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 (2018) *Levels of training in adult critical care echocardiography*
- College of Intensive Care Medicine Statement IC-24 (2016) *Statement on the role of Echocardiography in Intensive Care Medicine*
- College of Intensive Care Medicine Training Policy T-35 (2020) *Focused Cardiac Ultrasound in Intensive Care Syllabus policy*

Summary

The use of ultrasound has evolved over the last 25 years into a crucial first-line test for the cardiac evaluation of symptomatic patients. The advancements in ultrasound machine technology and the incorporation of updated educational curriculum in residency training programs have streamlined the integration of focused cardiac ultrasound into specialised practices. In the speciality of intensive care department (ICU), 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 physicians (1).

The College of Intensive Care (CICM) supports FoCUS in intensive care and now mandates training for all new trainees (2). Ultrasound imaging has shown to enhance the physician's ability to assess and manage patients with a variety of acute illnesses and injuries leading to improving patient outcomes.

FoCUS program requirements

1. Introductory course
    a. Recognition of prior learning (RPL)
2. Skill development
3. Assessment/Credentialing
4. Auditing
5. Skill maintenance

Introductory course

A one-day introductory course is required prior to commencing the skills development component of FoCUS training. Pre-reading and completion of an online physics module will be necessary before starting this course. Details for these requirements will be provided.

The introductory course will include didactic presentations covering machine and ultrasound probe orientation (knobology), FoCUS protocol familiarisation, and integration of ultrasound image findings as well as hands on training on a model and or ultrasound simulator.

Recognition of Previous Learning (RPL)

MH acknowledges introductory courses conducted by external training organisations. If a physician provides evidence of introductory course completion within the past two years, they might qualify for RPL. In such cases, they would need to fulfill credentialing requirements by undertaking 30 scans and completing two summative assessments, as outlined in Appendix 4.

Similarly, external graduate certificates(such as CCPU) and prior grandfathering via work experience may also be subject to RPL consideration*. Physicians may need to complete five scans alongside a summative assessment. Regardless of whether it pertains to RPL for introductory courses or the overall credentialing process, it is crucial that all physicians comply with skill maintenance stipulations.

*Senior medical staff with formal post graduate ultrasound qualifications, such as DDU, UQ, UniMelb with satisfactory logbook, FRACP Cardiology with imaging fellowship are exempt from the PoCUS program credentialing processes.

Skill development

After completing the introductory course, ultrasound scanning skills are further developed through bedside one-on-one training sessions with either sonographer educators or ICU faculty[#]. During these sessions, a minimum of five scans must be completed. Additionally, physicians are expected to engage in self-directed learning, which includes reviewing FoCUS learning tools, studying cases, reading journals, and utilising other online resources. Refer to Appendix 1 for recommendations and targets regarding FoCUS training timelines.

[#]The sonographer educators and ICU faculty conducting the training sessions are CICM approved Cardiac assessors.

Please note that if there are three cancellations of one-on-one sessions without reasonable notice, physicians will need approval from ICU governance to re-enter the program.

During the skill development phase, physicians must perform a minimum of 30 examinations, with at least 5 of these being clinically indicated (e.g., in the context of cardiac arrest or hemodynamic compromise). All FoCUS images should be stored in an image storage system and reviewed by the sonographer educator (this may be done retrospectively using recorded images or loops). Findings should be compared with clinical data, and accuracy noted.

Documentation of findings for ALL examinations MUST be completed on the patients Electronic Medical Record (EMR) under the adhoc tab (refer to Appendix 4). A scan is only considered valid if the physician is the person performing the scan and multiple entries of the same patient in the same episode of care by that physician are not counted towards the total numbers.

To ensure understanding of normal and abnormal echo appearances, physicians should interpret an additional 25 examinations prepared by the sonographer educator. This interpretation may occur as part of practical supervision or as a separate component, such as online image interpretation.

During this training and skills development stage, physicians will receive support and feedback as needed.

Assessment/Credentialling

Following the skills development phase, physicians should demonstrate proficiency in both image acquisition and interpretation (refer to Appendices 2 and 3). Assessments are essential for skill development, offering valuable feedback to both learners and trainers and highlighting areas for improvement. During FoCUS training, it is advised to undergo at least one formative and two summative assessments.

Successful credentialing in FoCUS requires completing two in-person, practical summative assessments (refer to Appendix 5), conducted by a sonographer educator and a qualified ICU faculty. There is no limit on the number of attempts for summative assessments.

Upon completion of 30 scans and 2 summative assessments, physicians become credentialed to perform FoCUS at MH.

Auditing

Auditing is conducted and data maintained by the sonographer educator with quarterly audit reports provided to the ICU Governance committee. Auditing consists of assessing physician's scans using a simple system (see below) evaluating the technical adequacy and diagnostic accuracy of the scan, concerning correlative imaging, surgical or clinical findings where available.

eLOGBOOK QUALITY AUDIT - FEEDBACK	
3	Good scan, minor technical errors at least 3 images of diagnostic quality
2	Moderate technical errors - gains, focal zone and depth but no misdiagnosis 2 or less images of diagnostic quality
A	Extensive technical errors rendering the scan non-diagnostic OR suboptimal imaging due to pt body habitus/status
1	False negative
0	False positive

Audit results and comments for physician feedback will be provided in personal eLogbook's maintained for physicians. A minimum 30 FoCUS examinations will be audited until a physician achieves MH credentialing in FoCUS.

Auditing will continue on a more limited capacity in the skills maintenance phase.

Skills Maintenance

After receiving MH credentialing, the physician 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). A random audit of a minimum of 10 scans per annum will be conducted, with feedback provided where required, to ensure the maintenance of skill and quality.
2. Undertake 3 hours of ultrasound education annually. A one-hour session with a sonographer educator to receive ongoing feedback through review of their own logged cases, audit scores and practical scanning is highly recommended.

APPENDIX 1

Cardiac FoCUS training timeline recommendations/targets

This document is intended to be used as a reference guide only. Learners will vary in training and learning characteristics and timelines should be adapted to individuals as required.

Introductory course

- Book in first 1-on-1 training at introductory course

Skills development and Assessments

1 month – 1-2 sessions of 1-on-1 training

- Knobology
- Patient positioning
- Protocol review
- Demonstration before scan if needed
- 1-2 scans per session

1-3 months – 3 sessions of 1-on-1 training onwards

- Demonstration usually not required
- Reinforce probe movements
- Encourage independent practise
- 3 scans per session
- Add A2C/3C and TAPSE

3 months – ~10-15 scans

- Formative assessment to assess independent scanning
- Schedule "Echo Interpretation" session

3-6 months – ~20-25 scans

- Independent practise
- Focus on clinical application and pathology assessment
- +/- formative assessment

6 months – ~30 scans

- Auditing review
- Summative assessment

Post credentialing

3 – 6 months

- Remind of maintenance requirements, updated auditing feedback

9-12 months

- Review status of maintenance requirements, updated auditing feedback

Appendix 2

Details of FoCUS Training & Evaluation

A competent FoCUS physician is expected to adhere to the following steps:

System Set-up

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

Transducer Positioning

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

Image optimisation

- Overall gain
- TGC
- Depth
- Frequency

Anatomy and Physiology

- Identification of normal cardiac anatomy
- Assessment of 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 (PLAX)

- The transducer in the left parasternal region at 3rd to 5th intercostal space oriented to right shoulder (10 o'clock position) depth should be adjusted as necessary
- Visualise the RV, LV, mitral valve (MV), aortic valve (AV), ascending aorta and left atrium (LA).
- Assess LV and RV size as a ratio to each other (LV 2/3 RV 1/3)
- Assess RV to aortic root to LA size ratio (roughly 1:1:1)
- Assess overall LV function: normal vs abnormal
- Identify pericardial effusion
- Identify fluid in the pleural cavity

Parasternal Short Axis (PSAX)

- The transducer in the left parasternal region at 3rd to 5th intercostal space oriented to left shoulder (1 o'clock position), depth should be adjusted as necessary
- 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

Apical 4 Chamber

- Patient position left lateral if possible
- 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 should be adjusted as necessary
- Demonstrate the ventricles, atria and atrioventricular 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 Excursion (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 MM (m-mode)
- Freeze and measure a single continuous line from the lowest point (diastole) to the highest point (systole)

Apical 2 Chamber view

- Rotate the probe approximately 45 degrees anti-clockwise to between 12 and 1 o’clock, depth should be adjusted as necessary
- Elongate the LV as much as possible to open the LV and LA
- Assess LV function

Apical 3 chamber/long axis view

- Rotate the probe approximately 45 degrees anti-clockwise. The probe marker should be in the same orientation as the parasternal long-axis view at 10 o'clock depth should be adjusted as necessary
- Open the AV and LA – the image should appear like a parasternal long axis with the apex up.
- Assess LV function

Subcostal Long Axis

- Patient position preferably supine and no more than 30 degrees erect
- Probe marker pointing towards the patient left side (3 o'clock) place the probe over the liver and point to the heart, depth should be adjusted as necessary
- Obtain a four-chamber view maximising LV length and minimising RV foreshortening
- Observe any free fluid over the right atrium(RA), RV and LV
- Identify any 2D signs of RA and/or RV inversion

- Assess the size of the RV in relation to the LV
- Assess LV and RV function

Subcostal Short Axis at the level of the mid LV

- Rotate the transducer 90^{o} (12 o'clock) anti-clockwise keep the heart in the image
- Fan the transducer towards the mid LV 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 (IVC) longitudinal

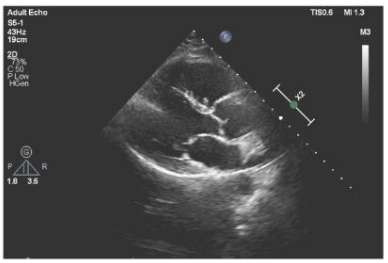
- Maintaining the probe marker position (12 o'clock) fan the probe towards the patient's right side. Identify the IVC entering the RA and traversing the liver
- Freeze image and use callipers to measure the diameter of the IVC (>2.1cm dilated)
- On live imaging ask patient to sniff-in forcefully and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

Integration of results to management of the patient

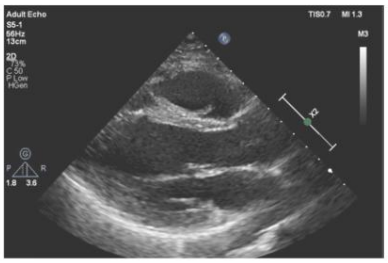
- Recognise the limitations of a scan.
- Recognise patients requiring formal imaging assessment
- Incorporate ultrasound findings with the rest of the clinical assessment

Appendix 3

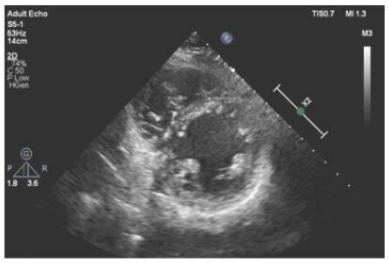
Focused Cardiac Ultrasound



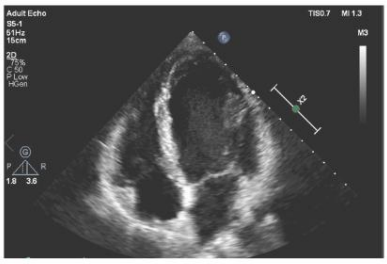
1.PLAX Deep



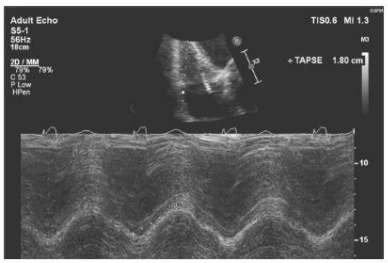
2.PLAX



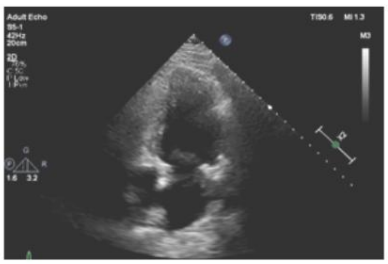
3. PSAX mid LV



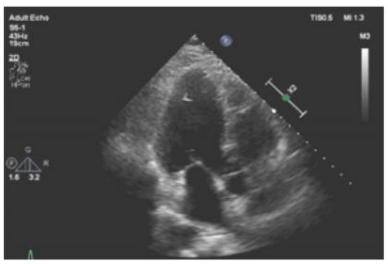
4. AP4



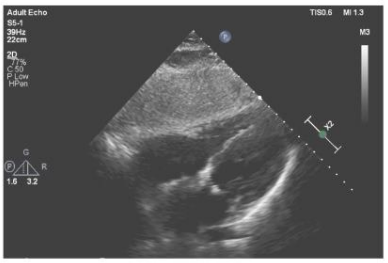
5. TAPSE



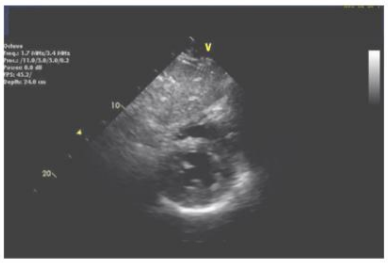
5. AP2



6. AP3



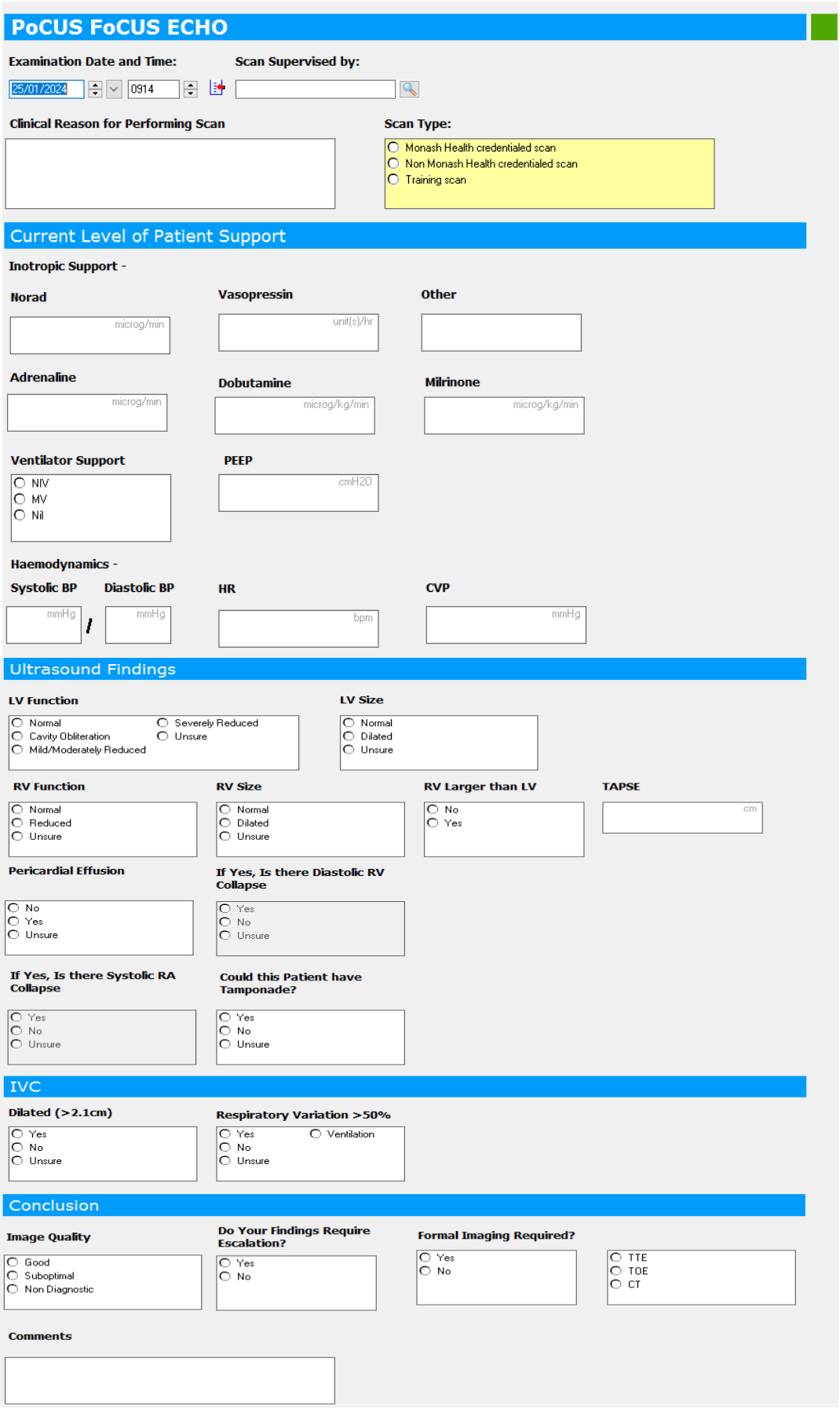
7. SUB LAX



8 .SUB SAX

9. SUB IVC

Appendix 4



PoCUS FoCUS ECHO

Examination Date and Time: 25/01/2024 0914

Scan Supervised by:

Clinical Reason for Performing Scan

Scan Type:
- ○ Monash Health credentialed scan
- ○ Non Monash Health credentialed scan
- ○ Training scan

Current Level of Patient Support

Inotropic Support -

Norad (microg/min)

Vasopressin (unit(s)/hr)

Other

Adrenaline (microg/min)

Dobutamine (microg/kg/min)

Milrinone (microg/kg/min)

Ventilator Support
- ○ NIV
- ○ MV
- ○ Nil

PEEP (cmH2O)

Haemodynamics -

Systolic BP (mmHg) / **Diastolic BP** (mmHg)

HR (bpm)

CVP (mmHg)

Ultrasound Findings

LV Function
- ○ Normal
- ○ Cavity Obliteration
- ○ Mild/Moderately Reduced
- ○ Severely Reduced
- ○ Unsure

LV Size
- ○ Normal
- ○ Dilated
- ○ Unsure

RV Function
- ○ Normal
- ○ Reduced
- ○ Unsure

RV Size
- ○ Normal
- ○ Dilated
- ○ Unsure

RV Larger than LV
- ○ No
- ○ Yes

TAPSE (cm)

Pericardial Effusion
- ○ No
- ○ Yes
- ○ Unsure

If Yes, Is there Diastolic RV Collapse
- ○ Yes
- ○ No
- ○ Unsure

If Yes, Is there Systolic RA Collapse
- ○ Yes
- ○ No
- ○ Unsure

Could this Patient have Tamponade?
- ○ Yes
- ○ No
- ○ Unsure

IVC

Dilated (>2.1cm)
- ○ Yes
- ○ No
- ○ Unsure

Respiratory Variation >50%
- ○ Yes
- ○ No
- ○ Unsure
- ○ Ventilation

Conclusion

Image Quality
- ○ Good
- ○ Suboptimal
- ○ Non Diagnostic

Do Your Findings Require Escalation?
- ○ Yes
- ○ No

Formal Imaging Required?
- ○ Yes
- ○ No

- ○ TTE
- ○ TOE
- ○ CT

Comments

Appendix 5

Monash Health Practical Evaluation for FoCUS Credentialing

- **Name:**
- **Hospital:**
- **Assessor:**
- **Date:**
- **Start/finishing time:**

Evaluation
Completion in < 15 minutes
Satisfactory or Non-satisfactory only
Any score of 0 = Non-satisfactory
Scores 1 or 2 = Satisfactory
2 levels of Pass scores are for feedback and to monitor areas for improvement

Explain Examination	**0** Incomplete or Misinformation	**1** Explanation Complete but Brief	**2** Full Explanation with Indication and Limitations
Patient and scanning environment setup Positioning patient, removing ECG dots, turning off lights.	**0** Not attempted	**1** Partial attempt of patient and environment setup	**2** Excellent patient and scanning environment setup
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
PLAX – 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
PSAX – on axis doughnut shaped LV	**0** Incomplete demonstration	**1** Structures demonstrated but unsystematic approach	**2** Systematic approach in demonstrating all structures
Apical 4 Chamber	**0** Incomplete demonstration	**1** Structures demonstrated but unsystematic approach	**2** Systematic approach in demonstrating all structures
TAPSE	**0** Inappropriate/ inaccurate imaging	**1** Measurement approach and result demonstrated with unsystematic approach	**2** Systematic approach in acquisition and measurement technique

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
Subcostal View – Demonstration of heart in the 4 chamber view.	**0** Incomplete demonstration	**1** Structures demonstrated but unsystematic approach	**2** Systematic approach in demonstrating all structures
Subcostal View – Demonstration of heart in the subcostal short axis view.	**0** Incomplete demonstration	**1** Structures demonstrated but unsystematic approach	**2** Systematic approach in demonstrating all structures
Subcostal View – Pericardium including IVC sniff	**0** Incomplete demonstration	**1** Structures demonstrated but unsystematic approach	**2** Systematic approach in demonstrating all structures
Clean of gel, cover patient and turn on room light. Clean machine and probe thoroughly. Leave chords near and tangle free	**0** Not attempted	**1** Incomplete	**2** Complete
Interpretation and Documentation	**0** Absent/inappropriate documentation Incorrect interpretation	**1** Incomplete documentation Some inaccuracies without major errors in interpretation	**2** Systematic approach in documentation and accurate reporting
Comments:			

Result: Competent / Incompetent

Assessor/Signature/Date:

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.