

Hennepin County
Medical Center
Department of
Emergency Medicine

Resident Emergency
Ultrasound Training and
Credentialing Manual

2008-2009

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Introduction

The use of ultrasound by emergency physicians has improved the time and accuracy in the evaluation and treatment of emergency department patients. Ultrasound is immediately available, and provides rapid and non-invasive delineation of anatomy, pathology, and guides procedures in the emergency department.

Standard curricula have been established for the training and clinical application of ultrasound by emergency physicians. Emergency ultrasound is typically divided into traumatic, abdominal, pelvic, cardiac, and procedural applications.

The American College of Emergency Physicians (ACEP) supports the use of emergency ultrasound. ACEP has recommended training and credentialing guidelines for clinical use, and advocates future research and development of ultrasound by emergency physicians. The majority of emergency medicine residencies currently have formal training in emergency ultrasound.

The American Medical Association (AMA) House of Delegates approved a resolution recommending hospital credentials' committees follow specialty specific guidelines for hospital credentialing decisions involving the use of diagnostic ultrasound. This resolution requires specialties using ultrasound in the clinical setting to specify unique guidelines.

The Department of Emergency Medicine at Hennepin County Medical Center presents resident training and proficiency guidelines for the clinical application of emergency ultrasound.

Clinical Application

Emergency physician performed ultrasound examinations differ from ultrasound evaluations by other specialties. Typically ultrasound is performed in conjunction with the history, physical examination, and resuscitation. The bedside ultrasound examination performed by the emergency physician is used to quickly answer a focused clinical question.

The application of ultrasound by emergency physicians has been extensively reported in the medical literature. Procedural applications have also been described. Ultrasound examination in assessing trauma, emergency echocardiography, the abdominal aorta, pregnancy (pelvic), the biliary tract, and the renal system are discussed.

Training and Credentialing

A residency-based pathway has been established for the Hennepin County Medical Center emergency medicine residents in order to achieve competency in emergency ultrasonography during their 36-month ACGME approved program. Organization and training is the responsibility of the emergency ultrasound director, Dr. Robert Reardon. Emergency medicine faculty will supply additional supervision. At least one ultrasound machine will be available for use by emergency medicine residents and faculty in the emergency department at all times.

The practice based training pathway will include a 16-hour course encompassing the above outlined topics in the primary application of emergency ultrasound. The course will include both didactic (8 hours) and hands-on laboratory (8 hours) sessions.

The training phase for residents will include review of ultrasound examinations by the emergency ultrasound directors. Ultrasound examinations performed during the training and credentialing period will be reviewed for technique, image acquisition, and outcome. A total of 200 examinations will be reviewed for the attainment of proficiency. These will include; 25 trauma, 25 emergency echocardiographic, 25 abdominal aortic, 50 pelvic (25 endovaginal and 25 transabdominal), 50 biliary, and 25 renal ultrasound examinations. Ten percent of submitted examinations will be expected to have pathologic findings for proficiency.

Procedural application of emergency ultrasound will not require additional credentialing. Basic ultrasound techniques will be used in conjunction with the previously credentialed procedure.

All examinations used for the credentialing process will be performed by the noted provider, contain an interpretable image, and contain quality assessment information on the appropriate ultrasound data collection form (Appendix). The emergency department ultrasound directors will review all ultrasound examinations. The competency and outcome will be confirmed by direct supervision of the emergency ultrasound, over-reading of static images, confirmatory testing via other imaging procedures, or confirmation of patient clinical outcome. After review, a copy of the review will be returned to the emergency medicine resident. Upon completion of the credentialing guidelines, the emergency medicine resident will be notified and appropriately credentialed.

Emergency department credentialing for emergency ultrasound will include: satisfactory completion of the introductory course, satisfactory completion of reviewed

training ultrasound examinations, and participation in department lectures and case review (as applicable).

The use of emergency ultrasonography will be limited to emergency medicine residents (and rotating residents) in the emergency department. Clinical application and decision-making will be limited to emergency department faculty, and appropriately trained and credentialed emergency medicine residents.

Trauma Ultrasound (FAST Examination)

In the setting of traumatic injuries, diagnostic peritoneal lavage has essentially been replaced by ultrasound examination. Indications for the use of ultrasound in trauma include blunt or penetrating torso injuries where intraperitoneal hemorrhage, pericardial tamponade, and/or hemothorax are suspected. The four-view trauma ultrasound includes visualization of the hepatorenal space, splenorenal space, subcostal view of the pericardium, and pelvic view to visualize the retrovesical or retrouterine regions. The hepatorenal and splenorenal windows may also be used to assess the spaces above and below the diaphragm.

The curriculum will require residents to:

- Describe the indications, clinical algorithms, limitations, and bedside ultrasound in blunt and penetrating thoracoabdominal trauma.
- Define the relevant local anatomy including the liver, spleen, kidneys, bladder, uterus, pericardium, and lung bases.
- Understand the standard ultrasound protocol and views required when evaluating for hemoperitoneum, hemoperitoneum, and hemothorax.
- Recognize the relevant focused findings and pitfalls related to the detection of hemoperitoneum, hemopericardium, and hemothorax.

Emergency Echocardiography

Assessment of the pericardium and cardiac activity is essential in evaluation of the patient presenting in shock or cardiac arrest. The presence or absence of both cardiac mechanical activity or a pericardial effusion is critical information early in evaluation of the emergency department patient.

Indications for emergency echocardiography include clinical suspicion of a pericardial effusion or the necessary assessment of cardiac activity and/or hemodynamic instability. Transthoracically, the common views include subcostal, apical four chamber, and parasternal long and short views. Global function and abnormal fluid collections are examined. Echocardiographic evidence of cardiac tamponade physiology is defined as: the presence of a pericardial effusion with right atrial collapse, right ventricular diastolic collapse and a non-collapsible inferior vena cava and hepatic veins.

The curriculum will require residents to:

- Describe the indications and limitations of focused emergency echocardiography.
- Define the relevant cardiac anatomy including cardiac chambers, valves, pericardium, and aorta.
- Understand the standard ultrasound windows (subcostal, parasternal, and apical) and planes (four chamber, long and short axis) necessary to perform focused echocardiography when evaluating for cardiac activity and pericardial effusions.
- Recognize the relevant focused findings to detect cardiac activity and pericardial effusions with or without tamponade.

Abdominal Aorta

The early diagnosis of patients presenting with signs and symptoms suggestive of abdominal aortic aneurysm is essential. The use of emergency ultrasound is crucial in these patients. In the unstable patient, emergency ultrasound will expedite appropriate operative intervention. In the stable patient, emergency ultrasound will allow appropriate monitoring and treatment.

Indications for abdominal aortic ultrasound in the appropriate population are; syncope, shock, hypotension, abdominal pain, palpable or pulsatile abdominal mass, and back or flank pain. The abdominal aorta is examined in the entire length from diaphragm to bifurcation in both transverse and sagittal views.

The curriculum will require residents to:

- Describe indications and limitations of focused ultrasound in evaluation of abdominal aortic aneurysms.
- Define the local relevant anatomy including the aorta with major branches, inferior vena cava, and vertebral bodies.
- Understand the standard ultrasound protocol and views required when evaluating for abdominal aortic aneurysms.
- Recognize the relevant focused findings and pitfalls when evaluating for abdominal aortic aneurysms.
- Describe the types of aortic aneurysms.

Pelvic Ultrasound (Pregnant)

Complications associated with first trimester pregnancy are common presenting complaints to the emergency department. Evaluation for the presence of an ectopic pregnancy is the primary concern of the emergency physician. Current practice utilizes both pelvic ultrasound and quantitative β -human chorionic gonadotropin levels in distinguishing early intrauterine pregnancies.

The indication for first trimester pelvic ultrasound is to establish the presence of an intrauterine pregnancy. Secondary goals are to establish fetal cardiac activity and fetal viability. Pelvic ultrasounds are used in first trimester pregnant patients with pain, bleeding, near syncope, syncope, shock, and asymptomatic patients with risk factors for ectopic pregnancy. Confirmation of an intrauterine pregnancy is made by complete examination of the uterus for a gestational sac with appropriate contents; a dual decidual sign, yolk sac, and/or fetal pole. The cul-de-sac and adnexa are visualized for complex masses, embryonic structures, or fluid collections. Additionally, visualization of the hepatorenal space for free intra-abdominal fluid will assist in the diagnosis of ruptured ectopic pregnancy.

Second and third trimester ultrasound examinations in the emergency department are utilized to establish the presence of fetal cardiac activity, fetal movement, and in the evaluation of the pregnant trauma patient. Trans-abdominal views are typically adequate.

The curriculum will require residents to:

- Describe the indications and limitations of focused sonography in first trimester pregnancy pain and bleeding.

- Understand the role of ultrasound in a clinical algorithm for first trimester pregnancy pain and bleeding.
- Primary focus on intrauterine pregnancy identification and free intraperitoneal fluid.
- Role of quantitative β -human chorionic gonadotropin levels.
- Describe the relevant local anatomy including the uterus, cervix, adnexa, bladder, and cul-de-sac.
- Understand the standard ultrasound protocol using transabdominal and endovaginal views when performing focused pelvic ultrasound in early pregnancy.
- Recognize the relevant focused findings and pitfalls when evaluating for early intrauterine pregnancy and ectopic pregnancy.
- Identify early embryonic structures.
- Recognize a pseudogestational sac.
- Recognize adnexal masses.

Biliary Tract Ultrasound

Abdominal pain is a common presenting complaint to the emergency department. Cholecystitis and cholelithiasis are frequently included in the differential diagnosis of upper abdominal pain. Gallbladder ultrasound has been shown to decrease emergency department lengths of stay.

Indications for biliary tract ultrasound include upper abdominal pain, flank pain, or right shoulder pain. Ultrasound is performed to assess for shadowing hyper-echoic material, gallbladder wall thickness, and the presence of pericholecystic fluid. The presence of a sonographic Murphy's sign or an abnormal size of the common bile duct may be identified.

The curriculum will require residents to:

- Describe the indications and limitations of focused biliary tract ultrasound.
- Define the relevant local anatomy including the gallbladder, portal triad, inferior vena cava, and liver.
- Understand standard ultrasound protocol when performing focused right upper quadrant ultrasound.
- Recognize the relevant focused findings and pitfalls when evaluating for cholelithiasis and cholecystitis.

Renal Ultrasound

Ultrasound examination of the kidneys may be used to evaluate for the presence and degree of renal outflow obstruction. The indications for renal ultrasound are costovertebral, flank, and/or abdominal pain with or without vomiting. This examination evaluates particularly for hydronephrosis. The kidneys are entirely visualized in both coronal and transverse planes, delineating hydronephrosis and suggestive findings of nephrolithiasis. Adequate hydration is necessary.

The curriculum will require residents to:

- Describe the indications and limitations of focused renal ultrasonography.
- Define the relevant local anatomy including the kidneys and collecting systems, bladder, liver, and spleen.
- Understand standard ultrasound protocol when performing focused renal ultrasound.
- Recognize the relevant focused findings and pitfalls in evaluating for hydronephrosis and renal calculi.

Procedural Ultrasound

Ultrasound may be used to assist in the performance of a variety of procedures. Ultrasound can improve the speed, accuracy, and reduce associated complications in the performance of procedures in the emergency department.

The curriculum will require residents to:

- Describe the indications and limitations when using ultrasound to assist in bedside procedures.
- Define the relevant local anatomy for the particular application.
- Understand standard protocols when using ultrasound to assist in procedures. These procedures may include:
 - Vascular access - central and peripheral.
 - Pericardiocentesis.
 - Paracentesis.
 - Thoracentesis.
 - Foreign body detection and removal
 - Bladder aspiration.
 - Arthrocentesis.
 - Pacemaker placement and capture.
- Recognize the relevant focused findings when performing ultrasound for procedural assistance.

Pathway for Resident Emergency Ultrasound Training

Didactics

Attends residency curriculum covering emergency ultrasound curriculum
or
Attends introductory emergency ultrasound course

Experiential

Training in residency with supervision, over-reads, gold standards, confirmatory testing or patient outcome review

Proficiency

Ultrasound Director certifies ultrasound training by the ACEP emergency ultrasound proficiency guidelines and ABEM “The Model of the Clinical Practice of Emergency Medicine”

Credentialing

Acquired at local hospital setting within departmental privileges

HCMC Ultrasound Credentialing Requirements

Ultrasound credentialing must be completed in the PGY-1 year of training for EM categorical residents and by the end of the PGY-2 year for EM/IM combined residents. Examinations performed during the credentialing process must be directly proctored by either an EM faculty or credentialed EM senior resident. A total of 200 exams are required.

Examination	# Required
FAST	25
Cardiac	25
Aorta	25
OB/GYN Transabdominal	25
OB/GYN Transvaginal	25
Gallbladder	50
Renal	25

Each of these exams must be reviewed and approved by Dr. Reardon prior to accepting the study for credentialing. The Portal- US website is used to store, review and provide feedback on these examinations. Detailed instructions on the use of the Portal-US system are provided below.

Instructions for Uploading Ultrasound Exams to the Portal-US Website

Press “freeze” during your ultrasound exam when you have an image that is satisfactory.

To transmit that image to the central Osirix archive on the iMac, do the following:

On the sonosite machine, press “save image.”

On the ultrasonix machine, press “print 1”

On the Toshiba machine, press “rec still”

You may record as many still images as you like.

Note that video may also be saved and transmitted to the Osirix database but you cannot send video to the portal-us website at this time. Only still images can be sent.

If you experience trouble sending your images to the iMac archive, here are some tips:

The sonosite machine must be plugged in about 30 seconds prior to turning them on. This allows them to connect and log on to the network.

Do not turn unplug the Toshiba machine before turning it off. This resets the network settings and it may not transmit images.

To download your images to a USB drive, do the following steps:

Go to the iMac in TCA, TCB or TCC and insert your USB drive into the USB slot.

Locate your study in Osirix. Click on the specific images you would like to upload.

From the drop-down menu at the top, press “File→export to .jpg”

Navigate to your USB drive.

Press “choose”

The images will be saved on your USB drive in a folder with the patient’s name.

To upload your images to the Portal-us.com website, do the following steps.

Find a computer with internet connection and open the internet browser.

Navigate to www.portal-us.com

Click “login”

Type in your username, which should be your email address.

Type in your password, which is initially set to “ultrasound”. Then press “login.”

Click “ok” on the disclaimer that pops up.

On the next screen, click “upload.” At this point you may be prompted to install a small java applet if you have never used the website on your computer. Click “yes.”

On the dialogue box that pops up, navigate to the ultrasound images on your USB drive. Select the images you want to upload and press “open.” A thumbnail of your ultrasound should then appear on the portal-us web page.

Click “upload.”

At this point you will be directed to a page that asks you to choose what type of ultrasound exam you have uploaded. From the drop-down menu, click either “cardiac, trauma, OB/Gyn, gallbladder, kidney, or aorta.”

Next, enter your interpretation of the ultrasound using the checkboxes or comments section. Then click “submit for review.” Your images are now submitted for review.

Images will be reviewed by Dr. Reardon and comments for credentialing and quality assurance will be returned via the portal-us system.