Imaging the Musculoskeletal System

AHMAD AMER Al-BOUKAI

Associate Professor & Consultant Radiologist
Radiology & Medical Imaging Department
King Khalid University Hospital

PART 2 - 2012

Radiology Team 429

In this team we used the outlines from the:

Doctor's slides

Lecture notes are in red boxes

427 Radiology team

Diagnostic Imaging –PETER ARMSTRONG – 6Th Edition

Sorry we don't hold responsibility for any missing information or perhaps – perhaps -wrong material.

We tried our best to present this lecture in the best way, and we hope what we wrote is enough to cover the subjects.

Team Leaders:

Abdulmajeed Al-Sadhan, Ibrahem Al-Sadhan, Sarah Mahasin

Team Members:

Mashail Al Towariqi, Abdullah Alessa

Best Wishes :)

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:

- Normal radiological anatomic landmarks
- System of analyzing findings

  "Where to look & What to look for"
- Recognize features of certain disease entity

Imaging to the Musculoskeletal System

- Metabolic and Endocrine Disorders:
  - Osteoporosis
  - Osteomalacia
  - Renal Osteodystrophy
  - Hyperparathyroidism
  - Acromegaly
- Arthritis
  - Rheumatoid Arthritis
  - Osteoarthritis
  - Psoriatric arthritis
  - Gouty Arthritis
- Musculoskeletal Tumors
  - Osseus, chondral, fibrous, soft tissue

METABOLIC & ENDOCRINE BONE DISORDERS

A A Al-BOUKAI-3

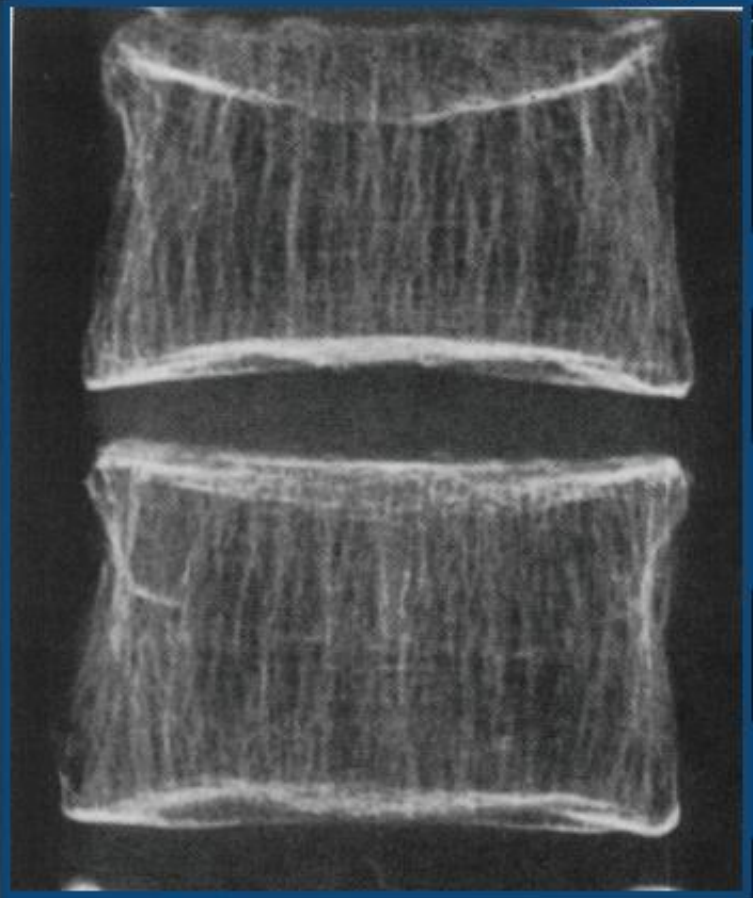
CASE NO. 1

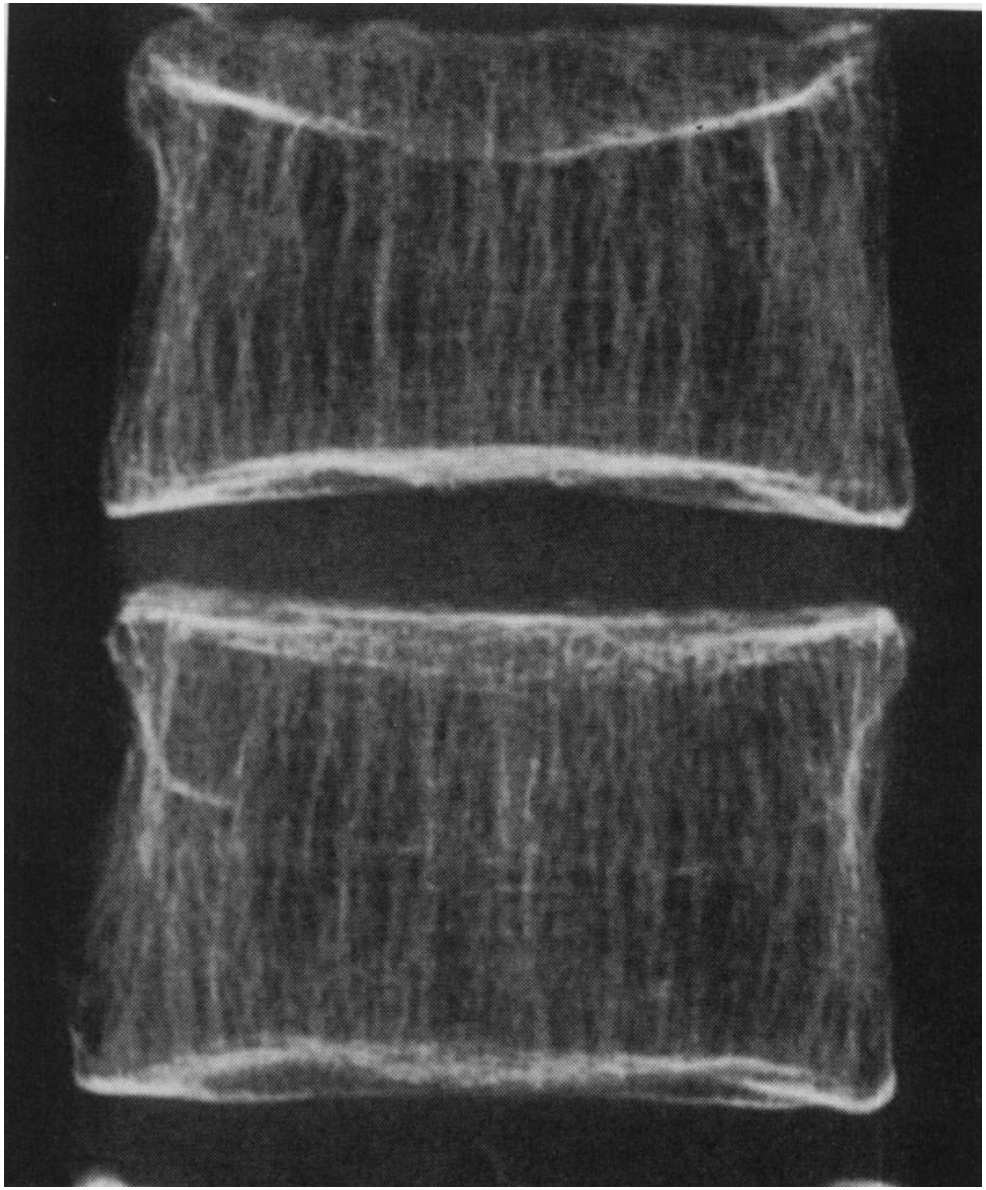
54 years- old female with low back pain
X-ray of lumbosacral spine requested

A A Al-BOUKAI-4

A A Al-BOUKAI-5

Case no.1:
an X-ray of lumbosacral spine that shows a decreased bone density of the vertebra. Which is obvious by looking at the margins which is markedly increased when compared to the body of vertebra
Also, Trabeculae are seen , which are vertical lines on the vertebral bodies, due to reduction of the matrix “bone density” and the horizontally trabeculae will be lost and vertical ones will be obvious.





- Reduction of the bone matrix
- Concave end plates
- Trabecule are clear and vertical, (lines inside the vertebrae)
- Uneven density
- Cortex is thin and sharp
- Margins are sharp and sclerotic
- Reduction in the height of the vertebrae

Patient A

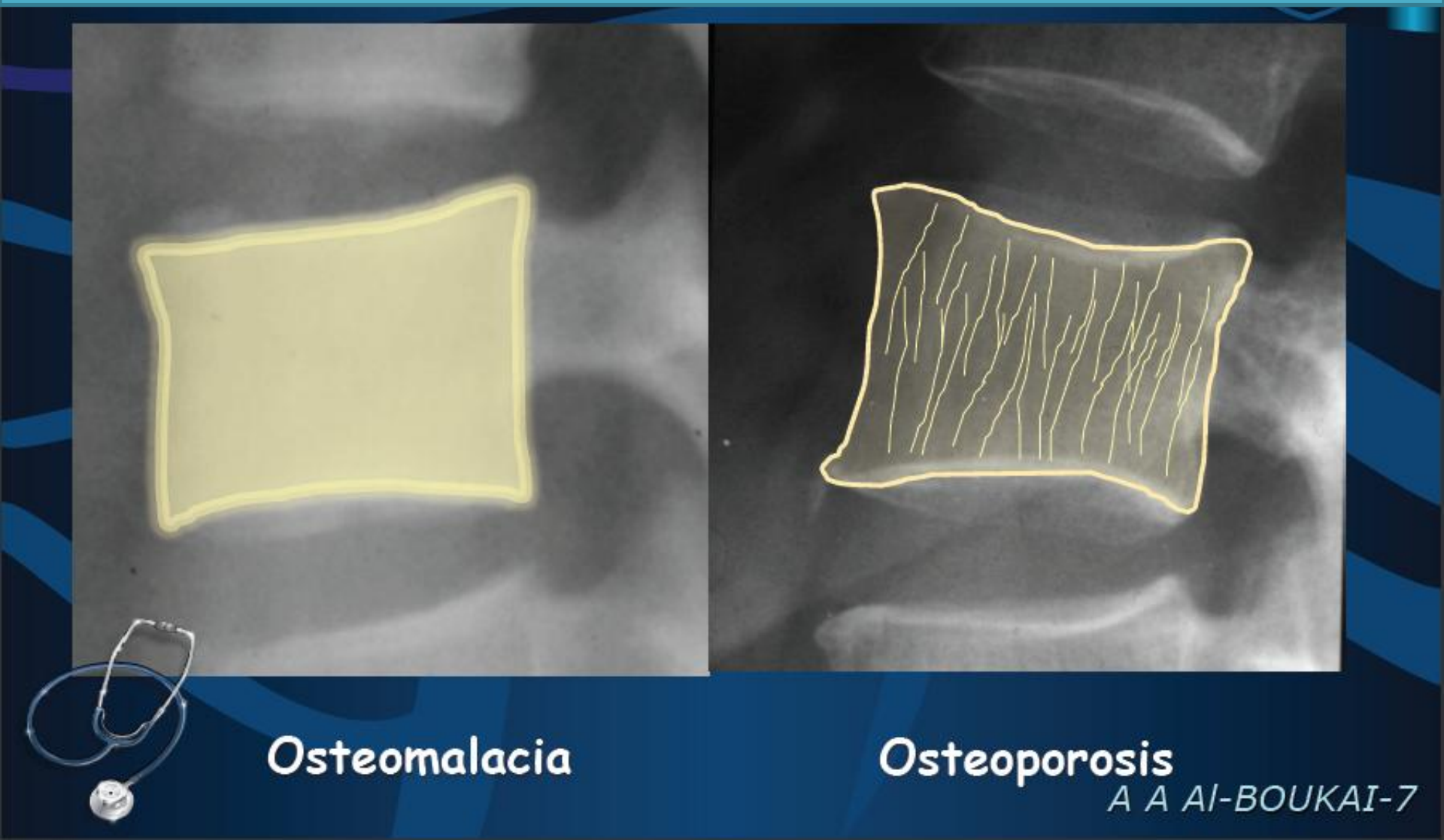
Patient B

Osteomalacia

Osteoporosis

A A Al-BOUKAI-7

Patient (A): Osteomalacia”Rickets in children”
Bone density may be normal but bone is soft and there is a defect in mineralization and ill defined margins with no vertically oriented trabeculae.
Patient (B): Osteoprosis
There is reduction in bone density , sharp margins of the vertebral body with obvious vertically oriented trabeculae.



CASE NO. 2

27 years- old male with long standing history of renal failure

X-ray of lumbosacral spine requested

Osteosclerosis

"Rugger Jersey Spine"

A A Al-BOUKAI-9

Case no.2: Patient with renal failure → No absorption & metabolism of vitamin D.
On x-ray, **2 White margins** with **lucent central** and vertical trabeculae which is called (**Rugger jersey spine**), these changes are due to renal dystrophy.
The rugger-jersey sign is diagnostic of osteosclerosis.

- Decreased bone density of the central portions (black area)
- Sclerotic vertebral end plates
- Caused by reabsorption of the minerals, but increased activity of the

METABOLIC & ENDOCRINE BONE DISORDERS

Renal Osteodystrophy

Presents with

Osteoporosis

Osteomalacia

Secondary Hyperparathyroidism

Osteosclerosis

20 years old lady, weakness and lower limbs pain

Looser zones (OSTEOMALACIA)

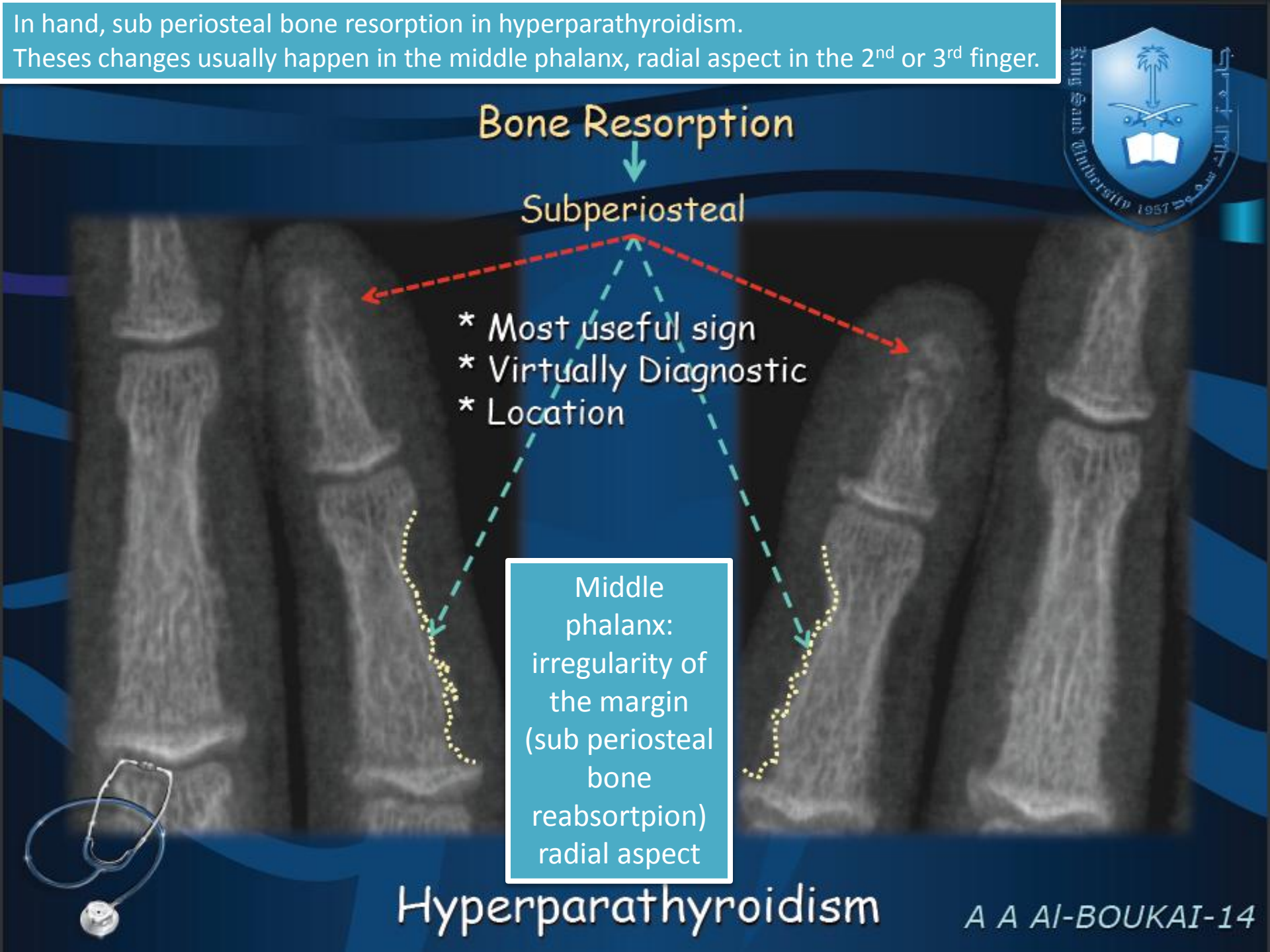
- Medial aspect of the femur neck
- CT: check texture of the cortex
- MRI: check changes in the bone marrow
- Insufficient fracture of the femur neck due to softening of the bone
- Looser zones: presents as pain during movement, lower limb weakness

HYPERPARATHYROIDISM

- ✓ Bone Resorption
- ✓ Bone Softening
- ✓ Brown Tumors
- ✓ Osteosclerosis
- ✓ Soft tissue calcifications

A A Al-BOUKAI-13

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

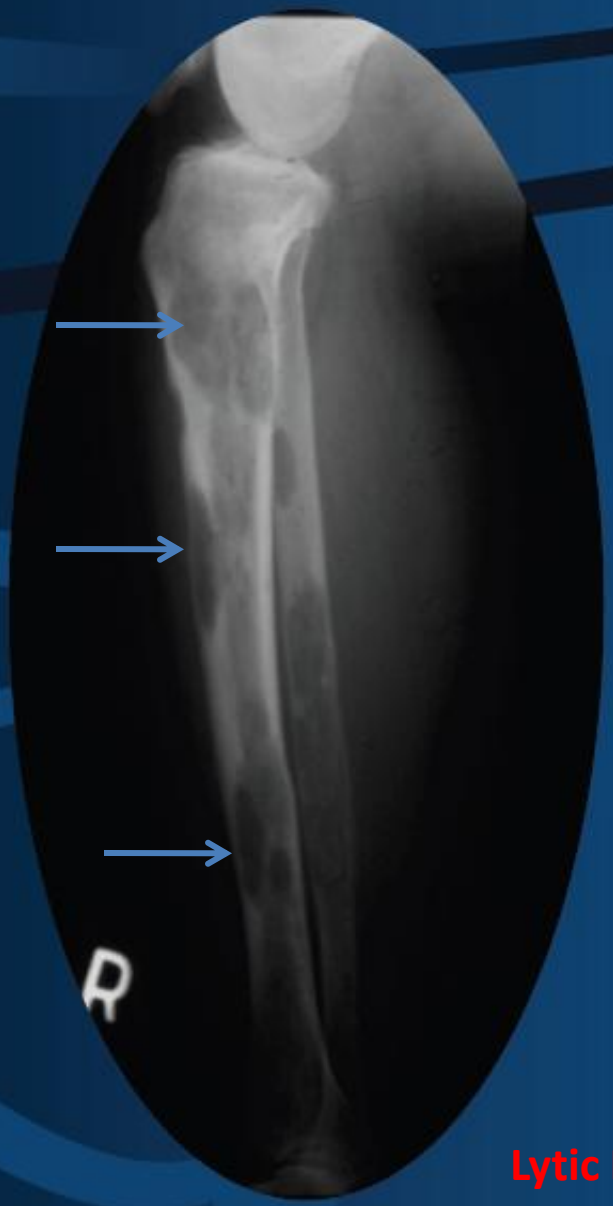


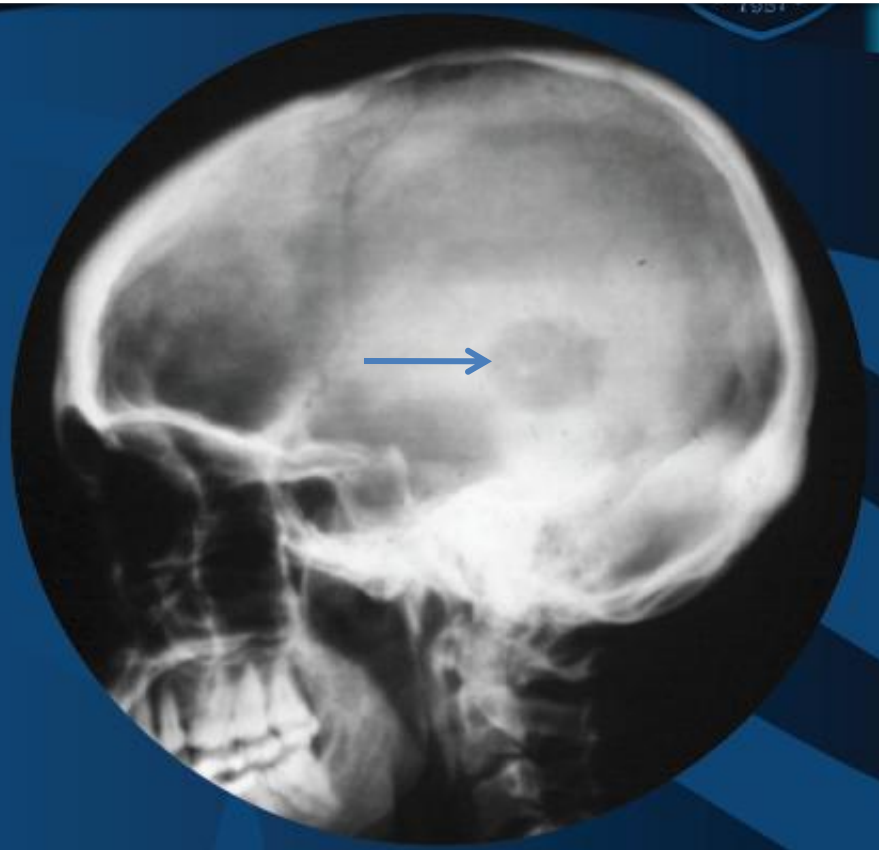
Brown tumors features:

Affect long or flat bones. .1

Single or multiple .2

Have a sharp outline but with no obvious margins .3





Lytic Lesions

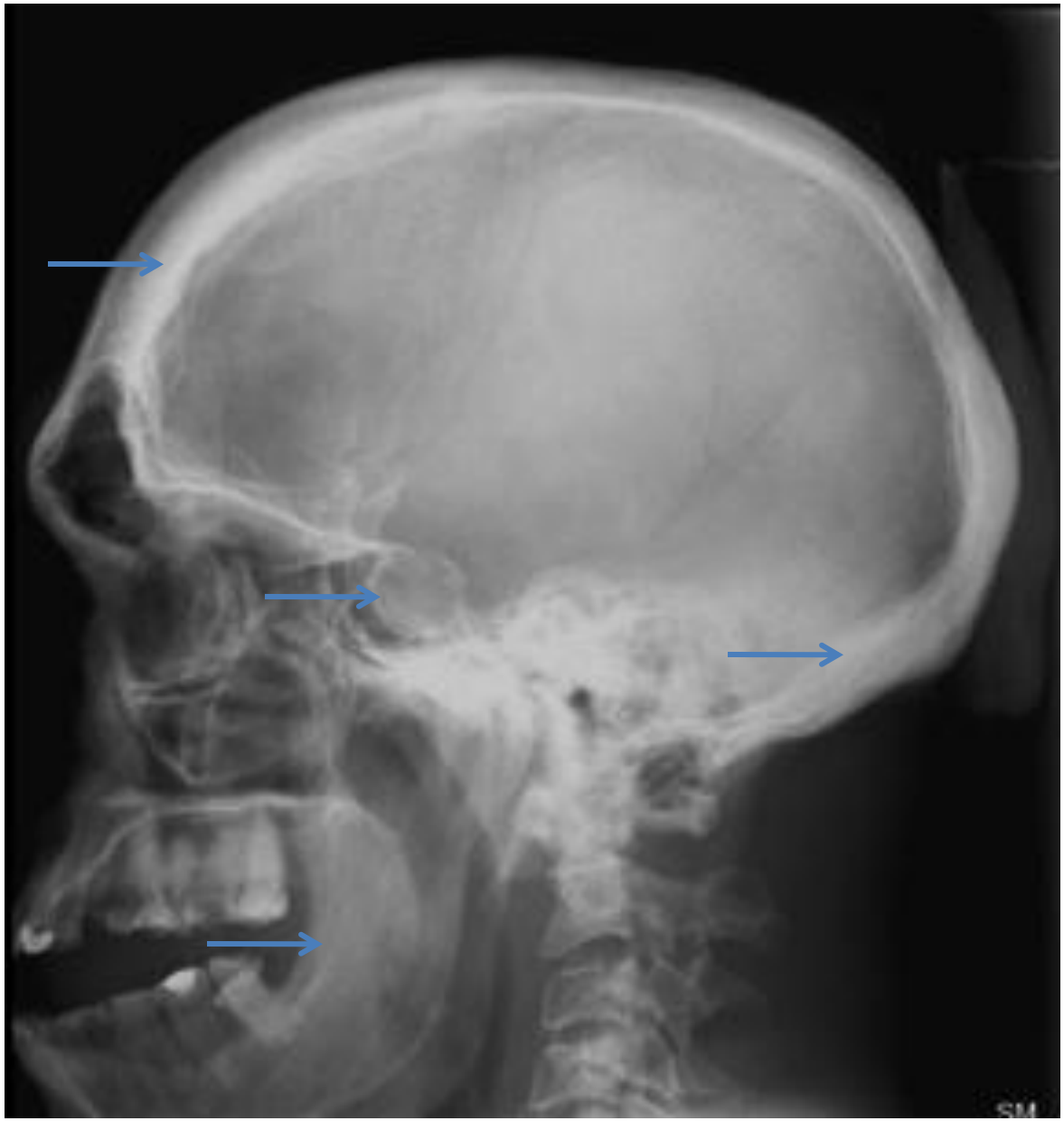
Brown Tumors

CASE NO. 3

45 years- old male presented with history of bone enlargement

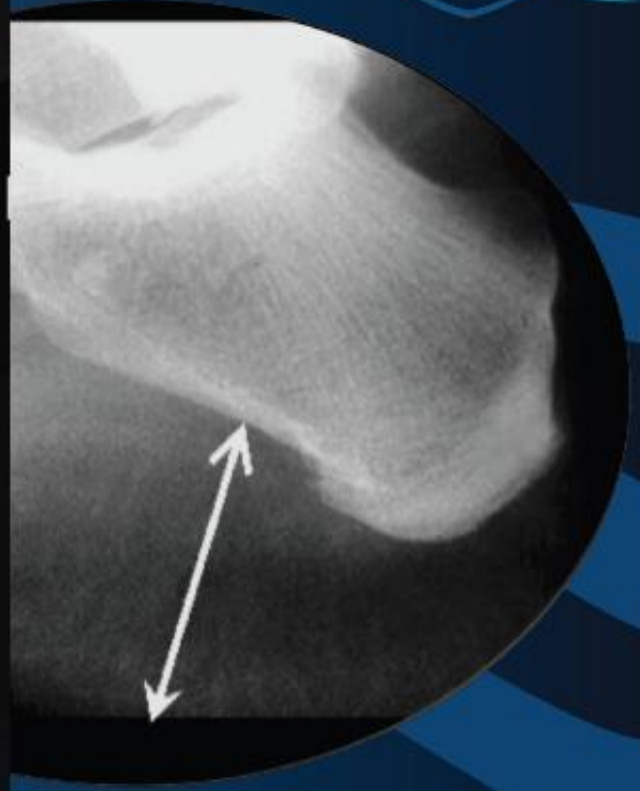
X-ray of skull and hand are requested


Acromegaly

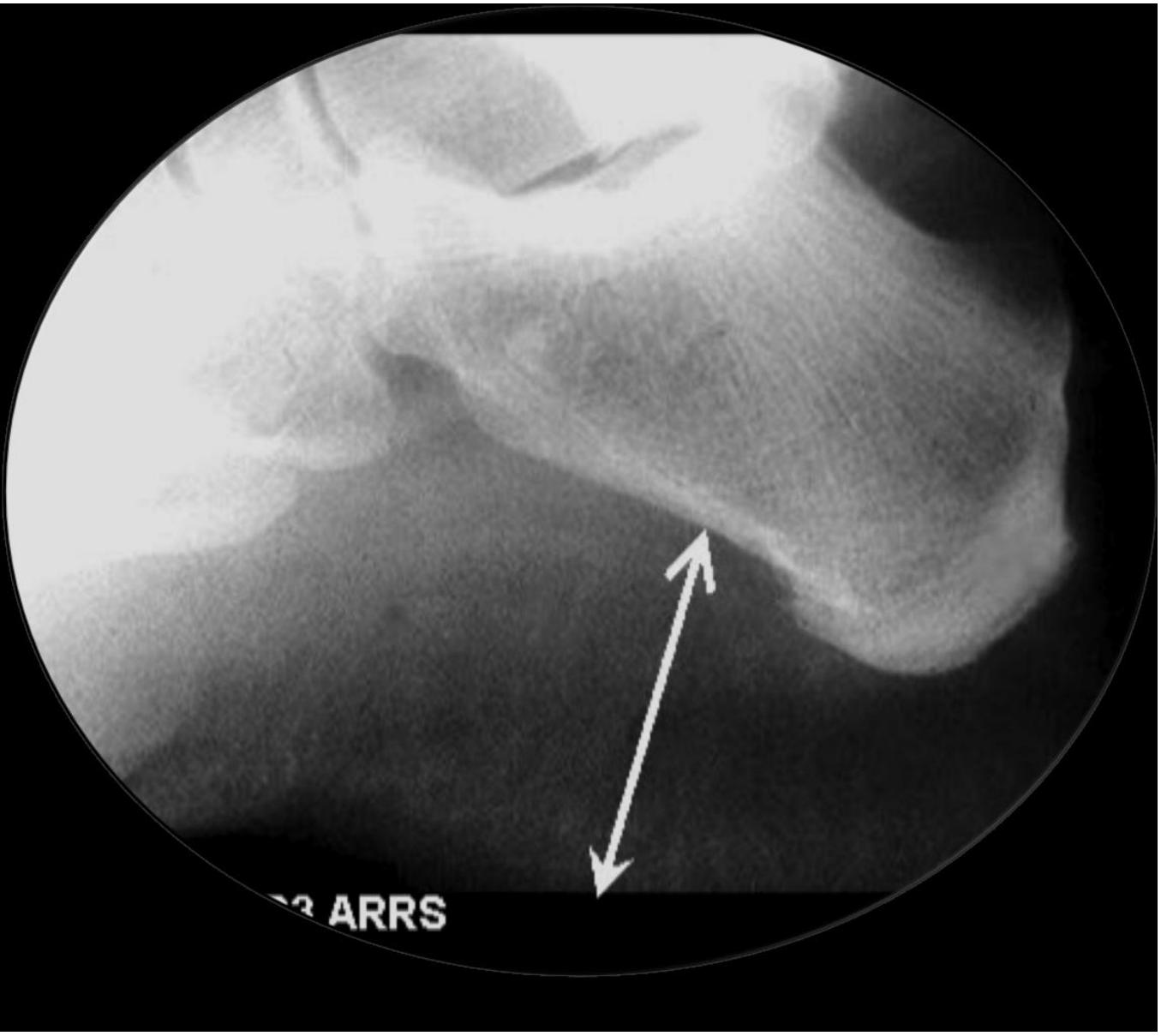


- Sella turcica is rounded & enlarged which may indicate pituitary pathology that caused the acromegaly
- Jaw and frontal sinus are enlarged
- Occipital protuberance
- Thickening of the calvarium
- Sellae of the pituitary is enlarged due to adenoma

Acromegaly



Hands: Enlargement of the soft tissue, early osteoarthritis


ARRS

ARTHRITIS

A A Al-BOUKAI-19

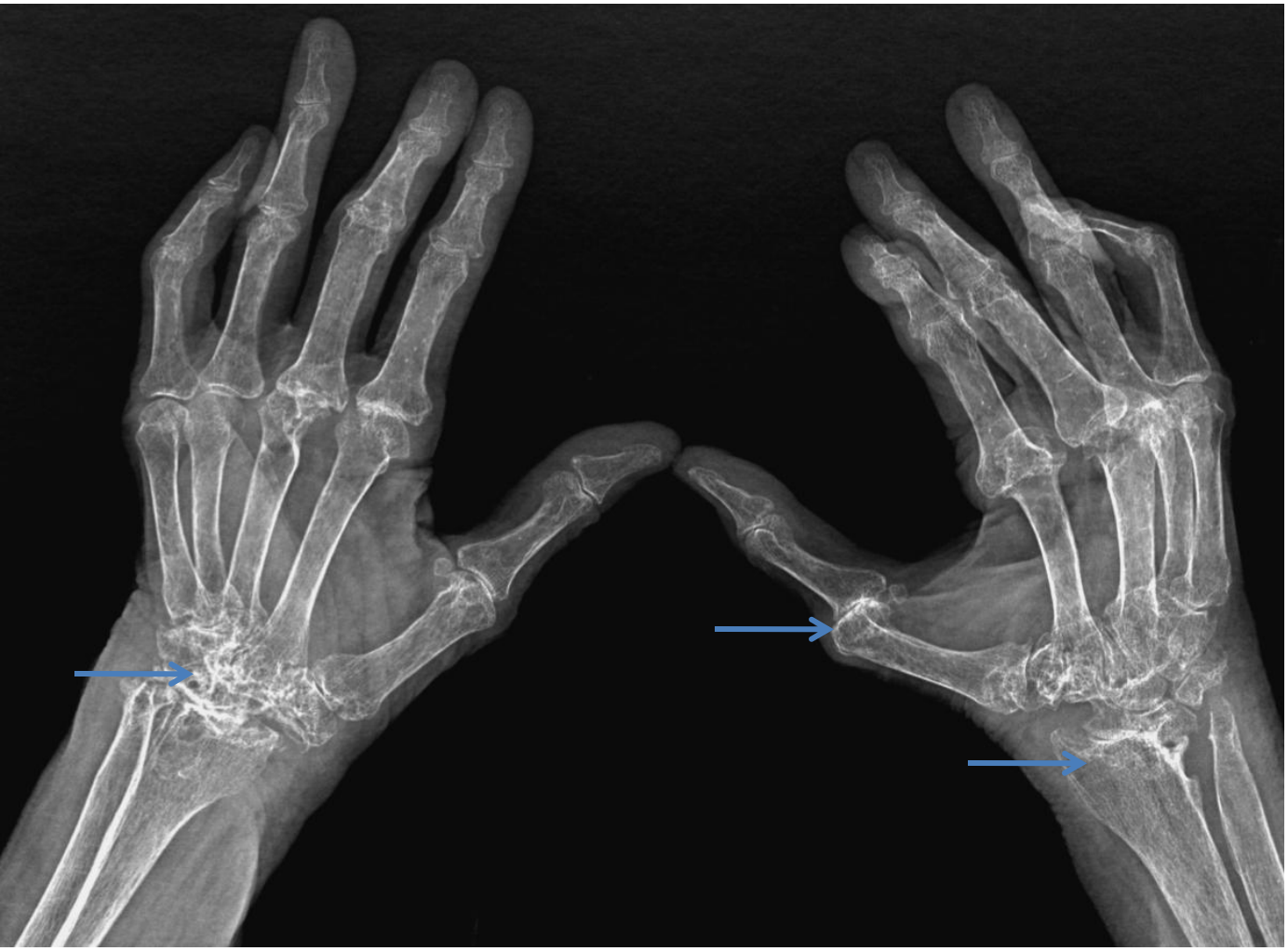
CASE NO. 4

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

Imaging of Musculoskeletal System 2012

Rheumatoid Arthritis

A A Al-BOUKAI-21



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

Rheumatoid Arthritis

- Carpals aren't clear, proximal disease
- Changes involve the head of the metacarpal, metacarpal pharyngeal joints

•Rheumatoid arthritis:
•Look → Bone density, texture & outline.
•Some of the signs of rheumatoid arthritis are: Periarticular erosions (periarticularosteopenia), loss of joint spaces.

Rheumatoid Arthritis

A A Al-BOUKAI-23

- Around joint, periarticularosteopenia/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. 5

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

A A Al-BOUKAI-24

Osteoarthritis

A A Al-BOUKAI-25

- 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

- 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

Osteoarthritis

- 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

Osteoarthritis

A A Al-BOUKAI-27


Erosive Osteoarthritis

Psoriatic Arthritis

Involvement of middle finger and fusion

CASE NO. 6

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

Gouty Arthritis

A A Al-BOUKAI-31

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 arthropath with soft tissue component, seen in Gout

Notes

- 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

Musculoskeletal Tumors

- ✓ Osseous
- ✓ Chondral
- ✓ Fibrous
- ✓ Soft tissue

Musculoskeletal Tumors

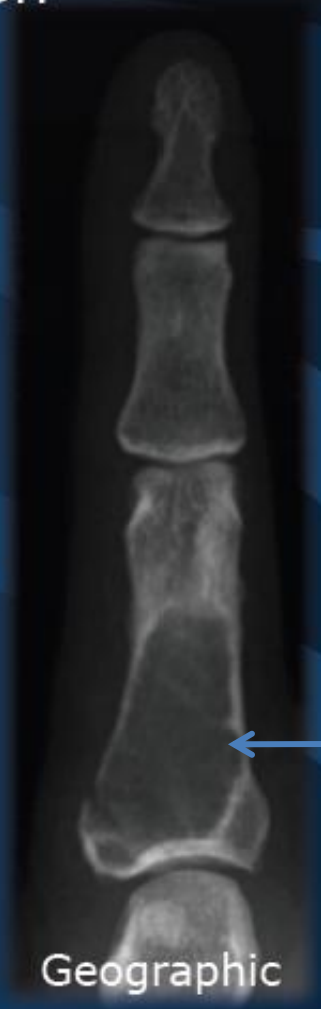
KEY FEATURES

- ✓ Morphology
  - Pattern of bone destruction
  - Size, Shape & Margin of lesion
  - Texture of lesion Matrix
  - Cortex & Periosteal reaction
- ✓ Behavior of lesion
- ✓ Age of patient
- ✓ Site (Location)

Musculoskeletal Tumors

Pattern of bone destruction

Geographic lesions: benign, sharp out line



Musculoskeletal Tumors

Pattern of bone destruction

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

Musculoskeletal Tumors

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

Musculoskeletal Tumors

KEY FEATURES

- ✓ Morphology
- ✓ Behavior of lesion
- ✓ Age of patient
- ✓ Site (Location)


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

CASE NO. 7

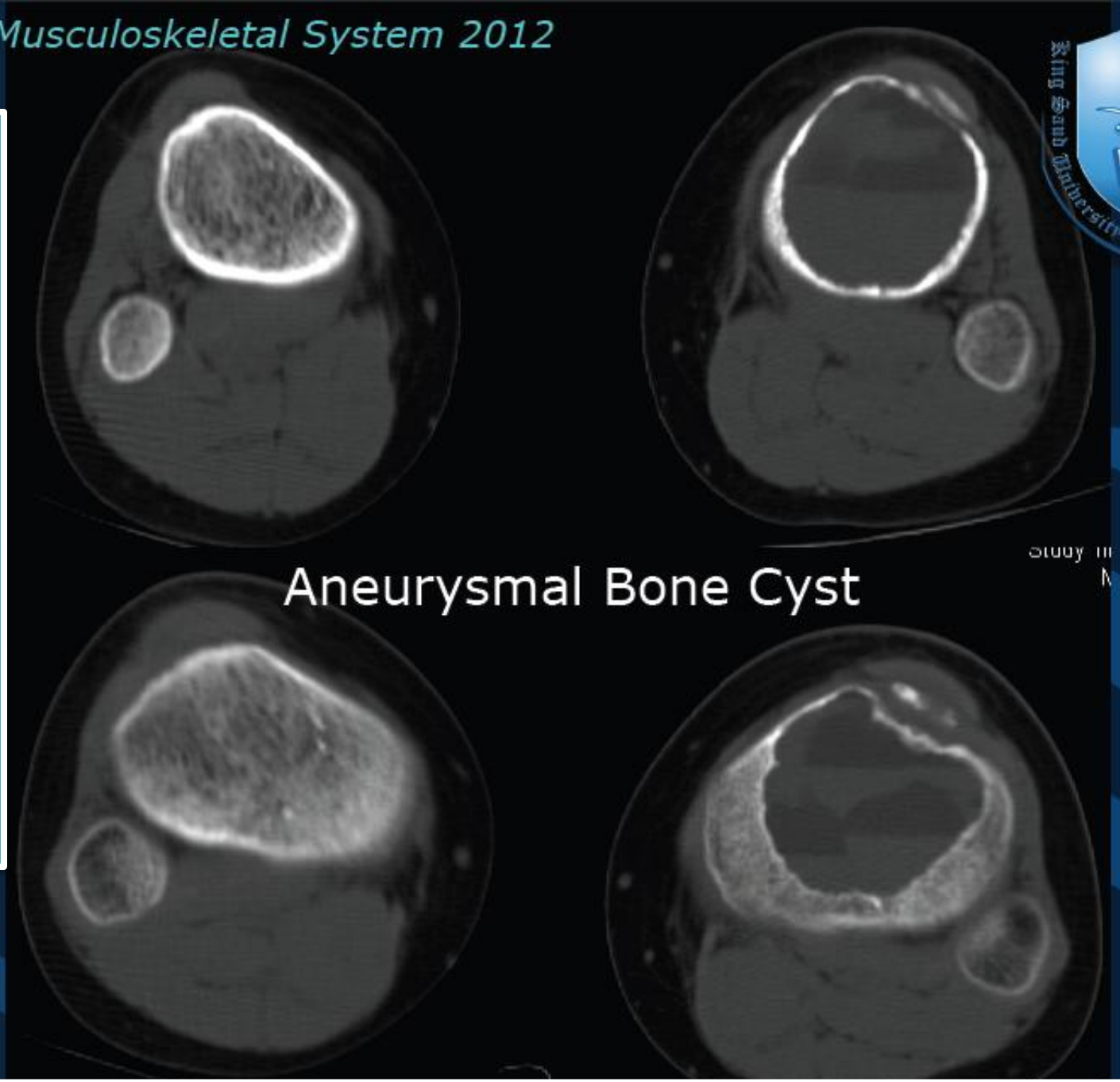
13 year-old boy patient presented with knee pain and swelling
X-ray of knee requested

Lytic expansile lesion located on the metaphysis (benign)

Aneurysmal Bone Cyst

CT or MRI might be done to check the texture of the lesion.

- Within the metaphysis, doesn't extent to the epiphysis
- Geographical
- X ray: expansilelytic lesion , cortex is thinned out
- CT: fluid level blood, vascular benign lesion
- Cause: aneurysm bone cyst (age, location, appearance)

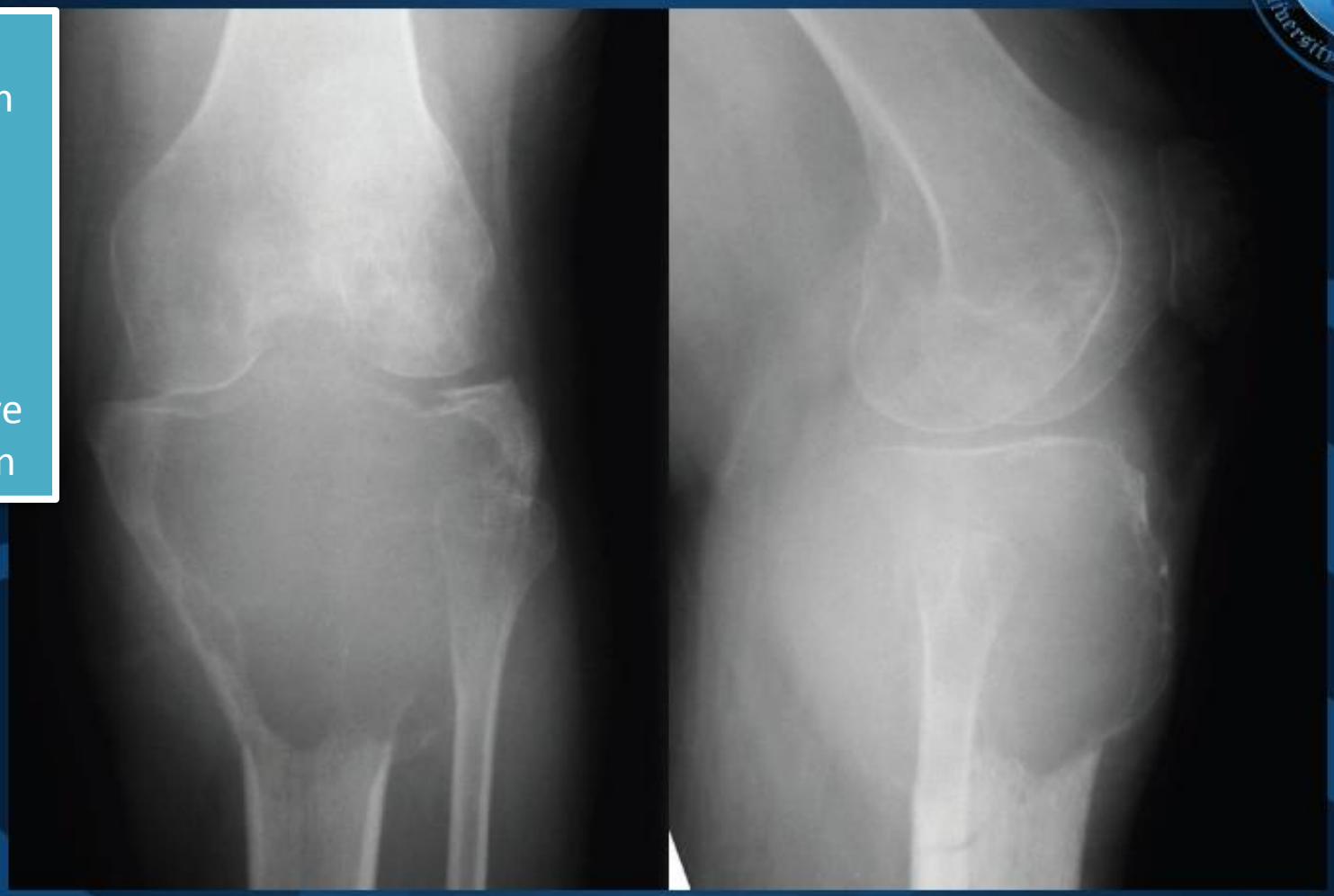


Aneurysmal Bone Cyst

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

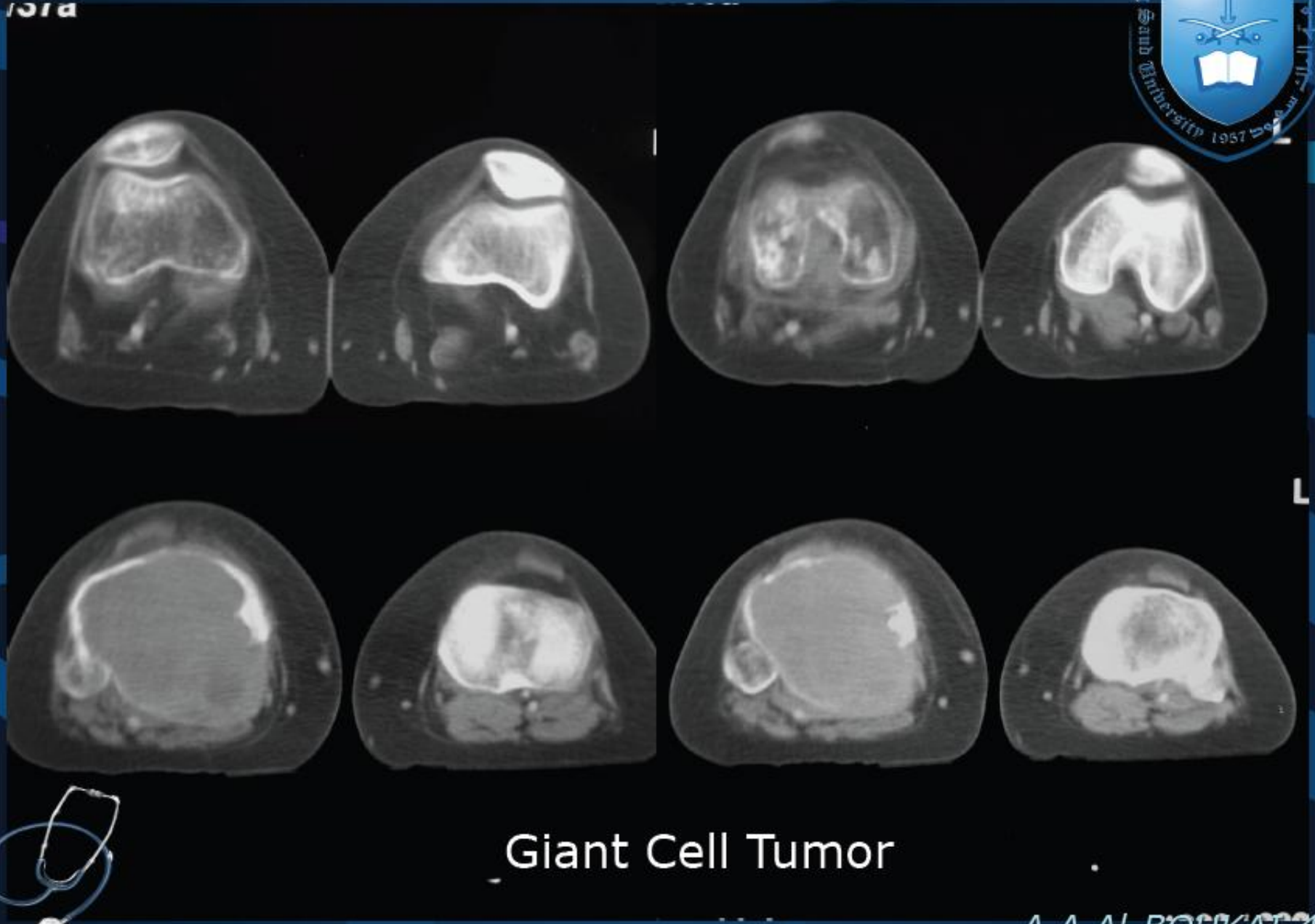
Adult Patient

- Expansile
- lytic lesion
- sub-articular surface
- violated cortex
- Aggressive bone lesion

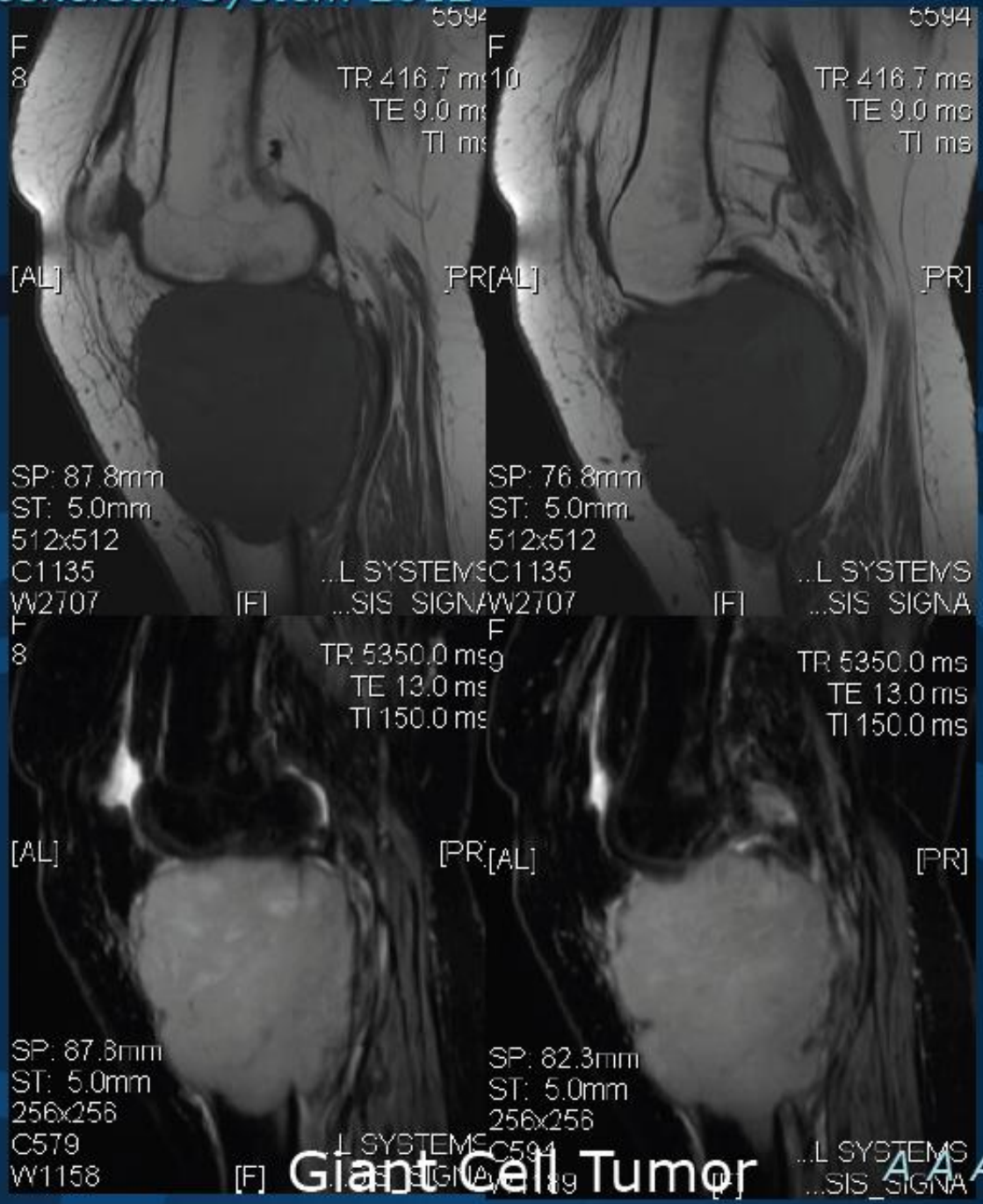


Giant Cell Tumor

two different densities



Giant Cell Tumor

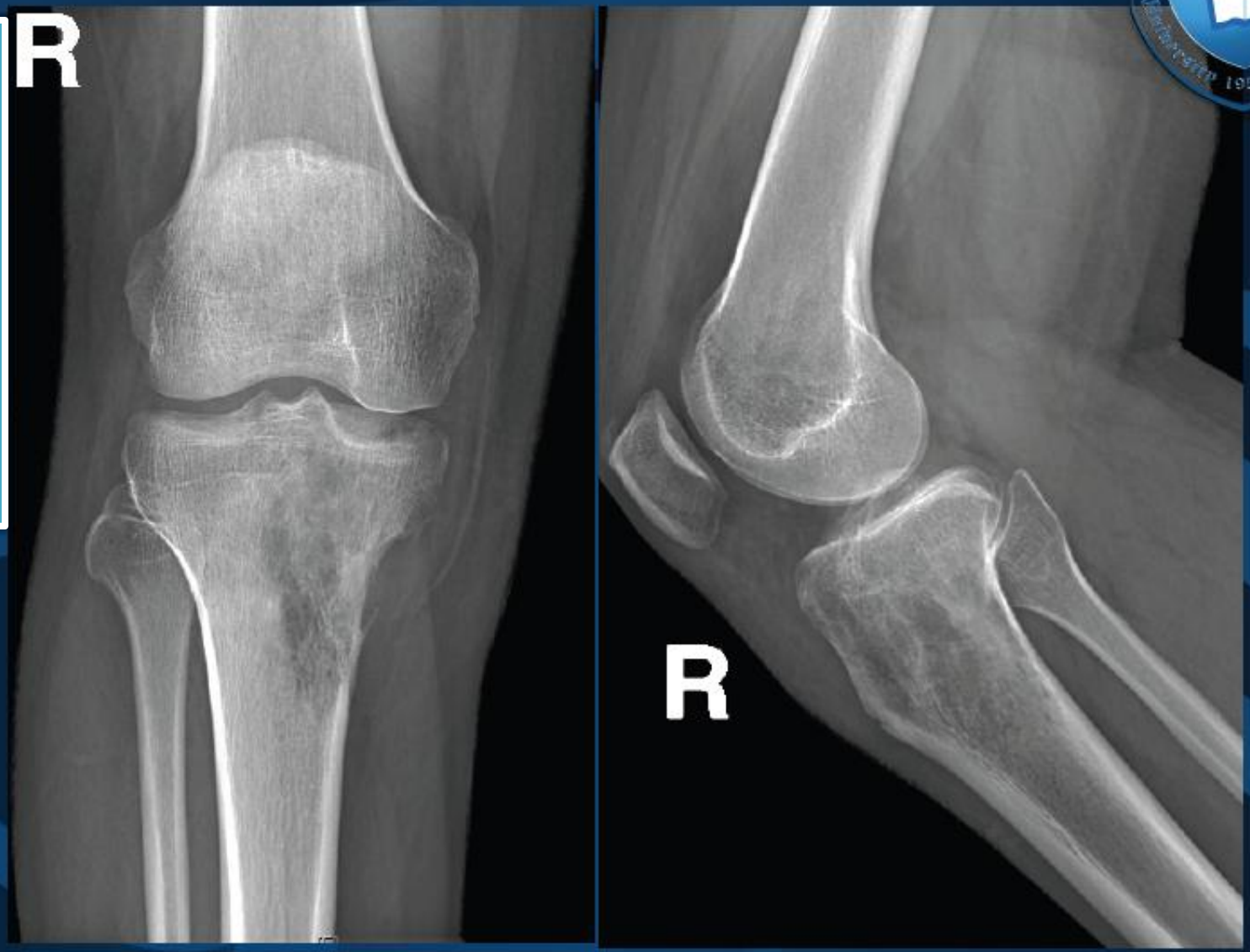


MRI

Giant Cell Tumor

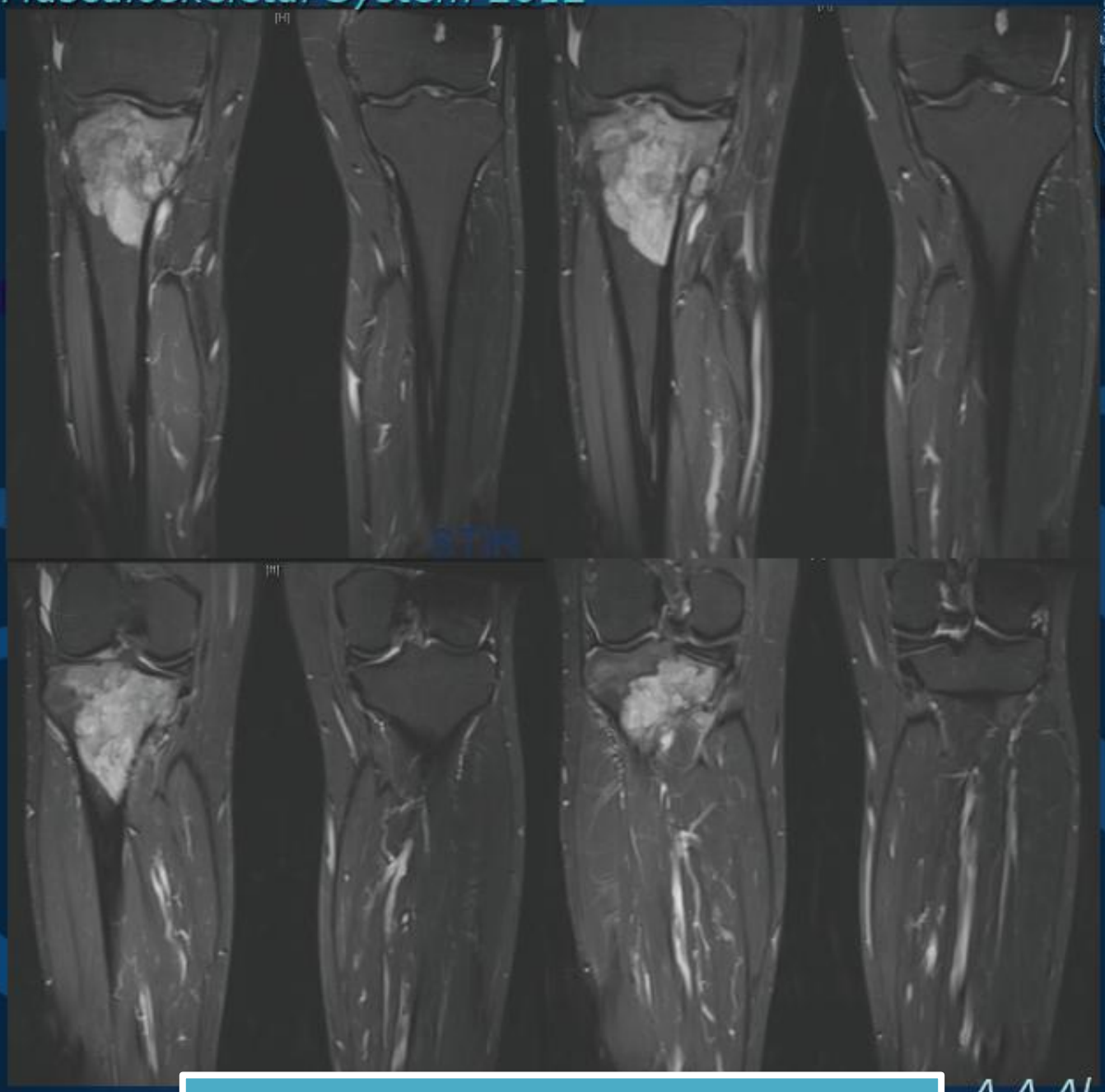
Permeative Pattern

- Moth eaten, permeated (no margins)
- Violating the cortex
- Leukemia, lymphoma, sarcoma



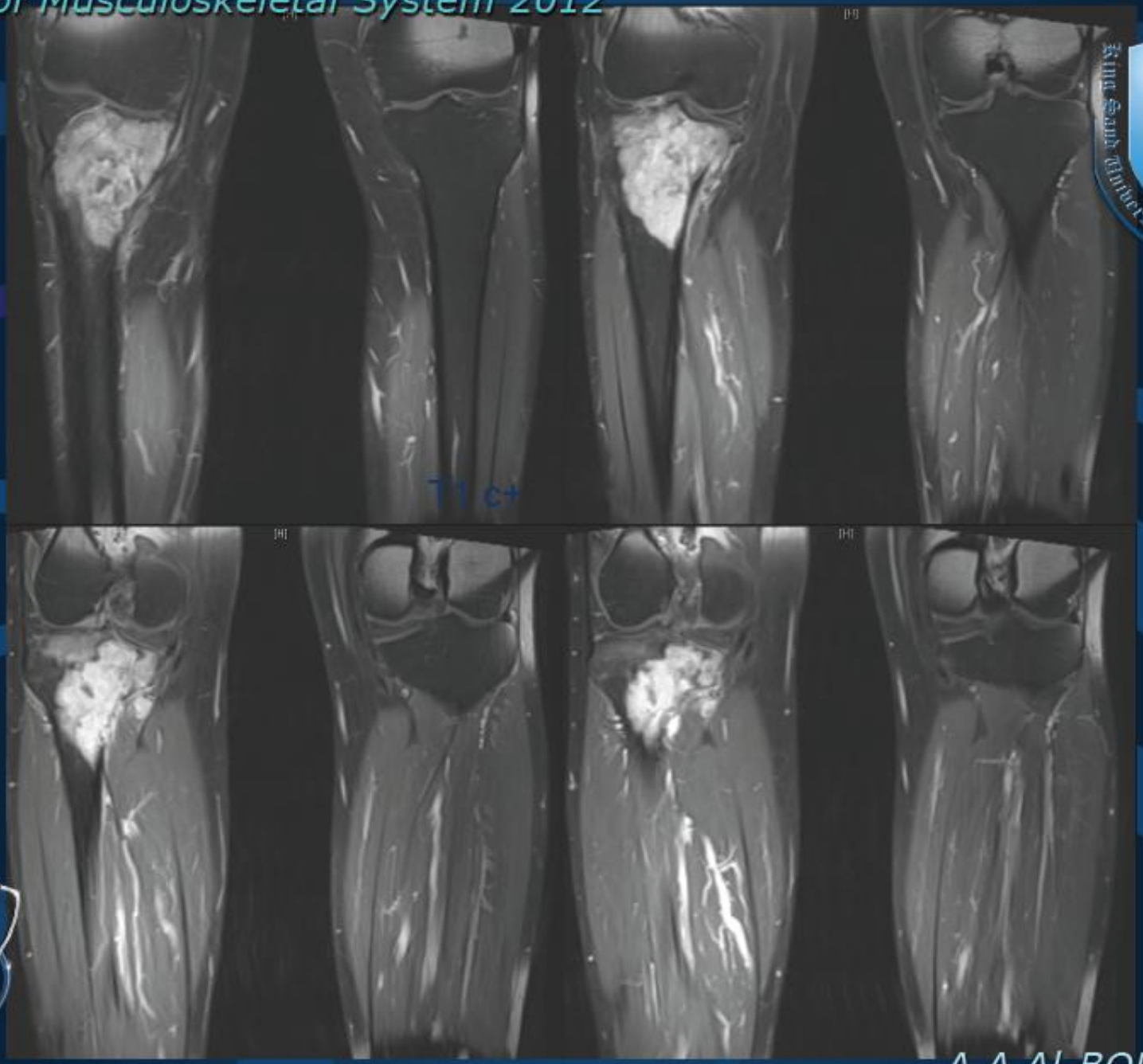
Osteosarcoma / Lymphoma

A A Al-BOUKAI-44



MRI: heterogeneous, extends beyond cortex

A A Al-BOUKAI-45



A A Al-BOUKAI-46

CASE NO. 8

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

A A Al-BOUKAI-47

- soft tissue swelling of the hand, between thumb and finger
- no bone destruction
- Soft tissue swelling but no bone is disrupted, so it is only a swelling.

Soft Tissue Lipoma

A A Al-BOUKAI-48

•MRI: lesion is white
•Another image is adjusted to cancel the fat (black)
•Possible lesions: Lipoma, fibroma, rhabdomyoma, fibrous cystocytoma, hemangioma, neurofibroma

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?)

ue Lipoma

Good Luck!
Radiology Team

A A Al-BOUKAI-50