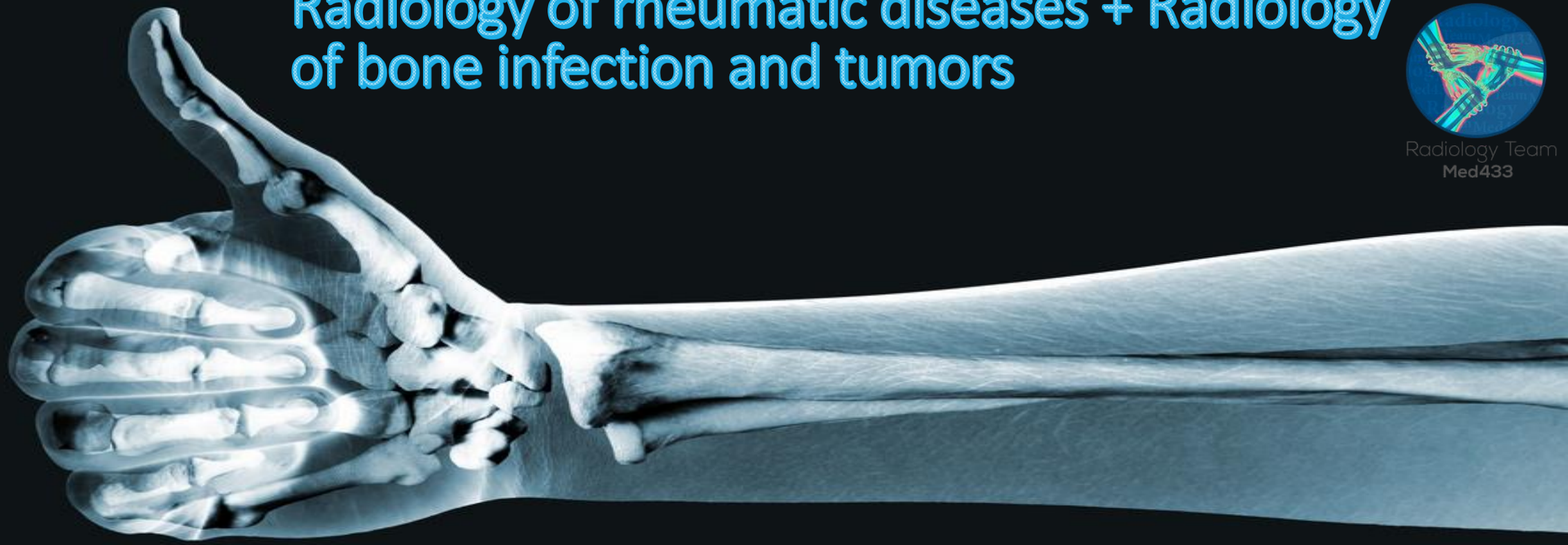
Lecture 13&14:

Radiology of rheumatic diseases + Radiology of bone infection and tumors



Radiology Team
Med433

● Slides ● Explanation ● Notes ● Additions ● Important

Objectives

The main focus and objective of this lecture is to help student to be competent in looking at MSK images and interpreting findings, by learning:

1- Normal radiological anatomic landmarks.

2- System of analyzing findings.

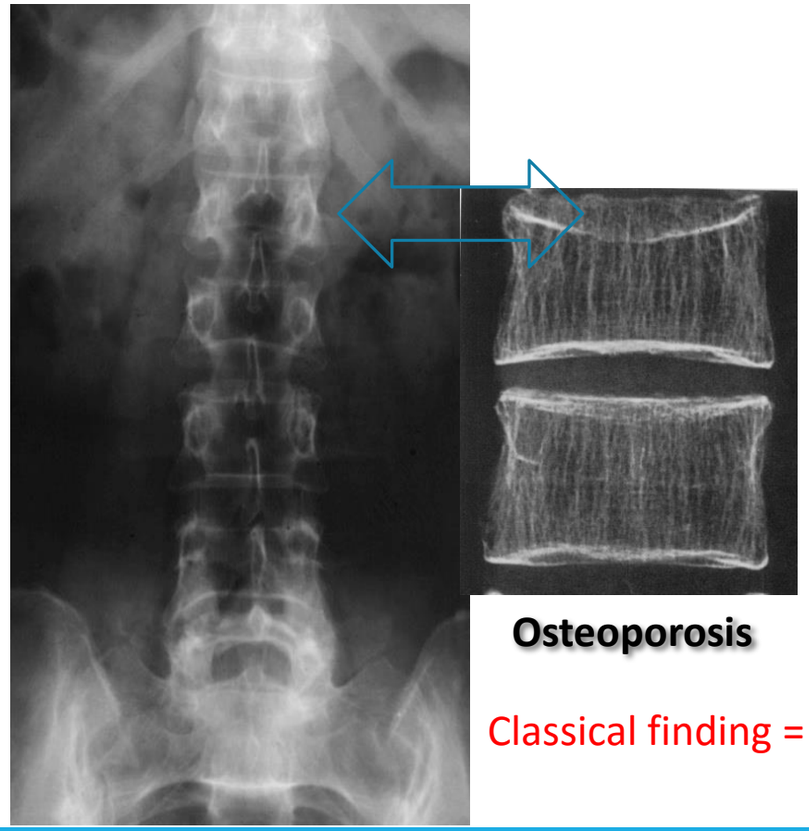
“Where to look & What to look for”.

3- Recognize features of certain disease entity.

1)METABOLIC & ENDOCRINE BONE DISORDERS

Case No.1

54 years- old female with low back pain . X-ray of lumbosacral spine requested



Osteoporosis

Findings

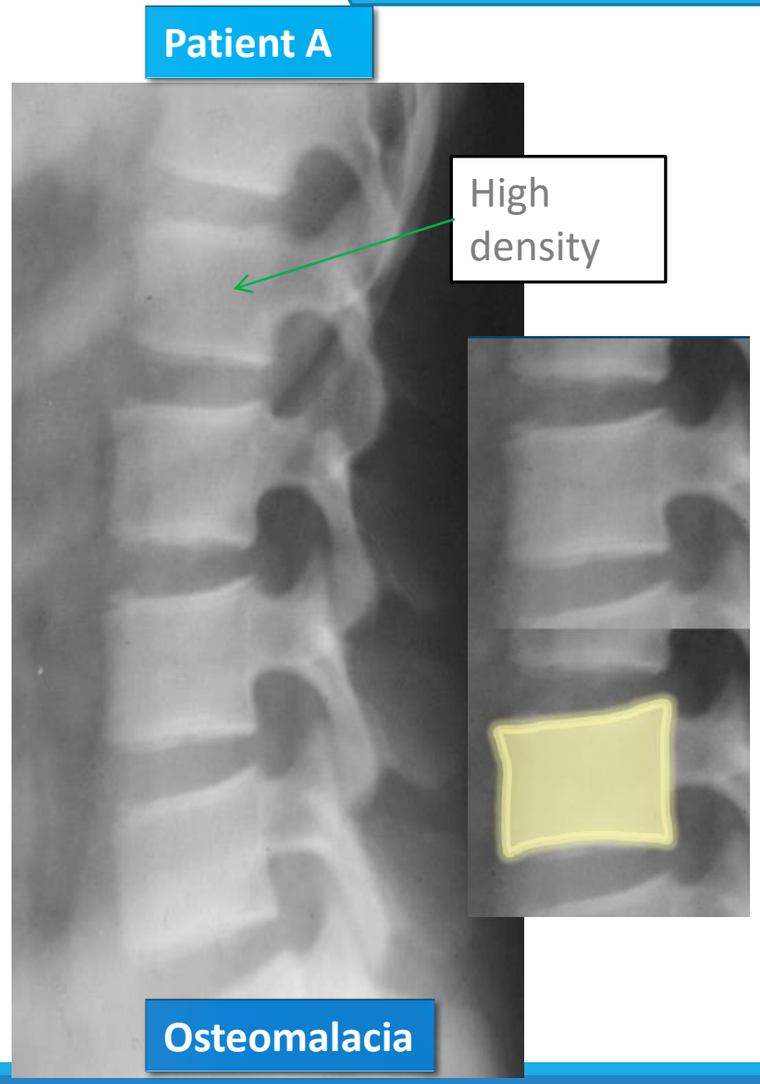
1. Reduction of the bone matrix.
2. Concave end plates.
3. Trabecula are clear and vertical (white lines inside the vertebrae).

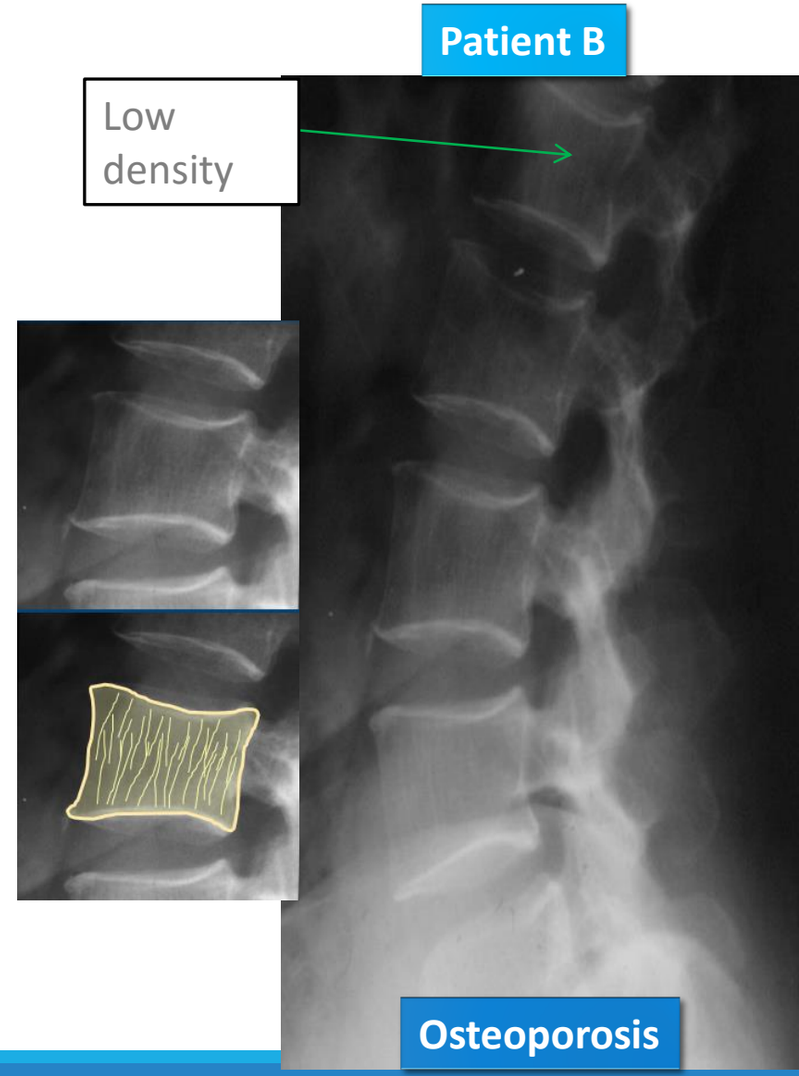
Classical finding = Trabiculation

To differentiate between Osteomalacia VS Osteoporosis

- Renal failure can lead to Disturbance of the metabolism of vitamin D and parathyroid hormone consequently can lead to changes in the bone.
- Bone density is decreased within the central portion (osteopenic) when you compare it with the end plate of the:

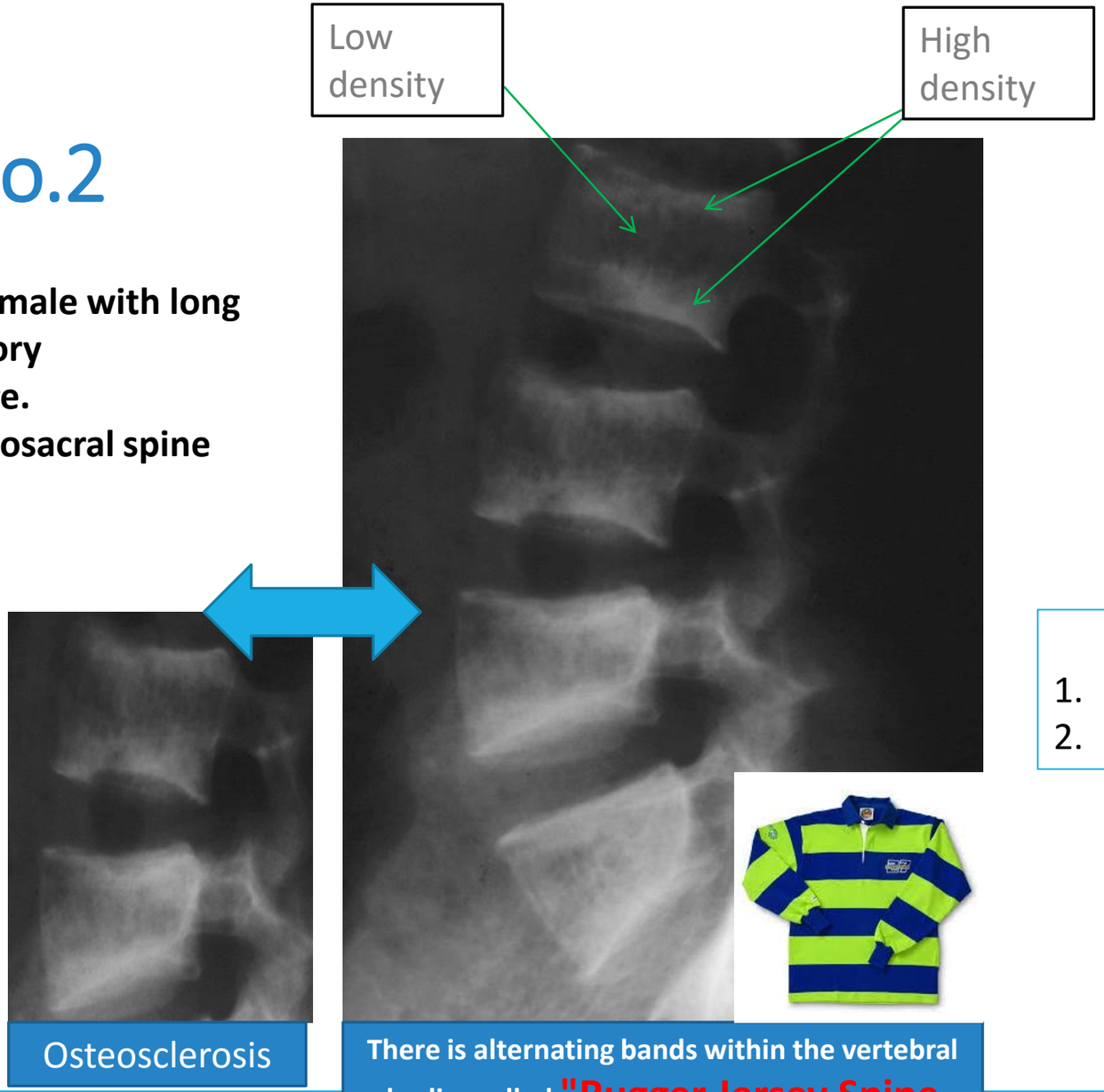
✓ vertebral body which are whitish.
✓ sclerotic thick margins.
✓ Soft bone + hazy margins means Osteomalacia .
✓ Soft bone + sharp Margins means Osteoporosis.
✓ Trabeculae present means Osteoporosis.





Case No.2

27 years- old male with long standing history of renal failure.
X-ray of lumbosacral spine requested.



Osteosclerosis

There is alternating bands within the vertebral bodies called "Rugger Jersey Spine which diagnostic of osteosclerosis.

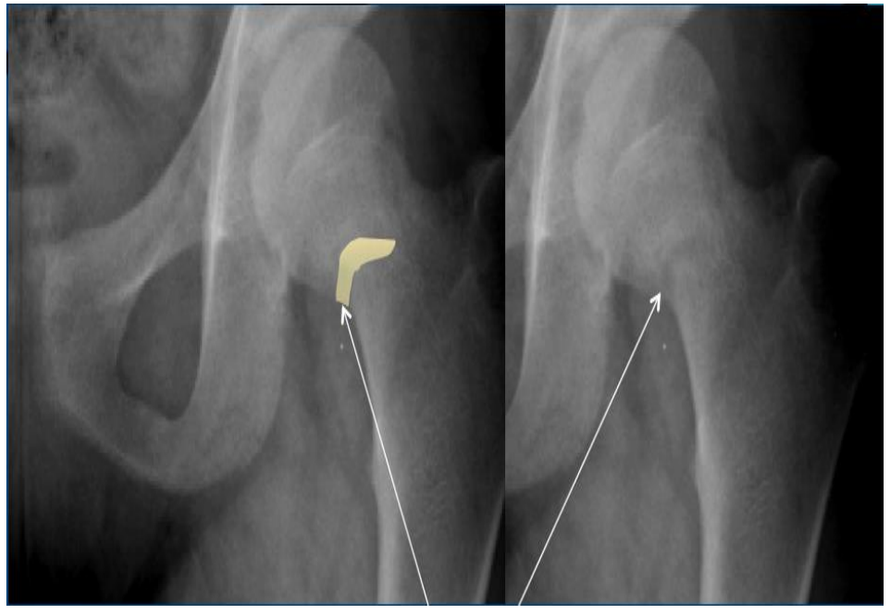
Renal Osteodystrophy

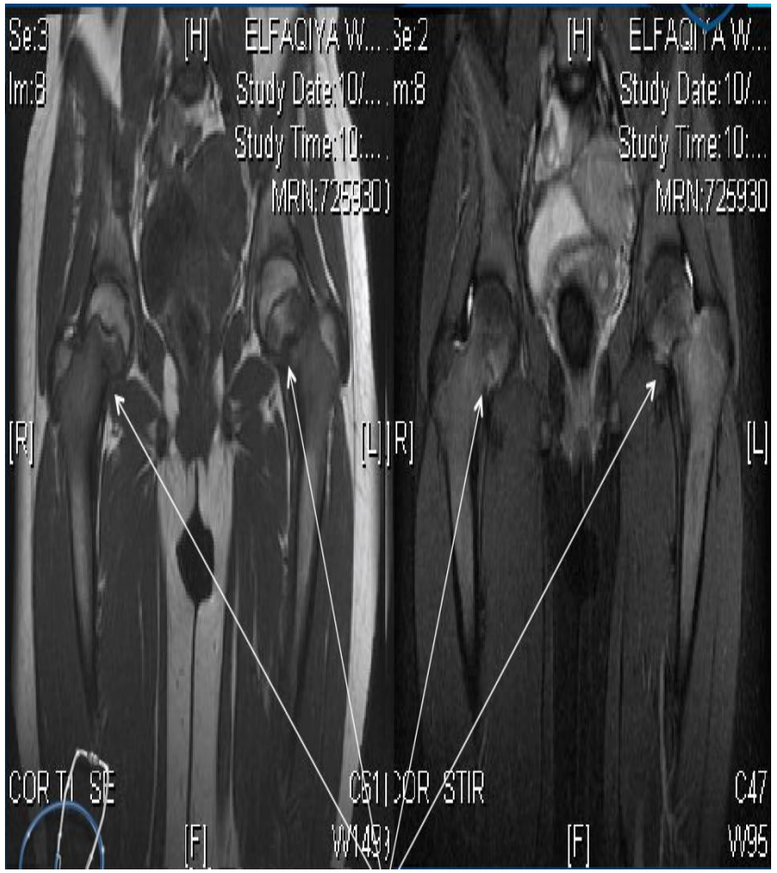
Presents with :
1. Osteoporosis
2. Osteomalacia
3. Secondary Hyperparathyroidism
4. Osteosclerosis

Findings
1. Decrease bone density in central portions(Black).
2. Increase bone density in peripheral portions(White).

Case No.3

20 years old lady, weakness and lower limbs pain





Looser zones (OSTEOMALACIA)

Usually the patients present with no Hx of trauma

1) Medial aspect of the femur neck
2) CT: check texture of the cortex
3) MRI: check changes in the bone marrow
4) Insufficient fracture of the femur neck due to softening of the bone
5) Looser zones: presents as pain during movement, lower limb weakness

Case No.4

1. Bone Resorption.
2. Bone Softening.
3. Brown Tumors.
4. Osteosclerosis.
5. Soft tissue calcifications.

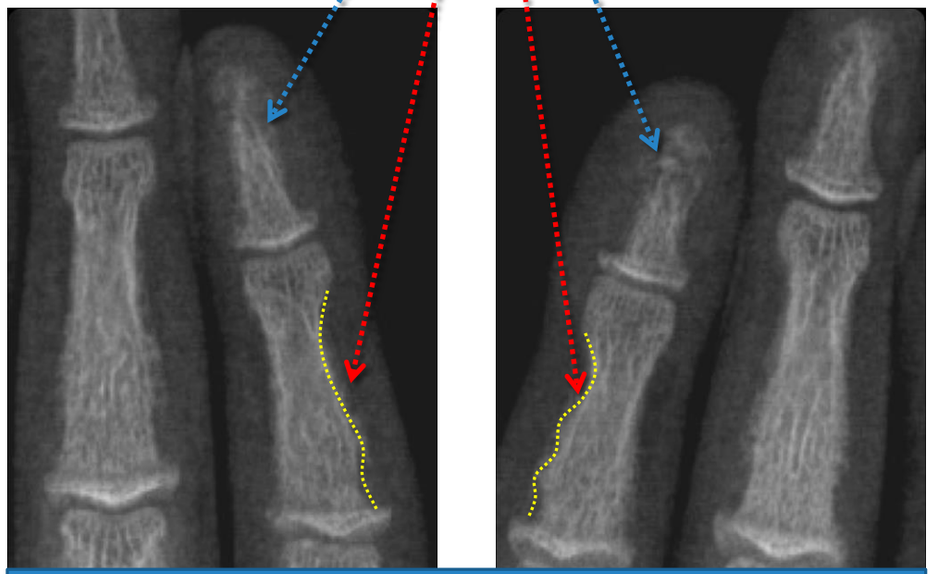
- In hand, sub periosteal bone resorption in hyperparathyroidism .
- Theses changes usually happen in the middle phalanx, radial aspect in the 2nd or 3rd finger.

HYPERPARATHYROIDISM

Bone Resorption

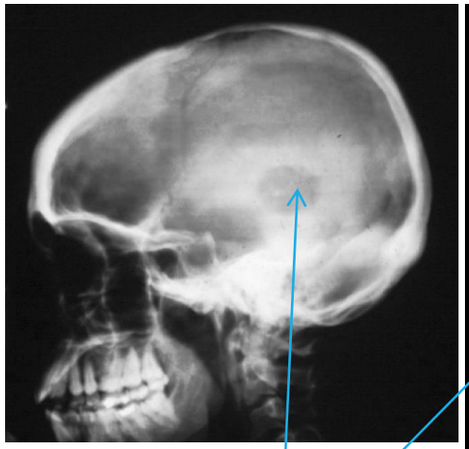
↓

Subperiosteal



- Most useful sign
- Virtually Diagnostic
- Location

Irregularity of the cortical outline at the middle
And distal phalanges



Brown Tumors

Lytic lesions

Increase osteoclast

Brown tumors features

1) Affect long or flat bones.
2) Single or multiple.
3) Have a sharp outline but with no obvious margin.

Case No.5

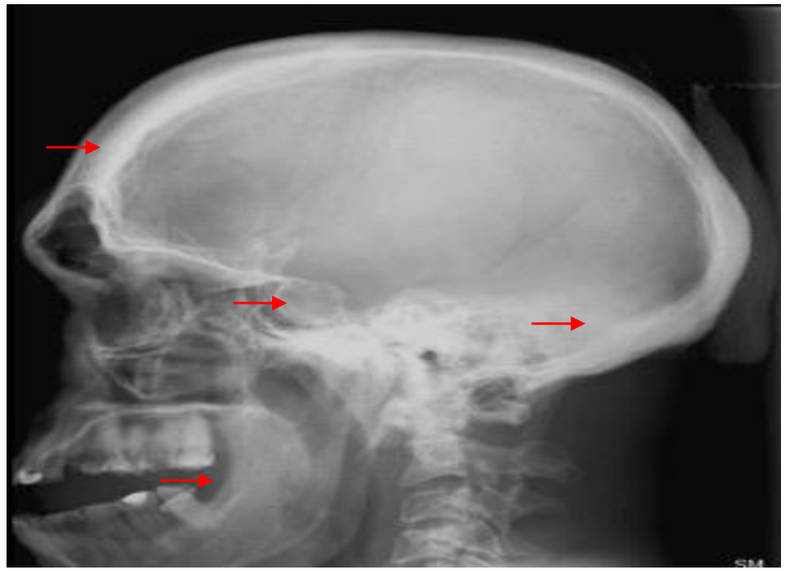
45 years- old male presented with history of bone enlargement.
X-ray of skull and hand are requested

Findings:

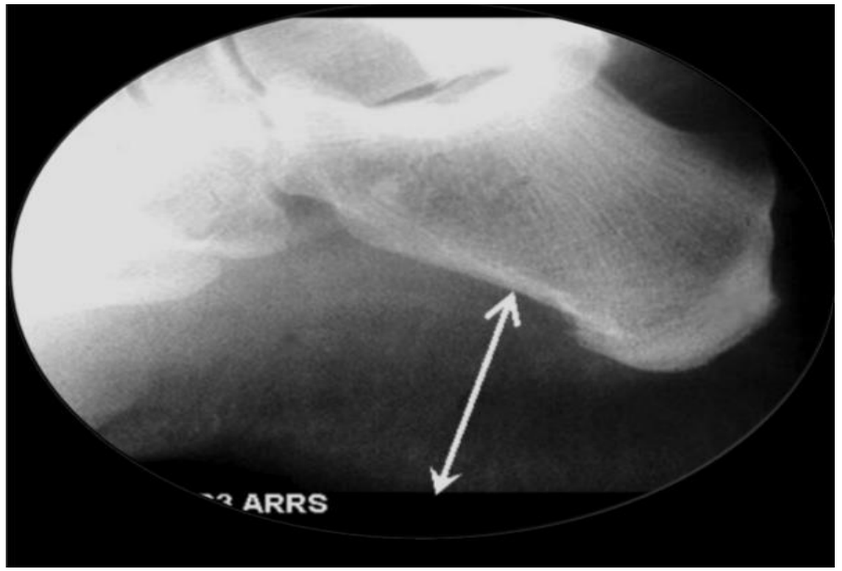
- ✓ Sella turcica is rounded & enlarged which may indicate pituitary pathology that caused the acromegaly.
- ✓ Jaw and frontal sinus are enlarged.
- ✓ Occipital protuberance
- ✓ Thickening of the calvarium

- Widening of the joint space.
- Enlargement of the soft tissues of the hand

Acromegaly
Pituitary adenoma



- **Huge jaw**
- **Frontal enlarge**
- **Enlargement of the hand**



- This is the Heel pad sign, one of acromegaly signs.

2)Rheumatic diseases

CASE NO.1 "Rheumatoid Arthritis"

48 years-old female presented with joint pain of the hands and feet. X-ray of hand requested.

-Distribution: Wrist + MCPs (proximal).
-Rheumatoid usually affects younger females.
-Rheumatoid arthritis is very hyper vascular > decrease in bone density > osteopenia (more blood flow comes to the bones > more resorption).

- Decreased bone density.
- Oblique view: alignment is disturbed (first metacarpal).
- Carpal bones are destroyed and eroded.
- Reduced distance between radius and carpal bones.

•Carpals aren't clear, proximal disease.
•Changes involve the head of the metacarpal, metacarpophalangeal joints.
•Rheumatoid arthritis:
-Look > Bone density, texture & outline.
-Some of the signs of rheumatoid arthritis are: Periarticular erosions (periarticulosteopenia), loss of joint spaces.

•Around joint, periarticulosteopenia/osteoporos
•Erosive changes
•Erosive arthropathy: caused by the rheumatoid arthritis
•Changes more to the proximal joints than distal
•Dislocation of the joints, swan neck deformity of the neck, extensive erosive
•Early radiological sign: decreased density around the joint
•Mal-alignment of the fingers , ulnar deviation of left hand & dislocation of the thumb of the left hand.

CASE NO.2 "Osteoarthritis"

Elderly male patient presented with joint pain of the hands. X-ray of hand requested.

- Carpals are clear
- Metacapoparyngeal: no defect or erosive changes
- Proximal inter pharyngeal space
- Distal: osteosclerosis: margins of the bone and extends, osteospike
- Reduction of the joint space, sclerotic changes, osteo

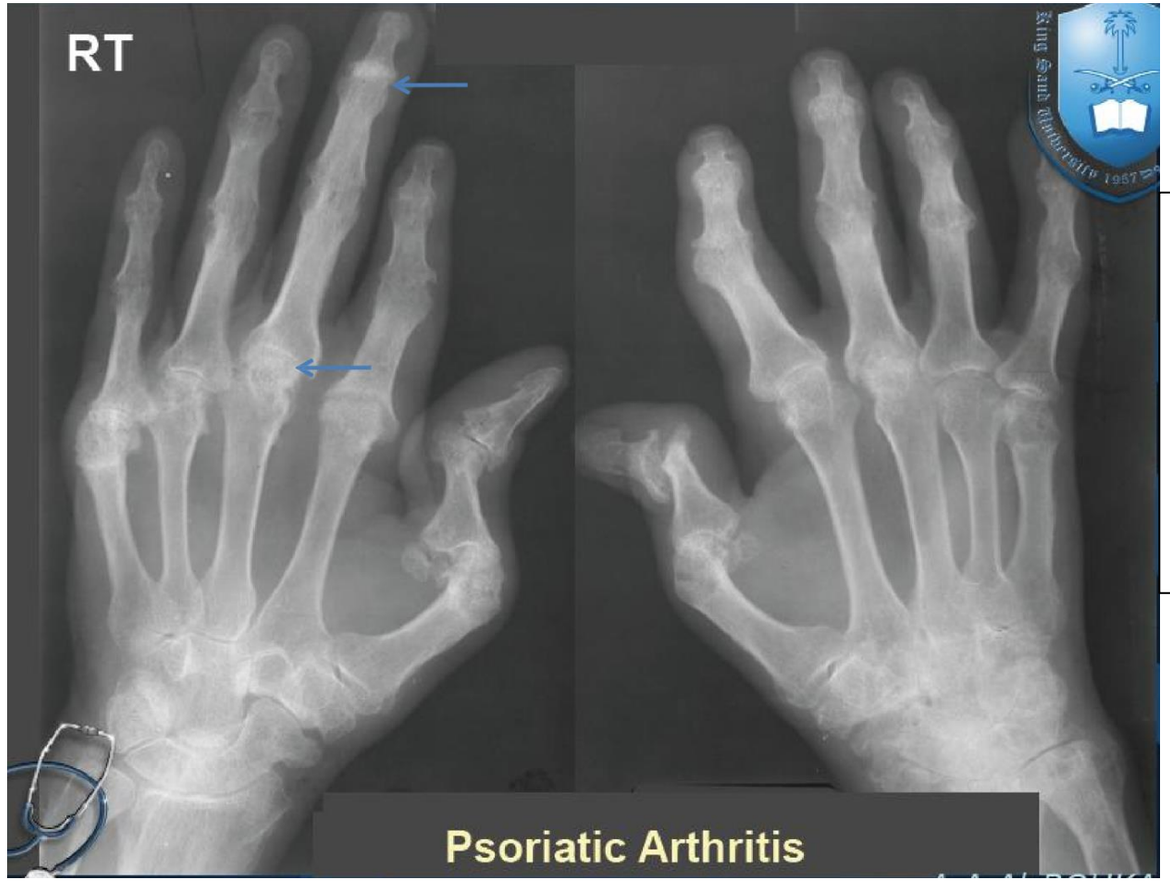
-Osteoarthritis usually affects elderly.
-In hand: most common base of the thumb or distal IP joints.
-3 classic findings of osteoarthritis: Joint space becomes narrow > bones become sclerotic (increased density around that part) > extra bone forming around it (osteophyte formation).

- Sclerosis and narrowing of the joint
- First carpal metacarpal joint (thumb)
- If an arthritis is non erosive (osteoarthritis, large joints), erosive (rheumatoid, small joints) synovial joints.

- Osteoarthritis: Distal interphalangeal joint osteoporosis. Non-erosive. Distal rather than proximal.

- Destruction of the head of the metacarpal
- Ossified joints
- Psoariaisis can be similar but more severe, affect proximal to distal of one finger, ankylosis of the bone

CASE NO.3 "Psoriatic arthritis"



Involvement of middle finger and fusion.
Most common distal arthropathy is psoriasis. Psoriasis usually:
-Distal involvement.
-Causes fusion.
-Causes swollen finger (sausage digits).
-Causes increased density of one of the fingers due to fusion (ivory phalanx).

CASE NO.4 "Gouty Arthritis"

-Foot and hand findings are the same in gout.
-Main finding in gout is soft tissue swelling.
Soft tissue swelling + erosion associated with which type of arthrtopathy? Gouty arthritis.

43 year-old male patient presented with hands and feet pain and swelling. X-ray of hand requested.

Seen in the x-ray:
-Erosions.
-Malalignment
-Around the erosion there is a swelling " Rounded soft tissue enlargement".

- Erosive changes ring finger
- Soft tissue swelling (white area means it is dense)
- Erosive arthropathy with soft tissue component, seen in Gout

DX

- Gouty Arthritis , gout is caused by the deposition of **monosodium urate (uric acid)crystals**.

The feet and hands are commonly involved. Joint involvement can occur in a very asymmetric (random) polyarticular pattern.

- Tophi (plural) are soft tissue masses created by the deposition of urate crystals. The varying densities seen on radiographs is due to calcium precipitation with the urate crystals. Tophi are typically located in the peri-articular area along the extensor surface, but may be intra-articular or not associated with the joint at all.
- In contrast to rheumatoid arthritis, mineralization is maintained. Despite multiple erosions, there is no osteopenia.

Cont...Gouty Arthritis

Figure 1

Figure 2

Tophus (singular) white areas
Lytic or sclerotic lesions
1st MTP (big toes) is the most common site for gout
(AKA. podagra)

Notes (from doctor's slides):

- **Matrix** is chondroid tissue, deposited with phosphorous and calcium.
- **Osteopenia:** is not a disease, but reduction in bone density.
- **Osteoporosis:** can be secondary to trauma, immobilization, medicine such as heparin because the mass is reduced and not the minerals.
- **Osteomalacia:** caused a by defect in minerals (inadequate amounts of available phosphorus and calcium, or because of overactive reabsorption of calcium from the bone as a result of hyperparathyroidism).
- Osteomalacia in children is called Rickets.

-Hallmark of arthritis is bone erosion.
-Diagnosis often depends on pattern of bone involvement (e.g. some are more proximal (Wrist + MCPs), some are more distal (IP joints).

3)Musculoskeletal tumors

Type of lesion

- **Osseous** : Sclerotic , Lytic or Mixed
- **Chondral**
- **Fibrous**
- **Soft tissue**

Key Features

- **Morphology :**
  - Pattern of bone destruction (geographic, Moth-eaten, Permeative)
  - Size , shape and margin of lesion
  - Texture of lesion matrix
  - Cortex and periosteal reaction
- **Behavior of lesion**
- **Age of patient**
- **Site (Location)**

1)Morphology

Pattern of bone destruction:

1) Geographic
2) Moth-eaten
3) Permeative

Geographic lesions
benign , sharp out line

Moth eaten
- non-homogenous
- widen margin
- transition zone is wider
- malignant

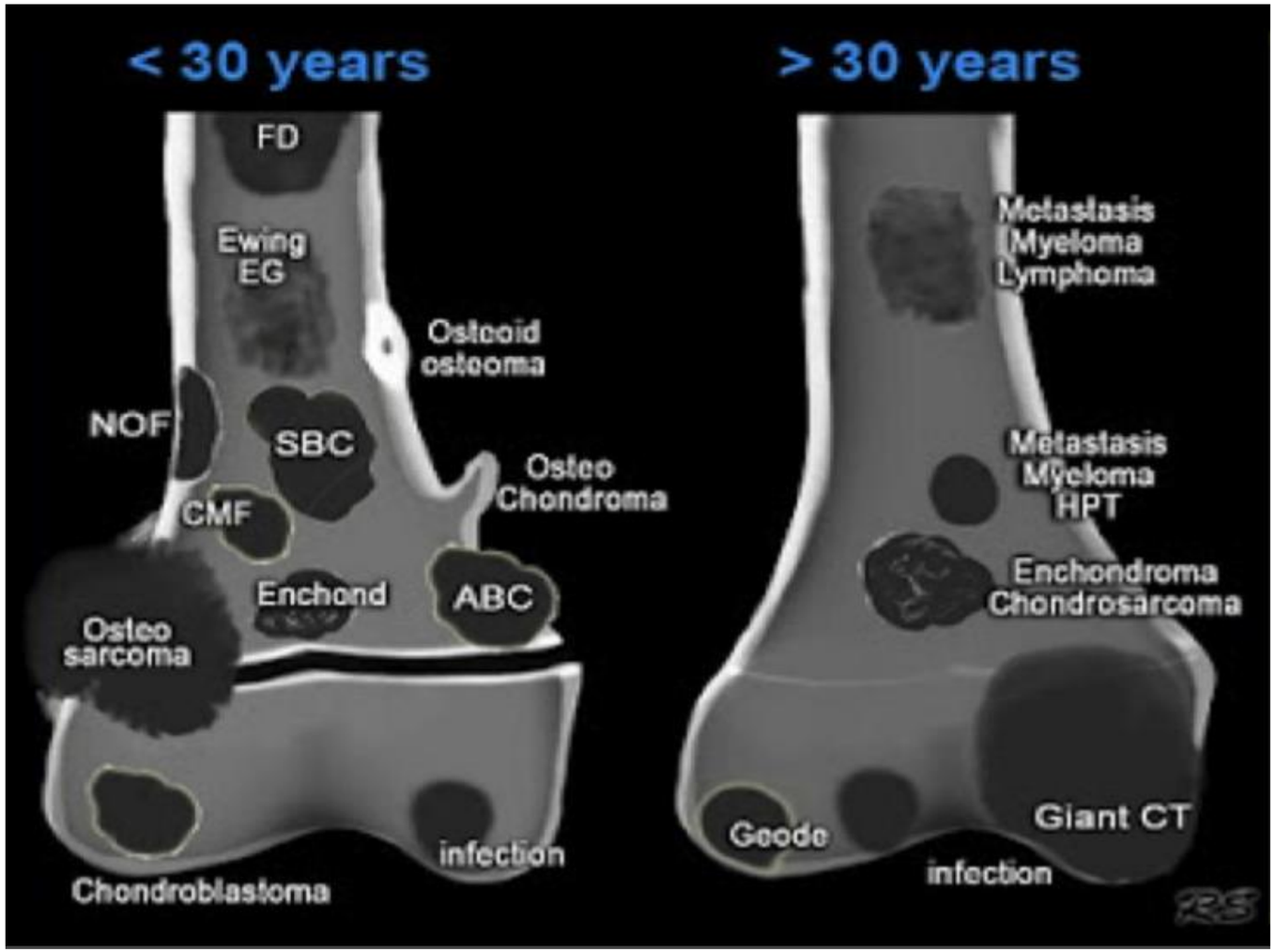
Permeative
- ill defined margins
- aggressive lesion
- wide zone transition
- aggressive malignant process or non-malignant as infection

Cont…Morphology

periosteal reaction

Periosteal reaction:
- the periosteum is intact with cortex
- looser in the pediatric
- any violation to the cortex and the bone will react to the tumor by forming callous and periosteom
- slow growing tumors allow the periosteum to grow
- periosteom will be thick
- benign

2)Age of patient



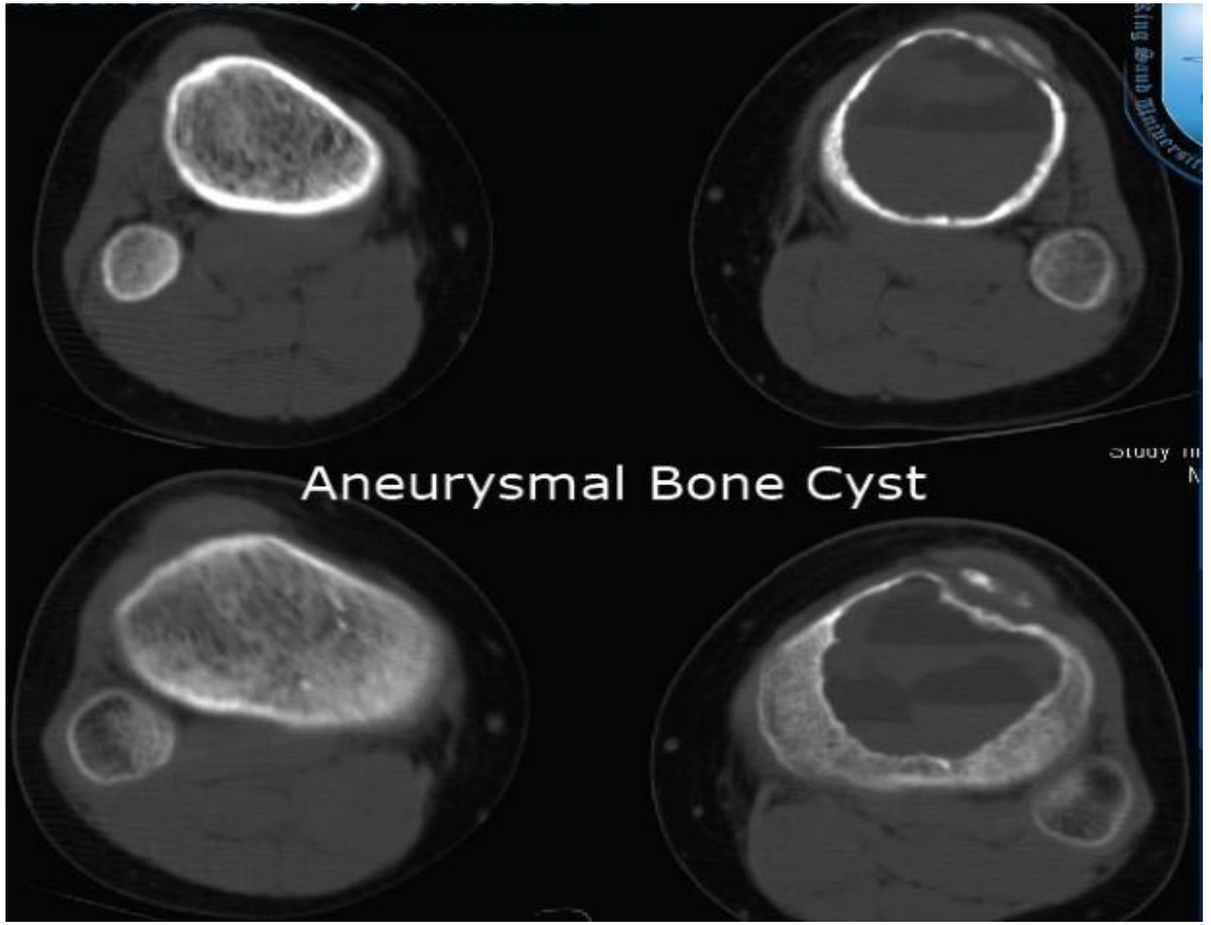
Case No.1

13 year-old boy patient presented with knee pain and swelling ,X-ray of knee requested.

- Osteolytic, Geographic (red circle) , because it is sharply demarcated it is in the metaphyseal lesion that indicates a benign lesion .
- **DDx**
- Either simple bone cyst -- > which is simple content that involve the bone and it occur in paediatrics age group and it is in the metaphyseal portion of proximal humorous or tibia ·
- Or aneurismal bone cyst (cyst that contain blood)
- The lesion was found in the X-ray but to get more details about tissue character we need CT and MRI.
- There is fluids with different densities we call it fluid-fluid level(red circle) confirms that it is an aneurysmal cyst.

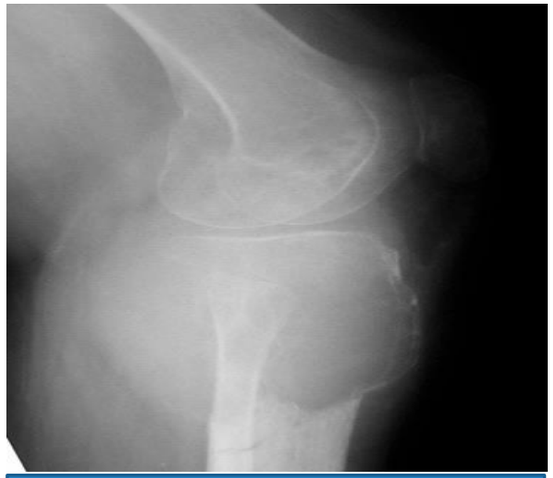
Aneurysmal Bone Cyst

continue ……Case No.1



On CT there are some spots that suggest that it contains blood > Aneurysmal bone cyst.

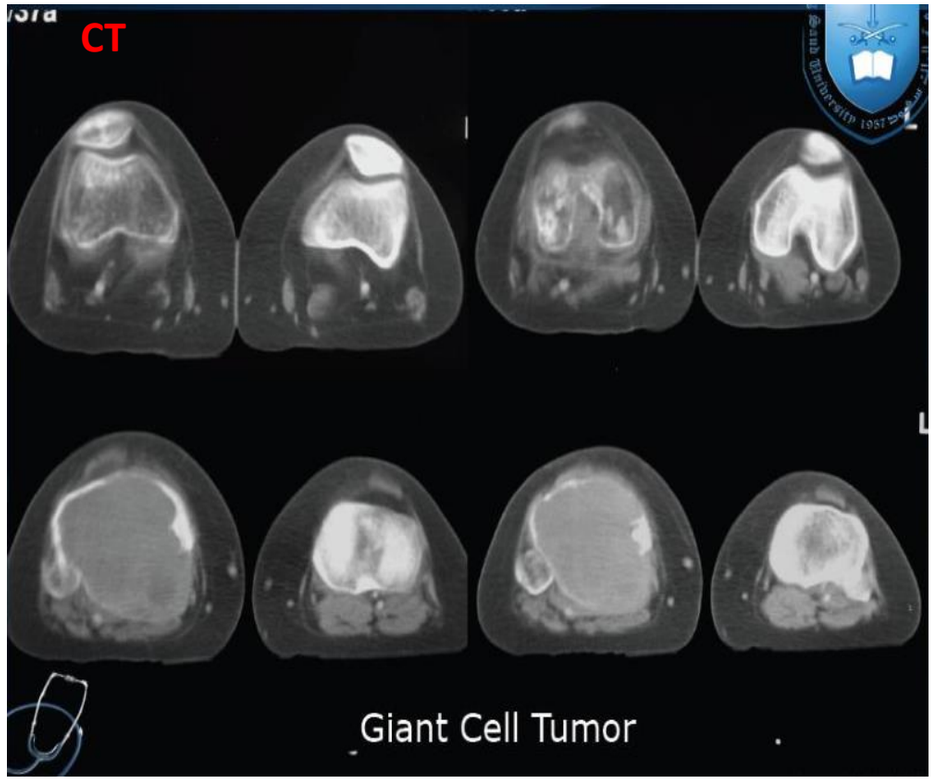
Case No.2

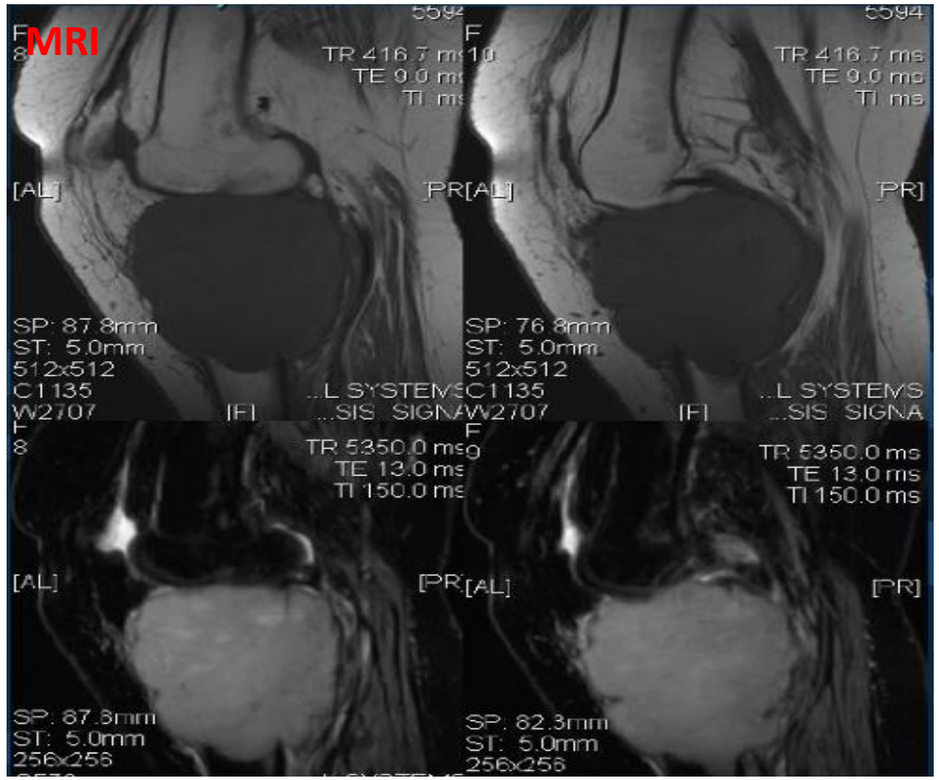


- Expansile • lytic lesion
- subarticular surface
- violated cortex
- Aggressive bone lesion

Adult patient

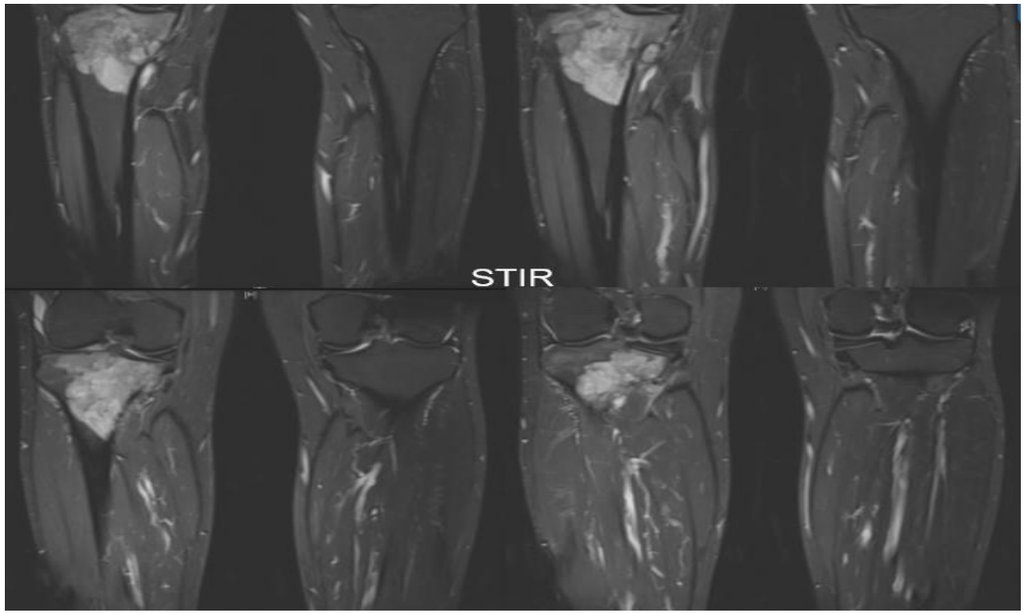
Giant cell tumor

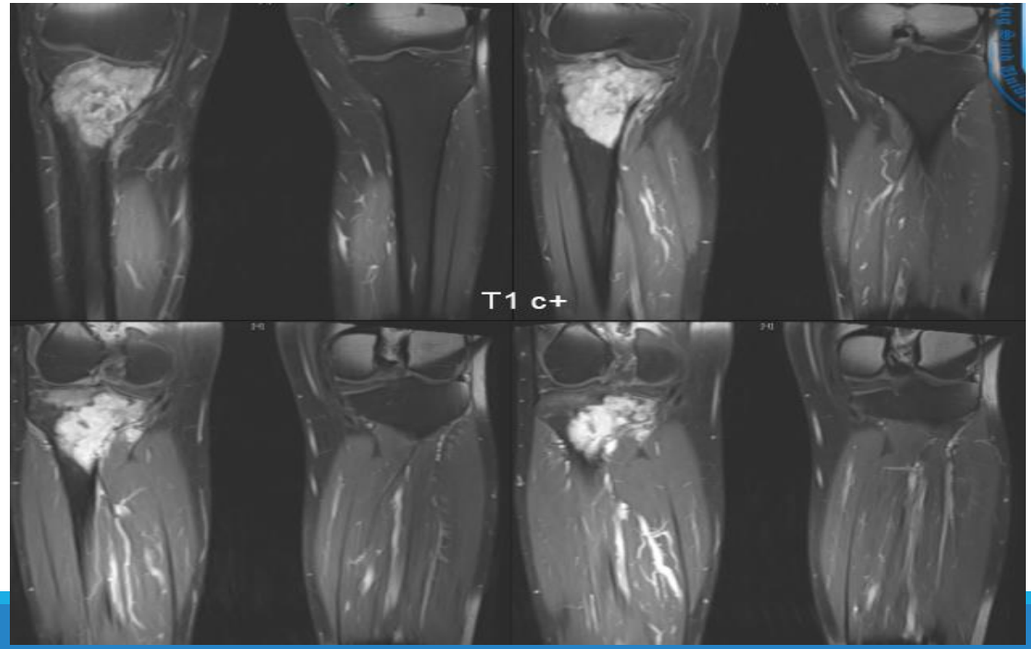




Case No.3

- Permeative pattern:
- because the margins are not clear which indicates an aggressive lesion like neoplastic or infectious lesion but it is more likely a malignant process because if it is infectious, the lesion will be all around the bone not skipped lesion like here.
- Here it is osteosarcoma and one of the deferential is(lymphoma, leukaemia, infection or sarcoma in younger patients.





Case No.4

Adult female patient presented with hand swelling , X-ray of hand requested

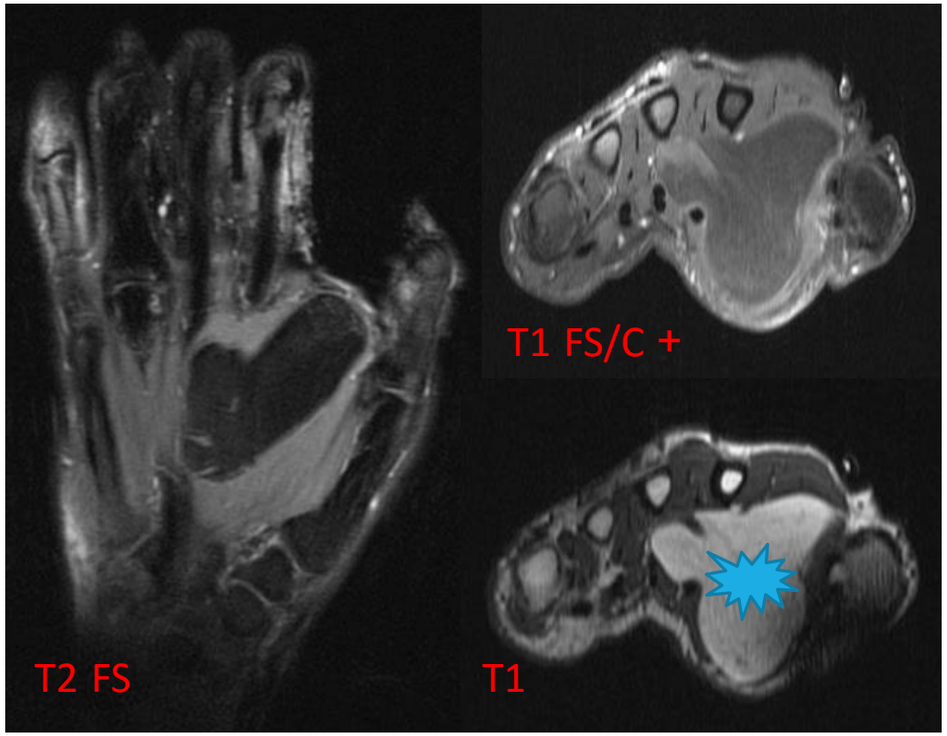
- Soft tissue swelling but no bone is disrupted, so it is only a swelling.
- This mass lesion can arise from any soft tissue structure from skin to the bone including skin, fat (red circle) , vascular structures or nerves.

❖ Deferential diagnosis :

- lipoma
- angioma
- Schwannomas
- neuromas

– After determining the deferential diagnosis we come to tissue characterization in CT scan or even better in MRI as in this image.
– In the usual MRI which is T1 will show subcutaneous fat appears white similarly the lesion is white.
– We suppressed the Fat signal in T1FS/C+ with contrast and the lesion got suppressed as well this indicates that the lesion is composed of fat.
– Soft tissue lipoma was the diagnosis

MRI or CT scan



Fluid and fat appear too bright

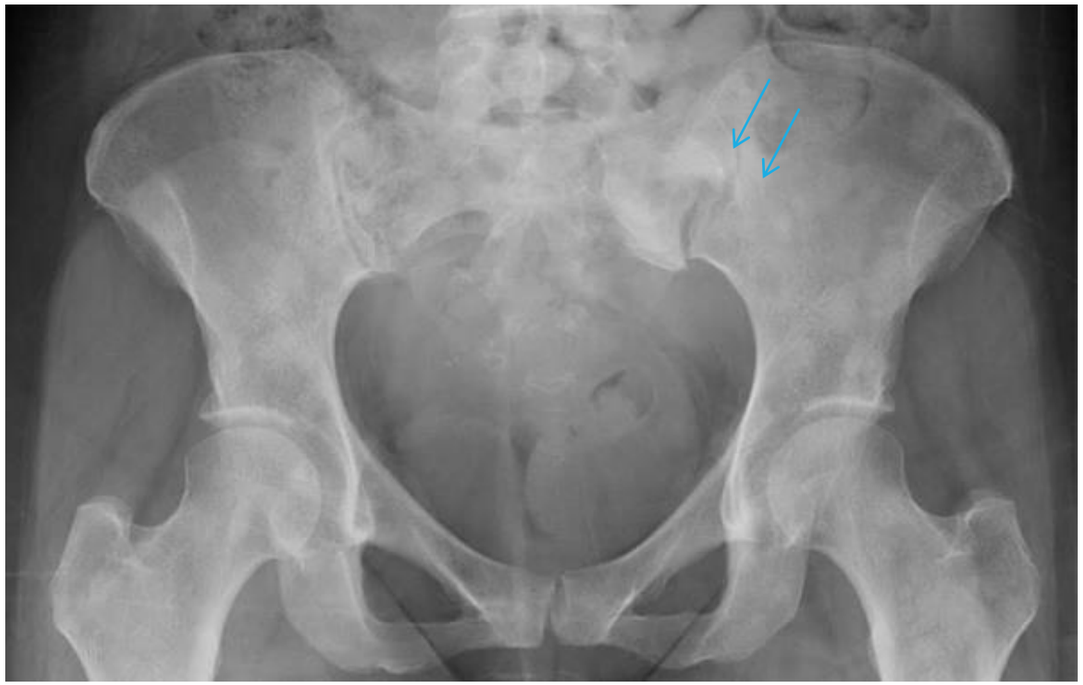
MRI is done and the lesion appeared white “subcutaneous fat” and to make sure it is a fatty lesion we asked the machine to take off the fat and the lesion became black >supports our hypotheses (lipoma(

Case No.5

57 years old female patient presented with bone ache.
Had history of breast carcinoma
DX :

- **Metastatic bone tumor from breast cancer**
- **Multiple sclerotic bone lesions suggestive of a systemic disorder rather than a localized lesion.**

❖ **Breast cancer is the most common sclerotic bone metastatic lesion in female, in male prostate cancer.**



There are patches of white areas (Osteosclerosis) which are involving the whole bone.

Thank You!

We hope you found this helpful and informative.

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