

Ultrasound Curriculum

Pulmonary Critical Care Fellowship Program

Educational Goals and Objectives:

The goals of are to provide the fellows with didactic instruction, direct hands-on training, interpretation and application of the use of ultrasound for procedure-guidance and in the care of patients.

During the fellowship:

1. Fellows will acquire knowledge of:
 - a. basic ultrasound physics
 - b. machine controls and transducer manipulation.
 - c. normal and abnormal ultrasound anatomy
 - d. image acquisition and interpretation
 - e. clinical applications and limitations of ultrasonography
2. Fellows will be able to recognize when an ultrasound examination is beyond their technical or interpretive capability.
 - a. They will recognize the limitations of ultrasonography
 - i. for identification of pleural fluid
 - ii. for not visualizing lung sliding
 - iii. for identification of intraperitoneal fluid
 - b. They will recognize when they cannot identify a safe site for vascular access
 - c. They will gain the knowledge not to perform a compression maneuver if there is a visible thrombus
3. Fellows will develop competence in the indications for and the use of general critical care ultrasonography (GCCUS) at the bedside, specifically with:
 - a. Pleural ultrasonography for identification of:
 - i. a hypoechoic space surrounded by typical anatomic boundaries
 - ii. surrounding structures (liver/ascites, spleen, kidneys, pericardium/pericardial effusion)
 - iii. dynamic findings of pleural effusion
 - iv. differences in fluid characterization
 - v. pleural thickening/masses
 - vi. qualitative fluid volume
 - b. Lung ultrasonography for identification of:
 - i. A-lines, B-lines, sliding lung, lung pulse, and lung point
 - ii. Normal aeration pattern
 - iii. Alveolar-interstitial pattern
 - iv. Consolidated lung with and without air bronchograms
 - v. the air artifacts that rule out pneumothorax
 - vi. the findings that rule in pneumothorax

- c. Abdominal ultrasonography for identification of:
 - i. Intraperitoneal fluid by locating a relatively echo-free space surrounded by typical anatomic boundaries
 - ii. Abdominal structures (abdominal wall, peritoneum, diaphragm, liver, spleen, kidneys, bladder, bowel, uterus, spinal column, aorta, IVC)
 - iii. Dynamic findings of intraperitoneal fluid
 - iv. Differences in fluid characterization
 - v. Qualitative fluid volume
 - vi. Distended bladder
 - vii. Qualitative assessment of intra-vesicular volume
 - viii. Normal kidney, hydronephrosis
 - ix. Abdominal aortic aneurysm
- d. Vascular ultrasonography: guidance of vascular access for:
 - i. Knowledge of the effects of patient positioning
 - ii. identification of relevant veins and arteries (IJ/carotid, subclavian, axillary, brachial, radial artery, femoral, peripheral veins), adjacent non-venous structures, normal anatomic variability, vascular thrombosis
 - iii. differentiation of artery from vein
 - iv. identifying a safe site for obtaining access
- e. Vascular ultrasonography: diagnosis of venous thrombosis for
 - i. Identification of venous thrombosis
- 4. Fellows will develop competence in the indications for and the use of basic critical care echocardiography at the bedside for evaluation and management of:
 - a. Echocardiographic patterns
 - b. Global LV size and function
 - c. Homogenous/heterogenous LV contraction pattern
 - d. Global RV size and function
 - e. Assessment for pericardial fluid/tamponade
 - f. IVC size and respiratory variation
 - g. Basic color Doppler assessment for severe valvular regurgitation
- 5. Fellows will develop expertise in the use of ultrasound guidance in the performance of:
 - a. Central venous catheterization
 - b. Arterial catheterization
 - c. Thoracentesis / Pleural Procedures
 - d. Abdominal paracentesis
 - e. Chest tube placement
 - f. CPR

Educational methods:

1. Introductory didactics and hands-on training in image-acquisition
2. Supervised direct patient care: image acquisition and interpretation
3. Maintenance of logbook
4. Self-study (reading list)
5. Formative assessment using standardized checklists
6. Quarterly US Conference and case base studies
7. Annual US Workshop
8. Elective Rotation with Department of Interventional Radiology
9. Monthly Radiology Conference with Chief of Radiology Department

Educational resources:

Fellows will have access to multiple educational resources (see appendix), including but not limited to web-based resources (digital ultrasound libraries), and an online database that includes many review and evidence-based articles on critical care ultrasound. The fellows are encouraged to attend formal ultrasound review course offered by national societies. The fellows are registered to Sonosim online course and self assessment that can be accessed anytime.

Supervision:

Faculty will directly and indirectly supervise fellows on image acquisition, interpretation and application to patient care.

Appendix:

The Ultimate Guide to Point-of-Care Ultrasound-Guided Procedures Editors: Adhikari, Srikar, Blaivas, Michael (Eds.)

The ICU Ultrasound Pocket Book Keith Killu

Comprehensive Critical Care Ultrasound, 2nd Edition Eric Su, MD; Mark Hamlin, MD, MS

Credits: Association of Pulmonary Critical Care Medicine Program Directors (APCCMPD)