AMSER Case of the Month: July 2019

25 y/o male with gradual onset of right shoulder swelling and discomfort

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Patient Presentation

- HPI: 25 y/o male who presented with 3 month history of gradual swelling of the right humerus and mild right shoulder discomfort. Patient denies a history of trauma
- PMHx + PSHx: Nothing relevant
- Social: Drinks alcohol. Denies smoking or recreational drug use
- Physical Exam: Tense skin over right upper arm with increased arm circumference compared to left. Full range of motion of both upper limbs with no neurologic deficits
- Relevant labs: Alk Phos – ↑1595 U/L (38 – 126 U/L)

What is the first imaging we should order?

ACR Appropriateness Criteria

Variant 1: **Atraumatic shoulder pain. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
Radiography shoulder	Usually Appropriate	☢
CT arthrography shoulder	Usually Not Appropriate	☢☢☢☢
CT shoulder with IV contrast	Usually Not Appropriate	☢☢☢
CT shoulder without and with IV contrast	Usually Not Appropriate	☢☢☢
CT shoulder without IV contrast	Usually Not Appropriate	☢☢☢
MR arthrography shoulder	Usually Not Appropriate	O
MRI shoulder without and with IV contrast	Usually Not Appropriate	O
MRI shoulder without IV contrast	Usually Not Appropriate	O
US shoulder	Usually Not Appropriate	O
X-ray arthrography shoulder	Usually Not Appropriate	☢

This imaging modality was ordered by the physician

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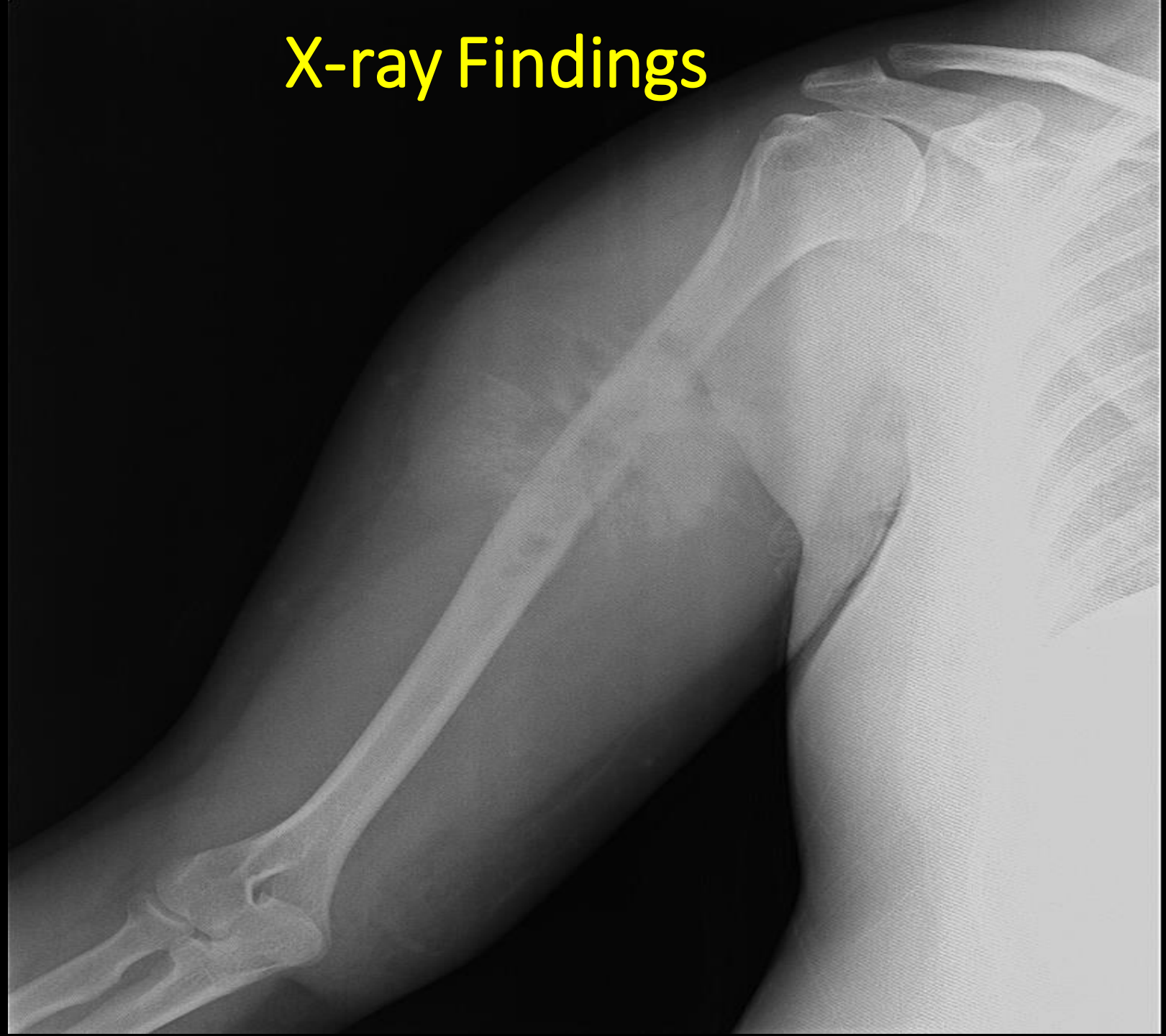
X-ray Findings



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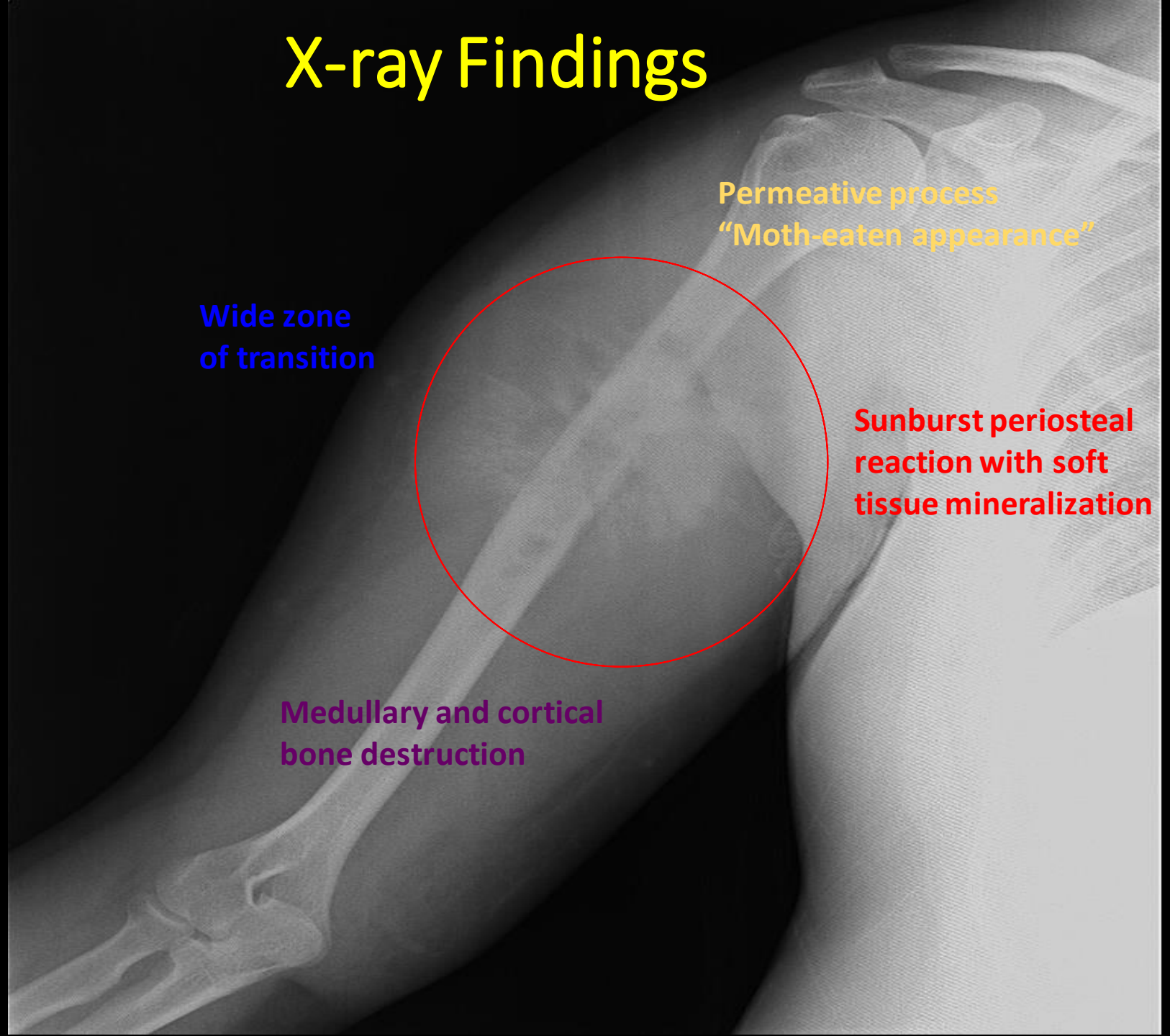
X-ray Findings



Differential Diagnosis

1. Malignant lesions
    - Osteosarcoma
    - Ewing sarcoma
    - Bone metatases from a separate primary malignancy

2. Benign lesions
    - Osteochondroma
    - Osteoid osteoma

3. Non-neoplastic processes
    - Osteomyelitis
    - Aneurysmal bone cyst

Additional Imaging - ACR Appropriateness Criteria

Variant 8: **Lesion on radiographs. Aggressive, suspicious for malignancy.**

Radiologic Procedure	Rating	Comments	RRL*
MRI area of interest without and with IV contrast	9		O
MRI area of interest without IV contrast	8		O
CT area of interest without IV contrast	7	This procedure is especially useful for areas with complex osseous anatomy.	Varies
Tc-99m bone scan whole body	6	This procedure is particularly helpful to look for multifocal disease.	☢☢☢
X-ray skeletal survey	5	Perform this procedure if there is concern that the lesion represents multiple myeloma.	☢☢☢
CT area of interest without and with IV contrast	5	Perform this procedure if MRI is contraindicated.	Varies
FDG-PET/CT whole body	5	This procedure is particularly helpful to look for multifocal disease.	☢☢☢☢
CT area of interest with IV contrast	2		Varies
US area of interest	1		O

Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

*Relative Radiation Level

These imaging modalities were next ordered by the physician

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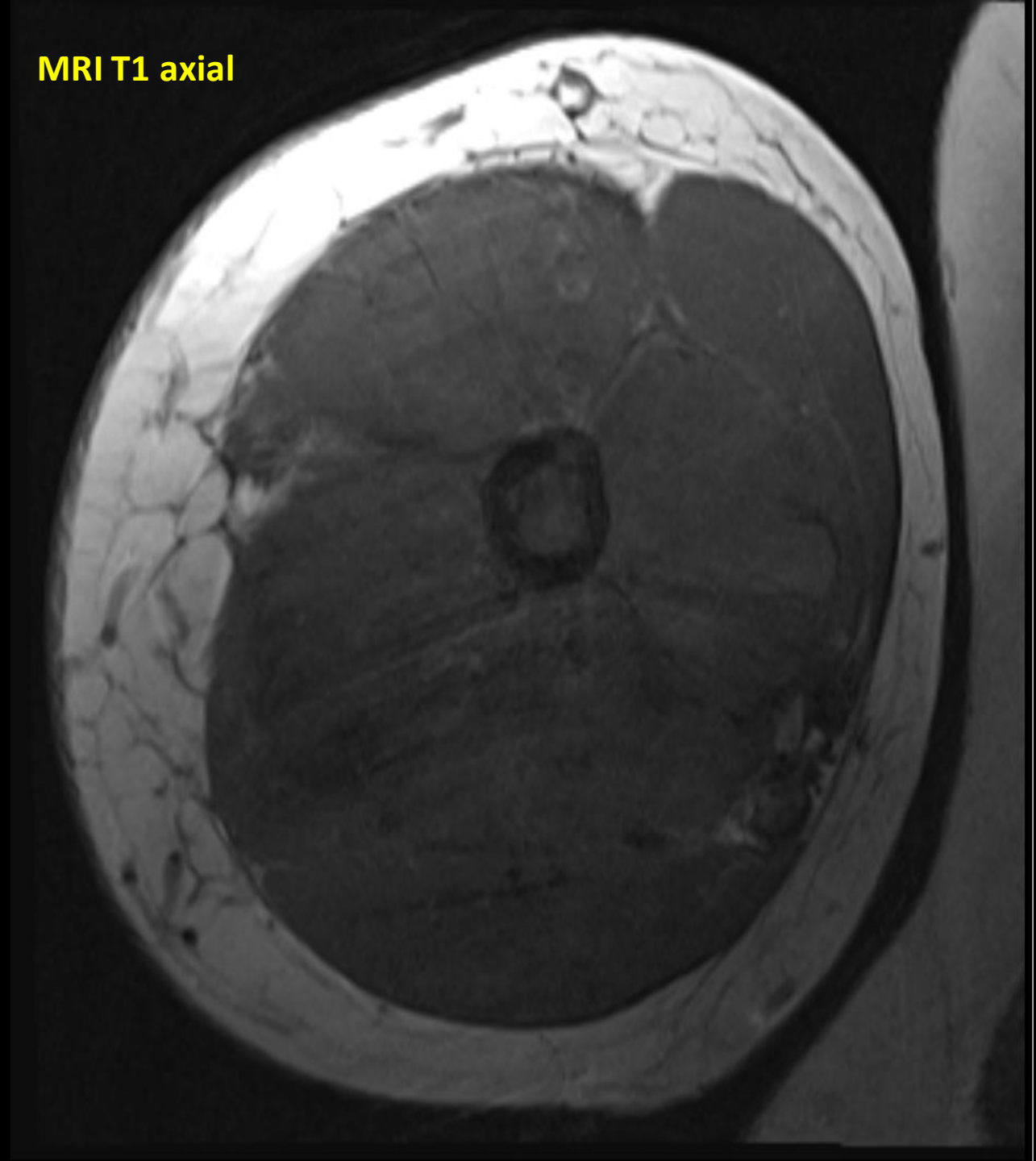
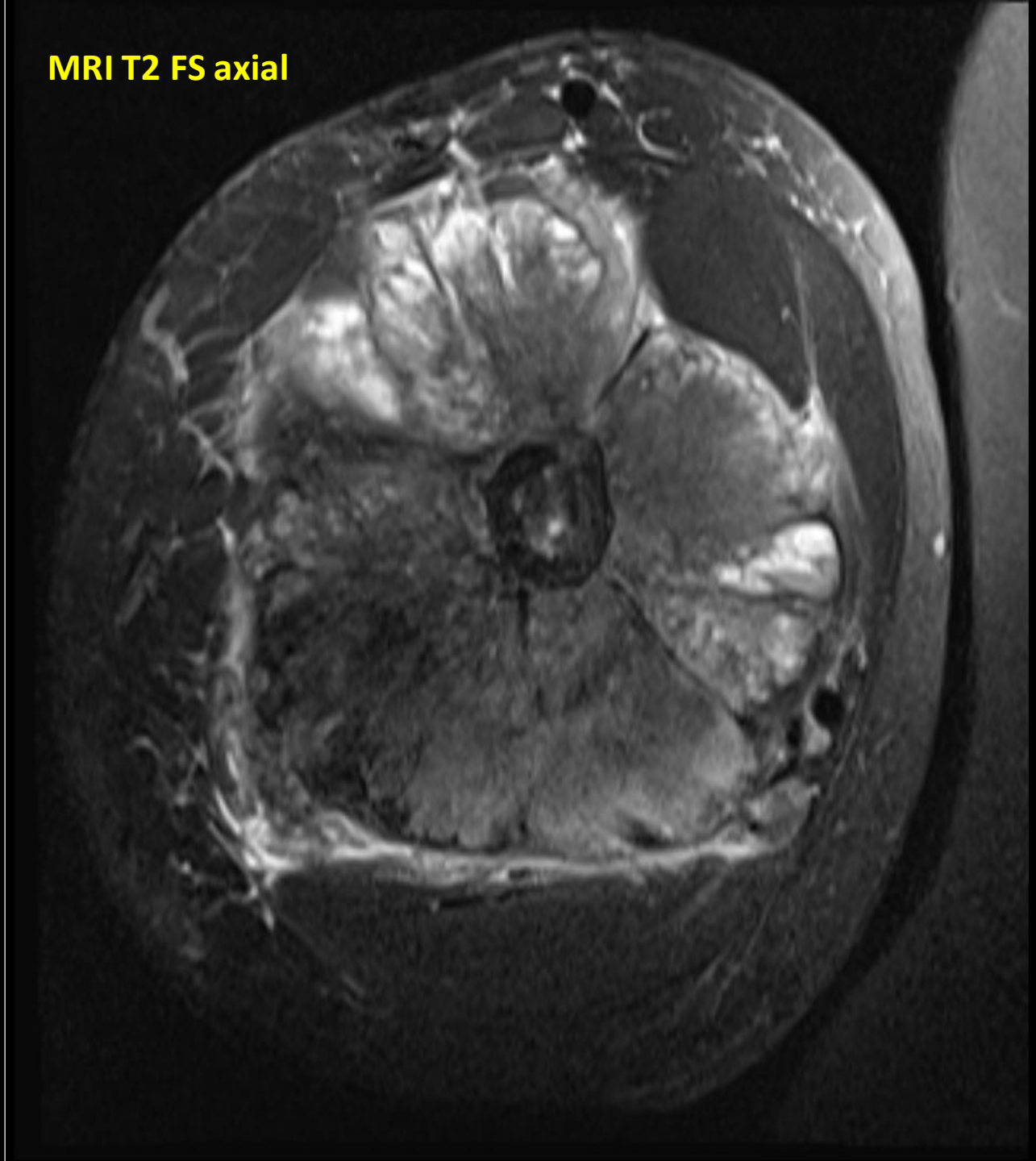
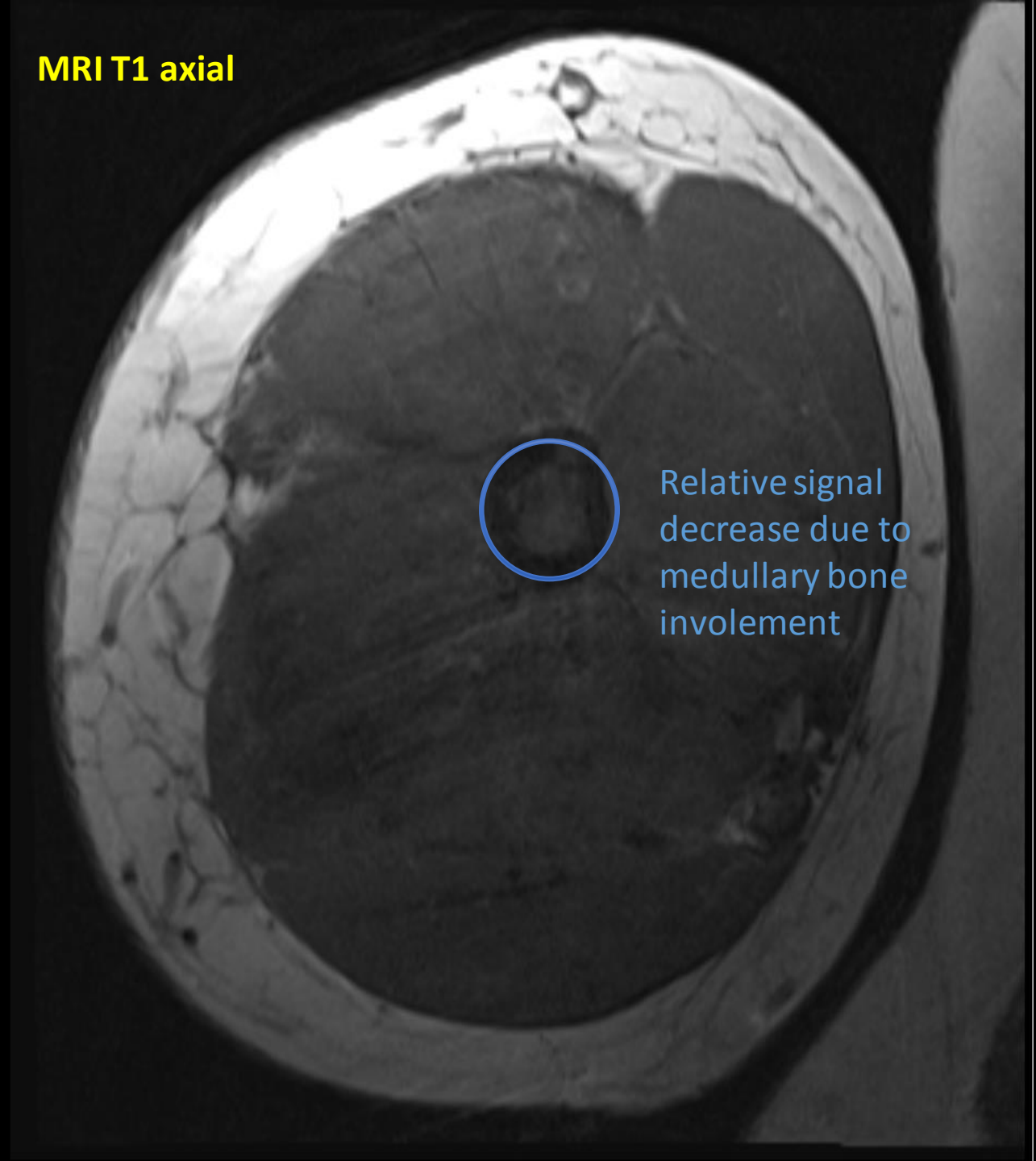
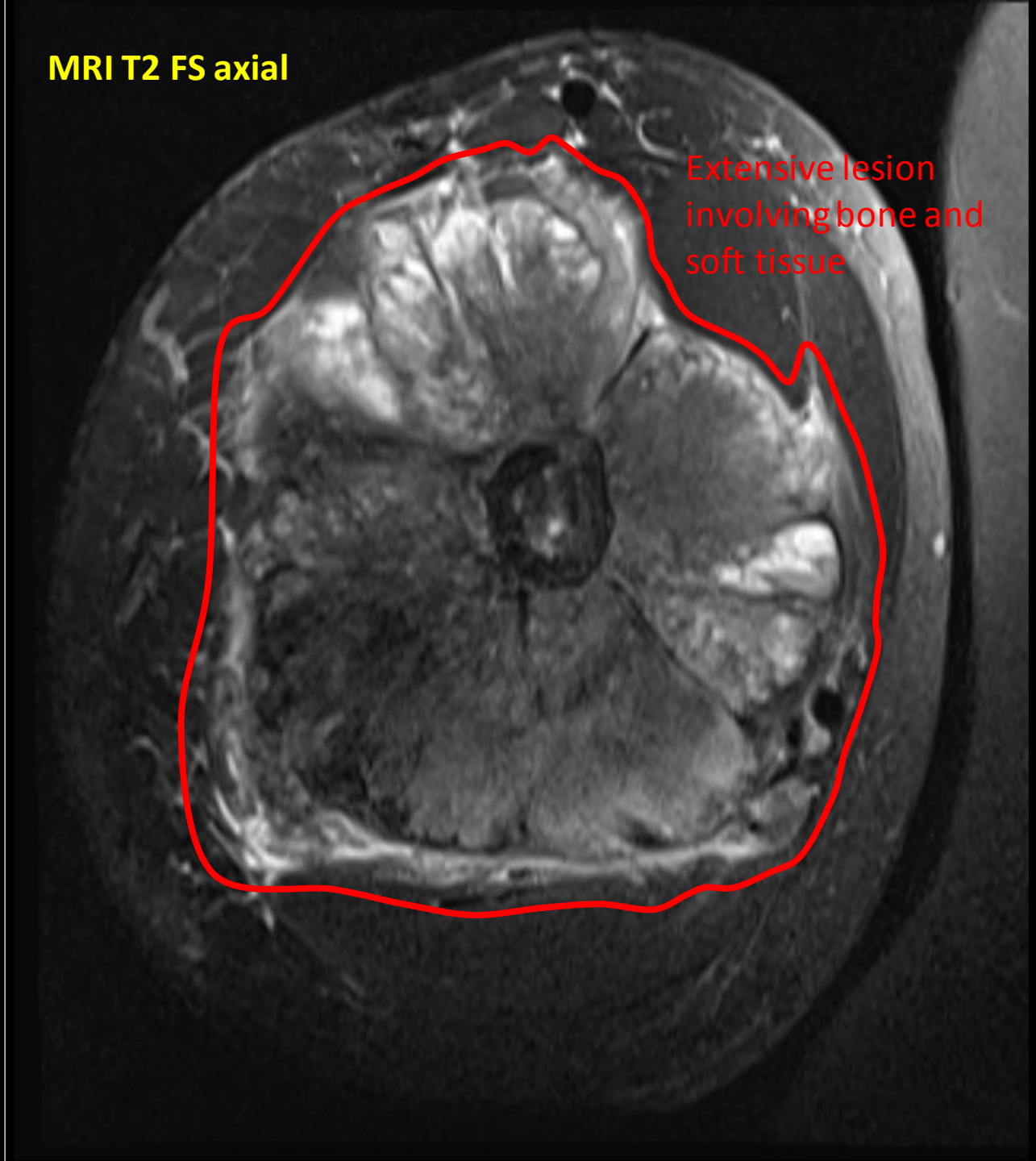
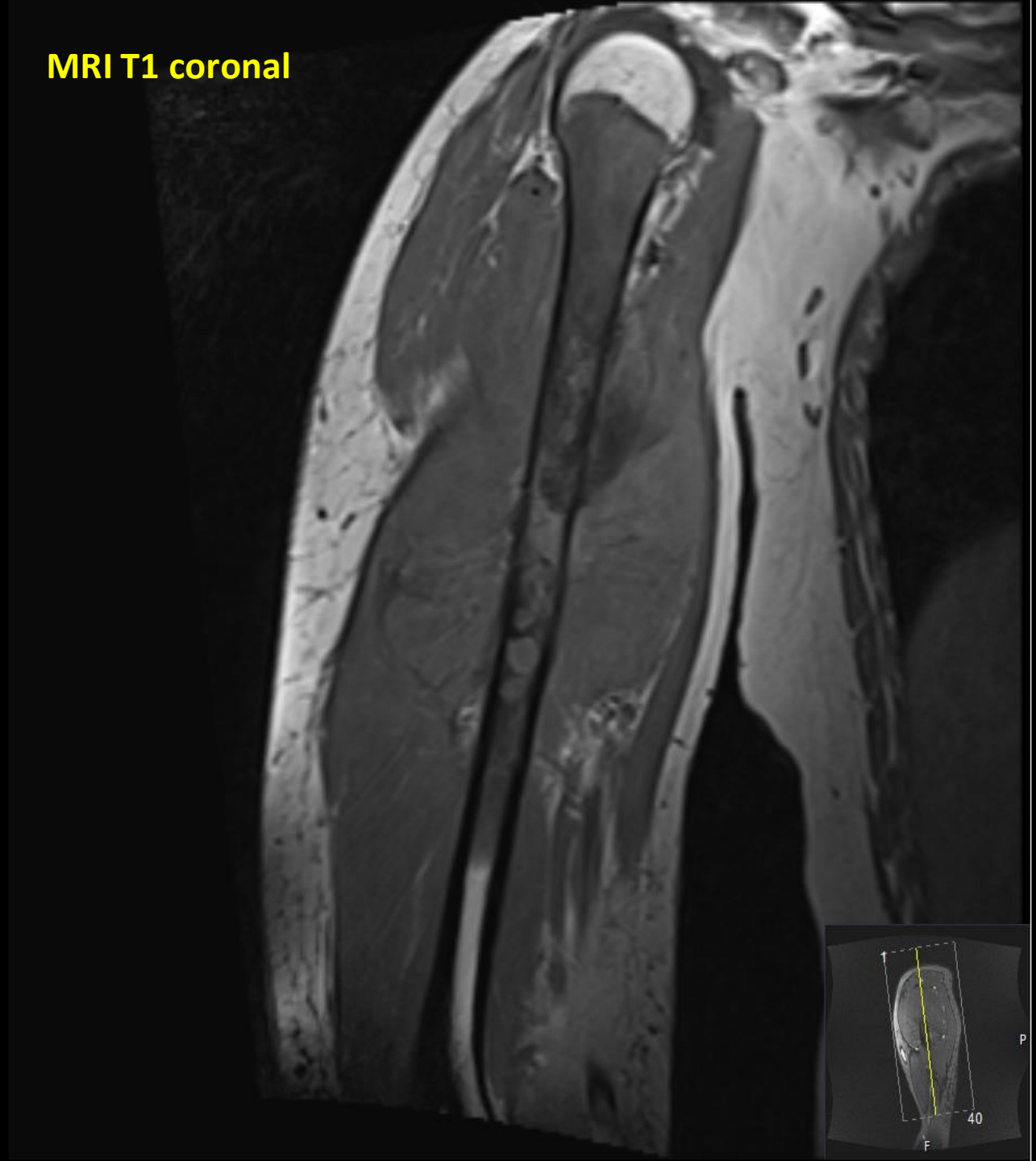
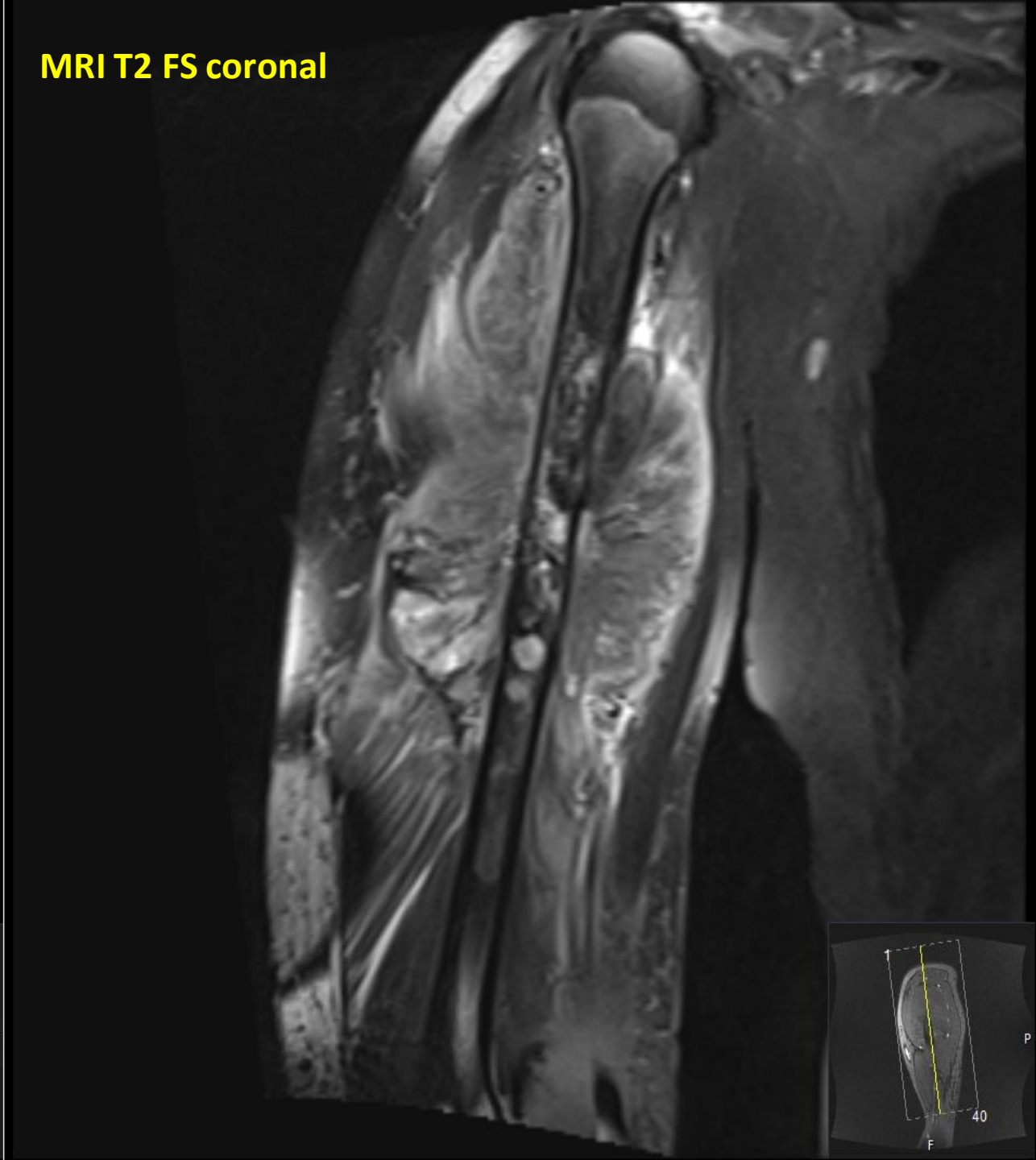

MRI T1 axial

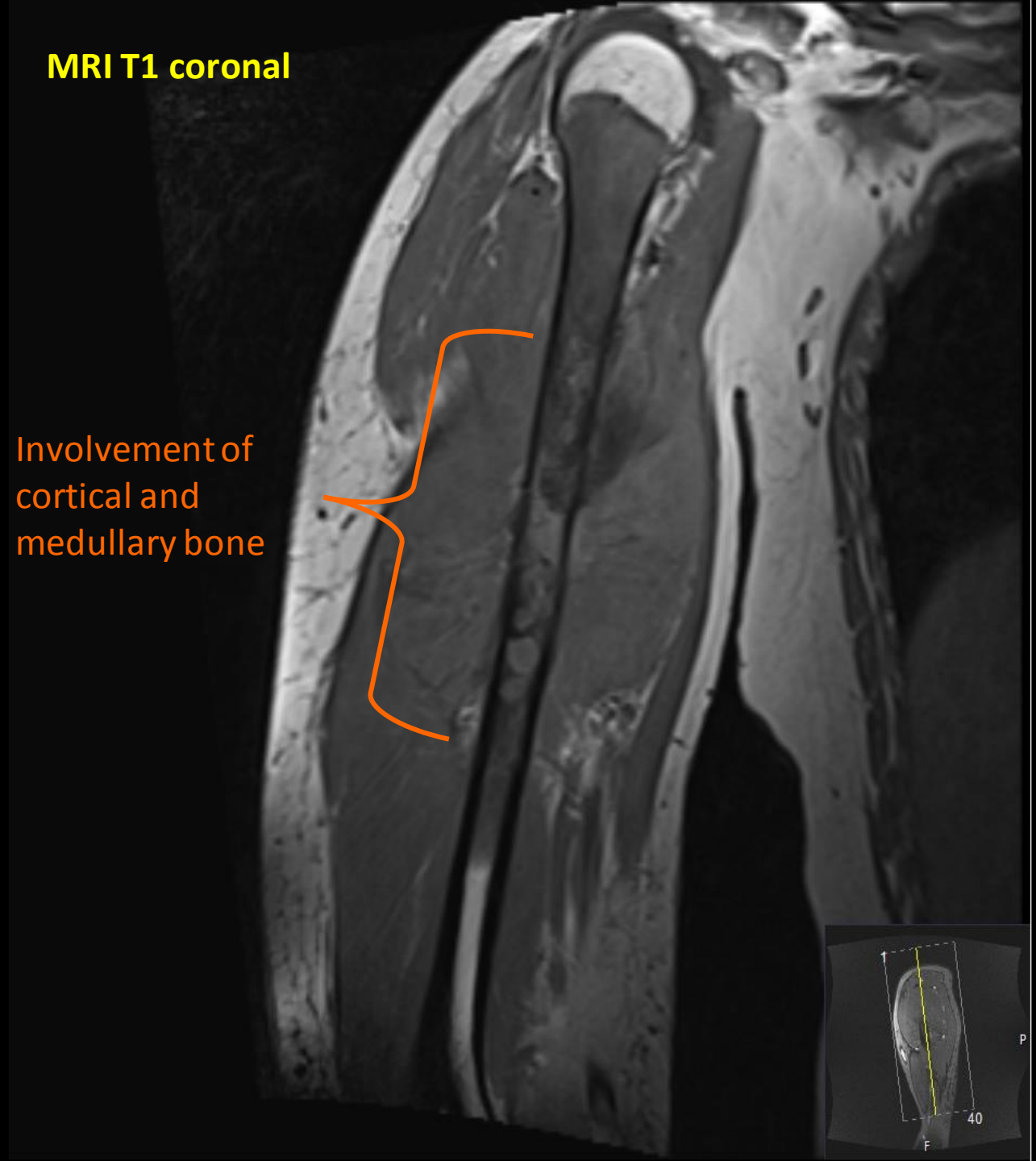

MRI T2 FS axial


MRI T1 axial
Relative signal decrease due to medullary bone involement


MRI T2 FS axial
Extensive lesion involving bone and soft tissue


MRI T1 coronal
1
40
P
F


MRI T2 FS coronal
1
40
P
F


MRI T1 coronal
Involvement of cortical and medullary bone


MRI T2 FS coronal
Lesion measured to be 15 x 10 x 10 cm (H x W x L)
Heterogenous appearance due to overlapping areas of mineralization and soft tissue involvement

Technetium-99 MDP Bone Scan

- Intense radiotracer uptake in irregular pattern in right upper arm
- Normal radiotracer uptake in bladder
- Young patient with no uptake to suggest degenerative change

Final Diagnosis (after CT-guided biopsy)

High grade osteosarcoma

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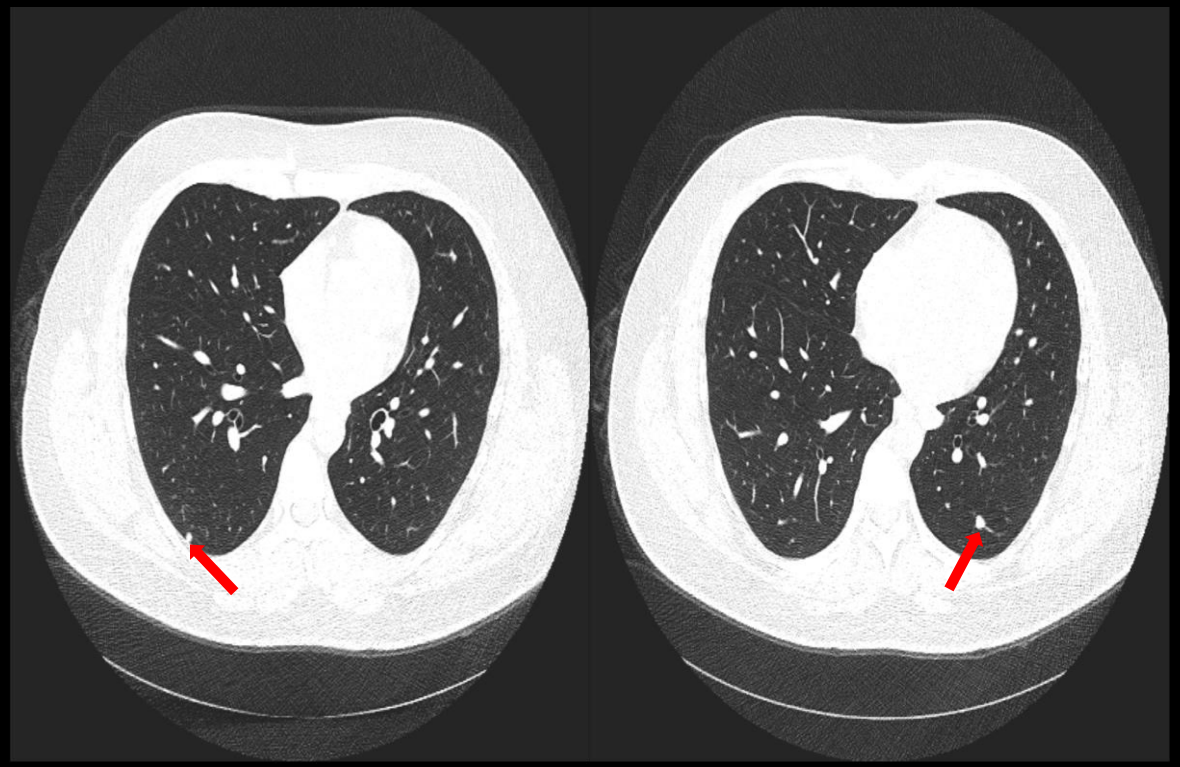
Case Discussion - Osteosarcoma

- 2nd most common form of primary bone tumour (20%) after multiple myeloma (30%)
- Primary form affects younger patients, often the metaphysis of long bones due to increased activity
  - Common sites = Femur (40%), tibia (16%), humerus (15%)
- Secondary form occurs in older patients and is more common in flat bones like the pelvis
  - Often sequelae of Paget's disease or previous primary bone lesions treated with radiation
- Macrometastases demonstratable in 10-20% of cases at time of presentation with lungs being most common site
- Patients without overt metastases are presumed to have occult micrometastatic disease and are managed as such



CT Chest performed without IV contrast – axial lung slices
- Presence of likely metastases denoted by red arrows

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Case Discussion - Management

- Slight variations based on subtype and staging but in general

  = CHEMOTHERAPY + SURGERY

- Neoadjuvant chemotherapy → Re-staging → Surgical resection → Adjuvant chemotherapy

  - Adjuvant chemotherapy regimen will be decided based on response to neoadjuvant treatment

- Range of chemotherapy options

  - This patient → Cisplatin, doxorubicin and MTX (with leucovorin rescue)
  - Consider pre-chemotherapy fertility consultation for appropriate patients

- Prognosis

  - 70% long-term survival but <20% in patients with a large metastatic burden
  - 35-40% long-term survival rate if limited pulmonary metastases

References

1. UpToDate – Osteosarcoma: Epidemiology, pathogenesis, clinical presentation, diagnosis and histology

   - Accessed July 2019

2. https://www-dynamed-com.proxy.library.rcsi.ie/topics/dmp~AN~T917268/Osteosarcoma-in-adults

3. https://radiopaedia.org/articles/osteosarcoma?lang=us

4. Kundu Z. S. (2014). Classification, imaging, biopsy and staging of osteosarcoma. *Indian journal of orthopaedics*, *48*(3), 238–246. doi:10.4103/0019-5413.132491