the CICM Critical Care Ultrasound Group agrees that this is an important aspect of learning, we do not support models of learning in ultrasound based largely on didactic lectures and feel that ongoing use of ultrasound in clinical practice and appropriate feedback from a qualified supervisor will contribute much more to learning and development of proficiency overall. Therefore minor variations in the course component of the syllabus are acceptable and

relying on existing courses for delivery of this content is deemed to be the most optimal method. It is acknowledged that some of what may be taught in these courses will be beyond the scope of what is required for the CICM Focused Cardiac Ultrasound syllabus (see Appendix 2).

The alternative of mandating certain commercially available courses has been considered, but as these do not completely overlap in content and delivery either, do not have the capacity to provide places for all intensive care trainees and represent a significant financial burden on the trainee, having this as a sole option was not deemed suitable. As there are numerous well established in-house courses already, we did not feel that requiring these to change to mandated College developed content would serve our purpose. The College does not seek regulatory control over the available courses as the accreditation process implies validity. Obtained knowledge and skills will be formally assessed by the College before the Focused Cardiac Ultrasound component of the curriculum is deemed to have been satisfied by the trainee. For courses it will also be a requirement to renew accreditation periodically and any concerns raised with regards to appropriate content delivery and suitability for the purposes of CICM Focused Cardiac Ultrasound training will be reviewed accordingly.

A list of suitable courses will be made available on the CICM website. For institutions undertaking to develop an in-house course, support and information will be provided by the CICM Critical Care Ultrasound Group.

Courses that were undertaken by trainees prior to the implementation of the accreditation process or courses that are not on the accredited list will be considered on an individual basis.

LOGBOOK

During training reporting of Focused Cardiac Ultrasound scans will be done on the standard form provided (see Appendix 3). Images and reports will be submitted for review by an Assessor and will be marked as satisfactory or non-satisfactory. The platform for this evaluation will be an online logbook system which will be available via the CICM website and will be an integrated part of the online training portfolio.

PERFORMING FOCUSED CARDIAC ULTRASOUND SCANS WHILST TRAINING Imaging should generally only be carried out when an indication and relevant clinical question exists, where Focused Cardiac Ultrasound is likely to provide useful information. Scans on healthy volunteers are a recognized means of practicing image acquisition but these scans do not contribute to learning to assimilate findings and answering relevant questions. This does not exclude submitting scans with normal findings for assessment as long as they were undertaken for a clinical indication.

Focused cardiac ultrasound scan reports should not be entered into patient notes, images should however be archived to be available for review or future comparison.

Performance of Focused Cardiac Ultrasound scans should ideally commence as soon as possible after completing the course component of the competency, but no later than 1 year from when the course was attended. Studies undertaken prior to completing the course component or later than 1 year from when a course was completed will not be assessed.

It should be noted that assessor supervised examinations where immediate feedback is

available is often the best method for learning. The CICM Critical Care Ultrasound Group recognizes however, that especially in the inception phase, this will not universally be possible and a proportion of trainees may require remote assessment.

The College envisions that with the rapidly growing pool of qualified Intensivists (such as those obtaining the DDU or similar) will mean most large (and hopefully eventually even the smaller training units) will have in-house Assessors available and remote assessment will only be required for a small number of trainees.

MAINTAINING PRIVACY AND CONFIDENTIALITY

Submitted case studies and logbooks should be de-identified before they are reviewed unless the assessor is involved with the patients care. Identifiable Patient information (including name, date of birth, address, hospital or healthcare identification numbers, etc.) is confidential and must not be disclosed. De-identification can be done at the time of exporting files from the echo machine or from the echo work-station (post-processing). Potentially the easiest method is to transfer studies to a standard movie format specifying that they be de-identified prior to creating the file. The movie clips can then be sent to the assessor. Trainees should contact their respective assessor to ensure compatibility and ease of review.

Trainees should be aware that failing to comply with these requirements is considered a breach of confidence and questionable professional conduct and may result in disciplinary measures. Individual hospital employment contracts may also have similar requirements (e.g.: Privacy Act [amended] of 1988, Commonwealth of Australia), and failure to comply with the above guidelines may result in legal proceedings.

ASSESSORS

An advanced level of experience is required to be a certified CICM Focused Cardiac Ultrasound Assessor. A basic level of knowledge and qualifications (such as the Certificate in Clinician Performed Ultrasound (CCPU) from ASUM) is not considered suitable.

Advanced qualifications accepted include:

- Diploma in Diagnostic Ultrasound (DDU) Critical Care or Cardiology - Australasian Society for Ultrasound in Medicine (ASUM)
- Cardiology specialist qualification (FRACP / FCSANZ)
- American Echo Board Exam (ASCeXAM)
- Graduate Certificate in Critical Care Echo (GCCritCareEcho), University of Queensland
- Diploma in Clinical Ultrasound, University of Melbourne

It is recognised that many of the above qualifications have only been established in the last few years and that Intensive Care specialists with extensive training and experience in echocardiography may not have a formal qualification, or they may have qualifications from other credentialing bodies not mentioned above. These situations will be reviewed on a case by case basis. If a fellow has no formal qualifications, a letter of recommendation from an accredited Assessor will also be required.

Application to be an Assessor is entirely optional and a completed application form is required (see appendix 3). Assessors will be required to validate each scan that a trainee performs. Multiple assessors can be involved with each trainee, although individual mentorship is encouraged. Assessors are requested to review images in a timely manner. Differences in interpretation and reasons for judging a scan non-satisfactory should be communicated to the trainee. The study review process requires documentation via the online trainee logbook, regardless of whether in-person feedback has taken place or not.

A list of Assessors will be available on the CICM website. Local assessors will be given preference if at all possible, but a considerable portion of supervision (especially during the inception of the CICM Focused Cardiac Ultrasound curriculum) will be done remotely. Therefore many trainees will have to send their completed scans to Assessors remotely (see section 'Transfer of Focused Cardiac Ultrasound scans to an Assessor' below).

The Assessor can decide on the number of trainees accepted for assessment, based on clinical and non-clinical workload and other commitments.

Based on an estimate of 80 new trainees per year performing 30 studies each over a two year training period, it is anticipated that on average up to 2-3000 studies will require assessment each year. Allowing 20 minutes for each study assessment and allocating 1 hour (3 studies) per week per assessor, a pool of 20 assessors will be able to provide this service adequately. The estimated number of Intensivists with appropriate qualifications is significantly larger than this and it is hoped that with an ever-growing base of Intensivists with formal training in echocardiography, workload as an assessor will not impact significantly on the burden of existing clinical and non-clinical duties.

ONLINE EXAMINATION

A short on-line time-limited MCQ style exam will be available on the CICM website consisting of multiple choice answers relating to a combination of traditional questions, video loops and still images. A 70% correct answer rate will be required to pass. Candidates can repeat the exam as often as is necessary with a required time interval between attempts. Questions will be randomly selected from a large database to ensure different questions for each attempt. The on-line exam can be taken at any time, but it is encouraged to attempt it after more than 15 scans have been completed.

LIMITATIONS AND SCOPE OF PRACTICE

The CICM Critical Care Ultrasound Group is well aware of the passionate debate about scope of practice and implications of applying the obtained ultrasound diagnostic skills routinely as part of the clinical decision making process.

Inappropriate use of Focused Cardiac Ultrasound has the potential for adverse effects, as with any clinical tool, and the appropriate use of ultrasound needs to be considered. There is the potential for following up on false positives, but more seriously there is the impact of false negatives, and failure to follow up with formal imaging because of a 'normal' Focused Cardiac Ultrasound. The greatest value in the Focused Cardiac Ultrasound is as an adjunct to the

history and physical examination in an attempt to provide more rapid and appropriate patient management in the early phases of their presentation (1).

Trainees should be aware that there is evidence to suggest that common errors made whilst training in focused cardiac ultrasound is to 'overcall' and to overestimate the severity of echocardiography abnormalities, leading to a lower positive predictive value (14).

It is a general expectation that trainees should have insight into their level of experience with regard to all diagnostic modalities and recognize their limitations in obtaining and interpreting Focused Cardiac Ultrasound images, not dissimilar to any other diagnostic modality that they learn to use or interpret during their training. A good understanding of the inherent pitfalls and limitations of the Focused Cardiac Ultrasound study is a very important element of training and this aspect should be covered both in the course component as well as during assessment and in providing feedback for scans submitted by the trainees. The learning process is not a binary phenomenon and although once trainees have completed the competency they are expected to be able to safely apply their findings in clinical practice, ongoing feedback, peer review and supervision will continue to be paramount.

NB: Prior to the completion of the competency, treatment decisions should not be made on findings without review by a senior colleague with appropriate experience in echocardiography (with the exception of cardiac arrest situations where a Focused Cardiac Ultrasound reveals a potentially reversible cause and senior help is not immediately available).

The CICM Critical Care Ultrasound Group believes that ultrasound in critical care should be treated no differently than any other basic diagnostic tool that we use (such as interpreting physical findings, biochemistry results, X-rays or CT scans) in that it is the responsibility of the person evaluating the information to have a clear understanding of their own limitations in interpretation and to apply their diagnostic findings to clinical practice appropriately or refer for more complete evaluation accordingly.

It is a general expectation for example, that trainees interpret radiology images at a very competent level as part of their fellowship examination. This is an expectation without any formal training in radiology or any formal competency assessments used as barrier to prevent trainees from applying their findings in clinical practice during training. Trainees build this skill as a continuum and reaching a comfort level where clinical decisions are based on their own interpretation will vary from person to person. Learning to acquire and interpret Focused Cardiac Ultrasound images is no different and therefore introducing an overly complex framework aimed at regulating this learning process will only hinder or make it impossible for trainees to progress

TRANSFER OF COMPLETED SCANS TO AN ASSESSOR

Study images may be reviewed by assessors locally if possible but will require the Focused Cardiac Ultrasound scan report to be submitted and evaluated online via the CICM online training portfolio. For remote assessment, Focused Cardiac Ultrasound reports and de-identified images will be required to be sent to the Assessor via the CICM online training portfolio. In the

interim phase of the software platform development it is an alternate possibility to send de-identified video loops via CD or DVD. Image standards will be published at the time of the Training Portfolio becoming active from 2014. Technical support will be provided.

EQUIPMENT RECOMMENDATIONS

CICM does not specify mandatory equipment parameters. In general any cardiac echo capable machine with a dedicated cardiac probe and good quality 2D imaging is sufficient for the purposes of the Focused Cardiac Ultrasound study. Ideally it should be continuously available for clinical operations, training and maintenance of competence (7). Storage of images is required for studies submitted for assessment. This is also recommended for review and quality improvement.

MAINTENANCE OF COMPETENCY

It is well known that skills levels fall with time, and echocardiography is no exception. Focused Cardiac Ultrasound requires regular use and practice in a variety of clinical situations. A minimum number of scans need to be done annually, once an introductory level of competence is achieved.

It is expected that trainees and fellows will have the responsibility to adequately maintain their skills in Focused Cardiac Ultrasound similar to maintaining proficiency in all other procedures and image and data interpretation required in daily clinical practice.

RECOGNITION OF QUALIFICATIONS

Trainees who have obtained the ASUM CCPU (RCA – Rapid Cardiac Assessment) or any higher level certificate (as detailed in the Assessors section of this document) will be recognized as having satisfied the requirements of the competency.

Trainees in echocardiography training positions of at least 6 months duration, upon receipt of a satisfactory performance review from their supervisor, will be recognized as having satisfied the requirements of the competency.

The Curriculum Review Committee is aware that a number of units run comprehensive in-house training programs aimed at achieving comparable or higher level competency in echocardiography. These will be reviewed on an individual basis. Trainees in approved training programs, upon receipt of a satisfactory performance review from their supervisor, will be recognized as having satisfied the requirements of the competency.

The Curriculum Review Committee is aware that a number of other Colleges, such as the Australasian College for Emergency Medicine (ACEM) is currently undertaking review of their training program and considering inclusion of certain elements of basic critical care ultrasound, which will have implications for dual trainees in particular. The potential for cross accreditation of successfully completed competencies from another College can not be commented on at this point, but will be subject to ongoing review.

CICM – ULTRASOUND EDUCATION WEBSITE

The CICM website is under significant development and this will become the portal for the online training portfolio which will incorporate a section dedicated to the CICM Focused Cardiac Ultrasound training curriculum. Trainees will have access to their logbook and may at a future date be able to submit reports as well as images online. They will be able to access a list of accredited courses, and online training resources. They will have the ability to request an assessor and have access to the on-line exam.

BASIC CRITICAL CARE ULTRASOUND

Focused Cardiac Ultrasound comprises a part of the overall skill set termed Basic Critical Care Ultrasound. This includes not only cardiac but thoracic (pleura and lung), limited abdominal, vascular and procedural ultrasound components. Unlike cardiac echo, competencies at a basic level in the above modalities are not yet clearly defined. The CICM Critical Care Ultrasound Group in consultation with the Curriculum Review Committee will undertake the required literature review and expert consultation to define the competency requirements. The actual training, supervision and credentialing framework for these areas will be progressively implemented following on from the introduction of Focused Cardiac Ultrasound into the curriculum in 2014.

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Appendix 1



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FOCUSED CARDIAC ULTRASOUND CASE FORM

This is a training report only and should not be included in patient notes or influence patient management without discussion with an expert.

Please send the completed form to education@cicm.org.au.

Trainee	
Assessor	
Date of case	
Patient reference*	
Image quality (please circle)	Good / Adequate / Poor
Result (please circle)	Passed / To be repeated

*Non-identifiable information required if the case is to be sent to an Assessor who is not involved in the patient's care.

LV function	<input type="checkbox"/> Normal <input type="checkbox"/> Hyperdynamic <input type="checkbox"/> Mild / moderate dysfunction <input type="checkbox"/> Severe dysfunction <input type="checkbox"/> Unsure	RV function	<input type="checkbox"/> Normal <input type="checkbox"/> Hyperdynamic <input type="checkbox"/> Severe dysfunction <input type="checkbox"/> Unsure
LV dilation	<input type="checkbox"/> Normal <input type="checkbox"/> Small <input type="checkbox"/> Dilated <input type="checkbox"/> Unsure	RV dilation	<input type="checkbox"/> Normal or mildly dilated <input type="checkbox"/> Significantly dilated <input type="checkbox"/> Unsure

✓ Please tick	YES	NO	UNSURE
Is there pericardial fluid?			
Is there tamponade?			
Is significant hypovolaemia present?			
Is referral for formal imaging required?			N/A

Conclusion (including clinical significance):

Trainee signature: _____ Assessor signature: _____

Appendix 2:

CICM FOCUSED CARDIAC ULTRASOUND SYLLABUS

A: Physics and imaging basics

1. Indications / scope of practice for critical care ultrasound in assessment of the critically ill patient

2. Basic 2D ultrasound physics & instrumentation

- Properties of sound waves
- Beam and image formation
- Image resolution
 - Lateral
 - Axial
 - Temporal

2. Transducers and Knobology

- Types of basic transducer
- Image optimisation
- Frequency
- Overall gain and time gain compensation
- Depth

3. Basic artefacts

- Artefacts based on assumptions made by ultrasound imaging
- Beam characteristic artefacts
 - Beam-width artefacts
 - Slice thickness artefacts
- Multiple reflection artefacts
 - Reverberation artefacts, comet tail, ring-down artefacts
 - Mirror image artefacts
- Refraction artefacts
- Attenuation and enhancement artefacts

B: Echocardiography

1. Image acquisition

Systematic approach

- Pre-examination preparation (including infection control precautions)
- Appreciation of patient safety and comfort
- Image optimisation
- Image acquisition
- Integration of echo findings in clinical picture

Standard echocardiography views

- Para-sternal long and short axis
- Apical 4 chamber view
 - + optional discussion on obtaining 3 and 2 chamber views
- Subcostal views

2. Left heart assessment

- LV size and simple assessment of contraction
- Use of basic parasternal view M-mode for LV, LA and aorta size
- Simple assessment of mitral and aortic valve opening

3. Right heart assessment

- Right ventricle size and assessment of contraction (TAPSE)
- Grossly abnormal interventricular septal motion
- Right atrium size

4. Pericardial assessment

- Presence of pericardial effusion
- Recognition of basic echographic features of tamponade (RA and RV collapse)
 - Emphasis of physiological requirements for diagnosis of tamponade essential

5. Fluid responsiveness

- IVC size and collapsibility assessment
- Limitations of basic ultrasound assessment of fluid responsiveness

NB: Colour or spectral doppler assessment is not considered part of basic critical care ultrasound.

Appendix 3:



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APPLICATION FOR ACCREDITATION CICM FOCUSED CARDIAC ULTRASOUND ASSESSOR

Please return the completed form to education@cicm.org.au.

Name: _____

Year of award of Fellowship (FCICM): _____

Years of experience in echocardiography: _____

Hospital & Location: _____

Do you consent to your email being made available to a trainee seeking an assessor: Yes No

Only your name and location will be made available on the website.

Qualification(s):

To be an approved assessor, an advanced level of experience is required; a basic level of knowledge and qualifications (such as the Certificate in Clinician Performed Ultrasound (CCPU) from ASUM) is not considered suitable.

- Please mark relevant box and indicate year in which qualification was achieved.
- Please provide photocopy of certificate for proof of qualification.

✓	Qualification	Year obtained
	American Echo board exam (ASCeXAM)	
	Cardiology specialist qualification <i>FRACP / FCSANZ</i>	
	Diploma in Clinical Ultrasound <i>University of Melbourne</i>	
	Diploma of Diagnostic Ultrasound – DDU (Critical Care) <i>Australian Society of Ultrasound in Medicine (ASUM)</i>	
	Diploma of Diagnostic Ultrasound – DDU (Cardiology) <i>Australian Society of Ultrasound in Medicine (ASUM)</i>	
	Graduate Certificate in Critical Care Echo (GCCritCareEcho) <i>University of Queensland</i>	
	Other (please specify)	

It is recognised that many of the above qualifications have only been established in the last few years and that Intensive Care specialists with extensive training and experience in echocardiography may not have a formal qualification, or they may have qualifications from other credentialing bodies not mentioned above. These situations will be reviewed on a case-by-case basis. If a Fellow has no formal qualifications an additional letter of recommendation from an accredited assessor will be required.

Signature: _____

Date: _____