

# Ultrasound

This exam content assesses the candidate's knowledge and skills related to the clinical practice of ultrasound. 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 thoracic ultrasound (but not cardiac echo or transesophageal echo). Knowledge of scanning technique, image acquisition, and anatomy as well as gray scale, Doppler, elastography, 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.

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[Domain Critical Concepts](#)

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## **Domain Critical Concepts**

1. Scanning technique
  - a. Understand how to optimize image acquisition
  - b. Understand how to appropriately image and measure structures
  - c. Recognize basic normal anatomy
  - d. Distinguish artifacts from pathology; understand the cause and significance of common ultrasound artifacts, how to eliminate or mitigate artifacts, and how to distinguish artifacts from pathology
2. Vascular
  - a. Understand Doppler technique and optimization
  - b. Be familiar with Doppler finding including spectral Doppler waveform analysis (arterial and venous) in normal and abnormal conditions.
  - c. Diagnose arterial and venous pathology
  - d. Be familiar with transplant vascular evaluation and recognize normal and abnormal US findings
3. Neck
  - a. Identify, diagnose, and manage diffuse thyroid disease, thyroid nodules, parathyroid conditions, and salivary gland disease
  - b. Recognize and manage pathologic lymph nodes and soft tissue mass evaluation
4. 1st trimester OB
  - a. Be familiar with image optimization and endovaginal technique
  - b. Distinguish artifacts from pathology
  - c. Recognize the normal ultrasound findings of early pregnancy
  - d. Distinguish intrauterine from ectopic pregnancy and pregnancy of unknown location, retained products of conception, failed pregnancy, and gestational trophoblastic neoplasia
  - e. Recognize predictors of poor prognosis
5. 2nd/3rd trimester OB

- a. Identify major / common anomalies
  - b. Recognize OB Emergencies (demise, oligohydramnios, polyhydramnios, incompetent cervix, abruption, previa, abnormal placentation)
  - c. Understand standard normal OB anatomic measurements and protocols
6. Basics of US guidance for interventions

### **Domain Blueprint**

1. Breast: 0%
  - a. Relevant and appropriate Diagnostic Ultrasonographic applications and findings are listed in the Breast section
2. Cardiac: up to 5%
  - a. Does NOT specifically 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 on vascular US exams reflecting cardiac disease
  - 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
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. Scrotal
  - l. Uterus
  - m. Adnexa

5. Head and Neck: 10%-15%
  - a. Thyroid
  - b. Parathyroid glands
  - c. Lymph nodes
  - d. Salivary Glands
  - e. Masses
6. Musculoskeletal 0%
  - a. Relevant and appropriate Diagnostic Ultrasonographic applications and findings in the entities are listed in the MSK section.
7. OB:10-15%
  - a. Normal findings, all trimesters
  - b. Failed or failing first trimester pregnancy
  - c. Ectopic pregnancy
  - d. Multiple gestations
  - e. Common congenital anomalies
  - f. Recognition of fetal abnormalities that require high risk obstetrics referral
  - g. Borderline findings (nuchal thickening, choroid plexus cyst etc)
  - h. Oligohydramnios and polyhydramnios
  - i. Placental abnormalities
  - j. Cervix (normal and abnormal)
  - k. Umbilical cord
  - l. Postpartum complications
  - m. Biophysical profile
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
  - e. Chest wall
  - f. Axilla
10. Ultrasound guidance for interventions: up to 5%
  - a. Paracentesis and thoracentesis techniques
  - b. Drainage of fluid collections
  - c. FNA thyroid nodules
  - d. Soft tissue biopsies
  - e. Intraoperative biopsies
  - f. Identification of post procedure complications
11. Vascular: 20%-25%
  - a. Peripheral venous (upper and lower)
  - b. Peripheral arterial (upper and lower)
  - c. Arterial bypass grafts, stents, EVAR
  - d. Hemodialysis fistulae/grafts

- e. Carotid and vertebral arteries
- f. Transplants (hepatic, renal, pancreas)
- g. Hepatic Doppler
- h. Renal Doppler
- i. Aorta
- j. Inferior vena cava
- k. Mesenteric vessels
- l. Pelvic vasculature

## **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
    2. Peritoneal space
    3. Gallbladder
    4. Bile ducts
    5. Liver
    6. Kidney/bladder/urethra
    7. Pancreas
    8. Spleen
    9. Retroperitoneum
    10. Bowel
    11. Thyroid
    12. Parathyroid
    13. Scrotum
    14. Transabdominal/transvaginal pelvis
    15. Obstetrics
    16. Vascular
    17. US guided procedures
  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. Diffuse disease
  1. Steatosis, including focal steatosis and focal sparing
  2. Acute and chronic hepatitis
  3. Cirrhosis
  4. Edema
  5. Elastography
3. 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. Post-liver transplantation collections

### 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
  5. Systemic

### 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)
  5. 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
    7. Hemangioma
  4. Trauma
6. Peritoneal cavity
1. Normal anatomy
  2. Ascites
  3. Hemorrhage
  4. Abscess
  5. Omental/peritoneal metastasis
  6. Omental infarct
  7. Mesothelioma

- 8. Free air
- 7. 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. Lymphoma
  - 6. Metastasis
- 9. Infection
  - 1. Pyelonephritis
  - 2. Xanthogranulomatous pyelonephritis
  - 3. Emphysematous pyelonephritis
  - 4. Abscess
  - 5. Perinephric abscess
- 10. Other
  - 1. Medullary nephrocalcinosis
  - 2. Infiltrative disease
  - 3. Renal transplant (see vascular section)
- 2. Ureters and renal collecting system
  - 1. Dilatation of the collecting system
  - 2. Megaureter
  - 3. Ureterocele (including ectopic ureterocele)
  - 4. Ureteral stone
  - 5. Pyonephrosis
  - 6. Clot in collecting system
  - 7. Urothelial 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. Urothelial carcinoma
    - 2. Pheochromocytoma
    - 3. Endometriosis
  - 7. Cystitis, including emphysematous cystitis
  - 8. Hemorrhage
  - 9. Wall thickening
  - 10. Bladder outlet obstruction
  - 11. Diverticula
  - 12. Ureterocele, including ectopic ureterocele
  - 13. Ureterovesical junction (UVJ) stone
  - 14. Fungus balls
- 4. Adrenal glands
  - 1. Normal echotexture/echogenicity/size/version/flexion, including pre versus post menopausal appearance
  - 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/version/flexion, including pre versus post menopausal appearance
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 sonographic architecture/size, including physiologic variation during phases of menstrual cycle
  1. Follicles
  2. Corpus luteum
2. Polycystic ovarian syndrome
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
7. Ovarian cancer
3. Cervix
  1. Normal sonographic architecture
  2. Stenosis
  3. Polyp
  4. Cancer
  5. Fibroid
4. Fallopian tube
  1. Hydrosalpinx
  2. Pyosalpinx
5. Post-hysterectomy appearance of pelvis
6. Free pelvic fluid
7. Peritoneal inclusion cyst
5. Obstetrics
  1. First trimester
    1. Normal findings of intrauterine pregnancy
      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 hCG levels and menstrual dates
    2. Multiple gestations (chorionicity and amnionicity)
    3. Failed early pregnancy
      1. Spontaneous complete/incomplete abortion
      2. Anembryonic gestation (failed IUP)
      3. Embryonic demise
      4. Predictors of poor prognosis
      5. Subchorionic hematoma
    4. Ectopic pregnancy, including unusual ectopic pregnancy locations
      1. Tubal
      2. Interstitial
      3. Cervical
      4. Ovarian
      5. Scar (Caesarian)
      6. Abdominal
      7. 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/standard measurements/dating
    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. Hydrancephaly
    10. Chromosomal abnormalities and syndromes
    11. Hydrops
    12. Congenital infections
    13. Chest masses
    14. Cardiac malformations and arrhythmias
    15. Diaphragmatic hernia
    16. Abdominal wall defects
    17. Abdominal masses
    18. Gastrointestinal tract obstruction/abnormalities
    19. Ascites
    20. MSK abnormalities including skeletal dysplasias, club foot, polydactyly
    21. Cleft lip/palate
    22. Complications of twin pregnancy
  5. Borderline findings
    1. Nuchal thickening
    2. Choroid plexus cyst
    3. Echogenic cardiac focus
    4. Echogenic bowel
    5. Borderline hydrocephalus
    6. Hydronephrosis versus extrarenal pelvis

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, length, and 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
11. Fetal Cranial Doppler
12. Biophysical Profile
13. Guidance for amniocentesis
14. Post-partum abnormalities
6. Thyroid/neck
  1. Thyroid
    1. Normal echotexture/echogenicity/size
    2. Congenital variants
    3. Diffuse thyroid conditions
      1. Hashimoto thyroiditis
      2. Graves disease
      3. Subacute thyroiditis
    4. 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
    - vii. Cervical lymph nodes
  - 3. Non-specific nodules
  - 4. Multinodular goiter
- 5. National consensus guidelines for performing fine-needle aspiration (FNA/ use of TIRADS)
- 6. Post-thyroidectomy neck surveillance for recurrence of papillary thyroid cancer – role of ultrasound
  - 1. Central versus lateral neck, nodal 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. Lymph node level classification

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

6.Other neck masses

- 1. Squamous cell carcinoma
- 2. Benign and malignant soft tissue neoplasms
- 3. Epidermal inclusion cyst
- 4. Neck infections

7. Chest

- 1.Normal anatomy
- 2.Pleural effusion
- 3.Pneumothorax
- 4.Atelectasis
- 5.Pneumonia

- 6. Lung cancer
- 7. Lung metastasis
- 8. Pleural metastasis
- 9. Adenopathy
  - 1. Mediastinal and axillary
  - 2. Metastasis
  - 3. Lymphoma
  - 4. Reactive
- 10. Mediastinal tumors
- 11. 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/spectral Doppler waveform
    - 2. Aneurysm
    - 3. Dissection
    - 4. Thrombosis
    - 5. Post operative interventional (EVAR, stent, arterial bypass graft) findings including endoleak
    - 6. Coarctation
    - 7. Stenosis
    - 8. Mesenteric ischemia
    - 9. Mesenteric aneurysms
    - 10. Pseudoaneurysms
  - 2. Mesenteric venous thrombosis
    - 1. Bland
    - 2. Malignant
  - 3. Spleen
    - 1. Normal artery and vein size/appearance/Doppler waveform
    - 2. Artery
      - 1. Thrombosis
      - 2. Aneurysm
    - 3. Vein
      - 1. Thrombosis
      - 2. Varices
    - 4. Infarction
  - 4. Lower and upper extremity arterial
    - 1. Normal appearance and spectral Doppler waveforms
    - 2. Stenosis

3. Occlusion/thrombosis
  4. Post catheterization or post traumatic complications
    1. Pseudoaneurysm/Arteriovenous fistula/dissection/hematoma
  5. Arterial bypass graft
    1. Normal
    2. Abnormal
  6. Peripheral vascular aneurysm
  7. Thoracic outlet syndrome
  8. Radial artery mapping
5. Renal artery
1. Normal appearance and spectral Doppler waveform
  2. Stenosis
  3. Occlusion
  4. Dissection
  5. Bypass grafts
  6. Stent/Angioplasty
  7. Aneurysm/pseudoaneurysm
  8. Arteriovenous fistula/malformation
  9. Fibromuscular dysplasia
  10. Renal infarction
  11. Post biopsy complication
  12. Subcapsular hematoma
6. Renal vein
1. Normal appearance and spectral Doppler waveform
  2. Congenital anomalies
  3. Thrombosis (bland and tumor)
  4. Nutcracker phenomenon
  5. Arteriovenous fistula/malformation
7. Carotid artery
1. Normal appearance and spectral Doppler waveforms
  2. Atherosclerotic plaque/Fibrointimal thickening
  3. Stenosis and mimics
  4. Occlusion
  5. Waveform analysis
    1. Changes reflective of proximal or distal cardio/cerebral vascular disease
    2. Iatrogenic complications
  6. Dissection
  7. Arteriovenous fistula
  8. Aneurysm
  9. Pseudoaneurysm
  10. Carotid body tumor
  11. Vasculitis (FMD, Takayasu arteritis, radiation arteritis, giant cell arteritis)
  12. Status post carotid endarterectomy and stent

1. Normal
2. Restenosis
3. Complications

#### 8. Vertebral artery

1. Normal appearance and spectral Doppler waveforms
2. Normal variants
3. Stenosis/Occlusion (proximal or distal)
4. Subclavian steal syndrome
5. Partial subclavian steal
6. Complications of trauma (dissection, PSA, AVF)

#### 9. Hemodialysis graft/fistula

1. Normal appearance and spectral Doppler waveforms
2. Stenosis
3. Occlusion
4. Lack of maturation
5. Fluid collections
6. Pseudoaneurysms
7. Steal

#### 10. Inferior vena cava

1. Normal appearance and spectral Doppler waveform
2. Congenital variants
3. Thrombosis (bland and tumor)
4. Filter
5. Masses

#### 11. Lower and upper extremity venous

1. Normal appearance and spectral Doppler waveform analysis
2. Deep vein thrombosis, acute and chronic
3. Superficial venous thrombosis
4. Arteriovenous fistula
5. Tricuspid regurgitation, right heart failure
6. Proximal obstruction to flow
7. Chronic venous insufficiency
8. Pre-arterial bypass graft/dialysis access vein mapping
9. Nonvascular causes of leg pain and swelling

#### 12. Hepatic vasculature (native)

1. Normal hepatic artery, portal vein and hepatic vein size/appearance/spectral Doppler waveform
2. Normal variants
3. Hemodynamics of cirrhosis, portal hypertension, and CHF/tricuspid regurgitation
4. Portal vein
  1. Bland thrombosis
  2. Tumor in vein
  3. Cavernous transformation



4. Varices
  5. Hepatic artery
    1. Thrombosis
    2. Stenosis
    3. Aneurysm/Pseudoaneurysm/AVF
  6. Hepatic vein
    1. Bland thrombosis
    2. Tumor in vein
    3. Budd-Chiari syndrome
    4. Stenosis
13. TIPS evaluation
1. Normal appearance and spectral Doppler waveforms
  2. Stenosis
  3. Occlusion
  4. Complications
14. Renal transplant
1. Normal appearance of spectral 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/debris in the collecting system
15. Liver transplant
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
    - 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
    - 2. Epididymitis
    - 3. Spermatocele/cyst
    - 4. Adenomatoid tumor and other masses
    - 5. Appearance after vasectomy
  - 3. Other
    - 1. Hydrocele
    - 2. Pyocele
    - 3. Fournier gangrene

4. Scrotal edema/cellulitis
5. Hematocele
6. Varicocele
7. Hernia
8. Nondescended testis

10. Interventional

1. Techniques for ultrasound-guided invasive procedures: understanding important landmarks and pitfalls of percutaneous procedures, including recognition of critical structures to be avoided
2. Ultrasound-guided paracentesis
3. Ultrasound-guided thoracentesis
4. Aspiration of fluid collections, cysts
5. Biopsy of soft tissue masses
6. Fine needle aspiration versus core biopsy in specific applications
  1. Focal liver mass
  2. Renal mass
  3. Thyroid/parathyroid mass
  4. Lymphadenopathy
7. Random core liver biopsy
8. Random core renal biopsy
9. Intraoperative ultrasound guidance
10. Identification of post procedure complications