

# University of Florida Critical Care Medicine (CCM) Ultrasound Curriculum

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Bedside point of care ultrasound is quickly becoming an important tool for the critical care physician. Graduated fellows will be competent to perform basic abdominal, pulmonary, pleural, cardiac, and vascular ultrasonography as part the curriculum in critical care medicine. These goals are supported by the American College of Chest Physicians Statement on Competence in Critical Care Ultrasonography and Society of Critical Care Medicine guidelines towards an ultrasound curriculum in critical care. The training program will incorporate self-learning as well as instructor based teaching sessions.

## Primary Applications in the ICU:

1. **Vascular/Procedural Guidance (improves patient safety)**
  - a. Central venous line placement (internal jugular, subclavian, femoral) should always be done with ultrasound if possible. Images can be obtained with the line in any view (short or long axis), and must be able to show either needle, short catheter, or guidewire in vein when saving image (preferable long axis view)
  - b. Ultrasound can be useful in difficult arterial line placements (radial, axillary, femoral)
  - c. Peripheral lines can also be placed using ultrasound for difficult access
  - d. Chest tube thoracostomy, pericardiocentesis, paracentesis, and lumbar puncture assisted with ultrasound will be done only in presence of those credentialed by Shands to perform procedural ultrasound but will also count towards this primary application
2. **FAST (Focussed Assessment with Sonography for Trauma) (improves diagnosis)**
  - a. At least 3 out of 4 views are required (echo, hepatorenal, splenorenal, rectovesical; labeled on screen)
  - b. Comment specifically on findings (no free fluid, no pericardial fluid, rather than FAST negative)
  - c. Extended FAST for evaluation of pneumothorax or hemothorax is optional
3. **Transthoracic echo (limited) (Transesophageal will be part of a separate credentialing process) (improves diagnosis)**
  - a. The image must include both ventricles, a clear view of the septum, and pericardium. Cardiac motion is to be recorded by using M-mode. Preferable views are parasternal long, parasternal short, and apical.
  - b. Pericardial effusion present or absent, right ventricle enlarged or not visible, and RV/LV contractility poor, normal, or hyperdynamic are to be documented
  - c. Lung ultrasound evaluation must also be done to determine A, B, or A/B profiles

- d. IVC evaluation must also be done to determine size and respiratory variability

#### 4. **Hemodynamic hTEE (improves diagnosis)**

- a. New modality incorporated this academic year for use in patients with difficult transthoracic views, chest/abdomen surgical sites preventing adequate transthoracic views
- b. TTE views must be suboptimal/failed
- c. hTEE use criteria must be followed: intubated patients, expected survival greater than 48 hours, esophagus and stomach intact, other preclusions to catheter placement (tbi and cannot tolerate placement, history of bradycardia with other oral or gastric tubes). SEE separate document on website for full list (<http://ccm.anest.ufl.edu/education/ultrasound>)
- d. hTEE **will** be used in:
  - i. Sepsis protocol patients who have received 4L of fluid in less than 12 hours FROM THE SEPSIS PROTOCOL (not total for the day) and are still being told by the computer to give more fluid.
  - ii. Sepsis protocol patients who remain hypotensive despite a CVP  $\geq 10$ .
  - iii. Sepsis protocol patients on pressors or inotropes for more than one hour.
  - iv. MELD 35 patients (pre-op transplant) who do not have a contraindication to a NGT from varices who have one of the following criteria: AKI or renal failure; moderate or severe ARDS as defined as P/F ratio of  $<200$ ; or shock requiring pressors or inotropes.
- e. hTEE **may** be used in:
  - a. Patients on pressors or inotropes.
  - b. Persistent traumatic shock to assist determining etiogolgy (hemorrhagic vs. neurogenic, vs. cardiogenic, etc.)
  - c. Suspected cardiogenic shock in conjunction with myocardial infarction.
  - d. Unable to adequately assess volume status via other objective means (CVP, bedside TTE).
  - e. ARDS patients who require paralytics or flolan **but are not candidates for proning**.
  - f. Post-op liver transplant patients who do not appear to be 'extubatable' from the ventilator  $> 48$  hours.
  - g. Non-septic patients who have received more than 4L of fluid in  $< 24$  hours (ex. pancreatitis).
  - h. Any patient you think requires a pulmonary arterial catheter or Flotrac monitor.

#### 5. **Lung (improves diagnosis)**

- a. Pneumothorax – for evaluation as E-FAST (extended fast) and after line placement; comment on presence or absence of lung sliding, Comet tails present/absent, and M mode Beach sign or Barcode sign

- b. Hemothorax/Pleural Effusions – for evaluation of possible need of chest tube and oxygenation issues; note small, moderate, or large effusion
- c. Interstitial syndrome – A lines and B lines for evaluation of presence/absence of alveolar fluid
- d. Alveolar consolidation – Tissue like sign and shred sign for evaluation of consolidation

### **Optional Applications in the ICU**

#### 1. **Aorta**

- a. 4 views needed (transverse and longitudinal views of both proximal and distal aorta (remember most AAA's are infrarenal)
- b. Measure the aorta from outer wall to outer wall (>3cm = abnormal)
- c. Name any visualized branches

#### 2. **Gallbladder**

- a. Comment on presence or absence of gallstones
- b. Comment on presence or absence of wall thickening (>3mm = abnormal)
- c. Comment on the presence or absence of sonographic Murphy's sign
- d. If the common bile duct is visualized, comment on size (>7mm = abnormal)
- e. Comment on presence or absence of fluid around gallbladder

#### 3. **Renal**

- a. Both poles of both kidneys need to be visualized (compare, contrast, collecting system, contour)
- b. The collecting system needs to be free of rib shadows or any other artifact to be able to comment on presence or absence of hydronephrosis

### **University of Florida Critical Care Medicine (CCM) Ultrasound Training Outline**

**Overview:** The RRC has no specific requirements for ultrasound training in critical care fellowship, but certainly encourage it. Many other specialties including emergency medicine, anesthesiology, obstetrics, and surgery require ultrasound training as part of the curriculum to graduate. The best methods for training and certification are still under review, but many organizations have put forth training recommendations. Most organizations also have ultrasound interest groups and continue to work towards a proposal for a more defined curriculum. Proficiency is not only determined by number of ultrasounds done, but by the consistent performance by the individual throughout the training period. Quality assessment must also be performed on a periodic basis of all ultrasounds performed in the ICU.

**Competence:** Competence is composed of an individual's knowledge, skills, and attitude to ensure excellent performance in a certain situation. We will use guidance from American College of Surgery (ACS), American

Institute of Ultrasound in Medicine (AIUM), American College of Radiology (ACR), American College of Emergency Physicians (ACEP), World Health Organization (WHO), European Federation of Societies for Ultrasound in Medicine and Biology, and World Interactive Network Focused on Critical Ultrasound to determine competence when training in ultrasound for the evaluation of the critically ill patient.

**Purpose:** The purpose of learning ultrasound in the critically ill patient is to use it as a real-time point of care method to answer clinical questions that will lead to a better understanding of the underlying disease process and changes in management (for example, free fluid or no free fluid, pericardial effusion or no pericardial effusion). The bedside ultrasound does **NOT** replace a formal ultrasound in which more specific measurements are made. The final endpoint should be a trained critical care physician that can use ultrasound as an adjunct to the evaluation of a specific problem (hypotension, respiratory distress, oligoanuria, and difficult vascular access) in the critically ill patient.

**Key principle:** Bedside critical care ultrasound differs from radiology ultrasound in that it serves primarily as a bedside screening tool looking for LIMITED NUMBER of emergency clinical problems and situations as opposed to organ based evaluation. These include the evaluation of hypotension (unstable hemodynamics), screening for free fluid in the abdomen, detection of pericardial fluid (trauma and non-trauma settings), and evaluation for aortic aneurysm. An example of how this has already changed in clinical practice is the origin of the FAST exam. Originally called focused abdominal sonography for trauma assessment (organ system based), it became focused assessment with sonography in trauma (problem based).

**Multiple goal problem based approach:** Critical care is oriented towards complex disease states rather than single organs, indicating the need for timely and accurate approach for multiple systems, rather than a comprehensive exam of a single anatomical region. The training candidate should start out by improving skill in various organ specific ultrasound techniques. Once individual components are mastered, the candidate should move on to more problem based evaluation such as hypotension, respiratory distress, chest pain, acute abdomen, cardiac arrest, and oligoanuria.

**Advancing the use of ultrasound in critical care:** Additional uses include but are not limited to:

1. Soft tissue evaluation (cellulitis versus abscess; hematoma evaluation)
2. Ocular (foreign body, optic nerve sheath measurements, retinal detachment)
3. Lumbar puncture (for optimal positioning)
4. Pneumothorax (lung sliding and comet tail artifacts in evaluation of relative movement of pleural surfaces)
5. DVT studies (evaluation of vessel compressibility, generally done at femoral and popliteal sites)
6. Airway/Lung sonography for pleural fluid evaluation (chest tube placement, emergent cric/tracheostomy)
7. Circulation (defibrillation recovery, pericardiocentesis, thoracentesis, paracentesis, peritoneal lavage)

8. Vascular (caval vessel responsiveness)

**How to achieve proficiency:**

1. Must record ultrasounds and submit them to appropriate reviewer on monthly basis for feedback (done through Qpath)
  - a. We will be saving images and then uploading to your epic note [refer to Qpath documents).
  - b. The studies are reviewed on a monthly basis and feedback is given on ways to improve interpretation/image through the current quality assurance process (see QA worksheet).
  - c. Suboptimal studies will be logged and returned with teaching points to review.
  - d. At minimum 25 images must be done with a preference towards 50 of each primary application
2. Must do continuously throughout the year (performing 20 scans in 2 months and then zero in the next 10 months will not help you, even though you reach your numbers required)
3. Complete self-directed learning requirements (viewing videos and reading prepared material)
4. Attendance of at least 24 hours of didactic and hands on learning experiences offered throughout the year, with preference towards 64 hours
5. Participate in instructor led teaching sessions (Hands On Training simulation and Bedside Proctored Practice)
6. Submit image portfolio for review by ultrasound director (via Qpath)
7. Credentialing evaluation including at least 2 observed examinations in each category (Procedural, TTE, FAST, Lung) using a pass-fail exam standard form

**Educational Module Structure (One Academic Year)**

1. Introductory workshops (5 hours didactic, 5 hours hands on)
  - a. Theoretical sessions: didactic sessions, multimedia lectures, interactive cases, pre-course training
  - b. Practical sessions: demonstrations and hands on training, simulated cases
2. CCM Ultrasound Scanning Rounds & Bedside Proctored Practice (65 hours throughout year)
  - a. Supervised scanning (5-10 scans)
  - b. Independent scanning with delayed review (>25 scans, with some percentage of positive findings)

- c. Occurs on Tuesdays 3:30 to 4:30 pm to find abnormal scans in department and give opportunity to trainees present to obtain abnormal scans for portfolio (scheduled 2 max per week)
  - d. If other trainees want independent sessions, can arrange through the Director of Critical Care Ultrasound - Rohit Patel ( [rohitpatel@ufl.edu](mailto:rohitpatel@ufl.edu))
3. Self Directed Learning (200+ hours) - Didactic Modules
    - a. Published reading material distributed monthly
    - b. Video and web based learning instruction modules (made publicly available on <http://www.sonosite.com>) done prior to core ultrasound lectures
  4. Ultrasound Lecture Series (4 hours)
    - a. Quarterly didactic component of core topics (Procedural guidance, FAST, TTE, Lung)
  5. Advanced Ultrasound Lecture Series (4 hours)
    - a. Critical care focus topics change from organ system based to problem based (hypotension, cardiac arrest, respiratory distress, oligoanuria)
  6. CCM Journal Club (4 hours)
    - a. Quarterly journal club occurring during noon lecture with Quality Review
  7. Quality Assurance and Review (12 hours)
    - a. Monthly Q&A process to review with faculty/fellows
  8. Hands On Training Simulation Sessions (24 hours)
    - a. Simulated training sessions on specific core ultrasound procedures by faculty; as well as tricks of the trade in obtaining images from our ultrasound techs
  9. Credentialing evaluation (2 hours)
    - a. Case studies (5 real case studies presented with follow up results)
    - b. Multiple choice test (25-50 questions)
    - c. Video recognition test (5-10 disease processes)
    - d. Competence based test on simulated and real patients

**Quality Assurance (see separate Quality Assurance worksheet for specifics)**

1. The most common reasons for studies deemed to be 'inadequate' are:

- a. Technically limited scan (not showing both poles of kidneys, only one view of gallbladder)
  - b. Too much or too little gain
  - c. Inadequate patient identifiers
  - d. Forgetting to delete previous patient's name
  - e. Submitting image without giving interpretation
2. Scans that have an 'official' scan done will be reviewed and any discrepancy will be noted in the excel file sheet as well as on the ultrasound interpretation form.
  3. Identifying documentation will be protected according to HIPPA (encrypted file devices and network drives)

### References

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