Radiology Residency Core Curriculum
Ultrasound

I. General US

a. Physics
   i. Definition of ultrasound, relationship of sound waves used in imaging to those of higher/lower frequency with other properties
   ii. Working knowledge of frequency, sound speed, wavelength, intensity/decibels
   iii. Interaction of sound waves with tissues: reflection, attenuation, scattering, refraction, absorption, acoustic impedance
   iv. Generation/detection of ultrasound waves
   v. Doppler phenomenon
   vi. Pulse-echo principles
   vii. Beam formation/focusing

b. Biosafety
   i. Thermal/nonthermal effects on tissue
   ii. Relative effects of gray scale, M-Mode, pulsed wave Doppler, color flow imaging, power imaging, harmonics

c. Imaging technique and optimization
   i. Transducer choice
      1. Frequency: gray scale/Doppler (understand tradeoff of penetration/resolution), optimal gray scale probe may not be the optimal Doppler probe
      2. shape: linear, sector, curved
      3. approach: external, endocavitary, translabial
   ii. Display
      1. Gray scale, M-Mode, pulsed wave Doppler, color/power imaging, 3-D
   iii. Image Orientation
      1. Standard images in different planes
   iv. Optimization
      1. power output, gain, time gain compensation

d. Artifacts
   i. Underlying principles (straight narrow sound beams, simple reflection, constant sound speed)
   ii. Beamwidth artifacts, sidelobes, slice thickness
   iii. Multiple reflection artifacts - mirror image/reverberations
   iv. Tissue characteristics- shadowing/enhancement
   v. Refractive artifacts
   vi. Doppler artifacts- pulse wave, color imaging (includes aliasing)
   vii. Quality assurance

e. Contrast agents
f. Endoscopic US?

II. Abdomen

a. Liver
    i. Technique and normal, variant anatomy
    ii. Focal masses
        1. Benign
        2. Malignant
    iii. Diffuse liver disease
        1. Fatty liver
        2. Hepatitis
        3. Cirrhosis
    iv. Vascular disease
        1. Normal hemodynamics
        2. Portal hypertension
        3. Passive congestion
        4. Transplant
        5. Portosystemic shunts/TIPS

b. Gallbladder
    i. Technique and normal, variant anatomy
    ii. Cholelithiasis, cholesteroloses, polyps
    iii. Acute and chronic cholecystitis
    iv. Primary and secondary malignancy

c. Biliary tree
    i. Technique and normal, variant anatomy
        1. Choledochal cysts
        2. Caroli's disease
    ii. Obstruction
        1. Choledocholithiasis
        2. Stricture
        3. Neoplasm
    iii. Cholangitis
        1. Ascending
        2. PSC
        3. Recurrent pyogenic
        4. PBC

d. Kidney
    i. Technique and normal, variant anatomy
    ii. Renal vascular disease
        1. Normal hemodynamics and waveforms

2. RAS
3. RVT

iii. Infection
iv. Obstruction
1. Stones
2. Structure
3. Extrinsic causes
4. TCC

v. Ischemia
vi. Chronic disease
vii. Nephrocalcinosis
viii. Transplantation
ix. Masses
1. Solid
2. Cystic

e. Adrenal Gland
i. Focal mass
ii. Neonatal hemorrhage (covered in peds)

f. Pancreas and spleen
i. Pancreatitis
1. complications
ii. Pancreatic masses
iii. Transplantation
iv. Splenic masses
v. Splenomegaly

g. Appendix and bowel
i. Appendicitis
ii. Intussception
iii. Obstruction
iv. Pyloric stenosis

h. Peritoneal cavity
i. Location, quantification and aspiration of fluid (free/loculated), abscess, blood, free air, omental mass

i. Retroperitoneum
i. Adenopathy
ii. Aorta
1. Normal dimensions
2. Aneurysm
3. Dissection
4. Rupture

iii. Inferior Vena cava

III. Pelvis

a. Bladder
   i. Normal
   ii. Diverticula
   iii. Infection/Inflammation
   iv. Anatomic variants eg. ureterocele
   v. Obstruction/ureteral jets
   vi. Mass- clot, neoplasms benign and malignant

b. Gynecologic US
   i. Normal anatomy and variant
   ii. Uterus and endometrium
   iii. Ovaries and adnexa
   iv. Cervix
   v. Acute pelvic pain
   vi. Pelvic congestion

c. Obstetrical US
   i. Technique and normal anatomy, Guideline for each trimester
   ii. First trimester
      1. Normal
         a. GS, YS, Growth, CRL, Fetal Pole, FH, Amnion, Chorion, hCG, normal growth, multiple gestation
         b. First trimester screening
      2. Abnormal
         a. Fetal evaluation
         b. Ectopic pregnancy
         c. Abortion
         d. Subchorionic hemorrhage

   iii. Second and third trimester
      1. Neurologic evaluation: Normal CNS and abnormal with emphasis on significance of findings
         a. Head
         b. Neck
         c. Spine
      2. Fetal thorax
         a. Lung
         b. Cardiac
      3. GI
      4. GU
      5. MSK
      6. Placenta, Umbilical cord, cervix

   iv. Twins

d. Scrotum
    i. Normal anatomy of scrotum, testis, spermatic cord, epididymus
    ii. Undescended testes
    iii. Hernia/inguinal canal pathology
    iv. Infection
    v. Torsion
    vi. Trauma
    vii. Infarct
    viii. Intratesticular and extratesticular masses

e. Penile
    i. Normal anatomy
    ii. Venous thromboses
    iii. Trauma

f. Prostate
    i. Endorectal US- normal anatomy
    ii. Infection and complications
    iii. Neoplasm
    iv. Intervention

IV. Neck

a. Thyroid and parathyroid
    i. Normal anatomy
    ii. Diffuse disease
    iii. Focal
        1. Benign
        2. Malignant masses

V. US guided intervention

a. Pleural collections and Thoracentesis
b. Thyroid biopsy
c. Liver biopsy
d. Renal biopsy

VI. MSK

a. Soft tissue
b. Popliteal fossa, entrapment, masses

VII. Vascular

a. Arterial
    i. Renal arteries and veins
    ii. Carotid
    iii. Peripheral arterial
        1. Upper

a. Hemodialysis graft and fistulas
b. Pseudoaneurysm, fistula

2. Lower extremity
a. Arterial insufficiency
b. Pseudoaneurysm, fistula
c. Aneurysm
d. Dissection

b. Venous
i. DVT
1. Upper extremity
2. Lower extremity

Additional topics covered in other sections

Breast US
Neonatal Head US
Bowel US in pediatrics

Required Reading:

A. First 2 rotations:
1. Diagnostic Ultrasound, Rumak CM, Wilson, SR, Charboneau, JW. Elsevier Mosby; 3rd edition (October 22, 2004) Sections on Physics, Abdominal, pelvic, and thoracic sonography, Small parts and venous sonography
2. ACR ultrasound videodisc

B. Second 2 rotations:
1. Diagnostic Ultrasound, Rumak CM, Wilson, SR, Charboneau, JW. Elsevier Mosby; 3rd edition (October 22, 2004)
2. Ultrasonography in Obstetrics and Gynecology. Callen, PW. W.B. Saunders Company; 4th edition (June 15, 2000)
2. ACR videodisc

C. Additional Reading

1. Ultrasound , the Requisites. Kurtz, AB, Middleton, W.D. C.V. Mosby; 2nd edition (December 31, 2003) good as an overview for the first rotation
2. Diagnostic Ultrasound. Rumak et al. Obstetrics and Fetal Sonography.
C. Reprints of timely/interesting journal articles/review articles which are available in the department and which can be borrowed by residents during the rotation