

DIAGNOSTIC RADIOLOGY RESIDENCY ULTRASOUND CURRICULUM

From the curriculum developed by:

THE SOCIETY OF RADIOLOGISTS IN ULTRASOUND

Curriculum Committee

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This ultrasound curriculum is intended to serve as a guideline for diagnostic radiology residency training programs, utilizing the goals and objectives format required by the American Council of Graduate Medical Education (ACGME).

At the conclusion of each one-month rotation, the resident should be able to demonstrate competence in these six specific areas: medical knowledge, patient care, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice, as outlined below.

The resident should understand this material through a “hands-on” clinical experience, including ultrasound scanning, combined with formal didactic teaching such as conferences, and independent learning utilizing teaching files, textbooks, and on-line electronic web-based tools such as medical journal articles, etc.

There are two parts to the medical knowledge portion of the curriculum. The first, Section A, lists hands-on scanning objectives to be mastered by the end of each clinical rotation. The second, Section B, is a more comprehensive list of entities that the resident should understand by the end of each rotation. Each institution may have its own individual system for acquiring this knowledge base.

Core Curriculum

1. Vascular:

--Lower extremity DVT.

--Abdomen: venous thrombosis (hepatic and renal veins, inferior vena cava); portal hypertension; TIPS; renal stenosis.

--Aortic diseases (aneurysm)

--Carotid artery duplex evaluation (vascular surgery rotation)

--Complications of percutaneous vascular interventions: pseudoaneurysm and AV fistula

--Upper extremity DVT

-- vascular characterization of a mass

2. Biliary Tree and Gall Bladder

--Normal anatomy

--Biliary obstruction : benign and malignant causes

- Congenital anomalies of the common bile duct—choledochal cysts
 - Gallstones
 - Inflammatory disease of the gall bladder—acute cholecystitis and complications
 - Gall bladder carcinoma
 - Cholecystoses
3. Liver and Spleen
- Normal anatomy
 - Neoplastic disease—hepatoma, metastases, cysts.
 - Infection—Abscess
 - Cirrhosis and portal hypertension.
 - Other parenchymal disease (steatosis)
 - Trauma---biloma, hematoma
4. Pancreas
- Normal anatomy
 - Inflammatory disease
 - Complications of acute pancreatitis--pseudocyst
 - Chronic pancreatitis
 - Ductal calculi
 - Neoplasms: adenocarcinoma, micro- and macro cystic adenomas, IPMN
5. Gastrointestinal
- Appendicitis
 - Inflammatory bowel processes—colitis, Crohn's Disease
 - Bowel Obstruction
 - Bowel related mass: neoplasm, phlegmon
6. Kidney
- Normal anatomy
 - Congenital Anomalies: ectopia, horseshoe kidney, duplex collecting system, UPJ obstruction
 - Infection: renal abscess and pyonephrosis
 - Calculous disease
 - Neoplasms: renal cell carcinoma, transitional cell carcinoma, angiomyolipoma, metastasis, cystic neoplasms.
 - Cystic Diseases: cortical cysts, polycystic kidney disease, medullary cysts.
 - Hydronephrosis
7. Retroperitoneum
- Anatomy: perirenal and pararenal spaces, pelvic extraperitoneal spaces.
 - Adrenal neoplasms and other masses
 - Lymphadenopathy
 - Neoplasms
 - Hematoma
 - Abscess
8. Peritoneal cavity
- Anatomy
 - Intraperitoneal collections: ascites and abscess

- Neoplasm: carcinomatosis
- Hemoperitoneum
- Peritoneal inclusion cyst

9. Gynecology

- Normal Anatomy
- Uterus
 - Cyclic change in the endometrium
 - Leiomyoma
 - Leiomyosarcoma
 - Adenomyosis
 - Endometrial pathology: carcinoma, polyp, hyperplasia, changes related to tamoxifen
 - Gestational trophoblastic disease Postpartum—retained products of conception
 - Cervical carcinoma
 - Intrauterine contraceptive device
- Adnexa
 - Polycystic ovarian syndrome
 - Ovarian cysts; follicular, corpus luteum, theca lutein
 - Acute conditions
 - Hemorrhagic cyst
 - Ovarian torsion
 - Ectopic pregnancy
 - Neoplasms:
 - Surface epithelial—cystadenoma/carcinoma
 - Germ Cell—teratoma
 - Metastatic (Sex cord/stromal)
 - Pelvic inflammatory disease
 - Hydro/pyo salpinx
 - Tuboovarian abscess and complex

10. Thyroid/Head and Neck

- Normal Anatomy
- Nodules: patterns suggestive of benignity
- Neoplasms
- Nodular goiter and other conditions such as Thyroiditis
- Parathyroid mass: adenoma
- Submandibular and parotid gland masses
 - Benign and malignant lymph nodes

11. Scrotum

- Normal Anatomy
- Neoplasms
 - Seminoma and other germ cell tumors
 - Metastatic
- Benign masses

- Simple cysts
- Epidermoid cysts
- Epididymal cysts and sperm granuloma
- Infections
 - Epididymitis/orchitis
 - Testicular and scrotal abscess/pyocele
 - Fournier's gangrene
- Trauma
 - Testicular hematoma/rupture
 - Scrotal wall hematoma
 - Hematocele
- Varicocele
- Torsion
- Hernia
- Extratesticular masses: spermatocele, adenomatoid tumor

12. Obstetrics

First Trimester

- Diagnosis of intrauterine pregnancy and relationship to bHCG levels
- Basic anatomy and normal developmental features of embryo and early fetus
- Dating—CRL
- Complications
 - Ectopic pregnancy
 - Anembryonic pregnancy
 - Subchorionic hematoma
 - Intrauterine demise
- Anomalies identifiable in first trimester

Second and third trimester

- Basic evaluation
- Anatomy—Guidelines of AIUM, ACR, ACOG
 - kidneys, stomach, urinary bladder, umbilical cord insertion, spine, cerebral ventricles and posterior fossa, 4-chambered heart
- Dating—BPD, FL, AC,
- Growth—EFW
- Placenta, location and morphology
- Amniotic Fluid
- Cervix—status, length, confirmation of IUG
- Diagnosis of chromosomal abnormalities
 - Biochemical screening
 - Genetic sonogram—markers of aneuploidy
- Fetal anomalies
 - CNS
 - Thorax/cardiac
 - Genitourinary
 - Gastrointestinal
 - MSK

I. MEDICAL KNOWLEDGE

A. "HANDS-ON" SCANNING

By the end of each level of training, the resident should be able to scan most of the clinical scenarios listed below in each training category.

Rotation 1

Gallbladder (gallstones/acute cholecystitis)
Liver (masses)
Kidney (hydronephrosis, stones)
Transabdominal/transvaginal pelvis (mass/cyst/free fluid)
Abdominal aorta (aneurysm)
Pleural effusion and ascites
Pregnancy (normal early intrauterine pregnancy)
Thyroid nodules

Rotation 2

Pancreas (pancreatitis, mass)
Biliary (common bile duct, biliary ductal dilatation)
Abdominal mass/adenopathy
Kidney (mass/cyst)
Basic Doppler (portal vein, pseudoaneurysm, arteriovenous fistula)
Pregnancy (first trimester, failed pregnancy, ectopic pregnancy)
Adnexal mass (ovarian and non-ovarian)
Testis (pain and masses)
Basics obstetrics (basic fetal biometry, basic second/third trimester fetal anatomy, placental localization, amniotic fluid volume)
Neonatal brain

Rotation 3

Advanced obstetrics (comprehensive second/third trimester)
Pediatrics (abdomen, spine, hips)
Ultrasound-guided interventional procedures
Parathyroid
Advanced abdominal Doppler (visceral organs, organ transplants)

Rotation 4

Advanced obstetrics (comprehensive second/third trimester)
Pediatrics (abdomen, spine, hips)
Ultrasound-guided interventional procedures
Parathyroid
Carotid artery
Advanced abdominal Doppler (visceral organs, organ transplants)
Peripheral vessels (arterial bypass grafts, upper extremity veins)
Lower extremity (deep vein thrombosis)

B. COMPREHENSIVE KNOWLEDGE

PHYSICS/INSTRUMENTATION

The resident should understand the basic principles of physics that form the foundation of clinical ultrasound.

Rotation 1

Define ultrasound, including the relationship of sound waves used in imaging

Straight narrow sound beams, simple reflection, constant sound speed

Beam shape: linear, sector, curved array

Probes: transabdominal, endocavitary

Endocavitary imaging: transvaginal, transrectal, endoscopic, laparoscopic

Display: Gray scale, M-mode, pulsed wave Doppler, color and power Doppler

Image orientation: standard images in different planes

Image optimization: power output, gain, time gain compensation

Image recording options: electronic (digital), film, paper

Acoustic properties of fluid, cyst, calcification, complex fluid and solid structures

Tissue characteristics: acoustic shadowing and enhancement

Focal zone

Rotation 2

Transducer choice: curvilinear, linear, sector, vector

Frequency, sound speed, wavelength, intensity, decibels, beam width, Fresnel zone, Fraunhofer zone

Interaction of sound waves with tissues: reflection, attenuation, scattering, refraction, absorption, acoustic impedance pulse-echo principles

Generation/detection of ultrasound waves

Doppler phenomenon, Doppler formula

Beam formation/focusing

Gray scale, M-mode, pulsed wave Doppler, color Doppler imaging, power Doppler imaging

Rotation 3

Beamwidth, sidelobe, slice thickness artifacts

Multiple reflection artifacts - mirror image/reverberation

Refractive artifacts

Doppler artifacts- pulse wave, color imaging, including aliasing

Gray scale versus Doppler (trade-off of penetration and resolution)

3-D volumetric imaging

Thermal/non-thermal effects on tissue: biological health risks

Image optimization

Harmonic imaging

Equipment quality assurance: phantoms, spatial/contrast resolution

Rotation 4

Beamwidth, sidelobe, slice thickness artifacts

Multiple reflection artifacts - mirror image/reverberation

Refractive artifacts

Doppler artifacts- pulse wave, color imaging, including aliasing

Gray scale versus Doppler (trade-off of penetration and resolution)

3-D volumetric imaging

Thermal/non-thermal effects on tissue: biological health risks

Image optimization

Harmonic imaging
Ultrasound contrast agents
Equipment quality assurance: phantoms, spatial/contrast resolution

CLINICAL APPLICATIONS

GENERAL

The resident should understand the importance of clinical ultrasound protocols. Published protocols/standards from the American College of Radiology (ACR) or the American Institute of Ultrasound in Medicine (AIUM) with or without local modification are acceptable frames of reference. Residents should also be familiar with ACR appropriateness criteria as a guide for appropriate clinical use of ultrasound and other imaging modalities.

The resident should gain a general understanding of both the clinical uses and limitations of ultrasound as well as the appropriate integration of other complementary cross-sectional imaging studies, particularly CT and MRI.

The resident should understand the importance of documentation and reporting skills/requirements, including the electronic applications in their institution.

The resident should understand the importance of clinical quality assurance, including radiologic-pathologic correlation, as well as sonographer-physician discrepancies.

ABDOMINAL

Rotation 1

Liver: normal echotexture, size, and shape (including anatomic variants), diffuse disease, (fatty infiltration, acute and chronic hepatitis, cirrhosis, edema), focal masses, metastases, granuloma

Gallbladder: normal appearance, wall thickening, gallstones, including supine, decubitus and erect positions, sludge, acute cholecystitis (calculous/acalculous), sonographic Murphy's sign, other etiologies of wall thickening, polyp

Bile ducts: normal intra- and extrahepatic bile duct diameters and dilatation

Pancreas: normal anatomy, pancreatic duct, mass

Spleen: normal echotexture, size and shape (including anatomic variants), focal masses (cystic versus solid), lymphoma, abscess, infarction, granuloma

Peritoneal cavity: ascites, fluid localization/quantification (free/loculated)

Pleural effusion

Rotation 2

Liver: hematoma, biloma, abscess

Post-liver transplantation collections: hematoma, biloma, abscess (see vascular section)

Gallbladder: hyperplastic cholecystoses, carcinoma

Bile ducts: bile duct stones, inflammatory disease, cholangitis, pneumobilia

Pancreas: neoplasm, cysts

Pancreatitis complications: abscess, pseudocyst and pseudoaneurysm, chronic pancreatitis

Peritoneal cavity: abscess, hemorrhage, omental mass, metastasis, carcinomatosis

Spleen: varices

Rotation 3

Liver: trauma

Bile ducts: neoplasm (cholangiocarcinoma)

Spleen: trauma

Chest: pericardial effusion, mass, atelectasis/pneumonia

Organ transplants: see vascular section

Gastrointestinal tract: normal gut ultrasound signature, acute appendicitis, diverticulitis, Crohn's disease

Peritoneal cavity: free air

Abdominal wall hernia, inguinal hernia

Rotation 4

Liver: trauma

Bile ducts: neoplasm (cholangiocarcinoma)

Spleen: trauma

Chest: pericardial effusion, mass, atelectasis/pneumonia

Organ transplants: see vascular section

Gastrointestinal tract: normal gut ultrasound signature, acute appendicitis, diverticulitis, Crohn's disease

Peritoneal cavity: free air

Abdominal wall hernia, inguinal hernia

KIDNEYS, URINARY BLADDER AND PROSTATE

Rotation 1

Renal: Normal renal cortical echotexture, size and shape, glomerulointerstitial renal disease, simple renal cyst, renal stones, hydronephrosis, pyonephrosis

Ureters: hydroureter

Urinary bladder: calculi, wall thickening, ureteral jets, bladder volume, including post-void residual

Rotation 2

Abscess/pyelonephritis, perinephric fluid

Post-renal transplant collections: hematoma, urinoma, abscess, lymphocele (see vascular section)

Complex renal cyst, adult polycystic disease and acquired renal cystic disease, renal cell carcinoma, angiomyolipoma

Urinary bladder: mass, infection, hemorrhage, wall thickening, bladder outlet obstruction, diverticula, ureterocele

Transabdominal prostate

Ureters: hydroureter

Rotation 3

Kidneys: xanthogranulomatous pyelonephritis, emphysematous pyelonephritis, congenital anomalies, pelvic kidney (see pediatrics section), medullary nephrocalcinosis

Adrenal glands: mass

Retroperitoneum: adenopathy, mass

Ureters: ureteral stone

Urinary bladder: ectopic ureterocele

Renal artery stenosis, renal vein thrombosis (see vascular section section)

Transrectal prostate

Rotation 4

Kidneys: xanthogranulomatous pyelonephritis, emphysematous pyelonephritis, congenital anomalies, pelvic kidney, medullary sponge kidney, nephrocalcinosis

Adrenal glands: mass

Retroperitoneum: adenopathy, mass

Ureters: ureteral stone

Urinary bladder: ectopic ureterocele

Renal artery stenosis, renal vein thrombosis (see vascular section section)

Transrectal prostate with biopsy

GYNECOLOGY

Rotation 1

Uterus: normal size, shape, position, echogenicity, fibroid identification

Endometrium: normal appearance during phases of menstrual cycle and thickness measurement (pre-menopausal, post-menopausal, effects of hormone replacement), intrauterine device, fluid

Ovary: normal size, shape, echogenicity, physiologic variation during phases of menstrual cycle (follicles, corpus luteum, hemorrhagic ovarian cyst)

Free pelvic fluid

Rotation 2

Uterus: congenital anomalies, endometrial polyp, endometrial hyperplasia, endometrial carcinoma, endometritis, pyometrium, fibroid localization (submucous, intramural, subserosal), adenomyosis

Ovarian cyst: hemorrhagic/ruptured cyst, endometrioma, polycystic ovarian disease, ovarian hyperstimulation syndrome

Ovarian neoplasm: cystic/solid adnexal masses, cystadenoma/carcinoma, dermoid, fibroma, germ cell tumor, Doppler evaluation

Ovarian torsion

Pelvic inflammatory disease, tubo-ovarian abscess

Cervix: mass, stenosis, endometrial obstruction

Fallopian tube: hydrosalpinx, pyosalpinx

Post-hysterectomy

Rotation 3

Uterus: congenital anomalies, endometrial polyp, endometrial hyperplasia, endometrial carcinoma, endometritis, pyometrium, fibroid localization (submucous, intramural, subserosal), adenomyosis

Ovarian cyst: hemorrhagic/ruptured cyst, endometrioma, polycystic ovarian disease, ovarian hyperstimulation syndrome

Ovarian neoplasm: cystic/solid adnexal masses, cystadenoma/carcinoma, dermoid, fibroma, germ cell tumor, Doppler evaluation

Peritoneal inclusion cyst

Ovarian neoplasm and cancer staging

Saline hysterosonography

Rotation 4

Uterus: congenital anomalies, endometrial polyp, endometrial hyperplasia, endometrial carcinoma, endometritis, pyometrium, fibroid localization (submucous, intramural, subserosal), adenomyosis

Ovarian cyst: hemorrhagic/ruptured cyst, endometrioma, polycystic ovarian disease, ovarian hyperstimulation syndrome

Ovarian neoplasm: cystic/solid adnexal masses, cystadenoma/carcinoma, dermoid, fibroma, germ cell tumor, Doppler evaluation

Peritoneal inclusion cyst

Ovarian neoplasm and cancer staging

Saline hysterosonography

OBSTETRICS

FIRST TRIMESTER

Rotation 1

Normal findings: gestational sac appearance, size, gestational sac growth, yolk sac, embryo, cardiac activity including normal embryonic heart rate, amnion, chorion, normal early fetal anatomy/growth, crown-rump length measurement, correlation with BHCG levels and menstrual dates

Rotation 2

Multiple gestations (chorionicity and amnionicity), failed early pregnancy, spontaneous complete/incomplete abortion, ectopic pregnancy, blighted ovum, embryonic death, subchorionic hematoma, gestational trophoblastic disease, gross embryonic structural abnormalities, anencephaly

Rotation 3

Multiple gestations (chorionicity and amnionicity), failed early pregnancy, spontaneous complete/incomplete abortion, ectopic pregnancy, blighted ovum, embryonic death, subchorionic hematoma, gestational trophoblastic disease,

gross and subtle embryonic structural abnormalities, anencephaly

Unusual ectopic pregnancy: interstitial, cervical, ovarian, scar, abdominal, rudimentary horn

Nuchal translucency

Chorionic villous sampling

Rotation 4

Multiple gestations (chorionicity and amnionicity), failed early pregnancy, spontaneous complete/incomplete abortion, ectopic pregnancy, blighted ovum, embryonic death, subchorionic hematoma, gestational trophoblastic disease,

gross and subtle embryonic structural abnormalities, anencephaly

Unusual ectopic pregnancy: interstitial, cervical, ovarian, scar, abdominal, rudimentary horn

Nuchal translucency

Chorionic villous sampling

SECOND AND THIRD TRIMESTER

Rotation 1

Normal findings: normal fetal anatomy/situs/development, placenta, biometry, amniotic fluid volume, multiple gestations

Anencephaly

Oligohydramnios (spontaneous premature rupture of membranes, renal disease, fetal death, intrauterine growth retardation, infection)

Polyhydramnios, placenta previa

Cervical appearance and length

Rotation 2

Recognition of fetal abnormalities that require high risk obstetrics referral, including intrauterine growth retardation, hydrops, holoprosencephaly, hydrocephalus, neural tube defects, multicystic dysplastic kidney, hydronephrosis

Placental abruption, placental masses, two-vessel umbilical cord, cord masses, retained products of conception

Rotation 3

Recognition of fetal abnormalities that require high risk obstetrics referral, including

congenital anomalies/chromosomal abnormalities and syndromes such as Down's syndrome and Turner's syndrome, hydrops, congenital infections, chest masses, cardiac malformations and arrhythmias, diaphragmatic hernia, abdominal wall defects, abdominal masses, gastrointestinal tract obstruction/abnormalities, ascites, skeletal dysplasias, cleft lip/palate, complications of twin pregnancy, hydrancephaly

Borderline findings: nuchal thickening, choroid plexus cyst, echogenic cardiac focus, echogenic bowel, borderline hydrocephalus

Placental cord insertion site/vasa previa, velamentous cord insertion, cord prolapse, succenturiate placenta, cervical incompetence

Umbilical cord Doppler, fetal cranial Doppler, biophysical profile

Guidance for amniocentesis

Placenta accreta, percreta, increta

Rotation 4

Recognition of fetal abnormalities that require high risk obstetrics referral, including congenital anomalies/chromosomal abnormalities and syndromes such as Down's syndrome and Turner's syndrome, hydrops, congenital infections, chest masses, cardiac malformations and arrhythmias, diaphragmatic hernia, abdominal wall defects, abdominal masses, gastrointestinal tract obstruction/abnormalities, ascites, skeletal dysplasias, cleft lip/palate, complications of twin pregnancy, hydrancephaly

Borderline findings: nuchal thickening, choroid plexus cyst, echogenic cardiac focus, echogenic bowel, borderline hydrocephalus

Placental cord insertion site/vasa previa, velamentous cord insertion, cord prolapse, succenturiate placenta, cervical incompetence

Umbilical cord Doppler, fetal cranial Doppler, biophysical profile

Guidance for amniocentesis

Placenta accreta, percreta, increta

THYROID/NECK

Rotation 1

Normal thyroid echotexture, size and shape

Thyroid disease: diffuse and focal disease

Multinodular thyroid

Rotation 2

Thyroid nodule characterization: echotexture, calcifications including microcalcifications, margins, recommendations for fine needle aspiration biopsy

Hashimoto's thyroiditis/Graves' disease

Rotation 3

Parathyroid mass: adenoma

Congenital cysts: branchial cleft

Lymph nodes: benign and malignant characterization

Post-thyroidectomy recurrence

Submandibular and parotid glands: normal and abnormal

Fine needle aspiration

Rotation 4

Parathyroid mass: adenoma

Congenital cysts: branchial cleft

Lymph nodes: benign and malignant characterization
Post-thyroidectomy recurrence
Submandibular and parotid glands: normal and abnormal
Fine needle aspiration

VASCULAR/DOPPLER

Rotation 1

Abdominal aorta: normal appearance and measurement, aneurysm
Inferior vena cava: normal appearance, thrombosis

Hematoma

Iatrogenic pseudoaneurysm

Rotation 2

Peripheral vascular aneurysm, including iliac and popliteal arteries

Hepatic vasculature: pulsed Doppler and color Doppler imaging of the portal veins, splenic vein, hepatic arteries and hepatic veins, including normal direction of flow

Hemodynamics of cirrhosis, portal hypertension and varices, portal vein thrombosis

Upper extremity venous thrombosis: subclavian and internal jugular vein thrombosis, axillary and brachial vein thrombosis

Carotid artery: normal, atherosclerotic plaque, carotid artery stenosis and occlusion

Renal vein thrombosis

Iatrogenic arteriovenous fistula

Rotation 3

Renal transplant: arterial resistive index (rejection, acute tubular necrosis), transplant vein thrombosis, renal infarction, post-biopsy complications, renal arterial stenosis

Liver transplants, including hepatic artery stenosis or thrombosis (resistive index), portal vein thrombosis, post-biopsy complications, inferior vena cava stenosis

Pancreas transplant: arterial and venous anastomosis, patency and stenosis

TIPS evaluation and complications

Lower extremities: chronic venous insufficiency

Arterial bypass graft

Mesenteric ischemia

Renal artery stenosis

Rotation 4

Liver transplants, including hepatic artery stenosis or thrombosis (resistive index), portal vein thrombosis, post-biopsy complications, inferior vena cava stenosis

Pancreas transplant: arterial and venous anastomosis, patency and stenosis

TIPS evaluation and complications

Vascular Lab/IR:

Lower extremities: chronic venous insufficiency

Arterial bypass graft

Hemodialysis graft/fistula

Carotid artery: waveform analysis, stenosis, dissection, pseudoaneurysm, stent

Vertebral artery: subclavian steal syndrome

Mesenteric ischemia

Lower extremity deep vein thrombosis

Pre-graft vein mapping

SCROTUM

Rotation 1

Testes: normal echotexture, shape and size

Epididymes

Testicular mass

Hydrocele

Rotation 2

Epididymitis, orchitis

Testicular torsion

Testicular mass characterization: microlithiasis, germ cell tumor, lymphoma, metastasis

Cystic ectasia of rete testis

Extratesticular masses/cysts, spermatocele, adenomatoid tumor, epididymal head cyst

Varicocele

Trauma

Rotation 3

Testicular mass characterization: microlithiasis, germ cell tumor, lymphoma, metastasis

Cystic ectasia of rete testis

Extratesticular masses/cysts, spermatocele, adenomatoid tumor, epididymal head cyst

Varicocele

Hernia

Non-descended testis

Fournier's gangrene

trauma

Rotation 4

Testicular mass characterization: microlithiasis, germ cell tumor, lymphoma, metastasis

Cystic ectasia of rete testis

Extratesticular masses/cysts, spermatocele, adenomatoid tumor, epididymal head cyst

Varicocele

Fournier's gangrene

trauma

PEDIATRICS

Rotation 1

Normal abdominal anatomy

Normal renal anatomy

Normal brain anatomy

Normal neck anatomy

Rotation 2

Brain: intracranial hemorrhage and complications, including periventricular leukomalacia and hydrocephalus, shunt evaluation

Kidneys: hydronephrosis, stones, hydroureters, anomalies of position and fusion, renal scarring, masses, cystic disease

Adrenal hemorrhage, masses (neuroblastoma)
Liver: cirrhosis, choledochal cysts, liver masses, hepatitis/biliary atresia
Gallbladder: gallstones, biliary stones, hydrops
Pancreatitis
Normal hip
Intussusception
Acute appendicitis
Acute pancreatitis
Hypertrophic pyloric stenosis
Scrotal: torsion, epididymitis, orchitis, masses, undescended testis, mass , trauma
Ovarian torsion

Rotation 3

Organ transplant
Polysplenia, asplenia
Kidneys: hydronephrosis, stones, hydroureters, anomalies of position and fusion, renal scarring, masses, cystic disease
Adrenal hemorrhage, masses (neuroblastoma)
Liver: cirrhosis, choledochal cysts, liver masses, hepatitis/biliary atresia
Hip dislocation
Congenital brain malformations, agenesis of corpus callosum, vein of Galen aneurysm, Dandy Walker Malformation, aqueductal stenosis
Neonatal spine: tethered cord, intraspinal mass
Liver Doppler
Imperforate hymen, uterine anomalies

Rotation 4

Organ transplant
Polysplenia, asplenia
Hip dislocation
Congenital brain malformations, agenesis of corpus callosum, vein of Galen aneurysm, Dandy Walker Malformation, aqueductal stenosis
Neonatal spine: tethered cord, intraspinal mass
Liver Doppler
Imperforate hymen, uterine anomalies

MUSCULOSKELETAL

Rotation 1

Mass
Hematoma
Baker's cyst, including rupture
Cellulitis
Abscess

Rotation 2

Normal tendon appearance
Foreign body
Soft tissue gas

Joint fluid
Muscle tear

Rotation 3

Tendon tear, inflammation
Rotator cuff tear

Rotation 4

Tendon tear, inflammation
Rotator cuff tear
Foreign bodies

BREAST

Rotation 1

Sonomammographic anatomy
Cystic versus solid mass
Mastitis/abscess

Rotation 2

Characterization of cysts
Lymph node characterization: axillary, supraclavicular, intramammary

Rotation 3 (There are three rotations in Mammography, including Breast US)

Characterization of solid masses: benign versus malignant
Architectural distortion
Intraductal masses/abnormalities
Galactocele
Screening
Multifocal malignancy
Elastography

INTERVENTIONAL

Rotation 1

Informed consent
Sterile technique
Localization of fluid for paracentesis or thoracentesis to be performed by another service
Ultrasound-guided paracentesis

Rotation 2

Pre-procedural evaluation: coagulation laboratory studies, anticoagulation medication
Stratification of risk for percutaneous procedures
Techniques for ultrasound-guided invasive procedures: understanding important landmarks and pitfalls of percutaneous procedures, including recognition of critical structures to be avoided
Biopsy of soft tissue masses
Random core liver biopsy
Aspiration of fluid collections, cysts and catheter placement for abscess and fluid drainage (pleural, peritoneal and other spaces)
Ultrasound-guided thoracentesis
Post-procedural evaluation: radiographic studies, patient monitoring, management of complications

Rotation 3

Aspiration of fluid collections, cysts and catheter placement for abscess and fluid drainage (pleural, peritoneal and other spaces)

Ultrasound-guided thoracentesis

Post-procedural evaluation: radiographic studies, patient monitoring, management of complications

Fine needle biopsy versus core biopsy in specific application, such as focal liver mass, renal mass, thyroid/parathyroid mass, retroperitoneal lymphadenopathy

Rotation 4

Aspiration of fluid collections, cysts and catheter placement for abscess and fluid drainage (pleural, peritoneal and other spaces)

Ultrasound-guided thoracentesis

Post-procedural evaluation: radiographic studies, patient monitoring, management of complications

Fine needle biopsy versus core biopsy in specific application, such as focal liver mass, renal mass, thyroid/parathyroid mass, retroperitoneal lymphadenopathy

Pseudoaneurysm management: contraindications and technique of non-surgical treatment with ultrasound-guided compression repair versus thrombin injection

Intraoperative ultrasound guidance

Assessment

ACR In-Service exam

ABR Exam

Faculty Evaluations

360 degree evaluations

Learning Portfolio

Pre-call skills list (Rotation 1)

Pre-call exam (Rotation 1)

II. PATIENT CARE

Rotation 1

Gather essential and accurate clinical and radiologic information about patients relevant to the interpretation of the ultrasound examination

Communicate effectively and demonstrate caring, respectful behavior when interacting with patients and their families, answering their questions and helping them to understand the ultrasound procedure as well as its clinical significance

Use information technology to support patient care decisions

Become familiar with common indications for ultrasound exams as well as limitation and capabilities of the modality for specific indications.

Rotation 2

Communicate effectively and demonstrate caring, respectful behavior when interacting with patients and their families, answering their questions and helping them to understand the ultrasound procedure as well as its clinical significance

Screen and supervise more complex ultrasound studies

Understand the importance of the physician/patient interaction during an ultrasound examination

Advise referring physicians (emergency staff) as to most appropriate diagnostic examinations.

Expedite more urgent cases referred on an emergency basis

Contact clinicians referring examinations to the ultrasound department if additional

information is needed.

Review prior radiologic studies and clinical information

Be responsive to individual patient needs.

Rotation 3

Communicate effectively and demonstrate caring, respectful behavior when interacting with patients and their families, answering their questions and helping them to understand the ultrasound procedure as well as its clinical significance

Screen and supervise, with increasing level of responsibility, most ultrasound studies

Prioritize exams based on urgency

Expedite cases

Gather the pertinent information for interventional cases

Understand the bioeffects and safety issues in diagnostic ultrasound

Review prior radiologic studies and clinical information

Be responsive to individual patient needs.

Rotation 4

Communicate effectively and demonstrate caring, respectful behavior when interacting with patients and their families, answering their questions and helping them to understand the ultrasound procedure as well as its clinical significance

Screen ultrasound requests for appropriateness.

Interview patients for procedure as to allergies, medications, medical history

Review prior radiologic studies and clinical information

Be responsive to individual patient needs.

Assessment

Faculty evaluation

360 degree evaluation

ACR In-Service Exam

ABR Exam

Learning Portfolio

III. PRACTICE-BASED LEARNING AND IMPROVEMENTS

Rotation 1

Use information technology to manage information, to access on-line medical information, and for self learning

Concentrate on acquiring technical competence in sonography. Observe the ultrasound technologists and backscan. Accompany the attending radiologist when he/she is obtaining additional views.

List interesting cases on database

Rotation 2

Use information technology to manage information, to access on-line medical information, and for self learning

Demonstrate knowledge of principles of research methods, statistical methods, study design and their implementation

Demonstrate critical assessment of the scientific literature

Demonstrate knowledge and application of the principles of evidence-based medicine in practice

List interesting cases on database

Follow up on interesting cases, including post-surgical and post-biopsy

Rotation 3

Use information technology to manage information, to access on-line medical information, and for self learning

Facilitate teaching of medical students, sonographers, other residents and other health care professionals

Participate in quality assurance programs for sonographers and physicians

Learn about equipment quality assurance programs

Apply basic knowledge of study design and statistical methods to the appraisal of clinical studies and other information on diagnostic and therapeutic effectiveness

List interesting cases on database

Follow up on interesting cases, including post-surgical and post-biopsy

Rotation 4

Use information technology to manage information, to access on-line medical information, and for self learning

Facilitate teaching of medical students, sonographers, other residents and other health care professionals

Participate in quality assurance programs for sonographers and physicians

Learn about equipment quality assurance programs

Apply basic knowledge of study design and statistical methods to the appraisal of clinical studies and other information on diagnostic and therapeutic effectiveness

List interesting cases on database

Follow up on interesting cases, including post-surgical and post-biopsy

Assessment

Faculty evaluation

ACR in service examination

ABR Exam

Medical Student evaluation

Learning Portfolio

IV . INTERPERSONAL AND COMMUNICATION SKILLS

Rotation 1

Dictate prompt, accurate and concise radiologic reports for basic ultrasound studies using available electronic software applications

Develop effective communication skills with patients, patients' families, physicians and other members of the health care team

Promptly communicate urgent, critical or unexpected ultrasound findings to residents, referring physicians or clinicians and document the communication in the radiological report

Provide basic explanations of ultrasound examinations to patients.

Establish a working relationship with ultrasound technologists.

Rotation 2

Interact with residents and attending physicians in consultation when clinical-radiologic correlation is necessary

Dictate accurate and concise radiologic reports for more complex ultrasound studies with concise impression including diagnosis and/or differential diagnoses

Explain exams and, where appropriate, results to patients and families

Rotation 3

Dictate accurate and concise reports for the most complex ultrasound studies with concise impression including diagnosis and/or differential diagnoses as well as recommendations for further imaging and/or management, when appropriate

Consult effectively with senior residents and attending physician in most aspects of ultrasound

Explain the exams and results to medical students and other learners

Rotation 4

Dictate accurate and concise reports for all, including the most complex ultrasound studies

Consult effectively with senior residents and attending physicians in most aspects of ultrasound

Explain the exams and results to medical students and other learners

Assessment

Faculty Evaluation

360 degree Evaluation

Medical Student Evaluation

ACR In-Service Exam

ABR Exam

Dictation Review

V. PROFESSIONALISM

Rotation 1

Demonstrate honor, integrity, respect and compassion to patients, other physicians and other health care professionals

Demonstrate positive work habits, including punctuality and professional appearance

Be discrete in discussing individual patient histories and findings.

Respect individual ethnic or religious preferences.

Rotation 2

Demonstrate a commitment to the ethical principles pertaining to confidentiality of patient information

Demonstrate responsiveness to the needs of patients that supercedes self-interest (altruism)

Demonstrate honor, integrity, respect and compassion to patients, other physicians and other health care professionals

Demonstrate positive work habits, including punctuality and professional appearance

Rotation 3

Demonstrate a commitment to the ethical principles pertaining to confidentiality of patient information

Demonstrate responsiveness to the needs of patients that supercedes self-interest (altruism)

Demonstrate honor, integrity, respect and compassion to patients, other physicians and other health care professionals

Demonstrate positive work habits, including punctuality and professional appearance

Demonstrate accountability to patients, society and the profession

Rotation 4

Demonstrate a commitment to the ethical principles pertaining to confidentiality of patient information
Demonstrate responsiveness to the needs of patients that supercedes self-interest (altruism)
Demonstrate honor, integrity, respect and compassion to patients, other physicians and other health care professionals
Demonstrate positive work habits, including punctuality and professional appearance
Demonstrate accountability to patients, society and the profession

Assessment

Faculty Evaluation
360 degree Evaluation
Medical Student Evaluation
ACR In-Service Exam
ABR Exam
Patient/Family Feedback, where appropriate

VI. SYSTEMS BASED PRACTICE

Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value.

Rotation 1

Start to understand how their professional practice affects other health care professionals, the health care organization, and the larger society, and how these elements affect their own practice
Assist referring clinicians in providing cost-effective health care
Begin to learn about practice cost-effective health care and resource allocation
Be prepared to evaluate the request for imaging as regards cost, effectiveness, and appropriateness, and to facilitate performance of an alternative study if indicated.
Become familiar with the ACR Appropriateness Criteria

Rotation 2

Understand how their professional practice affects other health care professionals, the health care organization, and the larger society
Learn how these elements affect DHMC
Help referring clinicians provide cost-effective health care
practice cost-effective health care and resource allocation that does not compromise quality of care
Be prepared to evaluate the US request for cost, effectiveness, and appropriateness
Understand the ACR Appropriateness Criteria

Rotation 3

Understand how their professional practice affects other health care professionals, the health care organization, and the larger society
Know how these elements affect their own practice
Help referring clinicians provide cost-effective health care
Practice cost-effective health care and resource allocation that does not compromise quality of care

Evaluate the US request for cost and effectiveness, and appropriateness
Facilitate performance of an alternative study if indicated.
Understand the ACR Appropriateness Criteria

Rotation 4

Understand how their professional practice affects other health care professionals, the health care organization, and the larger society

Know how these elements affect their own practice

Help referring clinicians provide cost-effective health care

Practice cost-effective health care and resource allocation that does not compromise quality of care

Evaluate the US request for cost, effectiveness, and appropriateness

Facilitate performance of an alternative study if indicated.

Understand the ACR Appropriateness Criteria

Assessment

Faculty Evaluation

360 degree Evaluation

Medical Student Evaluation

ACR In-Service Exam

ABR Exam

Patient/Family Feedback, where appropriate

SUGGESTED READING

Year I Rotations

Requisites, Middleton, Kurtz, Hertzberg, 2nd ed.

Ch 1-9, 13-20

Diagnostic Ultrasound, 2nd ed. McGahan, Goldberg

Ch. 39

Year II Rotation

Requisites

Ch 6, 10, 12, 21-23

Diagnostic US

Ch 25, 27-28, 32, 38

Year III Rotation

Diagnostic U/S

Ch 1-2, 11,15,40, 43-51

Year IV Rotation

Diagnostic U/S

Ch 4,5,7,10,12.18.19

Ultrasound Conferences

1. RUQ - Liver, GB, Biliary Tree (RDH)
2. Retroperitoneum - pancreas, spleen, aorta (RDH)
3. Kidneys (RDH)
4. GYN I - Uterus (RD)
5. GYN I - Uterus (RD)
6. GYN III - Infertility (MBP)
7. OB I - 1st Trimester (RDH)
8. OB II - Dating Growth (RDH)
9. OB III - Fetal CNS (RD)
10. OB IV - Fetal - Cardiac & Chest (RDH/JS)
11. OB V - Fetal GI (RD)
12. OB VII - Fetal MSK (EB)
13. OB VIII - Placenta, Cervix (RDH)
14. OB IX - Multiple Gestations (RD)
15. Scrotum (RDH)
16. U/S Doppler Principles (RD)
17. Pediatrics I (Sarge)
18. Pediatrics II (TV)
19. Vascular U/S (Visiting Prof)