

PROMISE series : ST tumours

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Tomorrow's imaging report

MRI RIGHT KNEE

FINDINGS:

There is a large joint effusion

The anterior cruciate ligament is completely torn 🤔

No cartilage injury 👍

The remainder the knee joint is normal 😊

General Principles

Soft tissue tumours are common

Superficial : Deep = 20:1

Superficial: Benign : Malignant = 100 : 1

nerve
sheath
tumour



ganglion

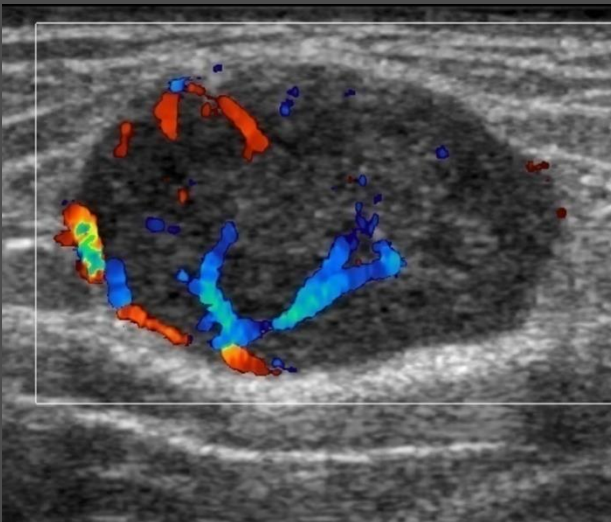
● Reassurance is usually what is required

General Principles

Superficial – any size
Deep & Small



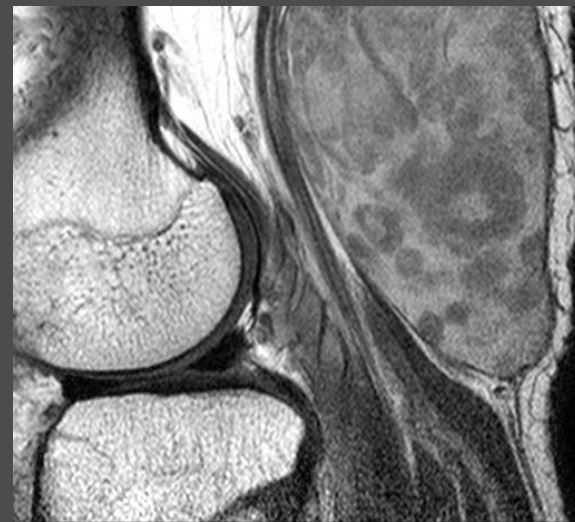
Ultrasound



Deep & Large



MRI



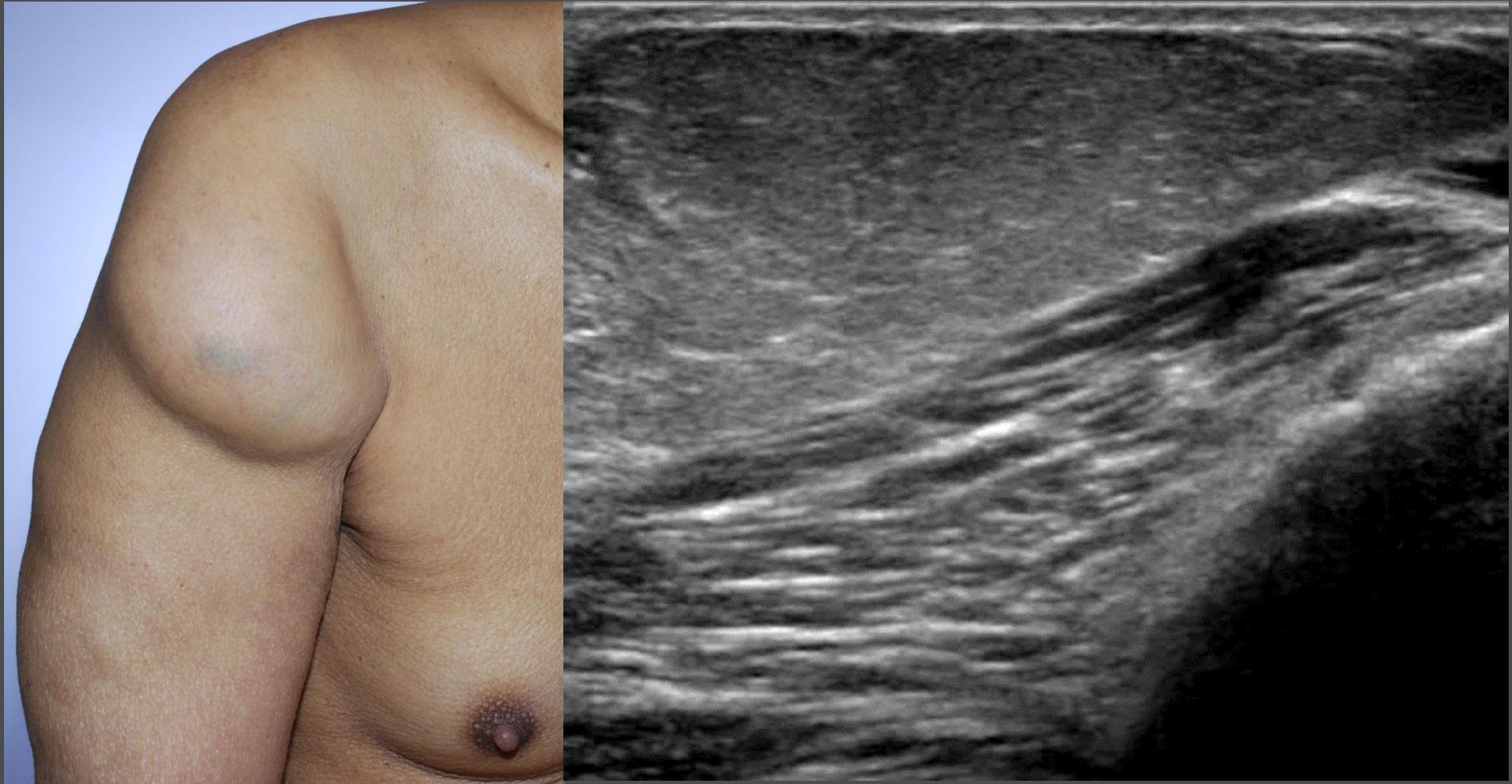
Reaching a diagnosis

- HISTORY
- LOCATION
- SPECIFIC IMAGING FINDINGS
- CONSIDER MIMICS
- IS BIOPSY NECESSARY?
- FOLLOW-UP, WHEN AND HOW

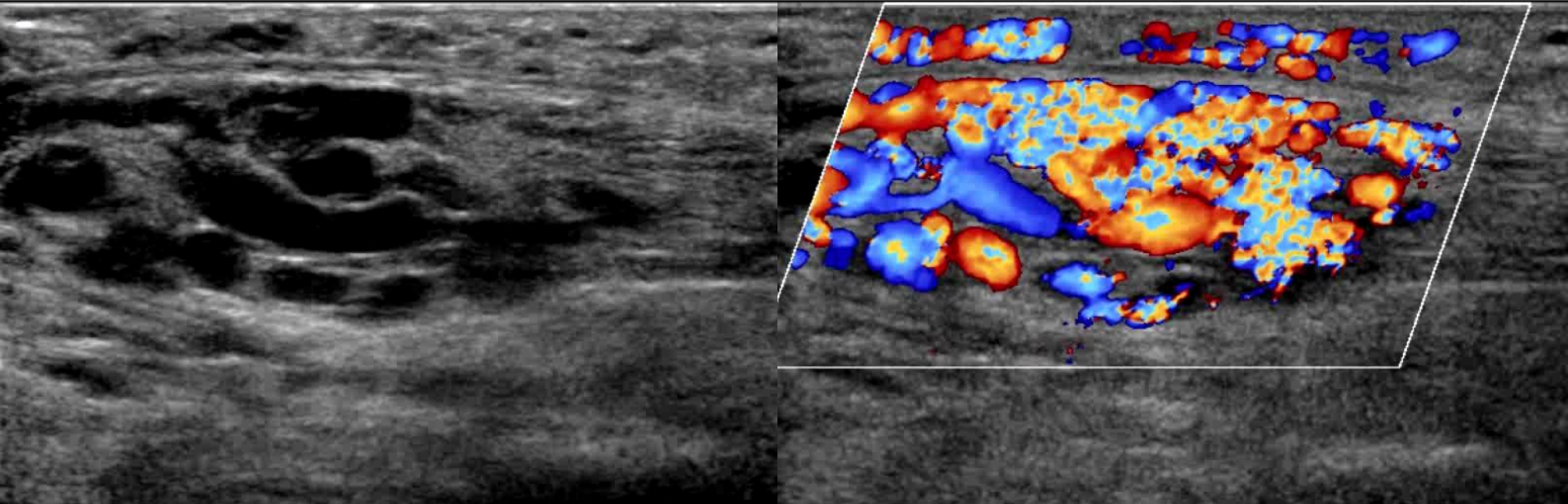
History

- Duration of lesion
- Rapidity of growth
- Episode of trauma (be careful)
- Change with exercise
- Dependency or diurnal
- Skin Changes
- Pain (shock-like)

Large subcutaneous lipoma

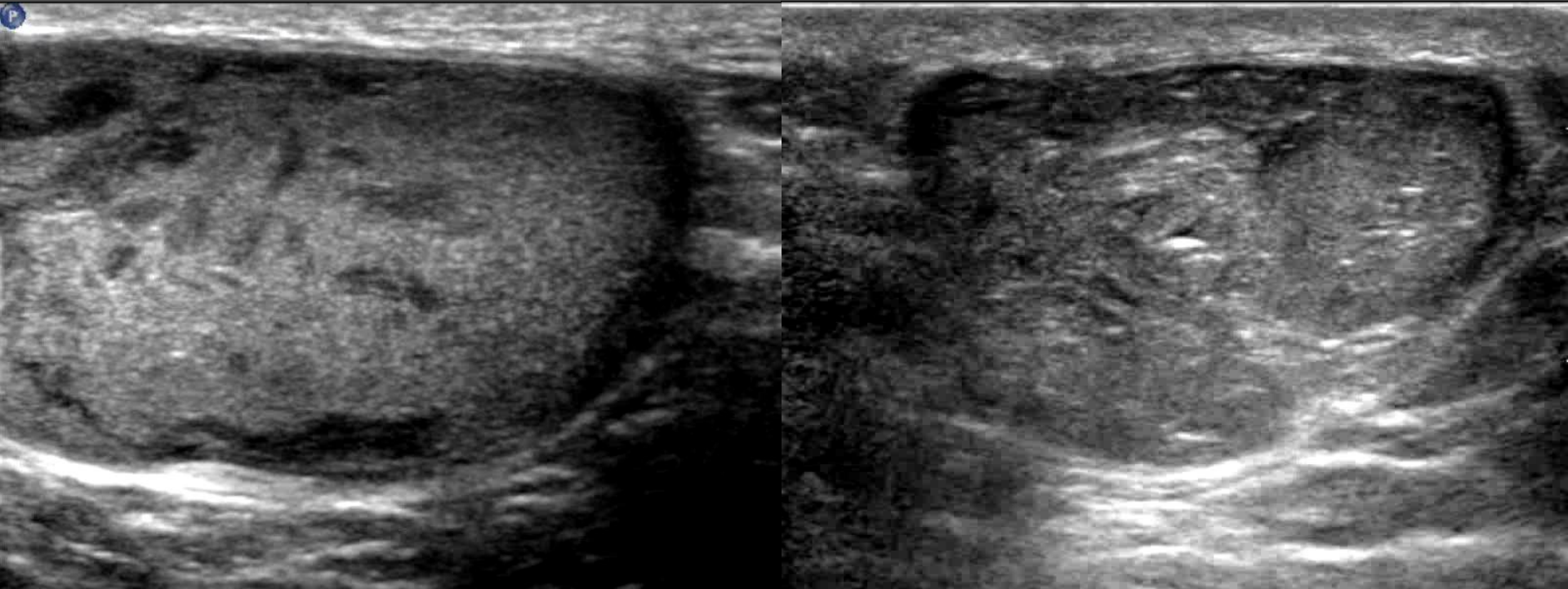


Vascular Malformation (high flow)



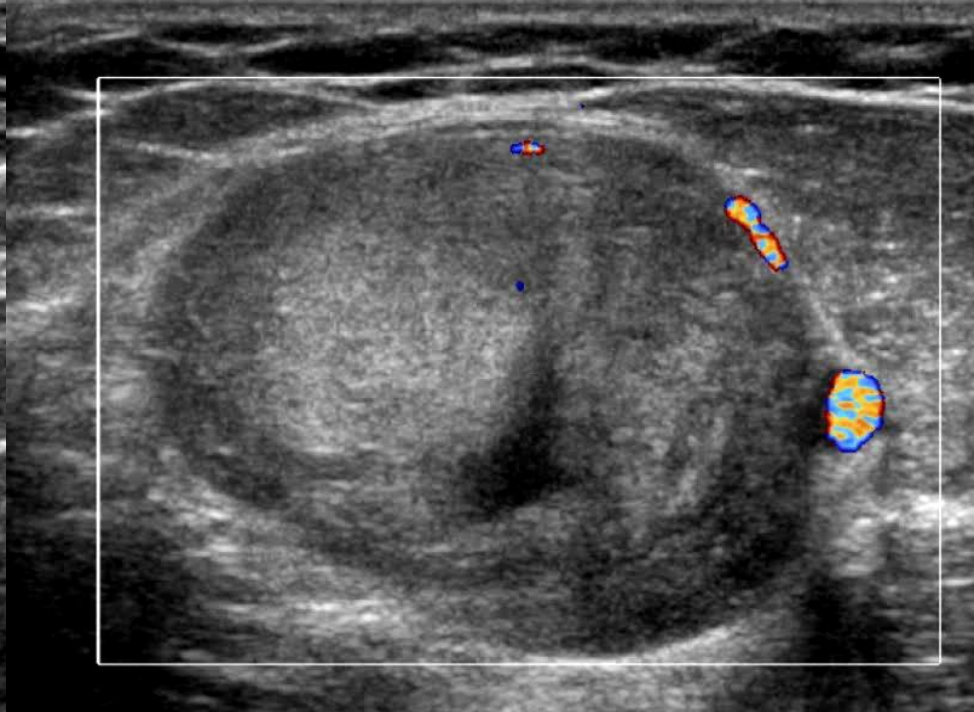
- Classify as 'low flow' or 'high flow'
- Capillary-venous or venous (low flow)
- Arteriovenous (high flow)

Epidermoid Cyst



- Well-defined
- Slightly echogenic, avascular, acoustic enhancement
- Hypoechoic ovoid or tubular 'clefts'
- Short thick echogenic lines (due to keratin)

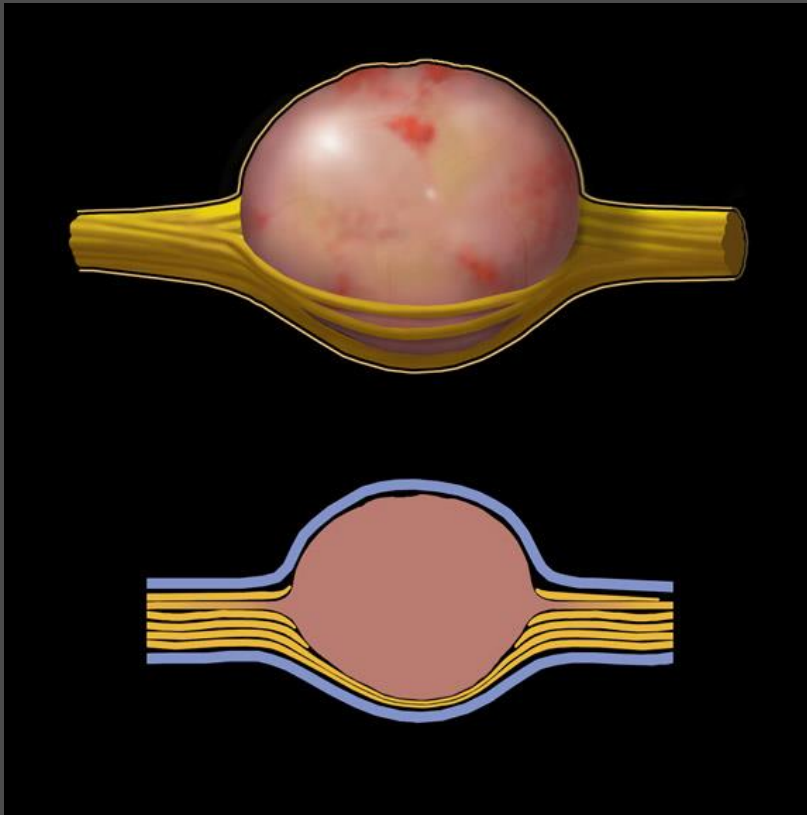
Nerve Sheath Tumour



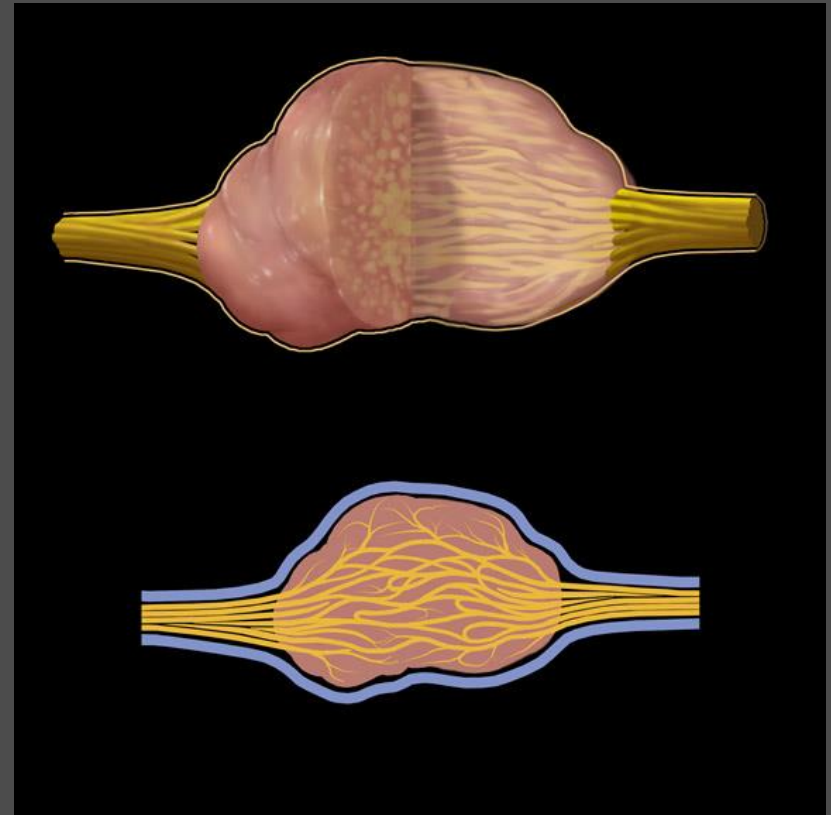
Nerve Sheath Tumour

Nerve Sheath Tumour

Schwann cell tumour : Schwannoma

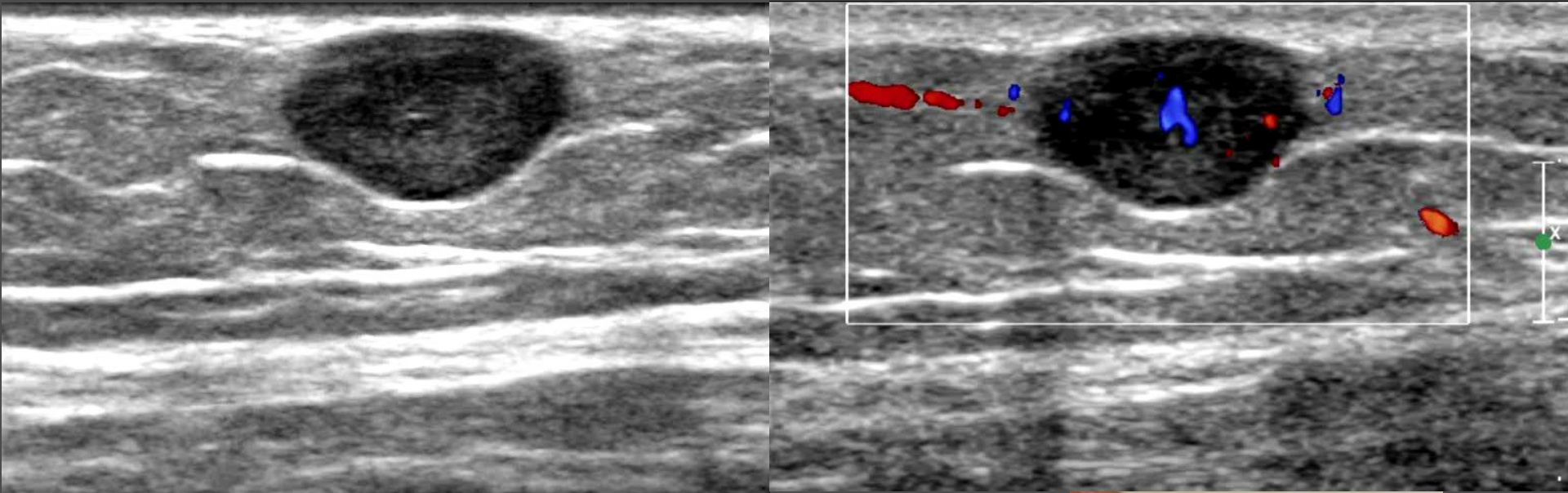


Connective tissue tumour : neurofibroma



● Not good at distinguishing schwannoma from neurofibroma

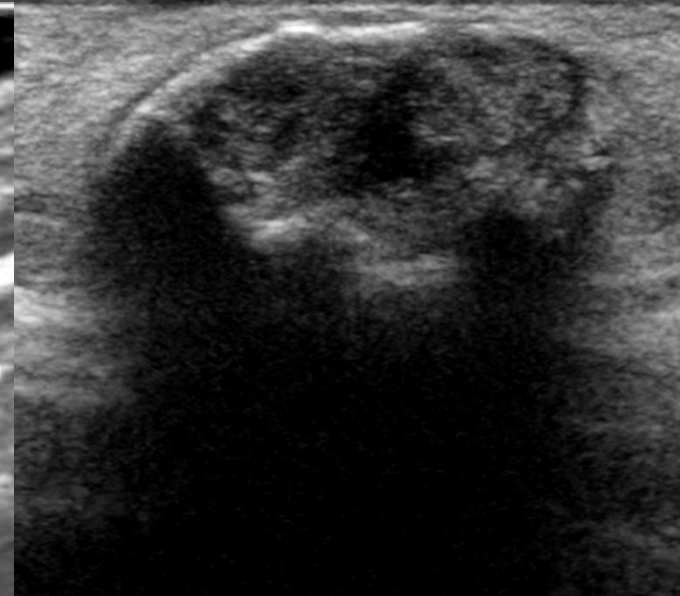
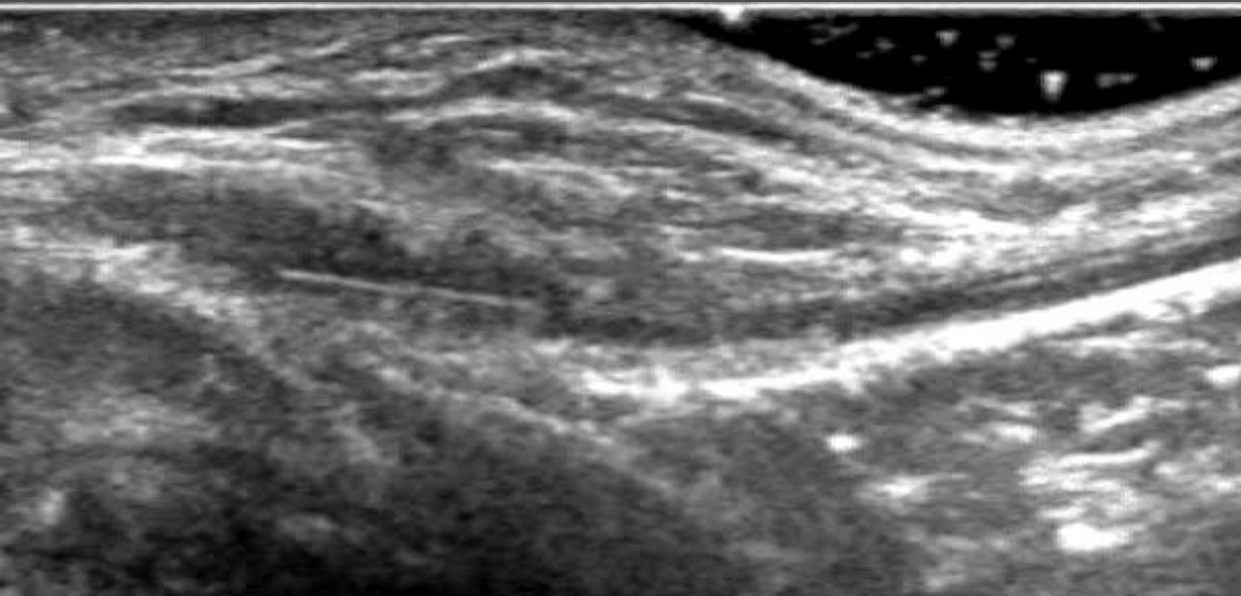
Vascular Leiomyoma



- Majority occur in foot and ankle region
- Occur along neurovascular bundle
- Similar to nerve sheath tumour but no neural tail



Pilomatixoma



- More common in children, > upper limb,
- Hypoechoic, calcified (75%), hypoechoic rim (50%)
- Mild to moderate vascularity (variable)

Ultrasound

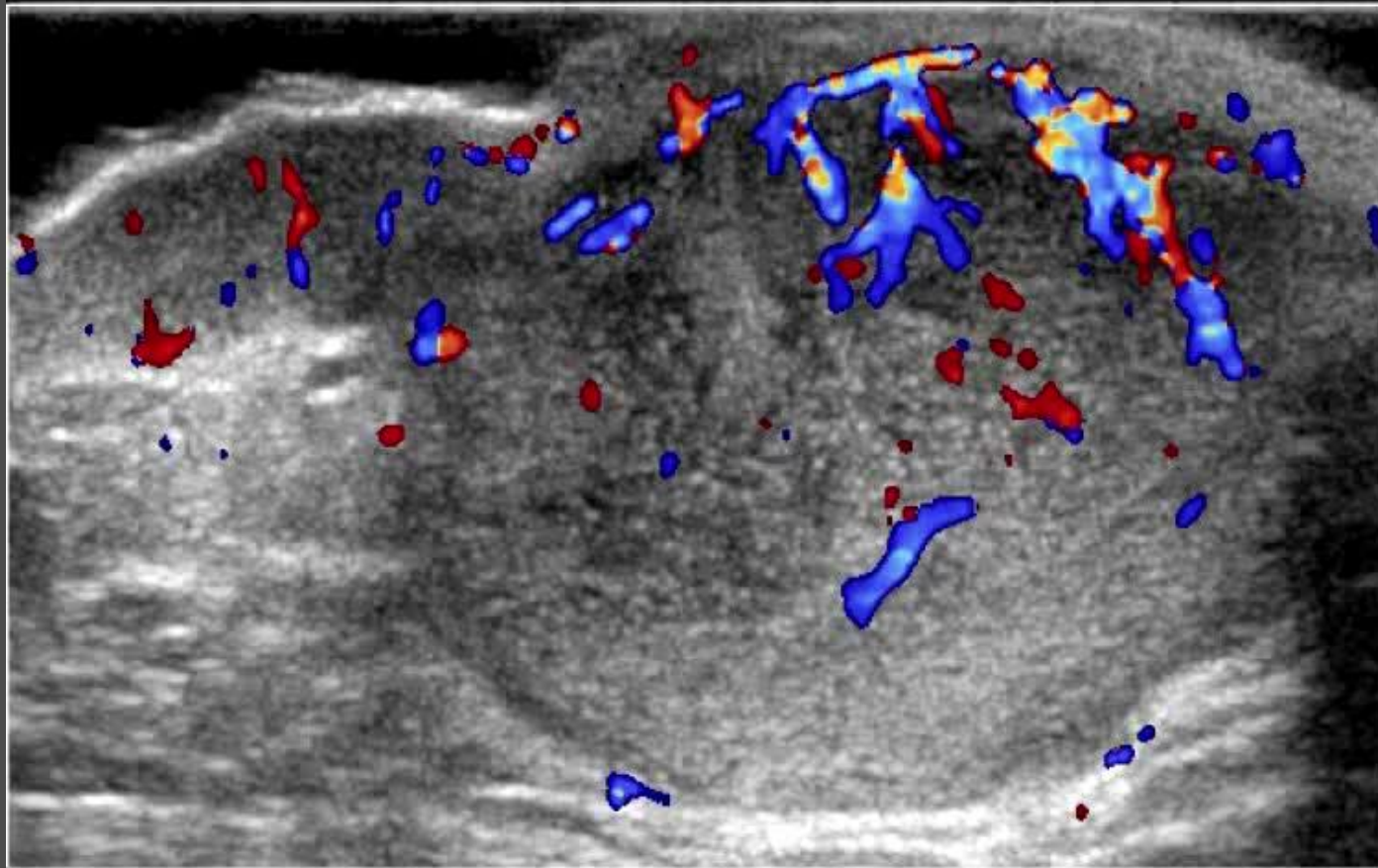
- Lipoma / angioliipoma
- Ganglion
- Nerve sheath tumour
- Epidermoid
- Lymph node
- Vascular malformation / haemangioma
- Vascular leiomyoma
- Pilomatrixoma

- Allow specific diagnosis in majority (>80%) cases
- Best sign of malignancy = suspicious features and does not look like any of benign tumours

Malignant Fibrous Histiocytoma



Dermatofibrosarcoma protruberans

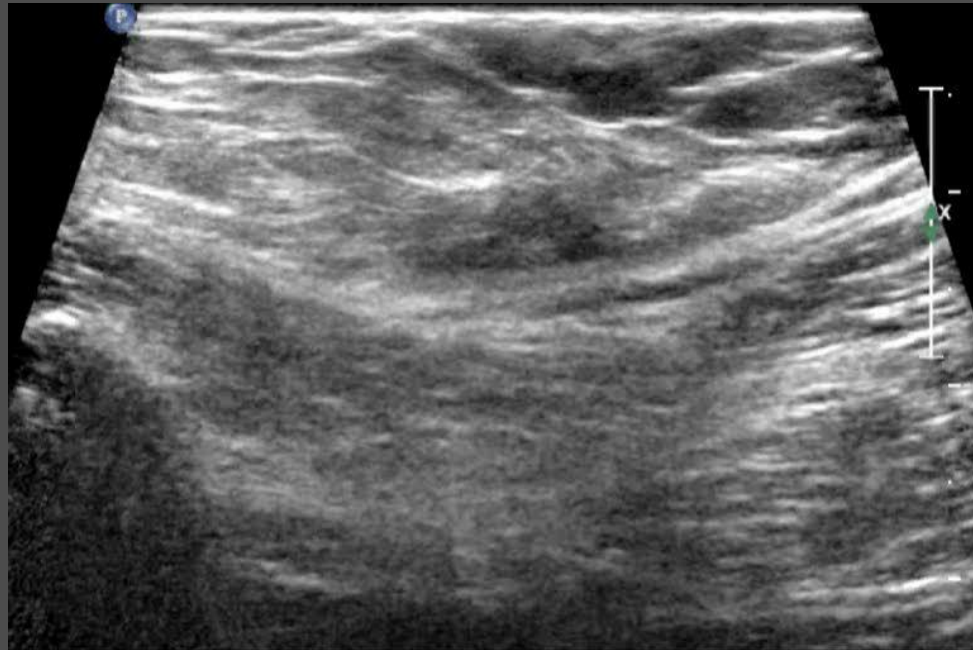


Deep tumour : move quickly to MRI

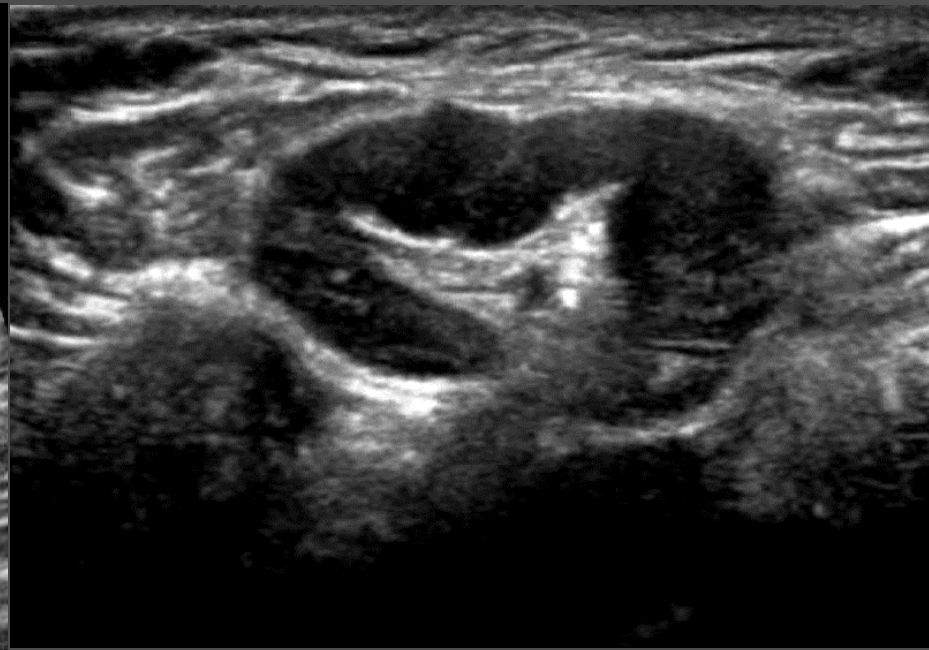
- Move quickly to MRI
- Don't be concerned re establishing extent with US
- Check hyperaemia, LNs and finish



Check regional lymph nodes



Malignant



Reactive

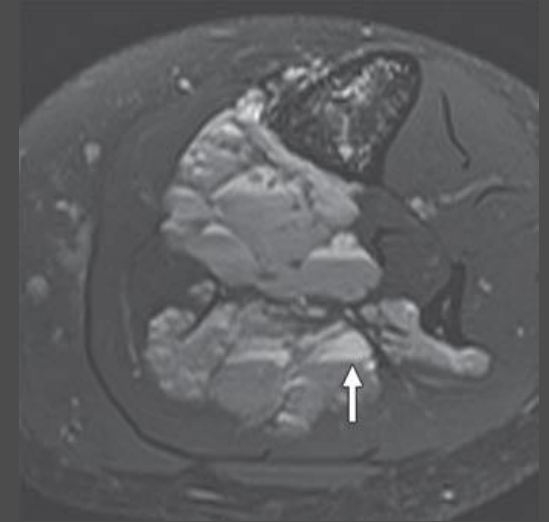
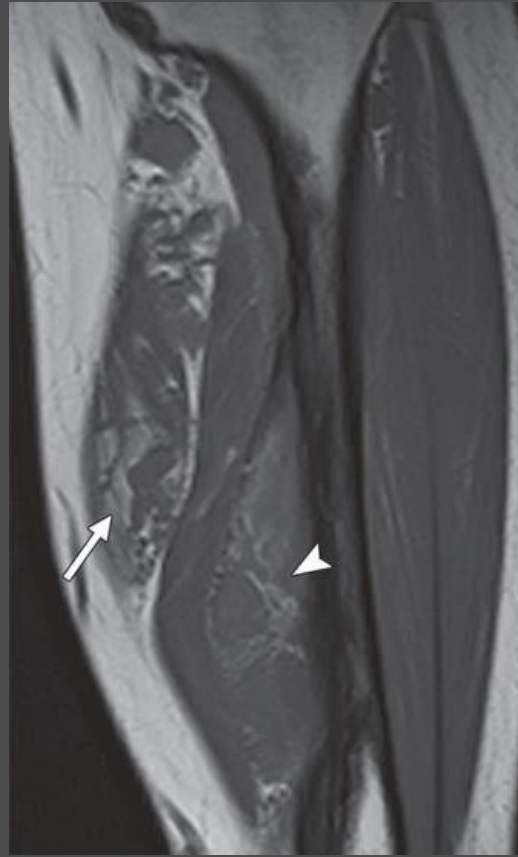
Radiography

Should be seen in all cases

Calcification (osteoid, chondroid, dystrophic)

- Calcification (scattered, peripheral or central, mature)
- Fat
- Bone scalloping
- Articular rather than juxtaarticular

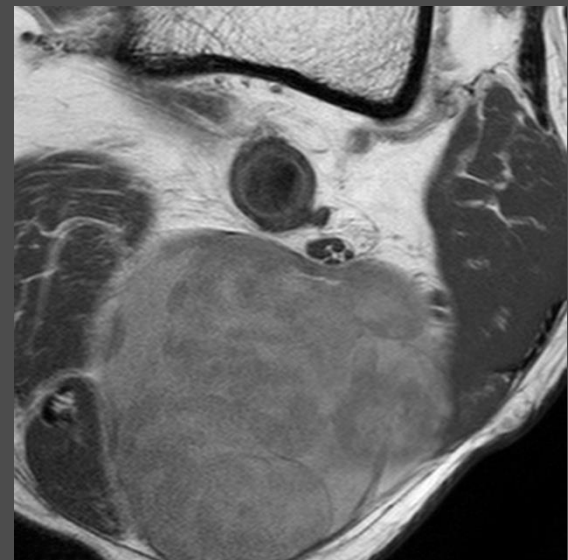
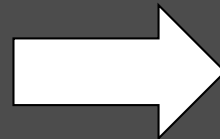
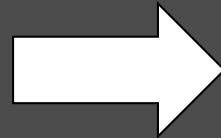
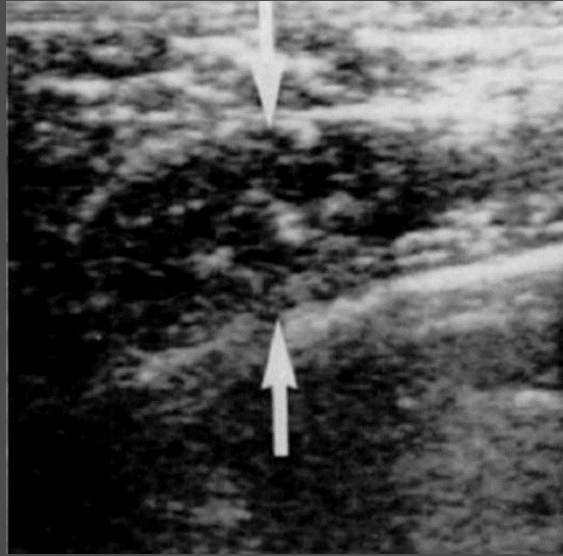
Radiography



Then

&

Now

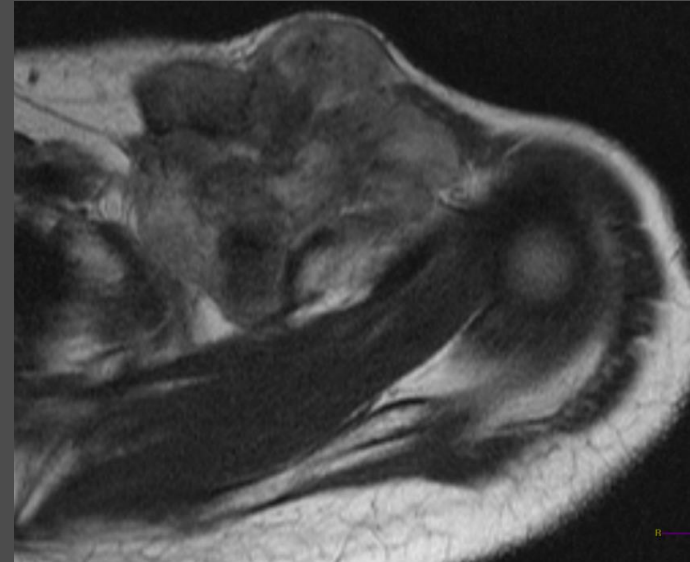


MR protocol

Axial imaging as primary imaging plane

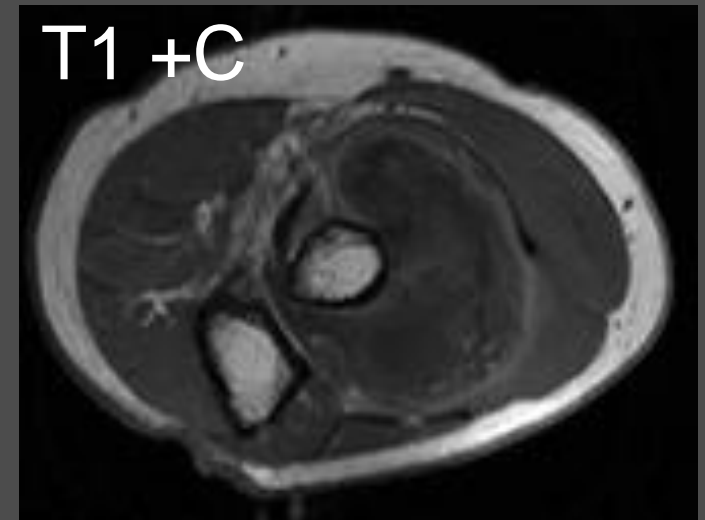
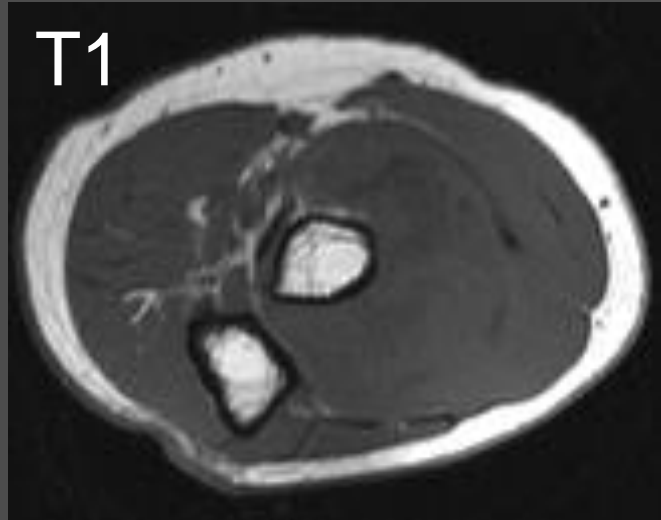
- Add on T1 weighted sequence (fat)
- 1 or 2 longitudinal scans
- GE imaging if haemosiderin considered
- T1-FS prior to contrast
- Do not always have to give contrast
- Additional small FOV imaging

Do not always need to give contrast



- Always ask question – will contrast help?

Often does help



● Better demarcation

MR evaluation

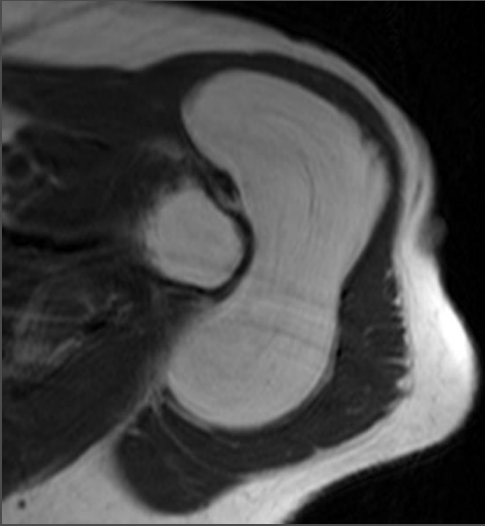
Location, location, location

- SC or subfascial, intermuscular or extramuscular, fascial or NVB
- Tissue characteristics
- Fat
- Flow voids
- Spread
- Enhancement
- Adenopathy

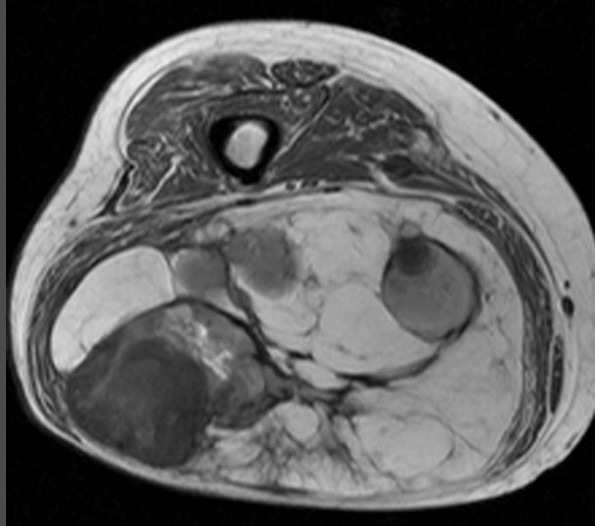
Soft Tissue Sarcoma

- Centrifugal growth
- Pseudocapsule compresses rather than invades
- Lymph node mets 5%
(clear cell sarcoma, angiosarcoma, ASPS, synovial sarcoma and rhabdomyosarcoma)
- Recurrence

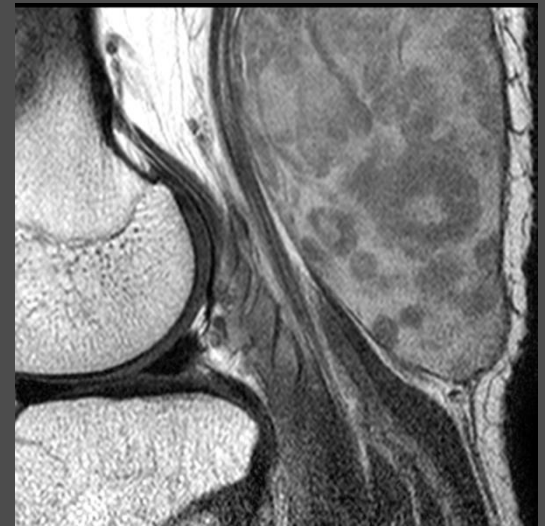
Tissue characterization by MRI



Lipoma



Liposarcoma



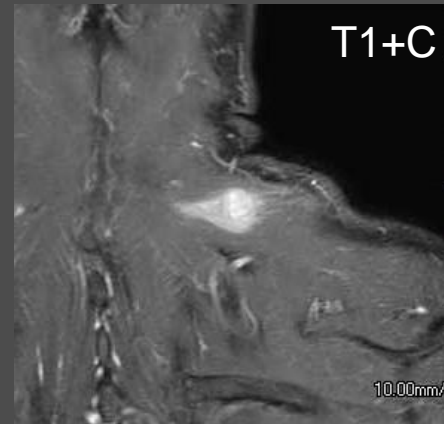
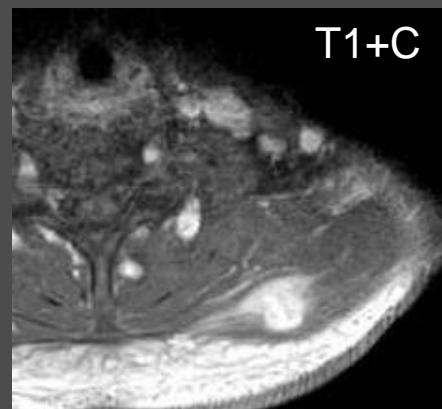
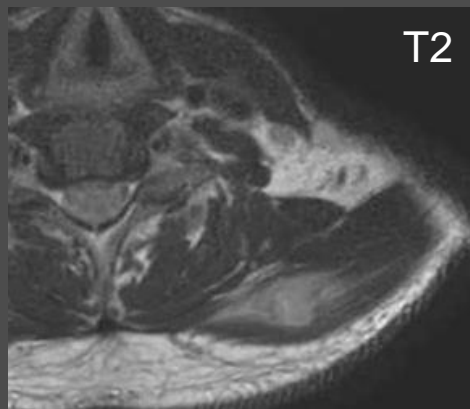
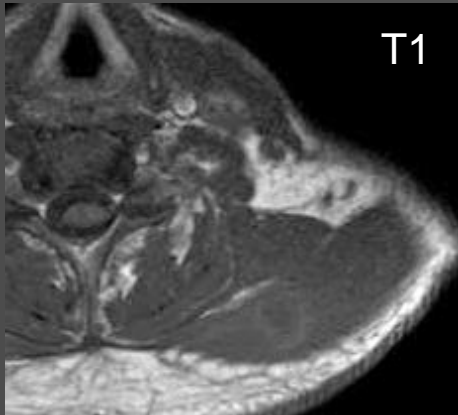
Soft tissue MFH

Is helpful but limited

MRI will never replace biopsy even with DWI, MRS etc

Even with histology, difficulty with tumour type

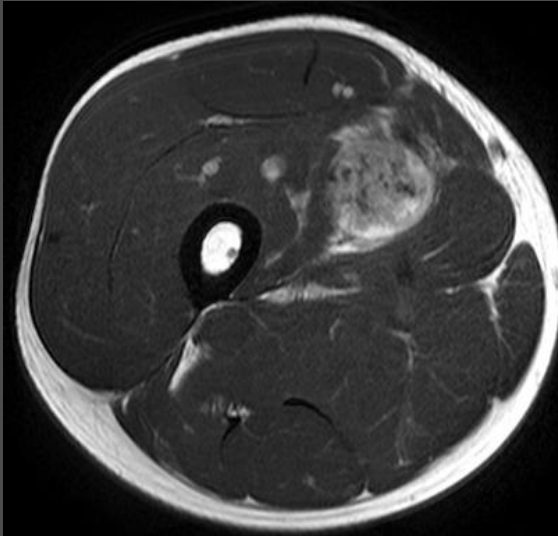
Typical Case



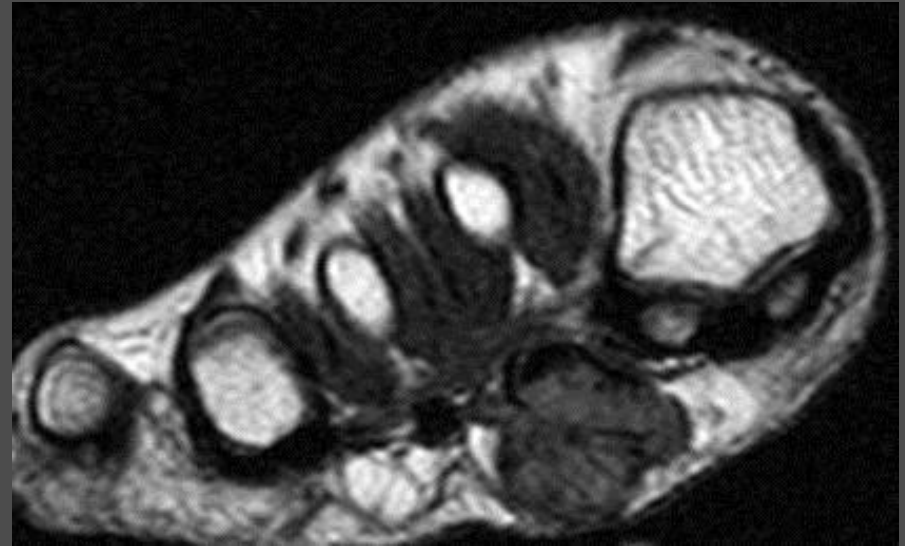
Nodular fasciitis

- Benign proliferative fibroblastic lesion
- Upper limbs, shoulder
- Along fascia (investing, intermuscular)
- \pm myxoid ('target sign')
- Linear extension along fascia ('fascial tail')

Tissue characterization



Fibromatosis

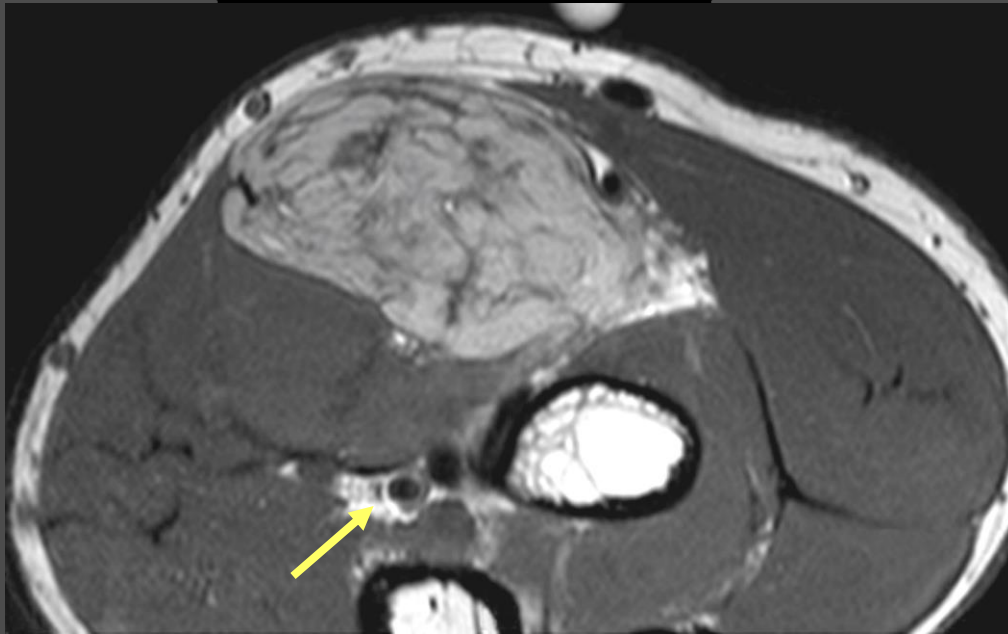
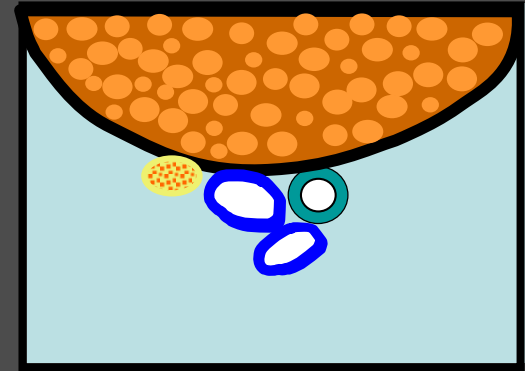
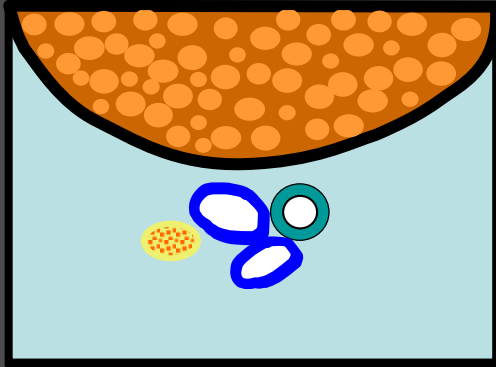


Fibromatosis

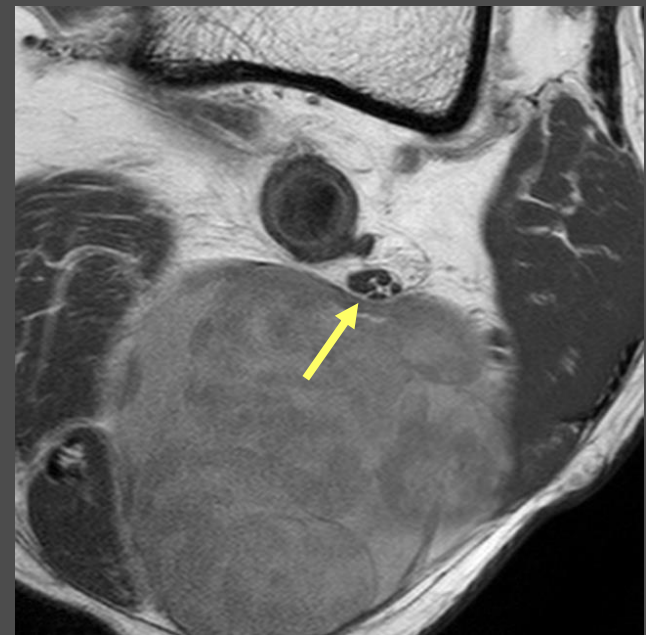
Definitive dx 30% of deep soft tissue masses

- Only call something benign when you can definitely put a label on it. Otherwise either follow-up or biopsy

Neurovascular bundle invasion

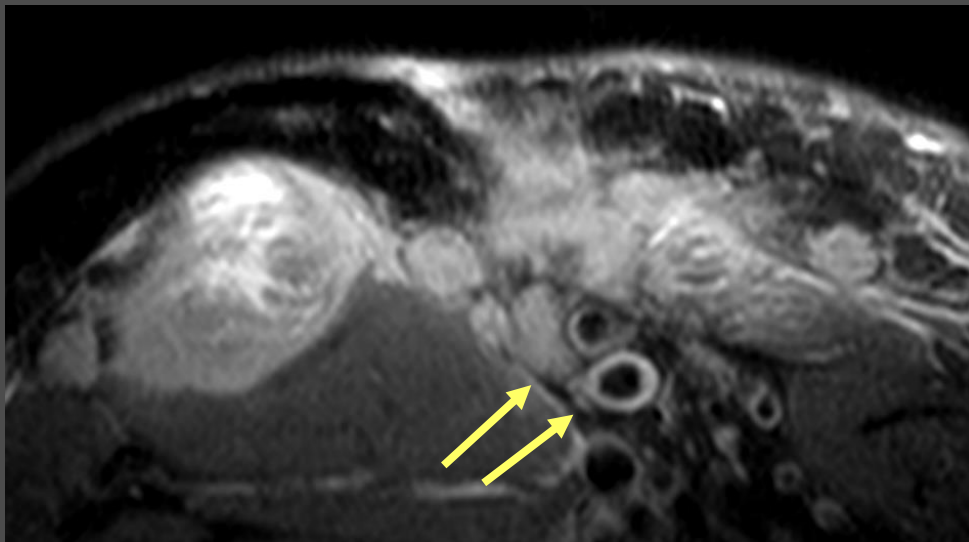
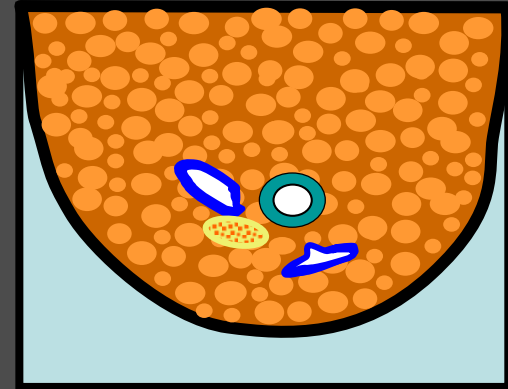
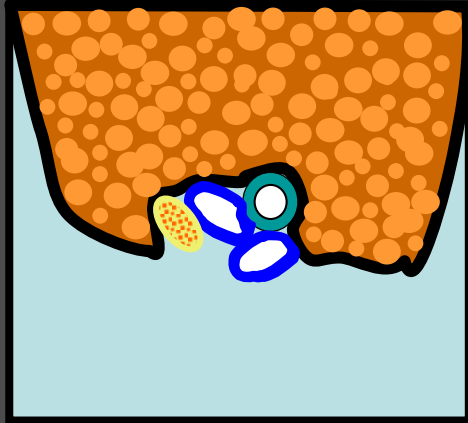


Low grade fibromyxosarcoma

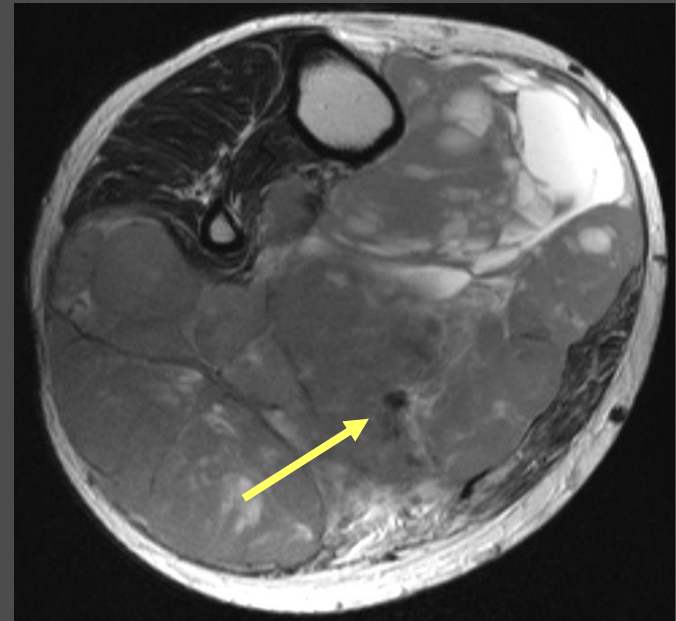


Malignant Fibrous Histiocytoma

Neurovascular bundle invasion

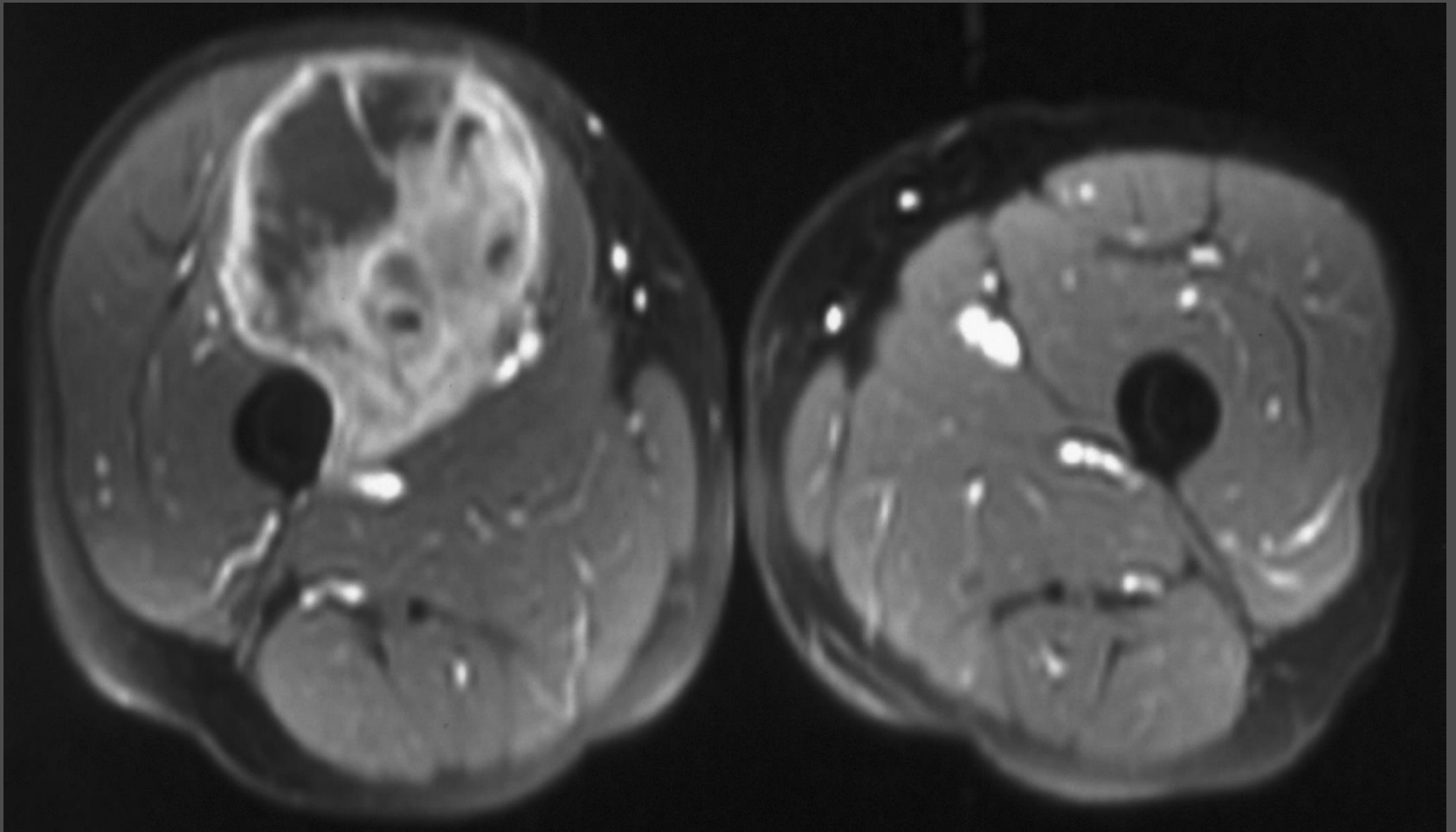


Fibrosarcoma

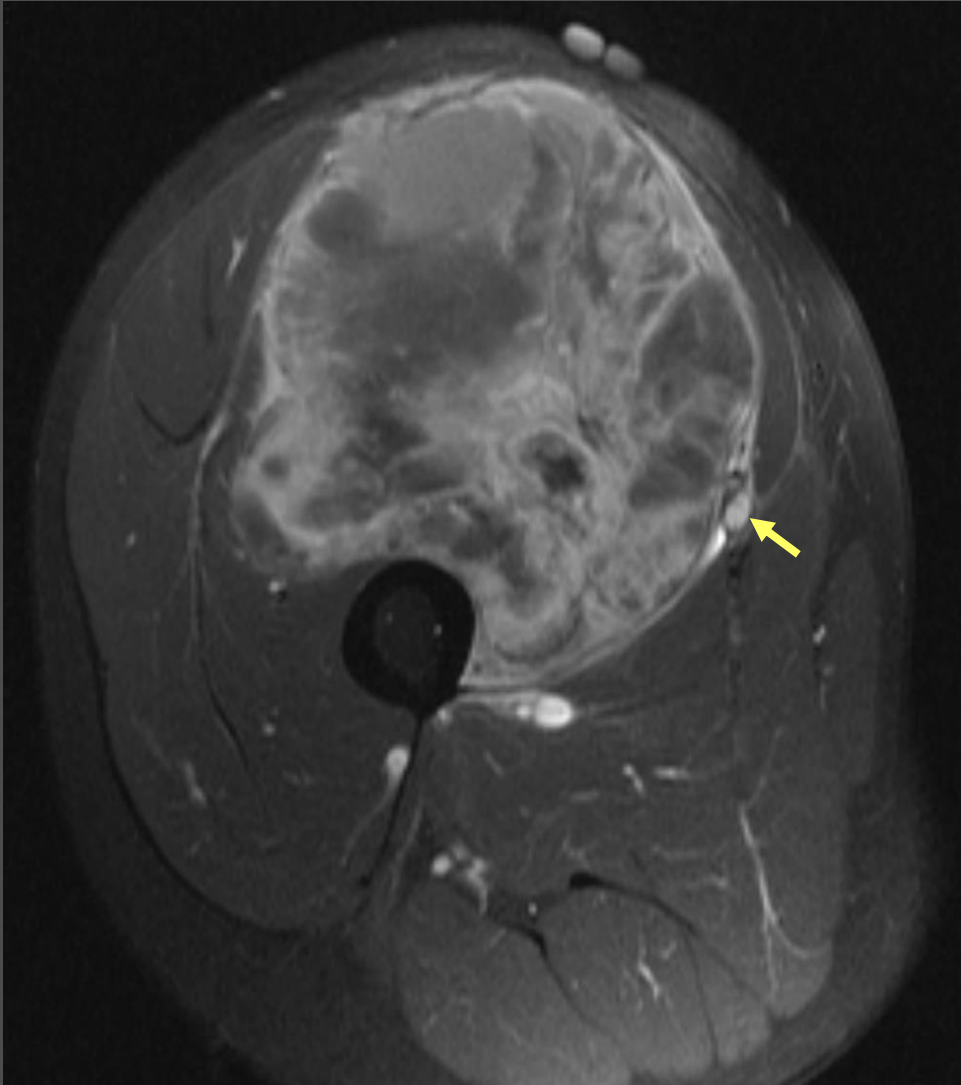


Synovial sarcoma

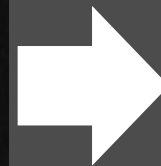
Optimise imaging to surgically relevant features



Same day – Same coil

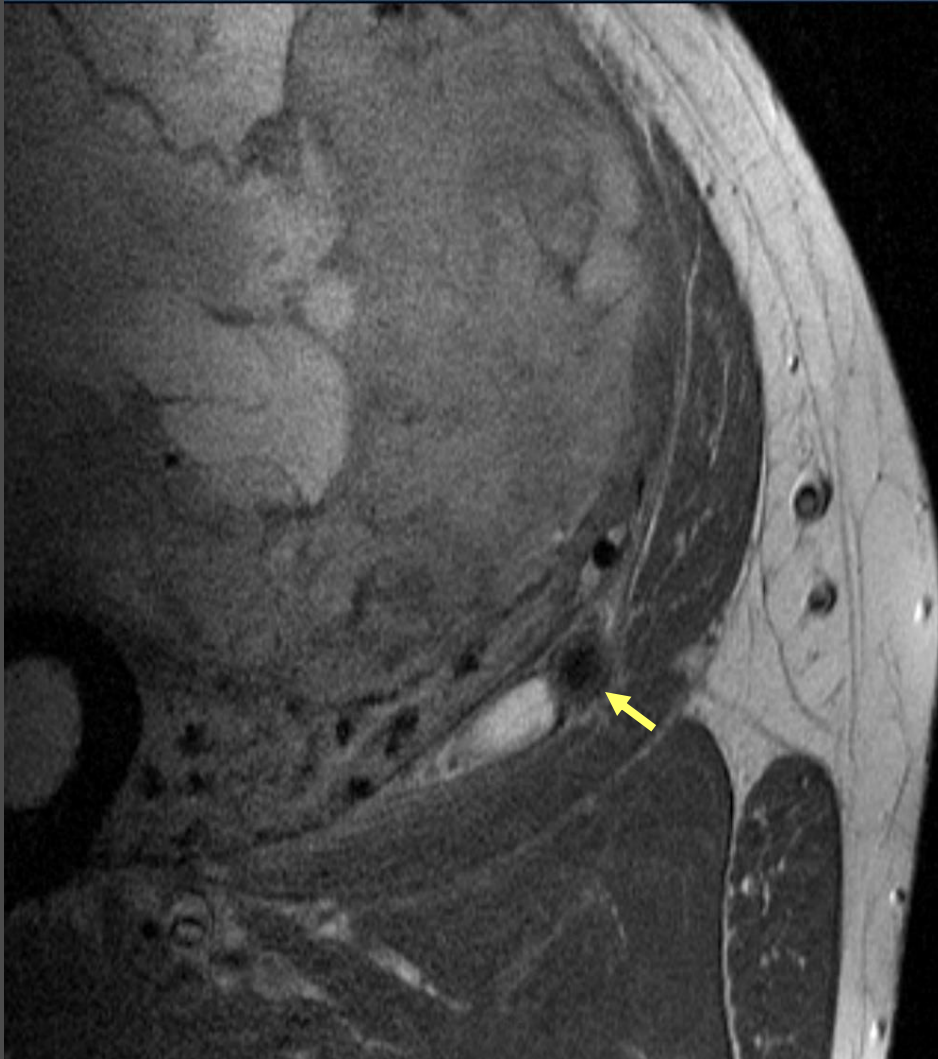


One thigh

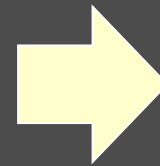


Probably
not involved

Same day – Surface coil

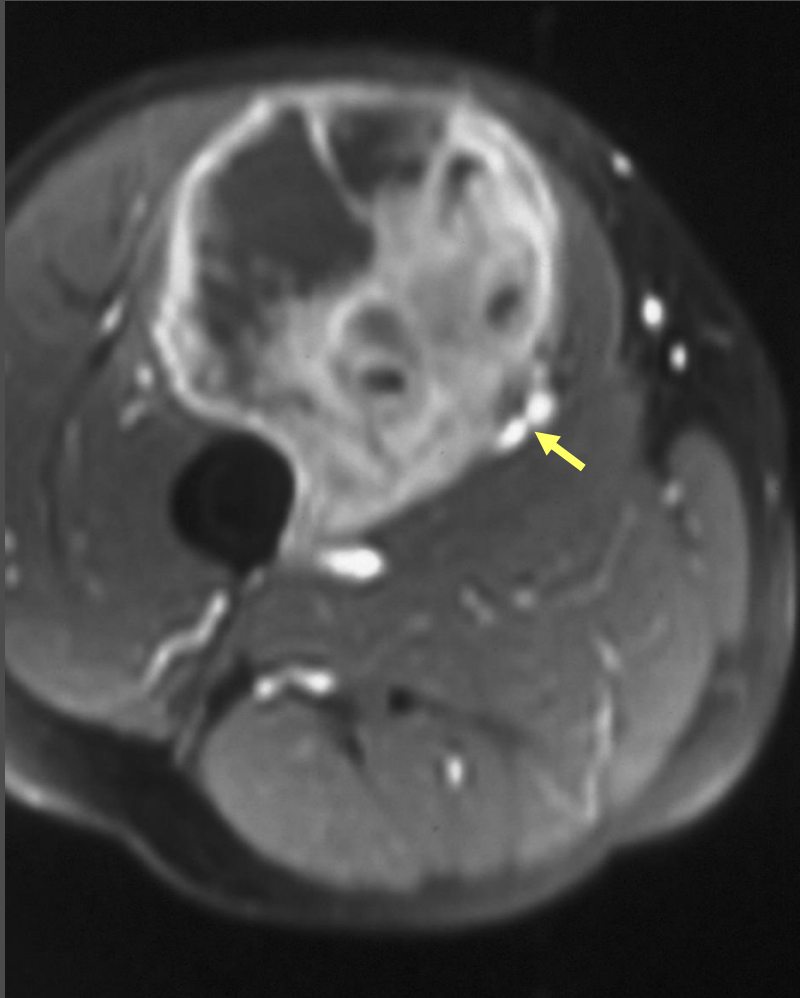


Small surface
coil

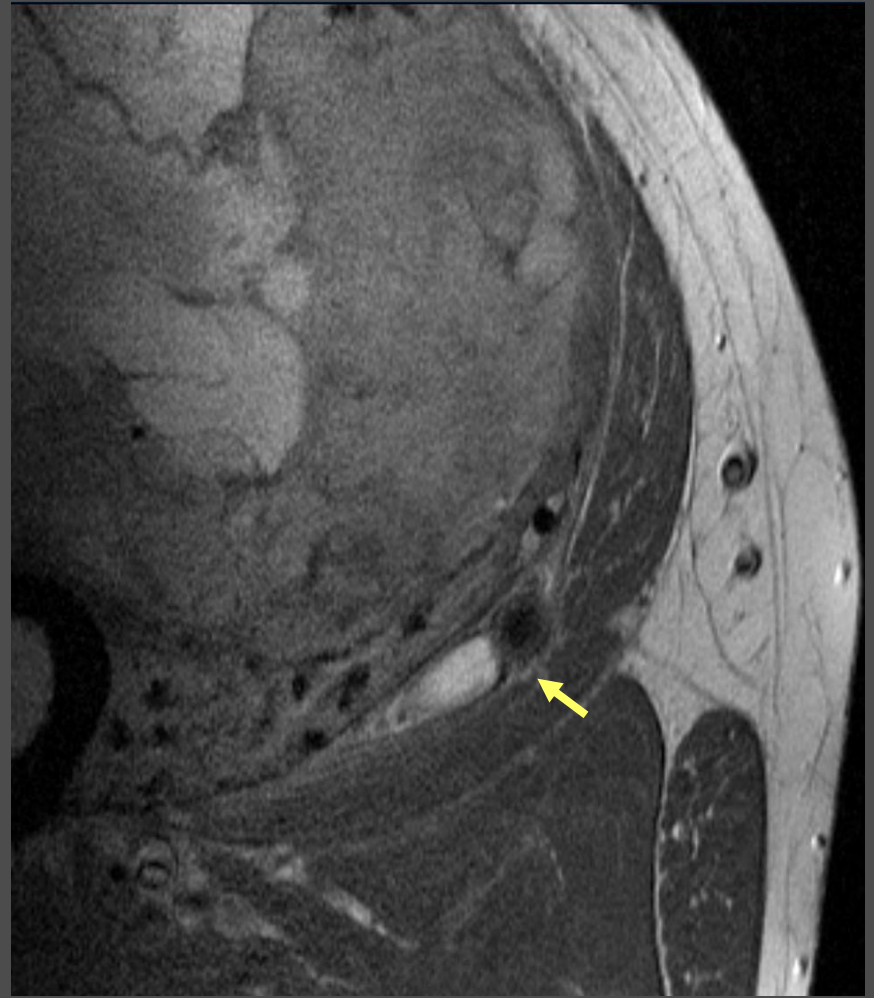


Definitely
not involved

Same tumour – same day – same scanner



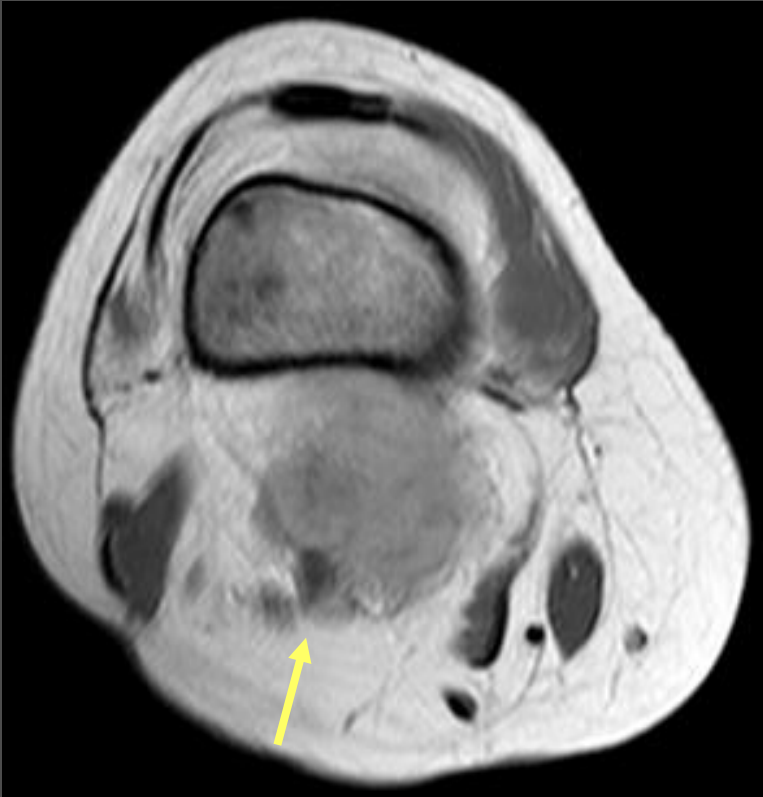
? NVB involvement



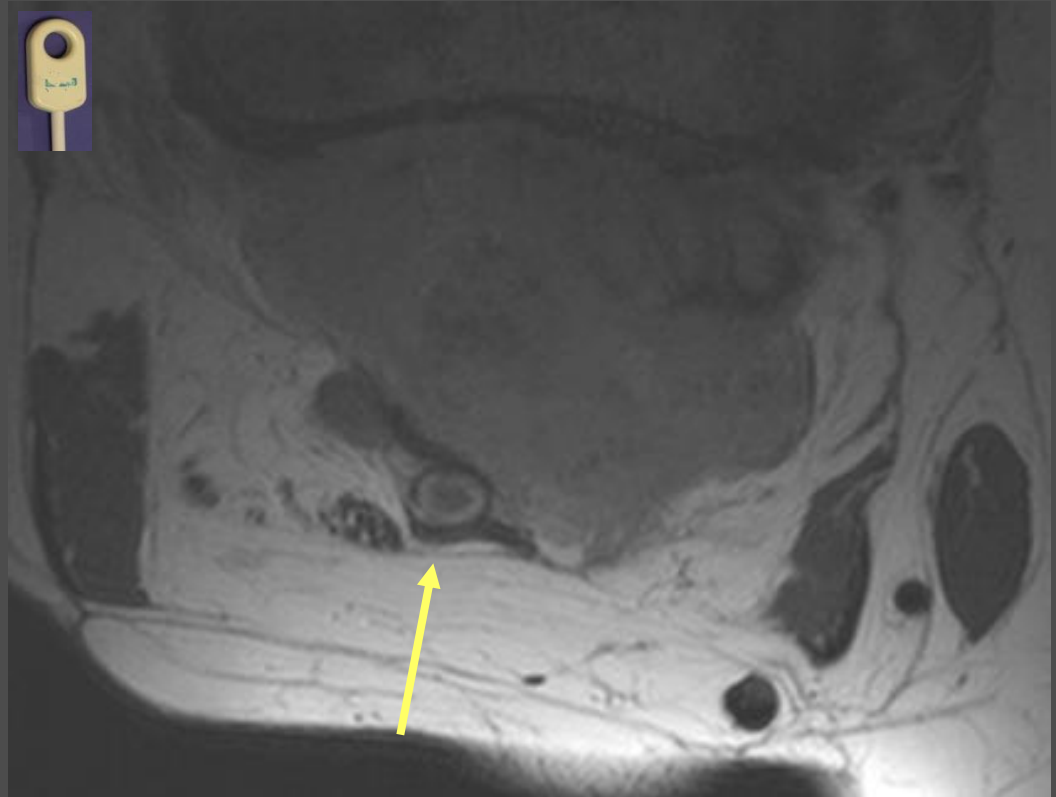
No NVB involvement

? Neurovascular bundle involvement

Malignant fibrous histiocytoma



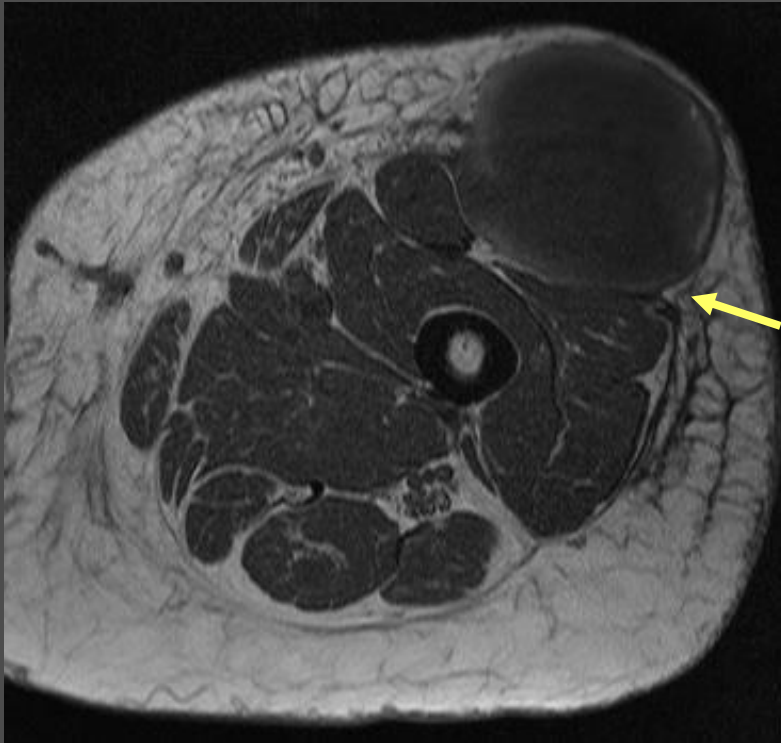
? NVB involvement



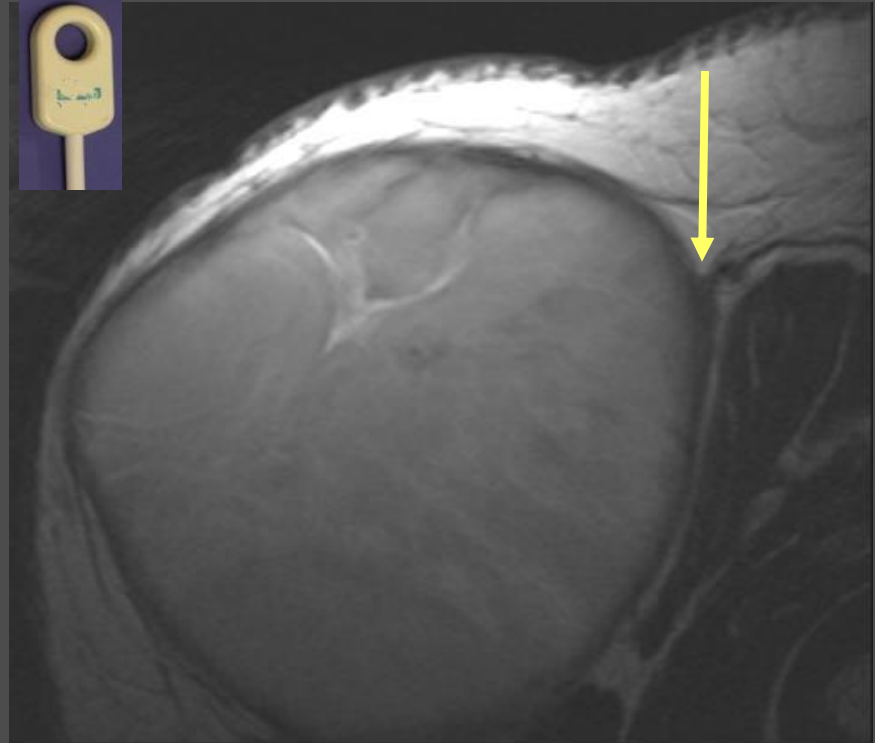
No NVB involvement

? Compartment

Very few (0.25%) superficial masses = sarcoma

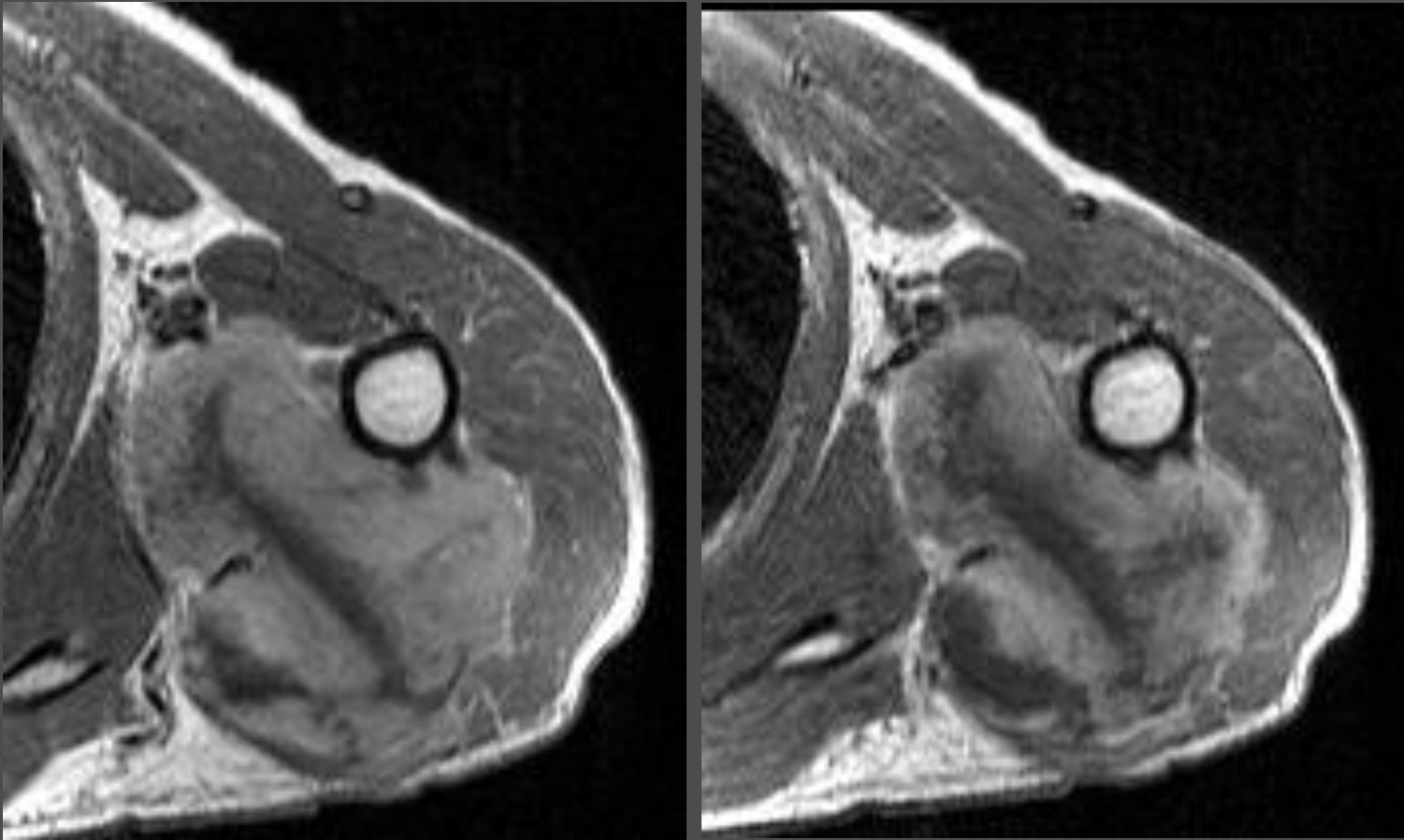


? sc or subfascial



Subcutaneous
MFH

Bone involvement

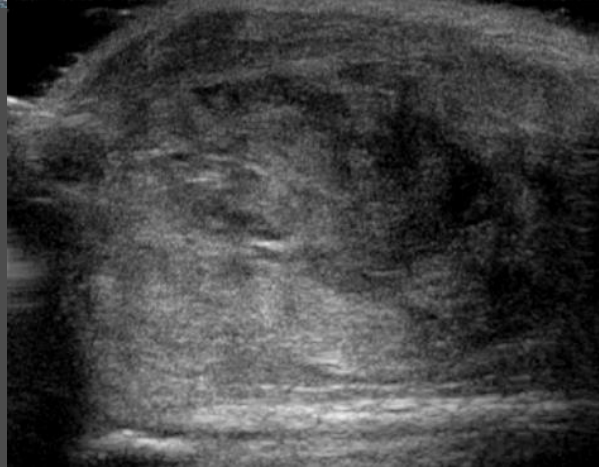
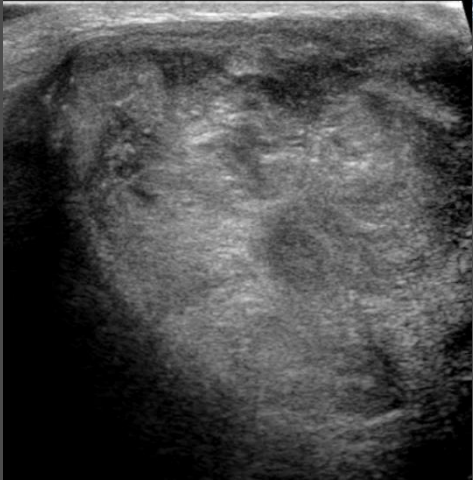


Bony change : assume cortical infiltration

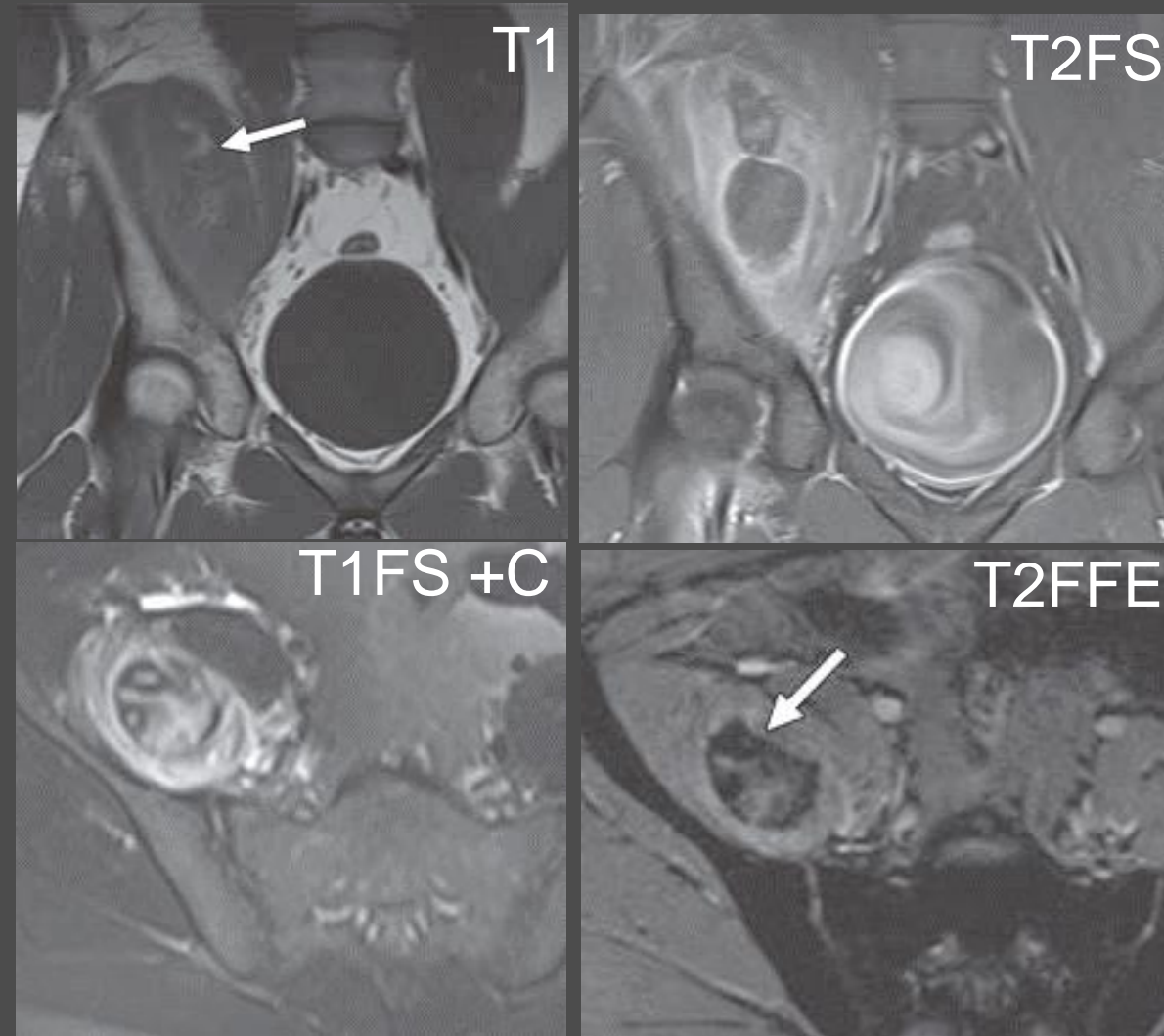
Non-neoplastic mimicking neoplasia

- Myositis ossificans
- Elastofibroma dorsi
- Calcific tendinitis
- Muscle tears
- Infection
- Haematoma
- Tumoural calcinosis
- Haemophilic pseudotumour

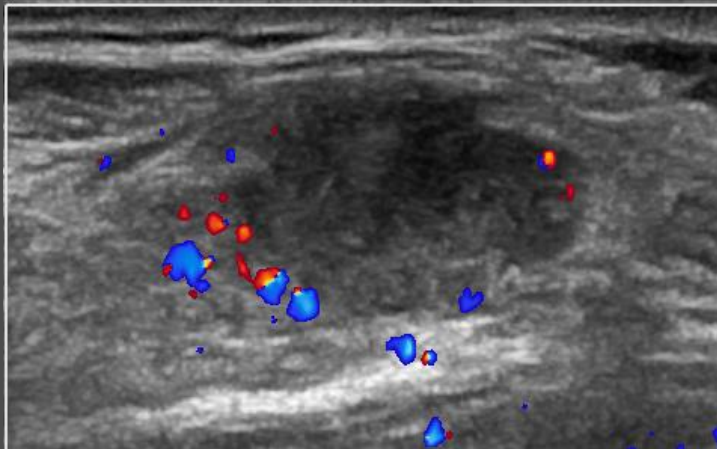
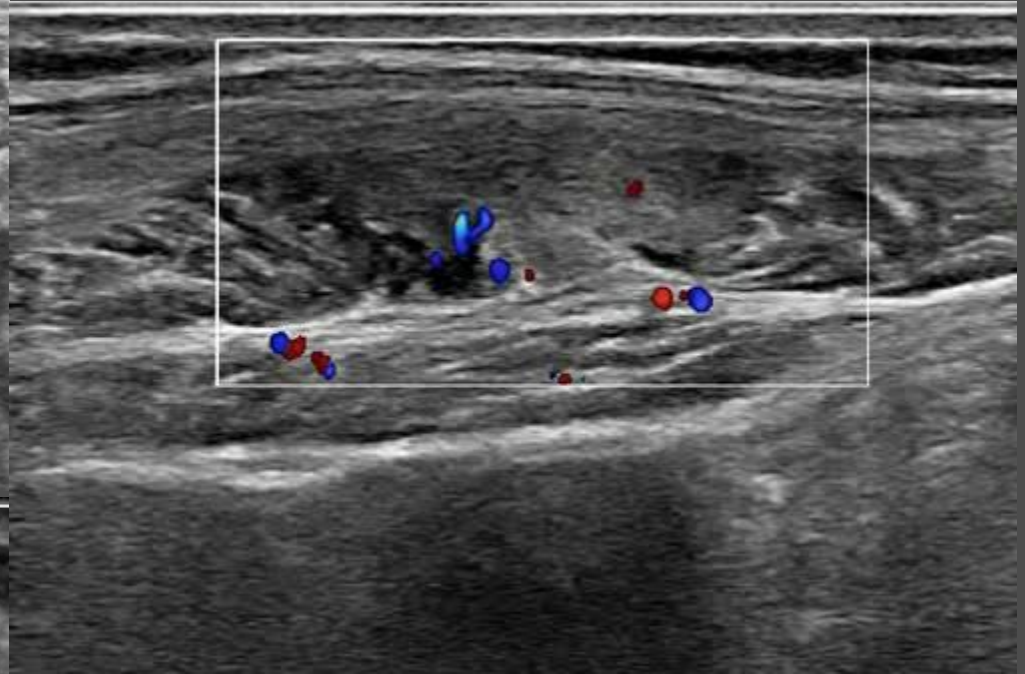
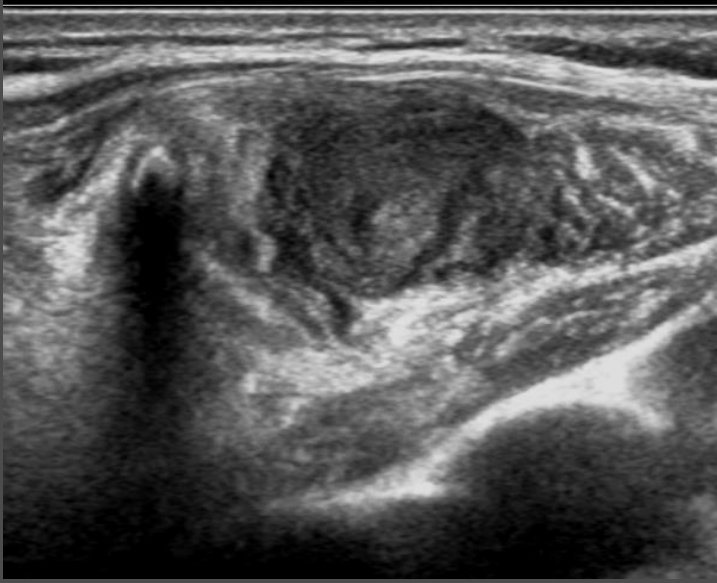
Expanding haematoma



Comparable MR images

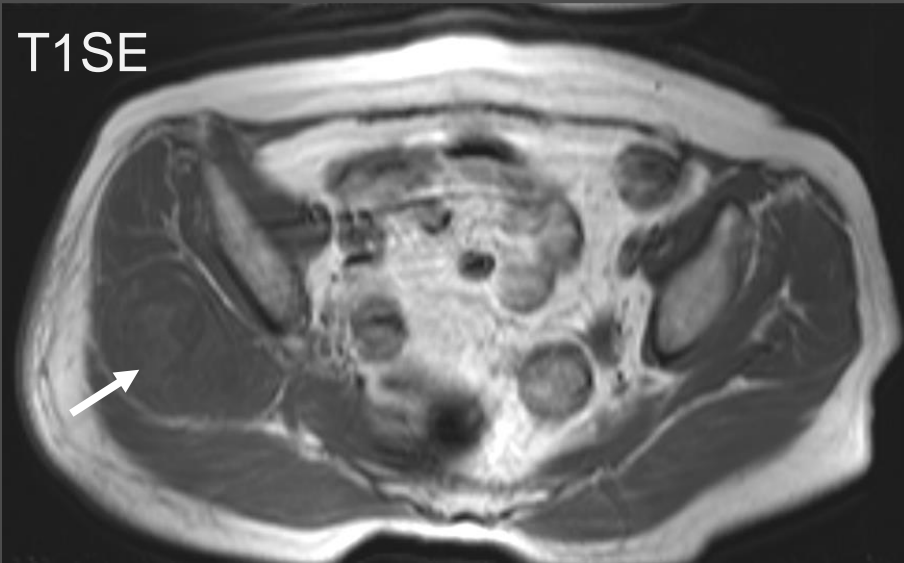


Healing muscle tear



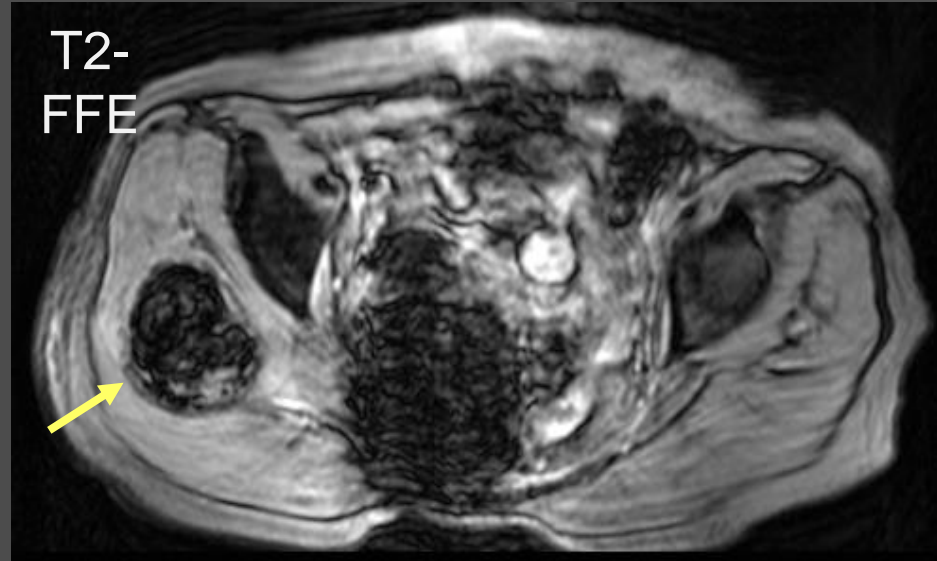
Sarcoma vs Mimic

T1SE



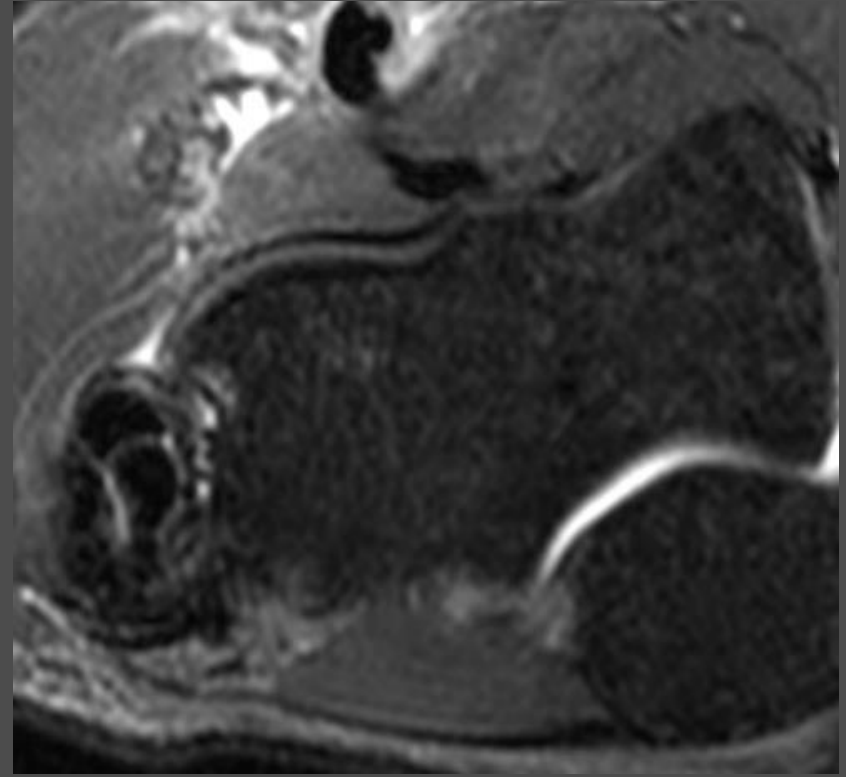
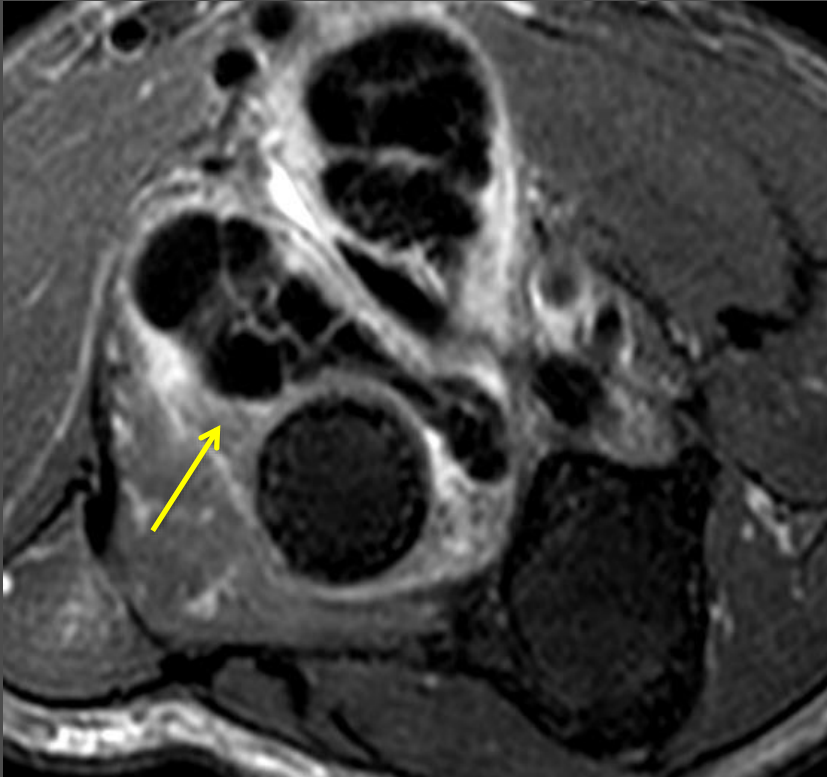
? gluteal STS

T2-
FFE

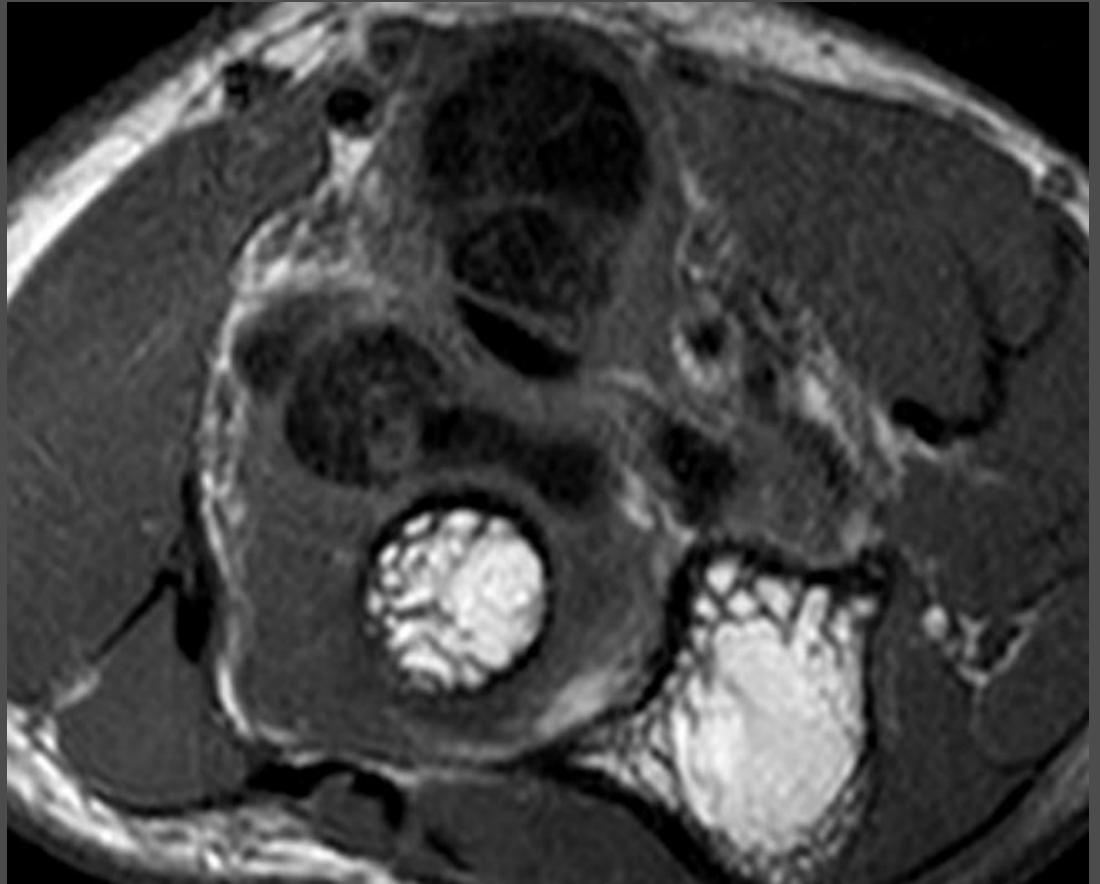


Gluteal haematoma

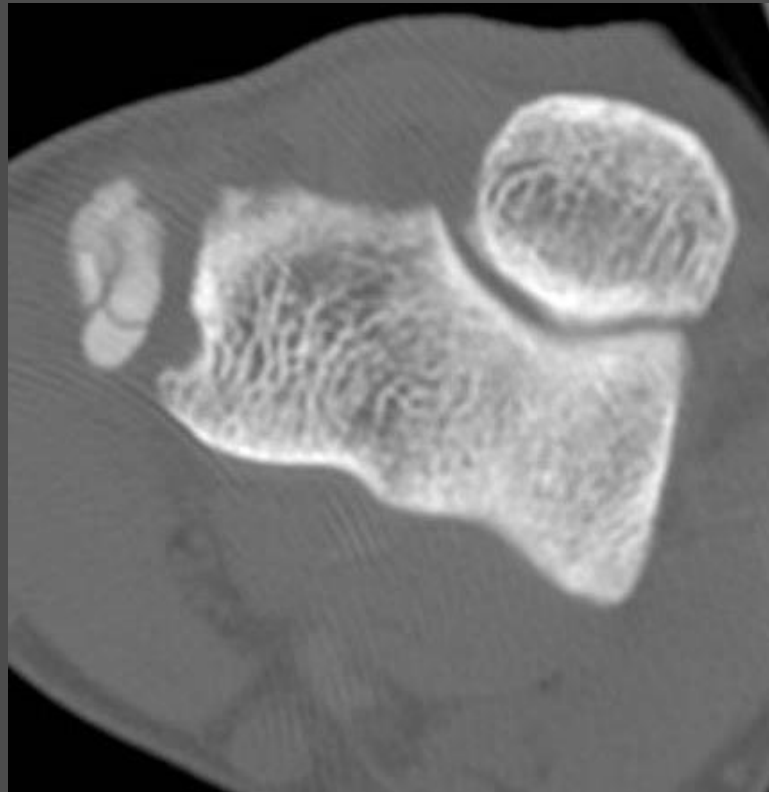
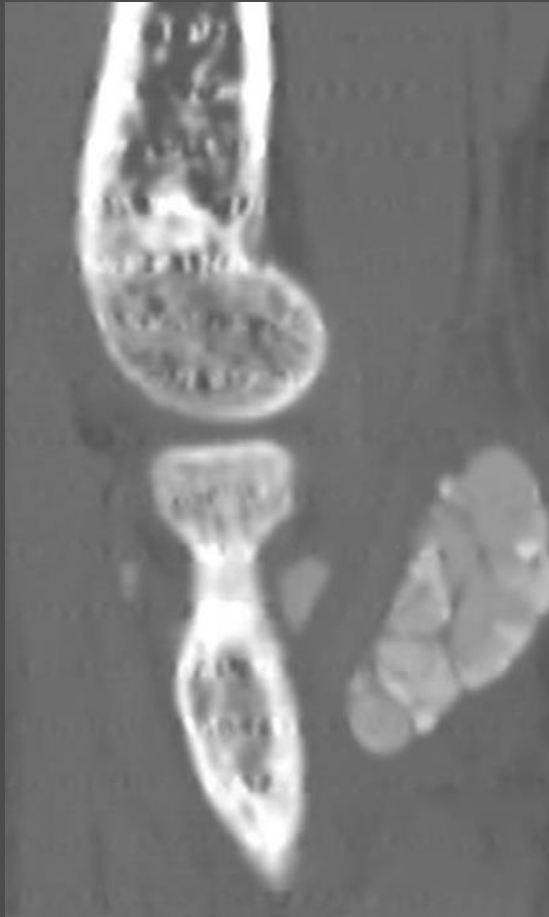
Elbow mass ? Sarcoma



Elbow mass ? Sarcoma



Tumoral calcinosis

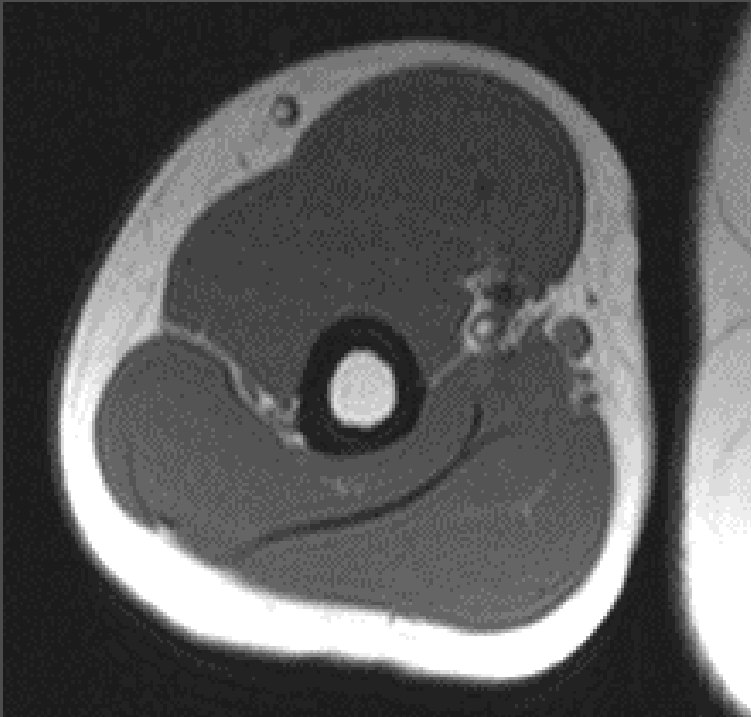


Minic



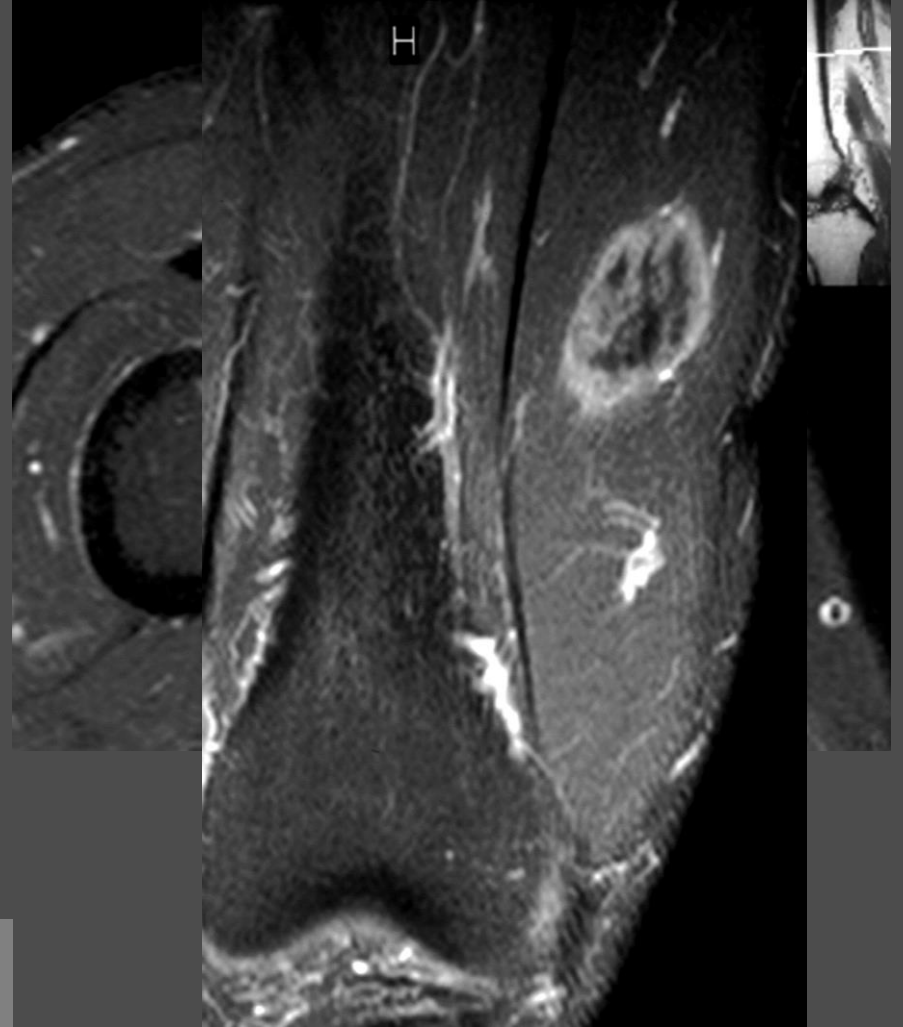
Accessory popliteus muscle

Minic



Healing tear / contusion

Minic



Chronic tear vasta lateralis

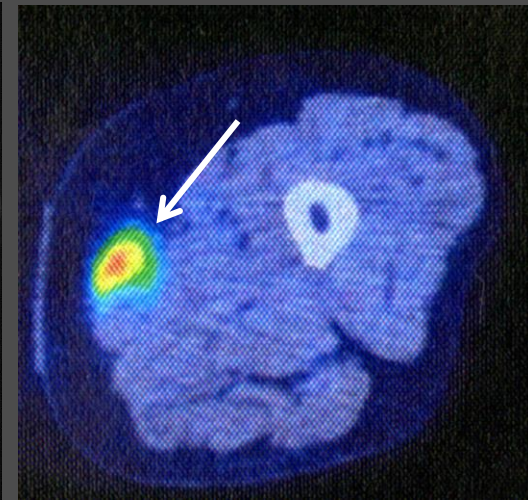
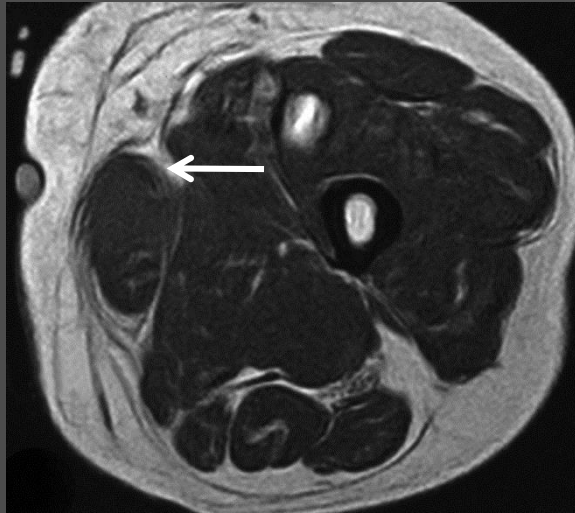
Minic



Chronic haematoma



Minic

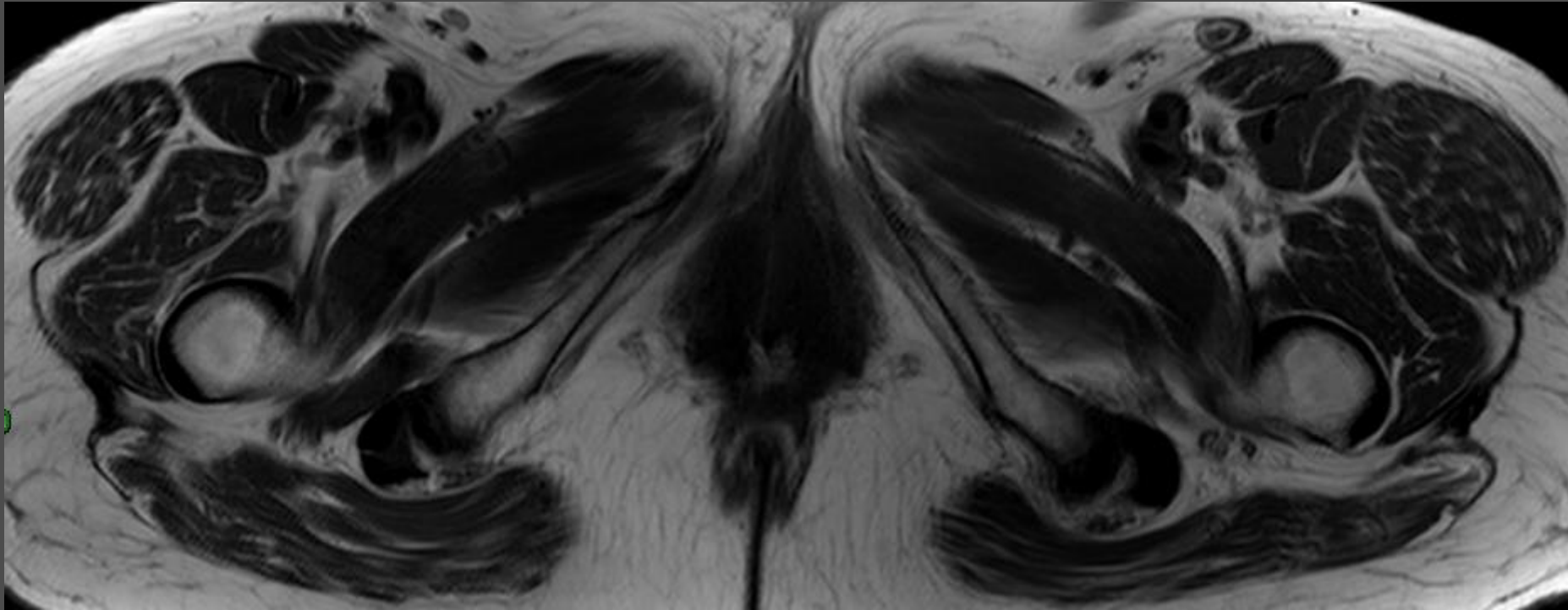


SUV = 4.4

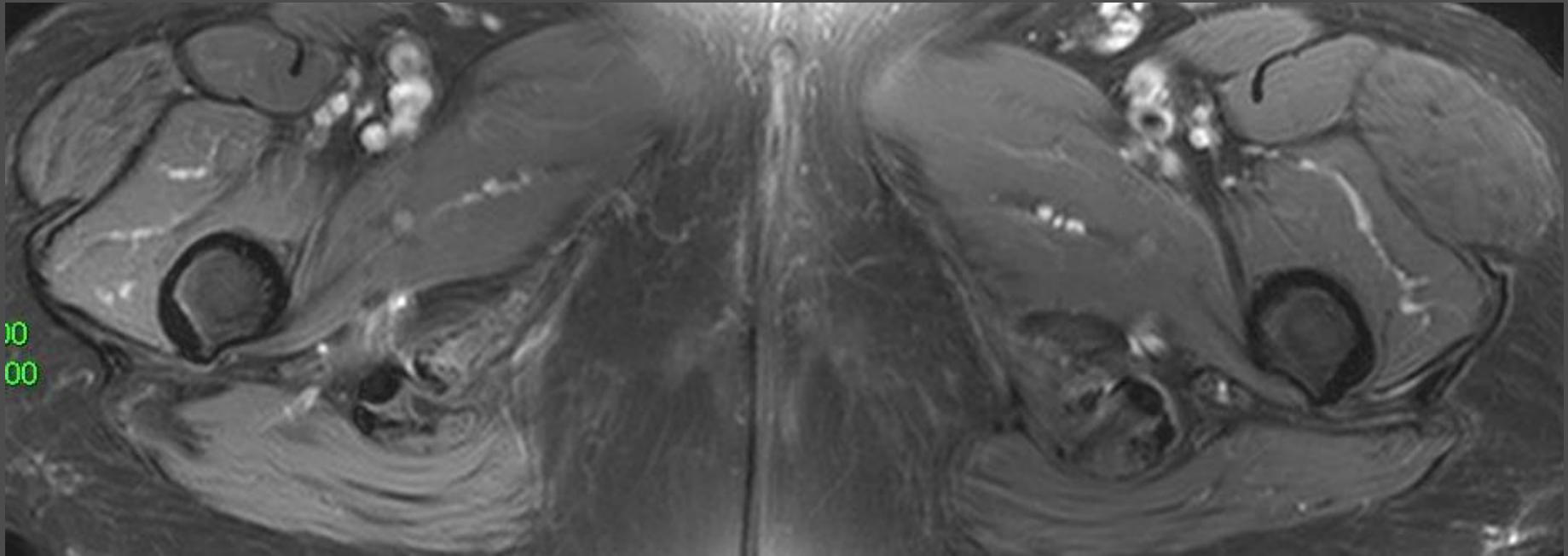
? Muscle sarcoma

Eventual diagnosis =
healing muscle tear

Left thigh mass ? Sarcoma

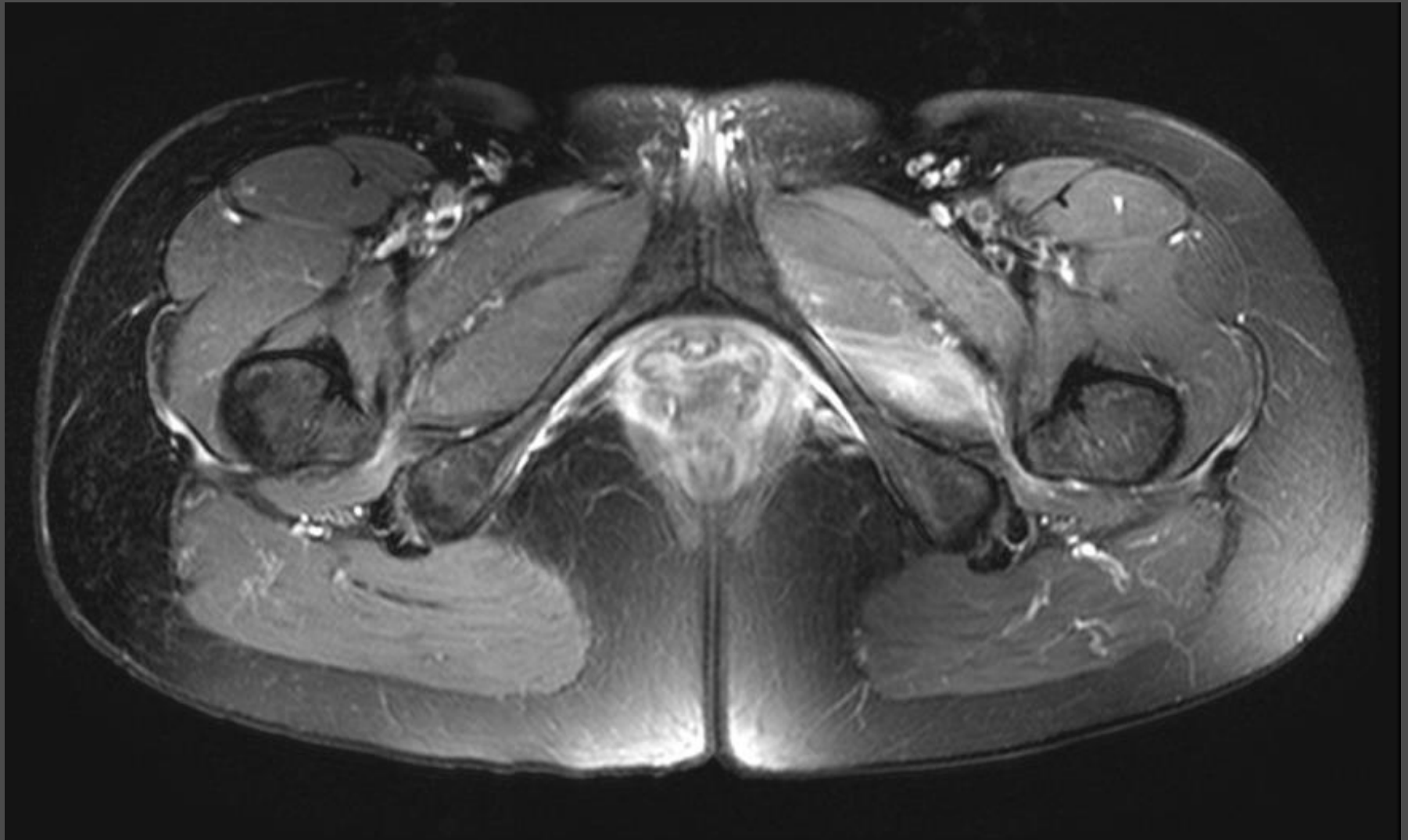


Left thigh mass ? Sarcoma

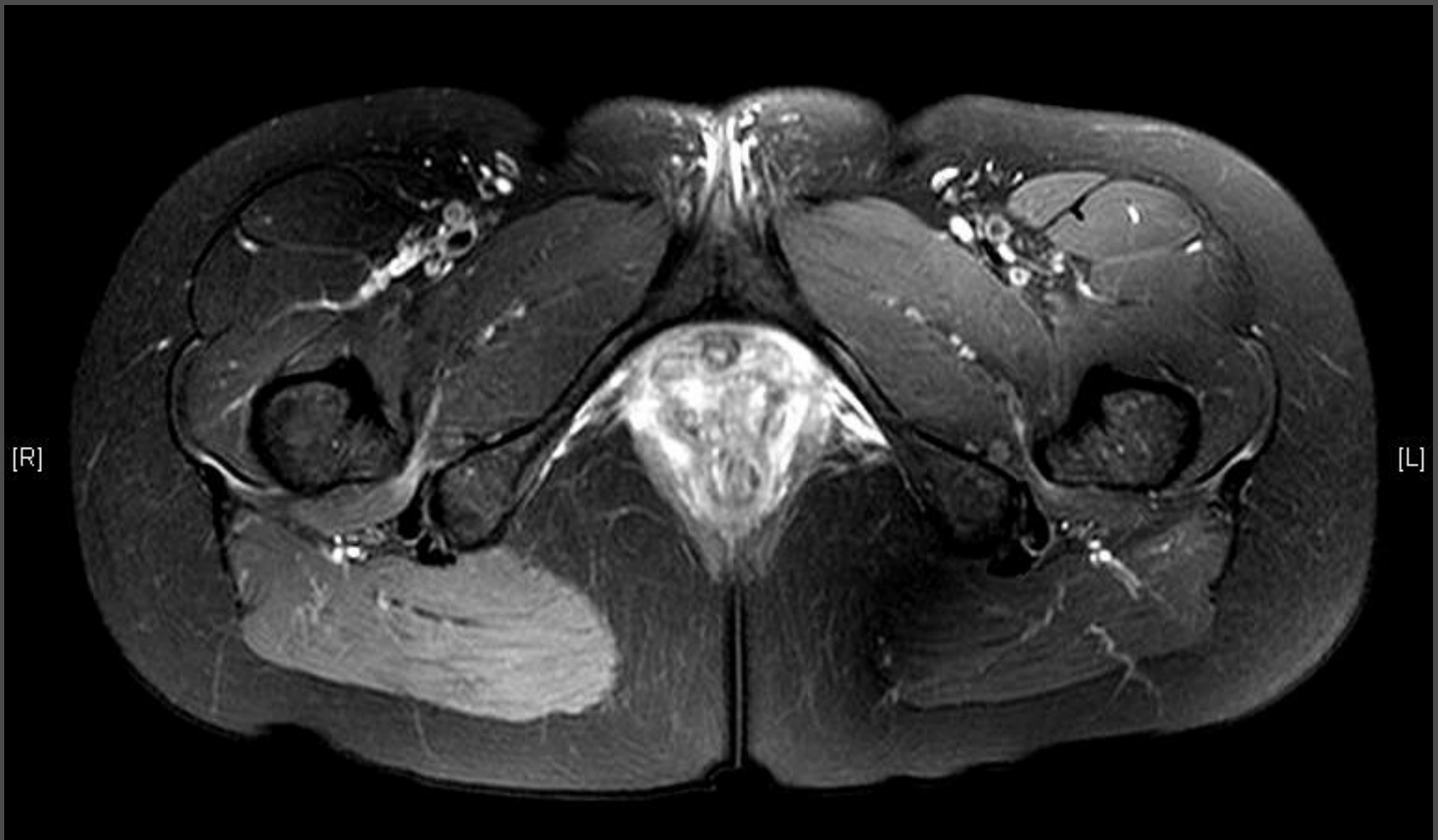


Hypertrophy tensor fascial lata muscle

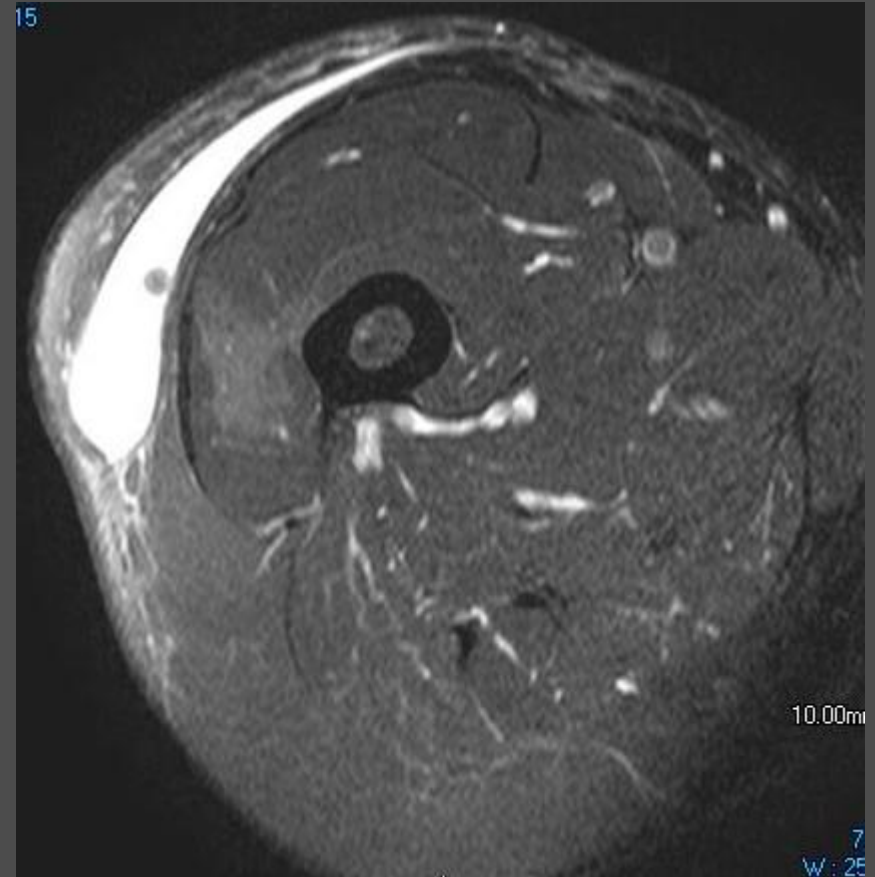
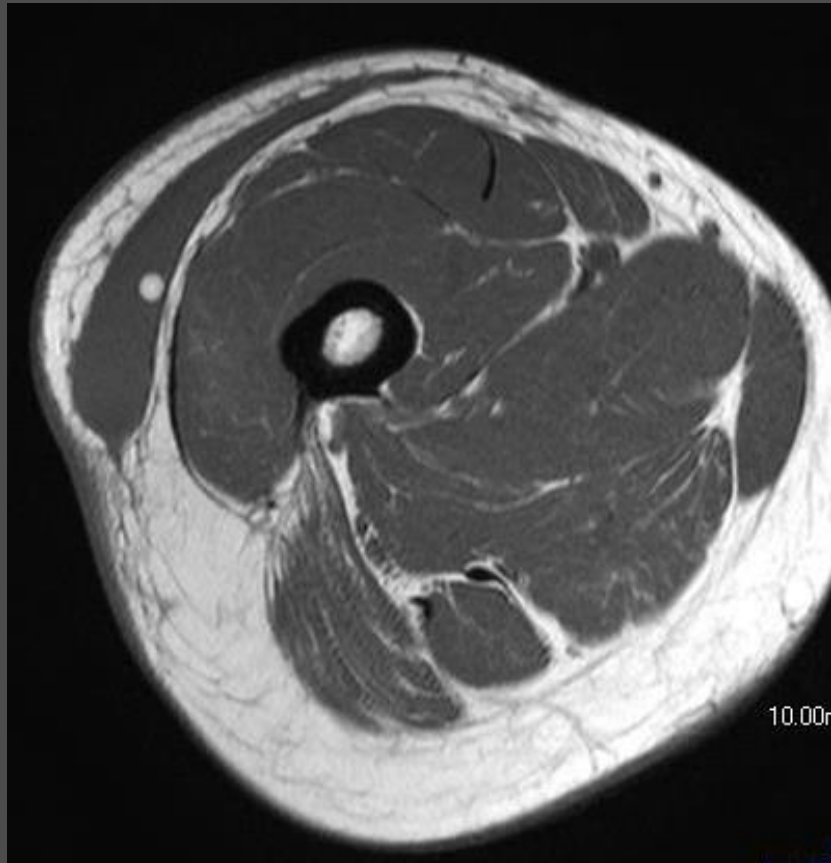
27-year old female/ left hip pain



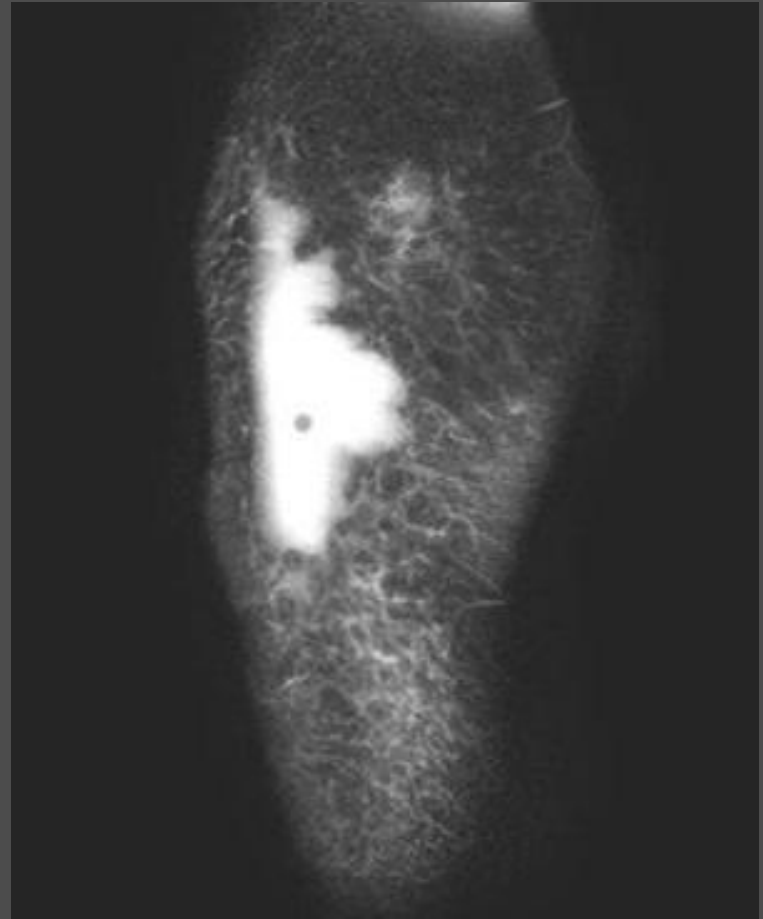
Follow-up MRI 6 months later



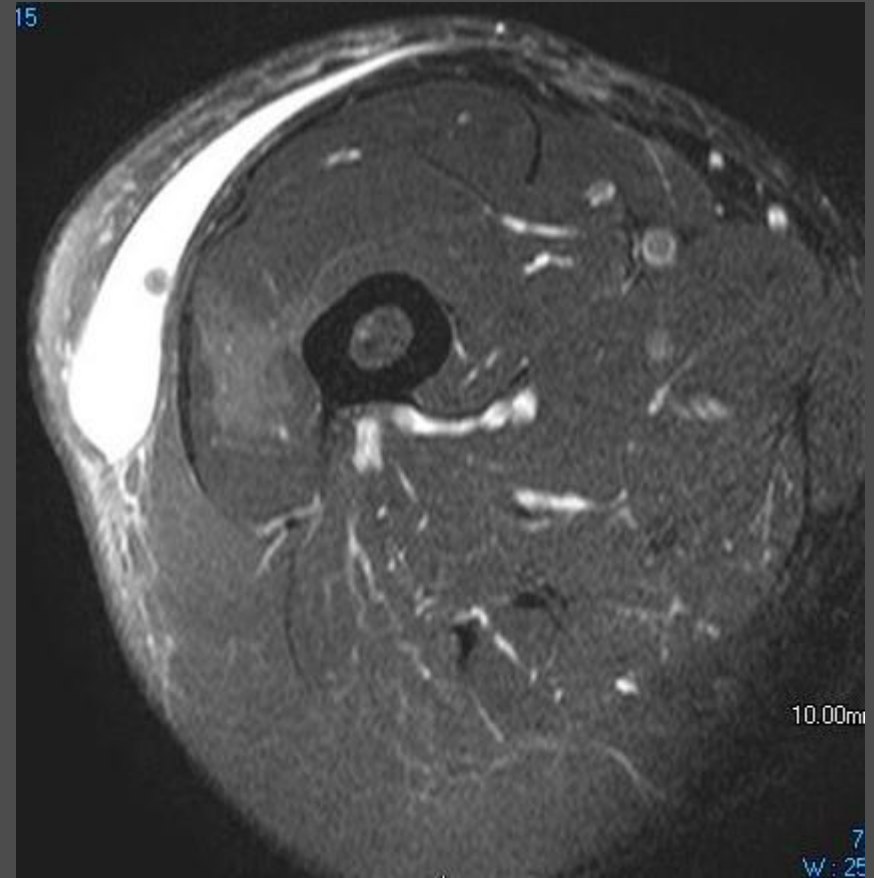
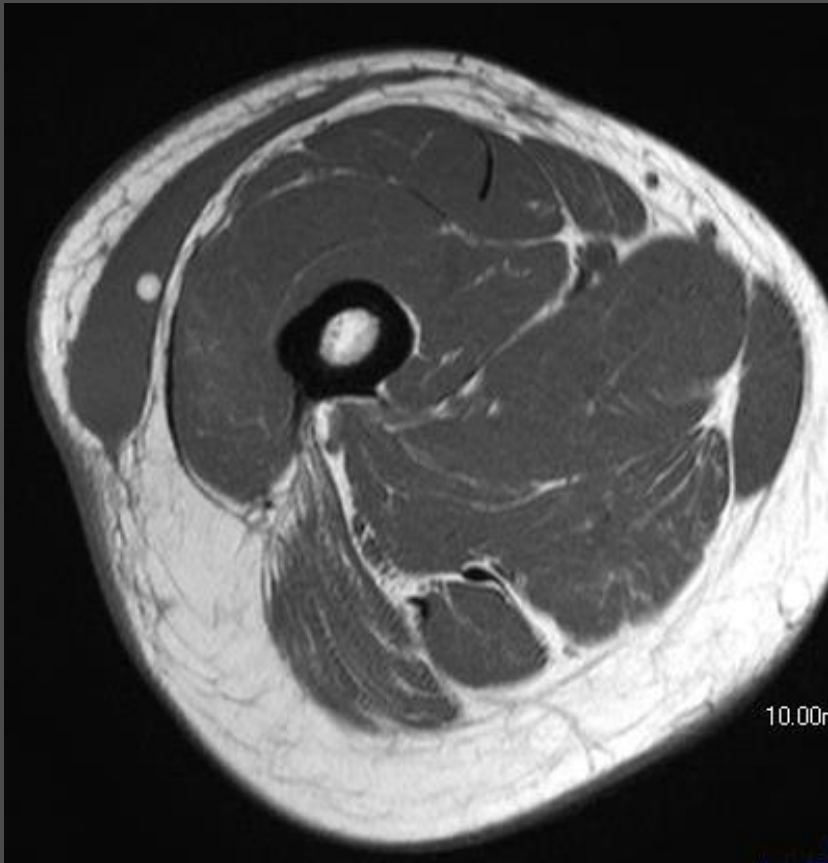
31-year old lateral thigh swelling ? sarcoma



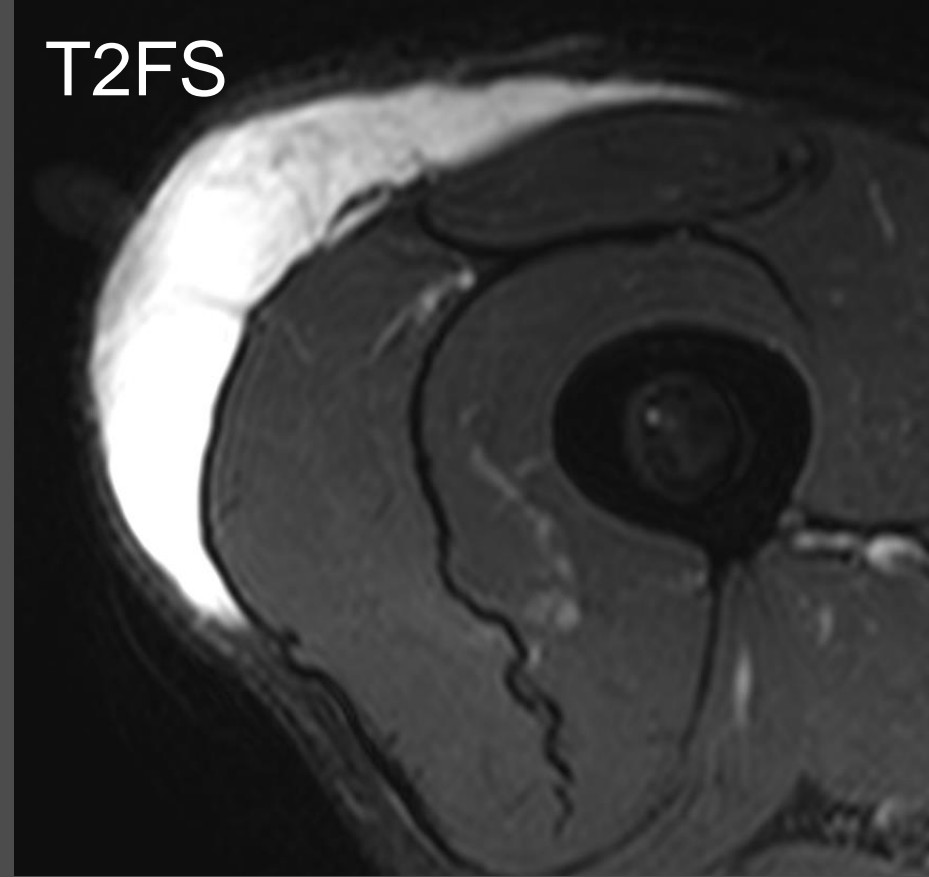
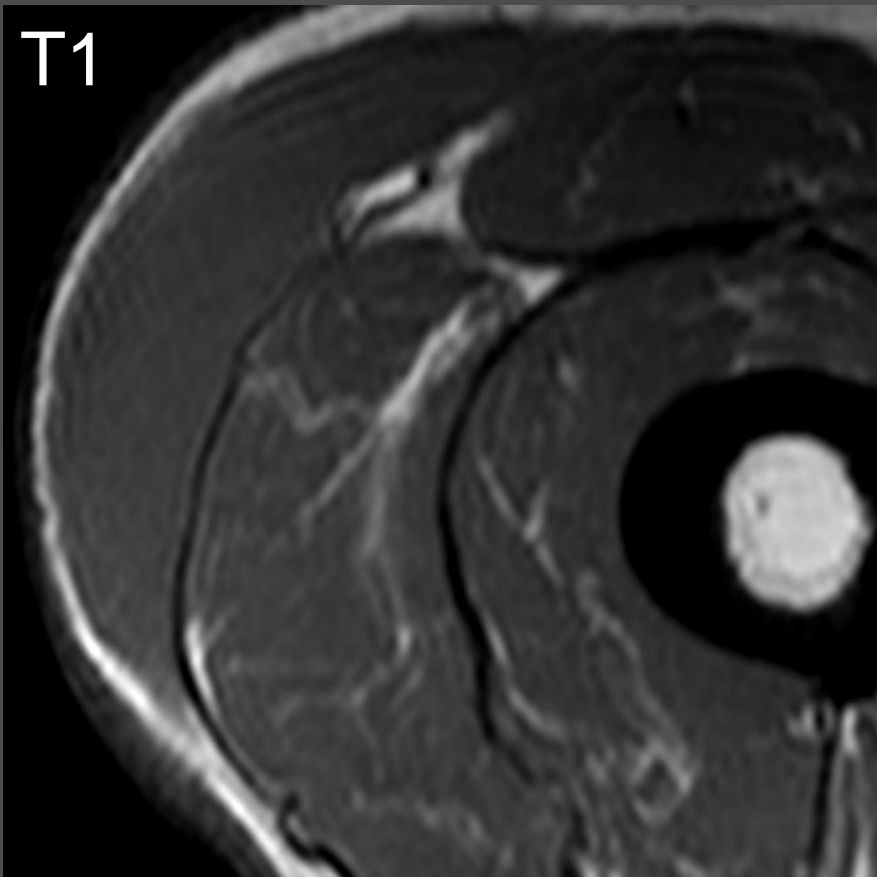
31-year old lateral thigh swelling ? sarcoma



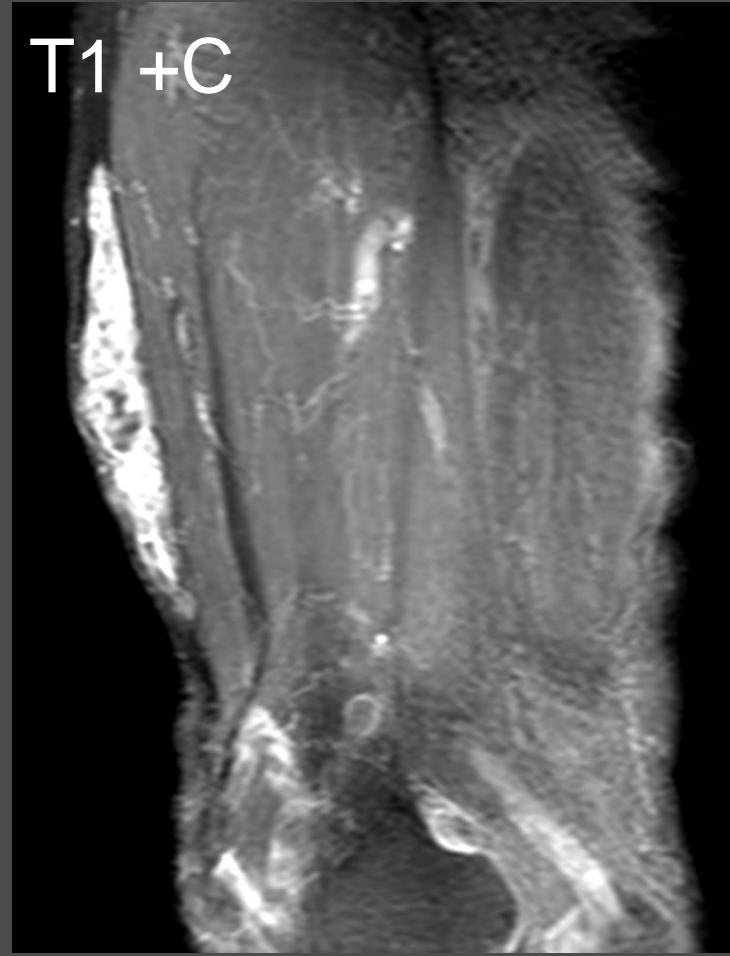
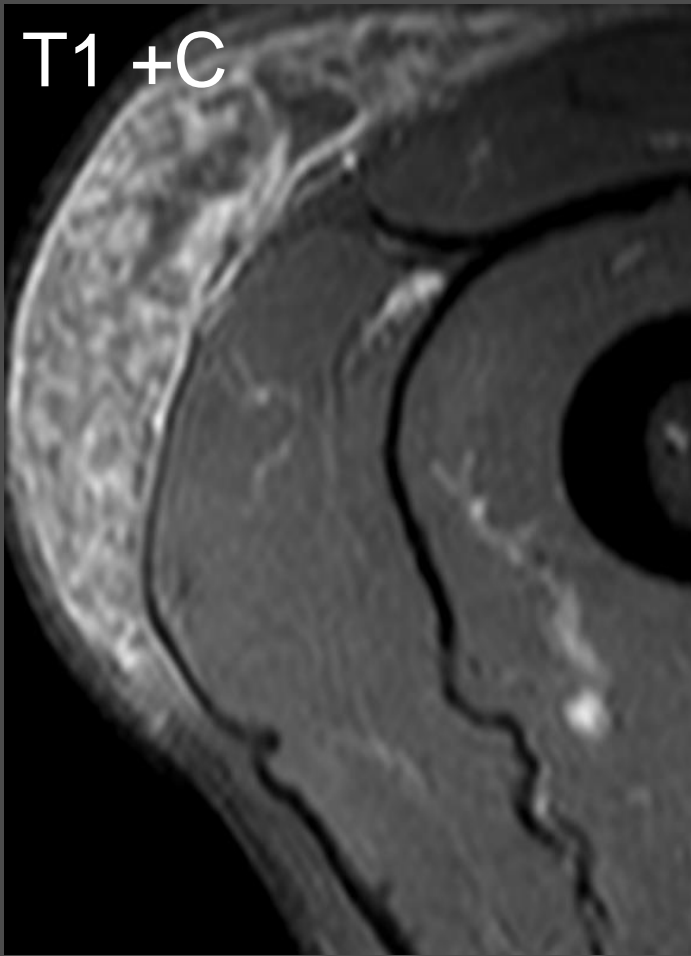
Morel-Lavellee lesion (shear injury)



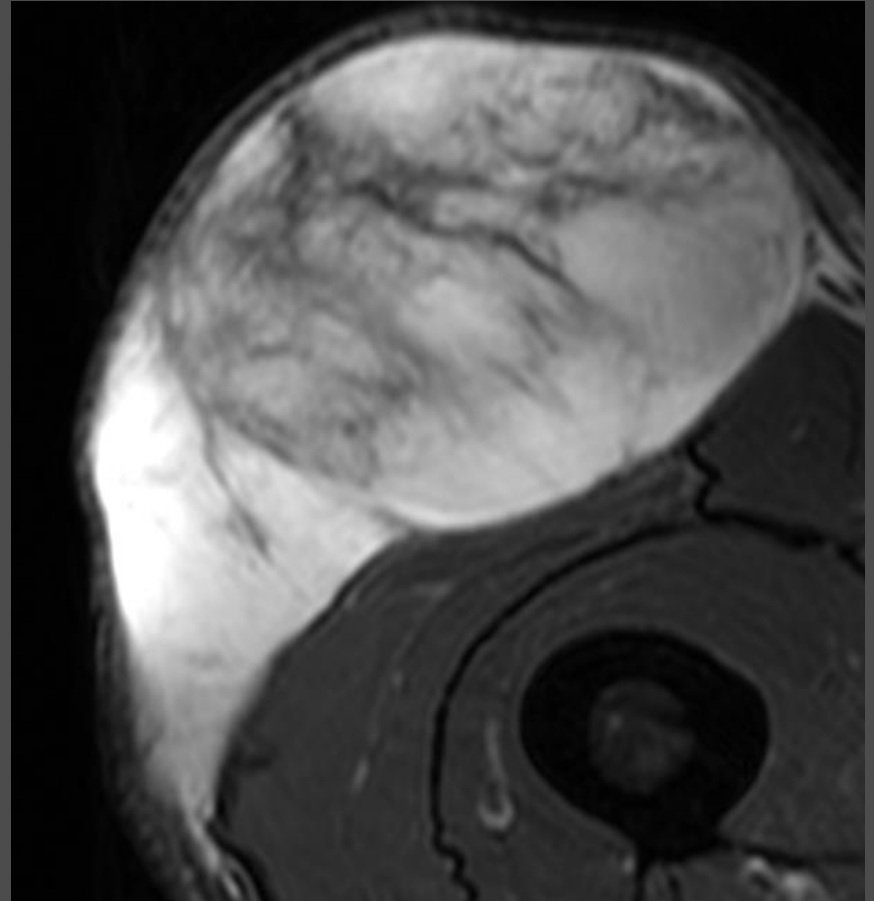
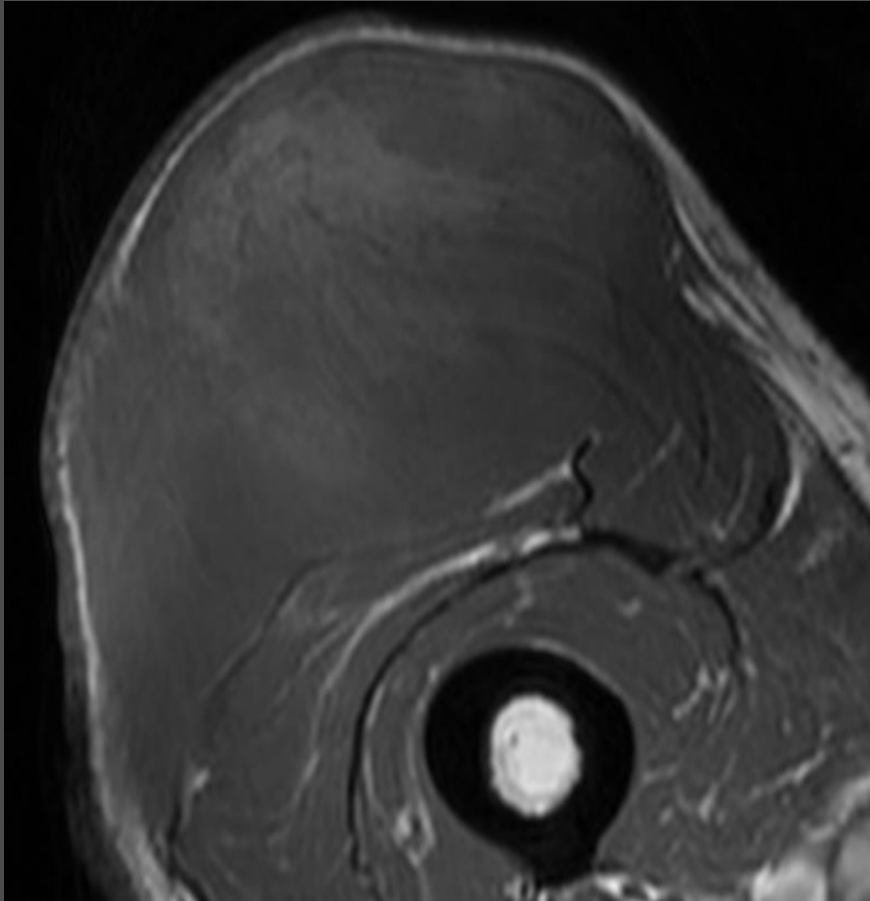
Subcutaneous tumour



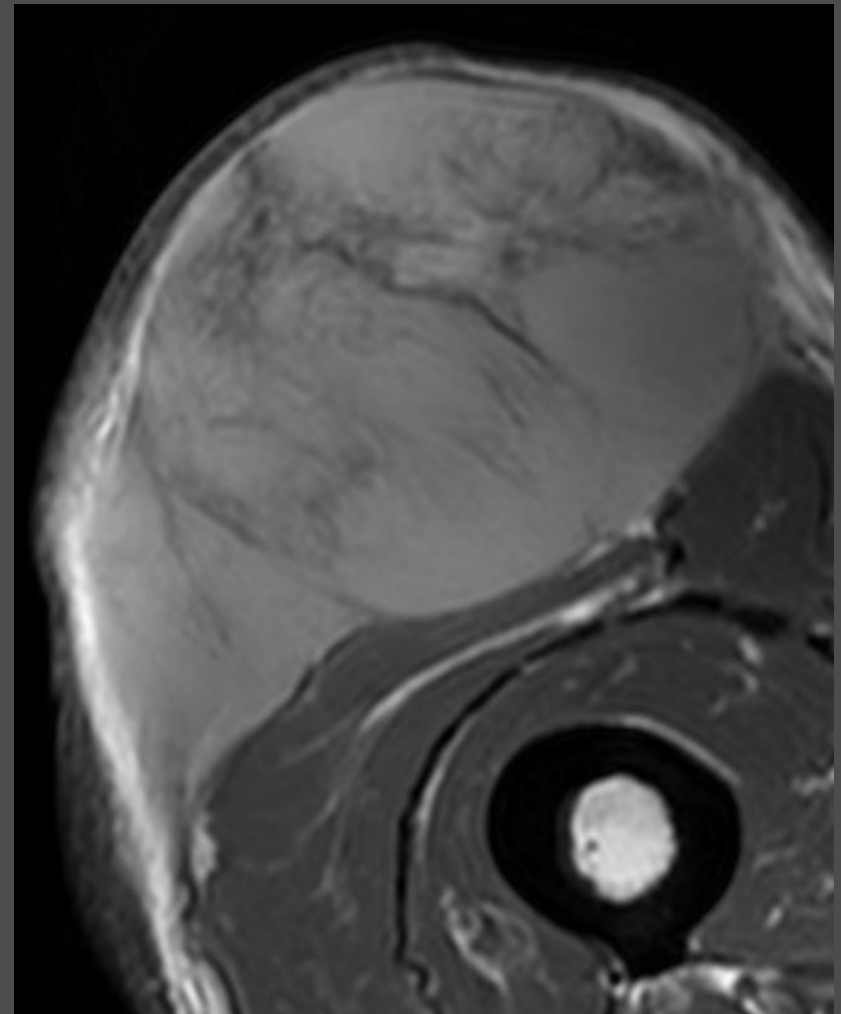
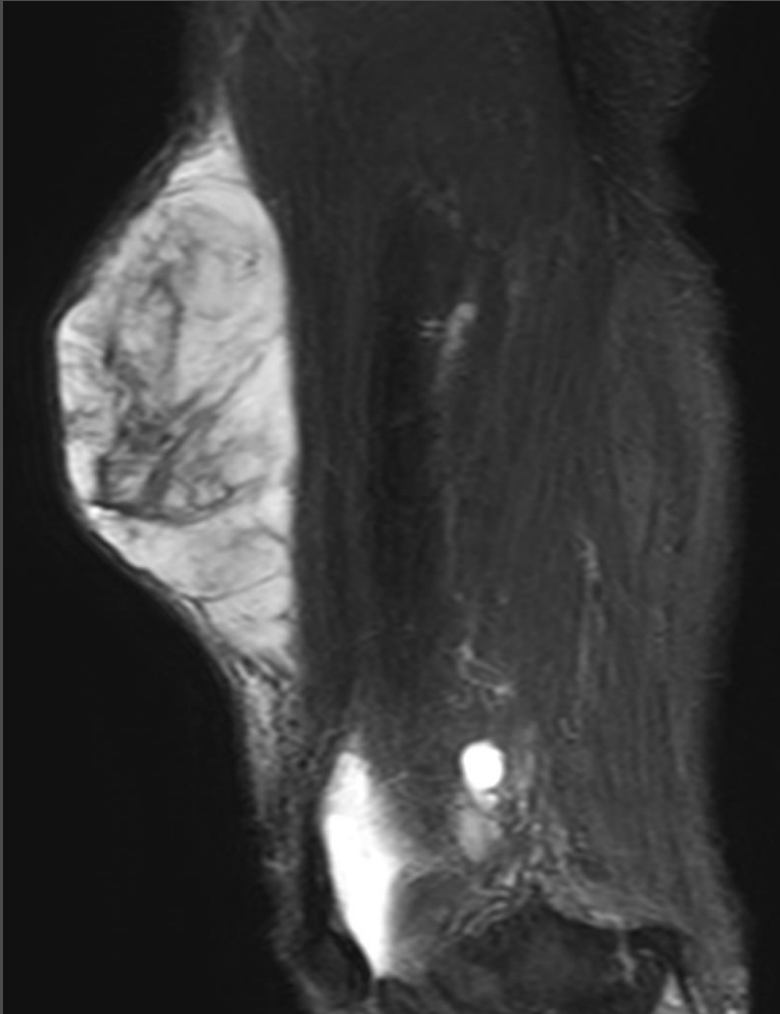
Subcutaneous tumour



Two years later



Two years later



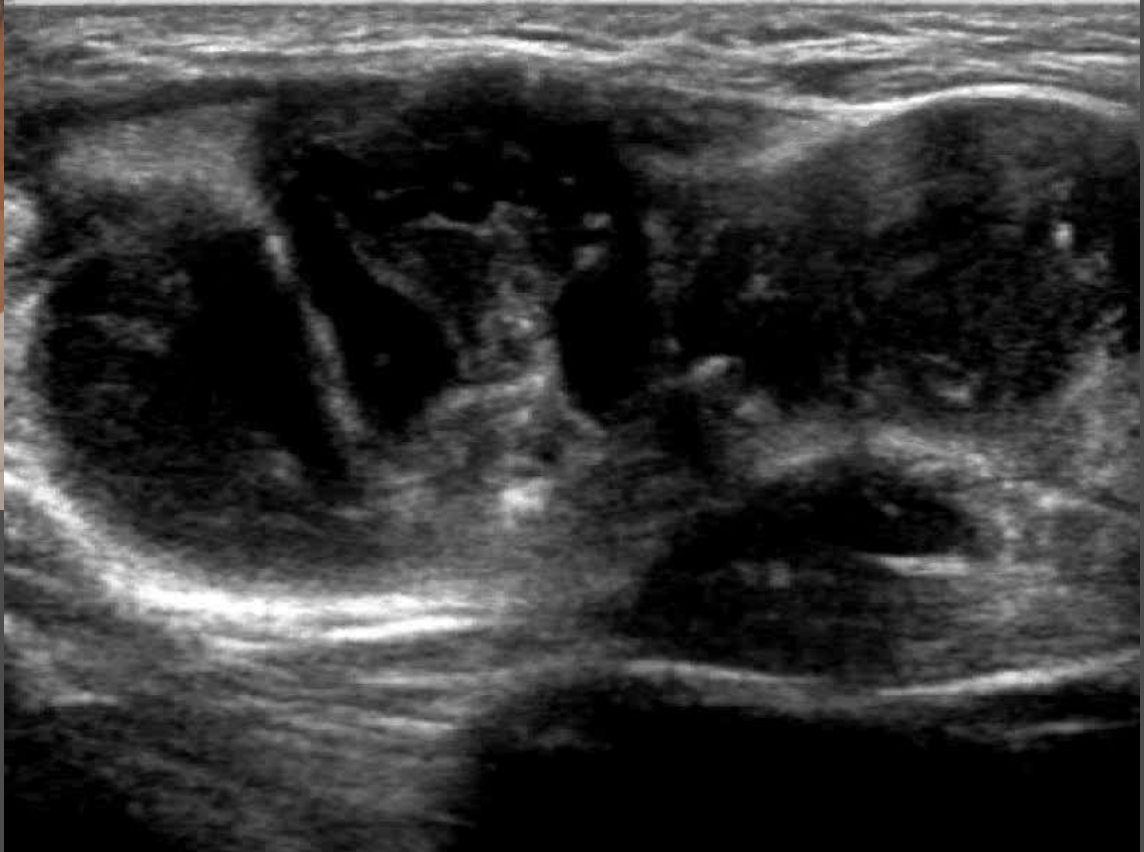
Pleomorphic Hyalinizing Angiectatic Tumor

- rare mesenchymal tumor
- Locally aggressive
- considered low malignant potential
- subcutaneous / extremities
- extension along fascial planes
- treatment of choice wide local excision

Neoplastic mimicking non-neoplastic

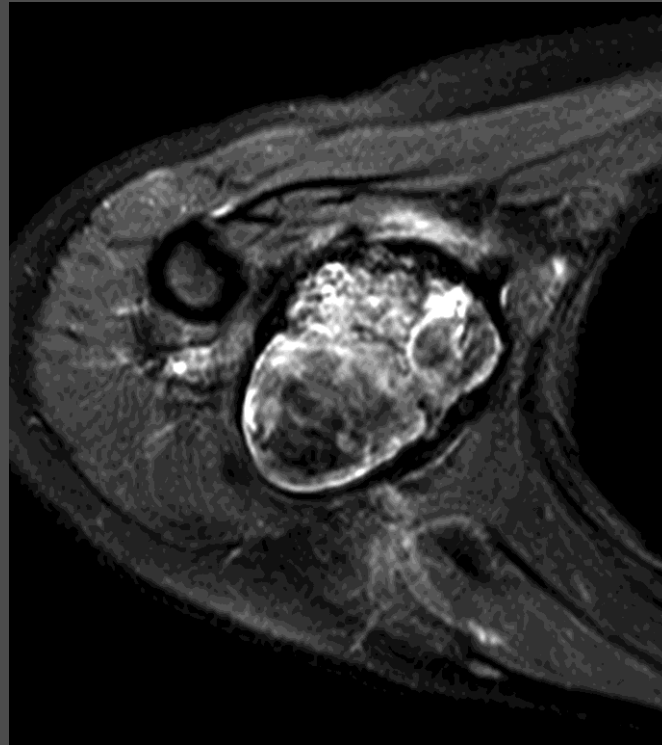
- Myxoid liposarcoma
- Haemorrhagic tumour
- Myxofibrosarcoma

Hemorrhagic tumour



Thought to be vascular malformation
Biopsy consistent with expanding haematoma

Hemorrhagic tumour



? Expanding
haematoma with
underlying
vascular
malformation

Excision → angiomatoid malignant fibrous histiocytoma

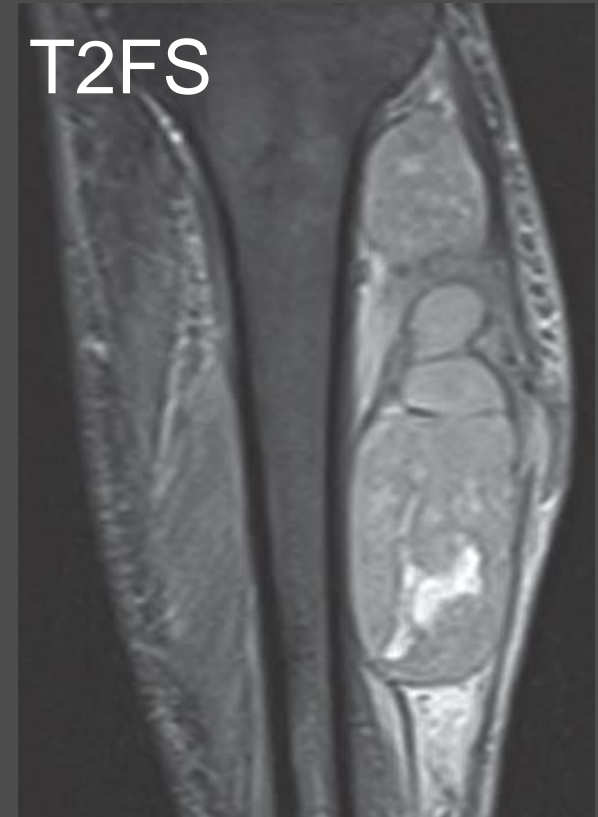
79-yr-old female with #NOF



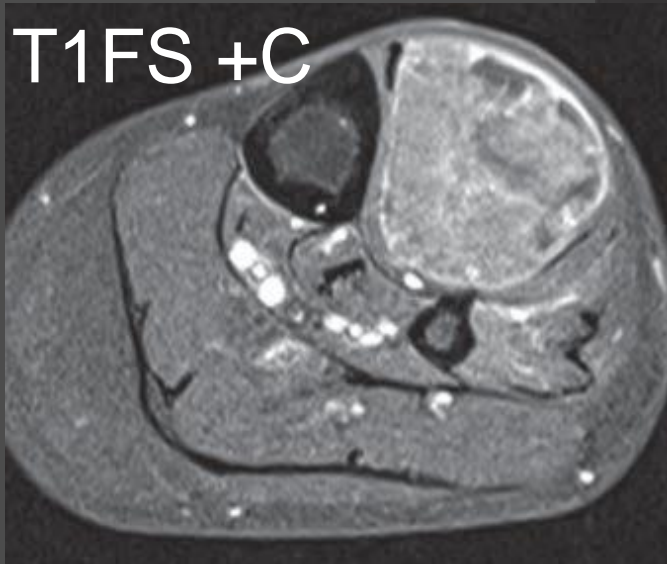
T1



T2FS



T1FS +C

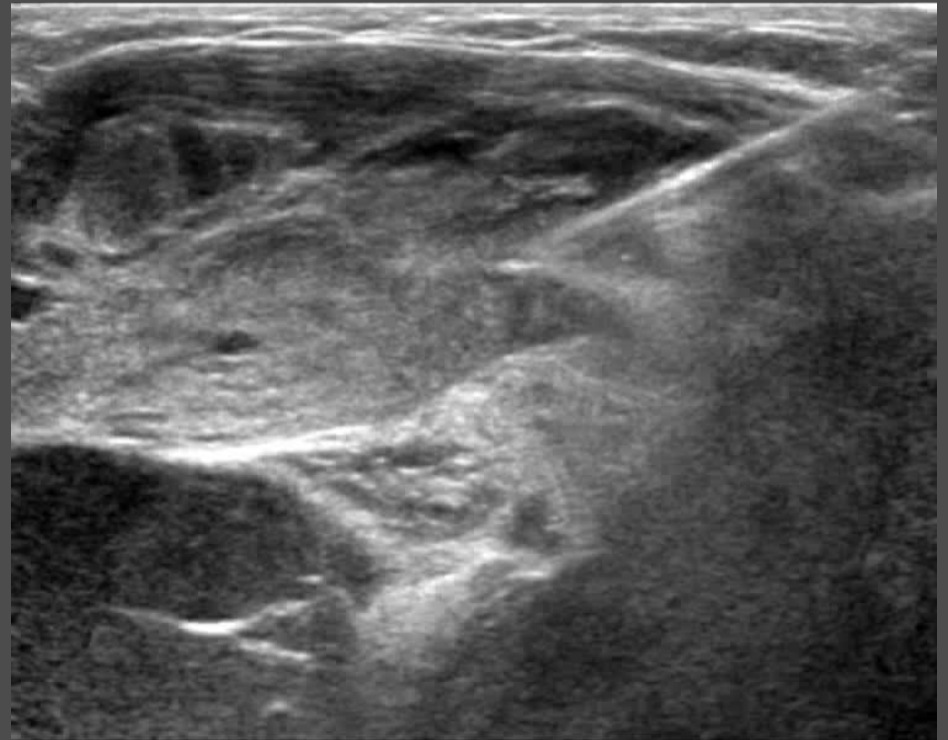
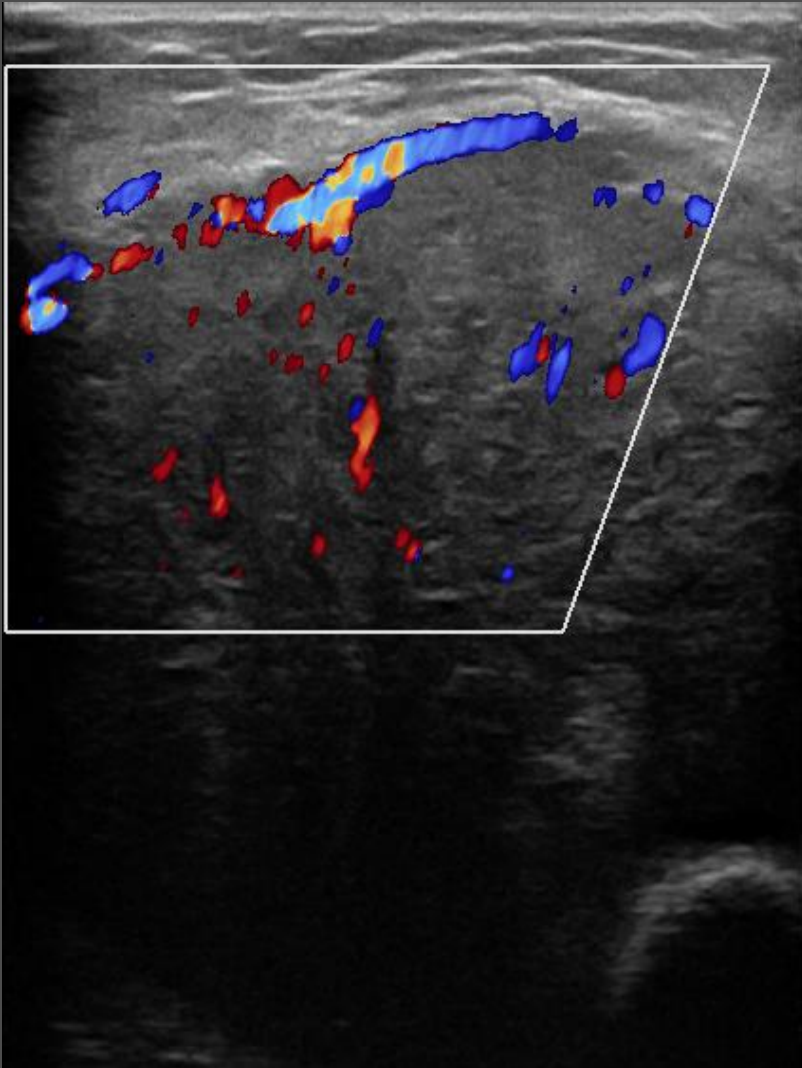


Undifferentiated
pleomorphic sarcoma

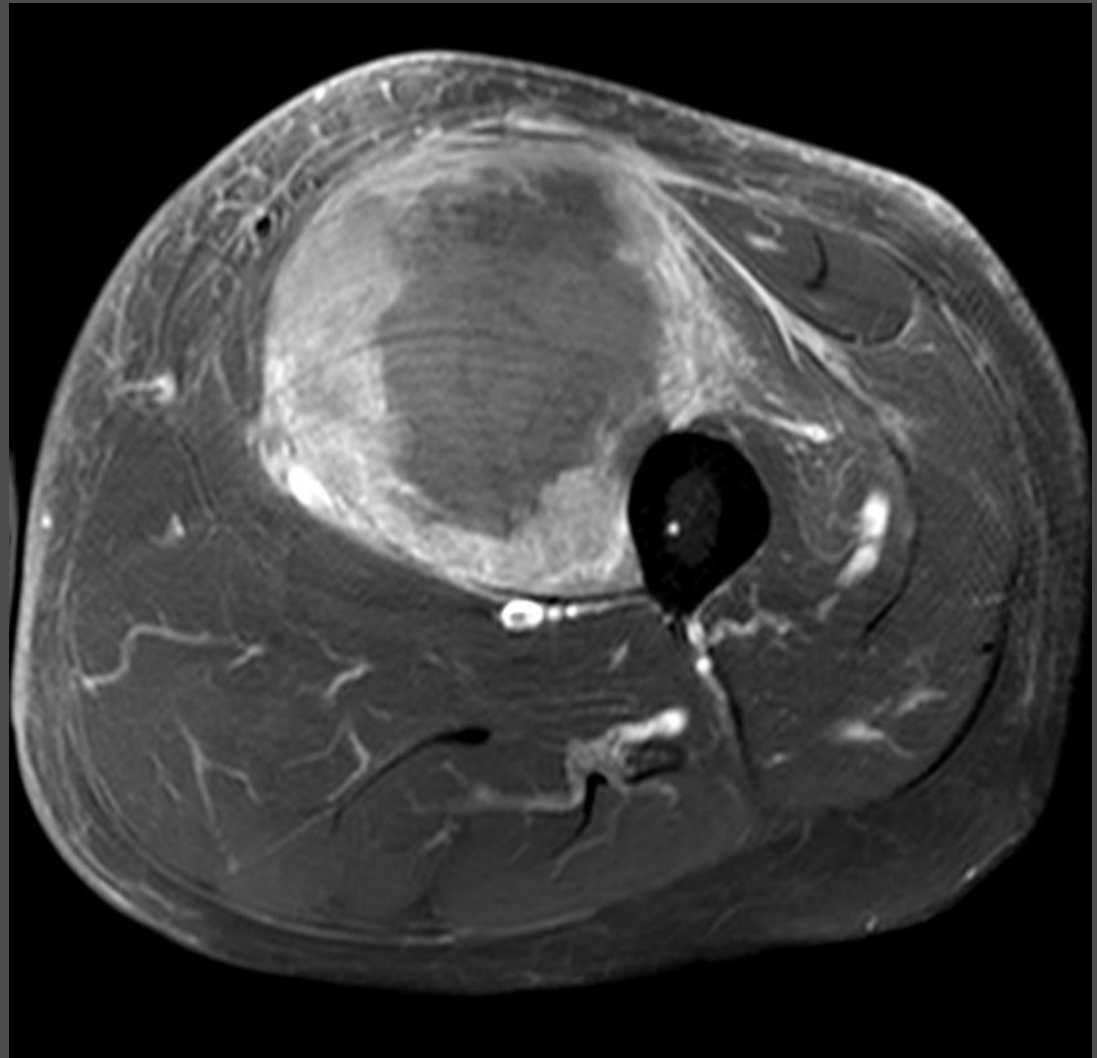
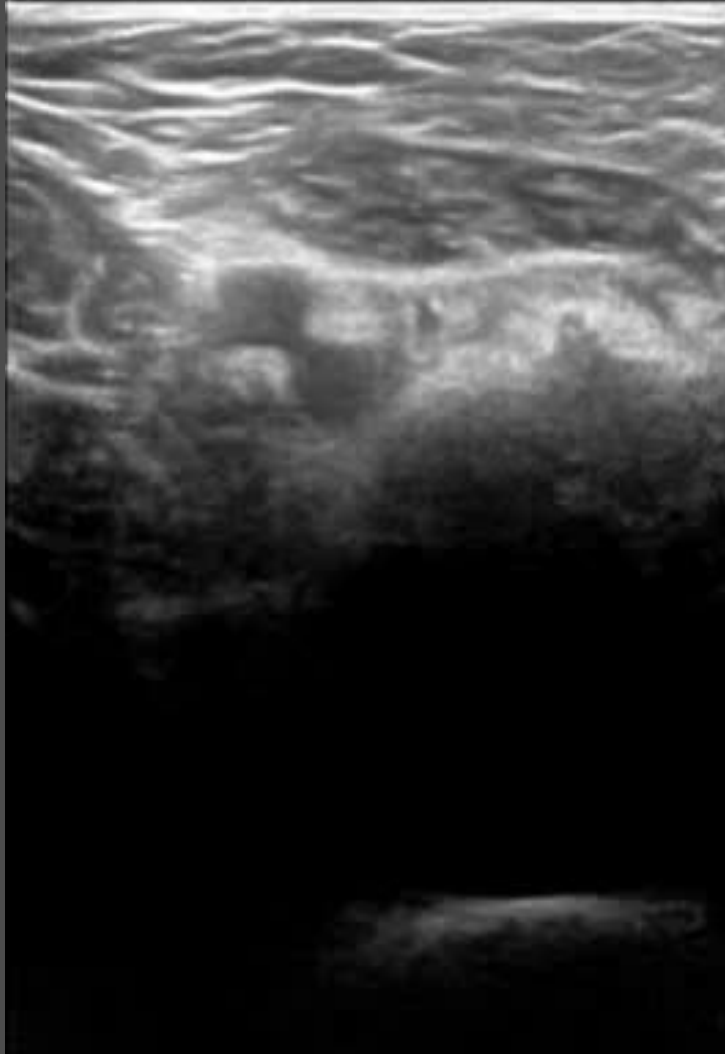
Reaching a diagnosis

- HISTORY
- LOCATION
- SPECIFIC IMAGING FINDINGS.
- Does it require biopsy?
- BIOPSY (most vascular area, most suspicious part)

Biopsy ST tumour margins and hyperaemic areas



Biopsy ST tumour margins



Soft Tissue Sarcoma

Mesenchymal Origin (WHO STS 2002)

Fibrous

Fatty

Smooth muscle

Fibrohistiocytic

Chondro-osseous

Vascular

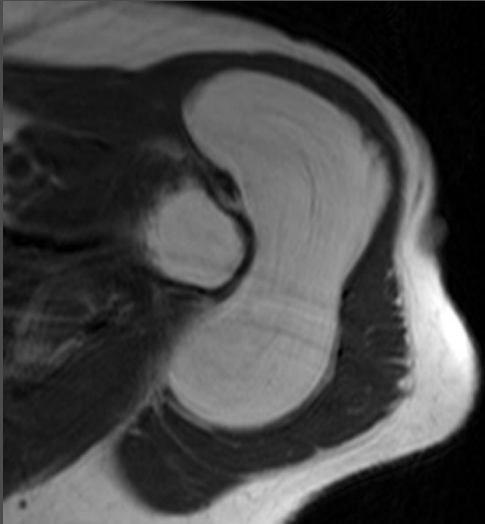
Skeletal muscle

Uncertain differentiation

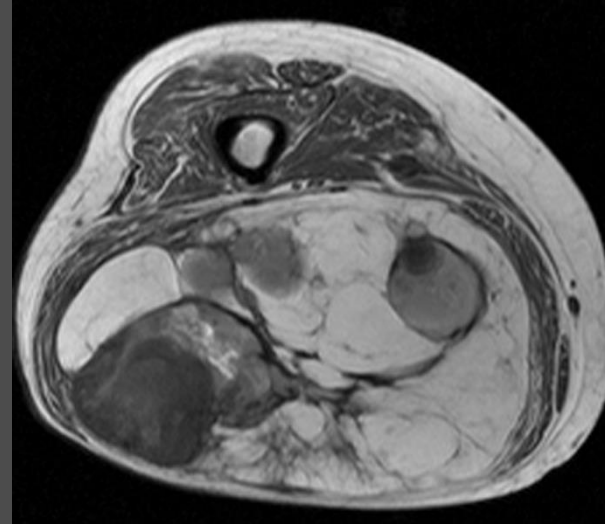
Liposarcoma

- Well-differentiated
- Myxoid (thigh, <25% fat, high metastatic potential)
- Round cell (high grade)
- Pleomorphic (high grade, elderly, periphery)
- Dedifferentiated (high grade, > in recurrence)

Lipoma vs liposarcoma



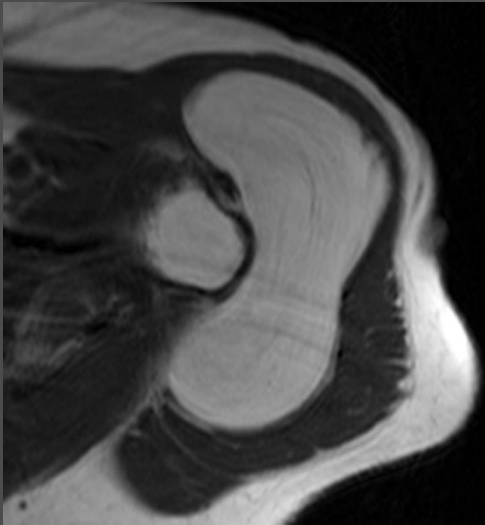
Lipoma



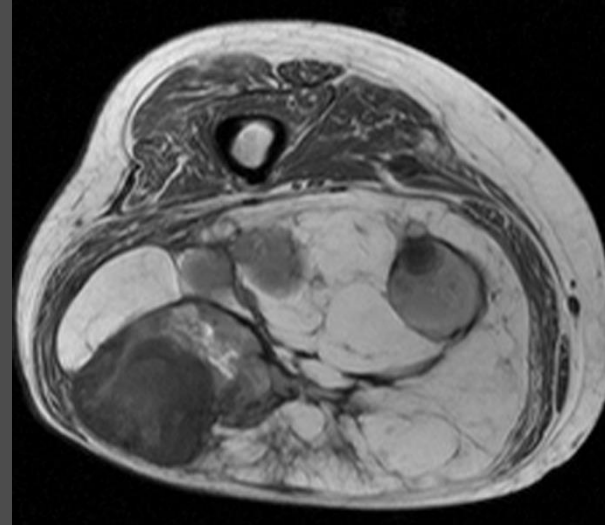
Liposarcoma

- $> 10\text{cm}$
- thick ($>2\text{mm}$) septa
- Nodular non-fatty areas
- $> 25\%$ non-fatty component
- Foci of T2-hyperintensity
- Enhancing areas

Lipoma vs liposarcoma



Lipoma

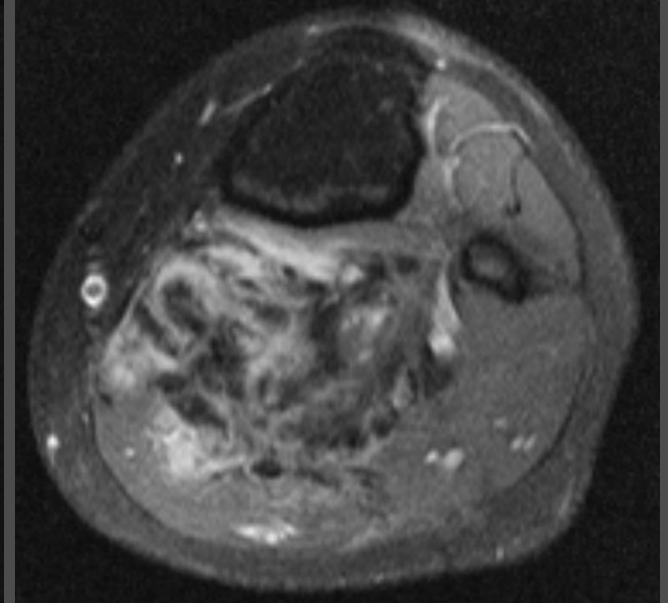


Liposarcoma

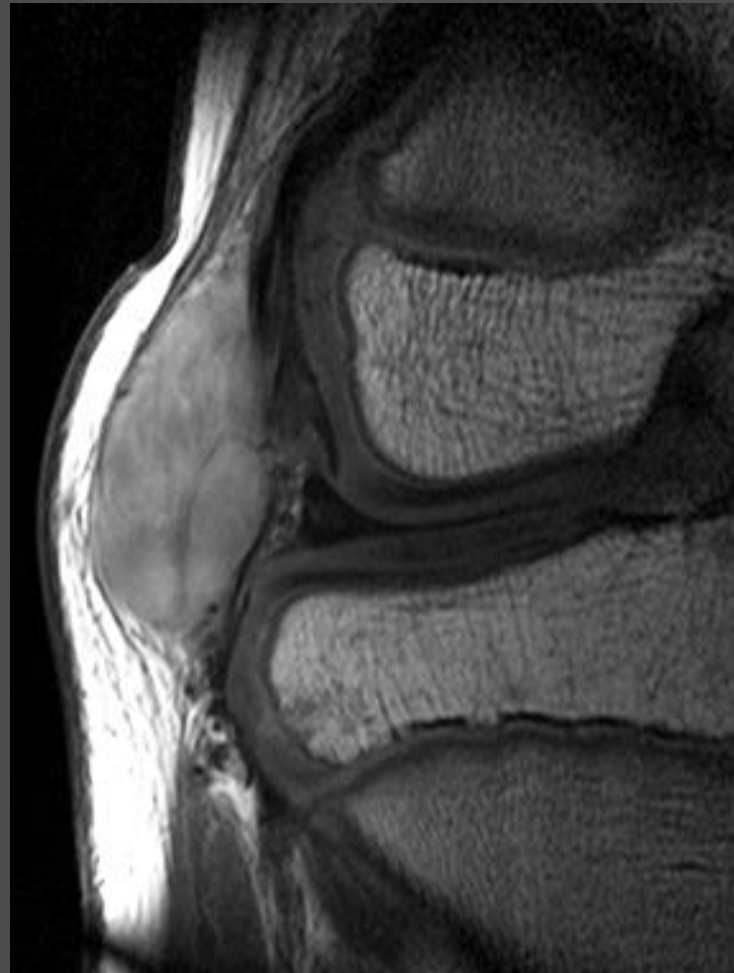
- Radiologists correctly call nearly all liposarcomas
- Over-call many atypical lipoma as liposarcoma
(fat necrosis, calcification, myxoid tissue within lipoma)
- Relevant since biopsy often uncertain

Desmoid tumour / Aggressive fibromatosis Desmoplastic fibroma

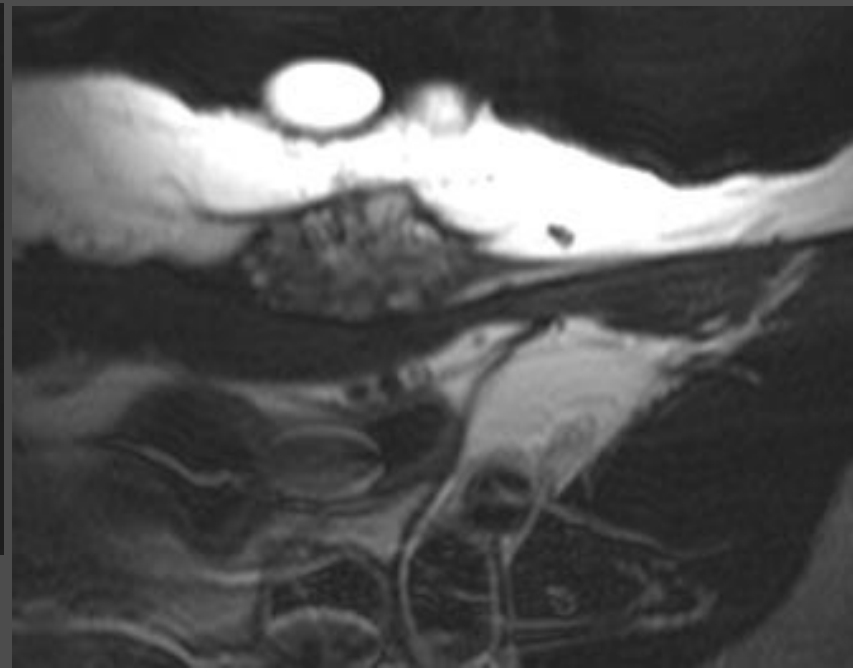
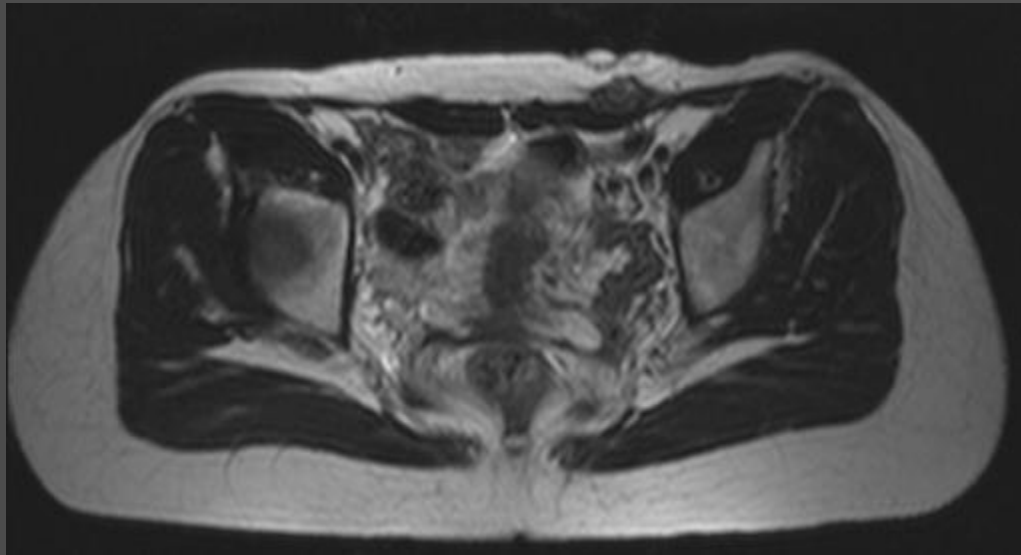
- Locally aggressive
- Usually infiltrative
- Scar tissue, aponeurotic tissue, rectus abdominus



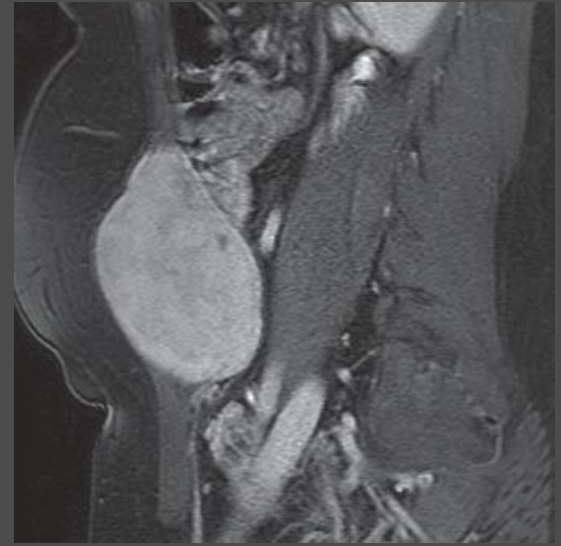
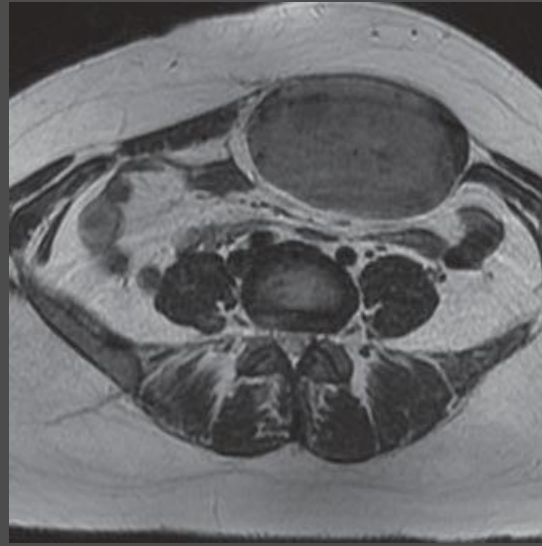
Desmoid tumour / Aggressive fibromatosis Desmoplastic fibroma



**Desmoid tumour / Aggressive fibromatosis
Desmoplastic fibroma**



Desmoid tumour / Aggressive fibromatosis Desmoplastic fibroma



Chemotherapy response fibromatosis

For most tumours:

↓ Size is the only criterion of response
MRS, DWI, DCEMRI not necessary

For fibromatosis:

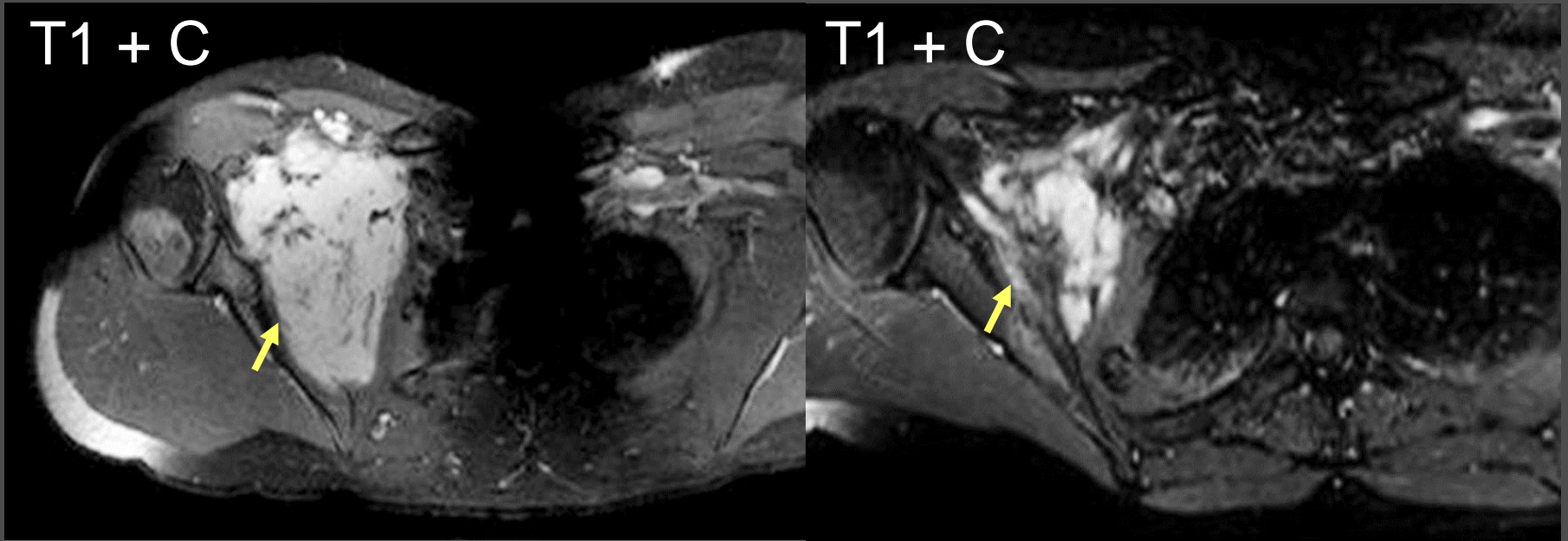
↓ Size

↓ T2-hyperintensity

↓ Enhancement

....are all markers of response

Fibromatosis : ↓ size

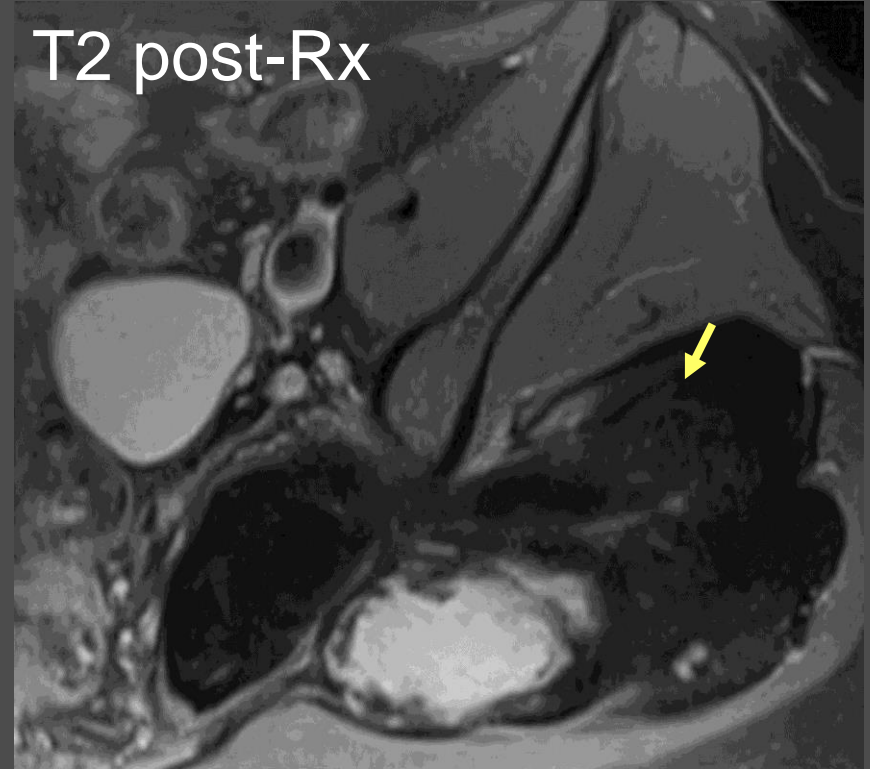


Pre-Rx

Post-Rx

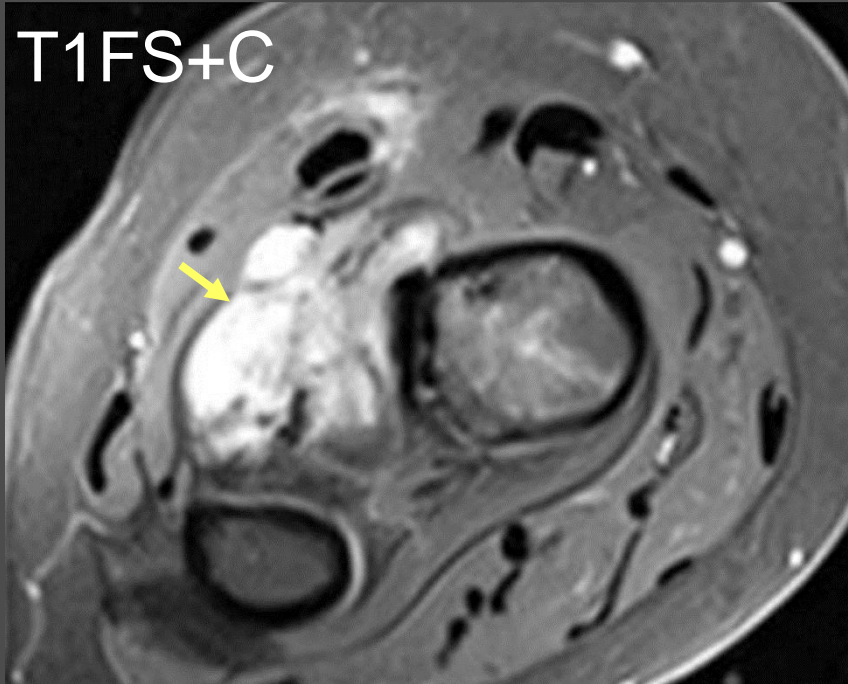
Rxd with methotrexate/vinblastine.

Fibromatosis ↓ T2-hyperintensity

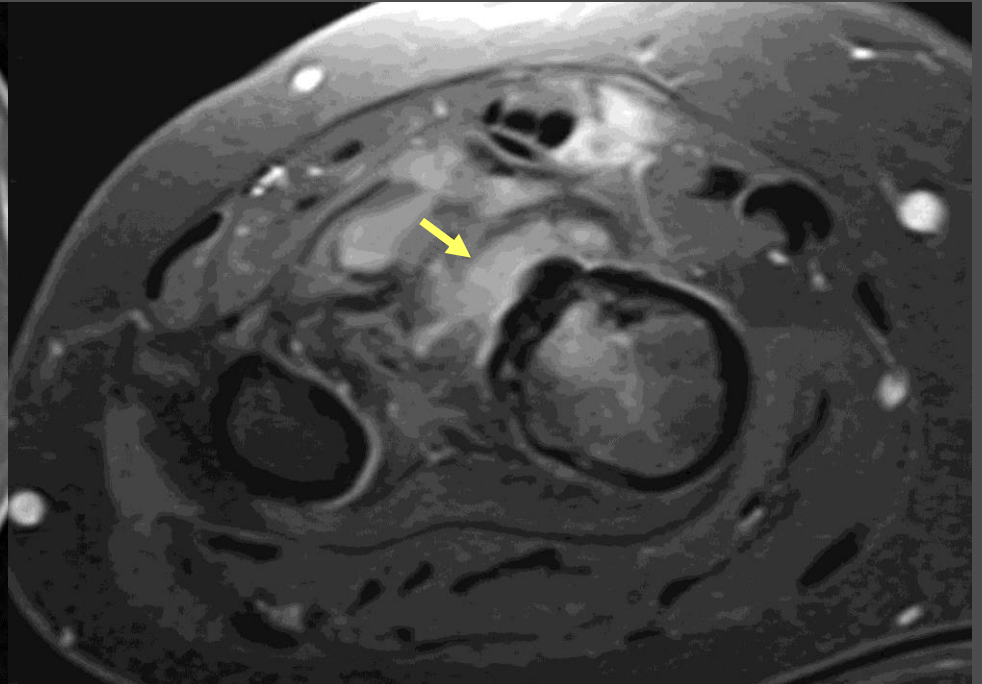


Tumour size unchanged
Collagen maturity

Fibromatosis ↓ enhancement



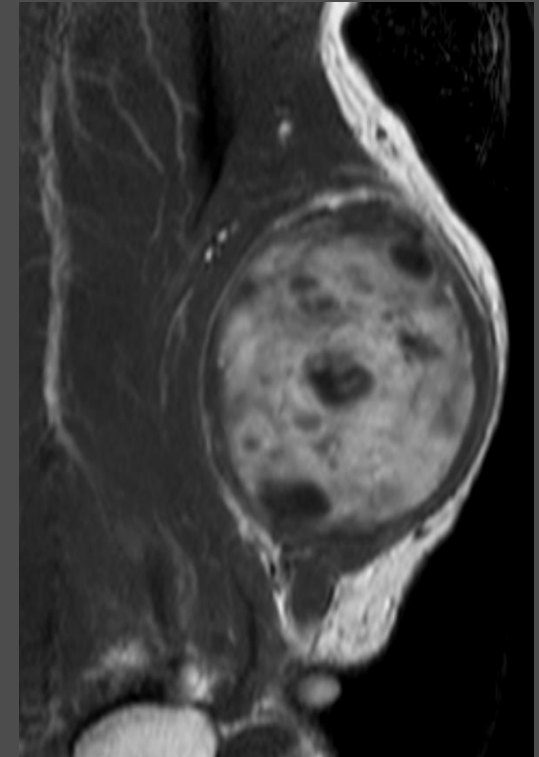
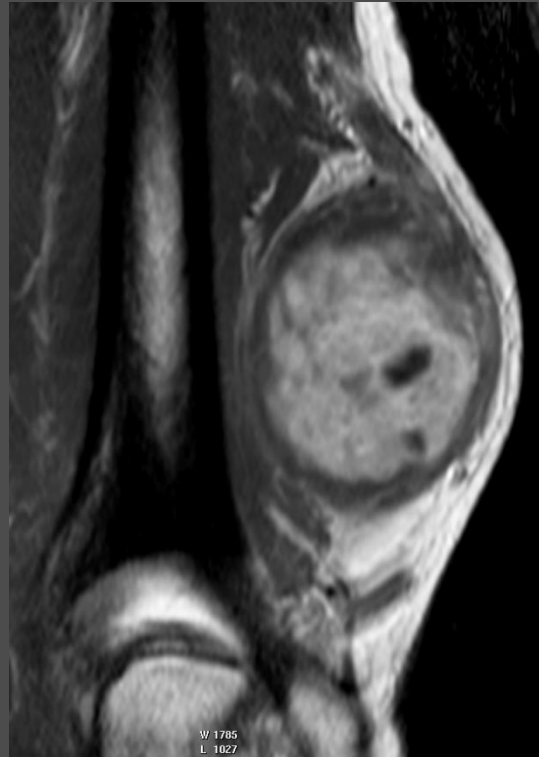
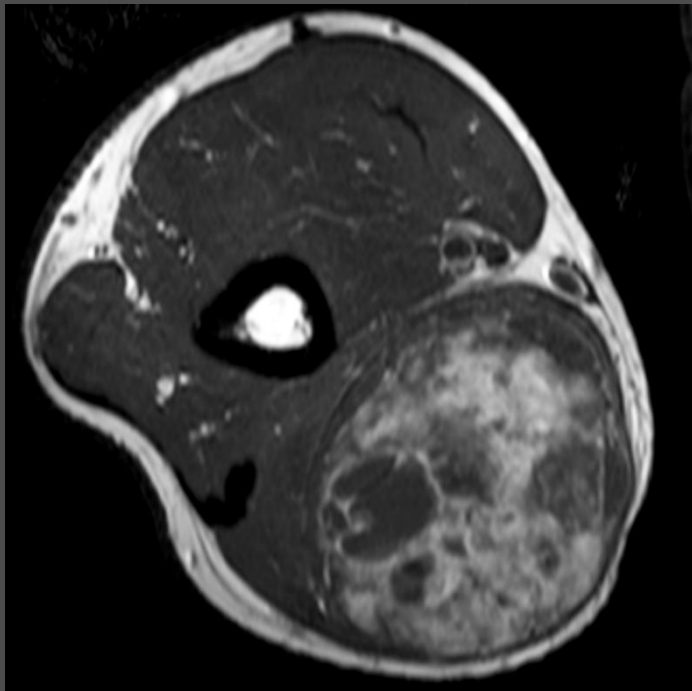
Pre-Rx



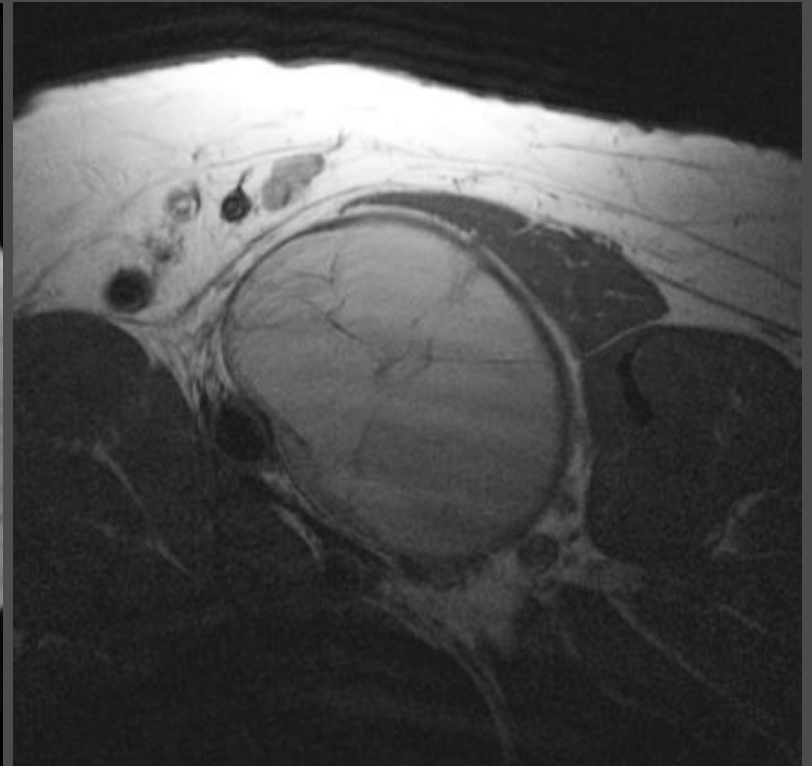
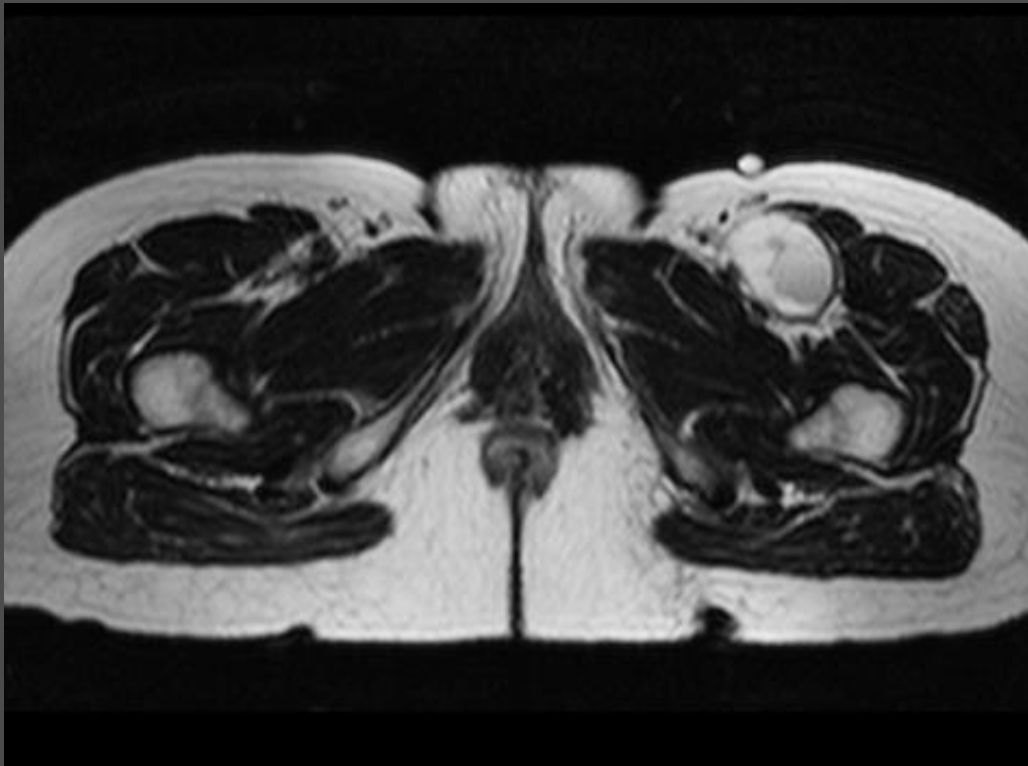
Post-Rx

Tumour size unchanged

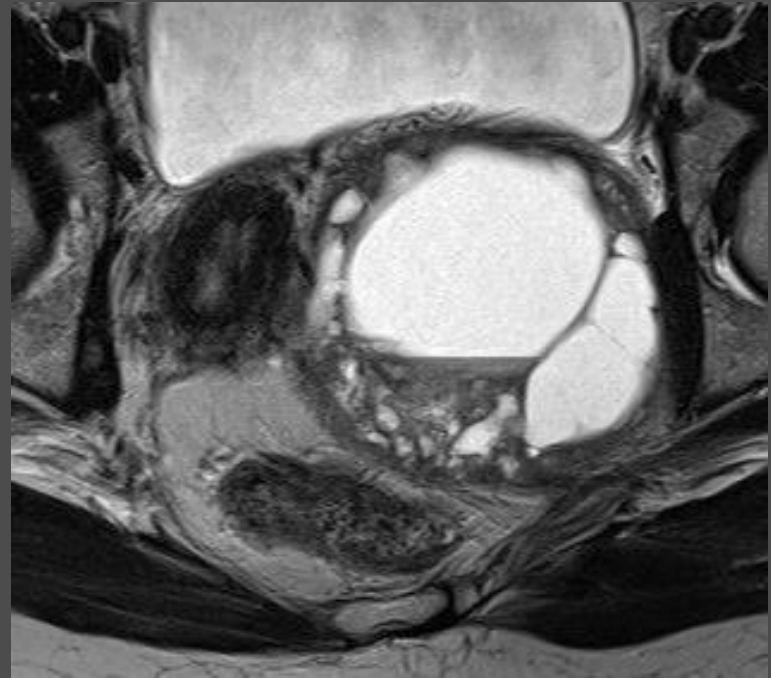
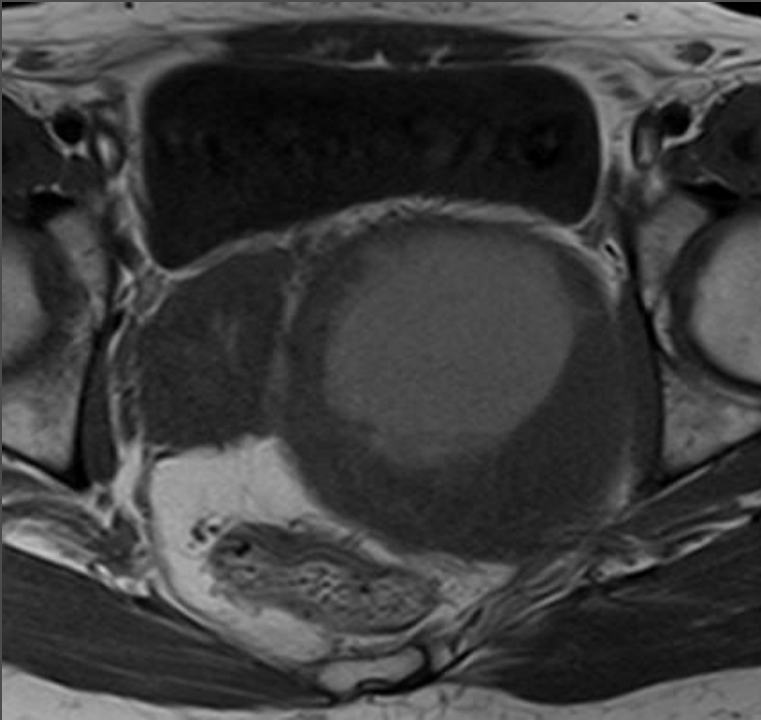
Nerve sheath tumour



Nerve sheath tumour

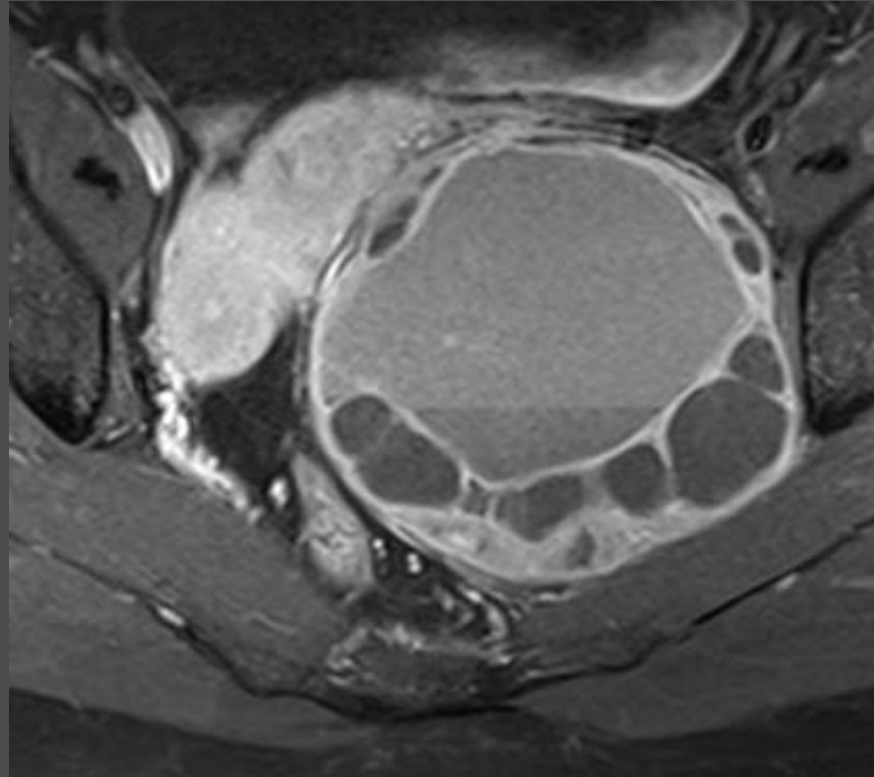


39-year-old female with abdo pain



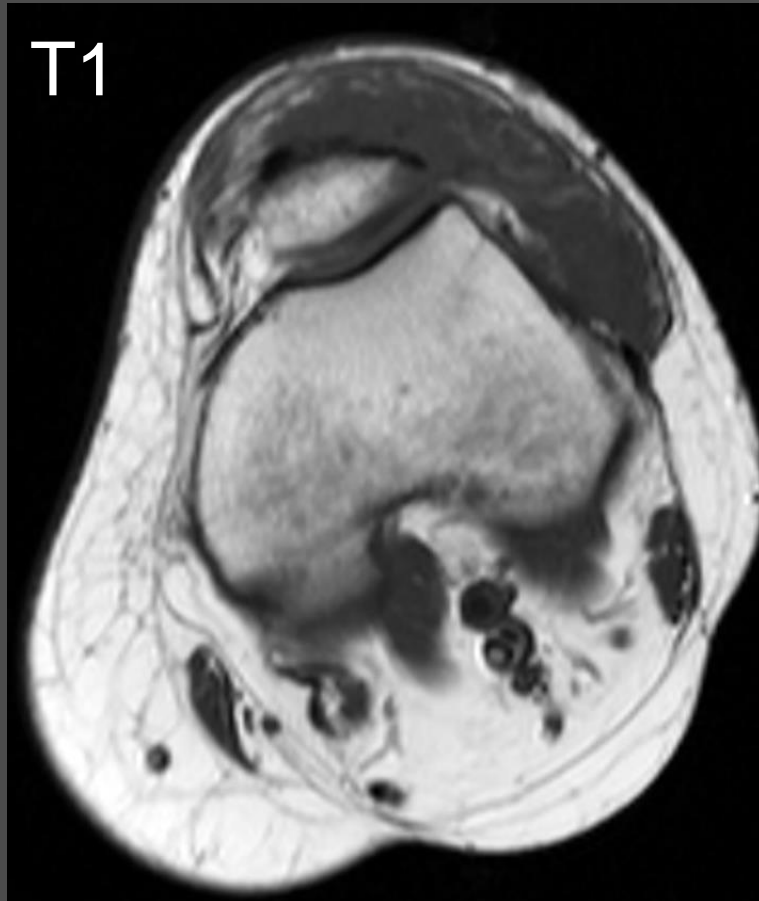
Well-defined multiloculated cystic mass with enhancing wall and septum in the left hemipelvis. Retroperitoneal mass may represent a serous cystadenoma or serous cystadenocarcinoma

39-year-old female with abdo pain



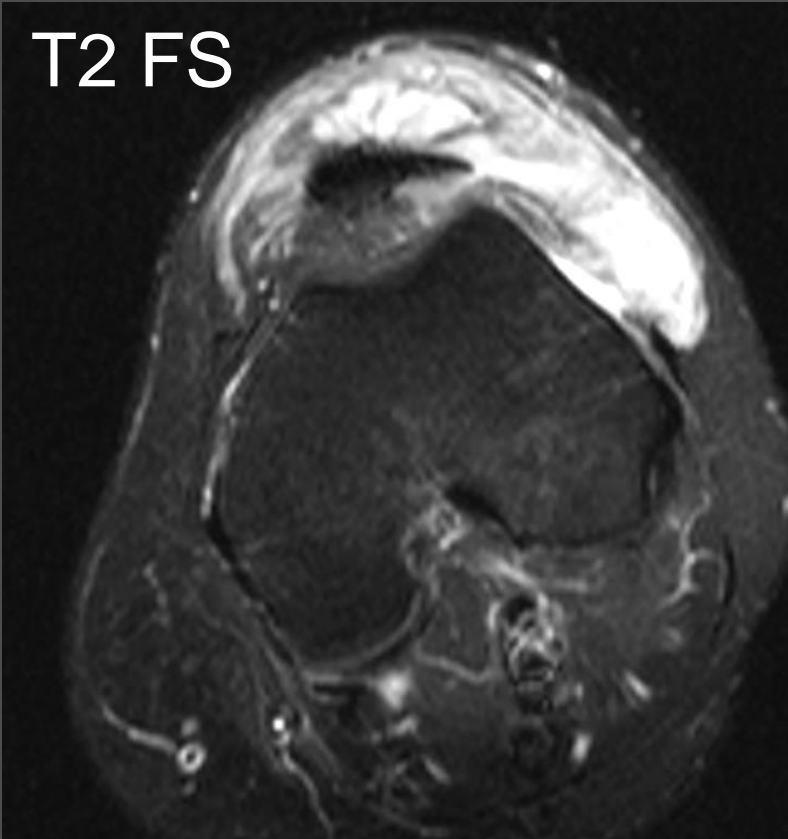
TAS/TVS – left hypoechoic cyst with fluid interface
?dermoid followed by laparoscopy

39-year-old female with ant knee swelling for years and recent fall

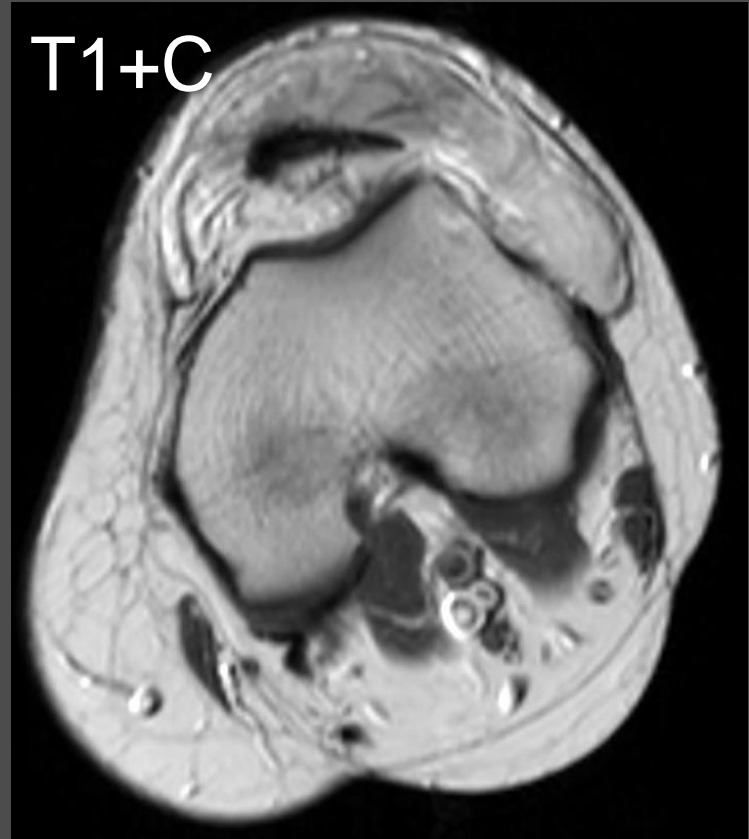


39-year-old female with ant knee swelling for years and recent fall

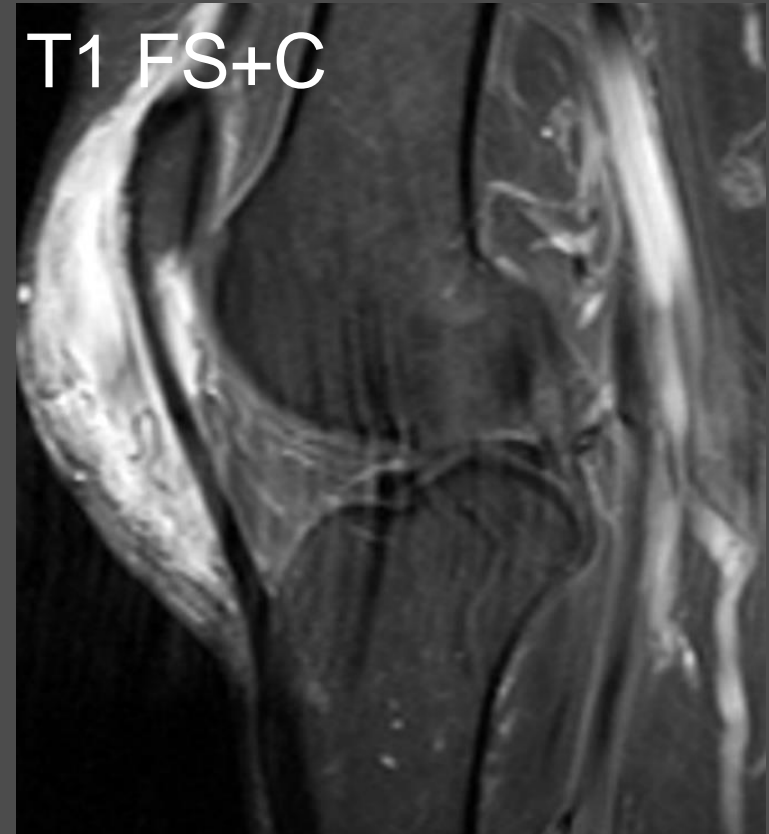
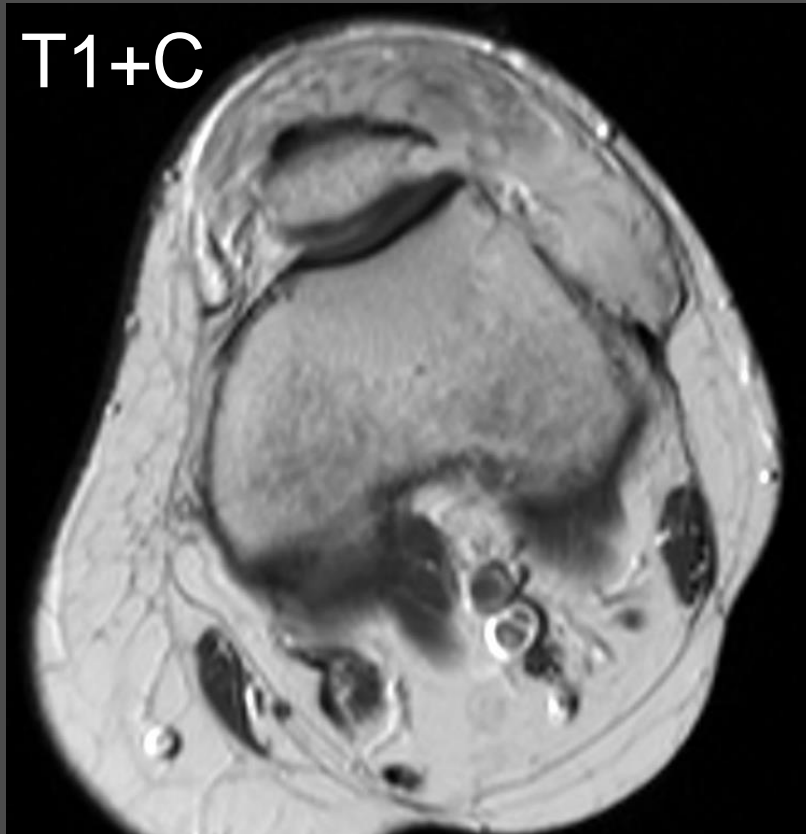
T2 FS



T1+C



39-year-old female with ant knee swelling for years and recent fall



Plexiform neurofibroma

Malignant peripheral NST

- 50% have NF Type 1
- Growth
- Size > 5cm
- Peritumoral oedema
- Necrosis with peripheral enhancement
- Locally aggressive

Location Size and Signal

- 266 soft tissue tumours referred to MRI

LOCATION

- 97 superficial : 27 (28%) malignant
- 169 deep : 75 (44%) malignant

SIZE

- 125 <5cm: 31 (25%) malignant
- 141 >5cm: 71 (50%) malignant

Location Size and Signal

- 266 soft tissue tumours referred to MRI

T2 HETEROGENEITY (>30% heterogenous signal)

- 86 homogeneous : 13 (15%) malignant
- 108 heterogenous: 89 (82%) malignant

Using SI, Size and Depth

- Sensitivity 64%, Specificity 85%, Accuracy 77%



Thank you

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The Chinese University of Hong Kong