Breast Imaging

Cardiovascular Imaging

Gastrointestinal Imaging

Genitourinary Imaging

Interventional Radiology

Musculoskeletal Imaging

Neuroradiology

Nuclear Radiology

Pediatric Radiology

RISC

Thoracic Imaging

Ultrasound

Breast Imaging

This exam content evaluates the candidate's knowledge and skills related to the clinical practice of breast imaging. The domain encompasses mammography, ultrasound, and breast MRI technologies. Screening and diagnostic concepts as well as interventional and therapeutic procedures will be included.

Included in this document:

Domain Critical Concepts
Domain Blueprint
Domain Overview

Domain Critical Concepts

1. Recognize cancer on:
    a. Mammography
    b. Ultrasound
    c. MRI
2. Differentiate benign vs malignant calcifications
3. Recognize benign processes in the breast
4. Recognize and understand management of breast abscess
5. Recognize male breast cancer vs gynecomastia
6. Understand rad-path correlation for breast biopsy results—concordant versus discordant
7. Correctly use BI-RADS assessment categories
8. Understand breast interventional procedures—indications, approach, technique, complications

Domain Blueprint

1. Screening: 1%-5%
    a. Anatomy
    b. Lesion detection/CAD
    c. Risk analysis (demographics)
2. Regulations/Standards: 1%-5%
    a. BI-RADS
    b. Medical audit
    c. MQSA
3. Technique: 1%-5%
    a. Views
    b. Positioning
    c. Equipment
    d. Image display/MRI CAD/US harmonics/workstations/etc.
4. Pathology: 5%-10%
    a. Benign breast disease
    b. High risk lesions
    c. Invasive ductal NOS
    d. DCIS

    e. Special cancer types
5. Symptomatic: 5%-10%
    a. Discharge
    b. Lump/thickening
    c. Nipple retraction/skin changes
    d. Pain
6. Inflammatory: 1%-5%
7. Calcifications: 10%-15%
    a. Benign
    b. Malignant
8. Masses: 10%-15%
    a. Benign
    b. Malignant
9. Architectural distortion: 1%-5%
10. Asymmetry: 1%-5%
11. Lymph nodes: 1%-5%
12. Male: 1%-5%
13. Post-operative breast: 1%-5%
14. BC Workup: 5%-10%
    a. Staging/surgical planning
    b. Specimen radiography
    c. Post BCT
15. Anatomy 1%-5%
16. Breast MRI 5%-10%
    a. Normal physiology and anatomy
    b. Kinetics
    c. Pathology

Domain Overview

1. Regulatory/Standards of Care
    1. Components and desired goals of the medical audit for breast cancer detection
    2. Appropriate application of the Breast Imaging Reporting and Data System (BI-RADS) terminology and assessment categories
    3. Mammography Quality Standards Act (MQSA) requirements
    4. Quality determinants of mammography, breast ultrasound, and breast MRI, including positioning, image processing, artifacts, optimal technique, and equipment
2. Screening
    1. Indications
    2. Normal anatomy (mammography, ultrasound, MRI)
    3. Lesion detection and localization
    4. Computer-aided detection
    5. Breast cancer risk factors, including the identification and management of women at high risk for breast cancer
3. Diagnostic Breast Imaging
    1. Appropriate mammographic views for work-up of a breast lesion
    2. Evaluate and manage women and men with breast symptoms
        1. Palpable masses

        2. Breast thickening
        3. Nipple discharge
        4. Nipple retraction
        5. Skin changes
        6. Pain
    3. Appearance and management of inflammatory processes in the breast
        1. Benign
        2. Malignant
    4. Role of imaging in surgical staging and surgical planning in women with recently diagnosed breast cancer
    5. Normal and abnormal appearance after surgical procedures
        1. Breast implants
        2. Breast augmentation
        3. Breast reduction
        4. Breast reconstruction
        5. Normal and abnormal appearance of breast-conserving therapy
4. Pathology
    1. Appearance and management of benign breast lesions, high-risk lesions, ductal carcinoma in situ, invasive ductal carcinoma, and other special types of breast carcinoma
    2. Appearance and causes of benign and malignant male breast disease
5. Imaging findings
    1. Characteristics of benign and malignant breast calcifications
    2. Characteristics of benign and malignant breast masses
    3. Identify and appropriately manage imaging findings
        1. Mammography
            1. Abnormal calcifications
            2. Masses
            3. Asymmetries
            4. Architectural distortion
        2. Ultrasound
            1. Masses
            2. Architectural distortions
            3. Normal anatomic structures
        3. Breast MRI
            1. Masses
            2. Non-mass findings
            3. Background parenchymal enhancement
    4. Identify and understand the causes of abnormal lymph nodes on mammography, ultrasound, or MRI
6. Breast Intervention
    1. Percutaneous breast biopsy techniques
        1. Wire localization/Mag seed placement
        2. Core biopsy
        3. Vacuum-assisted biopsy
        4. Fine-needle aspiration
        5. Galactography
        6. Cyst aspiration

2. Specimen radiography
3. Concordant versus discordant percutaneous biopsy results for imaging appearance of a breast abnormality and appropriate management
4. Patient safety

Cardiovascular Imaging

This exam content assesses the candidate's knowledge and skills related to the clinical practice of cardiovascular imaging. (Please note that vascular interventions will be covered under the interventional radiology portion of the exam.) The domain encompasses mostly CT and MR. Radiography of cardiovascular conditions will be covered by thoracic radiology.

Included in this document:

Domain Critical Concepts
Domain Blueprint
Domain Overview

Domain Critical Concepts

1. Identify imaging findings of myocardial ischemia and infarction
    a. Coronary artery territories
    b. Approach to atherosclerosis on CT
    c. Complications of infarction
2. Diagnose infiltrative cardiomyopathies
3. Recognize the diagnosis and management of acute aortic syndromes on CT/MR
4. Diagnose anomalous coronary arteries
5. Diagnose valvular stenosis or regurgitation

Domain Blueprint

1. Valvular: 10%-15%
    a. Anatomy
    b. Regurgitation
    c. Stenosis
    d. Endocarditis
    e. Anomaly
    f. Prosthesis
2. Pericardial: 10%-15%
    a. Effusion
    b. Calcification
    c. Absence
    d. Cyst
    e. Hemorrhage
    f. Infection
    g. Pneumopericardium
    h. Constriction
3. Myocardial: 10%-15%
    a. Infarct
    b. Perfusion
    c. Aneurysm
    d. Myocarditis

    e. Cardiomyopathy
    f. Dyskinesis
4. Great vessels: 5%-10%
    a. Aorta
        i. Atherosclerosis
        ii. Aneurysm
        iii. Dissection/intramural hematoma
        iv. Penetrating ulcer
        v. Vasculitis
        vi. Trauma
    b. Systemic veins
        i. Superior vena cava syndrome
        ii. Thrombosis
    c. Pulmonary arteries
        i. Pulmonary hypertension
        ii. Arteriovenous malformation
        iii. Aneurysm
        iv. Vasculitis
    d. Pulmonary veins
        i. Anatomy
        ii. Ablation
5. Coronary: 10%-15%
    a. Anatomy
    b. Calcification
    c. Stenosis
    d. Aneurysm
    e. Bridging
    f. Anomaly
    g. Bypass graft
    h. Stent
    i. Collateral
6. Tumor/mass (including pericardial): 10%-15%
    a. Thrombus
    b. Metastasis
    c. Benign tumor
    d. Primary malignant tumor
7. Congenital (preoperative and postoperative): 5%-10%
    a. Valvular
    b. Aortic
    c. Pulmonary vascular
    d. Shunt
    e. Cyanotic disease
    f. Complex anomaly
8. Devices, lines, and tubes: 1%-5%
    a. Central venous catheter
    b. Pulmonary artery catheter
    c. Pacemaker
    d. Defibrillator

e. Intra-aortic balloon pump
f. Left ventricular assist device

Domain Overview

Cardiac

1. Normal Anatomy, Including Variants, Encountered on Radiography, CT, and MRI
    1. Heart, including chambers, valves, pericardium, and coronary arteries
    2. Aorta and pulmonary arteries
    3. Venae cava and pulmonary veins
2. Physiological Aspects of Cardiac Imaging as Assessed with Radiography, CT, and MRI
    1. Normal cardiac cycle
    2. Physiological anatomy of cardiac muscle
    3. Mechanics of cardiac contraction
    4. Physical basis for blood flow, pressure, and resistance
        1. Ventricular volume and pressure relationship
        2. Functional cardiac measurements
            1. Ejection fraction
            2. Stroke volume
            3. Left ventricular mass
            4. Flow (Q = V x A)
            5. Pressure gradient (modified Bernoulli equation, $\Delta P = 4v2$)
            6. Pulmonary-to-systemic flow (Qp/Qs) ratio
            7. Regurgitant volume and regurgitant fraction
            8. Diastolic heart function
        3. Normal cardiac and pulmonary pressures
        4. Vascular regions supplied by the coronary arteries
3. Ischemic Heart Disease
    1. Risk factors, primary prevention, and screening
    2. Roles of echocardiography, angiography, SPECT, PET, CT, and MRI in the evaluation of a patient with suspected ischemic heart disease, including the advantages and limitations of each modality
    3. Inducible myocardial ischemia
    4. Acute myocardial infarction
    5. Chronic myocardial infarction
    6. Post-myocardial infarction complications
        1. Cardiac rupture
        2. Left ventricular aneurysm and pseudoaneurysm
        3. Papillary muscle rupture
        4. Congestive heart failure
        5. Dressler syndrome
    7. Myocardial perfusion and viability
        1. Stunned myocardium
        2. Hibernating myocardium
    8. Role of myocardial delayed-enhancement imaging in guiding management of left ventricular dysfunction
    9. Coronary artery stenosis and aneurysm
    10. Role of coronary CT angiography in guiding management of chest pain

11. Therapeutic and interventional options

4. Cardiomyopathy
    1. Hypertrophic
    2. Dilated
    3. Restrictive
        1. Distinguish restrictive cardiomyopathy from constrictive pericarditis
    4. Arrhythmogenic right ventricular dysplasia
    5. Therapeutic and interventional options
5. Cardiac Masses
    1. Thrombus
        1. Distinguish thrombus from tumor
    2. Primary benign tumors
        1. Myxoma
        2. Lipoma
        3. Rhabdomyoma
        4. Fibroma
        5. Lipomatous hypertrophy of the interatrial septum
    3. Primary malignant tumors
        1. Angiosarcoma
        2. Lymphoma
    4. Metastases
    5. Therapeutic and interventional options
6. Valvular Disease
    1. Myxomatous degeneration
    2. Rheumatic heart disease
    3. Infective endocarditis
    4. Congenital valve disease
    5. Specific lesions
        1. Aortic stenosis
        2. Aortic regurgitation
        3. Mitral stenosis
        4. Mitral regurgitation
        5. Mitral annular calcification
        6. Tricuspid regurgitation
        7. Pulmonary stenosis
        8. Pulmonary regurgitation
    6. Therapeutic and interventional options
7. Pericardial Disease
    1. Acute pericarditis
    2. Constrictive pericarditis
        1. Distinguish restrictive cardiomyopathy from constrictive pericarditis
    3. Pericardial effusion
        1. Hemopericardium
        2. Tamponade
    4. Pericardial cyst
    5. Pericardial defect
    6. Pneumopericardium
    7. Therapeutic and interventional options

8. Congenital Heart Disease
    1. Left-to-right shunts
        1. Atrial septal defect
        2. Ventricular septal defect
        3. Partial anomalous pulmonary venous connection
        4. Scimitar syndrome
        5. Patent ductus arteriosus
    2. Eisenmenger syndrome
    3. Admixture lesions (bidirectional shunts)
        1. Transposition of the great arteries
        2. Truncus arteriosus
        3. Total anomalous pulmonary venous connection
    4. Right-to-left shunts
        1. Tetralogy of Fallot and pulmonary atresia with ventricular septal defect
        2. Ebstein anomaly
    5. Great vessel anomalies
        1. Coarctation of the aorta
            1. Distinguish from pseudocoarctation
    6. Double aortic arch
    7. Right aortic arch
        1. Mirror image
        2. Non-mirror image
    8. Pulmonary sling
    9. Persistent left superior vena cava
    10. Coronary artery anomalies
        1. Retroaortic course
        2. Interarterial course
    11. Miscellaneous anomalies
        1. Cardiac malposition, including situs abnormalities
        2. Congenitally corrected transposition of the great arteries
    12. Therapeutic and interventional options
9. Acquired Disease of the Thoracic Aorta and Great Vessels
    1. Aneurysms
        1. Atherosclerotic
        2. Marfan syndrome
        3. Ehlers-Danlos syndrome
    2. Pseudoaneurysms
        1. Mycotic
        2. Post-traumatic and post-surgical
    3. Dissection
        1. Intramural hematoma
    4. Aortitis and arteritis
    5. Atherosclerosis
        1. Plaque
        2. Ulcerated plaque
        3. Penetrating ulcer
    6. Thromboembolism
        1. Acute pulmonary embolism

        2. Chronic pulmonary embolism
    7. Pulmonary hypertension
    8. Pulmonary arteriovenous malformation
    9. Compression
    10. Superior vena cava syndrome
    11. Pulmonary vein complications after radiofrequency ablation
    12. Therapeutic and interventional options
10. Devices and Postoperative Appearance
    1. Monitoring and support devices
        1. Intra-aortic balloon pump
        2. Pacemaker generator and pacemaker leads
        3. Implantable cardiac defibrillator
        4. Left ventricular assist device
        5. Pericardial drain
    2. Postoperative chest
        1. Coronary artery bypass graft surgery
        2. Cardiac valve replacement
        3. Transluminal septal closure
        4. Aortic graft and aortic stent
        5. Heart transplant

Vascular Imaging

1. Normal and Variant Anatomy as Depicted by Various Imaging Modalities (US, MRI, CT, and angiography)
    1. Arterial (excluding heart and CNS since that content will be covered in neurology and cardiac sections)
    2. Venous (again excluding heart and CNS)
2. Vascular Anatomy/Pathology before and after Intervention. Examples include:
    1. Aortic aneurysms before and after stent graft placement
    2. Arterial and venous stenosis/occlusions before and after endovascular procedures, such as angioplasty, stent placement, lysis, or thrombectomy
    3. Anatomy and pathology seen before and after open vascular procedures. Procedures include bypass grafts for tissue perfusion and dialysis access.
3. Vascular Pathology as Depicted by Various Imaging Modalities. Categories include:
    1. Congenital anomalies
    2. Inflammatory conditions such as vasculitis
    3. Neoplasia
    4. Embolic phenomena
    5. Trauma – blunt and penetrating
    6. Atherosclerosis

Gastrointestinal Imaging

This exam content assesses the candidate's knowledge and skills related to the clinical practice of gastrointestinal imaging. The domain encompasses fluoroscopy and radiography, CT, MRI, and ultrasound. The domain also includes testing of knowledge pertaining to percutaneous abdominal interventions and management in patients with gastrointestinal abnormalities on imaging.

Included in this document:

Domain Critical Concepts
Domain Blueprint
Domain Overview

Domain Critical Concepts

1. Identify normal anatomy, normal and abnormal postoperative and other iatrogenic GI tract findings throughout the GI tract
2. Diagnose benign and malignant neoplastic, inflammatory, and infectious bowel disease
3. Recognize motility disorders, hollow viscus obstructions, and etiologies of perforations
4. Identify mesenteric and/or bowel ischemia and gastrointestinal bleeding disorders
5. Diagnose, stage and recommend management for pancreatic cystic and solid tumors, inflammatory conditions and congenital abnormalities
6. Identify hepatic diseases
    a. Liver neoplasms both benign and malignant
    b. Diffuse liver disease including ancillary intra-abdominal findings
7. Recognize common biliary variants and pathology including causes of biliary obstruction, inflammation, and tumors
8. Diagnose common splenic pathologies on imaging
9. Identify normal and abnormal imaging findings of the mesentery and abdominal compartments, including abdominal wall hernias
10. Evaluate abdominal trauma including
    a. Staging
    b. Management
11. Recognize imaging findings in normal and abnormal transplants (non-vascular issues) for the liver and pancreas

Domain Blueprint

1. Pharynx/esophagus: up to 10%
    a. Technique of examination
    b. Normal anatomy, variations and function
    c. Benign diseases
    d. Malignant tumors
    e. Postoperative findings, expected appearance and complications
2. Stomach: up to 10%
    a. Techniques of examination
    b. Normal anatomy, variations and function

    c. Benign disease
    d. Malignant disease, primary and metastatic
    e. Postoperative stomach, expected appearance and complications
3. Duodenum/small bowel: 10-15%
    a. Techniques of examination
    b. Normal anatomy, variations and function
    c. Benign diseases
    d. Malignant diseases
    e. Postoperative findings, expected appearance and complications
4. Colon, appendix: 10%-15%
    a. Techniques of examination
    b. Normal anatomy, variations and function
    c. Benign disease
    d. Malignant disease
    e. Postoperative findings, expected appearance and complications
5. Pancreas: 10-15%
    a. Techniques of examination
    b. Normal anatomy, variations and function
    c. Pancreatitis
    d. Pancreatic neoplasms, benign and malignant
    e. Transplantation
    f. Postoperative findings, expected appearance and complications
6. Liver: 15%-20%
    a. Techniques of examination
    b. Normal anatomy, variations and function
    c. Diffuse diseases of the liver
    d. Focal diseases of the liver, benign and malignant
    e. Transplantation
    f. Postoperative findings, expected appearance and complications
7. Spleen: up to 10%
    a. Techniques of examination
    b. Normal anatomy, variations and function
    c. Splenomegaly
    d. Focal lesions, benign and malignant
8. Gall bladder, biliary: 5%-15%
    a. Techniques of examination
    b. Normal anatomy, variations and function
    c. Congenital abnormalities
    d. Benign Disease
    e. Malignant Disease
    f. Postoperative findings, expected appearance and complications
9. Peritoneum and retroperitoneum: up to 10%
    a. Techniques of examination
    b. Normal anatomy, embryology, variations and function
    c. Fluid collections
    d. Inflammatory diseases
    e. Primary tumors
    f. Metastatic tumors

g. Mesenteries

10. Multisystem: 5%-15%
    a. Techniques of examination
    b. Acute abdomen
    c. Abdominal and GI system trauma
    d. Syndromes involving the gastrointestinal tract
    e. Hernias
    f. Obstruction

Domain Overview

1. Pharynx
    1. Normal anatomy, variations
    2. Benign diseases
        1. Types of diverticula
        2. Foreign bodies
        3. Trauma
        4. Inflammatory conditions
    3. Motility disorders
    4. Malignant tumors
    5. Postoperative findings, expected appearance and complications
2. Esophagus
    1. Benign diseases
        1. Diverticula
        2. Trauma
        3. Esophagitis
            1. Reflux
            2. Infectious
            3. Caustic
            4. Drug-induced
            5. Other inflammatory conditions
        4. Barrett esophagus
        5. Rings, webs, and strictures
        6. Perforations/fistulas
        7. Varices
        8. Benign tumors and tumor-like conditions
        9. Extrinsic processes affecting the esophagus
            1. Pulmonary lesions
            2. Mediastinal structures
    2. Malignant tumors
        1. Squamous
        2. Adenocarcinomas
        3. Other malignant tumors
            1. Lymphoma
            2. Kaposi
            3. Metastases (lymphatic and hematogenous)
    3. Motility disorders
        1. Primary motility disorders

2. Secondary motility disorders
4. Postoperative esophagus
    1. Tubes, stents, devices
    2. Post surgical and post endoscopic interventions
3. Stomach
    1. Benign diseases
        1. Hiatal hernia (types and significance)
        2. Diverticula
        3. Gastritis
            1. Erosive
            2. Atrophic
            3. Infectious
            4. Other
        4. Peptic ulcer disease
        5. Hypertrophic gastropathy
        6. Varices
        7. Volvulus
        8. Entrapment after diaphragmatic injury
    2. Malignant diseases
        1. Primary
            1. Adenocarcinoma
            2. Lymphoma
            3. GI stromal tumors
            4. Carcinoid
        2. Metastatic
    3. Postoperative stomach
        1. Expected surgical appearance
            1. Bariatric, including gastric banding
            2. Nissen and other fundoplications
            3. Whipple
            4. Billroth procedures
    4. Complications
4. Duodenum
    1. Benign diseases
        1. Congenital abnormalities
        2. Diverticula and complications
        3. Trauma
        4. Inflammation
            1. Duodenitis
            2. Ulcer disease
            3. Crohn disease
        5. Aortoduodenal fistula
        6. Benign tumors and tumor like conditions
            1. Carcinoid
            2. Ampullary adenoma
            3. Polyps
            4. Pancreatic rest
    2. Malignant diseases

1. Adenocarcinoma
2. Lymphoma
3. Gastrointestinal stromal tumors
4. Carcinoid
5. Metastatic disease

5. Small Intestine
    1. Benign diseases
        1. Congenital disorders
        2. Diverticula
        3. Trauma
        4. Vascular diseases
            1. Intestinal ischemia and infarction
            2. Radiation enteritis
            3. Scleroderma
            4. Vasculitides
                1. Henoch-Schönlein purpura
                2. Polyarteritis nodosa
                3. Systemic lupus erythematosus
            5. Malabsorption
                1. Sprue
                2. Lymphangiectasia
                3. Other
            6. Inflammatory diseases
                1. Crohn disease
                2. Infectious and parasitic diseases
            7. Benign tumors
                1. Sporadic
                2. Associated with polyposis syndromes
                3. Lipomas
            8. Malrotation/Volvulus
            9. Obstruction
                1. Etiologies
                2. Associated complications
            10. Hemorrhage
            11. Other
                1. Etiologies of edema/bowel wall thickening
                2. Status post bone marrow transplant
                3. Drug effects
                    i. NSAID enteritis
                    ii. ACE inhibitors
    2. Malignant tumors
        1. Adenocarcinoma
        2. Lymphoma
        3. Carcinoid
        4. GI stromal tumors
        5. Metastases
    3. Postoperative findings, expected appearance and complications
6. Colon and Appendix

1. Benign disease
    1. Congenital abnormalities
    2. Diverticular disease
    3. Inflammatory diseases
        1. Crohn disease
        2. Ulcerative colitis
        3. Infectious colitis
            1. Pseudomembranous
            2. Viral
            3. Bacterial
            4. Colitis in AIDS
            5. Tuberculosis
        4. Appendicitis
    4. Benign neoplasms
        1. Adenoma
        2. Mesenchymal tumors
        3. Polyposis syndromes
        4. Appendiceal mucocele
        5. Carcinoid
    5. Malrotation/volvulus
    6. Obstruction
        1. Etiologies
        2. Complications
    7. Ischemic colitis
    8. Hemorrhage
2. Malignant diseases
    1. Adenocarcinoma, including mucinous
    2. Other malignant tumors
        1. Lymphoma
        2. Carcinoid
        3. Melanoma
        4. Squamous (anal)
        5. Metastases
    3. Rectal cancer staging
3. Postoperative findings, expected appearance and complications

7. Pancreas
    1. Congenital abnormalities and variants
    2. Pancreatitis, including nomenclature
        1. Acute
        2. Chronic
        3. Complications
        4. Autoimmune
    3. Pancreatic neoplasms
        1. Duct cell adenocarcinoma
        2. Cystic pancreatic neoplasms
            1. Intraductal papillary mucinous neoplasm (IPMN)
            2. Mucinous cystadenomas
            3. Serous cystadenomas

        4. Solid pseudopapillary tumors
    3. Neuroendocrine tumors
    4. Lymphoma
    5. Metastases
4. Other focal pancreatic lesions
    1. Accessory spleen
    2. Cysts
    3. Focal fat infiltration
5. Postoperative and post endoscopic intervention findings, expected appearance and complications

8. Liver
    1. Normal anatomy
    2. Diffuse diseases of the liver
        1. Cirrhosis
        2. Diseases associated with infiltration
            1. Fatty infiltration/nonalcoholic steatohepatitis (NASH)/NAFLD
            2. Hemochromatosis
            3. Storage diseases
        3. Vascular diseases
            1. Portal hypertension
            2. Portal vein occlusion
            3. Hepatic venous hypertension/Budd Chiari syndrome, passive congestion
        4. Inflammatory and infectious conditions
            1. Hepatitis
            2. Microabscesses
            3. Granulomatous disease
            4. Radiation induced
    3. Focal diseases of the liver
        1. Benign
            1. Hematoma
            2. Abscess
            3. Cavernous hemangioma
            4. Liver cell adenoma
            5. Focal nodular hyperplasia
            6. Regenerative nodules
            7. Perfusion defects, portosystemic collaterals
            8. Epithelioid hemangioendothelioma
            9. Hamartoma
            10. Biliary mucinous cystic neoplasm
            11. Cysts
            12. Polycystic disease
        2. Malignant
            1. Hepatocellular carcinoma, including LIRADS
            2. Cholangiocarcinoma
            3. Metastases
            4. lymphoma
            5. Angiosarcoma
            6. Biliary mucinous cystic neoplasm

4. Postoperative and post endoscopic intervention findings, expected appearance and complications
5. Liver transplantation
    1. Surgical candidate work up
    2. Expected postoperative appearance
    3. Complications

9. Spleen
    1. Congenital anomalies
    2. Splenomegaly
    3. Focal lesions
        1. Benign
            1. Hematoma
            2. Cysts
            3. Hemangioma
            4. Infarction
            5. Abscess/microabscesses
            6. Granulomatous disease
        2. Malignant
            1. Metastases
            2. Angiosarcoma
10. Bile Ducts and Gallbladder
    1. Congenital abnormalities and variants
        1. Variant biliary anatomy
        2. Choledochal cysts
        3. Caroli disease
        4. Biliary hamartomas
    2. Inflammatory diseases
        1. Gallbladder
            1. Acute cholecystitis
            2. Emphysematous cholecystitis
            3. Gangrenous cholecystitis
            4. Mirizzi syndrome
            5. Porcelain gallbladder
            6. Stone disease
            7. Adenomyomatosis
        2. Biliary ducts
            1. Primary sclerosing cholangitis
            2. Ascending cholangitis
            3. Recurrent pyogenic cholangitis
            4. AIDS cholangiopathy
            5. Ischemic injury
            6. Stone disease
    3. Tumors
        1. Gallbladder cancer
        2. Cholangiocarcinoma
        3. Metastases
        4. Polyps
    4. Postoperative and post endoscopic intervention findings, expected appearance and

complications

11. Peritoneal Spaces
    1. Normal anatomy
    2. Fluid collections
    3. Diseases of the peritoneum
        1. Hematoma/hemorrhage
        2. Inflammatory diseases
            1. Bacterial peritonitis
            2. Tuberculosis
            3. Sclerosing peritonitis
            4. Other
        3. Primary tumors
        4. Metastatic tumors
    4. Mesenteries
        1. Normal anatomy
        2. Pathologic conditions
            1. Defects
            2. Sclerosing mesenteritis/misty mesentery
            3. Mesenteric fibromatosis
    5. Perforations
    6. Retroperitoneum
        1. Normal anatomy
        2. Retroperitoneal spaces
        3. Benign diseases
            1. hematoma/hemorrhage
            2. Fibrosis
            3. Inflammatory diseases
        4. Malignant tumors
12. Multisystem Disorders
    1. Acute abdomen
    2. Trauma
        1. Hollow organ
            1. Acute findings
            2. Complications
        2. Solid organ
            1. Acute findings
            2. Evolution of injuries
            3. Complications
    3. Syndromes involving the GI tract
    4. Hernias, including internal hernias
    5. Obstruction and complications
    6. Vascular abnormalities/ ischemia/GI bleeding
    7. Benign etiologies of pneumatosis

Genitourinary Imaging

This exam content assesses the candidate's knowledge and skills related to the clinical practice of genitourinary imaging. The domain encompasses fluoroscopy and radiography, CT, MRI, and ultrasound (including MRI and CT for obstetrical complications). The domain also includes testing of knowledge pertaining to percutaneous abdominal interventions and management in patients with abnormalities on genitourinary imaging studies.

Included in this document:

Domain Critical Concepts
Domain Blueprint
Domain Overview

Domain Critical Concepts

1. Diagnose and distinguish between benign and malignant focal renal lesions
2. Identify benign and malignant urothelial pathology, understand management issues
3. Recognize and classify GU tract trauma
4. Diagnose and distinguish between benign and malignant adrenal lesions
5. Recognize US/MR appearance and staging of gynecologic malignancies:
6. Understand and identify prostate anatomy, infection, and tumor on MRI
7. Identify and distinguish benign from malignant scrotal lesions
8. Identify emergency GU imaging pathologies
9. Recognize GU congenital anomalies and genetic syndromes
10. Identify normal and abnormal (nonvascular) appearance of renal of transplants

Domain Blueprint

1. Adrenal: 5%-10%
    a. Congenital abnormalities
    b. Neoplasms
    c. Endocrine disorders
    d. Acquired diseases and conditions
2. Female infertility: up to 5%
    a. Embryology, congenital anomalies
    b. Acquired
3. Male infertility: up to 5%
    a. Congenital anomalies
    b. Acquired
4. Uterus, Cervix: 5%-10%
    a. Benign and malignant masses, neoplasms
    b. Acquired disease and conditions
    c. Normal and abnormal post-menopausal appearance
5. Ovary, Vulva, Vagina: 15%-20%

    a. Benign and malignant masses, neoplasms, cysts and cystic lesions
    b. Acquired conditions, hemorrhage, torsion, pelvic inflammatory disease
6. Penis/Scrotum: up to 5%
    a. Congenital abnormalities
    b. Benign and malignant masses, neoplasms
    c. Trauma
    d. Torsion
    e. Inflammation/infection
7. Kidney: 20%
    a. Benign and malignant masses
    b. Congenital syndromes involving the kidney
    c. Infection/inflammation
    d. Cystic disease
    e. Congenital abnormalities
    f. Trauma
    g. vascular
8. Renal transplant: up to 5%
9. Pelvcaliceal system/ureter: 5%-10%
    a. Obstruction
    b. Tumors
    c. Infection/inflammation
    d. Hereditary
    e. Congenital
    f. trauma
10. Prostate/seminal vesicles: up to 7%
    a. Neoplasms
    b. Infections
    c. Congenital anomalies
11. Urethra: Up to 5%
    a. Congenital
    b. Infection/inflammatory
    c. Tumors
    d. Trauma
12. Stone disease: up to 5%
13. Bladder: 5%-10%
    a. Urachus
    b. Tumors
    c. Infection/inflammation
    d. Obstruction
    e. Fistulae
    f. Hernias
    g. Hereditary
    h. Trauma
14. Retroperitoneum: up to 7%
    a. Tumors
    b. Infection/inflammation
15. Post-operative complications: up to 5%
16. Miscellaneous: up to 5%

a. Pessaries
b. Sphincters
c. Implants
d. Bulking agents
e. Anatomy

17. Genitourinary interventional radiology: up to 5%
    a. Percutaneous biopsy
    b. Percutaneous/endovaginal drainage
    c. Vascular intervention
    d. Thermal ablation
    e. Indications and contraindications

Domain Overview

1. Adrenal
    1. Congenital abnormalities
    2. Benign masses
    3. Malignant primary and secondary neoplasms
    4. Endocrine disorders
    5. Acquired diseases and conditions
        1. Infection
        2. Inflammatory conditions
        3. Hemorrhage
2. Female genitourinary tract
    1. Congenital abnormalities
    2. Infertility
    3. Urethra
    4. Uterus (including endometrium) and cervix
        1. Benign and malignant masses
        2. Acquired conditions (infection, hemorrhage)
    5. Ovaries and fallopian tubes
        1. Benign and malignant masses
            1. Cysts and cystic lesions
        2. Acquired conditions (infection, hemorrhage)
            1. Infections
                1. Pelvic inflammatory disease
            2. Torsion
            3. Ovarian failure
    6. Vulva and vagina
        1. Benign and malignant masses
            1. Cysts and cystic lesions
3. Obstetrical and Fetal Imaging (CT and MRI)
    1. Abnormal placentation
    2. Ectopic pregnancy
    3. Congenital fetal anomalies
    4. Maternal disorders in pregnancy
4. Male Genitourinary Tract
    1. Scrotum, testes, penis, seminal vesicles, vas deferens, ejaculatory ducts

        1. Congenital abnormalities
        2. Benign and malignant masses
        3. Trauma
        4. Torsion
    2. Infertility
5. Prostate Gland and Seminal Vesicles
    1. Malignant tumors
    2. Benign tumors and hyperplasia
    3. Infection/inflammation
    4. Trauma/iatrogenic
    5. Congenital anomalies
6. Urethra and Penis
    1. Malignant tumors
    2. Benign tumors
    3. Infection/inflammation
    4. Trauma/iatrogenic
    5. Congenital anomalies
    6. Stricture
7. Kidneys
    1. Malignant tumors
        1. Primary
        2. Secondary
    2. Benign tumors
    3. Hereditary tumor syndromes
    4. Cystic disease
    5. Complicated cysts
    6. Granulomatous diseases
    7. Infection/inflammation
    8. Hemorrhage
    9. Infarction and ischemia
    10. Trauma/iatrogenic
    11. Congenital anomalies
    12. Medical renal disease
    13. Metabolic disease
    14. Renal Transplantation
8. Ureter
    1. Malignant tumors
    2. Benign tumors
    3. Infection/inflammation
    4. Trauma/iatrogenic
    5. Congenital anomalies
    6. Stricture
    7. Filling defects
9. Bladder and Neobladder
    1. Malignant tumors
    2. Benign tumors
    3. Infection/inflammation

4. Hemorrhage
5. Trauma/iatrogenic
6. Congenital anomalies

10. Retroperitoneum, abdominal wall and perineum
    1. Primary and secondary malignant tumors
    2. Benign tumors
    3. Additional
        1. Hemorrhage
        2. Trauma/iatrogenic
        3. Congenital anomalies and venolymphatic malformations
        4. Aortic aneurysm
        5. Retroperitoneal fibrosis
        6. Pelvic lipomatosis
        7. Venous anomalies
        8. Infection, including Fournier gangrene
        9. Endometriosis
11. Vascular Diseases Affecting the Genitourinary Tract
    1. Aneurysms
    2. Stenoses
    3. Vasculitis
    4. Malformations
    5. Fistulae
    6. Occlusions
    7. Congenital anomalies
12. Intravascular Contrast Media
    1. Iodinated/gadolinium-based/ultrasound contrast agents
    2. Extravasation/intravasation
    3. Physiology
    4. Use in hysterosalpingography

Interventional Radiology

Interventional radiology is now a primary specialty that is closely aligned with diagnostic radiology. Diagnostic radiologists must demonstrate in-depth knowledge related to basic image-guided procedures and must have an understanding of the indications, contraindications, and complications of more complex interventional radiology procedures. In addition, diagnostic radiologists must demonstrate knowledge of imaging findings pertinent to the domain of interventional radiology. The Qualifying (Core) Exam assesses the candidate's knowledge of imaging, procedural, and clinical aspects of interventional radiology pertinent to the safe and effective practice of diagnostic radiology.

Included in this document:

Domain Critical Concepts
Domain Blueprint
Domain Overview

Domain Critical Concepts

1. Possess knowledge of tools of interventional radiology including imaging modalities used for diagnosis and intervention
2. Be familiar with vascular IR tools and techniques related to embolization, locoregional tumor management, recanalization, and management of thromboembolic disease
3. Understand non-vascular IR techniques and devices: biopsy, aspiration, drainage, ablation, biliary drainage, urinary drainage, and gastrointestinal intervention
4. Understand radiation and biohazard safety related to IR
5. Be familiar with patient care issues including physical exam, consent, sedation, pre-, peri- and post- procedure care.
6. Understand pharmacology related to IR procedures
7. Diagnose emergencies related to IR procedures
8. Identify imaging findings of vascular diseases pertinent to IR

Domain Blueprint

1. Fundamentals of image-guided intervention and invasive diagnostic procedures: 15%-20%
    a. Imaging modalities used to guide procedures
        i. Fluoroscopy
        ii. US
        iii. CT
        iv. MR
        v. DSA
    b. Basic tools
        i. Needles
        ii. Guidewires
        iii. Catheters

iv. Contrast agents

c. Access techniques
    i. Arterial
    ii. Venous
    iii. Hollow organ
    iv. Solid organ
d. Devices and techniques for complex vascular intervention
    i. Arterial/venous embolization
    ii. Arterial/venous recanalization
    iii. Locoregional management of malignancy
    iv. Management of thromoboembolic disease
    v. Foreign body retrieval
e. Devices and techniques for nonvascular interventions
    i. GI
    ii. GU
    iii. Biliary
    iv. Biopsy
    v. Drainage
    vi. Ablation
f. Patient care in interventional radiology
    i. Focused history and physical
    ii. Informed consent
    iii. Sedation
    iv. Contrast agents
    v. Pharmacologic agents pertinent to IR
    vi. Management of emergencies: contrast allergy, oversedation, bleeding, sepsis
    vii. Peri-procedural patient care and follow up

2. Vascular imaging and diagnosis: 15%-20%
    a. Normal and variant vascular anatomy
        i. Arterial
        ii. Venous
        iii. Pulmonary
        iv. Portal
    b. Vascular pathophysiology imaging findings
        i. Angiographic findings of vascular disease – examples are stenosis, occlusion, aneurysm, dissection
        ii. Arterial disorders
        iii. Venous disorders
        iv. Vascular malformations
3. Systemic arterial interventions[1] (territories include the aorta and its branches in the thorax, abdomen, pelvis and extremities): 20%
    a. Indications

i. Trauma
ii. Iatrogenic injury
iii. Hemorrhage
iv. Acute or chronic ischemia
v. Benign or malignant tumor
vi. High flow vascular malformation
vii. Aneurysmal disease

b. Techniques
i. Angiography
ii. Angioplasty
iii. Stent placement – bare, covered
iv. Embolization – plug, coil, particulate (permanent, temporary), liquid, sclerosant
v. Chemoembolization
vi. Lysis / Thrombectomy
vii. Arterial closure; management of access site complications

4. Nonarterial vascular intervention and invasive diagnostic procedures[1]: 20%
a. Systemic venous intervention indications
i. Chronic central venous occlusion
ii. Deep venous thrombosis
iii. Venous insufficiency – pelvic, gonadal, lower extremity
iv. Malfunction of hemodialysis graft/fistula
v. Retained foreign body
vi. Low flow vascular malformation
vii. Need for diagnostic information
viii. Need for central venous access

b. Systemic venous intervention techniques
i. Venography
ii. Angioplasty
iii. Stent placement
iv. Lysis/thrombectomy
v. Caval filtration
vi. Embolization/sclerosis
vii. Foreign body retrieval
viii. Venous sampling
ix. Transvenous biopsy
x. Venous access device placement

c. Portal venous interventions
i. TIPS
ii. Variceal obliteration
iii. Recanalization / angioplasty / stent placement

d. Pulmonary artery interventions
i. Management of pulmonary emboli – lysis, thrombectomy

        ii. Arteriovenous malformation management
    e. Lymphatic interventions
        i. Lymphangiography
        ii. Thoracic duct embolization
5. Nonvascular interventions and invasive diagnostic procedures[1]:25%
    a. Percutaneous biopsy
    b. Abscess drainage
    c. Tumor ablation – hepatic, renal, lung
    d. Management of noninfected fluid collections
        i. Simple drainage
        ii. Tunneled catheter
        iii. Sclerosis
    e. Gastrointestinal interventions
        i. Enteral access for feeding or decompression
        ii. Stricture management
    f. Biliary interventions
        i. Percutaneous transhepatic cholangiography
        ii. Transhepatic biliary drainage
        iii. Cholecystostomy tube placement
        iv. Biliary stone management
        v. Biliary stricture management
    g. Renal and urinary tract interventions
        i. Percutaneous nephrostomy
        ii. Nephroureteral stent / ureteral stent
        iii. Ureteroplasty
        iv. Suprapubic cystostomy
    h. Reproductive tract interventions
        i. Hysterosalpingography
        ii. Fallopian tube interventions

[1]The exam will assess the candidate's knowledge of the procedural technique and imaging findings, as well as procedural indications, contraindications, pre-procedure work-up, post-procedure follow-up, and potential procedural complications.

Domain Overview

1. Basic Procedures
   Questions will assess whether the candidate possesses the knowledge and skills needed for safe and effective care before, during, and after the procedure. Candidates are expected to have a detailed knowledge of the procedure, as well as pre- and post-procedure care. Candidates should know how to recognize and manage complications of these procedures.

1. Biopsies and aspirations: neck, chest, abdomen, pelvis, and extremities, including thyroid, lung, chest wall, liver, pancreas, renal, retroperitoneal, pelvic, and extremity. Note: breast biopsies will be covered in the mammography section. Bone biopsies will be covered in the musculoskeletal section and lumbar punctures will be covered in the neuroradiology section.
2. Abscess drainage: uncomplicated chest, abdomen, pelvic, and superficial abscesses
3. Catheter injections: cholangiography, abscessogram, nephrostograms, and feeding tube checks
4. Central venous access: PICCs and uncomplicated non-tunneled catheters
5. Extremity venography

2. Complex Procedures

   Because these procedures are typically performed by radiologists with more specialized training, Qualifying (Core) Exam candidates are not expected to possess the knowledge, skills, and abilities required to perform these procedures. However, candidates are responsible for a general knowledge of these procedures. Test items will also cover pre- and post-procedure care in more detail because general radiologists are often the first to encounter patients whose clinical presentation and imaging findings warrant these complex interventions. Candidates are also expected to correctly distinguish between expected and unexpected clinical and imaging findings after these procedures.

   1. Arteriography and arterial interventions, including angioplasty, stent placement, stent graft placement, embolization, thrombectomy, and lytic therapy
   2. Central venography and venous interventions, including inferior vena cava (IVC) filter placement, IVC filter retrieval, angioplasty, stent placement, lysis, thrombectomy, sclerosis, tunneled/implanted catheter placement, dialysis interventions, and TIPS.
   3. Biliary interventions, including percutaneous transhepatic cholangiography (PTC), internal/external drainage, stent placement, stone removal, and percutaneous cholecystostomy
   4. Nephrostomy and ureteral stent placement, manipulation, and exchange
   5. Locoregional tumor management (radiofrequency, cryoablation, bland embolization, chemoembolization, and radioembolization)
   6. Feeding tube placement, manipulation, and exchange
   7. Complicated drainages, including transrectal drainage, tunneled catheter placement for pleural/peritoneal collections, and pediatric procedures

Musculoskeletal Imaging

This exam content tests the candidate's knowledge and skills related to the clinical practice of musculoskeletal radiology. The domain encompasses radiographic, fluoroscopic, ultrasound, CT and MRI imaging of bone, joint and soft tissue.

Included in this document:

Domain Critical Concepts
Domain Blueprint
Domain Overview

Domain Critical Concepts

1. Distinguish benign from malignant bone lesions and recognize common lesions in both categories
2. Trauma
    a. Recognize and characterize fractures including pathologic and stress/insufficiency fracture
    b. Recognize and characterize traumatic injuries to muscles, tendons, ligaments and cartilage
3. Recognize manifestations of soft tissue and bone infection
4. Recognize normal musculoskeletal anatomy and congenital variants
5. Recognize normal appearance of and common complications of orthopedic hardware
6. Recognize and differentiate MSK manifestations of common hematologic endocrine and metabolic disorders
7. Procedures – understand how to access large and intermediate joints (hip, shoulder, wrist and ankle) and recognize normal and abnormal arthrogram
8. Recognize and differentiate common arthropathies
9. Recognize ligament, cartilage and tendon abnormalities of shoulder, elbow, hip, knee and ankle

Domain Blueprint

1. Trauma: 20%-25%
    a. Fractures/dislocations
    b. Fracture complications
    c. Myotendinous
    d. Ligament
    e. Neurovascular
    f. Articular
    g. Fragility
2. Infection: 5%-10%
    a. Osseous
    b. Soft tissue

    c. Joints
    d. Spine
3. Neoplasms: 10%-15%
    a. Osseous, benign
    b. Osseous, malignant
    c. Soft tissue, benign
    d. Soft tissue, malignant
    e. Tumor-like/sclerosing bone disease
    f. Metastases and myeloma
    g. Treatment monitoring
    h. PVNS
    i. Treatment complications
4. Metabolic: up to 5%
    a. Hyperparathyroidism/Renal osteodystrophy
    b. Osteoporosis
    c. Rickets/osteomalacia
    d. Hypertrophic osteoarthropathy – primary and secondary
5. Marrow: up to 5%
    a. Osteonecrosis
    b. Hemoglobinopathies
    c. Marrow infiltration
    d. Marrow conversion
6. Post-operative: up to 5%
    a. Spine
    b. Implants
    c. Prosthesis
    d. Internal derangement
7. Congenital: up to 5%
    a. Foot deformities
    b. Coalitions
    c. Normal variants
    d. Dysplasias
8. Arthritis: 15%-20%
    a. Osteoarthritis
    b. Inflammatory
    c. Connective tissue disease
    d. Crystal
    e. Neuropathic
9. Paget disease: up to 5%

Domain Overview

1. Imaging Techniques—Indications and Limitations
    1. Musculoskeletal modalities
        1. Considerations for musculoskeletal modalities
            1. Appropriateness, limitations, contraindications, and safety issues
            2. Protocols, standard positioning, technique
            3. Indications for contrast with MRI and CT

        4. Artifacts and pitfalls
    2. Interventional musculoskeletal procedures
        1. Types
            1. Arthrography
            2. Joint aspiration and injection
            3. Percutaneous biopsy
            4. Therapeutic procedure
        2. Considerations for musculoskeletal procedures
            1. Appropriateness, limitations, contraindications, and safety issues
            2. Universal protocol
            3. Approach and technique
            4. Injectate (composition and amount)
            5. Laboratory studies
            6. Complications
        3. Dual-energy X-ray Absorptiometry (DEXA)
            1. Indications and follow-up
            2. WHO classification
            3. DEXA positioning
            4. DEXA artifacts and pitfalls
2. Normal/Normal Variants
    1. Musculoskeletal anatomy pertinent to the various imaging modalities
    2. Primary and secondary ossification centers and sequence of ossification
    3. Physiologic radiolucencies and radiodensities
    4. Physiologic bowing
    5. Sesamoids, accessory ossicles, and related syndromes
    6. Accessory muscles
    7. Tug lesions
    8. Cortical desmoid
    9. Dorsal defect of the patella
    10. Glenoid labrum variants
3. Congenital Anomalies and Dysplasias
    1. Lower extremity
        1. Developmental hip dysplasia
        2. Discoid meniscus
        3. Talipes equinovarus
        4. Metatarsus adductus
        5. Pes cavus and planus
        6. Tarsal coalition
        7. Proximal focal femoral deficiency
        8. Protrusio acetabuli
        9. Acetabular version
        10. Patella baja and alta
    2. Upper extremity
        1. Madelung deformity
        2. Congenital dislocation of the radial head
        3. Carpal coalition
        4. Sprengel deformity

5. Supracondylar process
6. Radial ray anomaly
7. Ulnar variance

3. Spine (see neuroradiology section)
4. Diffuse/multifocal
    1. Achondroplasia
    2. Osteogenesis imperfecta
    3. Sclerosing osseous dysplasias
        1. Melorheostosis
        2. Osteopathia striata
        3. Osteopoikilosis
    4. Osteopetrosis
    5. Cleidocranial dysplasia/dysostosis
    6. Neurofibromatosis
    7. Cerebral palsy
    8. Mucopolysaccharidosis
    9. Trisomy 21
    10. Macrodystrophia lipomatosa
    11. Nail-patella syndrome
    12. Wormian bones
    13. Thanatophoric dwarf
    14. Marfan syndrome
    15. Tuberous sclerosis

4. Infections (including routes of spread and predisposing factors)
    1. Osteomyelitis
        1. Demographics
        2. Acute vs subacute vs chronic osteomyelitis
        3. Features with different imaging modalities
        4. Terminology
        5. Bacterial vs nonbacterial
        6. Congenital syphilis
    2. Septic arthritis, bursitis, and tenosynovitis
    3. Soft tissue
        1. Abscess
        2. Cellulitis
        3. Pyomyositis
        4. Gas gangrene
        5. Necrotizing fasciitis
        6. Cat-scratch disease
        7. Cysticercosis

5. Tumors and Tumor-Like Conditions
    1. Demographics
    2. Imaging features and description
    3. Benign and malignant primary bone lesions
        1. Cartilaginous tumors
            1. Osteochondroma
            2. Enchondroma
            3. Chondroblastoma

        4. Periosteal chondroma
        5. Chondromyxoid fibroma
        6. Chondrosarcoma
    2. Osteogenic tumors
        1. Osteoid osteoma
        2. Osteoblastoma
        3. Osteoma
        4. Osteosarcoma
        5. Conventional osteosarcoma
        6. Telangiectatic osteosarcoma
        7. PaSurface osteosarcoma
    3. Fibrohistiocytic tumors
        1. Non-ossifying fibroma
    4. Ewing sarcoma
    5. Hematopoietic tumors
        1. Plasma cell myeloma (Myeloma)
        2. Solitary plasmacytoma of bone
        3. Primary non-Hodgkin lymphoma of bone
        4. Giant cell tumor of bone
    6. Notochordal tumors
        1. Chordoma
    7. Vascular tumors
        1. Hemangioma
    8. Lipogenic and epithelial tumors
        1. Lipoma
        2. Adamantinoma
    9. Tumors of undefined neoplastic nature
        1. Aneurysmal bone cyst (primary and secondary)
        2. Unicameral bone cyst
        3. Fibrous dysplasia
        4. Osteofibrous dysplasia
        5. Langerhans cell histiocytosis
4. Bone metastases
    1. Primary bone tumor vs metastases
    2. Blastic vs. lytic and other differentiating features
5. Tumor syndromes
    1. Enchondromatosis (Ollier and Maffucci)
    2. Polyostotic fibrous dysplasia, McCune-Albright, and Mazabraud
    3. Hereditary multiple osteochondromas
    4. Neurofibromatosis
6. Malignant transformation
    1. Paget
    2. Radiation induced
    3. Tumor syndromes (see above)
7. Benign and malignant soft tissue tumors
    1. Adipocytic tumors
        1. Lipoma
        2. Liposarcoma

3. Lipomatosis of nerve (fibrolipomatous hamartoma of nerve)

2. Fibroblastic/myofibroblastic tumors
    1. Nodular fasciitis
    2. Fibromatosis
    3. Elastofibroma
    4. Dermatofibrosarcoma protuberans
    5. Fibrosarcoma
3. So-called fibrohistiocytic tumors
    1. Tenosynovial giant cell tumor (includes localized and diffuse forms of pigmented villonodular synovitis as well as extra-articular giant cell tumor)
4. Smooth-muscle tumors
    1. Leiomyosarcoma
5. Pericytic tumors
    1. Glomus
6. Skeletal-muscle tumors
    1. Rhabdomyosarcoma
7. Vascular tumors
    1. Hemangioma
    2. Lymphangioma
8. Nerve sheath tumors
    1. Schwannoma
    2. Neurofibroma
    3. Malignant peripheral nerve sheath tumor
9. Tumors of uncertain differentiation
    1. Myxoma
    2. Synovial sarcoma
10. Undifferentiated/unclassified sarcoma
    1. Undifferentiated pleomorphic sarcoma (malignant fibrous histiocytoma)

8. Non-neoplastic masses
    1. Ganglion
    2. Geode
    3. Morton neuroma
    4. Postamputation neuroma
    5. Epidermal inclusion cyst
    6. Xanthoma of the tendon

6. Trauma and Overuse
    1. General principles of osseous trauma and overuse
        1. Types
            1. Closed vs open
            2. Pathologic
            3. Fatigue
            4. Insufficiency
                1. Subchondral insufficiency fracture
            5. Pediatric
                1. Nonaccidental
                2. Salter-Harris
                3. Greenstick, bowing, and torus

4. Slipped capital femoral epiphysis

2. Relationship of force and deformation to fracture
3. Mechanisms of injury
4. Fracture patterns, bone contusions, and associated injuries
5. Fracture description
6. Fracture healing
7. Complications of fracture healing
8. Fracture eponyms and overuse syndromes

2. Dislocations
3. General principles of soft-tissue trauma and overuse
    1. Tendinosis, tendon tears, and tenosynovitis
    2. Muscle injuries and grading
    3. Ligamentous injuries and grading
    4. Bursitis
    5. Hematomas
    6. Degloving injuries and Morel-Lavallee lesions
    7. Myositis ossificans
    8. Compartment syndrome
    9. Myonecrosis
4. Site-specific entities (should know important fractures and dislocations for all sites)
    1. Shoulder
        1. Labral and ligamentous tears
            1. Bankart and Bankart variants
            2. Superior labrum anterior posterior (SLAP; not including subtypes)
            3. Paralabral cysts
            4. Humeral avulsion glenohumeral ligament (HAGL)
        2. Rotator cuff
            1. Partial vs full-thickness
            2. Acute vs chronic
            3. Tendinopathy (including hydroxyapatite deposition disease/calcific tendinosis)
        3. Acromial-clavicular injuries
        4. Biceps tears and dislocations
        5. Pectoralis major injuries
        6. Adhesive capsulitis
        7. Impingement disorders
        8. Little leaguer shoulder
    2. Elbow
        1. Biceps and triceps tears
        2. Epicondylitis and tears of the common flexor and extensor tendons
        3. Tears of the medial and lateral collateral ligamentous complexes
        4. Osteochondral lesions
        5. Little leaguer elbow
    3. Wrist and hand
        1. Ulnar abutment
        2. Triangular fibrocartilage, scapholunate, and lunatotriquetral ligament tears

3. De Quervain tenosynovitis
4. Intersection syndrome
5. Tendon tears and dislocations
6. Scapholunate advanced collapse
7. DISI, VISI, and perilunate wrist instability
8. Gamekeeper and Stener lesions

4. Spine (see neuroradiology section)
5. Hip
    1. Labral tears and paralabral cysts
    2. Femoroacetabular impingement
    3. Tears of the gluteal and hamstring tendons
    4. Apophyseal injuries
    5. Psoas tendon abnormalities
6. Knee and leg
    1. Meniscus
        1. Normal variants and pitfalls
        2. Types of tears
        3. Parameniscal and Intrameniscal cysts
    2. Tears and abnormalities of the cruciate and collateral ligaments
    3. Posterolateral corner injury
    4. Iliotibial band syndrome
    5. Osteochondral lesions
    6. Patellar tracking disorder
    7. Tennis leg
    8. Tendon tears
    9. Jumper's knee, Sinding-Larsen-Johansson, and Osgood-Schlatter disease
7. Ankle and foot
    1. Plantar fasciitis
    2. Sinus tarsi syndrome
    3. Tendon tears and dislocations
    4. Impingement disorders
    5. Haglund deformity
    6. Ligamentous tears
    7. Osteochondral defect

7. Nerve Entrapment and Associated Disorders
    1. General principles of nerve entrapment
    2. Specific disorders
        1. Suprascapular nerve entrapment
        2. Acute brachial neuritis (Parsonage-Turner)
        3. Quadrilateral space syndrome
        4. Carpal, cubital, and tarsal tunnel syndromes
        5. Sciatic and peroneal nerve entrapment
        6. Radial, median, posterior interosseous, and ulnar nerve entrapment
        7. Obturator and femoral nerve entrapment
8. Metabolic Disorders
    1. Osteoporosis and osteopenia
    2. Hyperparathyroidism
    3. Thyroid acropachy

4. Hypothyroidism
5. Scurvy
6. Rickets and osteomalacia
7. Renal osteodystrophy
8. Tumoral calcinosis
9. Calciphylaxis
10. Acromegaly
11. Bisphosphonate-related fractures
12. Intoxication/poisoning
    1. Heavy metal/lead
    2. Hypervitaminosis A and D
    3. Fluorosis

9. Hematologic and Marrow Disorders
    1. Sickle cell and thalassemia
    2. Hemophilia
    3. Myelofibrosis
    4. Extramedullary hematopoiesis
    5. Marrow reconversion
    6. Leukemia and myelodysplasia
    7. Radiation-induced marrow changes
    8. Mastocytosis
    9. Gaucher disease
10. Osteonecrosis and Related Disorders
    1. Osteonecrosis
        1. Etiology
        2. Imaging characteristics
    2. Osteochondritis dissecans
    3. Bone marrow edema syndromes (transient osteoporosis of the hip)
    4. Osteochondroses
        1. Legg-Calve-Perthes
        2. Kienböck
        3. Kohler
        4. Panner
        5. Freiberg
        6. Sever
        7. Scheuermann
        8. Tibia vara (Blount disease)
11. Miscellaneous
    1. Paget disease
    2. Sarcoidosis
    3. Hypertrophic osteoarthropathy (primary and secondary)
    4. Periosteal changes from venous stasis
    5. Infantile cortical hyperostosis/Caffey disease
    6. Complex regional pain syndrome (reflex sympathetic dystrophy)
    7. Muscle infarction
12. Arthropathy
    1. General features
        1. Distribution and demographics

2. Imaging findings
2. Osteoarthritis (including erosive osteoarthritis)
3. Inflammatory
    1. Rheumatoid arthritis
    2. Psoriatic arthritis
    3. Reactive arthritis
    4. Ankylosing spondylitis
    5. Enteropathic arthritis
    6. Juvenile idiopathic arthritis
    7. SAPHO syndrome and chronic recurrent multifocal osteomyelitis (CRMO)
4. Connective tissue diseases
    1. Systemic lupus erythematosus (SLE)
    2. Scleroderma
    3. Dermatomyositis
    4. Polymyositis
5. Crystal-associated
    1. Gout
    2. Calcium pyrophosphate deposition disease (CPPD)
    3. Hydroxyapatite deposition disease (HADD)
6. Neuropathic
7. Miscellaneous
    1. Hemochromatosis
    2. Pigmented villonodular synovitis
    3. Synovial chondromatosis
    4. Osteitis condensans ilii
    5. Osteitis pubis and pubic instability
    6. Degenerative disk disease
    7. Diffuse idiopathic sclerosing hyperostosis (DISH)
    8. Ossification of the posterior longitudinal ligament
    9. Alkaptonuria/ochronosis
    10. Lipoma arborescens
    11. Post-traumatic osteolysis
    12. Scheuermann disease
13. Postoperative Imaging
    1. Internal and external fixation (including spine)
        1. Important types of hardware
        2. Appropriate positioning of hardware
        3. Complications
            1. Infection
            2. Loosening
            3. Component fracture
    2. Arthroplasty
        1. Important types
        2. Appropriate positioning
        3. Complications
            1. Infection
            2. Loosening, cement fractures, component shift, and subsidence
            3. Osteolysis (particle disease)

4. Component (polyethylene liner or prosthesis) wear, breakage, and dislocation
5. Periprosthetic fracture
6. Heterotopic ossification
7. Metallosis

3. Other postoperative imaging
    1. Normal vs abnormal appearance of the following surgeries:
        1. Anterior cruciate ligament
        2. Meniscus
        3. Vertebral augmentation
        4. Sarcoma resection
        5. Rotator cuff
        6. Glenoid labrum
        7. Osteochondral lesions

14. ACR Appropriateness Criteria Specific to Musculoskeletal Imaging

Neuroradiology

This exam content assesses the candidate's knowledge and skills related to the clinical practice of neuroradiology. The domain encompasses the brain, skull base, orbit, face, neck, and spine. Common modalities and procedures covered include CT, MRI including diffusion imaging, CT or MRI angiography, CT or MRI perfusion, x-rays, and common neuroradiology procedures such as myelography, catheter angiography, and routine biopsies. Cases typically will be examples of common entities that are expected to have been seen during the first three years of a radiology residency program.

Included in this document:

Domain Critical Concepts
Domain Blueprint
Domain Overview

Domain Critical Concepts

1. Identify imaging features of stroke (hemorrhagic and non-hemorrhagic) and understand basics of imaging workup
2. Diagnose common white matter diseases in the brain and spinal cord including multiple sclerosis, acute demyelinating encephalomyelitis (ADEM) and other inflammatory diseases
3. Recognize fundamental imaging features of common tumors and vascular lesions in the brain, spine, and head and neck, and understand basics of their management
4. Identify normal anatomy and anatomic variants in the brain, spine, and head and neck
5. Diagnose common congenital abnormalities in the brain, spine, and head and neck
6. Diagnose common infections in the brain, spine, and head and neck

Domain Blueprint

1. Brain: 45%-50%
    a. Inflammatory/demyelinating
    b. Vascular
    c. Degenerative
    d. Trauma
    e. Tumor
    f. Metabolic/toxic
    g. Congenital/developmental
    h. Anatomy
    i. Cyst/hydrocephalus
    j. Pineal region
    k. Ventricles
    l. Calvarium
2. Extracranial Head & Neck: 25%-30%
    a. Sella/parasellar
    b. Cerebellopontine Angle-Internal Auditory Canal (CPA-IAC) and Temporal bone
    c. Skull base

d. Orbit/ocular
e. Nose and sinus
f. Facial bones including maxilla and mandible
g. Suprahyoid and infrahyoid neck and oral cavity

3. Spine: 25%-30%
    a. Inflammatory/demyelinating
    b. Vascular
    c. Degenerative
    d. Trauma
    e. Tumor
    f. Congenital/developmental
    g. Anatomy

Domain Overview

1. Brain
    1. Normal Anatomy & Variants
        1. Brain And CSF Spaces
        2. Vascular
        3. Skull And Dura
    2. Congenital/Genetic
        1. Lipoma
        2. Chiari malformations (1,2,3)
        3. Corpus Callosum: Dysgenesis/Agenesis
        4. Hindbrain Malformations
        5. Holoprosencephaly & Variants Including Syntelencephaly
        6. Septooptic Dysplasia
        7. Megalencephaly/ Hemimegalencephaly
        8. Microcephaly
        9. Focal Transmantle Cortical Dysplasia (Focal Cortical Dysplasia with or without Balloon Cells)
        10. Neuronal Migration
        11. Cortical Organization and Late Migration
        12. Congenital Calvarial Defects
        13. Neurocutaneous syndromes
        14. Inherited Metabolic
    3. Infection/Inflammation
        1. Congenital/Neonatal
        2. Pyogenic
        3. Granulomatous
        4. Viral
        5. Immunocompromised
        6. Parasitic
        7. Prion Disease
        8. Lyme Disease
        9. Rasmussen Encephalitis
    4. Spontaneous Hemorrhage
        1. Intracerebral

2. Subarachnoid (aneurysmal and non-aneurysmal)
3. Epidural/ Subdural
4. Germinal matrix hemorrhage/pediatric intraventricular hemorrhage
5. Superficial siderosis

5. Vascular Disease/ Structural Lesions
    1. Atherosclerosis
    2. Nonatheromatous
    3. Aneurysms (all types including pseudoaneurysm and dolichoecstasia)
    4. Arteriovenous Malformations
    5. AV Fistula (including carotid cavernous)
    6. Vein of Galen Malformation
    7. Cavernoma/Cavernous malformation
    8. Developmental venous anomaly (DVA)
    9. Capillary telangiectasia
    10. Hemangioma, calvarial (venous malformation)
6. Ischemia/infarction
    1. Thrombo-embolic infarction
    2. Hypoxic Ischemic/Anoxic Injury
    3. Venous Thrombosis
    4. Lacunar infarction
    5. Borderzone/ watershed infarction
    6. Posterior reversible encephalopathy syndrome (PRES)
    7. Transient Global Amnesia
    8. Fat Emboli
    9. Periventricular leukomalacia (PVL)
    10. Hydranencephaly
    11. Porencephalic Cyst
7. Neoplasm, Supratentorial, Intra-Axial
    1. Astrocytoma including glioblastoma
    2. Oligodendroglioma including mixed
    3. Multifocal glioma
    4. DNET
    5. Ganglioglioma
    6. Desmoplastic Infantile Ganglioglioma (DIG)
    7. Metastases
    8. Lymphoma any type including PTLD
    9. Neoplasm, Supratentorial, Intra-Axial: Rare and Miscellaneous
8. Neoplasm, Extra-Axial
    1. Dural/leptomeningeal
    2. Pineal Region
    3. Osseous
9. Neoplasm, Supratentorial, Intraventricular
    1. Choroid Plexus Papilloma or Carcinoma
    2. Meningioma
    3. Metastasis
    4. Ependymoma/subependymoma
    5. Neurocytoma, Central
    6. Subependymal giant cell astrocytoma

10. Neoplasm, Posterior Fossa
    1. Diffuse infiltrating pontine glioma/diffuse midline glioma
    2. Ependymoma/Subependymoma
    3. Medulloblastoma
    4. Pilocytic Astrocytoma
    5. Hemangioblastoma
    6. Metastases
    7. Lymphoma any type including PTLD
    8. Rare and Miscellaneous
11. Cysts
    1. Epidermoid or Dermoid Cyst
    2. Arachnoid Cyst
    3. Colloid Cyst
    4. Leptomeningeal Cyst
    5. Rare and Miscellaneous
12. Hydrocephalus
    1. Benign Extracerebral Collections of Childhood (External Hydrocephalus)
    2. Obstructive Hydrocephalus, Intraventricular or Extraventricular
    3. Normal Pressure Hydrocephalus
    4. CSF Shunts And Complications including Slit Ventricle Syndrome (Shunt Dependence)
13. Demyelinating Disease
    1. Multiple Sclerosis
    2. Neuromyelitis Optica (Devic) including spectrum disorder
    3. Acute Disseminated Encephalomyelitis (ADEM)
    4. Tumefactive Demyelination
    5. Demyelinating Disease: Rare and Miscellaneous
14. Acquired Metabolic/Toxic
    1. Carbon Monoxide Poisoning
    2. Osmotic Demyelination Syndrome
    3. Hypoglycemia/Hyperglycemia
    4. Hepatic Failure
    5. Parathyroid Disorders, CNS Manifestations
    6. Methanol/Ethanol Poisoning
    7. Medication toxicity
    8. Wernicke Encephalopathy
    9. Rare and Miscellaneous
15. Neurodegenerative
    1. Alzheimer Disease
    2. Frontotemporal Lobal Degeneration (Pick Disease)
    3. Neurodegeneration with Brain Iron Accumulation (NBIA), (PKAN)
    4. Parkinson Disease and Parkinson's plus (MSA, PSP, OPCD)
    5. Amyotrophic Lateral Sclerosis (ALS)
    6. Hypertrophic Olivary Degeneration
    7. Rare and Miscellaneous
16. Trauma
    1. Calvarial and skull base fractures
    2. Traumatic hemorrhage including Duret

3. Traumatic axonal injury/Diffuse axonal injury
4. Encephalomalacia, Post-Traumatic
5. Non-accidental trauma (abuse)
6. Herniation syndromes

17. Treatment/Post Surgery Effects
    1. Skull
    2. Devices and Complications including Sinking Skin Flap Syndrome
    3. Radiation and Chemotherapy Including Pseudoprogression
    4. Avastin (Bevacizumab) and Pseudo-Response
    5. Stroke Like Migraines After Radiation Therapy (SMART) Syndrome
    6. Cerebral Hyperperfusion Syndrome
    7. Thrombolysis & Anticoagulation Complications
    8. Immune reconstitution inflammatory syndrome (IRIS)
18. Miscellaneous
    1. Intracranial Hypotension (Craniospinal Hypotension Syndrome)
    2. Idiopathic Intracranial Hypertension (Pseudotumor Cerebri), including venous stenosis
    3. Mesial Temporal Sclerosis & Status Epilepticus
    4. Paraneoplastic Syndromes/Limbic Encephalitis
    5. Hypertrophic Pachymeningitis
    6. Fibrous Dysplasia
    7. Paget Disease

2. Extracranial Head & Neck
    1. Sella/Parasellar
        1. Normal Anatomy and Variants
        2. Congenital/Genetic
        3. Infection/Inflammation
        4. Pituitary Infarction, Hemorrhage or Sheehan syndrome
        5. Neoplasm, Sellar
        6. Neoplasm, Supra/Juxtasellar
        7. Cysts and Tumor-like Lesions
        8. Treatment/Post Surgery Effects
    2. Cerebellopontine Angle-Internal Auditory Canal (CPA-IAC) and Temporal Bone
        1. Normal Anatomy and Variants including carotid artery and jugular vein variants
        2. Congenital/Genetic
        3. Infection/Inflammation
        4. Vascular
        5. Neoplasm
        6. Cysts and Tumor-like lesions
        7. Trauma (including ossicles)
        8. Treatment/Post Surgery Effects
    3. Skull Base
        1. Normal Anatomy and Variants (including foramina and arachnoid granulation)
        2. Infection and Inflammation
        3. Neoplasm
        4. Cysts and Tumor-Like Lesions
        5. Trauma
        6. Treatment/Post Surgery Effects

4. Orbit/Ocular
    1. Normal Anatomy and Variants
    2. Congenital/Genetic
    3. Infection/Inflammation
    4. Vascular
    5. Neoplasm, Benign
    6. Neoplasm, Malignant/Metastatic
    7. Cysts and Tumor-Like Lesions
    8. Trauma
    9. Treatment/Post Surgery Effects
5. Nose and Sinus
    1. Normal Anatomy and Variants
    2. Congenital/Genetic
    3. Infectious/Inflammatory
    4. Neoplasm, Benign
    5. Neoplasm, Malignant
    6. Treatment/Post Surgery Effects
    7. Miscellaneous including CSF Leak
6. Facial Bones including maxilla and mandible
    1. Normal Anatomy and Variants
    2. Congenital/Genetic
    3. Infectious/Inflammatory including dental
    4. Neoplasm, Benign
    5. Neoplasm, Malignant
    6. Cysts and Tumor-Like Lesions
    7. Trauma
    8. Treatment/Post Surgery Effects
7. Suprahyoid & Infrahyoid Neck and Oral Cavity
    1. Normal Anatomy and Variants
    2. Congenital/Genetic
    3. Infection/Inflammation
    4. Vascular
    5. Neoplasm, Benign
    6. Neoplasm, Malignant
    7. Cysts and Tumor-Like Lesions
    8. Trauma

3. Spine
    1. Normal Anatomy and Variants
    2. Congenital/Genetic
    3. Infection/Inflammation
    4. Vascular
    5. Neoplasm
    6. Cysts and Tumor-Like Lesions
    7. Systemic/Metabolic
    8. Inflammatory and other arthritides
    9. Degenerative/Arthropathic
    10. Trauma
    11. Postoperative/Post-Procedural

Nuclear Radiology

This exam content assesses the candidate's knowledge and skills related to the clinical practice of nuclear radiology. The domain encompasses diagnostic planar, SPECT/CT, and PET/CT imaging using a variety of radiopharmaceuticals. The domain includes oral radioiodine therapy for hyperthyroidism and thyroid cancer.

Included in this document:

Domain Critical Concepts
Domain Blueprint
Domain Overview

Domain Critical Concepts

1. Central Nervous System
    a. Recognize presence or absence of cerebral blood flow on brain scan
    b. Differentiate dementias on FDG PET/CT
2. Cardiovascular & Lymphatic Systems
    a. Distinguish ischemia from scar on myocardial perfusion SPECT
    b. Understand lymphatic pathways and apply to pre-operative imaging
3. Pulmonary System
    a. Apply interpretation criteria in diagnosis of acute and chronic pulmonary embolism on V/Q scan
4. Gastrointestinal System
    a. Recognize and localize active hemorrhage on gastrointestinal bleeding scan
    b. Differentiate acute and chronic gallbladder disease, and recognize biliary complications on IDA scan
5. Genitourinary System
    a. Recognize kidney and urinary tract pathology on DMSA and MAG3 scans
6. Musculoskeletal System
    a. Differentiate benign and malignant skeletal diseases on skeletal scintigraphy
7. Endocrine System
    a. Localize overactive parathyroid gland(s) on planar and SPECT/CT imaging
8. Infection & Inflammation
    a. Identify sources of infection and inflammation on planar and SPECT/CT imaging
9. Neoplasms
    a. Differentiate physiological from pathological biodistribution in oncologic FDG PET/CT
10. Therapy & Theranostics
    a. Integrate thyroid imaging with uptake and laboratory values to plan radioiodine therapy in hyperthyroidism
    b. Integrate whole-body imaging with laboratory values and surgical staging to plan radioiodine therapy in thyroid cancer
11. Technical & Quality
    a. Recognize altered radiopharmaceutical biodistribution
    b. Recognize imaging artifacts
    c. Recognize pitfalls in quantitative analysis

Domain Blueprint

1. Central Nervous System (CNS): 8%-9%
2. Cardiovascular & Lymphatic (CV & L) Systems: 8%-9%
3. Pulmonary System: 4%
4. Gastrointestinal (GI) System: 12%-13%
5. Genitourinary (GU) System (including Breast): 8%-9%
6. Musculoskeletal (MSK) System (including Integument): 6%
7. Endocrine System: 6%
8. Infection & Inflammation (I & I): 4%
9. Neoplasms: 25%
10. Therapy & Theranostics: 10%
11. Technical & Quality (excluding Physics & RISE): 6%

Domain Overview

1. Central Nervous System (CNS)
    1. Brain viability
    2. Dementias & behavioral disorders
    3. Movement disorders
    4. Seizure focus
    5. Cerebrovascular disease
    6. Cerebrospinal fluid (CSF)
2. Cardiovascular & Lymphatic (CV & L) Systems
    1. Myocardial perfusion imaging, coronary artery disease
    2. Myocardial perfusion imaging, non-coronary artery disease
    3. Myocardial metabolism & viability
    4. Multigated acquisition (MUGA)/gated cardiac blood pool imaging
3. Pulmonary System
    1. Ventilation & perfusion (thromboembolism; non-thromboembolism; airways)
4. Gastrointestinal (GI) System
    1. Liver & spleen
    2. Biliary
    3. Bowel (GI bleed; GI motility)
5. Genitourinary (GU) System
    1. Renal perfusion & function (native kidneys)
    2. Renal diuretic challenge (native kidneys)
    3. Renal cortex (native kidneys)
    4. Renal transplant
    5. Urinary leak (native & transplant kidneys)
    6. Bladder/nuclear cystogram

6. Musculoskeletal (MSK) System (including Integument)
    1. Tumor-like or associated conditions
    2. Metabolic & vascular conditions
    3. Trauma
    4. Extra-skeletal processes (on skeletal scintigraphy)
7. Endocrine System
    1. Thyroid gland
    2. Parathyroid gland
8. Infection & Inflammation (I & I)
    1. CNS
    2. CV & L
    3. Pulmonary
    4. GI
    5. GU (including Breast)
    6. MSK (including Integument)
9. Neoplasms (benign; malignant primary; malignant metastatic)
    1. CNS
    2. CV & L
    3. Pulmonary
    4. GI
    5. GU (including Breast)
    6. MSK (including Integument)
    7. Endocrine
10. Therapy & Theranostics
    1. GI, parenteral (^{90}Y microspheres: pre-mapping, post-imaging)
    2. Endocrine, oral (^{131}I NaI)
11. Technical & Quality (patient issues/preparation; radiopharmaceutical issues/contamination; imaging issues/protocols/processing/artifacts)
    1. CNS
    2. CV & L
    3. Pulmonary
    4. GI
    5. GU
    6. MSK
    7. Endocrine
    8. I & I
    9. Neoplasms
    10. Therapy & Theranostics

Pediatric Radiology

This exam content assesses the candidate's knowledge and skills related to the clinical practice of pediatric radiology. The domain encompasses a wide range of ages in pediatric imaging including fetal and neonatal studies. All clinical areas will be tested including neuroradiology, general radiology, and a limited number of pediatric-specific interventional procedures.

Included in this document:

Domain Critical Concepts
Domain Blueprint
Domain Overview

Domain Critical Concepts

1. Neuroradiology
    a. Be familiar with spine/cranial sonography
    b. Diagnose congenital brain anomalies
    c. Identify brain tumors
2. Chest/Airway
    a. Diagnose neonatal lung disease
    b. Identify congenital lung lesions
    c. Recognize foreign bodies
    d. Understand imaging of common airway pathology (e.g. abscess, croup, epiglottitis)
3. Cardiovascular
    a. Diagnose congenital heart disease
        i. Plain radiography
        ii. MRI in common conditions
        iii. Recognize appearance of surgical corrections
    b. Identify vascular conditions (e.g. Takayasu arteritis, Kawasaki disease)
4. GI
    a. Identify neonatal bowel obstruction and underlying pathologies
    b. Diagnose benign and malignant liver tumors
    c. Recognize imaging features in emergency conditions (e.g. appendicitis, intussusception)
5. GU
    a. Diagnose genitourinary tract tumors
    b. Identify congenital renal lesions
    c. Recognize imaging features in emergency conditions (torsion, trauma)
6. MSK
    a. Identify pediatric fractures
    b. Diagnose bone tumors
    c. Recognize non-accidental trauma
    d. Identify Imaging features of common syndromes (eg. osteogenesis imperfecta, ostechondromatosis)
7. Multisystem
    a. Diagnose systemic conditions (e.g. Langerhans cell histiocystosis, cystic fibrosis, sickle cell disease, NF)

b. Recognize normal and malpositioned lines
c. Identify imaging features of syndromes (eg. Trisomy 21, neurocutaneous, VACTERL)
d. Diagnose imaging findings in cancer predisposition syndromes (e.g., Beckwith-Wiedemann, hemihypertrophy)

Domain Blueprint

1. Neuroradiology: 15%-20%
2. Cardiovascular: 5%-10%
3. Chest/pulmonary/lung: 15%-20%
4. Gastrointestinal: 20%-25%
5. Multisystem disease: up to 5%
6. Genitourinary: 15%-20%
7. Musculoskeletal: 15%-20%
8. Fetal: up to 5%

   Categories of disease include:
   a. Infectious/inflammatory
   b. Neoplastic
   c. Traumatic
   d. Congenital/syndrome
   e. Toxic/metabolic
   f. Normal variant
   g. Vascular
   h. Idiopathic
   i. Normal/growth and development

Domain Overview

1. General Pediatric Imaging: Basic Knowledge/Competency
    1. National patient safety goals as they apply to pediatric imaging
    2. Contrast reactions in children (features, prevention, and treatment)
    3. General knowledge of practice-based imaging guidelines and appropriateness criteria (ACR Appropriateness Criteria and Practice Guidelines and Technical Standards)
    4. ALARA principles (e.g., Image Gently Campaign) for modalities using ionizing radiation
    5. Age-related development and normal anatomy
    6. Appropriate appearance of surgical devices and support apparatus
    7. Communication of urgent/emergent findings
    8. List of urgent/emergent findings in children
2. Brain, Head and Neck, and Spine
    1. Skull
        1. Congenital
            1. Synostoses
            2. Congenital dermal sinus
            3. Dermoid/epidermoid
        2. Inflammatory
            1. Osteomyelitis

3. Trauma
    1. Caput succedaneum
    2. Subgaleal hemorrhage
    3. Cephalohematoma
    4. Fractures (especially non-accidental injury/abuse)
4. Basic temporal bone anatomy
    1. Congenital
    2. Mondini malformation
    3. Michele malformation
5. Inflammatory disorders
    1. Cholesteatoma
    2. Mastoiditis
6. Variants
    1. Lückenschädel
    2. Wormian bones
    3. Parietal foramina

2. Vertebral column
    1. Congenital
        1. Absence or hypoplasia of odontoid
        2. Os odontoideum
        3. Segmentation anomalies
        4. Klippel-Feil anatomy
        5. Sprengel deformity
        6. Butterfly vertebra
        7. Spinal dysraphism
        8. Diastematomyelia
        9. Sacral agenesis (including caudal regression syndrome)
        10. Partial absence (including Currarino triad/ASP)
    2. Inflammatory
        1. Discitis
        2. Infectious spondylitis (tuberculosis)
    3. Neoplasms
        1. Ewing sarcoma
        2. Aneurysmal bone cyst
        3. Osteoblastoma
        4. Osteoid osteoma
        5. Langerhans cell histiocytosis
        6. Metastases (including leukemia and lymphoma)
    4. Trauma
        1. Fractures/dislocations
        2. Atlanto-dens and atlanto-occipital injuries
        3. Spondylolysis/spondylolisthesis
        4. Insufficiency fracture (and etiologies)
    5. Miscellaneous

6. Dysplasia/syndromes
    1. Mucopolysaccharidoses
7. Scheuermann disease
8. Scoliosis (repair and hardware complications)

3. Brain
    1. Congenital
        1. Migrational disorders
        2. Lissencephaly
        3. Pachygyria
        4. Schizencephaly
        5. Heterotopic gray matter
        6. Polymicrogyria
        7. Holoprosencephaly
        8. Anomalies of corpus callosum
        9. Hydranencephaly
        10. Dandy-Walker malformations
        11. Chiari malformation types I and II
        12. Cephalocele
        13. Neurocutaneous syndromes
        14. Vein of Galen malformation
        15. Causes of hydrocephalus
            1. Aqueductal stenosis
            2. Syndromic
            3. Masses
    2. Inflammatory
        1. Bacterial infections
        2. Meningitis
        3. Cerebritis
        4. Abscess
        5. Viral infections (encephalitis)
        6. TORCH infections
    3. Neoplasms
        1. Posterior fossa
            1. Medulloblastoma
            2. Ependymoma
            3. Brainstem glioma
            4. Astrocytoma
        2. Supratentorial
            1. Pineal region tumors
            2. Craniopharyngioma
            3. Astrocytoma
            4. Oligodendroglioma
            5. Primitive neuroectodermal tumor (PNET)
            6. Choroid plexus tumors

4. Cerebral infarction/ischemia
    1. Childhood infarcts
    2. Arteritis
    3. Sickle cell (including moyamoya)
    4. Carotid occlusion
    5. Venous sinus thrombosis
    6. Intracranial hemorrhage
    7. Neonatal hypoxic ischemic injury
    8. Vascular borderzone infarctions
    9. Multicystic encephalomalacia
5. Trauma (including nonaccidental injuries)
    1. Cerebral injury (including shearing injuries and concussion)
    2. Subdural hematoma
    3. Epidural hematoma
    4. Subarachnoid hemorrhage
6. Syndromic/systemic
    1. Neurocutaneous syndromes
7. Vascular
    1. Arteriovenous malformations, congenital “aneurysms” (vein of Galen)
8. Congenital
    1. Myelomeningocele/meningocele
    2. Lipomyelomeningocele
    3. Diastematomyelia
    4. Tethered cord
    5. Dermal sinus
    6. Intradural lipoma
    7. Hydrosyringomyelia
    8. Neurenteric cysts
9. Tumors
    1. Neurofibroma
    2. Astrocytoma
    3. Ependymoma
    4. Metastases
    5. Neuroblastoma, ganglioneuroblastoma, ganglioglioma
10. Sacrococcygeal masses
    1. Germ cell tumors (i.e., teratoma)
    2. Neuroblastoma
    3. Lymphoma
    4. Rhabdomyosarcoma
11. Other
    1. Infections
    2. Demyelinating disorders
    3. Trauma
    4. Vascular malformations

4. Neck
    1. Congenital
        1. Fibromatosis colli
        2. Lymphatic malformations
        3. Branchial cleft cysts
        4. Thyroglossal duct cysts
    2. Neoplasms
        1. Lymphoma
        2. Neuroblastoma
        3. Rhabdomyosarcoma
        4. Hemangiomas
    3. Infectious/inflammatory
        1. Adenitis
        2. Retropharyngeal abscess
    4. Thyroid disorders
        1. Absence/hypoplasia/ectopic
        2. Thyroiditis
        3. Thyroid masses
        4. Goiter
5. Head/Face
    1. Congenital
        1. Vascular malformations
        2. Persistent hyperplastic primary vitreous (PHPV)
    2. Inflammatory
        1. Orbital masses
        2. Ocular masses
        3. Orbital cellulitis
        4. Sinusitis
    3. Neoplastic/mass like
        1. Retinoblastoma
        2. Nasopharyngeal masses
        3. Carcinoma
        4. Juvenile angiofibroma
        5. Sinus masses
    4. Trauma
        1. Facial fracture (Le Fort classification)

3. Chest and Airway
    1. Upper airway
        1. Congenital
            1. Tracheomalacia/bronchomalacia/laryngomalacia
            2. Laryngeal stenosis, web, cleft
            3. Choanal atresia
            4. Masses: hemangioma
        2. Inflammatory

1. Tonsillar enlargement/adenoidal hypertrophy
2. Croup
3. Epiglottitis
4. Tracheitis
5. Retropharyngeal abscess

3. Neoplasm
    1. Juvenile angiofibroma
    2. Subglottic hemangioma
    3. Laryngeal papilloma
4. Trauma
    1. Foreign body
    2. Acquired subglottic stenosis

2. Chest
    1. Congenital
        1. Agenesis/hypoplasia
        2. Venolobar syndrome
        3. Bronchial atresia
        4. Bronchopulmonary foregut malformations
            1. Sequestration
            2. Bronchogenic cyst
            3. Congenital pulmonary airway malformation (CPAM)
            4. Congenital lobar overinflation
            5. Hybrid lesions
            6. Tracheal bronchus
            7. Tracheoesophageal fistula
    2. Inflammatory
        1. Infections
            1. Bacterial pneumonia
                1. Streptococcus
                2. Staphylococcus
                3. Pertussis
                4. Chlamydia
                5. Mycoplasma
                6. Round pneumonia
            2. Complications
                1. Necrosis
                2. Abscess
                3. Fistulae
                4. Empyema
                5. Pneumatocele
            3. Viral pneumonia
                1. Respiratory syncytial virus (RSV)
                2. Influenza
                3. COVID

4. Tuberculosis
5. Fungal infections
6. Other opportunistic infections
7. inflammatory pseudotumor

2. Small airways disease
    1. Reactive airways disease
    2. Viral pneumonia
3. Bronchiectasis: causes
    1. Cystic fibrosis
    2. Immotile cilia syndrome
    3. Chronic infection (primary immune disorders)
    4. Foreign body
    5. Aspiration

3. Neoplasms/mass-like lesions
    1. Anterior mediastinal masses
        1. Lymphoma/leukemia
        2. Germ cell tumors
        3. Thymoma/carcinoma
        4. Other masses: thymic cysts and bronchogenic cysts
        5. Normal prominent thymus and thymic rebound
    2. Middle mediastinal masses
        1. Adenopathy (lymphoma/mets)
        2. Congenital masses: bronchogenic cysts, esophageal duplication cyst and neurenteric cyst
    3. Posterior mediastinal masses
        1. Neurogenic tumors
    4. Primary lung tumors
        1. Adenoma/carcinoid tumor
    5. Chest wall neoplasms/masses
        1. Ewing sarcoma family (including Askin tumor)
        2. Benign rib and spine neoplasms
        3. Vascular malformations
        4. Infections

4. Trauma
    1. Contusion
    2. Air leak
        1. Pneumothorax
        2. Pneumomediastinum
        3. Bronchopleural fistula
        4. Fracture of tracheobronchial tree
            1. Airway foreign body
            2. Post-traumatic diaphragmatic hernia

5. Vascular
    1. Pulmonary thromboembolic disease

2. Other venous thrombosis or occlusion, anomalous vessels
3. Arteriovenous malformations

6. Unique chest problems in neonate
    1. Respiratory distress syndrome
    2. Transient tachypnea of newborn
    3. Neonatal pneumonia
    4. Congenital diaphragmatic hernia
    5. Chronic lung disease of infancy (bronchopulmonary dysplasia)
    6. Meconium aspiration syndrome
    7. Extracorporeal membrane oxygenation (ECMO) therapy and its complications
    8. Air leak in the neonate
        1. Including pulmonary interstitial emphysema
7. Miscellaneous: includes chest manifestations of systemic disorders
    1. Idiopathic pulmonary hemosiderosis
    2. Alveolar proteinosis
    3. Collagen vascular diseases
    4. Spontaneous pneumothorax and pneumomediastinum
    5. Cardiogenic and noncardiogenic pulmonary edema
    6. Histiocytosis

4. Cardiovascular: Cardiac
    1. Congenital Heart Disease
        1. Anomalies of visceroatrial situs
            1. Asplenia
            2. Polysplenia
            3. Situs inversus
        2. Left-to-right shunts
            1. Ventricular septal defect
            2. Patent ductus arteriosus
            3. Atrial septal defect
            4. Atrioventricular septal defect
            5. Aortopulmonary window
            6. Partial anomalous pulmonary venous return
        3. Intermixing (admixture) states with increased pulmonary blood flow
            1. Total anomalous pulmonary venous connection (TAPVC) without obstruction
            2. D-transposition of the great arteries
            3. Truncus arteriosus
            4. Single ventricle
        4. Intermixing (admixture) states with decreased pulmonary blood flow
            1. Tetralogy of Fallot
            2. Pulmonary atresia with ventricular septal defect (VSDV
            3. Single ventricle with right ventricular outflow tract (RVOT) obstruction
        5. Left-sided obstruction

    1. Coarctation
    2. Hypoplastic left heart syndrome
    3. Cor triatriatum
    4. Obstructed TAPVC
6. Other congenital heart disease
    1. Pulmonary valve stenosis
    2. Pulmonary atresia with intact ventricular septum
    3. Ebstein anomaly
    4. Congenital absence of the pericardium
    5. Vascular rings and slings
    6. Right aortic arch with aberrant left subclavian artery
    7. Double aortic arch and variants
    8. Circumflex aortic arch
    9. Pulmonary sling
7. Anomalous coronary artery origins
    1. Anomalous right coronary artery from the left sinus of Valsalva
    2. Anomalous left coronary artery from the right sinus of Valsalva
    3. Anomalous left coronary artery from the pulmonary artery
8. Systemic venous variants
    1. Left superior vena cava (SVC)
    2. Interrupted inferior vena cava (IVC) with azygos continuation
9. Cardiac masses
    1. Rhabdomyoma, fibroma
    2. Thrombus
10. Syndromes with congenital heart disease or vascular disease
    1. Marfan syndrome
    2. Loeys-Dietz syndrome
    3. Ehlers-Danlos syndrome
    4. Williams syndrome
    5. Alagille syndrome
    6. Neurofibromatosis type 1
    7. Trisomy 21
    8. Holt Oram syndrome
    9. Turner syndrome
    10. PHACE syndrome
11. Acquired cardiac disease
    1. Pericarditis
    2. Myocarditis
    3. Kawasaki disease
12. Cardiomyopathies
    1. Hypertrophic
    2. Dilated
    3. Restrictive
    4. Arrhythmogenic right ventricular dysplasia (ARVD)

13. Cardiac operations
    1. Atrial switch for transposition of great arteries
    2. Norwood procedure
    3. Glenn Shunt
    4. Fontal shunt

5. Cardiovascular: Vascular
    1. Congenital
        1. Vascular malformations
    2. Trauma
        1. Acute traumatic aortic injury
        2. Arterial contrast extravasation
        3. Pseudoaneurysm
        4. Arteriovenous fistulae
        5. Hypoperfusion complex
    3. Inflammatory/infectious
        1. Aortitis
    4. Vasculitides
        1. Takayasu disease and Kawasaki disease
    5. Syndromic/systemic vascular diseases
        1. Syndromes
            1. Ehlers-Danlos
            2. Marfan
            3. Neurofibromatosis and other causes of mid-aortic syndrome
            4. Williams
    6. Idiopathic
        1. Fibromuscular dysplasia
        2. Mid-aortic syndrome
        3. Thrombotic
        4. Deep venous thrombosis
        5. Catheter-related thrombosis and evaluation
6. Gastrointestinal (GI) tract
    1. Biliary system
        1. Congenital
            1. Biliary atresia
            2. Neonatal hepatitis
            3. Choledochal cyst (classification)
            4. Acquired miscellaneous
        2. Cholelithiasis
        3. Hydrops of gallbladder
        4. Cholangitis
        5. Cholecystitis
    2. Liver
        1. Infection
            1. Abscess

        2. Hepatitis
    2. Tumors and tumor-like conditions
        1. Benign
            1. Mesenchymal hamartoma
            2. Hemangioma
        2. Malignant
            1. Hepatoblastoma
            2. Hepatoma
            3. Metastases
        3. Trauma
            1. Lacerations
            2. Subcapsular hematoma
            3. Contusion
        4. Vascular
            1. Portal vein thrombosis
            2. Cavernous transformation
            3. Portal hypertension
            4. Budd-Chiari syndrome
            5. Transplant complications
    3. Other: systemic conditions involving liver
        1. Glycogen storage disease
3. Spleen
    1. Congenital
        1. Abnormal visceroatrial situs
        2. Wandering spleen
    2. Infection
        1. Fungal abscesses
    3. Benign
        1. Lymphangioma
    4. Malignant
        1. Lymphoma/leukemia
    5. Trauma
    6. Splenic infarction
    7. Sickle cell disease
    8. Etiologies for splenomegaly
4. Pancreas
    1. Pancreas divisum
    2. Cystic fibrosis
    3. Pancreatitis (and pseudocyst)
    4. Non-accidental trauma
    5. Choledochal cyst
    6. Familial pancreatitis
5. Aerodigestive track
    1. Pharynx and esophagus

1. Congenital and developmental anomalies
    1. Esophageal atresia and tracheoesophageal fistula (classification)
2. Inflammatory lesions
    1. Retropharyngeal abscess/cellulitis
    2. Infectious esophagitis
3. Trauma
    1. Foreign bodies
    2. Iatrogenic perforation
4. Esophageal stricture (etiologies)
5. Gastroesophageal reflux

2. Stomach
    1. Congenital/neonatal
        1. Volvulus
        2. Gastric outlet obstruction
        3. Hypertrophic pyloric stenosis
    2. Inflammatory
        1. Corrosive ingestion
        2. Inflammatory
        3. Peptic diseases
    3. Bezoars

3. Small Bowel
    1. Congenital
        1. Duodenal webs, stenosis, and other obstructions
        2. Malrotation with/without midgut volvulus
        3. Duodenal, jejunal, and ileal stenosis and/or atresia
        4. Meconium ileus
        5. Meconium peritonitis
        6. Mesenteric and omental cysts
        7. Duplication cysts
        8. Meckel diverticula (including other omphalomesenteric anomalies)
        9. Abdominal wall defects
            1. Omphalocele and gastroschisis
            2. Hernias
    2. Neoplasms
        1. Benign
            1. Polyps and leiomyomas
        2. Malignant
            1. Lymphoma
            2. Gastrointestinal stromal tumors
    3. Malabsorption
        1. Cystic fibrosis
    4. Trauma
    5. Miscellaneous

1. Necrotizing enterocolitis
2. Ischemic bowel
3. Intussusception
4. Henoch-Schölein purpura
5. Graft vs host disease

4. Colon
    1. Congenital
        1. Imperforate anus /anorectal malformation
        2. Duplications
        3. Colonic atresia
        4. Hirschsprung disease
        5. Meconium plug/neonatal small left colon syndrome
    2. Infectious/inflammatory
        1. Appendicitis
        2. Infectious colitis/typhlitis
    3. Neoplasms
        1. Benign: polyps, leiomyoma
        2. Malignant – lymphoma

7. Genitourinary system
    1. Growth and development/normal variants: kidney (echogenic pyramids, lobulation)
    2. Kidneys
        1. Congenital anomalies
            1. Ureteropelvic junction (UPJ) obstruction
            2. Duplication
            3. Multicystic dysplastic kidney
            4. Agenesis
            5. Horseshoe kidney
            6. Ectopia
                1. Ptosis
                2. Pelvic
                3. Crossed fused ectopia
            7. Relationship of congenital renal anomalies with other congenital anomalies (VATER association, spinal dysraphism, etc.)
        2. Cystic renal disease
            1. Autosomal recessive
            2. Autosomal dominant
            3. Cysts associated with syndromes
            4. Associated liver disease (fibrosis)
        3. Inflammatory
            1. Acute pyelonephritis
            2. Chronic pyelonephritis
            3. Abscess
            4. Reflux nephropathy
        4. Neoplasms

        1. Wilms tumor, renal cell, clear cell, rhabdoid tumor
        2. Nephrogenic rests
        3. Mesoblastic nephroma
        4. Cystic nephroma
        5. Leukemia/lymphoma
    5. Trauma
        1. Subcapsular hematoma
        2. Perinephric hematoma
        3. Laceration (including those communicating with collecting system)
        4. Contusion
        5. Avulsion of vascular pedicle
        6. UPJ avulsion or laceration
    6. Vascular
        1. Arterial stenosis
        2. Renal vein thrombosis
        3. Tumor thrombus
    7. Involvement by systemic disorders
        1. Tuberous sclerosis
        2. Von Hippel-Lindau disease
        3. Miscellaneous
        4. Urolithiasis/nephrocalcinosis
        5. Renal transplantation
3. Adrenal gland
    1. Neoplasms
        1. Neuroblastoma
        2. Adrenocortical carcinoma
        3. Pheochromocytoma
    2. Trauma
        1. Hemorrhage (neonatal) and adrenal calcification
        2. Other
    3. Congenital adrenal hyperplasia
4. Bladder, ureters, and urethra
    1. Congenital
        1. Posterior urethral valves
        2. Ureterovesical junction obstruction
        3. Primary megaureter
        4. Bladder diverticula
        5. Ureteral duplication
        6. Ureterocele
        7. Urachal abnormalities
        8. Epispadias/exstrophy
        9. Prune belly syndrome
        10. Urologic sequela of anorectal anomalies
    2. Infectious/inflammatory

1. Urinary tract infection
2. Viral cystitis
3. Hemorrhagic cystitis
4. Trauma
5. Extravasation

3. Neoplasms
    1. Rhabdomyosarcoma
4. Miscellaneous
    1. Vesicoureteral reflux
    2. Neurogenic bladder
    3. Dysfunctional voiding

5. Male genital tract: scrotal
    1. Emergency
        1. Testicular torsion
    2. Infectious/inflammatory
        1. Epididymitis/orchitis
    3. Differential for scrotal fluid collections
        1. Hernia
        2. Undescended testis
    4. Neoplasms
        1. Germ cell tumors
        2. Stromal cell tumors
        3. Metastases
        4. Leukemia/lymphoma
6. Female genital tract
    1. Congenital
        1. Cloacal anomalies
    2. Ovaries
        1. Torsion
        2. Ovarian cysts (including neonatal physiologic)
        3. Germ cell tumors
        4. Cystic neoplasms
        5. Polycystic ovarian disease
    3. Uterus and vagina
        1. Congenital anomalies: vaginal occlusion (hydrometrocolpos, etc.)
        2. Fusion anomalies of the müllerian duct (uterus didelphys, etc.)
        3. Masses
            1. Rhabdomyosarcoma
            2. Clear cell adenocarcinoma
        4. Intersex states

8. Musculoskeletal imaging
    1. Normal growth and development/variants
    2. Congenital and neonatal
        1. Thanatophoric dysplasia

2. Chondrodysplasia punctata
3. Achondroplasia
4. Asphyxiating thoracic dystrophy
5. Multiple cartilaginous exostoses
6. Enchondromatosis
7. Polyostotic fibrous dysplasia
8. Neurofibromatosis
9. Osteogenesis imperfecta
10. Osteopetrosis
11. Amniotic band syndrome
12. Congenital bowing deformities and pseudoarthroses
13. Tarsal coalition
14. Mucopolysaccharidoses and mucolipidoses
15. Developmental dysplasia of hip

3. Skeletal abnormalities associated with neuromuscular diseases
    1. Meningomyelocele
    2. Cerebral palsy
    3. Muscular dystrophy
4. Infectious inflammatory
    1. Pyogenic osteomyelitis
    2. Septic arthritis
    3. Toxic synovitis of the hip
    4. Tuberculosis
    5. Multifocal osteomyelitis
    6. Dermatomyositis/polymyositis and other inflammatory myopathies
5. Arthropathies
    1. Juvenile idiopathic arthritis
    2. Hemophilic arthropathy
6. Neoplasm
    1. Benign
        1. Osteochondroma
        2. Unicameral bone cyst
        3. Aneurysmal bone cyst
        4. Nonossifying fibroma/fibrous cortical defect
        5. Fibrous dysplasia
        6. Langerhans cell histiocytosis
        7. Osteoid osteoma
        8. Osteoblastoma
        9. Chondroblastoma
        10. Chondromyxoid fibroma
    2. Malignant
        1. Ewing sarcoma
        2. Osteogenic sarcoma
        3. Metastases (including leukemia/lymphoma)

3. Vascular
    1. Vascular malformations
4. Trauma
    1. Fracture
        1. Accidental trauma (including Salter-Harris, greenstick-bowing, and buckle fractures)
        2. Nonaccidental trauma (battered child syndrome)
        3. Growth arrest/bone bar and non union
        4. Slipped capital femoral epiphysis
5. Endocrine/Metabolic
    1. Rickets
    2. Renal osteodystrophy
    3. Hyperparathyroidism
    4. Hypophosphatasia
    5. Scurvy
    6. Bone age determination
6. Osteochondroses
    1. Legg-Perthes disease
    2. Osgood-Schlatter and Sinding-Larsen-Johannson
    3. Kohler disease
    4. Freiberg disease
    5. Osteochondritis dissecans
    6. Blount disease and physiologic bowing

9. Select general/multiorgan system syndromes with salient imaging findings
    1. Syndromes
        1. Neurocutaneous syndrome
        2. Sturge-Weber syndrome
        3. Trisomy 21 syndrome
        4. CHARGE syndrome
        5. Marfan syndrome
        6. Beckwith-Wiedemann syndrome
        7. Turner syndrome
        8. Ehlers-Danlos syndrome
        9. DiGeorge syndrome
        10. Klippel-Trenaunay-Weber syndrome
    2. Multisystemic disorders/processes
        1. Systemic lupus erythematosus and other systemic vasculitides
        2. Juvenile idiopathic arthritis
        3. Primary immune deficiencies (severe combined immunodeficiency (SCIDS), chronic granulomatous disease, and DiGeorge syndrome)
        4. Sickle cell anemia
        5. Child abuse
        6. Immunocompromised host (transplant immune suppression, antibiotics, steroids, and chemotherapy)

7. Includes post-transplant lymphoproliferative syndrome
8. VATER/VACTERYL
9. Retained surgical material
10. Ventriculoperitoneal (VP) shunt complications

10. Interventional
    1. Intussusception reduction
    2. Vascular malformations
    3. Hip aspirations
    4. G and G-J Tube and complication
    5. Neonatal Line positions and complications

Radioisotope Safety Content (RISC)

These 35 questions assess the candidate's understanding and knowledge related to the safe use of radioactivity in the clinical practice of diagnostic or interventional radiology. The domain encompasses but is not limited to the Nuclear Regulatory Commission (NRC) requirements found in §35.290, §35.392, and §35.394. Twenty-five questions are tested on the Qualifying (Core) Exam and 10 are tested in the Essentials Module on the Certifying Exam. These RISC questions are integral components of each exam; they are scored toward the overall score, not scored separately.

Diplomates who meet the NRC training, experience, and documentation requirements, pass the RISC, and are certified by 12/31/2023 will receive the Authorized User-Eligible designation on their DR or IR/DR certificate.

Included in this document:

Domain Critical Concepts
Domain Blueprint
Domain Scope

RISC Domain Critical Concepts

1. Describe radiation protection programs and applicable regulations
    a. ALARA
    b. Radiation areas
2. Calculate mathematics of radioactivity measurement
    a. Units
    b. Decay
3. Know principles of radiation biology
    a. Dose
    b. Effects/cancer risks
4. Understand and apply principles of management of radioactive sources
    a. Radioactive packages
    b. Sealed sources
    c. Record keeping
    d. Area surveys
    e. Waste disposal
5. Know regulatory exposure limits and monitoring
    a. Occupational
    b. Pregnancy/fetal
6. Describe protocols involving radiopharmaceutical administration
    a. Record keeping
    b. Breastfeeding/lactation
7. Understand and apply administrative/practice controls and describe responsibilities
    a. NRC and agreement states
    b. Licenses (broad scope)
    c. Written directives, including oral I-131 NaI

    d. Radiopharmacy procedures
8. Describe response to radiation accidents/incidents
    a. Medical events
    b. Spills (major & minor)

RISC Domain Blueprint

1.	Radiation protection	5-10%
2.	Mathematics of radioactivity measurement	10%
3.	Radiation biology	15%
4.	Management of radioactive sources	20%
5.	Regulatory exposure limits	5-10%
6.	Radiopharmaceutical administration	10%
7.	Administrative/practice controls and responsibilities	20%
8.	Radiation accidents/incidents	10%

RISC Domain Scope

- 1.1 Radiation protection
  - 1.1.1 ALARA program
    - 1.1.1.1 Radiation protection program
    - 1.1.1.2 Audit program
    - 1.1.1.3 Operating & emergency procedures (including interventions)
  - 1.1.2 Radiation areas
    - 1.1.2.1 Restricted area
    - 1.1.2.2 Public area
    - 1.1.2.3 Caution signs
    - 1.1.2.4 Engineering controls
- 1.2 Mathematics of radioactivity measurement
  - 1.2.1 Radioactive decay
  - 1.2.2 Radioactive equilibrium
  - 1.2.3 Units of radioactivity
- 1.3 Radiation biology
  - 1.3.1 Radiation dose
    - 1.3.1.1 Absorbed dose
    - 1.3.1.2 Dose equivalent
    - 1.3.1.3 Effective dose
  - 1.3.2 Tissue reactions (deterministic effects)
  - 1.3.3 Linear no-threshold effects (stochastic)
  - 1.3.4 Risks of radiation-induced cancer
- 1.4 Management of radioactive sources
  - 1.4.1 Managing radioactive packages and exempt quantities
  - 1.4.2 Sealed sources QA/QC
  - 1.4.3 Records of written directives, calibrations, surveys, leak tests, QA/QC, & decay-in-storage
  - 1.4.4 Area surveys
  - 1.4.5 Waste management/disposal
- 1.5 Regulatory exposure limits
  - 1.5.1 Occupational dose limits for adults & minors
  - 1.5.2 Declared pregnant workers
  - 1.5.3 Public
  - 1.5.4 Embryo/fetus
  - 1.5.5 Respiratory protection
  - 1.5.6 Individual monitoring
  - 1.5.7 Safe use of unsealed license material
- 1.6 Radiopharmaceutical administration
  - 1.6.1 Confirming dosage
  - 1.6.2 Patient identity
  - 1.6.3 Record-keeping
  - 1.6.4 Fetal dose
  - 1.6.5 Breastfeeding/lactation precautions & cessation

- 1.6.6 Administration of prescribed dosage

1.7 Administrative/practice controls and responsibilities
- 1.7.1 NRC Authority/Agreement states
- 1.7.2 Personnel
  - 1.7.2.1 Technologists
  - 1.7.2.2 Radiation safety officer (RSO)
  - 1.7.2.3 Authorized user (AU)
  - 1.7.2.4 Authorized nuclear pharmacist
  - 1.7.2.5 Authorized medical physicist (AMP)
- 1.7.3 Licenses of broad scope: types A, B & C
- 1.7.4 Written directive (WD)
- 1.7.5 Oral I-131 NaI therapy safety
  - 1.7.5.1 Inpatient
  - 1.7.5.2 Outpatient
- 1.7.6 Radiopharmacy (“hot lab”)
  - 1.7.6.1 Safe procedures
  - 1.7.6.2 Thyroid bioassays
  - 1.7.6.3 Generator systems
    - 1.7.6.3.1 Elution
    - 1.7.6.3.2 QC
  - 1.7.6.4 Record keeping
- 1.7.7 Patient issues

1.8 Radiation accidents/incidents
- 1.8.1 Medical events/reportable events
- 1.8.2 Radiation spills
  - 1.8.2.1 Major spill
  - 1.8.2.2 Minor spill

Thoracic Imaging

This exam content assesses the candidate's knowledge and skills related to the clinical practice of thoracic imaging. The domain encompasses mostly CT and radiography. Some mediastinal MR may be included.

Included in this document:

Domain Critical Concepts
Domain Blueprint
Domain Overview

Domain Critical Concepts

1. Demonstrate knowledge of diffuse lung disease diagnostic approaches (based on demographic, pattern, location) on CT and CXR
2. Diagnose lung cancer and understand findings that may impact staging
3. Distinguish between mediastinal masses based on location and imaging properties
4. Recognize important findings on radiographs, including misplaced catheters and potential complications of catheters, lobar collapse, pneumonia and pleural conditions requiring intervention
5. Recognize acute PE and other pulmonary emboli

Domain Blueprint

1. Anatomy, normal variants: 5%-10%
    a. Lobar
    b. Segmental
    c. Azygous lobe
    d. Bronchi
    e. Mediastinum
2. Pneumonia: 5%-10%
    a. Immunocompetent
    b. Immunocompromised
    c. TB
    d. Fungal
    e. Viral
    f. Septic Emboli
3. Bronchogenic Cancer: 5%-10%
    a. Staging
    b. Treatment
    c. SPN
    d. Screening
    e. Perception
    f. Diagnostic approach

    g. Persistent consolidation
4. Other tumors: up to 5%
    a. Metastases
    b. Carcinoid
    c. Lymphoma
    d. Hamartoma
5. Lines, tubes, devices and cardiovascular radiography: up to 5%
    a. Central lines
    b. ETT
    c. Chest tubes
    d. NG tubes
    e. PA line
    f. Pneumoperitoneum
    g. Cardiac devices
    h. Cardiovascular conditions on radiography including pericardial effusions and valvular disease
6. Trauma: 5%-10%
    a. Pneumothorax
    b. Pneumomediastinum
    c. Bronchial injury
    d. Hemothorax
    e. Diaphragmatic injury
    f. Flail chest
    g. Fractures
    h. Aorta
7. Congenital lung/mediastinal disease: up to 5%
    a. Cysts
    b. Atresia
    c. AVM
    d. PAPVR
    e. Persistent left SVC
    f. Swyer-James
    g. Poland
    h. Sequestration
    i. Congenital cystic adenomatoid malformations
8. Interstitial lung disease: 5%-10%
    a. Cystic lung disease
    b. Pneumoconioses
    c. Fibrosis
    d. CHF
    e. Drug toxicity
    f. Lymphangioleiomyomatosis
    g. Sarcoid
9. Alveolar lung disease/inflammatory: up to 5%

    a. Pulmonary alveolar proteinosis
    b. Lipoid pneumonia
    c. Cyptogenic organizing pneumonia
    d. PIE
    e. HP
10. Central airways/bronchiectasis: up to 5%
    a. Tracheal tumors
    b. Cystic fibrosis
    c. Stenosis
    d. Immotile cilia
    e. Malacia
    f. Small airways disease
    g. MAI/MAC
    h. Bronchiolithiasis
    i. ABPA
    j. Aspiration pneumonia
11. Pulmonary manifestations of systemic disease: up to 5%
    a. Rheumatoid arthritis
    b. Collagen vascular disease
    c. Pulmonary/renal syndromes
    d. Hepatopulmonary syndrome
    e. Vasculitis
12. Pleura, diaphragm and chest wall: up to 5%
    a. Mesothelioma
    b. Metastases
    c. Empyema
    d. Pneumothorax
    e. Lipoma
    f. Fibrous tumors of the pleura
    g. Plaque
    h. Effusion
    i. Opacification
    j. Hernia
    k. Paralysis
    l. Neurofibromatosis
    m. Chest wall tumors
13. Mediastinal masses: up to 5%
    a. Superior
    b. Anterior
    c. Middle
    d. Posterior
    e. Fibrosing mediastinitis
    f. Esophageal lesion (achalasia)
    g. Vascular

h. Varices

14. Atelectasis and Collapse: up to 5%
    a. Lobar collapse
    b. Round atelectasis
    c. Golden S sign
    d. Whole lung collapse
15. Pulmonary arteries: up to 5%
    a. Acute PE
    b. Chronic PE
    c. Pulmonary infarct
    d. PE mimics
    e. Vasculitis
    f. Pulmonary pseudoaneurysm

Domain Overview

1. Basics of Imaging, including Chest Radiography (CXR), CT and MRI, Ultrasound (US), and Percutaneous Intervention
    1. Indications and limitations of the modalities
2. Normal Anatomy, including Variants, Encountered on CXR, CT, MRI and US
    1. Lungs, including tracheobronchial and pulmonary lobar anatomy, and fissures
    2. Mediastinal and thoracic inlet anatomy
    3. Chest wall anatomy
3. Physiology Relevant to Thoracic Imaging, including Pulmonary Function Tests, Restrictive and Obstructive Patterns
4. Definition, Identification, and Significance of Signs and Finding Nomenclature in Thoracic Radiology. Knowledge should include diseases for which these signs are classic, potential alternative diagnoses, or pitfalls [Hansell et al. Fleischner Society: Glossary of Terms for Thoracic Imaging. Radiology 2008;246:697-722]
    1. Air bronchogram
    2. Air crescent sign
    3. Deep sulcus sign on a supine radiograph
    4. Continuous diaphragm sign
    5. Ring around the artery sign
    6. Fallen lung sign
    7. Flat waist sign
    8. Gloved finger sign
    9. Golden S sign
    10. Luftsichel sign
    11. Hampton hump
    12. Silhouette sign
    13. Cervicothoracic sign, tapered margins sign
    14. Figure 3 sign
    15. Fat pad sign or sandwich sign
    16. Scimitar

17. Hilum overlay sign and hilum convergence sign
18. Beaded septum sign
19. Tree-in-bud
20. Centrilobular nodules
21. Perilymphatic nodules
22. Random or miliary nodules
23. Crazy paving
24. Ground glass halo
25. Mosaic attenuation
26. Consolidation
27. Ground glass opacity
28. Honeycombing
29. Interlobular and intralobular septal thickening and reticulation
30. Juxtaphrenic peak
31. Secondary pulmonary lobule
32. Mass and nodule
33. Parenchymal and subpleural bands
34. Pleural plaques or pseudoplagues
35. Reverse halo sign
36. Signet ring sign (also known as pearl ring sign)
37. Split pleura sign
38. Headcheese sign
39. Thoracoabdominal sign
40. Westermark sign
41. CT angiogram sign
42. Bulging fissure sign
43. Fleischner sign
44. Comet tail sign
45. Thymic sail sign
46. Split pleura sign
47. Positive bronchus sign
48. Double density sign
49. Unilateral hyperlucent lung/hemithorax
50. Opaque hemithorax with contralateral versus ipsilateral mediastinal shift

5. Infectious Pneumonia - CXR and CT Findings
    1. Mycobacterial and fungal
    2. Viral
    3. Community- and hospital-acquired bacterial pneumonia
    4. Pneumonia in the immunocompromised, including patients:
        1. with HIV/AIDS
        2. with post-transplantation status
        3. on chemotherapy, receiving corticosteroids, or with immune conditions
        4. Septic emboli
6. Lung Cancer and other Parenchymal Neoplasms

1. Solitary pulmonary nodule (SPN)
    1. Approach to diagnosis (contrast-enhancement, imaging features)
    2. Management (PET, biopsy, follow-up/comparison)
    3. Perception and errors in perception
2. Screening for lung cancer – current status
3. Chronic alveolar disease as a manifestation of neoplasm
4. Lung cancer staging
5. Manifestations of small cell and non-small cell carcinoma, and bronchoalveolar cell carcinoma, including common locations for metastases
6. Other tumors
    1. Metastases
    2. Carcinoid
    3. Hamartoma
    4. Lymphoma
    5. Chondrosarcoma

7. The Intensive Care Unit CXR - The Expected Location of the Support Devices and the Ability to Recognize Misplaced Lines and Complications (Pneumothorax, Hemothorax, Hematoma, Pneumoperitoneum)
    1. Central lines (including wrong vein and intra-arterial)
    2. Esophageal tubes/probes (including esophageal, nasogastric, and feeding tubes, endobronchial or intrapleural misplacement
    3. Endotracheal and tracheostomy tubes
    4. Pulmonary artery (Swan-Ganz) catheters (including peripheral placement and pseudoaneurysm formation)
    5. Chest tubes (including intraparenchymal and intrafissural placement)
    6. Assist devices
8. Trauma, including Blunt and Penetrating Trauma
    1. Acute traumatic aortic injury
    2. Esophageal injury
    3. Tracheobronchial injury
    4. Lung injuries (contusion, shear injury, aspiration, laceration)
    5. Diaphragm injury, both acute and delayed presentations
    6. Tension hemopneumothorax, pneumothorax, pneumomediastinum
    7. Flail chest, skeletal fractures, and dislocations
    8. Fat emboli
9. Congenital Lung and Mediastinal Disease Manifesting in the Adult
    1. Foregut duplication cysts, including bronchogenic cysts and esophageal duplication cysts
    2. Bronchial atresia
    3. Arteriovenous malformations
    4. Partial anomalous pulmonary venous return
    5. Left superior vena cava (SVC) and duplicated SVC
    6. Swyer-James syndrome (unilateral bronchiolitis obliterans)
    7. Poland syndrome
    8. Sequestration (intralobar and extralobar)

9. Congenital cystic adenomatoid malformation
10. Aortic arch anomalies

10. Diffuse Lung Disease
    1. Cystic disease
        1. Langerhans cell histiocytosis
        2. Lymphangioleiomyomatosis
        3. Tracheobronchial papillomatosis
        4. Lymphocytic interstitial pneumonia
        5. Cystic metastases
        6. Chronic pneumocystis
    2. Pneumoconioses
        1. Silicosis/coal workers pneumoconiosis
        2. Asbestosis
        3. Berylliosis
    3. Idiopathic /fibrotic
        1. Usual interstitial pneumonia (UIP)
        2. Nonspecific interstitial pneumonia (NSIP)
        3. Desquamative interstitial pneumonia (DIP)
        4. Acute interstitial pneumonia (AIP)
    4. Pulmonary edema
        1. Cardiogenic
        2. Noncardiogenic
    5. Drug toxicity, including chemotherapy agents such as bleomycin and medications such as Amiodarone
    6. Sarcoidosis, including CXR staging
    7. Lymphangitic carcinomatosis
    8. Differential diagnoses for chronic upper lobe predominant disease and chronic lower lobe predominant disease
11. Diffuse Alveolar Disease and Inflammatory Conditions
    1. Pulmonary alveolar proteinosis
    2. Lipoid pneumonia
    3. Organizing pneumonia, including cryptogenic
    4. Eosinophilic pneumonia
    5. Hypersensitivity pneumonia/extrinsic allergic alveolitis
    6. Differential diagnosis of peripheral alveolar opacities
12. Central Airways Diseases, Bronchiectasis, and Obstructive Lung Disease
    1. Tracheal/bronchial tumors or masses
        1. Squamous cell cancer and papillomas
        2. Adenocarcinoma
        3. Mucoepidermoid
        4. Adenoid cystic carcinoma
        5. Carcinoid
        6. Metastases
    2. Cystic fibrosis

3. Tracheal stenosis
    1. Inhalation and iatrogenic (such as tracheostomy or endotracheal tube)
    2. Granulomatous disease (Sarcoid, Wegener, tuberculosis)
    3. Amyloidosis
    4. Conditions that spare the posterior membrane (relapsing polychondritis; tracheopathia osteochondroplastica)
4. Tracheobronchomalacia
5. Bronchiectasis, including upper versus lower lobe predominant bronchiectasis
    1. Immotile cilia syndrome (Kartagener)
    2. Recurrent aspiration
    3. Tracheobronchomegaly (Mounier-Kuhn)
    4. Tuberculosis
6. Small airway disease
    1. Asthma
    2. Bronchiolitis obliterans
    3. Graft-versus-host disease
7. Small airway infection, including Mycobacterium avium-intracellulare (MAI)
8. Broncholithiasis
9. Allergic bronchopulmonary aspergillosis (ABPA)
10. Aspiration and foreign bodies
11. Emphysema, including centrilobular, paraseptal, panacinar, and paracicatricial
12. Giant bulla

13. Thoracic Manifestations of Systemic Disease
    1. Rheumatoid arthritis
    2. Scleroderma and mixed connective tissue disease
    3. Systemic lupus erythematosus
    4. Hepatopulmonary syndrome
    5. Vasculitis (Wegener, Goodpasture)
    6. Tuberous sclerosis
    7. Neurofibromatosis
    8. Sickle cell disease
    9. Polymyositis/dermatomyositis
    10. Sjögren syndrome
    11. Metastatic pulmonary calcification
14. Diseases of the Pleura, Chest Wall, and Diaphragm
    1. Mesothelioma
    2. Pleural metastases
    3. Fibrous tumor of the pleura
    4. Lipoma
    5. Empyema
    6. Chylothorax
    7. Pleural plaques, including asbestos exposure, hemothorax, prior infection
    8. Unilateral pleural calcification
    9. Pleural effusions, including differential diagnosis for unilateral and bilateral effusions

10. Diaphragmatic hernias, including post-traumatic, Bochdalek, Morgagni, sliding hiatal
11. Disorders of diaphragm motion, including role of sniff test
12. Neurofibromatosis
13. Chest wall tumors, including metastases, sarcomas, and desmoid tumors

15. Mediastinal Masses (Including Cardiac and Vascular-related Masses)
    1. Anterior mediastinum
        1. Thymic origin, including thymoma, carcinoma, carcinoid, and cyst
        2. Germ cell tumors, including seminoma and teratoma
        3. Lymphoma
        4. Goiter
    2. Middle mediastinum
        1. Duplication cysts
        2. Lymph node enlargement
        3. Esophageal origin, including cancer, diverticulum, achalasia, varices
        4. Airway masses
        5. Vascular masses
    3. Posterior mediastinum
        1. Nerve sheath tumors (neurofibromas, schwannomas)
        2. Paragangliomas (ganglioneuroma and ganglioneuroblastoma)
        3. Spine and paraspinal processes, including extramedullary hematopoiesis, metastases, diskitis
    4. Superior mediastinal / thoracic inlet masses
        1. Goiter
        2. Lymphangioma
    5. Differential diagnoses of mediastinal masses based on location and CT attenuation (fat, fluid, calcified, enhancing)/MRI signal characteristics
    6. Vascular masses (aneurysms and pseudoaneurysms)
    7. Diffuse mediastinal disease
        1. Mediastinitis
        2. Fibrosing mediastinitis
    8. Differential diagnosis for egg-shell calcifications
    9. Mediastinal lymph node enlargement
16. Atelectasis and Collapse, including CXR/CT Findings and Differential Diagnosis
    1. Lobar collapse (right upper, middle, right lower, left upper, lingual, left lower, and combined right middle/lower)
    2. Unilateral lung collapse
    3. Collapse from an obstructing mass
    4. Round atelectasis
17. Pulmonary Arteries
    1. Acute pulmonary embolism
    2. Chronic pulmonary embolism
    3. Pulmonary infarct
    4. Pulmonary embolism mimics, including pulmonary artery sarcoma
    5. Pseudoaneurysm

6. Vasculitis (Takayasu)

18. Postoperative and Post-treatment Thorax
    1. Lung resection, including post-lobectomy, post-wedge resection, pneumonectomy, and post-pneumonectomy syndrome
    2. Lobar torsion
    3. Radiation fibrosis and pneumonitis
    4. Post lung transplantation, including acute, subacute, and chronic complications, single and bilateral transplantation
    5. Post-esophagectomy
    6. Post-lung volume reduction surgery
    7. Airway and esophageal stents
    8. Eloesser flap
19. Percutaneous Thoracic Interventions
    1. Aspiration, biopsy and drainage
    2. Clinical indications and contraindications
    3. Techniques
    4. Accuracy
    5. Complications
    6. Post-procedure care

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.

Included in this document:

Domain Critical Concepts
Domain Blueprint
Domain Overview

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. Cpngenital 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