Radiology Knowledge Base

Imaging Modalities

X-ray (Radiography)

- **Principles**: Electromagnetic radiation absorption by tissues
- **Applications**: Chest, bone, abdominal imaging
- **Advantages**: Quick, inexpensive, widely available
- **Limitations**: Limited soft tissue contrast, radiation exposure

Computed Tomography (CT)

- **Principles**: Cross-sectional imaging using X-rays
- **Contrast**: Iodinated contrast for vascular and organ enhancement
- **Applications**: Trauma, oncology, vascular imaging
- **Radiation Dose**: Higher than conventional X-ray

Magnetic Resonance Imaging (MRI)

- **Principles**: Magnetic field and radiofrequency pulses
- **Sequences**: T1-weighted, T2-weighted, FLAIR, DWI
- **Contrast**: Gadolinium-based contrast agents
- **Contraindications**: Metallic implants, claustrophobia

Ultrasound

- **Principles**: High-frequency sound waves
- **Applications**: Obstetrics, cardiology, abdominal imaging
- **Advantages**: No radiation, real-time imaging, portable
- **Doppler**: Blood flow assessment

Chest Imaging

Chest X-ray Interpretation

- **Systematic Approach**: ABCDEFGHI method
- A: Airways (trachea, bronchi)
- B: Bones (ribs, spine, clavicles)

- C: Cardiac silhouette
- D: Diaphragm
- E: Effusions
- F: Fields (lung fields)
- G: Gastric bubble
- H: Hilum
- I: Iatrogenic (lines, tubes)

Common Chest Pathology

- **Pneumonia**: Consolidation, air bronchograms
- **Pneumothorax**: Pleural line, absent lung markings
- **Pulmonary Edema**: Bilateral infiltrates, cardiomegaly
- **Lung Cancer**: Mass, nodules, lymphadenopathy

CT Chest

- **Indications**: Lung nodule evaluation, staging, pulmonary embolism
- **HRCT**: High-resolution CT for interstitial lung disease
- **CTPA**: CT pulmonary angiogram for PE diagnosis

Abdominal Imaging

CT Abdomen/Pelvis

- **Phases**: Non-contrast, arterial, portal venous, delayed
- **Indications**: Abdominal pain, trauma, oncology staging
- **Oral Contrast**: Bowel opacification
- **IV Contrast**: Vascular and organ enhancement

Abdominal Ultrasound

- **Applications**: Gallbladder, liver, kidneys, pelvis
- **FAST Exam**: Focused Assessment with Sonography in Trauma
- **Doppler**: Portal vein, renal arteries assessment

MRI Abdomen

- **MRCP**: Magnetic Resonance Cholangiopancreatography
- **Liver MRI**: Hepatocellular carcinoma screening
- **Pelvic MRI**: Gynecologic and prostate imaging

Neuroimaging

CT Head

- **Indications**: Trauma, stroke, headache
- **Non-contrast**: Hemorrhage, mass effect
- **Contrast**: Tumor, infection evaluation
- **Window Settings**: Brain, bone, subdural windows

MRI Brain

- **Sequences**: T1, T2, FLAIR, DWI, T2*
- **Stroke Protocol**: DWI, ADC, FLAIR, T2*
- **Contrast**: Gadolinium for tumor, infection
- **Functional MRI**: Blood flow and activation studies

Stroke Imaging

- **Acute Stroke**: CT to rule out hemorrhage
- **Ischemic Stroke**: DWI hyperintensity, ADC hypointensity
- **Hemorrhagic Stroke**: CT hyperdensity, MRI susceptibility

Musculoskeletal Imaging

X-ray Interpretation

- **Fracture Description**: Location, pattern, displacement, angulation
- **Joint Assessment**: Alignment, joint space, degenerative changes
- **Bone Density**: Osteoporosis, osteopenia

MRI Musculoskeletal

- **Sequences**: T1, T2, STIR, PD
- **Applications**: Ligament tears, meniscal injuries, tumors
- **Contrast**: Gadolinium for infection, tumor

Bone Scan

- **Technetium-99m**: Bone metabolism assessment
- **Applications**: Metastases, infection, fractures

- **Three-phase**: Blood flow, blood pool, delayed images

Interventional Radiology

Vascular Interventions

- **Angioplasty**: Balloon dilation of stenotic vessels
- **Stenting**: Metallic scaffold placement
- **Embolization**: Vessel occlusion for bleeding, tumors
- **Thrombolysis**: Clot dissolution therapy

Non-vascular Interventions

- **Biopsy**: Image-guided tissue sampling
- **Drainage**: Abscess, fluid collection drainage
- **Ablation**: Tumor destruction using heat, cold, or chemicals

Radiation Safety

ALARA Principle

- **As Low As Reasonably Achievable**
- **Time**: Minimize exposure duration
- **Distance**: Maximize distance from source
- **Shielding**: Lead aprons, thyroid shields

Radiation Doses

- **Chest X-ray**: 0.02 mSv
- **CT Chest**: 7 mSv
- **CT Abdomen**: 10 mSv
- **Annual Background**: 2-3 mSv

Pregnancy Considerations

- **First Trimester**: Most sensitive period
- **Shielding**: Abdominal/pelvic protection
- **Alternative Modalities**: Ultrasound, MRI when possible