Imaging the Musculoskeletal System

(Part Three)

AHMAD AMER Al-BOUKAI

Clinical Associate Professor & Senior Consultant Radiologist
Radiology & Medical Imaging Department
King Saud University Medical city

OBJECTIVE

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

IMPORTANT SITES

BONE DENSITY & TEXTURE
BONE MARROW
ARTICULAR CORTICES
SOFT TISSUE

OUTLINES

- ✓ Introduce Imaging approach to skeletal metabolic disorders and Identify important findings including sequelae and complications

- ✓ Introduce Imaging approach to skeletal neoplastic disorders and Identify important findings including sequelae and complications

IMAGING OF MUSCULOSKELETAL SYSTEM PATHOLOGY

METABOLIC

IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

TERMINOLOGY IN METABOLID BONE DISORDERS

FEATURES

Describe Bone Density

Decreased
Increased

- Osteoporosis
- Osteomalacia
- Osteopenia
- Osteosclerosis

Describe Texture

Corticomedullary differentiation
Trabeculae

- Sharp
- Hazy

Describe Soft tissue changes

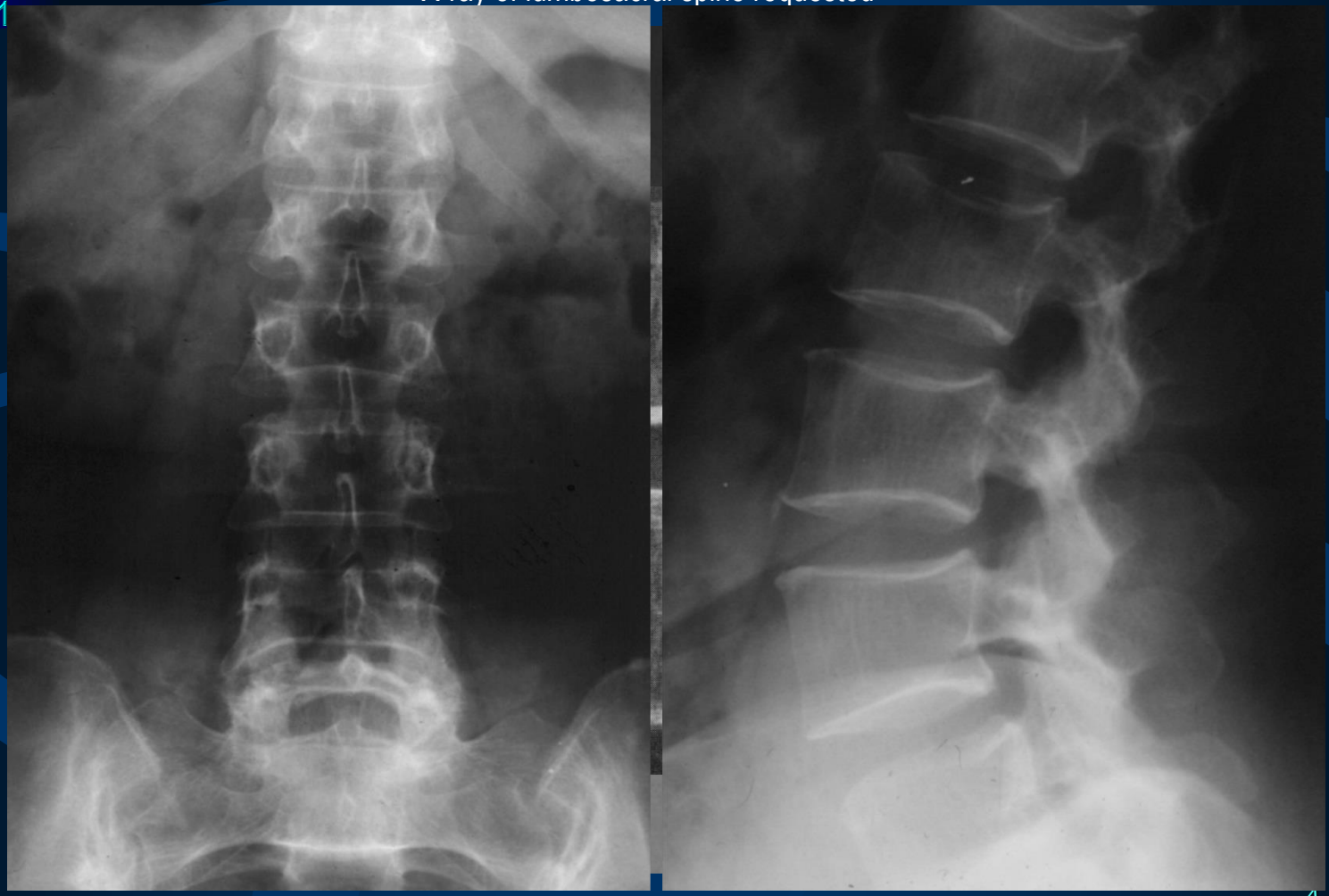
Density (swelling, increased,..)
Calcification (Heterotopic, Chondral, vascular,…)

IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

- ✓ Osteoporosis

CASE NO. 1

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



IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

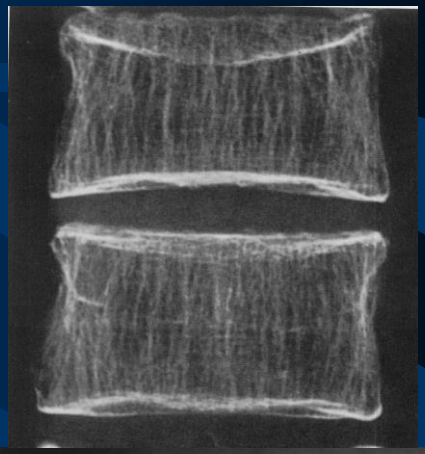
- ✓ Osteoporosis

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

CASE NO. 1

FINDINGS

- Generalized Osteopenia
- Sharp, thinned out cortices
- Sharp trabeculae



IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

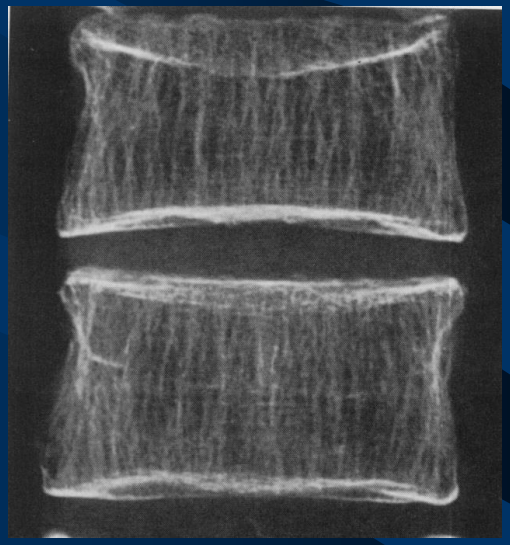
✓ Osteoporosis

CASE NO. 1

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

FINDINGS

- Generalized Osteopenia
- Sharp, thinned out cortices
- Sharp trabeculae

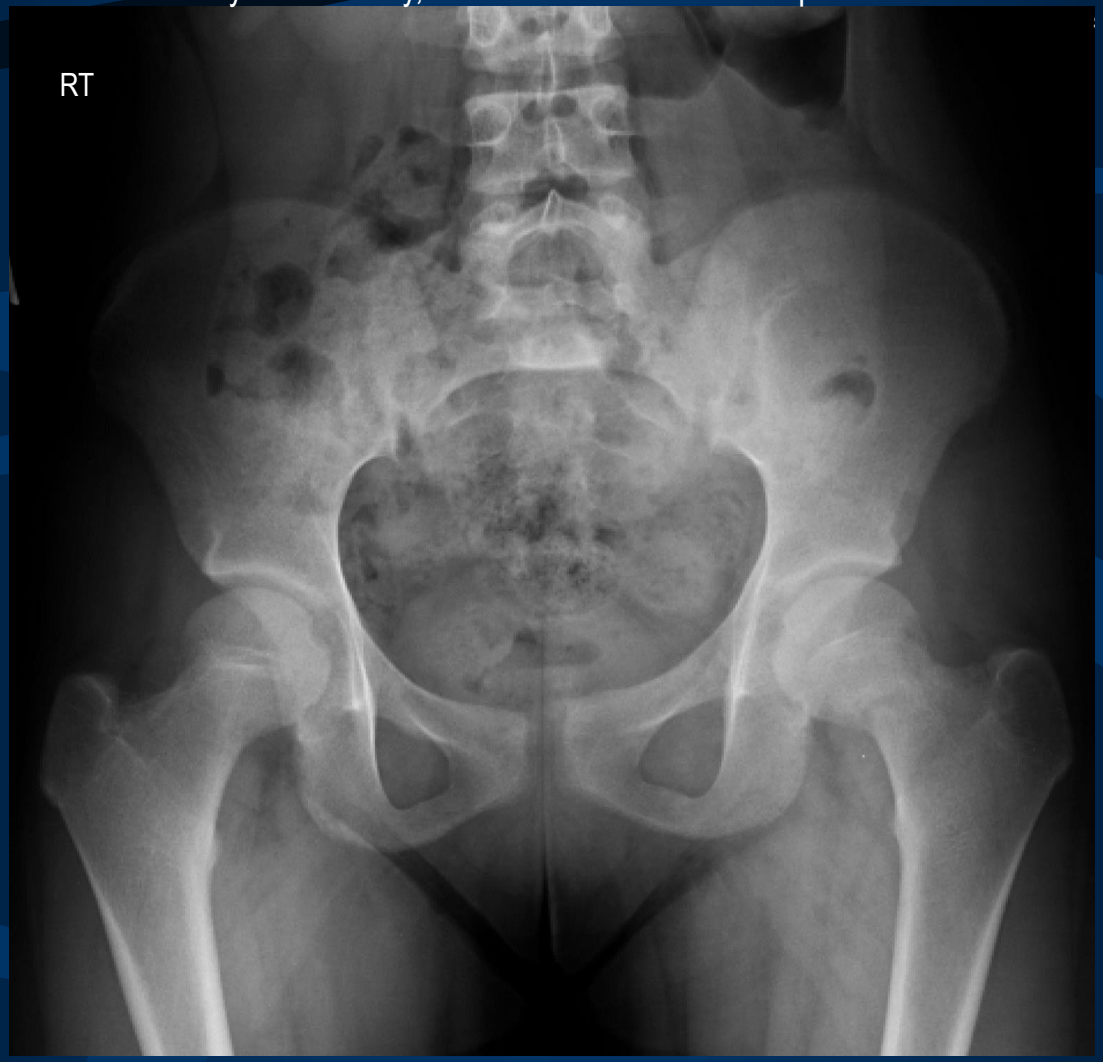


IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

- ✓ Osteomalacia

CASE NO. 2

20 years old lady, weakness and lower limbs pain

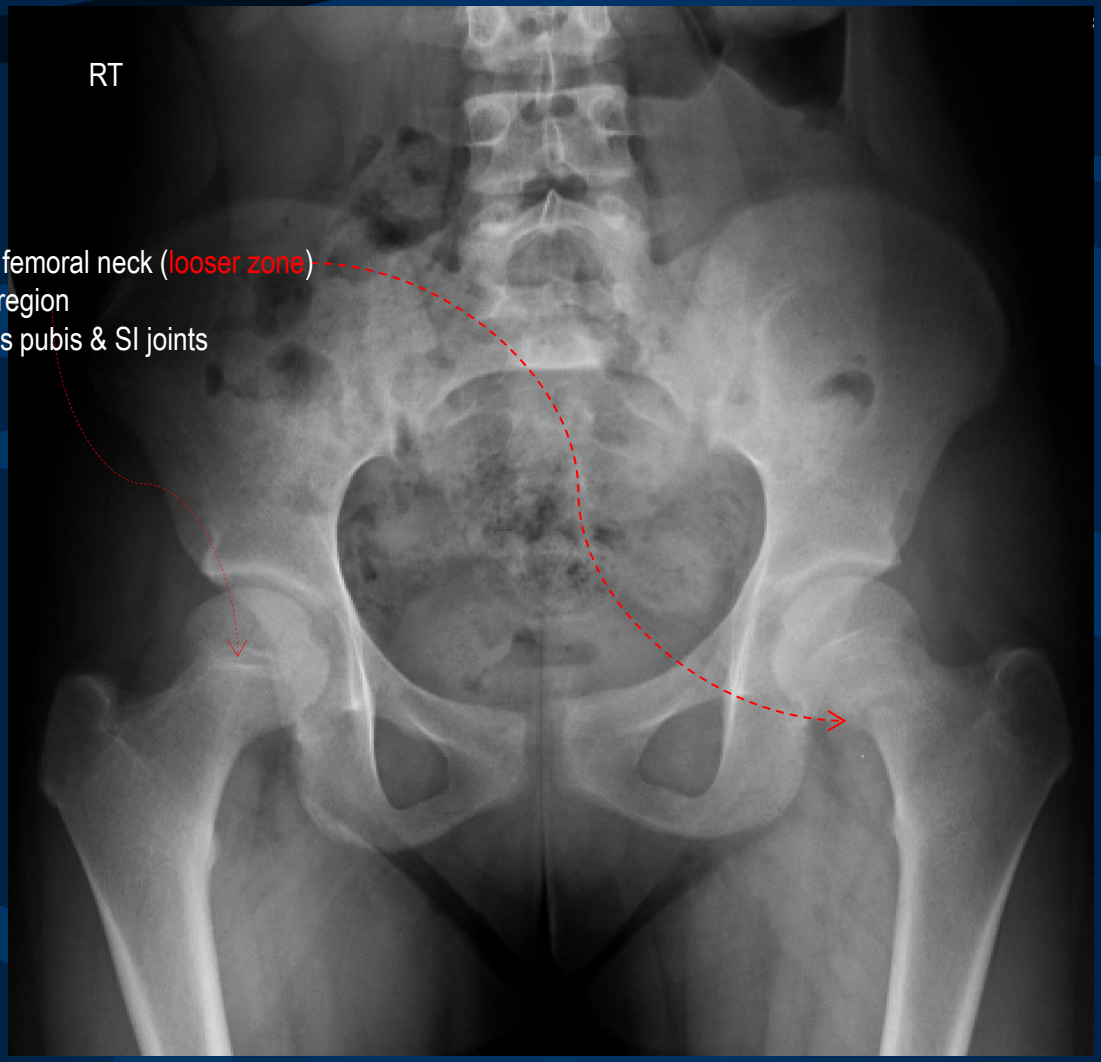


IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

✓ Osteomalacia

20 years old lady, weakness and lower limbs pain

CASE NO. 2



FINDINGS

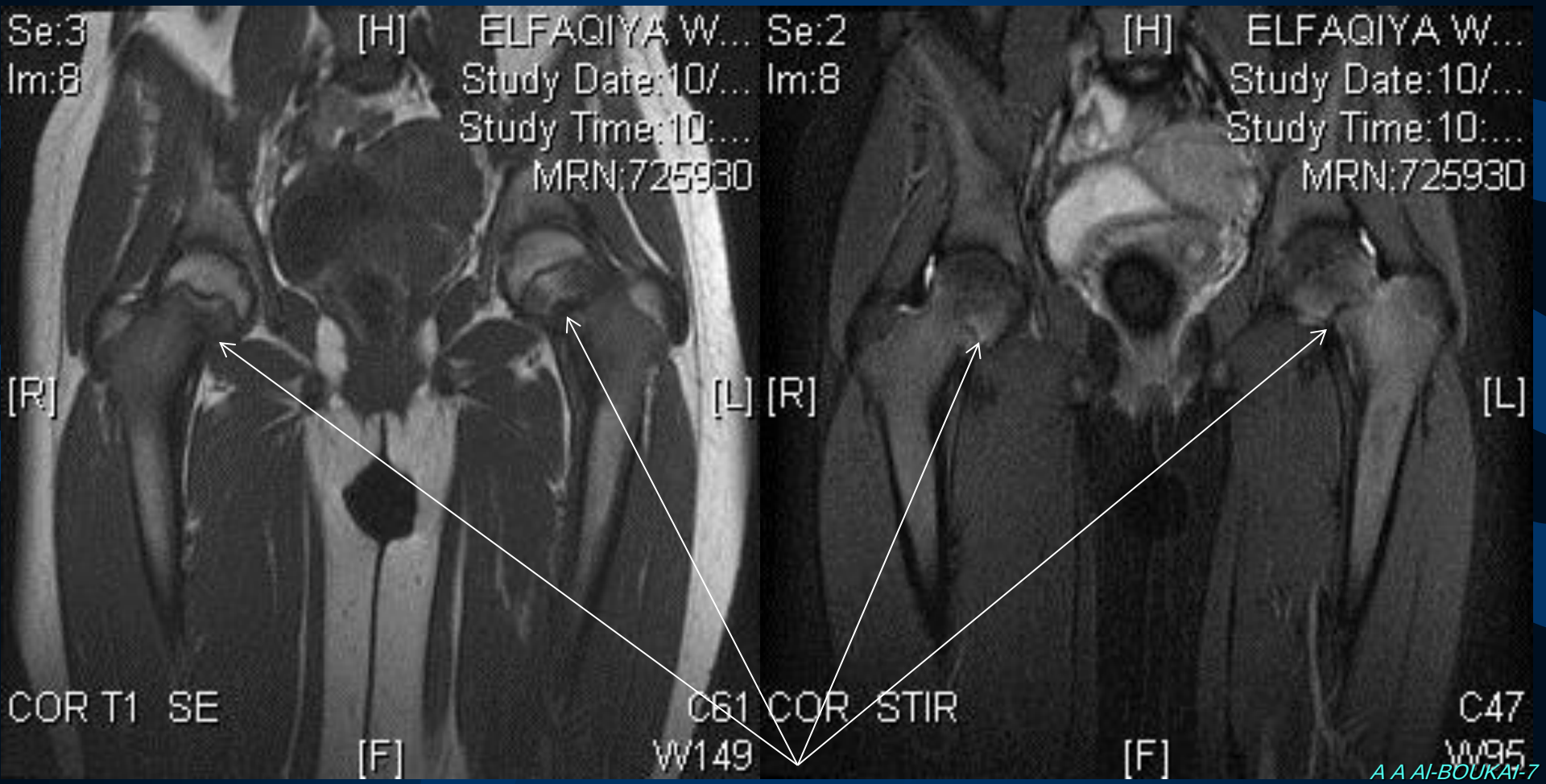
- Generalized mild osteopenia
- Lucent area within the medial femoral neck (looser zone)
- Lucent band at physeal plate region
- Indistinct cortices at symphysis pubis & SI joints

IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

- ✓ Osteomalacia — 20 years old lady, weakness and lower limbs pain

CASE NO. 2

RT



IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

- ✓ Osteoporosis vs. Osteomalacia

Patient A

Osteomalacia

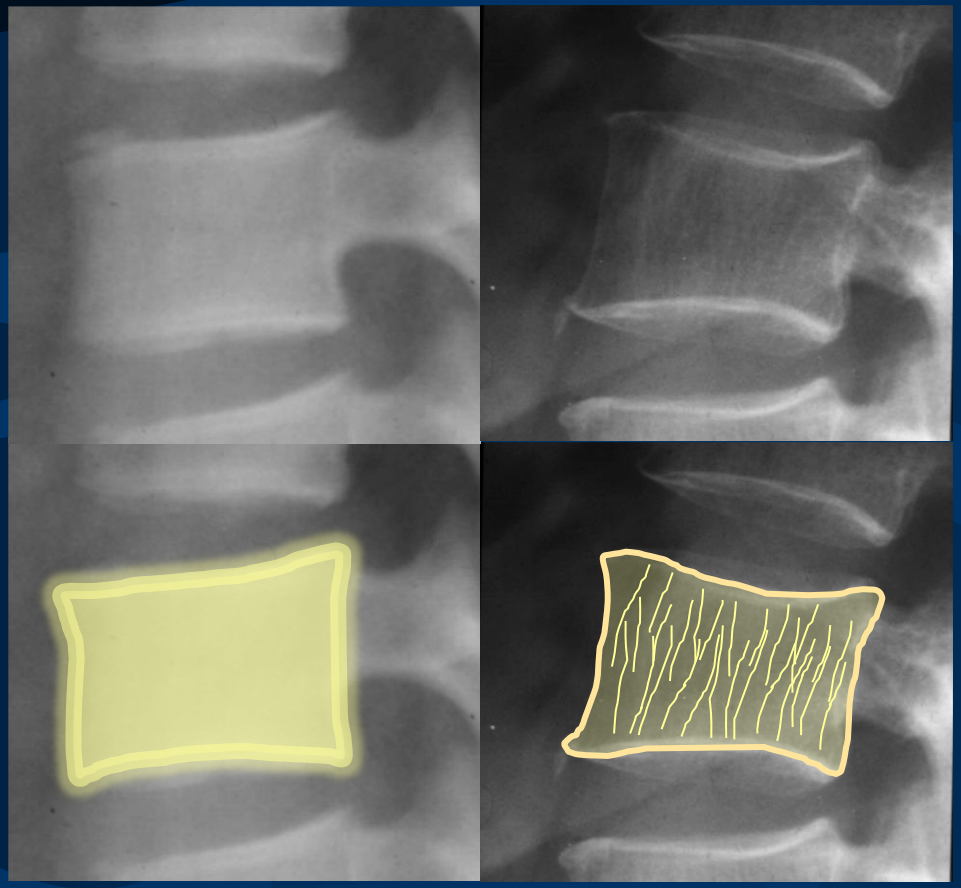
Patient B

Osteoporosis

Patient A

Patient B

IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS



Osteomalacia

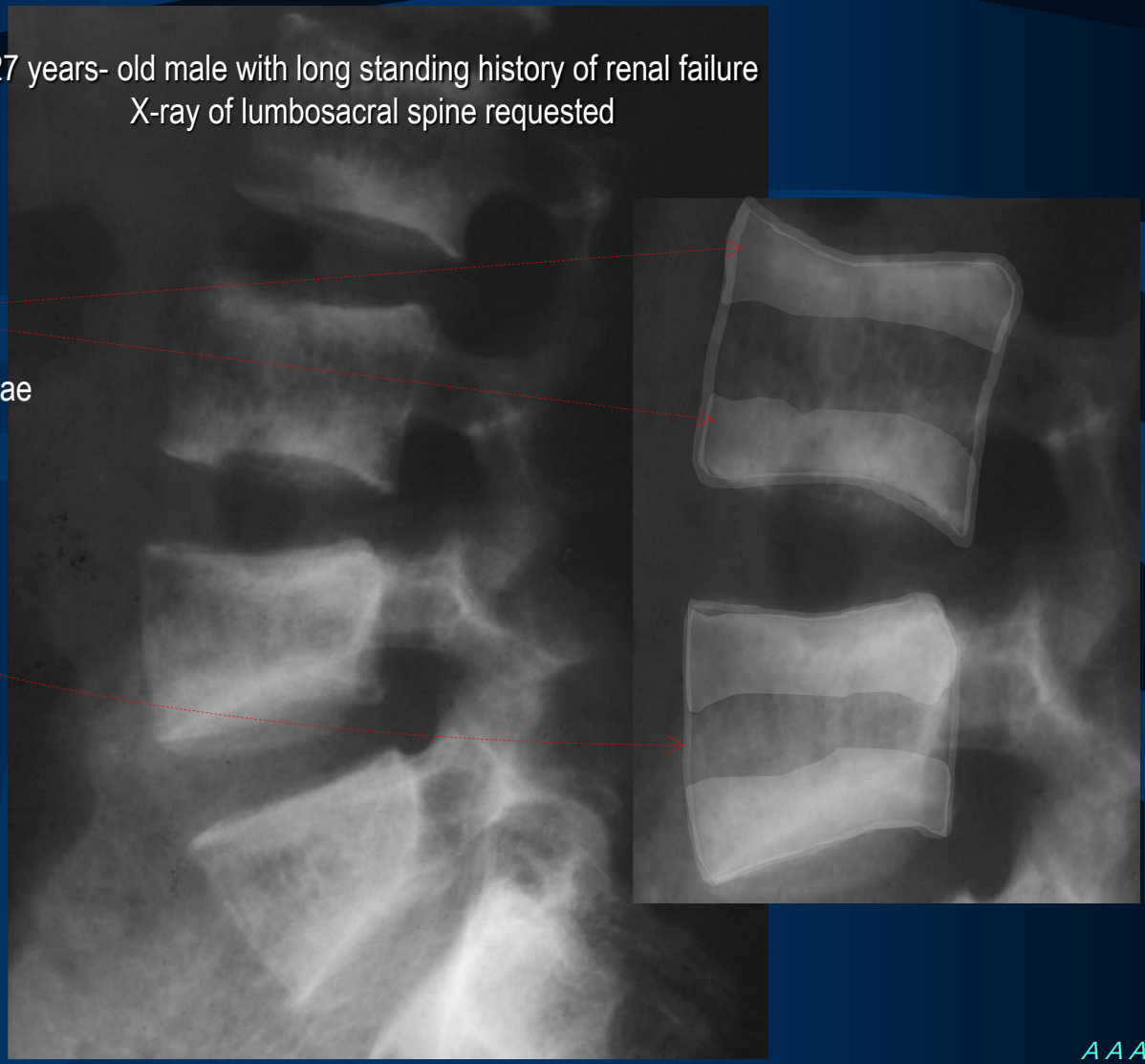
Osteoporosis

IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

✓ Renal Osteodystrophy

CASE NO. 3

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



FINDINGS

- Generalized Osteopenia
- Sclerotic end plates
- Hazy, indistinct cortices
- Hazy (Fuzzy) coarsened trabeculae

"Rugger Jersey Spine"

IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

- ✓ Renal Osteodystrophy

  - *Osteoporosis*
  - *Osteomalacia*
  - *Secondary Hyperparathyroidism*
  - *Osteosclerosis*

Bone Resorption

Bone Softening

Brown Tumors

Osteosclerosis

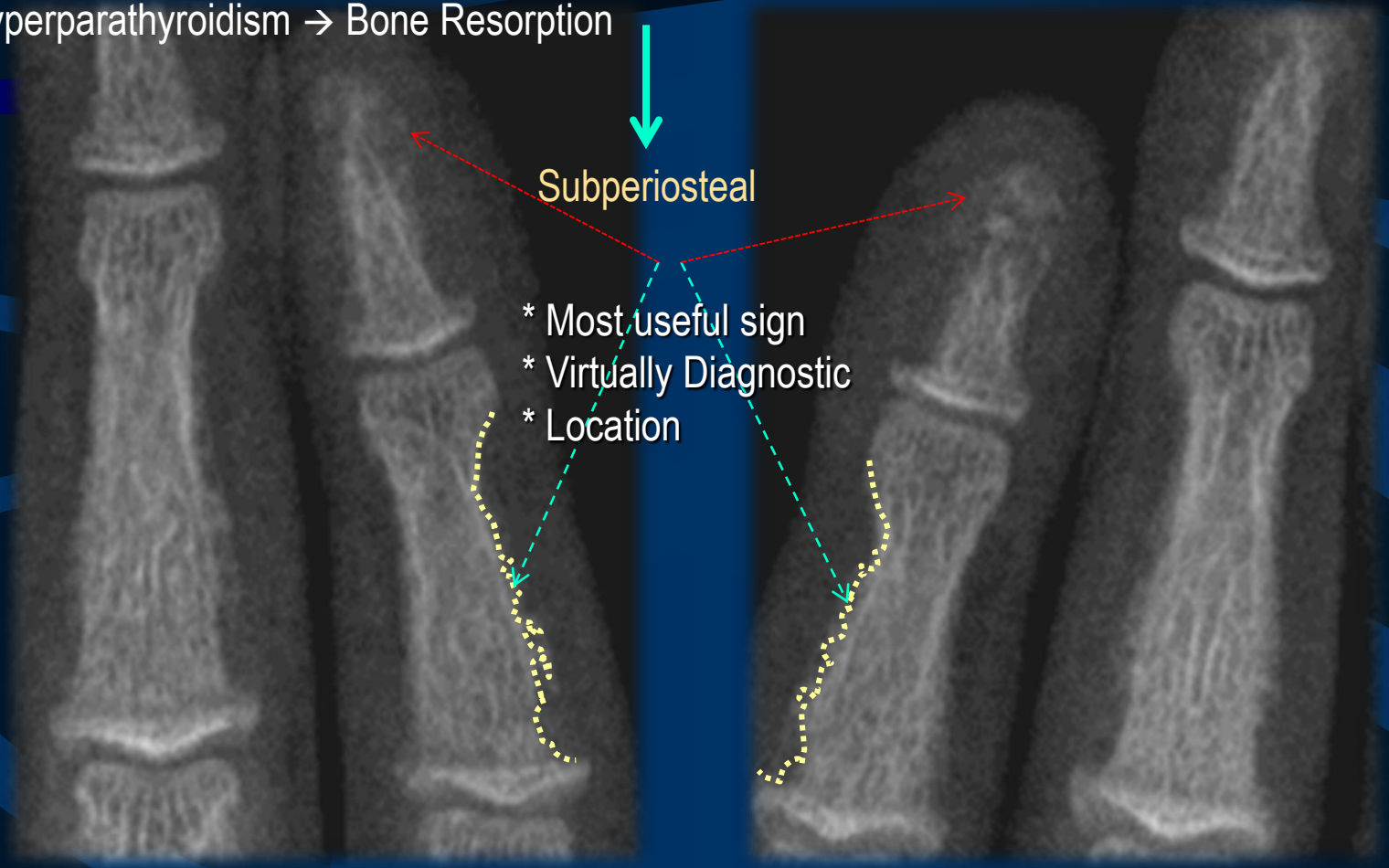
Soft tissue calcifications

IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

- ✓ Hyperparathyroidism → Bone Resorption

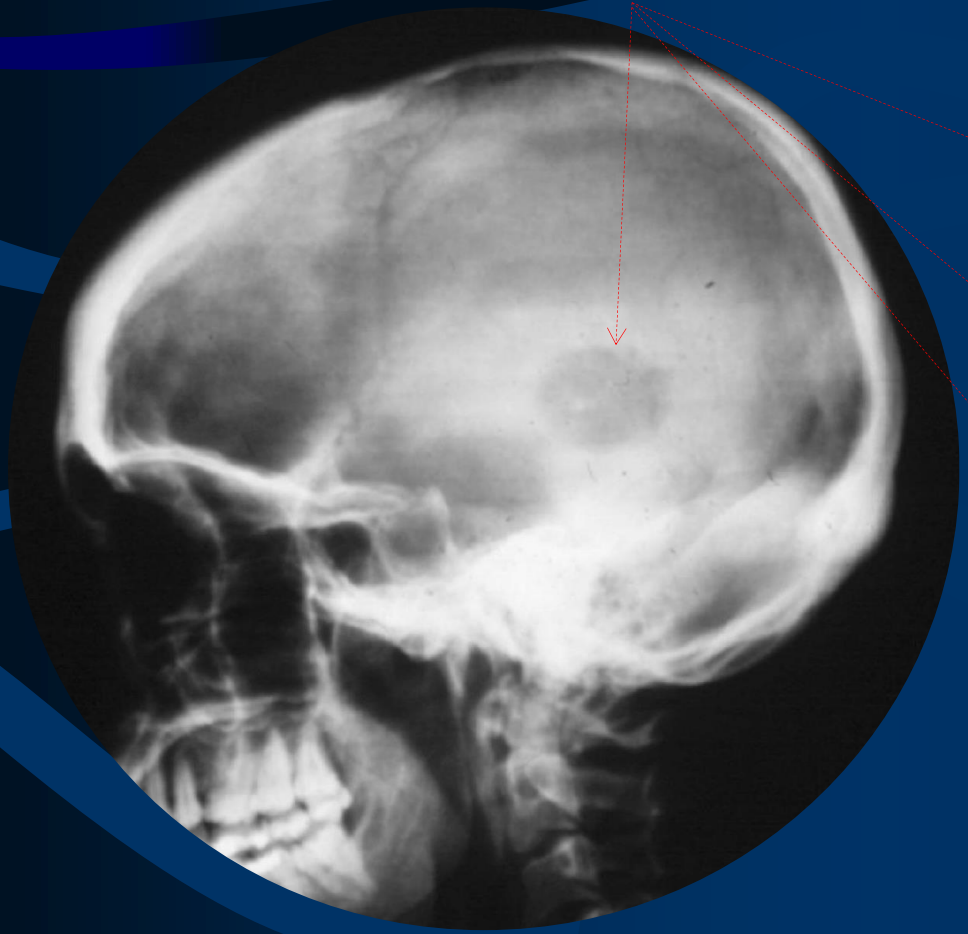
IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

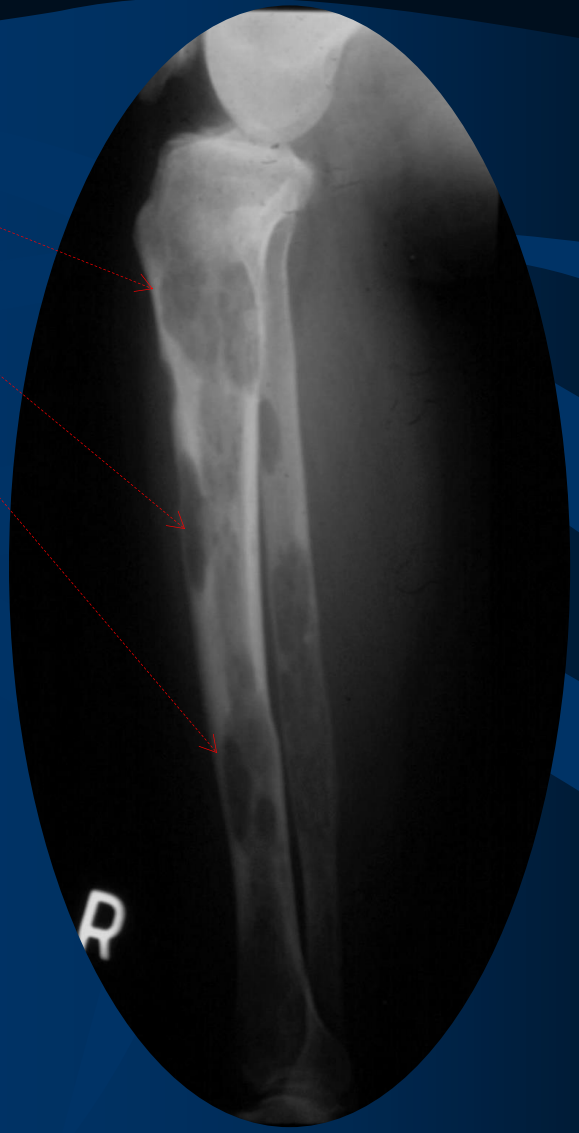
- ✓ Hyperparathyroidism → Bone Resorption



IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

- ✓ Hyperparathyroidism → Brown Tumors





IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

✓ Acromegally

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

CASE NO. 4

FINDINGS

- Calvarial thickening
- Enlargement of the sinuses (bossing of glabella)
- Enlargement of mandible
- Enlarged sella turcica (pituitary fossa)
- Prominent digits
- Increased heel pad thickness

IMAGING OF MUSCULOSKELETAL METABOLIC DISORDERS

✓ Acromegally

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

CASE NO. 4

FINDINGS

- Calvarial thickening
- Enlargement of the sinuses (bossing of glabella)
- Enlargement of mandible
- Enlarged sella turcica (pituitary fossa)
- Prominent digits
- Increased heel pad thickness

IMAGING OF MUSCULOSKELETAL SYSTEM PATHOLOGY

NEOPLASTIC

A A Al-BOUKAI-14

IMAGING OF MUSCULOSKELETAL SYSTEM PATHOLOGY

NEOPLASTIC

TYPES

- ✓ OSSEOUS — Osteoma -- Osteosarcoma
- ✓ CHONDRAL — Enchondroma -- Chondrosarcoma
- ✓ FIBROUS — Osseous Fibroma -- Fibrosarcoma
- ✓ SOFT TISSUE — Lipoma -- Liposarcoma

IMAGING OF MUSCULOSKELETAL NEOPLASTIC DISORDERS

KEY FEATURES

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

- Osteolytic
- Osteosclerotic
- Mixed
- Soft tissue

IMAGING OF MUSCULOSKELETAL NEOPLASTIC DISORDERS

KEY FEATURES

Morphology

- Pattern of bone destruction
- Size, Shape & Margin of lesion
- Texture of lesion Matrix
- Cortex & Periosteal reaction

Behavior of lesion

- Slow grow
- Rapid grow (Aggressive)

IMAGING OF MUSCULOSKELETAL NEOPLASTIC DISORDERS

Behavior of lesion Slow grow Vs Rapid grow (Aggressive)

KEY FEATURES

Morphology

Pattern of bone destruction

IMAGING OF MUSCULOSKELETAL NEOPLASTIC DISORDERS

KEY FEATURES

Morphology

Cortex & Periosteal reaction

IMAGING OF MUSCULOSKELETAL NEOPLASTIC DISORDERS

KEY FEATURES

Age of patient

Pediatric, Adult, Elderly

Site (Location)

Diaphyseal, metaphyseal or epiphyseal

Cortical vs. Medullary (eccentric vs. concentric)

IMAGING OF MUSCULOSKELETAL NEOPLASTIC DISORDERS

✓ Osteolytic / Benign / Pediatric

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

CASE NO. 5

FINDINGS

- Expansile lytic lesion
- Metaphyseal
- Homogeneous, no calcification
- No cortical destruction and no periosteal reaction
- No soft tissue swelling

Aneurysmal Bone Cyst

IMAGING OF MUSCULOSKELETAL NEOPLASTIC DISORDERS

✓ Osteolytic / Benign / Pediatric

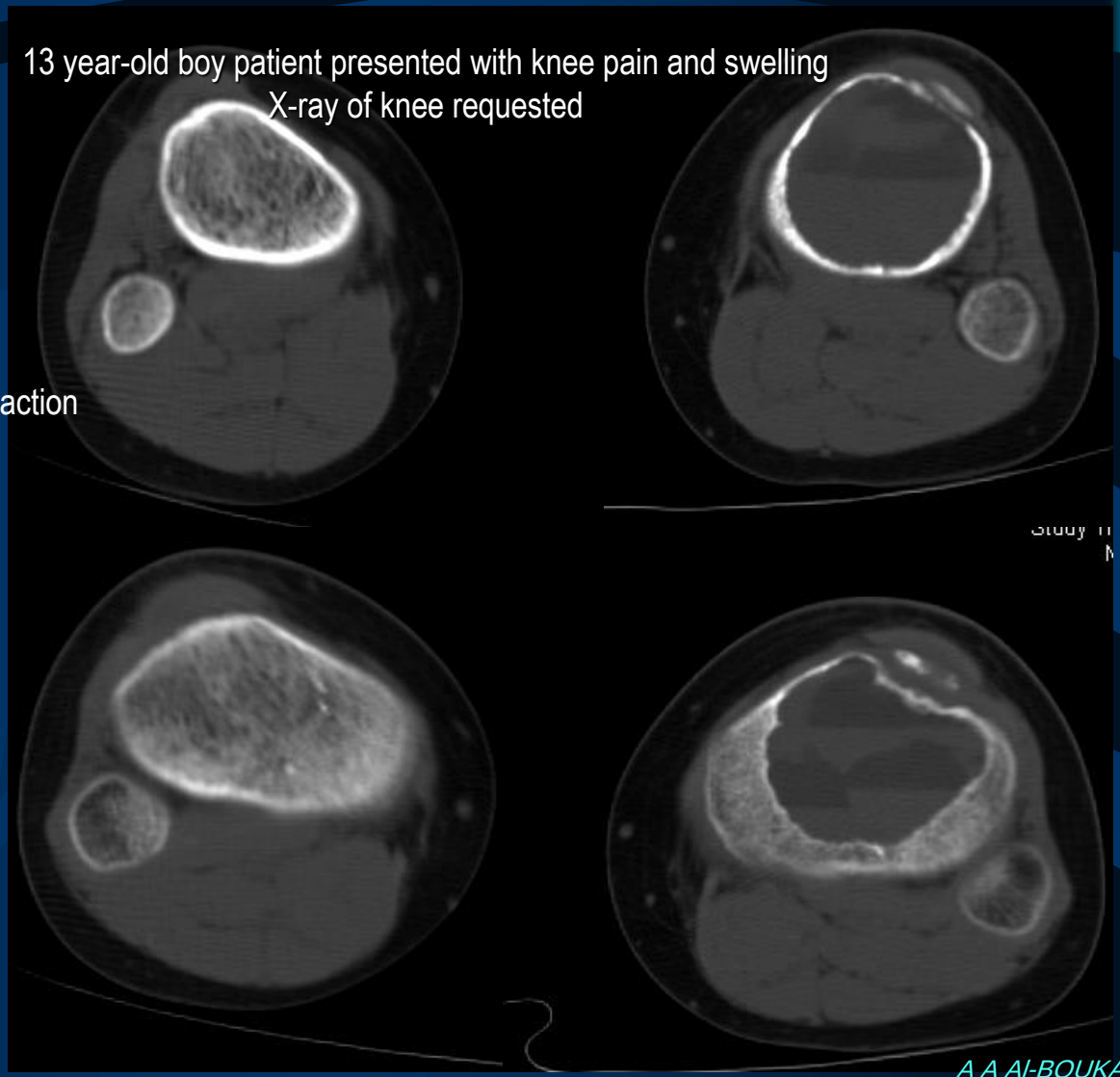
CASE NO. 5

FINDINGS

- Expansile lytic lesion
- Metaphyseal
- Homogeneous, no calcification
- No cortical destruction and no periosteal reaction
- No soft tissue swelling

Aneurysmal Bone Cyst

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

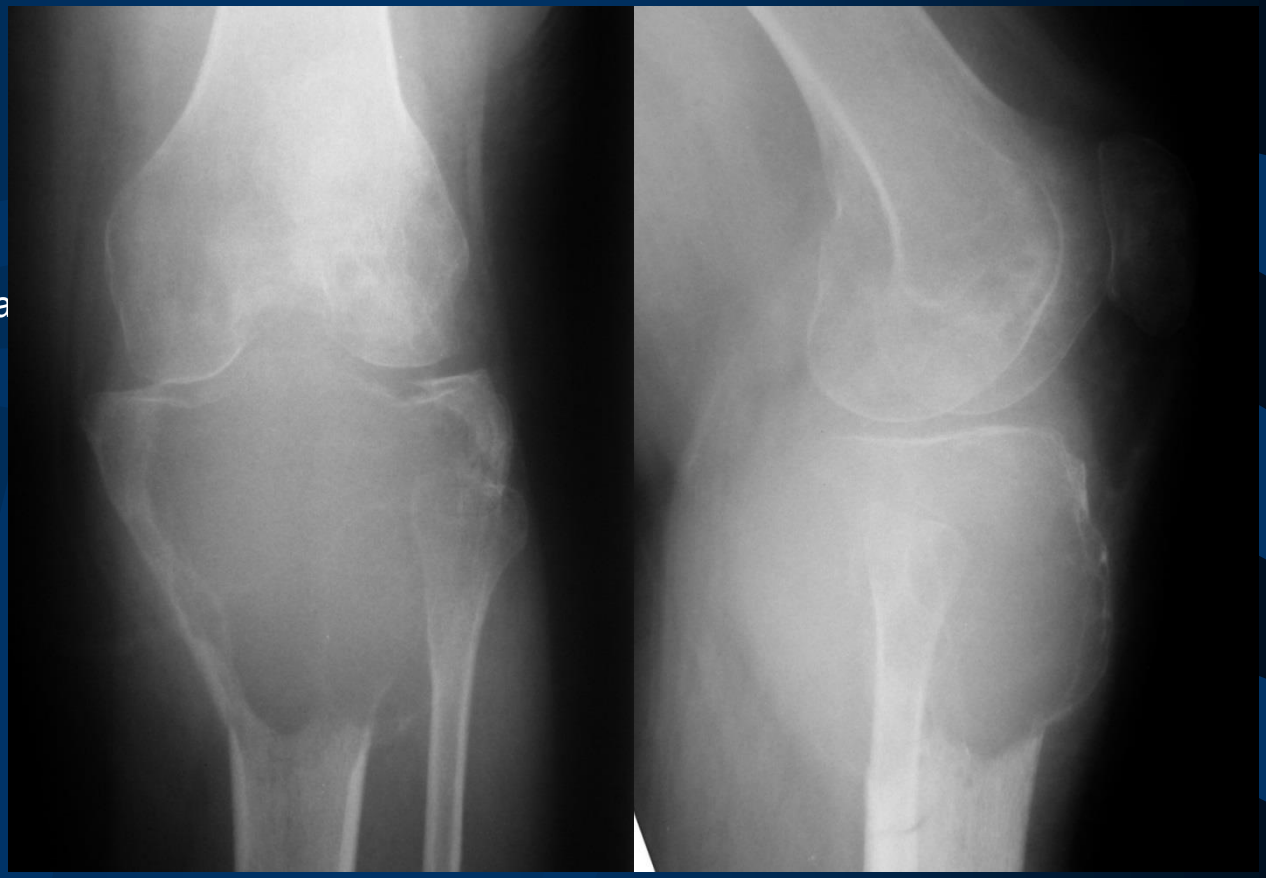


IMAGING OF MUSCULOSKELETAL NEOPLASTIC DISORDERS

✓ Osteolytic / Benign / Adult

CASE NO. 6

Adult man with knee pain and swelling



FINDINGS

- Expansile lytic lesion
- Metaphyseal / Subarticular
- Homogeneous, no calcification
- Cortical destruction and periosteal rea
- Soft tissue swelling

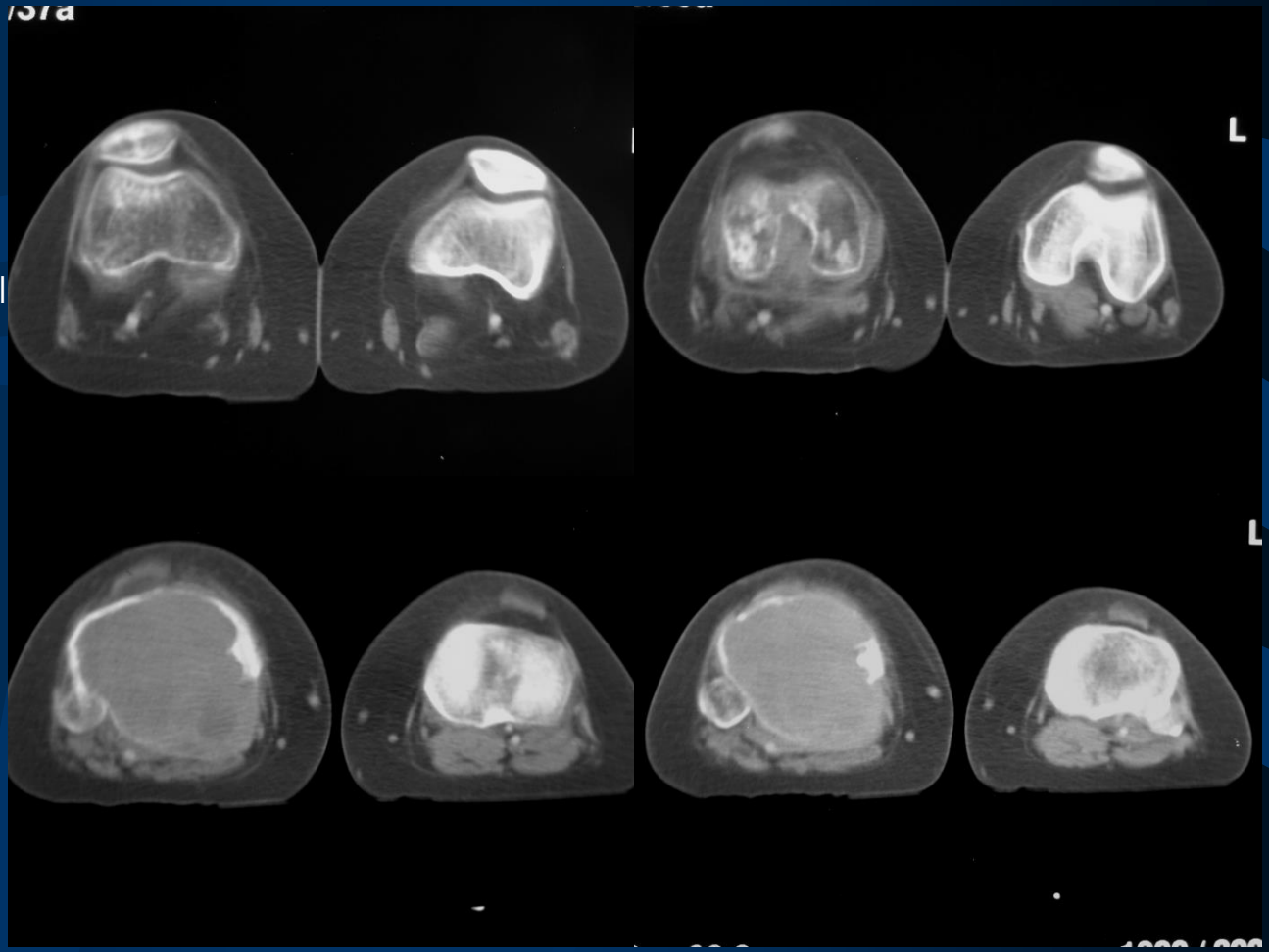
Giant Cell Tumor

IMAGING OF MUSCULOSKELETAL NEOPLASTIC DISORDERS

✓ Osteolytic / Benign / Adult

CASE NO. 6

Adult man with knee pain and swelling



FINDINGS

- Expansile lytic lesion
- Metaphyseal / Subarticular
- Homogeneous, no calcification
- Cortical destruction and periosteal
- Soft tissue swelling

Giant Cell Tumor

IMAGING OF MUSCULOSKELETAL NEOPLASTIC DISORDERS

✓ Osteolytic / Benign / Adult

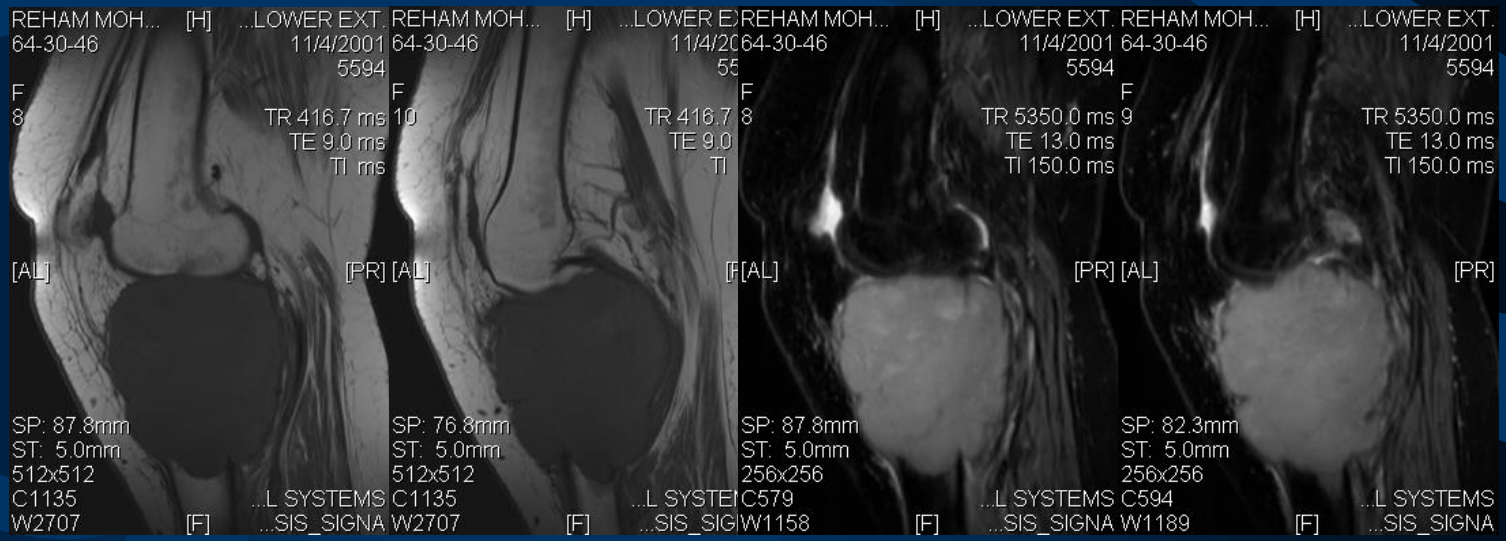
Adult man with knee pain and swelling

CASE NO. 6

FINDINGS

- Expansile lytic lesion
- Metaphyseal / Subarticular
- Homogeneous, no calcification
- Cortical destruction and periosteal reaction
- Soft tissue swelling

Giant Cell Tumor



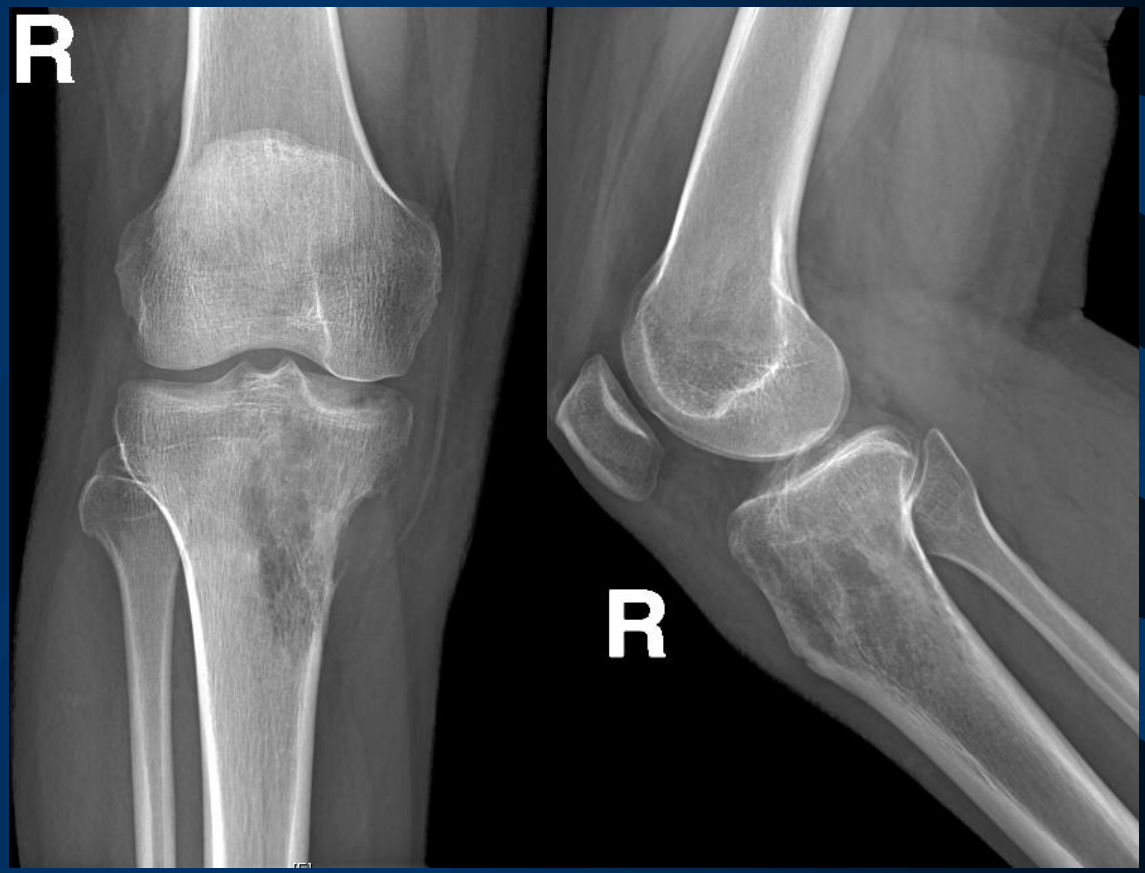
IMAGING OF MUSCULOSKELETAL NEOPLASTIC DISORDERS

✓ Osteolytic / Aggressive / Adult

CASE NO. 7

Adult man with knee pain

STIR T_1 C^+



FINDINGS

- Eccentric osteolytic lesion
- Metaphyseal / Subarticular
- Heterogeneous texture
- Cortical destruction and periosteal reaction
- Localized soft tissue extension

Permeative Pattern

Osteosarcoma / Lymphoma

IMAGING OF MUSCULOSKELETAL NEOPLASTIC DISORDERS

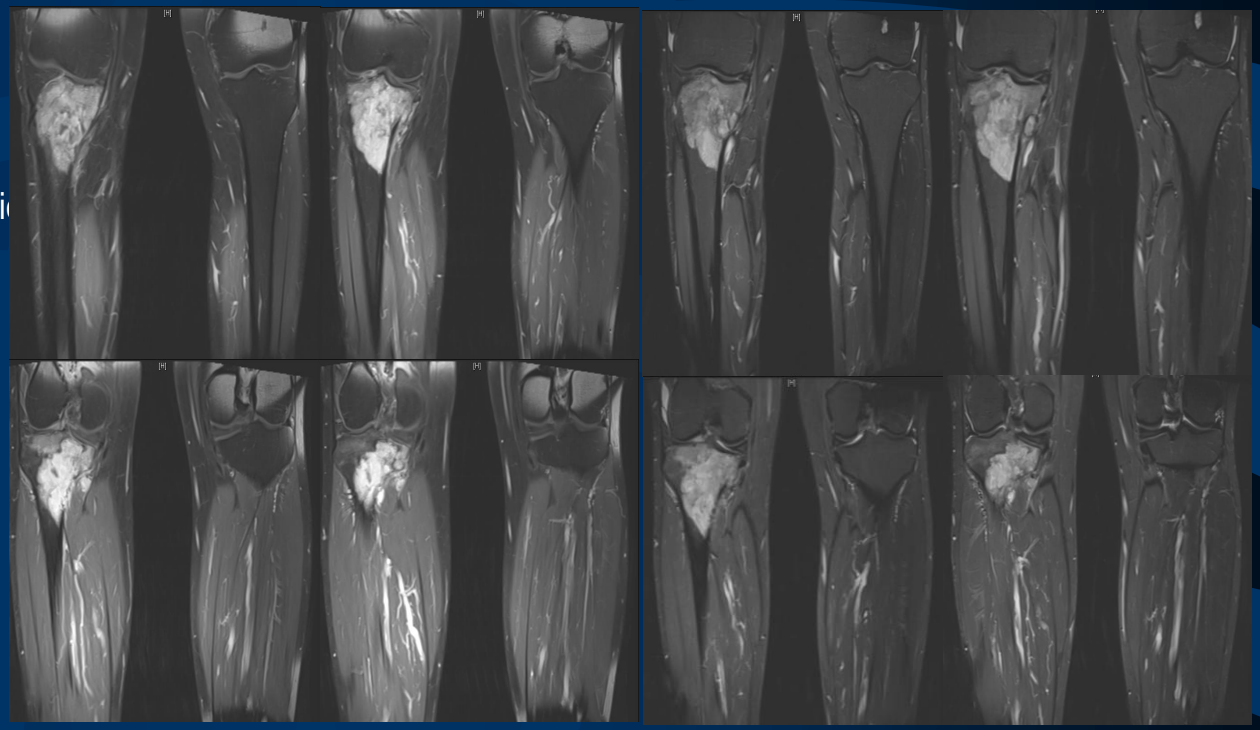
✓ Osteolytic / Aggressive / Adult

Adult man with knee pain

CASE NO. 7

T_1 C^+

STIR



FINDINGS

- Eccentric osteolytic lesion
- Metaphyseal / Subarticular
- Heterogeneous texture
- Cortical destruction and periosteal reacti
- Localized soft tissue extension

Permeative Pattern

Osteosarcoma / Lymphoma

IMAGING OF MUSCULOSKELETAL NEOPLASTIC DISORDERS

✓ Sclerotic Osseous Lesion

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

CASE NO. 8

FINDINGS

- Preserved bone density in general
- Sclerotic foci of variable sizes (islands)
- No destructive lesion

Sclerotic bone metastasis

IMAGING OF MUSCULOSKELETAL NEOPLASTIC DISORDERS

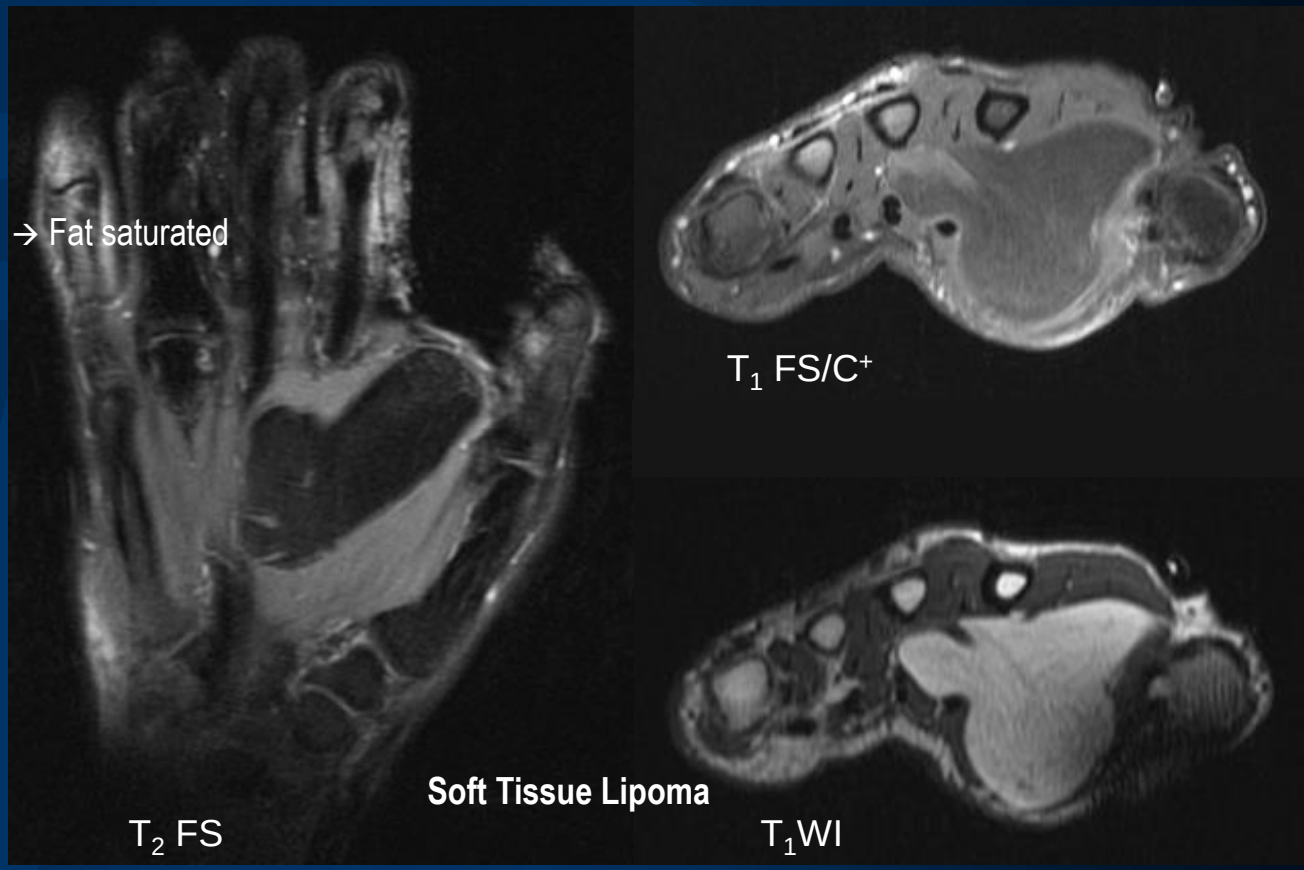
✓ Soft tissue Mass

CASE NO. 9

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

FINDINGS

- Soft tissue swelling (relatively lucent)
- No calcification
- No osseous involvement
- High signal on T_1WI and low in T_2FS → Fat saturated
- No enhancement



THANKS