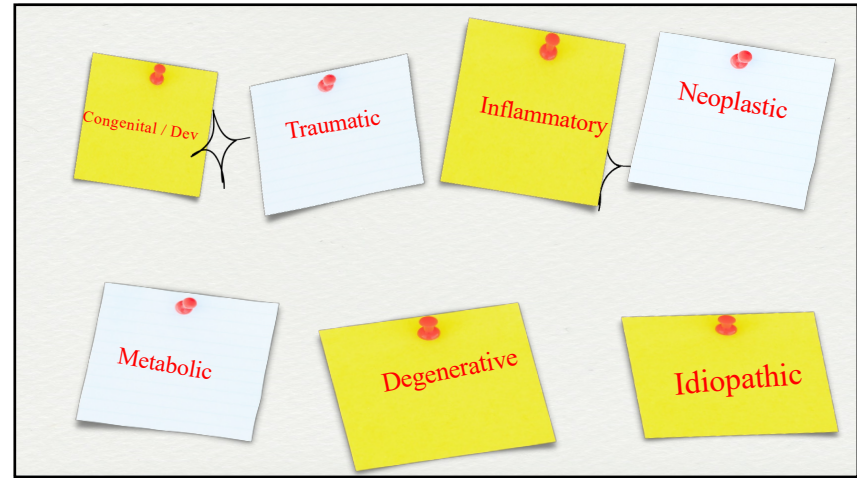


Understanding **Bone Tumor**

Dr. Ashish Gohiya
MS (Orth), FIAS, FIOS (UK)
Professor & Head Orthopaedics
GMC Bhopal

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2

Which Tissue

- Bone
- Cartilage
- Synovium
- Muscle
- Nerve
- Vessel

Neoplastic

Tumor Type

- Benign
- Malignant

3

	Benign	Malignant
Duration	Long history	Short history
Swelling	First symptom	-
Pain	-	First Symptom
Progression	Slow	Fast
History – Presenting Complaints		

4

	Benign	Malignant
Constitutional Symptoms	-	Present
Functional Limitation	Late (<i>Mechanical</i>)	Early (<i>Pain / Joint / Fracture</i>)
Complications	-	Present
History – Presenting Complaints		

5

	Benign	Malignant
General	-	Pallor, Lymphadenopathy
Systemic	-	RS
History – Presenting Complaints		

6

	Benign	Malignant
Skin	Normal	Tense , Shiny
Tenderness	Absent/ Minimal	Present
Temperature	Normal	Raised
Consistency	Uniform	Variiegated
Attachment	Absent	To tissues , and skin
Mobility	+	Fixed
Edge	Well Defined	Ill defined
Examination		

7

Predominant Tissue	Benign	Malignant
Bone forming	Osteoma Osteoid osteoma Osteoblastoma	Osteosarcoma: central peripheral parosteal
Cartilage forming	Chondroma Osteochondroma Chondroblastoma ?Chondromyxoid fibroma	Chondrosarcoma: central peripheral juxtacortical clear-cell mesenchymal
Fibrous tissue	Fibroma Fibromatosis	Fibrosarcoma
Mixed	?Chondromyxoid fibroma	
Giant-cell tumours	Benign osteoclastoma	Malignant osteoclastoma
Marrow tumours		Ewing's tumour Myeloma

8

Predominant Tissue	Benign	Malignant
		mesenchymal
Fibrous tissue	Fibroma Fibromatosis	Fibrosarcoma
Mixed	?Chondromyxoid fibroma	
Giant-cell tumours	Benign osteoclastoma	Malignant osteoclastoma
Marrow tumours		Ewing's tumour Myeloma
Vascular tissue	Haemangioma Haemangiopericytoma Haemangioendothelioma	Angiosarcoma Malignant haemangiopericytoma
Other connective tissue	Fibroma Fibrous histiocytoma Lipoma	Fibrosarcoma Malignant fibrous histiocytoma Liposarcoma
Other tumours	Neurofibroma Neurilemmoma	Adamantinoma Chordoma

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10

Osteochondroma

Clinical

Imaging

Pathology

Treatment

Prognosis

Definition

- Benign cartilage-capped bony projection from the metaphysis.
- Cortex and medullary canal are continuous with the parent bone.
- Arises from displaced growth plate cartilage.
- Also called Exostosis

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Osteochondroma

Definition

Imaging

Pathology

Treatment

Prognosis

Clinical


- Age: Childhood & adolescence.
- Sex: Males > Females (2:1).
- Sites: Distal femur, proximal tibia, proximal humerus.
- Symptoms:
 - Painless swelling
 - Mechanical irritation or deformity
 - Nerve/vessel compression (rare)
- Complications: Fracture, bursa, malignant change (<1%).

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Osteochondroma

- Definition
- Clinical
- Pathology
- Treatment
- Prognosis

Imaging




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Osteochondroma

- Definition
- Clinical
- Pathology
- Treatment
- Prognosis

Imaging

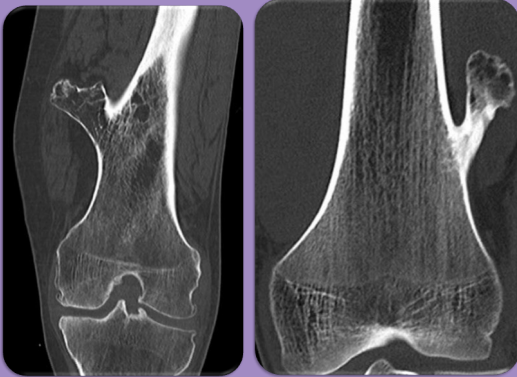


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Osteochondroma

- Definition
- Clinical
- Pathology
- Treatment
- Prognosis

Imaging

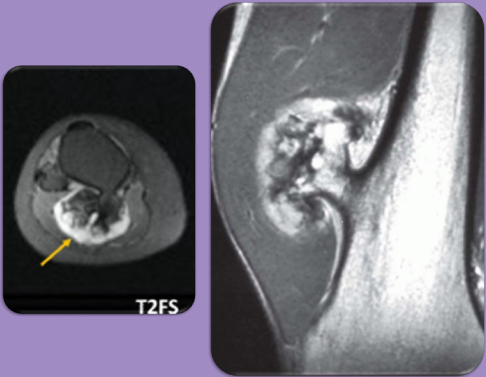


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Osteochondroma

- Definition
- Clinical
- Pathology
- Treatment
- Prognosis

Imaging



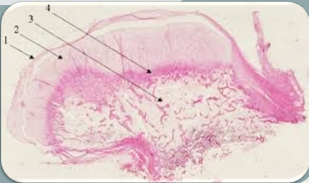
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Osteochondroma

- Definition**
- Clinical**
- Imaging**
- Treatment**
- Prognosis**

Pathology

- Gross: Bony stalk with glistening cartilage cap.
- Microscopy:
 - Hyaline cartilage cap with orderly endochondral ossification.
 - Beneath cartilage: trabecular bone with marrow continuity.
 - No atypia or mitotic activity.



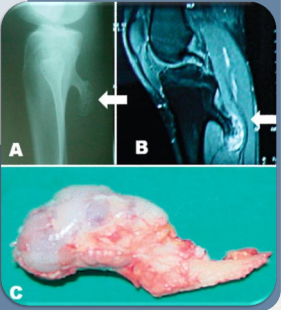
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Osteochondroma

- Definition**
- Clinical**
- Imaging**
- Pathology**
- Prognosis**

Treatment

- Observation for asymptomatic lesions.
- Surgical excision if:
 - Pain or cosmetic concern
 - Neurovascular compression
 - Fracture through stalk
 - Suspicious of malignant change
- Procedure: Marginal excision at base with perichondrium.



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Osteochondroma

- Definition**
- Clinical**
- Imaging**
- Pathology**
- Treatment**

Prognosis

- Excellent outcome in most cases.
- Recurrence rare if completely excised.
- Malignant transformation:
 - <1% in solitary cases
 - Up to 25% in MHE (pelvis, scapula, proximal femur)

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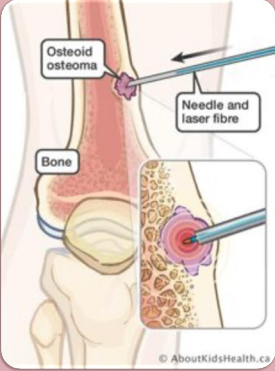
Osteoid Osteoma

- Clinical**
- Imaging**
- Pathology**
- Treatment**
- Prognosis**

Definition

Osteoid osteoma is a small (<2 cm) benign bone-forming tumor composed of a central nidus of osteoid and woven bone surrounded by reactive sclerosis.

It produces intense pain, typically relieved by NSAIDs.



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Osteoid Osteoma

Clinical

- Definition**
- Imaging**
- Pathology**
- Treatment**
- Prognosis**

- Age: Common in 10–25 years (young adults).
- Sex: Males > Females (2:1).
- Site Predilection:
 - Diaphysis or cortex of femur and tibia (70%).
 - Also spine (posterior elements), humerus, hands, feet.
- Symptoms:
 - Localized pain, worse at night.
 - Pain relieved dramatically by NSAIDs or aspirin.
 - Local tenderness and sometimes swelling.


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Osteoid Osteoma

Imaging

- Definition**
- Clinical**
- Pathology**
- Treatment**
- Prognosis**

- Small round/oval radiolucent nidus (<2 cm) with surrounding dense sclerosis.
- Nidus may show central mineralization.
- Commonly seen in cortex of long bone diaphysis.
- May be inconspicuous if deep (medullary/spinal).




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Osteoid Osteoma

Imaging

- Definition**
- Clinical**
- Pathology**
- Treatment**
- Prognosis**

- Small round/oval radiolucent nidus (<2 cm) with surrounding dense sclerosis.
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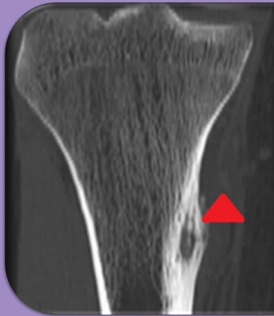
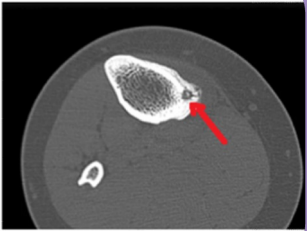


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Osteoid Osteoma

Imaging

- Definition**
- Clinical**
- Pathology**
- Treatment**
- Prognosis**

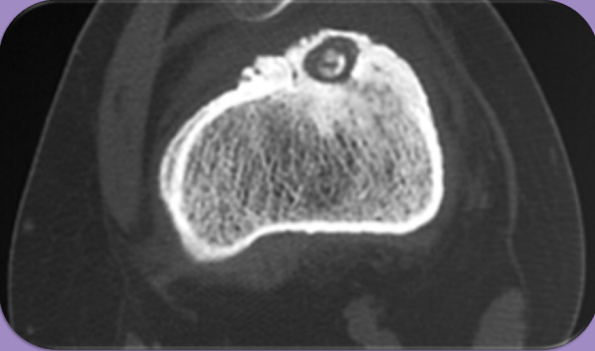



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Osteoid Osteoma

Definition
Clinical
Pathology
Treatment
Prognosis

Imaging



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Osteoid Osteoma

Definition
Clinical
Imaging
Treatment
Prognosis

Pathology

- Origin: From osteoblasts producing osteoid matrix.
- Structure:
 - Central nidus (<2 cm) of vascular osteoid tissue.
 - Surrounded by dense sclerotic cortical bone.
- Common sites: Diaphysis of long bones.

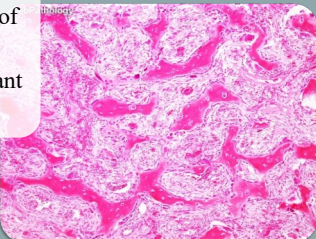
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Osteoid Osteoma

Definition
Clinical
Imaging
Treatment
Prognosis

Pathology

- Central nidus composed of interlacing trabeculae of osteoid and woven bone lined by osteoblasts.
- Richly vascular stroma.
- Peripheral reactive sclerosis of mature lamellar bone.
- No cellular atypia or malignant features.

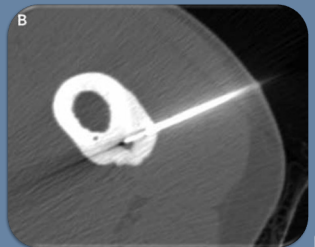


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Osteoid Osteoma

Definition
Clinical
Imaging
Pathology
Prognosis

Treatment



- CT guided Radiofrequency Ablation (RFA)
- Excision

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Osteoid Osteoma

Definition

Clinical

Imaging

Pathology

Treatment

Prognosis

- Excellent prognosis.
- Pain relief usually immediate after ablation/excision.
- Recurrence rare (<10%) if nidus completely removed.
- No malignant transformation or metastasis.

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Enchondroma

Clinical

Imaging

Pathology

Treatment


Prognosis

Definition

Enchondroma is a benign, slow-growing, intramedullary tumor composed of mature hyaline cartilage.

It arises from residual cartilage rests within the medullary cavity of bone.

Usually discovered incidentally or after a pathological fracture.



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Enchondroma

Definition

Imaging

Pathology

Treatment

Prognosis

Clinical

- Age: Common in 10–40 years.
- Sex: Equal in males and females.
- Site Predilection:
 - Small tubular bones of hand and foot (proximal phalanges, metacarpals).
 - Long bones: proximal humerus, distal femur.
- Symptoms:
 - Usually asymptomatic.
 - May present with swelling, deformity, or pathological fracture.
 - Rarely pain (consider malignancy if painful).

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Enchondroma

Definition


Clinical

Pathology

Treatment

Prognosis

Imaging



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Enchondroma

Definition

Clinical

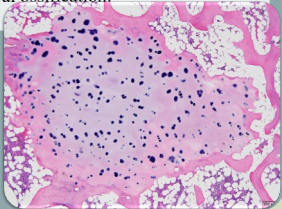
Imaging

Treatment

Prognosis

Pathology

- Origin: From residual growth plate cartilage or ectopic cartilage cells in the medullary cavity.
- Composition:
 - Lobules of mature hyaline cartilage with chondrocytes in lacunae.
 - May show mild cellularity and binucleate forms (still benign).
 - No atypia, mitoses, or permeation of host bone.
 - Calcified areas may show endochondral ossification.



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Enchondroma

Definition

Clinical

Imaging

Pathology

Prognosis

Treatment

- Asymptomatic lesions – observation and periodic radiological follow-up.
- Symptomatic or fractured lesions:
 - Curettage and bone grafting.

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Enchondroma

Definition

Clinical

Imaging

Pathology

Prognosis

Treatment

- Asymptomatic lesions – observation
- Symptomatic or fractured lesions:
 - Curettage and bone grafting.



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Enchondroma

Definition

Clinical

Imaging

Pathology

Treatment

Prognosis

- Excellent for solitary enchondromas.
- Recurrence rare after adequate curettage.
- Malignant transformation risk:
 - <1% in solitary lesions.
 - Higher (up to 30%) in multiple enchondromatosis (Ollier's, Maffucci's).

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Enchondroma

Definition

Clinical

Imaging

Pathology

Treatment

Prognosis

Feature	Maffucci Syndrome	Ollier's Disease
Primary feature	Multiple enchondromas and multiple hemangiomas	Multiple enchondromas only
Distribution of enchondromas	Typically bilateral	Often unilateral
Malignancy risk	Higher risk, including gliomas and ovarian tumors	Increased risk of chondrosarcoma (malignant tumor of cartilage)

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Giant Cell Tumor

Clinical

Imaging

Pathology

Treatment


Prognosis

Definition

Giant Cell Tumour (GCT) is a benign but locally aggressive bone tumour composed of numerous multinucleated giant cells dispersed among mononuclear stromal cells.

May rarely metastasize to lungs despite benign histology.

Also known as Osteoclastoma.



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Giant Cell Tumor

Definition

Imaging

Pathology

Treatment

Prognosis

Clinical

- Age: 20–40 years (skeletally mature individuals).
- Sex: Slight female predominance.
- Site Predilection: Around the knee (distal femur, proximal tibia).
- Symptoms:
 - Pain, swelling near joint.
 - Restriction of movement.
 - Pathological fracture (in 10–15%).
 - Occasionally asymptomatic and found incidentally.

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Giant Cell Tumor

Definition

Clinical


Imaging

Pathology

Treatment

Prognosis

- Site: Epiphyseal, extending to metaphysis.
- Appearance: Eccentric, expansile, lytic lesion with 'soap-bubble' appearance.
- Margins: Well defined but non-sclerotic.
- Part of Bone: Epiphysis (mature bone only).
- Type of Bone Destruction: Geographic, expansile, often thinning cortex.
- Periosteal Reaction: Absent unless pathological fracture.
- No matrix mineralization.



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Giant Cell Tumor

Definition

Clinical

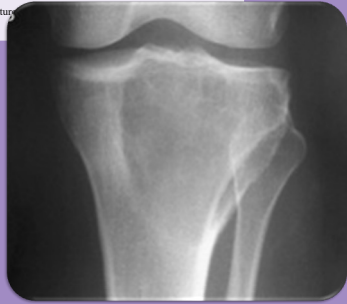
Pathology

Treatment

Prognosis

Imaging

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Giant Cell Tumor

Definition


Clinical

Pathology

Treatment

Prognosis

Imaging



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Giant Cell Tumor

Definition

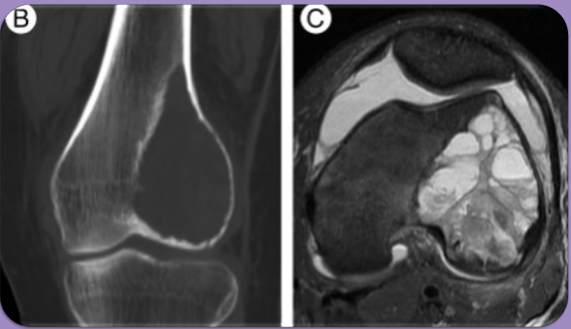
Clinical

Pathology

Treatment

Prognosis

Imaging



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Giant Cell Tumor

Definition

Clinical


Imaging

Treatment

Prognosis

Pathology

- Origin: From non-osteogenic stromal cells of bone marrow.
- Growth: Expansile, lytic lesion involving epiphysis extending to metaphysis.
- Behaviour: Locally aggressive, occasionally malignant.



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Giant Cell Tumor

Home

Definition

Clinical

Imaging

Treatment

Prognosis

Pathology

- Numerous uniformly distributed multinucleated giant cells.
- Background of mononuclear stromal cells with oval nuclei.
- Giant cells contain 20–50 nuclei, similar to stromal cell nuclei.
- No atypia or abnormal mitoses unless malignant transformation.

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Giant Cell Tumor

Home

Definition

Clinical

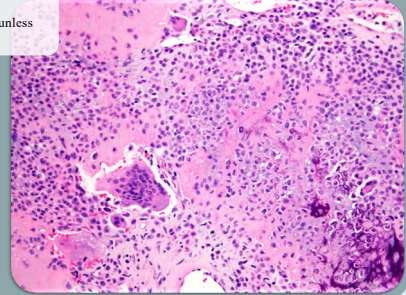
Imaging

Treatment

Prognosis

Pathology

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Giant Cell Tumor

Home

Definition

Clinical

Imaging

Pathology

Prognosis

Treatment

- Primary Goal: Eradicate tumour and preserve joint function.
- Options:
 - Extended intralesional curettage - with adjuvants (phenol, liquid nitrogen, bone cement).
 - Bone grafting or cementation after curettage.
 - Wide excision for recurrent/aggressive lesions.
 - Denosumab (RANKL inhibitor) for unresectable or recurrent tumours.
 - Pulmonary metastasectomy if lung metastases present.

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Giant Cell Tumor

Home

Definition

Clinical

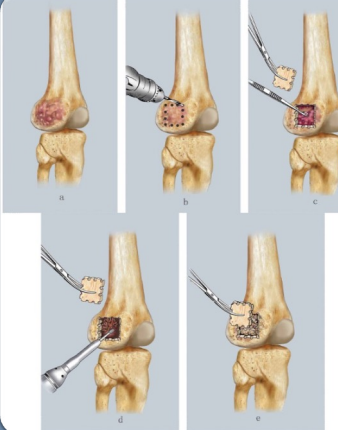
Imaging

Pathology

Prognosis

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Giant Cell Tumor

Treatment

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Definition
Clinical
Imaging
Pathology
Prognosis

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Giant Cell Tumor

Treatment

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 - Pulmonary metastasectomy if lung metastases present.

Definition
Clinical
Imaging
Pathology
Prognosis

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Giant Cell Tumor

Prognosis

- Generally good with adequate surgical removal.
- Recurrence rate: 10–25% (most within 2 years).
- Malignant transformation rare (~2%).
- Pulmonary metastases in 1–2% (histologically benign).
- Regular radiological follow-up required.

Definition
Clinical
Imaging
Pathology
Treatment

51

Osteosarcoma

Definition

Osteosarcoma is a highly malignant tumour of bone in which the neoplastic cells produce osteoid or immature bone.

It is the most common primary malignant bone tumour (excluding myeloma).

Clinical
Imaging
Pathology
Treatment
Prognosis

52

Osteosarcoma

Clinical


- Definition**
- Age: 10–25 years (during growth spurt).
- Sex: Males > Females (1.5:1).
- Symptoms:
 - Persistent, progressive pain (often worse at night).
 - Swelling and tenderness near joint.
 - Decreased range of motion.
 - Pathological fracture in advanced lesions.
 - Systemic symptoms uncommon unless metastasis present.
- Imaging**
- Pathology**
- Treatment**
- Prognosis**

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Osteosarcoma

Clinical

- Definition**
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 - Decreased range of motion.
 - Pathological fracture in advanced lesions.
 - Systemic symptoms uncommon unless metastasis present.
- Imaging**
- Pathology**
- Treatment**
- Prognosis**



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Osteosarcoma

Imaging


- Definition**
- Clinical**
- Part of Bone: Metaphysis of long bones.
- Type of Bone Destruction: Mixed lytic and sclerotic lesion with poorly defined margins.
- Periosteal Reaction: Characteristic 'Sunburst' appearance due to spiculated new bone formation; 'Codman's triangle' due to periosteal elevation.
- Matrix: Osteoid matrix – cloud-like dense ossification.
- Soft-tissue mass: Frequently seen with calcified osteoid.
- Pathology**
- Treatment**
- Prognosis**

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Osteosarcoma

Imaging

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- Pathology**
- Treatment**
- Prognosis**



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Osteosarcoma

Home icon

- Definition
- Clinical
- Pathology
- Treatment
- Prognosis

Imaging

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Osteosarcoma

Home icon

- Definition
- Clinical
- Imaging
- Pathology
- Treatment
- Prognosis

Biopsy – HPE

Needle / Tru cut / Open

Principles of Biopsy

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Osteosarcoma

Home icon

- Definition
- Clinical
- Imaging
- Treatment
- Prognosis

Pathology

- Origin: From primitive bone-forming mesenchymal cells (osteoblasts).
- Composition:
 - Malignant osteoblasts producing osteoid matrix.
 - Areas of bone, cartilage, and fibrous tissue may coexist.
- Growth: Rapidly destructive, infiltrates surrounding soft tissues.
- Subtypes:
 - Conventional (osteoblastic, chondroblastic, fibroblastic)
 - Telangiectatic, parosteal, periosteal, secondary osteosarcoma (Paget's disease, post-radiation).

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Osteosarcoma

Home icon

- Definition
- Clinical
- Imaging
- Treatment
- Prognosis

Pathology

- Malignant spindle to polygonal osteoblastic cells producing osteoid matrix.
- Irregular lace-like osteoid deposition within malignant stroma.
- Variable mitotic activity and cellular atypia.
- Subtypes (histologic variants): Osteoblastic, chondroblastic, fibroblastic, telangiectatic, small cell types.

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Osteosarcoma

Definition

Clinical

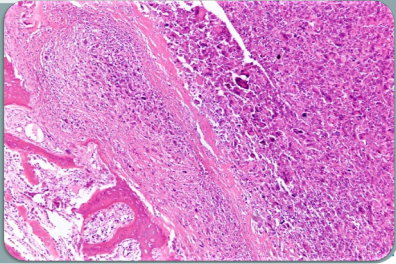
Imaging

Treatment

Prognosis

Pathology

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Osteosarcoma

Definition

Clinical

Imaging

Pathology

Prognosis

Treatment

- Multimodal Approach:
 - Neoadjuvant chemotherapy: Shrinks tumour and treats micrometastasis.
 - Surgical resection: Limb salvage surgery preferred over amputation when feasible.
 - Adjuvant chemotherapy: Postoperative systemic control.
- Chemotherapeutic agents: Doxorubicin, Cisplatin, Methotrexate, Ifosfamide.
- Radiotherapy: Limited role – for palliation or unresectable cases.

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Osteosarcoma

Definition

Clinical


Imaging

Pathology

Prognosis

Treatment

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Osteosarcoma

Definition

Clinical

Imaging

Pathology

Treatment

Prognosis

- With multimodal therapy, 5-year survival ~60–70%.
- Prognostic Factors:
 - Absence of metastasis at diagnosis (favourable)
 - Good histologic response to chemotherapy (>90% necrosis)
 - Tumour site: distal extremities better than pelvis.
- Lung is the most common site of metastasis.

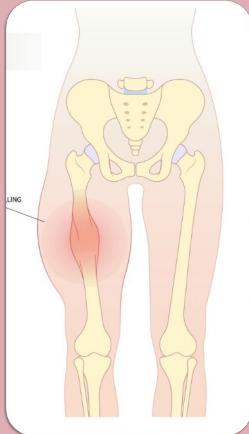
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Ewing's Sarcoma

Definition

Ewing's sarcoma is a highly malignant, small round cell tumour arising from the medullary cavity of bone.

It primarily affects children and adolescents and is part of the Ewing's family of tumours (including PNET – Primitive Neuroectodermal Tumour).



Clinical

Imaging

Pathology

Treatment

Prognosis

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Ewing's Sarcoma

Clinical

Definition

Imaging

Pathology

Treatment

Prognosis

- Age: Commonly 5–20 years.
- Sex: Slight male predominance (M:F = 1.5:1).
- Symptoms:
 - Pain and swelling at the affected site.
 - Local warmth, redness, tenderness (mimics osteomyelitis).
 - Fever, weight loss, malaise.
 - Pathological fractures in advanced cases.
- Commonly involves diaphysis of long bones or pelvis.

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Ewing's Sarcoma

Imaging

Definition

Clinical

Pathology

Treatment

Prognosis

- Part of Bone: Diaphysis or metaphyseal-diaphyseal region.
- Type of Bone Destruction: Permeative or moth-eaten pattern.
- Periosteal Reaction: 'Onion-skin' (lamellated) appearance due to multiple layers of periosteal new bone.
- Other Features: Cortical destruction, soft tissue mass, poor margination.
- May mimic infection radiologically.

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Ewing's Sarcoma

Imaging

Definition


Clinical

Pathology

Treatment

Prognosis

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Ewing's Sarcoma

Definition

Clinical


Pathology

Treatment

Prognosis

Imaging

- Part of Bone: Diaphysis or metaphyseal-diaphyseal region.
- Type of Bone Destruction: Permeative or moth-eaten pattern.
- Periosteal Reaction: 'Onion-skin' (lamellated) appearance due to multiple layers of periosteal new bone.
- Other Features: Cortical destruction, soft tissue mass, poor margination.
- May mimic infection



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Ewing's Sarcoma

Definition

Clinical

Imaging

Treatment

Prognosis

Pathology

- Sheets of uniform small round cells with scant cytoplasm and round nuclei.
- Areas of necrosis and hemorrhage frequent
- Cytoplasm contains glycogen (PAS positive, diastase sensitive).
- Immunohistochemistry: CD99 positive (membranous pattern).
- EWS-FLI1 gene fusion positive (by PCR or FISH).

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Ewing's Sarcoma

Definition

Clinical

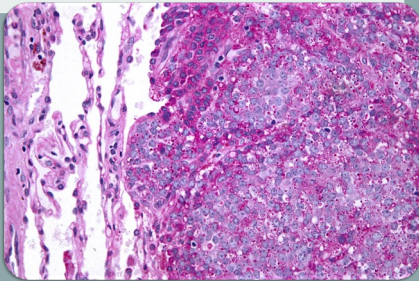
Imaging

Treatment

Prognosis

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Ewing's Sarcoma

Definition

Clinical

Imaging

Pathology

Prognosis

Treatment

- Multimodal Therapy:
 - Neoadjuvant chemotherapy – to reduce tumour size and treat micrometastases.
 - Surgery – limb salvage resection when feasible.
 - Radiotherapy – for local control or unresectable lesions.
 - Adjuvant chemotherapy – continuation after surgery.
- Common agents: Vincristine, Doxorubicin, Cyclophosphamide, Ifosfamide, Etoposide.

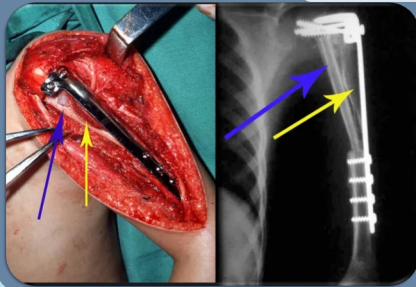
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Ewing's Sarcoma

- Definition
- Clinical
- Imaging
- Pathology
- Prognosis

Treatment

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Ewing's Sarcoma

- Definition
- Clinical
- Imaging
- Pathology
- Treatment

Prognosis

- Prognosis improved with multimodal therapy.
- 5-year survival rate:
 - Localized disease: ~70%.
 - Metastatic disease: <30%.
- Poor prognostic factors:
 - Metastases at diagnosis.
 - Pelvic or axial lesions.
 - Poor histological response to chemotherapy.

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Secondaries

- Definition
- Clinical
- Imaging
- Pathology
- Treatment
- Prognosis

- Metastatic tumours are the most common malignant bone lesions in adults.
- Arise mainly from breast, prostate, lung, kidney, and thyroid.
- Osteolytic, osteoblastic, or mixed lesions on imaging.
- Managed with systemic therapy, radiotherapy, and stabilization.
- Prognosis depends on control of primary cancer.

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Bone Tumor Summary - Dr. Ashish Gohiya

Questions to be Answered

- Is it a Tumor?
- Is it Benign / Malignant ?
- Tissue of Origin?
- Specific Tumor?



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