Ultrasound

This exam content assesses the candidate’s knowledge and skills related to the clinical practice of sonographic imaging throughout the body. Some of the content is distributed in the subspecialty sections (such as breast, musculoskeletal, and pediatric ultrasound). The domain covers gastrointestinal, genitourinary, obstetrical (including first through third trimester), vascular, head and neck, and routine findings on cardiac ultrasound (but not cardiac echo or transesophageal echo). Knowledge of gray scale, Doppler, and contrast enhanced ultrasound findings will be tested through case examples of common entities encountered during the first three years of a diagnostic radiology residency program.

Included in this document:

- Domain Critical Concepts
- Domain Blueprint
- Domain Overview

### Domain Critical Concepts

1. **Vascular**
   - a. Understand Doppler optimization and scanning technique
   - b. Be familiar with Doppler Spectral waveform analysis (arterial and venous) in normal and abnormal conditions.
   - c. Diagnose arterial stenosis
   - d. Be familiar with transplant vascular evaluation and identify normal and abnormal US findings

2. **Neck**
   - a. Identify and diagnose thyroid nodules, with recommendations for management
   - b. Understand pathologic lymph nodes / masses evaluation

3. **1st trimester OB**
   - a. Understand US scanning technique
   - b. Be familiar with image optimization
   - c. Distinguish artifacts from pathology
   - d. Identify and evaluate early pregnancy

4. **2nd/3rd trimester OB**
   - a. Identify major / common anomalies
   - b. Recognize OB Emergencies (demise, oligohydramnios, abruption, previa, abnormal placentation)
   - c. Understand standard normal OB anatomic measurements and protocols

### Domain Blueprint

1. **Breast: 0%**
   - a. Relevant and appropriate Diagnostic Ultrasonographic applications and findings in the entities are listed in the Breast section
2. Cardiac: up to 5%
   a. Does NOT include cardiac echo or transesophageal echo
   b. Does include findings reflecting cardiac disease that might be observed on a diagnostic radiology US examination
   c. Pericardial effusion
   d. Spectral Doppler waveform changes reflecting cardiac disease (such as tricuspid regurgitation, pulmonary hypertension, pericardial effusion, pulmonary embolus, aortic stenosis, aortic coarctation, aortic regurgitation, low cardiac output)
   e. Cardiac masses

3. Gastrointestinal: 15%-20%
   a. See also relevant and appropriate Diagnostic Ultrasonographic applications and findings in the entities listed in the GI section of this blueprint
   b. Liver
   c. Biliary tree
   d. Pancreas
   e. Bowel
   f. Spleen
   g. Peritoneal cavity
   h. Abdominal wall
   i. Lymph nodes
   j. Other

4. Genitourinary: 15%-20%
   a. See also relevant and appropriate Diagnostic Ultrasonographic applications and findings in the entities listed in the GU section of this blueprint
   b. Kidney
   c. Ureters
   d. Bladder
   e. Urethra
   f. Prostate
   g. Seminal vesicles
   h. Retroperitoneum
   i. Adrenal gland
   j. Penile
   k. Other

5. Head and Neck: 10%-15%
   a. Thyroid (including cervical lymph nodes)
   b. Parathyroid glands
   c. Lymph nodes
   d. Other

6. OB – 1st trimester up to 5%
   a. Abnormal placentation
   b. Ectopic pregnancy
   c. Fetal biometry and fetal growth
   d. Common congenital fetal anomalies
   e. Maternal disorders in pregnancy
f. Multiple gestations

7. OB - 2nd and 3rd trimester: up to 10%
   a. Normal findings
   b. Multiple gestations
   c. Common congenital anomalies
   d. Recognition of fetal abnormalities that require high risk obstetrics referral
   e. Borderline findings (nuchal thickening, choroid plexus cyst etc)
   f. Oligohydramnios and polyhydramnios
   g. Placental abnormalities
   h. Cervical appearance (normal and abnormal)
   i. Umbilical cord

8. Pediatrics: 0%
   a. Relevant and appropriate Diagnostic Ultrasonographic applications and findings in the entities are listed in the Pediatrics section of this blueprint

9. Thoracic: up to 5%
   a. Lung
   b. Pleural space
   c. Mediastinum
   d. Thoracic inlet (including neck)
   e. Chest wall
   f. Axilla
   g. Other

10. Vascular: 20%-25%
    a. Peripheral venous (upper and lower)
    b. Peripheral arterial (upper and lower)
    c. Arterial bypass grafts
    d. Hemodialysis fistulae/grafts
    e. Carotid and vertebral
    f. Transplants (hepatic, renal, pancreas)
    g. Hepatic Doppler
    h. Renal Doppler
    i. Aorta
    j. Inferior vena cava
    k. Mesenteric
    l. Pelvis
    m. Other

Domain Overview

1. Medical and Comprehensive knowledge
   1. “Hands-on” scanning: recognize the normal appearance as well as the most common pathology of the following:
      1. Pleural space (effusion)
      2. Peritoneal space
1. Ascites
2. Hemorrhage

3. Gallbladder
   1. Gallstones
   2. Acute cholecystitis

4. Biliary
   1. Common bile duct
   2. Biliary ductal dilatation

5. Liver
   1. Masses
   2. Steatosis
   3. Cirrhosis

6. Kidney
   1. Hydronephrosis
   2. Stones
   3. Mass/cyst

7. Pancreas
   1. Pancreatitis
   2. Mass/cyst

8. Retroperitoneal
   1. Abdominal mass
   2. Cyst
   3. Adenopathy

9. Alimentary tract
   1. Normal gut signature
   2. Appendicitis
   3. Intussusception
   4. Inflammatory bowel disease

10. Thyroid
    1. Nodules
    2. Diffuse disease

11. Parathyroid
    1. Adenoma
    2. Hyperplasia
    3. Testis/Epididymis/Scrotum
    4. Mass/cyst
    5. Torsion
    6. Trauma
    7. Infection

12. Transabdominal/transvaginal pelvis
    1. Uterus – measurement
    2. Fibroids
    3. Adenomyosis
    4. Endometrial stripe
5. Adnexal mass/cyst
6. Free fluid

13. First Trimester Pregnancy
   1. Normal
   2. Failed early intrauterine pregnancy
   3. Ectopic pregnancy

14. Obstetrics
   1. Basic fetal biometry
   2. Basic second/third trimester fetal anatomy
   3. Placental localization
   4. Amniotic fluid volume
   5. Comprehensive second/third trimester

15. Vascular
   1. Lower and upper extremity venous (deep vein thrombosis)
   2. Lower and upper extremity arterial
   3. Carotid and vertebral arteries
   4. Abdominal aorta (aneurysm, including how to measure)
   5. Abdominal Doppler
   6. Inferior vena cava (IVC)
   7. Hepatic and renal transplants

16. US guided procedures
   1. Aspiration
   2. Fine-needle aspiration (FNA)
   3. Biopsy
   4. Line placement

2. Physics/instrumentation: The resident should understand the basic principles of physics that form the foundation of clinical ultrasound.

2. Clinical applications
   1. General
      1. Understand the importance of clinical ultrasound protocols. Published guidelines from the American College of Radiology (ACR) 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.
      2. Understand the clinical uses and limitations of ultrasound, as well as the appropriate integration of other complementary cross-sectional imaging studies, particularly CT and MRI.
      3. Understand the importance of documentation, reporting, communication and reporting of critical findings.
      4. Understand the importance of clinical quality assurance, including radiologic pathologic correlation, as well as sonographer-physician discrepancies.
   2. Abdomen
      1. Liver
         1. Normal echotexture/echogenicity/size/shape
2. Normal variants
3. Diffuse disease
   1. Steatosis, including focal steatosis and focal sparing
   2. Acute and chronic hepatitis
   3. Cirrhosis
   4. Edema
4. Masses
   1. Cyst
   2. Cavernous hemangioma
   3. Focal nodular hyperplasia
   4. Adenoma
   5. Metastasis
   6. Hepatocellular carcinoma
   7. Lymphoma
   8. Cholangiocarcinoma
   9. Granuloma
   10. Hematoma
   11. Biloma
   12. Abscess
   13. Pyogenic/Echinococcal/Amebic
   14. Post-liver transplantation collections
   15. Hematoma/ Biloma/Abscess
2. Gallbladder
   1. Normal size/shape/wall
   2. Gallstones
   3. Sludge
   4. Acute cholecystitis
      1. Calculous/acalculous/gangrenous/perforated/emphysematous
   5. Other etiologies of wall thickening
      1. Polyp
      2. Hyperplastic cholecystosis
      3. Carcinoma
      4. Porcelain gallbladder
3. Bile ducts
   1. Normal intra- and extrahepatic bile duct appearance/size
   2. Normal variants
   3. Ductal dilatation
   4. Bile duct stones
   5. Cholangitis
      1. Primary sclerosing/Pyogenic/Recurrent pyogenic/AIDS
   6. Caroli disease
   7. Choledochal cysts
   8. Pneumobilia
   9. Cholangiocarcinoma
4. Pancreas
   1. Normal echotexture/echogenicity/size/shape
   2. Normal variants
   3. Pancreatic duct
   4. Masses
      1. Cyst
      2. Pseudocysts
      3. Cystic neoplasms
      4. Cancer
      5. Metastases
      6. Lymphoma
      7. Islet cell tumor
      8. Intraductal papillary mucinous neoplasm (IPMN)
4. Pancreatitis
   1. Abscess
   2. Pseudocyst
   3. Pseudoaneurysm
   4. Chronic pancreatitis
5. Spleen
   1. Normal echotexture/echogenicity/size/shape
   2. Normal variants
   3. Masses
      1. Cyst
      2. Lymphoma
      3. Metastases
      4. Abscess
      5. Infarct
      6. Granuloma
6. Trauma
7. Peritoneal cavity
   1. Normal anatomy
   2. Ascites
   3. Hemorrhage
   4. Abscess
   5. Omental/peritoneal metastasis
   6. Omental infarct
   7. Mesothelioma
   8. Free air
8. Gastrointestinal tract
   1. Normal gut ultrasound signature
   2. Acute appendicitis
   3. Diverticulitis
   4. Inflammatory bowel disease (Crohn disease, ulcerative colitis)
   5. Colitis
6. Bowel obstruction (including intussusception, malignancy)
7. Cancer
8. Lymphoma
9. GI stromal tumor (GIST)
10. Fistulae, abscess

8. Abdominal wall
1. Normal echogenicity/echotexture
2. Hematoma
3. Abscess
4. Hernia
5. Masses
   1. Primary tumor
   2. Metastasis
   3. Lymphoma
   4. Desmoids tumor
   5. Lipoma
   6. Endometriosis

9. Organ transplants: see vascular section

3. Urinary Tract and Adrenal Glands

1. Kidney
   1. Normal echotexture/echogenicity/size/shape
   2. Normal variants/congenital anomalies
   3. Calculi
   4. Hydronephrosis
   5. Glomerular & interstitial renal disease
   6. Cysts
      1. Simple
      2. Complex
      3. Peripelvic
      4. Adult polycystic disease
      5. Acquired renal cystic disease
   7. Perinephric fluid/collections
   8. Masses
      1. Angiomyolipoma
      2. Oncocytoma
      3. Multilocular cystic nephroma
      4. Renal cell carcinoma
      5. Transitional cell carcinoma
      6. Lymphoma
      7. Metastasis
   9. Infection
      1. Pyelonephritis
      2. Xanthogranulomatous pyelonephritis
      3. Emphysematous pyelonephritis
4. Abscess
5. Perinephric abscess
6. Medullary nephrocalcinosis
7. Infiltrative disease
8. Renal transplant (see vascular section)

2. Ureters
   1. Dilatation of the collecting system
   2. Megaureter
   3. Ureteroceles (including ectopic ureteroceles)
   4. Ureteral stone
   5. Pyonephrosis
   6. Clot in collecting system
   7. Transitional cell cancer
   8. Stents

3. Urinary bladder
   1. Normal size/shape/wall
   2. Calculi
   3. Wall thickening
   4. Ureteral jets
   5. Bladder volume, including post-void residual
   6. Masses
      1. Transitional cell carcinoma
      2. Pheochromocytoma
      3. Endometriosis
   7. Cystitis, including emphysematous cystitis
   8. Hemorrhage
   9. Wall thickening
   10. Bladder outlet obstruction
   11. Diverticula
   12. Ureteroceles, including ectopic ureteroceles
   13. Ureterovesical junction (UVJ) stone
   14. Fungus balls

4. Adrenal glands
   1. Normal echotexture/echogenicity/size/shape
   2. Masses
      1. Adenoma
      2. Pheochromocytoma
      3. Myelolipoma
      4. Metastasis
      5. Lymphoma
      6. Cancer
      7. Hemorrhage

4. Gynecology
   1. Uterus
1. Normal echotexture/echogenicity/size/shape

2. Endometrium
   1. Normal appearance during phases of menstrual cycle
   2. Thickness measurement
      i. Premenopausal
      ii. Postmenopausal
      iii. Effects of hormone replacement
   3. Normal variants/congenital anomalies
   4. Intrauterine device
      i. Normal location
      ii. Displaced/extruded
   5. Endometrial fluid
   6. Endometrial polyp
   7. Endometrial hyperplasia
   8. Endometrial carcinoma
   9. Endometritis

3. Myometrium
   1. Fibroids
   2. Leiomyosarcoma
   3. Adenomyosis

2. Ovary
   1. Normal echotexture/echogenicity/size/shape, including physiologic variation during phases of menstrual cycle
      1. Follicles
      2. Corpus luteum
      3. Hemorrhagic ovarian cyst
   2. Polycystic ovarian disease
   3. Ovarian hyperstimulation syndrome
   4. Masses/Cysts
      1. Simple/hemorrhagic/ruptured ovarian cyst
      2. Endometrioma
      3. Cystadenoma/carcinoma
      4. Dermoid
      5. Fibroma and other stromal tumors
      6. Germ cell tumor
      7. Metastasis
   5. Ovarian torsion
   6. Pelvic inflammatory disease
      1. Tubo-ovarian abscess
   7. Ovarian cancer, including staging

3. Cervix
   1. Normal echotexture/echogenicity
   2. Stenosis
   3. Polyp
4. Cancer
5. Fibroid

4. Fallopian tube
   1. Hydrosalpinx
   2. Pyosalpinx
   3. Postoperative changes
   4. Essure devices

5. Post-hysterectomy appearance of pelvis

6. Free pelvic fluid

7. Peritoneal inclusion cyst

5. Obstetrics

1. First trimester
   1. Normal findings of intrauterine gestational sac
      1. Size
      2. Gestational sac growth
      3. Yolk sac
      4. Embryo
      5. Cardiac activity, including normal embryonic heart rate
      6. Amnion
      7. Chorion
      8. Chorionic villus sampling (CVS)/Amniocentesis
      9. Normal early fetal anatomy/growth
      10. Crown-rump length measurement
      11. Correlation with \( \beta \)-hCG levels and menstrual dates
   2. Multiple gestations (chorionicity and amnionicity)
   3. Failed early pregnancy
      1. Spontaneous complete/incomplete abortion
      2. Anembryonic gestation
      3. Embryonic demise
      4. Subchorionic hematoma
   4. Ectopic pregnancy, including unusual ectopic pregnancy
      1. Interstitial
      2. Cervical
      3. Ovarian
      4. Scar (Caesarian delivery)
      5. Abdominal
      6. Rudimentary horn
   5. Gestational trophoblastic disease
   6. Nuchal translucency
   7. Embryonic structural abnormalities, anencephaly

2. Second and third trimester
   1. Normal findings
      1. Normal fetal anatomy/situs/development
      2. Placenta
3. Biometry
4. Amniotic fluid volume

2. Multiple gestations
3. Common congenital anomalies
4. Recognition of fetal abnormalities that require high-risk obstetrics referral
   1. Intrauterine growth retardation
   2. Hydrops
   3. Holoprosencephaly
   4. Hydrocephalus
   5. Neural tube defects
   6. Multicystic dysplastic kidney
   7. Hydronephrosis
   8. Anencephaly
9. Chromosomal abnormalities and syndromes
   i. Down syndrome
   ii. Turner syndrome
10. Hydrops
11. Congenital infections
12. Chest masses
13. Cardiac malformations and arrhythmias
14. Diaphragmatic hernia
15. Abdominal wall defects
16. Abdominal masses
17. Gastrointestinal tract obstruction/abnormalities
18. Ascites
19. Skeletal dysplasias
20. Cleft lip/palate
21. Complications of twin pregnancy
22. Hydranencephaly

5. Borderline findings
   1. Nuchal thickening
   2. Choroid plexus cyst
   3. Echogenic cardiac focus
   4. Echogenic bowel
   5. Borderline hydrocephalus

6. Oligohydramnios
   1. Spontaneous premature rupture of membranes
   2. Renal disease
   3. Fetal death
   4. Intrauterine growth retardation
   5. Infection

7. Polyhydramnios

8. Placenta
1. Placenta previa
2. Vasa previa
3. Abruption
4. Percreta-, increta- and accreta
5. Placental masses
6. Succenturiate placenta

9. Cervical appearance and length, cervical incompetence

10. Umbilical cord
   1. Two-vessel umbilical cord
   2. Cord masses
   3. Placental cord insertion site
   4. Velamentous cord insertion
   5. Cord prolapse
   6. Umbilical cord Doppler
   7. Fetal cranial Doppler
   8. Biophysical profile
   9. Guidance for amniocentesis
   10. Retained products of conception

6. Thyroid/neck
   1. Thyroid
      1. Normal echotexture/echogenicity/size/shape
      2. Hashimoto thyroiditis
      3. Graves disease
      4. Subacute thyroiditis
      5. Characterization of thyroid nodules
         1. Benign nodules
            i. Colloid cysts
            ii. Cysts
         2. Malignant nodules
            i. Papillary carcinoma
            ii. Follicular neoplasm
            iii. Medullary carcinoma
            iv. Anaplastic carcinoma
            v. Lymphoma
            vi. Metastasis
      3. Non-specific nodules
      4. Multinodular goiter
   6. National consensus guidelines for performing fine-needle aspiration (FNA)
   7. Post-thyroidectomy neck surveillance for recurrence of papillary thyroid cancer – role of ultrasound
      1. Central versus lateral neck, levels

2. Parathyroid
   1. Normal
2. Adenoma
3. Carcinoma
4. Hyperplasia

3. Congenital cysts
   1. Branchial cleft cyst
   2. Thyroglossal duct cyst

4. Lymph nodes
   1. Normal echotexture/echogenicity/size/shape
   2. Benign reactive
   3. Metastasis (including surveillance for papillary thyroid cancer)
   4. Lymphoma

5. Salivary glands
   1. Normal echotexture/echogenicity/size/shape
   2. Benign and malignant neoplasms
      1. Pleomorphic adenoma
      2. Warthin tumor
      3. Adenoid cystic carcinoma
      4. Mucoepidermoid carcinoma
   3. Infection
   4. Inflammation
   5. Stones

7. Chest
   1. Normal anatomy
   2. Pleural effusion
   3. Atelectasis
   4. Pneumonia
   5. Lung cancer
   6. Lung metastasis
   7. Pleural metastasis

8. Adenopathy
   1. Mediastinal and axillary
   2. Metastasis
   3. Lymphoma
   4. Reactive

9. Mediastinal tumors

10. Chest wall
    1. Hematoma
    2. Abscess
    3. Primary tumor
    4. Metastasis
    5. Lymphoma
    6. Lipoma

8. Vascular/Doppler
   1. Aorta and mesenteric branches
1. Normal size/measurements/appearance/Doppler waveform
2. Normal variants
3. Aneurysm
4. Dissection
5. Thrombosis
6. Status post stent graft placement including endoleak
7. Status post surgery
8. Coarctation
9. Stenosis
10. Mesenteric ischemia
11. Mesenteric aneurysms
12. Pseudoaneurysms
13. Mesenteric venous thrombosis

2. Spleen
   1. Normal artery and vein size/appearance/Doppler waveform
   2. Normal variants
   3. Artery
      1. Thrombosis
      2. Aneurysm
   4. Vein
      1. Thrombosis
   5. Infarction

3. Lower and upper extremity arterial
   1. Normal appearance and Doppler waveforms
   2. Stenosis
   3. Occlusion/thrombosis
   4. Post catheterization complications
      1. Pseudoaneurysm/Arteriovenous fistula/dissection/hematoma
   5. Arterial bypass graft
      1. Normal and abnormal
   6. Peripheral vascular aneurysm

4. Renal artery
   1. Normal appearance and Doppler waveform
   2. Stenosis
   3. Occlusion
   4. Bypass grafts
   5. Stent/Angioplasty
   6. Aneurysm
   7. Arteriovenous fistula/malformation
   8. Fibromuscular dysplasia
   9. Infarction

5. Renal vein
   1. Normal appearance and Doppler waveform
   2. Thrombosis (bland and tumor)
3. Arteriovenous fistula/malformation

6. Carotid artery
   1. Normal appearance and Doppler waveforms
   2. Atherosclerotic plaque/Fibrointimal thickening
   3. Stenosis
   4. Occlusion
   5. Waveform analysis
   6. Dissection
   7. Arteriovenous fistula
   8. Aneurysm
   9. Pseudoaneurysm
  10. Status post carotid endarterectomy and stent
      1. Normal
      2. Restenosis
      3. Complications

7. Vertebral artery
   1. Normal appearance and Doppler waveforms
   2. Normal variants
   3. Stenosis/Occlusion (proximal or distal)
   4. Subclavian steal syndrome
   5. Partial subclavian steal

8. Hemodialysis graft/fistula
   1. Normal appearance and Doppler waveforms
   2. Stenosis
   3. Occlusion (including outflow)
   4. Lack of maturation
   5. Fluid collections
   6. Pseudoaneurysms
   7. steal

9. Inferior vena cava
   1. Normal appearance and Doppler waveform
   2. Thrombosis (bland and tumor)
   3. Filter
   4. Masses

10. Lower and upper extremity venous
   1. Normal appearance and Doppler waveform
   2. Deep vein thrombosis
   3. Arteriovenous fistula
   4. Tricuspid regurgitation, right heart failure
   5. Chronic venous insufficiency
   6. Pre-arterial bypass graft/dialysis access vein mapping
   7. Nonvascular causes of leg pain and swelling

11. Hepatic vasculature (native)
1. Normal hepatic artery, portal vein and hepatic vein size/appearance/Doppler waveform
2. Normal variants
3. Portal vein
   1. Bland thrombosis
   2. Tumor thrombus
   3. Cavernous transformation
   4. Para umbilical vein
   5. Varices
4. Hepatic artery
   1. Thrombosis
   2. Stenosis
   3. Aneurysm/Pseudoaneurysm
5. Hepatic vein
   1. Bland thrombosis
   2. Tumor thrombus
   3. Budd-Chiari syndrome
   4. Stenosis
   5. Infarction
12. Hemodynamics of cirrhosis, portal hypertension, and varices
13. TIPS evaluation
   1. Normal appearance and Doppler waveforms
   2. Stenosis
   3. Occlusion
   4. Complications
14. Renal transplant
   1. Normal appearance and Doppler arterial and venous waveforms
   2. Causes of elevation of arterial resistive index
      1. Rejection
      2. Acute tubular necrosis
      3. Page kidney
      4. Hydronephrosis
      5. Pyelonephritis
      6. Renal vein thrombosis
   3. Renal infarction
   4. Post-biopsy complications
      1. Hematoma
      2. Pseudoaneurysm
      3. Arteriovenous fistula
   5. Renal arterial stenosis/thrombosis
   6. Renal vein stenosis/thrombosis
   7. Peritransplant fluid collections
   8. Post-transplant lymphoproliferative disorder/masses
   9. Pyelonephritis
10. Clot/pus in the collecting system

15. Liver transplants
   1. Normal appearance and Doppler arterial and venous waveforms
   2. Hepatic artery stenosis/thrombosis
   3. Resistive index
   4. Portal vein thrombosis/stenosis
   5. Hepatic vein thrombosis/stenosis
   6. Post-biopsy complications
      1. Hematoma
      2. Pseudoaneurysm
      3. Arteriovenous fistula
   7. Inferior vena cava stenosis/thrombosis
   8. Intrahepatic and peri-hepatic fluid collections
   9. Post-transplant lymphoproliferative disorder
  10. Abnormalities of the biliary tree

16. Pancreas transplant
   1. Normal appearance
   2. Arterial and venous thrombosis/stenosis
   3. Pancreatitis
   4. Peritransplant fluid collections
   5. Pseudoaneurysm

9. Scrotum
   1. Testes
      1. Normal echotexture/echogenicity/size/shape
      2. Orchitis
      3. Abscess
      4. Cysts
         1. Intratesticular
         2. Tunica cyst
      5. Cystic ectasia of rete testis
      6. Torsion/Detorsion
      7. Microlithiasis
     8. Masses
        1. Germ cell tumor
        2. Lymphoma
        3. Metastasis
        4. Stromal tumor
        5. Epidermoid cyst
        6. Infarct/hematoma
      9. Focal atrophy/fibrosis
     10. Sarcoidosis
     11. Tuberculosis
     12. Trauma
     13. Nondescended testis
2. Epididymis
   1. Normal echotexture/echogenicity/size/shape
   2. Epididymitis
   3. Spermatocele/cyst
   4. Adenomatoid tumor

3. Other
   1. Hydrocele
   2. Pyocele
   3. Fournier gangrene
   4. Scrotal edema
   5. Hematocele
   6. Varicocele
   7. Hernia
   8. Nondescended testis

10. Interventional
   1. Pre-procedural evaluation
      1. Coagulation laboratory studies
      2. Anticoagulation medication
      3. Stratification of risk for percutaneous procedures
   2. Informed consent
   3. Sterile technique
   4. Techniques for ultrasound-guided invasive procedures: understanding important landmarks and pitfalls of percutaneous procedures, including recognition of critical structures to be avoided
   5. Localization of fluid for paracentesis or thoracentesis to be performed by another service
   6. Ultrasound-guided paracentesis
   7. Ultrasound-guided thoracentesis
   8. Aspiration of fluid collections, cysts
   9. Biopsy of soft tissue masses
   10. Fine needle aspiration versus core biopsy in specific applications
       1. Focal liver mass
       2. Renal mass
       3. Thyroid/parathyroid mass
       4. Lymphadenopathy
   11. Random core liver biopsy
   12. Random core renal biopsy
   13. Catheter placement for abscess and fluid drainage (pleural, peritoneal, and other spaces)
   14. Postprocedural evaluation
       1. Radiographic studies
       2. Patient monitoring
       3. Management of complications
15. Pseudoaneurysm management: contraindications and technique of non-surgical treatment with ultrasound-guided compression repair versus thrombin injection

16. Intraoperative ultrasound guidance