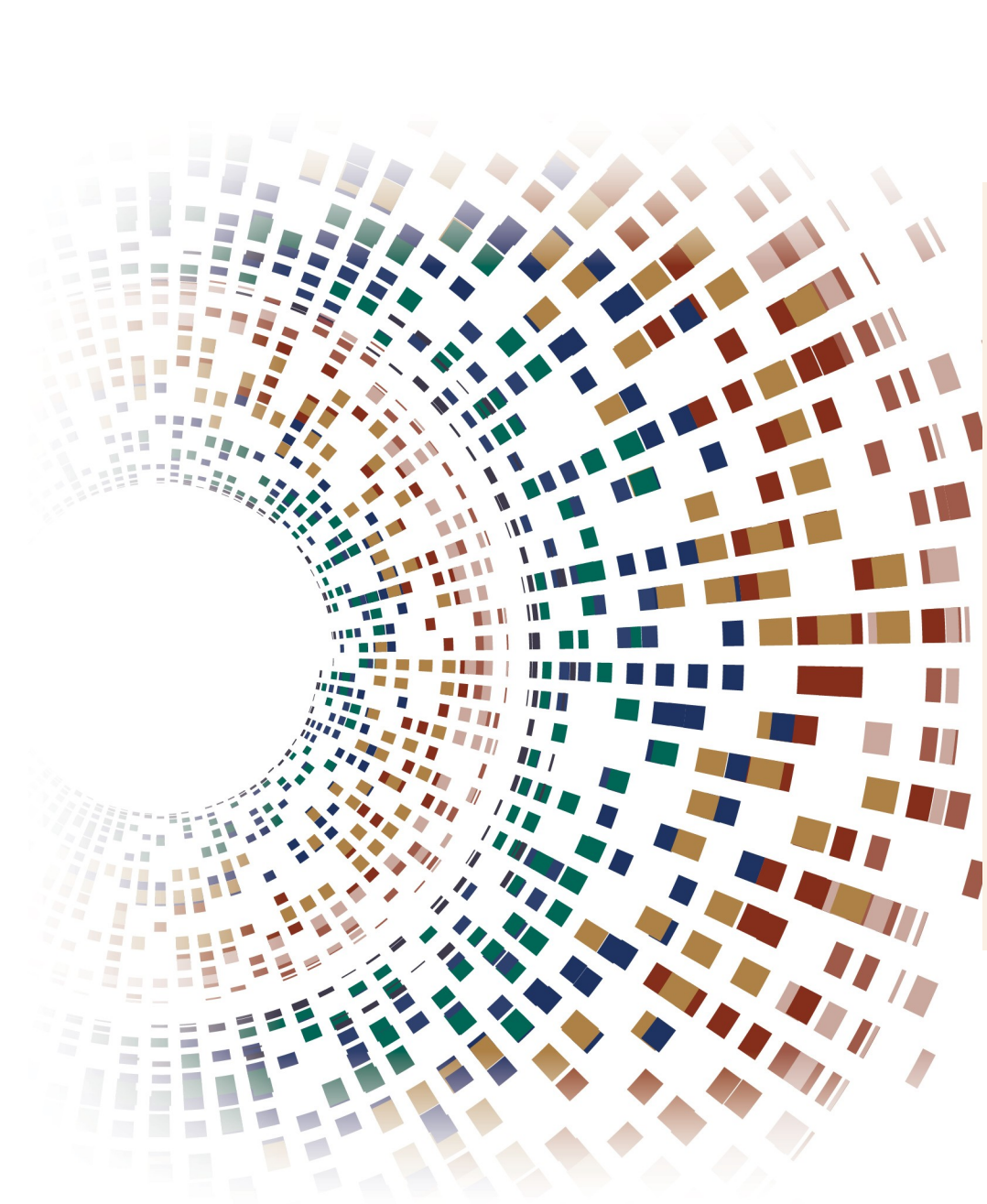


سُورَةُ الأَنبِيَاءِ

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

فَفَهَّمْنَاهَا سُلَيْمَانَ ۚ وَكُلًّا آتَيْنَا حُكْمًا وَعِلْمًا ۚ وَسَخَّرْنَا
مَعَ دَاوُودَ الْجِبَالَ يُسَبِّحْنَ وَالطَّيْرَ ۚ وَكُنَّا فَاعِلِينَ ﴿٧٩﴾

M.S.K.

Case (1)

History: Routine chest x-rays for a 65-years-old woman

Multiple myeloma

In this case:
Multiple lytic lesions in both clavicles + pathological fracture of the RT 6th posterior rib + multiple lucent lesions throughout the skull giving "raindrop skull" appearance

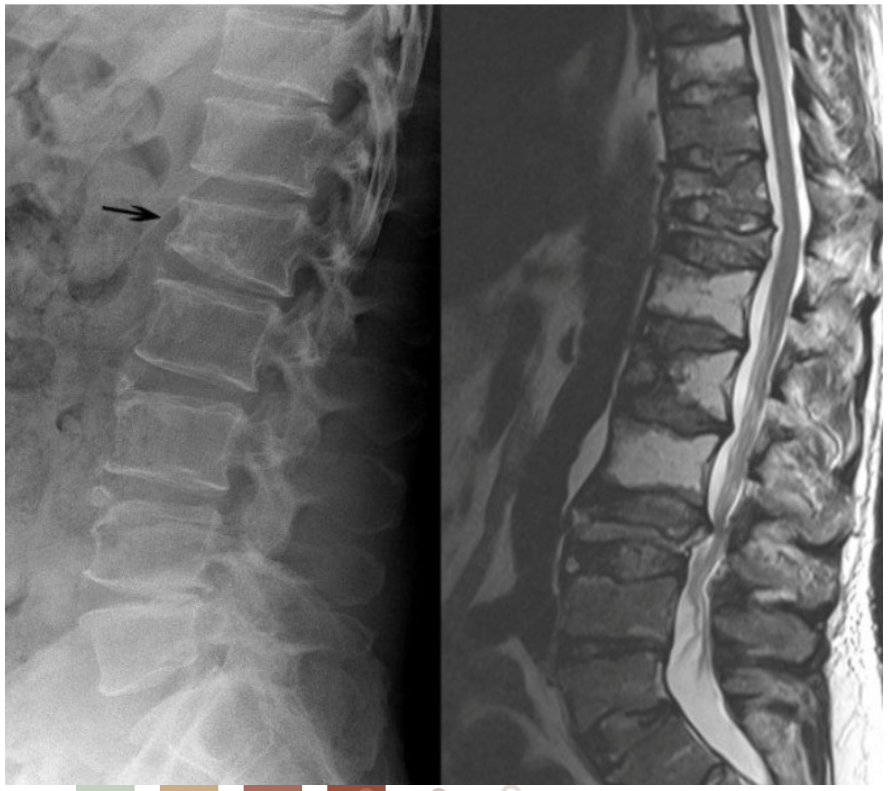
Distribution: Vertebrae (most common), ribs, skull

Purely lytic, sharply defined/ punched out

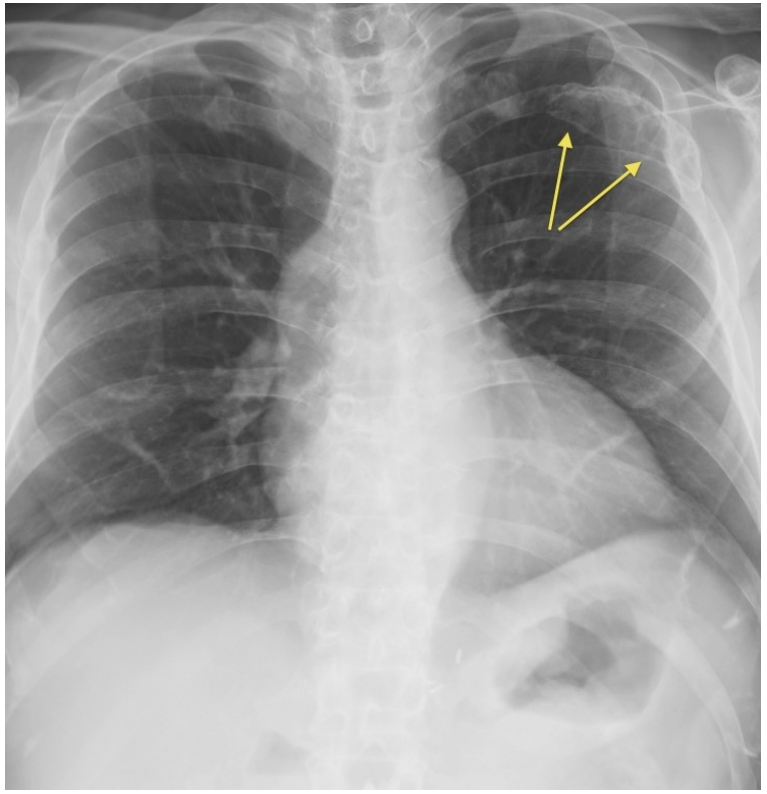
Pathological fracture is common

DD: Metastases:

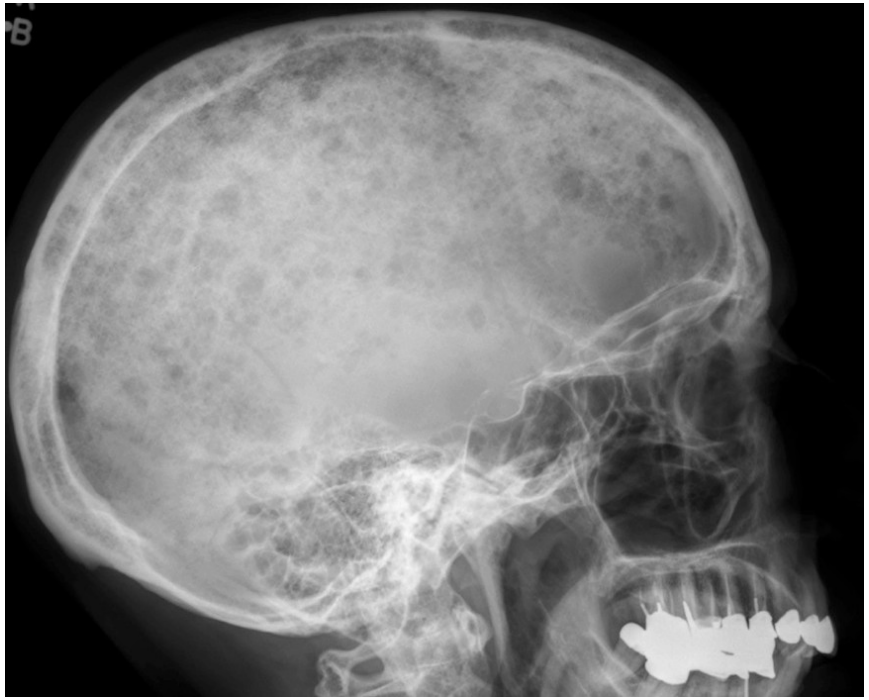
History + lytic lesions in the mandible more with MM



NB: Multiple skull lesions in a child:
EG
Epidermoid cyst
Tumors (Leukemia/Ewing/Mets from neuroblastoma)
Infection (OM)
Leptomeningeal cyst



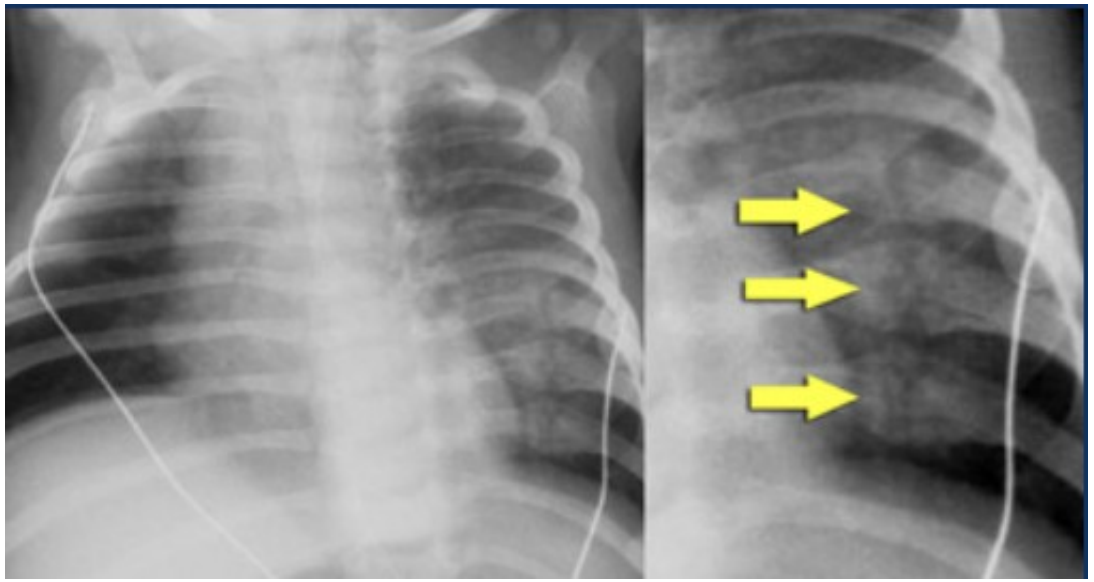
Posterior rib fracture in a child
Think of NAI (child abuse), also look for metaphyseal corner fracture and multiple fractures of different ages



Raindrop skull

Child abuse

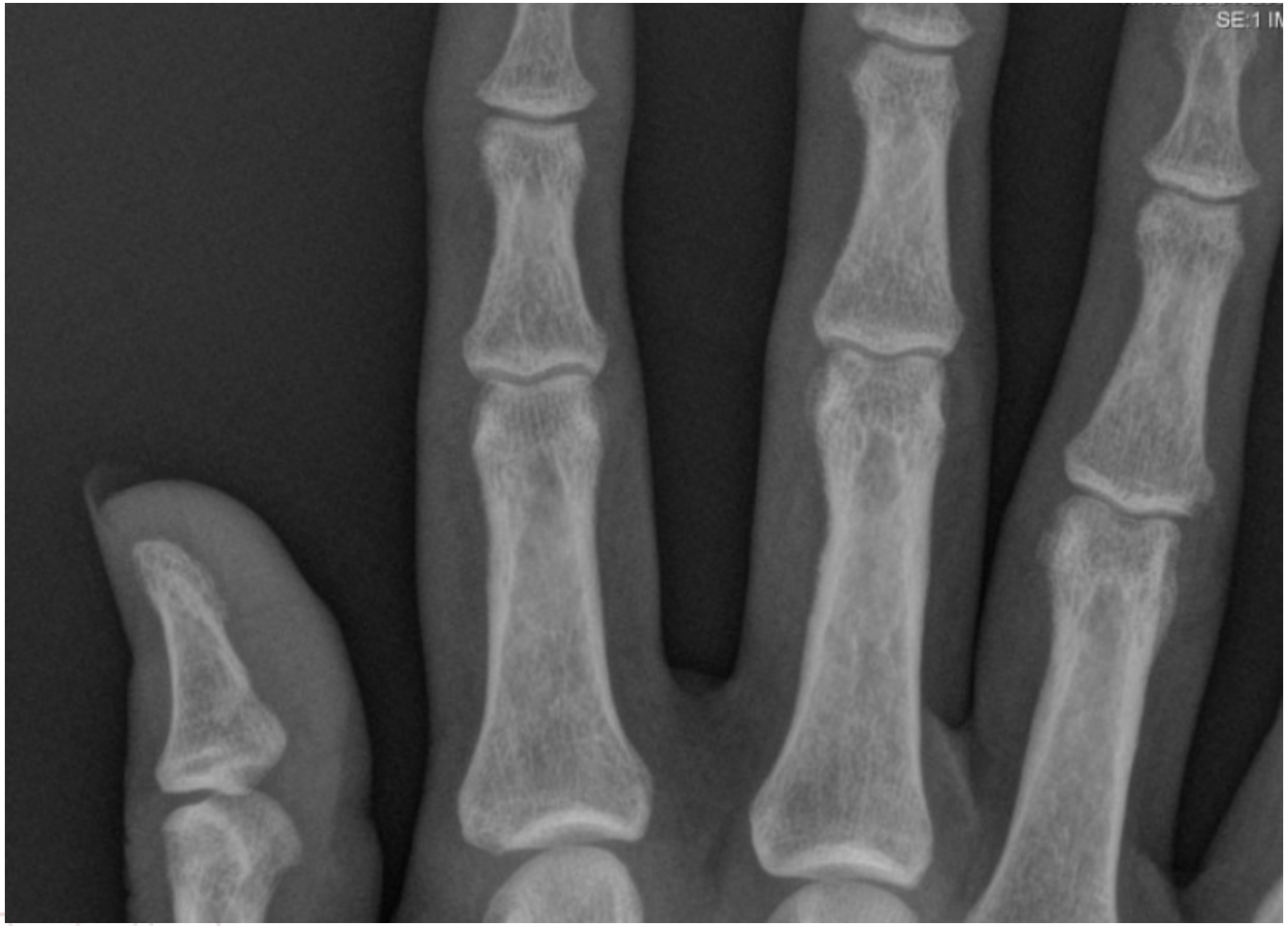
Metaphyseal corner fracture
Posterior rib fracture



High specificity	Classic metaphyseal lesion
	Rib fractures, especially posterior
	Scapular fractures
	Spinous processes fractures
	Sternal fractures

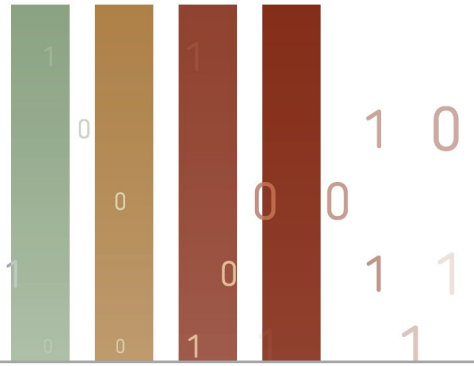
Case (2)

History: A 60-years-old man with chronic renal failure



Hyperparathyroidism

HPT = Osteopenia



DD Acro-osteolysis

1-HPT
2-Psoriasis
3-Scleroderma
4-Thermal injury
5-Phenytoin
6-Juvenile idiopathic arthritis

Skull: Salt & pepper (due to trabecular resorption)

Hands: Subperiosteal resorption of the radial aspect of the 2nd & 3rd middle phalanges + acro-osteolysis + brown tumors

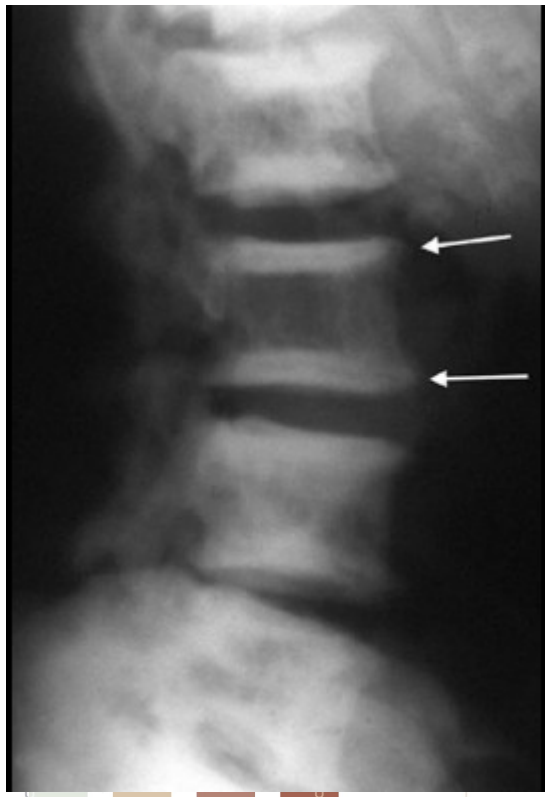
Spine: Rugger jersey spine (prominent endplate densities at multiple contiguous vertebral levels to produce an alternating sclerotic-lucent-sclerotic appearance)

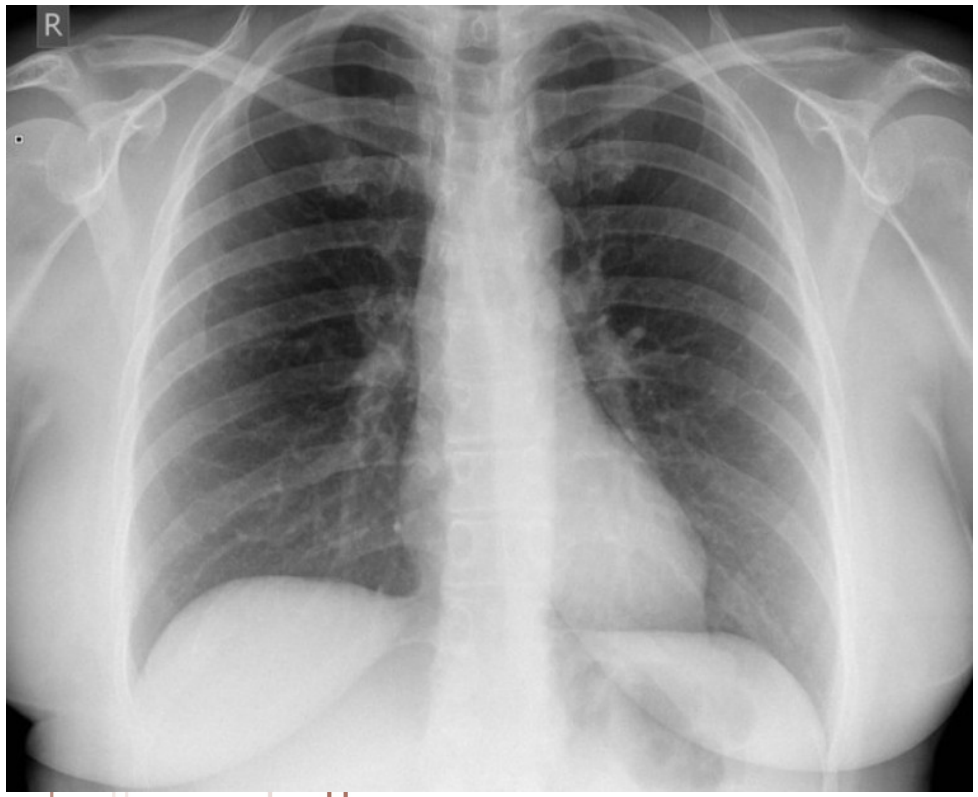
Clavicle: Subperiosteal resorption of the distal aspect (DD: traumatic/ RA/ Infection/ scleroderma)

Brown tumor any where

Every where>> Diffuse osteopenia

Hand: Subperiosteal resorption + acro-osteolysis + brown tumors + osteopenia

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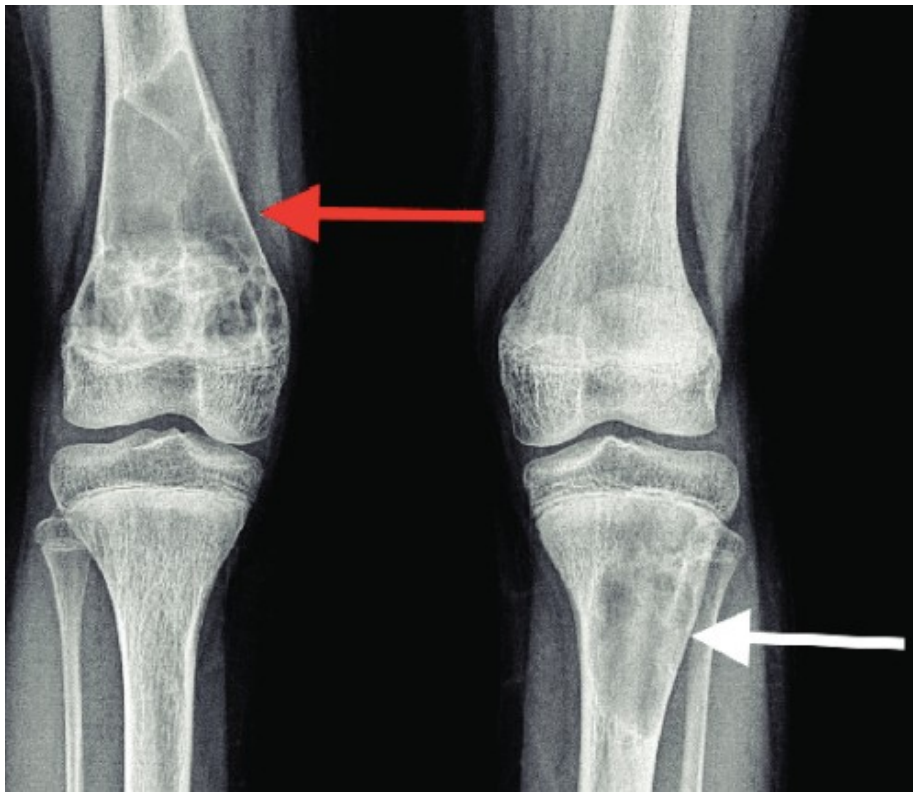


Case (3)

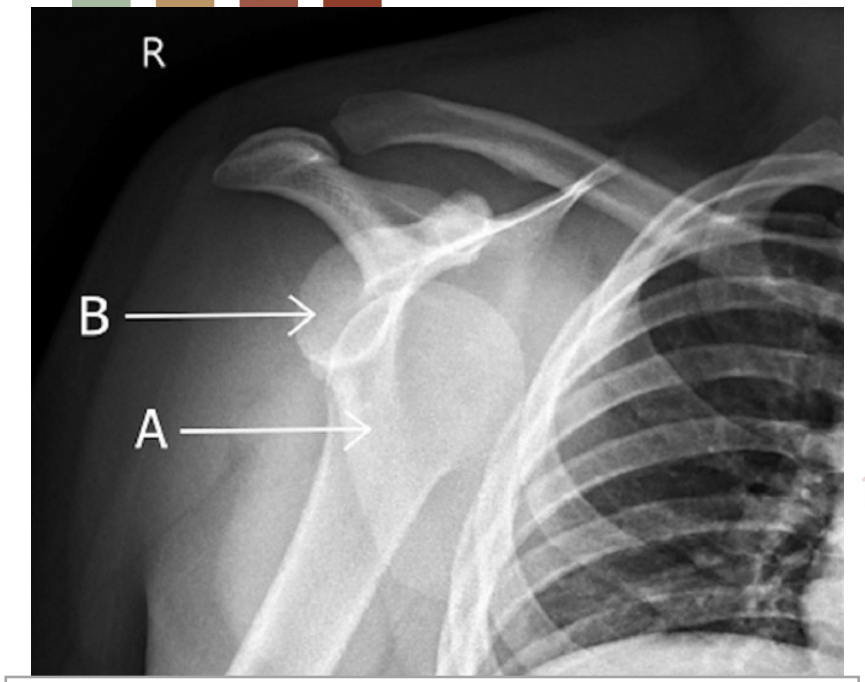
History: Withheld

Anterior shoulder dislocation

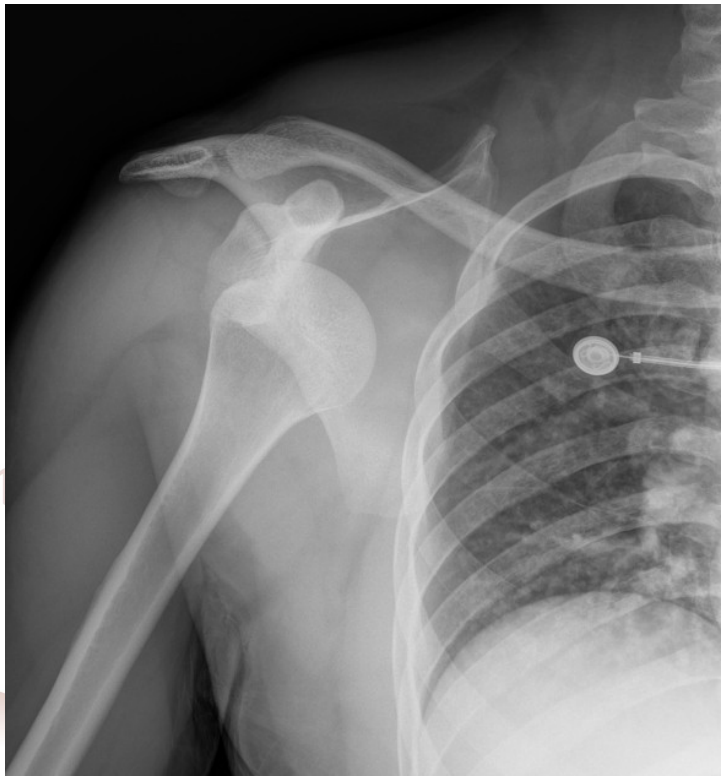
Most common type

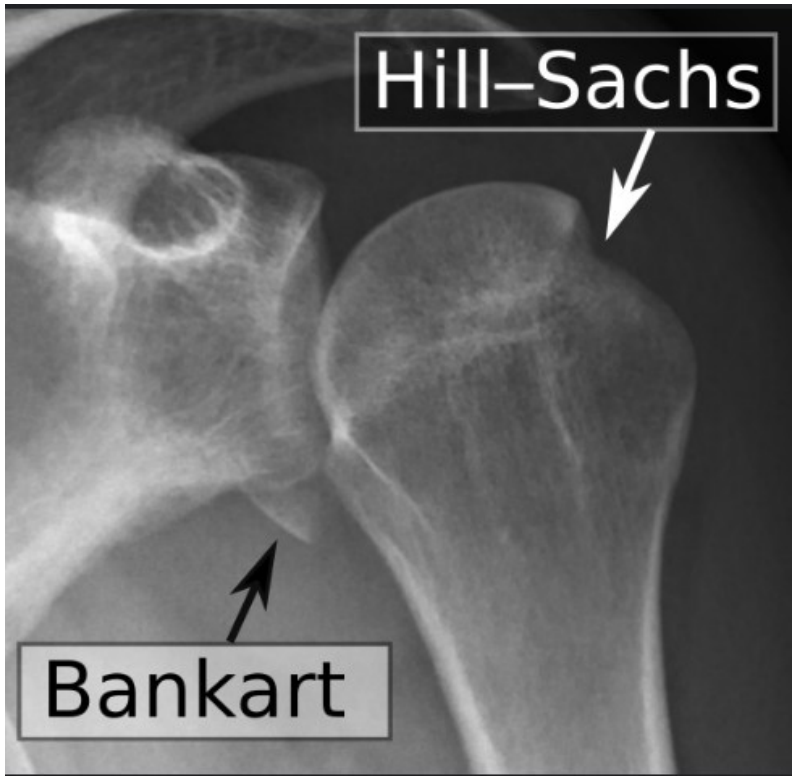
Direct force on the arm

Posterolateral humeral head (Hill sachs) strikes the anterior glenoid (bankart lesion)



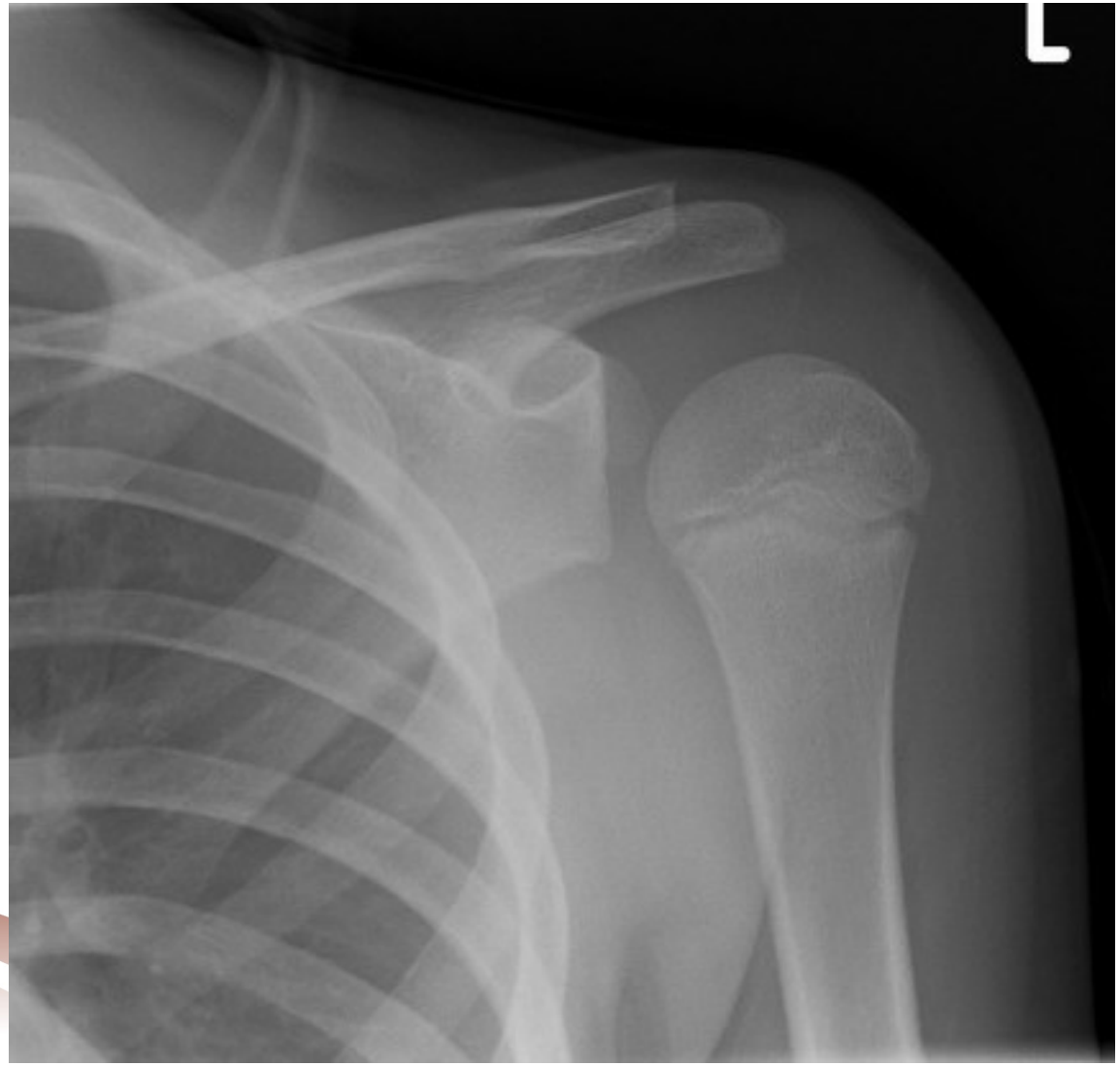
The head of the humerus (A) is dislocated anterior to the glenoid (B)



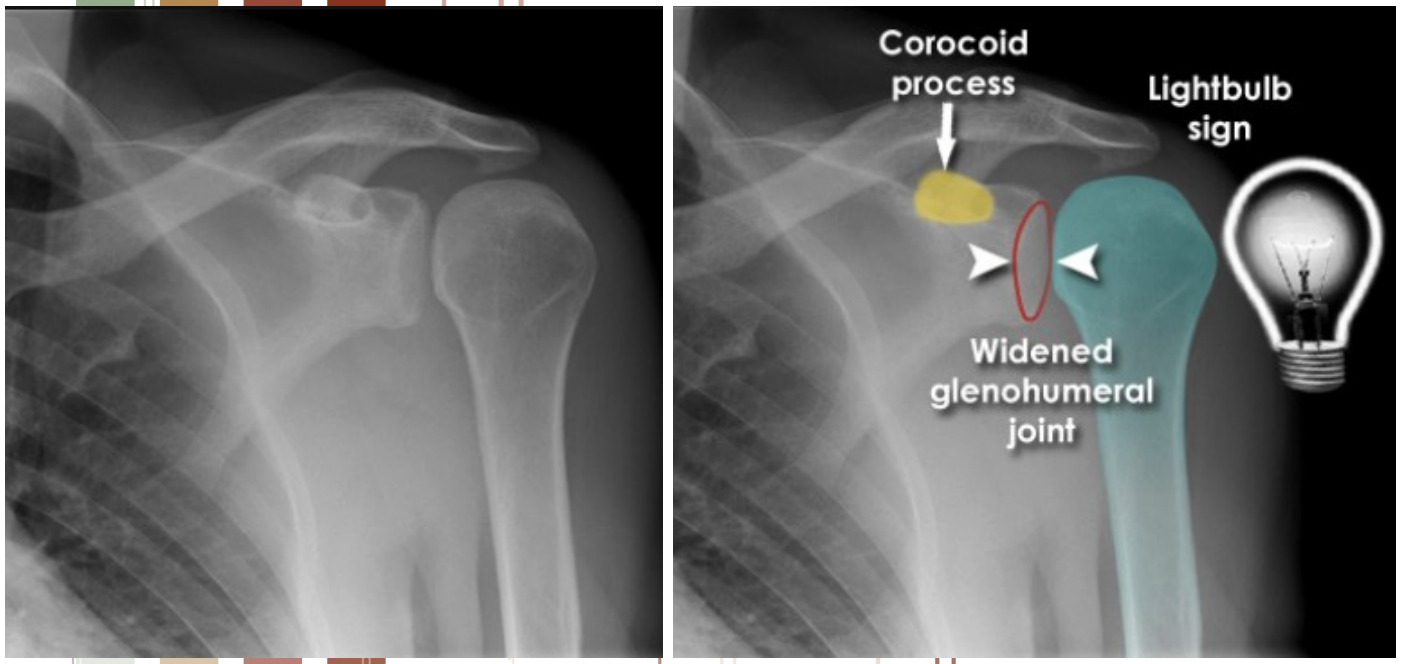


Case (4)

History: Withheld



Posterior shoulder dislocation



Light bulb sign

2-3%, seizures or electrocution (severe muscle spasm)

Signs:

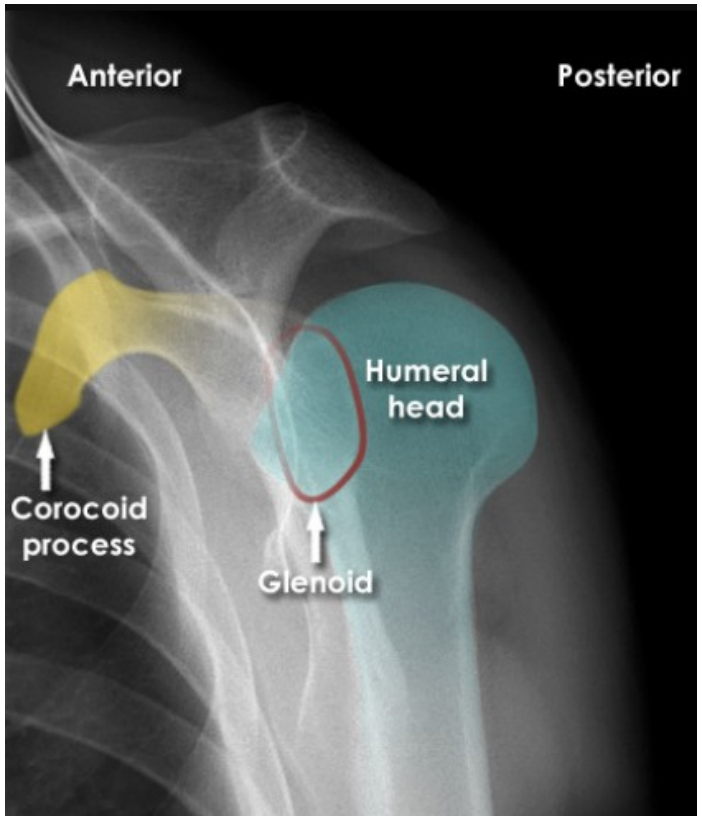
Light bulb sign (head of the humerus in the same axis as the shaft)

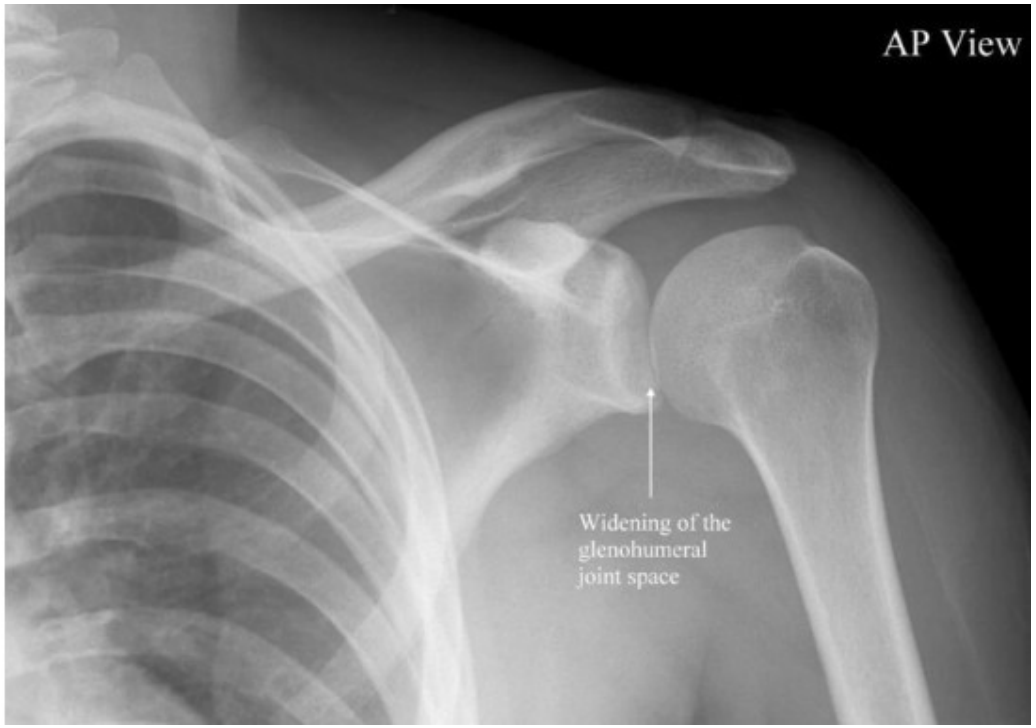
Trough sign (reverse hill sachs, anteromedial humeral head)

Rim sign (↑ ↑ distance between medial humeral head & glenoid > 6 mm)

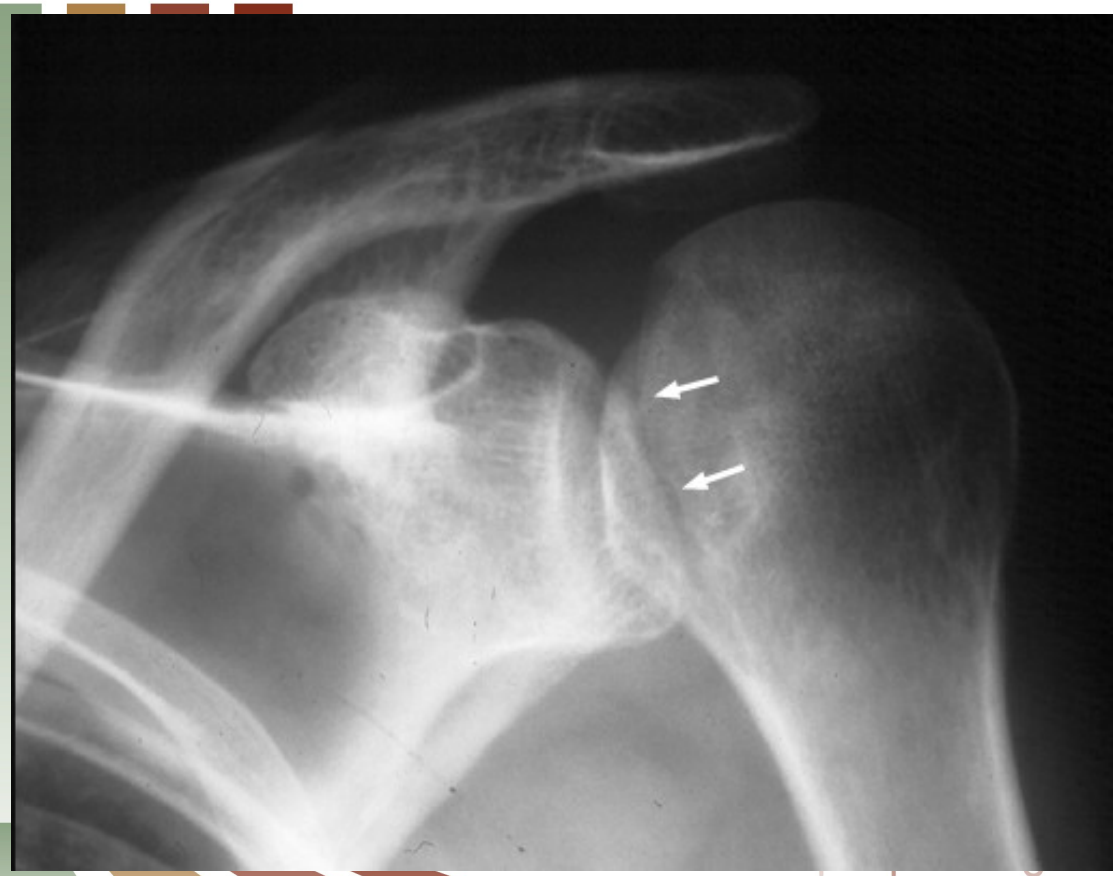
Reverse bankart lesion (posterior glenoid)


Anterior
Posterior


Anterior
Posterior
Humeral head
Corocoid process
Glenoid


AP View
Widening of the glenohumeral joint space

Rim sign



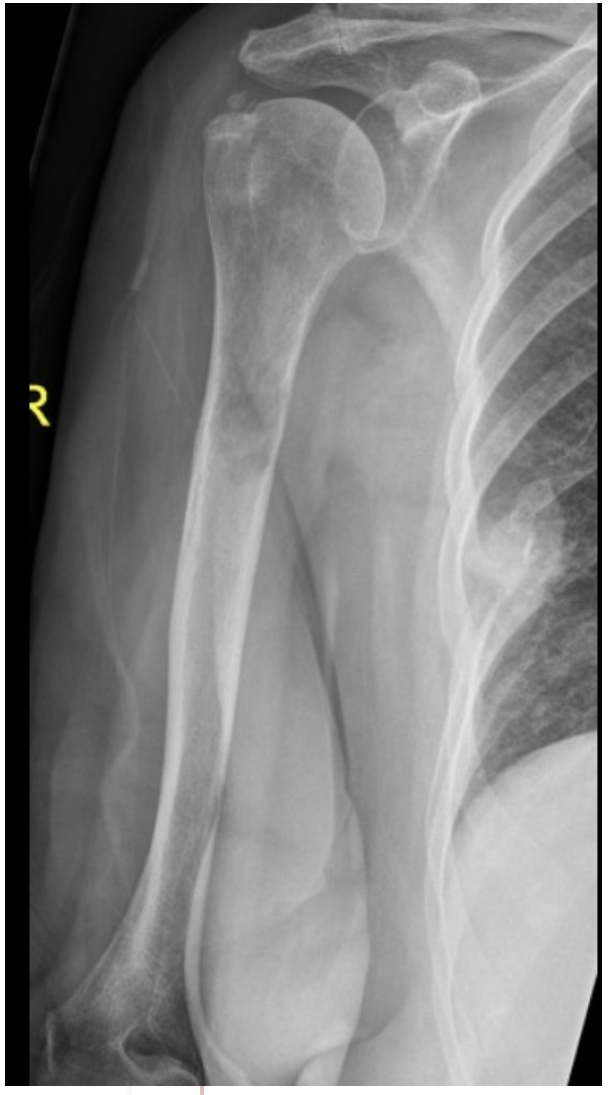
Trough sign

Case (5)

History: A 55-years-old man with left shoulder pain and swelling

Destructive lesion in the left humerus + pathological fracture

ill-defined lytic lesions of the left glenoid and proximal humerus with the focal loss of the cortex at the humerus head and irregularity of the glenoid inferior cortex



Lytic lesion demonstrated at the junction of the proximal and middle thirds of the humerus + soft tissue mass with associated bony destruction is noted at the posterior aspect of the right 6th rib

DD

Old age:

MM

Mets

Infection

Young age:

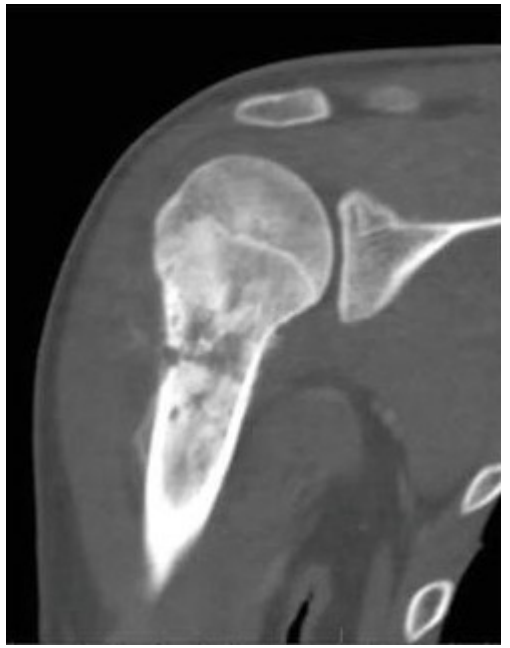
Ewing sarcoma/Osteosarcoma

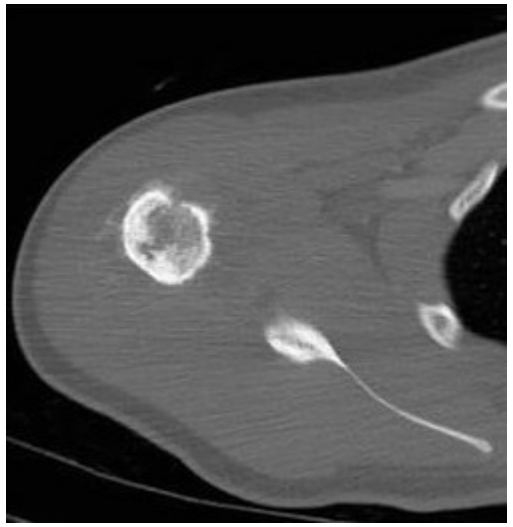
Infection

EG

1ry bone lymphoma


R

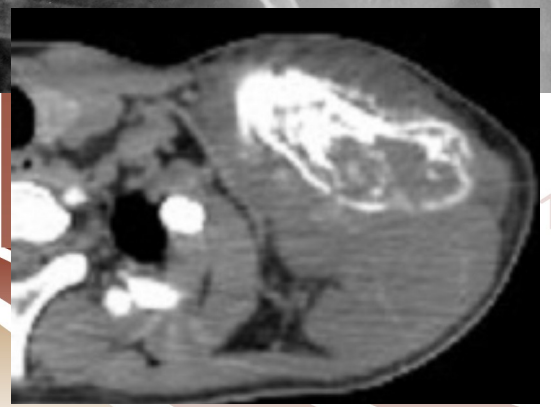




Case (6)

History: A 13-years-old boy with left shoulder pain and swelling

Aggressive lesion in the clavicle of a young patient



Ewing sarcoma

Ewing sarcoma

Age: 10-20 years

2nd malignant tumor after OS

Pain/ stiffness or swelling

Intermittent pain worsens at night

Diaphysis/ metadiaphysis of long bone (femur)

Flat bones (pelvis)

Permeative + onion skin periosteal reaction

Fever & weight loss = mets

20% of patients present with mets

DD

Ewing sarcoma

Osteosarcoma

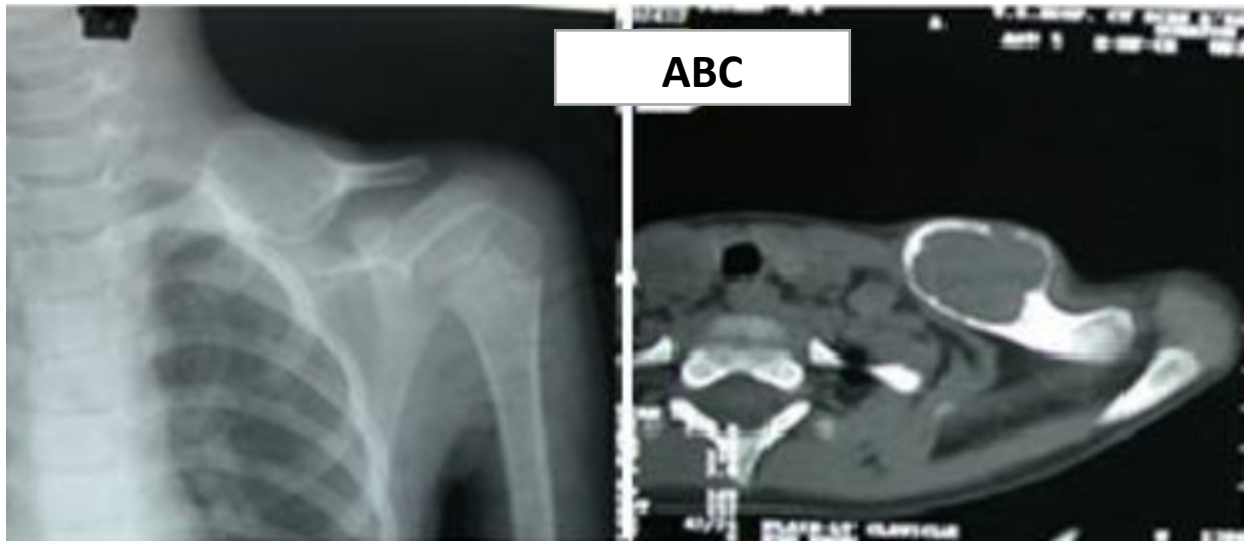
EG

OM

Lymphoma

Mets

ABC



ABC

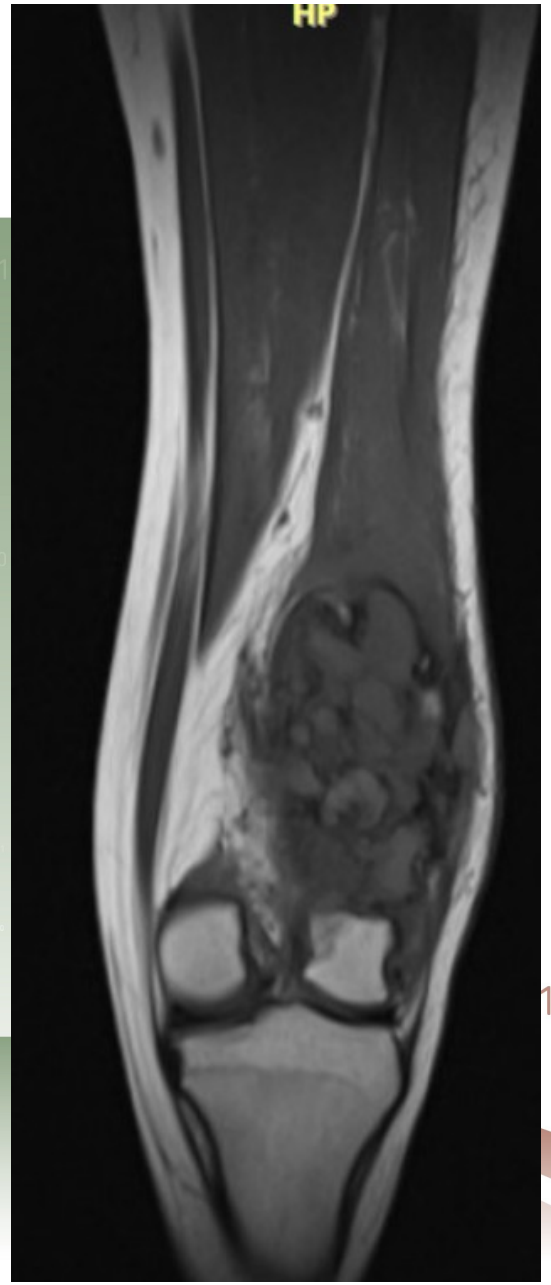
OS

OM

Case (7)

History: A 14-years-old girl with a lower limb mass

Next step?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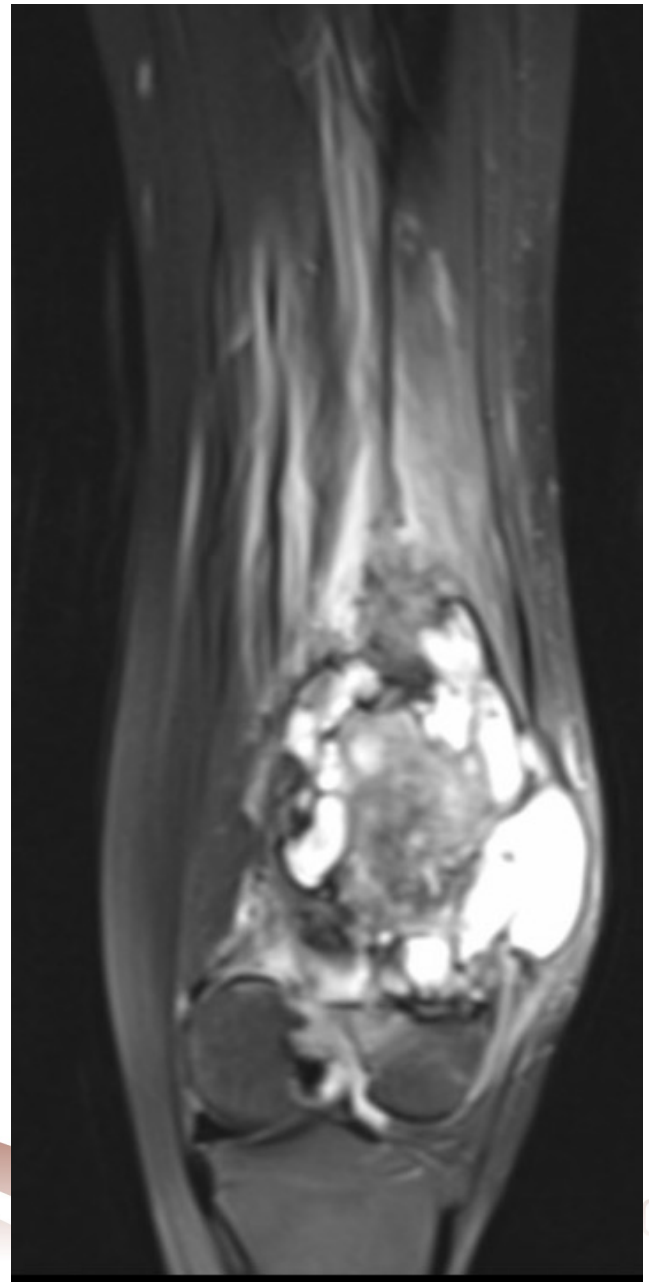
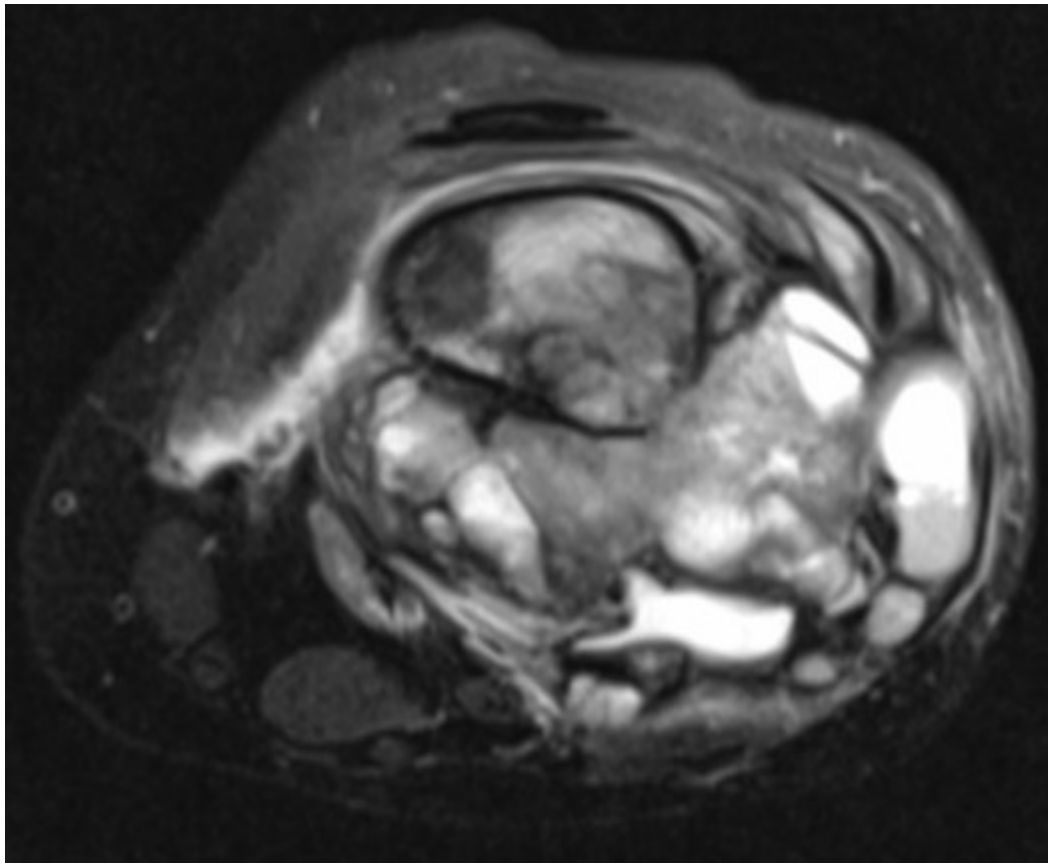
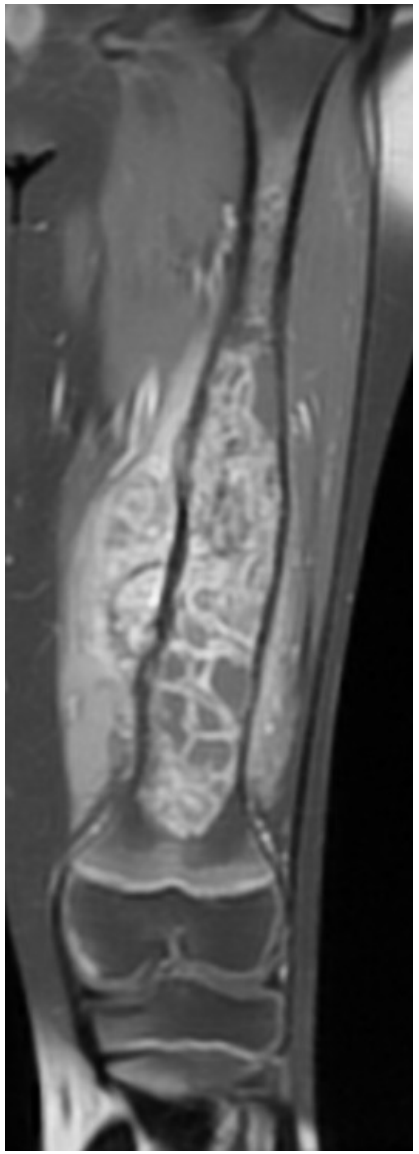




Telangiectatic osteosarcoma



Location: Metaphyses of long bones (distal femur most common)

X-rays: Geographic bony destruction with a wide zone of transition +/- pathological fracture

MRI: Fluid-fluid levels within the lesion + soft tissue component

DD:

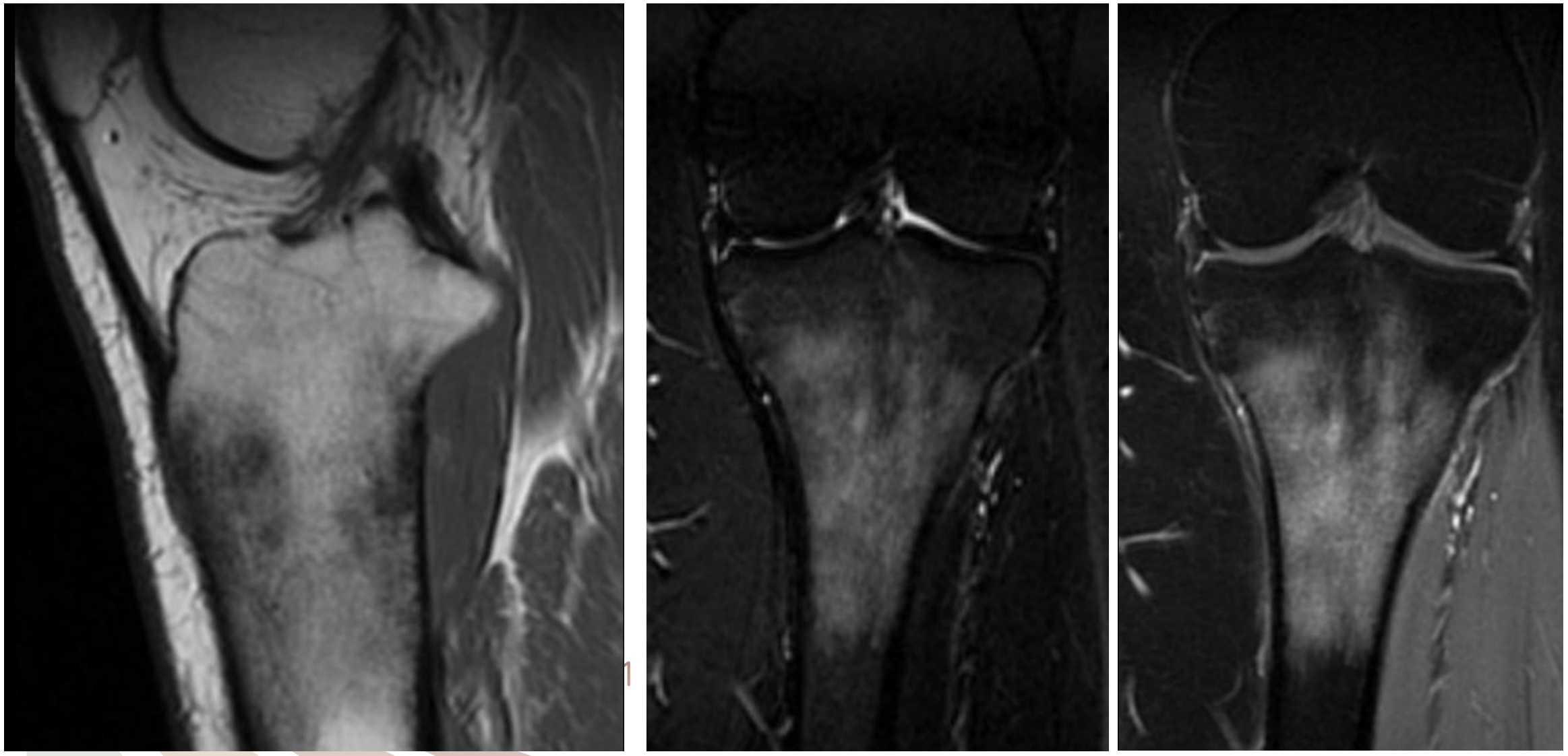
ABC (no soft tissue component + narrow zone of transition)

GCT (no soft tissue)

Mets (from RCC)

Case (8)

Next step?



Osteomyelitis

Thick solid periosteal reaction about the femur (arrows), anterior abscess (star) on the lateral radiograph

In this case:

X-rays: Lytic lesion in the metaphysis (red arrow) with periosteal reaction (green arrow)

DD: Aggressive bone lesion in a young patient (OM, Ewing sarcoma/Osteosarcoma, EG, 1ry bone lymphoma)

MRI: Diffuse marrow hyperintensity on STIR, more patchy, hypointense areas on T1, diffuse contrast enhancement

STIR is the best sequence for bone marrow changes

Signs favoring OM:

Solid periosteal reaction

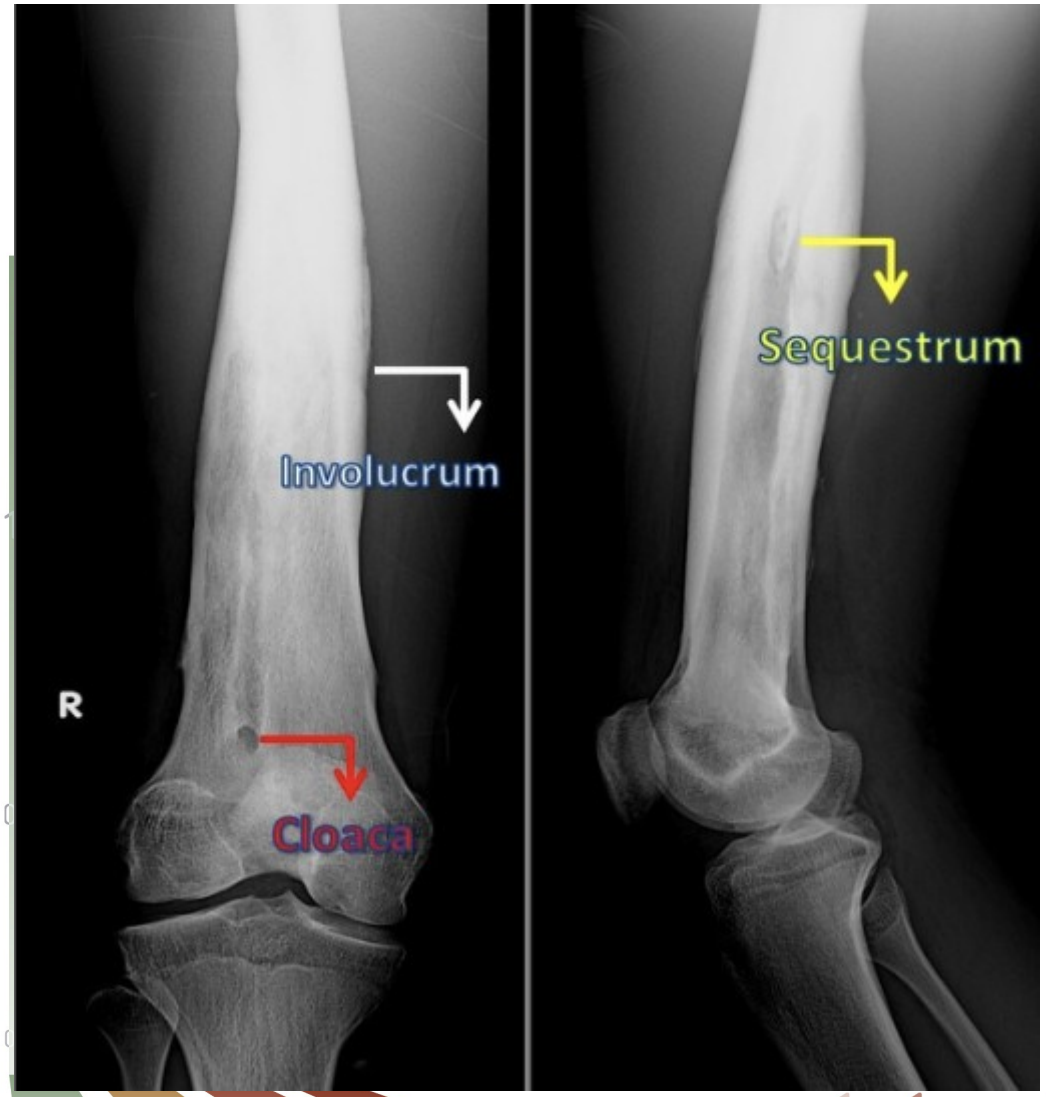
Bony sequestrum (sclerosis)

Cloaca: lucent + sinus tract from cloaca to the skin

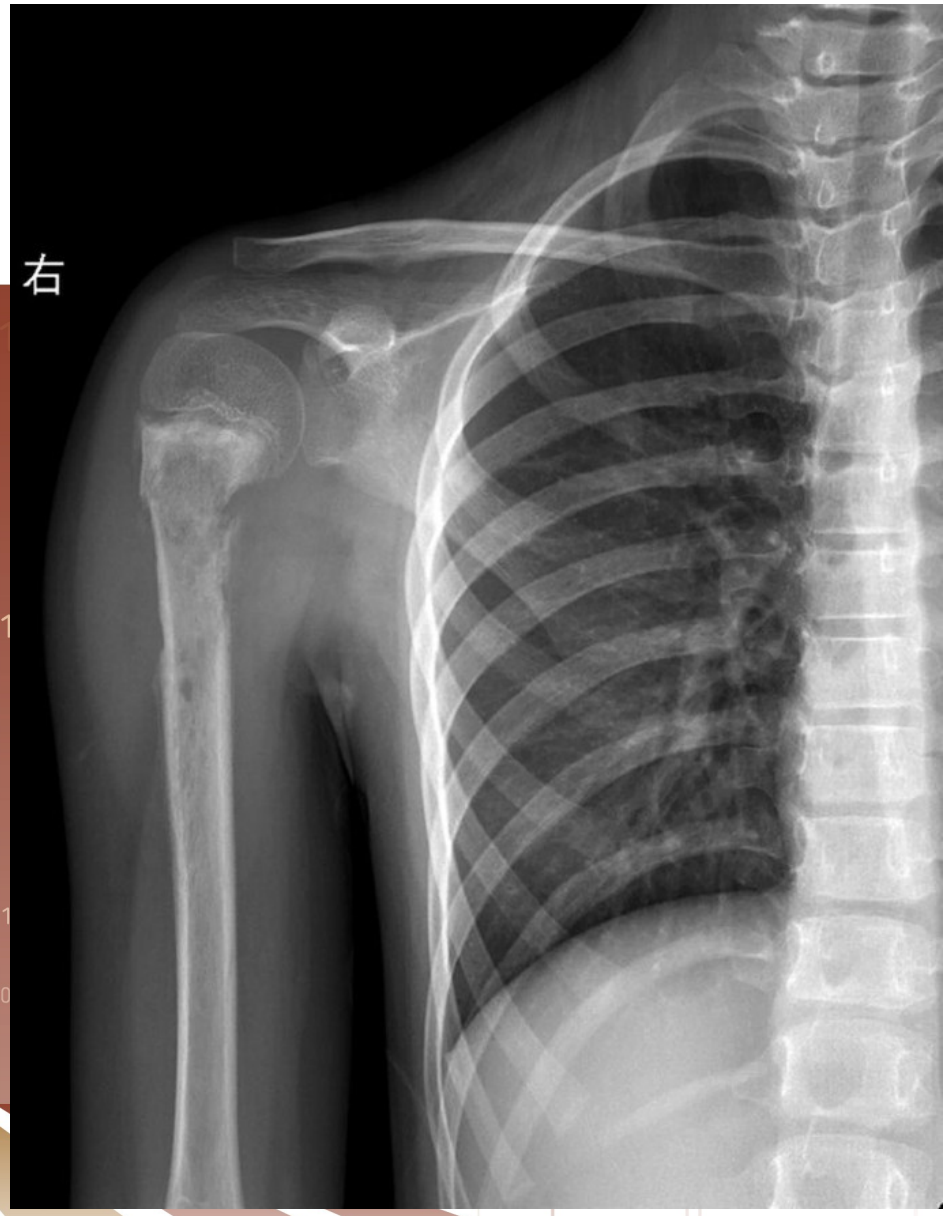
Involcurum: periosteal reaction

Soft tissue abscess

Skin sinus



Sclerosis of the femoral diaphysis with expansion cortical irregularity, centrally is a well defined sclerotic ossific fragment with a lucent surrounding rim (sequestrum)



11-year-old girl presented with redness and swelling of her right upper arm with pain
X-rays shows bony destruction of the right proximal humerus with interrupted periosteal reaction, there is associated secondary pathological fracture for DD as before

Biopsy in OM:

Biopsy is the gold standard for diagnosis of OM

When the patient is clinically stable, delay antimicrobial treatment until the biopsy is performed

Aspiration of the purulent material then send for culture & sensitivity

CT guided biopsy is performed using Trucut needle for histopathology

Open approach is ideal

Treatment:

IV Antibiotics

In case of chronic OM >> drainage &/ or surgical debridement

Amputation in case of life threatening infection

Case (9)

History: A 30-years-old woman with chronic pain at multiple joint

Bone infarction (osteonecrosis)

Seen around knee joint

Medullary lesion

Symmetrical &/ or multiple infarcts

X-rays: Sclerotic serpiginous border

MRI: sclerosis (Low in T1& T2), double line sign in T2 (T2 hyperintense granulation tissue adjacent to dark T2 signal reflecting sclerosis)

Causes:

1-Sickle cell anemia

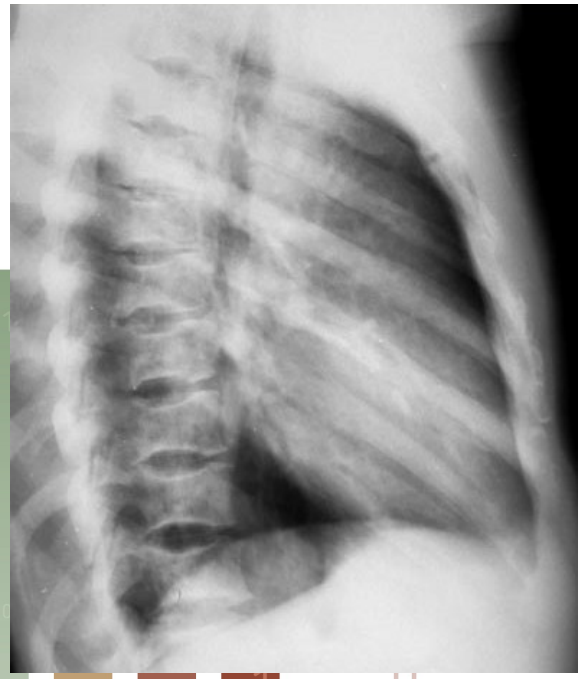
2-Steroids

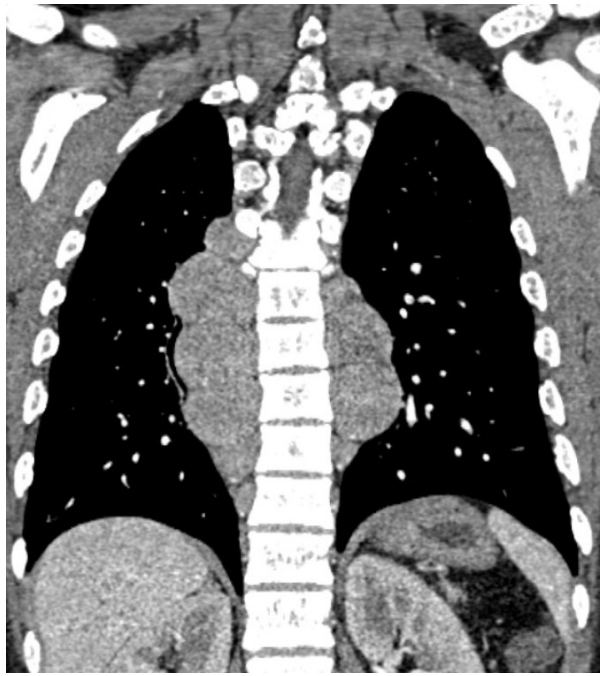
3-Trauma

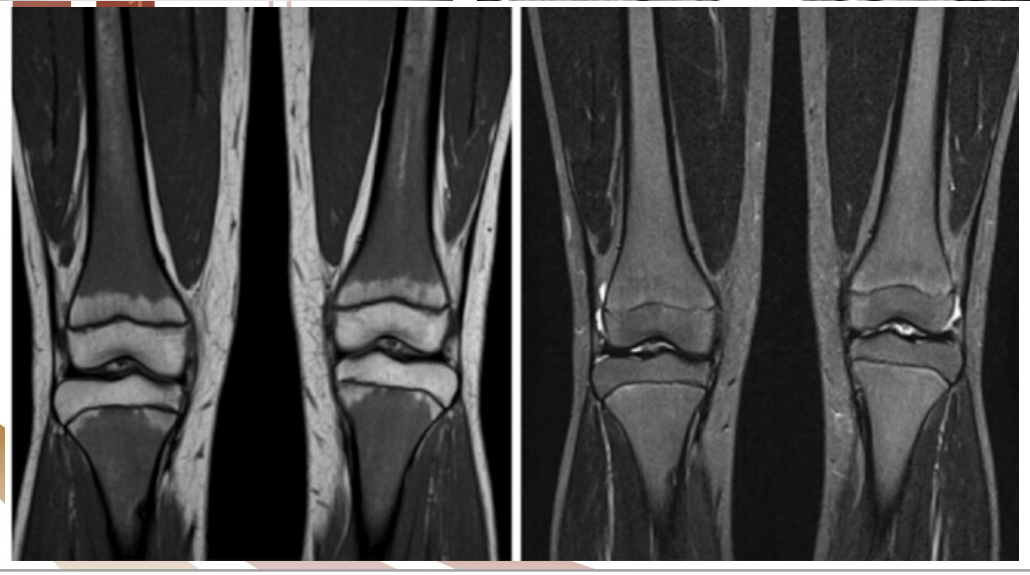
4-Caison disease

5-Radiotherapy

6-Renal transplantation







Red bone marrow conversion:
Low in T1, remains hyperintense in STIR in comparison to the muscles, so this is BM conversion not infiltration (infiltration won't suppress)

Osseous manifestations of SCD:

1-Bone infarction

2-Avascular necrosis (femoral head, humeral head)

3-H-shaped vertebrae

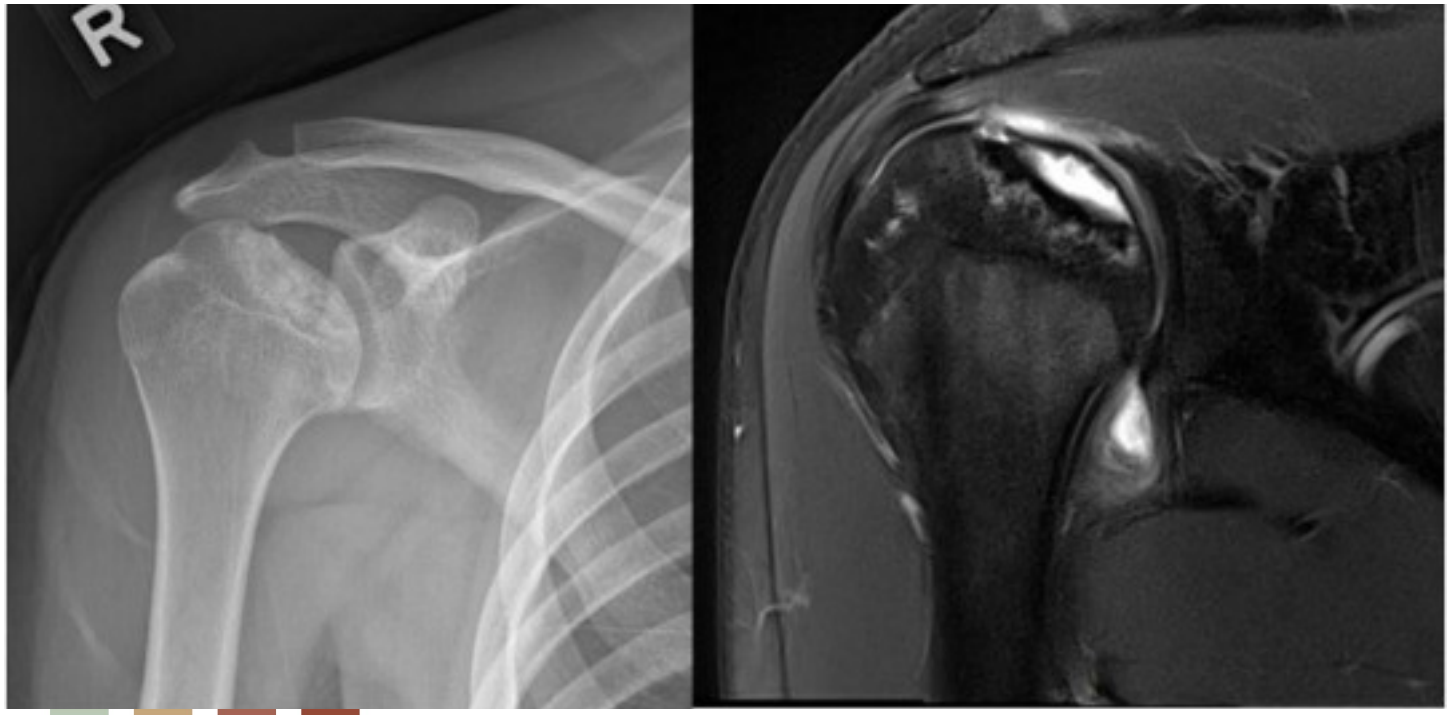
4-Extramedullary hematopoiesis

5-Vertebral OM/ Discitis

6-Red bone marrow conversion

7-Skull: Hair on end appearance

8-Iron overload (Hemosiderosis from multiple blood transfusions, iron in liver/ spleen/ bone marrow)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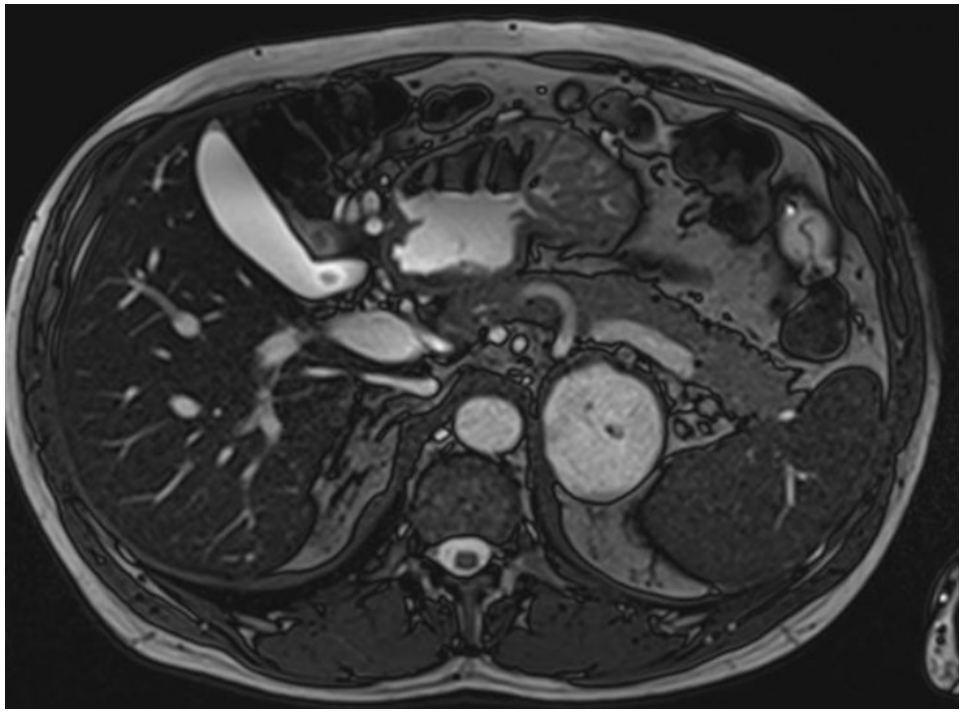

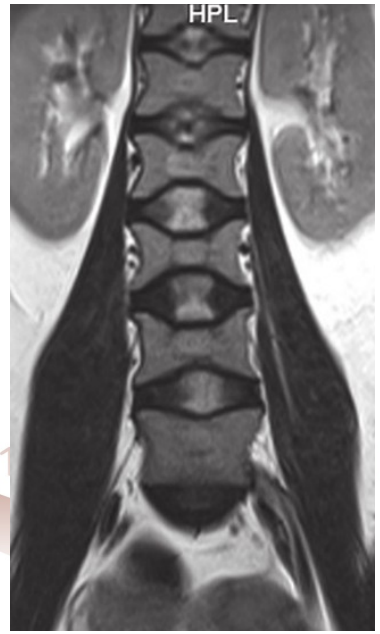
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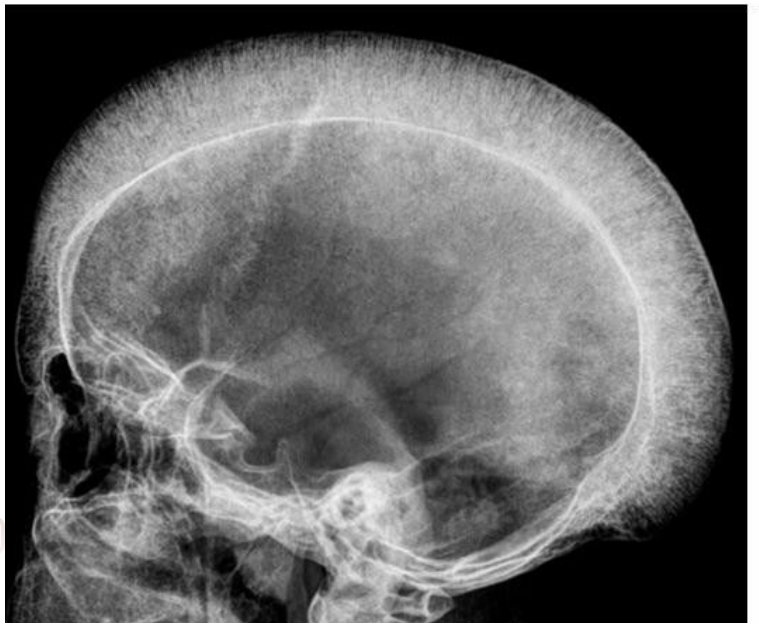


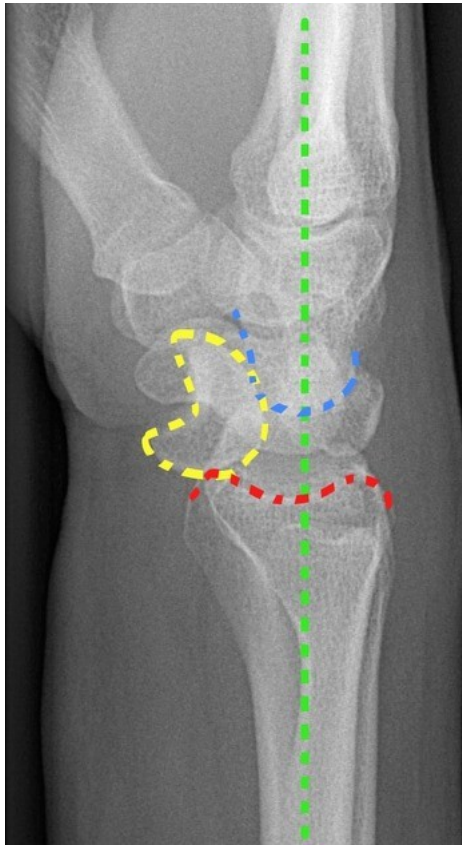
Case (10)

History: A 55-years-old man with wrist pain after motorcycle fall

Next step?

Lunate dislocation

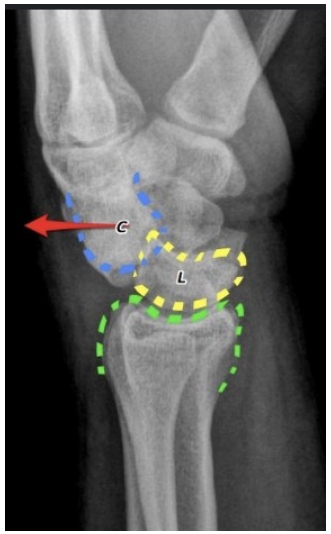
In this case:
AP: Misalignment of the first Gilula arch, in which the lunate 'overlaps' the capitate and the scaphoid, the lunate bone has a triangular appearance on AP projection
Lateral: Volar displacement of the lunate with its concave surface directed anteriorly (spilled teacup sign)



Case (11)

History: A 20-years-old man with wrist trauma

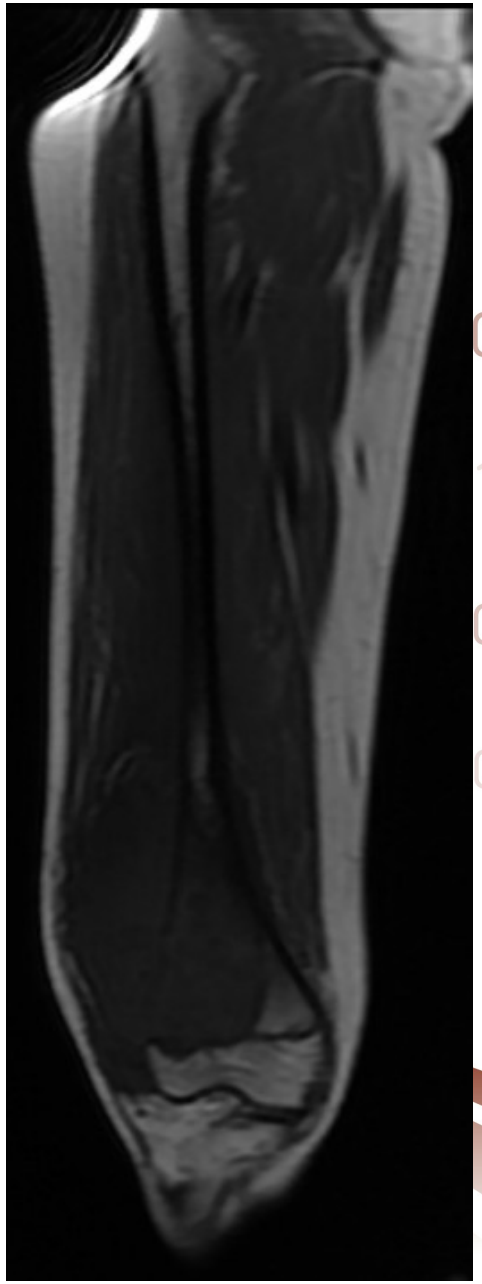
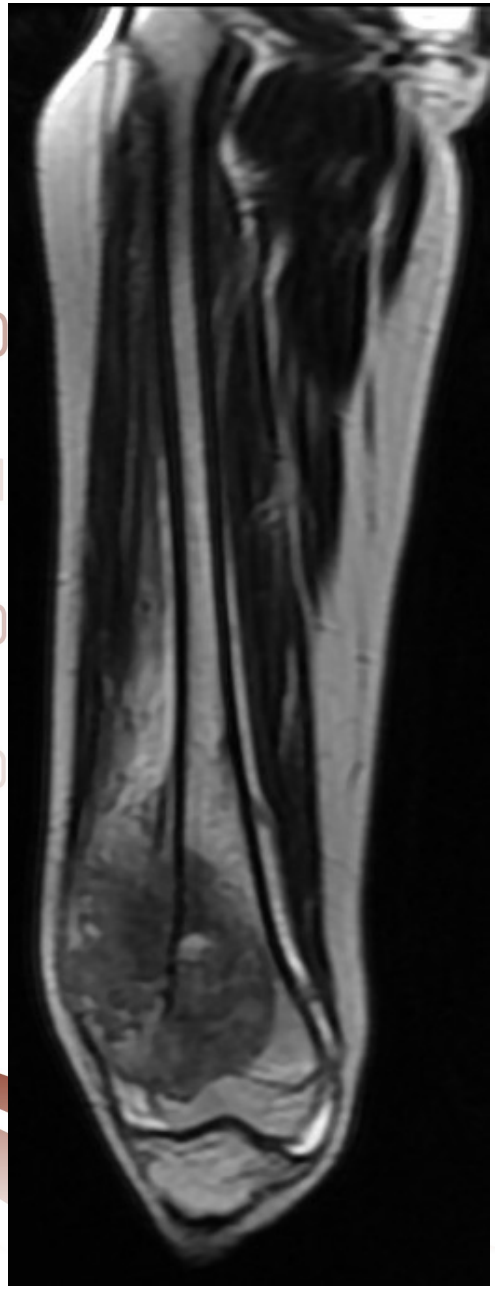
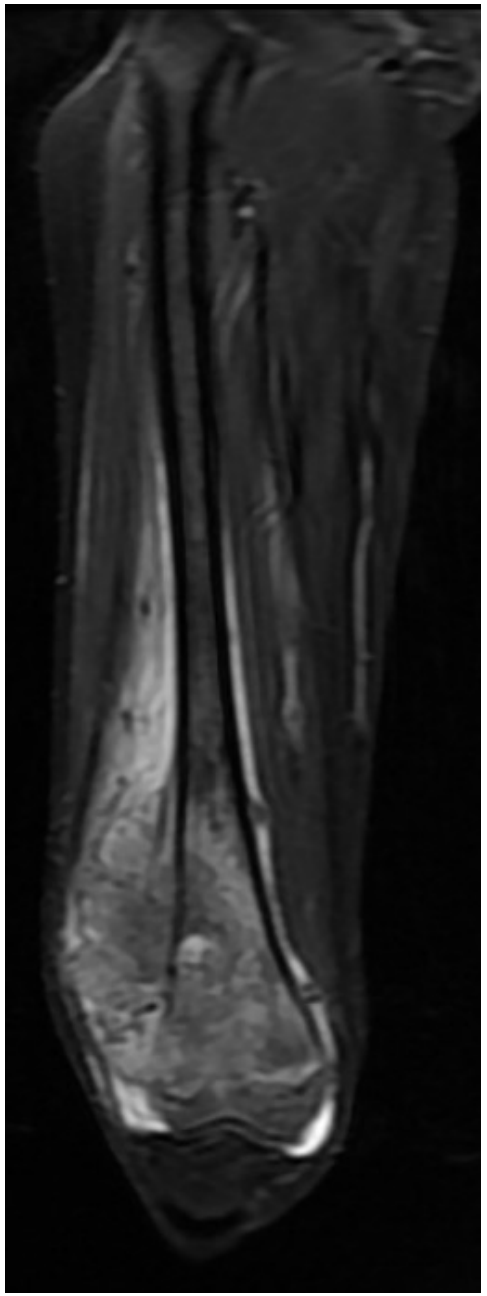
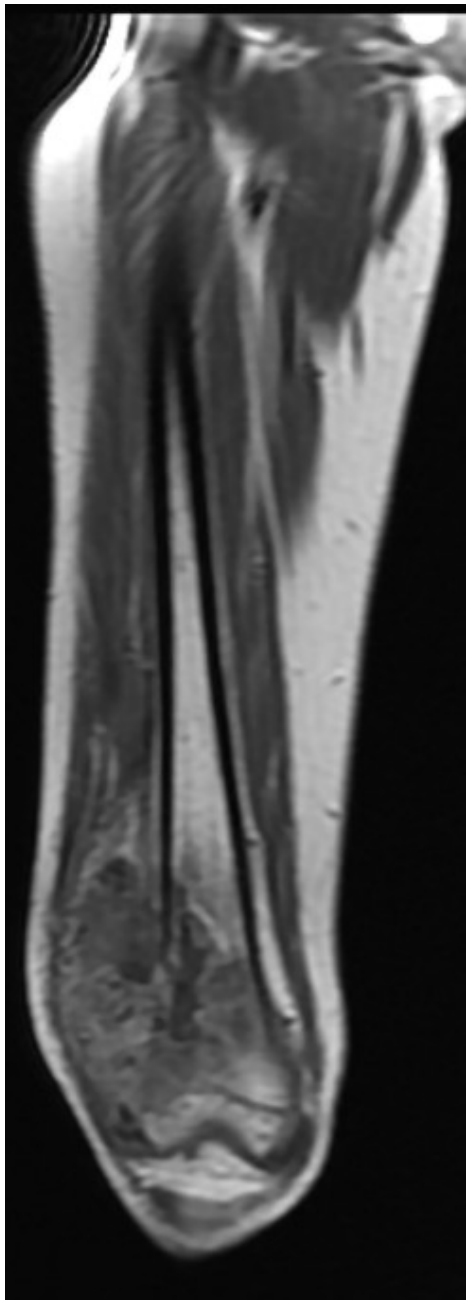
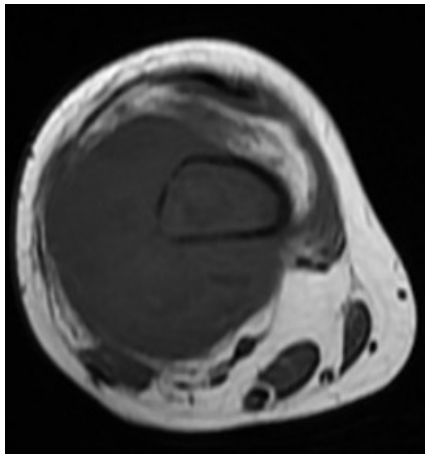
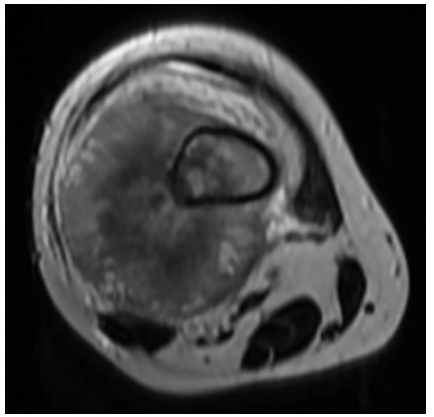
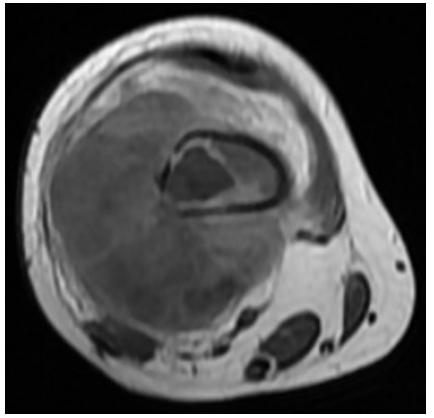
Trans-scaphoid perilunate dislocation



Case (12)

History: A 16-years-old female with right lower thigh pain for a few months

Next step?

Osteosarcoma

In this case:

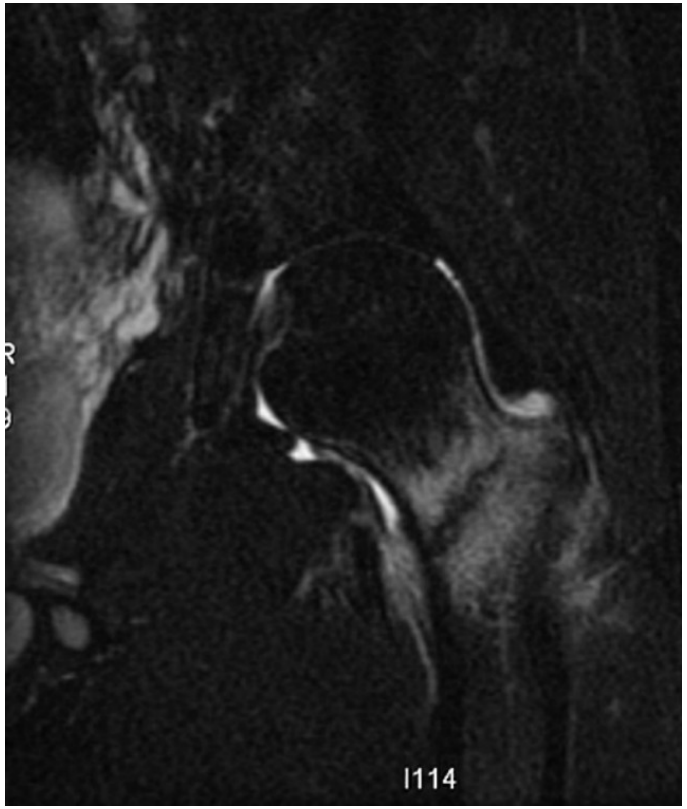
X-rays: Distal metaphyseal osseous lytic lesion is seen with wide zone of transition and aggressive pattern of bone destruction (permeative), aggressive periosteal reaction (Codman triangle) as well as osseous matrix and evidence of extraosseous soft tissue component

MRI: Metadiaphyseal osteolytic exophytic lesion + wide zone of transition + cortical destruction + extraosseous eccentric soft tissue component

Case (13)

History: A 62-years-old male with back pain

Femoral neck stress fracture



DD: Sclerotic area at the medial femoral neck:

Stress fracture

Osteoid osteoma

Healed OM

OS

Bone island

Single sclerotic mets

NB:

Osteomalacia with looser's zone (normal stress on abnormal bone): osteopenia + horizontal linear lucency in the medial femoral metaphysis, causes: ROD, HPT, Vit D deficiency

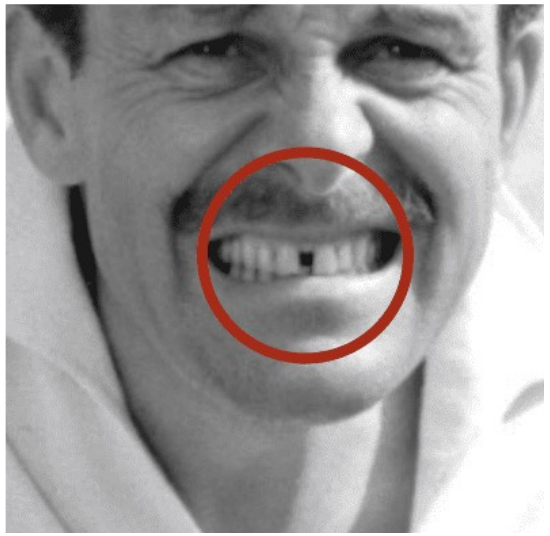
NB:

Fatigue fracture: Abnormal stress on normal bone

Case (14)

History: A 35-years-old female with acute wrist pain

Scapholunate dissociation



Terry Thomas sign:

Increase in the scapholunate interval > 4mm

Signet ring sign:

Ringed appearance of distal scaphoid

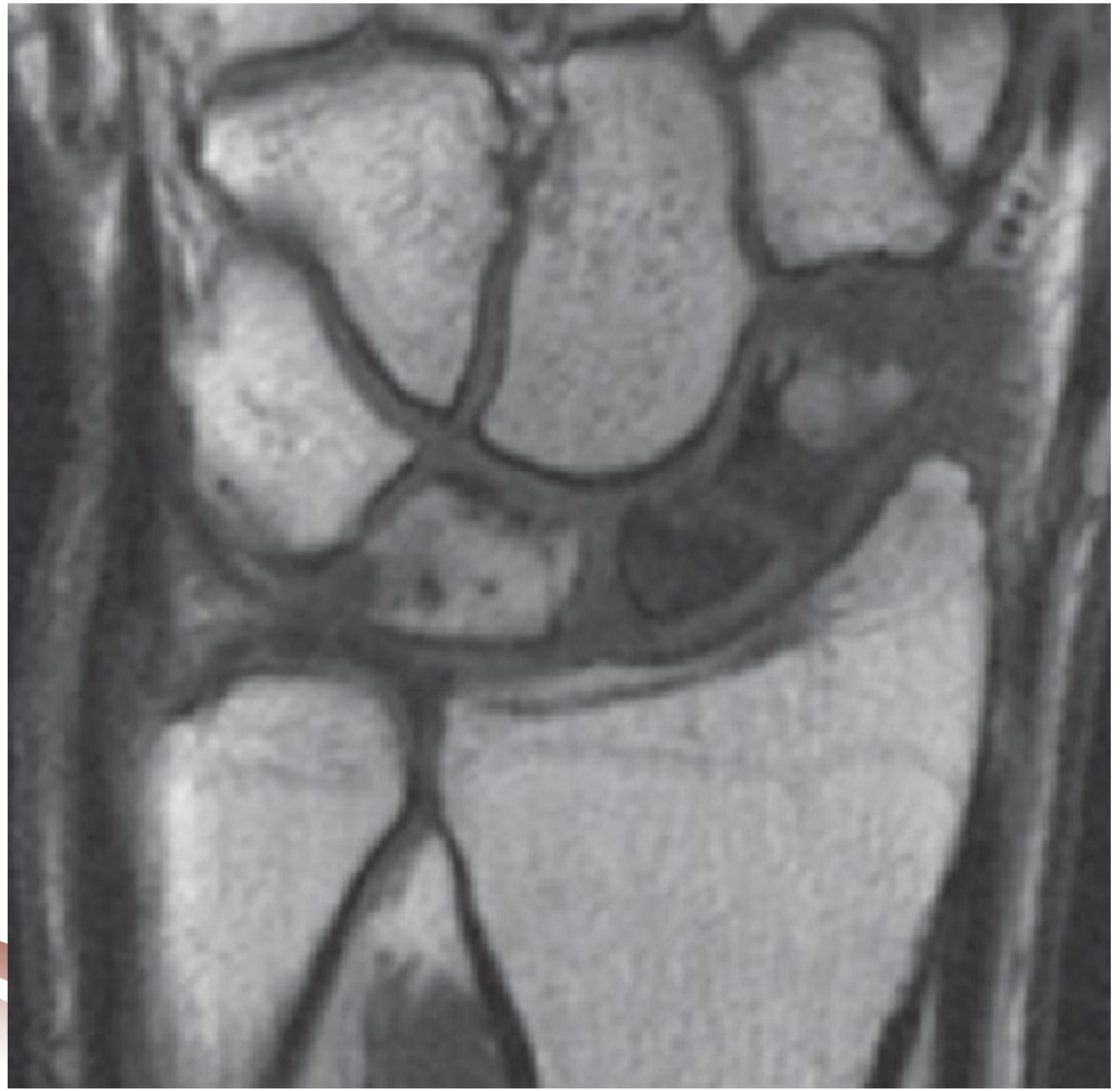
Dorsal intercalated segment instability (DISI) is a related carpal malalignment pattern that also results from scapholunate interosseous ligament rupture

SLAC (scapholunate advanced collapse): a sequela of chronic SL ligament injury

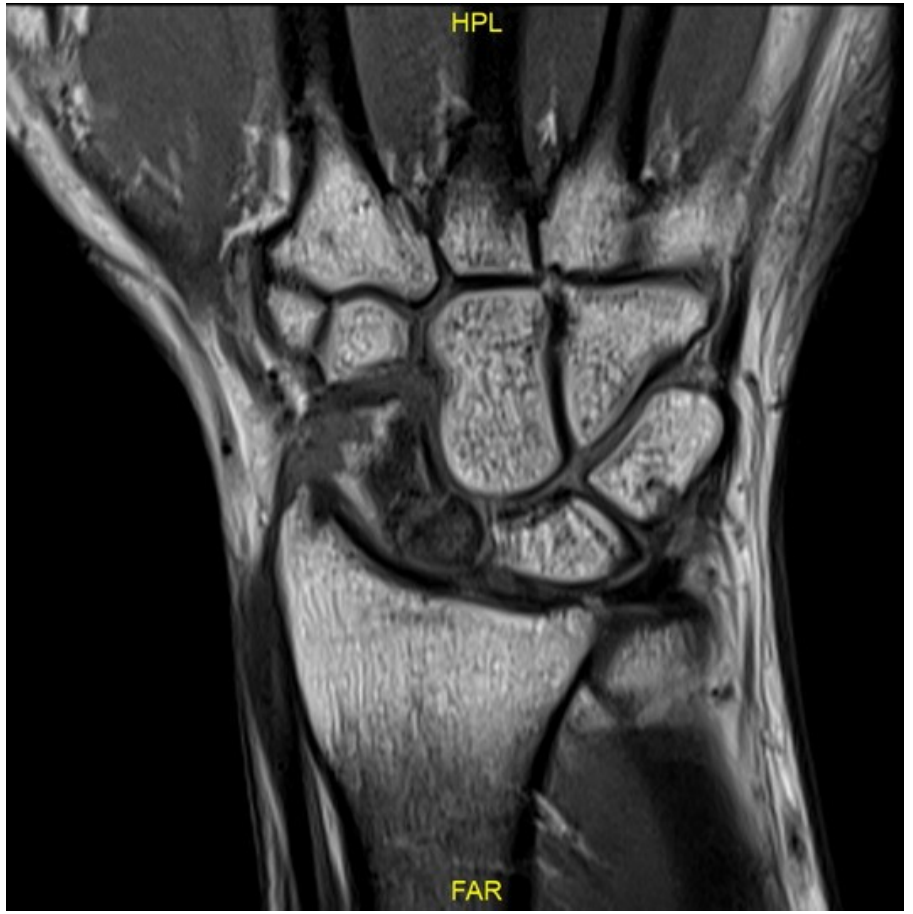
Case (15)

History: Withheld

Next step?



Scaphoid AVN due to non-union fracture



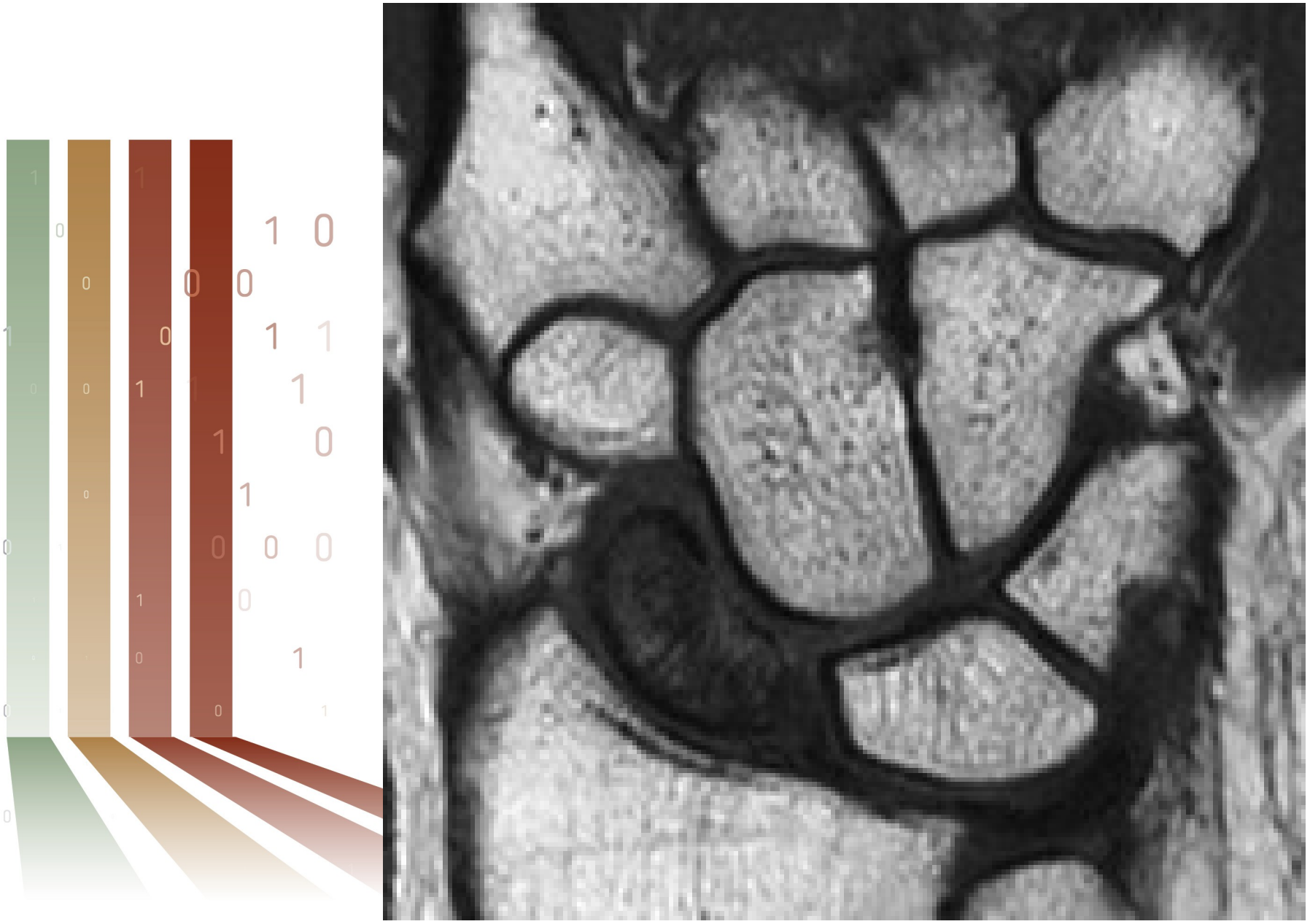
Blood supply to the scaphoid is interosseous from distal to proximal, the proximal pole has a weak blood supply and the proximal fractures have the highest risk of AVN

AVN is best seen on **T1** (↓ signal)

Case (16)

History: Withheld

Next step?



Preiser's Disease (Scaphoid AVN) idiopathic, no fracture

X-rays: Sclerosis, NO fracture line

NB:

AVN of lunate = kienbock disease

Case (17)

History: A 35-years-old male with history of fall from bicycle

Distal radioulnar joint dislocation

In this case:
Distal radioulnar joint dislocation with dorsal displacement of the ulna relative to the radius

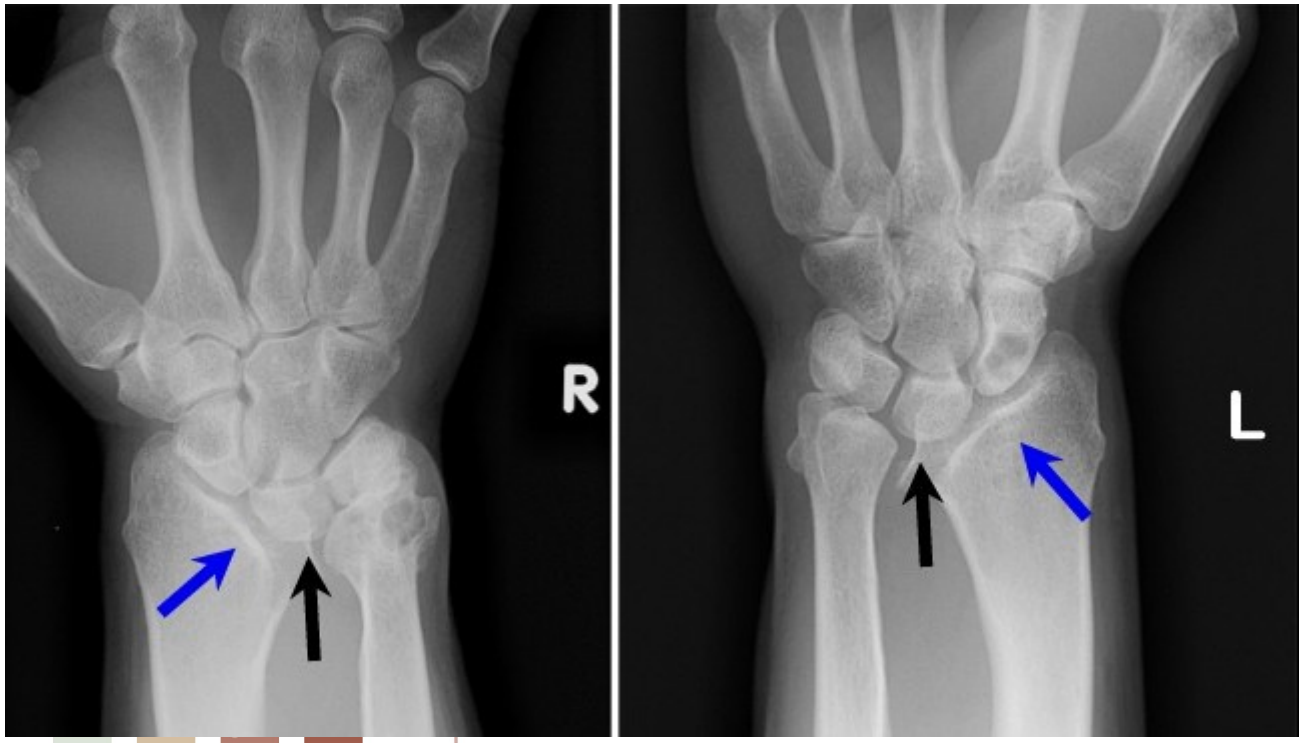
Causes of distal radioulnar joint instability:

1-Trauma (Galeazzi fracture, distal radial fracture)
2-Iatrogernic
3-inflammatory (RA)
4-Congenital (madelung deformity)

Case (18)

History: A 15-years-old girl with history of falling down

Madelung deformity

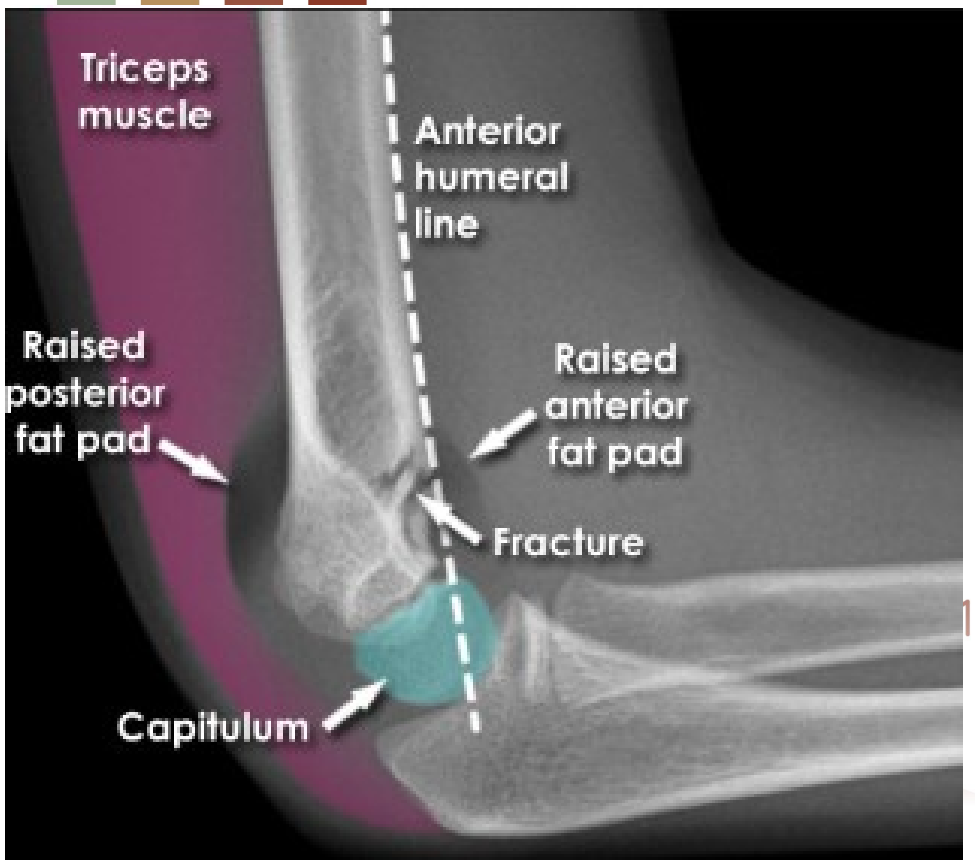


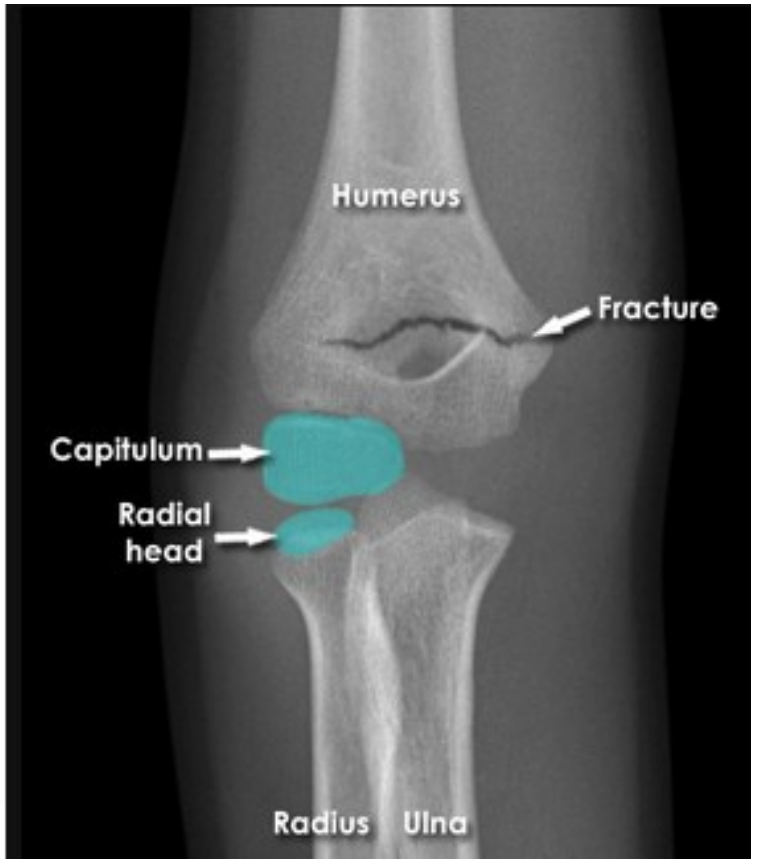
1-Shortening of the ulnar portion of the distal radius (+ve ulnar variance) + exaggeration of the radial inclination +/- bowing
2-Proximal migration of the proximal carpal row (V-shaped between radius & ulna)
3-dorsal dislocation of the ulnar head

Case (19)

History: A 4-years-old girl with history of right elbow pain, swelling and reduced range of movement

Supracondylar fracture





Lateral and AP radiographs are usually sufficient
In many instances demonstrate an obvious fracture, often, however, no fracture line can be identified

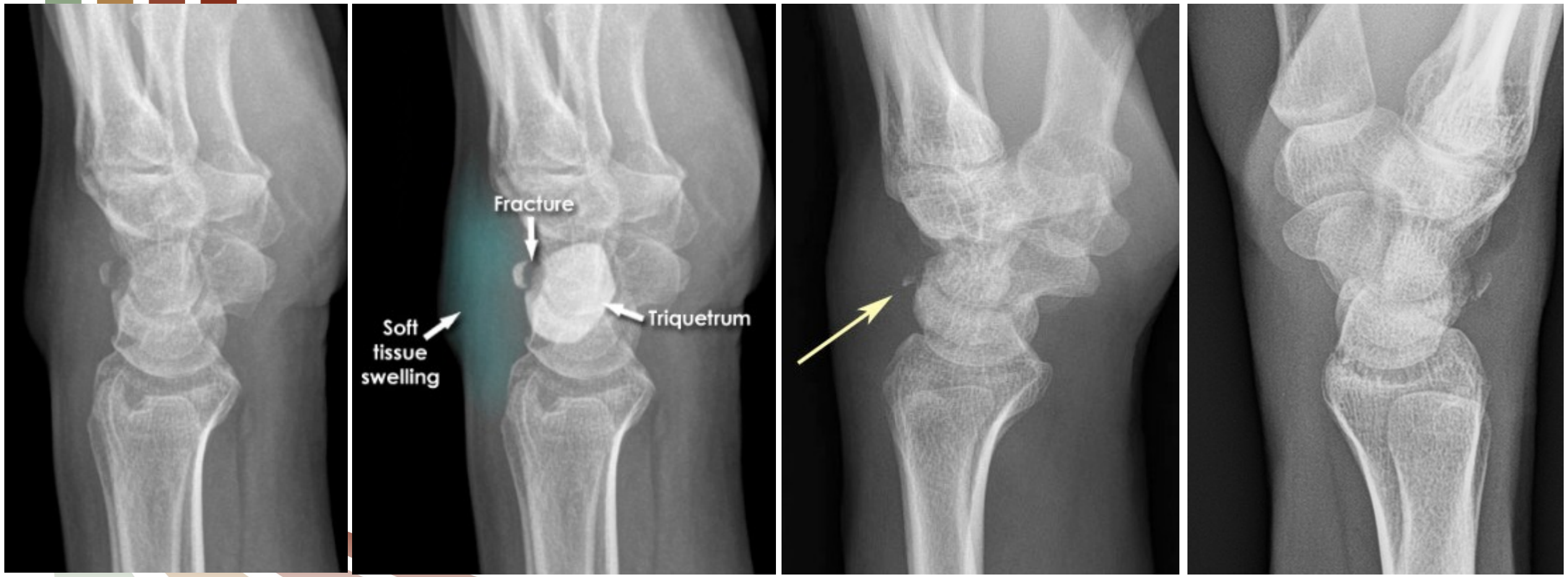
Indirect signs:

1-Anterior fat pad sign (sail sign)
2-Posterior fat pad sign
3-Anterior humeral line should intersect the middle third of the capitellum (f there is a displaced supracondylar fracture this line will pass in front of capitellum)

Case (20)

History: A 31-years-old man with history of football trauma, pain and tenderness on the dorsal wrist

Triquetral fracture



Case (21)

History: A 33-years-old man with history of a heavy object fell on the patient's right foot

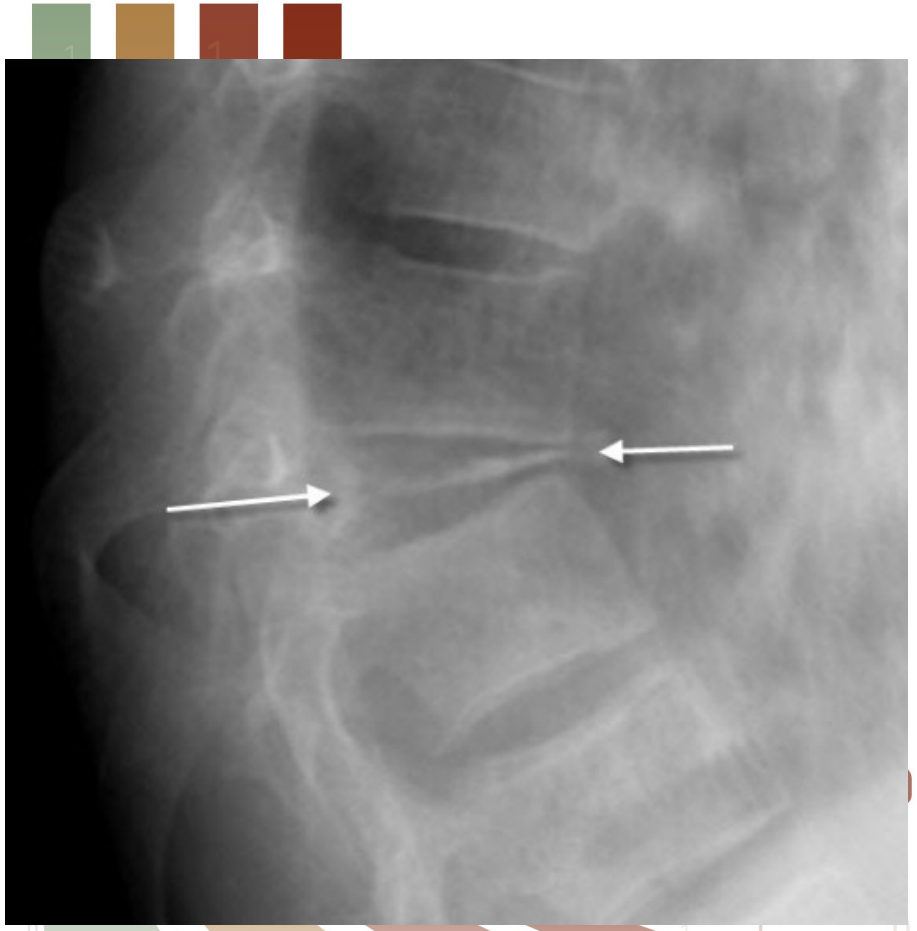
Medial cuneiform fracture

NB: Navicular fracture

Case (22)

History: A 65-years-old woman with history of generalized increased back pain

Vertebra plana



DD: (FETISH)
Fracture (Trauma / osteoporosis)
EG (if multiple, LCH)
Tumor (Mets, MM, Leukemia)
Infection
Steroids (AVN)
Hemangioma

Case (23)

History: A 12-years-old boy with pain at the wrist

Lunotriquetral coalition

Causes:
Congenital
Acquired (RA/ psoriasis/ reactive arthritis)

Lunotriquetral the most common

2nd most common is capitohamate

Case (24)

History: A 70-years-old woman with wrist pain

Erosive osteoarthritis

Affects distal joints (DIPs, PIPs, 1st CMC)

Gull wing: Central erosion + marginal osteophytes

DD:
OA (same distribution but no erosions)

RA (Different joint distribution, proximal joints in RA, osteopenia)

Psoriasis (DIP: pencil in cup erosions, sausage digit, no involvement of the 1st CMC, preserved mineralization)

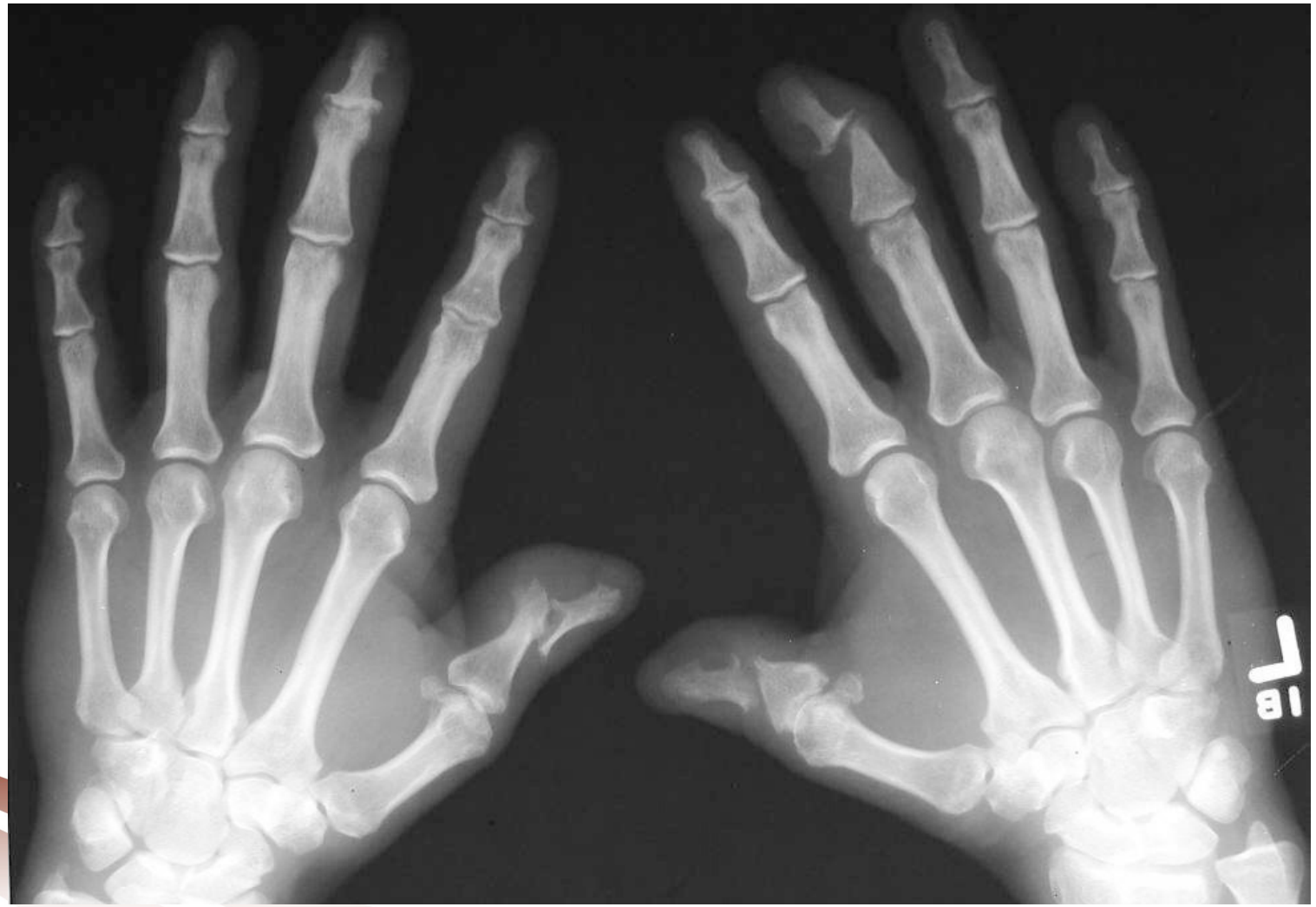

EROSIVE
OSTEOARTHRITIS


RHEUMATOID ARTHRITIS


PSORIATIC ARTHRITIS

Case (25)

History: A 35-years-old woman with swelling and restricted movement on both hands



Psoriatic Arthritis

Pencil in cup + distal erosions

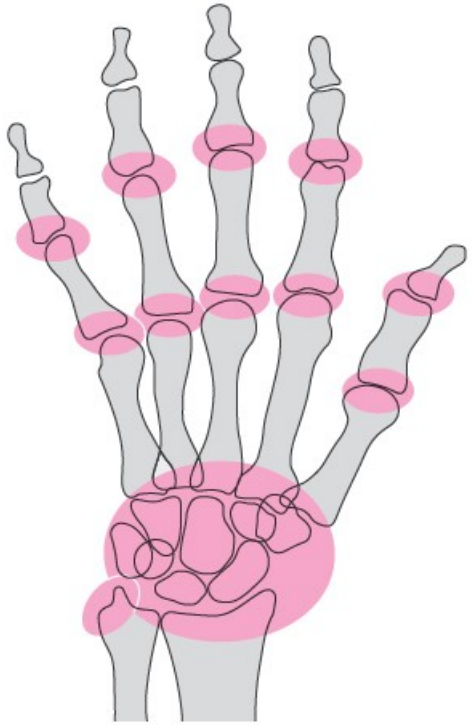
Sausage shaped digit

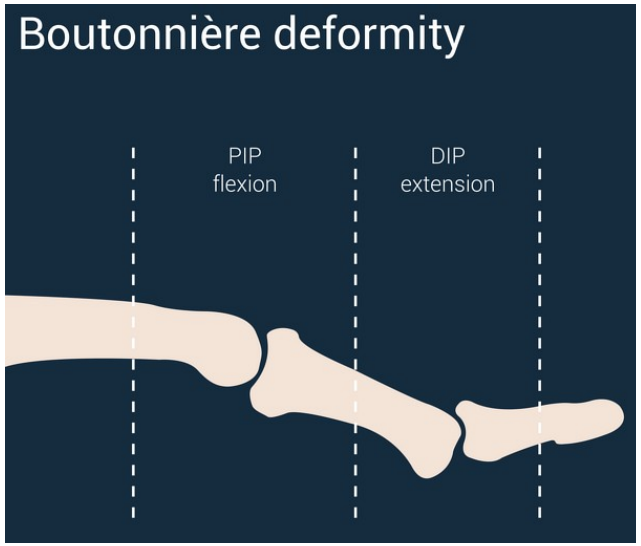
Case (26)

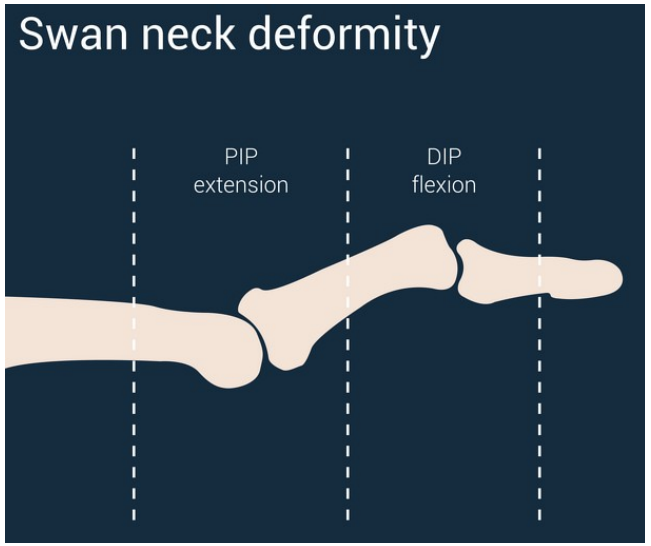
History: A 45-years-old man with bilateral hand pain

Rheumatoid arthritis

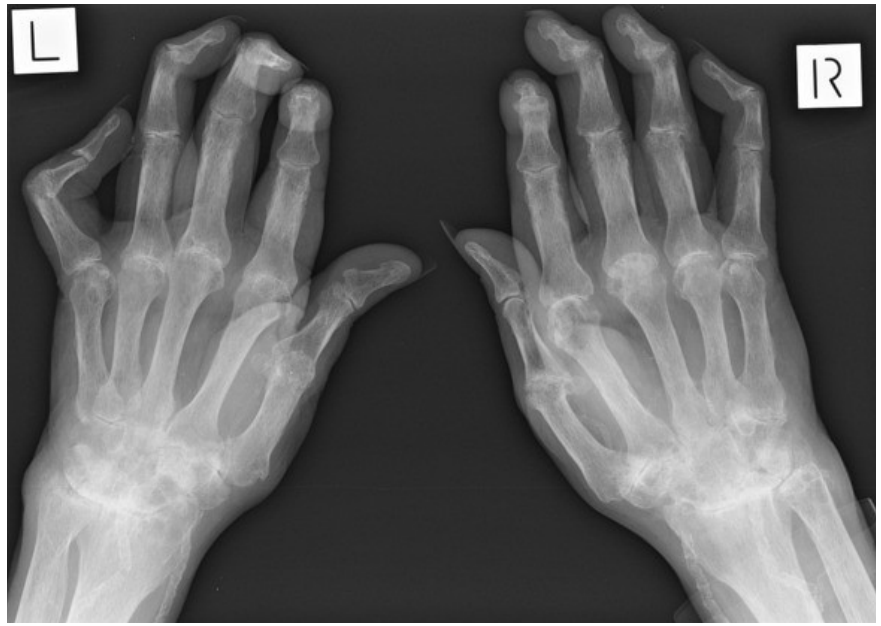
- Erosions + osteopenia
- Soft tissue swelling
- Diffuse symmetric joint space narrowing
- Erosions (radial aspect of the 2nd & 3rd MC heads)
- Proximal joints affection (MCP, PIP, **spared** DIP)
- Joint subluxation (boutonniere, swan neck, hitchhiker thumb)







Boutonnière deformity of 5th finger and Hitchhiker's thumb



Advanced RA: boutonniere + swan neck + osteopenia + fusion of carpal bones

Case (27)

History: A 20-years-old male with cat bite approximately 2 weeks prior, presenting with ongoing pain, swelling and limitation of motion of the right hand

Septic arthritis PIP joint

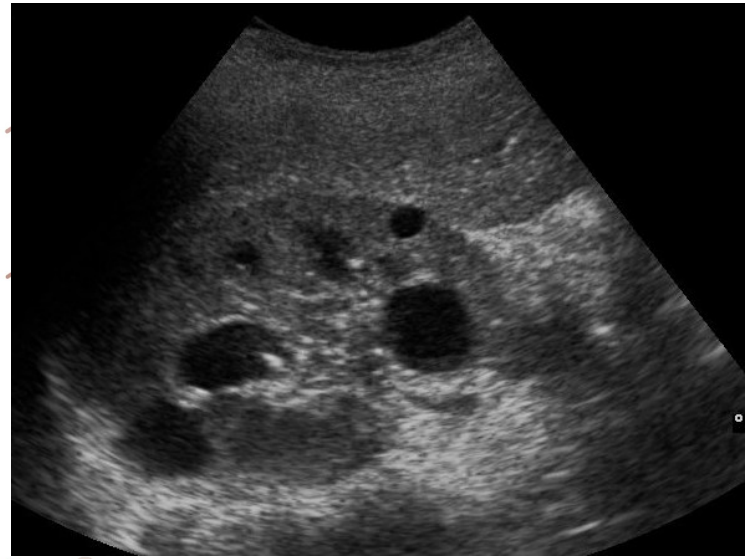
In this case:

Asymmetric and significant, right second digit, PIP joint space narrowing with soft tissue swelling of the digit especially centered around the affected joint

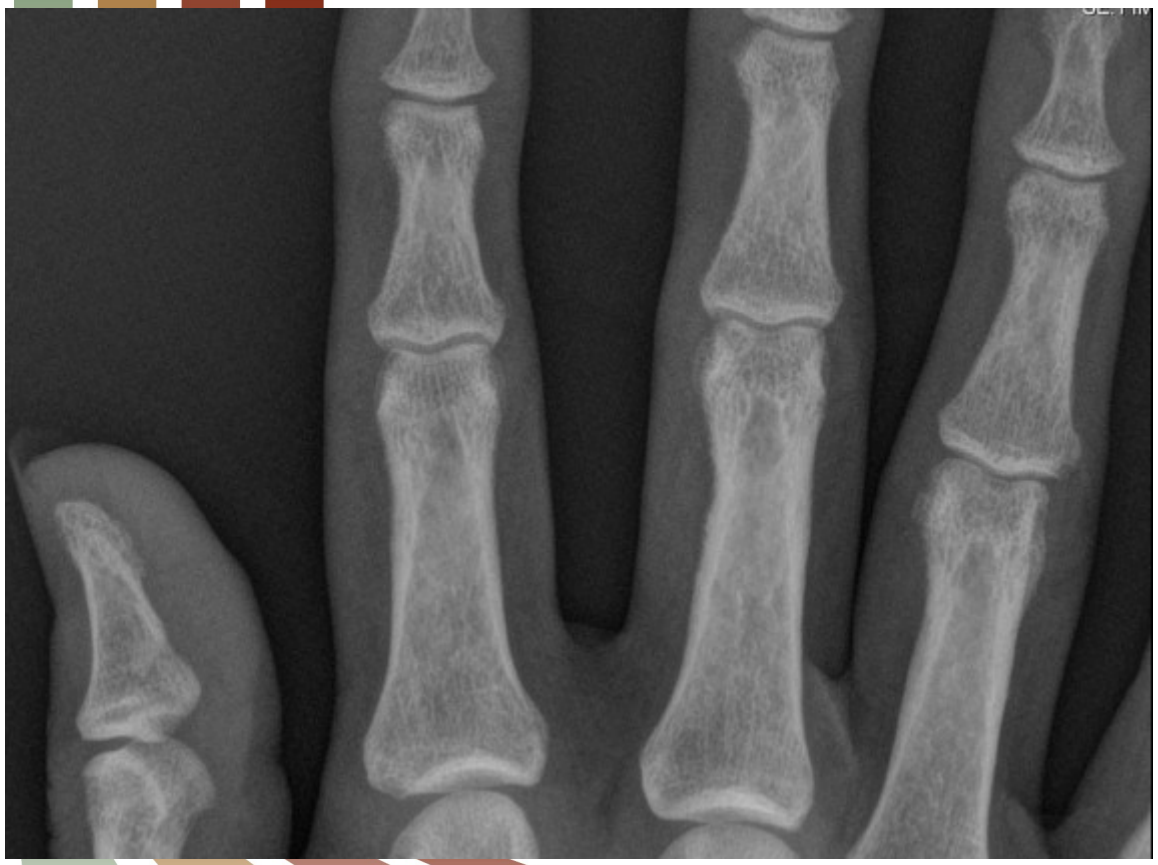
No erosions, no joints destruction

Case (28)

History: Withheld



2ry Hyperparathyroidism



Hands: Subperiosteal resorption of the radial aspect of the 2nd & 3rd middle phalanges + acro-osteolysis +/ brown tumors

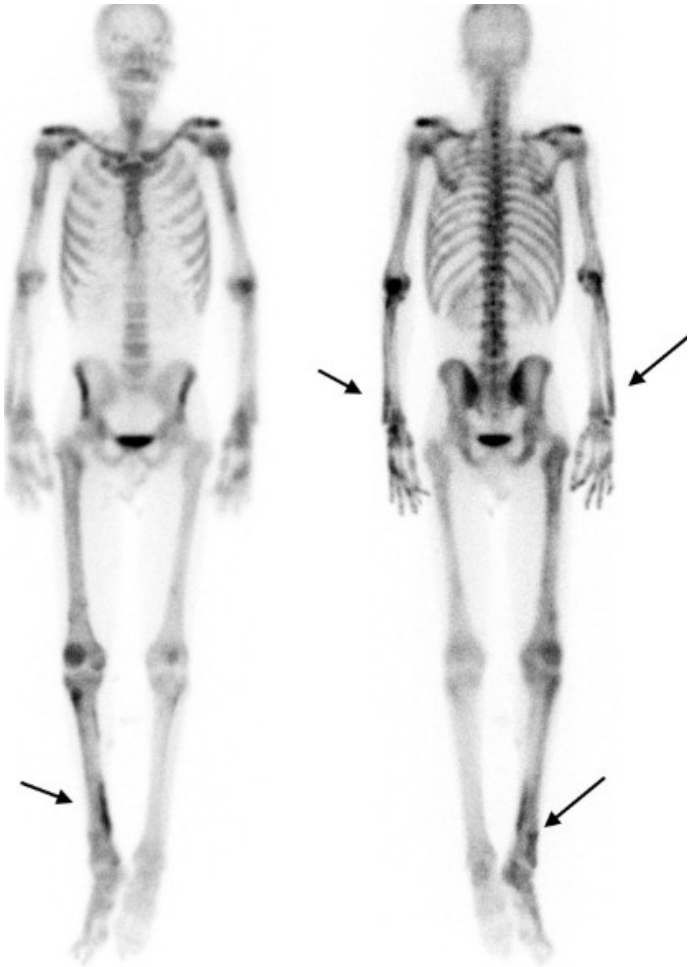
Brown tumor

Acro-osteolysis (arrow head), subperiosteal resorption (arrow)

Case (29)

History: Withheld

Hypertrophic osteoarthropathy



Periosteal reaction of long bones without an underlying bone lesion

Symmetrical

NM: Parallel track sign

Causes:

Idiopathic

Lung (cancer "non-small", lymphoma, abscess, mets, mesothelioma)

GIT (IBD, lymphoma)

DD:

1ry hypertrophic OA

Thyroid acropachy (Grave's disease)

Chronic venous insufficiency

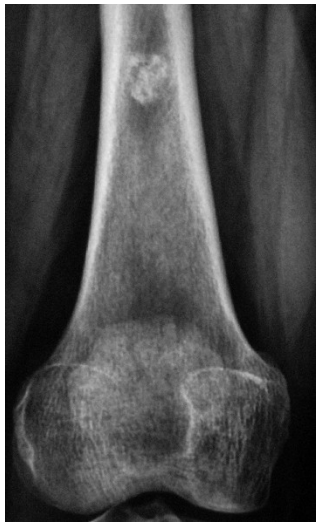
Hypervitaminosis A

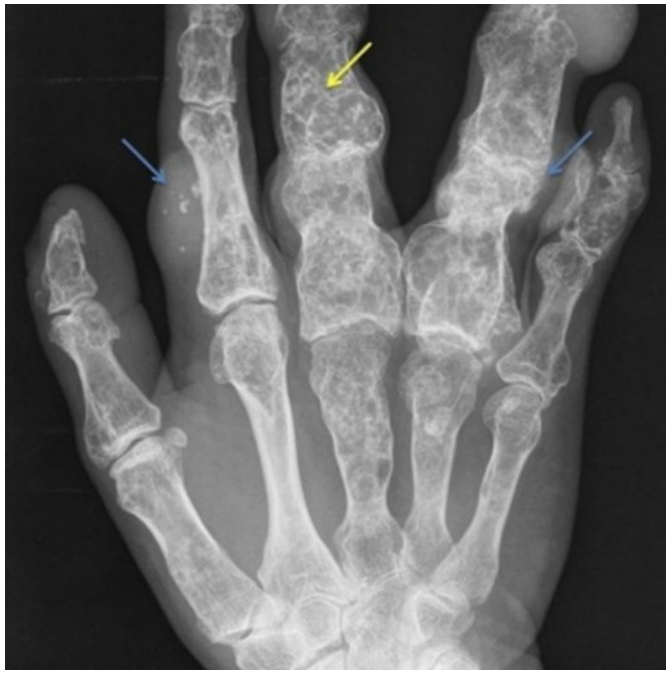
Periosteal proliferation at proximal phalanges

Case (30)

Enchondroma

Ollier's disease





Maffucci syndrome

Lytic lesion in the hand + endosteal scalloping & thinning of the surrounding cortex +/- pathological fracture

Long bones: pop corn calcification + lobulated margin, hyperintense in T2

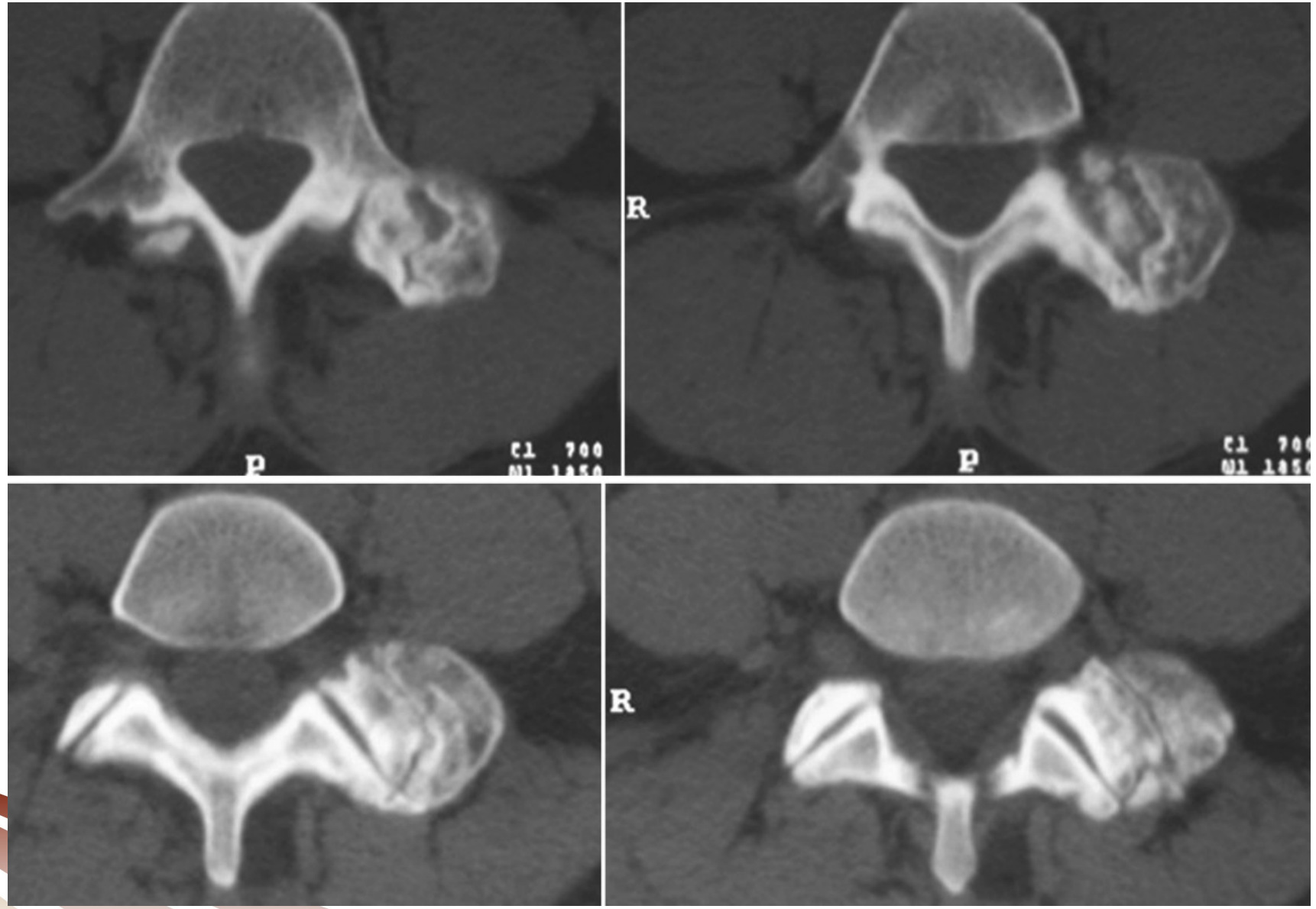
Multiple enchondromas = Enchondromatois = Ollier's disease

Multiple enchondromas + soft-tissue venous malformations = Maffucci syndrome

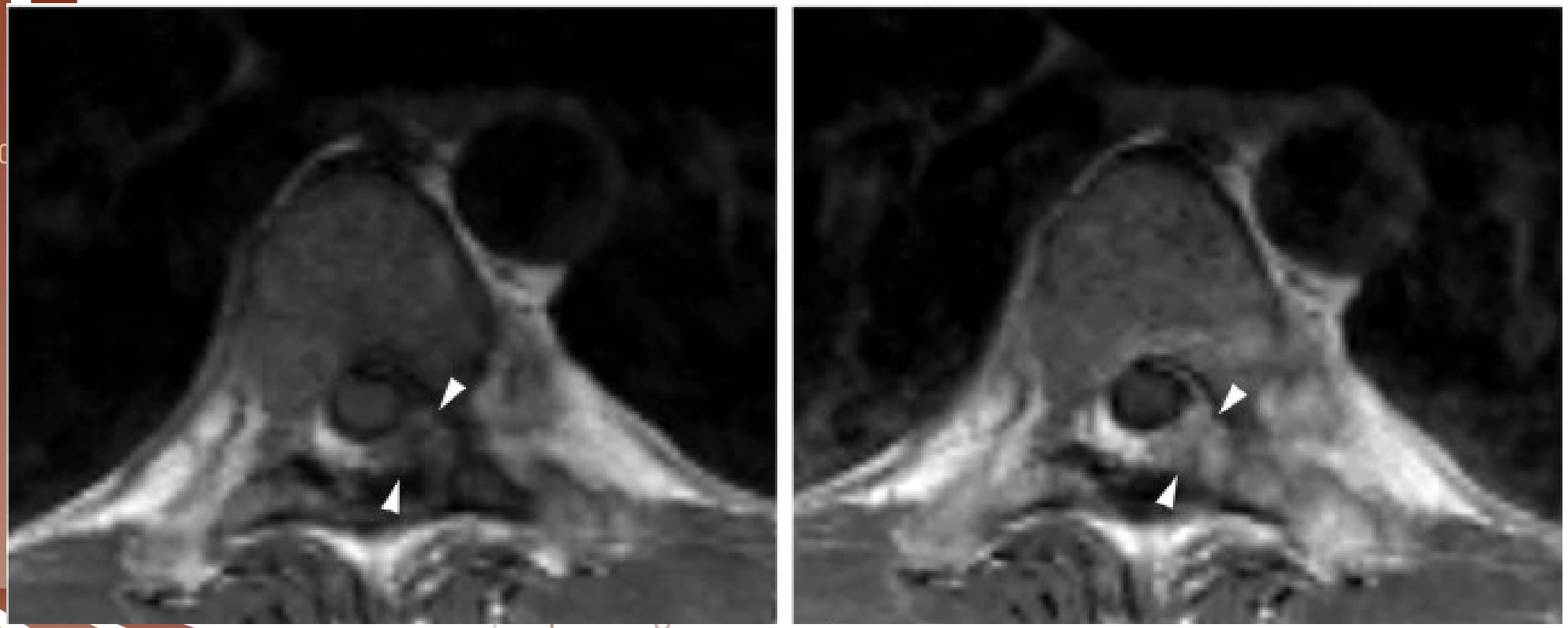
Case (31)

History: A 35-years-old male with back pain

Next step?



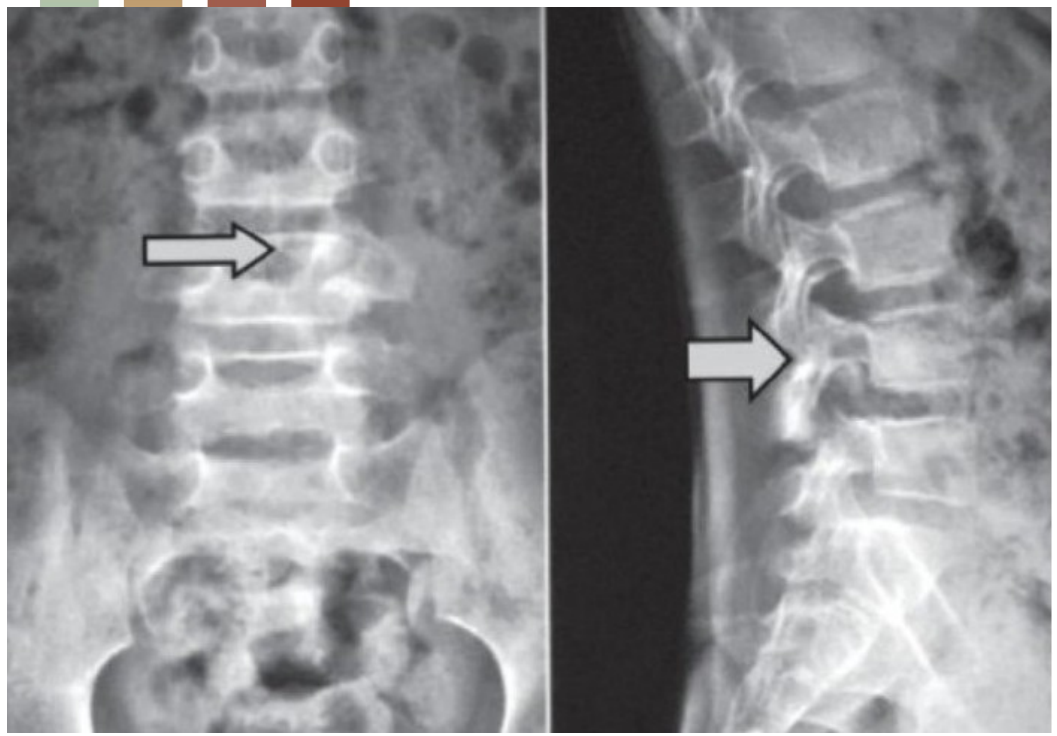
Next step?

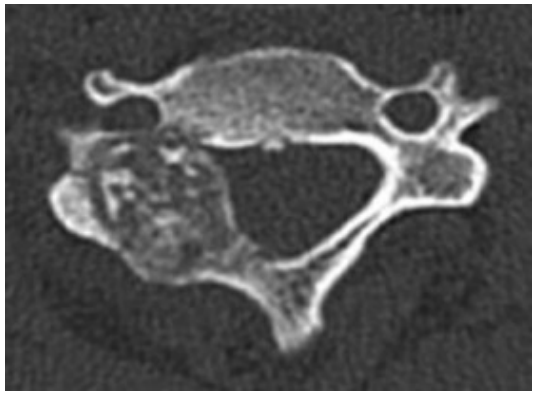


Osteoblastoma

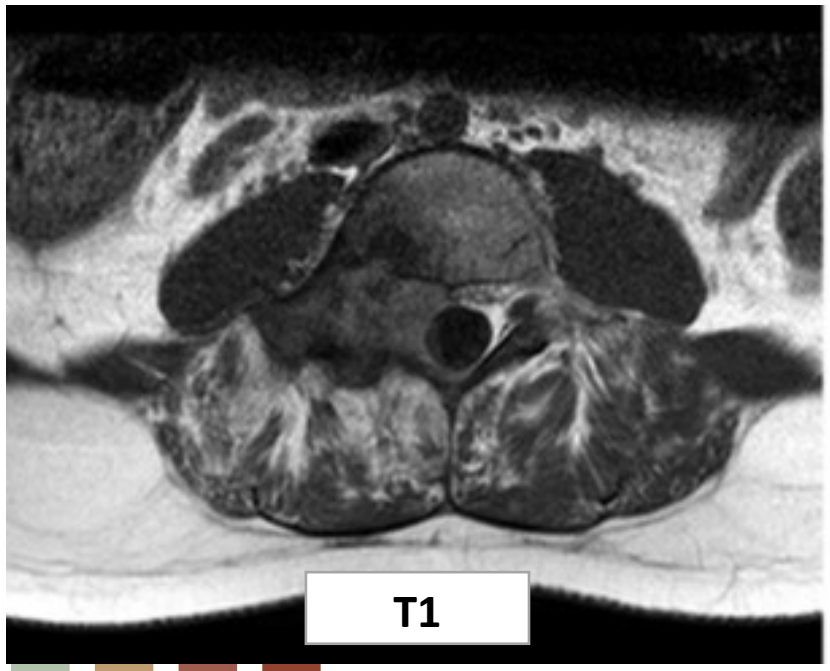
In this case:

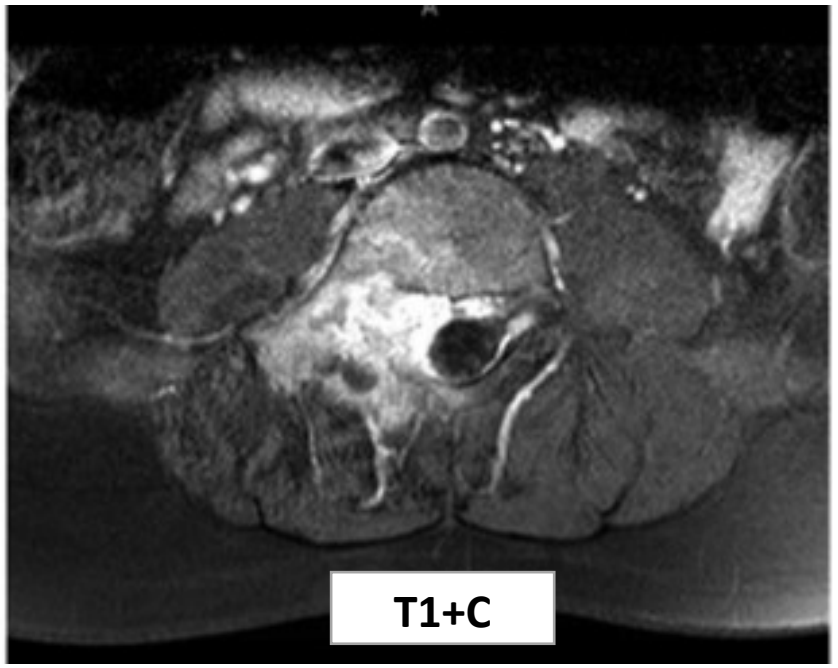
Osteoblastoma characteristically arising in the posterior or dorsal elements of vertebrae as seen in radiograph & CT
MRI: T2 & T1+C show the flare phenomenon adjacent to the tumor, i.e. abnormal swollen soft tissues in the spinal canal compressing the dural sac (arrow) lateral to the spinous process (arrowheads), showing hyperintensity on T2 & marked enhancement with contrast



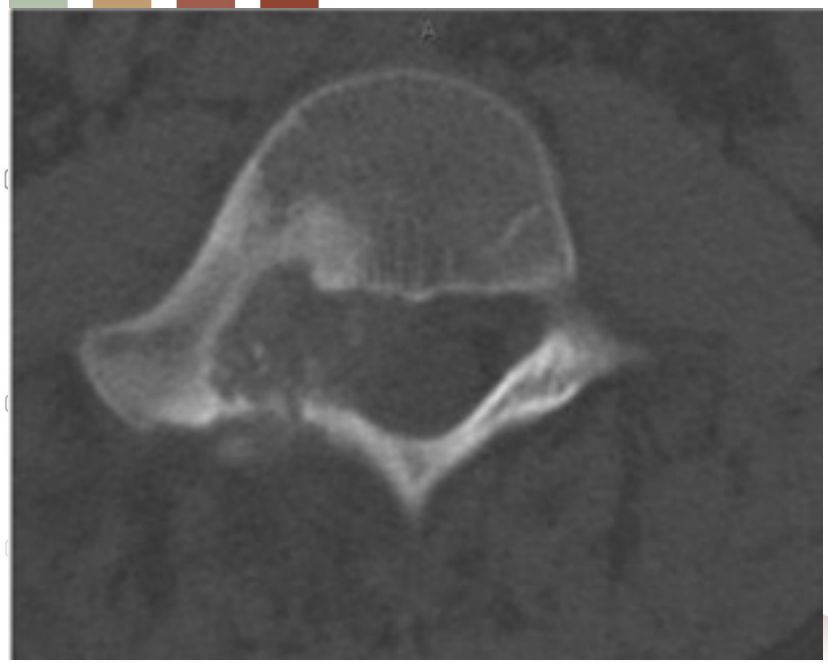


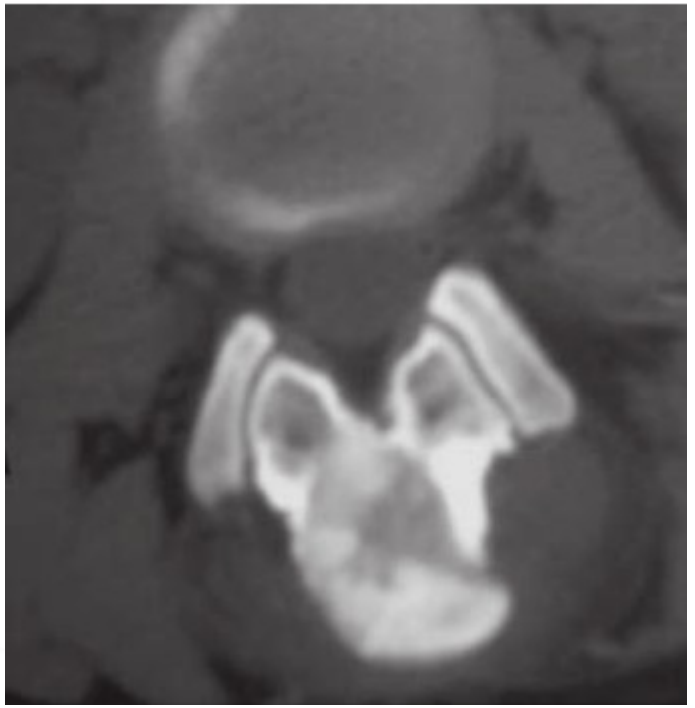
Location: Spine in the posterior element
X-rays & CT:
Expansile lytic + sclerotic rim +/- internal calcifications
MRI:
T1: Hypo to iso
T2: Iso to hypo + Flare phenomenon (high signal may be seen in surrounding bone marrow and soft tissues due to the edema)
In both T1 & T2: Foci of decreased intensity corresponding to the foci of calcification
T1+C: Avidly enhances, with associated enhancement of the surrounding soft tissues (flare phenomenon)
DD: OO/ ABC/ GCT/ EG





T1+C
*OB
Arrow heads: flare phenomenon

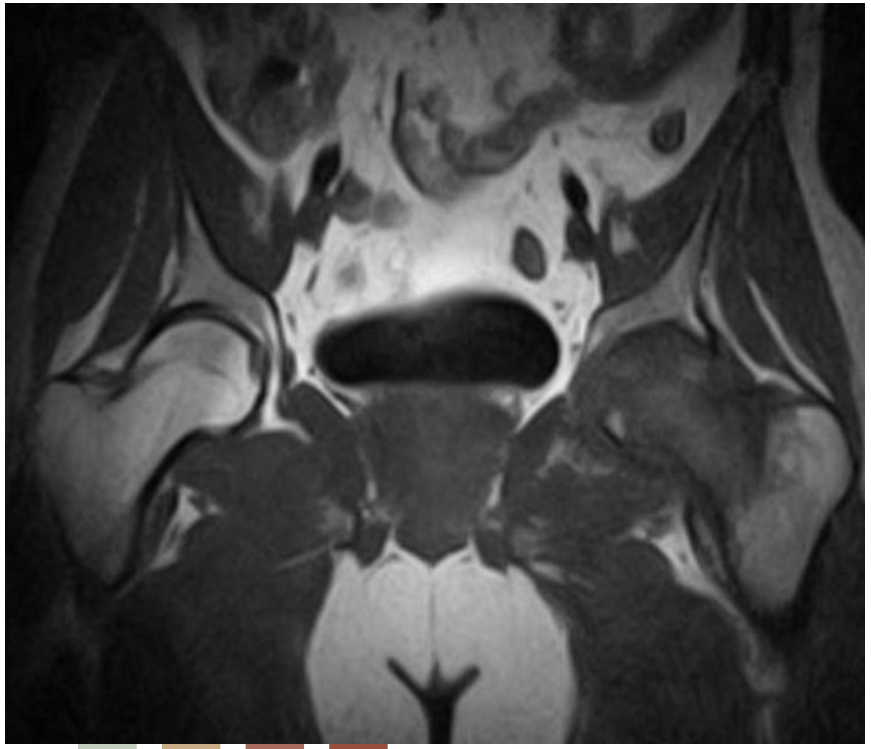


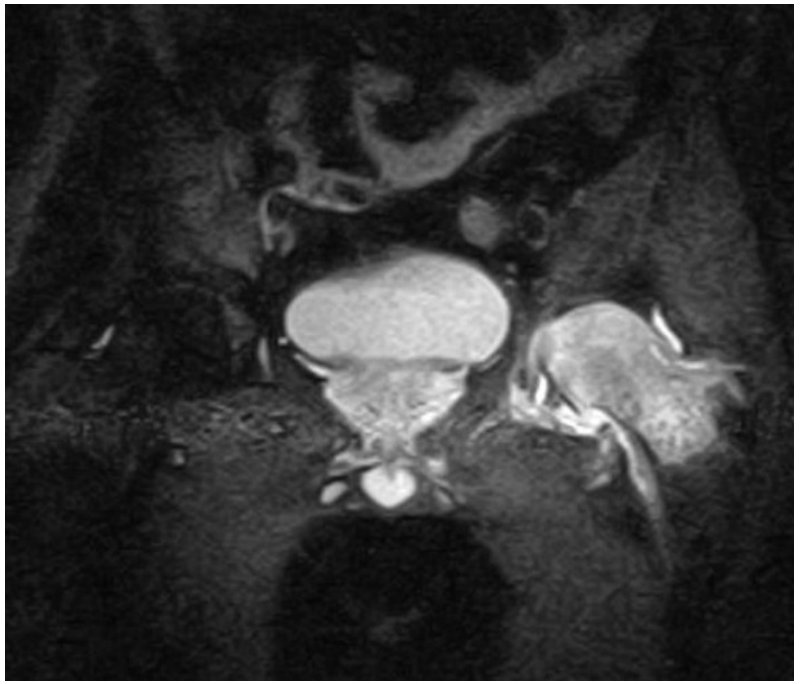


Case (32)

History: A 21-years-old male with left hip pain

Next step?



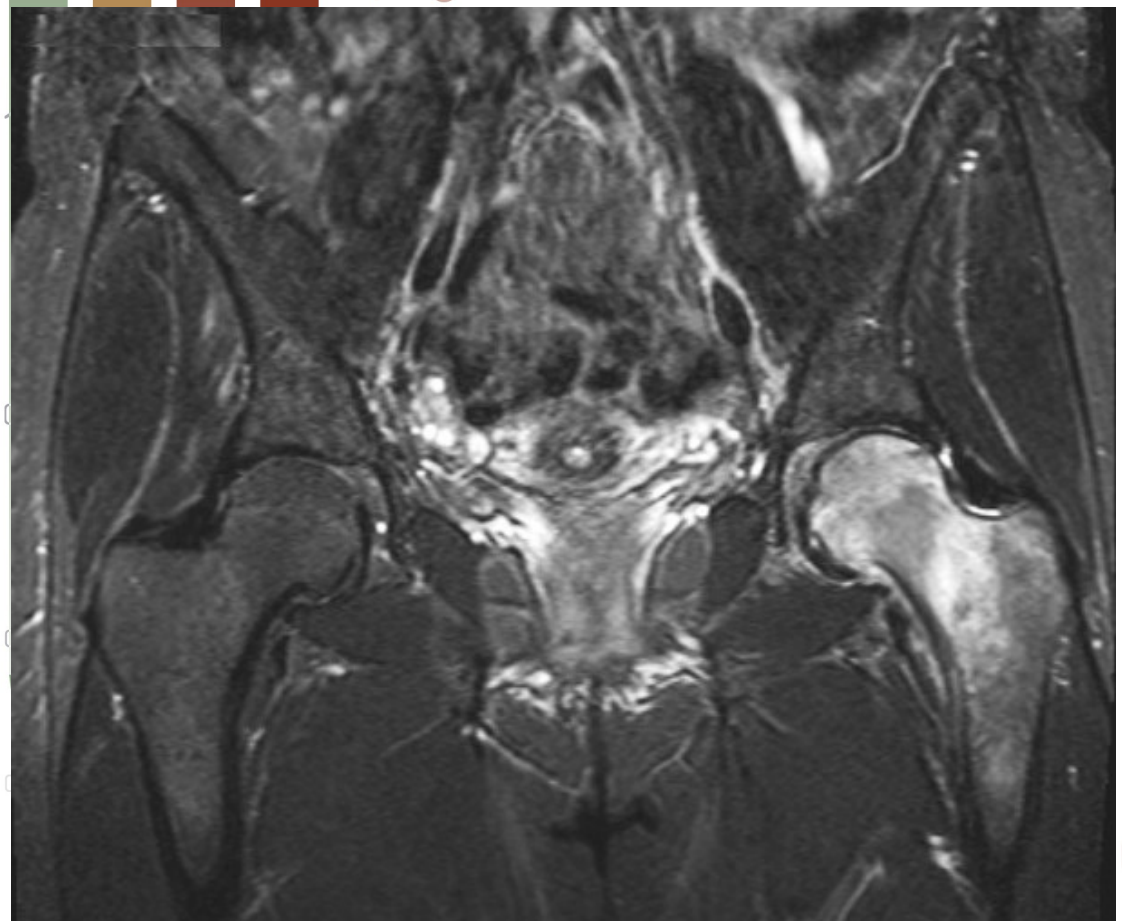


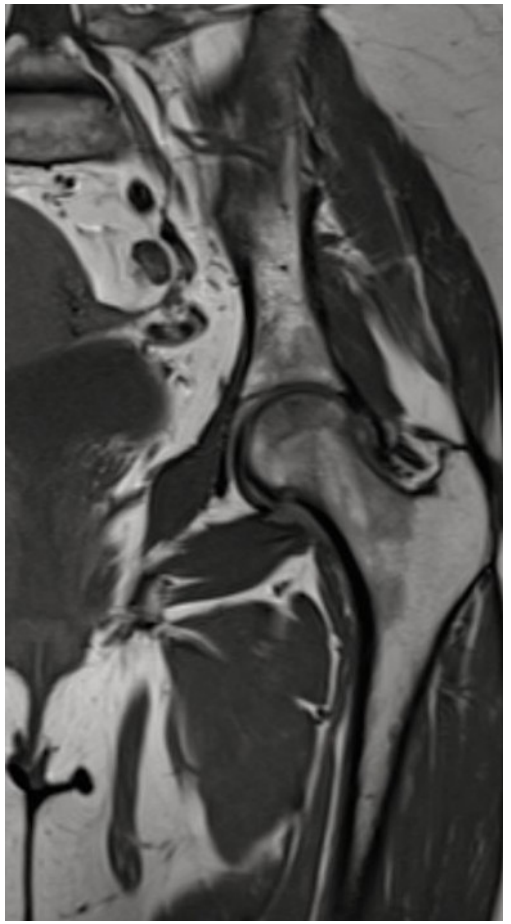
Transient osteoporosis of the hip

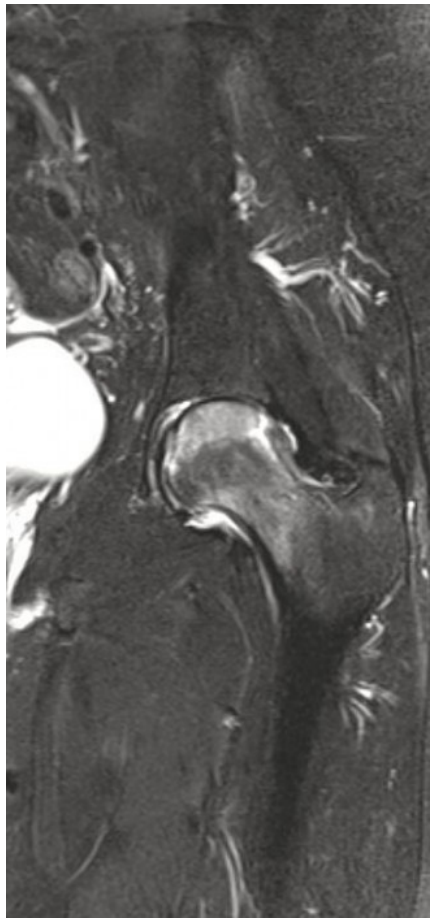
In this case:

X-rays: Reduction of the bone density (osteoporosis) of the left femoral head if compared to the right side

MRI: Abnormal bone marrow SI of the left femoral head, neck as well as intertrochanteric region with low SI on T1 & high SI on T2 and STIR







It is the diagnosis of exclusion

Exclude:

Femoral neck stress fracture

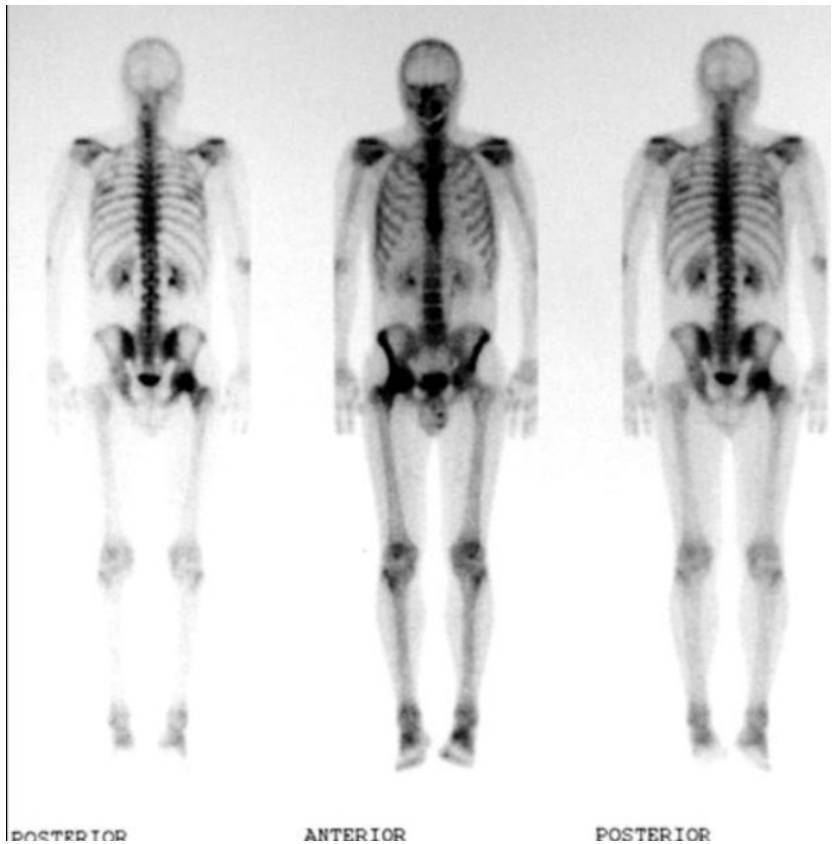
Infection

Malignancy

AVN


L


L


POSTERIOR
ANTERIOR
POSTERIOR

lucent geographic line + flattened femoral head

Collapsed femoral head

Transient osteoporosis:

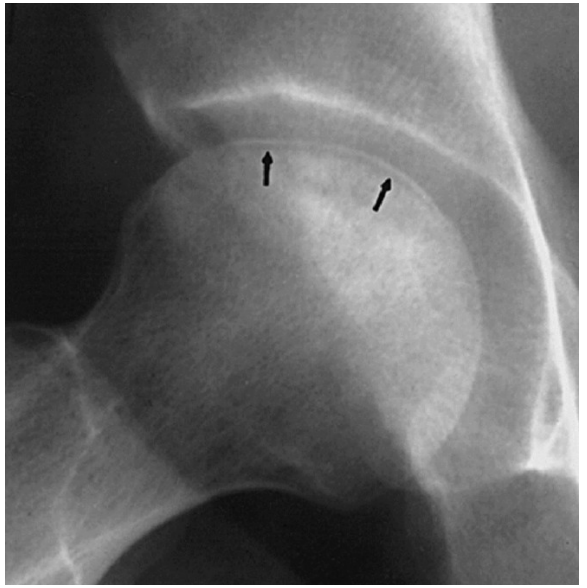
X-ray:

Left hip shows reduction of the bone density (osteoporosis) of the left femoral head if compared to the right side

AVN:

X-ray:

Localized sclerotic areas + crescent sign + collapse

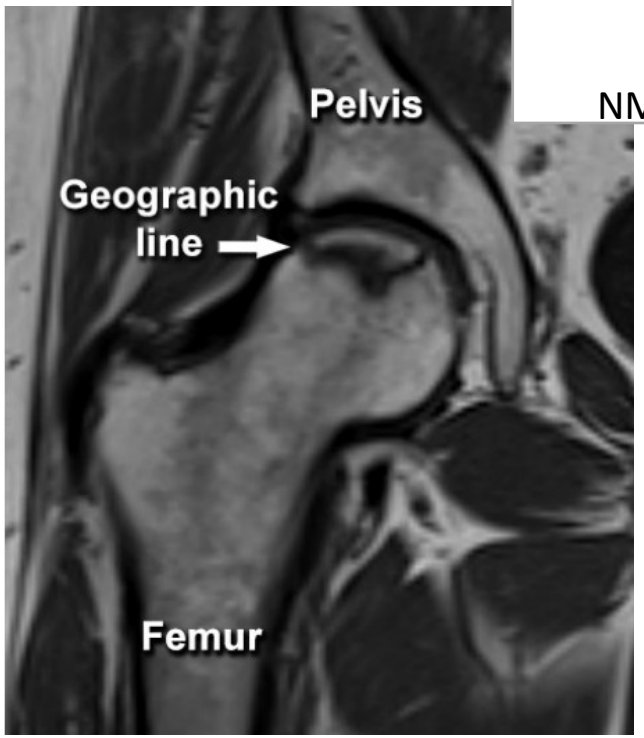


Crescent sign (hypointense crescent)

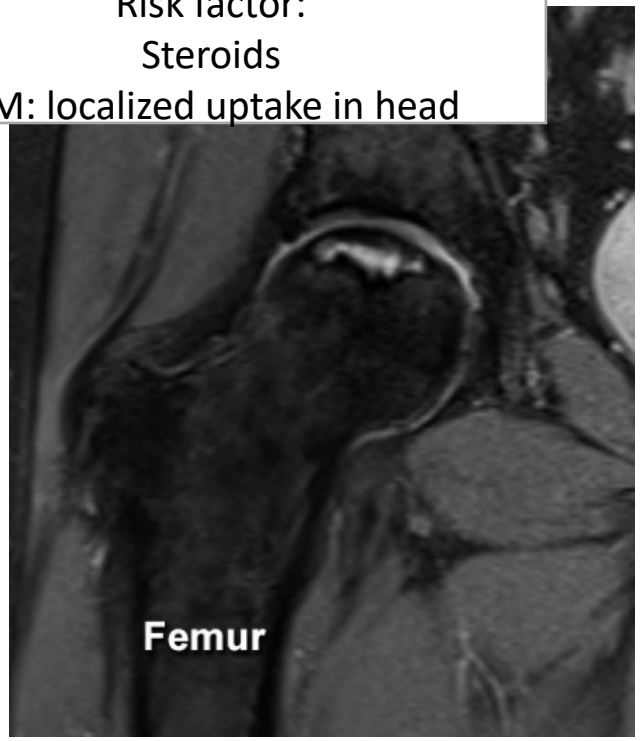
Risk factor:
3rd trimester of pregnancy
NM: diffuse uptake in head & neck

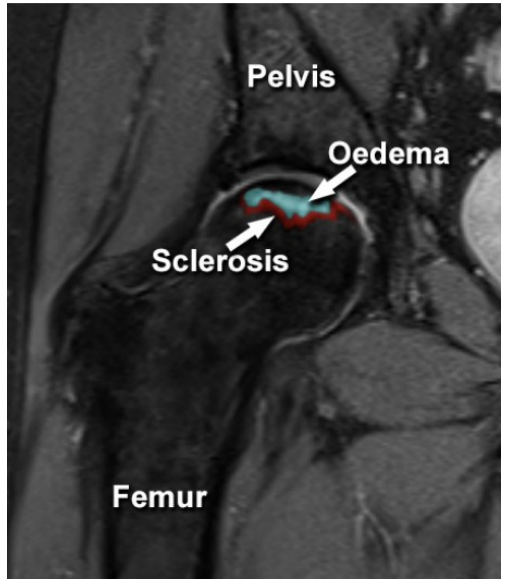
Transient osteoporosis:

MRI:
Diffuse edema on the femoral head & neck
(low T1 & high T2)



Risk factor:
Steroids
NM: localized uptake in head

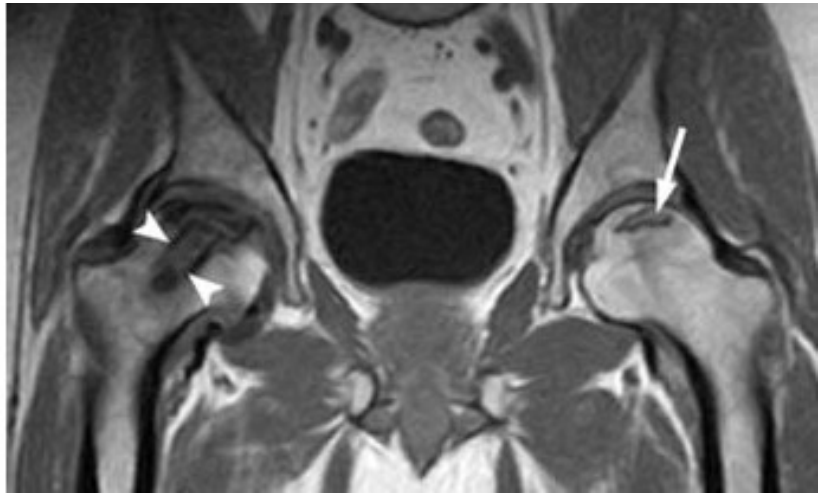




Double line sign

AVN:

MRI:
Focal defect (geographic line)
Low in T1 & T2 (sclerosis)
In T2: Double line sign (high signal granulation tissue surrounding the low signal sclerosis)



Case (33)

History: A 8-years-old girl with history of fell off the trampoline presented with wrist pain

Greenstick fracture: distal radius

Incomplete fracture of long bone in young children < 10 years

Mid-diaphyseal (forearm/ lower leg)

DD:

Torus fracture (buckle fracture):
metaphyseal, mostly the distal
radial metaphysis

Green stick fracture

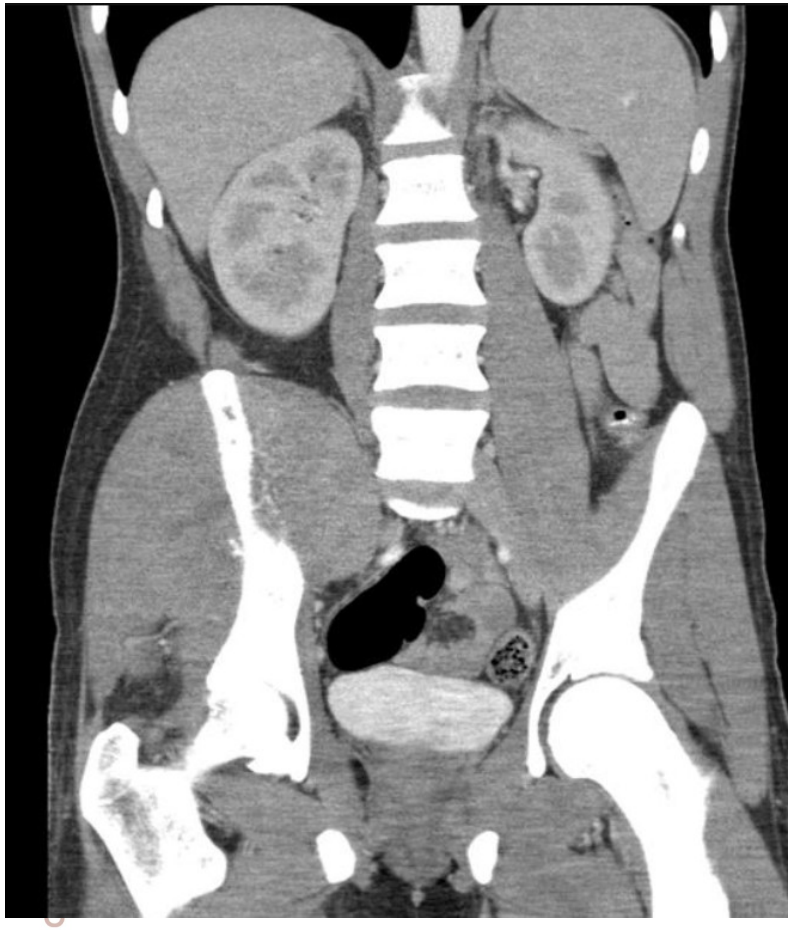
Torus fracture

Toddler's fracture (spiral fracture in the tibia)

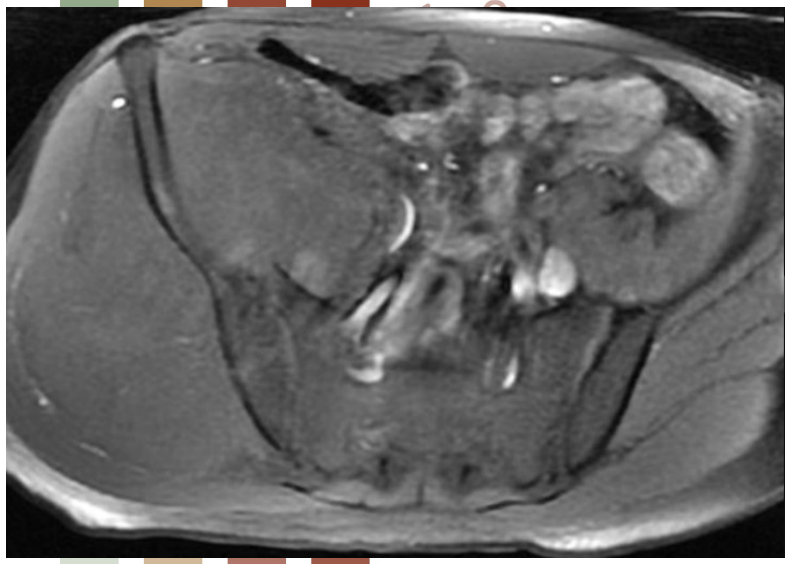
Case (34)

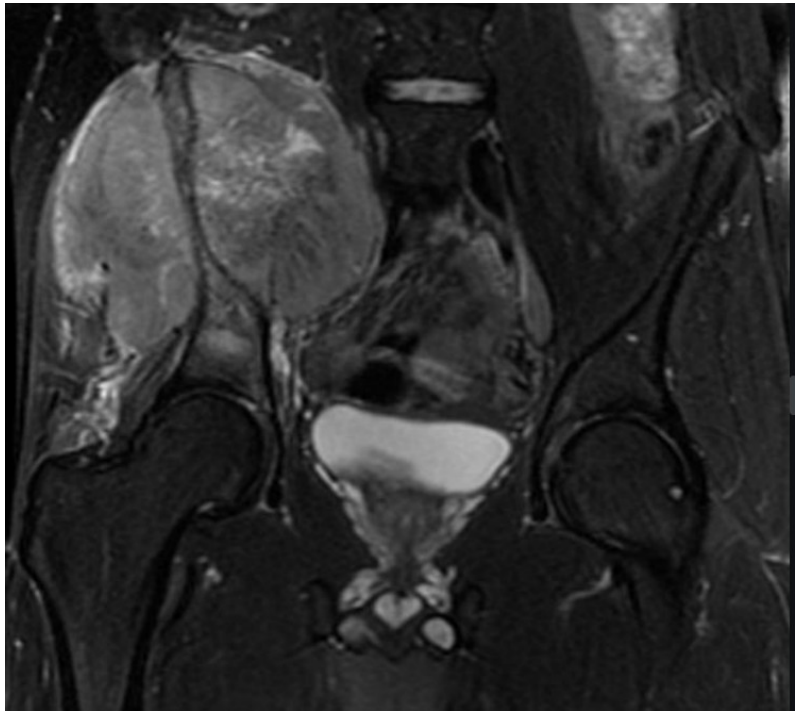
History: A 20-years-old male with back pain

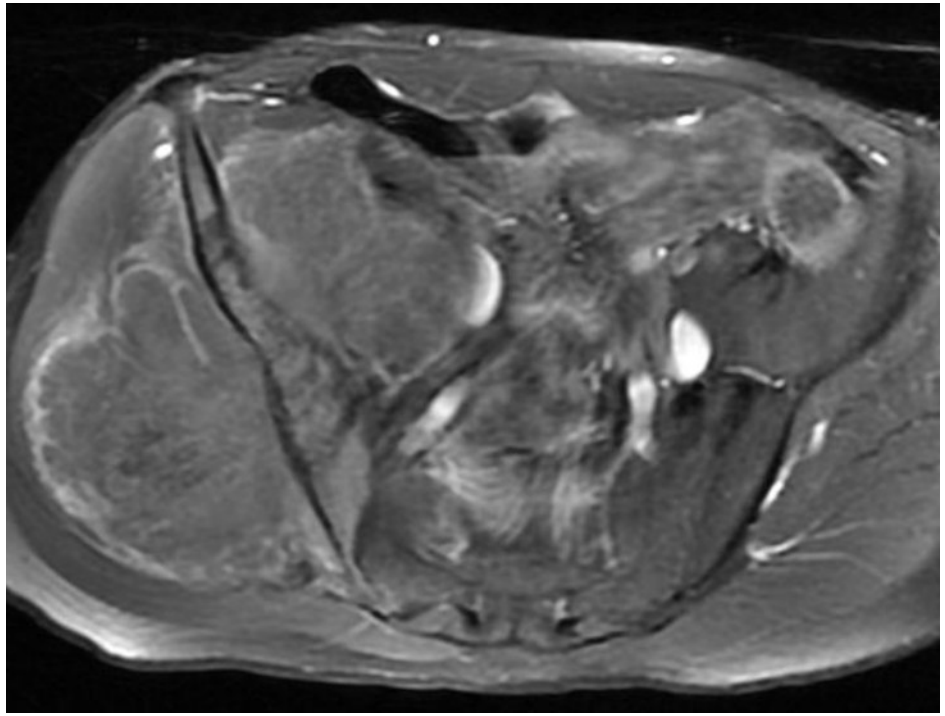
Next step?



Next step?



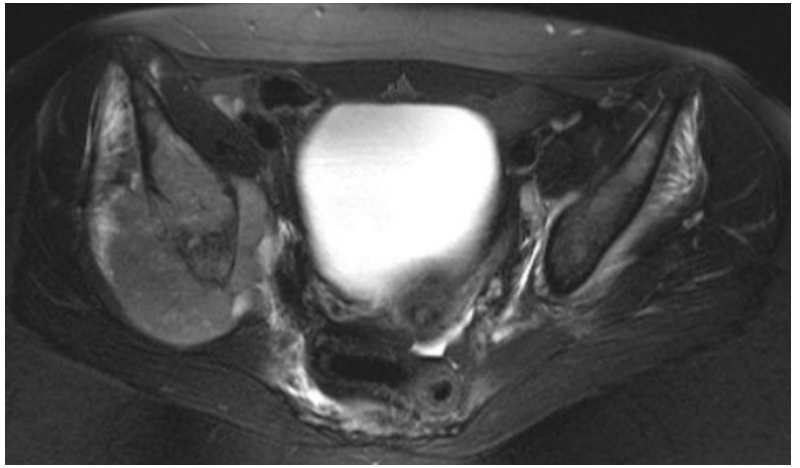


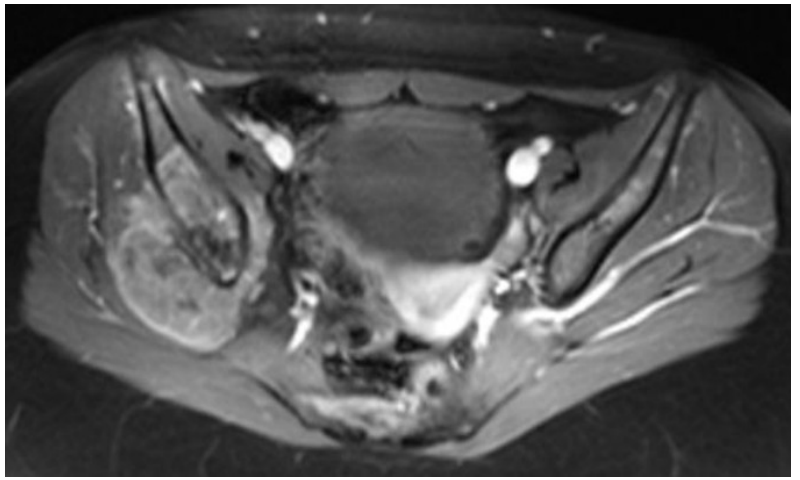


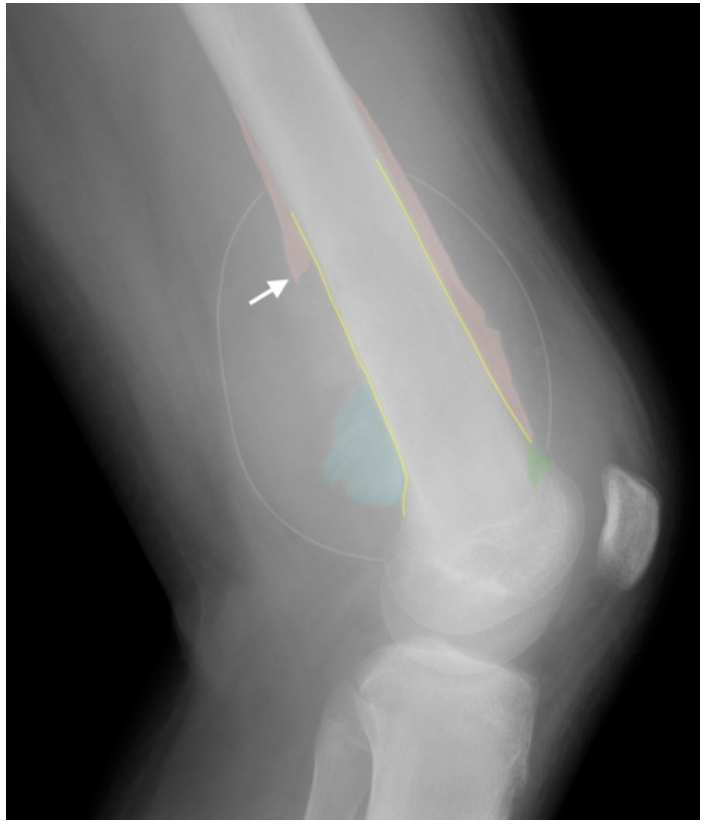
Ewing sarcoma

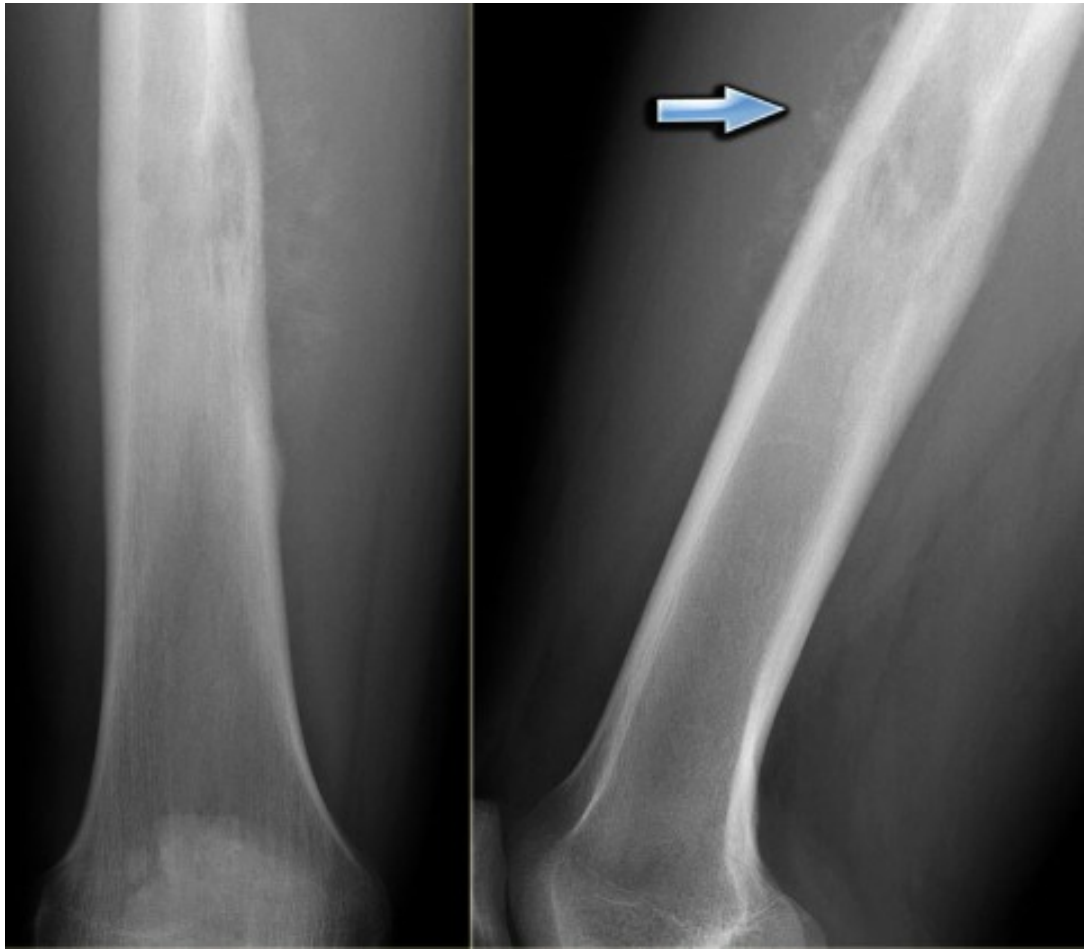
DD: Aggressive lesions
Osteosarcoma/ EG
OM/ Lymphoma/ Mets

In this case:
X-rays: ill-defined lucency on the right involving the pelvis with no convincing cortical breach or periosteal reaction
CT: Large soft tissue mass centered on the right hemi-pelvis
MRI: Confirms the CT findings



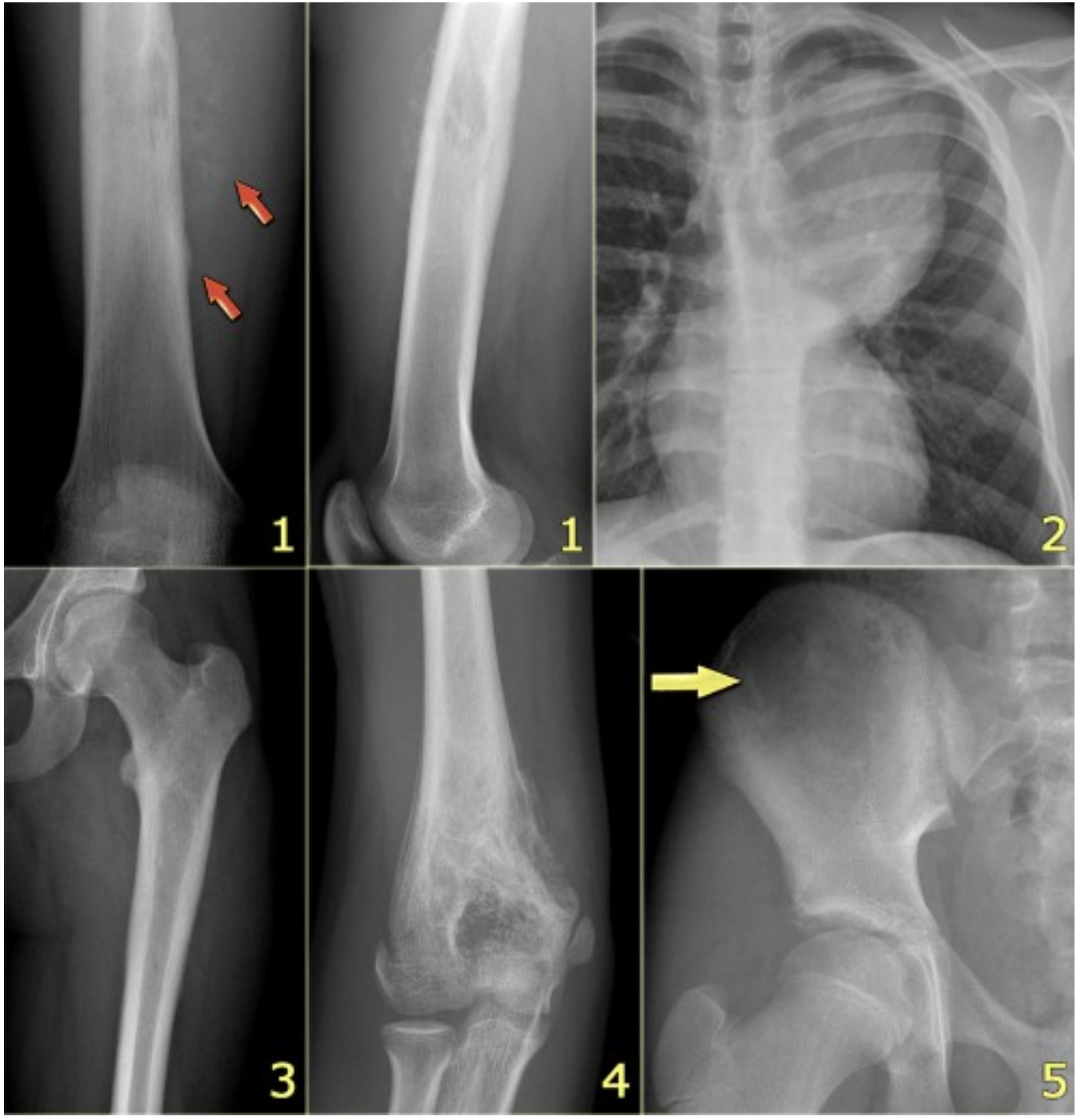






Green: Cortical bone destruction **Pink:** Periosteal reaction
Arrow: Codman triangle **Blue:** Sunburst appearance
Yellow lines: Cortical thinning **Gray lines:** soft tissue expansion

Mixed lytic-sclerotic lesion within the diaphysis of the femur + permeative pattern of destruction with a spiculated periosteal reaction and soft-tissue extension
DD: Osteosarcoma



1-Ewing sarcoma: ill-defined lytic permeative lesion in the diaphysis + reactive sclerosis, irregular periosteal reaction and soft tissue mass
DD: Osteosarcoma, lymphoma
2-Ewing sarcoma of the chest wall presenting with a large soft tissue mass
3-Ewing sarcoma of the proximal femur: almost normal radiographic appearance
4-Ewing sarcoma: ill-defined lytic lesion in the distal humerus, layered periosteal reaction laterally and irregular periosteal reaction with interruption on the antero-medial side
5-Ewing sarcoma of the iliac bone, hardly visible on plain radiograph

NB: Periosteal reaction in infant or child

1-Physiologic (< 4 months), not involving the metaphysis

2-Prostaglandin therapy (CHD)

3-Infectious (syphilis)

4-Neoplastic (Ewing, leukemia, OS, neuroblastoma mets)

5-Trauma

6-Metabolic (Rickets, scurvy > 6 months, Hypervitaminosis A)

7-Caffey disease

Case (35)

History: Withheld

Osteopetrosis

Osteopetrosis

Skull/ spine/ pelvis/ appendicular bones

Erlenmeyer flask deformity

Lucent bands (bones within bones)

DD: Diffuse bony sclerosis in children

Dysplasia (Osteopetrosis/ pyknodysostosis)

Metabolic (ROD)

Poisoning (Lead)

Idiopathic (Caffey disease)

In adults

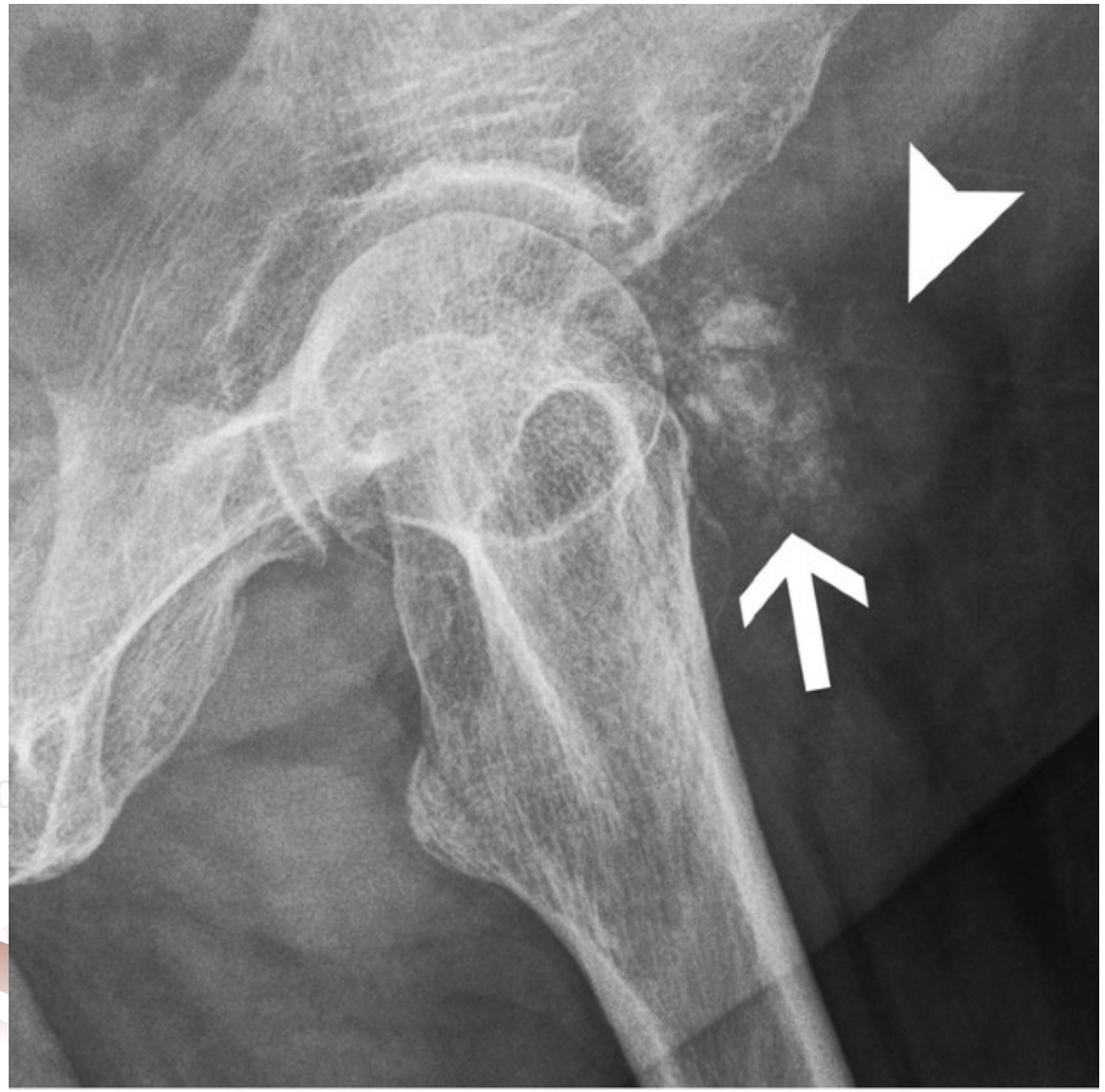
Osteoblastic metastases (prostate/ breast)

Paget's disease

Myelofibrosis/ Mastocytosis

Case (36)

History: A 47-years-old male with hip pain

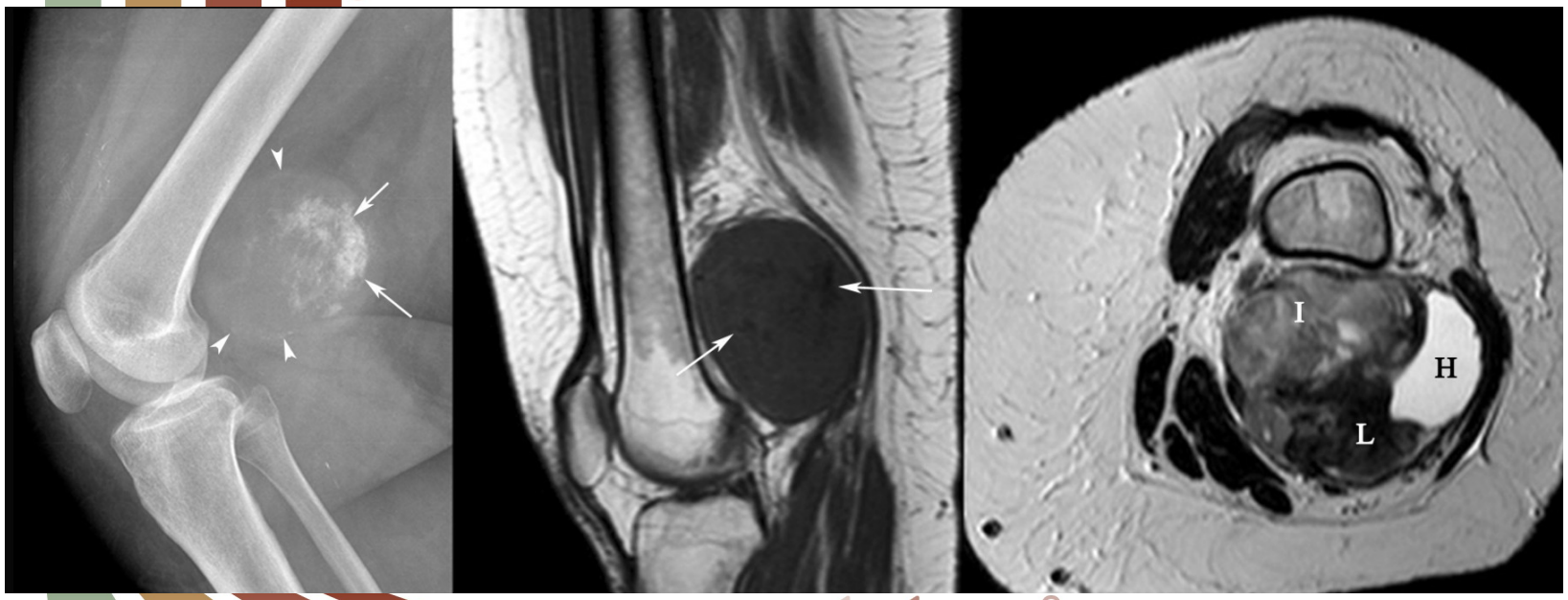


Next step?

Next step?

Soft tissue mass with calcification, Synovial sarcoma

In this case:
(a) Frog-leg radiograph, (b) axial CT image and (c) axial T1 of the left thigh show faint calcifications (arrow in a, b and c) that are located inside a tumor which is better seen on the CT and MRI assessment (arrowhead in a, b and c), Synovial sarcoma was found at pathology



DD: Soft tissue masses:
Malignant fibrous histiocytoma/ liposarcoma/ synovial sarcoma/ chondrosarcoma/ fibrosarcoma/ rhabdomyosarcoma

DD: Soft tissue calcification

1-Dystrophic soft tissue calcification (chronic venous insufficiency)

2-Vascular (arterial calcification/ phlebolith)

3-Metabolic (CPPD/ metastatic calcification/ idiopathic tumoral calcinosis)

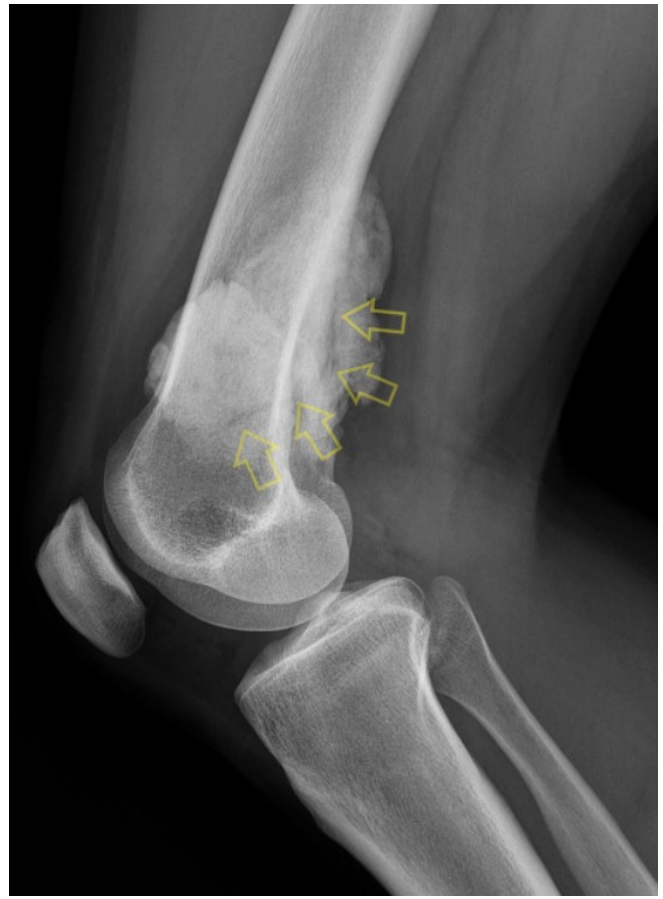
4-Traumatic (myositis ossficians)

5-Parosteal osteosarcoma

6-Soft tissue masses

7-Autoimmune (Scleroderma/ dermatomyositis)

8-Synovial osteochondromatosis



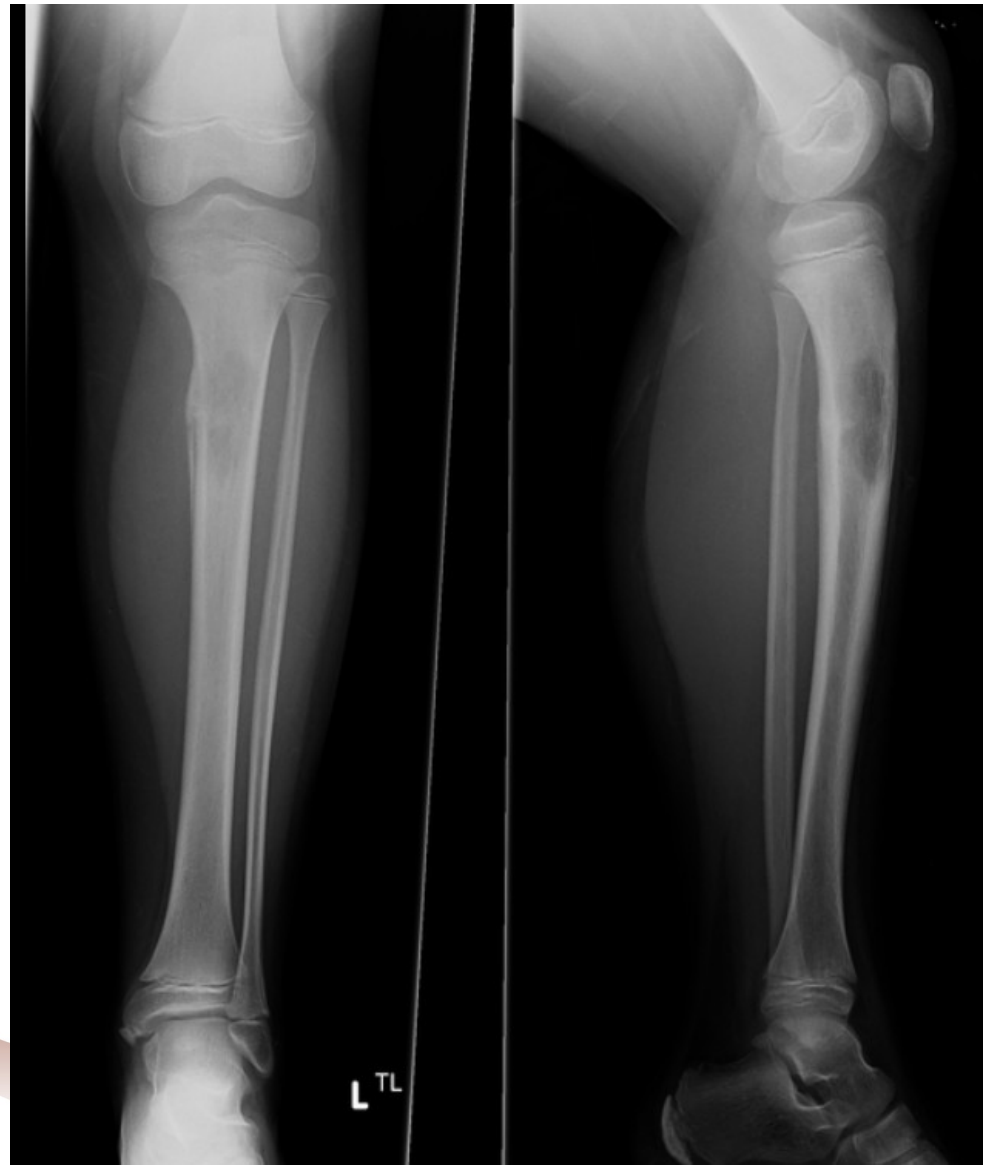
Myositis ossificans
Lateral X-ray shows that the bone cortex is not involved

Parosteal Osteosarcoma
Lobulated juxtacortical mass with dense calcification and smooth borders arising from the lateral cortex of the femoral metaphysis + curvilinear lucency between the tumor and cortex has been called the "string sign"

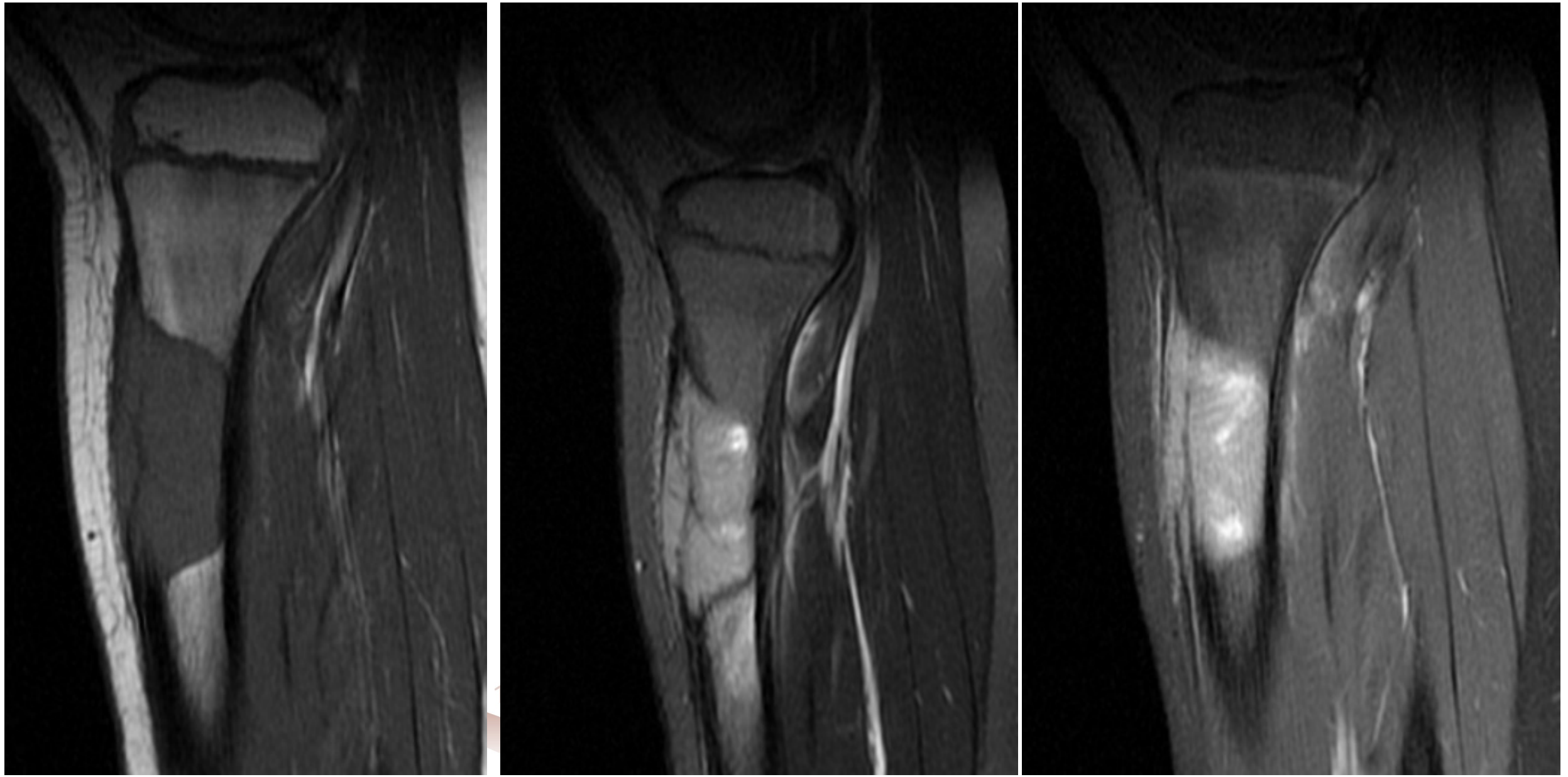
Synovial chondromatosis

Case (37)

History: A 29-years-old boy with leg pain



Next step?



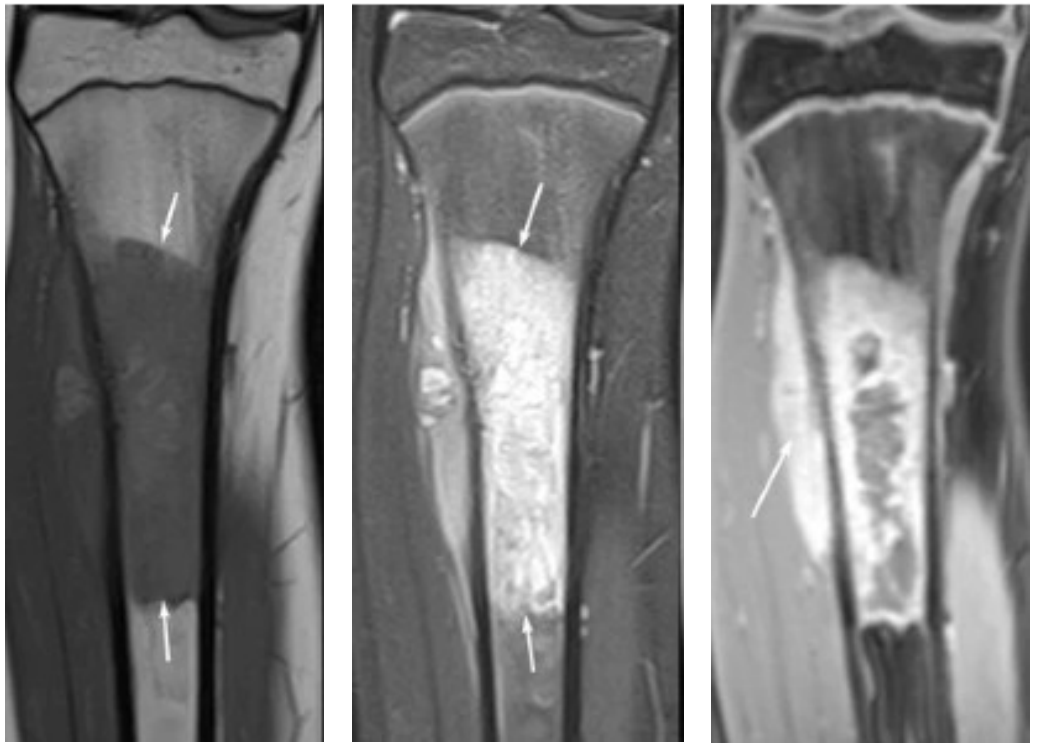
Ewing sarcoma

In this case:

X-rays: There is a lucent lesion located centrally within the proximal tibial diaphysis, it demonstrates a relatively narrow but indistinct zone of transition, periosteal reaction is seen involving the medial aspect of the tibia

MRI: The cylindrical lesion demonstrates intrinsic low T1 and high T2 signal, it extends through the anteromedial tibial cortex with destruction of the bone, periosteal elevation is also seen anteromedially, there is diffuse contrast enhancement and enhancement of a soft tissue component

Mottled, osteolytic lesion (blue circle) with poorly marginated edges in the diaphysis of the bone, there is sunburst periosteal reaction (red circle) & lamellated periosteal reaction (white arrows)



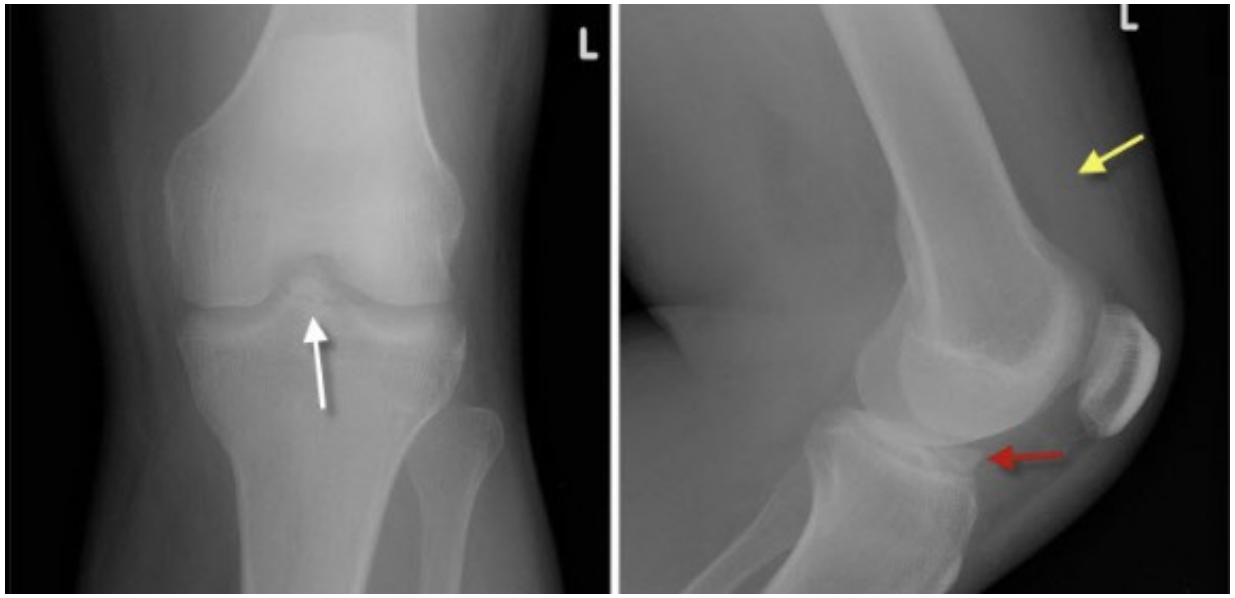
T1/ T2/ T1+C

Case (38)

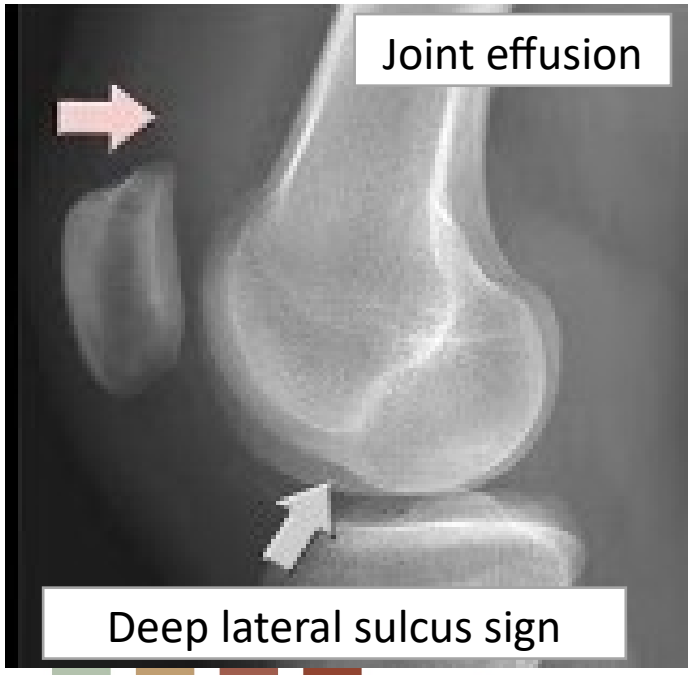
History: A 7-years-old boy with painful knee

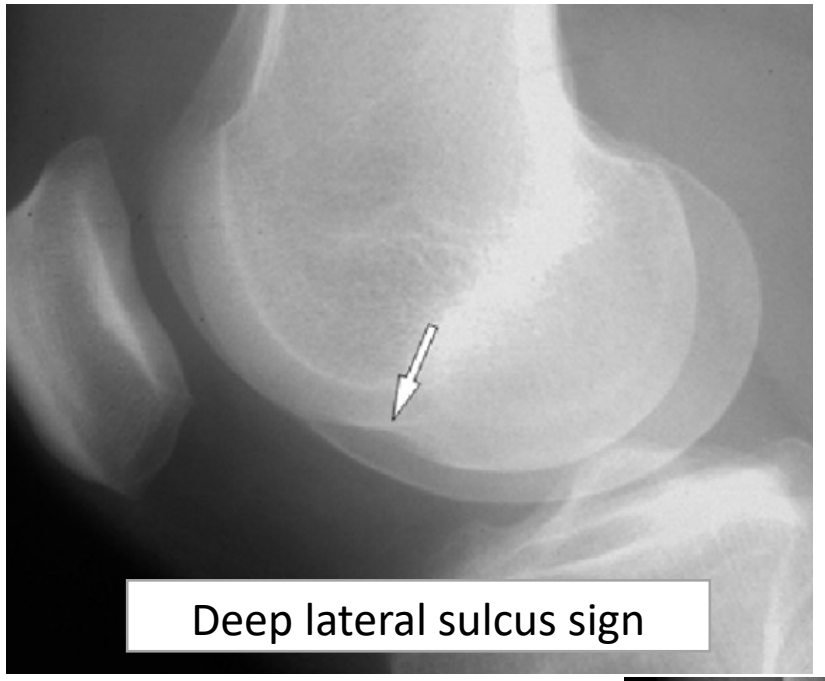
Segond fracture with avulsion of ACL

On AP view a curvilinear bony fracture is seen on the lateral aspect of the tibia reflecting a Segond fracture
Best seen on lateral projection, an avulsion of the anterior tibial spine can also be seen



The anterior tibial spine is the tibial attachment of the anterior cruciate ligament
On plain x-ray, fracture of anterior tibial spine reflects ACL avulsion fracture
Segond fracture is also an avulsion fracture seen at the lateral aspect of the tibial plateau, that is frequently associated with ACL tear





X-ray signs of ACL tear:

1-Segond fracture

2-Deep lateral sulcus sign (depression of the lateral femoral condyle representing impaction fracture)

3-Anterior tibial translocation

4-Joint effusion

5-Arcuate sign (avulsion fracture of the proximal fibula)

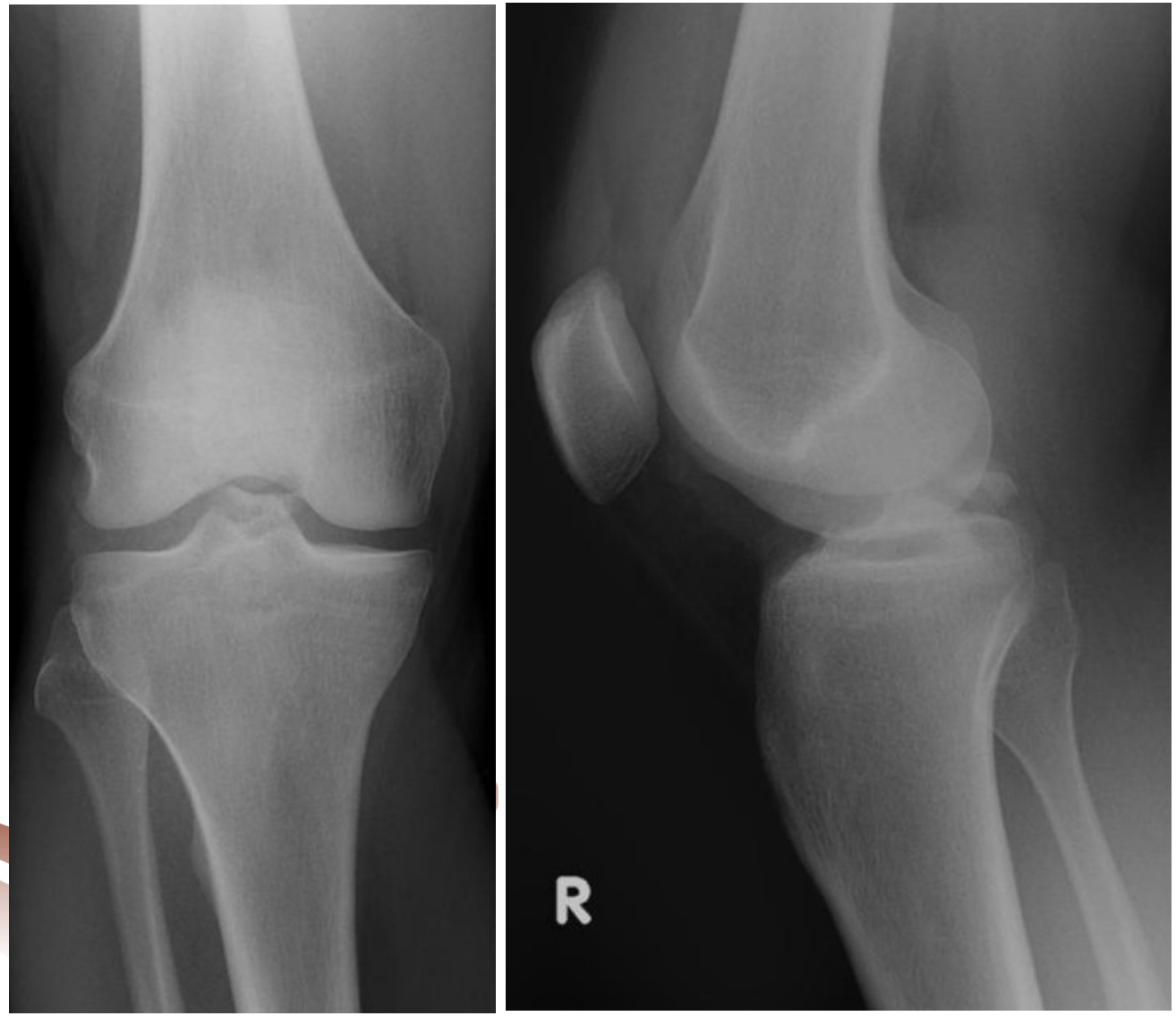
Normal ACL

ACL complete tear

Kissing contusions

Case (39)

History: A 31-years-old man with recent motorcycle accident



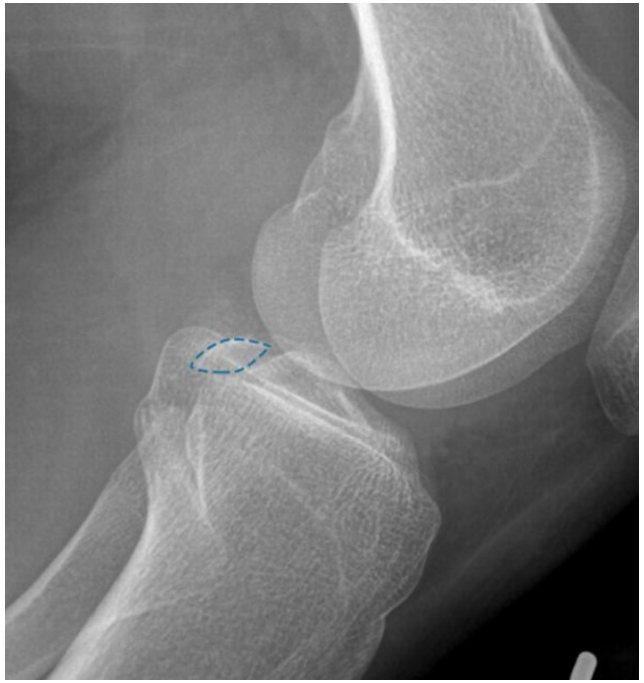
Next step?

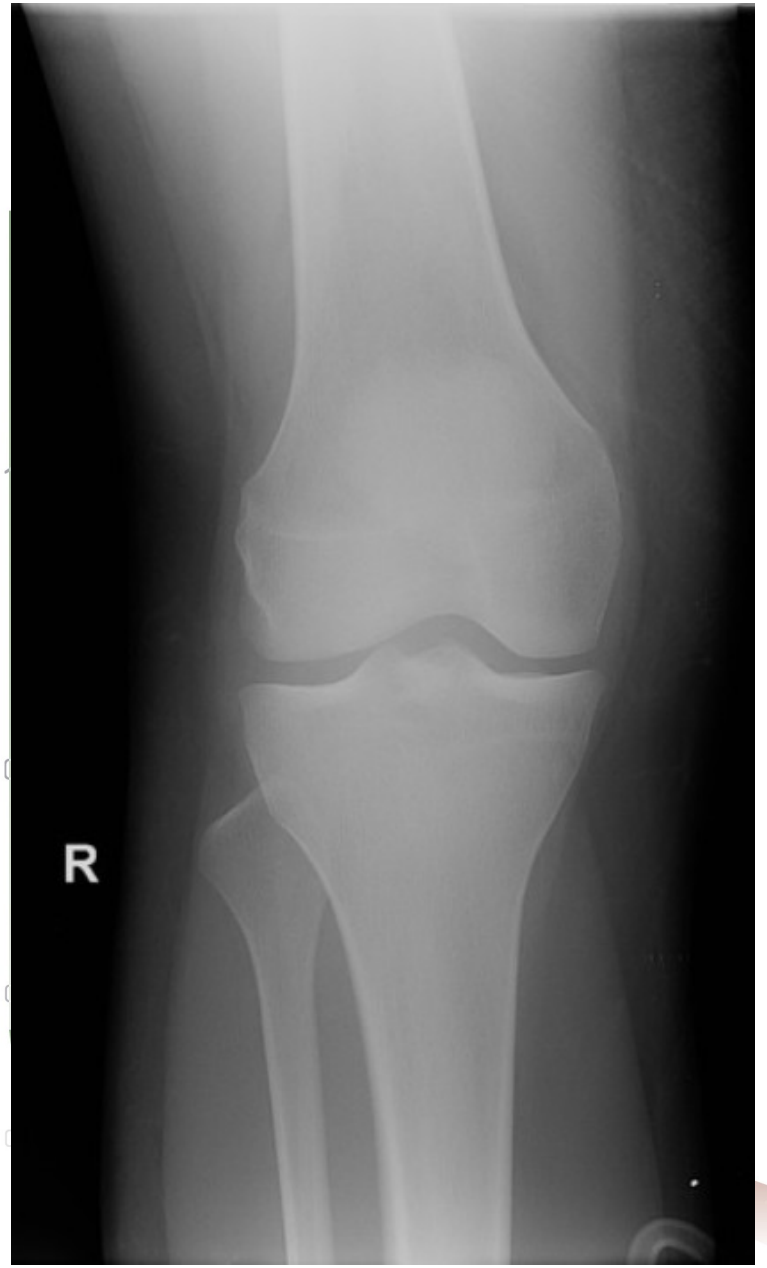
Next step?

PCL avulsion fracture

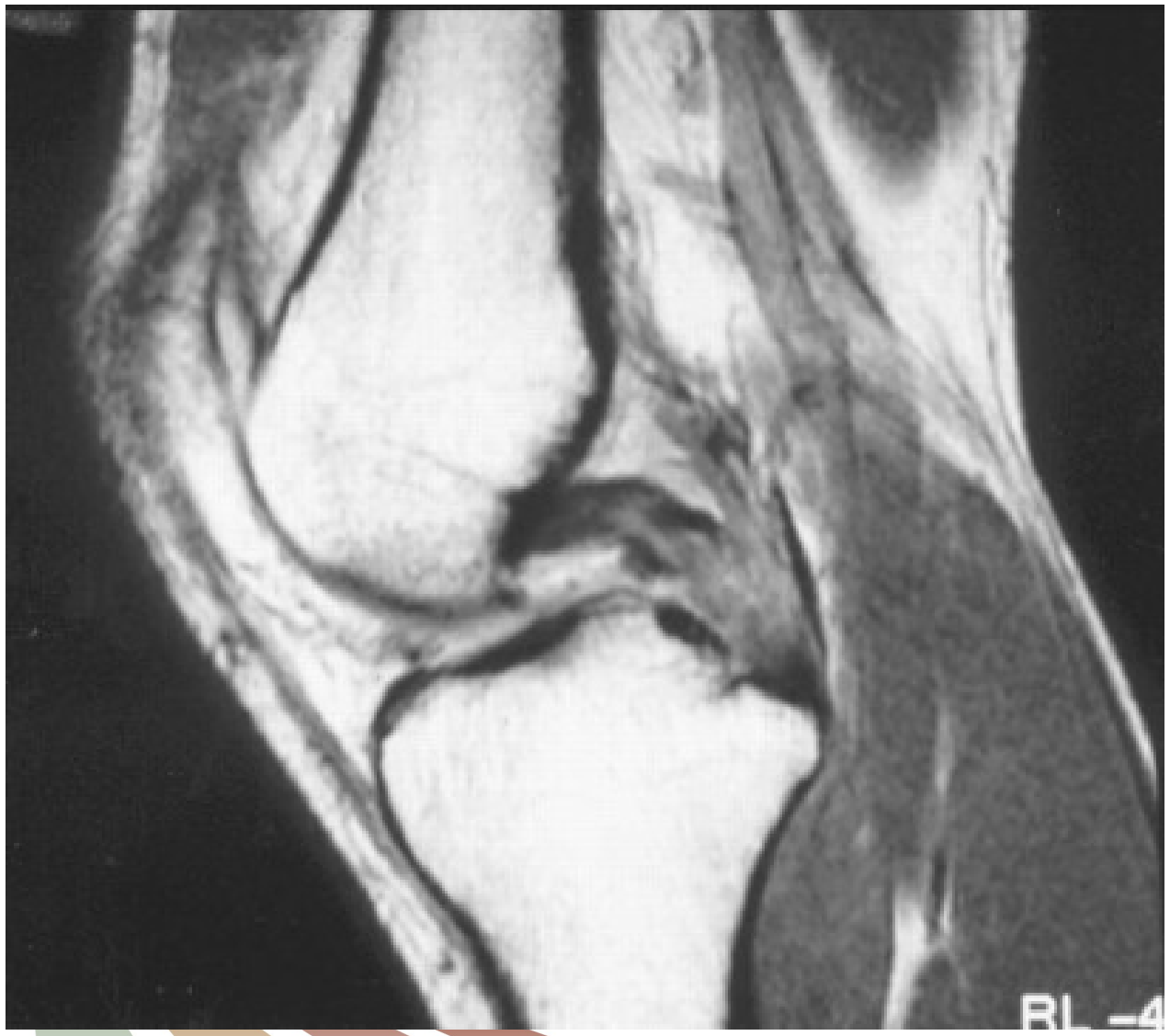
In this case:

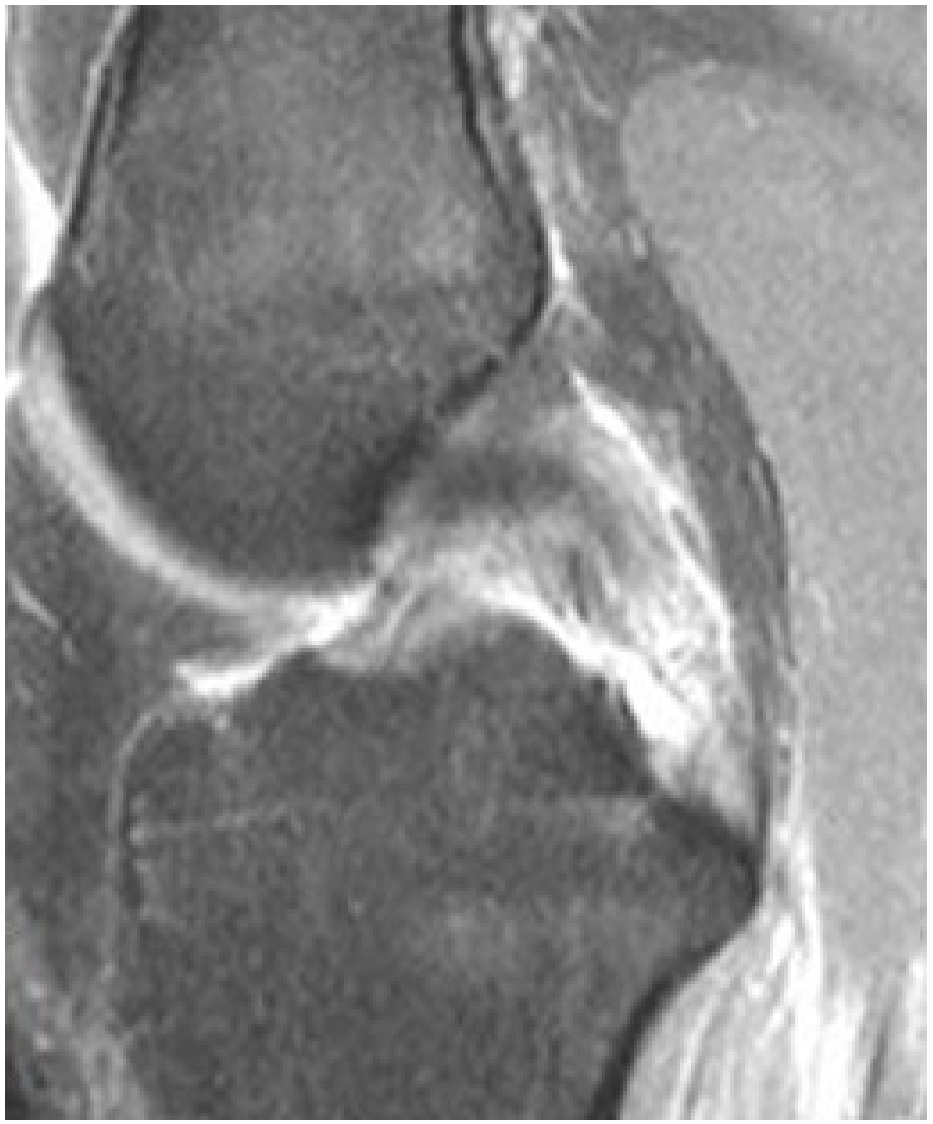
X-rays: Osseous fragment in the posteromedial joint space of the knee at the expected location of the PCL, suggesting an avulsion of the PCL insertion + suprapatellar effusion
CT: The avulsed segment identified on the plain film is well characterized + moderate displacement of the largest fragment and multiple comminuted fragments
MRI: Mid-substance posterior cruciate ligament fibers are ill-defined and discontinuous





There is a knee joint lipohemarthrosis
Minimally displaced fracture from the posterior tibial plateau is likely due to avulsion of the PCL with a bone fragment



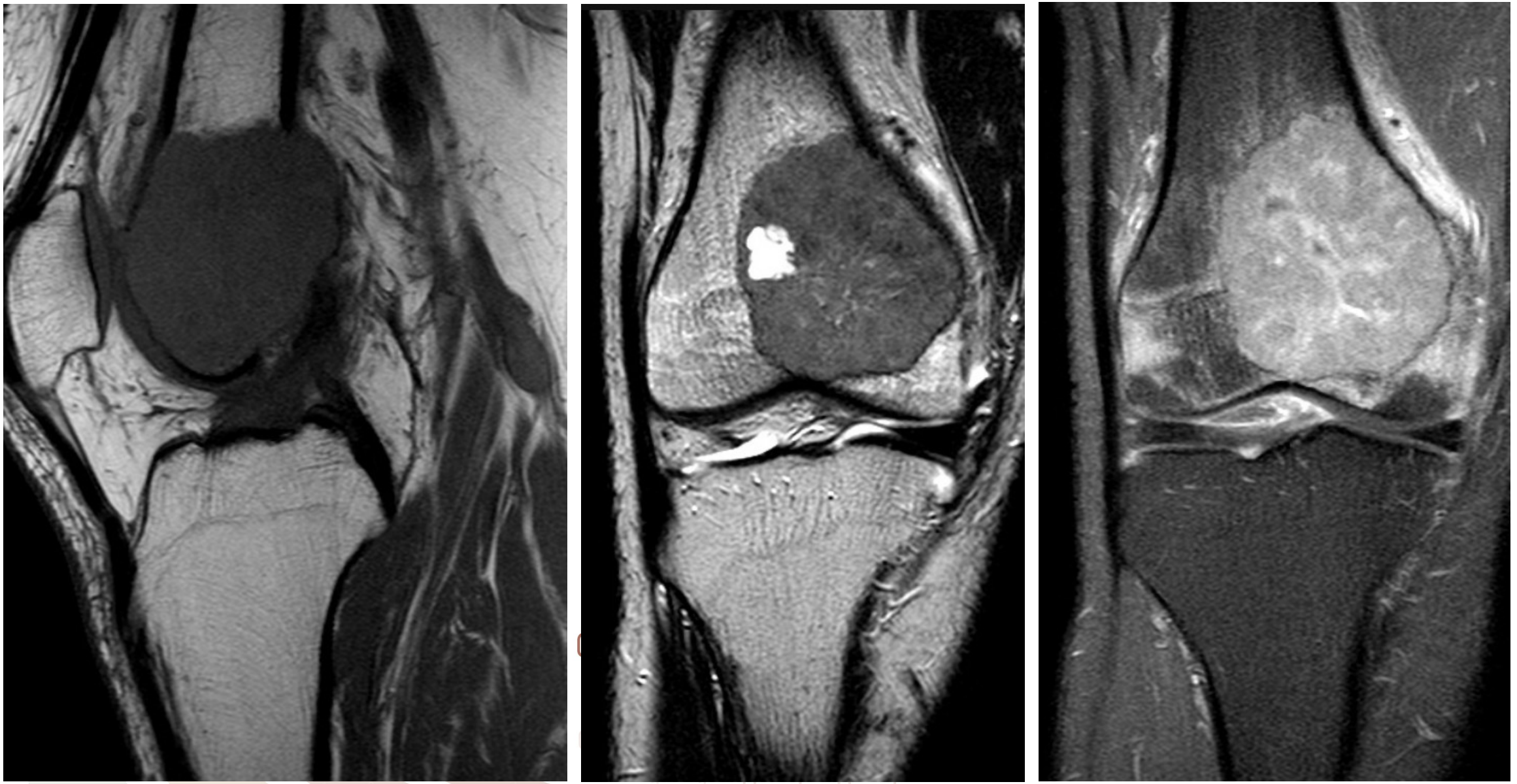


PCL tear

Case (40)

History: A 40-years-old man with knee pain

Next step?



GCT

Eccentric involving the epiphysis + closed growth plates

Expansile lytic lesion with no sclerotic rim with narrow zone of transition

Low in T1, high in T2, heterogeneous ++

DD:

Chondroblastoma: skeletally immature patients

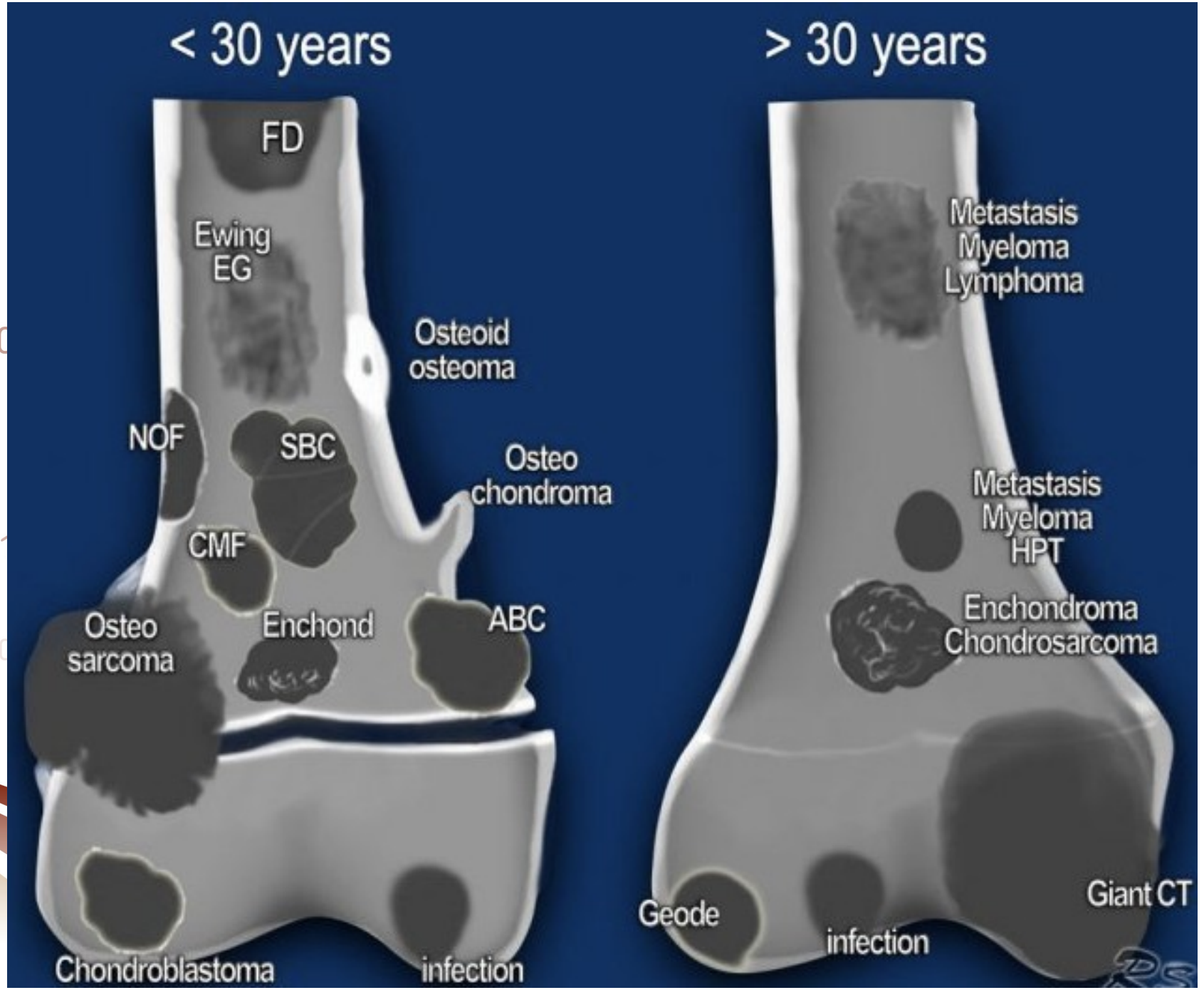
ABC

Brown tumor

Brodie abscess

Joint pathology (geode/ ganglion/ PVNS)

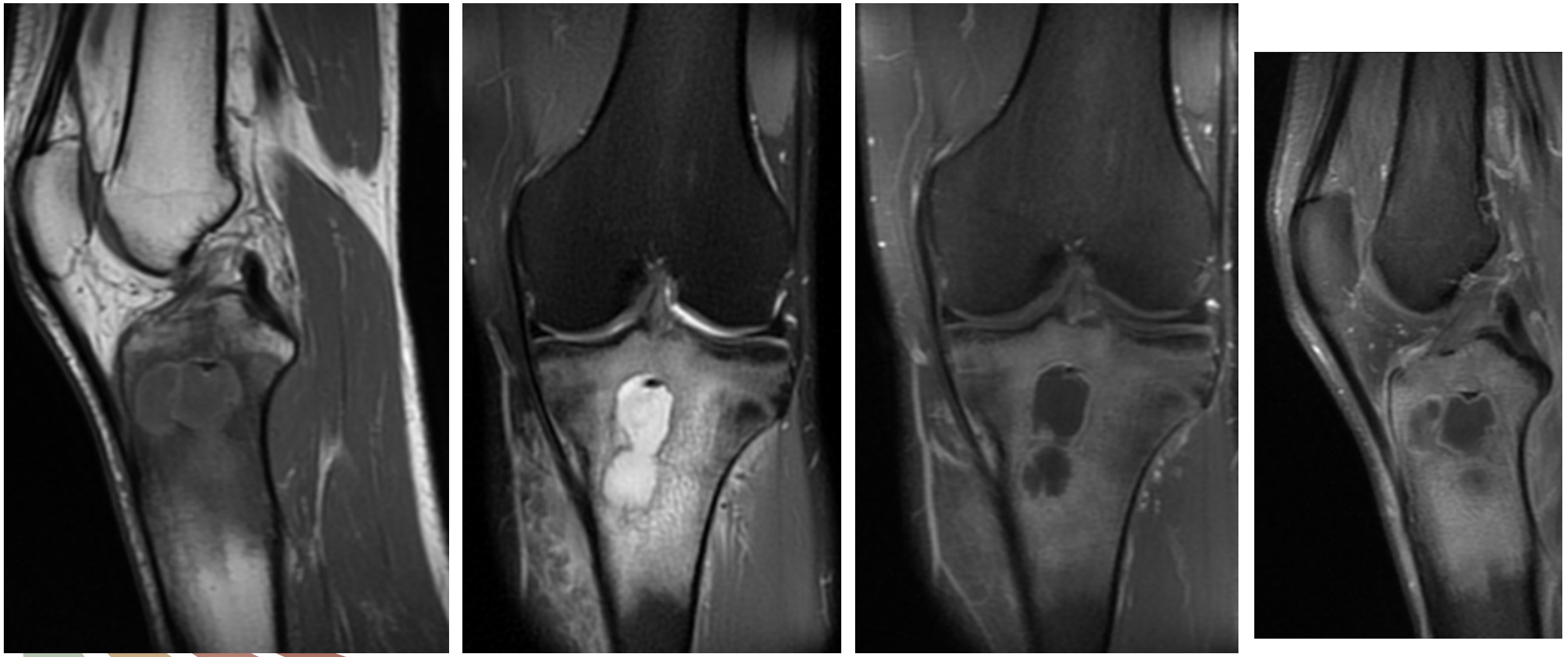
NOF


< 30 years
> 30 years
FD
Ewing
EG
Osteoid
osteoma
NOF
SBC
Osteo
chondroma
CMF
Osteo
sarcoma
Enchond
ABC
Chondroblastoma
infection
Metastasis
Myeloma
Lymphoma
Metastasis
Myeloma
HPT
Enchondroma
Chondrosarcoma
Geode
infection
Giant CT

Case (41)

History: A 20-years-old man with pain around the knee

Next step?



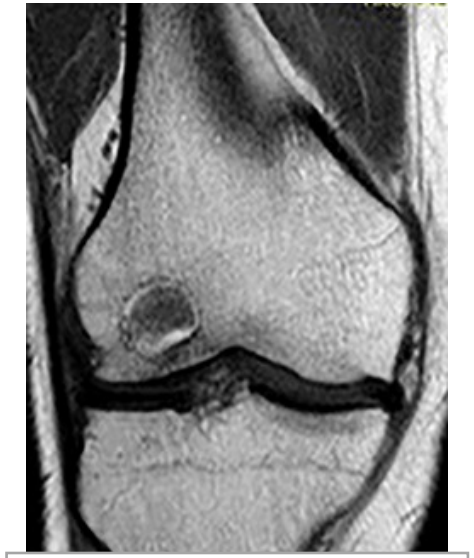
Brodie abscess

X-ray: Lytic lesion often in an oval configuration that is oriented along the long axis of the bone + sclerotic rim +/- lucent tortuous channel extending toward growth plate prior to physeal closure (pathognomonic)

MRI: The “penumbra sign” on MRI is useful for discriminating subacute osteomyelitis from other bone lesions

Penumbra sign in T1+C: High signal enhancing thin rim of granulation tissue surrounding a low intensity fluid abscess cavity

Lucent tortuous channel extending toward growth plate

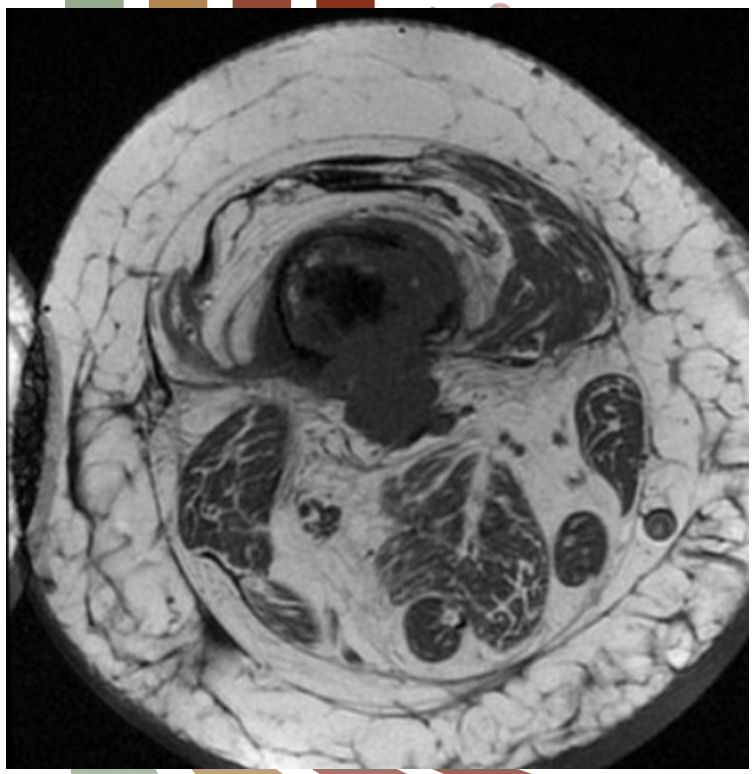


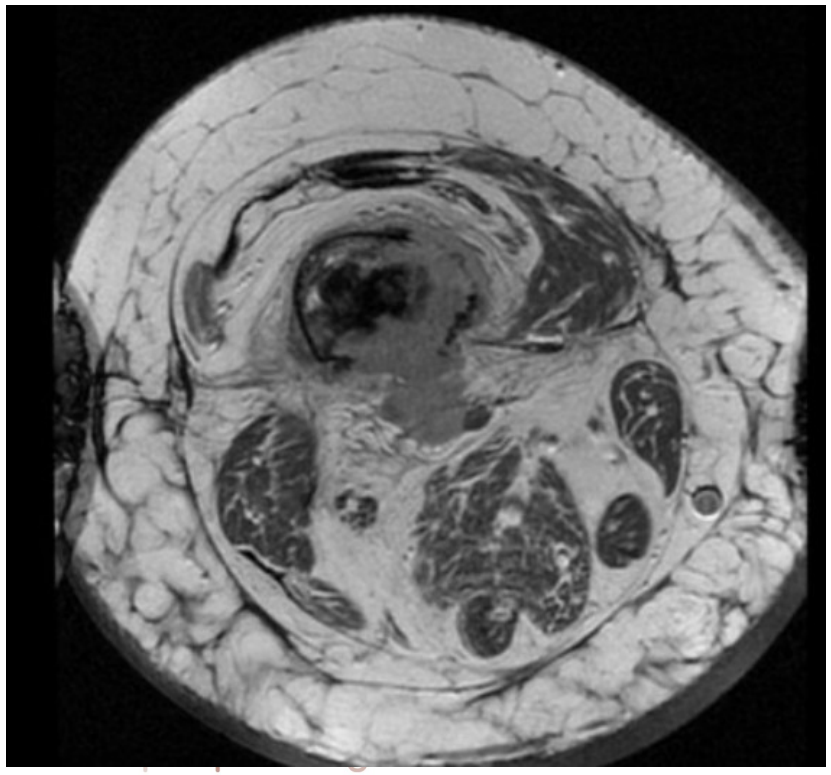
Penumbra sign

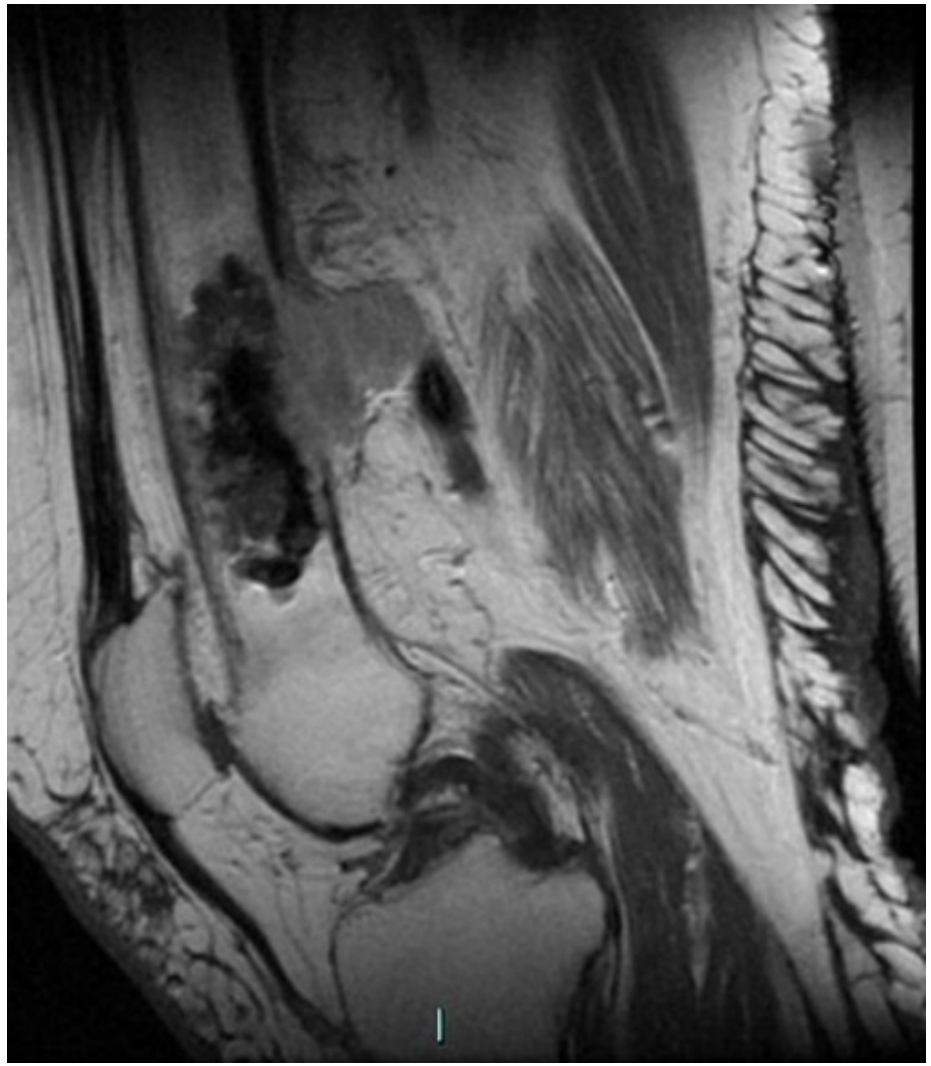
Case (42)

History: A 80-years-old woman with history of few months pain and swelling in the right knee in the suprapatellar region

Next step?





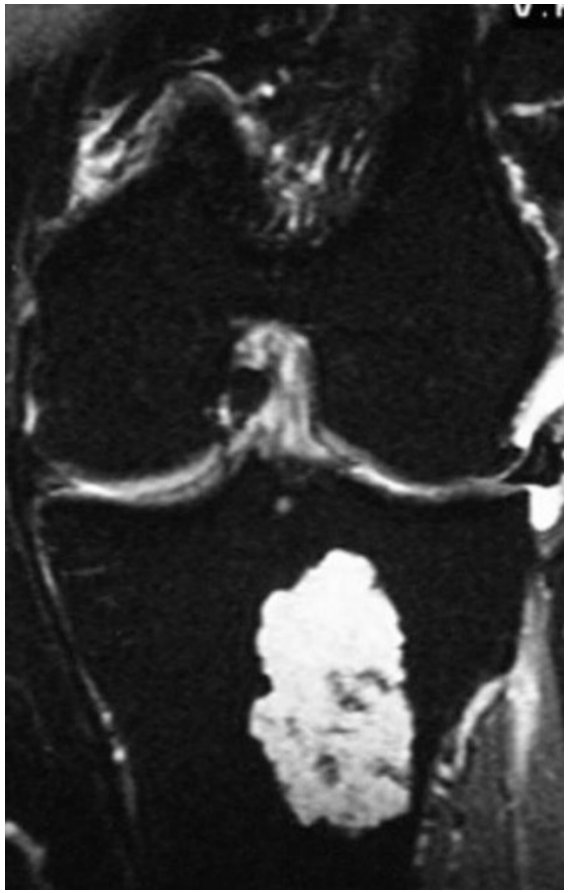


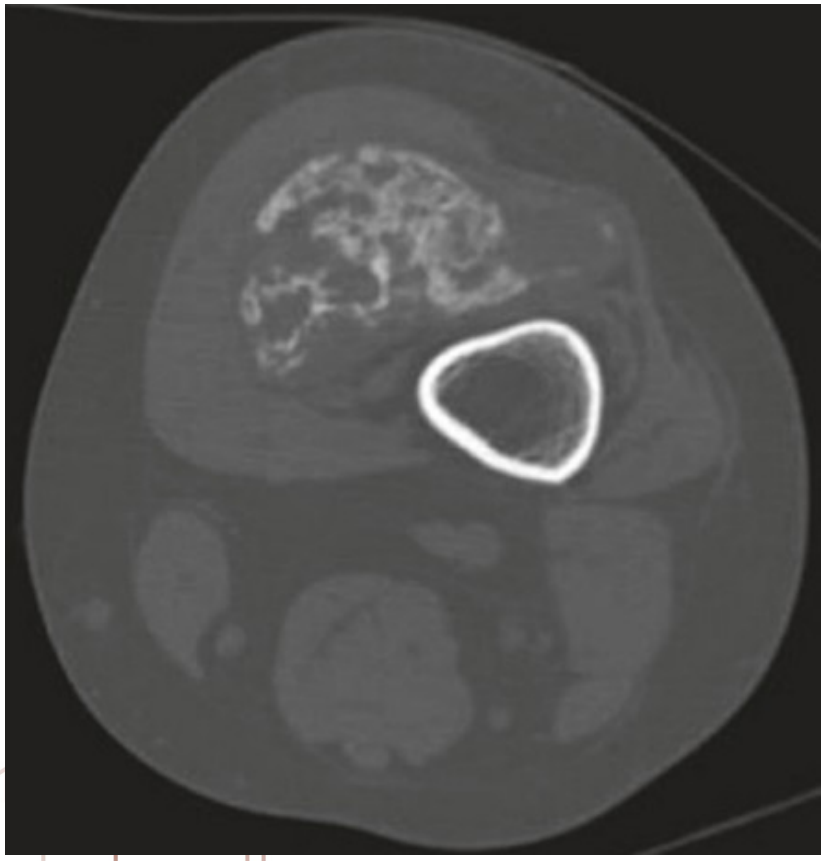
Chondrosarcoma

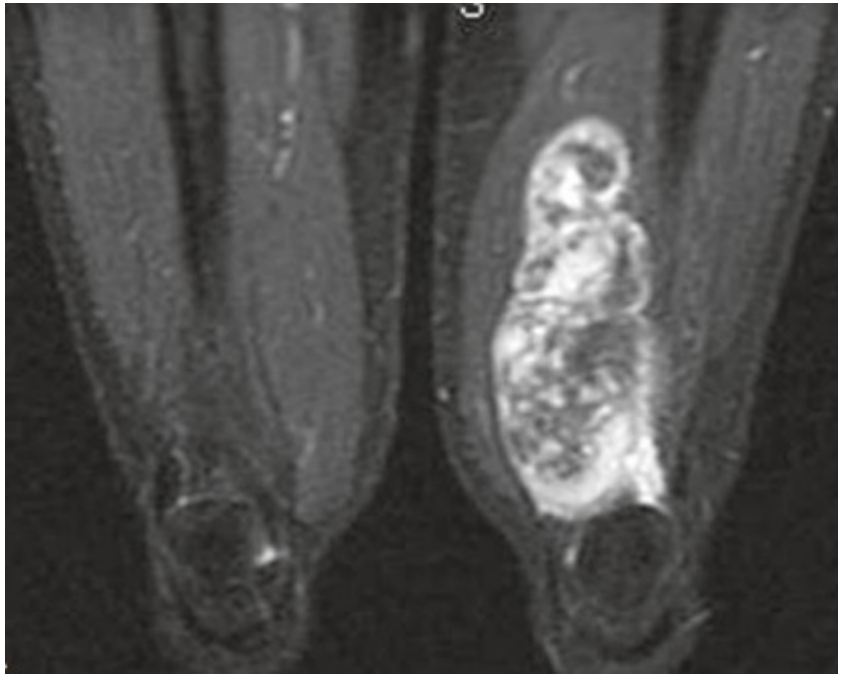
In this case:

X-rays: Chondrosarcoma of the distal femoral metaphysis, there is osteolysis around an earlier enchondroma and cortical extension exceeded in the soft part, DD: bone infarct/ enchondroma

MRI: The tumor tissue infiltrates all surrounding soft tissues especially laterally and posteriorly







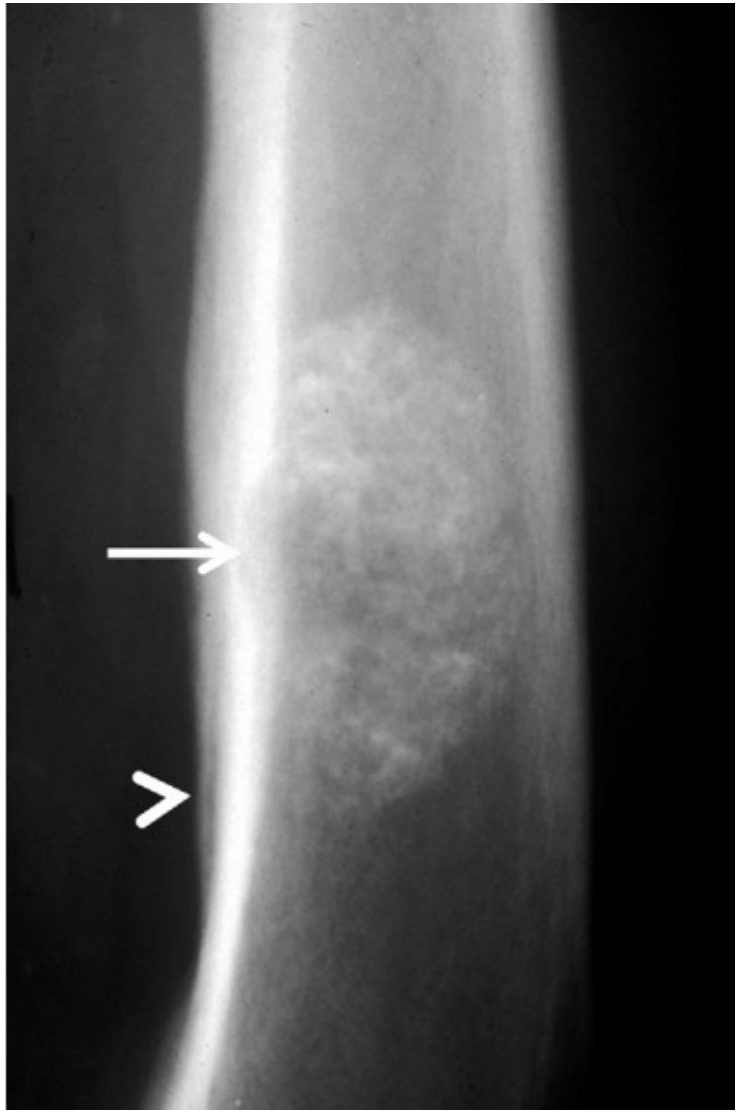
Chondrosarcoma in a knee

X-rays & CT show large areas of ossified or calcified matrix

T2 highlights the high-intensity non-calcified chondroid areas

Enchondroma, sharply defined margins, no growth through the cortex

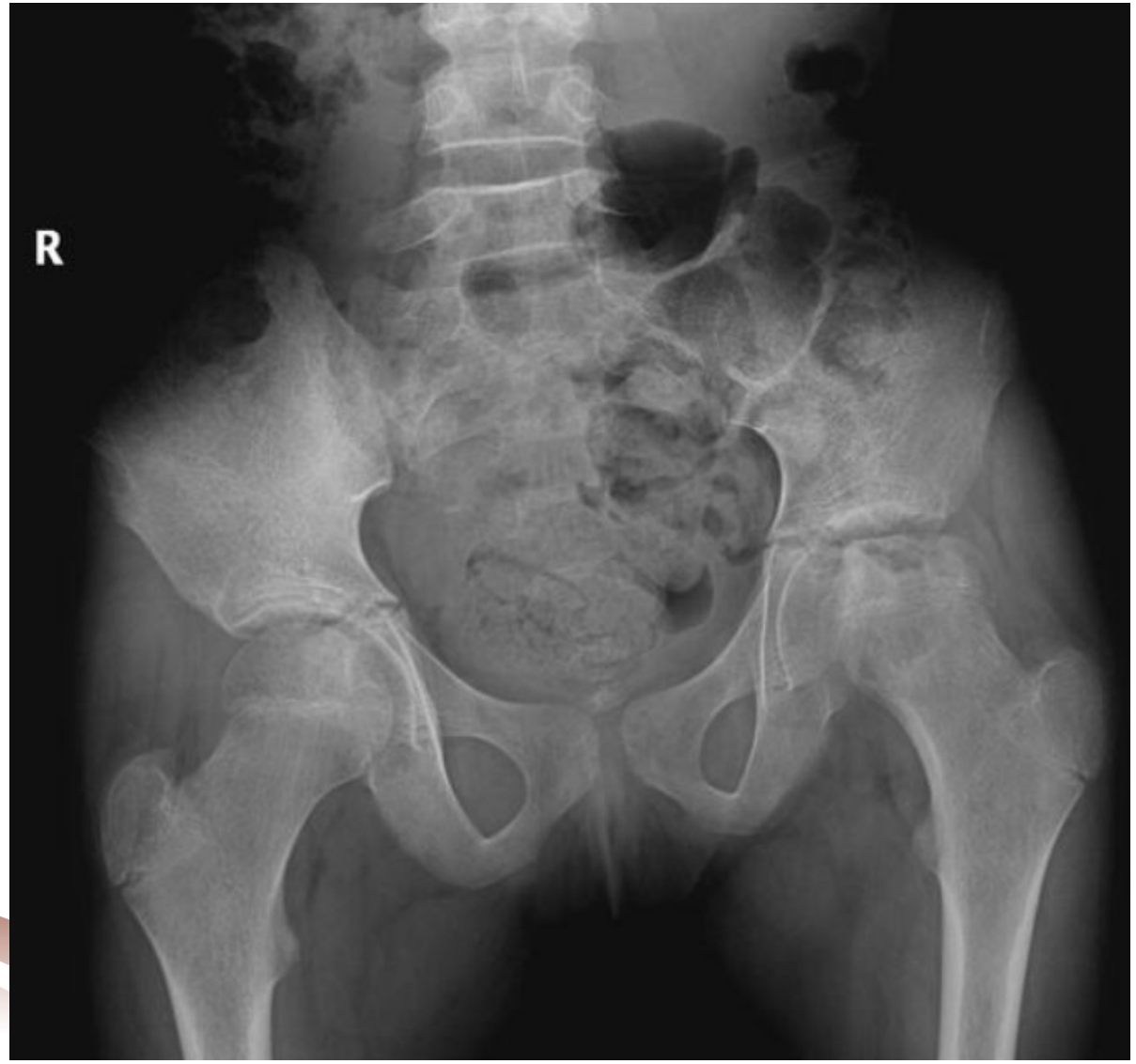
Bone infarction, serpiginous sclerotic



Chondrosarcoma: aggressive features with focal deep endosteal scalloping (arrow) and linear periosteal reaction (arrowhead)

Case (43)

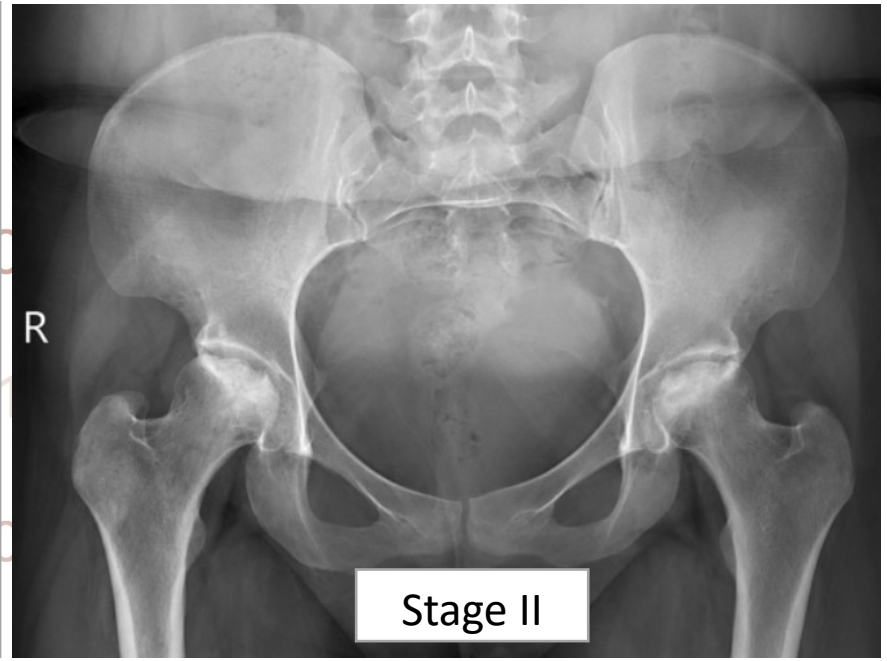
History: A 12-years-old girl with back pain

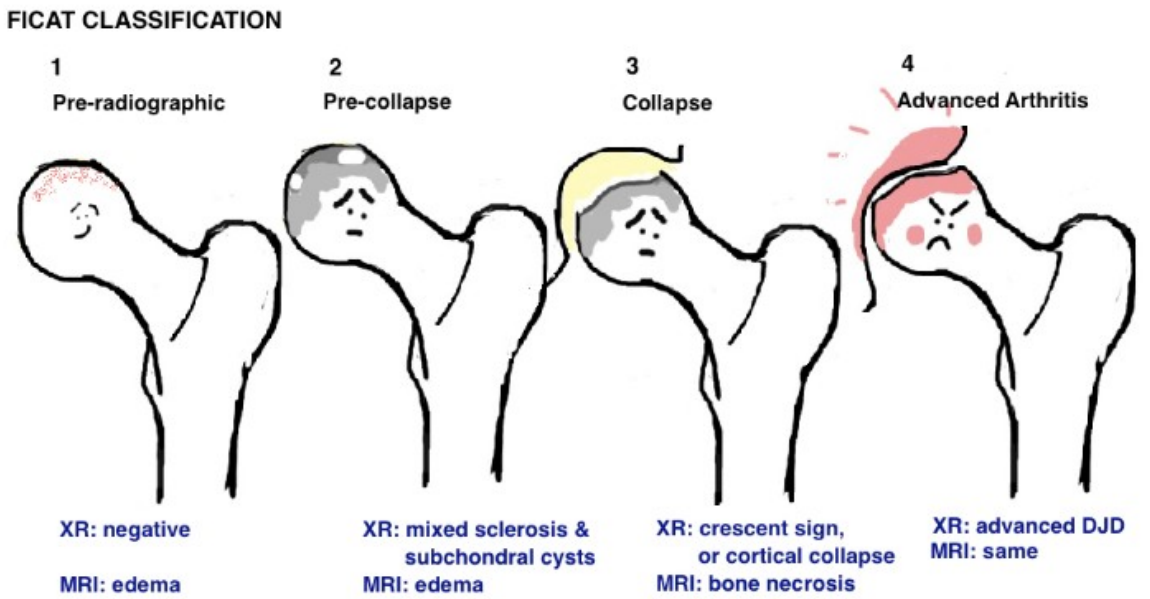


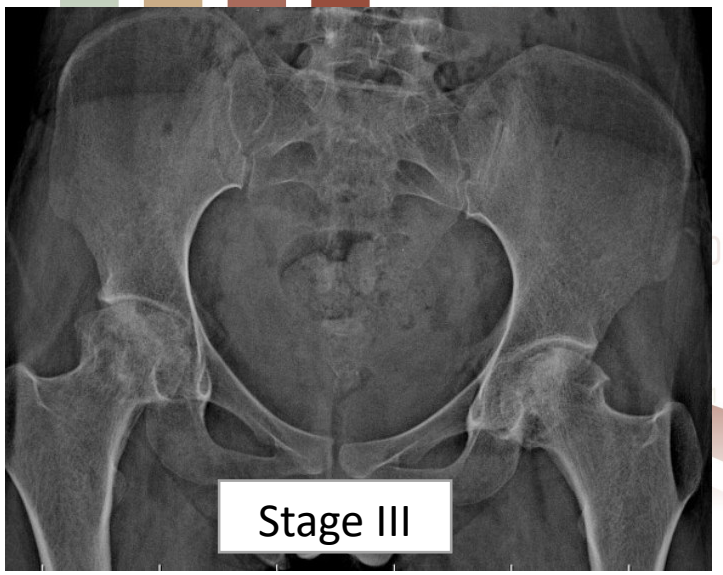
Avascular necrosis of the left hip

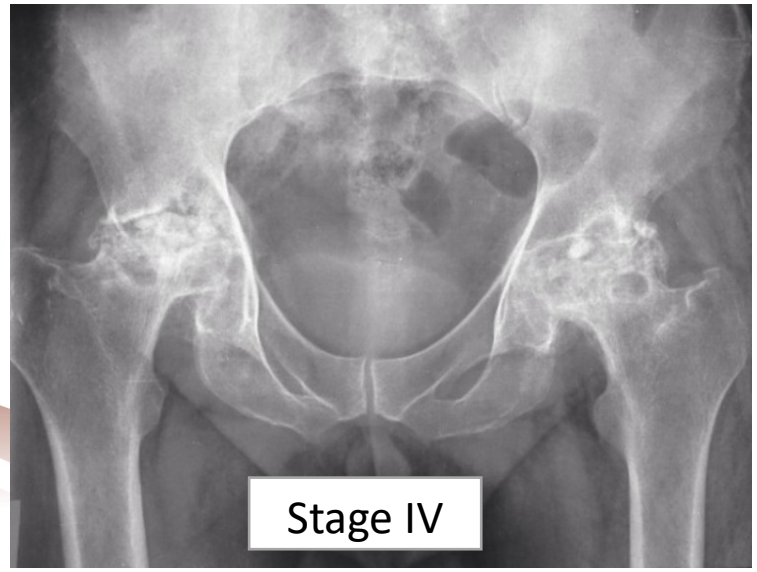
Causes:

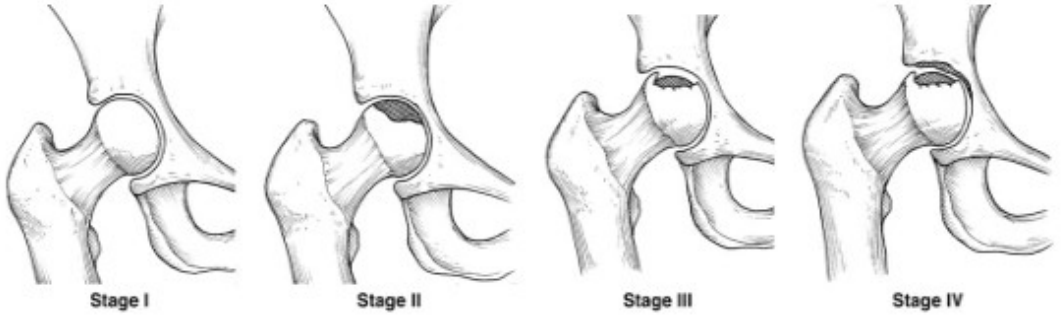
1-Idiopathic (perthe's disease)
2-Traumatic
3-Sickle cell
4-Steroids
5-Gaucher disease
6-Alcohol







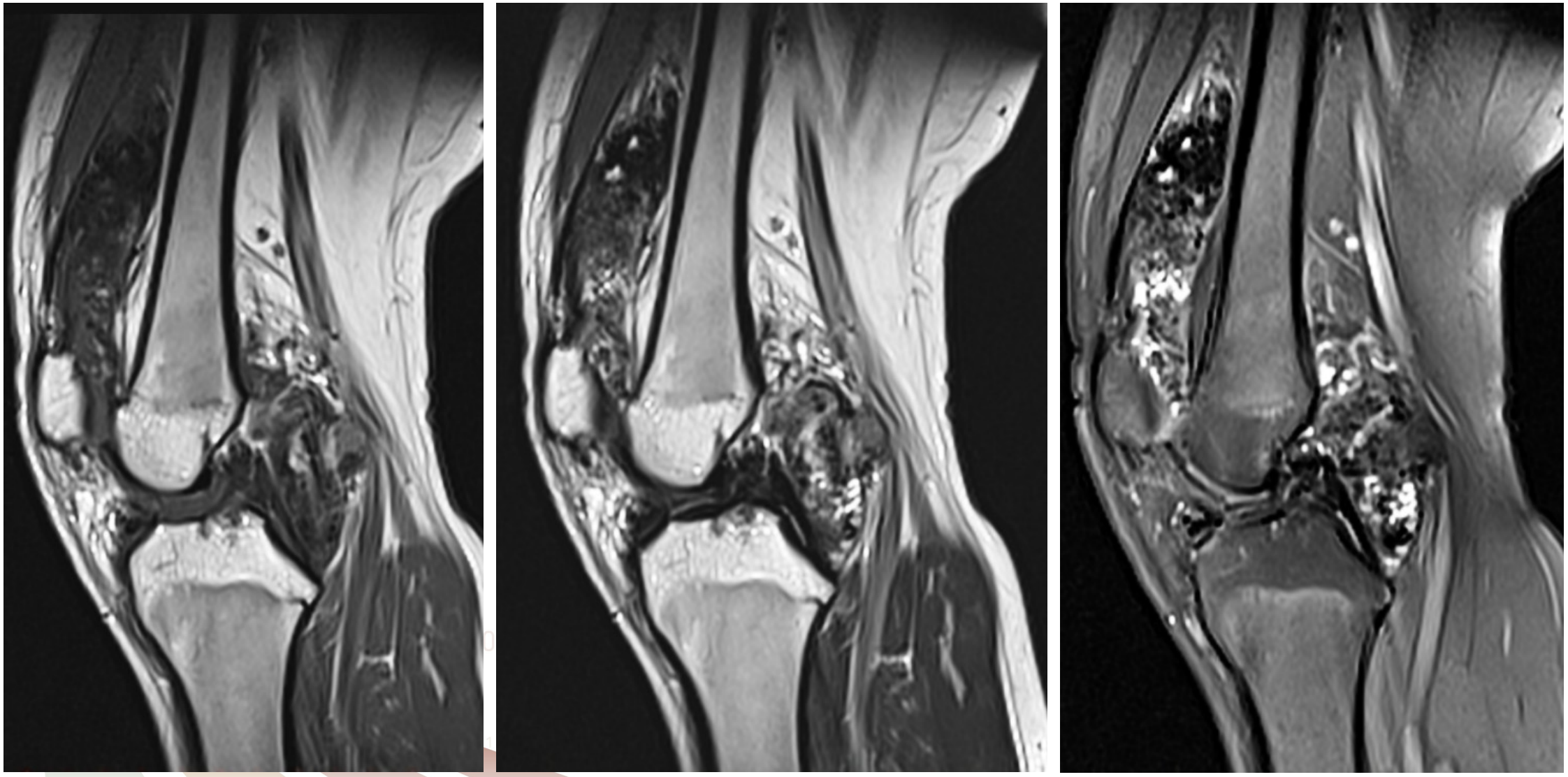




Case (44)

History: A 25-years-old male with chronic knee pain

Next step?



Haemophilic arthropathy

X-rays:

Widening of the intercondylar notch

Bulbous medial femoral condyle

Juxta-articular osteoporosis

Joint space narrowing

MRI:

Enhanced thickened synovium + low signal due to hemosiderin (blood breakdown products in various stages) + joint effusion

DD:

PVNS/ JIA

Case (45)

History: A 70-years-old woman with history of thigh pain following a fall from a car

Atypical fracture of the right femur due to bisphosphonate use

There is increased in cortical thickness and density

Case (46)

History: A 43-years-old man with sudden onset of pain in the back of the heel

Achilles tendon rupture

In this case:

T1: Markedly thickened and edematous distal Achilles tendon (arrow), abnormal laxity is noted along the course of the tendon

T2: Complete rupture of the Achilles tendon is seen approximately 4cm above the distal insertion, a small tendon gap (arrow) is readily apparent

Normal tendon

In normal:
Kager's fat pad: ▲shaped
Base (black arrow): Calcaneus
Posterior (arrow head): Tendon achilis
Anterior (white arrow): Flexor halluces longus tendon

Achilis tendon rupture:
Loss of the normal margins and increased density in the triangle (arrows) + poor definition of the fat stripe around the attenuation that is typically seen in the region of the Achilles tendon

Classification of tendon achilis rupture:
Type 1: Partial tear
Type 2: Complete rupture (defect 3 cm)
Type 3: Complete rupture (defect 3-6 cm)
Type 4: Complete rupture (defect >6 cm)

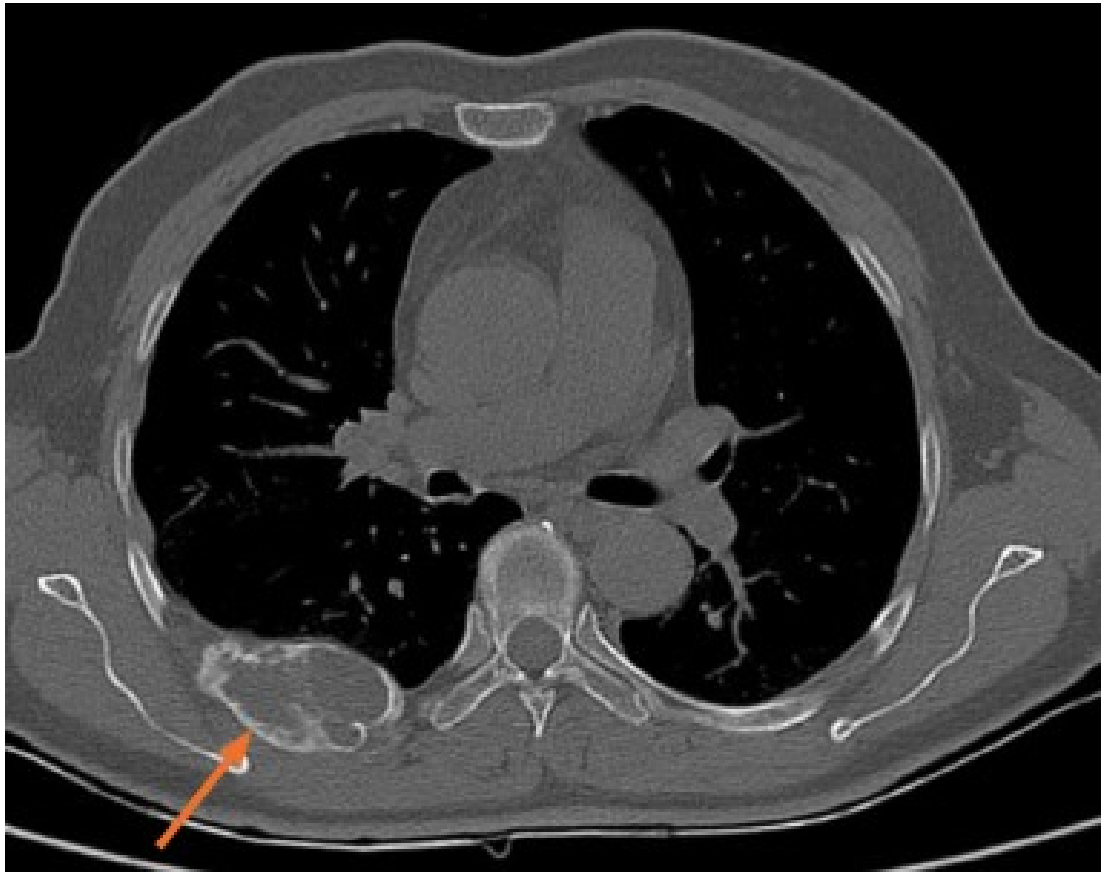
Significance of the gap:
Type 1: Conservative
Type 2: End to end anastomoses
Type 3 & 4: Graft

DD: increased soft tissue density in Kager's fat pad:
1-Tendon achilis injury
2-Accessory soleus
3-Haglund disease (retrocalcneal bursitis + thickened tendon achilis)

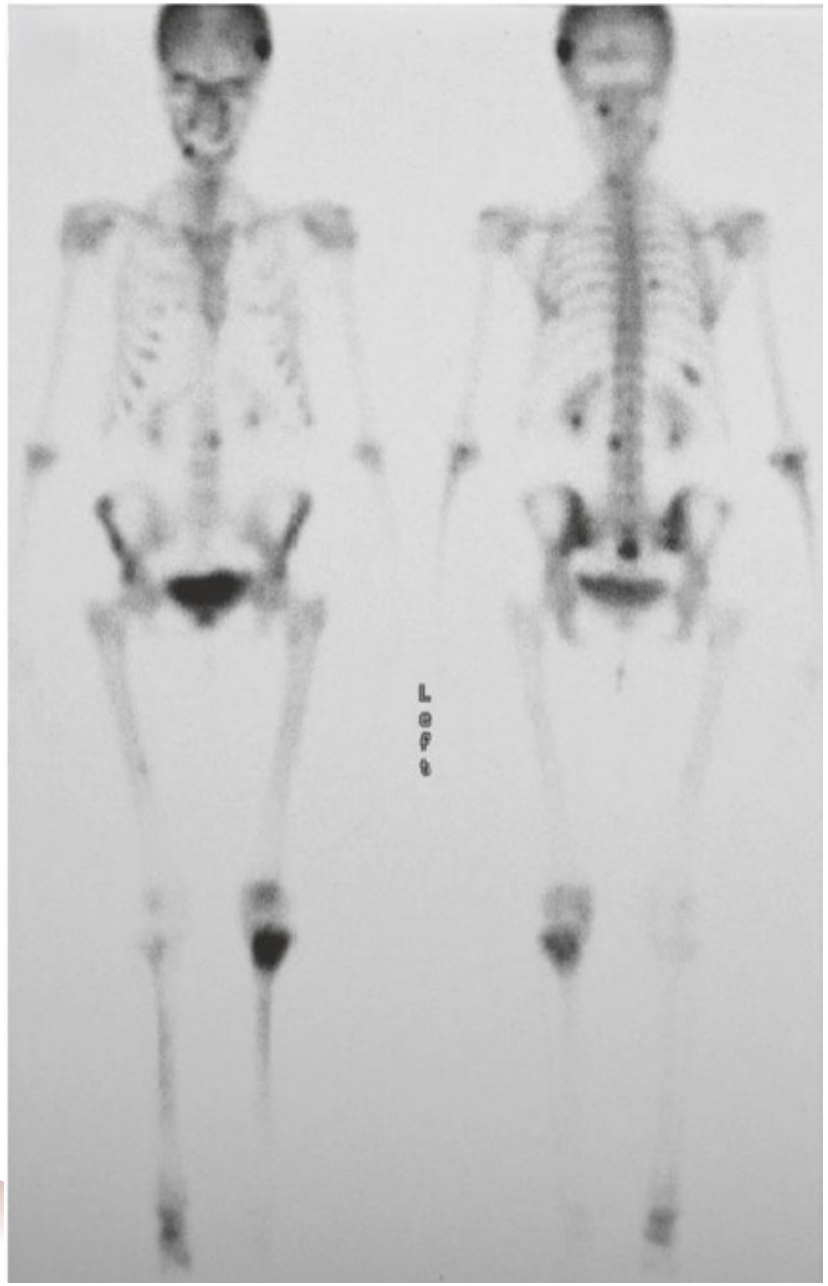
Case (47)

History: Withheld

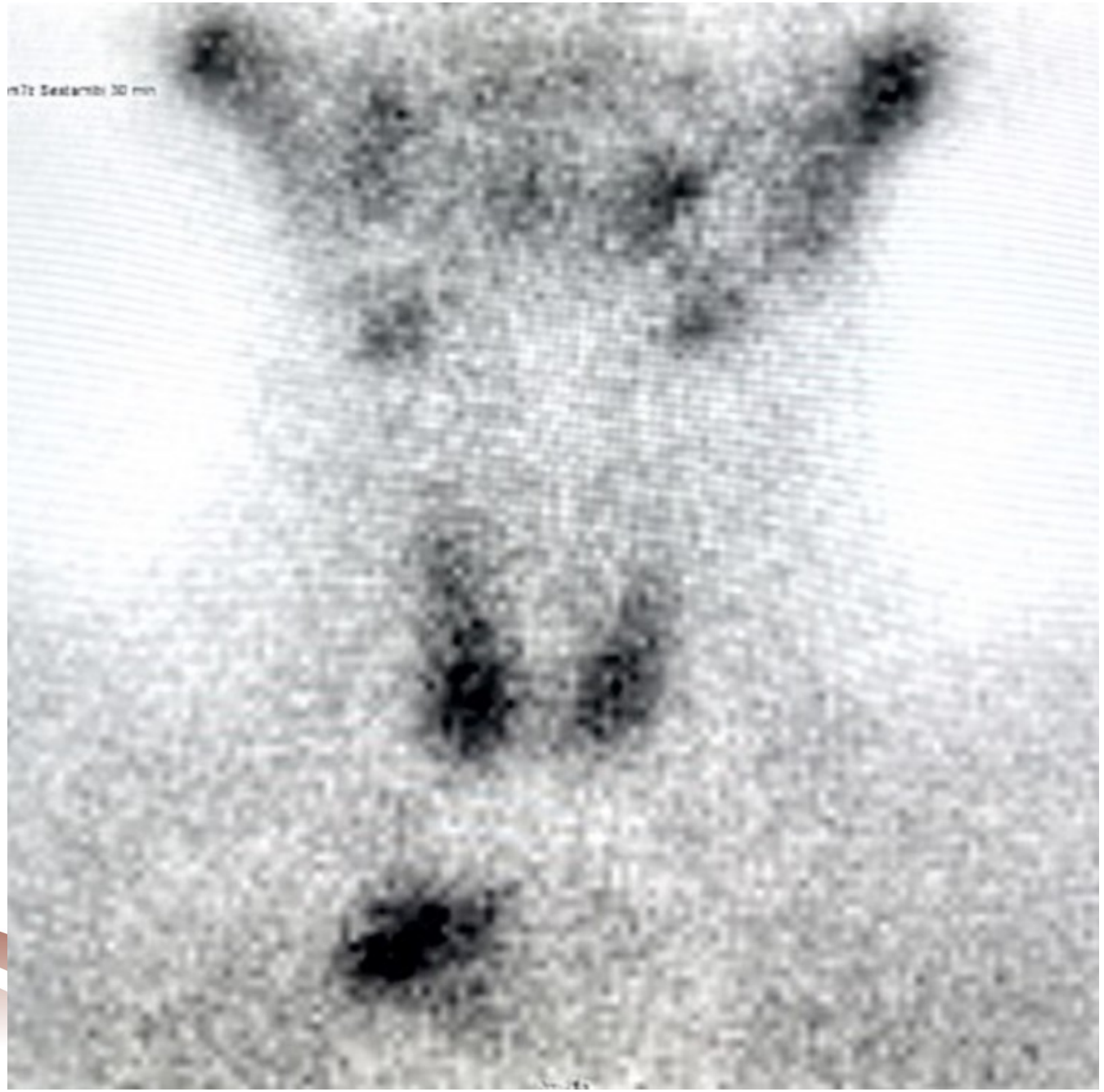
Next step?



Next step?



Next step?



Tc-99m Sestamibi parathyroid scan

Brown tumor (2ry HPT) due to ectopic parathyroid adenoma

DD: Expansile lytic lesion (FEGNOMASHIC)

FD/FCD
Enchondroma/ EG
GCT
NOF
OB
Mets/ MM
ABC
SBC
HPT (brown tumor)
Infection (OM)/ Infarction
Chondroblastoma

In this case:

X-rays: Osteolytic lesion in the proximal tibia (well-defined, no cortical destruction, no periosteal reaction)

CT: Multiple lytic lesions in the pelvic bone & the ribs

Bone scan: Superscan

Superscan:

No activity in the urinary tract (kidney & bladder) or soft tissue

All the activity is in the bone (especially the mandible & maxilla)

Causes:

(I) Diffuse metastases:

Prostatic, breast, MM, lymphoma, TCC

(II) Metabolic disease:

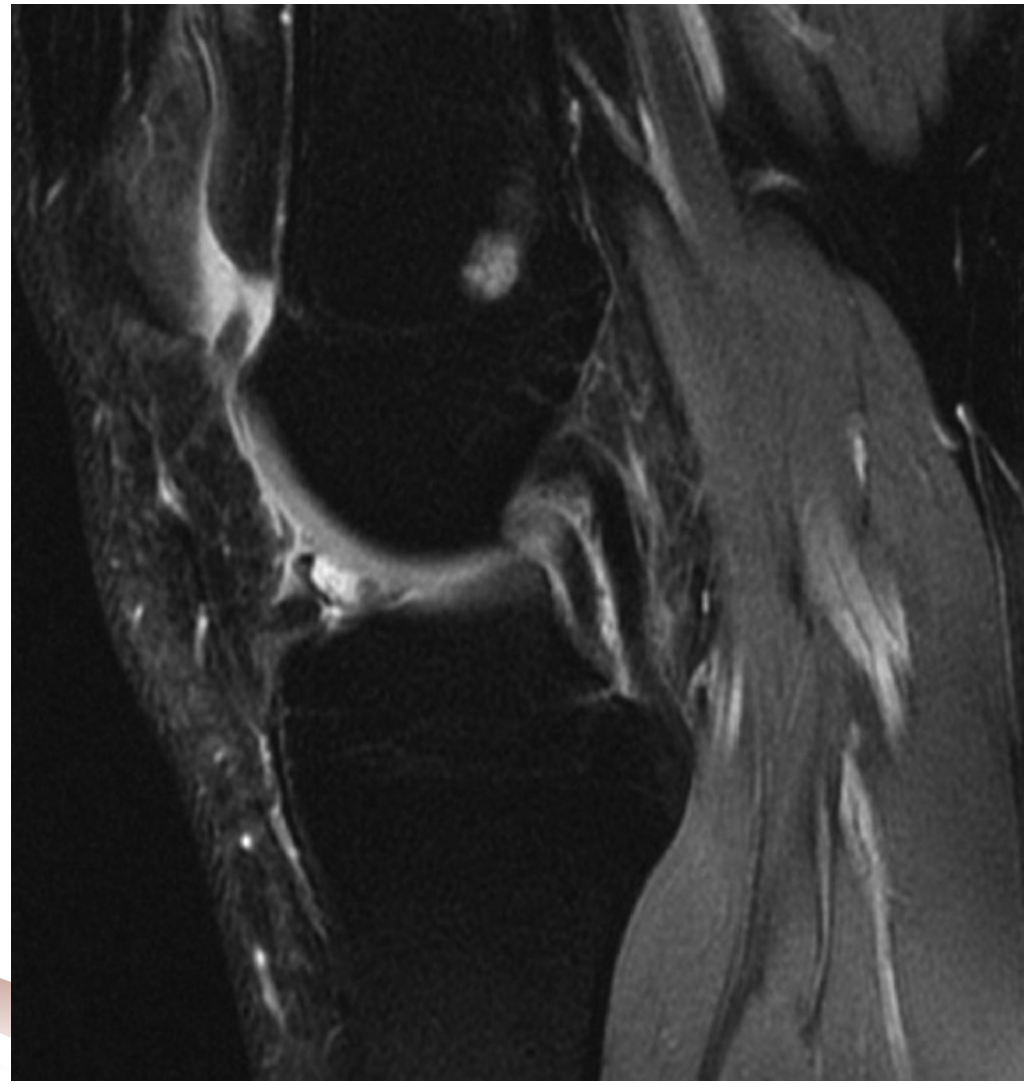
ROD/ HPT/ Osteomalacia

(III) Myelofibrosis/ Mastocytosis/ wide spread Paget's

NB: Metabolic (entire skeleton including distal appendicular skeleton), Metastases (axial + proximal appendicular skeleton)

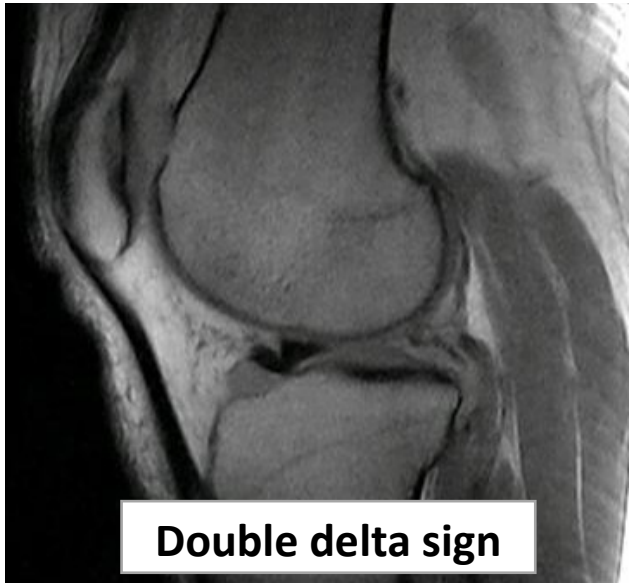
Case (48)

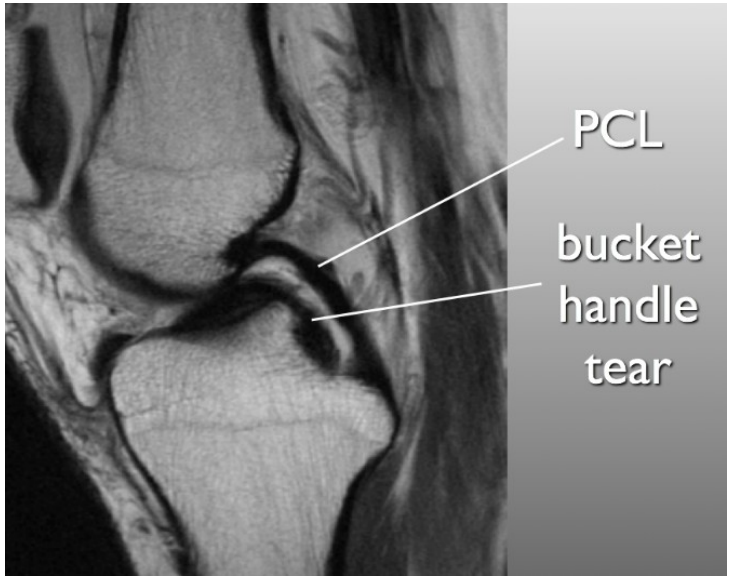
History: A 33-years-old man with knee pain



Double PCL sign (Bucket handle tear)

Bow tie sign





Extensive vertical tear >> free inner edge of the meniscus (mostly medial) gets displaced or flipped over

Signs:

Absent of bow tie sign

Location: anterior (double delta sign), posterior (double PCL sign)

Case (49)

History: A 60-years-old man with swelling of the foot

Neuropathic (Charcot) joint

6D

Dense bones (subchondral sclerosis)

Degeneration

Destruction of articular cartilage

Deformity (pencil-point deformity of metatarsal heads)

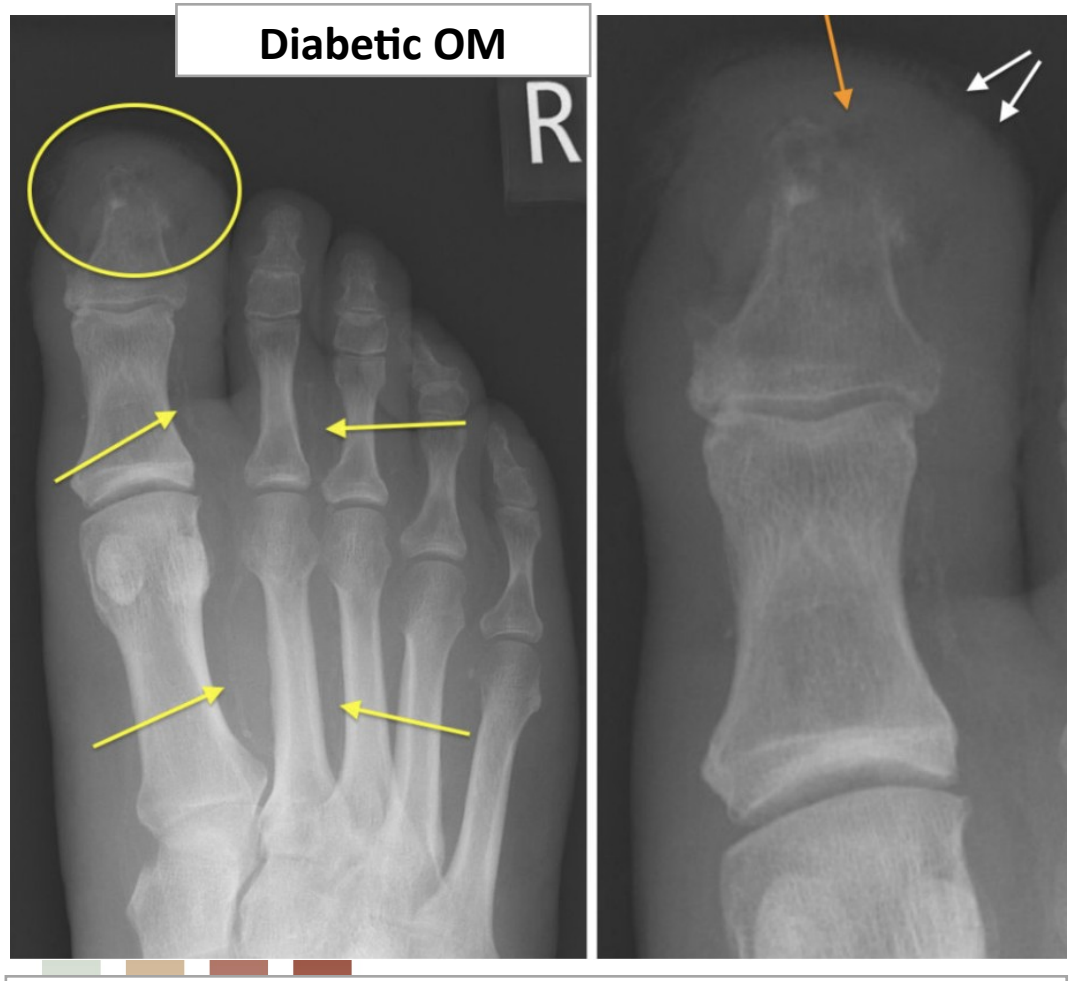
Debris (loose bodies)

Dislocation

2 forms:

(I) Hypertrophic (6D)

(II) Atrophic (shoulder, humeral head resorption with a sharp surgical like margin) + syringomyelia (cervical spine MRI)



Prominent calcification of several of the digital arteries in the forefoot (arrows)
Irregularity of the soft tissue in the distal aspect of the big toe, white arrows, corresponding to the ulcer, adjacent to this, the tuft of the distal phalanx shows features of osteomyelitis, with loss of the cortex and underlying bone destruction (circled on large image), small focus of gas in the soft tissues (orange arrow)

Presence of ulcers at the head of the first, second, and third metatarsal with associated osteomyelitis and significant bone resorption

DD: Diabetic foot osteomyelitis

*Diabetic foot OM>> Osteopenia + lytic areas + soft tissue swelling + cutaneous ulcer & sinus tract with cortical disruption +/- air +/-fever

Charcot joint: Mid foot + polyarticular involvement + absence of associated ulcer (sinus tract) + intact bony cortex

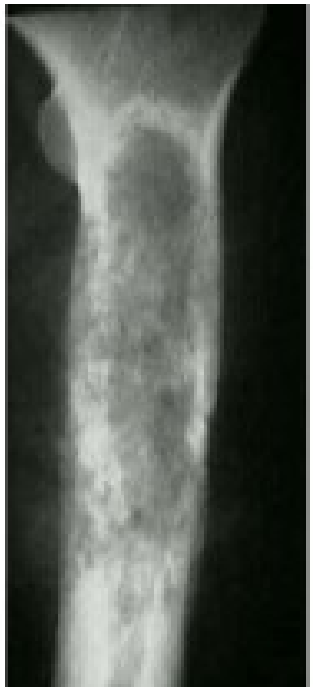
Case (50)

History: A 55-years-old man with shoulder pain

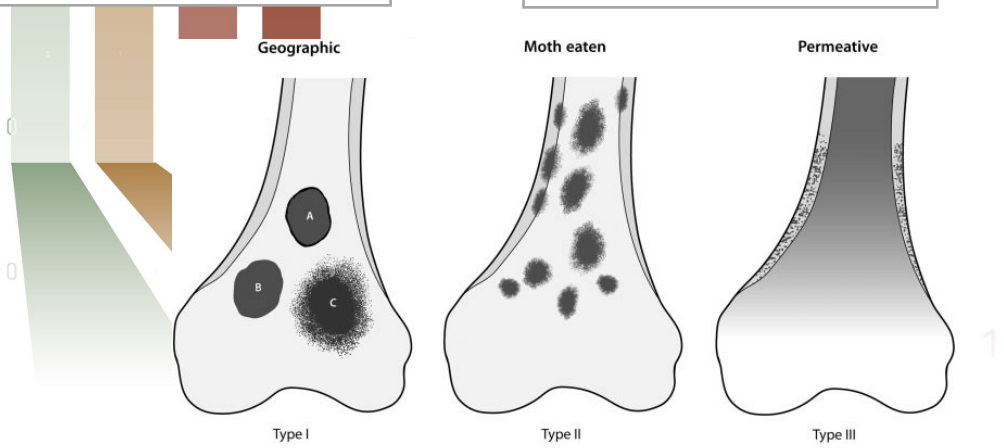
Permeative pattern for DD

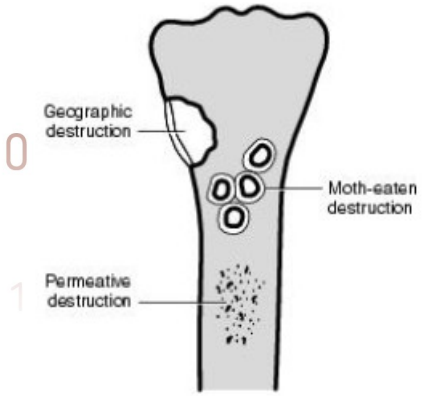
Type 1

Type 2



Type 3





Lodwick classification of bone destruction:

Type 1: Geographic pattern (thin zone of transition with well-defined sclerotic margins) = benign

Type 2: Moth eaten (difficult to define any border at all) aggressive

Type 3: Permeative (multiple tiny holes, infiltrate the bone), very aggressive (Lymphoma, Leukemia, Ewing sarcoma)

DD Aggressive bony lesions

Children (EG/ Infection/ Ewing sarcoma/ OS/ neuroblastoma metastases)

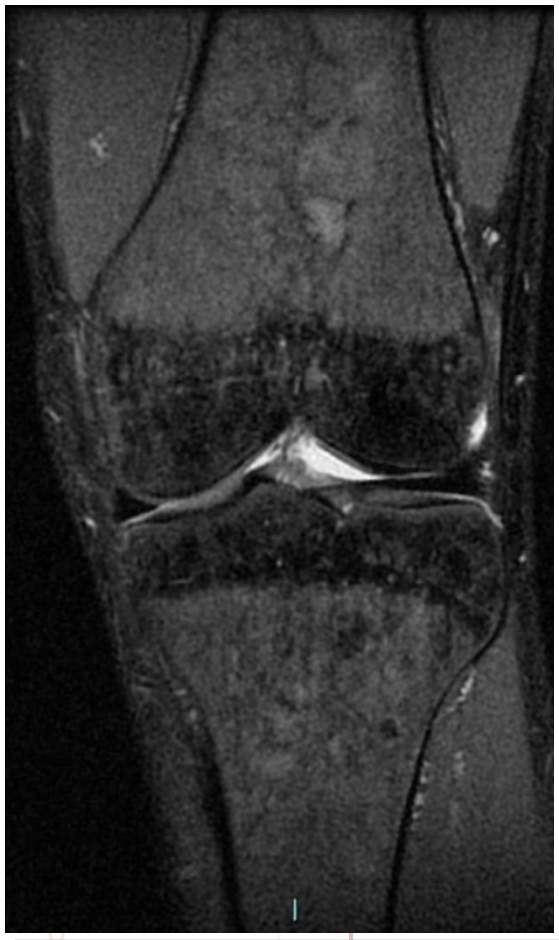
Adult (Metastases/ MM)

Case (51)

History: A 74-years-old woman with back pain

Diffuse bone marrow infiltration

T1
Low signal



PD FS
Loss of signal = reconversion

Diffuse bone marrow infiltration: MLML

Metastases / MM

Lymphoma/ Leukemia

Myelofibrosis/ Mastocytosis

Look at T1, normal marrow should be brighter than the intervertebral disc

To differentiate form bone marrow conversion, do STIR, infiltration won't be suppressed

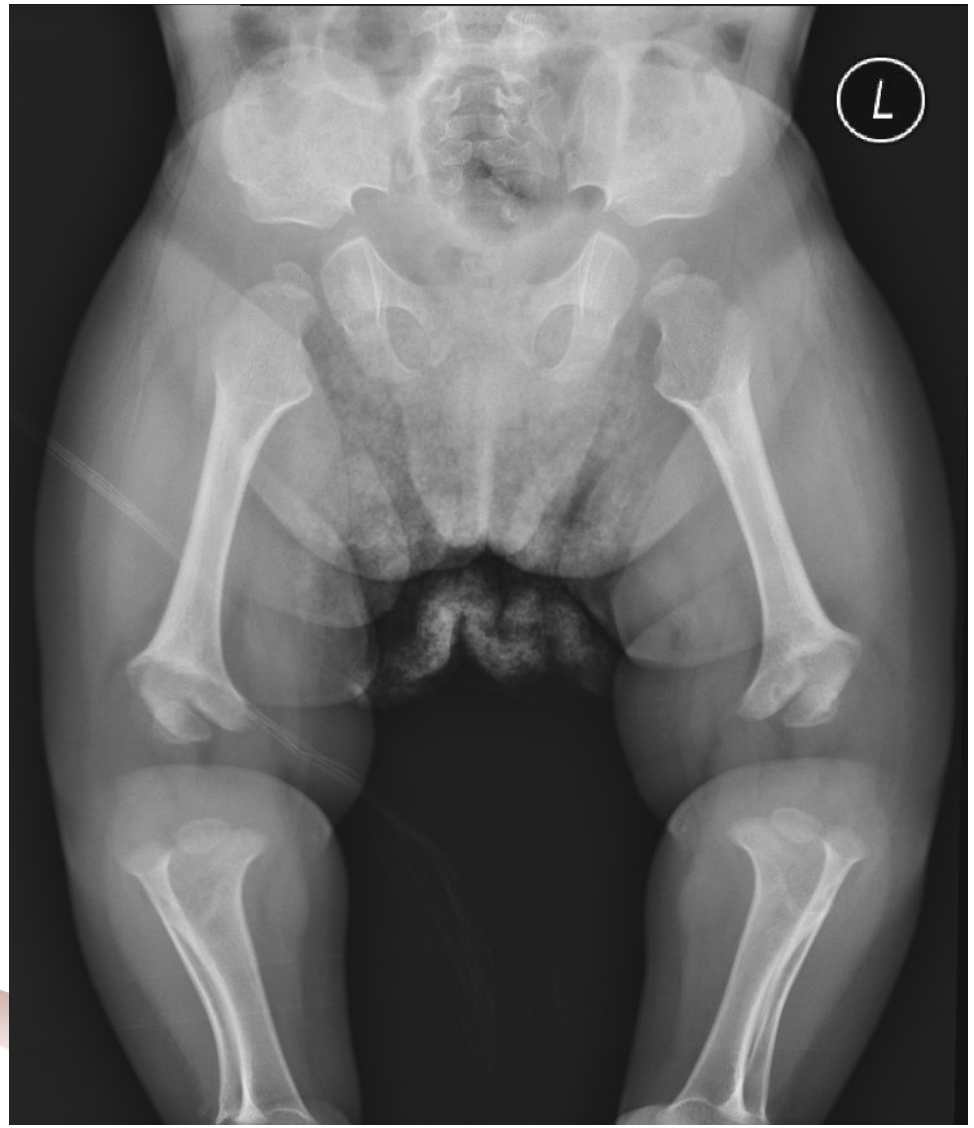
N.B. Causes of bone marrow reconversion:

Physiological (obesity/ smoking)

Pathological (thalassemia/ SCD/ DM)

Case (52)

History: Withheld

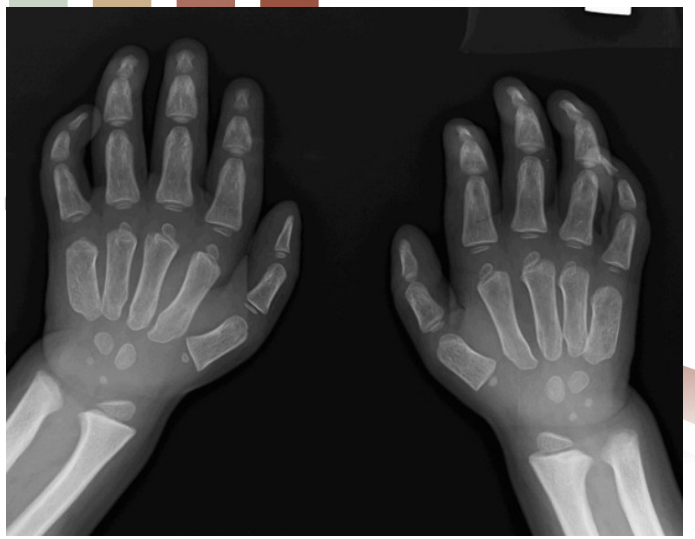


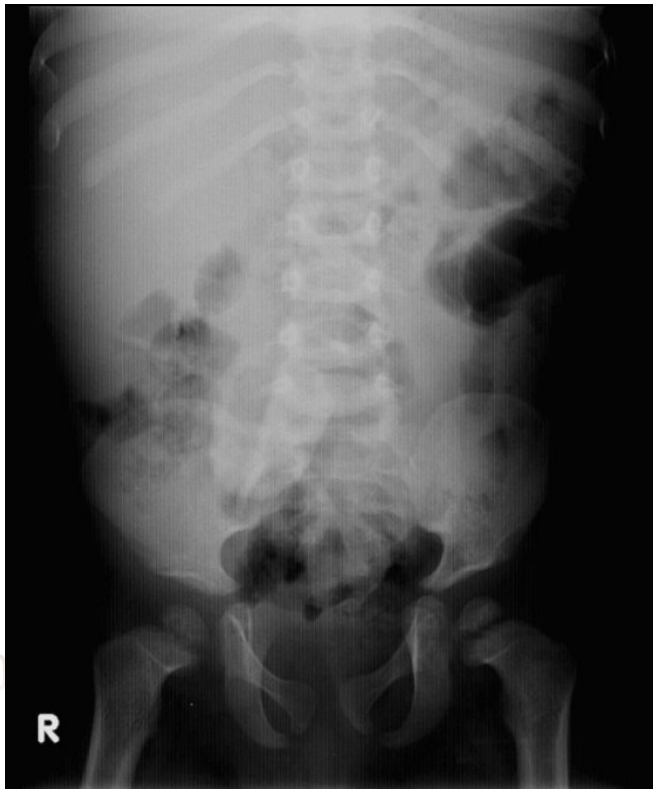
Achondroplasia

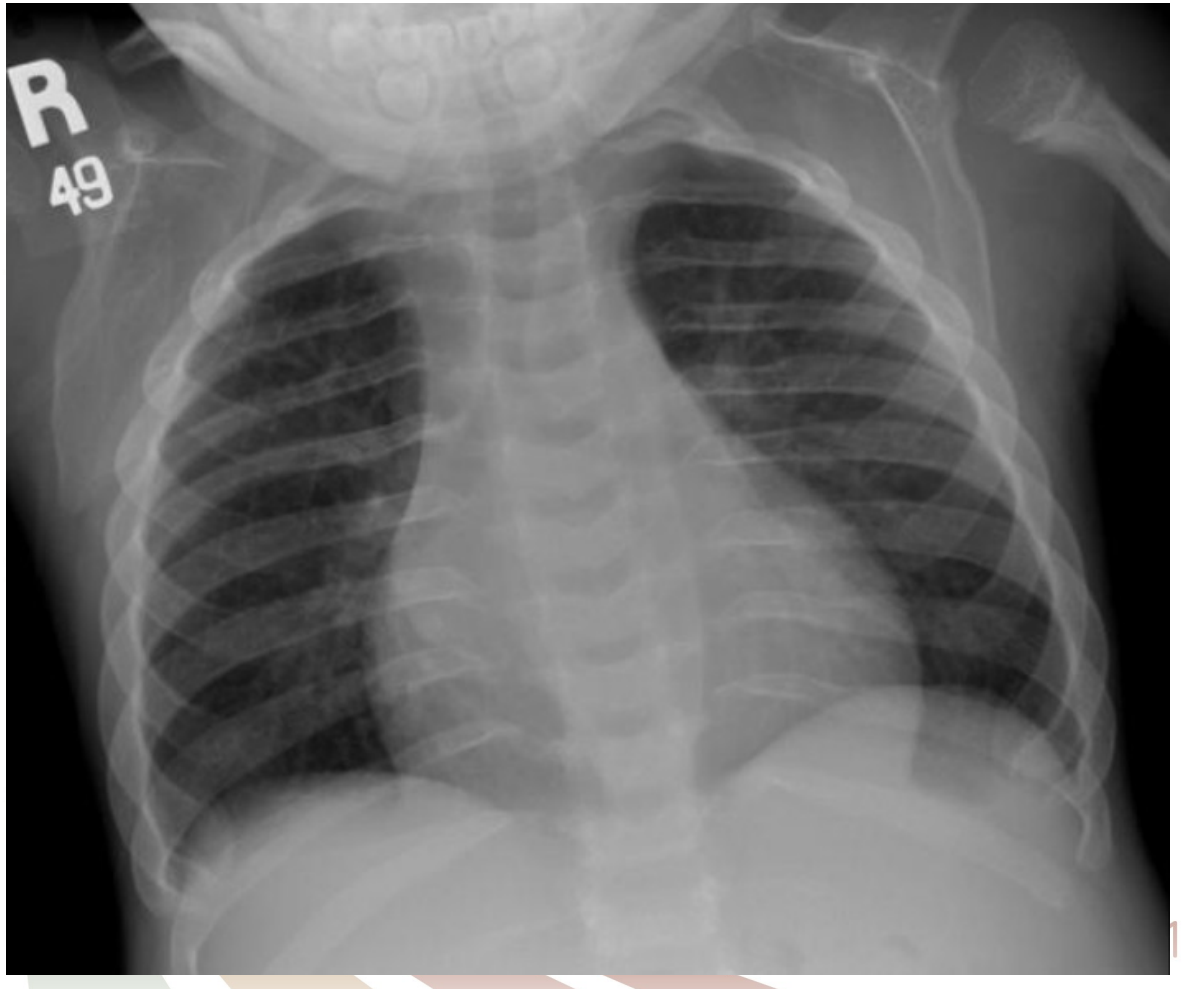
- Most common rhizomelic dwarfism
- Narrowed interpedicular distance
- Squared iliac wings
- Posterior scalloping of vertebral bodies
- J-shaped sella
- Narrow pelvis (champagne glass)

NB Mucopolysaccharidoses

Spine: Anterior vertebral beaking (bullet-shaped) + scalloping
Hurler's>> Inferior beaking, Morquio>> Middle (anterior beaking)
Ribs: Oar-shaped ribs (tapered proximal & wide distal)
Pelvis: Hypoplasia of the base of the ilia with enlargement of the acetabulum & coxa valga
Skull: Macrocephaly + J-shaped sella
Hand: Proximal pointing metacarpals



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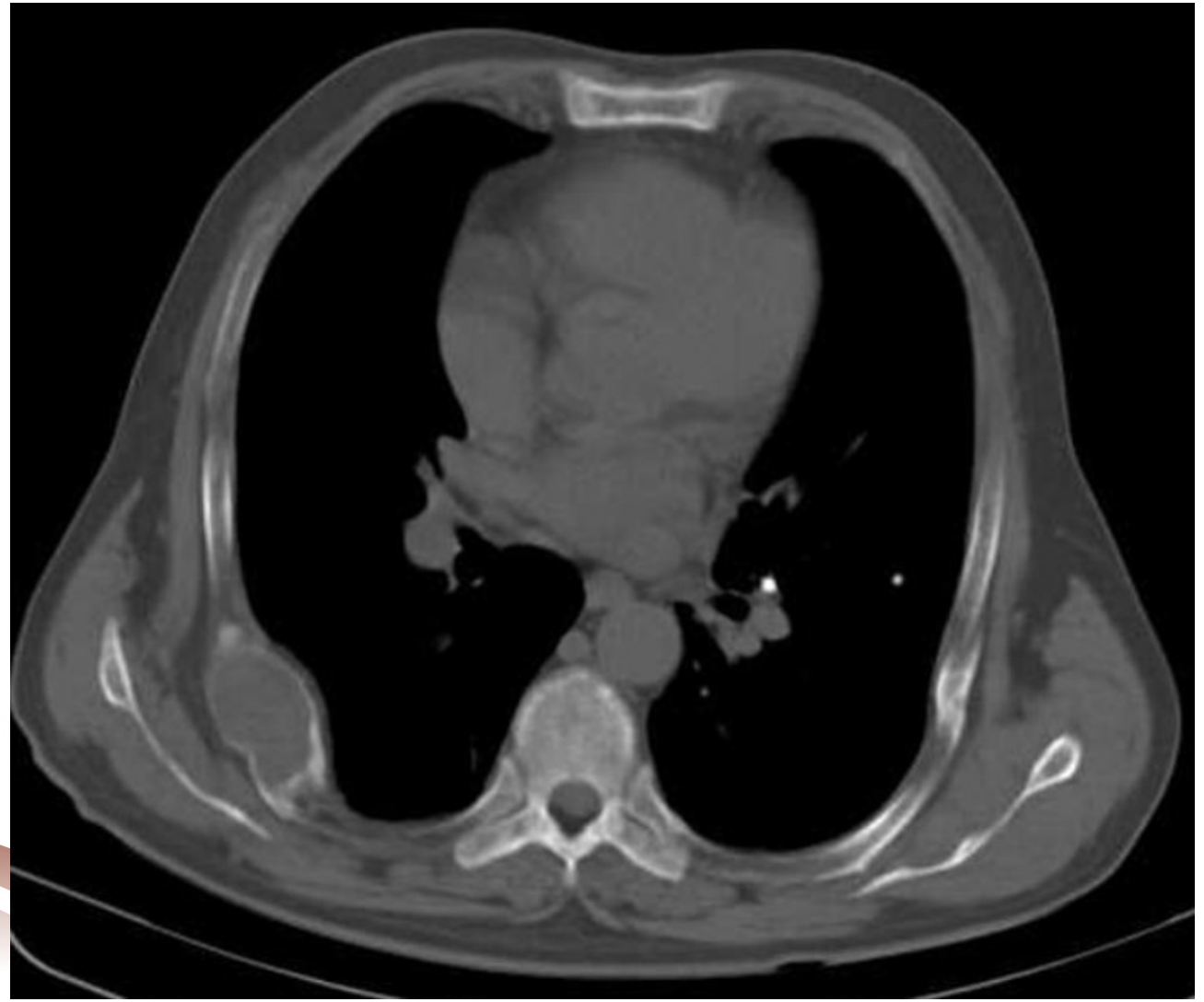
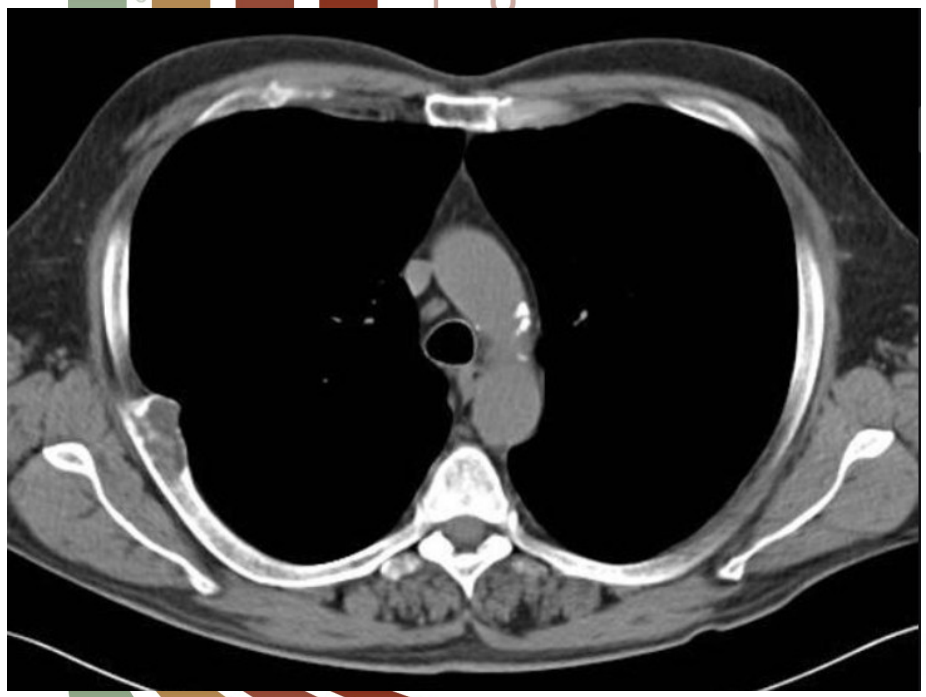
49

Case (53)

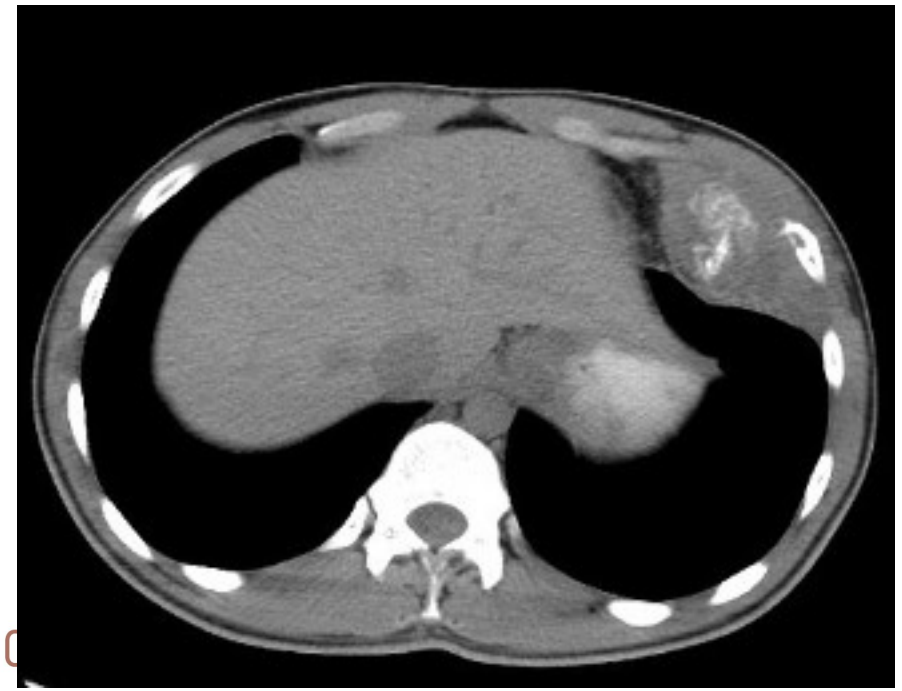
History: A 31-years-old man with painless right chest wall lesion



Expansile lytic rib lesion for DD



Enchondroma



Ewing sarcoma

Fibrous dysplasia (Ground glass matrix)

ABC (expansile)

Mets/ MM/Ewing sarcoma (soft tissue component)

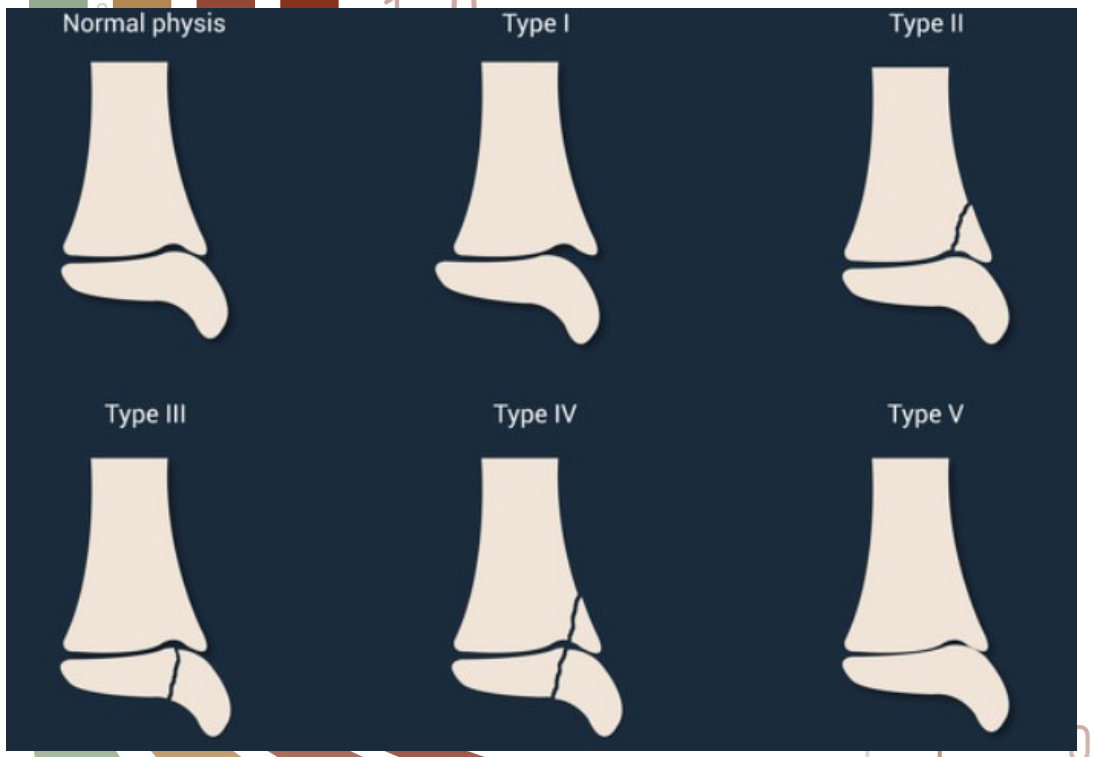
Enchondroma (chondroid matrix)

Brown tumor (signs of 2ry HPT)

Case (54)

History: A young boy presented with severe wrist pain after having fallen on his outstretched hand while playing soccer

Salter-Harris fracture (type 3)



SALTER

Type (I) **S**traight across

Type (II) **A**bove (Metaphysis)

Type (III) **L**ower (Epiphysis)

Type (IV) **T**hrough (metaphysis + epiphysis)

Type (V) **CR**ushed


Type II

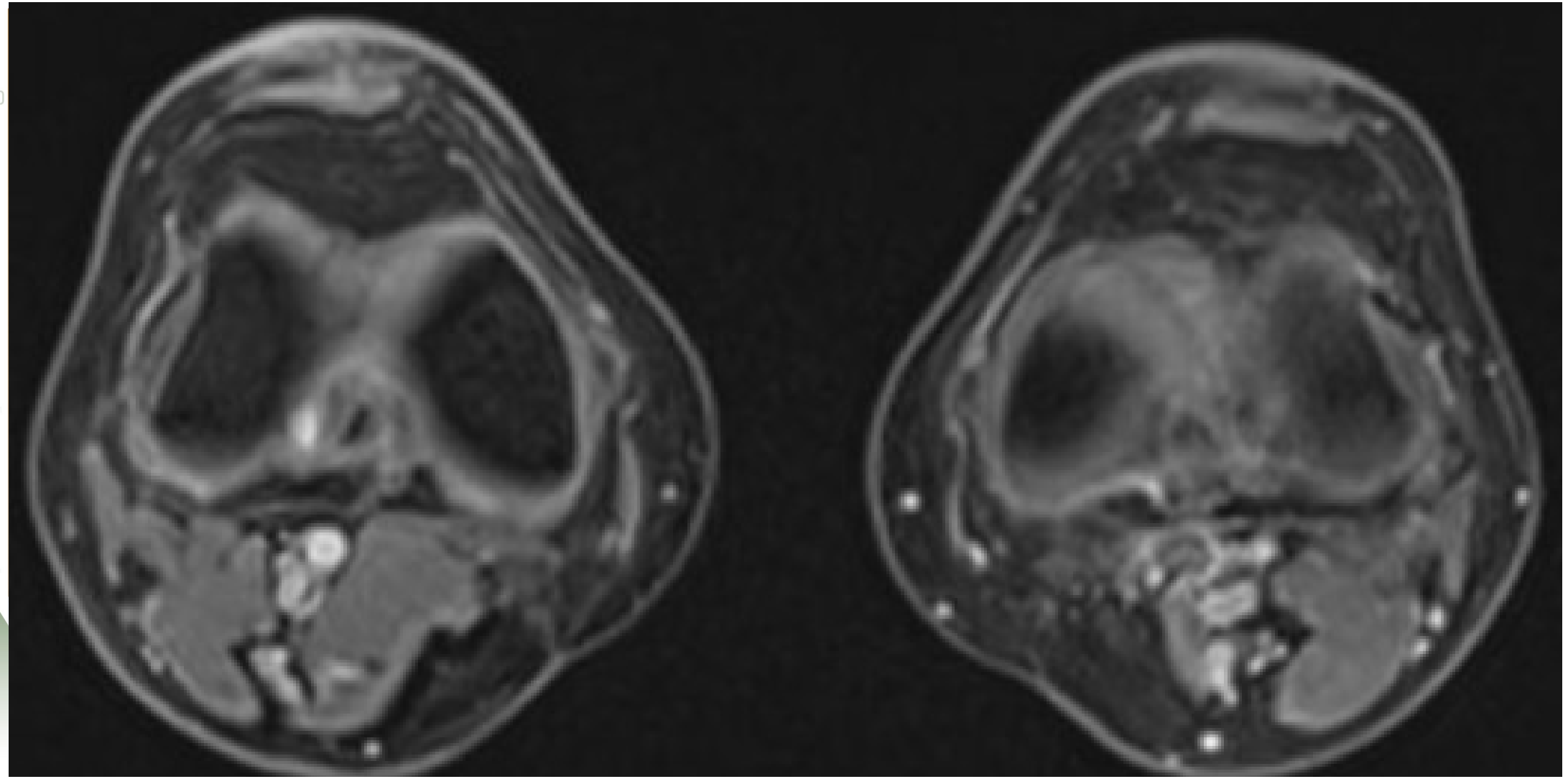

Type III


Type IV


Type V

Case (55)

History: A 25-years-old man with leg pain



Thrombosed LT Popliteal artery due to Popliteal artery entrapment syndrome

lateral location of the medial head of right gastrocnemius muscle (outlined) and medial displacement of right popliteal artery (black arrow), popliteal vein; white arrow

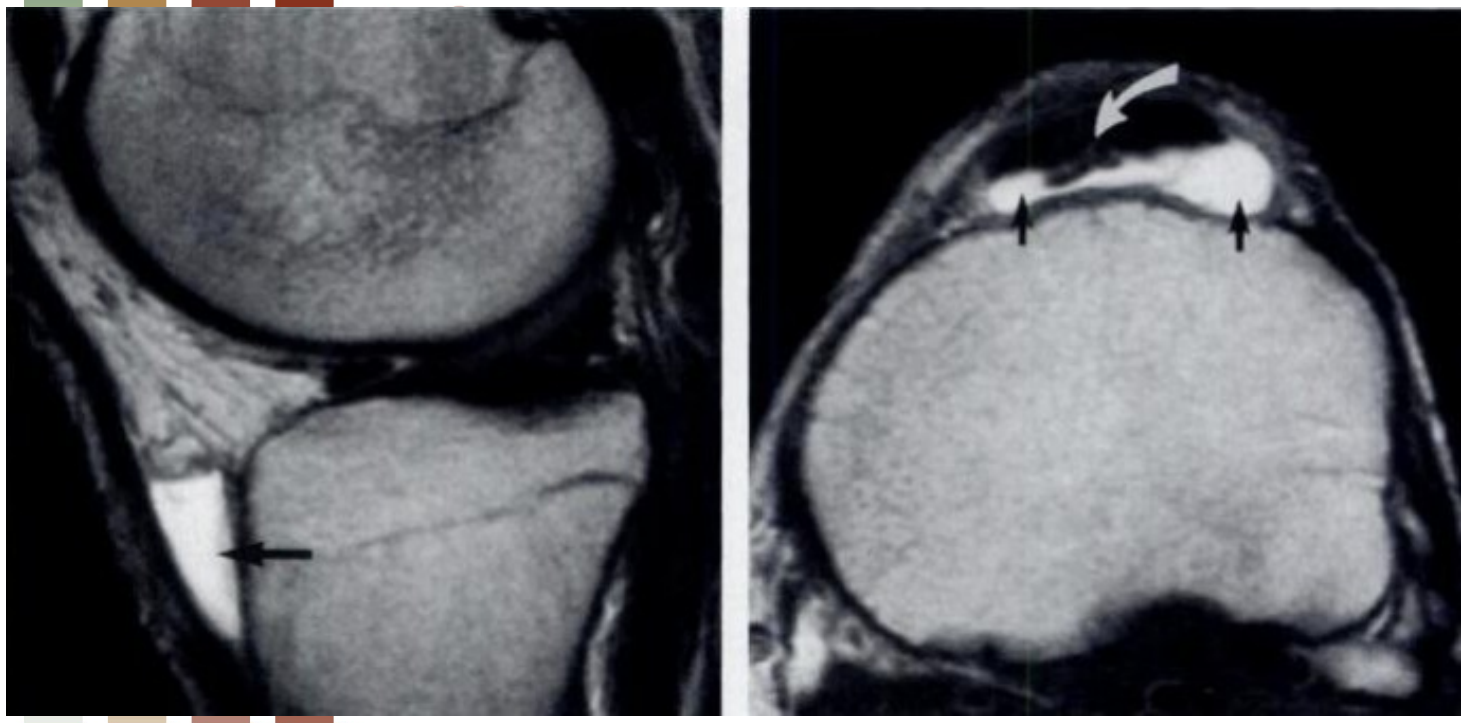
Refers to symptomatic compression or occlusion of the popliteal artery due to a developmentally abnormal positioning of the popliteal artery in relation to its surrounding structures such as with the medial head of gastrocnemius

DD Popliteal artery occlusion (atherosclerotic/ embolism/ trauma)

Case (56)

History: A 15-years-old boy with knee pain

Deep infrapatellar bursitis



Inflammation of the deep infrapatellar bursa

Uncommon condition in children

Associated with JIA, Osgood-schlatter disease, ankylosing spondylitis

U/S: distended deep infrapatellar bursa/ cystic mass + internal septations + heterogeneous soft tissue mass

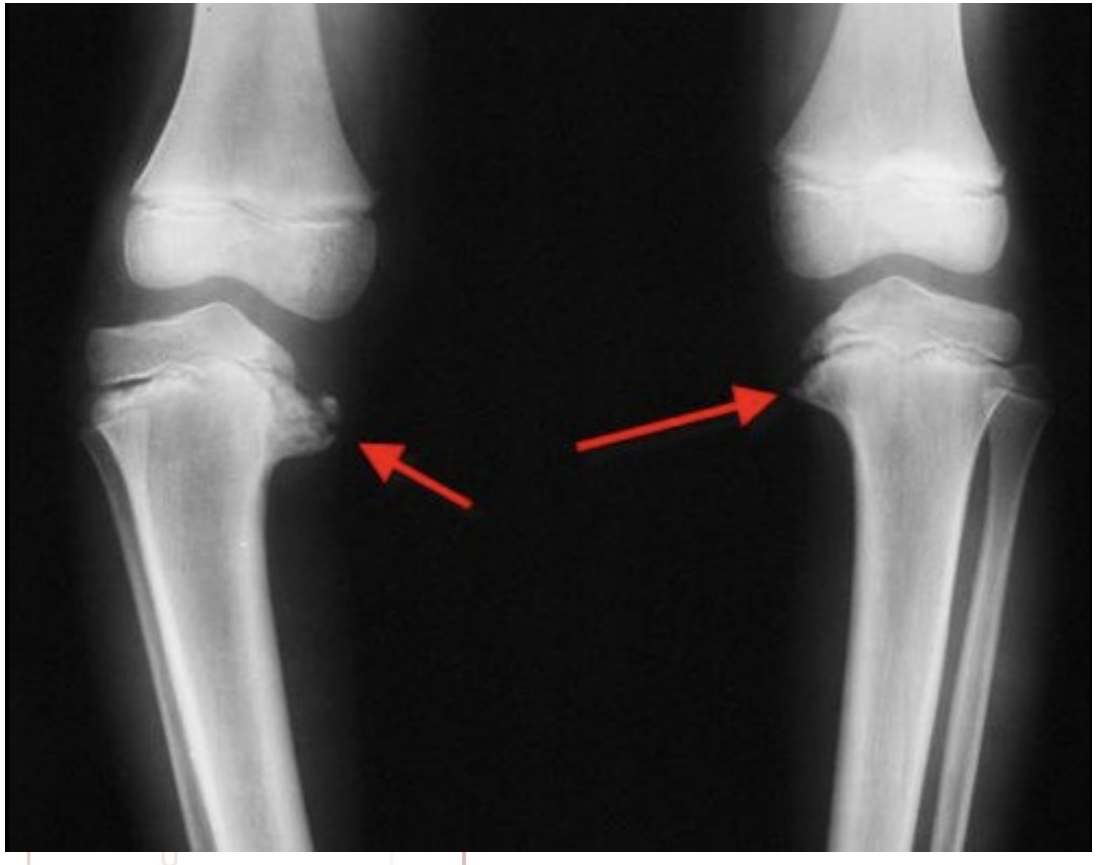
MRI: distension of the deep infrapatellar bursa + thickening of the synovium (low in T1, high in T2, enhancement of the synovial lining)

DD: Osgood-schlatter disease, jumper's knee & superficial infrapatellar bursitis

Case (57)

History: 2 different cases

Osgood schlatter disease & Blount disease



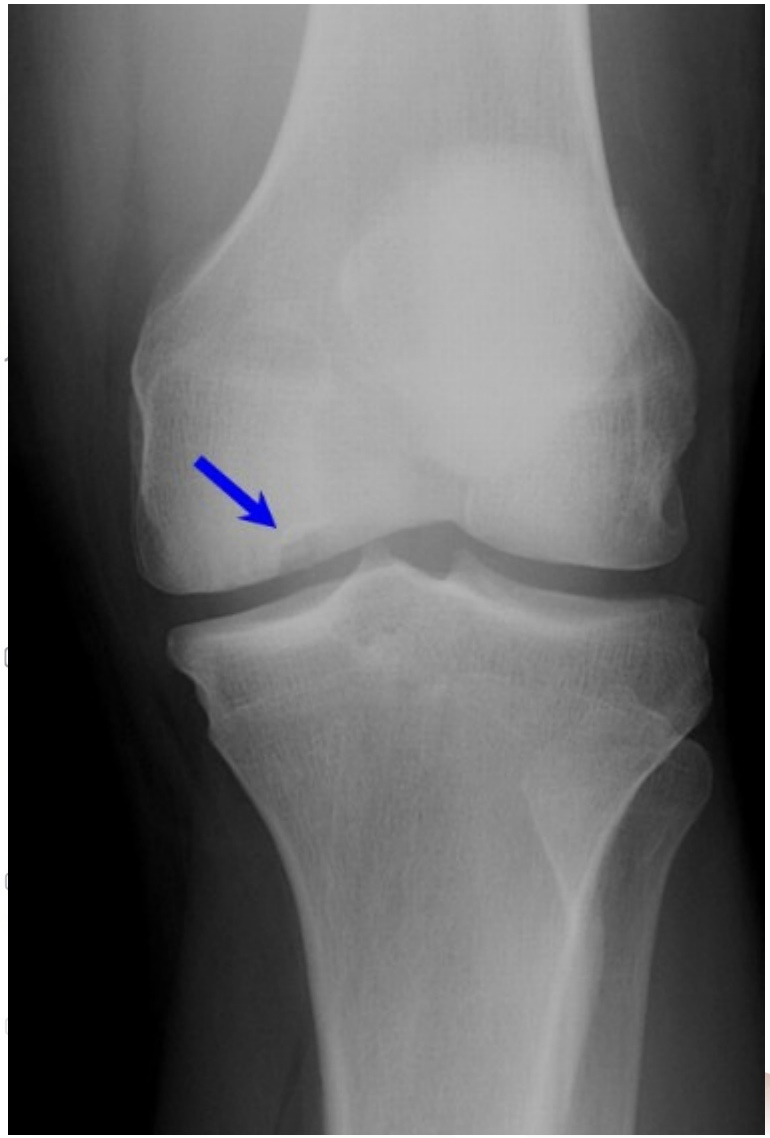
Osgood schlatter disease: fragmentation of the tibial tuberosity

Blount disease (infantile tibia vara): beaking, fragmentation & depression of the medial tibial metaphysis

Case (58)

History: A 32-years-old man with knee pain

Osteochondritis dissicans



Affects medial femoral condyle

Staging:

(I) Limited to intra-articular cartilage: BM edema

(II) Defect in the articular cartilage: defect in the cartilage + low signal surrounding the lesion (fibrous attachment)

(III) Defect + T2 high signal behind (semicircular fragment) unstable

(IV) Loose body & defect, unstable

Case (59)

History: A 55-years-old woman with foot pain

Talocalcaneal coalition

C-sign (arrow), talar beak (arrow head)

Anteater sign

Talocalcaneal coalition:

C-sign: Medial talus fuses with sustentaculum tali on lateral view

Talar beak: Triangular shaped beaking at the anterior aspect of the talus

Calceneo-navicular coalition:

Anteater sign (elongated process of the calcaneous)

Case (60)

History: A 65-years-old woman unable to weight bear

Lisfranc injury

Lisfranc joint (tarsometatarsal joint) is stabilized by the Lisfranc ligament (join between medial cuneiform & 2nd metatarsal base)

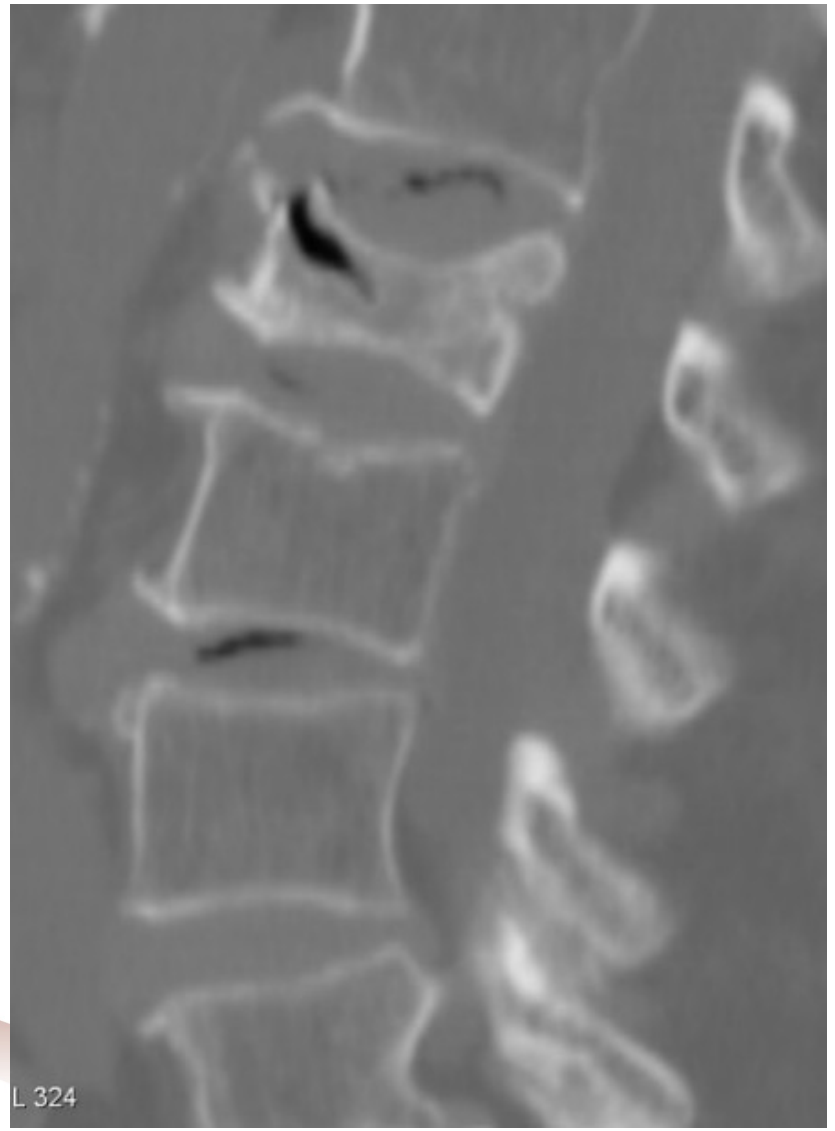
Classification of Lisfranc injury: according to the direction of dislocation of the 1st metatarsal

(I) Homolateral: All metatarsals will dislocate laterally

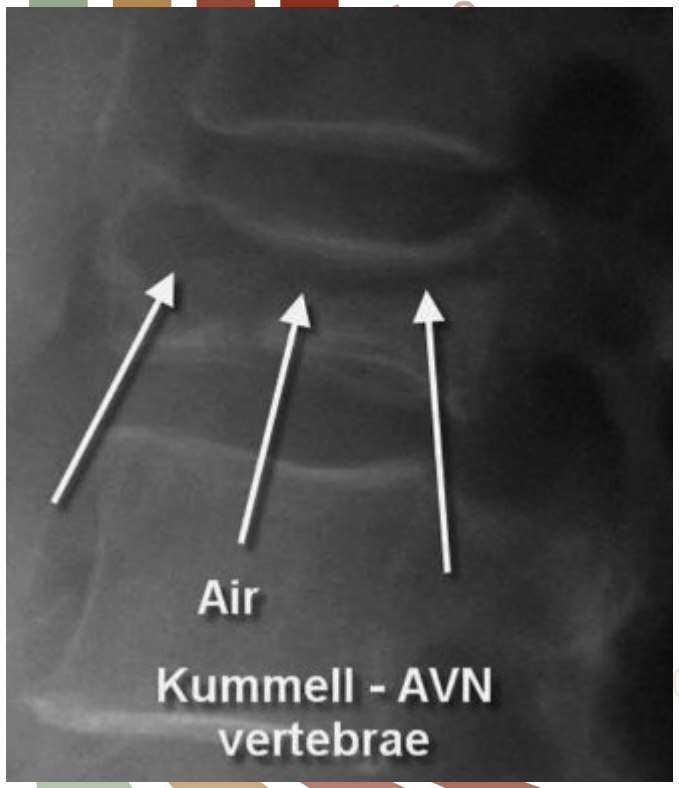
(II) Divergent: 1st metatarsal is medially dislocated & 2nd through 5th metatarsals are laterally dislocated

Case (61)

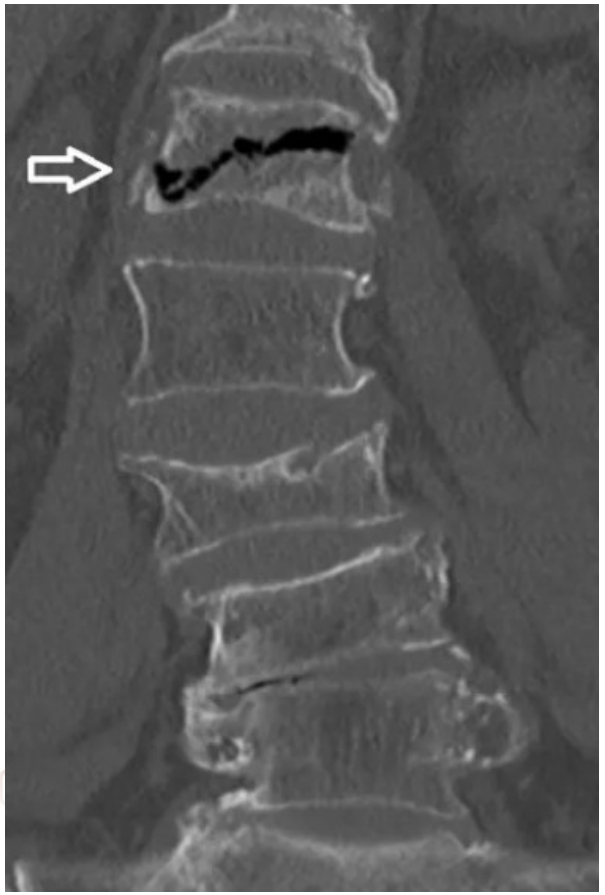
History: A 81-years-old woman with back pain



Vertebral body avascular necrosis (Kümmell disease)



Gas filled cleft within the vertebral body + wedge shaped compression fracture

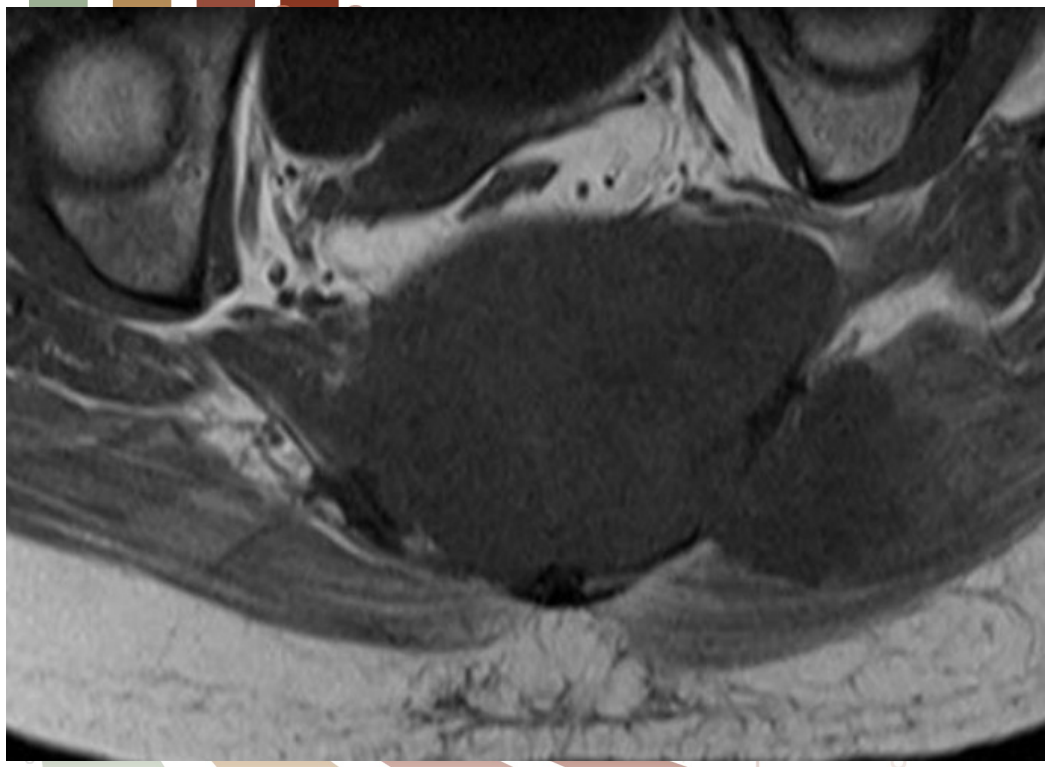


Case (62)

History: A 52-years-old woman with back swelling

Next step?

Next step?

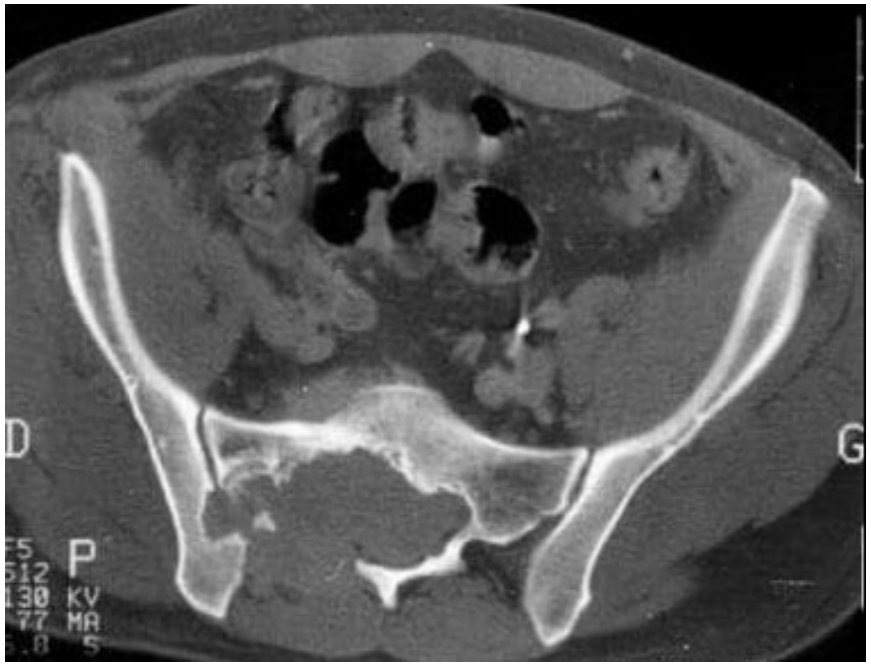


Sacrococcygeal chordoma

Consider for midline sacrococcygeal masses in adults

Destructive lesion

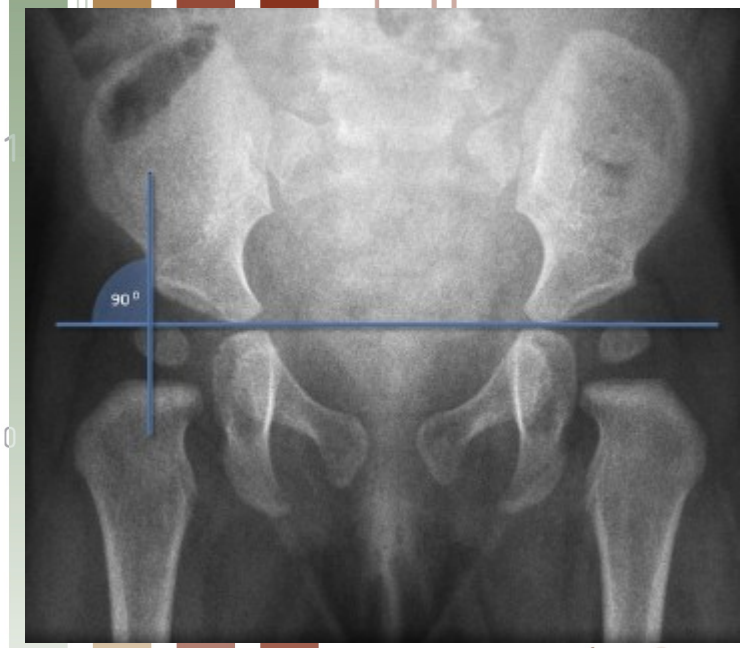
DD: Chondrosarcoma/ mets/ GCT/ lymphoma



Case (63)

History: A 18-months-old female with abnormal gait

Developmental dysplasia of the hip (DDH)



U/S: < 6 months of age

Normal:

Alpha angle > 60

Acetabulum covers > 50% of the femoral head

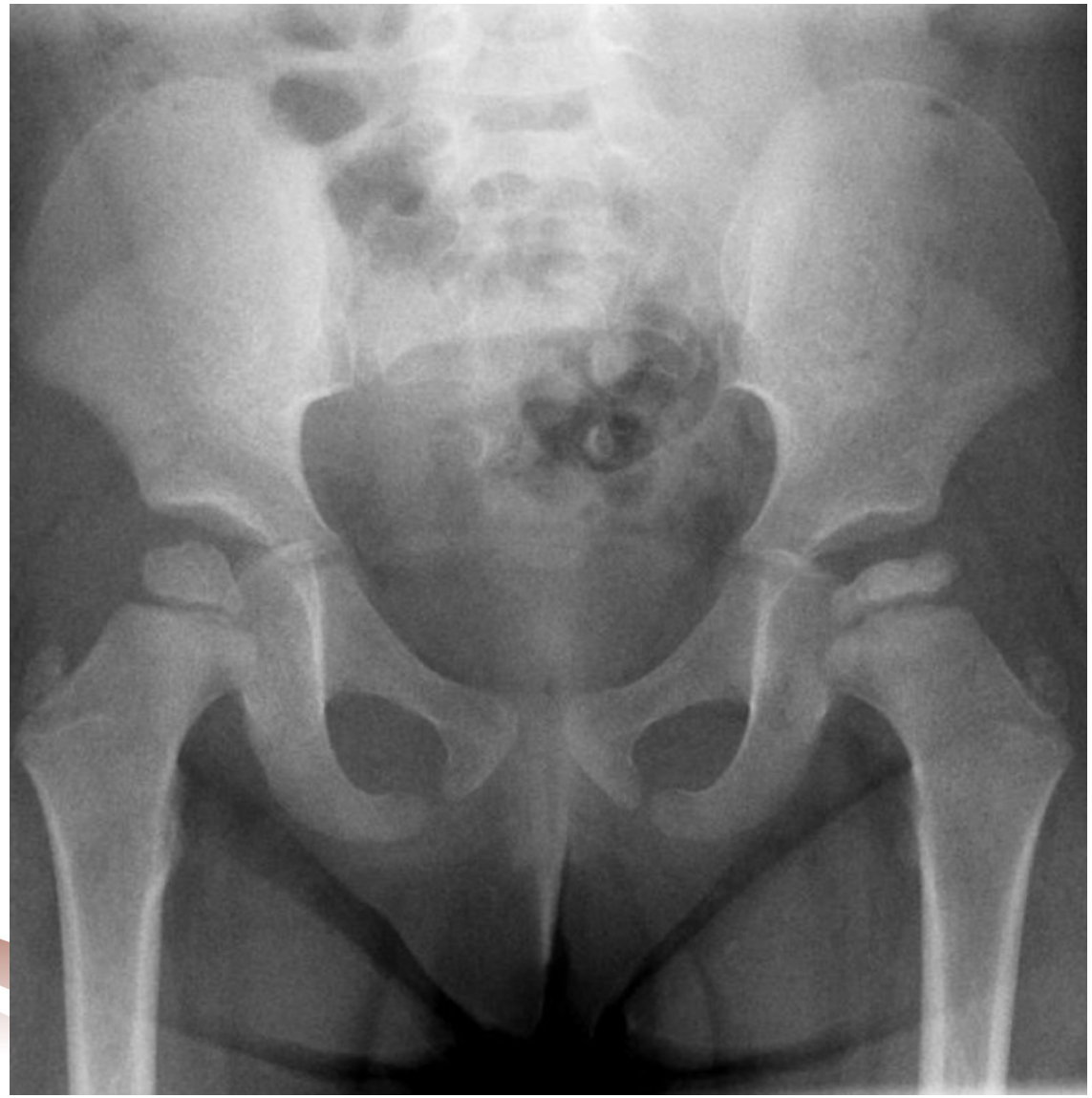
X-rays: > 6 months

H-line & P-line (normal= femoral head is in the inner lower quadrant)

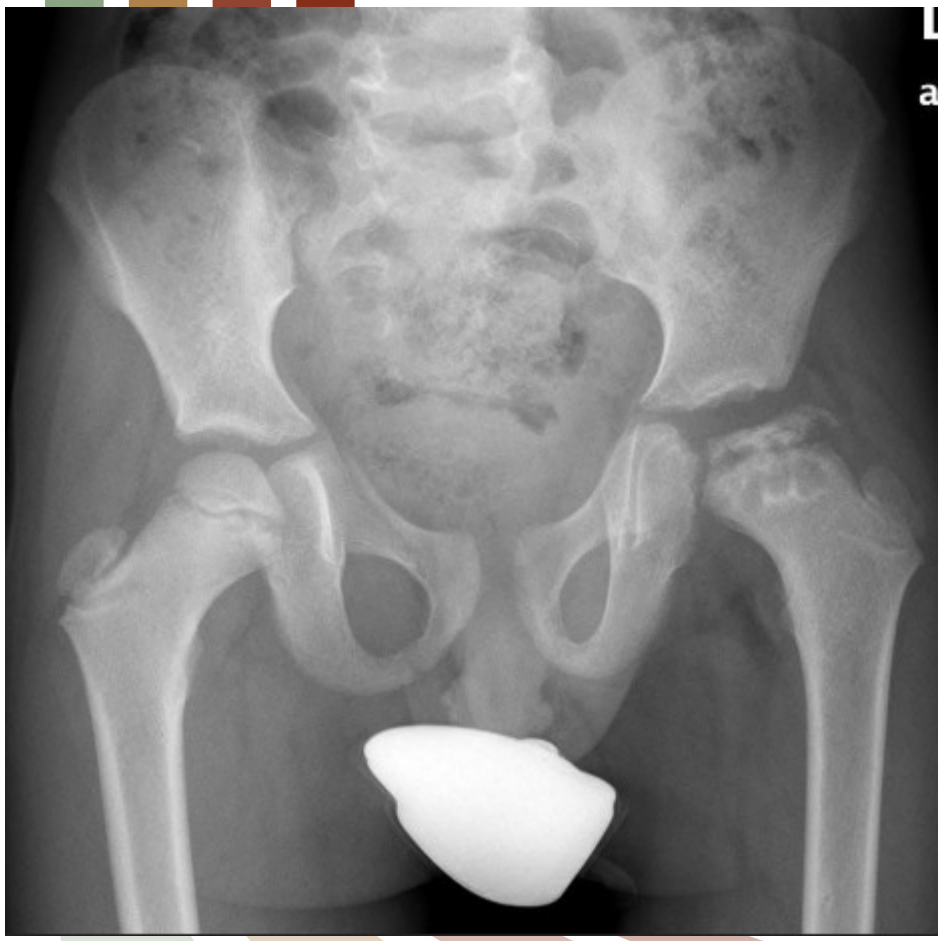
In DDH: Delayed ossification of the femoral head + lateral & superior displacement of the femur

Case (64)

History: A 5-years-old female with painful hip



Legg-Calvé-Perthes disease

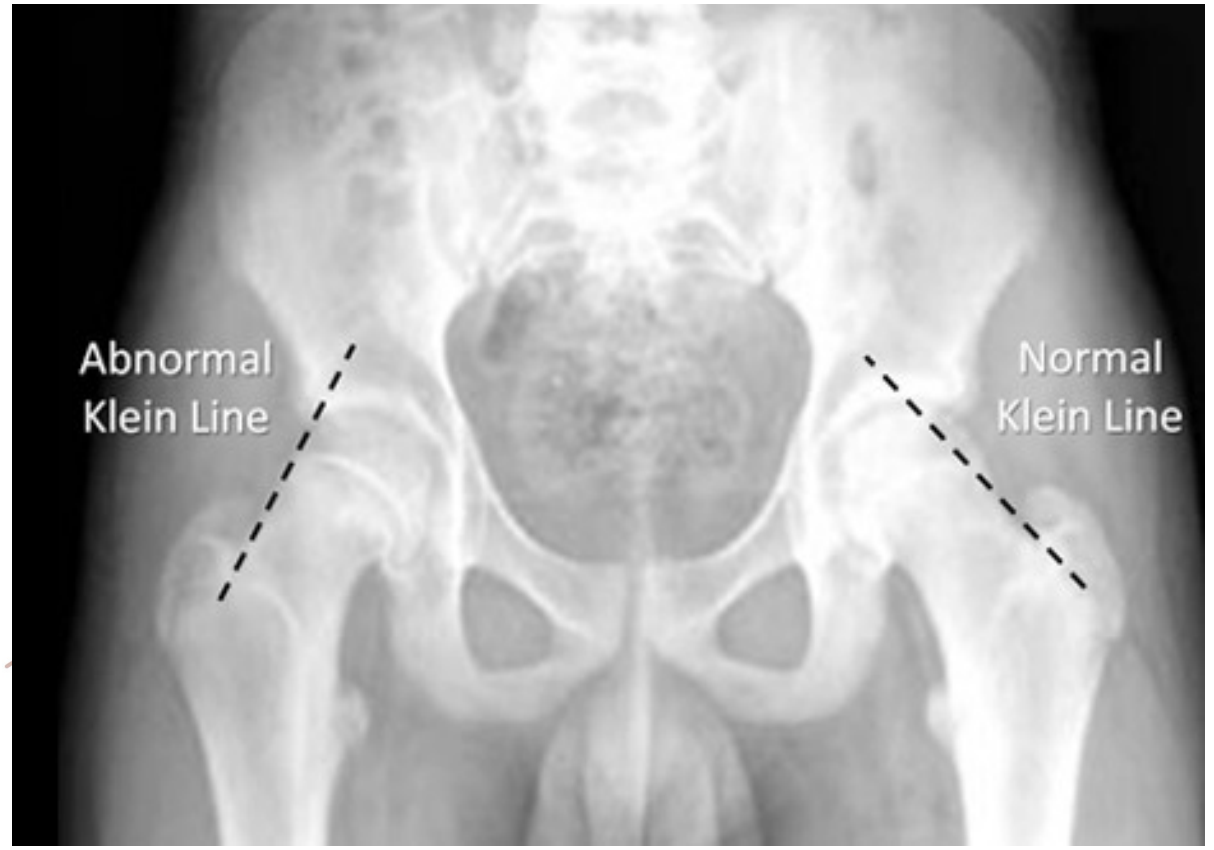


Case (65)

History: A 12-years-old male with painful hip

Slipped Capital Femoral Epiphysis (SCFE)

- Posterior & medial displacement of the femoral epiphysis relative to the metaphysis (ice-cream falling of the cone)
- Klein line: from the femoral neck should intersect the femoral head

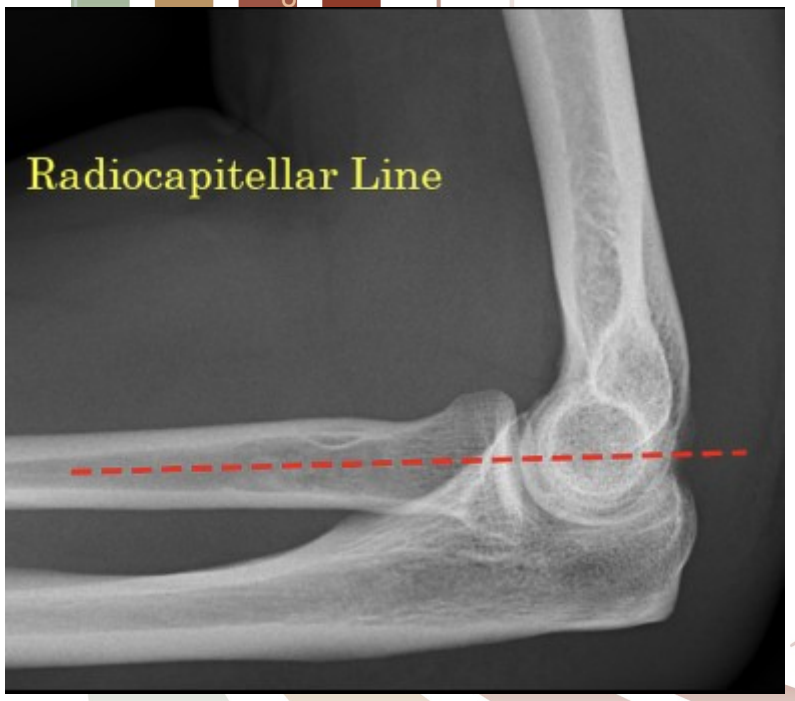


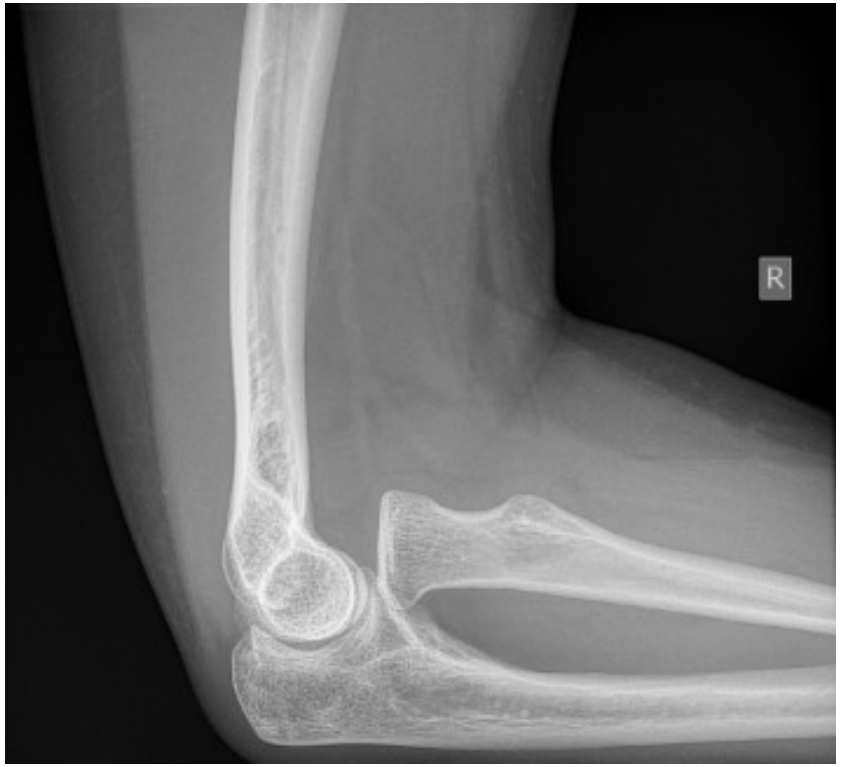
Case (66)

History: A 6-years-old girl with pain, bruising and swelling of the forearm

Radial head dislocation

In almost all cases of isolated traumatic radial head dislocation, the radial head is dislocated anteriorly, this is most easily seen in lateral projection, where there is malalignment of the radiocapitellar line (a line drawn down the radial neck should always intersect the capitellum), where this is lost, radial head dislocation has occurred

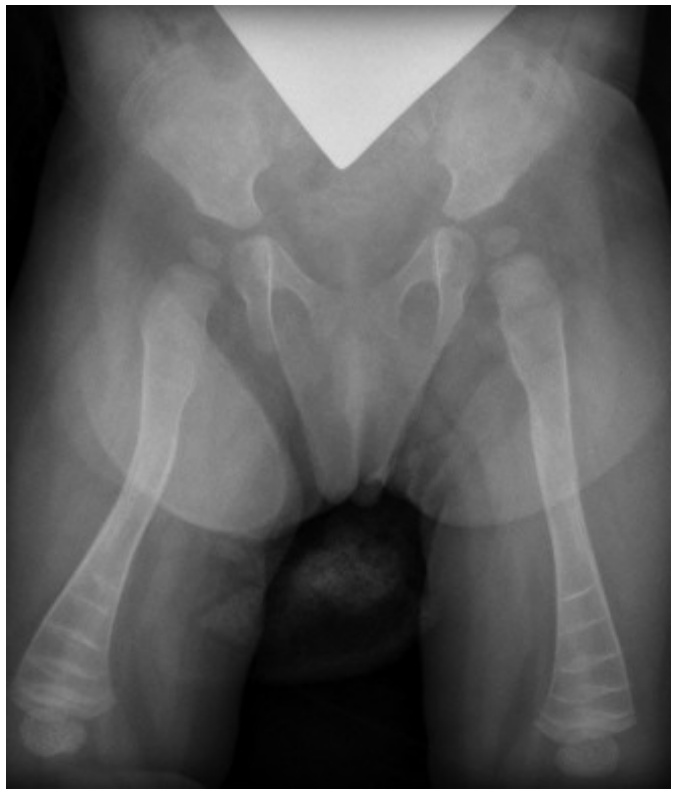




Case (67)

Osteogenesis imperfecta

Osteopenia + bowed long bones with multiple fractures + wormian bones + zebra stripe sign (from bisphosphonate)



DD: Wormian bones
Idiopathic, OI, CCD, Down, Rickets

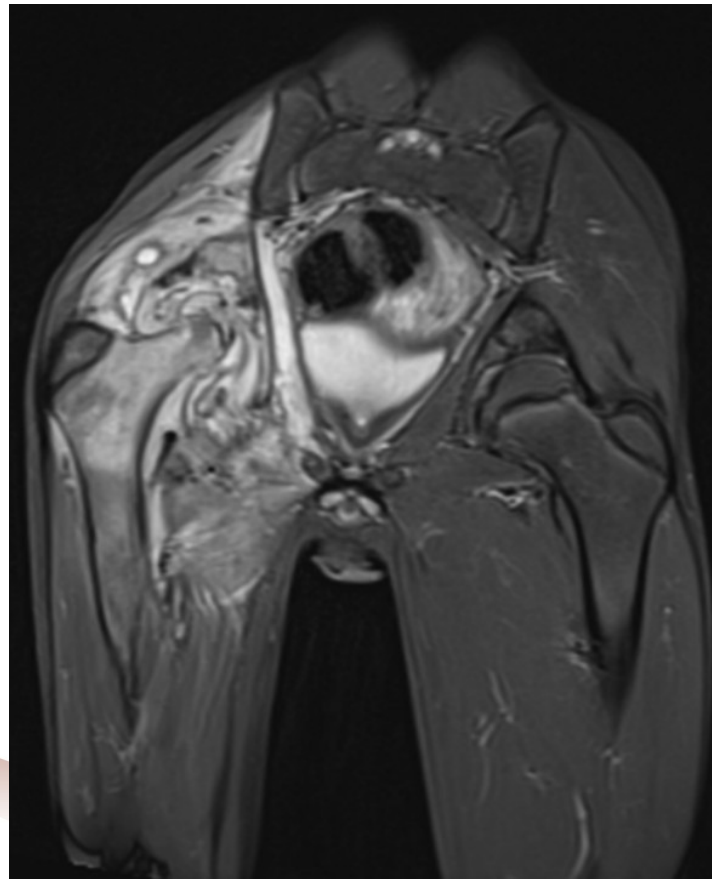
Case (68)

History: A 10-years-old boy with right hip pain and limitation of movement, history of recent chest infection

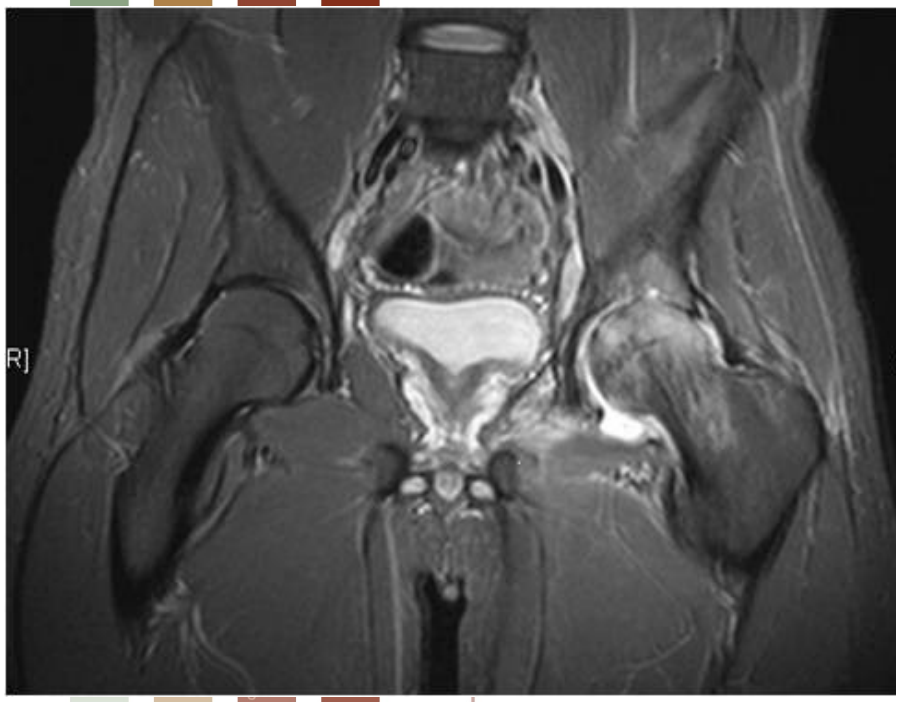
Septic arthritis of the hip joint

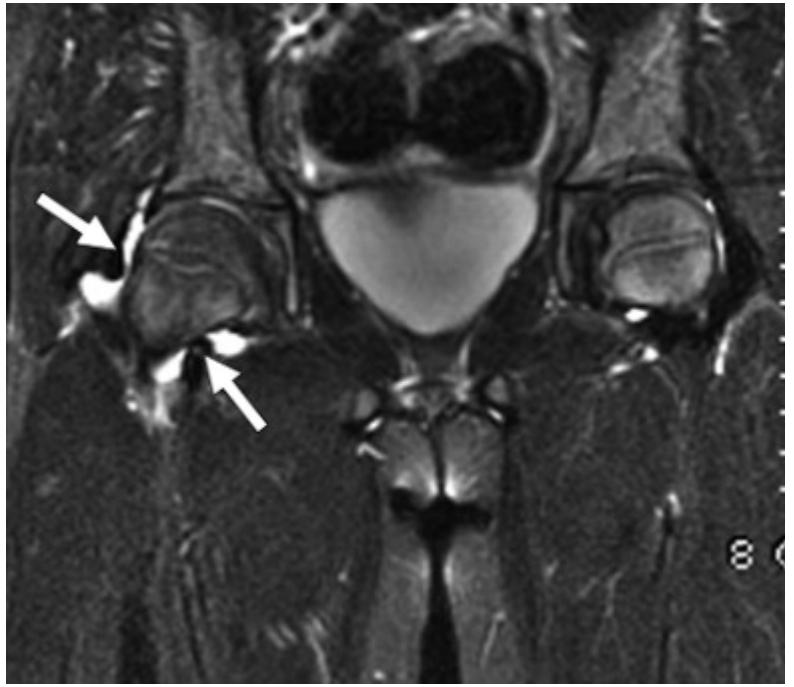
In this case:
Irregularity of the right femoral epiphysis as well as abnormal marrow signal of the right femoral epiphysis and opposing acetabular surface displaying low signal in T1 and bright signal in STIR/T2 FATSAT due to marrow edema, there is loss of joint space at the superior aspect of right hip joint with moderate joint effusion

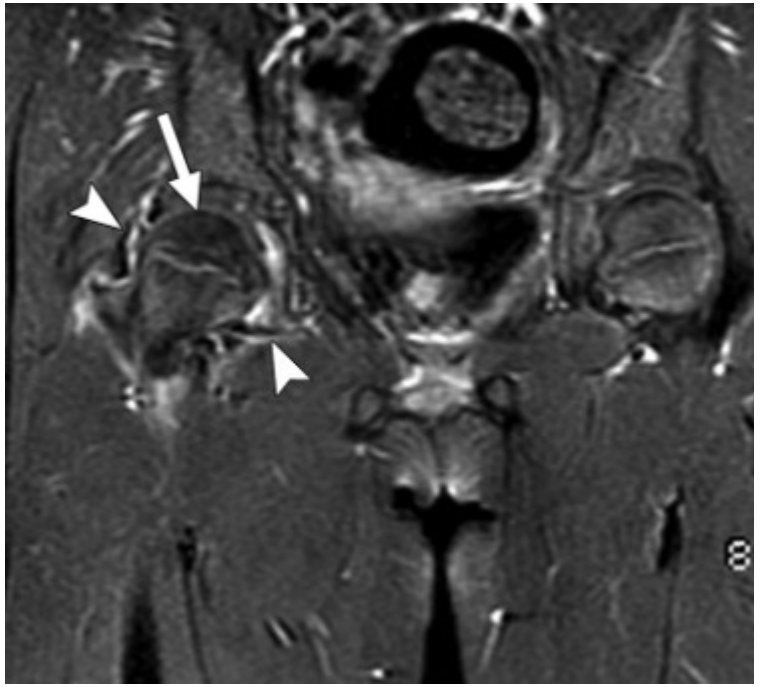
Emergency
Any hip joint effusion in a child should be immediately aspirated by U/S guidance to avoid joint destruction



Moderate joint effusion in the right hip joint, post contrast fat sat image demonstrate thickened, enhancing synovium, the right femoral epiphysis is markedly destructed + bone marrow edema is seen involving the upper 1/3 of the right femur + significant edema is noted in the surrounding soft tissues





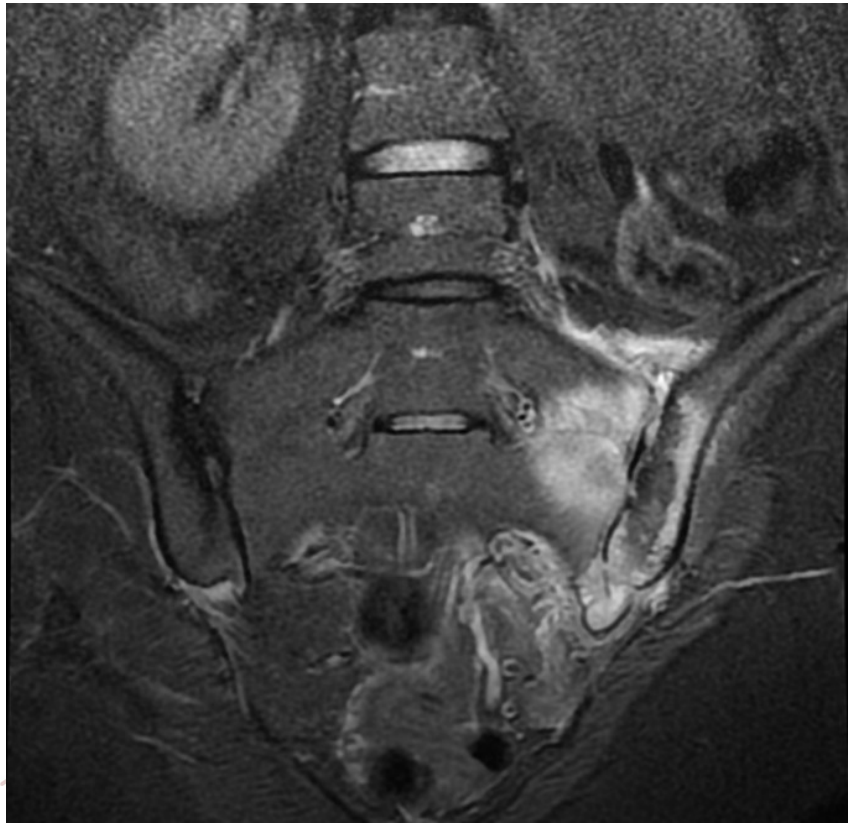


STIR demonstrates a confirmed case of TB septic arthritis of the left hip showing a joint effusion, joint space narrowing, bone marrow edema and cortical destruction

Coronal fat-suppressed T2 shows grade 2 effusion (arrows) in right hip joint
Coronal fat-suppressed T1+C shows low signal intensity (arrow) of right femoral head compared with contralateral femoral head and enhancement of synovial membrane (arrowheads) around right hip joint

Case (69)

History: A 26-years-old female with 3 weeks history of fever with lower lumbar pain radiating to the left lower limb



Septic sacroiliitis - brucellosis

In this case:
The MRI sequences demonstrate a subchondral bone marrow edema of both surfaces of the left sacroiliac joint of low signal on T1, high signal on T2 with prominent enhancement, joint effusion as well as adjacent abscess and edematous infiltration of the ipsilateral iliopsoas muscle

(a) Bilateral sacroiliitis:
(i) Symmetrical:
IBD (UC, Crohn's)
AS
RA
(ii) Asymmetrical:
Psoriasis
Reactive arthritis
OA
Gout

(b) Unilateral sacroiliitis:
(i) Septic arthritis (Fever)
Pyogenic, TB, brucellosis
(ii) Neoplastic destructive process

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