ULTRASOUND: Goals and Objectives

Ultrasound Imaging (Radiology Year 1)

MEDICAL KNOWLEDGE OBJECTIVES

At the end of the rotation, the resident should be able to:

• Discuss thoroughly the ultrasound procedures and findings in:
  o Gall bladder/biliary tree ultrasound (cholelithiasis/cholecystitis)
  o Renal ultrasound (obstruction/renal failure)
  o Pelvic ultrasound (ectopic pregnancy)
  o Cranial ultrasound (intracranial hemorrhage)
  o Duplex Doppler (venous thrombosis of extremities)
  o Liver (masses)
  o Thyroid Nodules
  o Abdominal Aorta (aneurysm)
  o Transabdominal and transregional pelvis (mass cyst free fluid)

• Discuss the basic ultrasound physics and instrumentation, especially related to equipment operation and the specifications for various probes.

• Describe, from observation, the technique used to perform each of the routinely performed procedures.

PRACTICE-BASED LEARNING OBJECTIVES

At the end of the rotation the resident should be able to:

• Review histories of patients to be examined each day to determine the relevance of the study to clinical symptoms.
• Record a pertinent history of the patient
• Advise the technologist about special views or specific parameters of the study that require special attention.
• Assist with the preparation and presentation of the noon conference.
• Be able to perform basic ultrasound equipment operation and the specifications for various probes.
• Describe from observation, the technique as well as perform some of the routinely performed procedures e.g. lower extremity DVT studies, pelvic US to evaluate for IUP/ectopic pregnancy, testicular US, gall bladder and renal US.
SYSTEMS BASED LEARNING

Review the request and all applicable clinical history and previous laboratory tests and previous imaging studies to be certain that the proper test has been ordered and that the patient’s condition is such that the examination is safe and that any necessary preparation for the test has been completed before starting the examination.

If the indication for the examination is unclear contact the referring physician or another of the patient’s appropriate and knowledgeable health care providers.

PATIENT CARE

By the end of the rotation the resident should be able to:

- Review histories of patients to be examined each day to determine the relevance of the study to clinical symptoms
- Record a pertinent history of the patient
- Advise the technologist about special views or specific parameters of the study that require special attention
- Make a preliminary review of the images and advise the technologists when additional views or repeat views are needed

INTERPERSONAL AND COMMUNICATION SKILLS OBJECTIVES

- Advise the technologist about special views or specific parameters of the study that require special attention.
- Make a preliminary review of the images and advise the technologists when additional views or repeat views are needed.
- Communicate effectively and courteously with referring clinicians:
  - Including obtaining relevant history for study interpretation
  - Regarding important findings on studies performed
- Work as an efficient team member i.e. with medical students, peers, other professionals participating in the US service including technologists and nurses.

PROFESSIONALISM

Demonstrate responsible work ethic.

This would include being present at the US Department at 9 A.M. and throughout the work day, completion of dictation of all reviewed studies in a timely manner, attendance at all departmental teaching conferences, and grand rounds presentations.

Facilitate the learning of medical students, peers and other professionals participating in the US service including technologies and nurses.
ASSESSMENT TOOLS UTILIZED

- Global ratings by faculty including rotation evaluation sheet
- Conference attendance logs
- In-service examination

Ultrasound Imaging  (Radiology year 2)

MEDICAL KNOWLEDGE

At the end of the rotation, the resident should be able to:

- Demonstrate thorough knowledge of the ultrasound procedure through performing or assisting the sonographer with performance of the following studies:
  - Liver/biliary tree (biliary obstruction/tumors)
  - Pancreas (acute and chronic inflammatory process/tumors)
  - Renal (Doppler, tumors and inflammatory processes)
  - Pelvis (uterine leiomyoma/ovarian neoplastic and non-neoplastic diseases)
  - Cranial ultrasound (hydrocephalus/cerebral hemorrhage)
  - Duplex Doppler (duplex sonography of carotids and abdominal duplex)
  - Testis
  - Pregnancy
  - Obstetric
- Given the appropriate sonograms, identify and discuss significant characteristics of the pathologies listed in #1 above.

PRACTICE-BASED LEARNING

At the end of the rotation the resident should be able to:

- Review histories of patients to be examined each day to determine the relevance of the study to clinical symptoms.
- Record a pertinent history of the patient.
- Advise the technologist about special views or specific parameters of the study that require special attention.
- Assist with the preparation and presentation of the noon conference.
- Review all scans as they are performed for significant findings that require prompt attention.
- Describe as well as perform some of the routinely performed ultrasound scans.

SYSTEM BASED LEARNING

Review the request and all applicable clinical history and previous laboratory tests and previous imaging studies to be certain that the proper test has been ordered and that the patient’s condition
is such that the examination is safe and that any necessary preparation for the test has been completed before starting the examination.

If the indication for the examination is unclear contact the referring physician or another of the patient’s appropriate and knowledgeable health care providers.

PATIENT CARE

At the end of the rotation the resident should be able to:

- Review histories of patients to be examined each day to determine the relevance of the study to clinical symptoms
- Record a pertinent history of the patient
- Advise the technologist about special views or specific parameters of the study that require special attention
- Make a preliminary review of the images and advise the technologists when additional views or repeat views are needed.

INTERPERSONAL AND COMMUNICATION SKILLS:

At the end of the rotation the resident should be able to:

- Make decisions in regard to notification of the referring physician if the faculty radiologist is not available for consultation.
- Read and/or dictate films with the assistance and review of the faculty radiologist.
- Advise the technologist about special views or specific parameters of the study that require special attention
- Make a preliminary review of the images and advise the technologist when additional views or repeat views are needed
- Communicate effectively and courteously with referring clinicians:
  - Including obtaining relevant history for study interpretation
  - Regarding important findings on studies performed
- Work as an efficient team member i.e with medical students, peers, other professionals participating in the US service including technologists and nurses.

PROFESSIONALISM

At the end of the rotation the resident should be able to:

- Demonstrate responsible work ethic.
  - This would include being present at the US Department at 9 AM and throughout the work day
  - Completion of dictation of all reviewed studies in a timely manner
  - Attendance at all departmental teaching conferences, and grand rounds presentations
- Facilitate the learning of medical students, peers, other professionals participating in the US service including technologists and nurses.
ASSESSMENT TOOLS UTILIZED

- Global ratings by faculty including rotation evaluation sheet
- Conference attendance logs
- In-service examination

Ultrasound Imaging (Radiology year 3)

MEDICAL KNOWLEDGE

At the end of the rotation, the resident should be able to:

- Solidify and continue to build on knowledge base from the earlier two rotations
- Build and strengthen knowledge and skills in OB Ultrasound:
  - Early obstetrical pregnancy, measurements, findings and ectopic pregnancy
  - 2nd and 3rd trimester fetus, normal and abnormal anatomy
  - 2nd and 3rd trimester placenta, cervix, growth measurements
- Become familiar with Pediatric abdominal ultrasound: Hypertrophic pylorus stenosis, pylorospasm, appendicitis, intussusception, mesenteric adenitis.
- Carotid Ultrasound
- Peripheral Vessels
- Discuss all aspects of ultrasound imaging, including indications, pathology and correlative studies used for each examination.

PRACTICE-BASED LEARNING

At the end of the rotation the resident should be able to:

- Review histories of patients to be examined each day to determine the relevance of the study to clinical symptoms.
- Record a pertinent history of the patient.
- Advise the technologist about special views or specific parameters of the study that require special attention.
- Assist with the preparation and presentation of the noon conference.
- Review all scans as they are performed for significant findings that require prompt attention.
- Describe as well as perform some of the routinely performed ultrasound scans.

SYSTEM BASED LEARNING

Review the request and all applicable clinical history and previous laboratory tests and previous imaging studies to be certain that the proper test has been ordered and that the patient’s condition is such that the examination is safe and that any necessary preparation for the test has been completed before starting the examination.
If the indication for the examination is unclear contact the referring physician or another of the patient’s appropriate and knowledgeable health care providers.

**PATIENT CARE**

At the end of the rotation the resident should be able to:

- Review histories of patients to be examined each day to determine the relevance of the study to clinical symptoms
- Record a pertinent history of the patient
- Advise the technologist about special views or specific parameters of the study that required special attention
- Make a preliminary review of the images and advise the technologist when additional views or repeat views are needed

**INTERPERSONAL AND COMMUNICATION SKILLS**

At the end of the rotation the resident should be able to:

- Make decisions in regard to notification of the referring physician if the faculty radiologist is not available for consultation.
- Read and/or dictate films with the assistance and review of the faculty radiologist.
- Advise the technologist about special views or specific parameters of the study that require special attention.
- Make a preliminary review of the images and advise the technologist when additional views or repeat views are needed.
- Communicate effectively and courteously with referring clinicians:
  - Including obtaining relevant history for study interpretation
  - Regarding important findings on studies performed.
- Work as an efficient team member i.e. with medical students, peers, other professionals participating in the US service including technologists and nurses.

**PROFESSIONALISM**

At the end of the rotation the resident should

- Demonstrate work ethic
  - This would include being present at the US Department at 9AM and throughout the work day
  - Completion of dictation of all reviewed studies in a timely manner
  - Attendance at all departmental teaching conferences, and grand rounds presentations
- Facilitate the learning of medical students, peers, other professionals participating in the US service including technologist and nurses.
ASSESSMENT TOOLS UTILIZED

- Global ratings by faculty including rotation evaluation sheet
- Conference attendance logs
- In-service examination

Ultrasound Imaging  (Radiology year 4)

MEDICAL KNOWLEDGE

The resident should continue to build and strengthen his/her knowledge based and technical skills from the previous rotations. Discuss all aspects of ultrasound imaging, including indications, pathology, and correlative studies used for each examination.

At the end of the rotation, the resident should be able to:

- Review and dictate with the faculty radiologist all scans performed
- Make preliminary decisions on all matters of study interpretation and consultation and recognize the need to obtain assistance in situations that require the expertise of the faculty radiologist.

PRACTICE BASED LEARNING

At the end of the rotation the resident should be able to:

- Review histories of patients to be examined each day to determine the relevance of the study to clinical symptoms.
- Record a pertinent history of the patient.
- Advise the technologist about special views or specific parameters of the study that require special attention.
- Assist with the preparation and presentation of the noon conference.
- Review all scans as they are performed for significant findings that require prompt attention.
- Describe as well as perform some of the routinely performed ultrasound scans

SYSTEM BASED LEARNING

Review the request and all applicable clinical history and previous laboratory tests and previous imaging studies to be certain that the proper test has been ordered and that the patient’s condition is such that the examination is safe and that any necessary preparation for the test has been completed before starting the examination.

If the indication for the examination is unclear contact the referring physician or another of the patient’s appropriate and knowledgeable health care providers
PATIENT CARE

At the end of the rotation the resident should be able to:

1. Review histories of patients to be examined each day to determine the relevance of the study to clinical symptoms
2. Record a pertinent history of the patient
3. Advise the technologist about special views or specific parameters of the study that require special attention
4. Make a preliminary review of the images and advise the technologist when additional views or repeat views are needed

INTERPERSONAL AND COMMUNICATION SKILLS

At the end of the rotation the resident should be able to

- Make decisions in regard to notification of the referring physician if the faculty radiologist is not available for consultation.
- Read and/or dictate films with the assistance and review of the faculty radiologist.
- Advise the technologist about special views or specific parameters of the study that require special attention.
- Make a preliminary review of the images and advise the technologists when additional views or repeat views are needed.
- Communicate effectively and courteously with referring clinicians:
  - Including obtaining relevant history for study interpretation
  - Regarding important findings on studies performed.
- Work as an efficient team member i.e. with medical students, peers, other professionals participating in the US service including technologists and nurses

PROFESSIONALISM

At the end of the rotation the resident should be able to

- Demonstrate work ethic
  - This would include being present at the US Department at 9AM and throughout the work day
  - Completion of dictation of all reviewed studies in a timely manner
  - Attendance at all departmental teaching conferences, and grand rounds presentations.
- Facilitate the learning of medical students, peers, other professionals participating in the US service including technologist and nurses.

ASSESSMENT TOOLS UTILIZED

- Global ratings by faculty including rotation evaluation sheet
- Conference attendance logs
- In-service examination
DIAGNOSTIC ULTRASOUND CURRICULUM

The material listed below will be covered during dedicated ultrasound rotations, as well as in the lecture series on Body CT/GI/GU Fluoroscopy. The resident should be familiar with this material as a result of hands-on clinical experience combined with formal teaching materials such as conferences, teaching files, books, etc.

ABDOMEN:

LIVER:
Normal size, shape, echotexture, Doppler and color imaging of hepatic arteries, veins, and portal veins, diffuse disease, focal mass (cyst, hemangioma, hepatocellular carcinoma, metastatic lesions), cirrhosis/portal hypertension, varices, transplant evaluation, intrahepatic porto-systemic shunt Doppler evaluation

GALLBLADDER/BILE DUCTS:
Normal gallbladder intra- and extra-hepatic duct size gallstones, acute cholecystitis (calculus/acalculus), hyperplastic cholecystoses, sludge, polyps, carcinoma, HIV related biliary disease, biliary obstruction/dilatation, duct stones

PANCREAS:
Normal anatomy/size, duct size, chronic pancreatitis, pseudocyst, calcifications, cysts, masses (benign/malignant)

SPLNE:
Normal anatomy/size, focal lesions (cystic vs. solid), trauma, splenic varices.

KIDNEYS/URETERS
Normal anatomy/size, cysts (simple/complex), cystic diseases, renal cell carcinoma, angiomyolipoma, hydronephrosis/hydroureter, calculi, abscess/pyelonephritis, perinephric fluid, renal arterial Doppler (including use of resistive index), renal transplant evaluation (include Doppler)

ADRENAL GLANDS
Focal lesion (cyst/solid), neonatal hemorrhage, normal
PERITONEAL CAVITY

Localization/quantification/aspiration of fluid (free/loculated) – including abscess, blood, ornental mass, free air

GASTROINTESTINAL TRACT:

Normal appearance, appendicitis, pyloric stenosis intussusception mass, inflammatory bowel disease

RETROPERITONEUM/VESSELS:

Adenopathy, aorta (normal/aneurysm, including proximal and distal extent), inferior vena cava (normal thrombosis), aortic aneurysm

PELVIS (excluding pregnancy)

URINARY BLADDER:

Mass, calculi, obstruction, infection, diverticula, ureterocele, color flow imaging of ureteral jets

UTERUS:

Normal size, shape, echogenicity

ENDOMETRIUM:

Normal thickness (premenopausal, postmenopausal, effect of hormone replacement), physiologic variation, carcinoma, hyperplasia, polyps, endometritis pyometra

MYOMETRIUM:

Leiomyomata, adenomyosis

CERVIX:

Mass, stenosis, obstruction. Saline hysterosonography
OVARY:

Normal size, shape, echogenicity, physiologic variation (follicles, corpus lutem). Torsion, infection, abscess, cystic/solid mass cystadenoma/carcinoma, hemorrhagic cyst, dermoid, endometrioma

FALLOPIAN TUBE:

Hydrosalpinx, pyosalpinx

PROSTATE:

Normal size, shape echogenicity, cystic/solid mass, carcinoma, abscess, biopsy

SCROTUM:

Normal size, shape, echogenicity of testis and epididymis, cystic/solid testicular of extratesticular mass. Testicular carcinoma, torsion, epididymitis/orchitis, varicocele, hydrocele, spermatocele, trauma, appendicceal torsion

OBSTETRICS

EARLY PREGNANCY

NORMAL FINDINGS:

Gestational sac appearance, size, growth, yolk sac, embryo, cardiac activity, amnion, chorion, embryology, normal early fetal anatomy/growth, crown rump measurement, multiple gestations, correlation with HCG levels

ABNORMAL FINDINGS:

Spontaneous abortion, embryonic death, blighted ovum, bleeding/hematoma, ectopic pregnancy, gestational trophoblastic disease, gross embryonic structural abnormalities

2nd/3rd TRIMESTER

NORMAL FINDINGS:

Fetal anatomy/development, placenta, biometry, amniotic fluid, multiple gestations, umbilical cord Doppler, alphafetoprotein testing, perform complete exam according to the AIUM/ACR guidelines. Amniocentesis, chorionic villious sampling guidance.
NON FETAL ABNORMALITIES:

Oligohydramnios, polyhydramnios, placenta previa, placenta abruption, placental masses, two vessel umbilical cord, cord masses, cervical shortening/dilatation (including translabial imaging)

FETAL ABNORMALITIES:


Understand significance of borderline findings: choroids plexus cyst, echogenic focus in heart, echogenic bowel, borderline hydrocephalus

EXTREMITIES

VASCULAR:

Venous thrombosis evaluation (upper and lower extremity) with compression/Doppler/color imaging, venous insufficiency, aneurysm, pseudoaneurysm/compression, ateriovenous fistula

PEDIATRICS

BRAIN AND SPINE:

Intraventricular hemorrhage (various grades), periventricular leukomalacia, anomalies

NECK:

Thyroglososal duct cyst, branchial cleft cyst

CHEST:

Pleural effusion, pericardial effusion, pneumonia

ABDOMINAL:

Kidney – obstruction, duplication, tumor, liver, spleen, pancreas, abdomen, biliary tree, choledochal cyst, hepatocellular carcinoma, adrenal tumor, hypertrophic pyloric stenosis, pylorospasm
PELVIS:
Posterior urethral valves, uterus, ovary, normal, anomalies, bicornuate uterus, PID, hemorrhagic cyst, TOA, ovarian cyst/follicles

VASCULAR:
Carotid arteries, DVT, jugular vein, renal vessels, hepatic vessels, tumor or clot in vessels

MISCELLANEOUS/MUSCULOSKELETAL:
Lymph nodes, developmental hip dysplasia, hip effusion

HEAD AND NECK

NEONATAL HEAD:
Hemorrhage, hydrocephalus, shunt evaluation, periventricular leukomalacia, congenital malformations

NEONATAL SPINE:
Lipoma, tethered cord, sacral skin dimple, normal anatomy, diastematomyelia

THYROID:
Size, shape, multinodular goiter, benign/malignant neoplasm, associated adenopathy, localization of parathyroid mass, biopsy of thyroid/parathyroid mass or adenopathy thyroglossal duct cyst

VASCULAR EXAMS:
Carotid duplex exam (with Doppler spectrum analysis including normal appearance, arterial occlusion, stenosis, plaque, subclavian steal, jugular thrombosis

CHEST
Pleural fluid (simple vs. loculated/complex) mass, aspiration/catheter drainage of fluid
Vascular: subclavian vein thrombosis
Cardiac: pericardial effusion
PHYSICS OF ULTRASOUND:
Will be addressed on the Physics lectures

RECOMMENDED READING LIST:
• Diagnostic Ultrasound by Carol Rumack
• Ultrasound: The Requisites, by Middleton
• ACR Case Review - Ultrasound

Didactic lectures in Diagnostic Ultrasound

INTRODUCTION
1. Sonogram Machine and Transducer Use. ACR Guidelines for Performance of Ultrasound Examination

ABDOMINAL ULTRASOUND
2. Biliary ultrasound – gallstones, acute cholecystitis, chronic cholecystitis, neoplasm
3. Hepatic – normal and metabolic condition affecting liver – cirrhosis etc
4. Hepatic masses – hemangioma, FNH and adenoma, abscess, hepatoma

EARLY OBSTETRICS
5. Ob ultrasound – normal first trimester, first trimester bleeding including ectopic and trophoblastic disease

PELVIS ULTRASOUND - GYN
6. Myomas and adenomyosis
7. Adnexal mass – endometriosis, dermoid, neoplasm
8. Ovarian torsion and acute PID

VASCULAR
9. Venous anatomy upper and lower extremities, deep vein thrombosis (subclavian vein, internal jugular vein thrombosis
10. Carotid ultrasound – stenosis and occlusion

11. Upper extremity arterial ultrasound including A-V graft study and A-V mapping

**OBSTETRICAL**

12. Ob ultrasound – 2\(^{nd}\) and 3\(^{rd}\) trimester anomalies

13. Placenta, biophysical profile of fetus

**ABDOMINAL ULTRASOUND**

14. Pancreas acute pancreatitis, chronic pancreatitis, neoplasm

15. Renal - medical renal disease, hydronephrosis

16. Renal masses infections and neoplasms

**PEDIATRIC ULTRASOUND**

17. Abdominal and renal hypertrophic pyloric stenosis, intussusception etc


**SMALL PARTS**

19. Thyroid and parathyroid, breast ultrasound

**EMERGENCY**