Training & Accreditation in Emergency Ultrasound

Module 3 BELS

This document describes the process for credentialing Emergency Physicians within Monash Health (MH) to perform Basic Echocardiography in Life Support (BELS).

This document should be read in conjunction with Australian College of Emergency Medicine (ACEM) documents

- Number G25, August 2019 (Rev Aug 2019): *Ultrasound Education Programs*
- Number P21 July 1999 (Rev Jul 2019): *Policy on the use of Focused Ultrasound in Emergency Medicine*
- Number P733, September 2020 (Rev Sep 2020): *Credentialing for emergency medicine ultrasonography*
- Number COR742, September 2020 (Rev Sep 2020): *Provision of focused ultrasound training and governance*

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 speciality of emergency medicine (ED), the Basic Echo in Life Support (BELS) 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 ED physician(1).

The ACEM supports the use of focussed ultrasound examinations in the Emergency Department, stating that ultrasound imaging has been shown to enhance the clinician's ability to assess and manage patients with a variety of acute illnesses and injuries and focused bedside ultrasound examinations performed by trained Emergency Physicians in order to answer specific clinical questions have been shown to improve patient outcomes.

This document describes the process for accrediting Emergency Physicians to perform Basic Echocardiography in Life Support.

1. Initial Training
2. Induction/ Skills Development / Electronic Log Book /MH Accreditation
3. Ongoing Audit / Skills Maintenance

Initial Training

Emergency Physicians intending to perform ultrasound within MH are expected to complete

- Appropriate practical ultrasound course
- Appropriate ultrasound physics module

These qualifications should be at a standard which is accredited by ASUM (e.g. Australian Institute Ultrasound Gold Coast course, ZEDU Ultrasound Training). The physics component can be completed as part of a course or as a separate online module.

ED Registrars and Consultants wishing to participate in this program should have their qualifications and suitability approved by their site EDUSEQ Committee representative before commencing.

Induction/ Skills Development / Electronic Log Book /MH Accreditation
BELS training and accreditation is only open to Monash Health employees who have attained Monash Health accreditation in eFAST.

Ultrasound scanning skills is achieved through one-on-one training with the Sonographer Educators and any accredited officers of EDUSEQ Committee. Practical scanning support, mentoring, and feedback is offered throughout the completion of this stage.

Additional self-directed learning is expected, including viewing BELS learning tools, revising MH cases, and other online resources.

Candidates should perform a minimum of 25 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.

At least five examinations should be performed under the direct supervision of a previously accredited physician or the sonographer educator.

Also, candidates should interpret a further 25 examinations prepaired by the sonogrpahereducator and authorised by the EDUSEQ.

This minimum of 50 cases must include at least two cases each of tamponade, right heart failure or massive PE, hypovolemia or distributive shock and left ventricular failure.

The candidate should demonstrate competence in image acquisition to the sonographer educator. It is recommended that this be performed in a structured manner. The candidate should demonstrate competence 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 examination, the adequacy of views, the findings and the conclusion of the study. If the examination 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 ED physician is the person performing the examination and:

- Multiple entries of the same patient in the same episode of care by a physician are not acceptable
- eFAST/AAA and BELS examinations performed on the one patient is acceptable and will be electronically logged for each scan type conducted
- The physician is to record an adequate BELS series of images as described in examination protocols

- The physician must complete Electronic Medical Record (EMR) forms for all scan findings for each examination performed

Auditing
Auditing will be conducted and data maintained by the sonographer educator with regular audit reports provided to the EDUSEQ committee. Examinations will be qualitatively assessed using a simple scoring system of diagnostic accuracy and technical adequacy of scans for training and research purposes. Each BELS examination will be audited until a physician achieves MH credentialing. After that, random audit of a minimum five examinations performed by MH credentialed Physicians will be conducted each year to ensure the maintenance of skills and quality control.

Accreditation
All BELS examinations in the Emergency Physicians log book series will be evaluated until MH accreditation is achieved. These images will be reviewed by the sonographer educator or a previously accredited member of the EDUSEQ committee.

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

On going skills mantenance
After completing the MH Accreditation process, the physician can perform BELS scans within MH. In order to maintain MH credentials, they are required to:

1. Perform and log a minimum of 25 BELS scans annually (no required number of positives after credentialed)

2. Undertake 4 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 or an appointed officer of EDUSEQ committee

BELS Training & Evaluation
What is expected in a BELS Scan:
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, rocking, rotating, fan)

Image optimization

- Overall gain
- TGC
- Depth
- Focal zone position

Image interpretation

- Recognition of the presence of fluid in the pericardium
- Differentiation between free fluid and complex fluid/blood
- Identification of cardiac anatomy
- Assessment of gross LV and RV function
- Assessment of RV size in relation to the LV
- Recognition of any other gross cardiac abnormalities

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 and bowel
- Artefacts from air-filled lung

Sub xiphoid four chamber

- 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%

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.
- 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

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

Evaluation

- Completion in $\leq$ 10 minutes
- Score: Satisfactory or Non-satisfactory only
- Any score of 0 = Non-satisfactory
- Scores 1 or 2 = Satisfactory
- Two levels of Pass scores are for feedback and to monitor areas for improvement

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
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
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 and 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	**0** Incomplete demonstration	**1** Structures demonstrated but unsystematic approach	**2** Systematic approach in demonstrating all structures
Apical 4 Chamber focused)	**0** Inappropriate imaging, measurements or M-mode	**1** Some inconsistency in imaging, measurements and M-mode	**2** Consistently records correct images, measurements and M-mode

References:

1. Labovitz AJ, Noble VE, Bierig M, Goldstein SA, Jones R, Kort S, et al. Focused cardiac ultrasound in the emergent setting: a consensus statement of the American Society of Echocardiography and American College of Emergency Physicians. J Am Soc Echocardiogr. 2010;23(12):1225-30.
2. Lang RM, Badano LP, Mor-Avi V, Afilalo J, Armstrong A, Ernande L, et al. Recommendations for cardiac chamber quantification by echocardiography in adults: an update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. J Am Soc Echocardiogr. 2015;28(1):1-39 e14.