Focused Cardiac Ultrasound (FoCUS)

Purpose of Document

This document describes the process for credentialing Intensive Care Physicians (registrar and consultants) within Monash Health (MH) to perform Focused Cardiac Ultrasound (FoCUS).

This document should be read in conjunction with

- College of Intensive care Medicine Policy IC-29 *Levels of training in adult critical care echocardiography*

Background

The use of ultrasound has developed over the last 20 years into an indispensable first-line test for the cardiac evaluation of symptomatic patients. The technologic improvement in ultrasound machine technology and the implementation of educational curriculum changes in residency training programs have facilitated integrating a focused cardiac ultrasound into practice by specialties. In the Critical Care, Focus Cardiac Ultrasound (FoCUS) has become a fundamental tool to expedite the diagnostic evaluation of the patient at the bedside and to initiate urgent treatment and triage decisions by the ICU physician(1).

The College of Intensive Care (CICM) supports FoCUS in intensive care and now mandates training for all new trainees(2). Ultrasound imaging has been shown to enhance the clinician's ability to assess and manage patients with various acute illnesses and injuries. FoCUS examinations, to answer specific clinical questions have been shown to improve patient outcomes.

This document describes the Monash Health process for accrediting Intensive Care Physicians in FoCUS.

1. Induction – where possible this is performed in a group teaching scenario. Didactic presentation of physics, machine orientation (knobology), protocol familiarisation, integration of findings into clinical management and hands-on training on a model.
2. Skills Development – bedside 1-on-1 training/scanning with the candidate and a sonographer educator or faculty member. All scans will be logged according to CICM and Monash Health requirements.
3. When the candidate's skills are assessed as competent by a faculty member and the sonographer educator, Monash Health Accreditation is conferred. At this stage, the candidate can apply to CICM for accreditation.
4. Ongoing Audit – clinicians remaining at Monash Health are expected to continue recording FoCUS scans in the EMR. Random audits for quality and interpretation will be performed by the sonographer educator.

Developed May 2015

Rev 5 2021

5. Skills Maintenance – credentialed clinicians have access to the sonographer educator for maintenance of skills.

Program Details

Monash Health recognises courses run by external training organisations. If a clinician presents proof of course completion that is less than 2 years old, they can progress directly to the 1-on-1 training step, after a 90-minute orientation to the MH PoCUS program.

All other clinicians need to fulfil the full accreditation process for FoCUS. Regular face to face didactic training session are scheduled through the year. Candidates are expected to do pre-reading and the physics module via the Monash Health *Latte* system.

Upon completing the didactic component of training, the development of ultrasound scanning skills is achieved through one-on-one training sessions with the sonographer educators or ICU faculty. The didactic course component is a minimum of 4 hours, but bedside training sessions are unlimited.

Additional self-directed learning is expected, including viewing FoCUS learning tools, revising cases, journal reading and other online resources.

Candidates should perform a minimum of 30 examinations. At least 5 of these should be clinically indicated (i.e. in the setting of cardiac arrest or haemodynamic compromise). These scans should be reviewed by the sonographer educator (this may occur later using recorded images/loops). Findings should also be compared with clinical data and noted whether the findings were accurate.

Candidates need to interpret a further 25 examinations that are provided by the sonographer educator. This hurdle is a Monash Health requirement over and above the CICM guidelines.

The candidate should demonstrate competence in image acquisition to the sonographer educator. The candidate should demonstrate proficiency in knowledge of normal anatomy and relevant pathological findings, and ability to interpret images, either as part of the practical supervision or by a separate component (e.g. online image interpretation).

Documentation of the examination should note the limited nature of the investigation, the adequacy of views, the findings and the conclusion of the study. If the scan was inadequate, this must be clearly stated as such studies should not be used to make a clinical decision.

An examination/scan is only valid if the physician is the person performing the examination and:

- Multiple entries of the same patient in the same episode of care by the same physician are not acceptable
- CHEST and FoCUS examinations performed on the one patient is allowed

The clinician is to record an adequate FoCUS series of images as described in examination protocols.

Developed May 2015

Rev 5 2021

The physician must complete the reporting template of scan findings for ALL examinations performed on the patients Electronic Medical Record.

All FoCUS images must be transferred to the PACS.

The physician is provided with support & feedback during this training & skills development stage as required.

Auditing

Auditing is conducted and data maintained by the PoCUS sonographer educator with regular audit reports provided to the ICU faculty committee, including the Directors of Non-Invasive Imaging MonashHeart and Director of Emergency. Examinations are assessed using a simple system evaluating the technical adequacy and diagnostic accuracy of the scan, concerning correlative imaging, surgical or clinical findings where available.

Audit results and comments for clinician feedback will be provided in personal elogbooks maintained for clinicians. A minimum 30 FoCUS examinations will be audited until a physician achieves MH credentialing in FoCUS. After that, a random audit of a minimum of ten scans per annum will be conducted yearly to ensure the maintenance of skill and quality.

Accreditation

All FoCUS examinations in the log book series will be evaluated until MH accreditation is achieved. These images will be reviewed by the sonographer educator or a previously accredited ICU faculty member.

Once logbook is completed, a brief practical competency assessment will be conducted by the sonographer educator as part of credential signoff.

Skills Maintenance

After completing the MH Accreditation process, the clinician can perform FoCUS scans within MH. To maintain MH credentials, they are required to:

1. Perform and log a minimum of 15 FoCUS scans annually (no required number of positives after credentialed)
2. Undertake 3 hours of ultrasound education annually, including a one-hour update session to receive ongoing tuition through review of their own logged cases, audit scores and practical scanning with sonographer educator

FoCUS Training & Evaluation

The following steps are what is expected from a competent FoCUS clinician:

System Set-up

- Turn machine on, enter patient UR, surname & Dr initials
- Select the correct transducer
- Select Cardiac pre-set
- Obtain ECG

Transducer Positioning

- The orientation of transducer and correlation with the image
- Demonstrates the ability to manipulate the transducer to achieve the required images (sliding, rocking, rotating)

Image optimisation

- Overall gain
- TGC
- Depth
- Frequency

Anatomy and Physiology

- Identification of normal cardiac anatomy
- Assessment of gross left ventricle (LV) and right ventricle (RV) function
- Assessment of RV size in relation to the LV
- Assessment of RV to aortic root to the left atrial ratio
- Recognition of the presence of fluid in the pericardium
- Differentiation between free fluid, thrombus and epicardial fat pad
- Recognition of any other gross cardiac abnormalities
- Recognition of pleural effusions and ascites

Recognition of artefacts and how to modify image accordingly:

- Increased attenuation of ultrasound beam due to patient habitus
- Patient movement or respiration
- Shadowing from ribs
- Shadowing from air-filled bowel
- Artefacts from air-filled lung

Parasternal Long Axis (PSLA)

- The transducer in the left parasternal region at 3rd to 5th intercostal space oriented to right shoulder (10 o'clock position). Starting from the 3rd intercostal space + 2cm lateral (left) from the sternum move the transducer down single intercostal spaces until a PSLA image is obtained. This may be as low as the 5th or 6 intercostal space; the higher up, the more on-axis.
- Demonstrate the right ventricle, left ventricle, mitral valve, aortic valve, ascending aorta and left atrium.

Developed May 2015

Rev 5 2021

- Assess LV and RV size as a ratio to each other (LV 2/3 RV 1/3)
- Assess RV to AoV/root to LA size ratio (roughly 1:1:1)
- Assess overall LV ventricular function normal vs abnormal
- Identify pericardial effusion
- Identify fluid in the pleural cavity

Parasternal Short Axis

- Holding the PSLA view, rotate the transducer approx. 90 degrees clockwise to obtain the short-axis view (1-3 o'clock). The image should appear doughnut in shape with the papillary muscle shown in the LV; this corresponds to the mid-LV level
- Aim to have the LV in the middle of the sector looking like a doughnut with the two papillary muscles visible in the LV cavity
- Assess overall ventricular function normal vs abnormal
- Assess the shape of the LV, round vs D shaped
- Assess for pericardial effusion
- Fan superiorly and identify MV, AoV and RV

Apical 4 Chamber Deep

- Patient position left lateral if possible. Supine imaging can also be done, but it will be more challenging.
- Start low and lateral; the heart is "proud" in the chest wall so have a shallow angle on the chest wall
- The marker should be facing the between 2 and 3 o'clock, depth at 15-20cm
- Sweep the probe medially, if no image presents, go back to the origin and move the probe 1 IC space cranial. Repeat the sweep
- Demonstrate the left and right ventricles, atria and AV valves
- Assess overall ventricular function normal vs abnormal
- Assess LV and RV size as a ratio to each other
- Identify a pericardial effusion and right heart inversion if present

Tricuspid Annular Plane Systolic Eexcursion (TAPSE)

- From the apical 4 chamber view, rock the probe towards the RV, bringing the RV annulus more into the centre of the screen
- Zoom up onto the annulus
- Bring the cursor down onto the annulus
- Hit MMODE
- Freeze and measure a single continuous line from the lowest point (Diastole) to the highest point (Systole)

Apical 4 to Apical 5 chamber

- Fanning the probe superiorly open the AoV at the crux of the heart - the apical 5 chamber view.
- Once the loop is acquired, return to the 4 chamber view

Apical 4 Chamber Focused

- Without moving the transducer reduce the depth to focus on the LV

Developed May 2015

Rev 5 2021

- Assess the overall function of the LV

Apical 2 Chamber view

- Rotate the probe approximately 45 degrees anti-clockwise
- Elongate the LV as much as possible to open the LV and LA
- Assess global LV function

Apical long axis/3 chamber view

- Rotate the probe approximately 45 degrees anti-clockwise. The probe marker should be in the same orientation as the parasternal long-axis view (10 o'clock)
- Open the aortic valve and left atrium – the image should appear like a parasternal long axis inverted apex up.
- Assess LV function

Sub xiphoid

- Patient position preferably supine and no more than 30 degrees erect
- Probe marker pointing towards the patient left shoulder (3 o'clock) place the probe over the liver and point to the heart.
- Obtain a four-chamber view maximising the Left Ventricle (LV) length and minimising Right Ventricle (RV) foreshortening
- Observe any free fluid over the Right Atrium (RA), RV and LV
- Identify any 2D signs of RA RV inversion
- Assess the size of the RV in relation to the LV
- Assess LV and RV function

Left Ventricle short-axis subxiphoid

- Rotate the transducer 90^{o} (12 o'clock) anti-clockwise keep the heart in the image
- Fan the transducer towards the left shoulder and obtain an LV short-axis image at the level of the papillary muscles
- Assess overall LV function
- Assess the shape of the LV as round versus D shaped

Inferior Vena Cava longitudinal

- Maintaining the probe marker position (12 o'clock) fan the probe towards the patient's right shoulder. Identify the Inferior Vena Cava entering the RA and traversing the liver
- Freeze image and use callipers to measure the diameter of the IVC before the mouth of the hepatic vein (>2.1cm dilated)
- On live imaging ask patient to sniff-in forcefully and assess the IVC for collapse.

2010 ASE guidelines	
Normal	IVC maximum ≤ 2.1 cm and collapsibility index > 50%
Intermediate	IVC maximum ≤ 2.1 cm and collapsibility index < 50%
High	IVC maximum > 2.1 cm and collapsibility index < 50%

Integration of results to management of the patient

- Recognise the limitations of a scan.
- Recognise patients requiring formal imaging assessment
- Incorporate ultrasound findings with the rest of the clinical assessment

Monash Health Practical Evaluation for BELS Accreditation

-
- **Name:**
- **Hospital:**
- **Date:**

Evaluation
Completion in ≤ 10 minutes
Satisfactory or Non-satisfactory only
Any score of 0 = Non-satisfactory
Scores 1 or 2 = Satisfactory

Explain Examination	**0** Incomplete or Misinformation	**1** Explanation Complete but Brief	**2** Full Explanation with Indication and Limitations
Entry of Patient Details, Selection of Transducer and Examination Presets	**0** Unable to complete task completely	**1** Task completed but with hesitancy	**2** Excellent knowledge of machine, accurate data input
Image optimisation (depth, gain, TGC, focus)	**0** Suboptimal image quality	**1** Optimizes image but uncertainty in use of controls	**2** Optimizes image appropriately with familiarity
Subxiphoid View – Demonstration of heart in the 4 chamber and short axis. Pericardium including IVC sniff	**0** Incomplete demonstration	**1** Structures demonstrated but unsystematic approach	**2** Systematic approach in demonstrating all structures
PSLA – on axis LV and able to see Aortic root prox ascending Ao	**0** Incomplete demonstration	**1** Structures demonstrated but unsystematic approach	**2** Systematic approach in demonstrating all structures
PSA – on axis doughnut shaped LV	**0** Incomplete demonstration	**1** Structures demonstrated but unsystematic approach	**2** Systematic approach in demonstrating all structures
Apical 4 Chamber Deep Including TAPSE	**0** Incomplete demonstration	**1** Structures demonstrated but unsystematic approach	**2** Systematic approach in demonstrating all structures

Developed May 2015

Rev 5 2021

Apical 4 Chamber focused	**0** Inappropriate imaging	**1** Some inconsistency in imaging	**2** Consistently records correct images
Apical 2 Chamber	**0** Inappropriate imaging	**1** Some inconsistency in imaging	**2** Consistently records correct images
Apical 3 Chamber	**0** Inappropriate imaging	**1** Some inconsistency in imaging	**2** Consistently records correct images

References:

1. Levitov A, Frankel HL, Blaivas M, Kirkpatrick AW, Su E, Evans D, et al. Guidelines for the Appropriate Use of Bedside General and Cardiac Ultrasonography in the Evaluation of Critically Ill Patients—Part II: Cardiac Ultrasonography. Critical Care Medicine. 2016;44(6):1206-27.
2. S Orde MR. Focused Cardiac Ultrasound in Intensive Care. College of Intensive Care Medicine of Australia and New Zealand 2014.