

Department of Emergency Medicine Residency Ultrasound Curriculum

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Name of Proposed Curricular Unit: Emergency Ultrasound Curriculum

Length of Unit: 4-year residency

Learners: Emergency Medicine Residents

Brief description of the program in which the unit resides: Washington University Emergency Medicine Residency, a 4-year Program in St. Louis, MO

Describe approval process: Washington University Education Faculty to review and approve.

Mission/Goals:

The mission of this curriculum is to provide all residents with a comprehensive and well-rounded education in Emergency Ultrasound. Using standards outlined by Emergency Medicine governing bodies, residents will achieve skills necessary to enhance their clinical acumen, improve patient care, and be well-prepared emergency physicians for any acute care job. The learners will be prepared to be POCUS leaders in their future work settings, both community and academic.

Objectives:

The objectives of this curriculum are as follows.

- I. Residents will comply with updated national standards regarding POCUS competence for all emergency medicine graduates on completion of their 4-year residency, including completion of 300 scans. The foundation will be laid during the intern rotation with a minimum expectation of 150 scans performed during the 4-week rotation.
- II. Residents will be able to adequately perform, appropriately interpret, and clinically integrate POCUS studies through use of the 4-week intern rotation, a 2-year cycling didactic curriculum as part of residency conference, and ongoing QA of performed studies. Additional opportunities for education include advanced electives and monthly ultrasound journal club.
- III. Learners will be able to appropriately position patient and ultrasound machine for indicated scans, adjust patient positioning for scan optimization, and appropriately cover patient for comfort.
- IV. Learners will utilize QPath as per departmental protocol by inputting patient information from the worklist or through use of MRN and last name when worklist is unavailable, identifying operator and supervising attending, appropriately labeling and saving images to allow for review of studies, completing appropriate worksheet while on shift, and signing all QPath notes, both clinical and educational.
- V. Learners will understand indications, clinical algorithms, and limitations of Emergency Medicine point of care ultrasound across relevant applications, including **cardiac, trauma, first trimester pregnancy, aorta, GU, thoracic, biliary, skin soft tissue, MSK, DVT, abdomen, ocular, and procedural guidance (see Exam Standards at the end of this document)**

- VI. For each of the above indications, learners will be able to integrate findings from clinically performed ultrasounds into patient management, as well as involve patient in discussion of results and decision making.
- VII. Learners will participate in QI not only in person during the intern rotation, but also longitudinally throughout residency by responding in a timely manner to emails and feedback form the Ultrasound Division.

Description of Activities:

- I. Intern Boot Camp-1 day introduction to US principles & paired hands-on scan sessions
- II. Intern Rotation-26 day rotation
 - A. Intern Orientation Day and Pretest/Survey
 - B. AEUS Narrated Lecture Series
 - C. Weekly Education days and scanning sessions
 - D. Academic Day Evaluations and End of Rotation Posttest/Survey
- III. Conference Didactics: core content 4/yearly on rolling 2-year schedule, optional Scholar Track 4/yearly
- IV. Regular QA feedback and response on ED exams throughout residency
- V. Monthly US Division Didactics and Journal Club: Required during intern rotation, async credit available throughout residency
- VI. Sim/Hands on sessions: throughout residency during Sim Conference time
- VII. Advanced Ultrasound Electives
- VIII. Future Goals
 - A. Longitudinal QA/Scanning opportunities
 - B. Graduation assessment
 - C. More organized integration w/ sim curriculum

Budget & Resources:

Laura Wallace-Core Faculty
 Erica Blustein-US Division
 Alli Zanaboni-US Division

Assessment:

- I. Formative: Image Review/Scan Day Evaluations, Year-Directed Sim, Scan Shift Feedback
- II. Summative:
 - a. Post-rotation Test/Survey
 - b. New Innovations Evaluations
 - c. Yearly Sim Day (in discussion with Sim group about feasibility)
 - d. Total Numbers during residency
 - i. (currently using numbers signed, in future hope to use credit/no credit)

Exam Standards

- I. Ultrasound basics: Learners will be able to select appropriate probe and settings based on scan. They will show how to optimize images by adjusting gain and depth. They will perform appropriate machine care and adhere to cleaning standards as per department protocol.
- II. Physics: Residents will be able to describe the Piezoelectric effect, define frequency and attenuation, describe echogenicity, doppler and aliasing. Learners will be able to identify common artifacts including reverberation, side lobe, mirror, shadowing, enhancement and ring down.
- III. Learners will be able to demonstrate standard cardiac echo views, including parasternal long, parasternal short, apical 4 chamber and subxiphoid, as well as the IVC view. Learners will be able to identify normal cardiac anatomy including identification of the cardiac chambers in each view, pericardium, papillary muscles, valves, aortic outflow tract, and descending thoracic aorta as well as the IVC and its confluence of the hepatic vein. Learners will identify pathology related to left ventricular function assessment through use of visual estimation, EPSS and fractional shortening, cardiac tamponade including assessment of RV diastolic collapse, RA systolic collapse and identification of a plethoric IVC, cardiac arrest including appearance of cardiac standstill, nonperfusing cardiac motion, and ventricular fibrillation, elevated right ventricular pressures including recognition of D sign and RV:LV ratio, volume assessment including plethoric or collapsed IVC and respiratory variation of the IVC.
- IV. Learners will be able to demonstrate standard eFAST views including subxiphoid or parasternal view, right upper quadrant view including liver, kidney and diaphragm, left upper quadrant view including spleen, kidney and diaphragm, pleural space, bladder in transverse and sagittal planes, uterus in females, prostate in males, ribs, and pleural line. Learners will be able to identify the normal pericardium, liver, spleen, kidneys, Morison's pouch, splenorenal space, paracolic gutters, retrovesicular space, pleural space, and lung sliding. Learners will identify pathology of intraabdominal hemorrhage including both anechoic fluid and mix echogenic appearance of clotted blood, pericardial effusion and hematoma, pneumothorax, hemothorax, and the spine sign.
- V. Learners will be able to demonstrate standard first trimester pregnancy views, including transabdominal and transvaginal (10 scans) modalities. Residents will understand the utility of quantitative beta-hcg in evaluating symptomatic first trimester pregnancy. Learners will be able to identify normal uterine and adnexal anatomy in both long and short axis views including identifying the Pouch of Douglas, endometrial strip, and cervix as well identify the bladder and cul-de-sac. Learners will identify pathology including gestational sac, yolk sac, fetal pole, fetal heart rate, measure fetal heart rate using M mode, perform crown-rump length measurement, and findings concerning for ectopic pregnancy including empty uterus in setting of pregnancy, intrauterine fluid collection, yolk sac/fetal pole outside the endometrial strip, and pelvic free fluid.
- VI. Learners will be able to demonstrate standard transverse and longitudinal abdominal aorta views as well as echo views of the thoracic aorta. Learners will be able to identify the aortic root, descending thoracic aorta, celiac axis, SMA and aortic bifurcation. Learners will be able to measure the abdominal aorta outer wall to outer wall in the transverse plane and recognize aneurysmal dilation, measure the aortic root, and identify aortic dissection flap.

- VII. Learners will be able to demonstrate standard long and short axis views of the kidneys and transverse and sagittal views of the bladder. Learners will be able to identify the renal cortex, medulla, and pelvis, and identify the bladder and measure volume. Learners will identify the pathology of mild, moderate and severe hydronephrosis, and use color to differentiate hydronephrosis from vasculature.
- VIII. Learners will be able to demonstrate 8 or 12 view thoracic exams. Learners will be able to identify normal findings of lung sliding and A lines artifact. Learners will identify pathology related to interstitial fluid/B line artifact and differentiate between focal B line pattern and diffuse B line pattern, identify findings suggestive of pneumothorax, identify lung point and recognize findings of pneumonia including lung consolidation, effusion and focal B lines.
- IX. Learners will be able to demonstrate standard right upper quadrant views including of the liver, gallbladder and portal triad. Learners will be able to identify normal gallbladder in short and long axis, as well as the common bile duct, hepatic vein, and hepatic artery. Learners will identify pathology including gallstones, WES sign, gallbladder sludge, pericholecystic fluid, thickened gallbladder wall measured in short axis, enlarged common bile duct measured inner wall to inner wall, and elicit a sonographic Murphy's sign.
- X. Learners will be able to demonstrate standard skin soft tissue views. Learners will be able to identify normal skin, adipose, fascial planes and lymph nodes. Learners will identify pathology of cobblestoning, abscess, necrotizing fasciitis, and foreign body.
- XI. Learners will be able to demonstrate standard MSK views. Learners will be able to identify normal anatomy of muscle, tendon, joint, bone and nerve. Learners will identify pathology related to tendon rupture, joint effusion, and fracture.
- XII. Learners will be able to demonstrate standard lower extremity DVT views. Residents will understand the differences between lower extremity venous CUS and radiology lab-or vascular lab-performed "Duplex evaluation". Learners will be able to identify greater saphenous vein, common femoral vein, femoral and deep femoral vein, popliteal vein and popliteal trifurcation, as well as a compressible normal vessel. Learners will identify pathology related to lack of compressibility in setting of a DVT.
- XIII. Learners will be able to demonstrate standard abdominal views for the evaluation of bowel obstruction and pneumoperitoneum. Learners will be able to identify normal small and large bowel, as well as a normal peritoneal line on ultrasound. Learners will identify pathology related to dilated loops of small bowel, non-peristalsing bowel, intraabdominal free fluid, thickened bowel wall and the enhanced peritoneal stripe sign.
- XIV. Learners will be able to demonstrate standard ocular views, including dynamic views of the globe. Learners will be able to identify normal anterior and poster chamber anatomy, pupil, lens, and optic nerve sheath. Learners will be able to identify pathology related to vitreous hemorrhage, vitreous detachment, retinal detachment, foreign body, widened optic nerve sheath diameter and optic disc elevation, and findings of globe rupture.
- XV. Learners will be able to demonstrate procedural techniques including needle guidance techniques both in short and long axis to facilitate ultrasound guided procedures. Learners will be able to identify normal vessels for canulation, confirm appropriate position of guide wire, identify fluids pockets for drainage and identify nerves and fascial planes for ultrasound guided regional anesthesia. Learners will be able to perform

ultrasound guided central line placement, peripheral line placement, arterial line placement, arthrocentesis, paracentesis, thoracentesis, cardiocentesis, and peripheral nerve block.