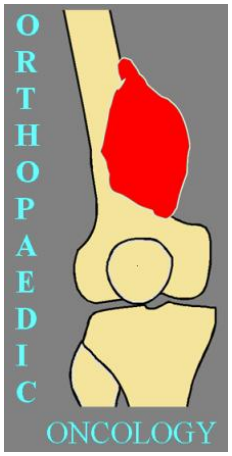


BENIGN BONE TUMORS

Dr Srinivas C H

M S Ortho, Fellowship Ortho Oncology,
Asst. Prof., Orthopaedic Oncosurgeon,
BGS Global Hospitals

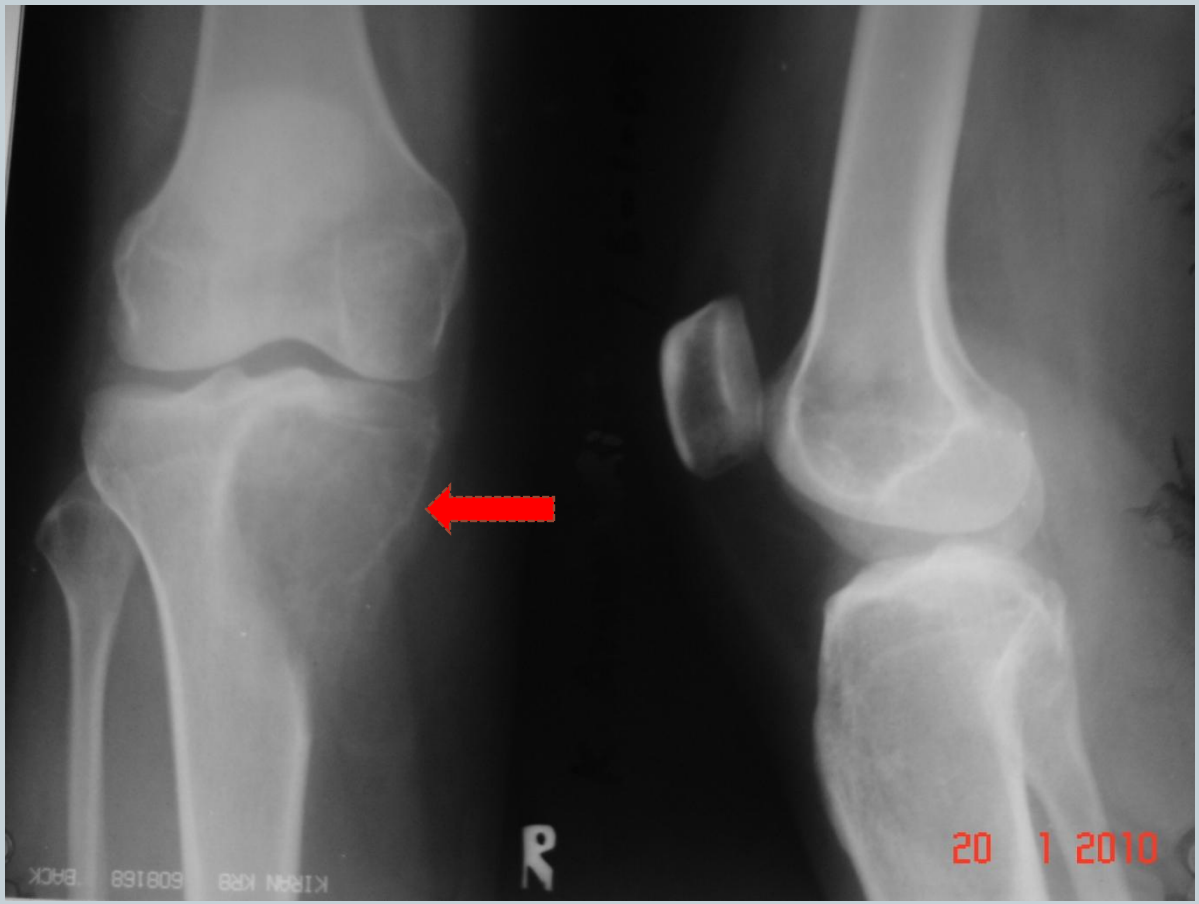
Overview of today's talk

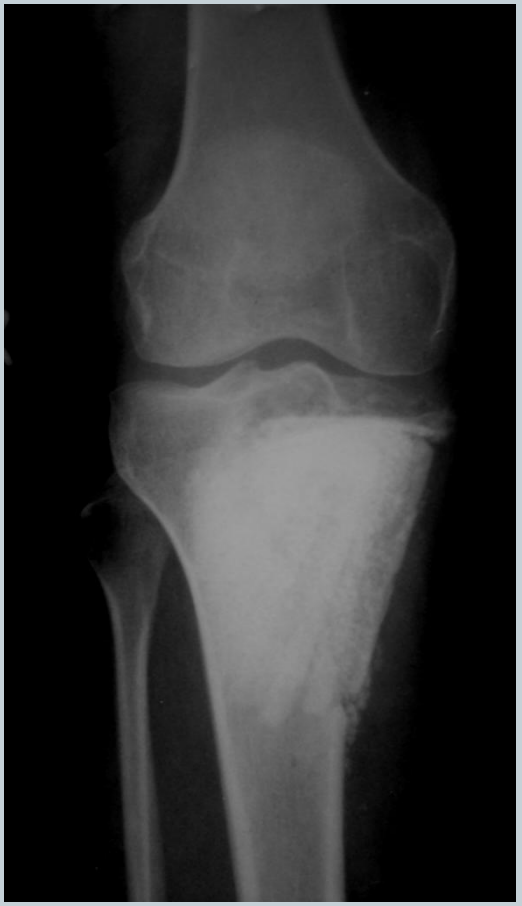
- Classification
- Clinical Features
- Radiology: salient features
- Evaluation
- Management

What is expected of you in your exam

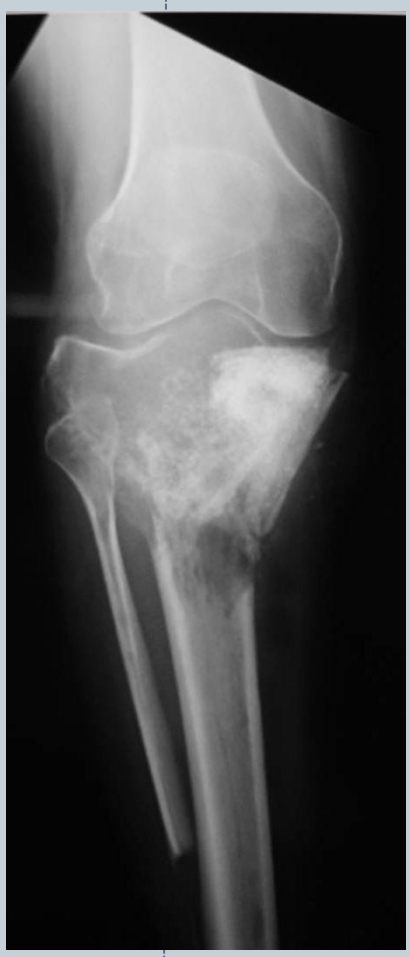
- GCT – Radius, Femur/Tibia
- Bone Cyst – Unicameral Bone cyst, ABC
- Chondroblastoma
- Osteochondroma / Exostosis
- Osteoid Osteoma
- Enchondroma

Case: Lytic lesion proximal Tibia





After 6 months of Rx



OSTEOSARCOMA

Now what ????

W.H.O. CLASSIFICATION OF BONE TUMOURS
(2002- Revised)

I. OSTEOGENIC TUMOURS

BENIGN

- OSTEOMA
- OSTEOID OSTEOMA
- OSTEOBLASTOMA

MALIGNANT

- OSTEOSARCOMA

II. CARTILAGE FORMING TUMOURS

Benign

- Chondroma
- Osteochondroma
- Chondromyxoid fibroma
- Chondroblastoma

Malignant

- Chondrosarcoma

III. FIBROGENIC

IV. FIBROHISTIOCYTIC

- Benign fibrous histiocytoma
- Malignant fibrous histiocytoma

V. NEUROECTODERMAL

- Ewing's sarcoma

VI. HEMATOPOETIC

- Lymphoma
- Multiple Myeloma

VII. GCT

VIII. NOTOCHORDAL TUMOURS

IX. VASCULAR

Benign

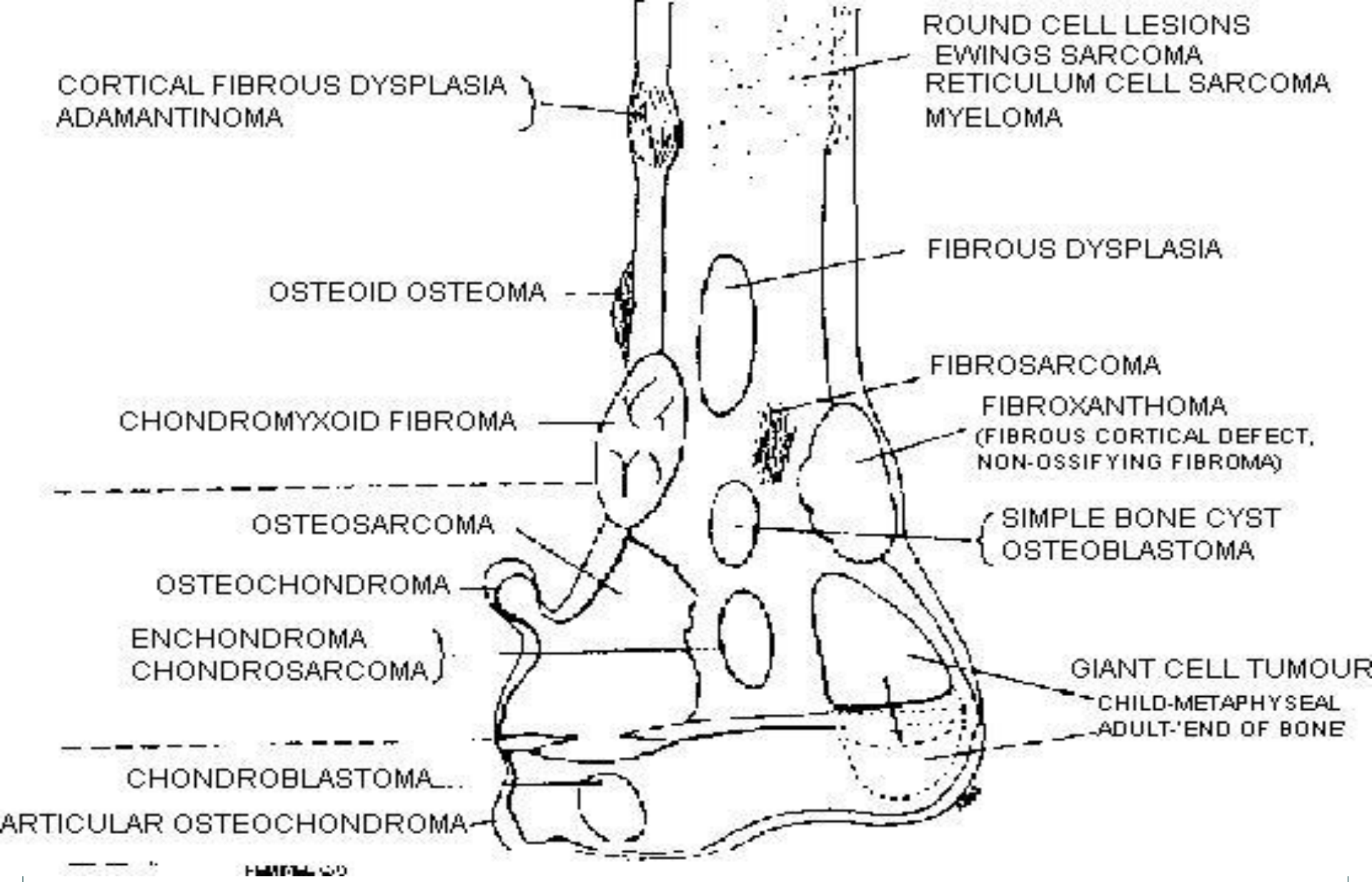
- Hemangioma
- Lymphangioma
- Glomangioma

Malignant

- Angiosarcoma

XI. MISCELLANEOUS

- Bone cysts-simple or aneurysmal
- Fibrous dysplasia-mono or polystotic
- Reparative giant-cell granuloma (e.G. Epulis)
- Fibrous cortical defect
- Eosinophilic granuloma
- Non ossfying fibroma
- Osteitis fibrosa cystica (brown tumour)



ANATOMICAL LOCATION IN BONE

Surgical Staging System for Musculoskeletal Tumors (Enneking and MSTS)

Benign:

1 Latent	**G 0 T 0 M 0**
2 Active	**G 0 T 0 M 0**
3 Aggressive	**G 0 T 1-2 M 0-1**

Site:

T 1: Intracompartmental (Confined within limits of periosteum)

T 2: Extracompartmental (Breach in an adjacent joint cartilage, bone cortex or periosteum, fascia lata, quadriceps, and joint capsule)

Metastasis:

M 0: No identifiable skip lesions or distant metastases.

M 1: Any skip lesions, regional lymph nodes, or distant metastases.

Discussion:

- **Benign tumor staging uses Arabic numbers (1,2,3)**
- Malignant tumors identified with Roman numerals and a letter (Ia, Ib, IIa, IIb, IIIa, IIIb)

STAGING- Enneking

Stage-1 (latent stage)

- remains static or heals spontaneously Eg: NOF
- intra capsular
- no growth
- well defined margins
- thick reactive bone
- not expanding cortex

Stage-2 (active)

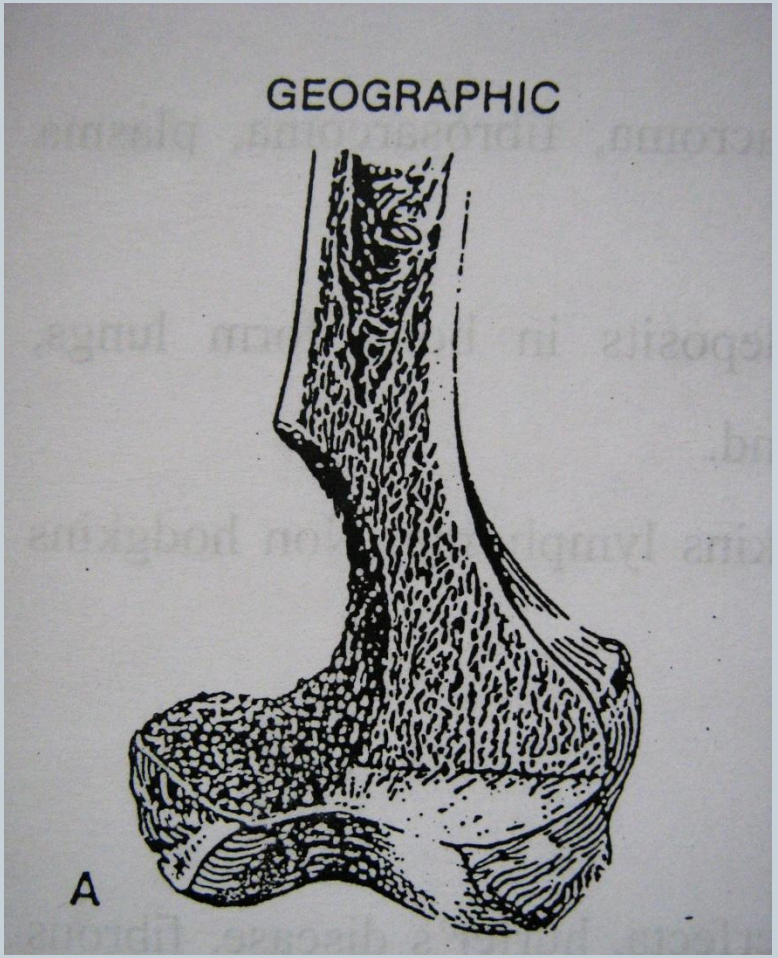
- progressive growth but limited by natural barriers Eg: Simple bone cyst
- intra capsular
- actively growing
- well defined margins
- thin rim of reactive bone
- cortical expansion with thinning

Stage 3 (aggressive)

- Progressive growth not limited by natural barriers eg: GCT
- Extracapsular
- Break through reactive bone/cortex

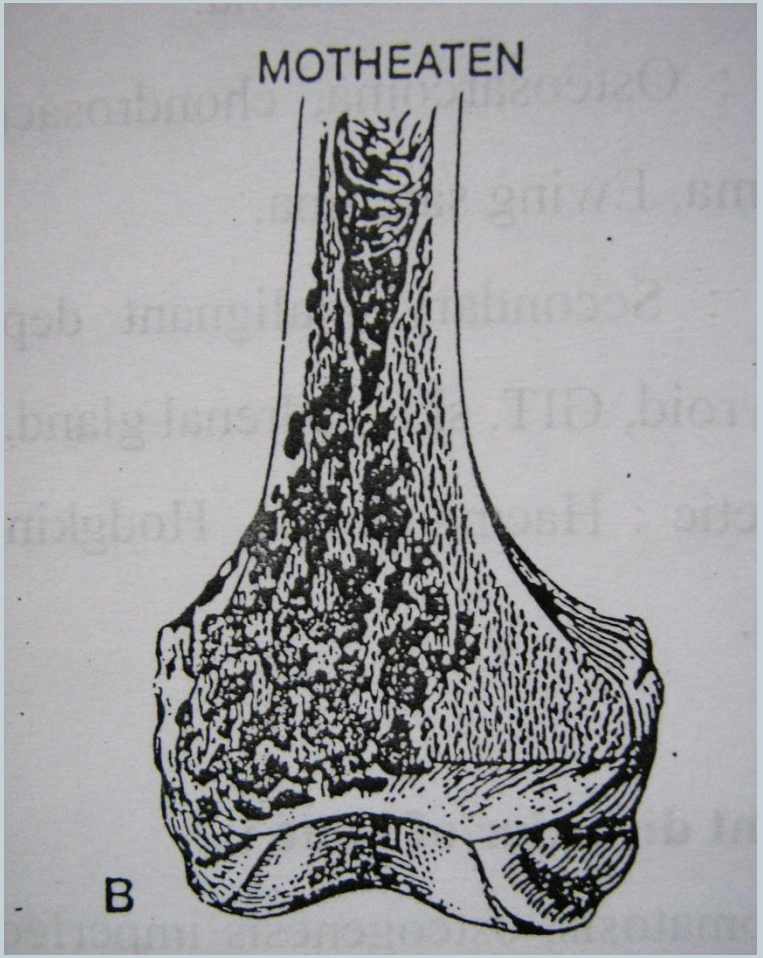
GEOGRAPHIC PATTERN

- Least aggressive
- Narrow zone of transition
- Benign



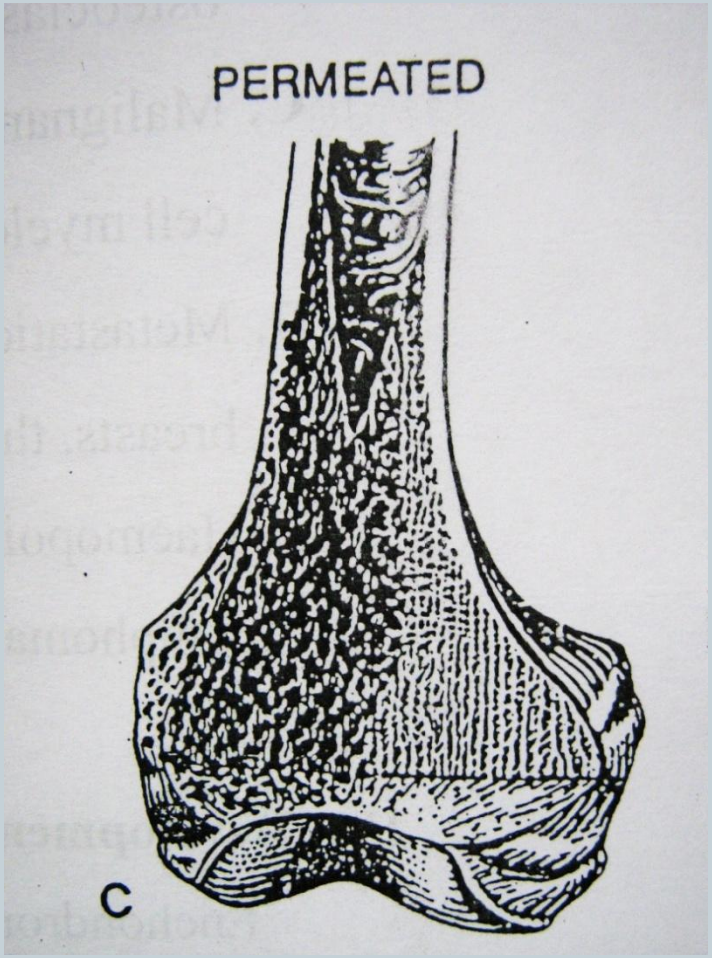
MOTH EATEN APPEARANCE

- Multiple holes 2-5mm
- Wide zone of transition
- More aggressive

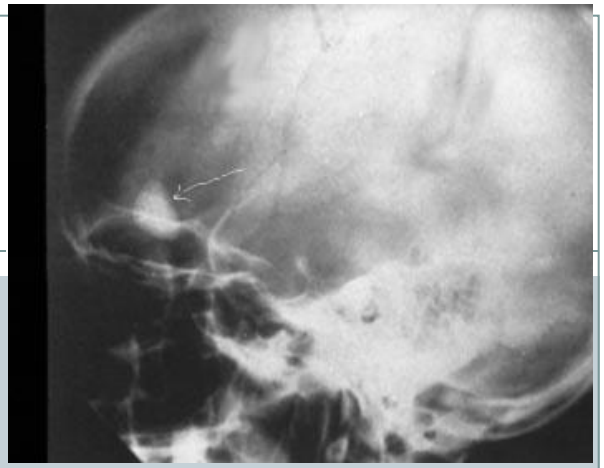


PERMEATIVE

- Multiple tiny holes <1mm
- Wide zone of transition
- Aggressive type

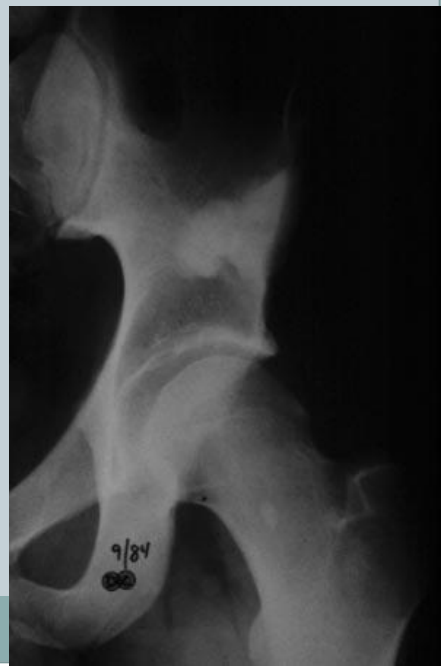


OSTEOMA

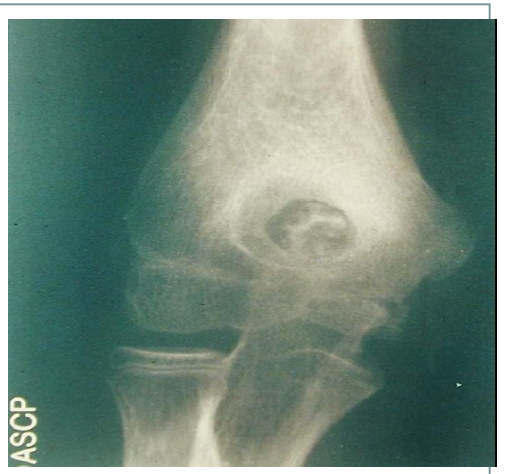


- Benign bony outgrowth of membranous bones.
- Multiple osteomas are associated with Gardner's syndrome

Highest incidence in the sixth decade
Male: female is 3:1
Asymptomatic
Excision if symptomatic



OSTEOID OSTEOMA



- Commonest benign osseous tumour
- Common in 1st& 2nd decade of life
- 10% of all benign bone tumours
- M:F – 2:1
- SITE: diaphysis, metaphysis of long bones

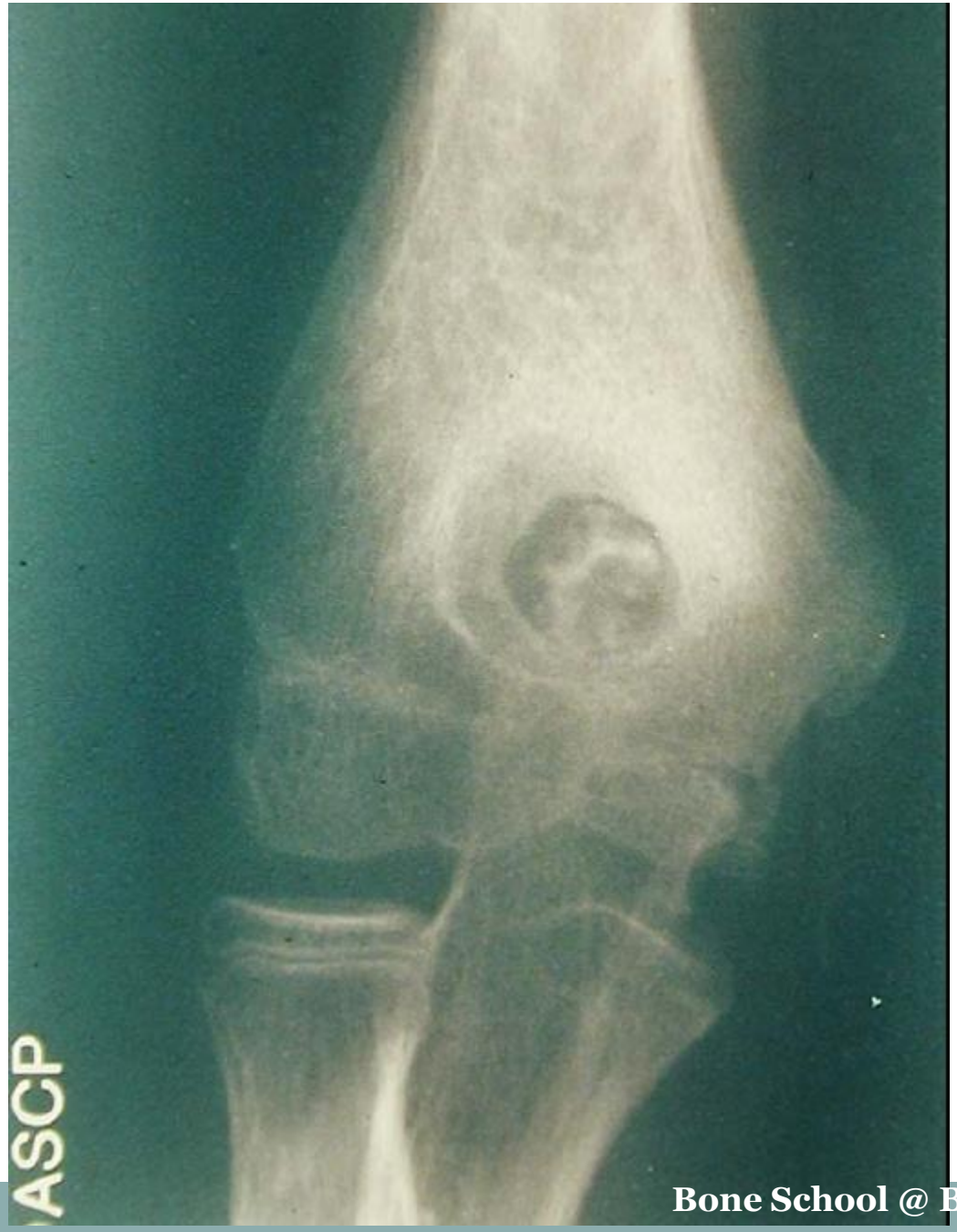
OSTEOID OSTEOMA

CLINICAL FEATURES

- Dull pain, worse at night **(night cries)** & responds to salicylates (aspirin)
- Swelling uncommon
- Tenderness

RADIOLOGICAL FEATURES

- A sharp round or oval lesion.
- Less than 2 cm in diameter.
- Radiolucent **nidus** surrounded by reactive sclerosis
- Nidus- osteolytic/partially/entirely calcified


ASCP

Investigations

CT SCAN:

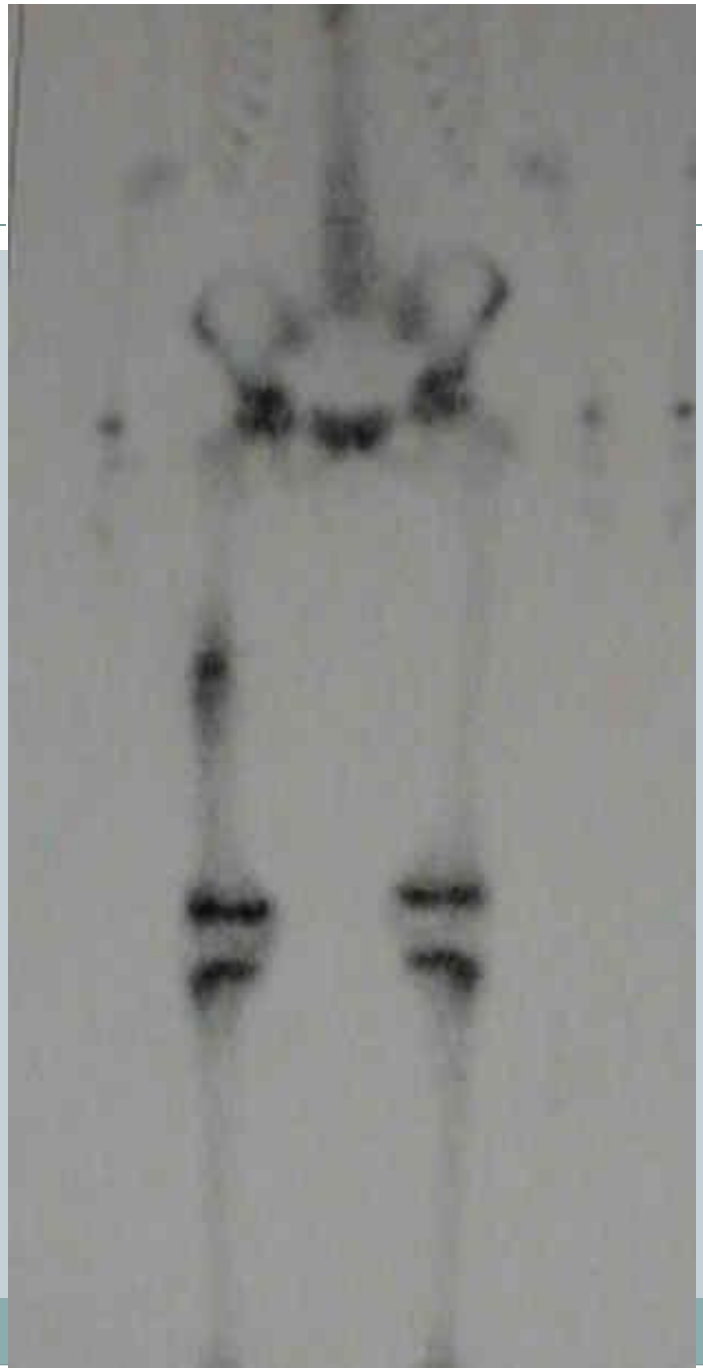
Nidus is best localized with CT (1 mm cuts)

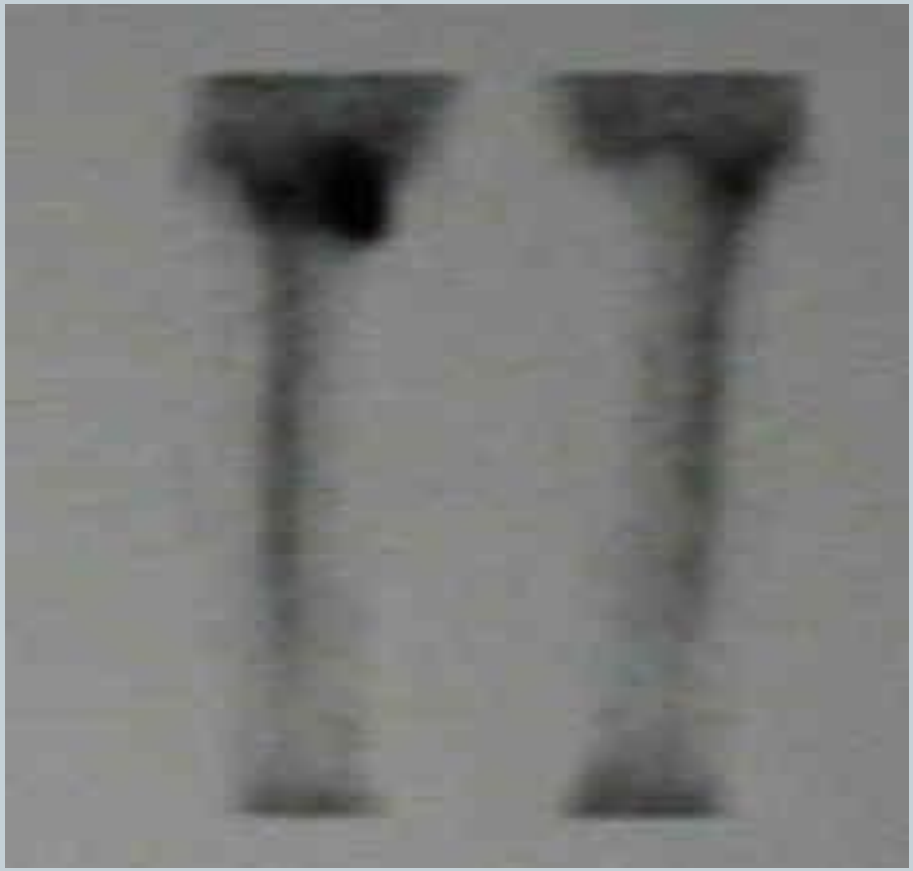
Bull's eye lesion

BONE SCAN: Tc99

- Due to intense radioisotope uptake by nidus and decreased uptake by surrounding sclerotic bone, a double density image is created that is typical of osteoid osteoma.

Headlight in fog appearance





Management

Course: Self limiting

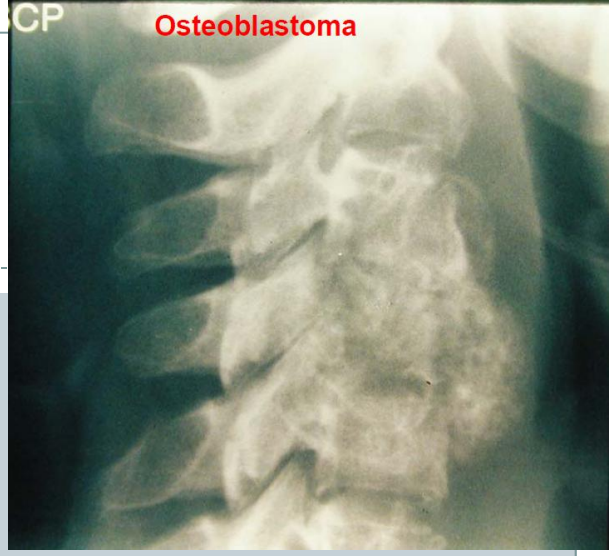
On maturation, ossify and merge with surrounding bone

No reports of malignant transformation till date

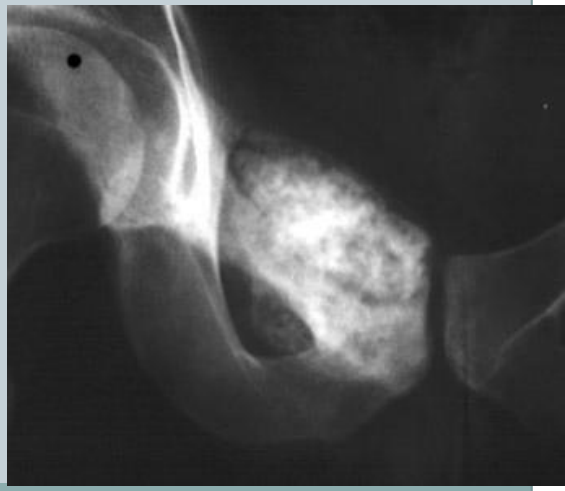
Treatment:

- Conservative - not recommended because of severity of pain
- Surgical: En Bloc resection, Burr down
- Percutaneous radiofrequency ablation (PRA)

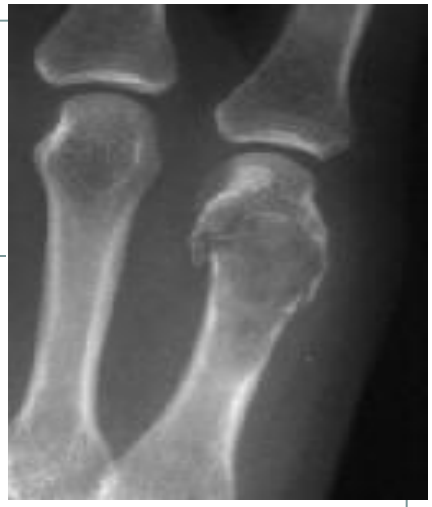
OSTEOBLASTOMA



- Benign osseous tumour similar to osteoid osteoma
- Progressive growth, absence of reactive perifocal bone formation
- 2^{nd}, 3^{rd} decade.
- M > F
- Sites: vertebrae- posterior elements
- Pain, long duration
- CT scan- 'cotton wool' if calcified



ENCHONDROMA

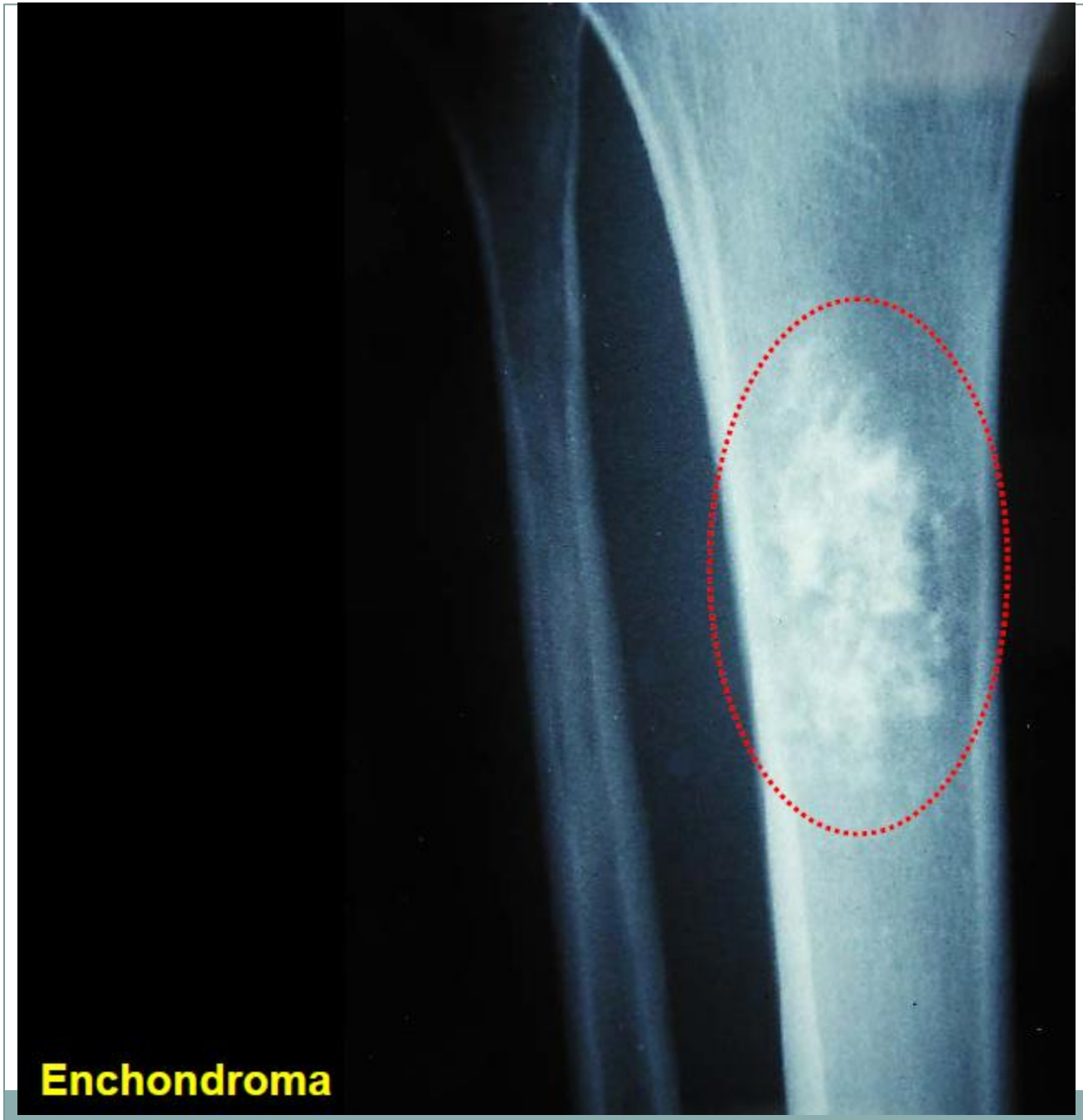


AGE: Most common between 2nd & 4th decades

SITES: Short tubular bones of hand (phalanges and metacarpals), followed by femur, humerus and ribs

RADIOGRAPHS: well circumscribed distinct area of rarefaction, expands the cortex

Calcification in older lesions - spotty/punctate


Enchondroma

Management

- Asymptomatic lesions - follow-up with serial radiographs
- Symptomatic – PET Scan or biopsy to r/o any malignancy
- Curettage and bone grafting
- Wide excision to avoid recurrence
- Pathologic fractures are allowed to heal with closed treatment, curettage and bone grafting is then required after fracture healing.

OLLIERS DISEASE

- Multiple enchondromatosis
- Non-hereditary disorder common in children
- Affects metaphysis of long bones
- Presentation – bony swellings leads to thickening and shortening and deformities

MAFFUCCI SYNDROME

- hereditary familial disease
- multiple enchondroma and cavernous haemangioma

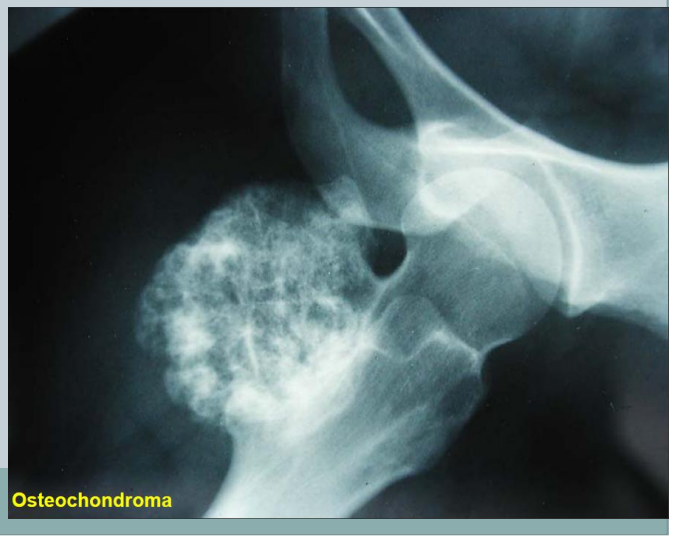
Osteochondroma

Also known as: Osteocartilaginous Exostosis

- Cartilage capped bony projection on external surface of bone.
- Commonest benign tumour of bone.
- Lesion has its own growth plate, usually stops growing at skeletal maturity.

AGE GROUPS: first two decades

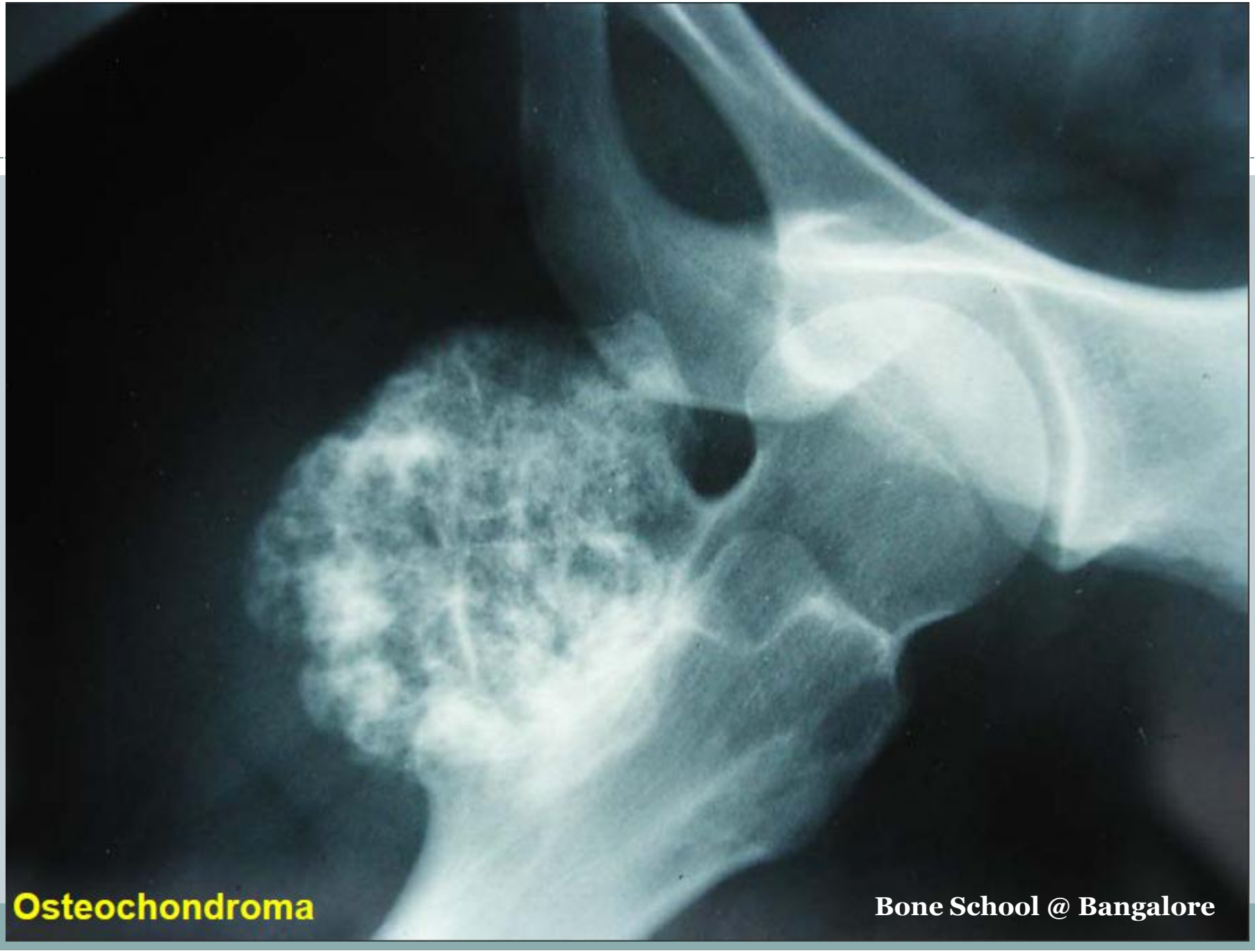
SEX PREDILECTION: M:F-1.5:1

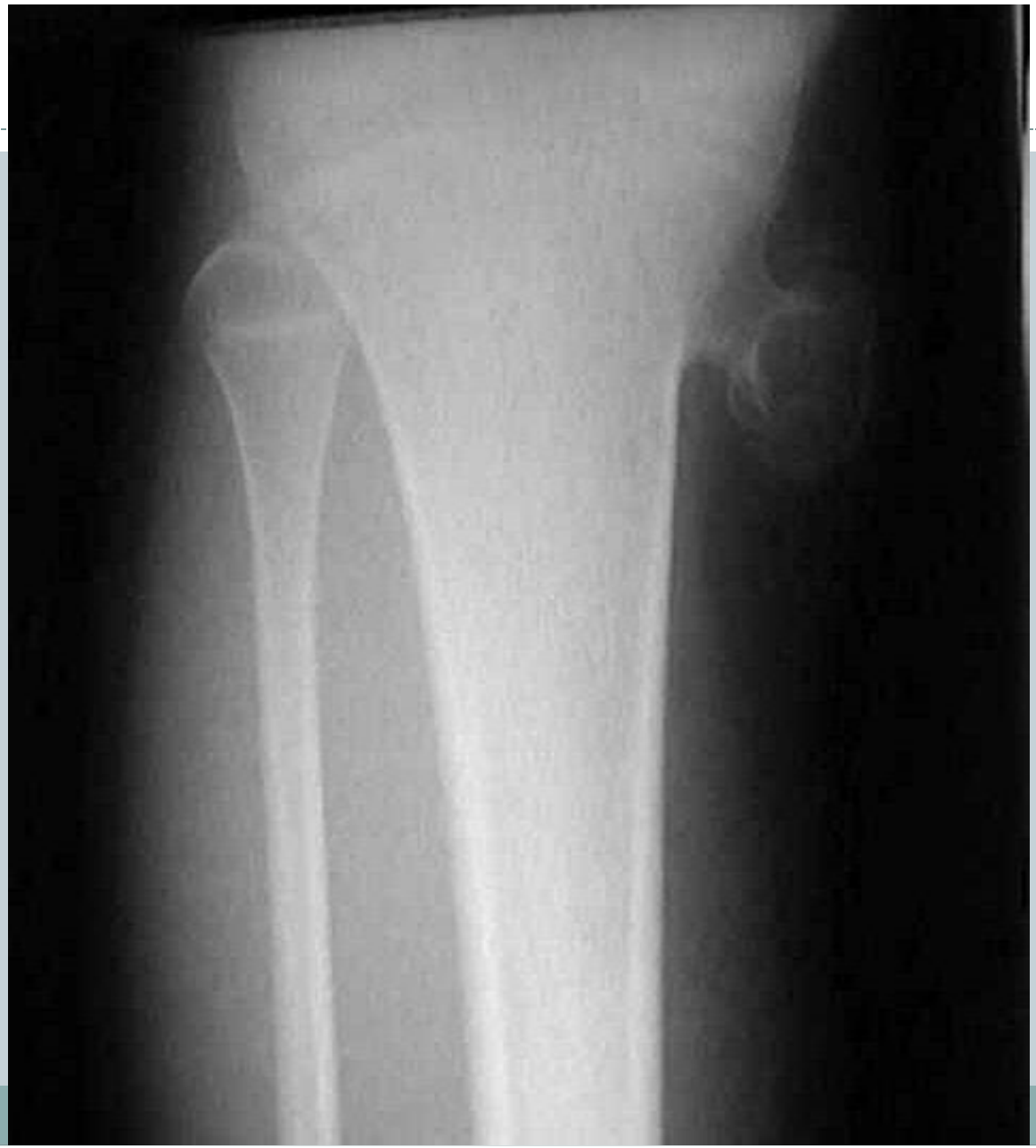


SITES OF PREDILECTION: Around the knee(40%) and proximal humerus.

LOCATION: Metaphysis/diaphysis of long bones.

- Asymptomatic
- Pain: Mechanical, Ischemic necrosis, Perilesional bursitis, Fracture of stalk, Malignancy <1%


Osteochondroma
Bone School @ Bangalore



Osteochondroma

- Growth disturbance of the extremity
- Block to joint motion
- No growth after skeletal maturity

X RAY

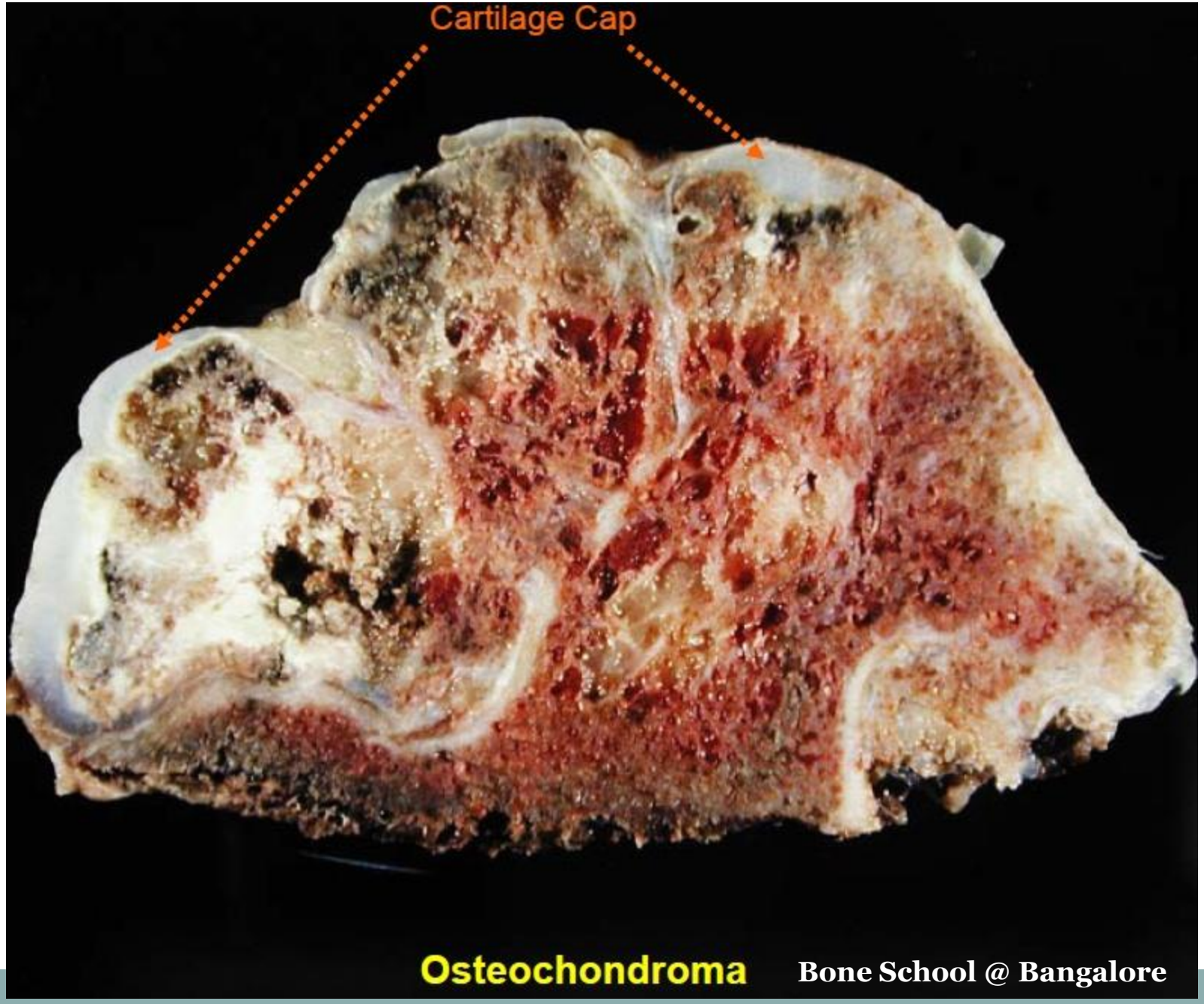
- Pedunculated / sessile – exophytic
- metaphysis / diaphysis
- Marrow and cortices of lesion continuous with bone
- Directed away from growing end
- Cartilage cap not seen on x ray

PATHOGENESIS:

- Herniation of a fragment of growth plate through periosteal bone cuff
- Misdirected growth of that portion of physis

HISTOLOGY:

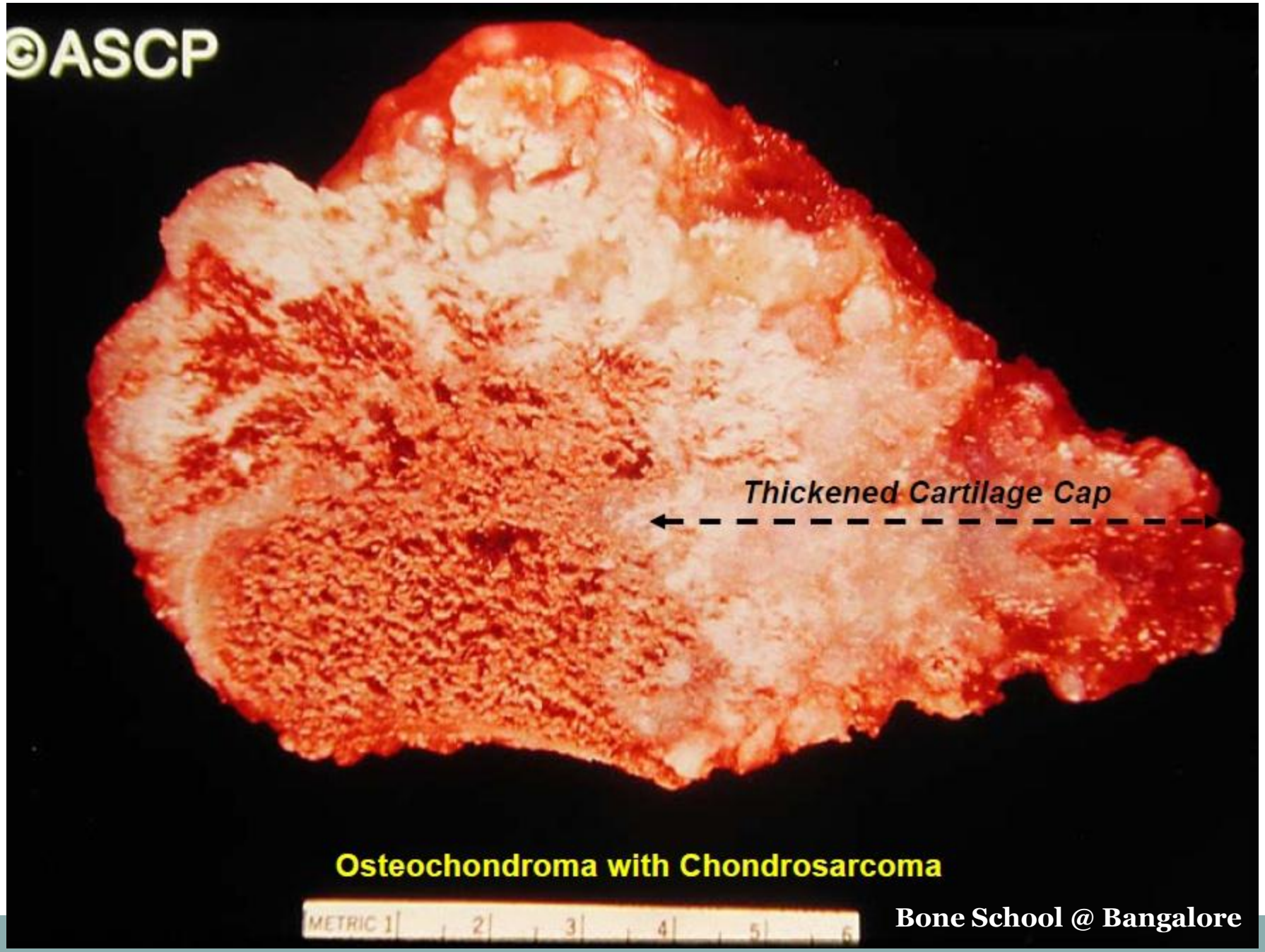
- Cartilage cap resembles layers of the normal growth plate
- The cartilage is more disorganized than normal
- Binucleate chondrocytes in lacunae
- Covered with a thin layer of periosteum.


Cartilage Cap
Osteochondroma

- Cartilage cap 1-3 mm thick, thicker in children

SIGNS OF MALIGNANCY:

- >2 cm after skeletal maturity indicates possible malignant transformation
- Growth spurt of lesion beyond skeletal maturity
- Development of soft tissue with calcifications
- Dispersed calcifications within the cartilaginous cap


©ASCP
Thickened Cartilage Cap
Osteochondroma with Chondrosarcoma
METRIC 1 2 3 4 5 6

Treatment

- Observe
- Delay excision until later adolescence
  - Pain, deformity, nerve palsy, movement restriction

HEREDITARY MULTIPLE EXOSTOSES (H.M.E)

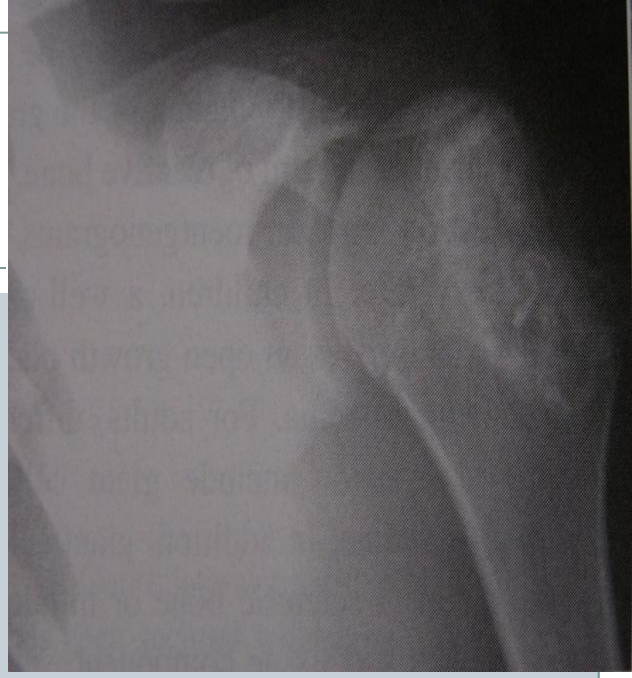
- Also known as: Multiple Exostoses, Diaphyseal aclasis

- Autosomal dominant hereditary disorder, 10% no family history. EXT1,2,3 genes

- Knees, ankles and shoulders are most frequently affected.
- Knobby appearance, Short stature
- Forearm deformity, Tibio-fibular synostosis, Genu valgum, Coxa valga

Rx - Excision of symptomatic exostosis
Correction of deformity and limb length discrepancy

CHONDROBLASTOMA



ALSO KNOWN AS: **Codman's Tumour**

Arises from immature cells of epiphyseal cartilage

AGE GROUPS: 10 to 20 yrs.

SEX PREDILECTION: Males more affected than females.

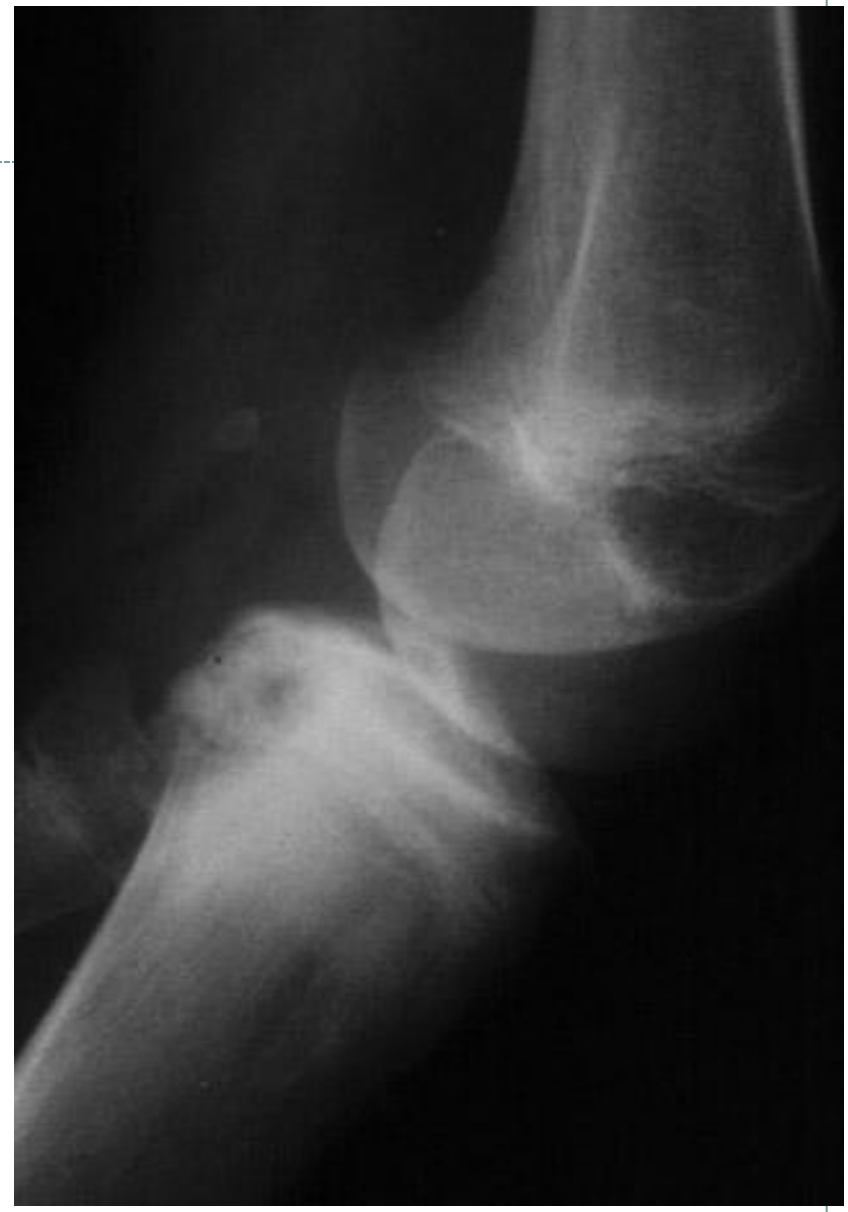
SITES OF PREDILECTION: Proximal part of the tibia, proximal part of the humerus and femur.

LOCATION: Epiphysis/ apophysis

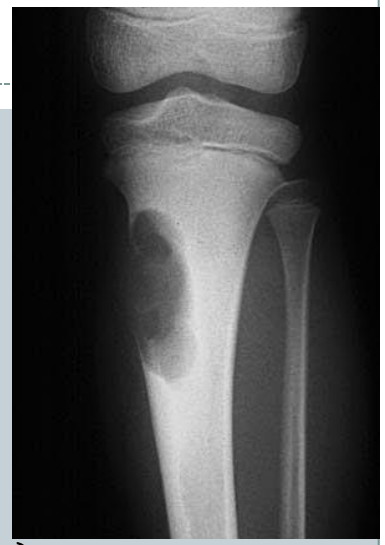
SYMPTOMS: Pain and local swelling of joint without h/o trauma

RADIOGRAPHS:

- Well defined oval lytic lesion
- Sclerotic margin
- Epiphysis
- Eccentric
- Cottonwool calcification
- HPE: Chicken-wire calcification



CHONDROMYXOID FIBROMA



- Rare benign bone tumour (<1%)
- Chondroid tumour with myxoid and fibrous elements

AGE GROUPS: Adolescents and young adults.

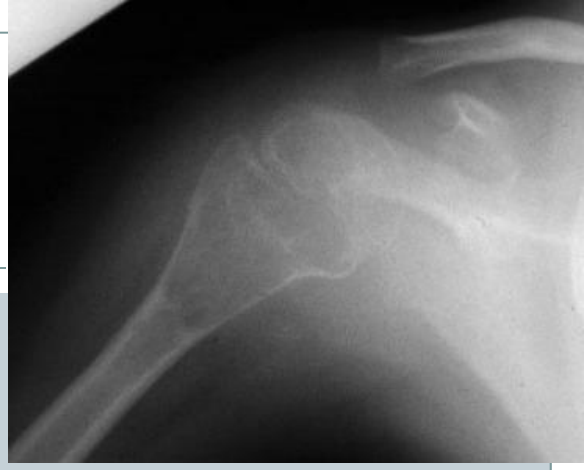
SEX PREDILECTION: Males more affected than females (2:1).

SITES OF PREDILECTION: Lower extremities usually proximal tibia.

LOCATION: Metaphysis.

SYMPTOMS: Peripherally located mass with local pain and swelling.

SIMPLE BONE CYST



Etiology: Unknown

C/F: 3-14 yrs, 2:1 male predominance. Silent until pathological fracture occurs.

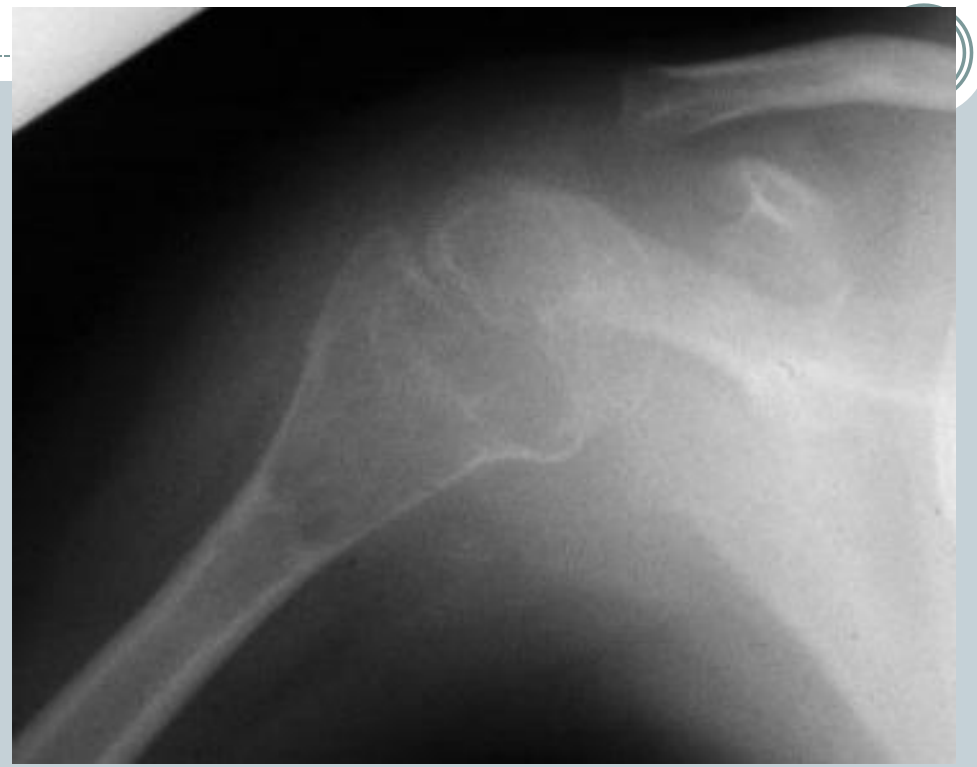
Location:75% - humerus and proximal femur.

Xray - *Fallen-leaf* or *Fallen-fragment* sign

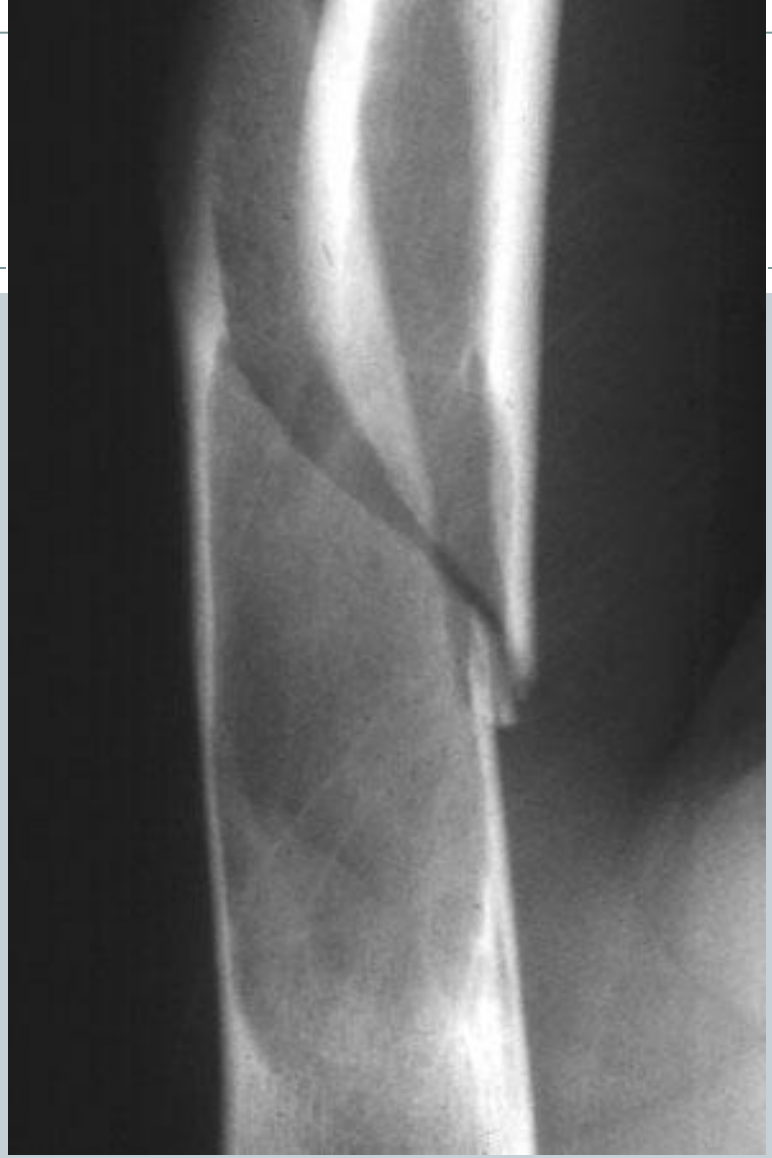
Histology: cyst filled with clear yellowish fluid, wall lined with fibrous tissue & hemosiderin.

Rx: Path # - Immobilize

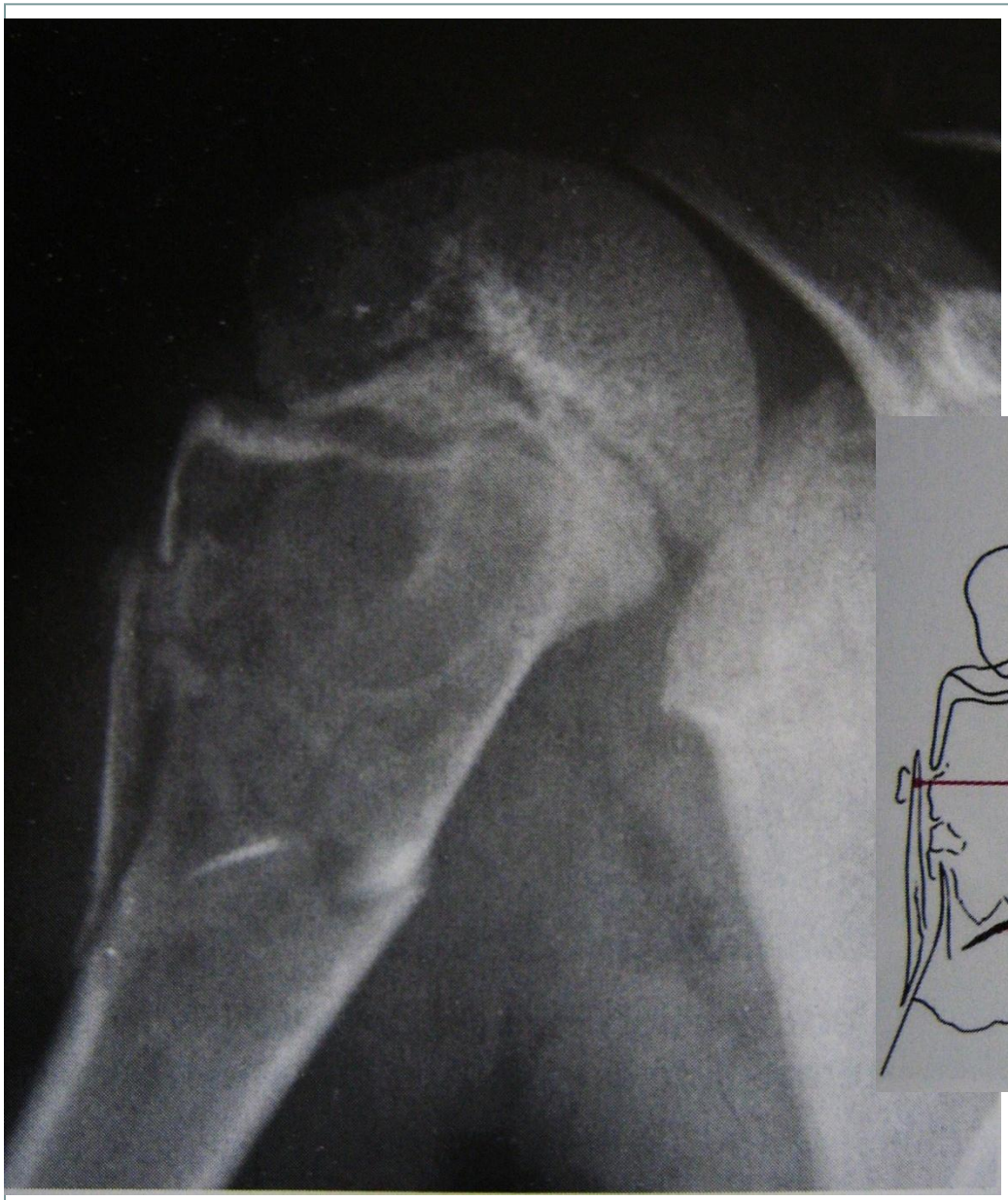
Drainage, Steroid injection

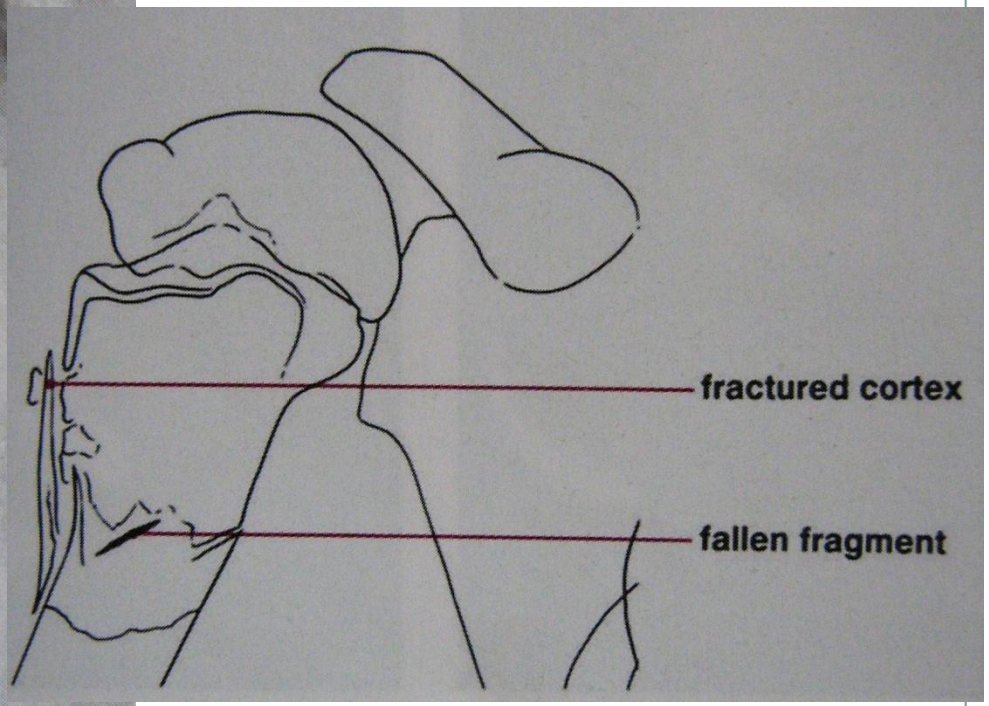


SBC of humerus(truncated cone appearance)



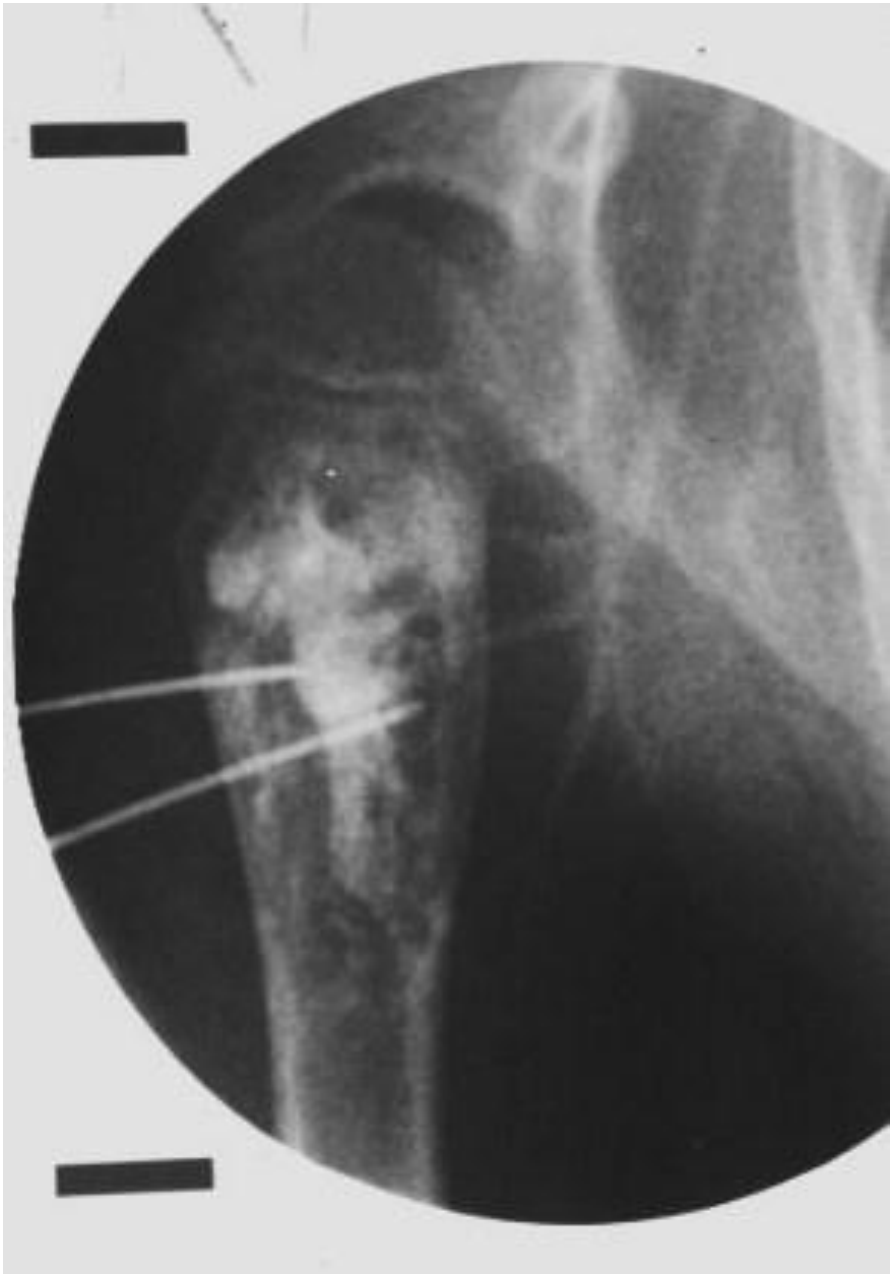
SBC with pathological fracture

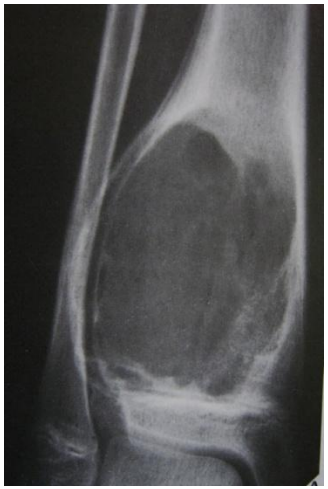




X ray of 6 yr old boy showing SBC with path #

Steroid injection in the cyst





ANEURYSMAL BONE CYST :

expansile, blood filled cystic cavity.

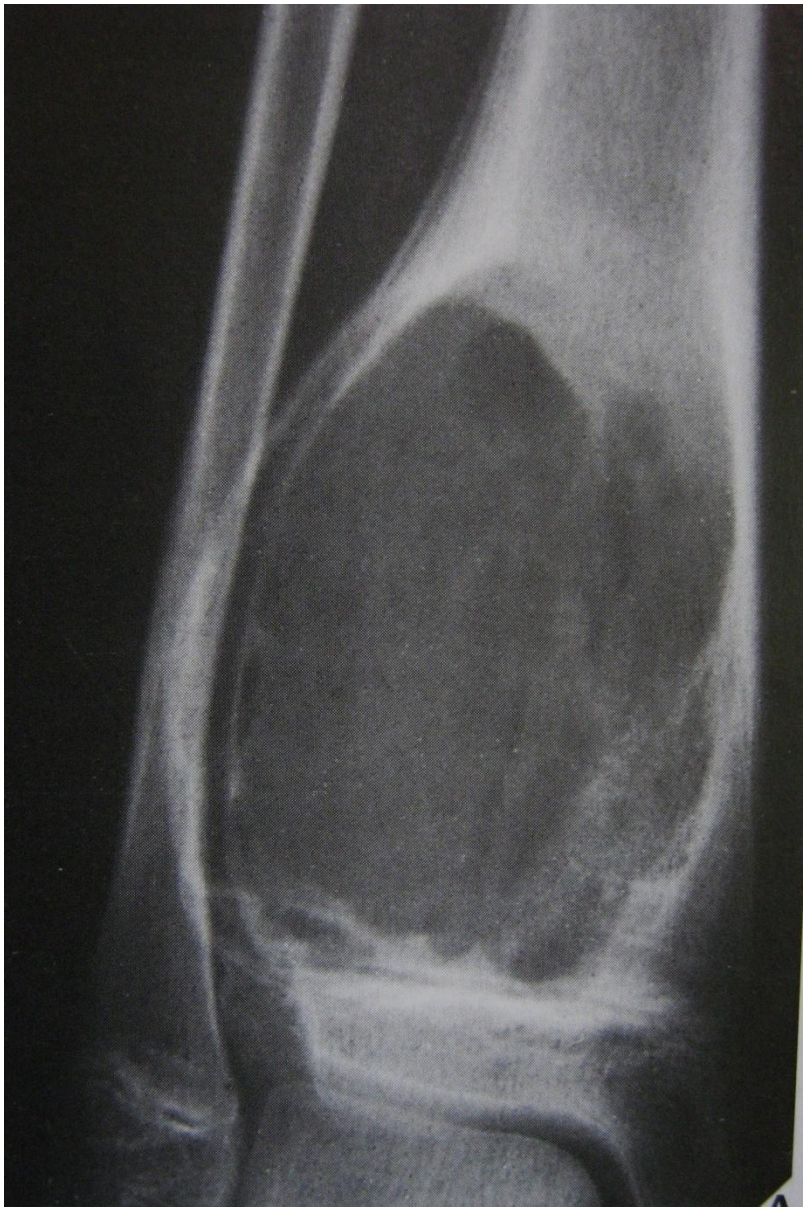
Etiology:

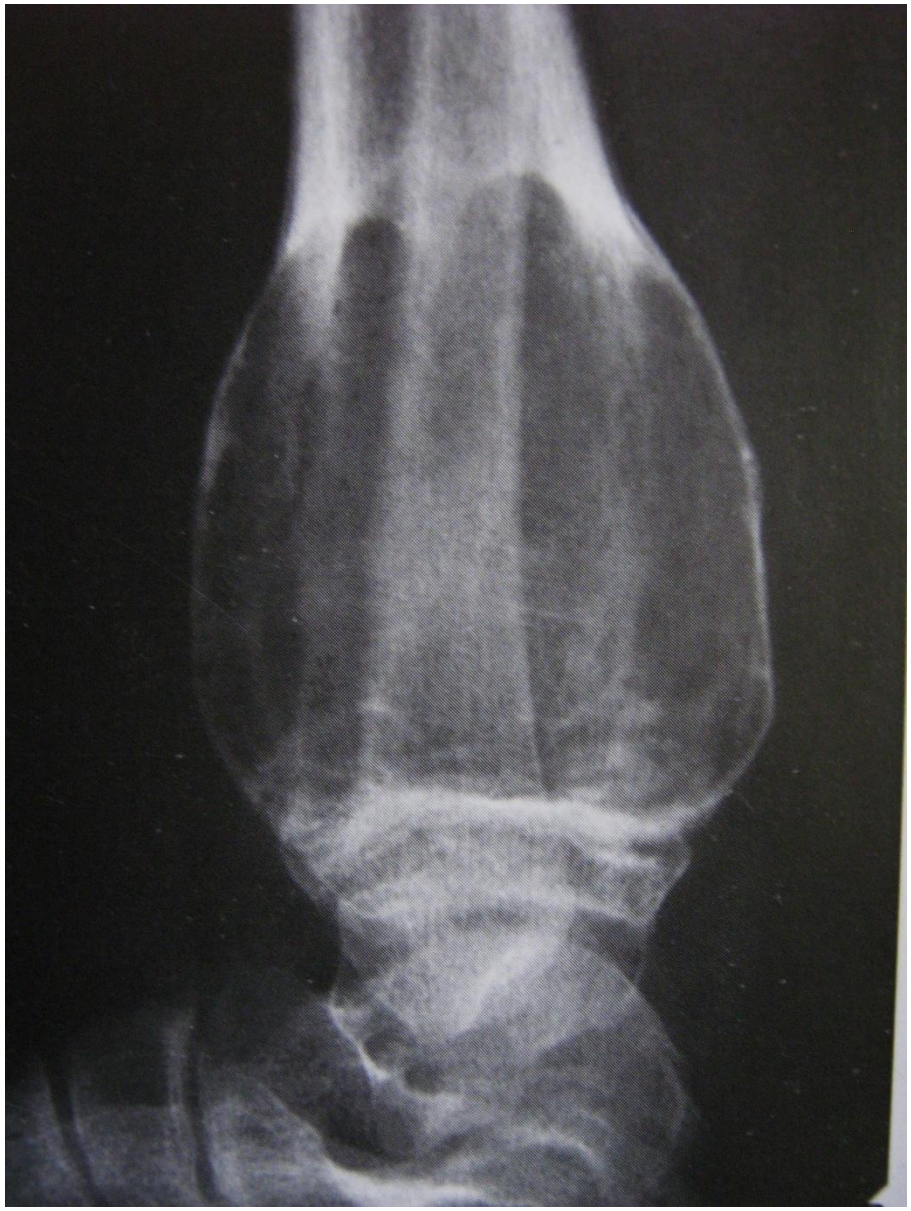
- Primary ABC (65-99%): Unknown
- Secondary ABC (1-35%): preexisting bone

C/F :

- 5-20 yrs, 60% in females.
- Presents with pain at the site.
- 80% of lesions – long bone like femur and tibia.
- Spinal lesions affect the neural arch, spinous process, transverse process, and lamina. The thoracic and lumbar spine are the common regions.

Histology: ABC consists of multiple blood filled sinusoid spaces. The solid, numerous multinucleated giant cells.





CT scan features: "blood *filled sponge*", fluid levels due to sedimentation of blood.

MRI : Multiple cysts: Fluid – fluid levels

Nuclear study: " donut sign " i.e. peripheral increased uptake.

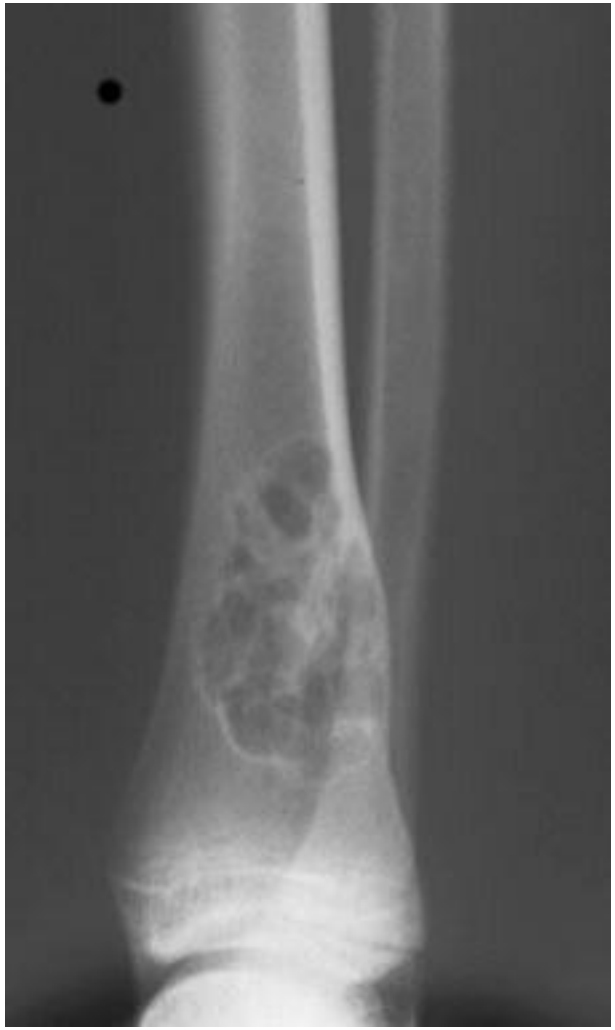
Angiography: hypervascularity in the periphery of the lesion.

Rx: Surgical curettage with bone grafting.

Recurrence rate is high

NONOSSIFYING FIBROMA

- Solitary
- Eccentric
- radiolucent, ovoid, bubbly
- metaphysis



FIBROUS DYSPLASIA

- Developmental anomaly of bone formation.

C/F : 3-15 yrs, M:F 1:1, Bowing deformities and pathologic fractures, Café-au-lait spots are present in 30% of patients.

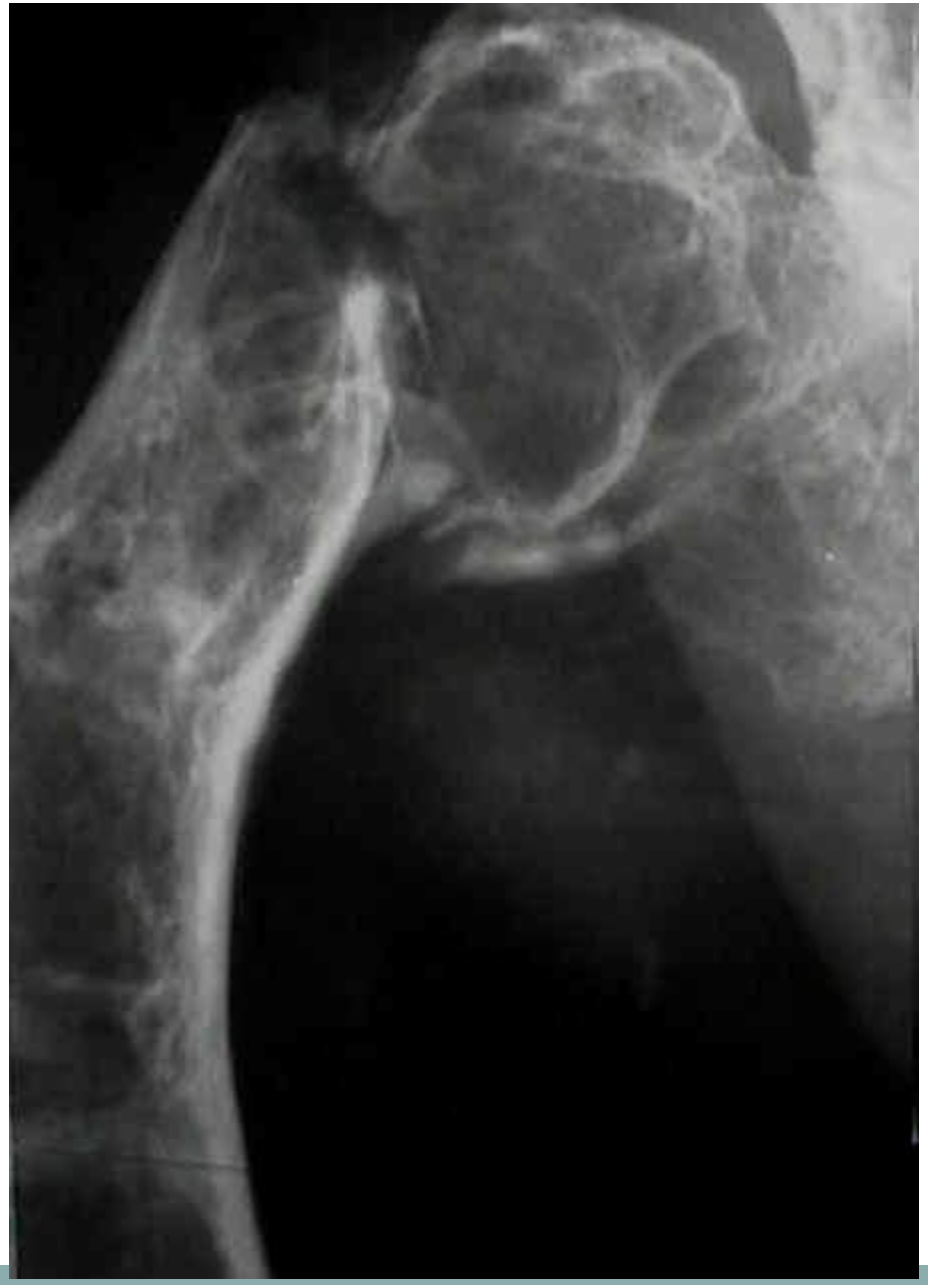
Monostotic fibrous dysplasia (solitary lesion): 70-80%

Polyostotic fibrous dysplasia (multiple bones)20-30%

McCune Albright syndrome:

Polyostotic fibrous dysplasia, Endocrine dysfunction: precocious puberty, hyperthyroidism, Café-au-lait spots (coast of Maine)

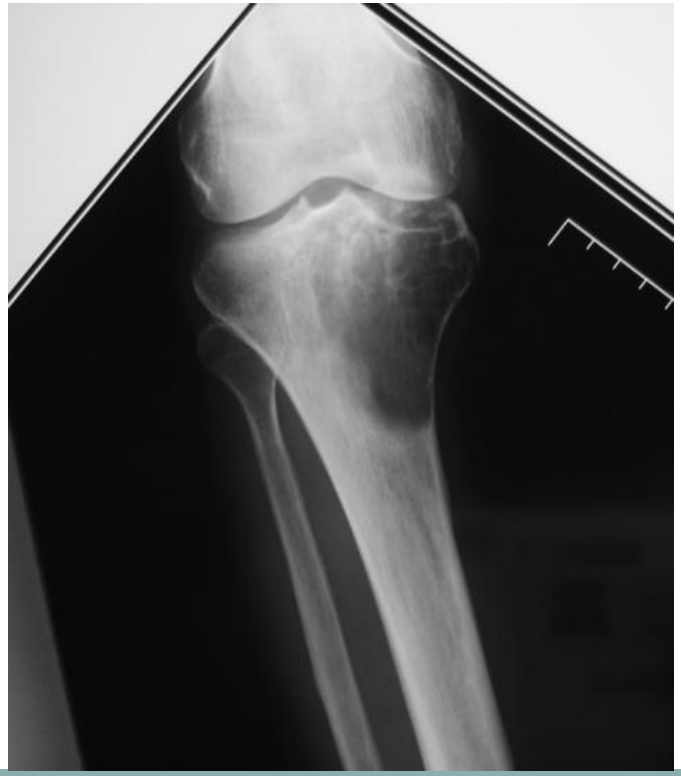
Fibrous dysplasia with Shepherd's crook deformity and pathological fracture



GIANT CELL TUMOUR (OSTEOCLASTOMA)

INCIDENCE : 5% of biopsied primary bone tumors.

CLINICAL FEATURES: 5Es- Elderly



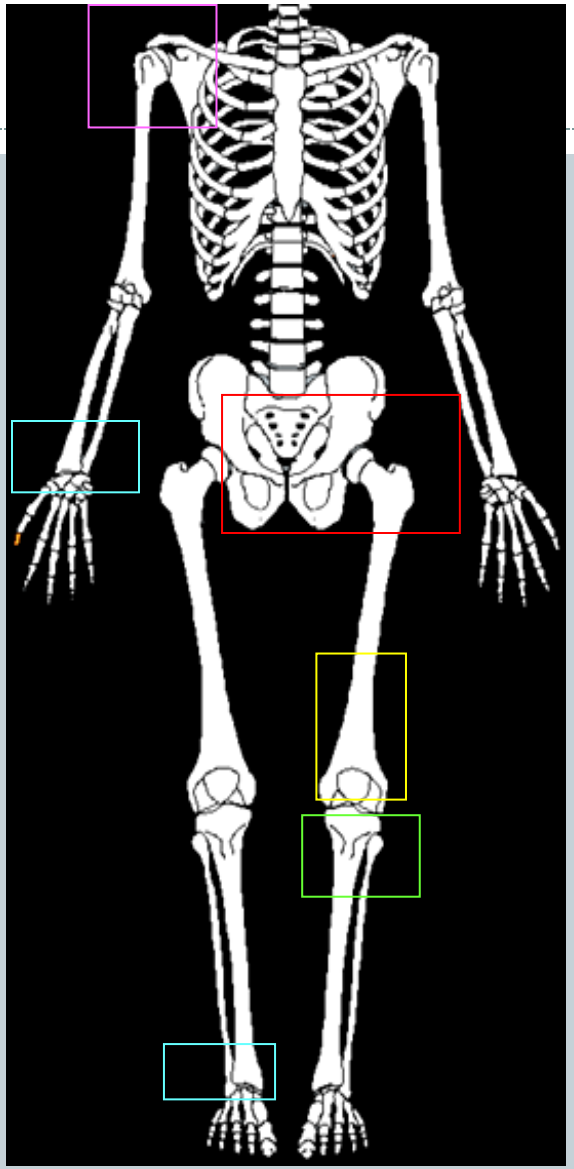
Epiphysis

Eccentric

Expansive

Egg shell crackling

Site



Campanacci Grading:

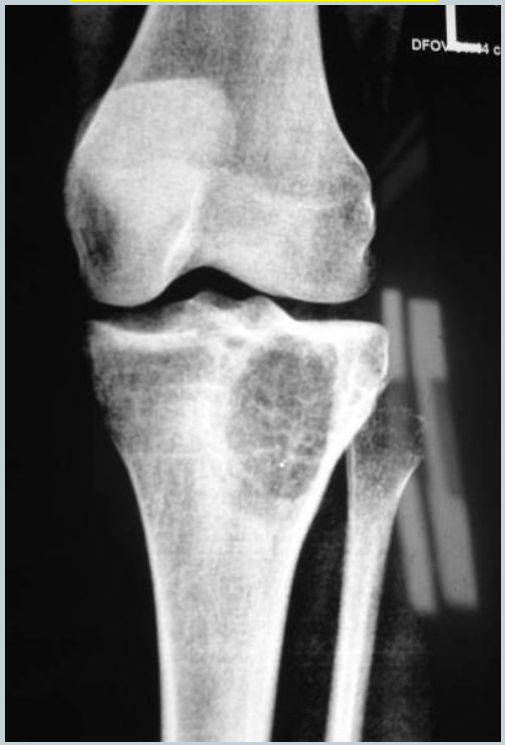
Grade I: Tumour associated with well defined margins and thin rim of mature bone

Grade II: Tumour is well defined but has no radiopaque rim

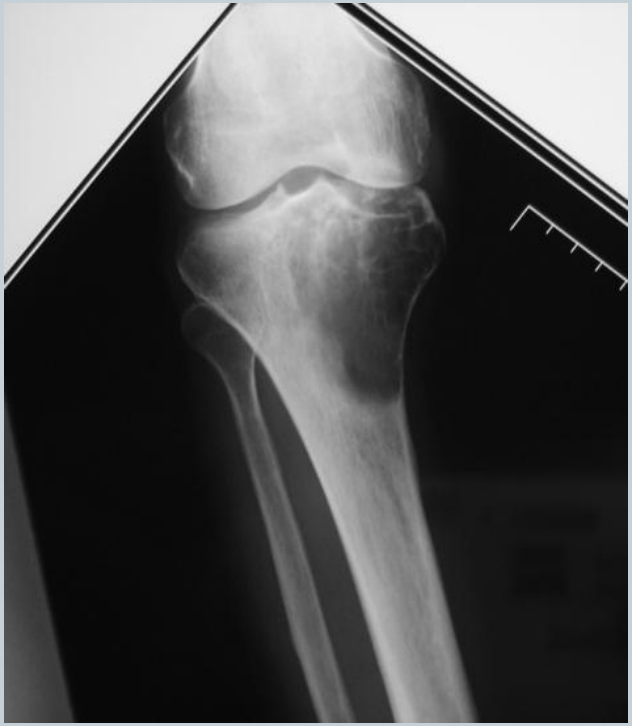
Grade III: Tumour has fuzzy borders

Campanacci Grading:

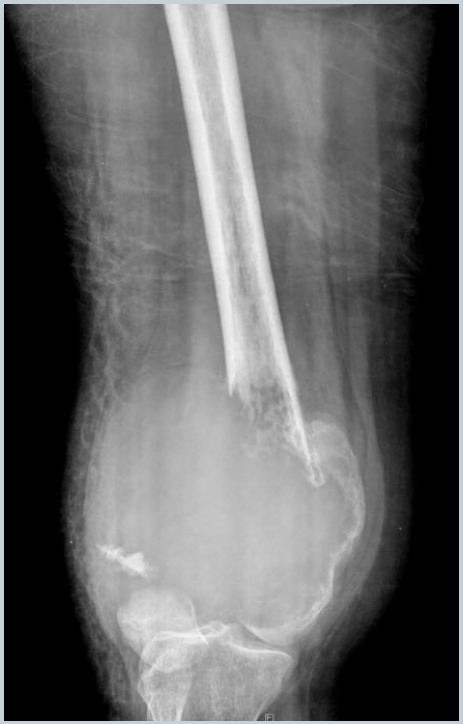
Grade I



Grade II

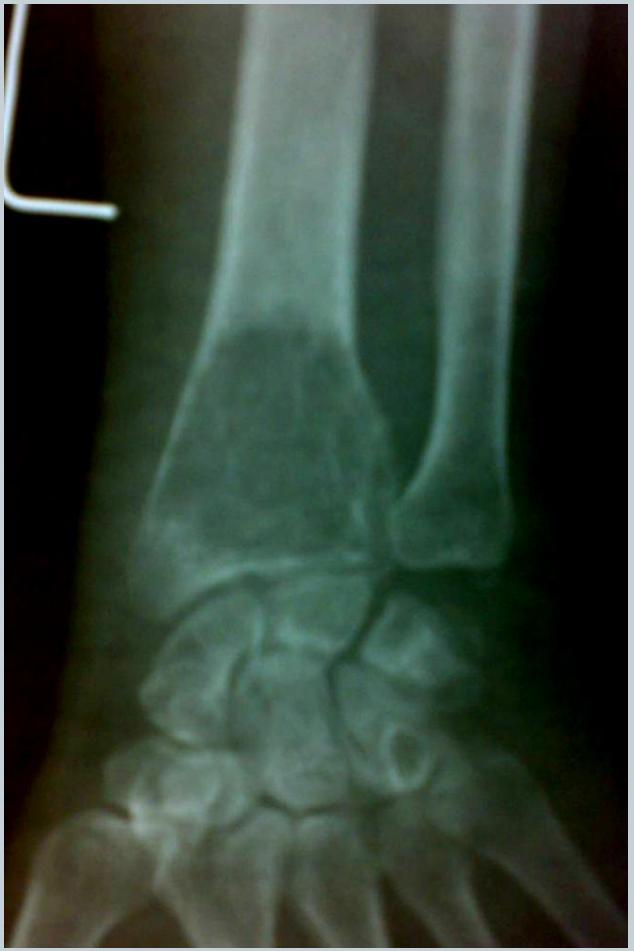


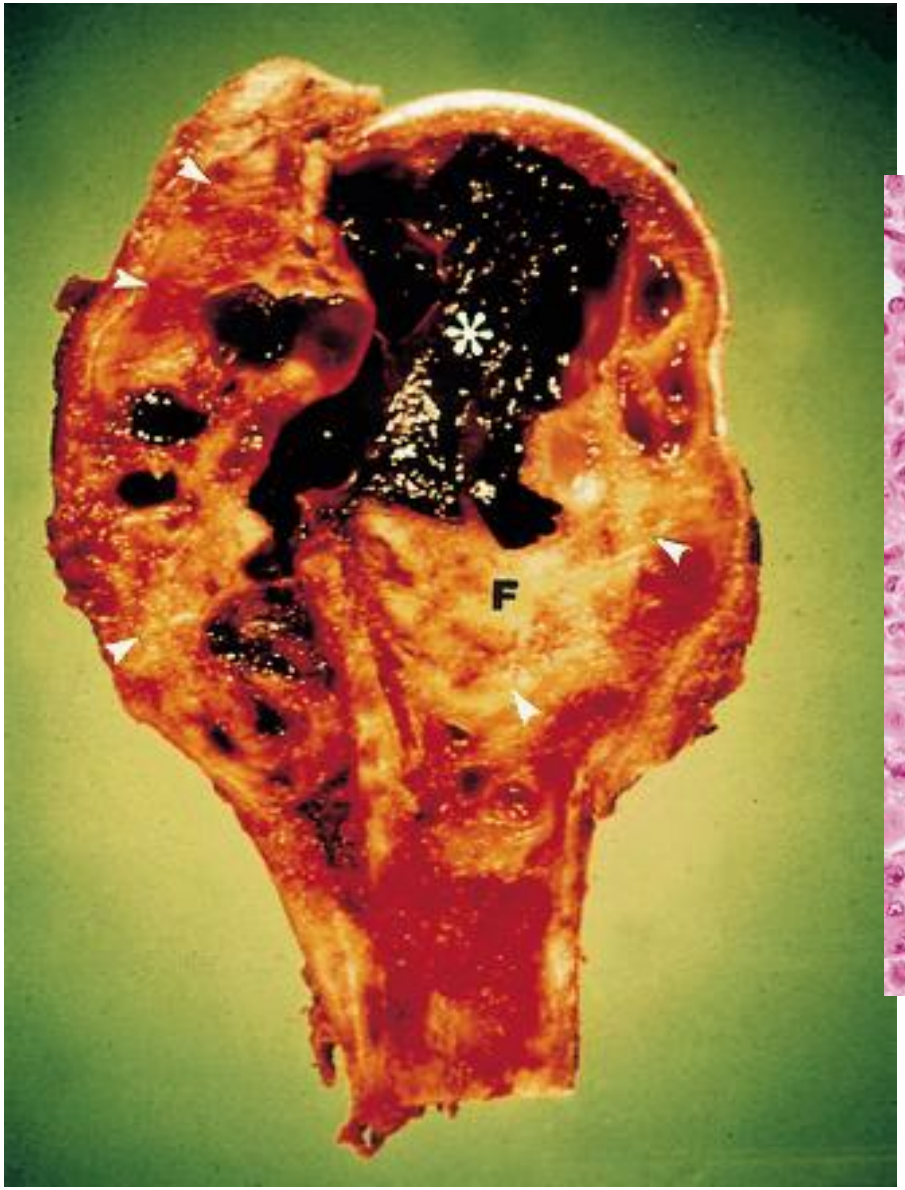
Grade III



Radiological Signs

- Lytic lesion
- Epiphysis
- Narrow zone of transition
- Thinning of cortex
- Honey comb appearance
- Soap bubble appearance

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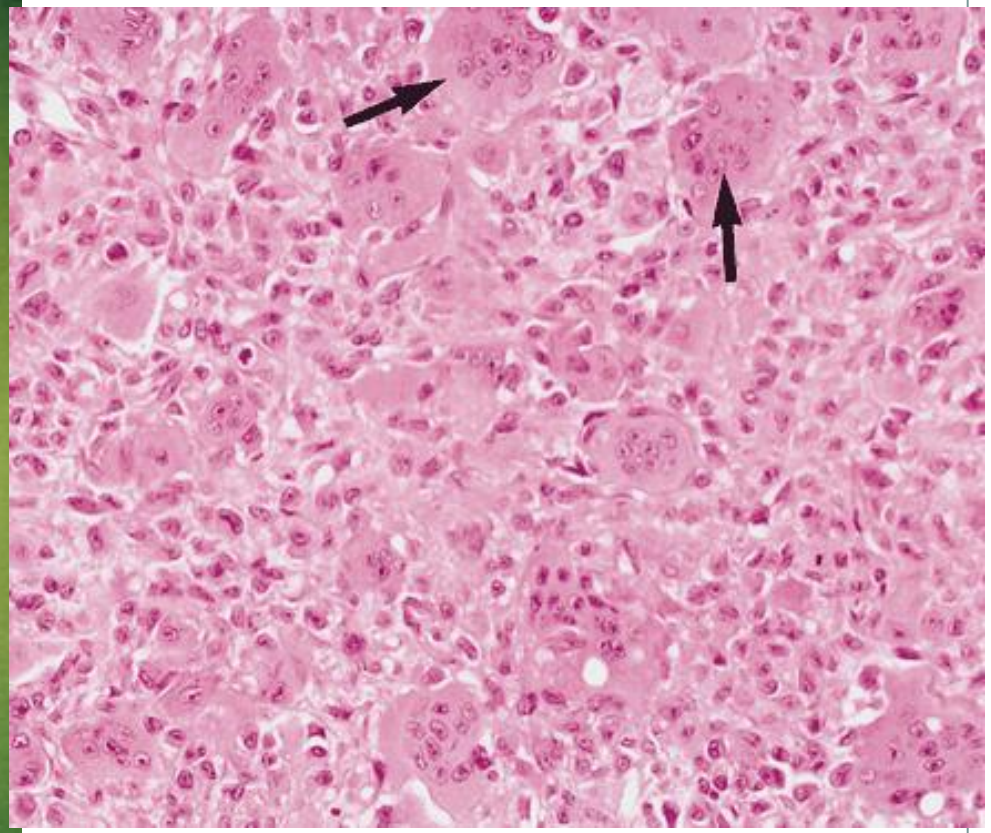


DD: GCT has to be differentiated from **giant cell variants**.

- Unicameral bone cyst
- Aneurysmal bone cyst
- Non-ossifying fibroma
- Chondroblastoma
- GCT of hyperparathyroidism (Brown tumor)

Treatment :

- ✓ Curettage and bone grating
- ✓ Curettage and placement of bone cement
- ✓ Curettage and cryosurgery
- ✓ Enbloc resection: Endoprosthesis, Arthrodesis
- ✓ Angioembolization
- ✓ Zolindronic acid

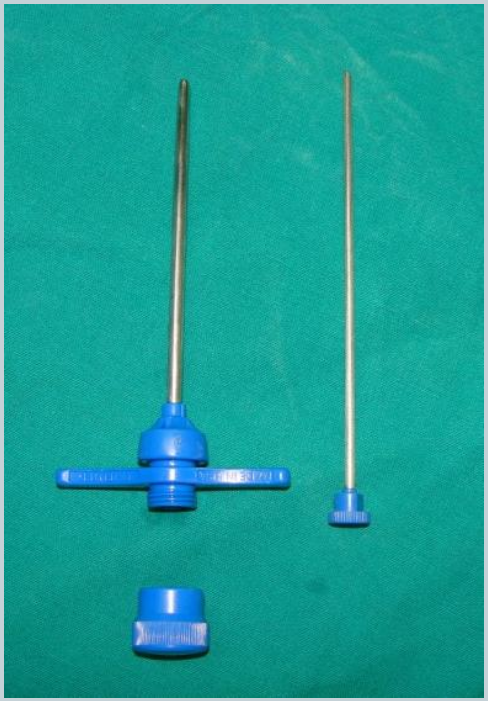
Follow-up :

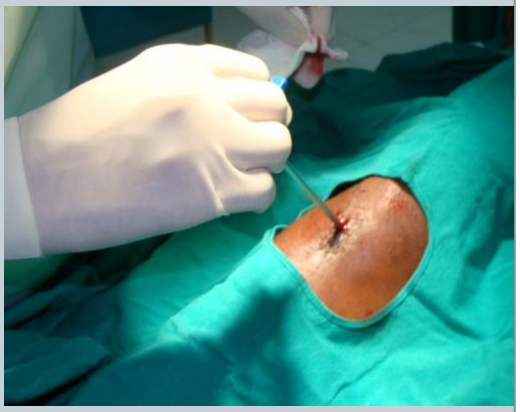
Follow-up examination is essential for at least 5 years.

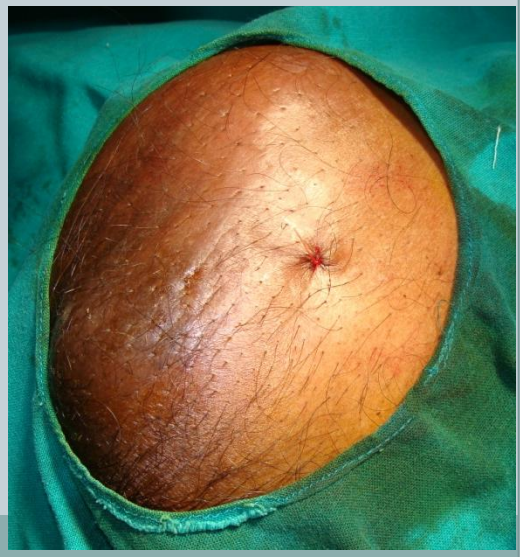
Biopsy

- Needle True Cut Biopsy
- Image Guided
- Open Biopsy

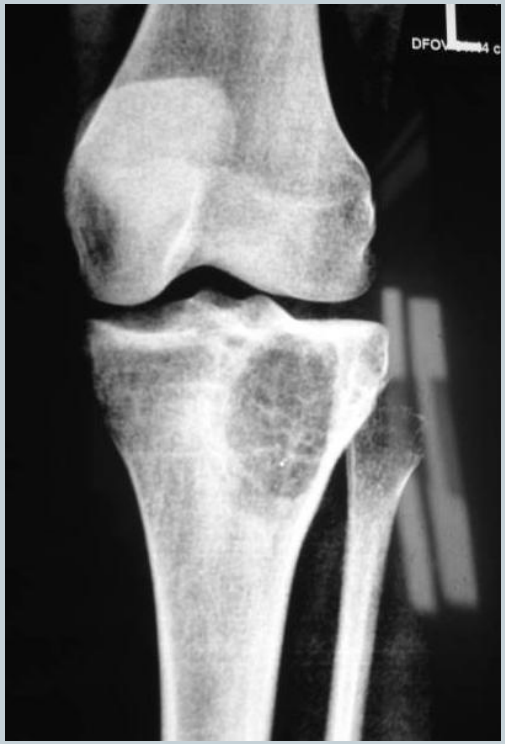
J- Needle

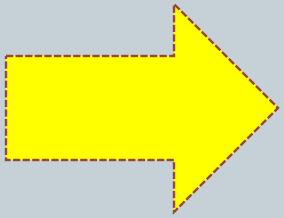


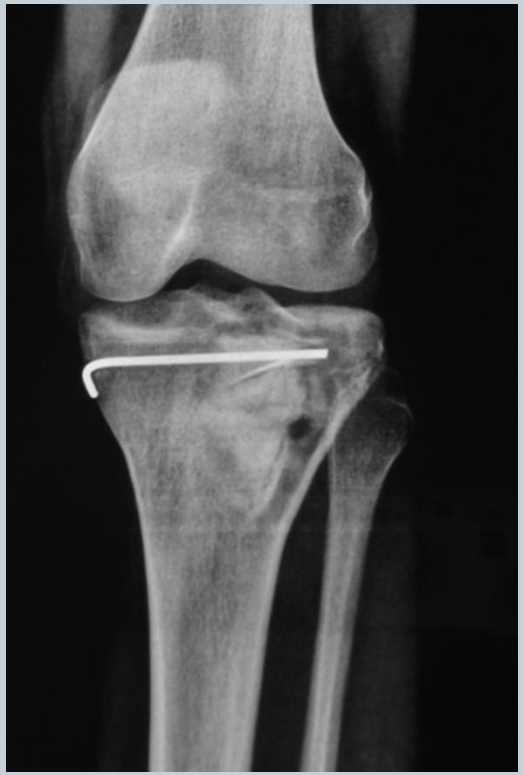




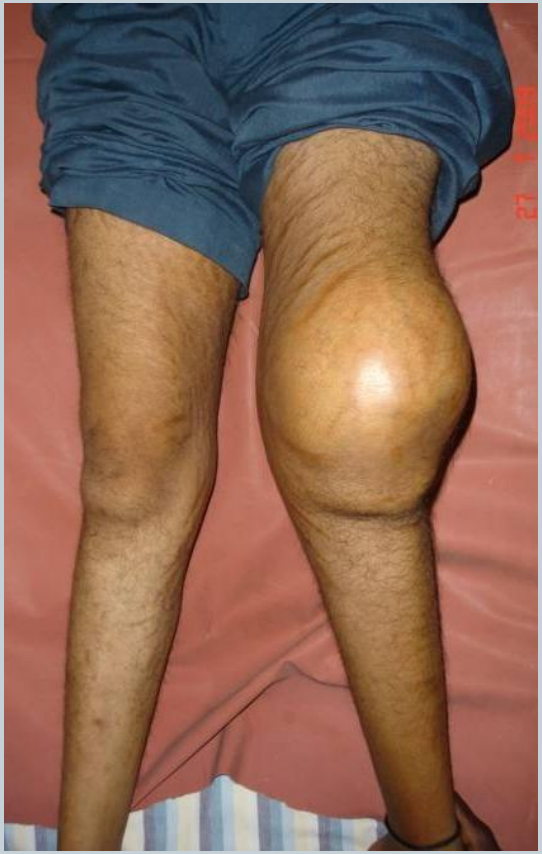
When to do what?

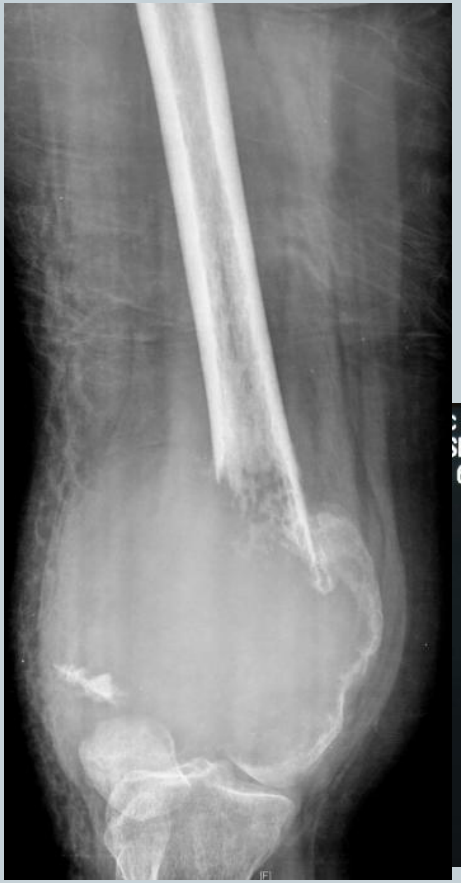


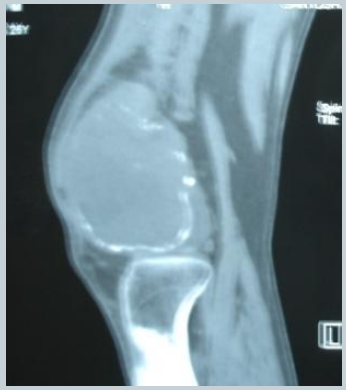


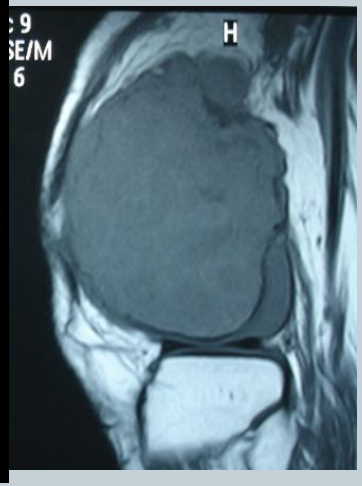


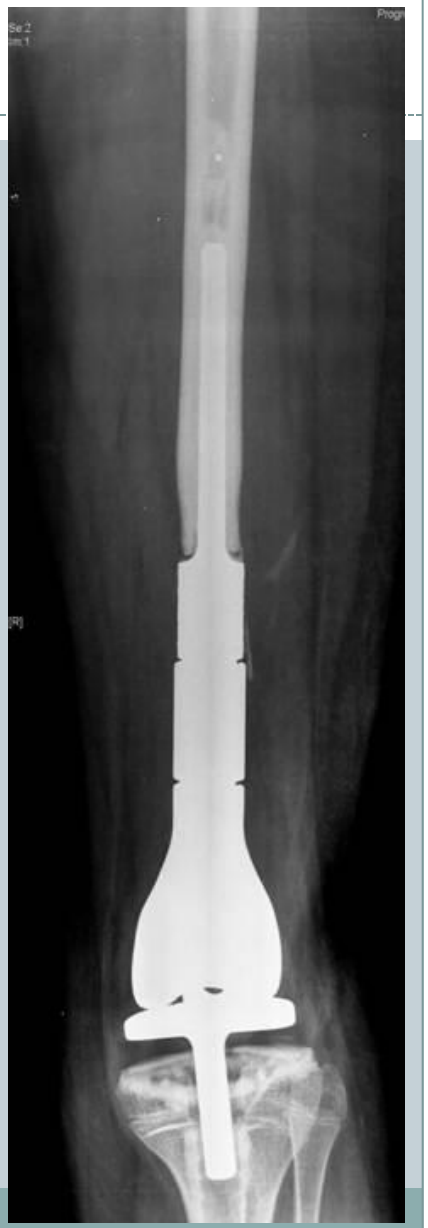
When to do what?



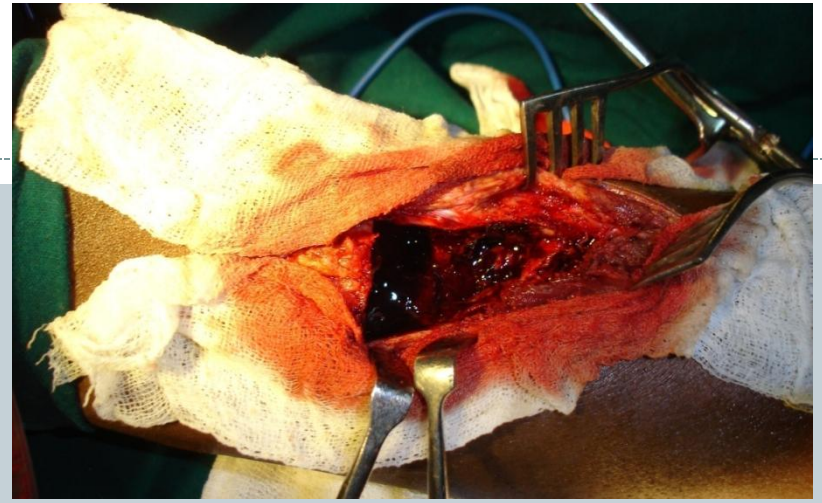


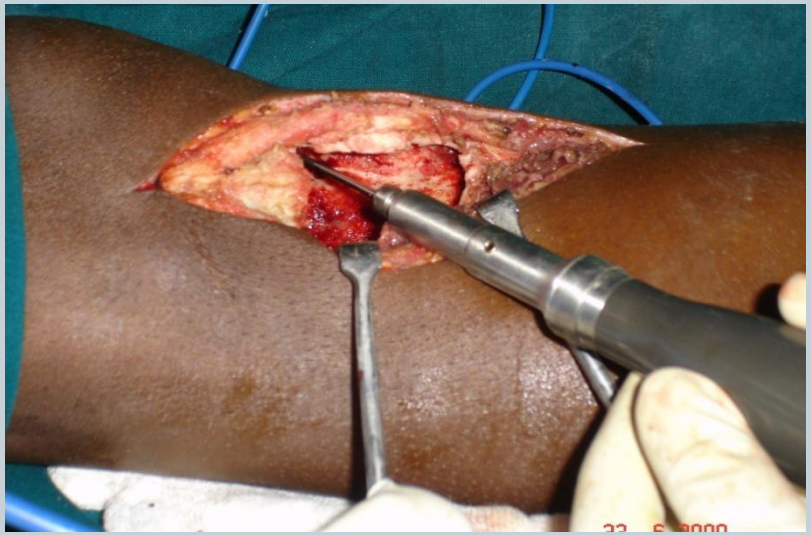




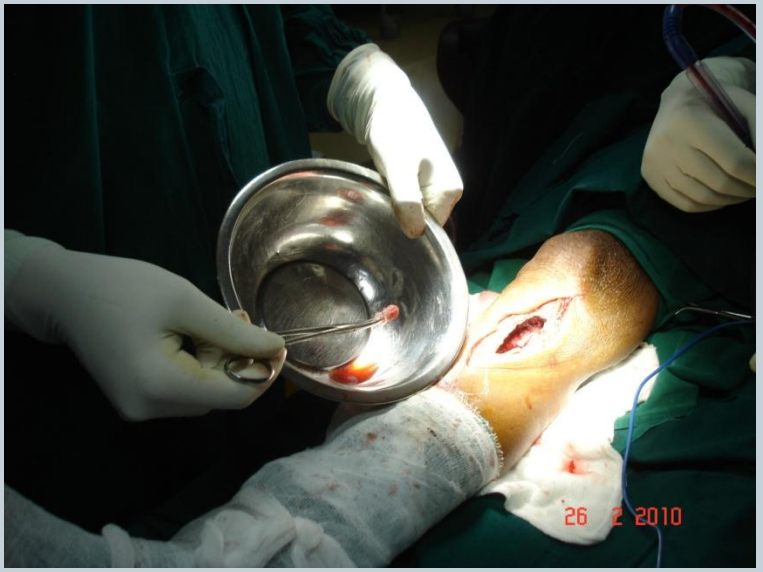


Curettage

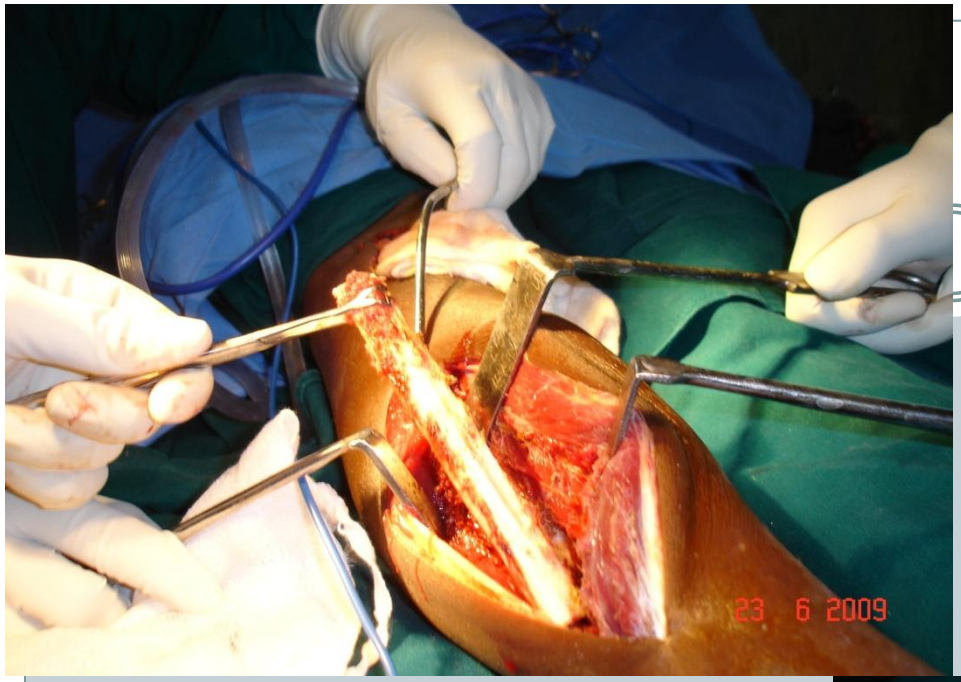




High speed Burr

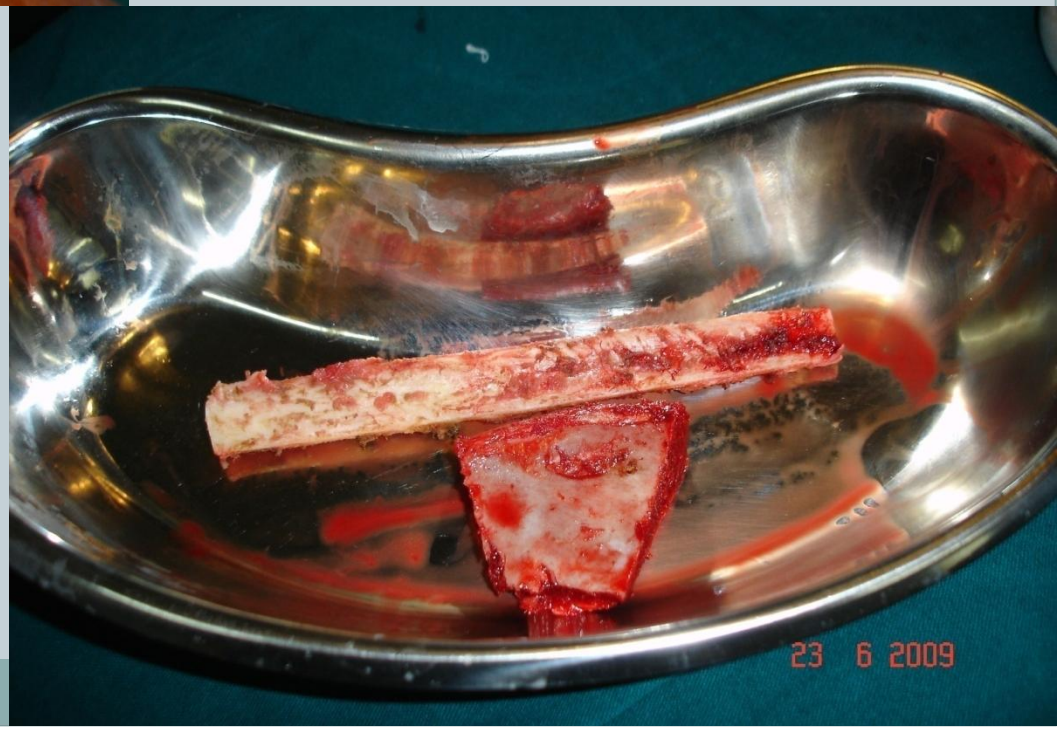


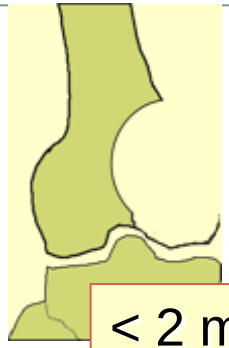
Adjuvant Therapy



T - Construct

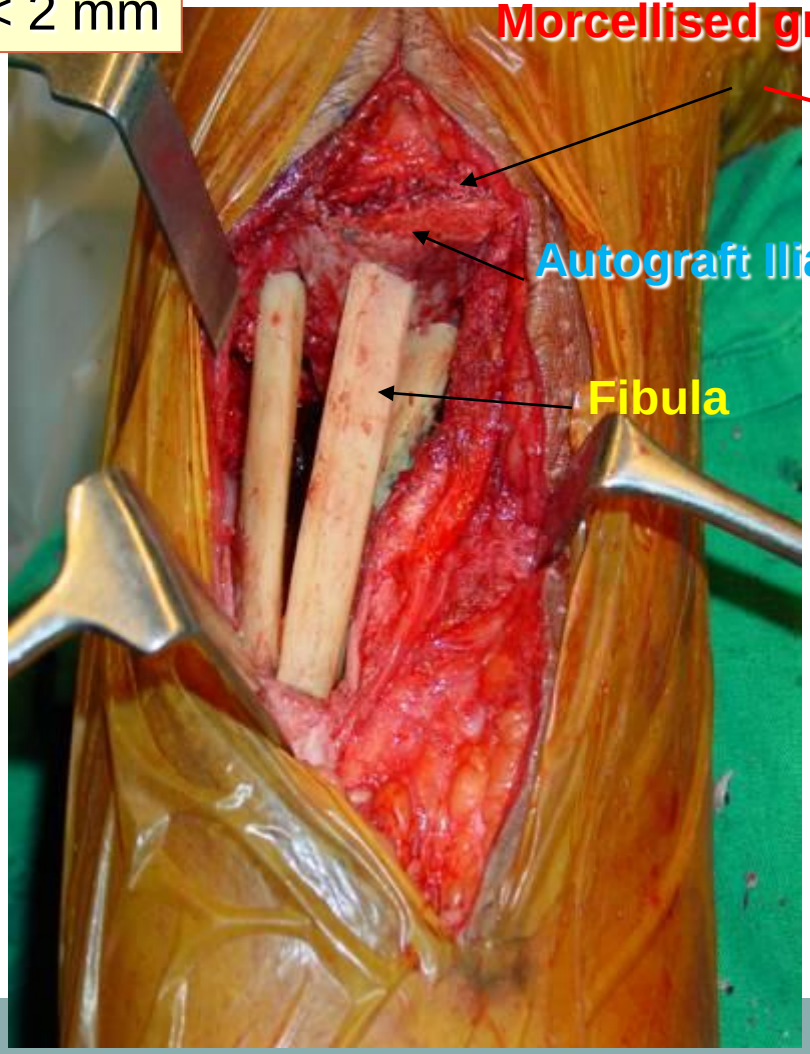
Auto fibula
Iliac crest

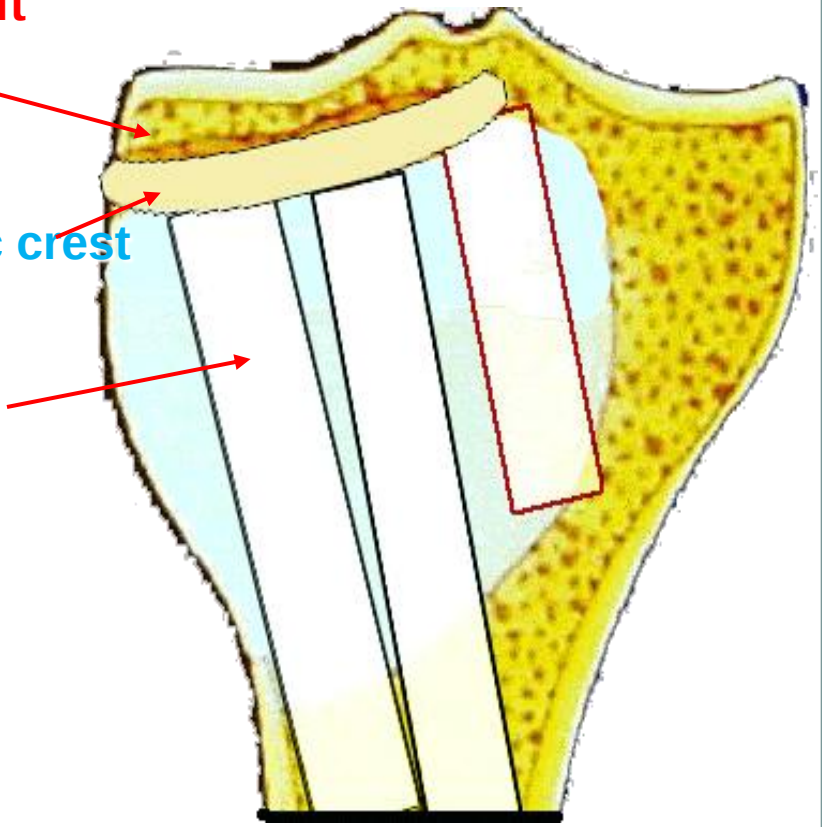




< 2 mm

T- Construct





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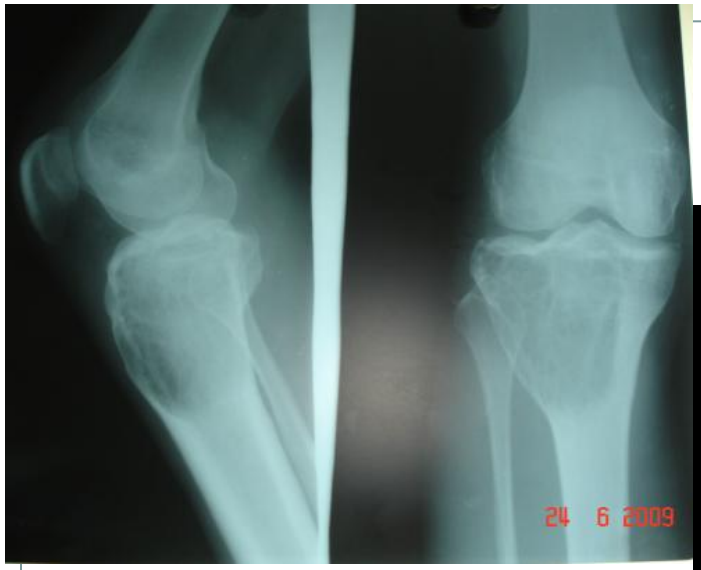

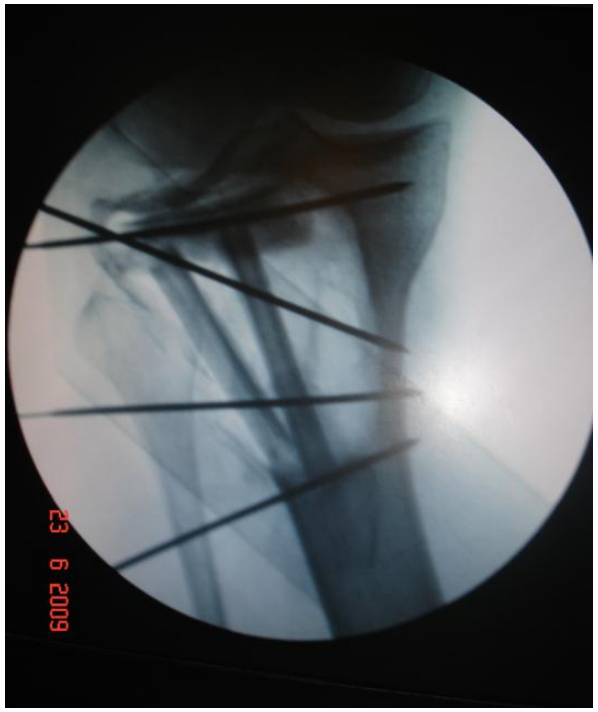

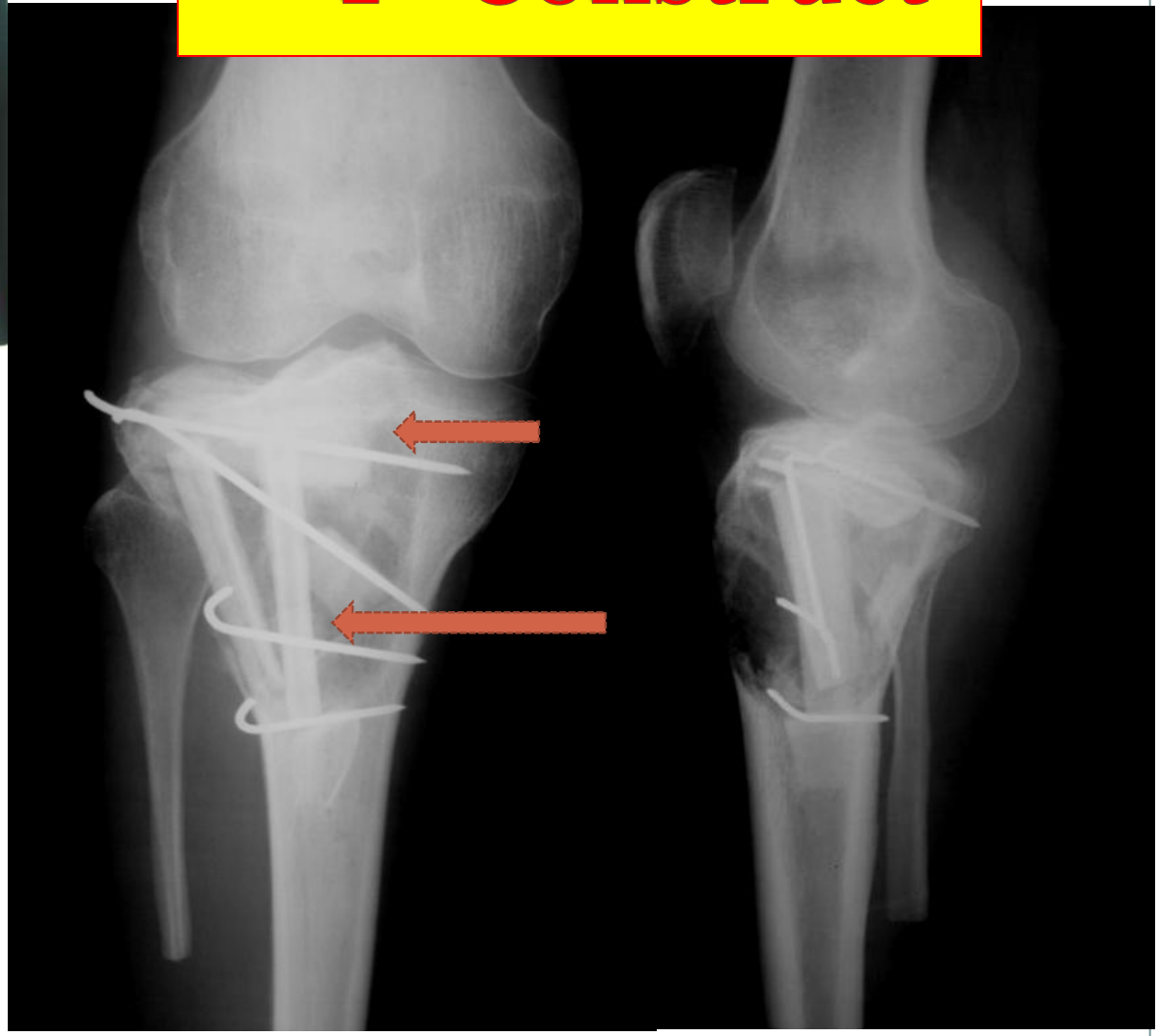

Thank you