



CRITICAL CARE ULTRASOUND

THE ROYAL COLLEGE OF PHYSICIANS AND SURGEONS OF CANADA

Objectives of Training and Specialty Training Requirements in Anesthesia

Specific Objectives in CanMEDS Format

OVERALL GOALS

This elective is one block in duration. It is open to one critical care resident on a first come- first served basis that is negotiated with Dr. Arntfield. Learning objectives will focus on the skills of acquisition and interpretation of point of care ultrasound images in critically ill patients.

Supervisor: Dr. Robert Arntfield (rarntfi@uwo.ca)

Site: Critical Care Trauma Centre, Medical Surgical ICU, Victoria Hospital ED

Responsibilities

The resident(s) carrying out their critical care ultrasound elective are responsible for providing point of care ultrasound services in the CCTC and, when possible, to other critically ill patients at Victoria Hospital during weekday hours. There are no nighttime or weekend call responsibilities. Given there is no known harm from ultrasound technology, ultrasound exams may be carried out liberally for both educational and diagnostic/therapeutic and procedural (when indicated) purposes. Patient selection for ultrasound may be driven by either a CCTC team member request or be self-initiated by the resident on service. If ultrasound exams are elective and educational in nature, they are not to delay or interfere with any aspects of care (nursing, medical, family) for the patient.

Ultrasound images obtained must all be archived appropriately using methods well described in tutorials made available to the resident. Further, meticulous organization of these studies within Qpath is expected in order to facilitate Dr. Arntfield's oversight as well as to track the number of studies being acquired by the resident across each indication. Benchmarks for each indication will be determined at the beginning of each rotation for each resident.

Upon completion of a non-educational ultrasound examination, the resident must communicate the findings to the medical team directly. Review of images with Dr. Arntfield may occur first if required. Direct image review is encouraged between the resident and the CCTC team member. A hand written or type written report must also be inserted in to the patient chart.

The resident will be responsible for completing a 5 hour critical care echocardiography curriculum prior to starting their rotation. An additional 9 hours of content must be reviewed by the resident in the first 2 weeks of the rotation.



At regular intervals, in person image review and hands on training with the rotation supervisor (Dr. Arntfield) will occur. This will supplement the wireless oversight of images being acquired via the hospital-based point of care ultrasound management software (Qpath).

At the conclusion of the rotation, the resident will be expected to contribute two small projects. Firstly, a case write up and accompanying images for the “case of the month” on the point of care ultrasound webpage “uwosono.ca”. The second will be to lead a lunchtime image review session for CCTC residents and staff, highlighting interesting cases and learning points from the past month.

ROTATION OBJECTIVES

At the completion of training, the resident will have acquired the following competencies and will function effectively as:

Medical Expert/Clinical Decision Maker

General Requirements

Residents will:

- Learn and apply basic ultrasound physics, machine controls and transducers in acquiring ultrasound images in critically ill patients.
- Appreciate the clinical syndromes where general critical care ultrasound and critical care echocardiography may play a pivotal role in guiding diagnosis and management.
- Achieve comfort in generating quality ultrasound images across different organ systems in a critically ill patient.
- Understand the limitations of ultrasound technology, its user-dependence as well as common imaging artifacts and imaging pitfalls.
- Learn how to integrate point of care ultrasound findings in to the care trajectory of the critically ill patient.
- Achieve comfort in a teaching role with junior residents in demonstrating some fundamental ultrasound teaching, especially as it relates to procedural guidance for vascular access.
- Learn to identify the role of cleaning and proper storage of point of care ultrasound machines as part of their upkeep and preservation in a busy ICU environment.
- Appreciate the importance of a quality assurance program as part of patient safety and proper training for point of care ultrasound and other user-dependent methods of patient care.
- Identify the role for diagnostic studies from other consultant imaging specialists for more complex clinical questions or when point of care imaging is unable to answer the clinical questions at hand.

Specific Knowledge Requirements

The resident is expected to describe:

- Factors influencing image acquisition quality when imaging critically ill patients
- Causes and ultrasound findings in circulatory failure due to various causes including:
 - Left ventricular failure
 - Hypovolemia
 - Acute right sided heart failure (cor pulmonale)
 - Cardiac tamponade
 - Acute massive left sided valvular regurgitation
 - Circulatory arrest
- Causes and ultrasound findings in respiratory failure due to various causes including:
 - Pleural effusion
 - Pneumothorax
 - Alveolar-interstitial syndrome (CHF, ARDS)
 - Normal aeration pattern (PE, obstructive lung disease)
 - Lobar collapse
- Requirements for acceptable cardiac ultrasound images and anatomic structures seen when images are obtained from the parasternal, apical and subcostal positions
- Knowledge of ultrasound artifacts, including mirror image, enhancement, edge, side lobe, ring down and reverberation artifacts
- Understanding of potential mimics, artifactual or anatomic, of common pathology (false positives) in both cardiac and general critical care ultrasound applications
- Understanding the difference between volume status and volume responsiveness
- Knowledge of the requirements for positive, negative and indeterminate ultrasound studies when assessing for binary clinical questions such as pleural fluid, pericardial fluid, pneumothorax
- Knowledge of qualitative and quantitative approaches to evaluating volume responsiveness, cardiac output, left ventricular function, pericardial fluid, pleural effusion, pneumothorax
- Understanding of the physics of Doppler, the distinction between continuous wave (CW) and pulse wave (PW) Doppler, aliasing, pulse repetition frequency and the Nyquist limit.
- Knowledge on how to use Qpath to generate reports and review feedback.
- Identify suitable critical care patients for point of care transesophageal echocardiography
- Identify patients where clinical questions require escalation to diagnostic imaging specialists

Specific Skill Requirements

The resident is able to:

- Generate interpretable general critical care ultrasound images in the assessment for pneumothorax, pleural effusion, ascites.
- Generate interpretable basic critical care echocardiography images from multiple transthoracic windows, including the parasternal, apical and subcostal points of view.
- Accurately recognize (interpret) the ultrasound findings consistent with pneumothorax, pleural effusion and ascites
- Accurately recognize (interpret) the echocardiographic findings consistent with pericardial effusion, various states of LV function, cor pulmonale, massive valvular pathology and a volume responsive IVC.
- Defer making interpretations on ultrasound images that are either of suboptimal quality or fall outside of the capabilities or scope of the resident's training and experience.
- Propose and discuss (with the patient's care team) appropriate clinical management plans in response to findings on point of care ultrasound.
- Landmark safe and high yield locations for chest drainage or abdominal drainage procedures using ultrasound.
- Demonstrate competence in cannulating various vessels (central veins, peripheral veins, peripheral arteries) with ultrasound guidance and sterile technique.
- Use echocardiography to assist in the resuscitation and prognosis of patients in cardiac arrest.

Communicator

The resident will be able to:

- Verbal communication of ultrasound findings to care team, including nurse and resident.
- Document all ultrasound findings in patient chart either by hand-written note or through a Qpath generated report (preferred).
- Provide point of care ultrasound support to ward patients on the CCOT service who may benefit from point of care assessment of circulatory or respiratory failure.

Collaborator

The resident will:

- Establishes trusting relationships with the nursing staff, residents and the patients.
- Liaise professionally and respectfully with all consultant services.



Health Advocate

On completion of the rotation, the trainee will:

- Recognizes that ultrasound is one of many tools to guide diagnostics and therapeutics in an ICU setting.
- Appreciates that patient positioning and patient exposure for ultrasound exams may be stressful or disruptive for patients.
- Patient safety: Thoroughly clean the machine and transducers after each use, using cavi-wipes.

Evaluation

The trainee will be evaluated with a number of tools.

Qualitatively:

A majority of individual ultrasound scans will be evaluated either in person or by using the electronic quality assurance software (Qpath) whereby reports on quality are emailed to the rotator. At the end of each week, an in person review session will occur, reviewing the week's work and focusing on bridging gaps in ultrasound image generation, interpretation or clinical integration.

Quantitatively:

At the beginning of each block, the resident and Dr. Arntfield will decide on an appropriate number of studies within each indication to be completed. In general, these will correspond to 40 cardiac studies and 25 each of thoracic and pleural studies. Studies will be tracked automatically by the image archiving software (Qpath). Some variation may occur if holidays or conference time is taken by the rotator. Failure to achieve these targets will result in a non-satisfactory evaluation.

Summary feedback will be provided at the end of the block along with an exit interview and practical hands-on evaluation. The In-Training Evaluation Report (ITER) will be reviewed with the trainee, signed, and forwarded to the office of the Critical Care Program Director.

Reviewed: August 2012, Dr. Granton