433 Teams

ORTHOPEDICS

Objectives:

By the end of this lecture you should know:

- How to reach a diagnosis by history, physical examination, and investigations.
- How to manage cases of bone tumors.

جامعة الملك سعود
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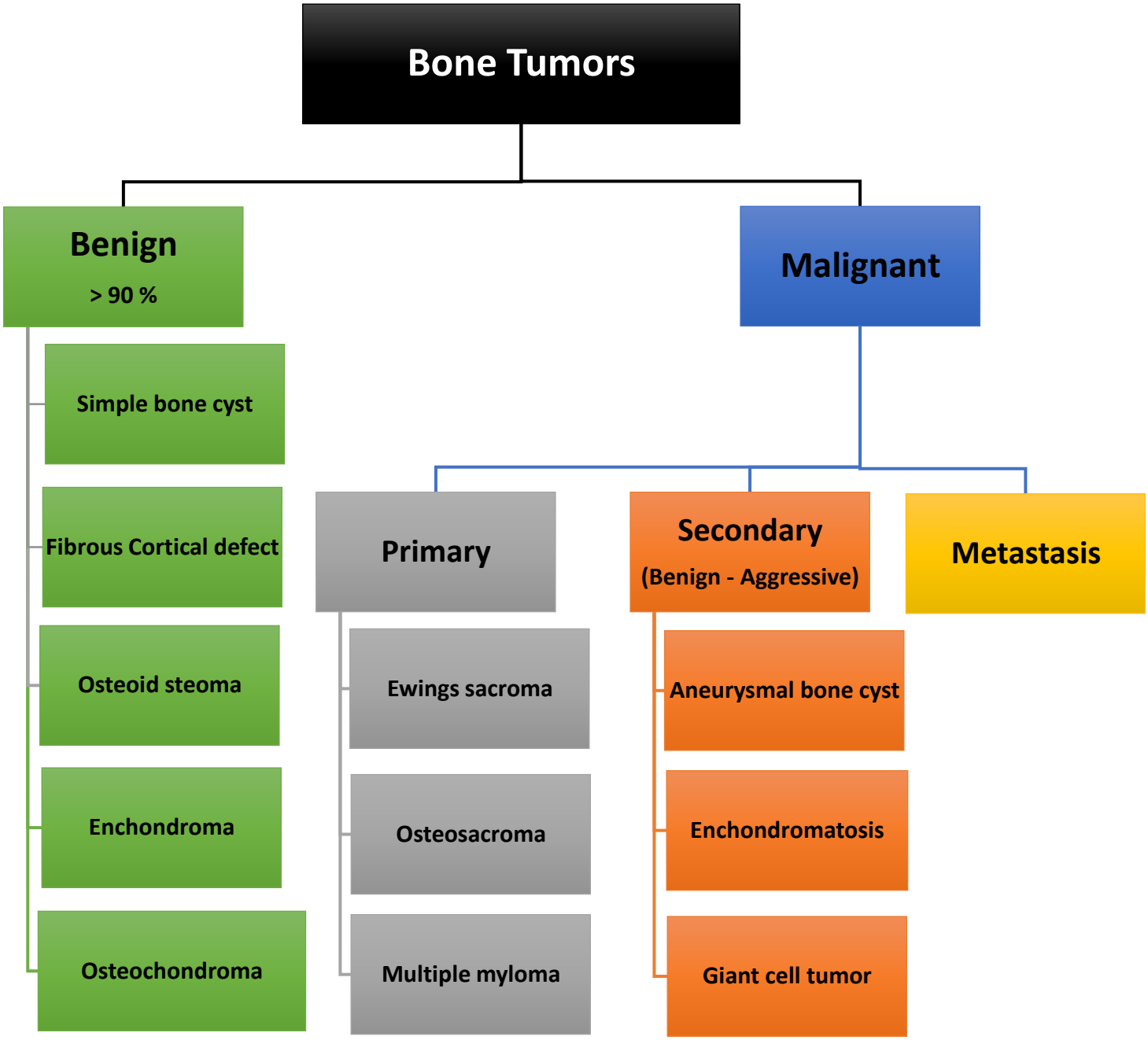

Bone Tumors
Benign
> 90 %
Malignant
Simple bone cyst
Fibrous Cortical defect
Osteoid steoma
Enchondroma
Osteochondroma
Primary
Secondary
(Benign - Aggressive)
Metastasis
Ewings sacroma
Osteosacroma
Multiple myloma
Aneurysmal bone cyst
Enchondromatosis
Giant cell tumor

The diagnosis of tumors is made by History, physical examination & investigations.

History:

- Age.
- Cc: Pain (duration, Site, Onset, Character, Radiation, Associations, Time course, Exacerbating/Relieving factors, Severity). or swelling/lump (duration, site, progression, persistence, associated symptoms).
- History of trauma.
- Neurological symptoms (paresthesia or numbness).
- Weight loss, night pain.
- Pathological fracture.
- Family history of bone tumor.
- Predisposing factors.

Physical Examination:

- General examination (cachectic).
- If there is a lump: 2Ts =tenderness, temperature, 3Ss = Site, size & shape, consistency, surface, margins, Overlying skin, mobility, discharge, Reducibility, Pulsatility & transillumination
- if the tumor is near a joint there may be effusion and/or limitation of movement.
- Lymphadenopathy - Involvement of local or regional lymph nodes.

Investigations:

- X-ray (AP, lateral).
- MRI.
- blood investigations for histopathology and culture.

X-Ray Reading describing a lesion should include the following:

1- Number: is the lesion solitary or are there multiple lesions?

2- Site: what type of bone is involved & where is the lesion in the bone?

Epiphysis, Diaphysis, or Metaphysis; most of the tumors arise from the metaphysis.

3- Shape/ Geographic appearance: usually ugly looking lesion are considered malignant.
Describe the tumor: e.g. oval shape, surface tumor, multiple tumor, etc.

4- Size. As a fundamental rule, big lesions (>5cm) are aggressive.

5- Centric (away from the border) or **eccentric** (in the bone border).

6- Border of the tumor:

- Well define & sharp borders → usually seen with benign tumors.
- Ill-defined borders →usually seen with malignant tumors.
- Sclerotic margin: sign of benign tumors.

7- Matrix of the tumor:

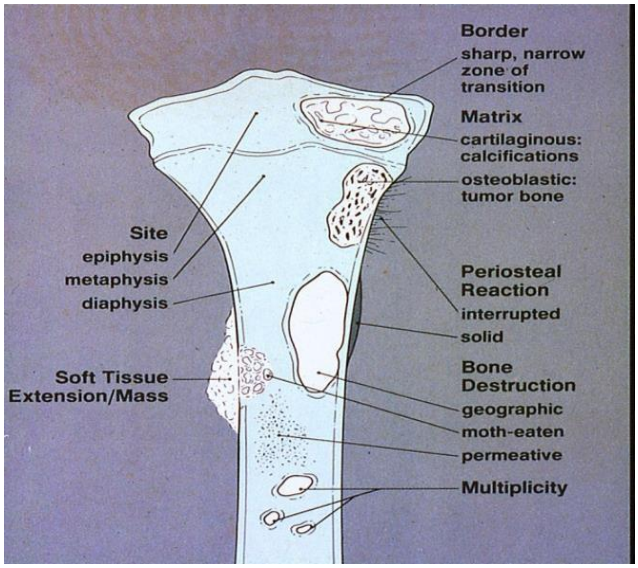
- Sclerotic: it means forming bone .so on x-ray → opaque.
- Lytic: it means forming tissue other than bone (it may be cartilage, fibrous tissue, or cystic) on X-ray → translucent.

N.B. this classification (lytic and sclerotic) helps in the differentiation b/w tumors. But, you cannot tell from this classification wither this tumor is benign or malignant.

8- Periosteal reaction: -occur in some bone tumors:

- Characteristic periosteal reaction: mostly occur with malignant tumors (teeth like).
- Smooth periosteal reaction: with benign tumor.

9- Soft tissue extension: soft tissue involvement occurs mostly with malignant tumors or aggressive benign.



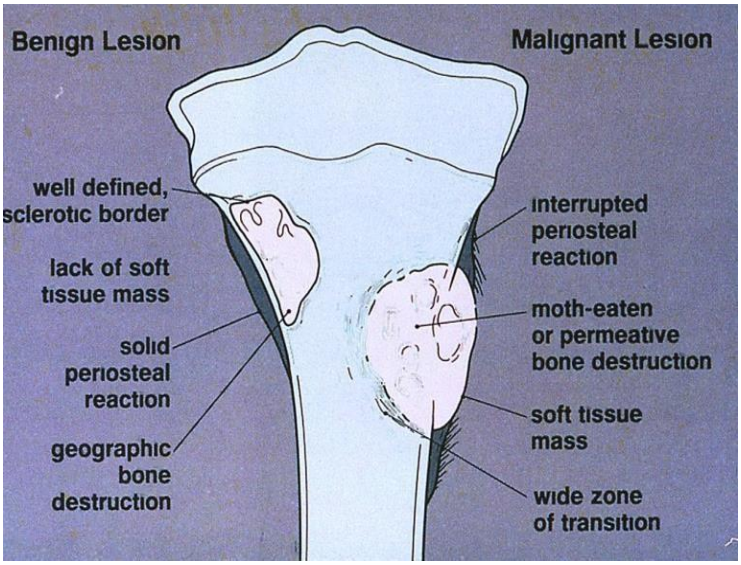
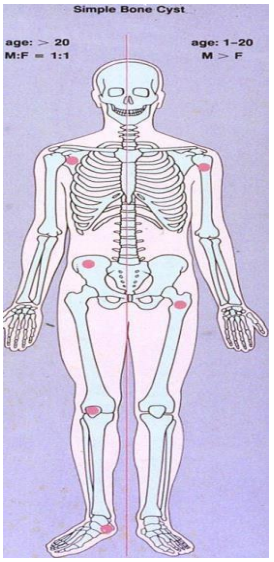


FIG. 13.2 CLASSIFICATION OF TUMORS AND TUMORLIKE LESIONS BY TISSUE OF ORIGIN

Tissue of Origin	Benign Lesion	Malignant Lesion
Bone-forming (osteogenic)	Osteoma Osteoid osteoma Osteoblastoma	Osteosarcoma (and variants) Juxtacortical osteosarcoma (and variants)
Cartilage-forming (chondrogenic)	Enchondroma (chondroma) Periosteal (juxtacortical) chondroma Enchondromatosis (Ollier's disease) Osteochondroma (osteocartilaginous exostosis, single or multiple) Chondroblastoma Chondromyxoid fibroma	Chondrosarcoma (central) Conventional Mesenchymal Clear cell Dedifferentiated Chondrosarcoma (peripheral) Periosteal (juxtacortical)
Fibrous and fibrohistiocytic (fibrogenic)	Fibrous cortical defect (metaphyseal fibrous defect) Nonossifying fibroma Benign fibrous histiocytoma Fibrous dysplasia (mono- and polyostotic) Periosteal desmoid Desmoplastic fibroma Osteofibrous dysplasia (Kempson–Campanacci lesion) Ossifying fibroma (Sissons' lesion)	Fibrosarcoma Malignant fibrous histiocytoma
Vascular	Hemangioma Glomus tumor Cystic angiomatosis	Angiosarcoma Hemangioendothelioma Hemangiopericytoma
Bone-marrow (hematopoietic) and lymphatic	Giant cell tumor (osteoclastoma) Eosinophilic granuloma Lymphangioma	Malignant giant cell tumor Histiocytic lymphoma Hodgkin's disease Leukemia Myeloma (plasmacytoma) Ewing's sarcoma
Neural (neurogenic)	Neurofibroma	Malignant schwannoma
Notochordal	Neurilemoma	Chordoma
Fat (lipogenic)	Lipoma	Liposarcoma
Unknown	Simple bone cyst Aneurysmal bone cyst Intraosseous ganglion	Adamantinoma

Benign Tumors

1) Simple bone cyst (unicameral cyst):

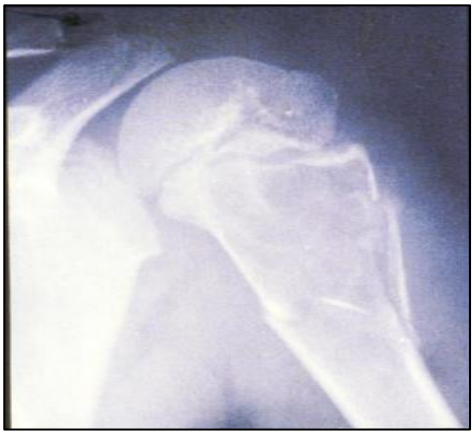


- Most commonly incidental finding. Most resolve within 2 years. But the patient may present with pathological fracture → Causes pain (after trauma & cyst may correct after fracture).
- Usually seen in children age group up to 20 years old, Male > Female.
- Children may present with limping.

Sites:

- Common in the proximal part of long bones (e.g. proximal humerus, femur or tibia).
- Upper & lower parts of the femur Pelvic (iliac crest), Calcaneus, Scapula, Patella.

Radiological feature:



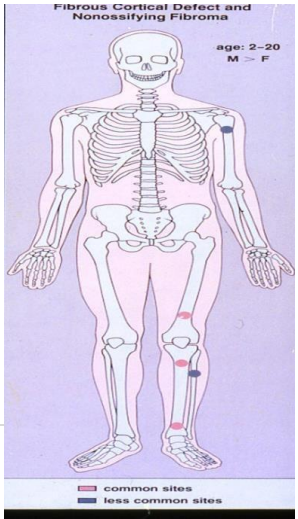
(X-ray is the main essential investigation in benign tumors)

1. Metaphysic lytic lesion
2. Sclerotic margin, well define.

Treatment:

- X-ray of pathological fracture in young age group:
  - Conservative treatment for the fracture & patient education regarding recurrence of fracture in this area.
- The same fracture in older age with displacement & angulation:
  - ORIF (Open Reduction and Internal Fixation) + Bone graft to fill the space.

2) Fibrous Cortical Defect (Non-Ossifying Fibroma):



- Benign lesion since birth.
- Never transfer to malignant.
- Not site for fracture.
- Eccentric lesion.

Sites:

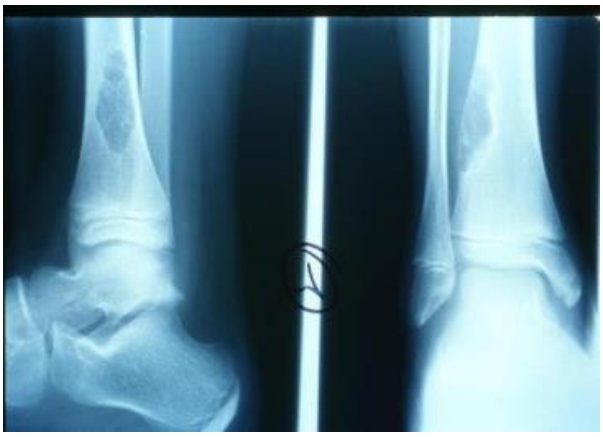
- Around knee: (lower femur, upper tibia).
- Lower tibia.

Presentation:

- Asymptomatic (no pain, no swelling & no pathological fracture) → discovered incidentally.

Radiological feature: (x ray of the right ankle of a child)

- lesion in the metaphyseal diaphysis junction.
- Margin: clear
- **Matrix: fibrous**
- Cortex: intact.
- Well-defined, sclerotic margin.
- Can't be simple bone cyst because of the site Metaphyseal lytic lesion (inside the cortex).

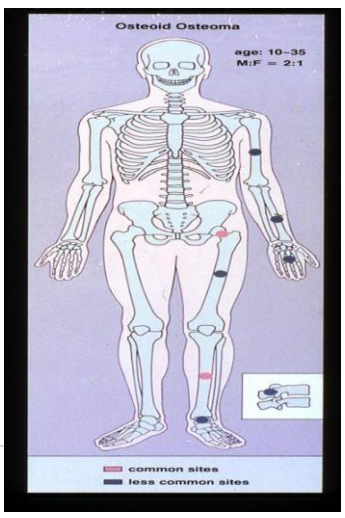


Treatment:

- Self-limited, healed by itself.
- Reassurance.
- If pain-full → **curettage +bone graft.**

3) Osteoid osteoma: (الورم العظمي العظماني)

- Benign tumor, which has different behavior → **main presentation is pain.**
- Usually affects young patients 10-35 and more common in males.
- May arise in the cortex of long bones, or occasionally in the cancellous bone of the spine and less commonly talus.



Presentation:

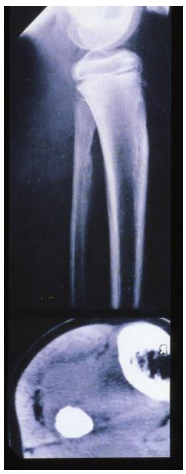
- Usually well localized pain (in the back or groin area) that is worse at night and prevents patient from sleep.
- **Night pain is important sign to think about tumors.**

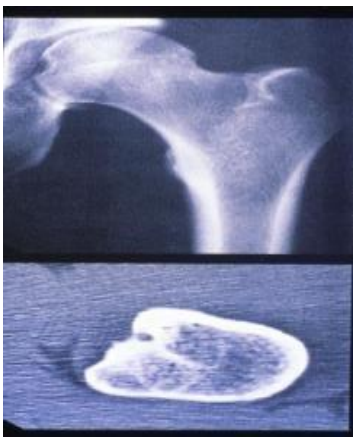
Character of pain:

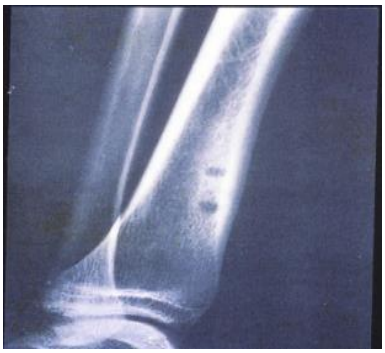
- Pain at the site of tumor.
- Aggravated by activity.
- Relived by aspirin & NSAID.

Radiological features:

- Make sure it is not acute vascular necrosis.
- Metaphyseal or diaphyseal lesion.
- Lytic lesion inside patch of sclerosis.
- The lytic lesion called **((nidus))** nidus is the part which is surrounded by a reactive zone of dense sclerotic new bone formation, therefore in the treatment → **we remove nidus only.**







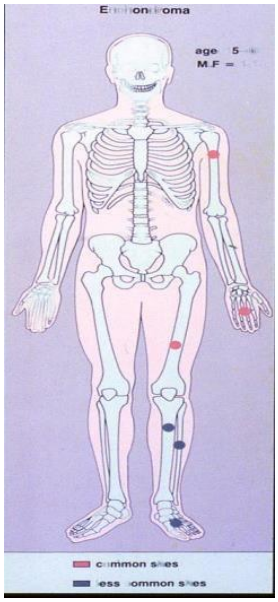
Investigations:

- **X-ray→** a nidus surrounded by a thick cortex (sclerosis). **(Not helpful)**
- **CT scan → nidus (modality of choice in the diagnosis)**
- **Bone scan used sometimes →** ↑uptake.

Treatment:

- **NSAIDs** for 3-6 weeks
- If not relived A CT-guided needle can be inserted in to the nidus and the lesion is ablated with radiofrequency, coagulation (also called **radio frequent ablation**).
- If it easy to access > excise it, label it then send it to histopathology.

4) Enchondroma:



- 15-50 age group.
- Tumor grows within the bone and expands it (ballooning).
- **It composed of translucent hyaline cartilage** and content inside Is chondroid.
- The affected bone is expanded by the tumor and its cortex is thinned.

Sites:

- Mainly **small bone e.g. phalanges in hand & foot** ...etc.
- Common in Femur, humerus and less commonly tibia &fibula

Presentation:

Usually found incidentally swelling. Females might notice it because they might feel that their ring became tight due to the swelling, Pathological fracture which may cause pain. Affect one side and prolonged healing.

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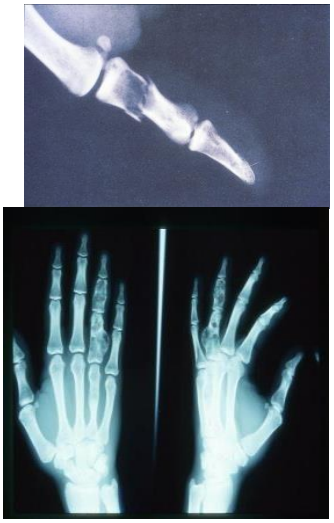
Radiological features:



- Location and contents is different from aneurysmal bone cysts.
- Enchondroma usually in digits, different from aneurysmal which occurs in long bones.
- Ground sub here contains fibrous tissue unlike aneurysmal which appears like glass.
- X- RAY of enchondroma is more hyper dense due to the chondroid.

Treatment:

- If it symptomatic (pain, become bulky) > surgery **(curettage + bone graft)** and fixation.
- N.B. any pathological, you must take a biopsy.

5) Osteochondroma: (الزيادة العظمية)

- **Commonest benign tumor of the bones.**
- The only surface tumor (outside the bone) therefore, it's called exostosis.
- **It is a combination of both bone & cartilage.**
- Usually in 10-20 age group and Male > Female.
- Painful in children due to growth plate compression and pressure effects on adjacent nerve or vascular structures.

Sites:

- The commonest are (around knee) distal femur
- proximal tibia
- proximal humerus,
- Scapula
- Neck of femur.

Presentation:

Swelling (progressive in size). Patient's usually present for cosmetic purposes.

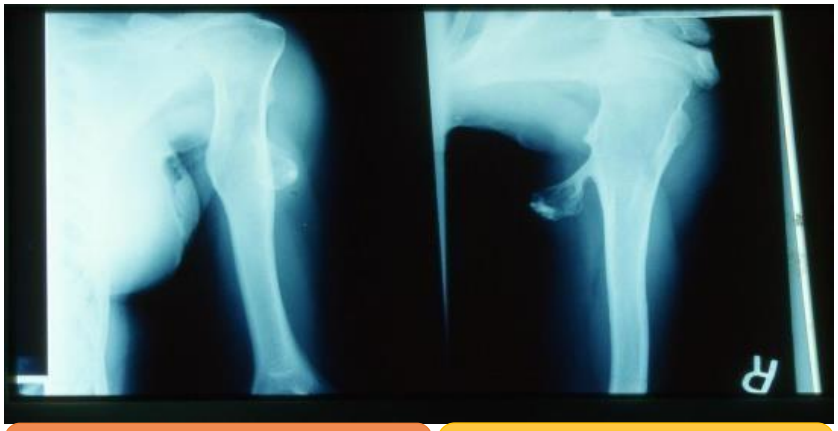
Symptoms of complications:

1. **Pressure symptom:**
   - Pseudo-aneurysm → artery.
   - Hypothesis or paresthesia→ nerve.
   - Rendering the movement → tendon.
   - Restrict the movement of the movement nearby the joint
   - Adventitia bursae.
2. **Fracture especially with pedunculated type If it transfers to malignant.**

Radiological features:

1. Metaphyseal lesion.
2. Mushroom-like stalk of the bony tumor (connected to the bone).
3. On x-ray the cartilaginous cap: which is the cartilaginous part of the tumor that is not seen (translucent & it is located around the bony part.
4. Direction of the tumor → away from the bone.

5. Start from the growth plate and Stops growing when patient stops to grow usually at 18 yrs.
6. According to the shape of the neck of the tumor, **<u>we divide it into:</u>**
   - **Pedunculated type:** has long & thin neck.
   - **Sessile type:** has short & thick neck.



Sessile type | Pedunculated type

Treatment:

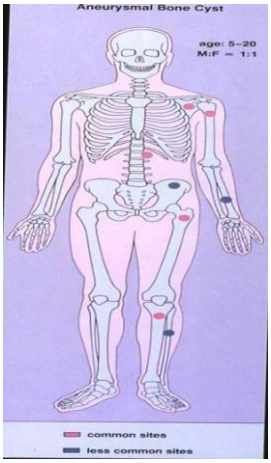
- Usually nothing is needed, reassure the patient.
- **Surgery (just excision, no need for bone graft b/c it is a surface tumor)**
- **The surgery is indicated if there is:**
  1. Sudden increase in size or pain.
  2. Presence of any complication (compression on nerves, vessels, or tendons).
  3. Transformation to malignancy "chondrosarcoma" (rare only 1%).Identified by:
     - Sudden increase in pain.
     - Sudden increase in size.
     - if **cartilaginous cap exceeds 2cm** on X-Ray.

- Most common site for excision of Osteochondroma is the knee, because of the effect on ligaments and compression on vessels.

Malignant Tumors - Secondary

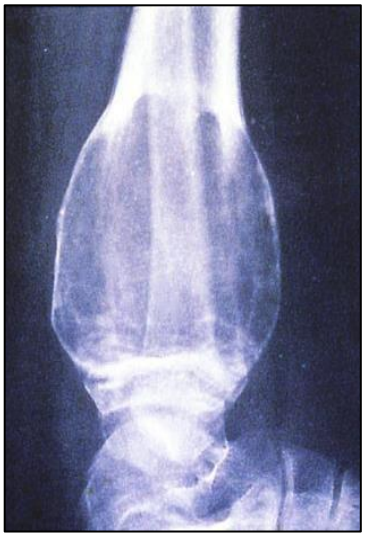
(Benign - Aggressive Tumors)

1) Aneurysmal bone cyst:



- **Aggressive and "balloon-like".**
- Progressive tumor like lesion.
- Recurrence rate is high.
- Fusiform cyst and Arteriovenous formation.
- Aneurismal cysts have **bloody content**, while simple cysts have **Orange colored contents (Looks like Straw/sun top juice).**

Sites:



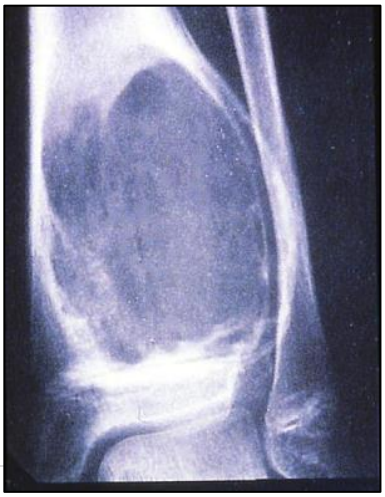
- Upper humerus
- Upper femur.
- Spine (neural arch: lamina &pedicle) may give pressure effect.
- Proximal tibia.
- Scapula.

Presentation:

- The usual presentation is **swelling.**
- Patient may present with pathological fracture → pain.

Radiological feature:

1. X-ray shows different contents inside the aneurysmal cyst unlike simple cysts.
2. Metaphyseal lytic lesion.
3. Well- defined & sclerotic margin.
4. Expansile →thin cortex (like egg shell).

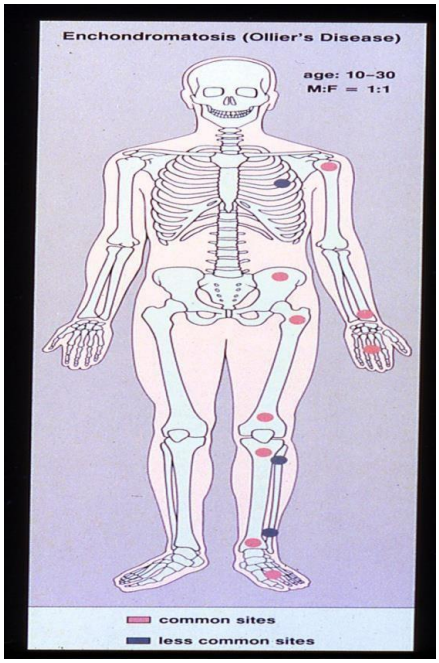


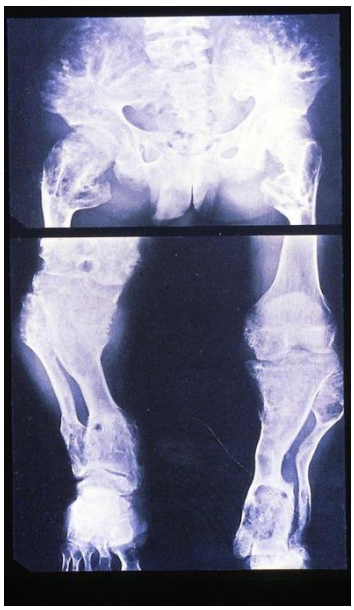
Treatment:

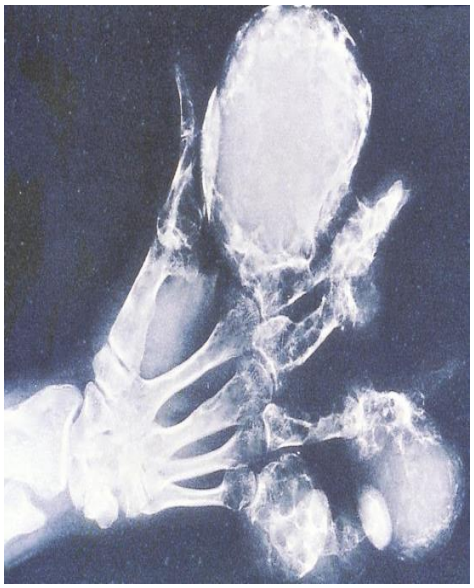
- ORIF + BONE graft (from fibula as support BCZ lesion is very big).
- Sequestration = divide it to small champers.
- Aspiration with alcohol, phenol & steroid.

2)Enchonromatosis:

- Multiple enchondromas of the major long bones occur mainly in the rare condition called **multiple enchonromatosis.**
- Benign, affects both sides, low grade destructive lesions Usually seen in children, and has a high risk of becoming a secondary tumor (malignant transformation).

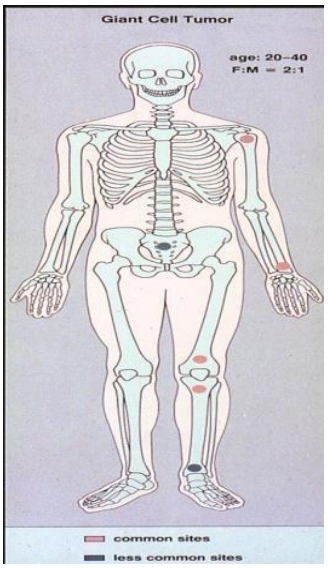






3)Giant cell tumor (GCT):

- From bone marrow.
- Occurs most commonly in young adults, 20-40 age groups.
- Benign aggressive tumor. So, the patient must be followed up every 3 months in the first year, every six months in the second year and once in a year after that.
- It's can metastases to the lung. So, it's important to get chest x-ray
- **Origin:** osteoclast, therefore it is osteoclastoma.
- Very destructive tumor.
- DDx: bone cyst, aneurysmal cyst.



Sites:

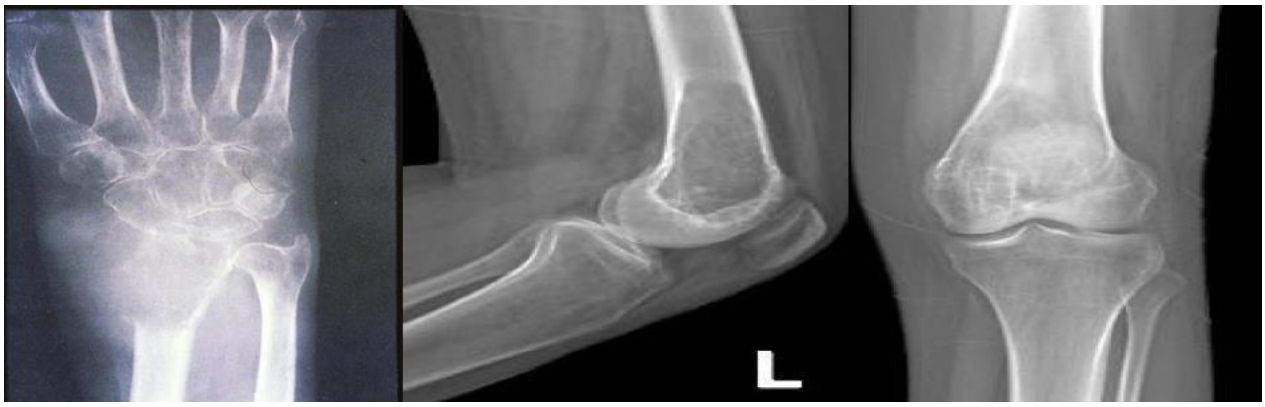
- Most common distal epiphysis of radius.
- Less common are distal tibia & sacrum.
- Very bad in the sacrum because it will affect nerve roots.

Presentations:

Mostly patients present first with: pain, then swelling & later with pathological fracture.

Radiological features:

1. **Epiphyseal lytic lesion.**
2. No new bone formation b/c the osteoclast will eat this new bone.
3. Radiograph shows lucent regions, lytic destruction of the bone with expansion of the cortex, without a sclerotic rim.
4. Ill-defined borders when aggressive or pre-malignant.
5. Usually looks like a bone cyst, **definite diagnosis made by biopsy.**
6. No marginal sclerosis.
7. Soft tissue extension.



Investigations:

The assessment depends on:

1. Soft tissue extension: by MRI.
2. Joint extension: the articular cartilage is a very resistant against progression of the tumor from going to the joint.
3. Bone extension: by CT scan.
4. Further investigation:

   - Bone scan: for metastasis.
   - **CBC**: to assess the general condition of the patient.
   - **Biopsy**: to confirm that it does not transform into malignant tumor.

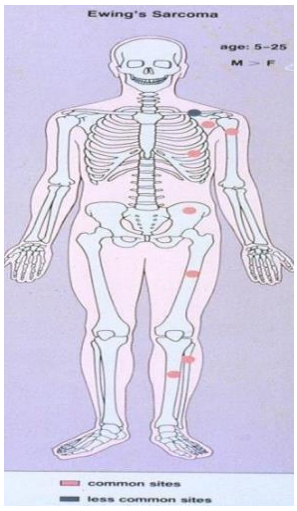
Treatment:

- Generally: **curettage and bone grafting**

- No place for conservative treatment.
- Excision followed by either bone graft or prosthesis depending on the site of the tumor:
  - If the tumor is in non-weight bearing area (e.g. lower radius): radical excision, bone graft and arthrodesis for nearby joint.
  - If the tumor is in weight bearing area (e.g. lower femur): excision and prosthesis (N.B. no bone graft here).

Malignant Tumors - Primary

1) Ewing's sarcoma:



- Origin: from the endothelial lining of the bone marrow canal.
- Most of the Ewing's sarcoma is miss-diagnosed as acute osteomyelitis. **(Mimics infections)** because of systemic symptoms and elevated ESR and elevated c- reactive protein.
- **Young age group 5-25.**
- Pulmonary metastasis can occur.

Sites:

- **It is the only bone tumor which takes it origin from diaphysis**
- The diaphysis of the femur are the most common sites followed by the tibia and humerus.

Presentations: Very characteristic:

1. Febrile patient.
2. High WBC's.
3. Local Pain & redness.
4. Ulceration of skin.
5. Swelling.

Radiological features:

1. **X-ray:** peal onion reaction.

2. You think it might be osteomyelitis: You do aspiration for drainage of pus > there will be no pus and you will find tumor tissue ﴾You do biopsy > Ewing's sarcoma. So, it is a **diaphyseal lytic lesion.**
3. Ill defined.
4. Sometimes with soft tissue extension.
5. N.B. you can't differentiate it from osteosarcoma unless **you do biopsy**.

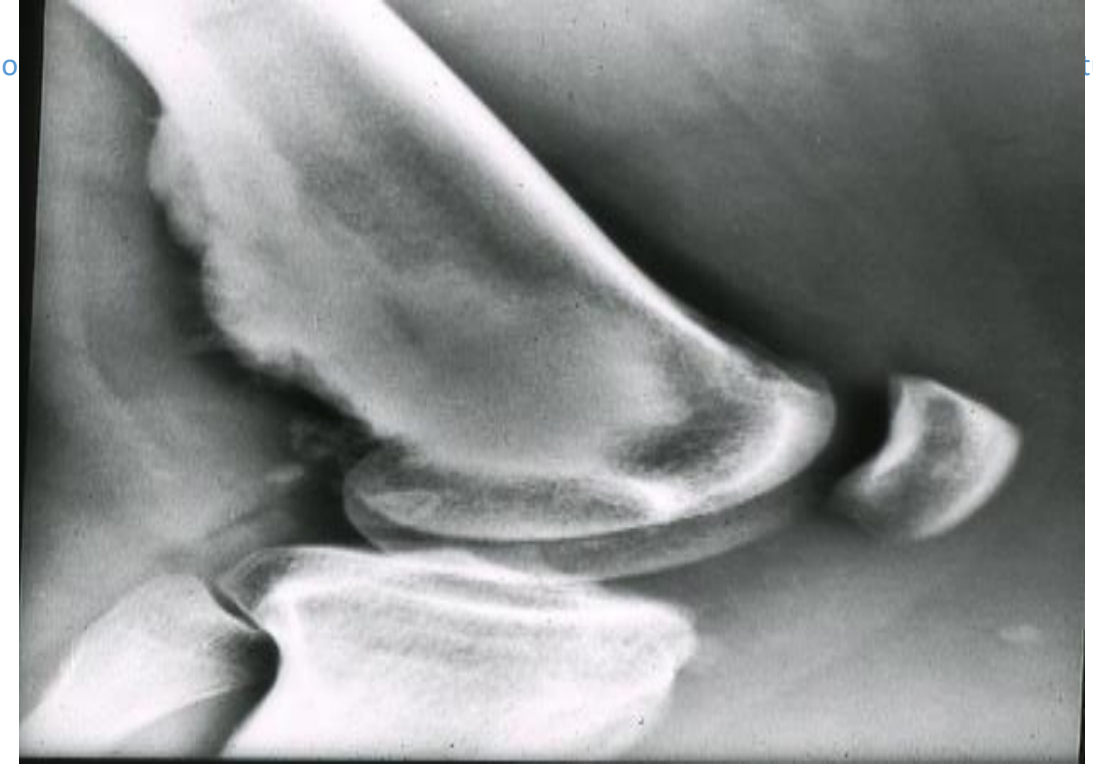
Investigations: MRI and biopsy make definitive diagnosis

Management: timing is important

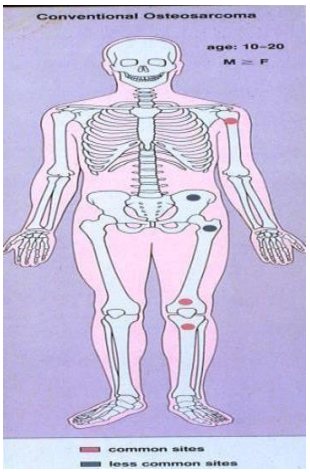
- Blood investigations, ESR
- Radiology (X-ray, bone scan, CT, MRI)
- Biopsy – same surgeon who will do surgery should take the biopsy- to avoid contamination then spreading the tumor.

Treatment:

1. It is sensitive to **chemotherapy**
2. So, start with chemotherapy to decrease the tumor in size so it will be easy to excise it and control metastasis (microcell) everywhere in the body as in bacteremia
3. Tumor treated by **operative excision** and disarticulation and you may need amputation.



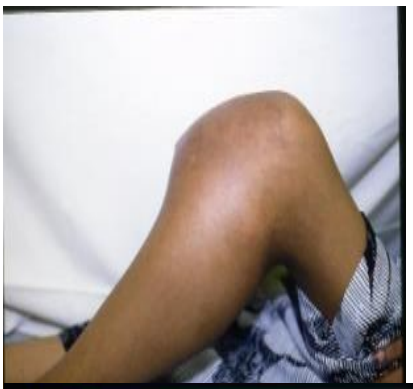
2) Osteosarcoma

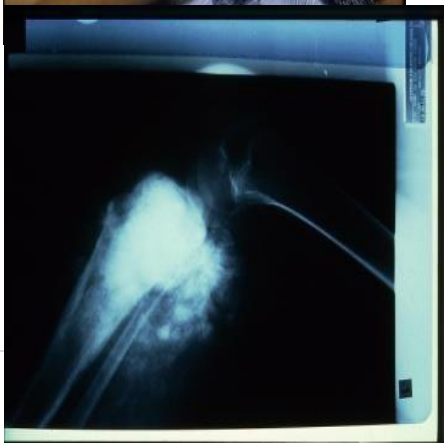


- {remember the most common malignant tumor is metastatic}
- **More common than Ewing's sarcoma**.
- 10- 25-year-old and Male > Female

Sites:

- Arises from primitive bone-forming cells.
- Found in metaphysis unlike the Ewing which is seen in the diaphysis.
- Around the knee.
- Common in the lower femur, upper tibia, and upper humerus.
- Less commonly clavicle.





Presentation:

- Patient present firstly with pain, then swelling, lastly pathological fracture (typical presentation of malignant tumor).
- **Overlying skin is warm due to high vascularity.**
- The patient may look cachectic (in late and advanced cases).

Radiological features:

1. Very dense.
2. Irregular medullary and cortical destruction of the metaphysis.
3. **Sun rise appearance** periosteal reaction (surrounded by low dense).
4. Could be lytic or sclerotic. “mixed"
5. Ill defines no sclerotic margin.
6. Metaphyseal lesion.
7. Definite diagnosis made by biopsy.

Investigations:

- CT scan = bone extension.
- MRI = soft tissue extension.
- Bone scan = metastasis.
- Search for metastasis.

Treatment:

- **3 stages: Adjuvant chemotherapy > surgery > Adjuvant chemotherapy.**
- Adjuvant Chemotherapy: It helps in:

  1.killing of micro metastasis.
  2.Shrinking the mass.
  3. After surgery, if necrosis >90% ⟶ continue the same.
  If necrosis <90% ⟶ we must add a new Adjuvant chemotherapy.

- Surgical interventions:

1. Limb salvage procedure **(limb sparing):** which is radical excision of the affected bone & the affected compartments (e.g. flexor compartment of thigh, adductor compartment of the thigh ... etc.) around the bone + followed by reconstruction (reconstruction may be: prosthesis, bone graft, or bone cement) + lastly, we do radiotherapy & chemotherapy.
2. Amputation: is indicated when the whole compartment around the bone is involved, (e.g. the flexor, adductor & extensor compartment of the thigh). If

there, the Vessels involved you can do bypass graft. The presence of Pathological fracture.

3) Multiple myeloma

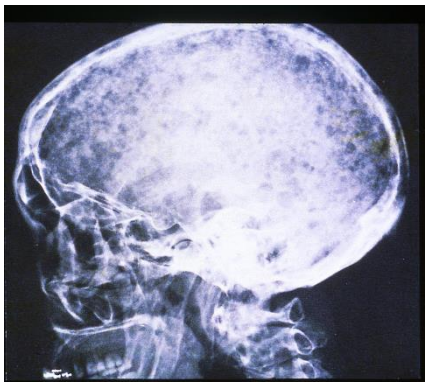
- Arise from plasma cells in the bone marrow.
- **The most common primary malignant tumor.**
- Age group: >45 years old. Males > females.
- **Bence jones proteins test found in 24- hour urine collection. (highly suggest diagnosis).**
- Disseminates too many parts of the skeleton through the blood stream, thus usually multiple.

Sites:

- Central bones (axial skeleton): skull, ribs, pelvic girdle. & spine.
- It may be solitary, multiple (commonest) or generalized osteoporosis (mylometosis: multiple myeloma + only generalized osteoporosis).

Presentation:

- Patient is ill (decreased immunity).
- Sclerotic (no more elasticity) so more prone to fractures
- **In skull, there will be pepper (lytic) & salt (sclerotic) appearance**. E.g. a patient came with bone ache (backache) + osteopenia.
- More common in periphery than center.
- **only definitive diagnosis is bone marrow aspiration.**



Treatment: (mainly medical)

- Bone marrow transplant: Success rate is 30% and it Costs millions
- Radiotherapy.
- Chemotherapy.
- The rule of orthopedic surgeon is only when you have pathological fracture, do internal fixation.

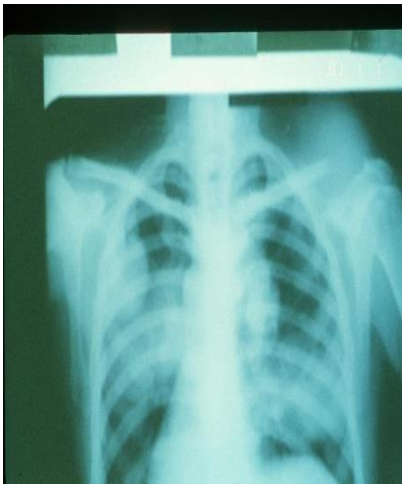
Malignant Tumors - Metastasis

- **More common than primary tumors in later adult life.**
- The most common tumors are: thyroid, lung, breast, colon, and prostate kidney.
- More than 45 in age, F<M.
- Affects same sites which are affected by multiple myeloma.
- Take biopsy to know where is the primary
- If there is fracture, do curettage first, then fixation.

Presentations:

- Patient may present with known primary tumor.
- May present with secondary metastasis. So, we must identify the primary site and treat it.
- Usually metastasis occurs in the highly vascular bones e.g. vertebral body, ribs, pelvis, upper end of femur, and humerus.

Radiological features:



1. It may be solitary or multiple (common) or just osteoporosis (called **carcinomatosis).**
2. **If the primary tumor is from the prostate** → the lesion will be sclerotic.
3. **If the primary tumor is from the breast** → the lesion will be lytic.

Investigations:

- X-ray shows decreased bone density (bone eaten away) with thinning of the cortex. Resembles bone cysts but the age group directs the diagnosis.
- CT- scan of the chest for definite diagnosis.

Treatment:

Same as multiple myeloma.

SUMMERY

- Most common bone Tumors → BENIGN.
- Most common benign tumors → OSTEOCHONDROMA.
- Majority of Malignant tumors → METASTATIC of other tumors elsewhere in the body.
- Most common primary malignant tumors → M. MYELOMA.

- Malignant Bone tumors are called SARCOMA.
- Primary Malignant bone tumors are minority.
- Benign bone tumors do not invade the soft tissue nor affect the cortex.
- Certain tumors have predilection for some bones (favorite places) which can be recognized by X-ray. E.g.:
  - Ewing's sarcoma most commonly seen in the DIAPHYSIS.
  - Giant cell tumors are almost always found in a subarticular position, i.e. METAPHYSIC location.

Tissue of origin	Benign	Malignant
Bone (osteogenic)	Osteodostema Osteooblastoma	Osteosarcoma (most common in epiphysis)
Cartilage (chondrogenic)	Enchodroma Chondrobalstoma	Chondrosarcoma
Bone and cartilage	Osteochondroma	
Fibrous (fibroginc)	Fibrous cortical defect	
Bone marrow (hematopoitic)	Gaint cell tumor	Multiple myeloma Ewing's sarcoma (most common in daiphysis
Unknown (lesion like tumor)	Single cyst Aneurismal bone cyst (ABC)	
Metastasize		Metastasis

MCQs

1)Which one of the following tumors behave like acute osteomyelitis?

A) Multiple myelon

B) Ewing’s sarcoma

C) Metastasis tumor

2) Which one of the following is the most common benign tumors?

A) Osteoid osteoma

B) Endochondroma

C) Osteochondroma

Answers: 1-B 2-C

information's were copied from 432 Orthopedics team and doctor's notes were added!

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