

Bone Tumors and Tumor-like Conditions



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Objectives

- General presentation of bone tumors
 - Benign tumors
 - Tumor-like lesions:
Bone cysts and cortical defects
 - Malignant:
 - Primary malignant
 - Metastasis in bone

Classification – predominant tissue

Tissue of Origin	Benign	Malignant
Bone forming	Osteoma Osteoid Osteoma Osteoblastoma	Osteosarcoma
Cartilage forming	Chondroma Osteochondroma Chondroblastoma	Chondrosarcoma
Fibrous tissue	Fibroma	Fibrosarcoma
Giant-cell tumor	Benign Osteoclastoma	Malignant Osteoclastoma
Marrow tumors		Ewing's Sarcoma Myeloma
Vascular	Haemangioma	Haemangiosarcoma
Other connective tissue	Fibrous histiocytoma Lipoma	Malignant fibrous histiocytoma Liposarcoma
Other tumors	Neurofibroma	Adamantoma

Clinical presentation - history

- Prolonged history:
 - In most benign lesions
 - Some malignant:
 - Slow growing (chondrosarcoma) / in pelvis (expandable)
- Age:
 - Childhood and adolescence
 - Most benign, and some malignant (e.g. Ewing's sarcoma)
 - 4th – 5th decade:
 - Chondrosarcoma
 - Sixth decade:
 - Myeloma (the commonest primary malignant bone tumor)
 - Over 50 yrs.:
 - Metastatic lesions are the commonest

Clinical presentation - history

- Pain:
 - In both malignant and benign (usually more in malignant)
 - May be caused by:
 - Rapid expansion – stretching of tissues
 - Central hemorrhage or degeneration
 - Insipient pathological fracture
 - Tense encapsulation in bone (e.g. osteoid osteoma)
- Swelling
- H/O Trauma
- Neurological symptoms
 - Pressure on nerve / stretching the nerve
- Pathological fracture: minor trauma / strange fracture line

Clinical examination

- A mass (lump)
 - Location
 - Discrete(separated) or ill-defined
 - Tenderness
 - Temperature
 - Pulsatile
 - Mobility
 -etc
- Range of motion
- LN, pelvis, abdomen, chest, spine

Imaging – x-rays

- Which bone, and which site in bone?
- Solitary or multiple?
- Bone forming or bone eating?
- Margins: well-defined or ill-defined?
- Calcifications in the lesion?
- Is cortex eroded or destroyed?
- Is there periosteal new bone formation?
- Soft tissue extension?

Shall be discussed
separately

Other imaging

- Bone scan (Tc^{99}):
 - Shows the site of lesion / skip lesions / metastasis
- CT:
 - Shows Intra and extra-osseous structure and extension
 - Good in deep bones (pelvis, spine)
- MRI:
 - Tumor spread
 - Within bone, into joints, into soft tissue
 - Relation to vessels
 - Soft tissue and cartilage tumors

Lab, investigations

- Look for infection:
 - CBC, differ WBC, CRP, blood c/s
- Look for metabolic disease
 - Brown tumor in hyperparathyroid disease
- Anemia, raised ESR
- S. Alkaline phosphatase
- Tumor markers
 - Bence Jones protein in urine: Myeloma
 - S. Acid phosphatase & PSA: Prostatic carcinoma
- Raised serum Calcium in metastasis

Biopsy

- Diagnostic
- Needle biopsy:
 - CT- guided
 - In the line of further surgical incision
- Open biopsy:
 - After all imaging techniques completed
 - More reliable
 - Site: considering further surgery
 - From boundaries



Jamshidi needle

Differential diagnosis

- Soft tissue hamartomas
- Myositis ossificans
- Stress fracture:
 - Histopathology may be confused with osteosarcoma?
- Tendon avulsion injuries
 - Near hip and knee (e.g. Osgood-Schlatter)
- Infection



<https://www.pedrad.org/>

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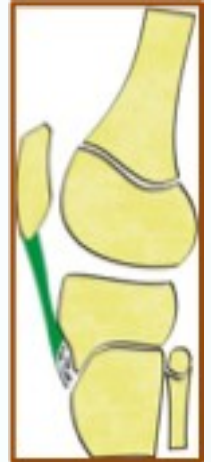
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Differential diagnosis

- Hyperparathyroid disease (Brown tumor)
- Gout: Large gouty typhus
- Other bone lesions:
 - Cortical defects, bone infarcts, “bone islands”



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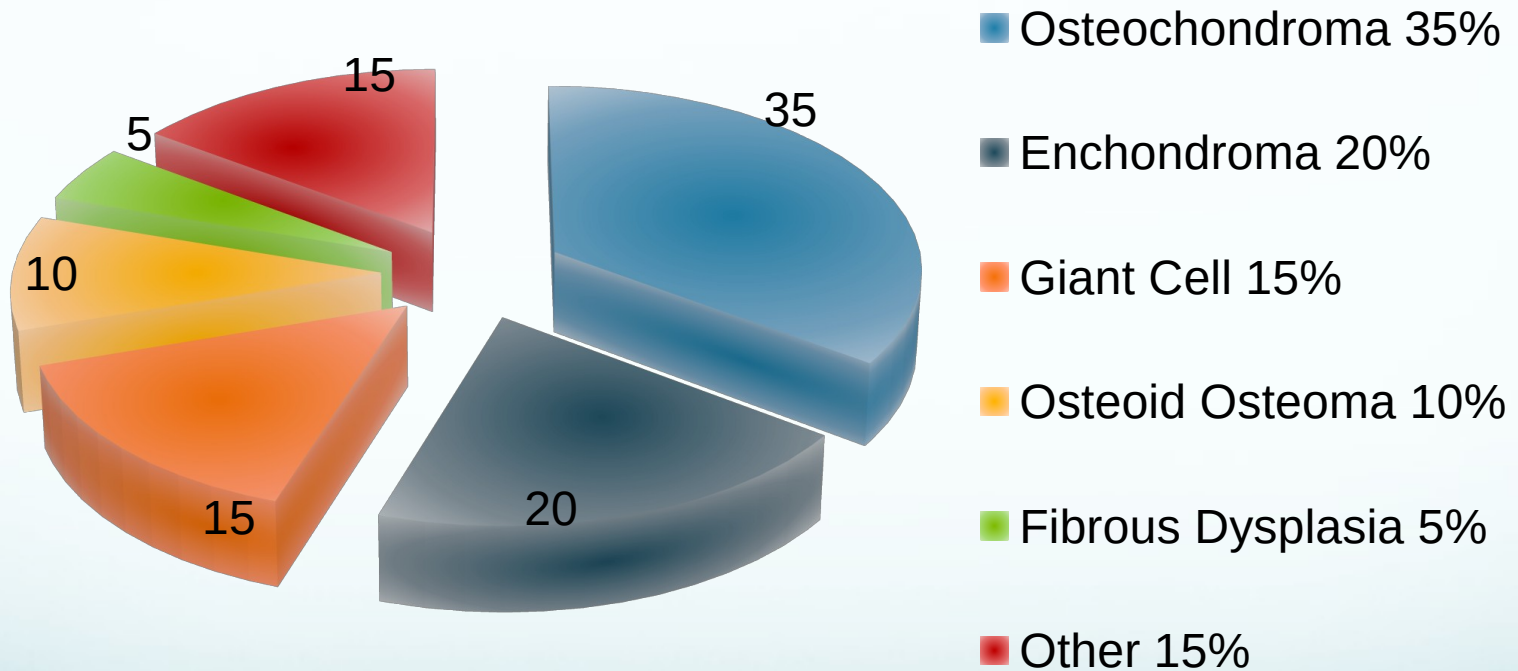
www.researchgate.net



www.radiologyassistant.nl/en/

Specific Lesions

Benign Bone Tumors

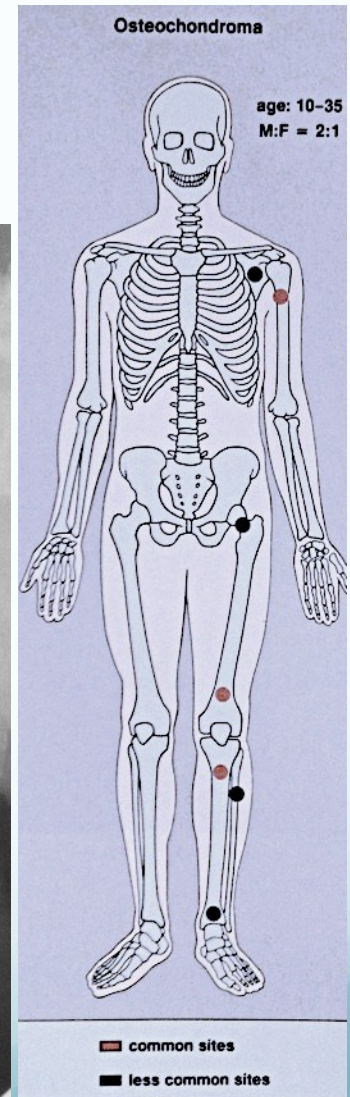


Benign bone lesions

- **Osteochondroma**
- Chondroma / chondroblastoma
- **Osteoid osteoma / osteoblastoma**
- **Non-ossifying fibroma**
- **Simple (Unicameral) Bone Cyst**
- **Aneurysmal Bone Cyst**
- **Giant Cell Tumor**

Osteochondroma (Exostosis)

- A common lesion
- Ends of long bone
- Bony overgrowth
 - Away from epiph. plate
 - Covered by cartilage
- Growth:
 - Stops when epiphysis close
 - If continues later:
 - ? Malignant transformation



Osteochondroma (Exostosis)



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Apley's System of Orthop. And Fractures

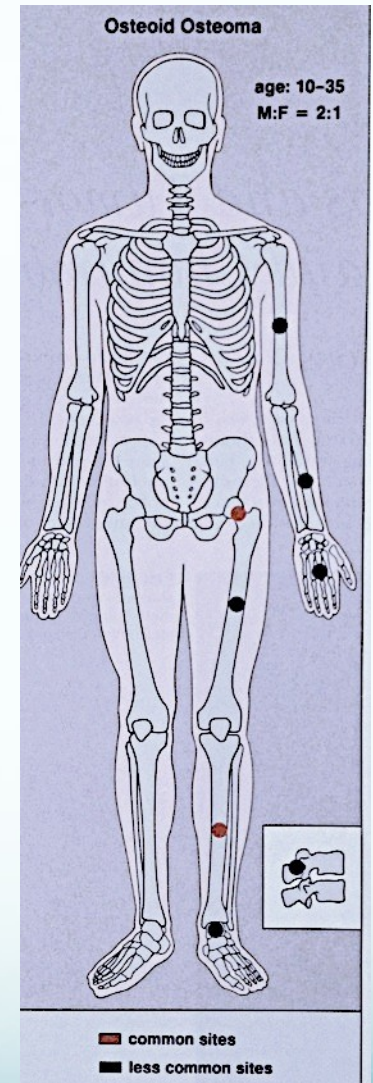
Osteochondroma (Exostosis)

- May fracture: becomes painful



Osteoid osteoma

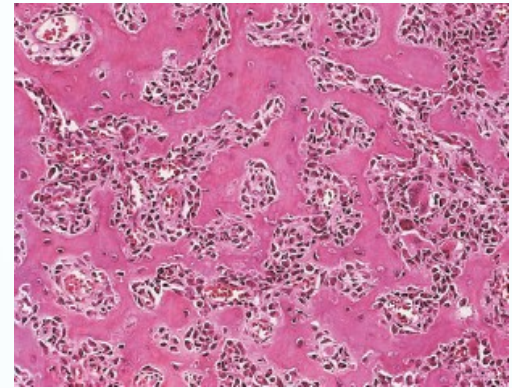
- Small tumor (<1 cm)
- Young adults
- Pain, pain, pain
 - Typically relieved by Salicylates
- Sites: Femur, tibia, spine
- X-ray:
 - Small radiolucent “nidus”
 - Surrounded by sclerotic bone
- CT: Shows “nidus” better
- Tc⁹⁹ scan: hot
- Treatment: surgical excision, or thermal ablation



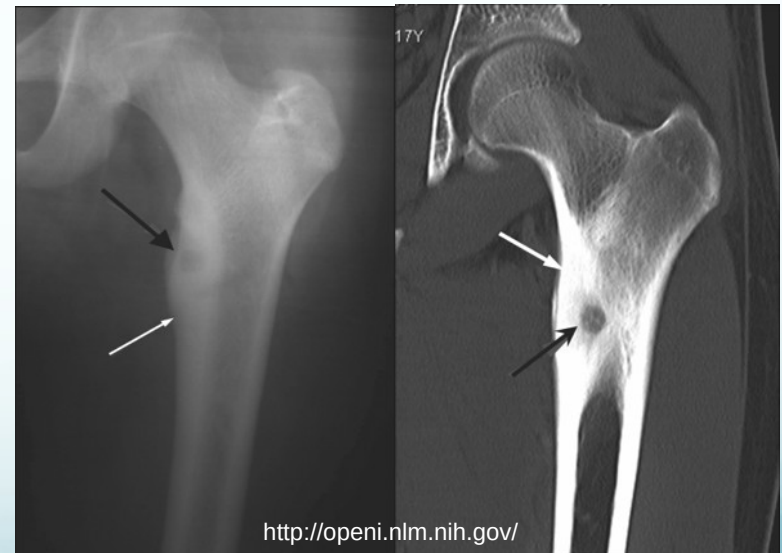
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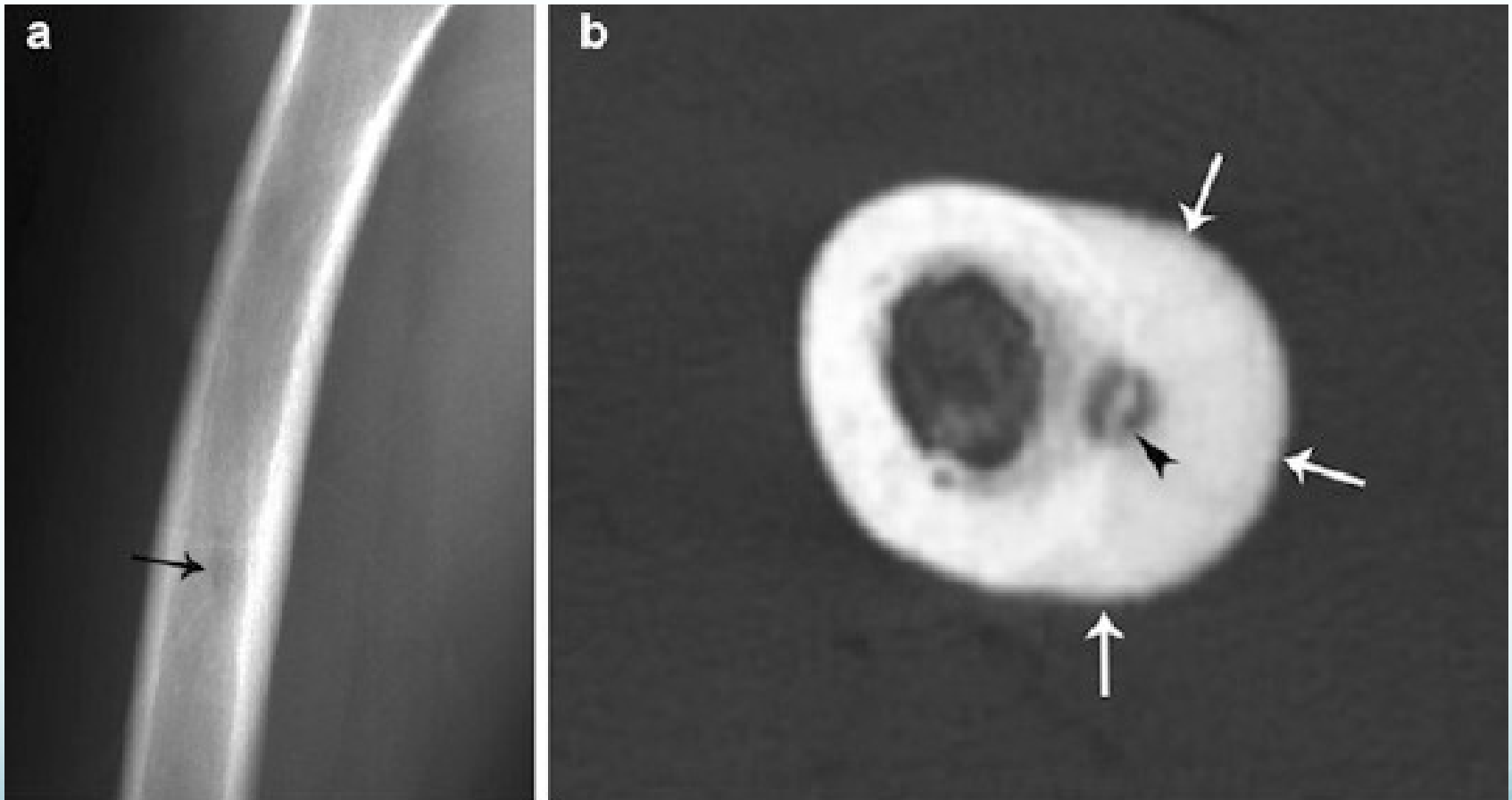
<http://openi.nlm.nih.gov/>

Osteoid Osteoma

- 11 year old boy: Pain in left hip



Osteoid Osteoma

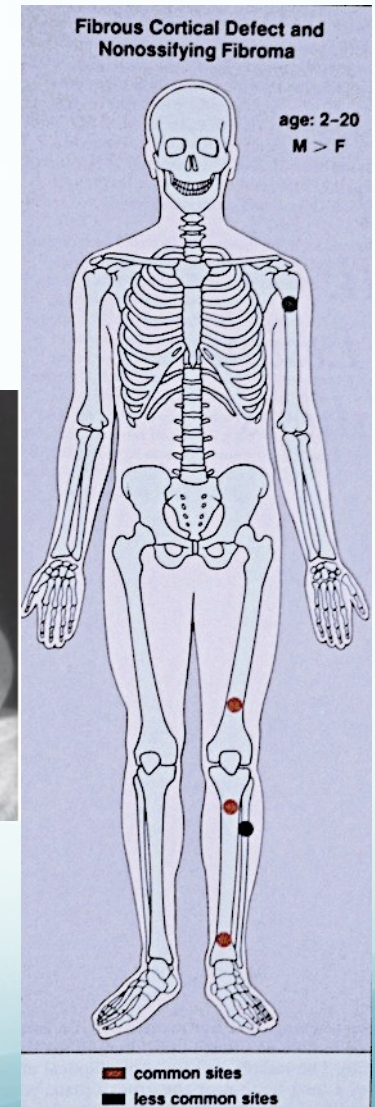


Non-ossifying fibroma

- Another name:
 - Fibrous cortical defect
- The commonest benign lesion of bone
- Asymptomatic
 - Incidentally discovered
- Children:
 - Disappears later
- Common site:
 - Metaphysis of long bones
- Treatment:
 - Observation
 - Surgery if very large



Apley's System of Orthop. And Fractures



Non-ossifying fibroma



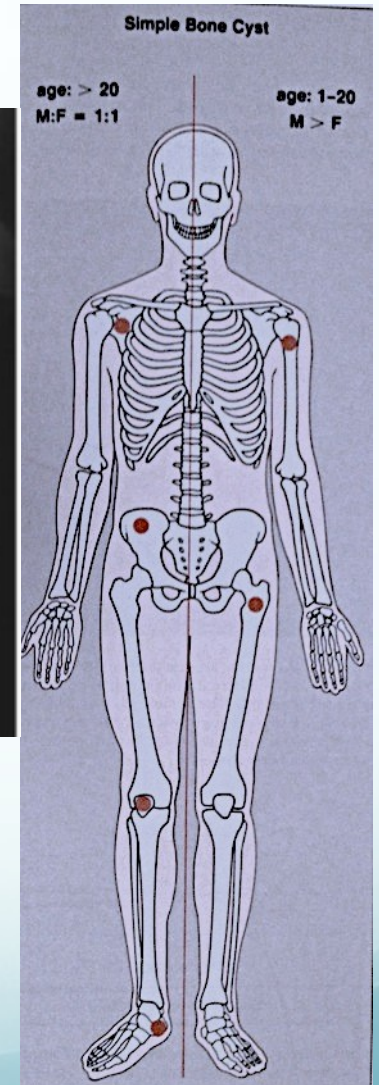
Non-ossifying fibromaFibrous cortical defect

Simple bone cyst

- Solitary – unicameral
- Children
- Metaphysis
 - Prox. Humerus and Femur
- Not a tumor
 - Not seen in adults
 - Heals spontaneously
- Pathological fracture / or incidental
- Aspirate is clear straw-colored



www.juniorbones.com



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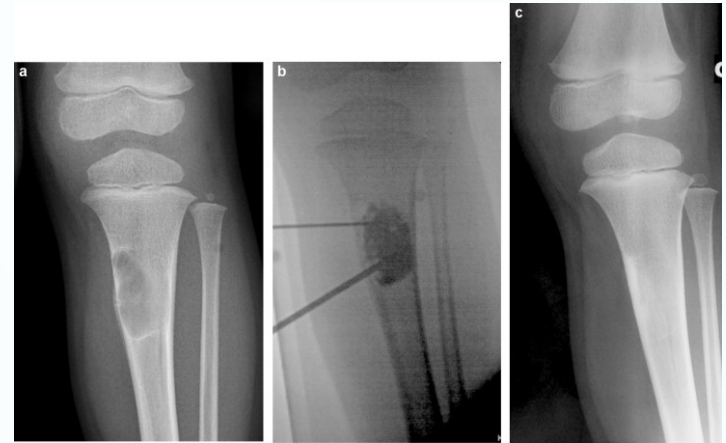
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Simple bone cyst

- Treatment:
 - Small, reducing in size
 - Leave alone
 - Increasing in size, active
 - Moderate trial of bone marrow injection
 - Large (risk of fracture) Curettage & grafting
 - Pathological fracture
 - Treat fracture
 - Cyst might heal
 - Recurrent / injection failed:
 - Surgical curettage and bone grafting



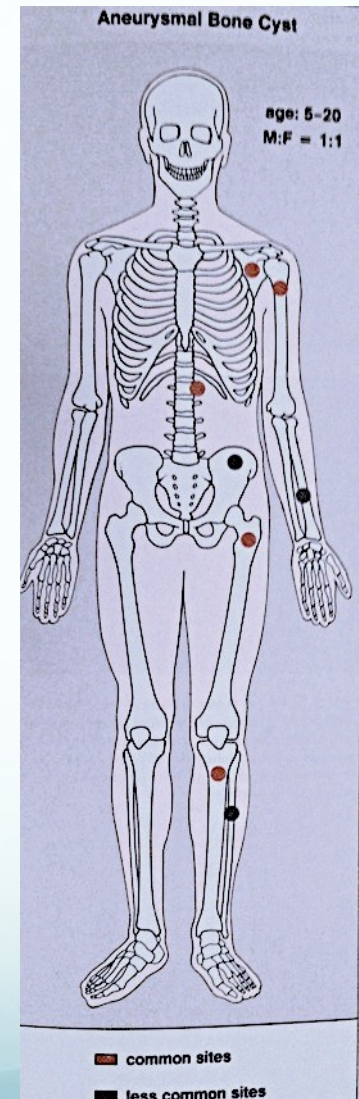
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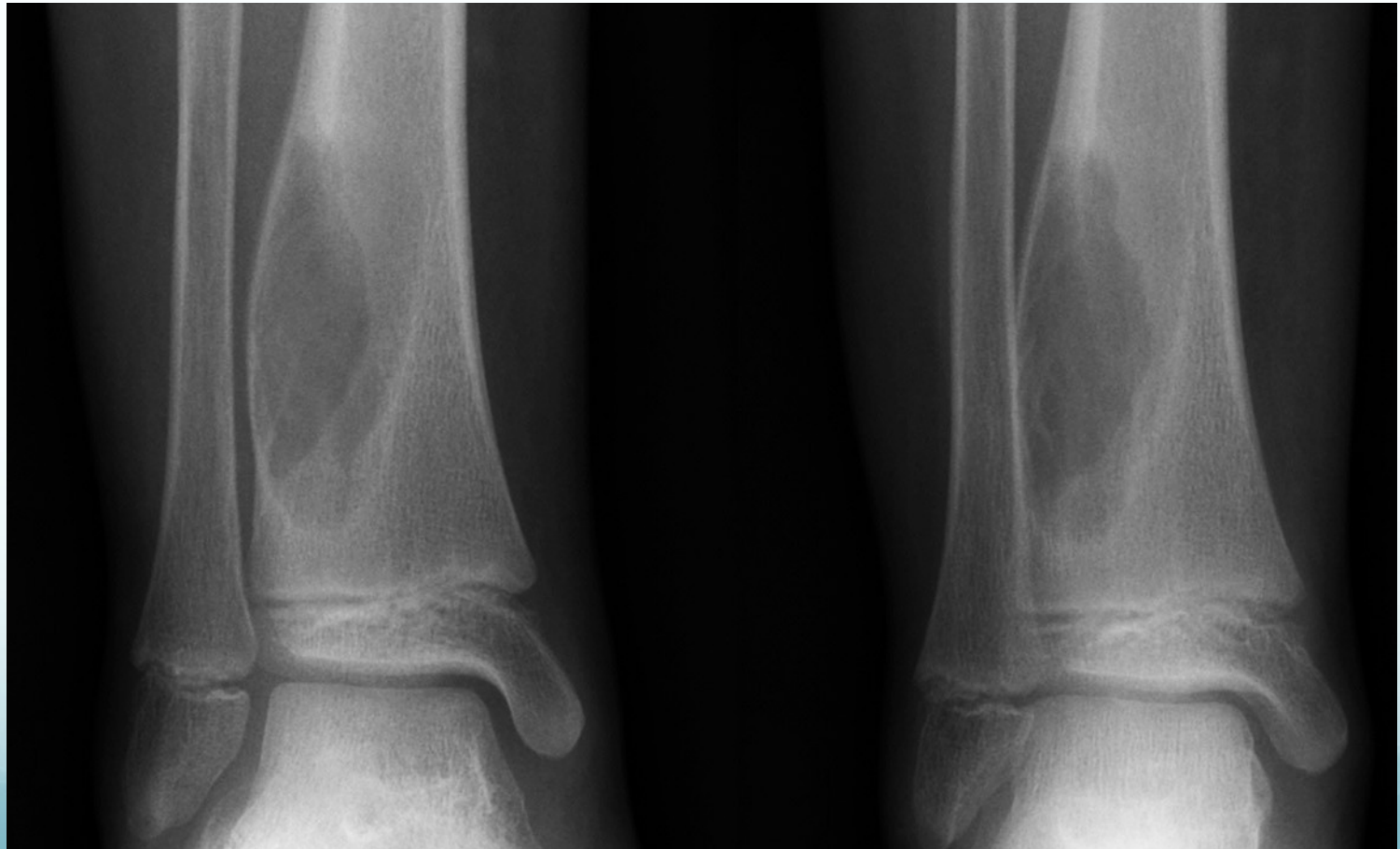
Aneurysmal bone cyst

- Child - young adult
- Metaphysis of long bone
- X-ray:
 - Well-defined cyst
 - Trabeculated
 - Eccentrically placed
 - Ballooning
- Bloody content
- Treatment:
 - Curettage and bone graft



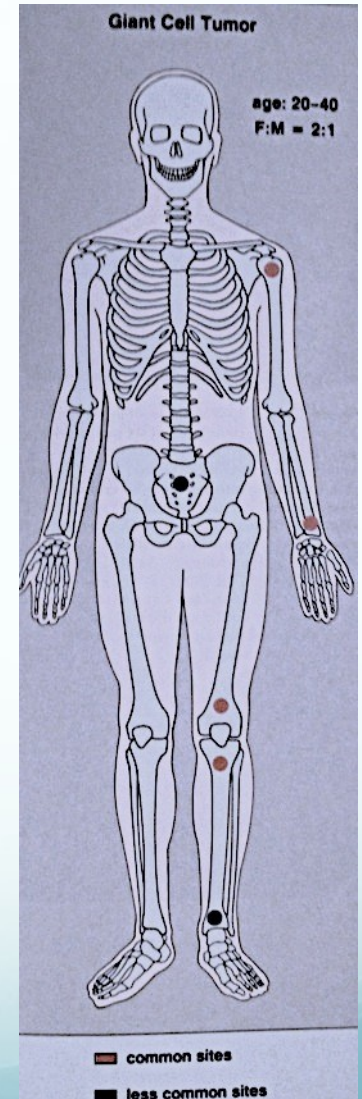
Aneurysmal bone cyst

- Metaphysis, Eccentric



Giant-Cell Tumor

- Unknown origin
 - Giant cells abundant
- Behavior:
 - One third benign
 - One third locally aggressive
 - One third (less) with distant metastasis
- Young adults
- Common sites:
 - Around knee
 - Proximal humerus
 - Distal radius



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Giant-Cell Tumor

- **Eccentric lesion**
 - Radiolucent
 - Soap bubble
 - Abuts(adjacent) against the joint
 - Thin cortex
- **Margins may be clear / unclear**
 - Depends on aggressiveness
- **Treatment**
 - Curettage & bone grafting
 - More wide excision in recurrent and aggressive lesions



Bone Tumors A Practical Guide to Imaging

Giant-Cell Tumor



Cyst-like lesions in bone



Simple bone cyst

- Fills medullary cavity
- Does not expand bone



Aneurysmal bone cyst

- At metaphyseal side of physis
- Expansile

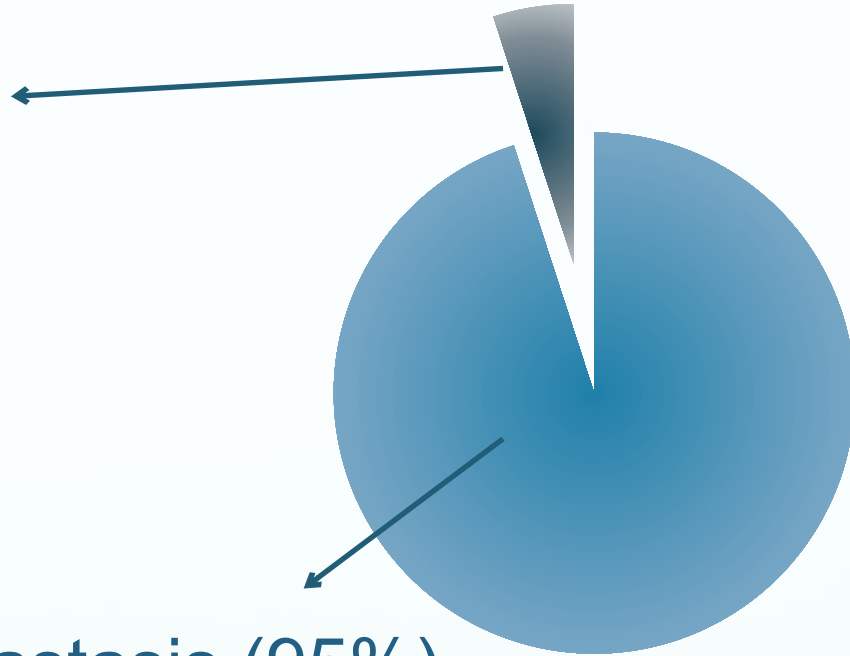


Giant-cell tumor

- After fusion of physis
- Extend to sub-articular

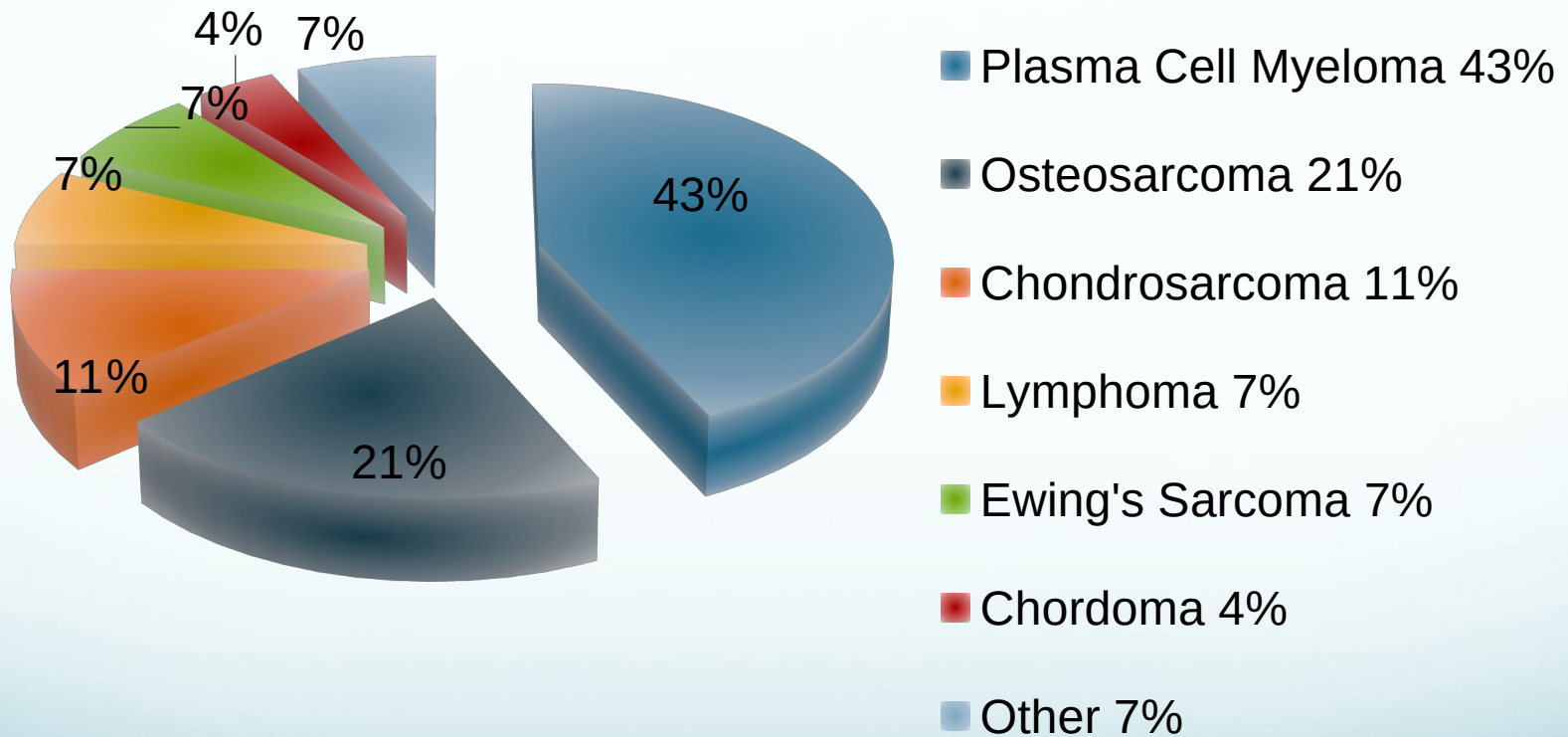
Malignant Bone Tumors

- Primary (5%)



- Secondary metastasis (95%)

Primary Malignant Bone Tumors

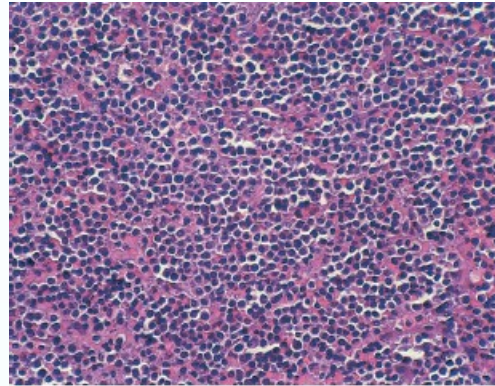


Primary malignant bone tumors

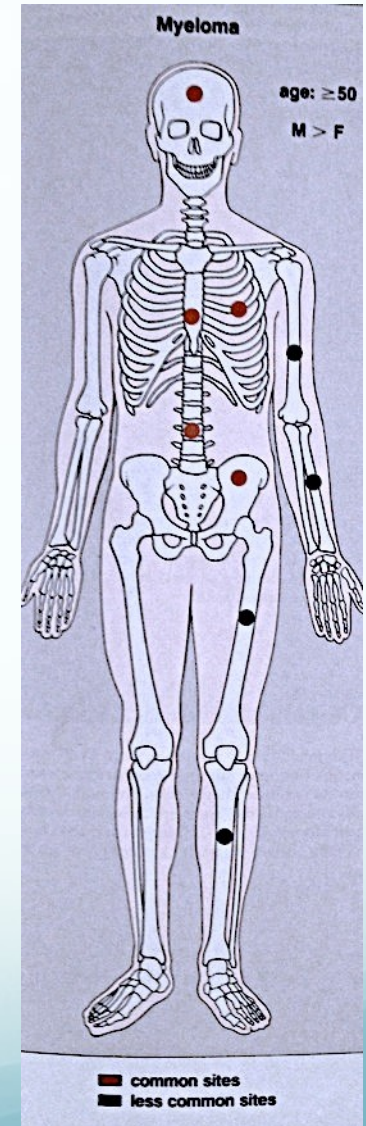
- Multiple myeloma
- Osteosarcoma
- Chondrosarcoma
- Ewing's sarcoma

Multiple Myeloma

- B-Cells of bone marrow
 - Plasma cells mainly
- Age: 45-65 yrs.
- Bone pains
- Increased serum Calcium
- Bence Jones protein in urine

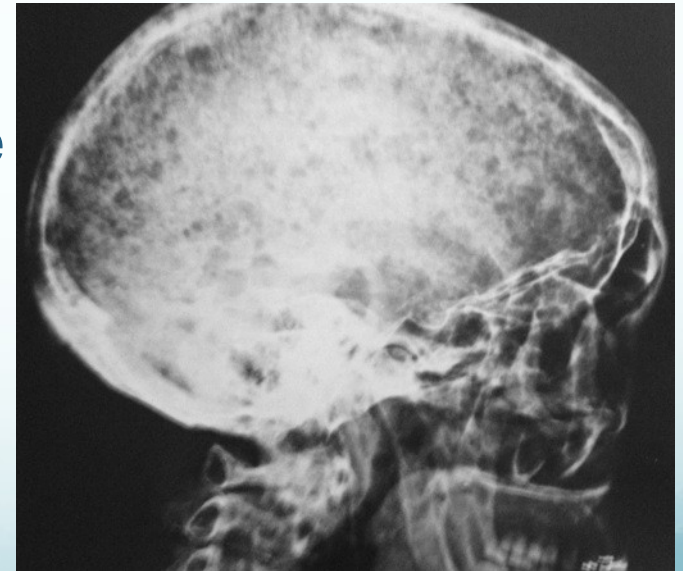


Apley's System of Orthop. And Fractures

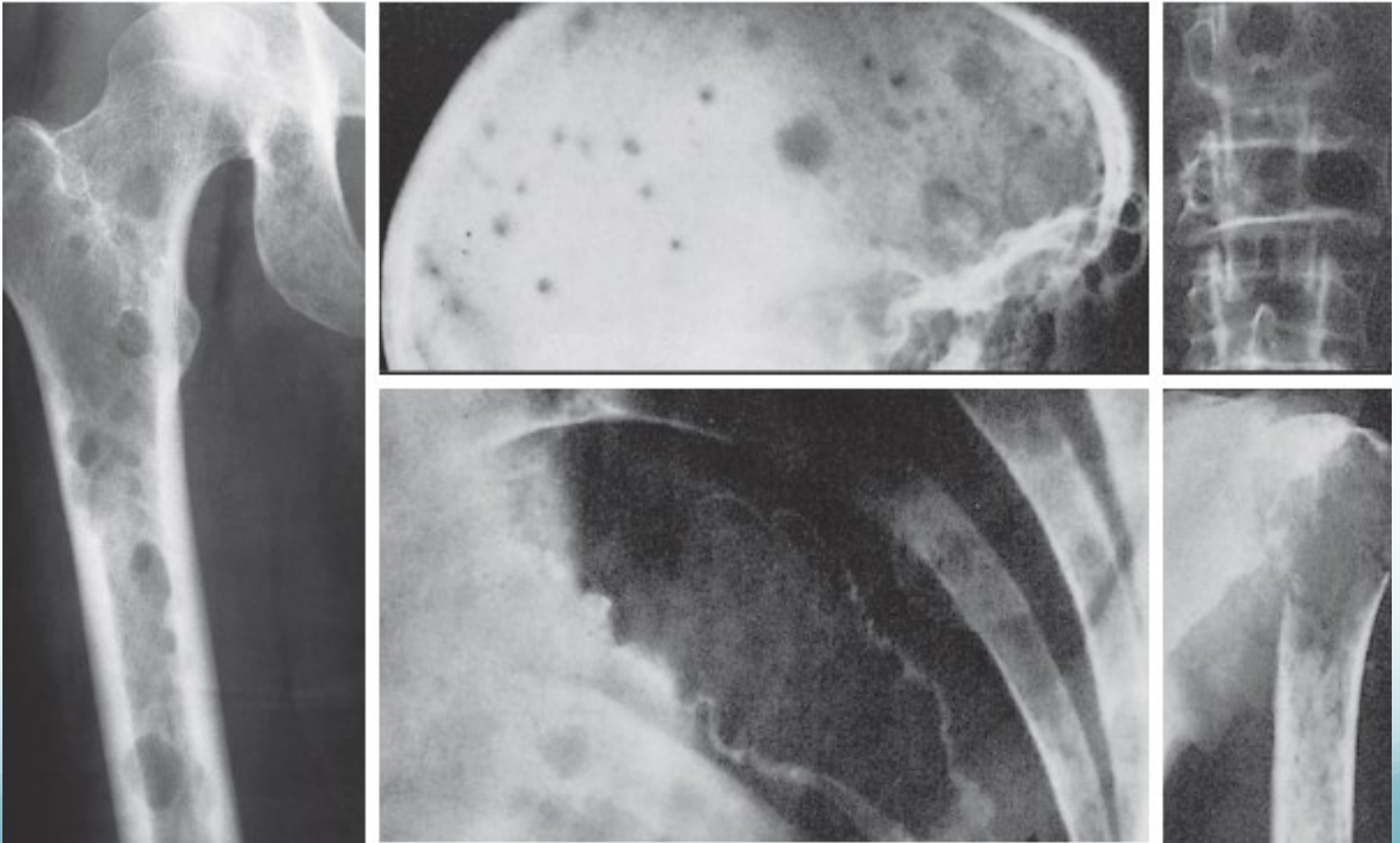


Multiple Myeloma

- X-ray:
 - Multiple punched-out lesions
 - Osteoporosis & Vertebral compression fracture:
 - If both present in a male >45: ? Myeloma
 - Common sites:
 - Skull, Prox. Femur, vertebrae
- Bone marrow biopsy

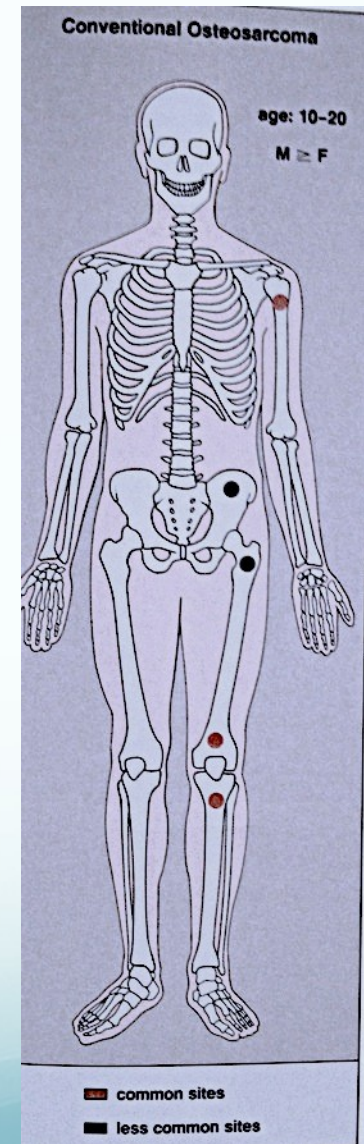
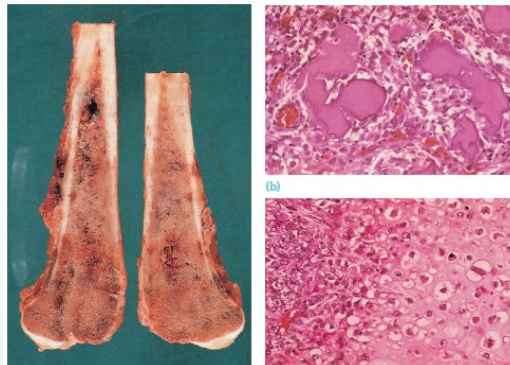


Multiple Myeloma



Osteosarcoma

- Usually highly malignant
 - (10% already lung metastasis)
- Children – adolescents (10-20 yrs.)
- Presentation:
 - Pain
 - Mass
- Sight:
 - Metaphysis of long bones
- Pathology
 - Bone forming: osteoblastic
 - With chondroblastic areas



Osteosarcoma

- X-ray:
 - Radiolucency and sclerosis
 - Poorly defined margins
 - Extends into soft tissue
 - Periosteal reaction:
 - Sunburst (sun-ray) appearance
 - Codman's triangle



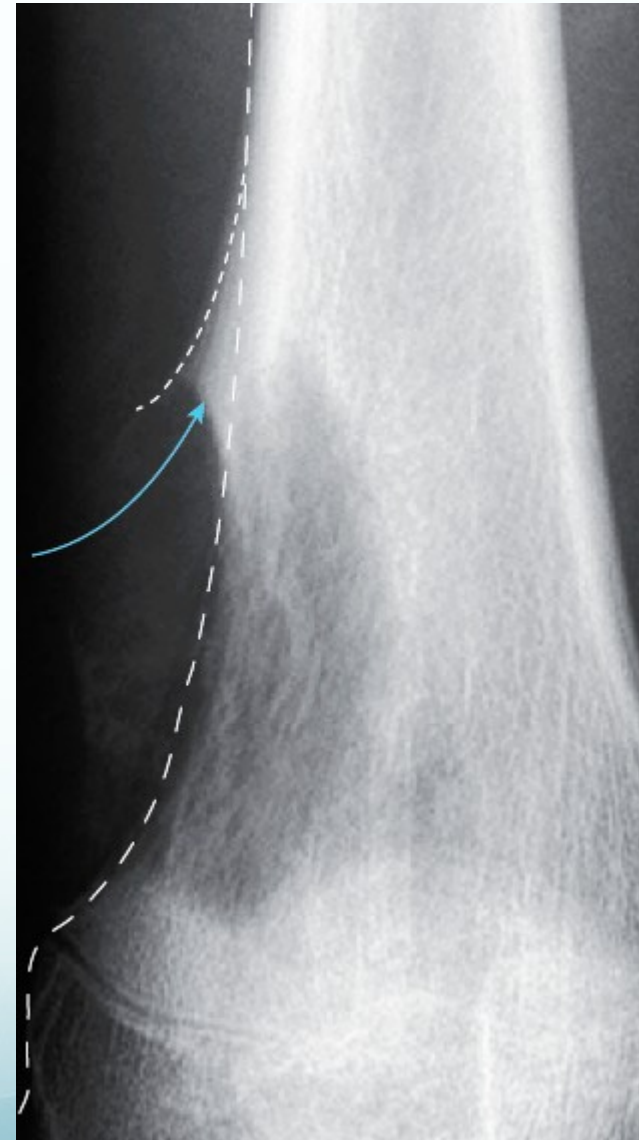
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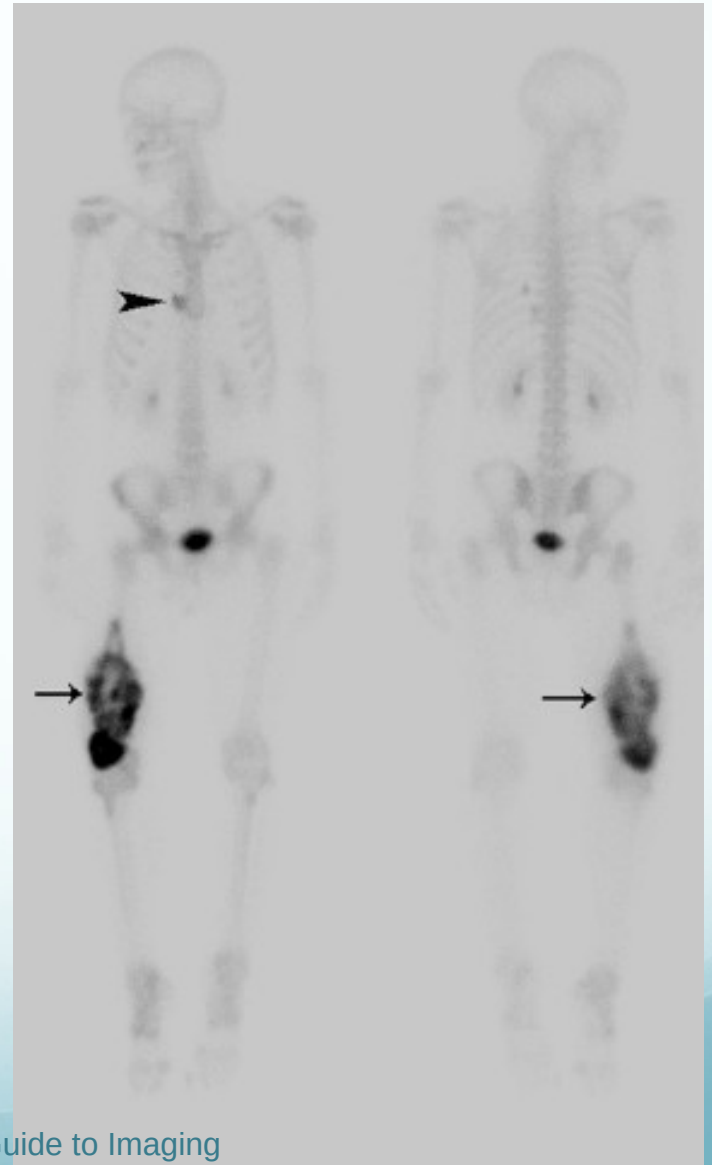
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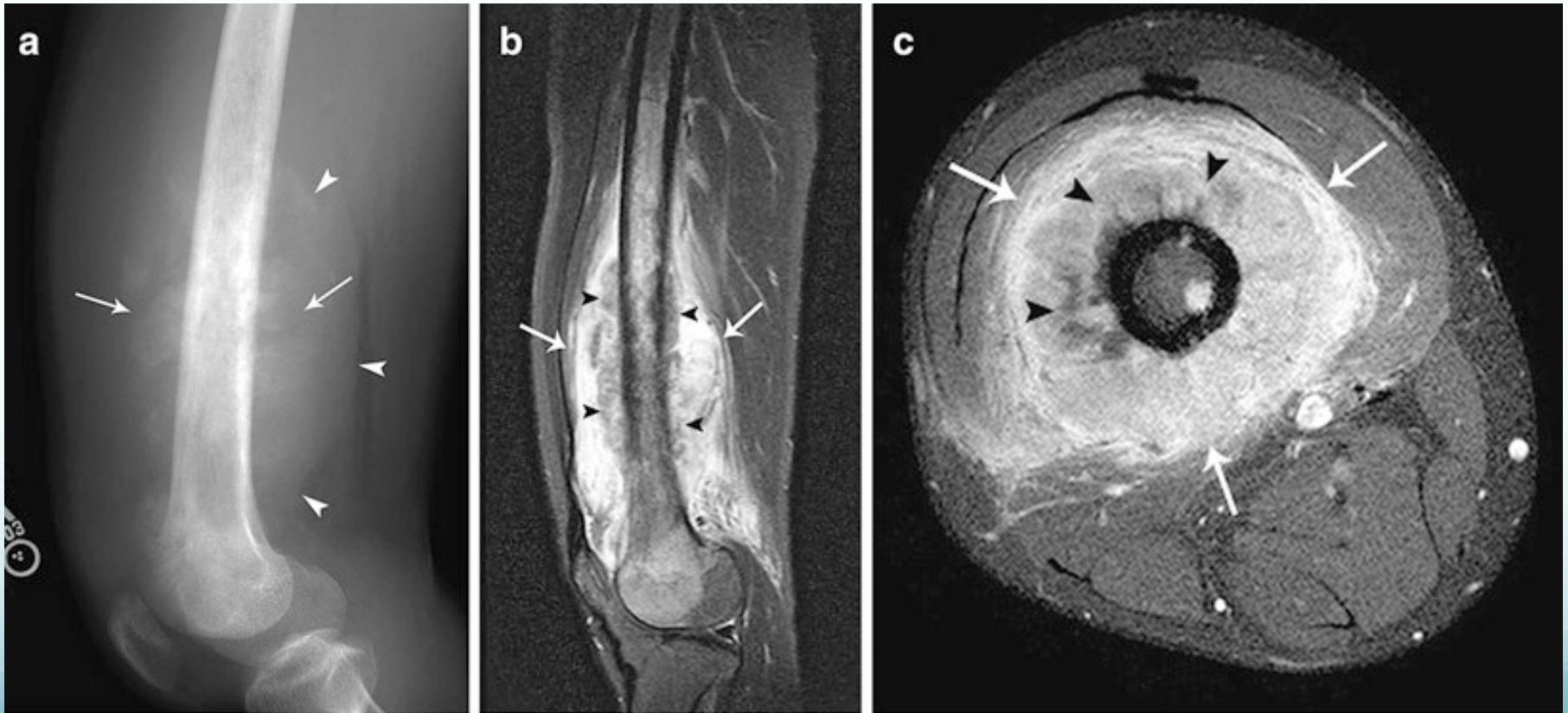
Osteosarcoma

- Bone scan
 - Primary lesion
 - Metastasis



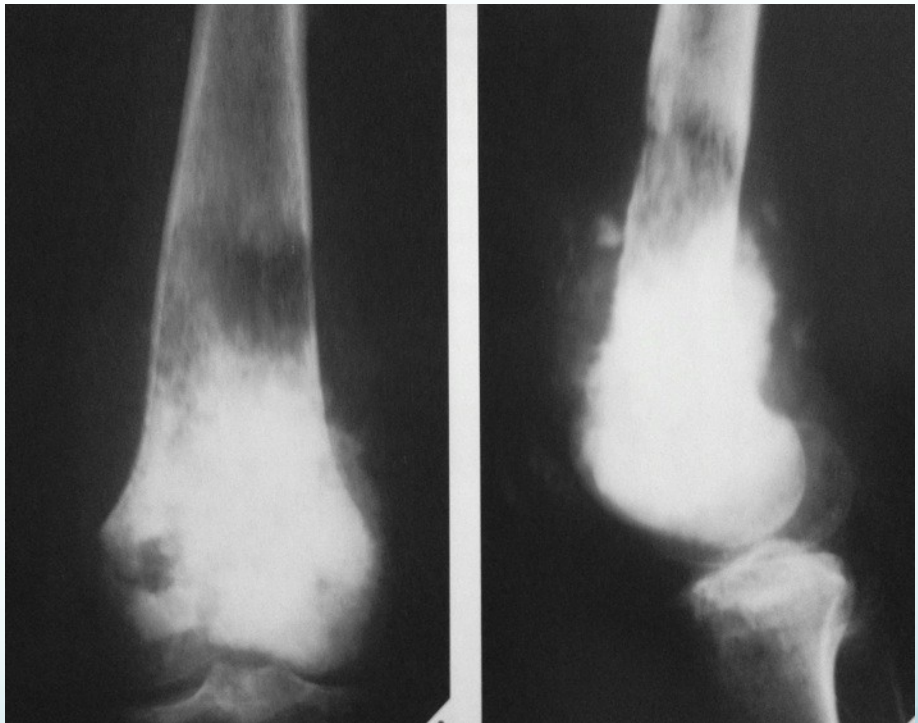
Osteosarcoma

- MRI very informative



Osteosarcoma

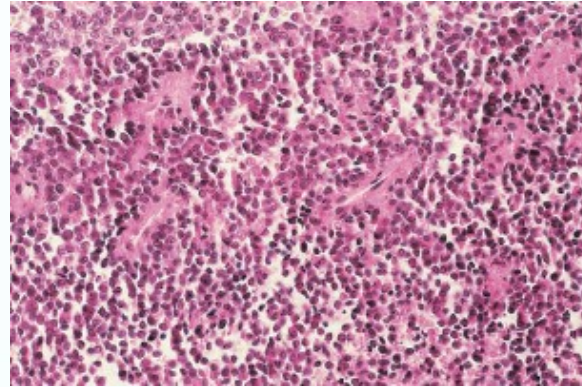
- Treatment:
 - Look for metastasis
 - Biopsy a must
 - Well planned incision
 - Chemotherapy
 - Surgery:
 - Wide resection
 - Amputation



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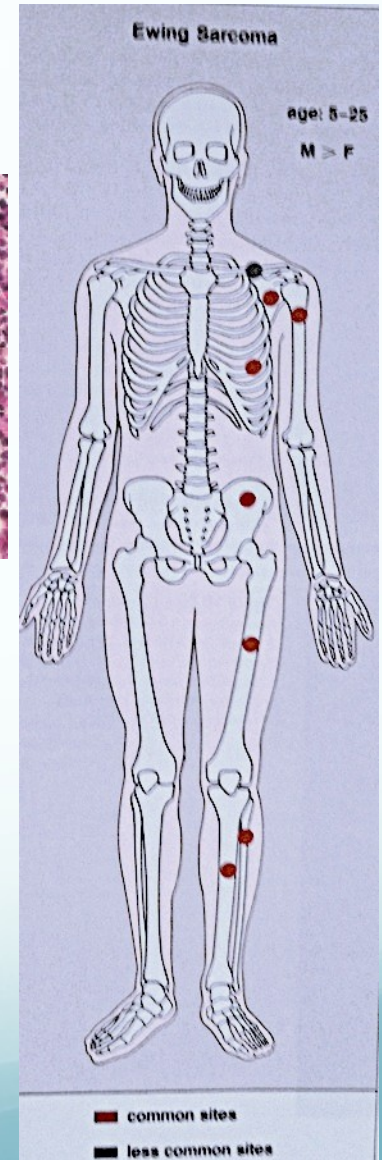
Ewing's Sarcoma

- From bone marrow cells
 - A round-cell tumor
- Age: 10-20 yrs.
- Tubular bone
 - Tibia, fibula, clavicle
- Presentation:
 - Throbbing pain
 - Swelling
 - Tenderness
 - Hotness
 - ESR raised



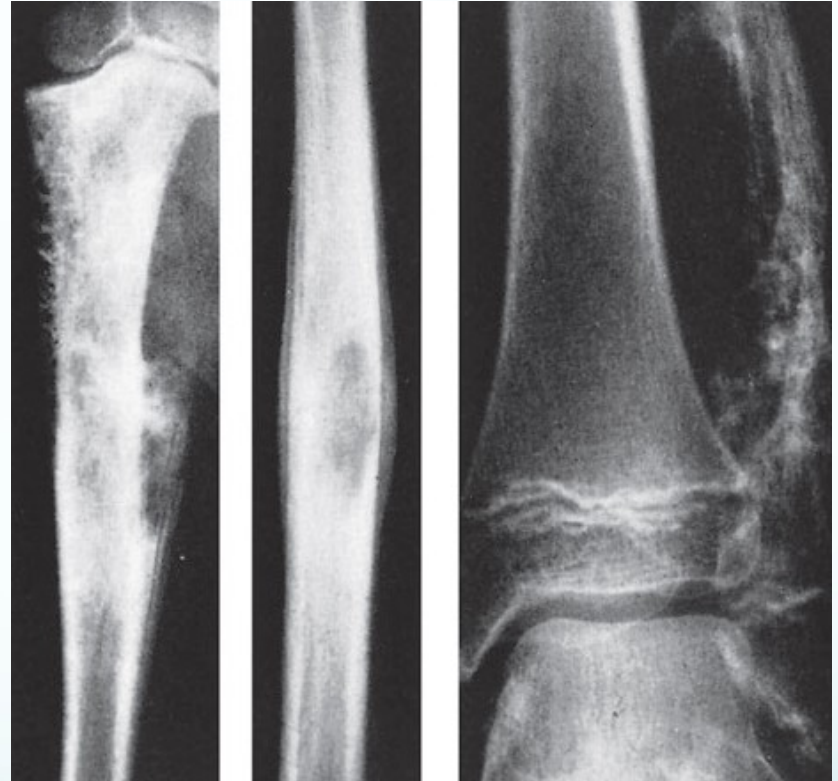
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Osteomyelitis ?



Ewing's Sarcoma

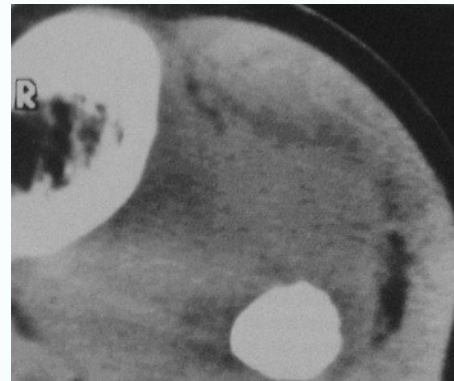
- X-ray:
 - Diaphyseal
 - Bone destruction
 - New bone formation
 - Along the bone
 - “Onion-peel” layers
 - ? “Sun-ray”
 - ? Codman's triangle
 - Secondaries – in skeleton



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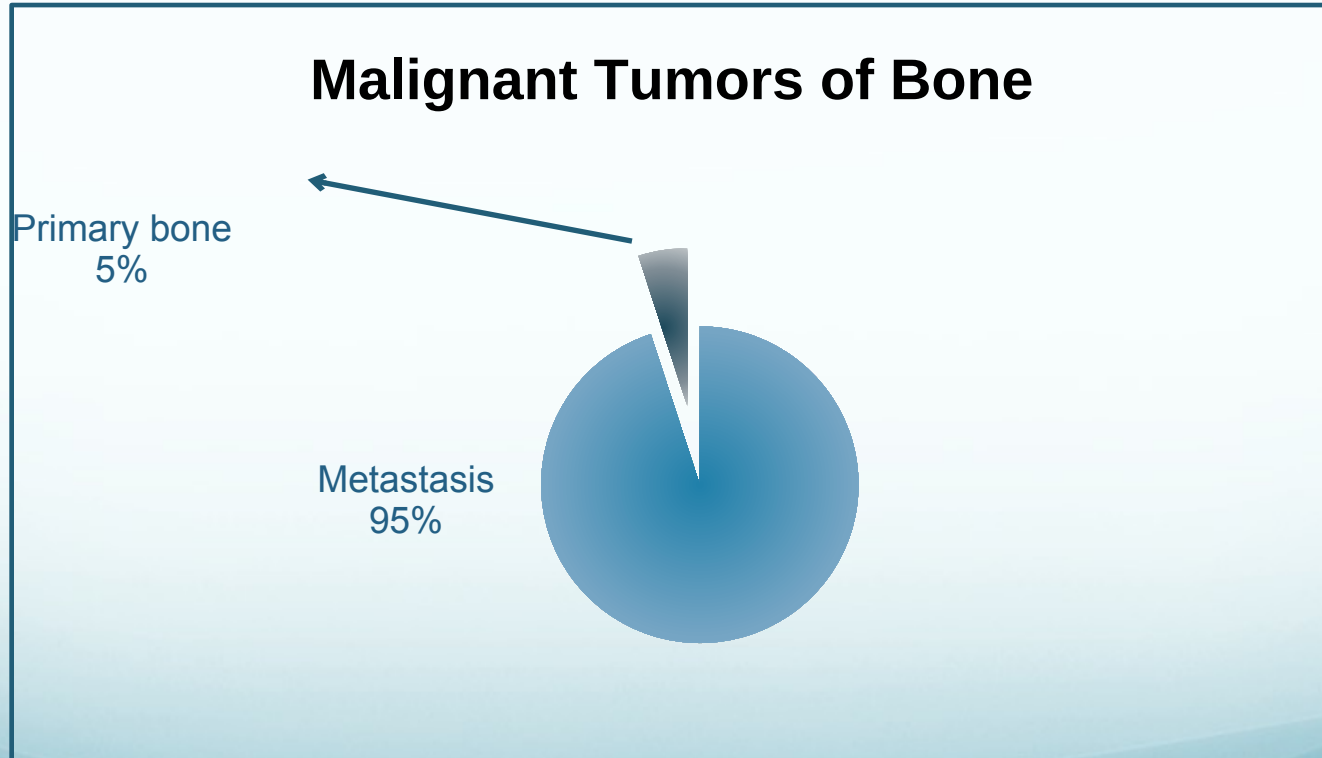


Ewing's Sarcoma

- Treatment
 - Poor prognosis – a killing tumor
 - Radiotherapy
 - Chemotherapy – multiple drugs

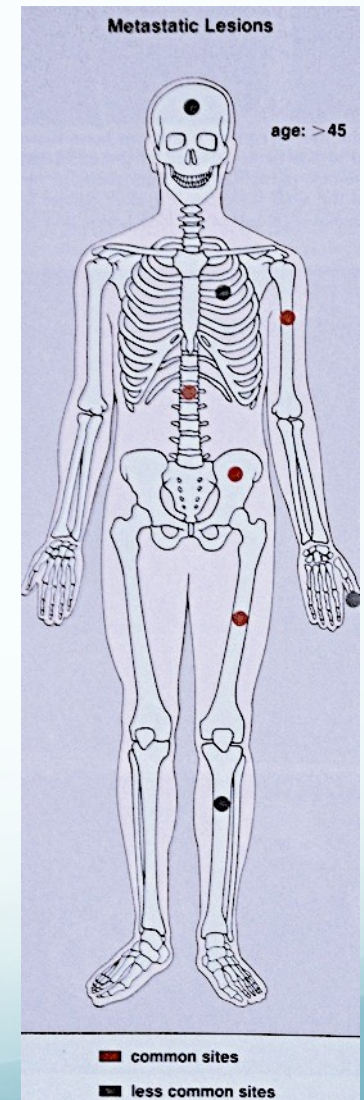
Metastatic bone disease

- Secondary metastasis in bone
 - Primary tumor in other tissue



Metastatic bone disease

- Common in skeleton
- In patients >50 yrs.:
 - metastasis more common than all primary tumors together
- Primary from:
 - Lung, Breast, Prostate, Kidney,, Thyroid, Bladder, GIT, ..
- Common sites:
 - Vertebrae, pelvis, Proximal femur and humerus



Metastatic bone disease

- Clinical features:
 - Age 50-70 yrs.
 - Pain – may be silent
 - H.O Carcinoma
 - Hypercalcaemia
- X-ray:
 - Osteolytic, moth-eaten
 - Osteoblastic in ca prostate
- Bone scan
- Anemia, raised ESR
- Antigen markers of tumors



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Metastatic - Prostate



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Metastatic bone disease



Summary

- Bone is a common site of tumors
- Primary bone tumors:
 - Benign tumors
 - Tumor-like: Cysts
 - Malignant
- Secondary metastatic
- Features, bone, site, age, and X-ray shape characteristic for each tumor
- Keep an open mind