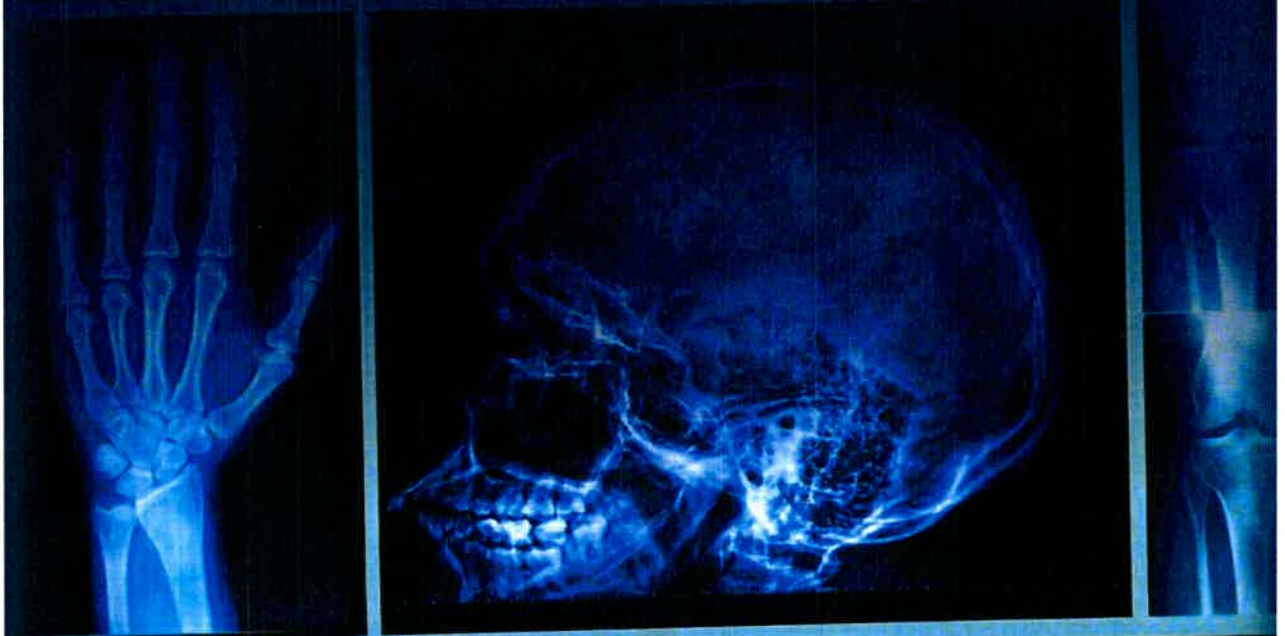


DNB Master Solutions Radiology



Vol. 1



Authored By The Faculty of Conceptual Radiology

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PAPER 1

DNB RADIOLOGY JUNE 2022

1. Child with limp: Imaging evaluation, causes
2. CNS manifestations in HIV: Listing, details of two, imaging
3. Leukocoria in child: Differential, imaging features
4. Salivary gland tumors: Types, imaging findings
5. Subarachnoid hemorrhage: Causes, imaging
6. Skeletal changes on imaging in hemolytic anemia and leukemia
7. Malignant thyroid lesions: Types, imaging features
8. Meniscal tears (knee) on MRI: Findings, MR arthrography
9. Nerve sheath tumors: Types, imaging features
10. Cystic jaw lesions: Types, imaging features

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8. MRI in intracranial hemorrhage—stage-wise findings
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3. Hypertrophic osteoarthropathy-causes, differential diagnosis.

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7. Inner ear anatomy, approach to congenital sensorineural hearing loss.
8. Rheumatoid arthritis imaging
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DNB RADIOLOGY PAPER-1 JUNE 2022

- 1. Child with limp: Imaging evaluation, causes**
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Question 1.

An 11- year- old male presented with a limp of 01-month duration.

a. How will you evaluate this patient radiologically? [5]

b. What are the possible causes in such a case? Describe their imaging features in brief. [2+3]

Answer 1.**Imaging Approach****a) Initial Evaluation**

- **Plain Radiographs** — first-line
 - **Views:** AP pelvis (both hips), frog-leg lateral hip, AP & lateral knee/ankle (if localizing symptoms or trauma).
 - **Purpose:** Detect fracture, SCFE, Perthes, tumor, infection, DDH, avulsion injuries.
 - **Pearl:** Always image both hips for comparison — subtle SCFE or Perthes may be missed if unilateral view only.

b) Ultrasound

- **Indications:**
 - Hip joint effusion (transient synovitis, septic arthritis).
 - Soft tissue pathology (bursitis, hematoma).
 - Dynamic assessment for hip instability.
- **Advantages:** No radiation, real-time assessment.
- **Doppler:** Assess hyperemia (infection vs inflammatory arthritis).

c) MRI

- **Indications:**
 - Early osteomyelitis / septic arthritis (marrow + soft tissue involvement).
 - Early Perthes before X-ray changes.
 - Stress fractures.
 - Occult fractures.
- **Sequences:** T1, T2/STIR, DWI, post-contrast (infection, tumor).
- **Pearl:** MRI is the most sensitive for marrow edema and early ischemic changes.

d) CT

- **Indications:**
 - Complex fractures (acetabular, pelvic).
 - Bone tumors — cortical detail.
 - Pre-operative planning (3D recon).
- **Caution:** Radiation — use sparingly in children.

e) Nuclear Medicine

- **Bone scan (Tc-99m):**
 - Multifocal pathology (tumor metastases, multifocal osteomyelitis).
 - Occult fractures not visible on X-ray/MRI.

Common Causes in an 11-Year-Old Boy — Imaging Findings

Condition	X-ray	Ultrasound	MRI	Notes
Transient Synovitis	Normal or mild joint space widening	Effusion without synovial thickening	Effusion, mild synovial enhancement	Self-limiting; most common cause in this age
Septic Arthritis	Early normal; later—joint space narrowing, erosions	Effusion + synovial thickening, Doppler hyperemia	Synovial enhancement, marrow edema, possible abscess	Surgical emergency
Legg-Calvé-Perthes	Sclerosis, flattening, fragmentation of femoral head	—	Early — marrow edema; later — collapse	4–8 yrs common; rare but possible in early teens
SCFE	Posterior-inferior displacement of epiphysis (Klein's line abnormal)	—	Physeal widening, marrow edema	Common in 11–14 yrs boys; frog-leg lateral best
Osteomyelitis	Early normal; later — periosteal reaction, lytic changes	—	Marrow edema, periosteal elevation, abscess	MRI sensitive in first 24–48 hrs
JIA	Periarticular osteopenia, joint space narrowing	Effusion, synovitis	Synovial thickening, erosions, marrow edema	Multiple joint involvement possible
Osteosarcoma / Ewing's	Aggressive periosteal reaction (sunburst/onion-skin), lysis	—	Soft tissue extension, marrow spread	Pain may precede radiographic changes
Stress fracture	Often normal initially	—	Cortical fracture line, marrow edema	Common in active kids
FAI / Hip Dysplasia	Abnormal head-neck contour / shallow acetabulum	—	Labral tear, cartilage damage	May present with activity-related limp

Question 2.

Enumerate the various CNS manifestations in HIV. Discuss the various CNS manifestations in HIV in any two of them. [4+(3+3)]

Answer 2.

Central nervous system (CNS) manifestations of AIDS remain a significant cause of morbidity and mortality in immunocompromised individuals despite antiretroviral therapy (ART). MRI plays a vital role in early diagnosis, differentiation, and management of these conditions. CNS involvement can be broadly categorized into:

- HIV-related neurologic diseases
- Opportunistic infections (OIs)
- ART-related inflammatory syndromes (e.g., IRIS)

1. HIV-Related Neurologic Diseases

A. HIV Encephalopathy (HAND)

- **Clinical:** Progressive cognitive decline, memory loss, motor dysfunction.
- **CD4:** Typically 200–500 cells/mm³.
- **MRI Findings:**
 - T2/FLAIR: Bilateral symmetric hyperintensity in periventricular and deep white matter.
 - T1: Hypointensity with cerebral atrophy in later stages.
 - No contrast enhancement or mass effect.
 - Advanced techniques: DTI shows altered connectivity, MRS shows decreased NAA.

2. Opportunistic Infections (OIs)

A. CNS Toxoplasmosis (CNS-Toxo)

- **Clinical:** Focal encephalitis, seizures, altered mental status.
- **CD4:** <100 cells/mm³.
- **MRI Findings:**
 - Multiple ring-enhancing lesions (<4 cm) in basal ganglia, thalamus, cerebellum.
 - Edema and mass effect.
 - Pathognomonic signs: Concentric target sign (T2), Eccentric target sign (T1 C+).
 - SPECT: Cold on thallium-201; FDG-PET: Hypometabolic.

B. Primary CNS Lymphoma (PCNSL)

- **Clinical:** Focal deficits, rapid progression.
- **CD4:** <50 cells/mm³; EBV DNA often positive.
- **MRI Findings:**
 - Large (>4 cm), ring or homogeneously enhancing lesions.
 - Commonly in corpus callosum, periventricular areas.
 - DWI: Restricted diffusion.
 - MRS: Elevated choline.
 - PET/SPECT: Hot lesions.

C. Progressive Multifocal Leukoencephalopathy (PML)

- **Etiology:** JC virus.
- **Clinical:** Insidious focal deficits, rapid deterioration.
- **MRI Findings:**
 - Asymmetric, non-enhancing T2 hyperintense white matter lesions.
 - Subcortical U-fiber involvement.
 - DWI: Milky way appearance, hyperintense advancing front.
 - No mass effect.
 - Diagnosis: JC virus DNA in CSF.

D. CNS Cryptococcosis (CNS-Crypt)

- **Etiology:** *Cryptococcus neoformans*.
- **CD4:** <100 cells/mm³.
- **MRI Findings:**
 - Gelatinous pseudocysts in basal ganglia, thalamus (soap bubble appearance).
 - T2 hyperintense, FLAIR low signal.
 - Meningeal enhancement in immune reconstituted patients.

E. CNS Tuberculosis (CNS-TB)

- **CD4:** Often <200 cells/mm³.
- **MRI Findings:**
 - Basilar meningeal enhancement.
 - Tuberculomas: Homogenous or ring-enhancing.
 - Hydrocephalus, infarcts (especially in basal ganglia).

3. ART-Related Inflammatory Syndromes**A. Immune Reconstitution Inflammatory Syndrome (IRIS)**

- **Trigger:** ART initiation in severely immunosuppressed.
- **Timeline:** Onset within 1–1.5 months.
- **MRI Findings:**
 - New/worsening enhancement and edema.
 - Mass effect may be present.
 - DWI: Peripheral restriction.
 - May occur in setting of PML, CNS-Toxo, CNS-Crypt.

Diagnostic Algorithm (Pattern Recognition)

MRI Pattern	Likely Diagnosis
Diffuse bilateral white matter	HIV encephalopathy
Multiple ring-enhancing lesions	CNS-Toxo or PCNSL
Non-enhancing asymmetric WM lesion	PML
Basilar meningeal enhancement	CNS-TB
Perivascular pseudocysts	CNS-Crypt
New enhancement post-ART	IRIS

Question 3.

A 3-year-old male child presented with leukocoria.

a. What are the possible causes?

[3]

b. Describe the imaging features of each of these.

[7]

Answer 3.

Leukocoria, also spelled leucocoria, refers to a white pupillary reflex observed during an eye examination. This white

reflex replaces the normal red reflex seen due to light reflecting off the healthy retina.

Causes of Leukocoria:

- **Retinoblastoma (most common in children):** Malignant tumor of the retina.
- **Cataract:** Clouding of the lens of the eye.
- **Coats' disease:** Exudative retinal vascular disease causing retinal detachment.
- **Persistent hyperplastic primary vitreous (PHPV):** Congenital developmental abnormality of the vitreous humor.
- **Toxocariasis:** Parasitic infection causing inflammation in the eye.
- **Retinopathy of prematurity (ROP):** Eye disease affecting premature babies.

Radiological Imaging Features:

A. Computed Tomography (CT):

- Can be helpful to identify calcifications within the eye.
- **Retinoblastoma:** May show a calcified intraocular mass.
- **PHPV:** May show a dense, well-defined intraocular mass.
- **Limited role:** CT has limitations in evaluating soft tissue details within the eye.

B. Magnetic Resonance Imaging (MRI):

- Preferred modality for detailed evaluation of leukocoria.
- **Retinoblastoma:** May show a well-defined intraocular mass with enhancement after contrast administration. May show areas of necrosis (cell death) within the mass.
- **Coats' disease:** May show subretinal fluid collection and thickening of the retinal pigment epithelium.
- **PHPV:** May show a well-defined, solid or mixed solid-and-fluid mass within the vitreous cavity.
- **Toxocariasis:** May show intraocular inflammatory signs and possible granuloma formation.
- **ROP:** May show abnormal retinal vascular proliferation and retinal detachment.

Radiological Imaging Features of Leukocoria-Causing Conditions:

Leukocoria, a white pupillary reflex, can arise from various conditions. Here's a breakdown of their key radiological imaging features for a radiology exam:

1. Cataract:

- **Imaging modality:** Primarily diagnosed clinically, with minimal role for radiology.
- **X-ray:** May show a faint increased density within the lens capsule in advanced cases.
- **Ultrasound:** Can be helpful in some cases to assess the lens opacity and internal structure. *Appears as a well-defined, increased echogenicity within the lens on B-scan.

2. Retinoblastoma:

- **Preferred modality:** MRI
- **MRI features:**
 - Well-defined, intraocular mass with enhancement after contrast administration.

- May show areas of necrosis (cell death) within the mass.
- Calcifications may be present but are not always seen.

3. Persistent Hyperplastic Primary Vitreous (PHPV):

- **Preferred modalities:** MRI and Ultrasound
- **MRI features:**
 - Well-defined, solid or mixed solid-and-fluid mass within the vitreous cavity.
 - May show extension through the pupil.
- **Ultrasound features:**
 - Dense, well-defined echogenic mass within the vitreous on B-scan.
 - May cause retrolental echoes (shadows behind the mass).

4. Coats' Disease:

- **Preferred modality:** MRI
- **MRI features:**
 - Subretinal fluid collection (accumulation of fluid between the retina and the underlying tissue).
 - Thickening of the retinal pigment epithelium (RPE).
 - May show intraretinal hemorrhage in severe cases.

5. Toxocariasis:

- **Preferred modalities:** MRI and Ultrasound (may be limited)
- **MRI features:**
 - Intraocular inflammatory signs like vitritis (inflammation of the vitreous) and choroiditis (inflammation of the choroid).
 - Possible granuloma formation (inflammatory mass) within the eye.
- **Ultrasound features:**
 - Non-specific findings like vitreous opacities and thickening of the retinal detachment.

Question 4.

Enumerate the salivary gland tumors. Discuss the role of imaging and the characteristic imaging findings of these tumors.

Answer 4.

Location:

- Parotid gland: 70%
- Minor salivary glands (including sublingual): 22% with the palate being most frequent (see: minor salivary gland tumors)
- Submandibular gland: 8%
- Overall ~80% of all parotid masses are benign and the majority of these are pleomorphic adenomas.

BENIGN	MALIGNANT
• Epithelial 1. Pleomorphic Adenoma: this is the most common ($\approx 50\%$) tumor of the parotid 2. Warthin tumor: essentially only found in the parotid, in older, usually male patients; smokers, it is bilateral in 10-15% 3. Intraductal papilloma of salivary glands 4. Oncocytoma of salivary glands 5. Myoepithelioma: until recently considered a subtype of pleomorphic adenoma; they can also originate in breast and bronchus • Non-epithelial 1. Hemangioma 2. Lymphangioma 3. Lipoma	1. Mucoepidermoid carcinoma: most of the malignant lesions 2. Adenoid cystic carcinoma 3. Myoepithelioma 4. Adenocarcinoma (not otherwise specified) 5. Acinic cell carcinoma of salivary glands 6. Squamous cell carcinoma of salivary glands 7. Lymphoepithelial carcinoma 8. Malignant mixed tumors of the salivary glands a. Carcinoma ex pleomorphic adenoma b. Carcinosarcoma (true mixed tumor of the salivary glands) c. Metastasizing pleomorphic adenoma 9. Salivary duct carcinoma 10. Metastases (mostly to intraparotid lymph nodes) a. Cutaneous squamous cell carcinoma b. Malignant melanoma c. Testicular seminoma (rare) Lymphoma (rare) -primary: arising from the parotid gland as a MALToma; secondary: involving the intraparotid lymph nodes

Salivary Gland Tumors: Radiological Imaging findings in Benign tumors:

- **Pleomorphic Adenoma (PA):**
 - Most common salivary gland tumor (50%).
 - **US: Well-circumscribed, hypoechoic mass.**
 - **CT: Well-defined, homogeneous**, may show central necrosis.
 - **MRI: T1- & T2-weighted: Variable signal intensity. Post-contrast: Homogeneous enhancement.**
- **Warthin's Tumor:**
 - Predominantly parotid gland. Often bilateral in older males.
 - **US: Well-circumscribed, heterogeneous mass with cystic areas.**
 - **CT: Well-defined, ovoid mass with central low attenuation.**
 - **MRI: T1-weighted: Low signal intensity. T2-weighted: High signal intensity in cystic areas. Post-contrast: Peripheral enhancement.**
- **Myoepithelioma:**
 - Can be benign or malignant.
 - **US: Variable appearance (solid, cystic, mixed).**
 - **CT: Well-defined**, may show calcifications.
 - **MRI: Variable signal intensity depending on composition. Post-contrast: Variable enhancement pattern since various components.**

Malignant Tumors:

- **Mucoepidermoid Carcinoma (MEC):**
 - Most common malignant salivary gland tumor (30%).

- **Subtypes:** Low, intermediate, high grade (affect imaging features).
- **Low-grade MEC:**
 - **US:** Well-defined, heterogeneous mass with cystic areas.
 - **CT:** Well-defined, may show internal septae. Post-contrast: Peripheral enhancement.
 - **MRI:** T1-weighted: Variable signal intensity. T2-weighted: High signal intensity in cystic areas. Post-contrast: Peripheral enhancement.
- **High-grade MEC:**
 - **US:** Ill-defined, solid mass.
 - **CT:** Ill-defined, heterogeneous mass with necrosis. Post-contrast: Irregular enhancement.
 - **MRI:** T1-weighted: Variable signal intensity. T2-weighted: High signal intensity. Post-contrast: Heterogeneous enhancement.
- **Acinic Cell Carcinoma (ACC):**
 - Usually arises in minor salivary glands.
 - **US:** Ill-defined, solid mass with possible cystic areas.
 - **CT:** Ill-defined, heterogeneous mass with possible necrosis. Post-contrast: Heterogeneous enhancement.
 - **MRI:** T1-weighted: Variable signal intensity. T2-weighted: High signal intensity. Post-contrast: Heterogeneous enhancement.
- **Adenoid Cystic Carcinoma (AdCC):**
 - Slow-growing but aggressive.
 - **US:** Ill-defined, solid mass with possible cystic areas.
 - **CT:** Ill-defined, heterogeneous mass with possible perineural spread.
 - **MRI:** T1-weighted: Variable signal intensity. T2-weighted: High signal intensity. Post-contrast: Heterogeneous enhancement with delayed washout.

Additional Considerations:

- **Size:** Larger size often suggests malignancy.
- **Margins:** Ill-defined margins favor malignancy.
- **Enhancement Pattern:** Peripheral enhancement is more common in benign tumors, while heterogeneous enhancement is more suggestive of malignancy.
- **Lymph Node Involvement:** Enlarged lymph nodes can indicate metastasis.

Advanced Imaging Techniques:

- **Diffusion-weighted MRI (DW-MRI):** May help differentiate benign from malignant tumors based on restricted diffusion in malignancy.
- **FDG-PET/CT:** Can assess metabolic activity and help identify distant metastases.

Question 5.

What are the causes of subarachnoid haemorrhage? Describe their imaging features in brief.

[4+6]

Answer 5.

Subarachnoid hemorrhage (SAH) is a type of extra-axial intracranial hemorrhage and denotes the presence of blood within the subarachnoid space.

1. Aneurysmal Rupture

- The most common cause of non-traumatic SAH, usually due to rupture of saccular (berry) aneurysms.
- **Radiologic Features:**
 - **CT Scan:** Hyperdense blood in the basal cisterns, Sylvian fissures, and interhemispheric fissure. Blood may also be seen layering in the ventricles if intraventricular hemorrhage is present.
 - **CT Angiography (CTA):** Identifies the aneurysm, its location, size, and relationship to surrounding vessels.
 - **Digital Subtraction Angiography (DSA):** Gold standard for detecting aneurysms, provides detailed images of cerebral vasculature.

Localization of the aneurysm	
Aneurysm	Subarachnoid
Carotid	Suprasellar
Anterior communicating artery	Septum pellucidum (in frontal lobes)
Middle cerebral artery	Sylvian fissure (in temporal lobe)
Anterior cerebral artery	Sylvian fissure
Basilary artery top	Interpeduncular fossa , brainstem or thalamus
PICA	4th ventricle

2. Arteriovenous Malformation (AVM)

- Congenital abnormal connections between arteries and veins, which can rupture.
- **Radiologic Features:**
 - **CT Scan:** Hyperdense blood in the subarachnoid space, sometimes associated with intraparenchymal hemorrhage.
 - **MRI/MRA:** Shows abnormal vascular nidus and draining veins.
 - **DSA:** Detailed imaging of AVM and its vascular anatomy.

3. Trauma

- Head injury leading to tearing of blood vessels in the subarachnoid space.
- **Radiologic Features:**
 - **CT Scan:** Hyperdense blood in the subarachnoid space, often accompanied by other signs of trauma such as skull fractures, epidural or subdural hematomas, and cerebral contusions.

4. Perimesencephalic Hemorrhage

- A benign form of SAH with an unknown exact cause, typically localized around the brainstem.
- **Radiologic Features:**
 - **CT Scan:** Blood localized around the midbrain and pons without extension into the sylvian or interhemispheric fissures.

- CTA/DSA: Usually normal, as no aneurysm or vascular malformation is identified.

5. Cerebral Vasculitis

- Inflammation of blood vessels in the brain, leading to vessel rupture.
- **Radiologic Features:**
 - **CT Scan:** Hyperdense areas in the subarachnoid space.
 - **MRI/MRA:** Vessel wall enhancement and narrowing, indicating inflammation.
 - **DSA:** Irregularities in vessel caliber and contrast enhancement.

6. Blood Dyscrasias

- Conditions such as leukemia, thrombocytopenia, or anticoagulant therapy causing spontaneous bleeding.
- **Radiologic Features:**
 - **CT Scan:** Diffuse or localized hyperdense areas in the subarachnoid space, similar to other causes.
 - **Laboratory tests:** Important for diagnosing underlying blood disorders.

7. Neoplasms

- Bleeding from brain tumors, particularly highly vascular tumors like metastatic melanoma or renal cell carcinoma.
- **Radiologic Features:**
 - **CT Scan:** Hyperdense areas in the subarachnoid space, possibly associated with mass effect or edema.
 - **MRI:** Enhancing mass with surrounding hemorrhage.

Imaging Modalities for SAH

- **Non-contrast CT Scan:** First-line imaging to detect acute SAH due to its high sensitivity within the first 24 hours. Blood appears hyperdense in the subarachnoid space.
- **CTA (CT Angiography):** Used to identify aneurysms, AVMs, and vascular abnormalities. Provides detailed vascular anatomy.
- **MRI/MRA (Magnetic Resonance Imaging/Angiography):** Useful for detecting underlying causes such as AVMs, aneurysms, and vasculitis, especially when CT is inconclusive.
- **DSA (Digital Subtraction Angiography):** Gold standard for detailed evaluation of cerebral vasculature and diagnosing aneurysms and AVMs.

Question 6.

Describe the skeletal changes on imaging in:

a. In haemolytic anaemia.

[5]

b. In leukemia.

[5]

Answer 6.

IMAGINE FEATURES OF HAEMOLYTIC ANAEMIA

1. Thalassemia

- **Radiographic Features:**

- **Skull:**
 - **Hair-on-end appearance:** Prominent vertical striations seen on lateral skull X-rays, caused by new bone formation on the outer table of the skull.
- **Long Bones:**
 - **Erlenmeyer flask deformity:** Widening of the metaphyses of long bones, particularly the femur and humerus, due to marrow expansion.
 - **Cortical thinning:** Due to marrow hyperplasia.
- **Spine:**
 - **Vertebral body changes:** The vertebrae may become biconcave, leading to a "fish vertebrae" appearance.
- **MRI:**
 - **Marrow changes:** Increased signal intensity in the bone marrow on T2-weighted images due to expanded red marrow and decreased fatty marrow.
 - **Iron deposition:** Low signal intensity on T2-weighted and T2* gradient-echo sequences due to hemosiderin deposition.
- **CT Scan:**
 - **Detailed cortical bone changes:** Can show cortical thinning and trabecular bone coarsening more precisely than X-rays.

2. Sickle Cell Anemia

- **Radiographic Features:**
 - **Skull:**
 - **Hair-on-end appearance:** Similar to thalassemia, with vertical striations on lateral skull X-rays.
 - **Long Bones:**
 - **Diaphyseal widening:** Due to chronic marrow hyperplasia.
 - **Cortical thinning and endosteal scalloping:** Due to increased marrow activity.
 - **Spine:**
 - **H-shaped vertebrae (Lincoln log vertebrae):** Due to infarction and collapse of the central portion of the vertebral bodies.
 - **Hand-foot syndrome (dactylitis):**
 - **Soft tissue swelling and periostitis** in the hands and feet in young children.
 - **Osteonecrosis:**
 - **Femoral and humeral heads:** Crescent sign indicating subchondral fracture due to avascular necrosis.
- **MRI:**
 - **Marrow infarction:** Areas of abnormal signal intensity in the bone marrow, with high signal on T2-weighted images and low signal on T1-weighted images.
 - **Osteonecrosis:** Double-line sign on T2-weighted images, with a peripheral hyperintense line and a central hypointense line.
- **CT Scan:**
 - **Detailed assessment of cortical and trabecular bone:** Useful for identifying bone infarcts and cortical irregularities.
 - **Detection of complications:** Such as osteomyelitis, which can coexist with bone infarcts.

3. Other Hemolytic Anemias (e.g., Hereditary Spherocytosis, G6PD Deficiency)

- **Radiographic Features:**
 - Generally less pronounced than in thalassemia and sickle cell anemia, but may show signs of chronic hemolysis:
 - **Marrow hyperplasia:** Similar patterns of bone expansion and cortical thinning, though less severe.
 - **Splenomegaly:** Often seen on abdominal imaging, which can have indirect skeletal implications, such as rib notching due to chronic expansion.
- **MRI:**
 - **Marrow changes:** Similar to other hemolytic anemias, with increased red marrow signal intensity.
- **CT Scan:**
 - **Bone changes:** Detailed imaging of marrow expansion and cortical thinning, though usually less pronounced than in thalassemia and sickle cell anemia.

IMAGINE FEATURES IN LEUKAEMIA

1. Osteopenia/Osteoporosis:

- Generalized reduction in bone density.
- **Imaging Findings:** X-rays may show a decrease in the radiopacity of bones. Bones appear less dense, with a more “washed out” appearance.

2. Metaphyseal Bands:

- Transverse radiolucent lines in the metaphyses of long bones.
- **Imaging Findings:** Visible as linear lucent bands parallel to the growth plate on X-rays.

3. Periosteal Reaction:

- Periosteal new bone formation due to subperiosteal hemorrhage or bone marrow infiltration.
- **Imaging Findings:** Visible on X-rays as a layering or lifting of the periosteum from the underlying cortex, often giving a “laminated” or “onion-skin” appearance.

4. Lytic Lesions:

- Localized areas of bone destruction.
- **Imaging Findings:** X-rays and CT scans show areas of decreased bone density with poorly defined borders, sometimes described as “moth-eaten.”

5. Sclerotic Lesions:

- Areas of increased bone density.
- **Imaging Findings:** Appear as localized regions of increased radiopacity on X-rays and CT scans.

6. Chloroma (Granulocytic Sarcoma):

- Extramedullary tumor mass composed of myeloid cells.
- **Imaging Findings:** MRI and CT scans show a soft tissue mass, which can be associated with bone destruction.

7. Bone Marrow Infiltration:

- Infiltration of bone marrow by leukemic cells.
- **Imaging Findings:** On MRI, bone marrow infiltration appears as areas of altered signal intensity. T1-weighted images may show low signal intensity, while
- T2-weighted images may show high signal intensity.

8. Pathological Fractures:

- Fractures that occur in weakened bone.
- **Imaging Findings:** Fractures visible on X-rays, often with minimal or no trauma history.

9. Joint Involvement:

- Leukemic infiltration can also affect the joints.
- **Imaging Findings:** MRI may show joint effusions, synovial thickening, and soft tissue masses around joints.

Question 7.

What are the malignant lesions affecting the thyroid gland? Describe in brief the imaging features of each. [3+7]

Answer 7.**1. Papillary Thyroid Carcinoma (PTC) Epidemiology & Pathology:**

- Most common thyroid malignancy (~80%).
- Often in women (20–50 yrs).
- Multifocal in up to 30%, frequently spreads via lymphatics to cervical nodes.
- Associated with RET/PTC rearrangements and BRAF mutations.

Radiological Evaluation:

- **Ultrasound (first-line):**
 - Hypoechoic relative to surrounding thyroid parenchyma.
 - Microcalcifications (psammoma bodies): punctate echogenic foci without shadowing, highly specific.
 - Irregular / spiculated margins.
 - Taller-than-wide shape on transverse imaging.
 - Increased internal vascularity on Doppler.
 - Possible cystic change in metastatic lymph nodes.
- **CT/MRI:**
 - CT: Ill-defined hypodense mass; assess extrathyroidal extension, tracheal/esophageal invasion, and nodal disease.
 - MRI: T1 iso- to hypointense, T2 variable; highlights soft tissue invasion.
- **Nuclear Medicine:**
 - Cold nodule on I-123 or Tc-99m scans (low uptake).

Pearls:

- Excellent prognosis; however, nodal metastases are common at presentation.
- Microcarcinomas (<1 cm) are often incidental on imaging.

2. Follicular Thyroid Carcinoma (FTC) Epidemiology & Pathology:

- Second most common (~10–15%).
- Slightly older age group than PTC.
- Spreads hematogenously — commonly to bone, lung.
- Diagnosis histologically requires capsular or vascular invasion (cannot be confirmed on cytology alone).