

IMAGING OF SOFT TISSUE TUMORS: A SYSTEMATIC APPROACH

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IMAGING OF SOFT TISSUE TUMORS: HOW TO STAY OUT OF TROUBLE

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LEARNING OBJECTIVES

- Provide a logical framework in radiologic evaluation of soft tissue tumors
- MRI emphasis
- Review common diagnoses and staging
 - Lesions with diagnostic appearance
 - Lesions with nonspecific appearance
- Provide information on the use of contrast

CANCER INCIDENCE

- Lung 228,820
- Breast 276,480
- CNS 23,890
- Soft tissue 13,130
- Bone/Joint 3,360

SOFT TISSUE NEOPLASM

- Incidence: 300/100,000
- Soft tissue cancers
 - 13,590/year (2024 NCI; increase 31% since 2008)
 - 5,200 deaths/year (increase of 41% since 2008)
 - Incidence 3.5/100,000; 8/100,000 >80 years (>twofold increase)
- Benign – Malignant (100:1 ratio)

SOFT TISSUE TUMORS: BENIGN

- Majority (>70%) only 8 diagnosis
- Lipoma and variants (16%)
- Fibrous histiocytoma (13%)
- Nodular fasciitis (11%)
- Neurogenic neoplasm (10%)
- Hemangioma (7%)
- Fibromatosis (7%)
- Tenosynovial giant cell tumor (PVNS) (4%)
- Ganglion (?)

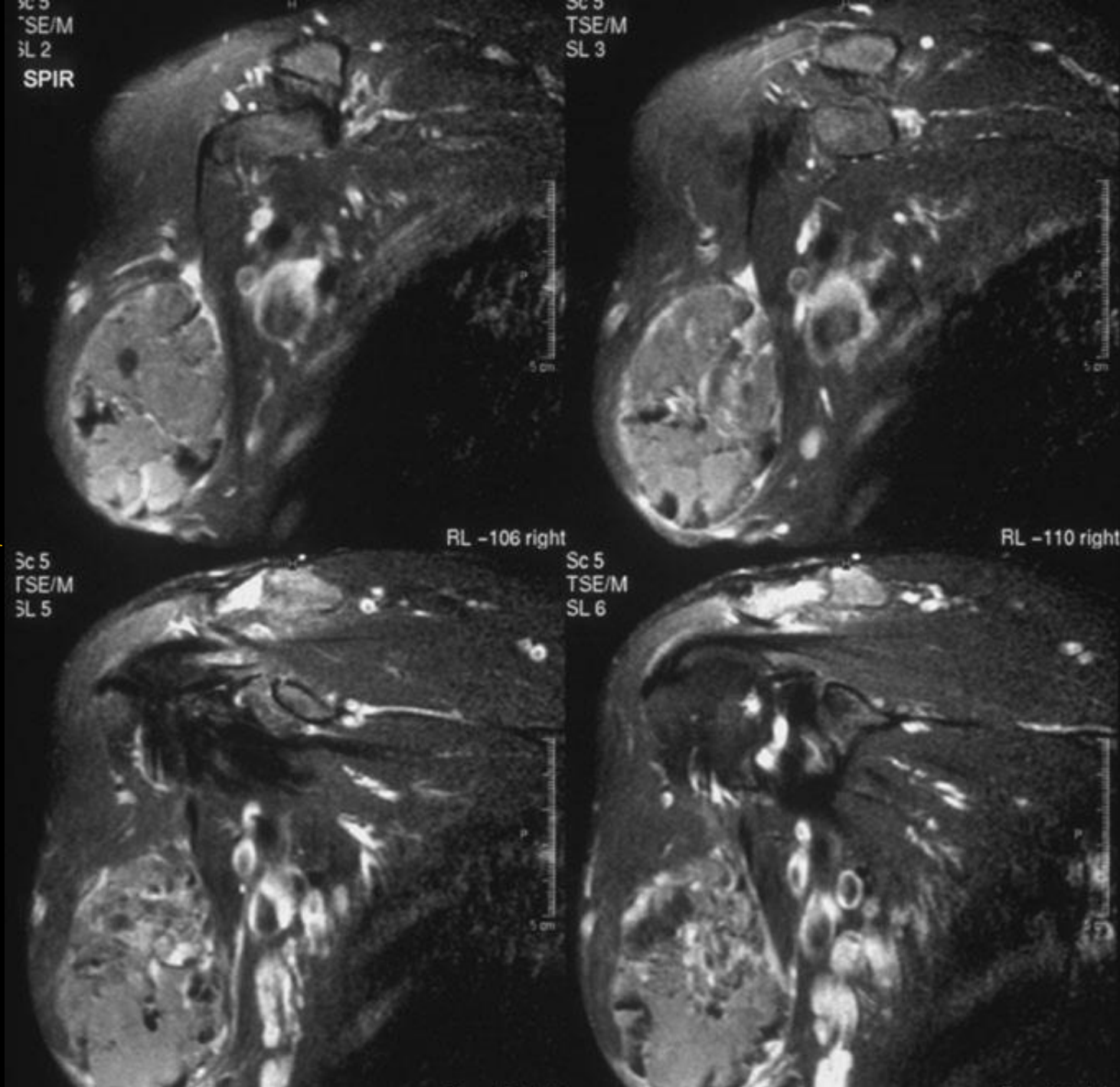
SOFT TISSUE TUMORS: MALIGNANT

- Majority (80%) only 8 diagnoses
- UPS (MFH)/Fibrosarcoma – 29%
- Liposarcoma – 14%
- Nonspecific spindle cell sarcoma – 12%
- Leiomyosarcoma – 8%
- Malignant peripheral nerve sheath tumor (MPNST) – 6%
- Dermatofibrosarcoma protuberans (DFSP) – 6%
- Synovial sarcoma – 5%

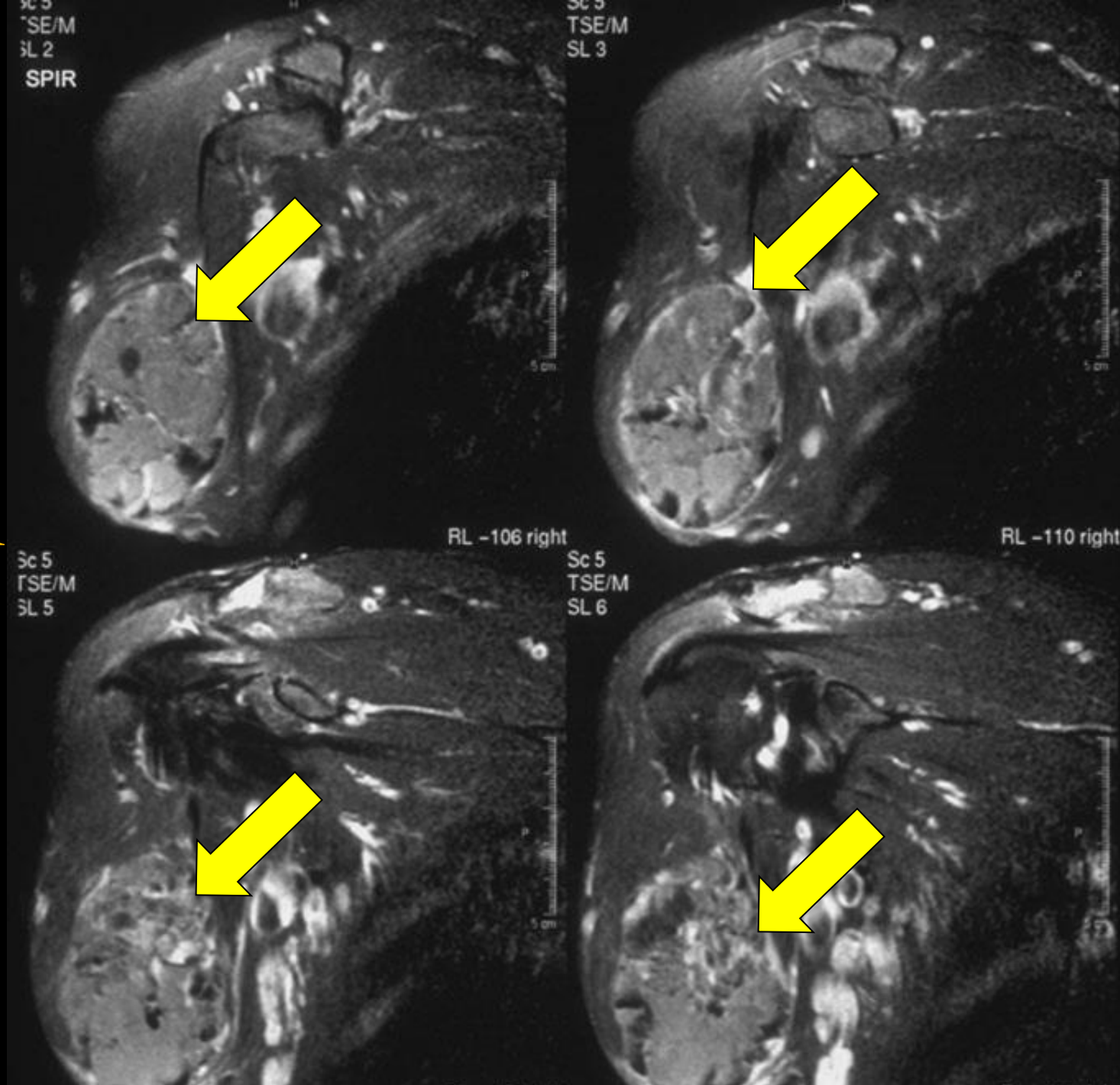
SOFT TISSUE TUMOR RADIOGRAPHS

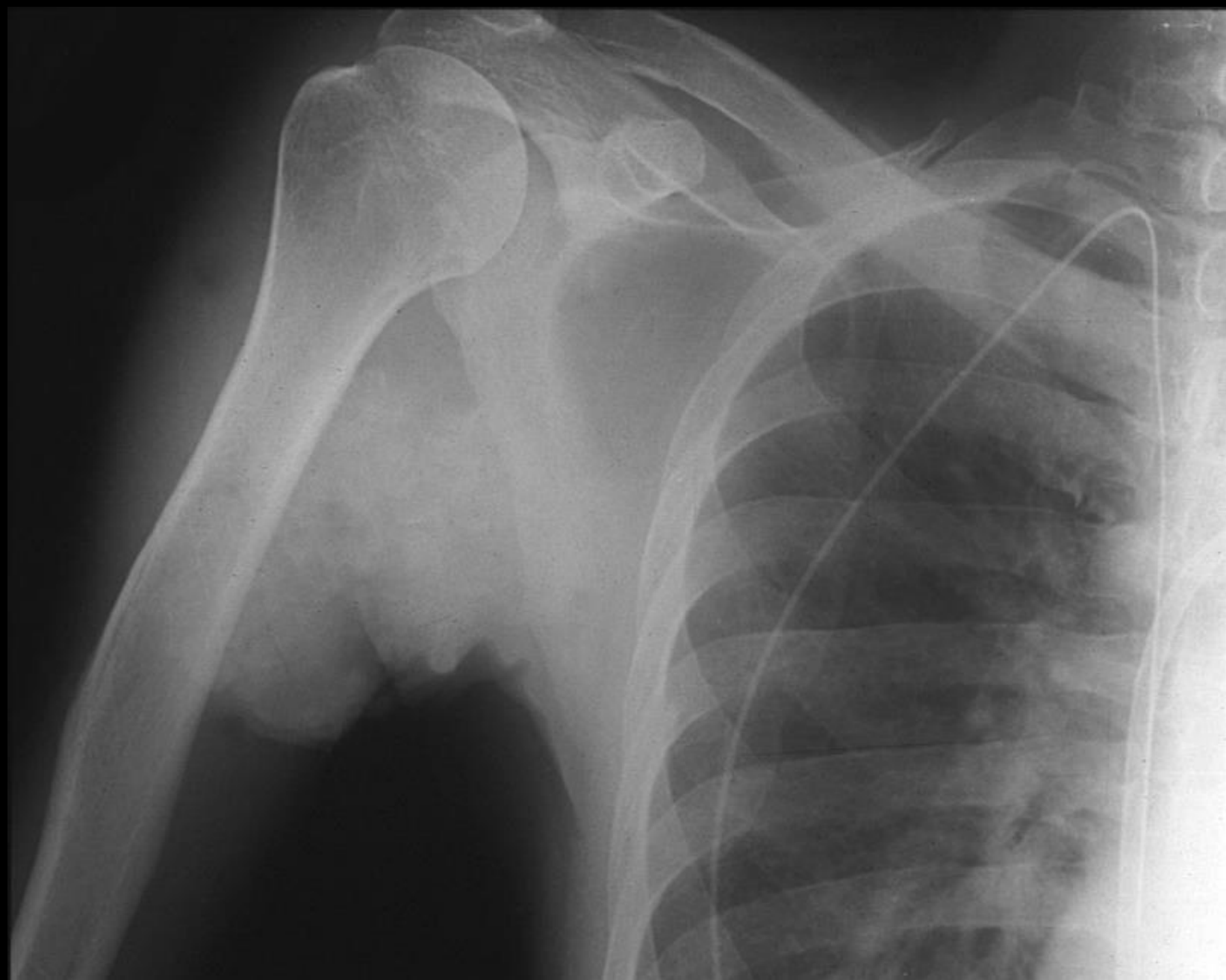
- Important to obtain
- Not as helpful as in bone tumors
- Underlying skeletal abnormality
 - Causing clinical mass (i.e. Osteochondroma)
 - Erosion, invasion, remodeling
- Mineralization/calcification (also CT)
 - Chondro/osteosarcoma, synovial sarcoma, hemangioma

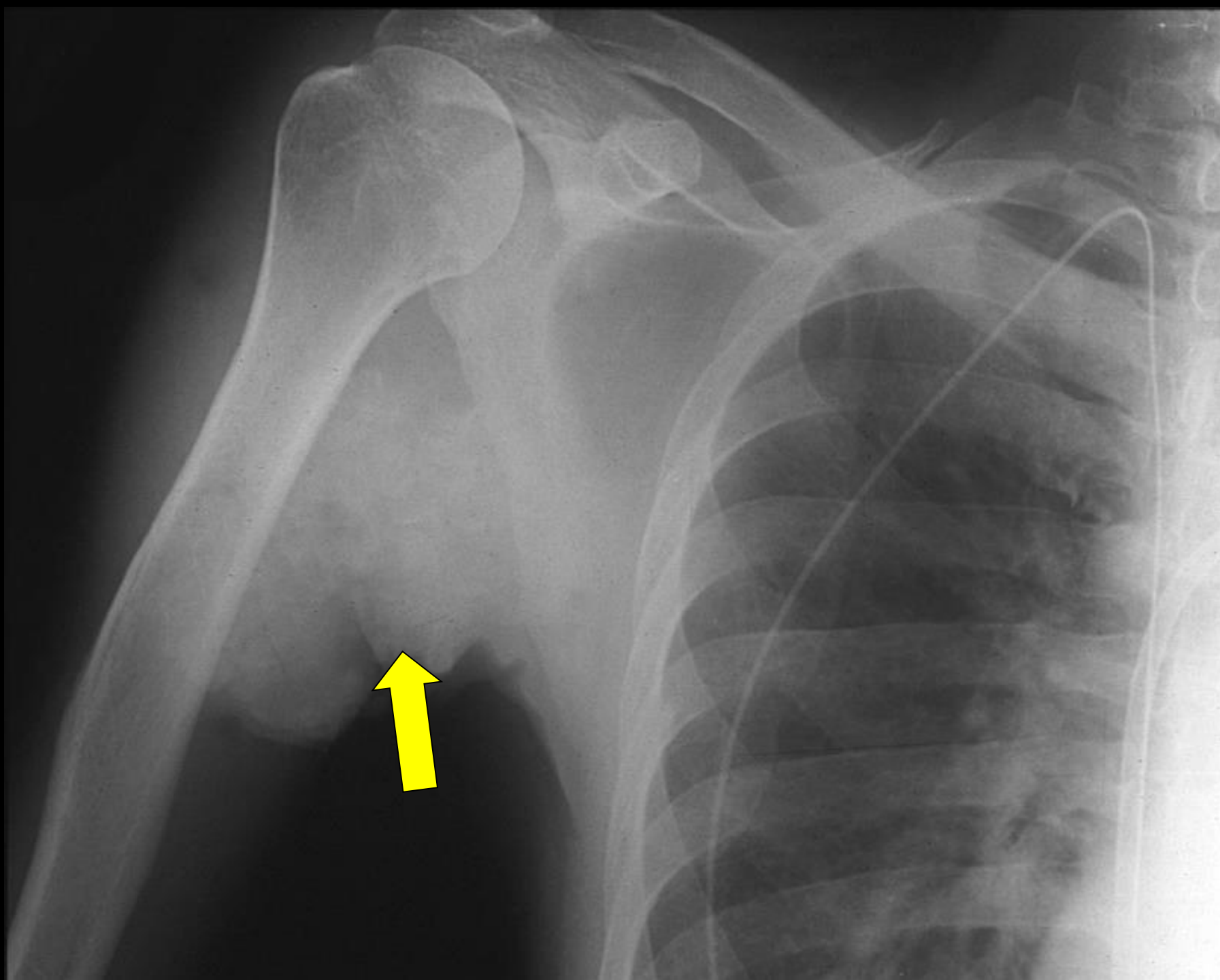
STIR

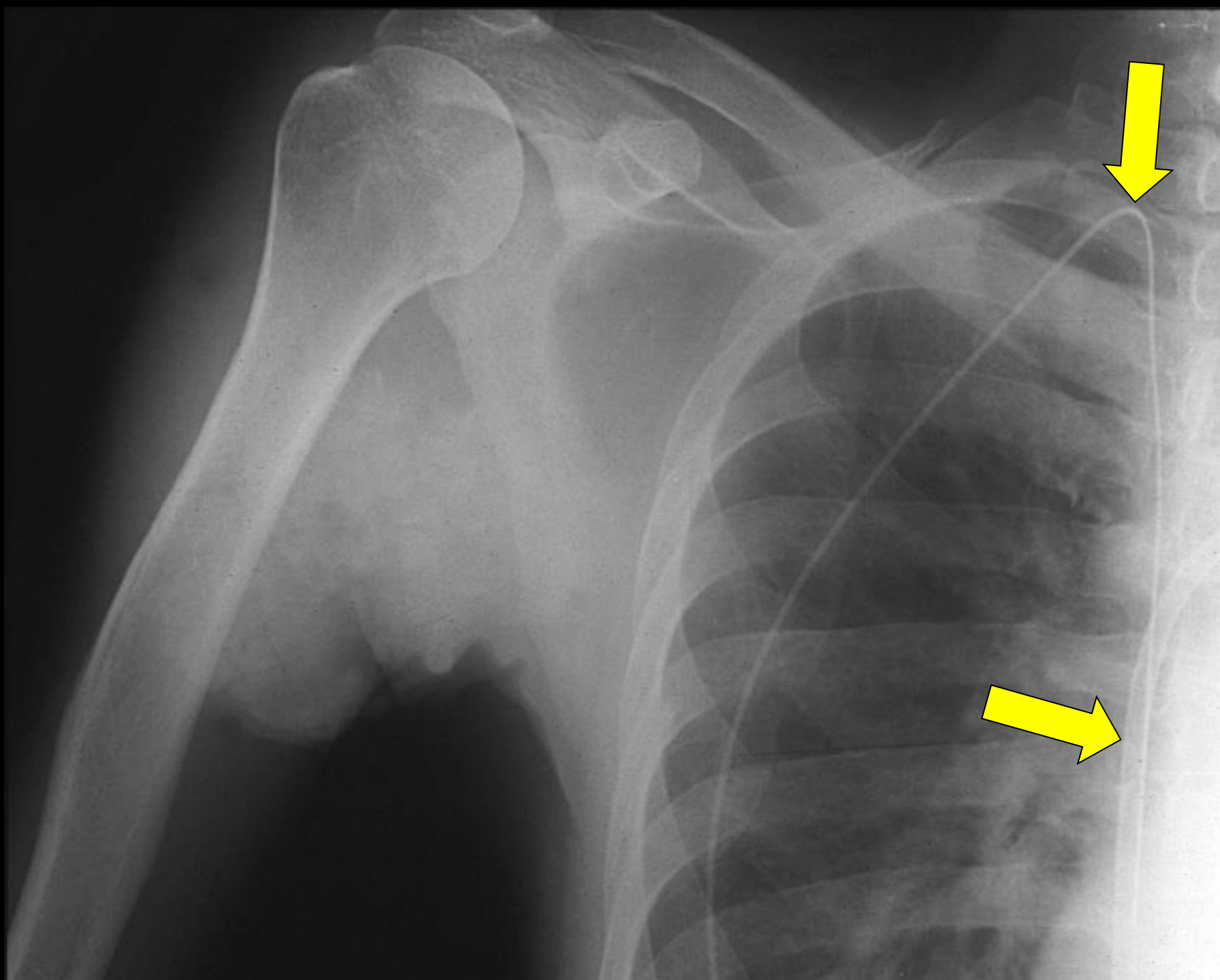


STIR



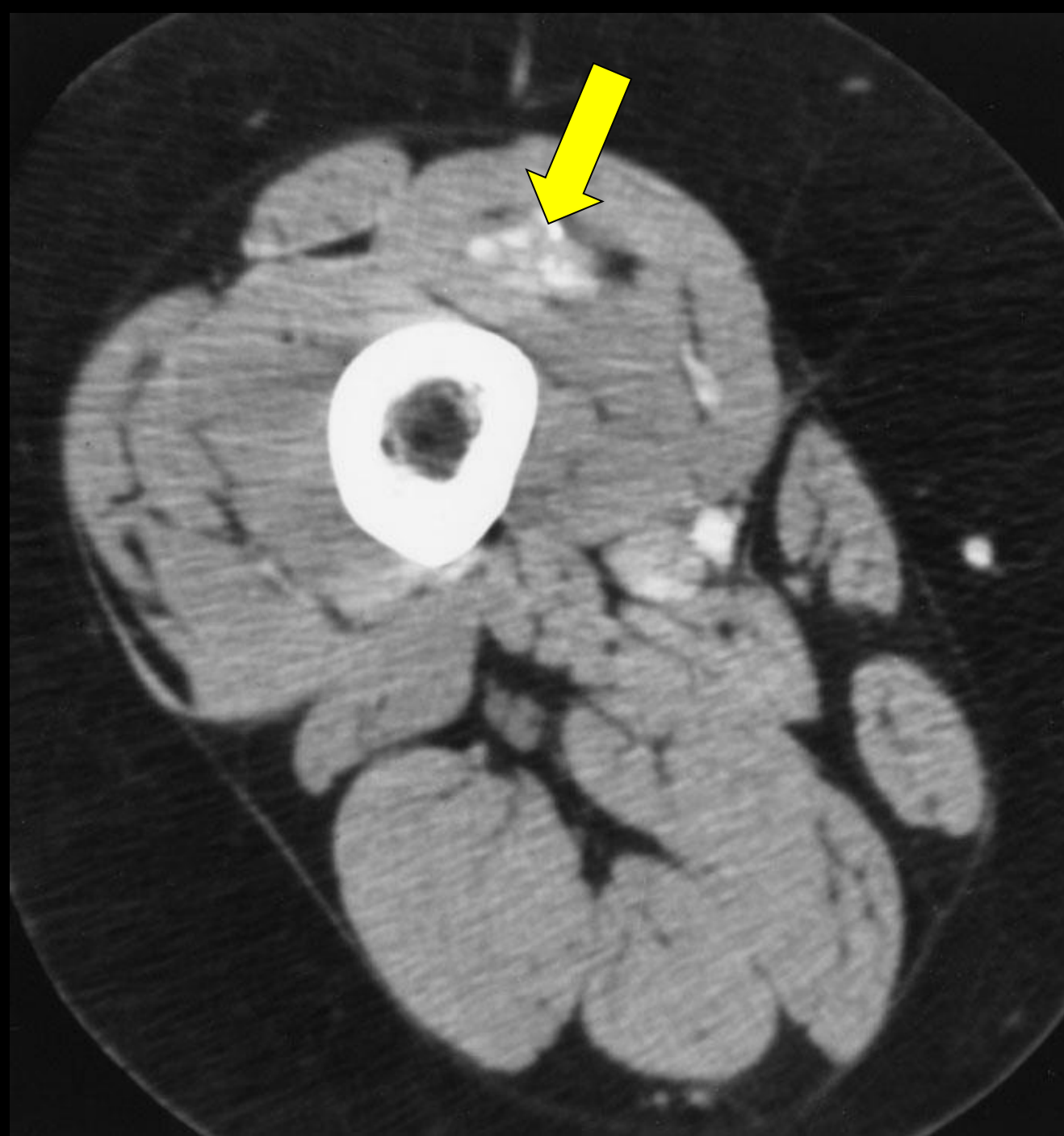


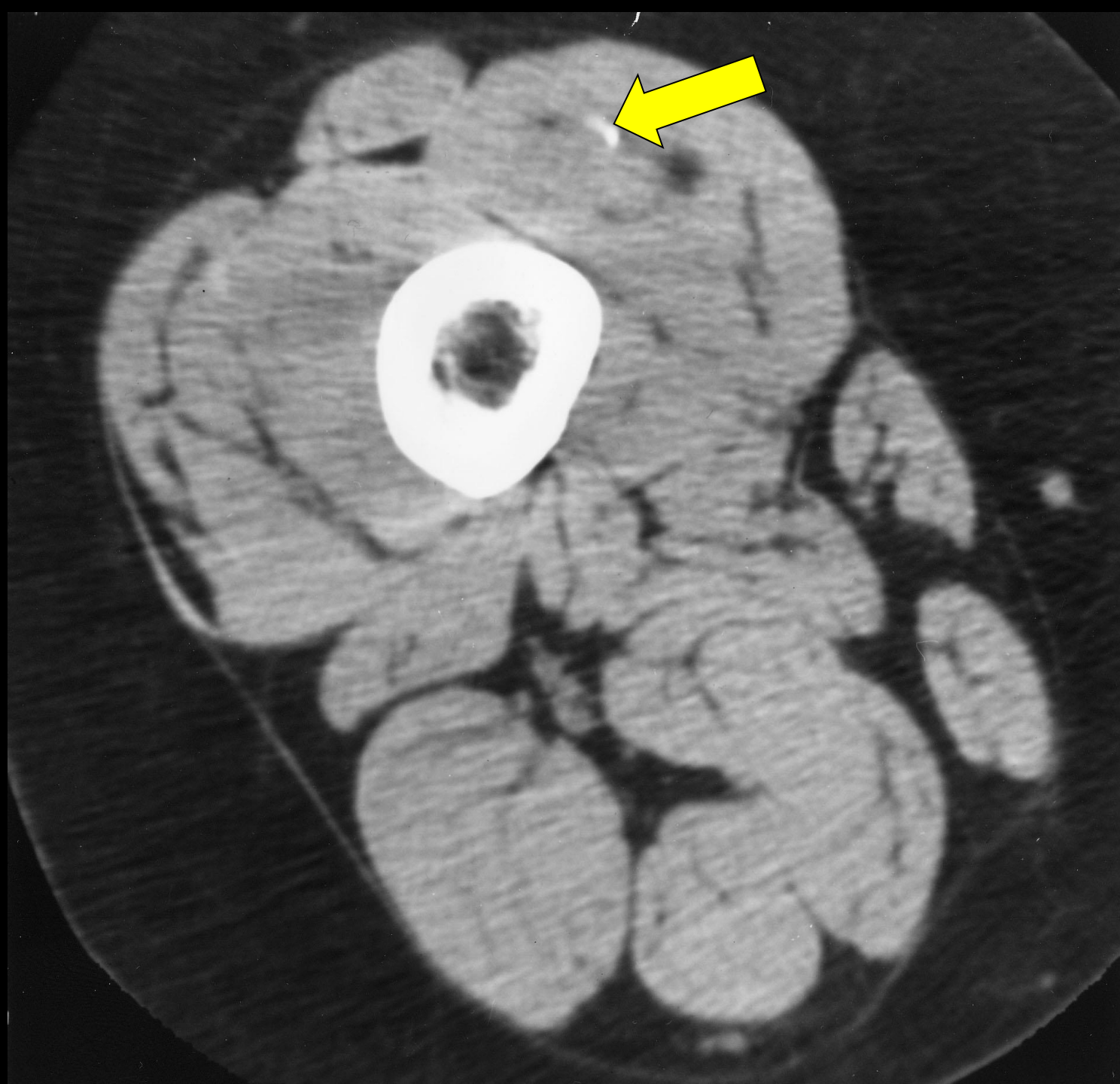




SOFT TISSUE TUMOR CT TECHNIQUE

- Few images through lesion pre-contrast
- Post-contrast images mandatory in vast majority
- Slice thickness depends on lesion size (3-5mm)
- FOV varies with lesion
- Marker on lesion (don't compress if mass superficial)





SOFT TISSUE TUMOR MRI TECHNIQUE

- Axial T1/T2 weighted SE
- Additional planes long axis
 - T1W/T2W (SE, FSE, STIR)
 - Anteroposterior mass: Sagittal
 - Mediolateral mass: Coronal
- FOV and contrast varies with lesion
- Marker on lesion (don't compress if superficial mass)

MRI EVALUATION OF SOFT TISSUE TUMORS:

THE

“W HERE
W HAT
W HEN
W HY”

4 W's APPROACH





SOFT TISSUE TUMOR WHERE, WHAT, WHEN

- Where is the lesion?
 - Location, location, location (just like bone tumors gives broad differential diagnosis!!!)
 - Subcutaneous, Intermuscular, Intramuscular, Intraarticular/Periarticular, Multifocal/Extensive, Specific sites
- What are the intrinsic imaging characteristics, lesion size and margin? Adds diagnostic specificity!
- When? (patient age)

SOFT TISSUE TUMORS

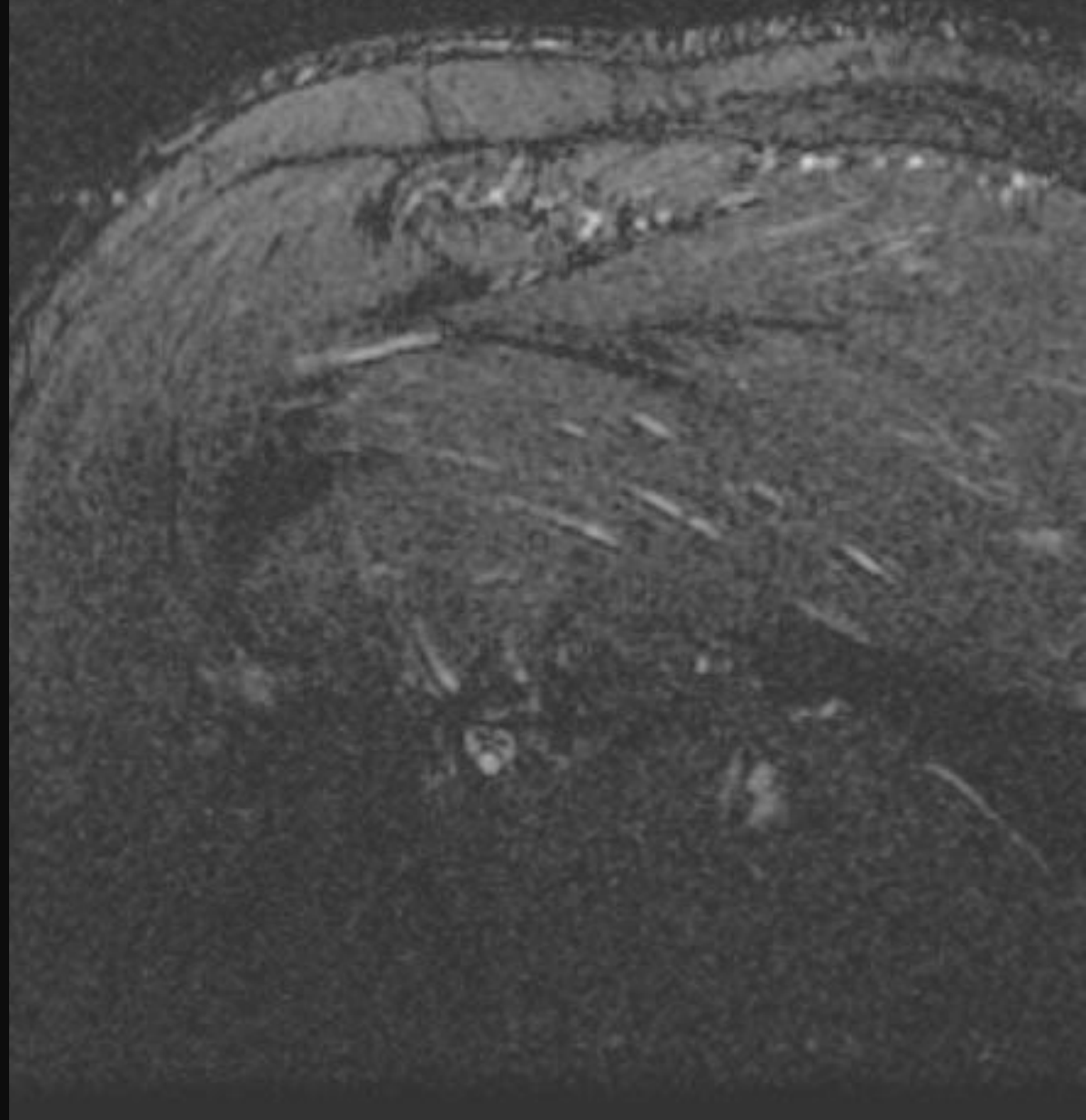
SUBCUTANEOUS: BENIGN

- Often not asked to image – clinical evaluation
 - Lipoma
 - Nodular fasciitis
 - Benign fibrous histiocytoma
 - Skin appendage tumors
 - Angiomatous lesions
 - Granuloma annulare (children)

T1



T2 FS



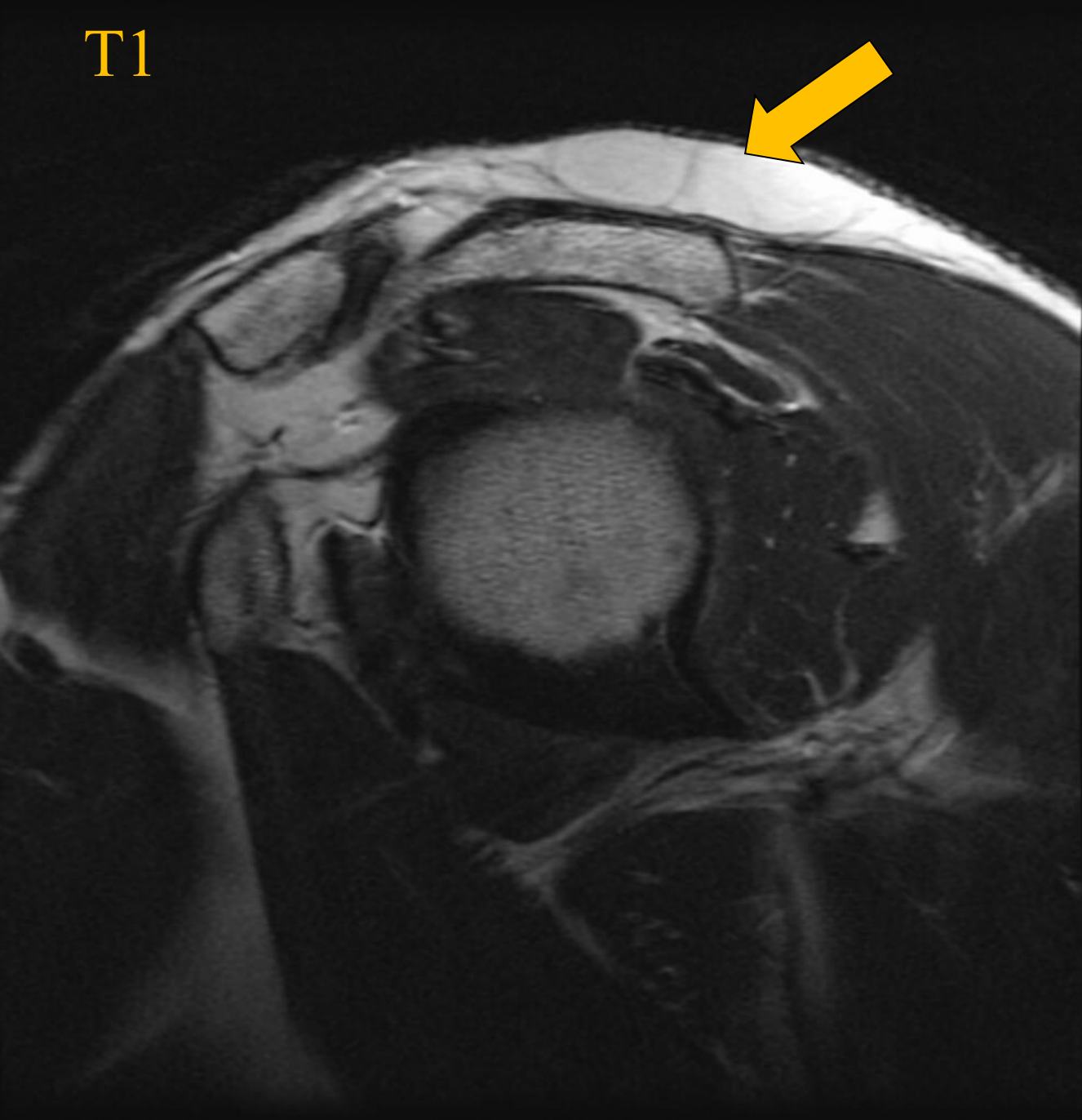
MURPHEY'S LAW #1

If there is a clinical history of a soft tissue mass and you can't see it in the first 5 msec.

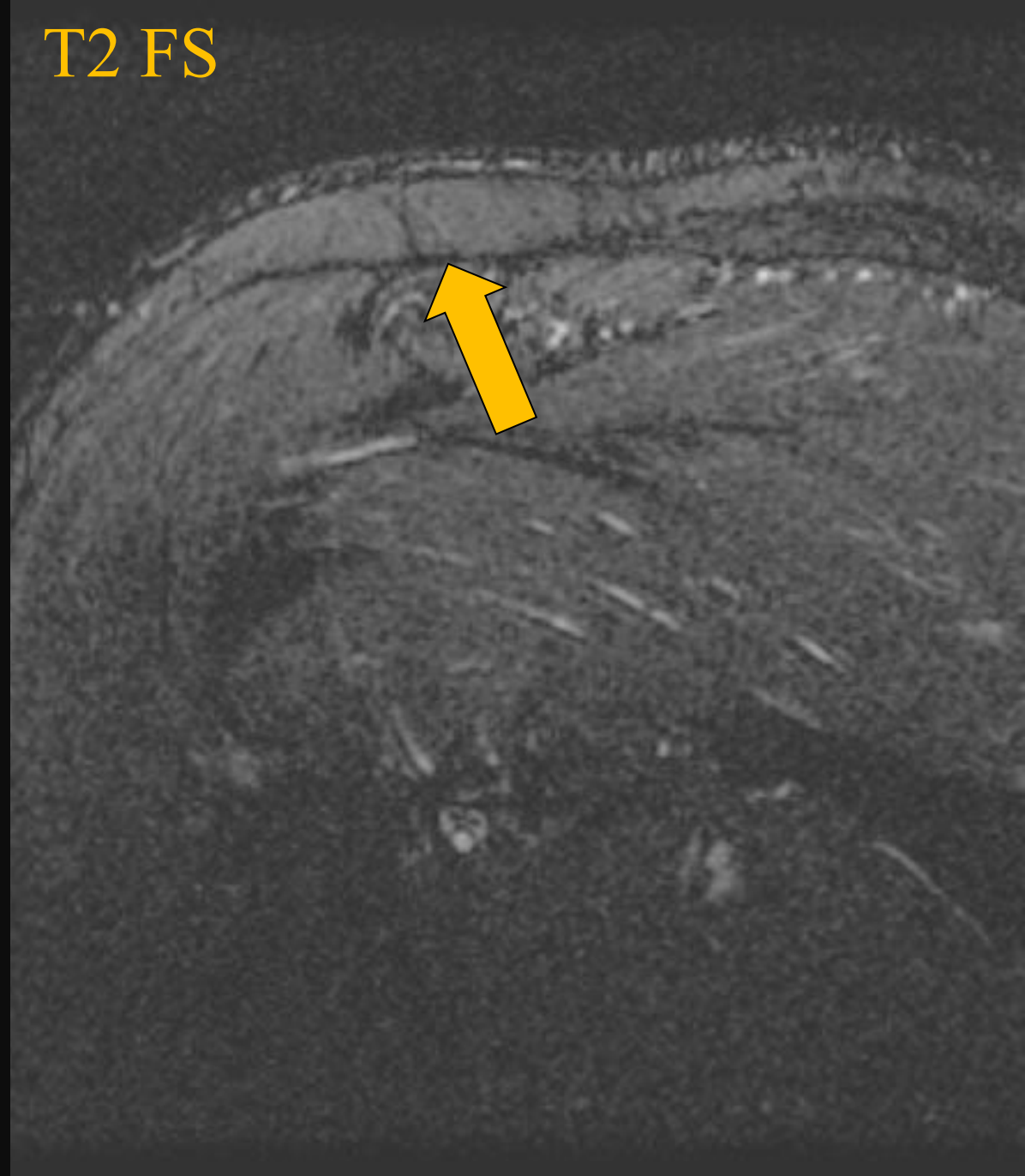
of looking at the MRI the diagnosis is a

subcutaneous lipoma!!!!!!!!!!

T1



T2 FS



MRI EVALUATION OF SOFT TISSUE TUMORS

1. HOW TO STAY OUT OF TROUBLE!!

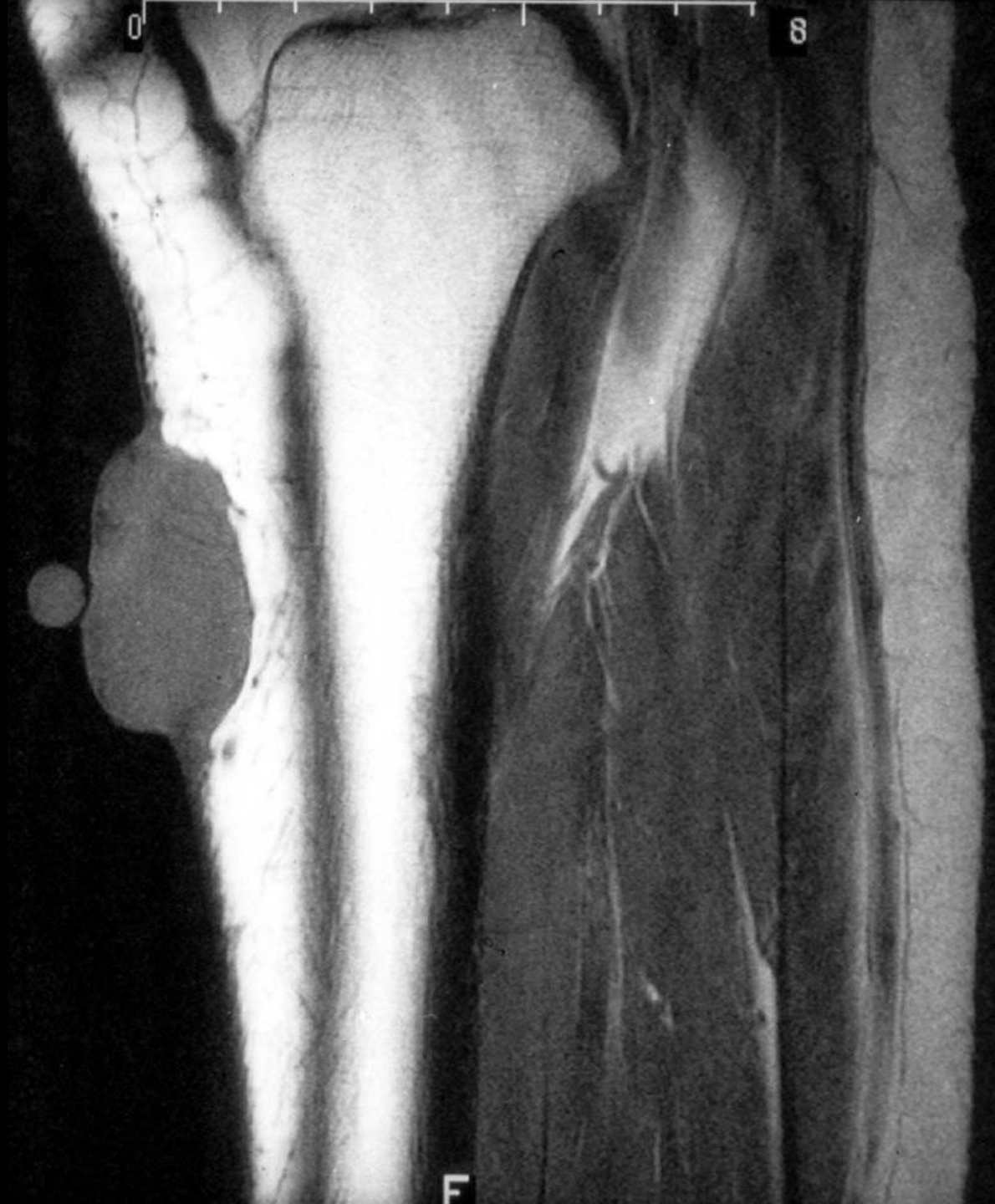
IF YOU CANNOT SEE A CLINICALLY
APPARENT SOFT TISSUE MASS EASILY ON MRI
THINK SUBCUTANEOUS LIPOMA, ACCESSORY
MUSCLE OR FASCIAL HERNIATION

SOFT TISSUE TUMOR

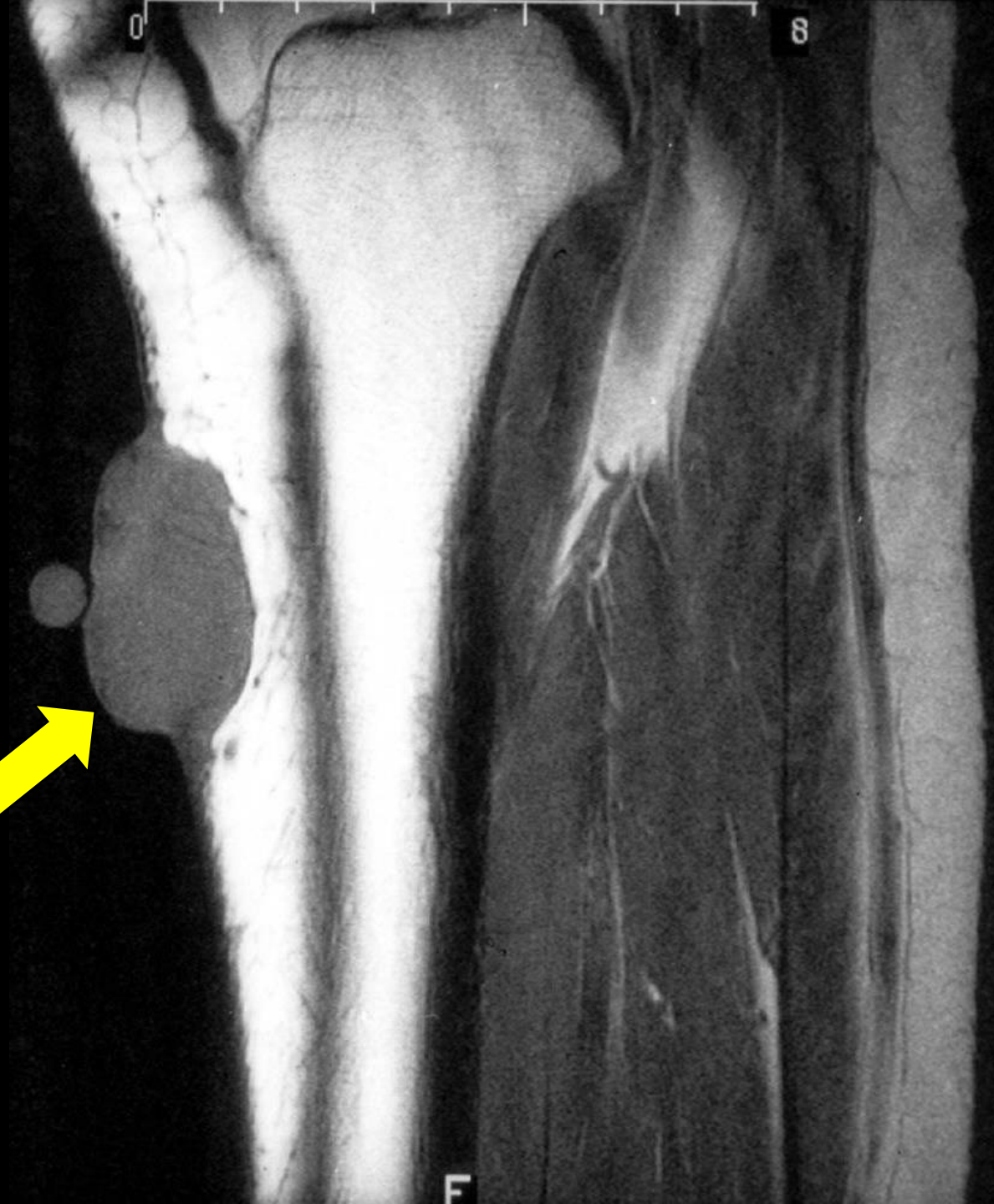
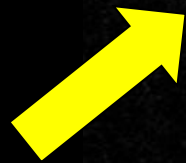
SUBCUTANEOUS: MALIGNANT

- Often not asked to image – clinical evaluation
 - Lymphoma
 - Leiomyosarcoma
 - Metastases (melanoma, breast)
 - Dermatofibrosarcoma protuberans (DFSP)
 - UPS (MFH)/Myxofibrosarcoma/Fibrosarcoma

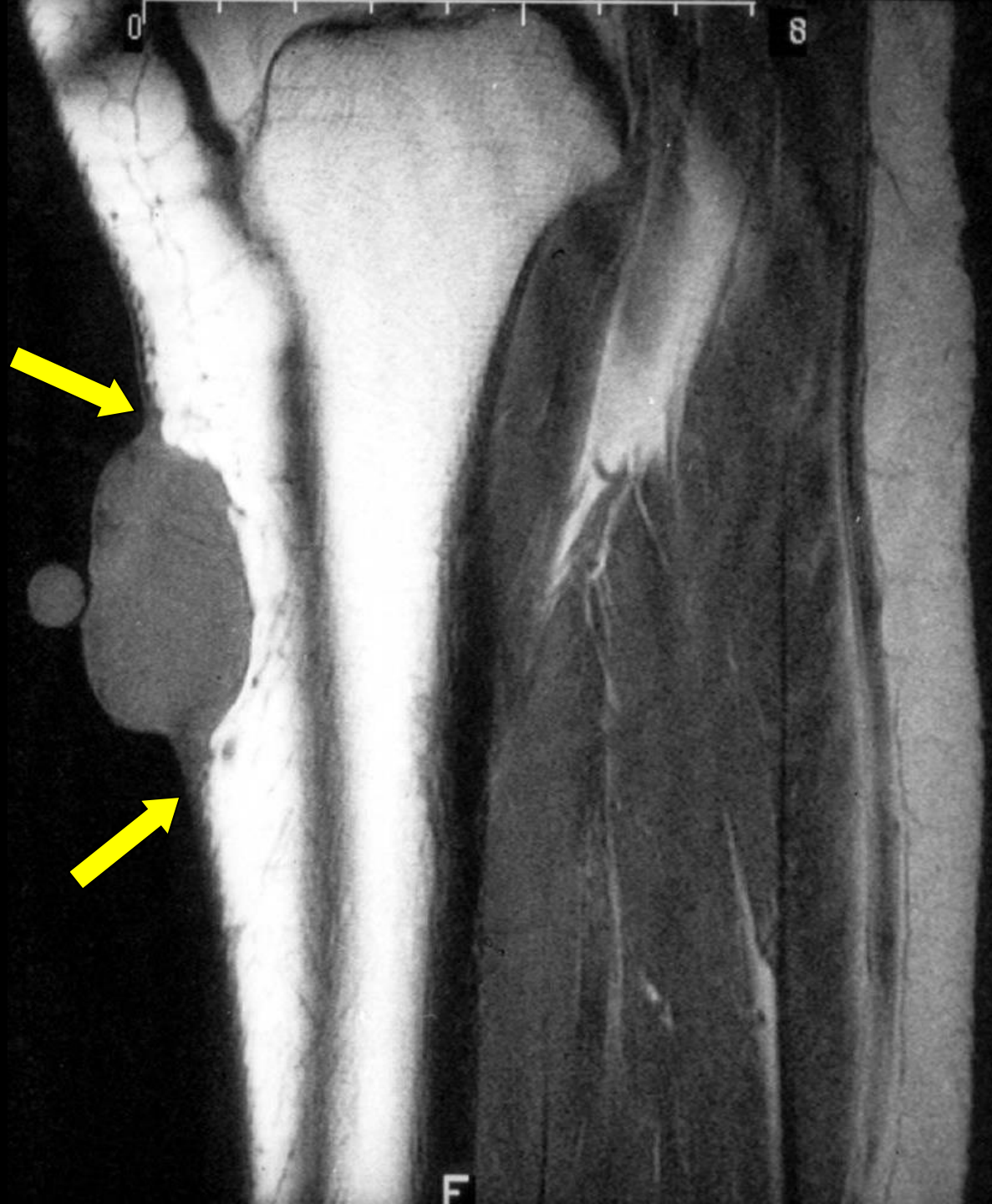
T1



T1



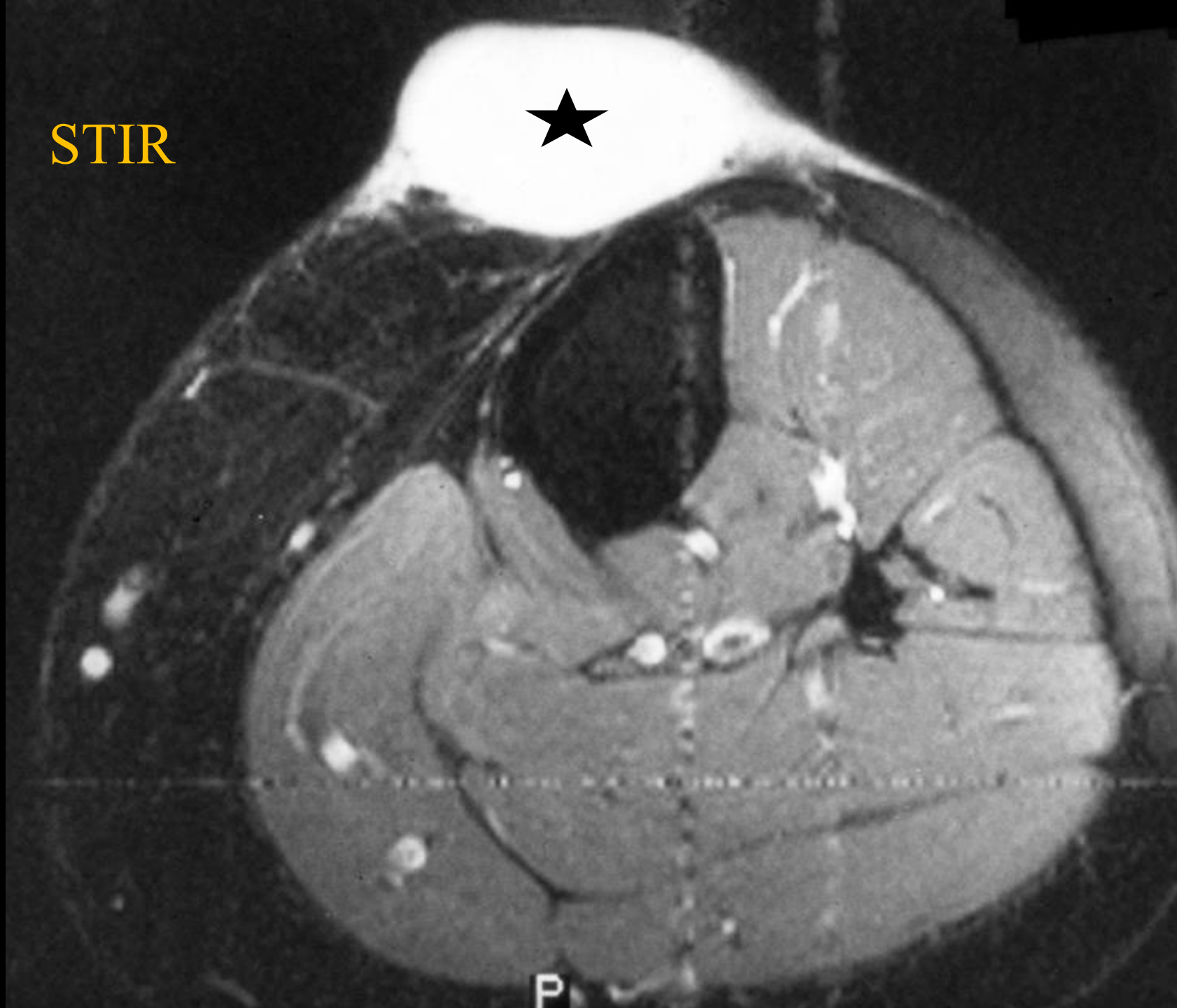
T1



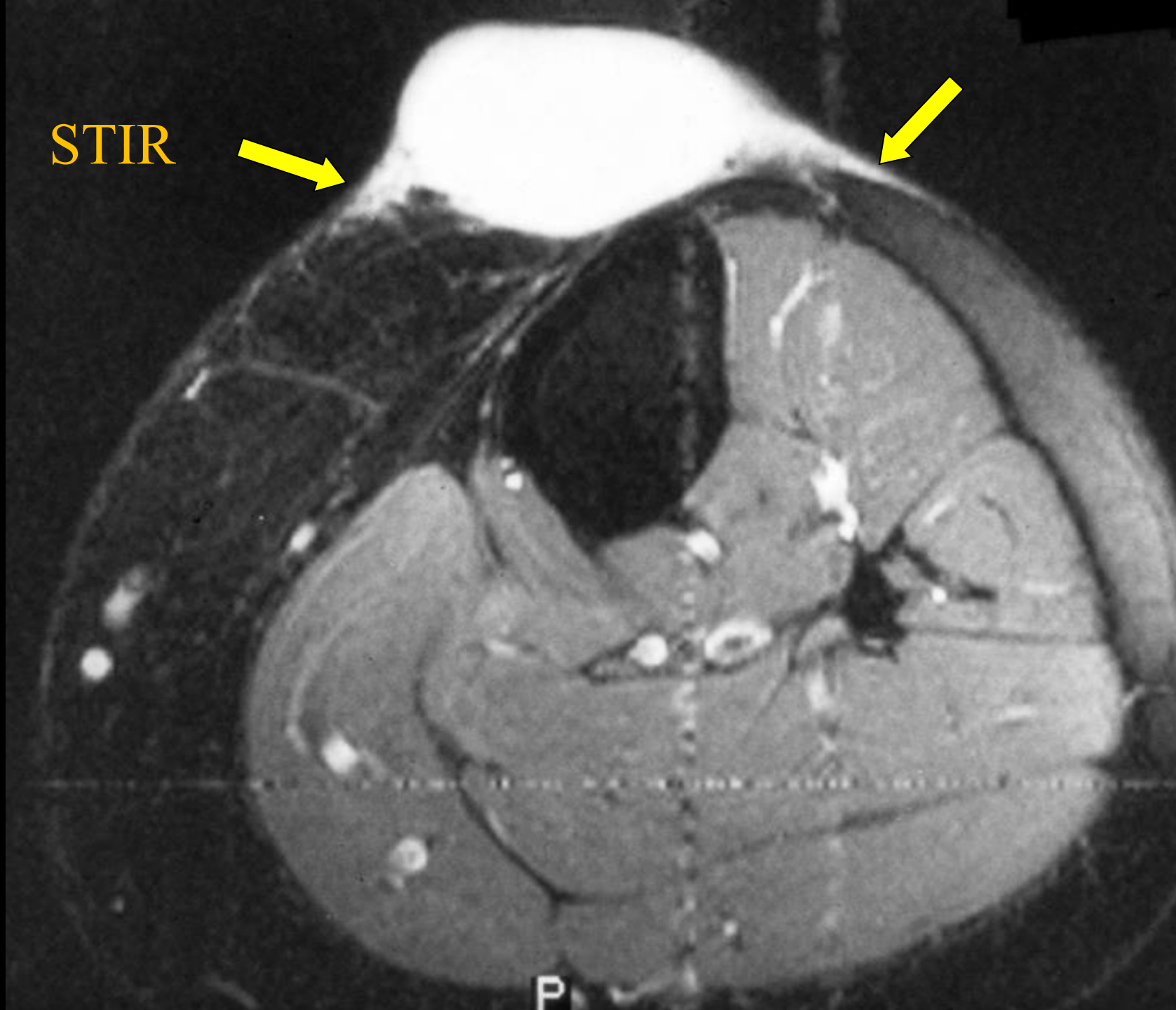
STIR



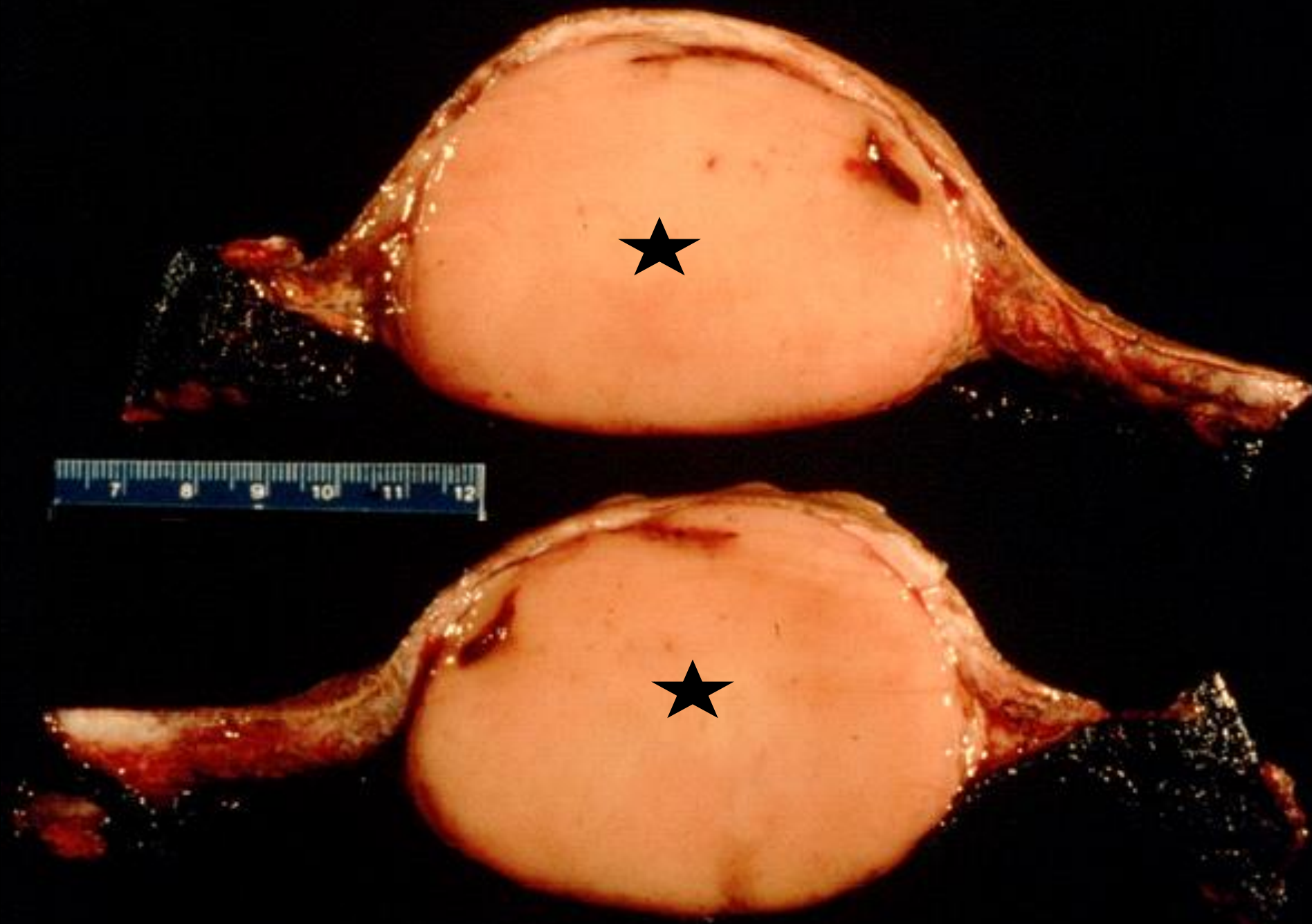
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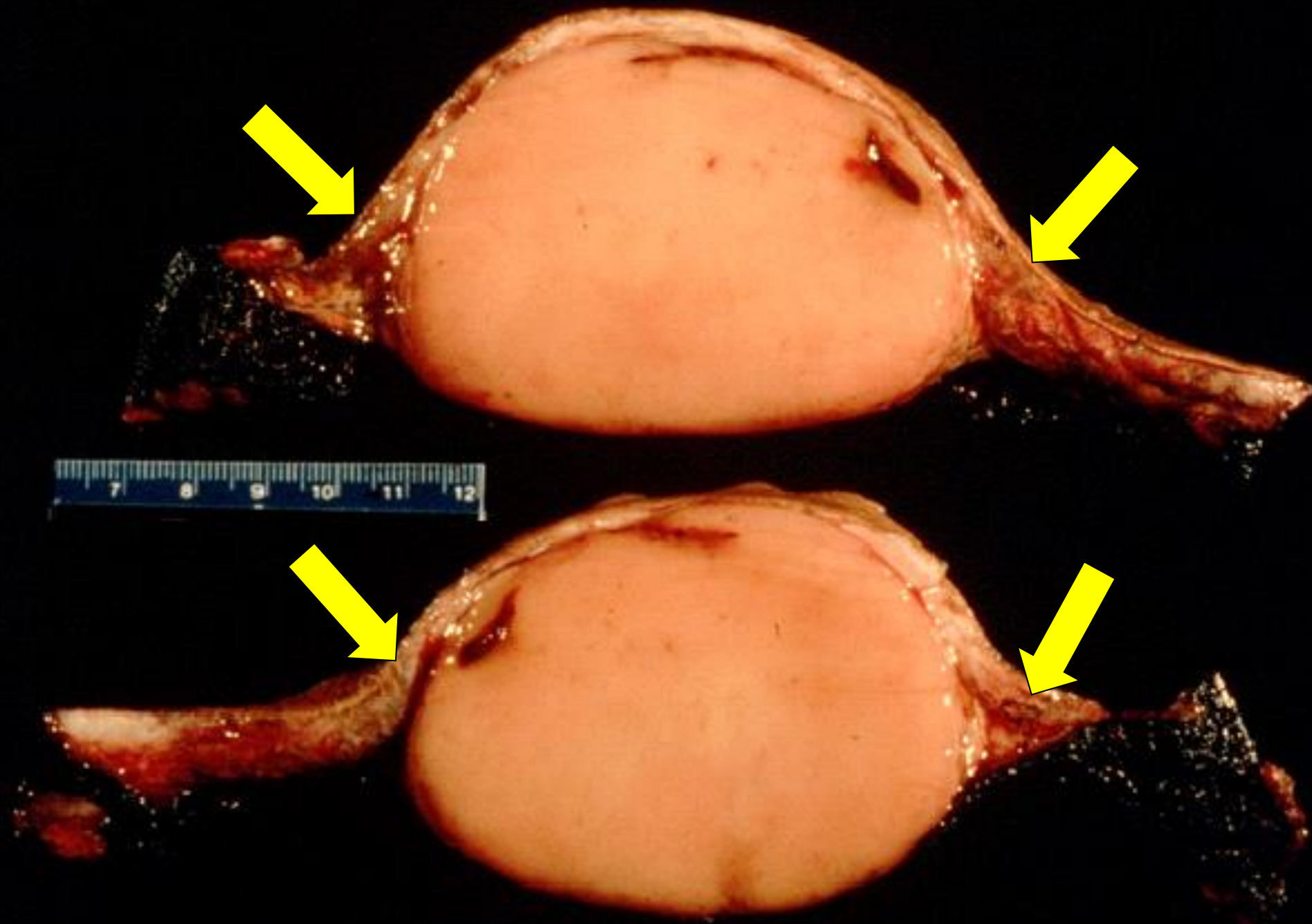


STIR



P



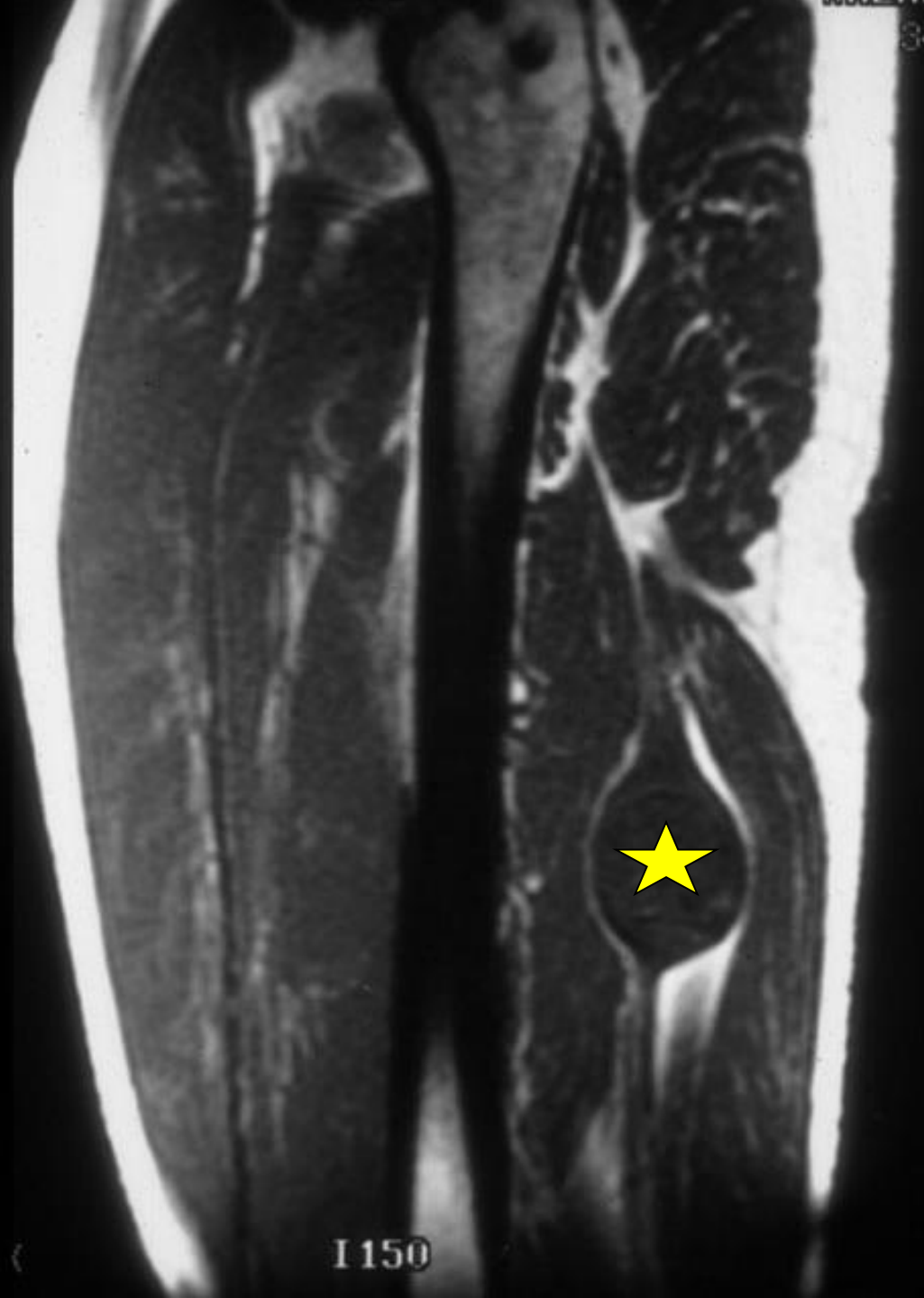


SOFT TISSUE TUMOR: INTERMUSCULAR

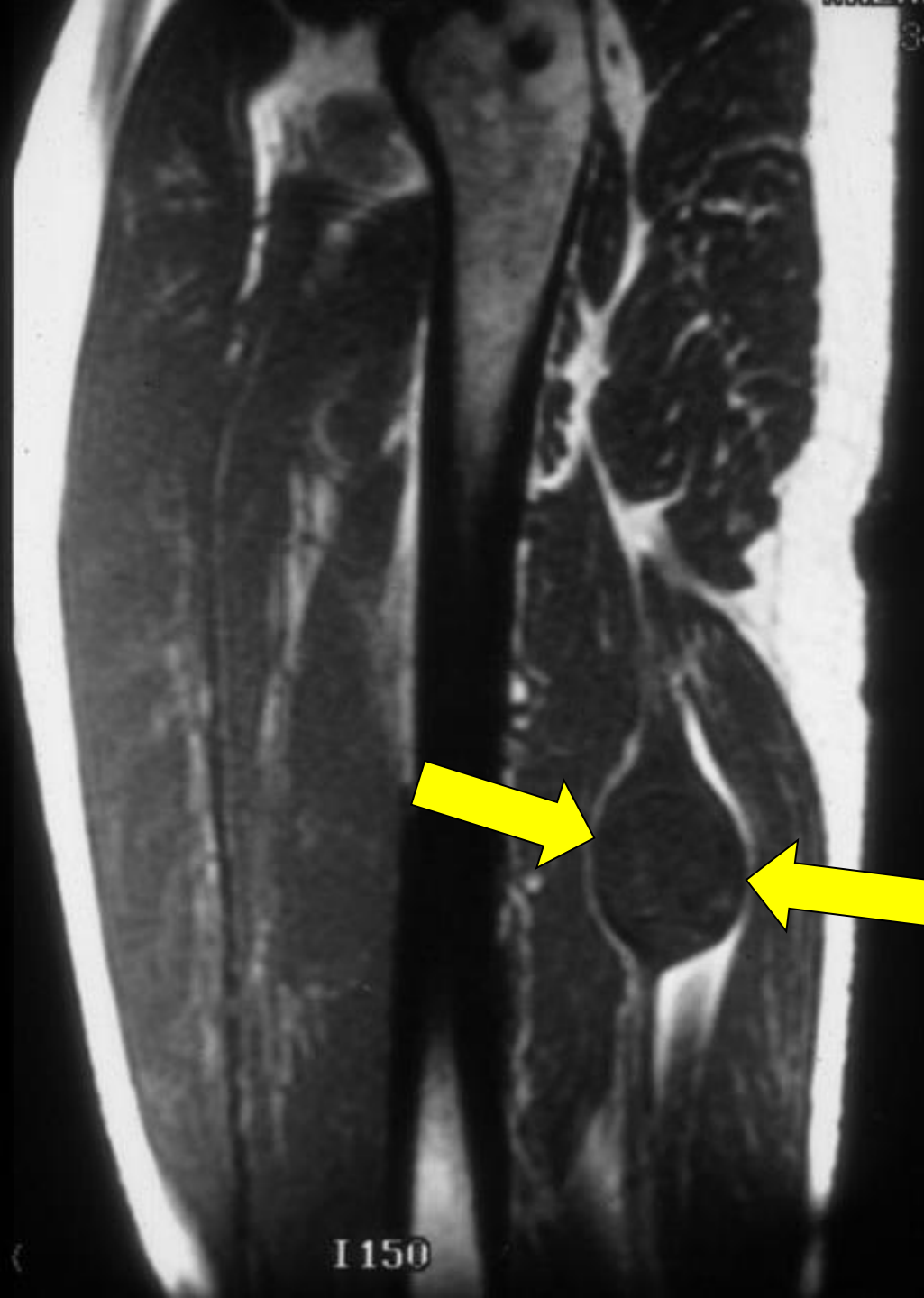
- Often easy-split fat sign
- Sometimes more difficult look at mass margin
 - Nodular fasciitis, fibromatosis
 - Ganglion, synovial cyst, bursa
 - Neurogenic tumors (Benign, MPNST)
 - Synovial sarcoma
 - Leiomyosarcoma
 - Lipoma and higher grade liposarcoma (myxoid & higher)



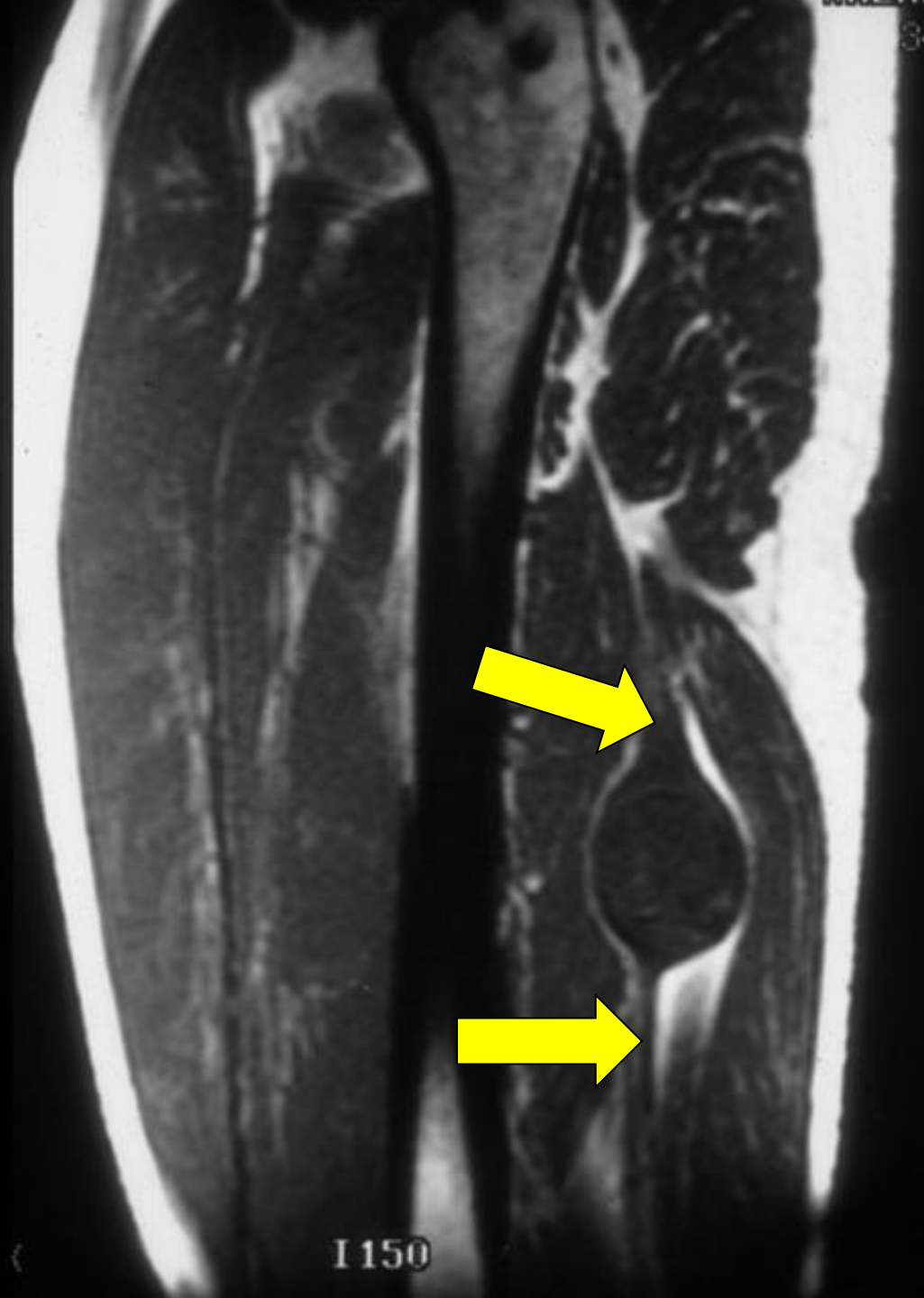
T1



T1



T1



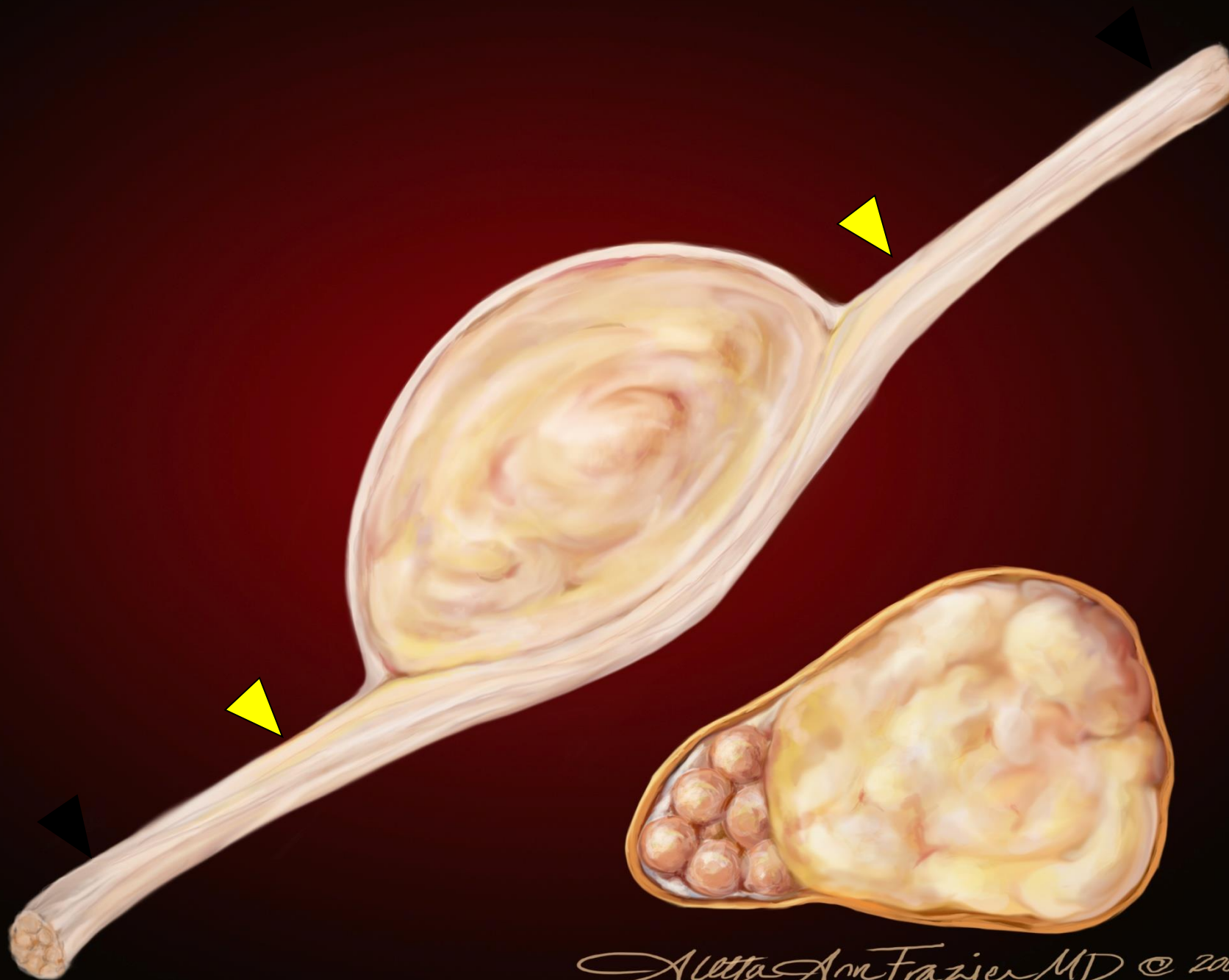
T1



T1



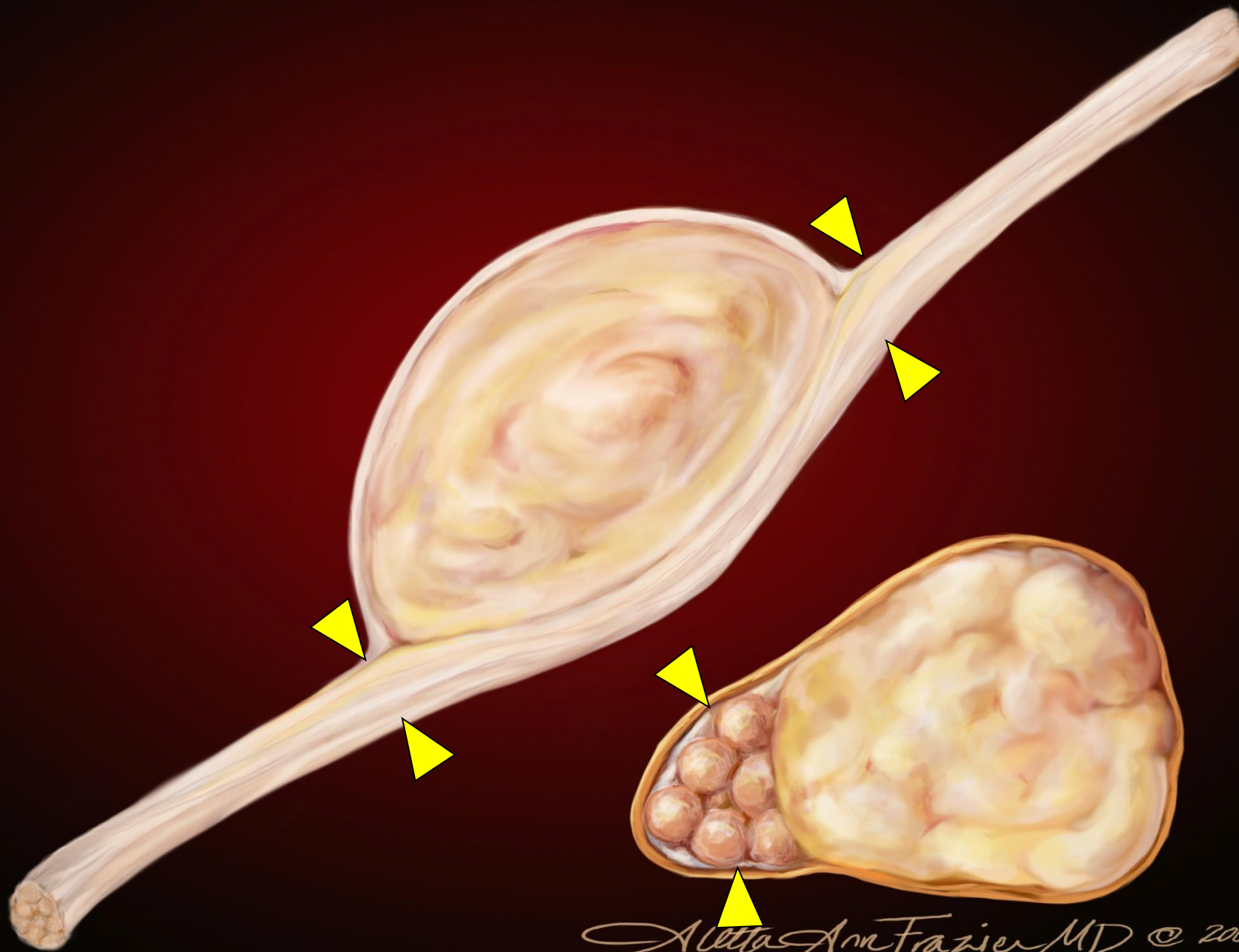
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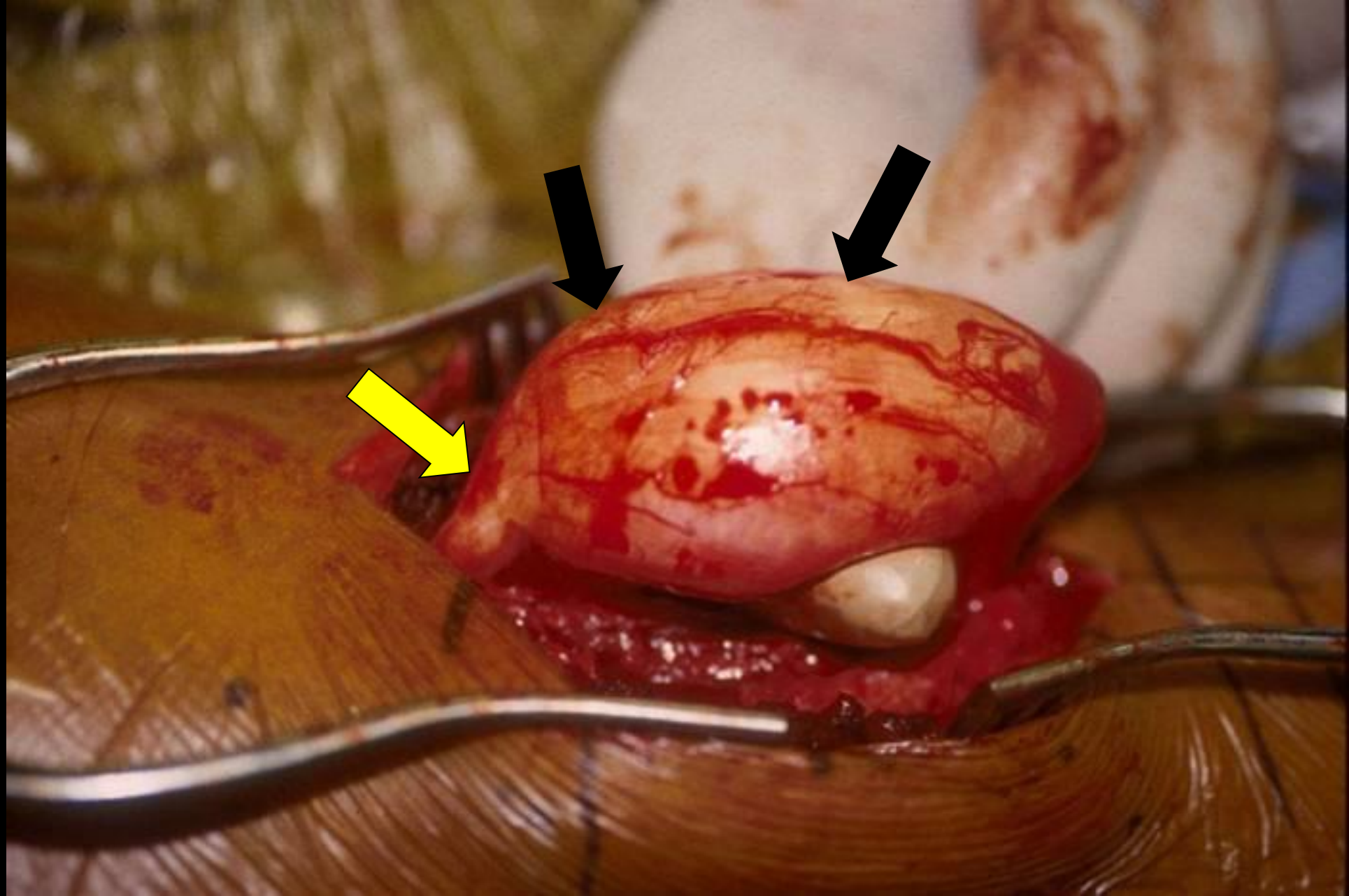
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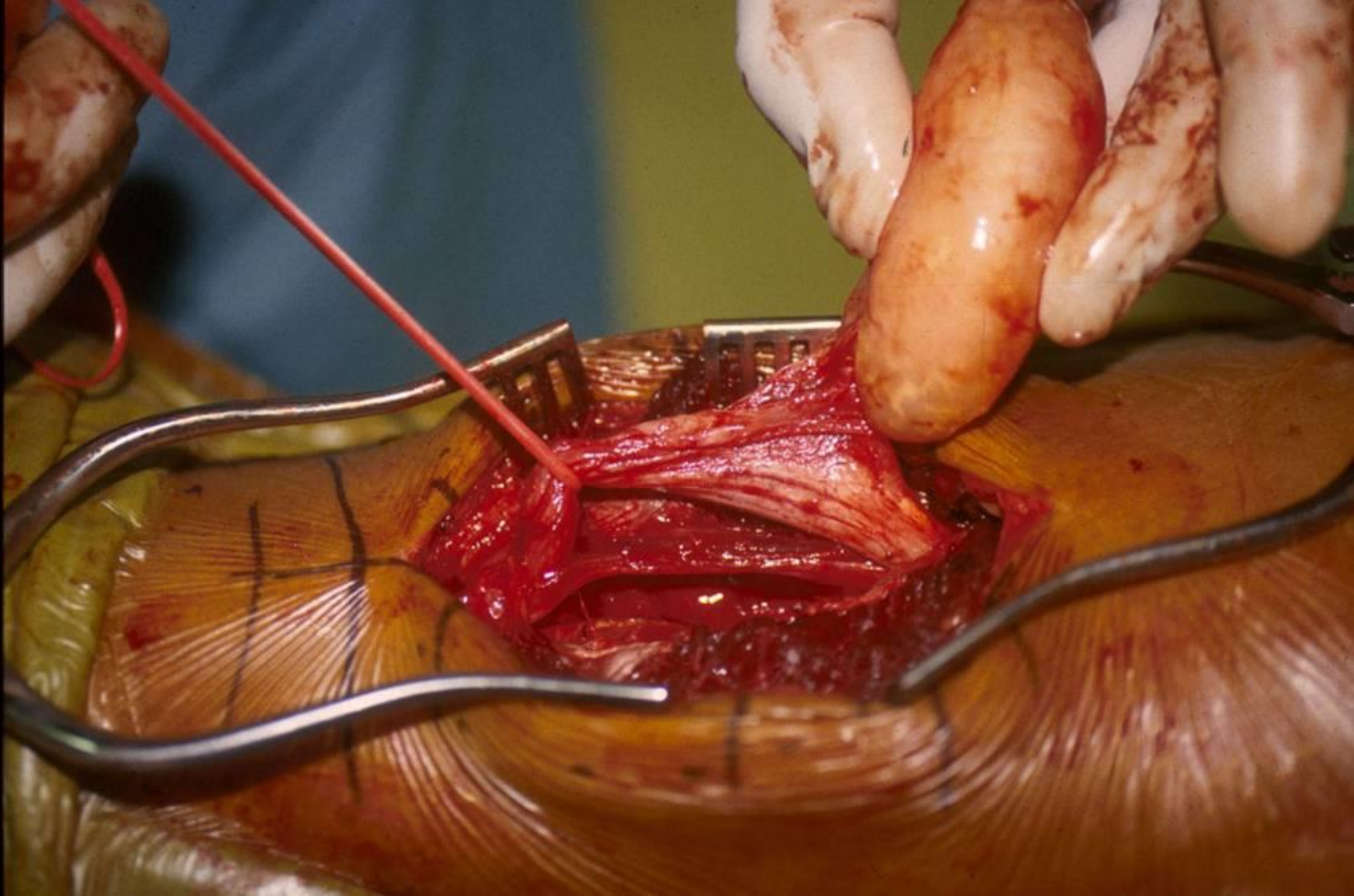


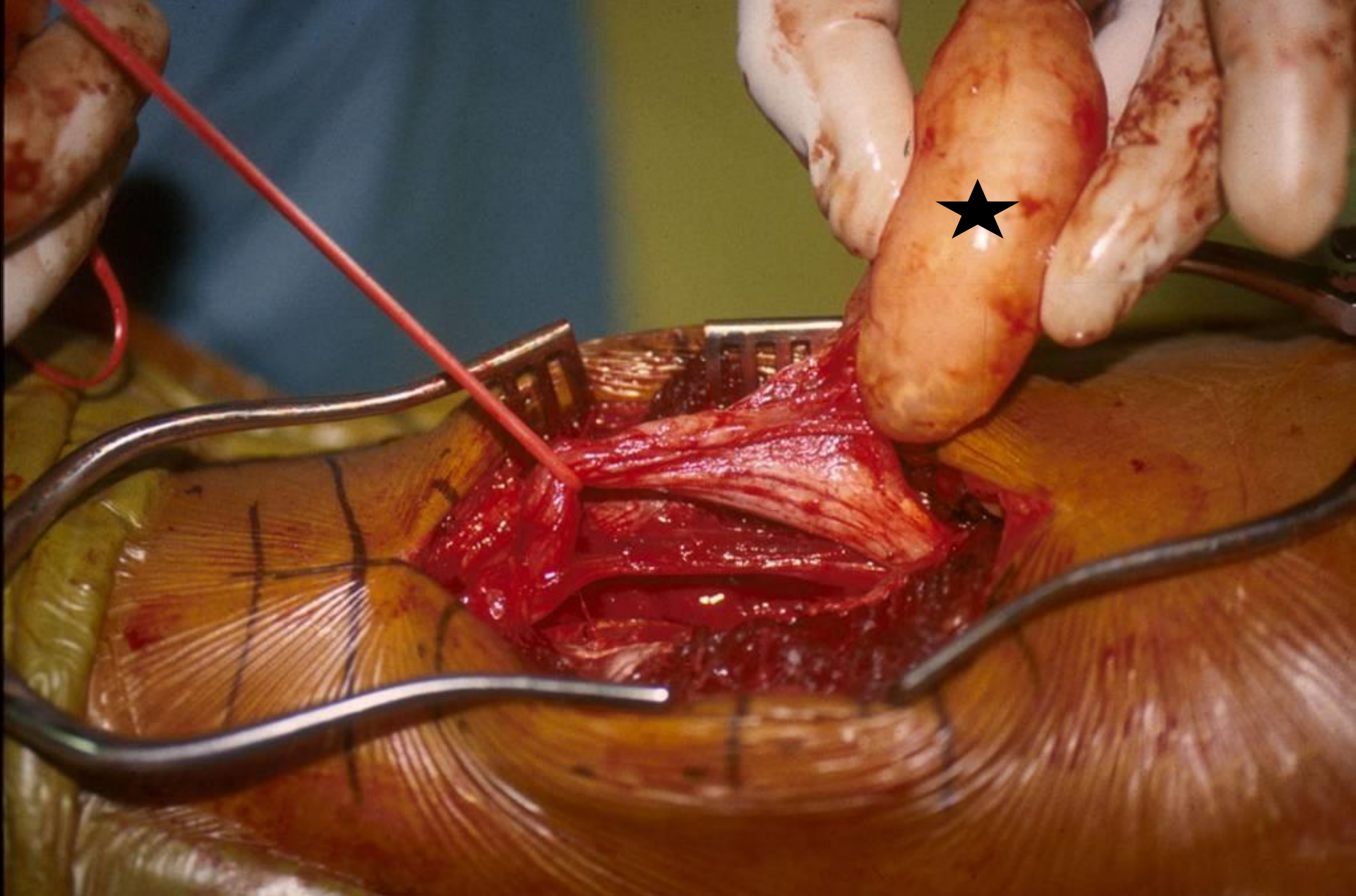
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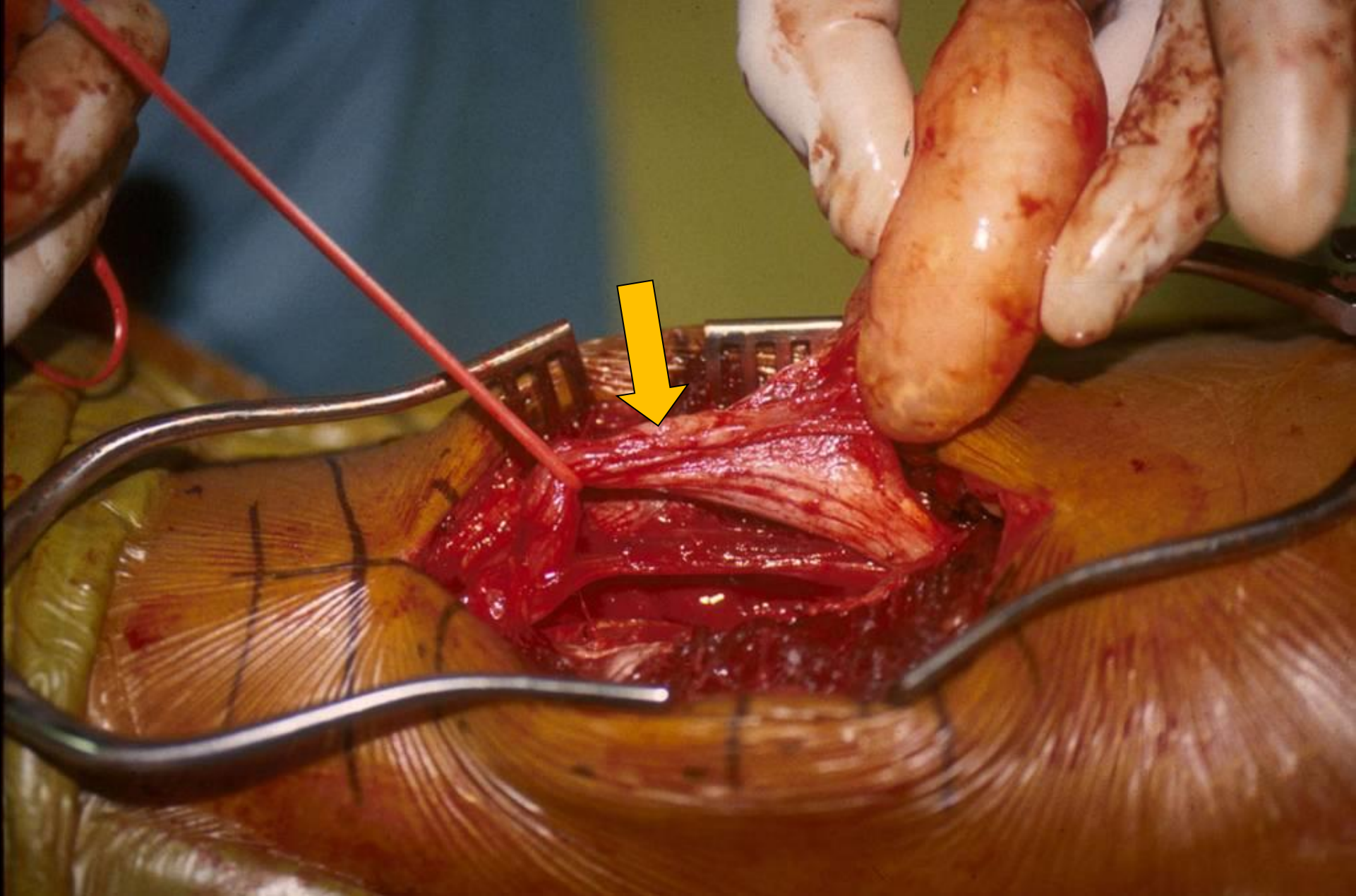












WE'LL DO AN MRI TO
BE SURE, BUT I'M FAIRLY
CERTAIN IT'S A SWANNOMA



© Morpovic

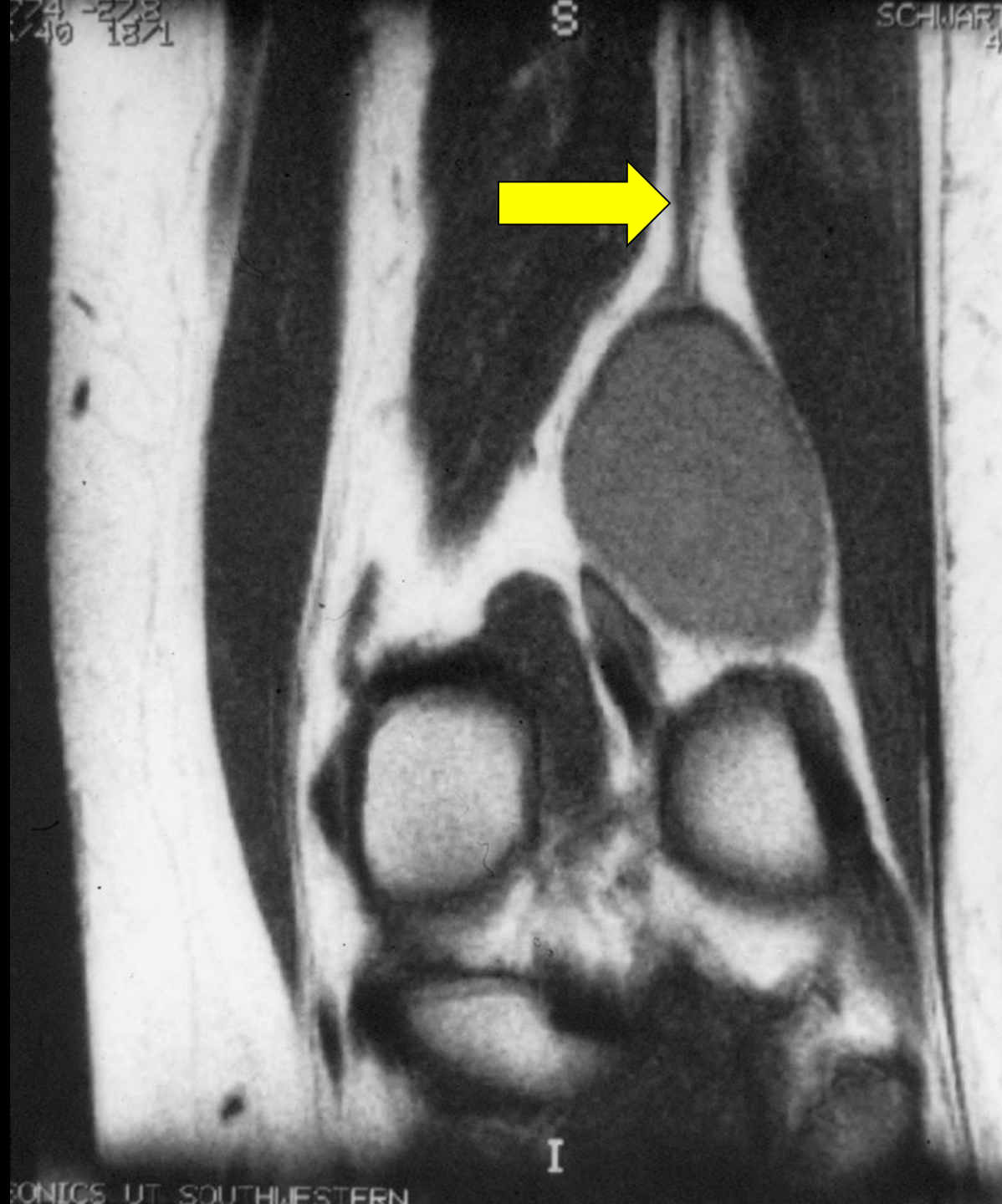
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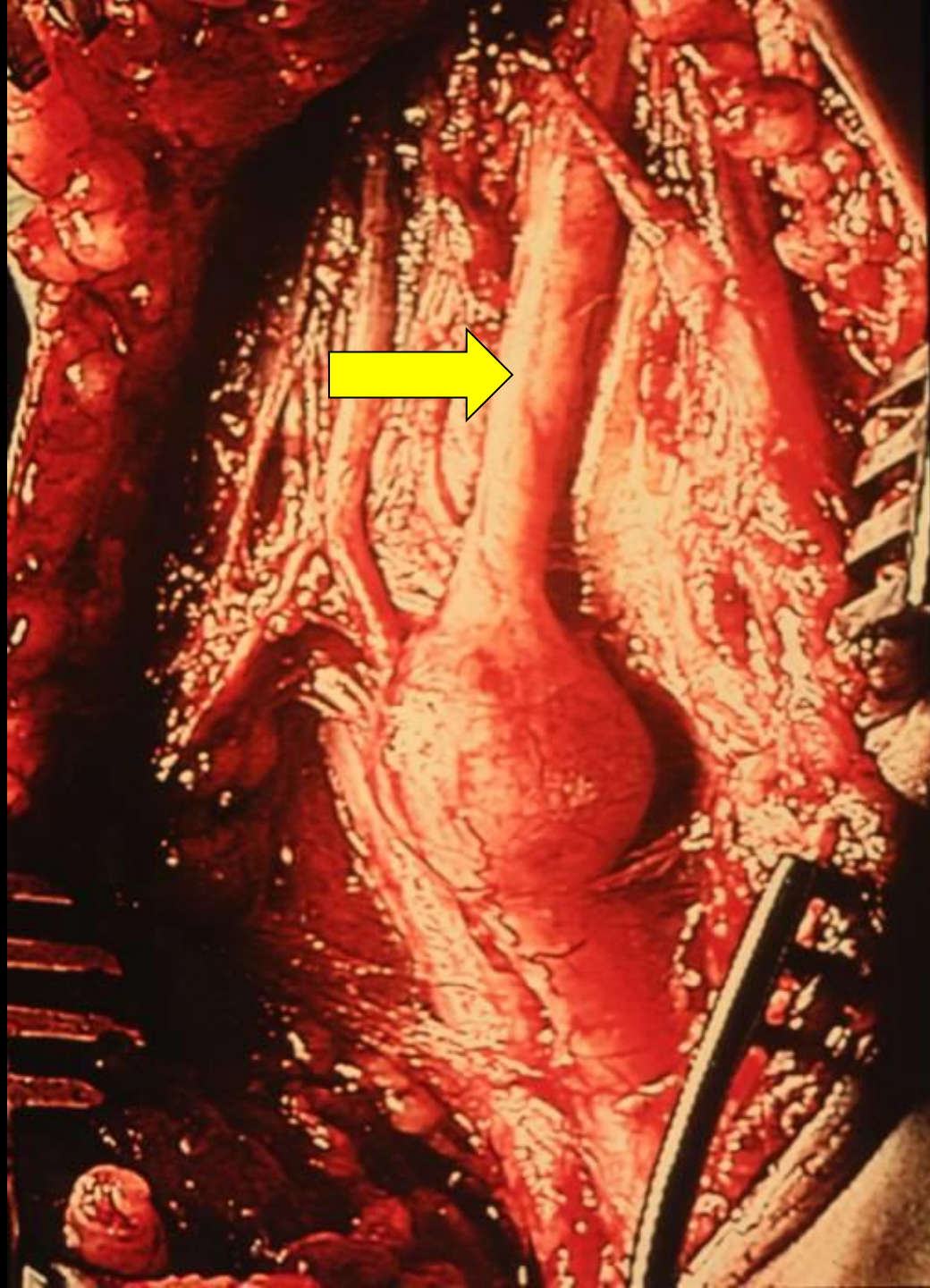
T1



T1





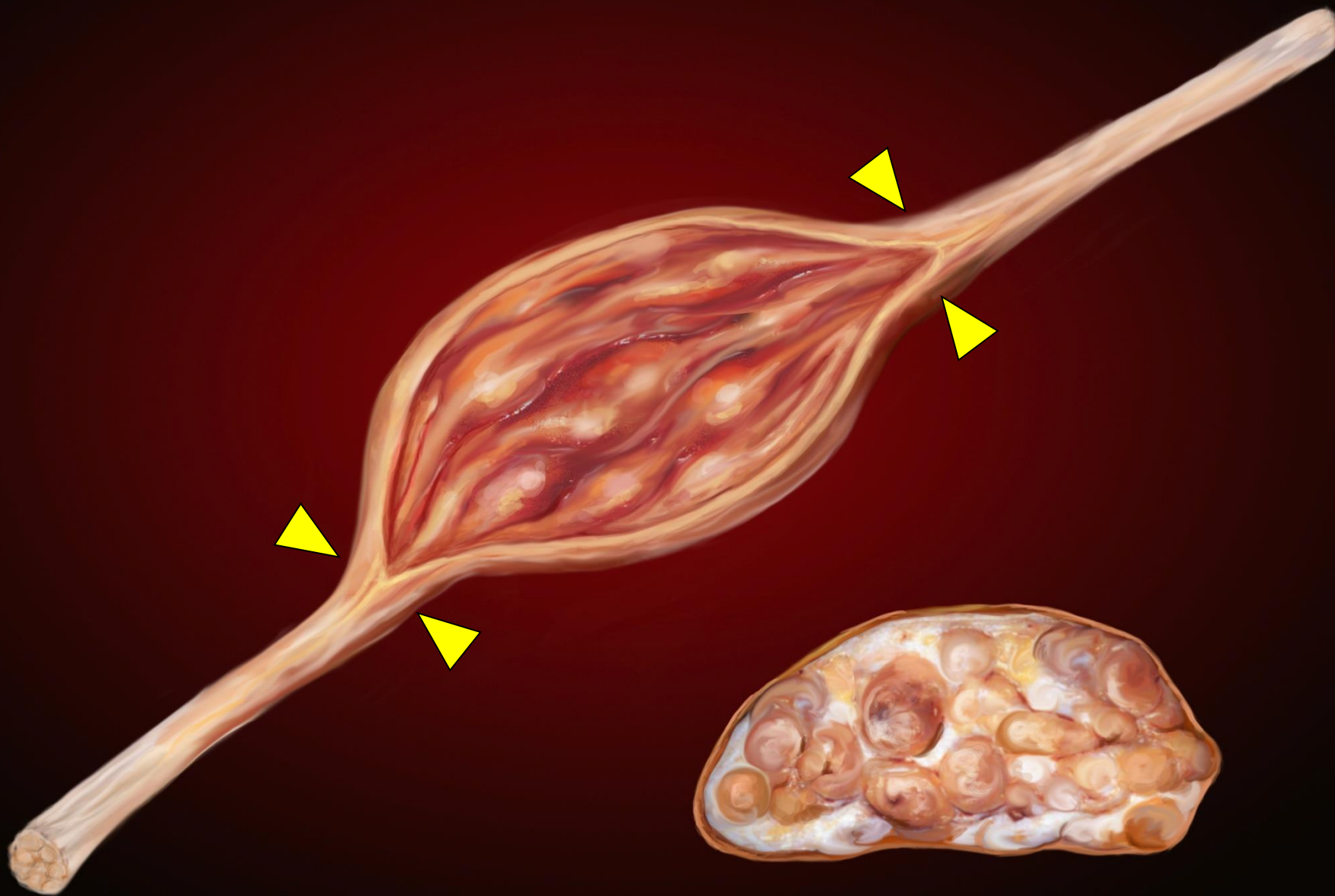




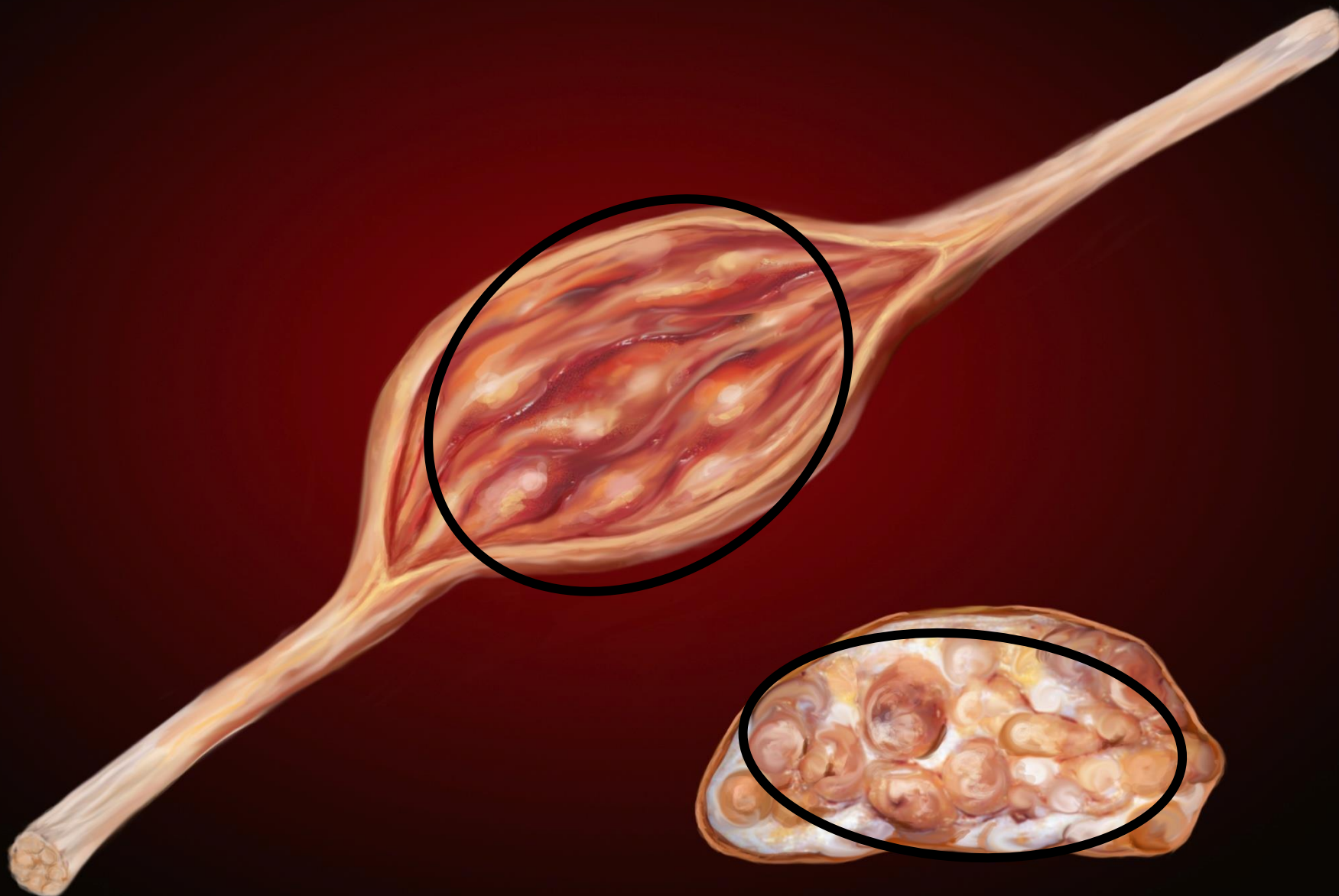
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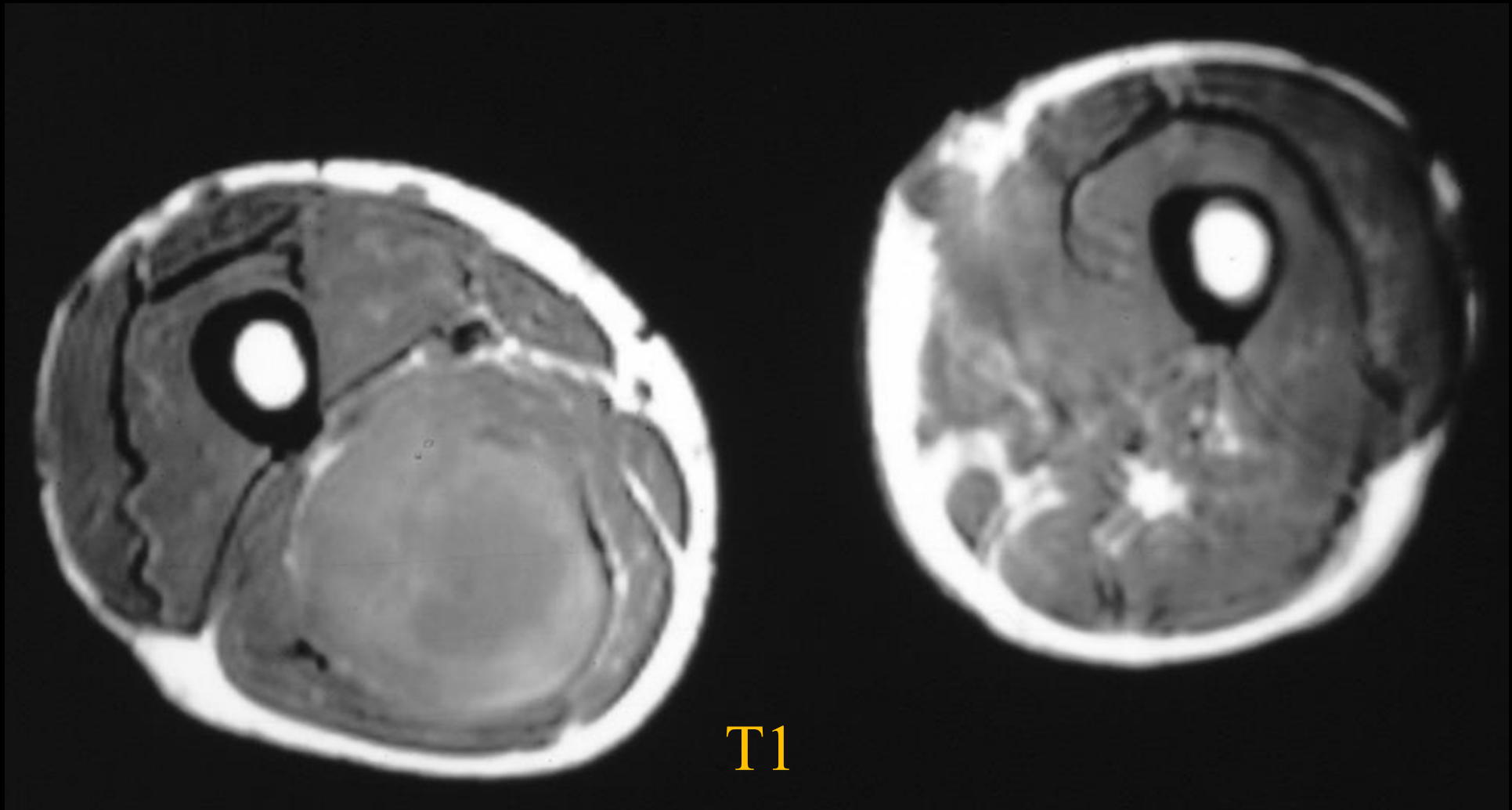
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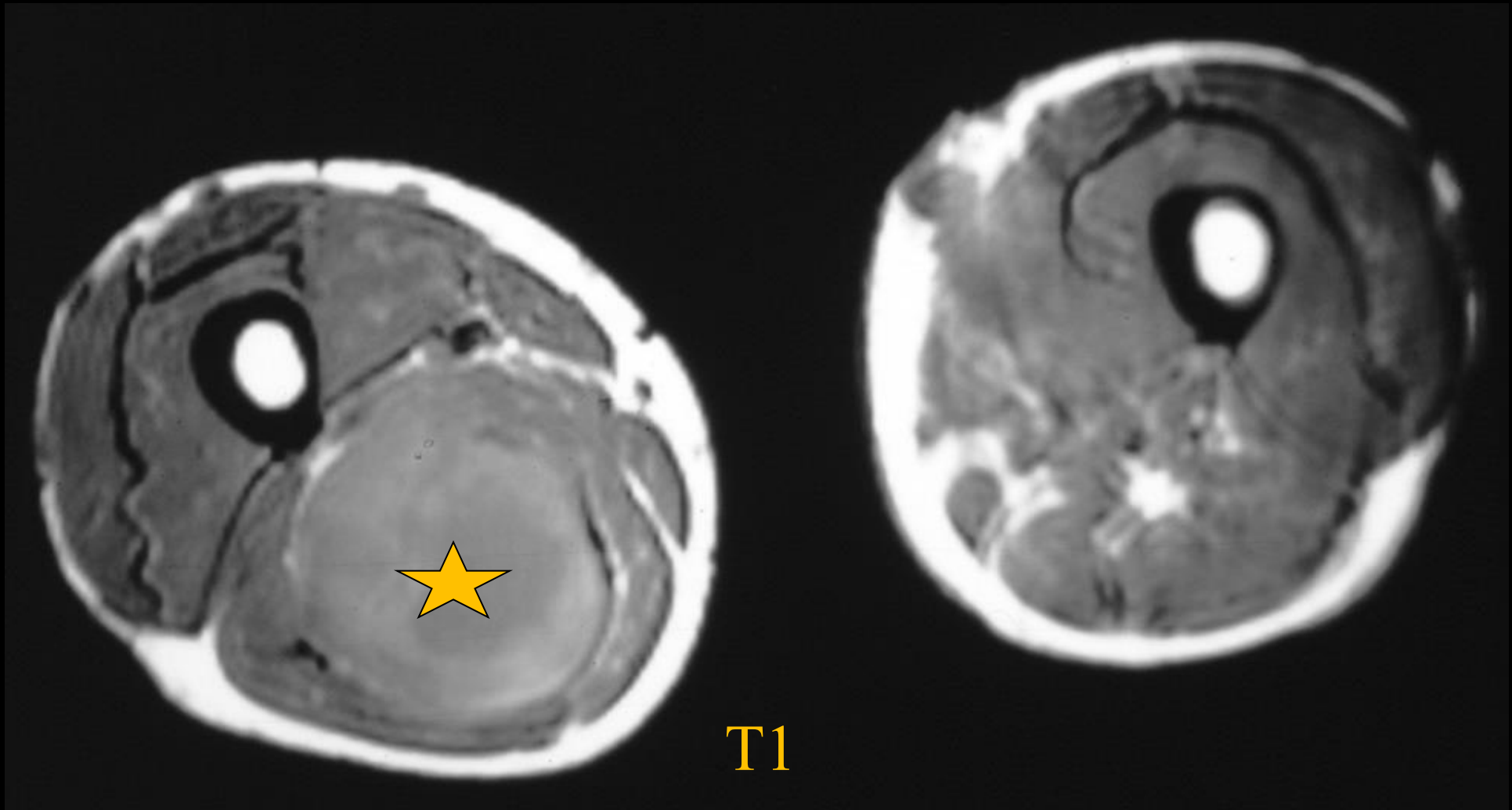


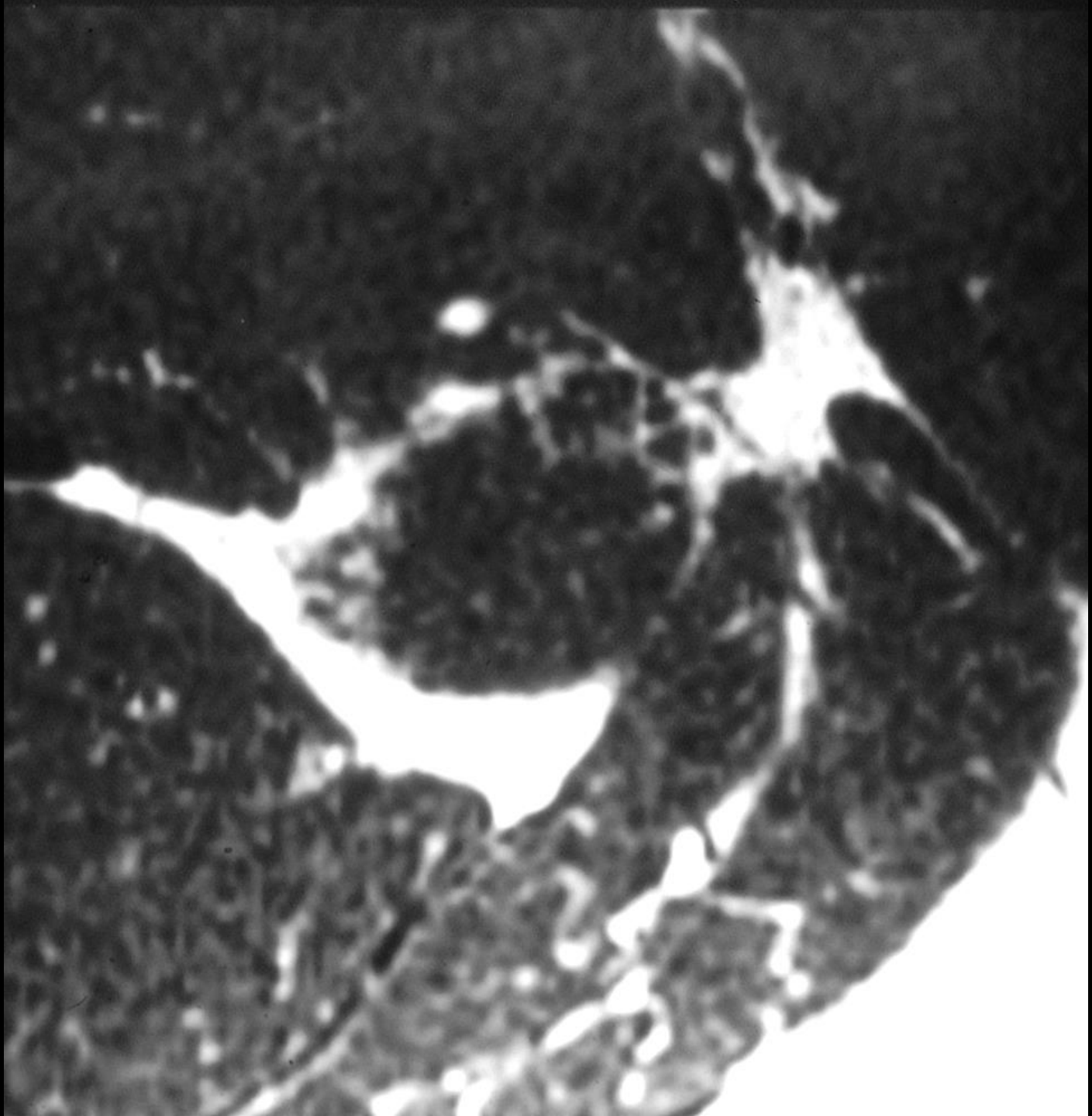
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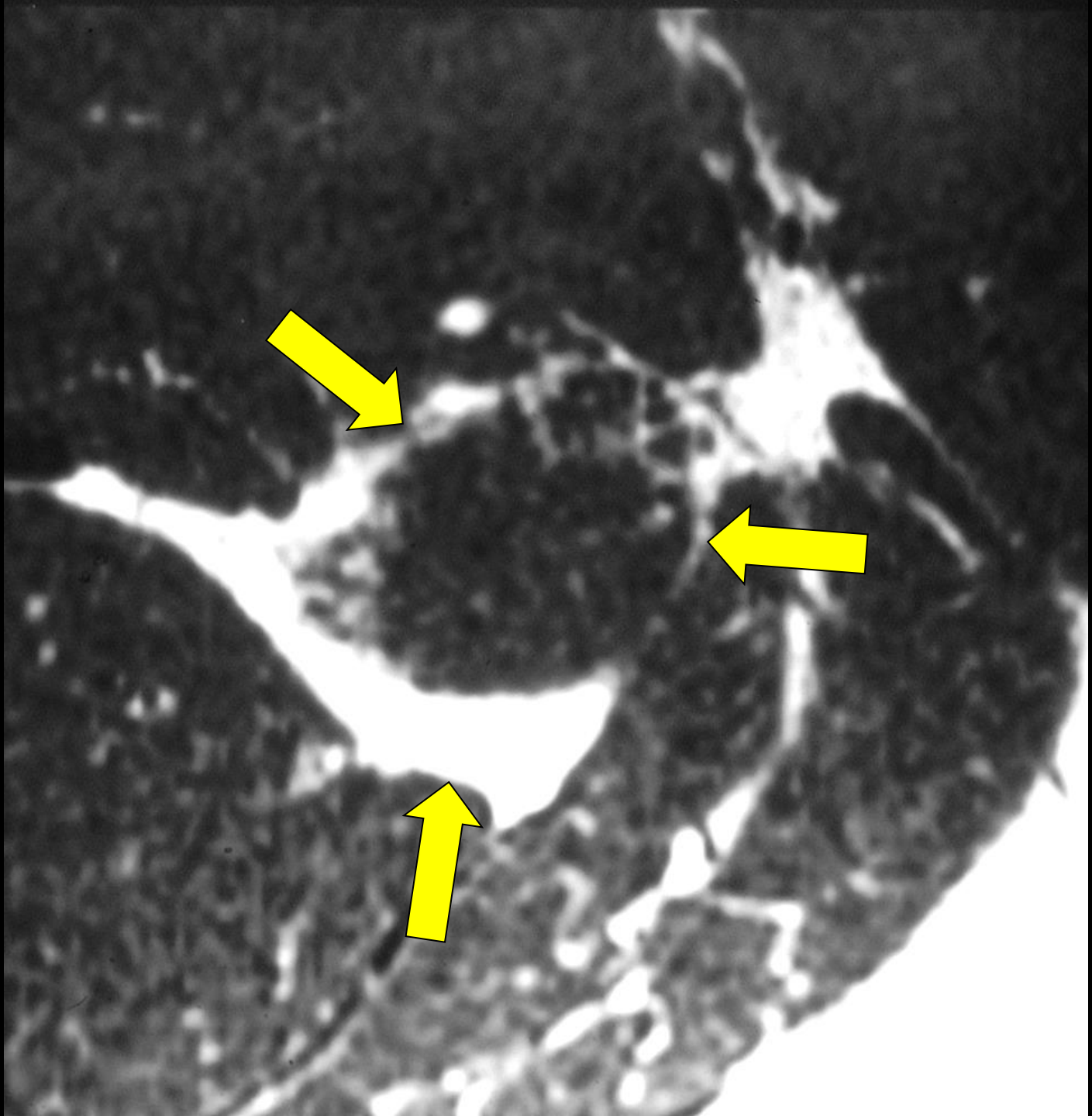
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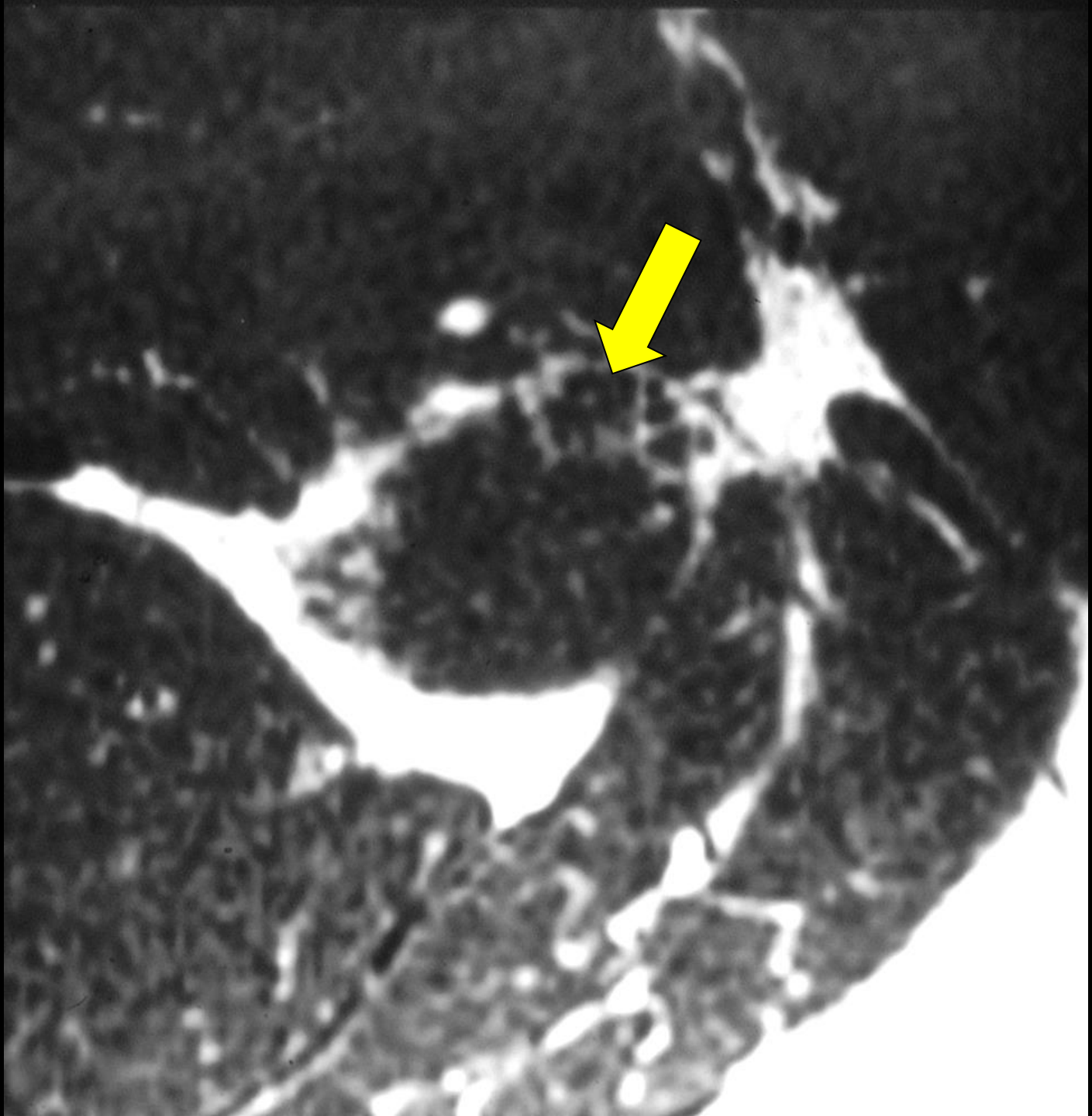




T1



T1

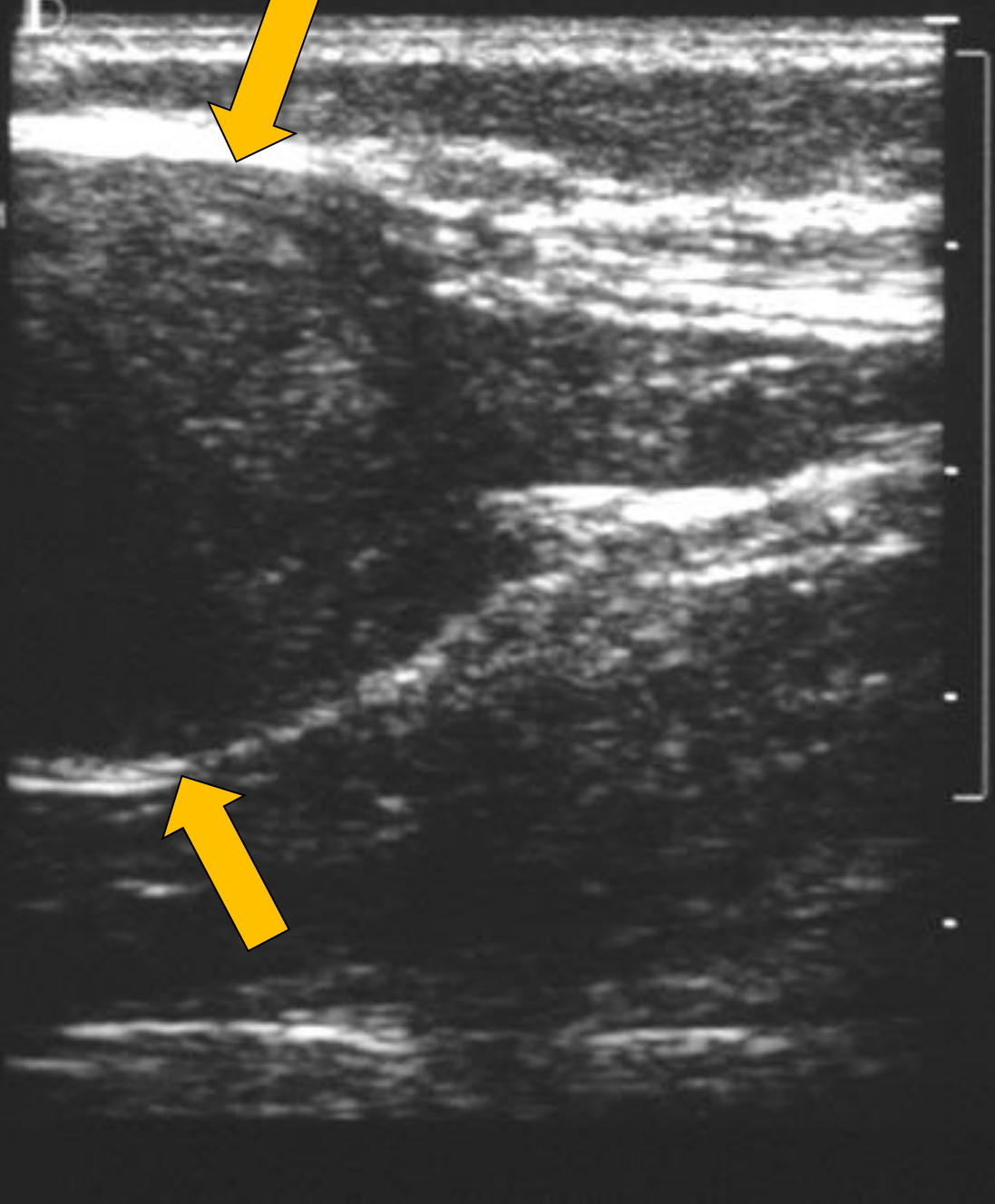


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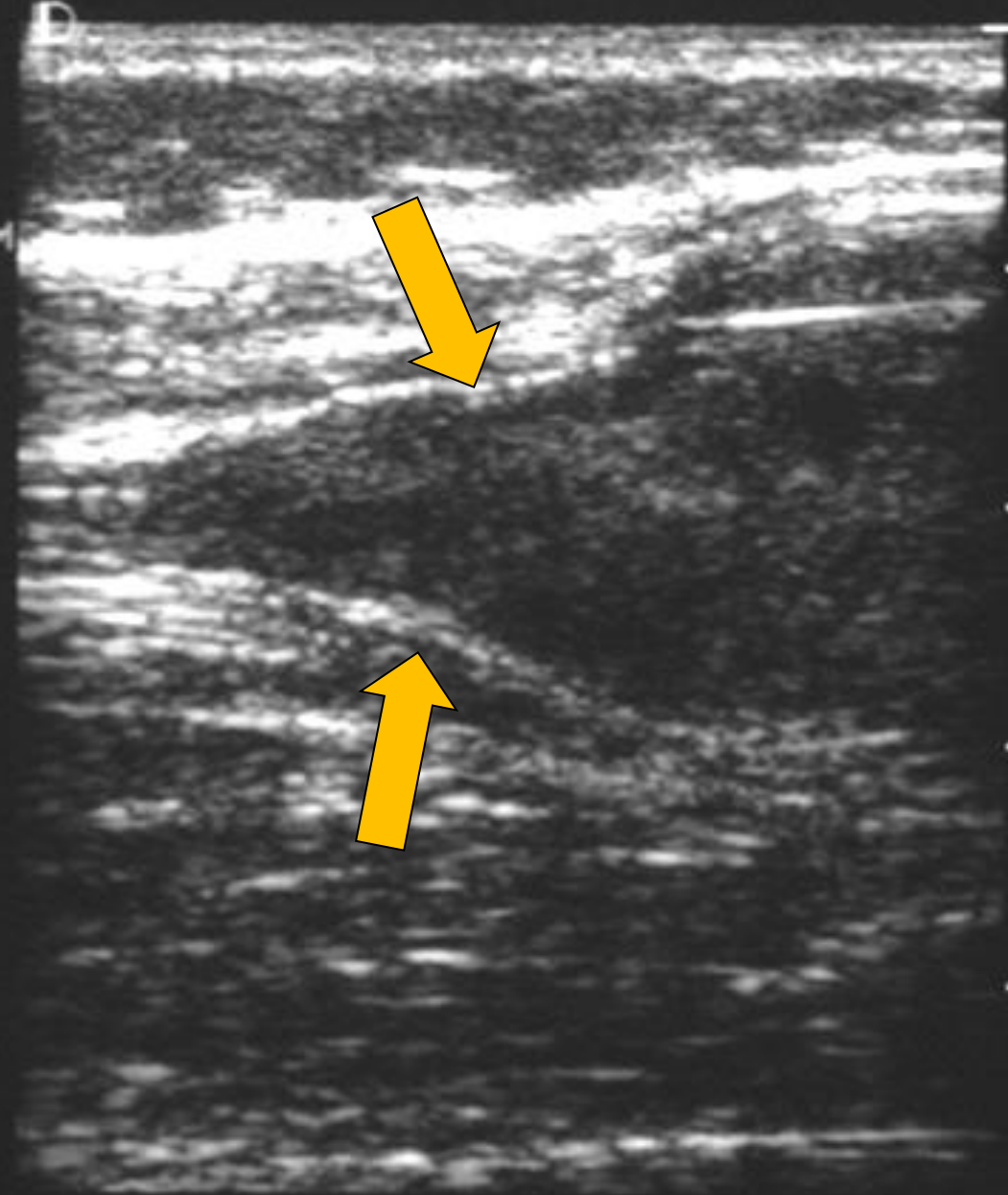


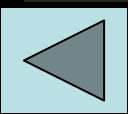
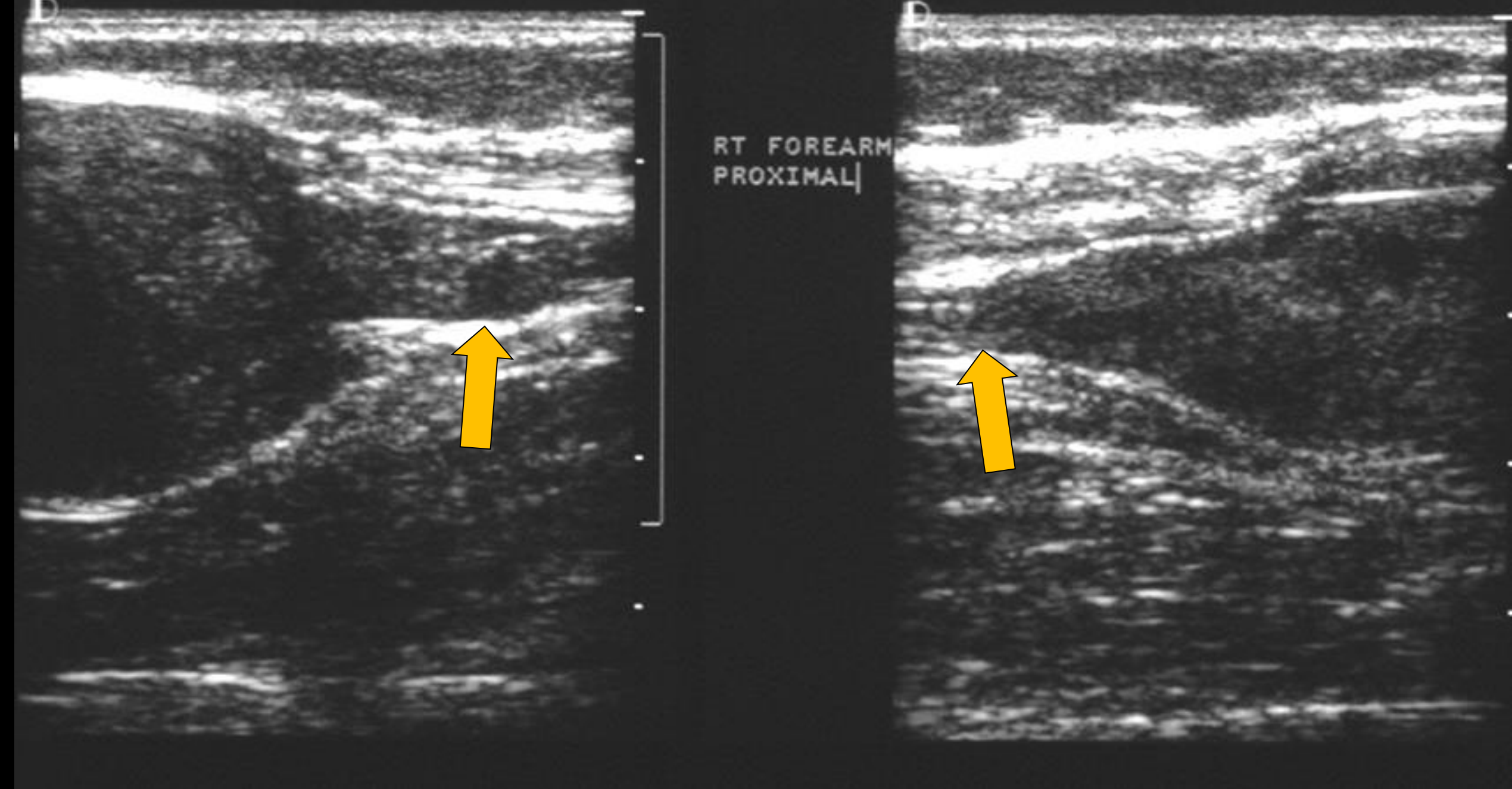
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PROXIMAL

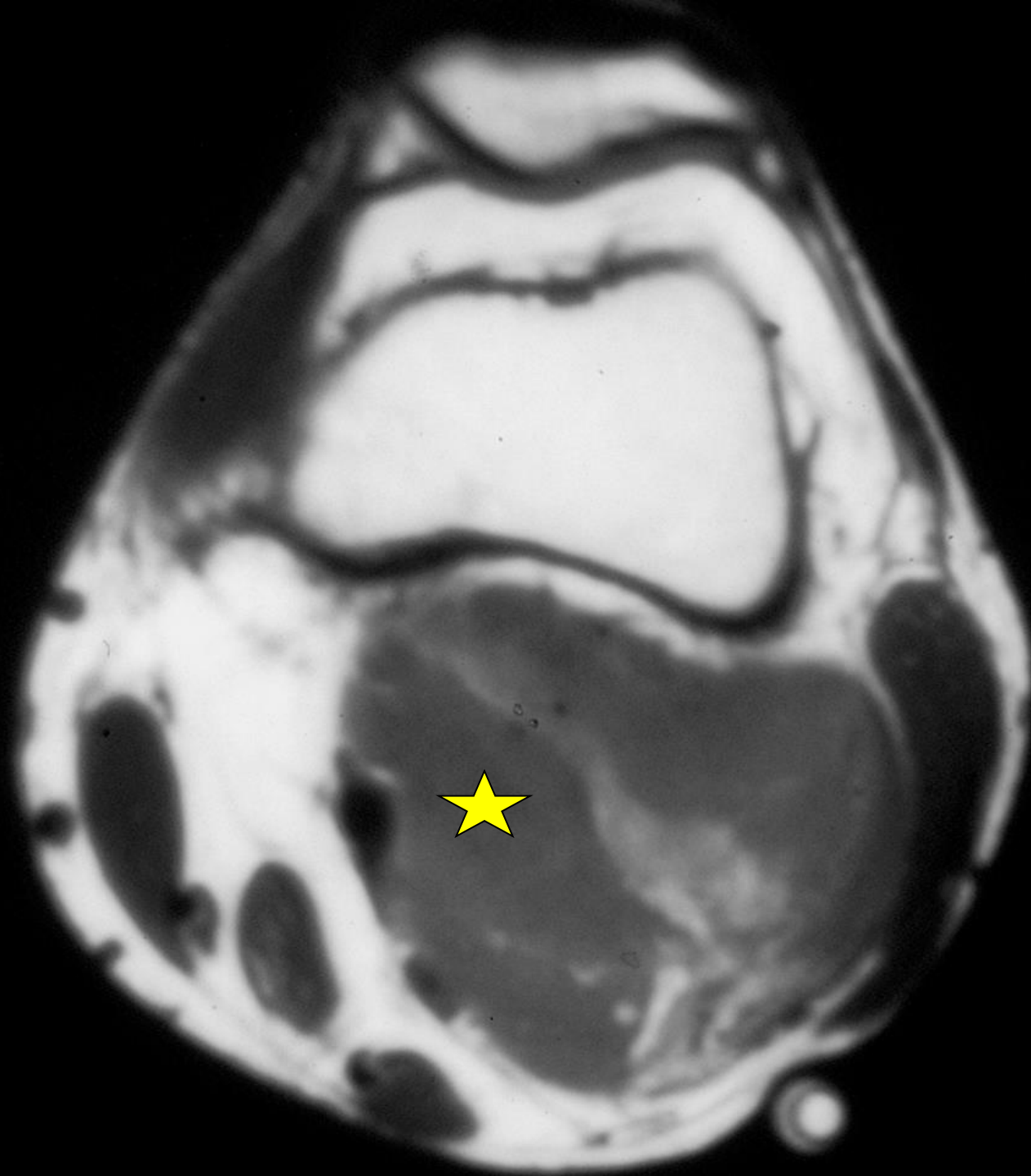




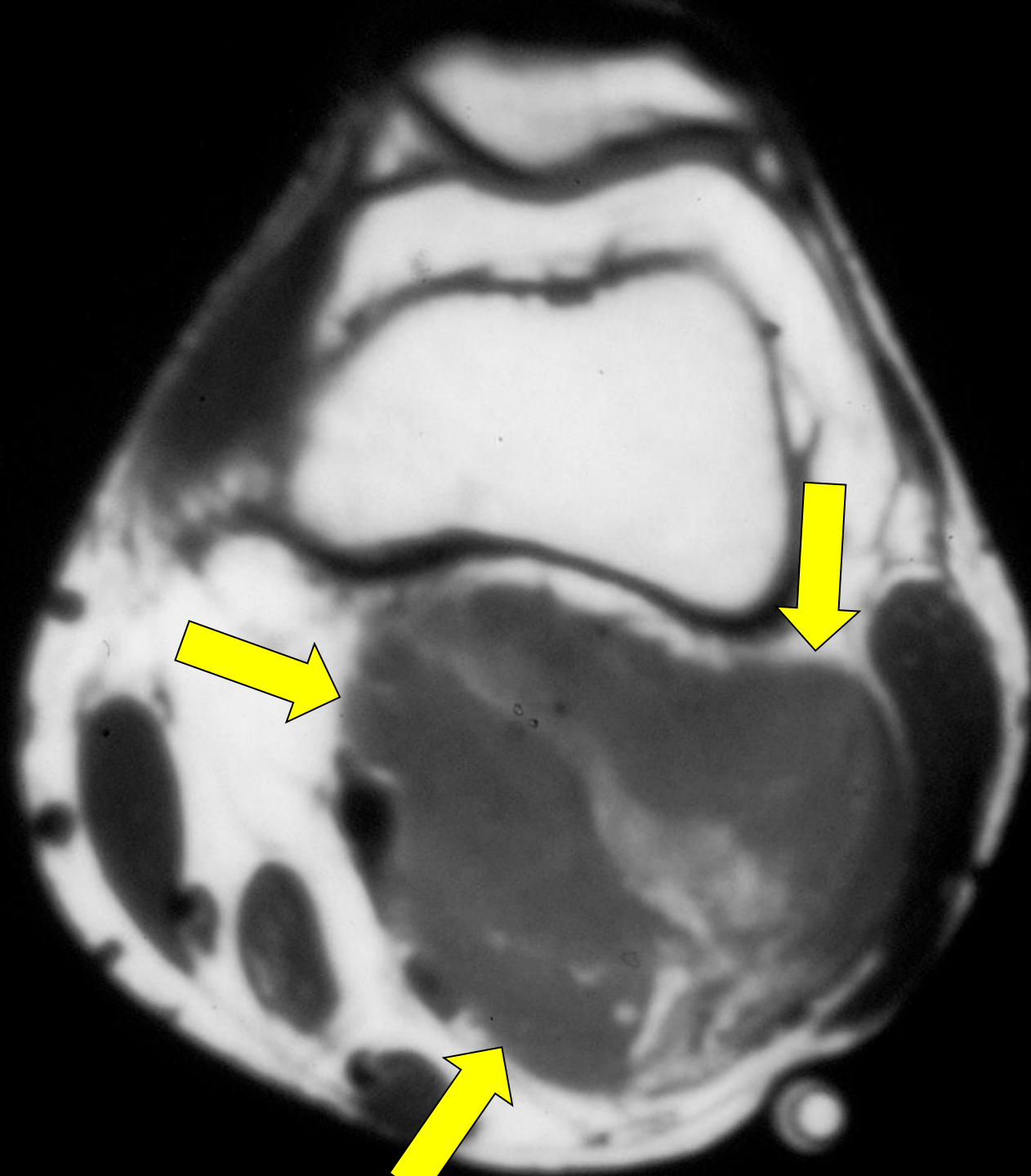
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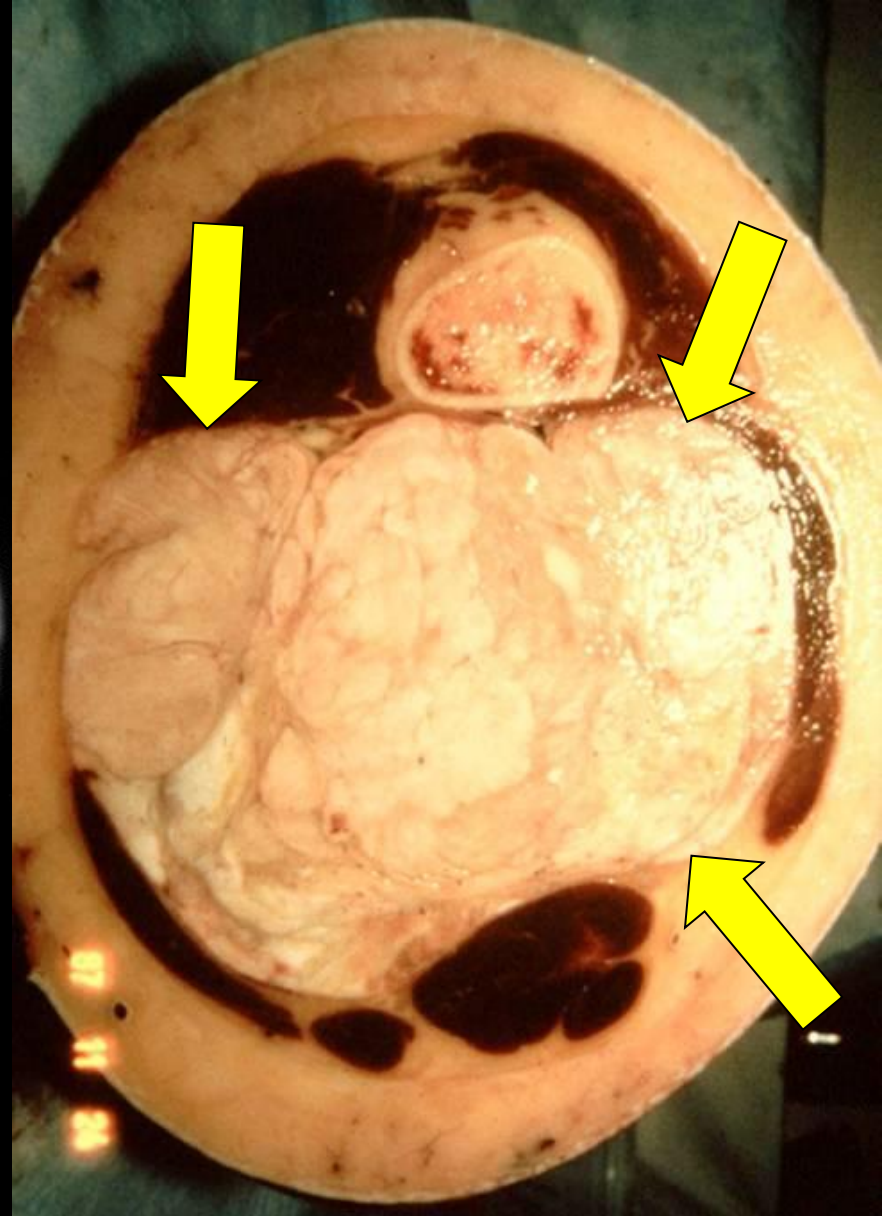
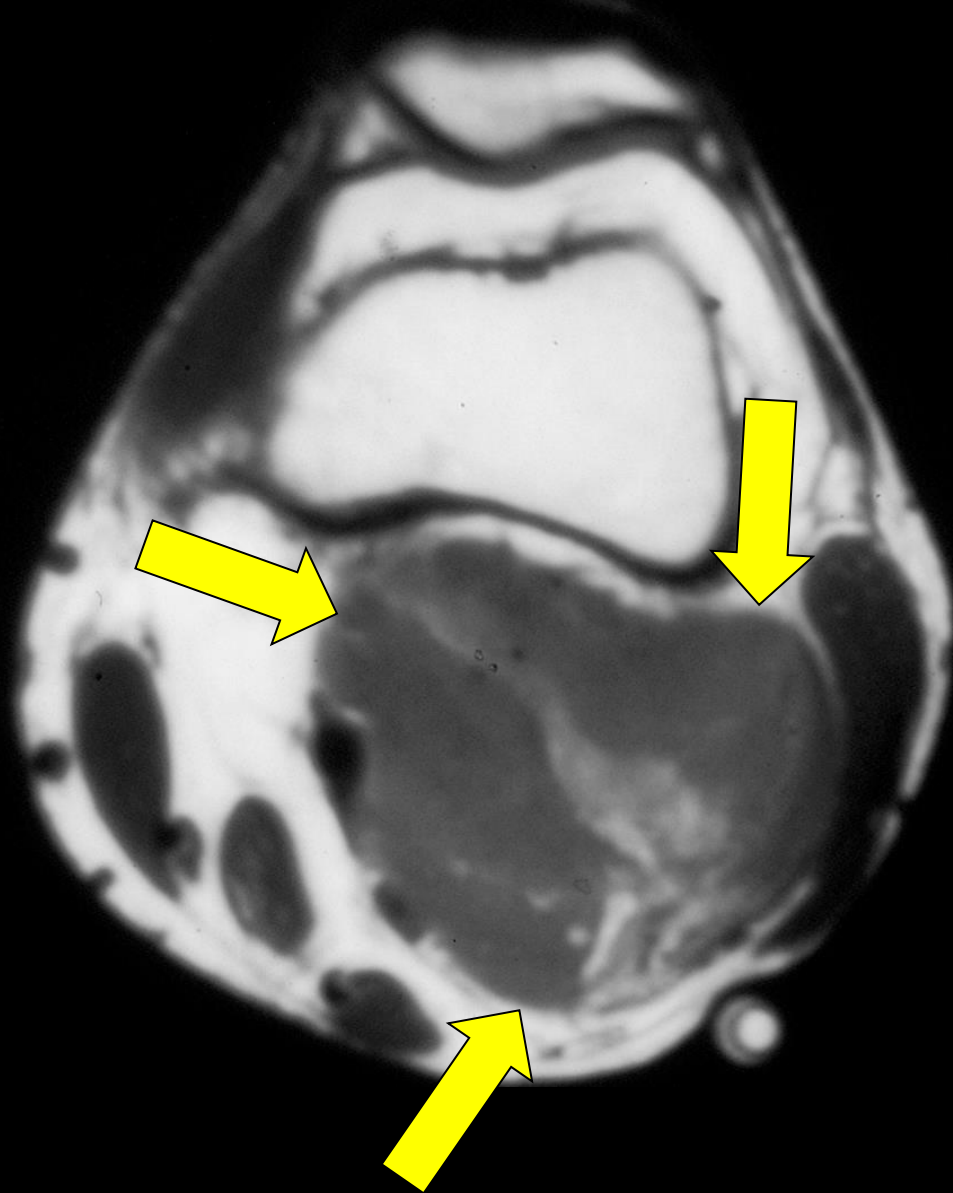


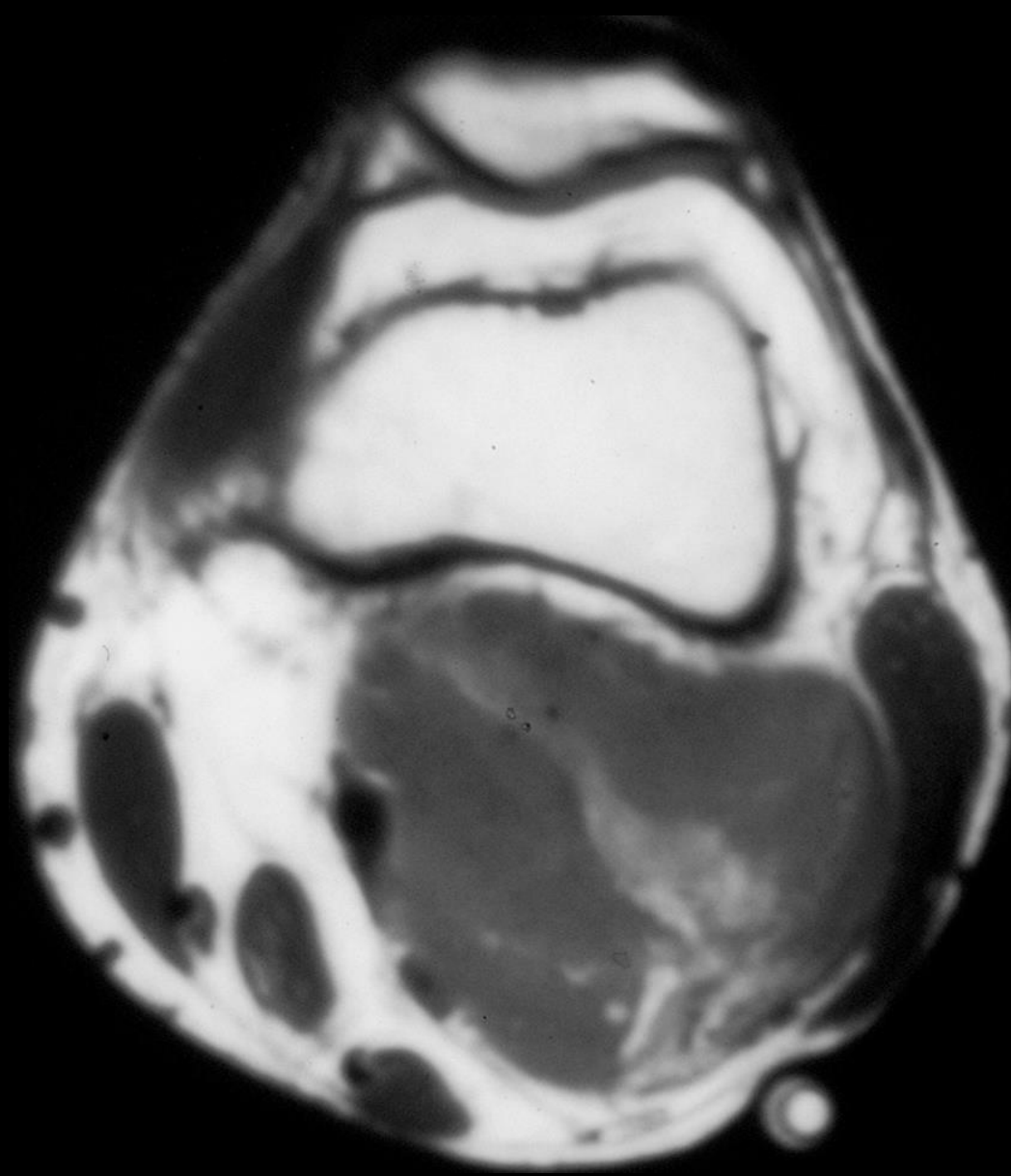


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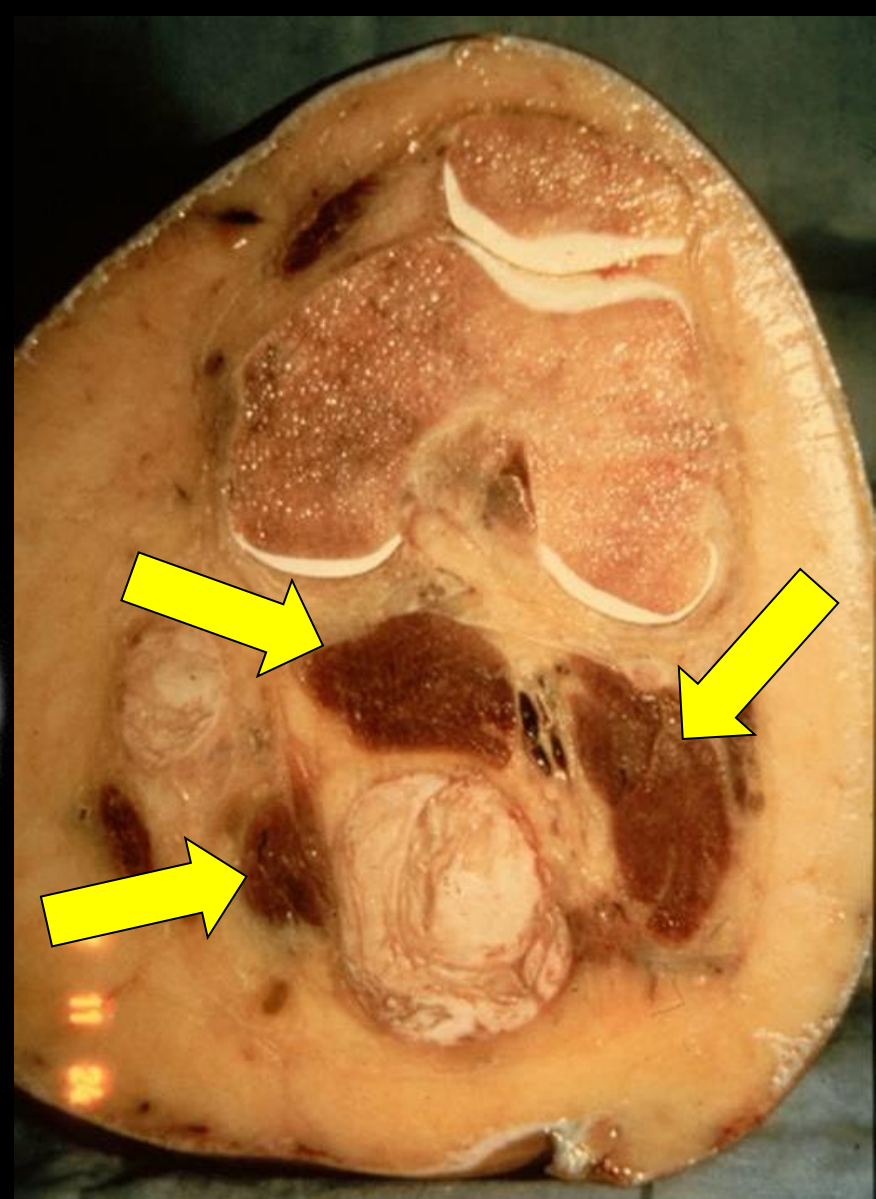


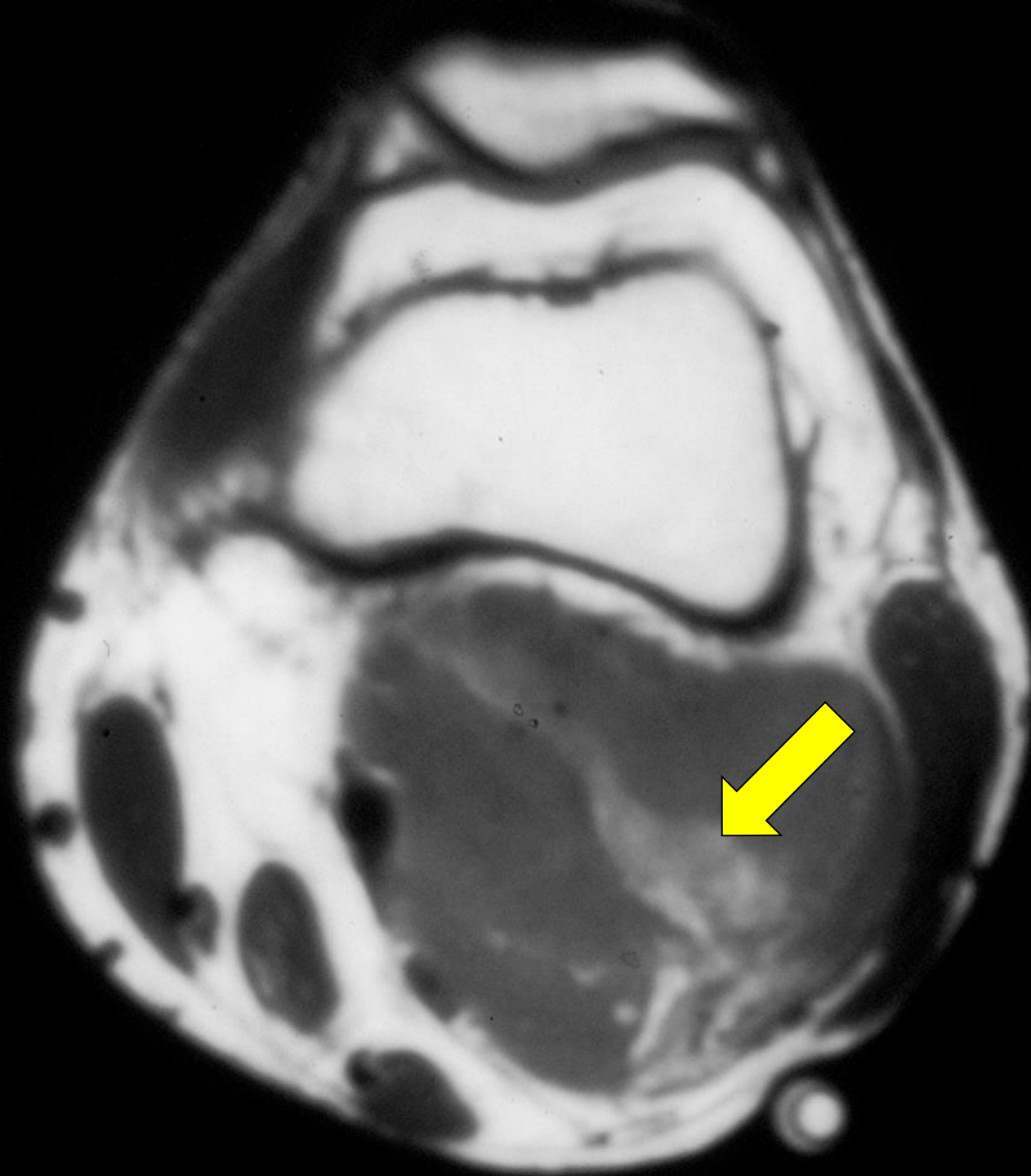
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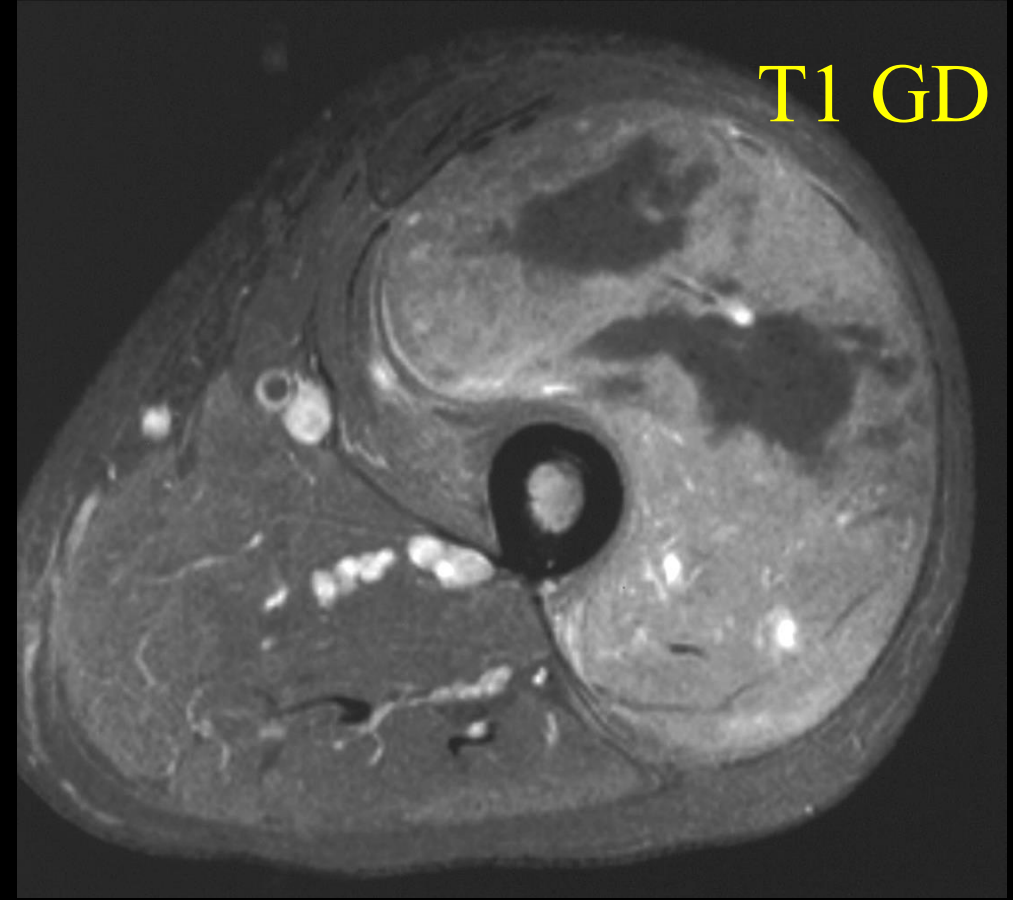


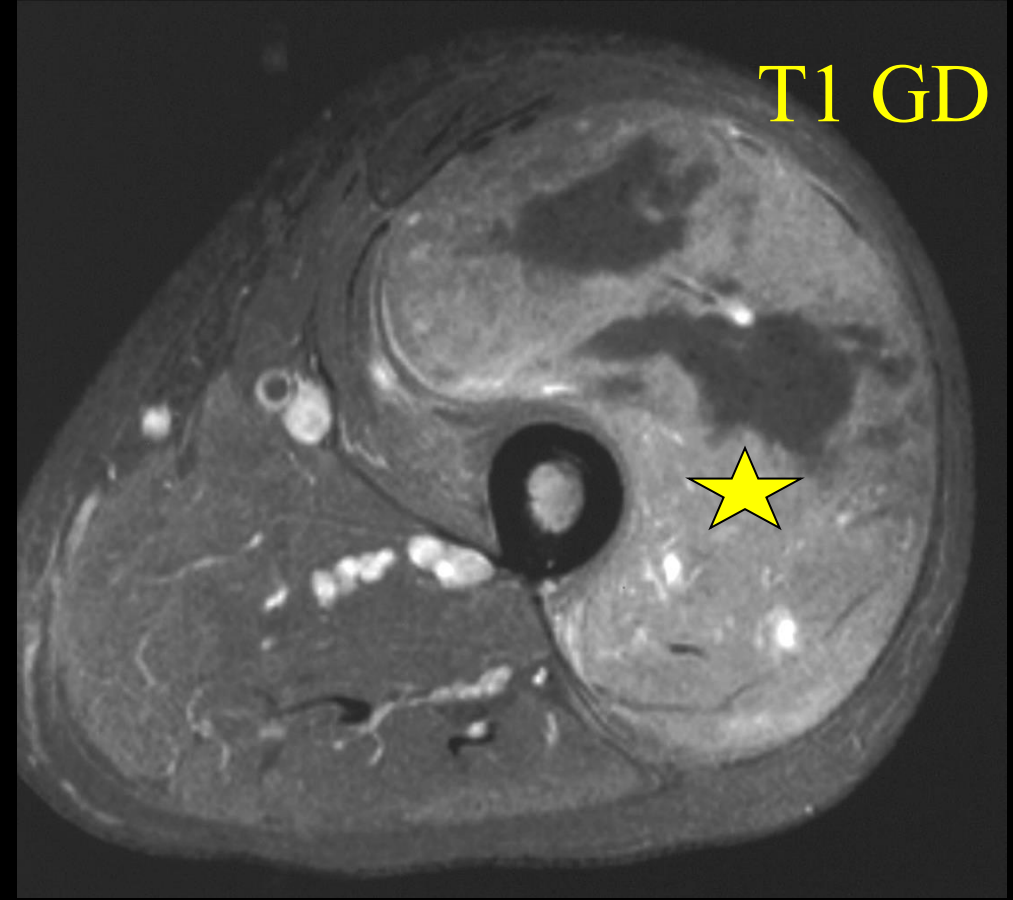


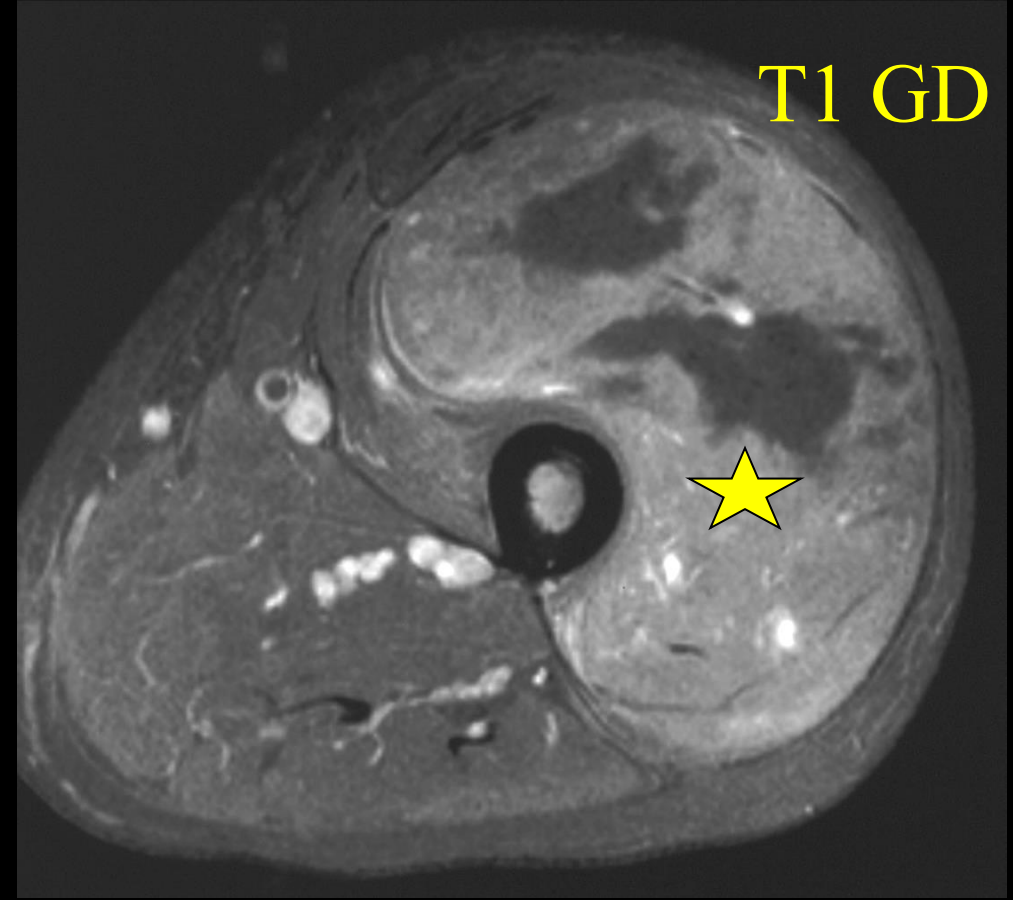
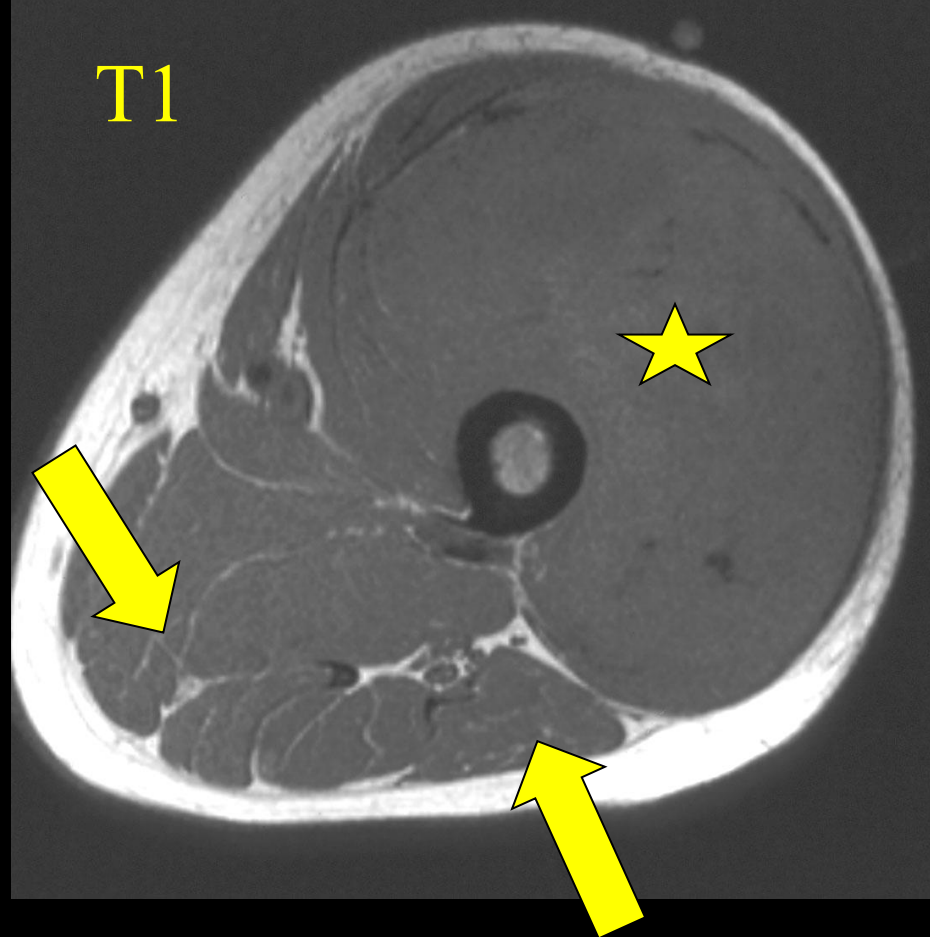
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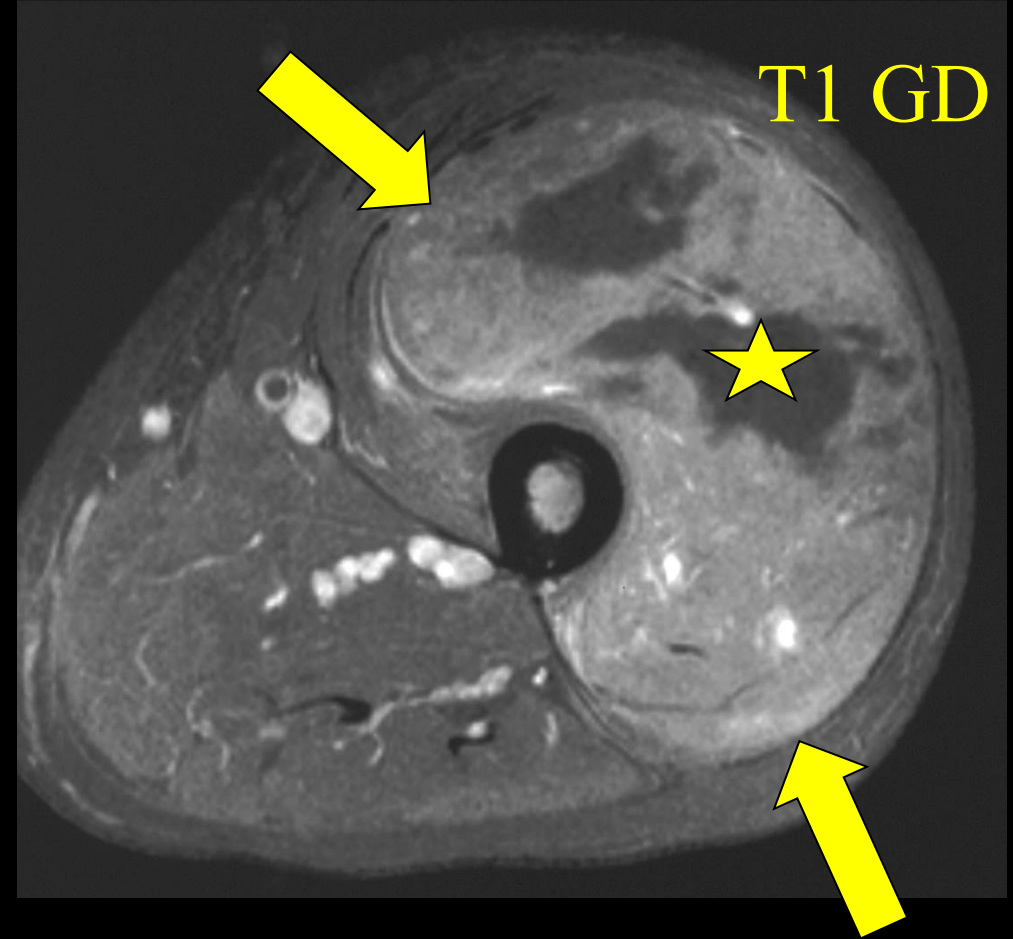
SOFT TISSUE TUMOR: INTRAMUSCULAR

- Surrounded by muscle; Usually no surrounding fat
 - Nodular fasciitis
 - Lipoma
 - Myxoma
 - Angiomatous lesions
 - UPS (MFH)/Myxofibrosarcoma/Fibrosarcoma
 - Low grade liposarcoma (well differentiated)
 - Leiomyosarcoma/Rhabdomyosarcoma
 - Soft tissue Ewing family of tumors





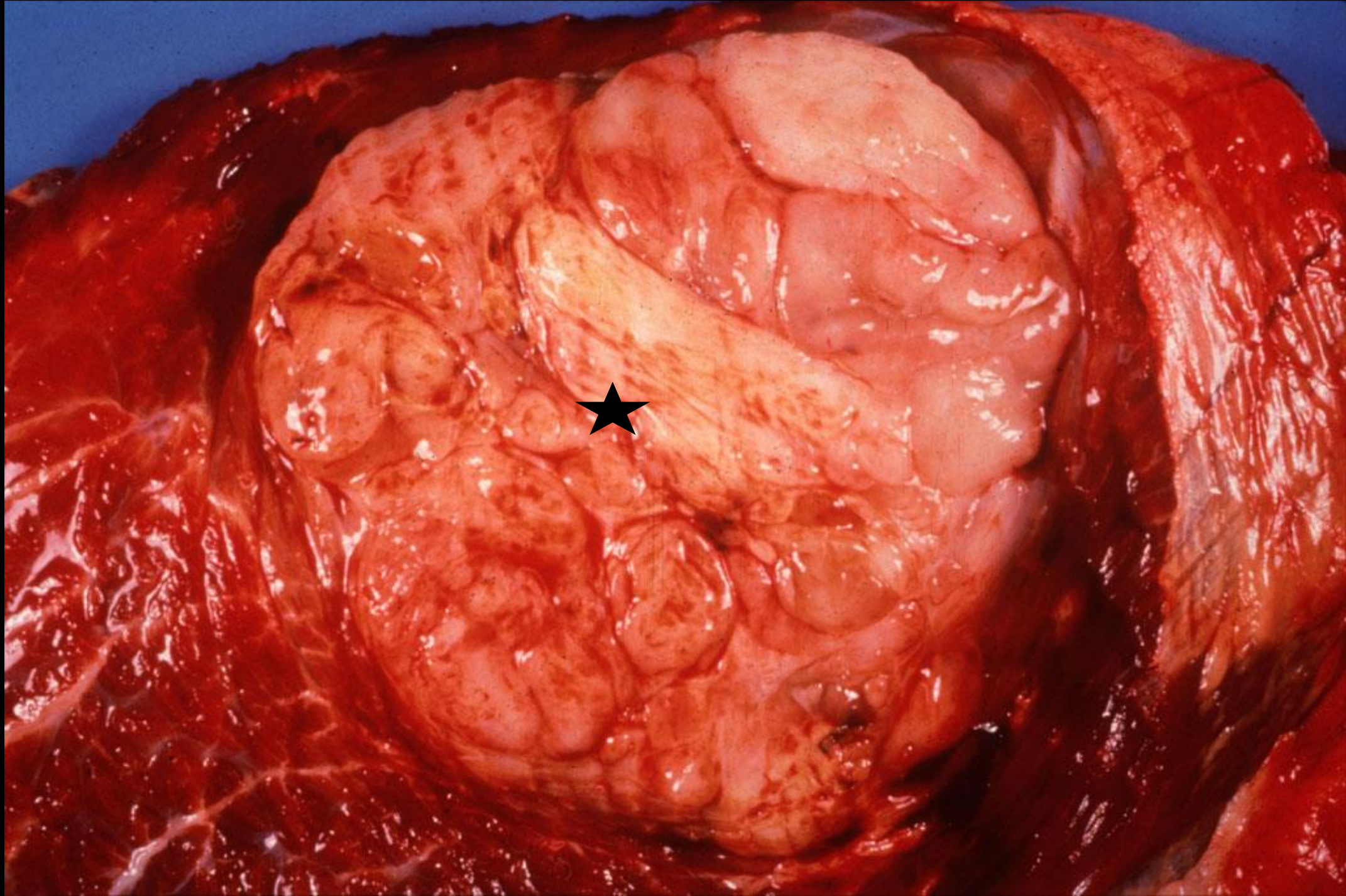


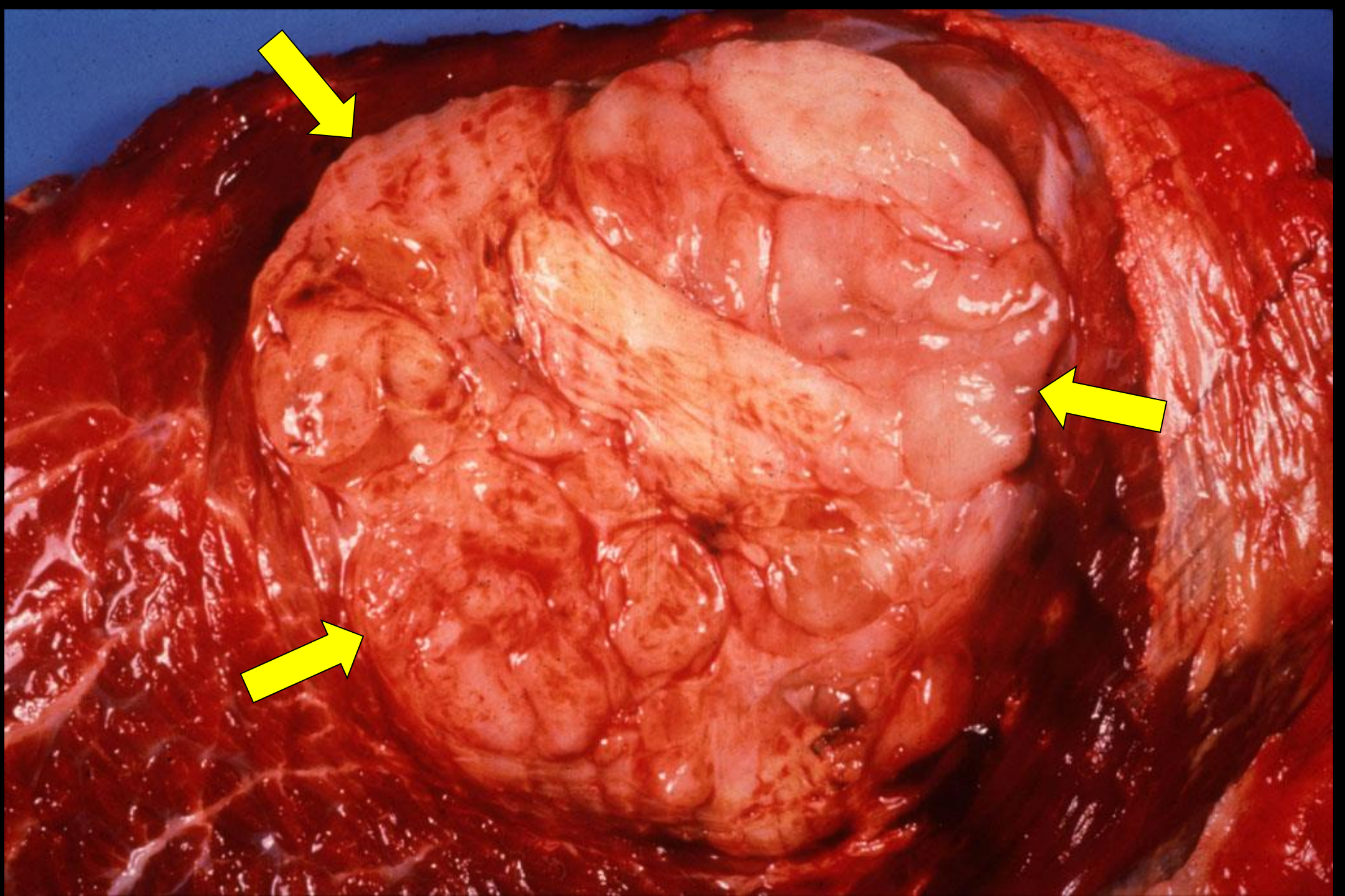


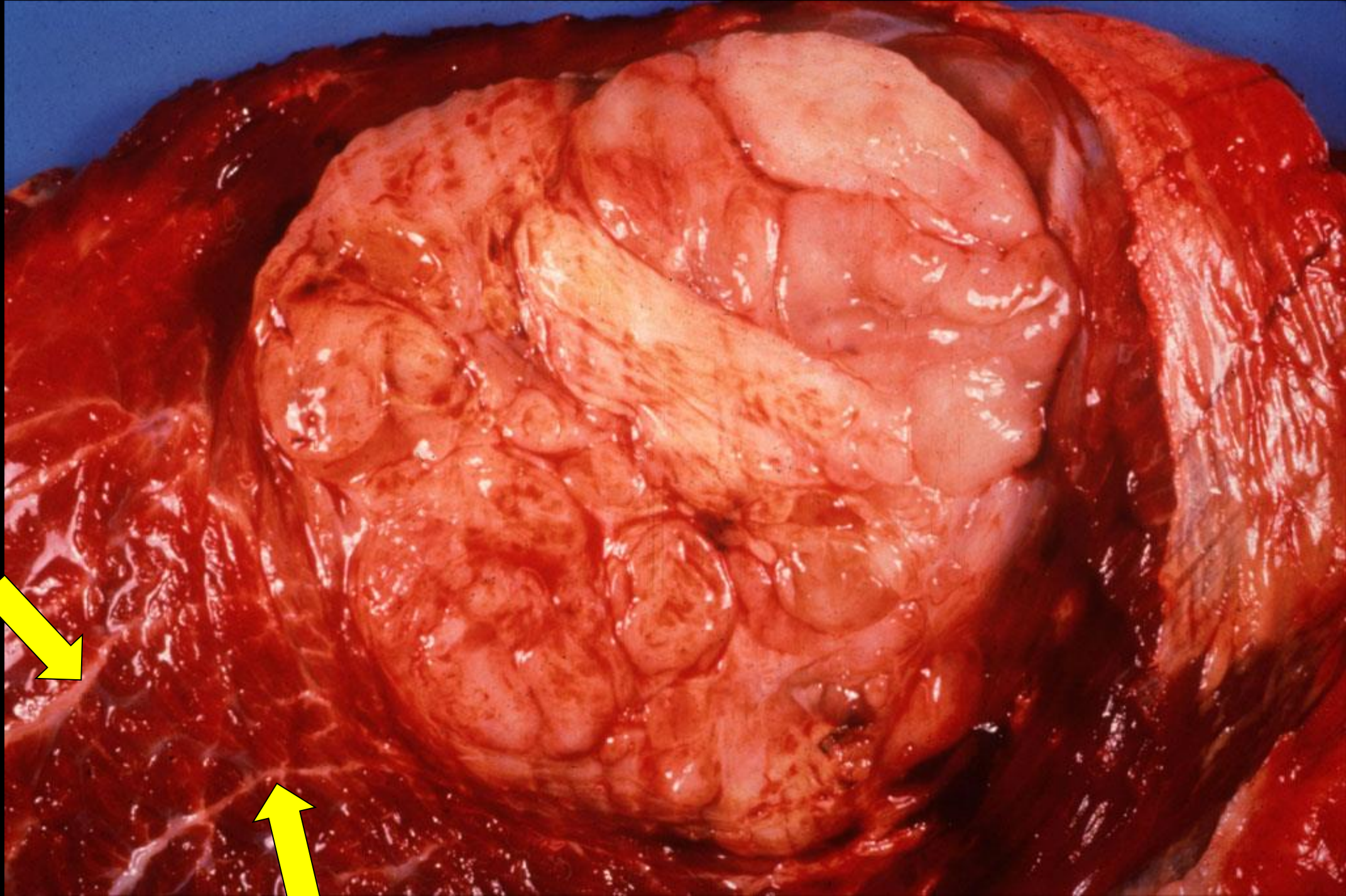
MRI EVALUATION OF SOFT TISSUE TUMORS

2. HOW TO STAY OUT OF TROUBLE!!

**DO NOT LET A WELL-DEFINED MARGIN
DETERMINE IF THE LESION IS BENIGN OR
MALIGNANT**

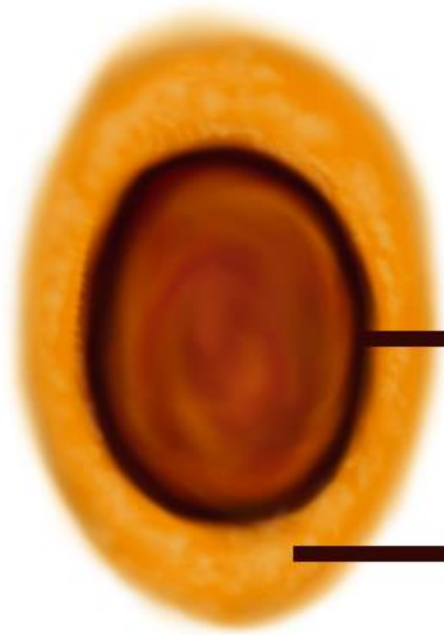






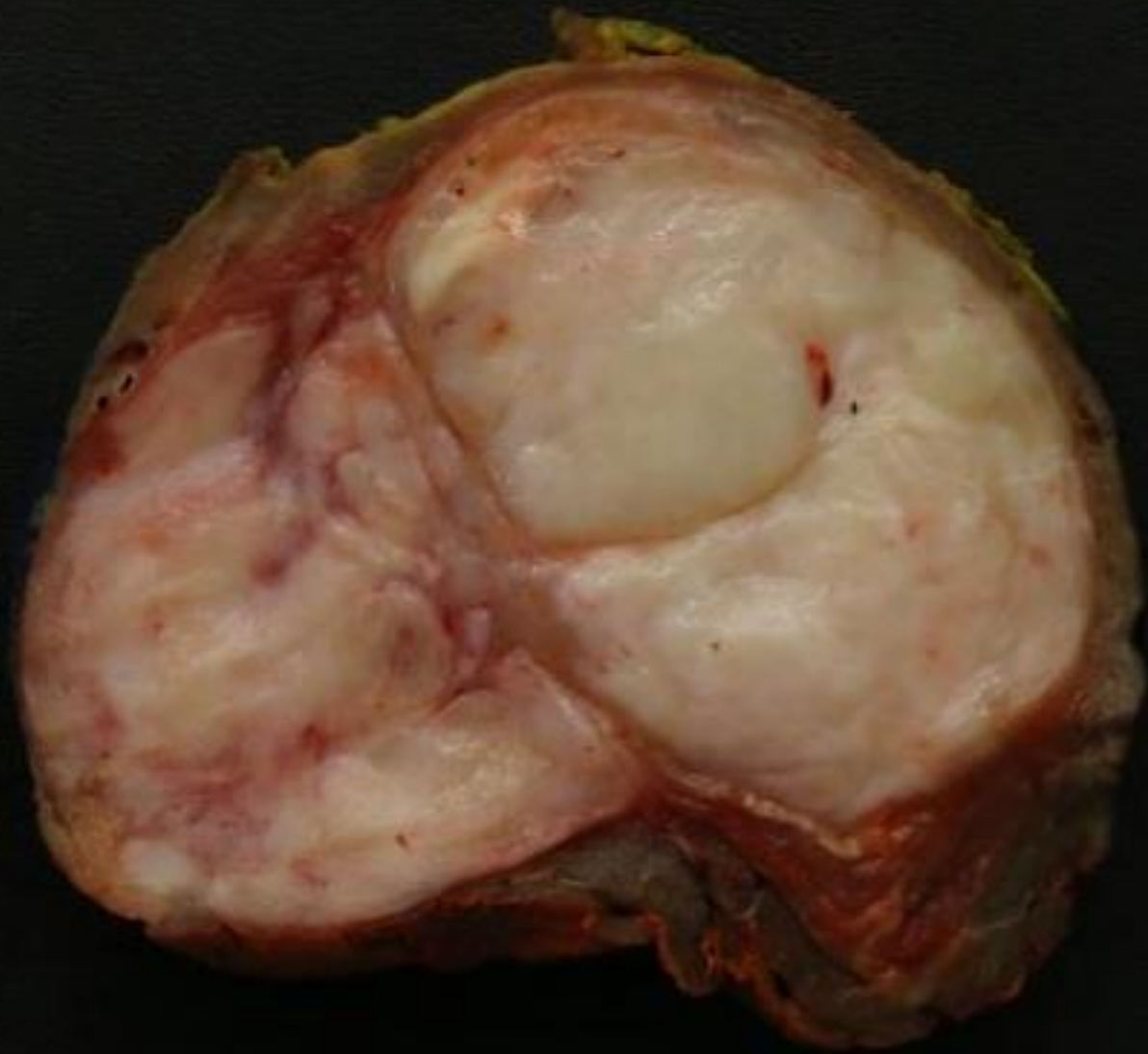
Musculoskeletal Tumors:

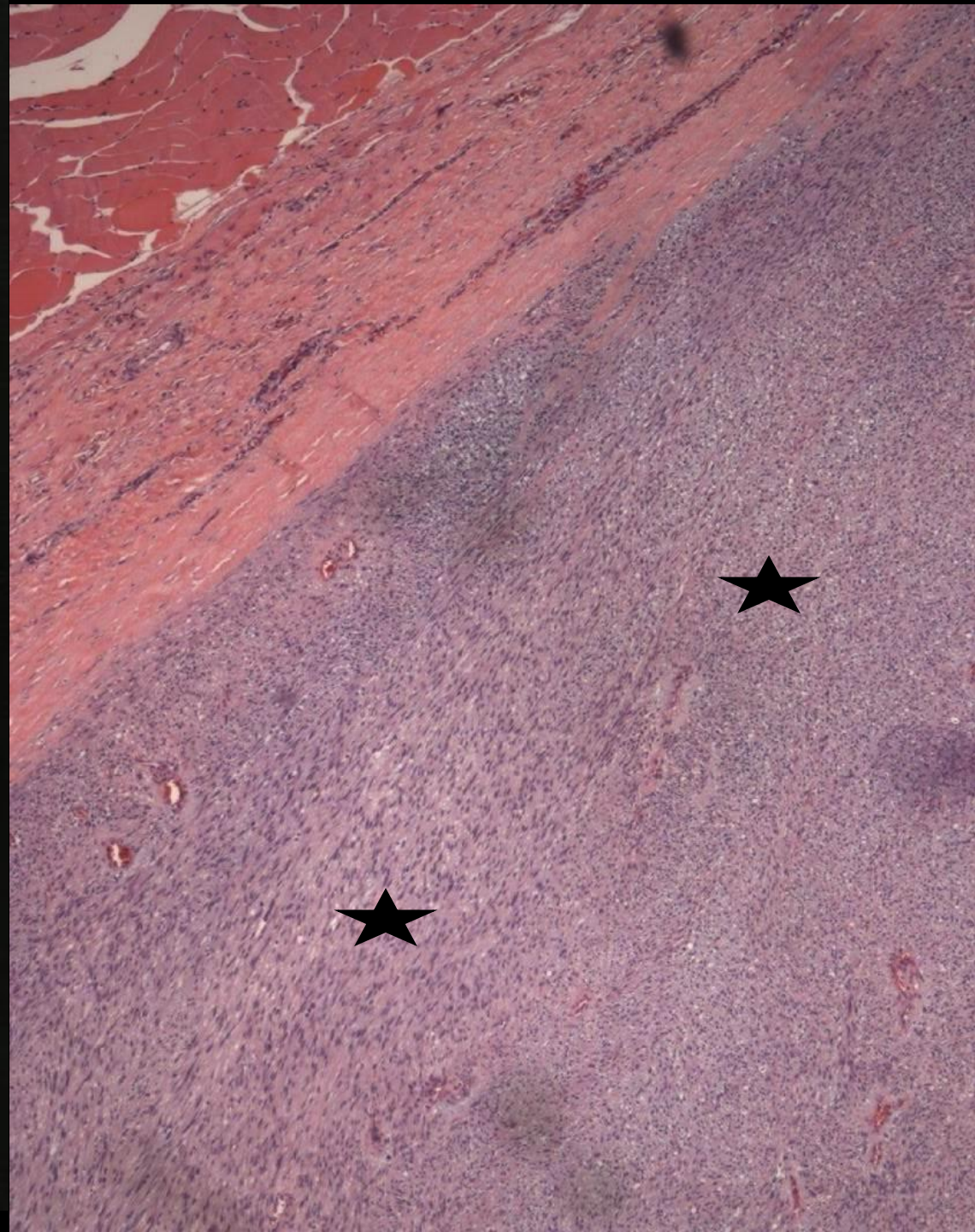
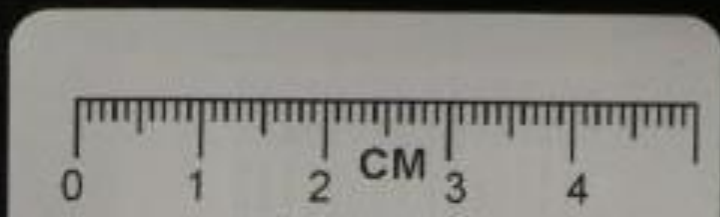
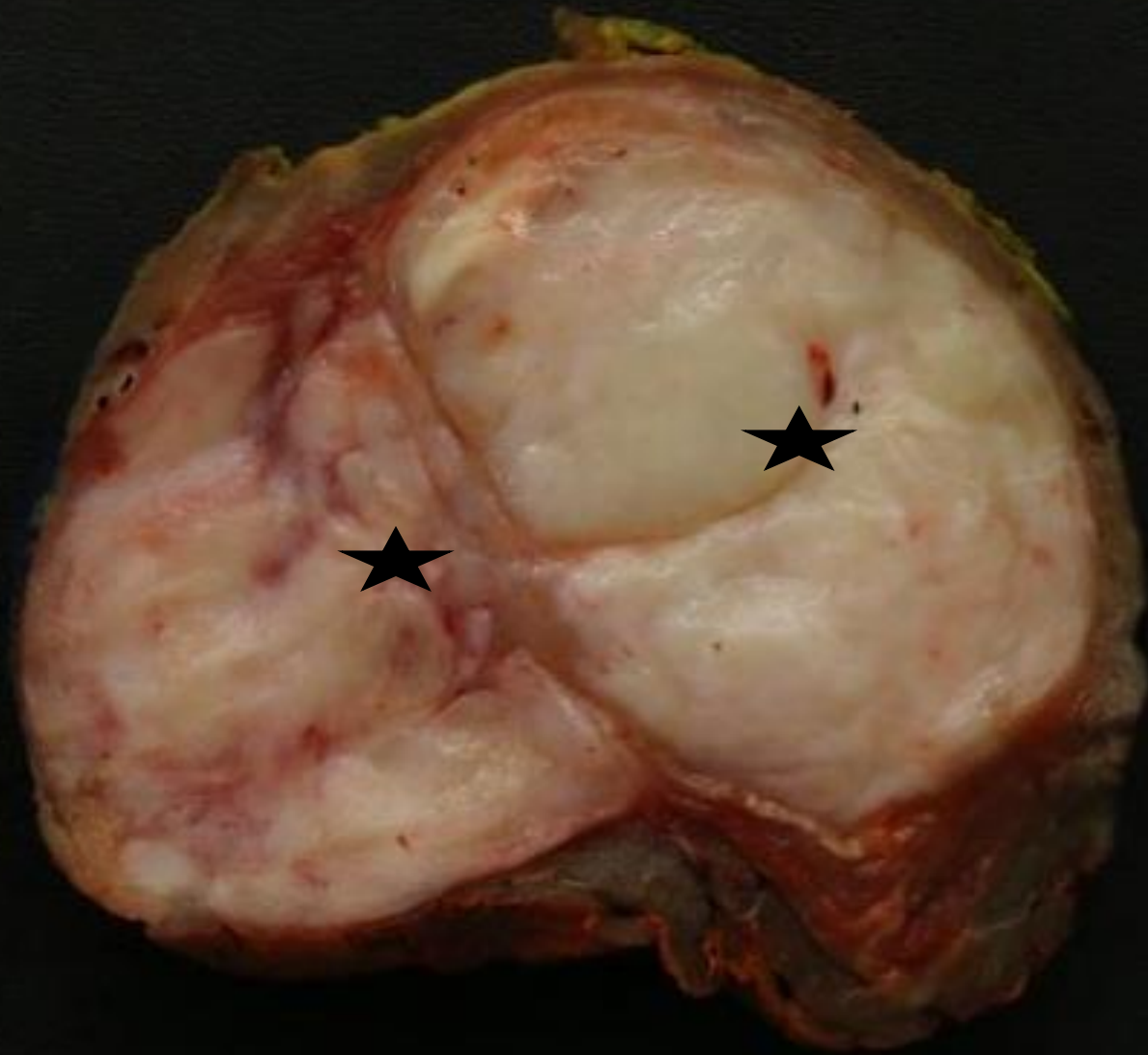
Surgical / Pathologic Zones

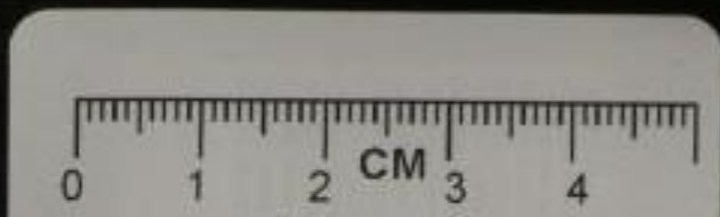
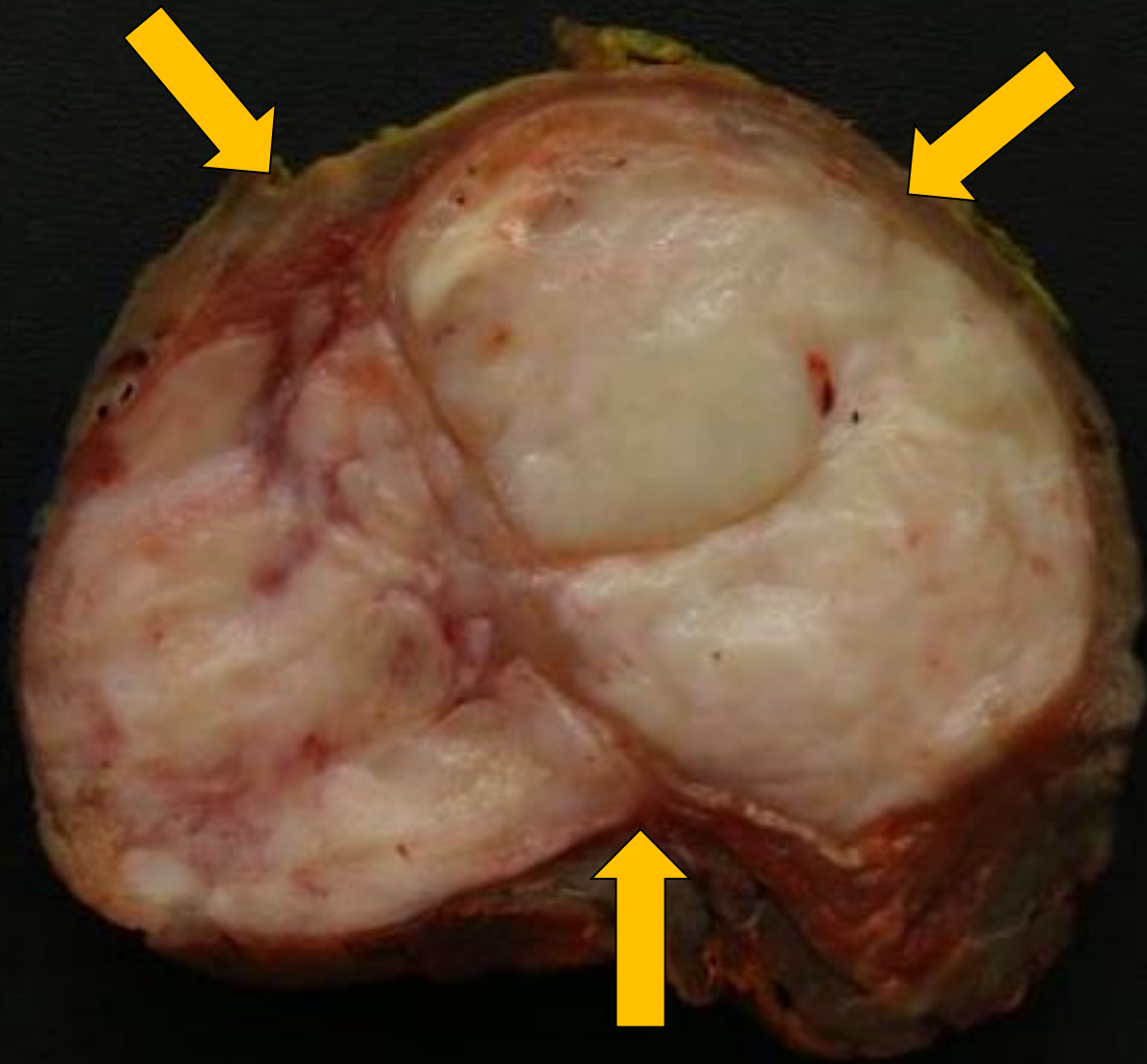


PSEUDOCAPSULE

REACTIVE ZONE







SOFT TISSUE TUMOR: INTRAARTICULAR/PERIARTICULAR

- Tenosynovial giant cell tumor (PVNS)
- Synovial chondromatosis
- Lipoma arborescens
- Synovial cyst, bursa, ganglion
- Soft tissue chondroma
- Tumoral calcinosis
- Synovial sarcoma (<10%)

Signa 1.5T SY#SIG00C0

H

PD

Ex: 8005

Se: 2/4

Im: 09/50

OS: R13.6

48 F 34918

08/30/94

17:44



SE/V
TR:2500
TE:17

Signa 1.5T SY#SIG00C0

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PD

Ex: 8005

Se: 2/4

Im: 09/50

OS: R13.6

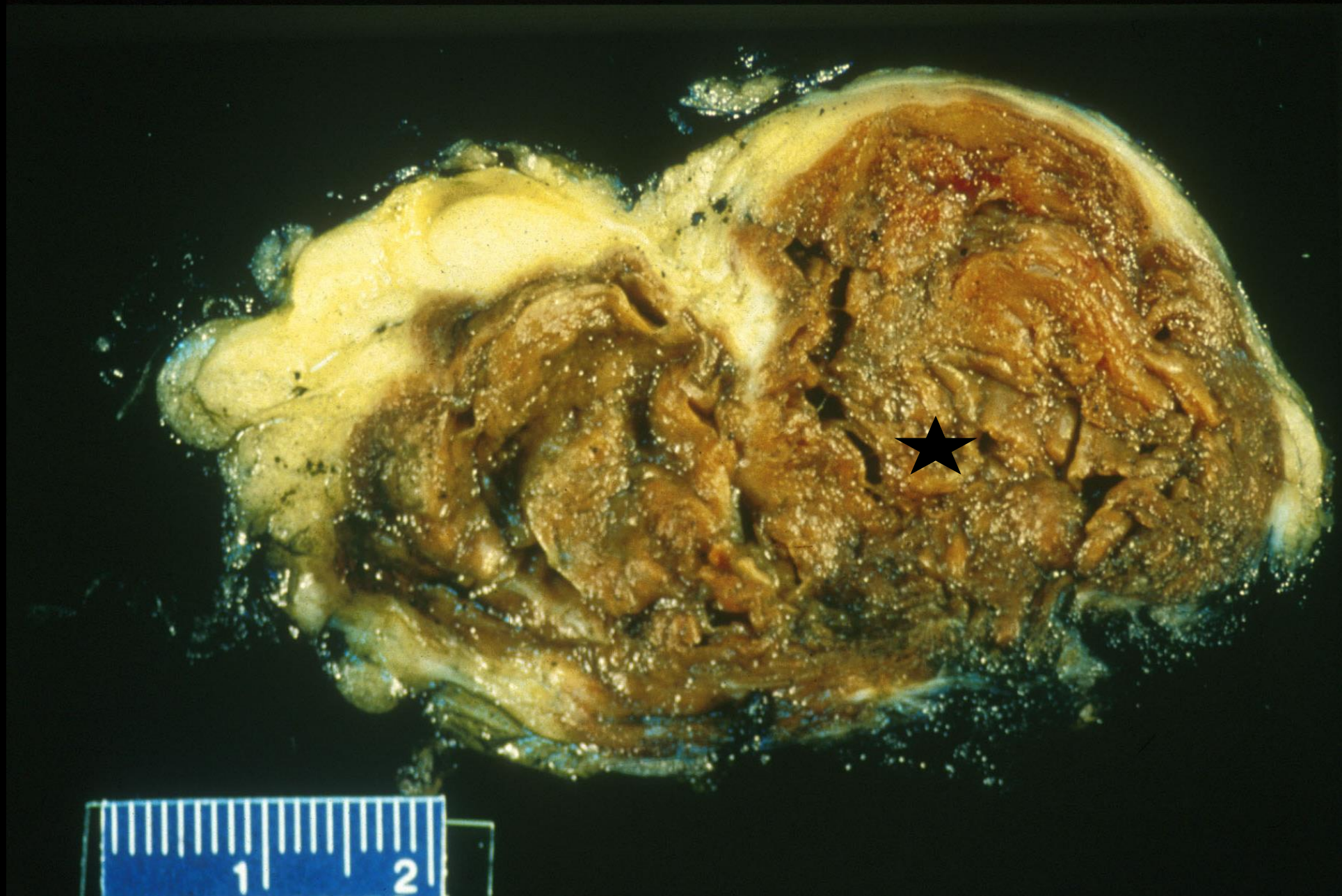
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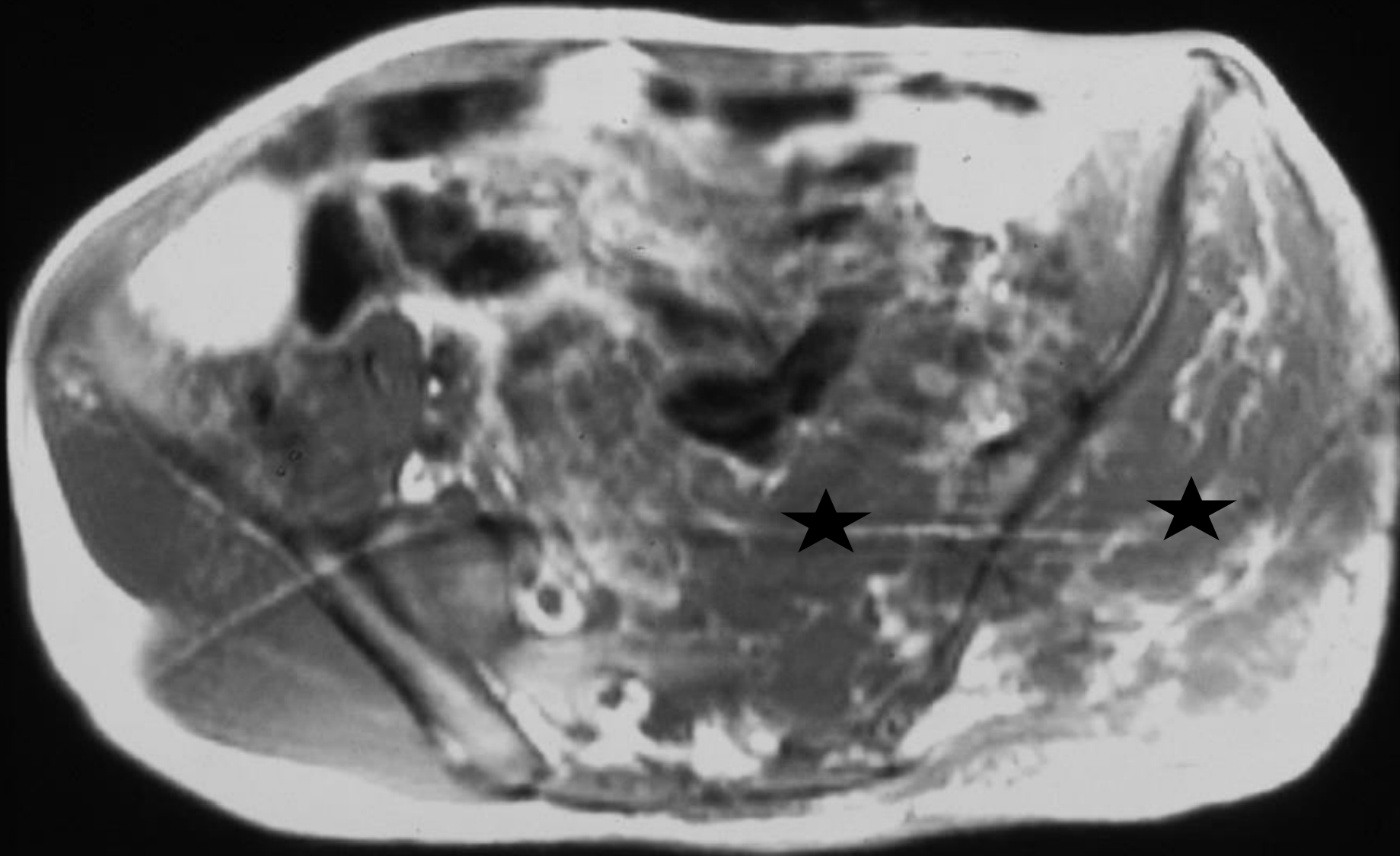
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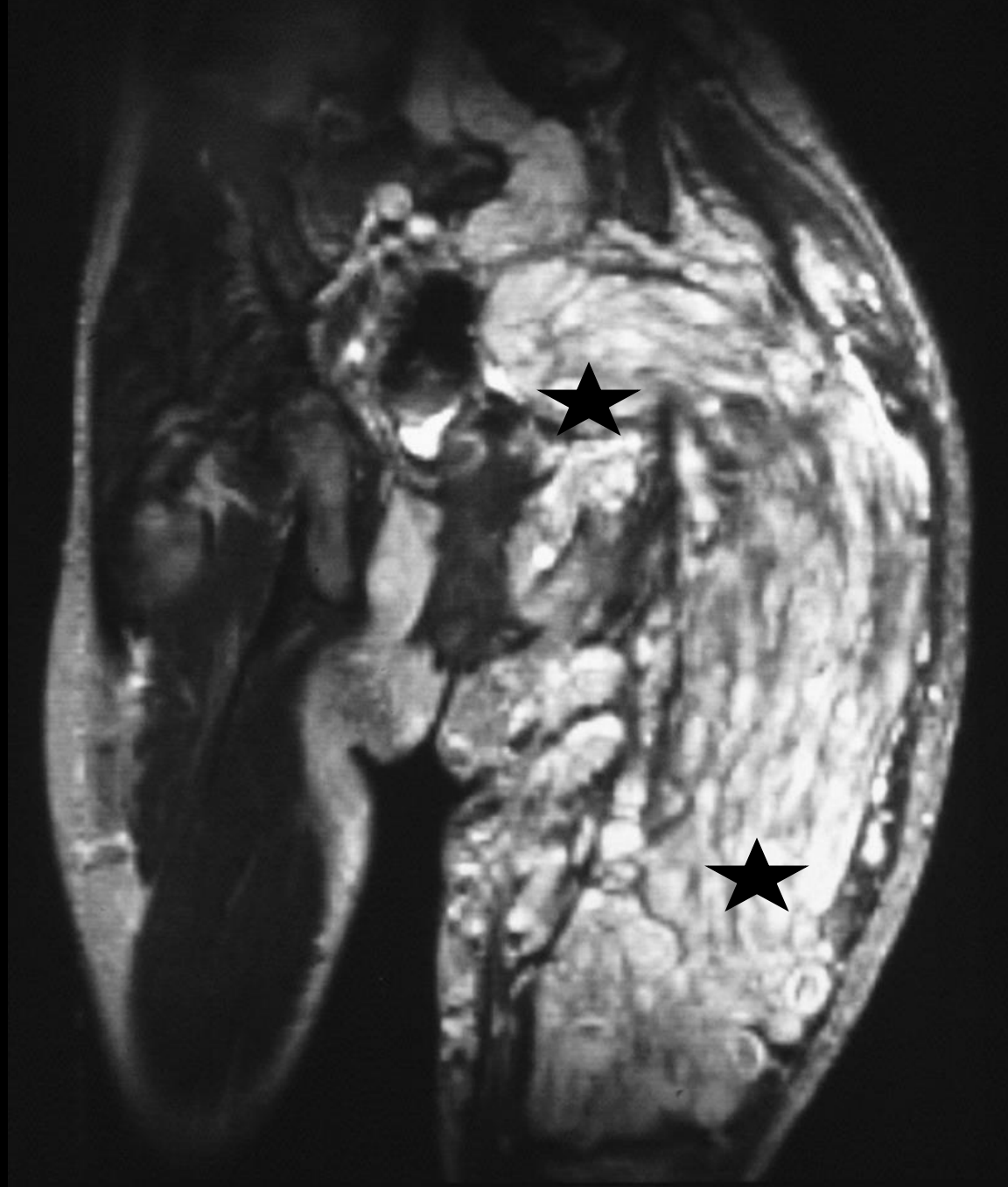


SOFT TISSUE TUMORS: MULTIFOCAL/EXTENSIVE LESIONS

- Angiomatous lesions (10%-20%)
- Neurofibromatosis Type I
- Fibromatosis (5%-20%)
- Lipoma (5%-15%)
Lipomatosis/ Lipoblastomatosis
- Myxomas (with F.D. – Mazabraud syndrome)
- Metastases, myeloma, lymphoma



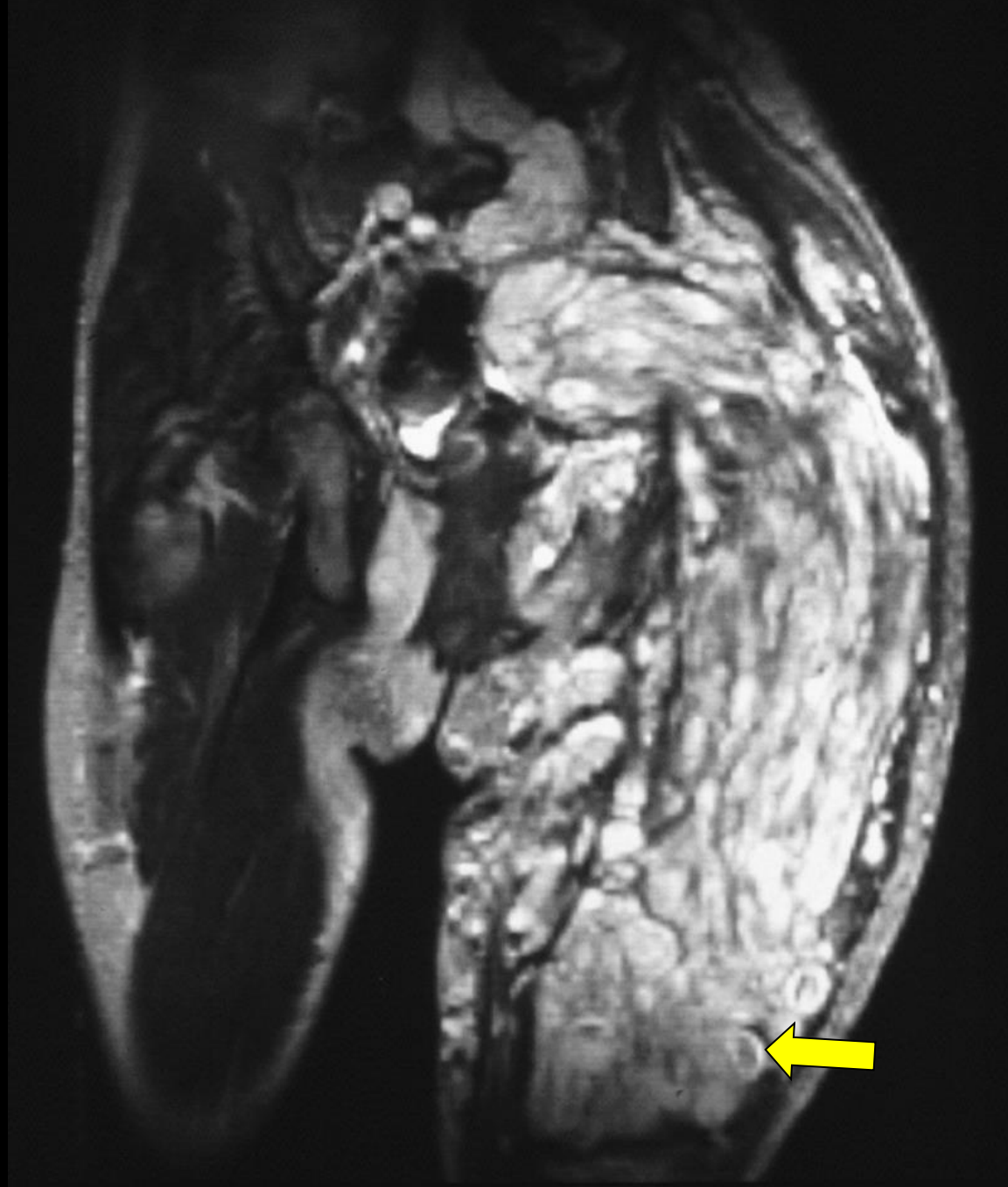
T1



T2



T2



T2



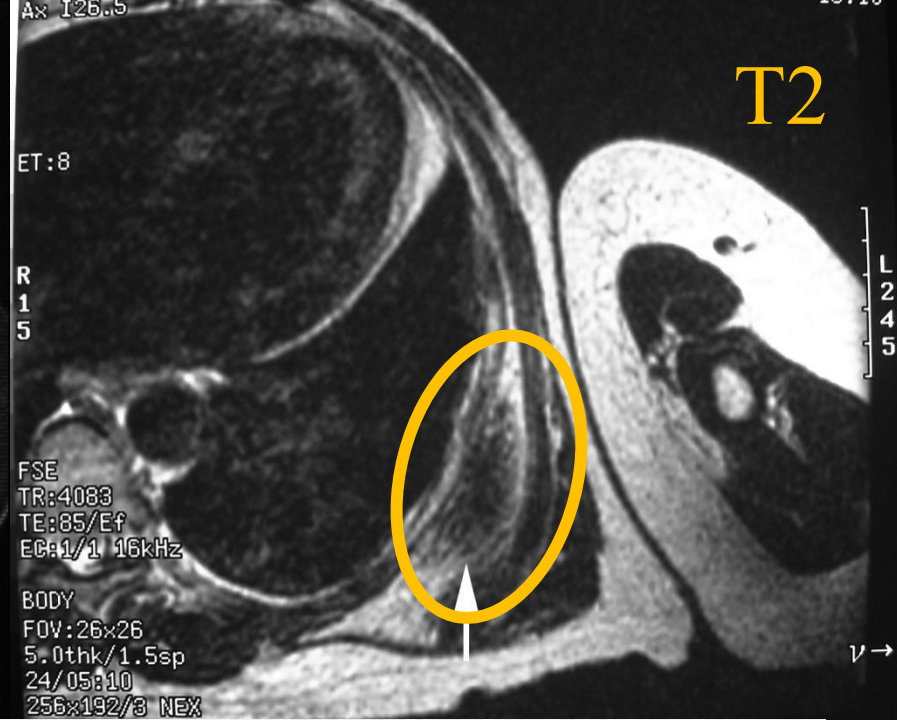
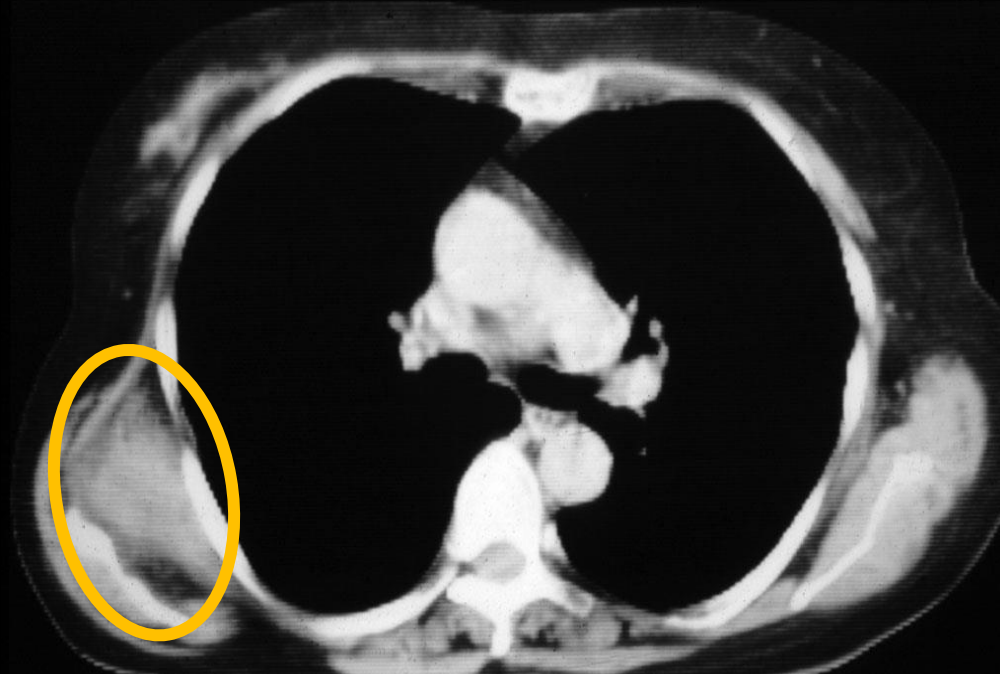
MRI EVALUATION OF SOFT TISSUE TUMORS

3. HOW TO STAY OUT OF TROUBLE!!

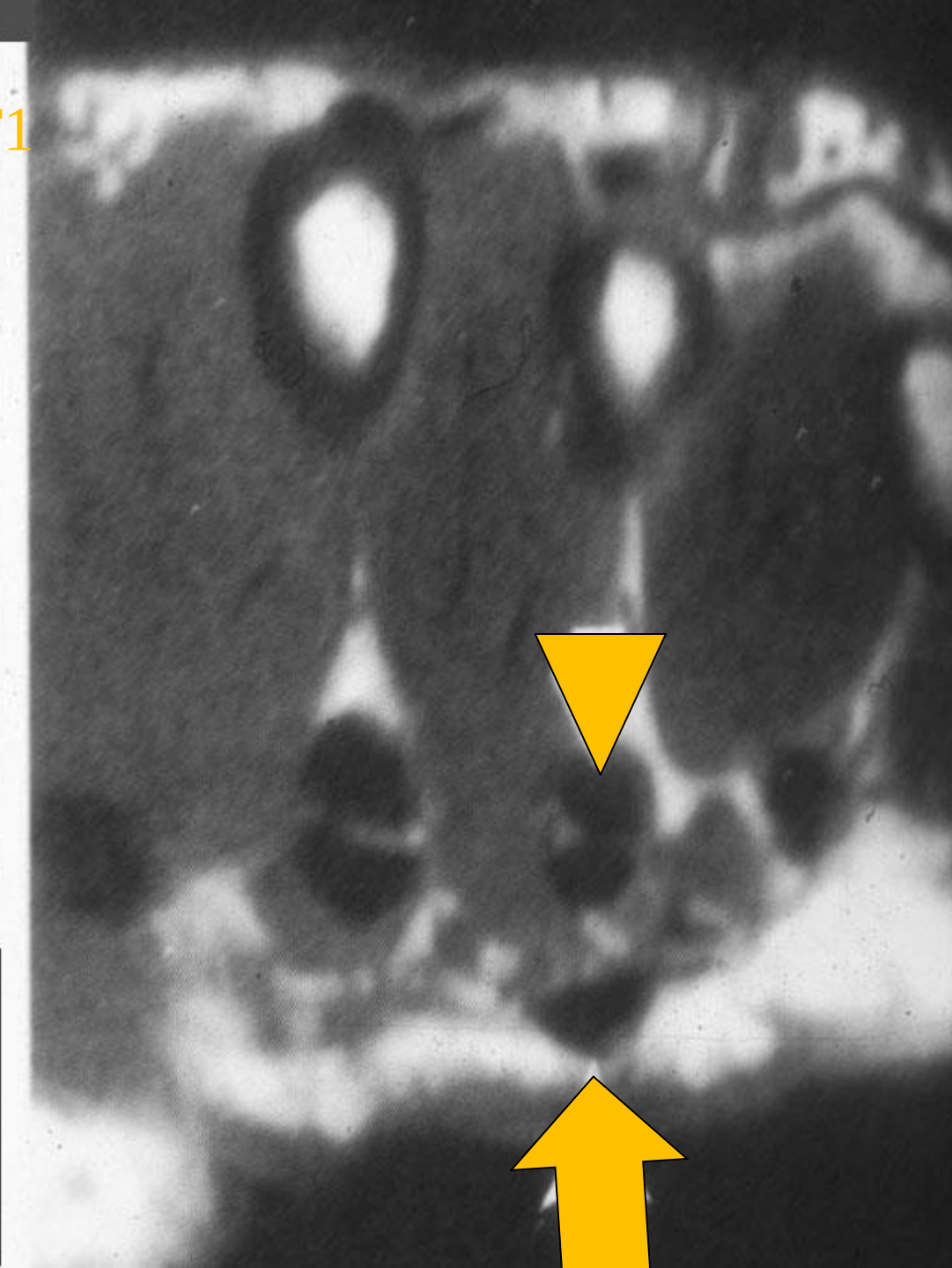
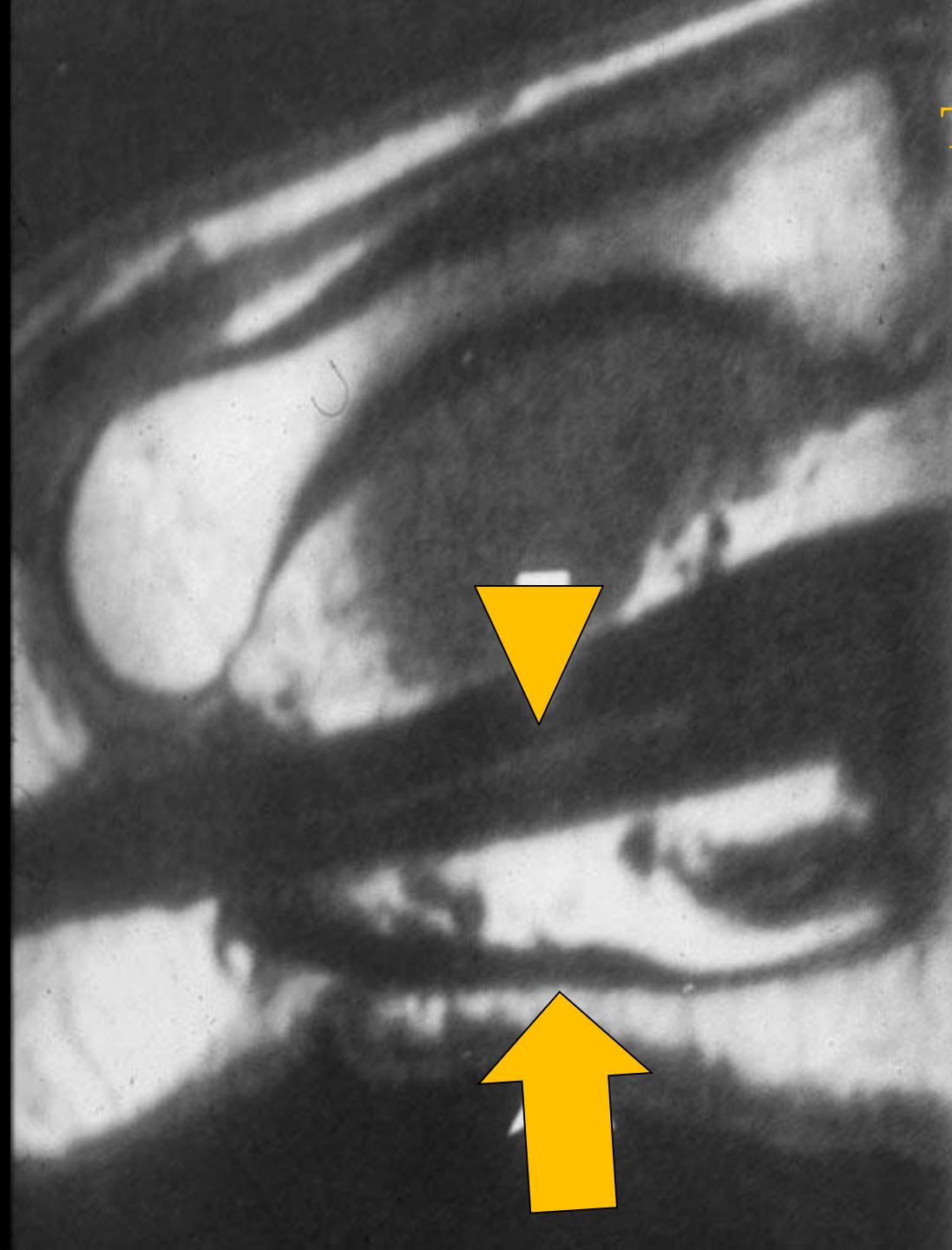
**IF MASSES ARE MULTIPLE AND
DEEP THINK PRIMARY LESION
NOT METASTASES**

SOFT TISSUE TUMORS: SPECIFIC LOCATIONS

- Elastofibroma – deep to scapular tip
- Plantar fibroma – plantar aponeurosis
- Tensor fascia lata – Hematoma (Morel Lavellee)
- Palmar superficial – palmer fibromatosis
- Superficial to AC joint – cyst related to rotator cuff tear
- Abdominal wall (rectus) – desmoid



T1



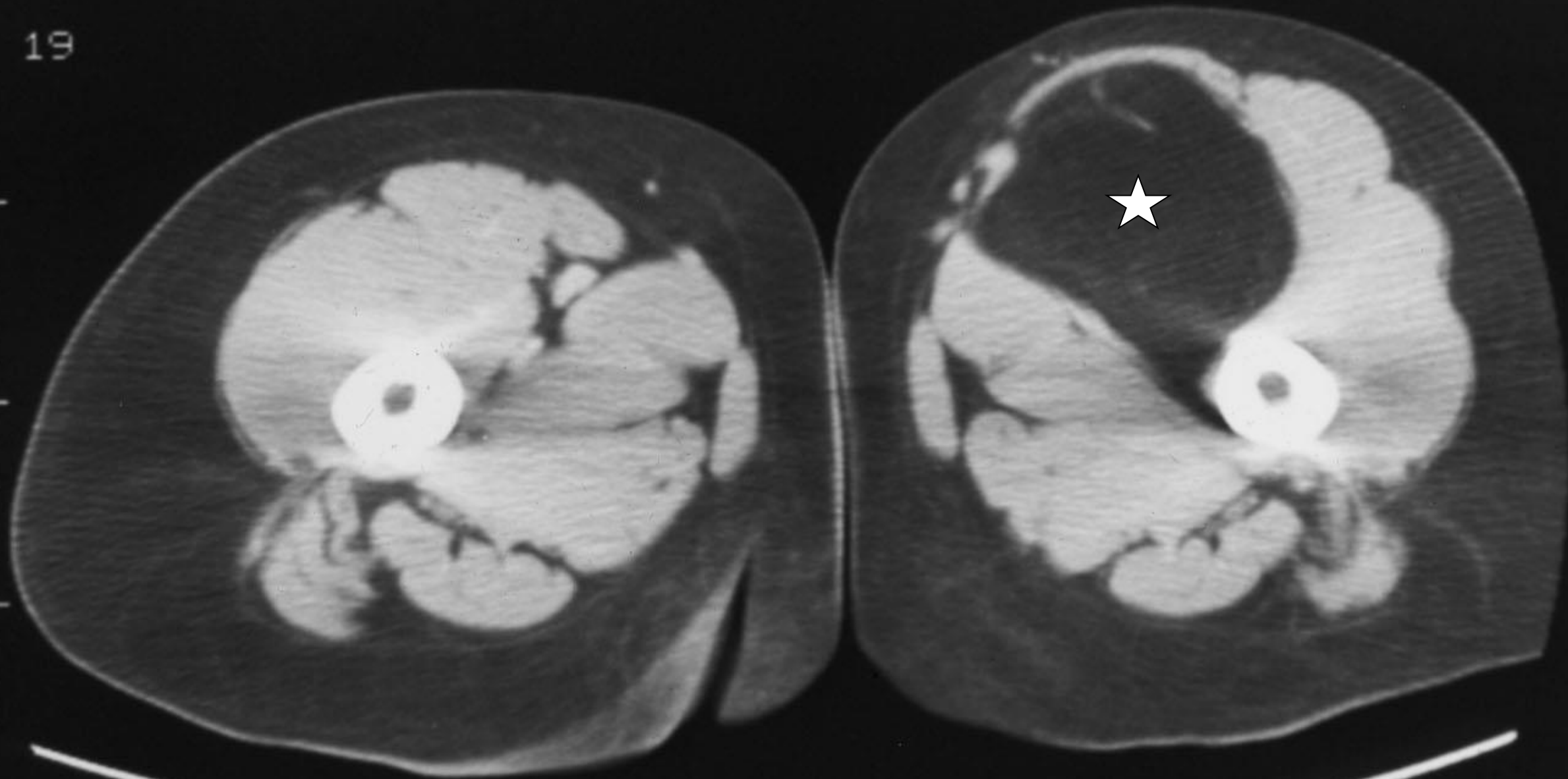
SOFT TISSUE TUMOR: WHERE, WHAT, WHEN

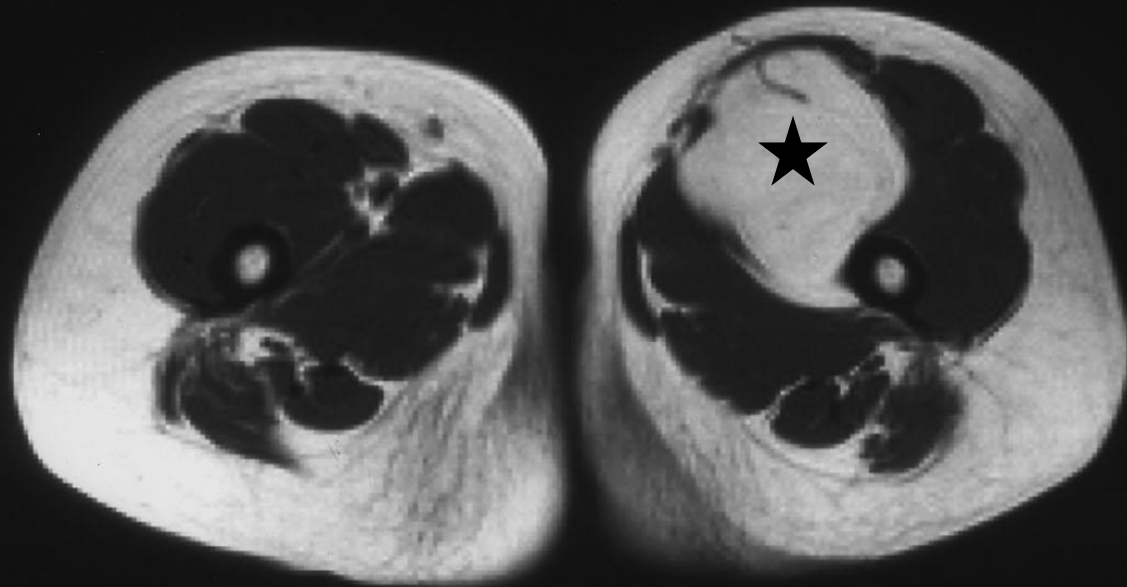
- Where is the lesion?
 - Location, location, location (just like bone tumors!!!)
 - Subcutaneous, Intermuscular, Intramuscular, Intraarticular
- What are the intrinsic imaging characteristics, lesion size and margin?
- When? (patient age)

SOFT TISSUE TUMOR: INTRINSIC CHARACTERISTICS

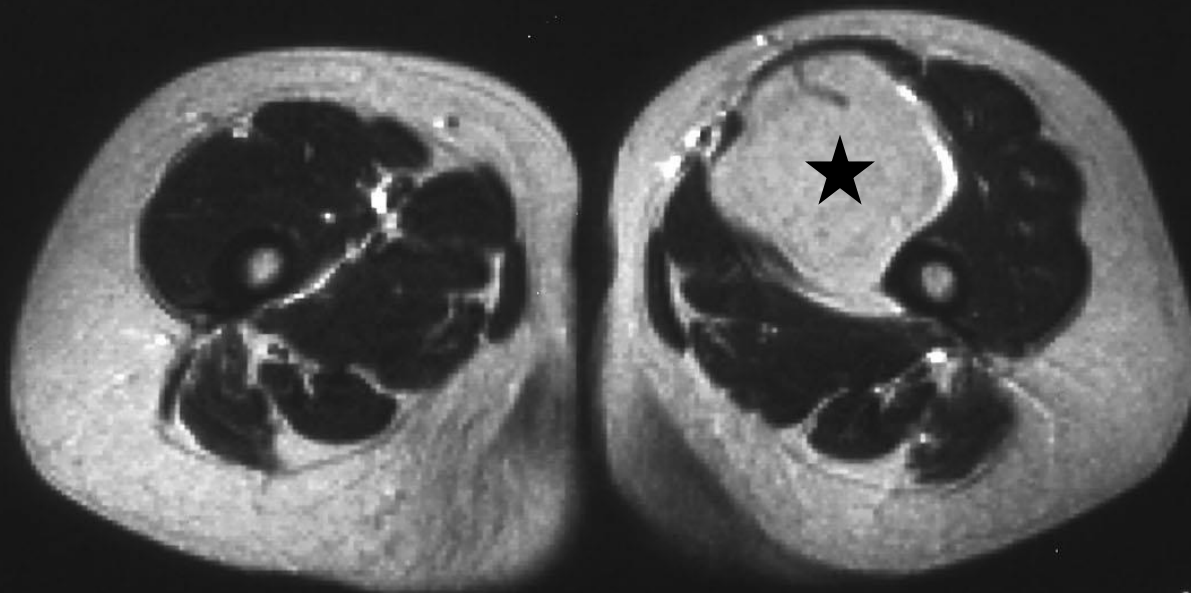
- Signal intensity
 - Fat (lipoma, hibernoma, liposarcoma)
 - “Cystic” (ganglion, synovial cyst, myxoid neoplasm)
 - Very long T2W MRI (calcification, hemosiderin, collagen)
- Lesion shape morphology
 - Serpentine structure (angiomatous lesion)
 - Related to nerve (neurogenic tumor)
 - Fascial extension (nodular fasciitis, fibromatosis, DFSP)
 - Surrounding edema (> in reactive/inflammatory)

19



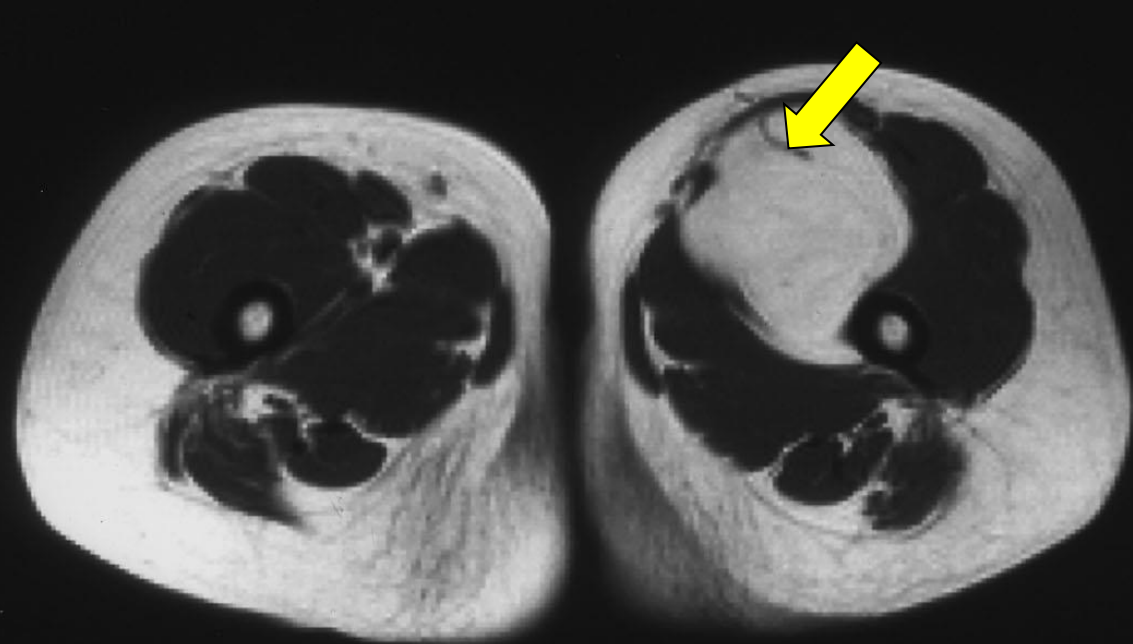


T1

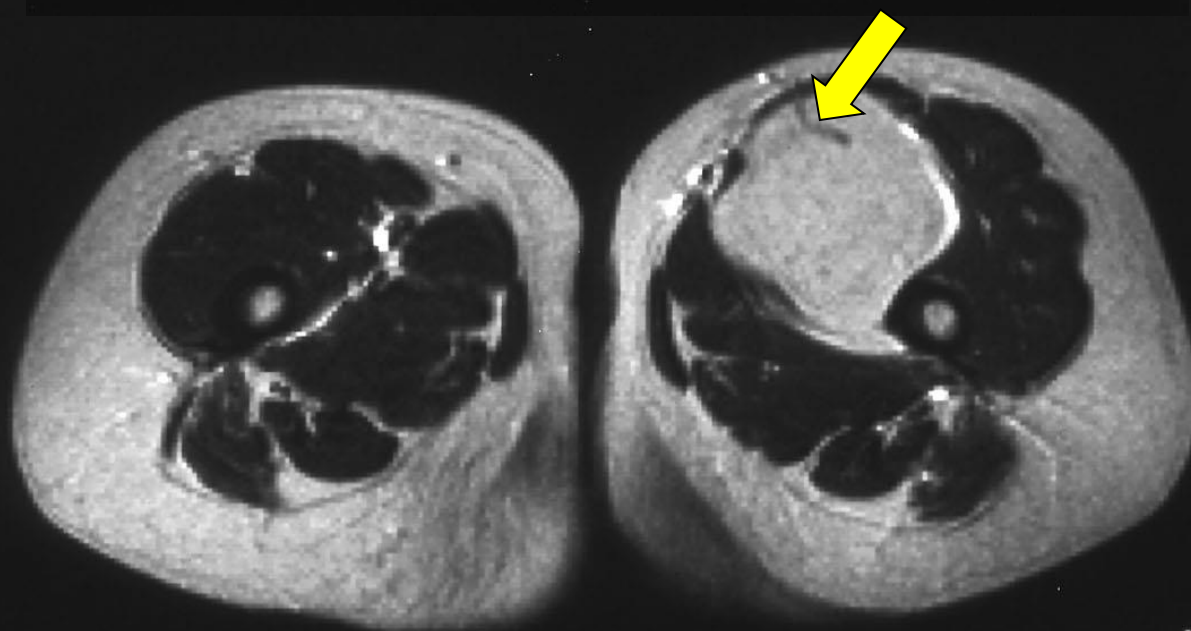


T2

W
C



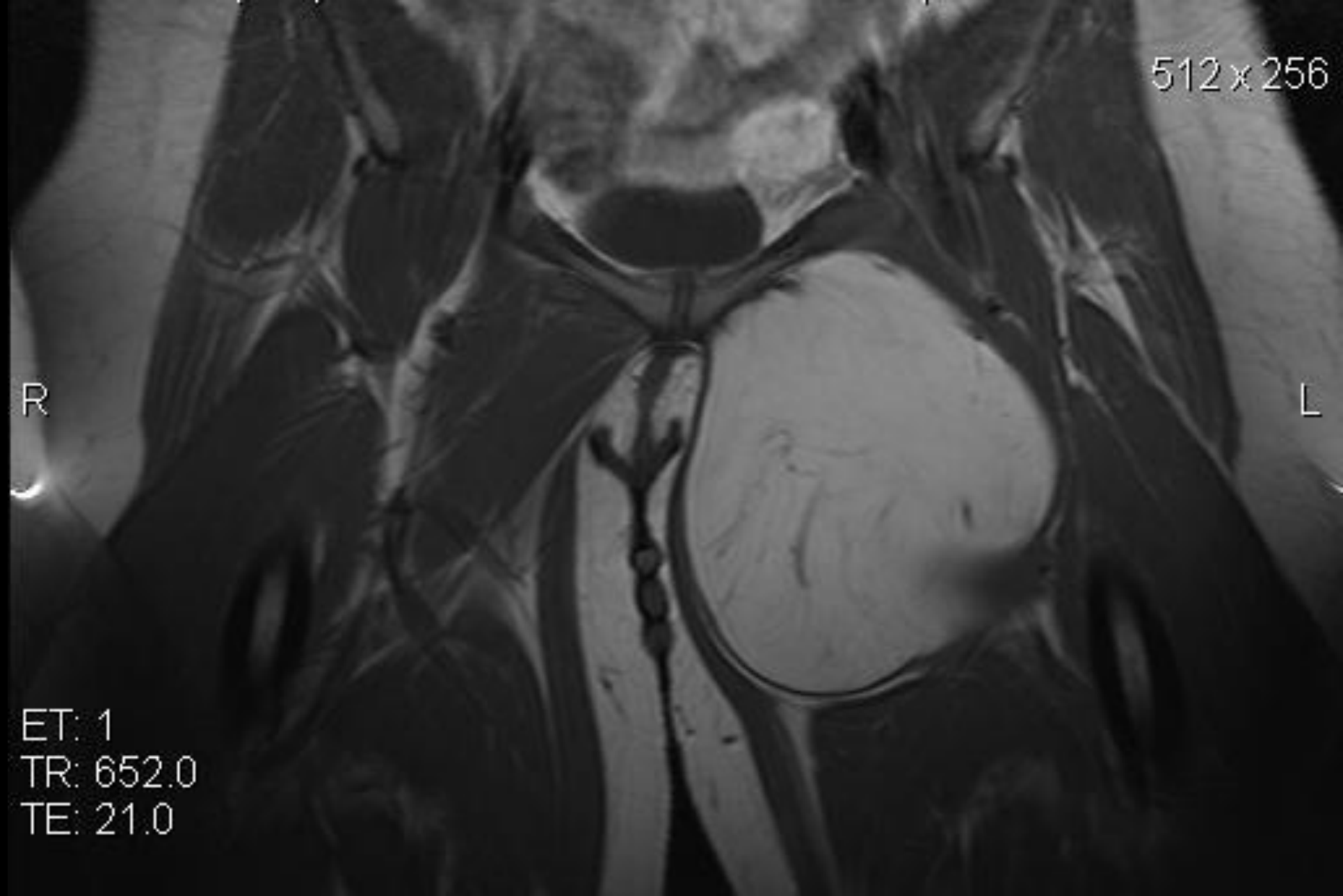
T1



T2

W
C





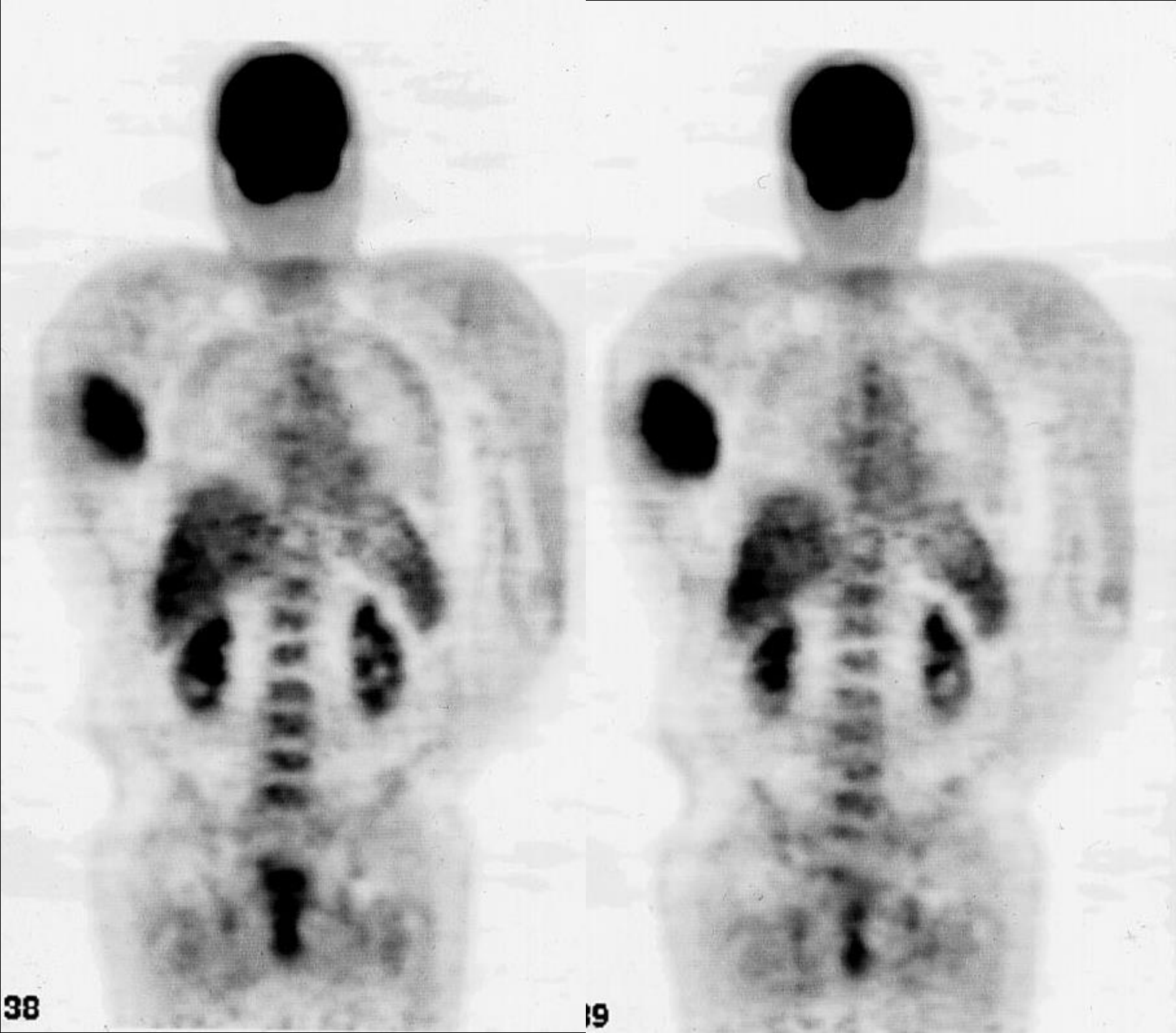
T1



T1



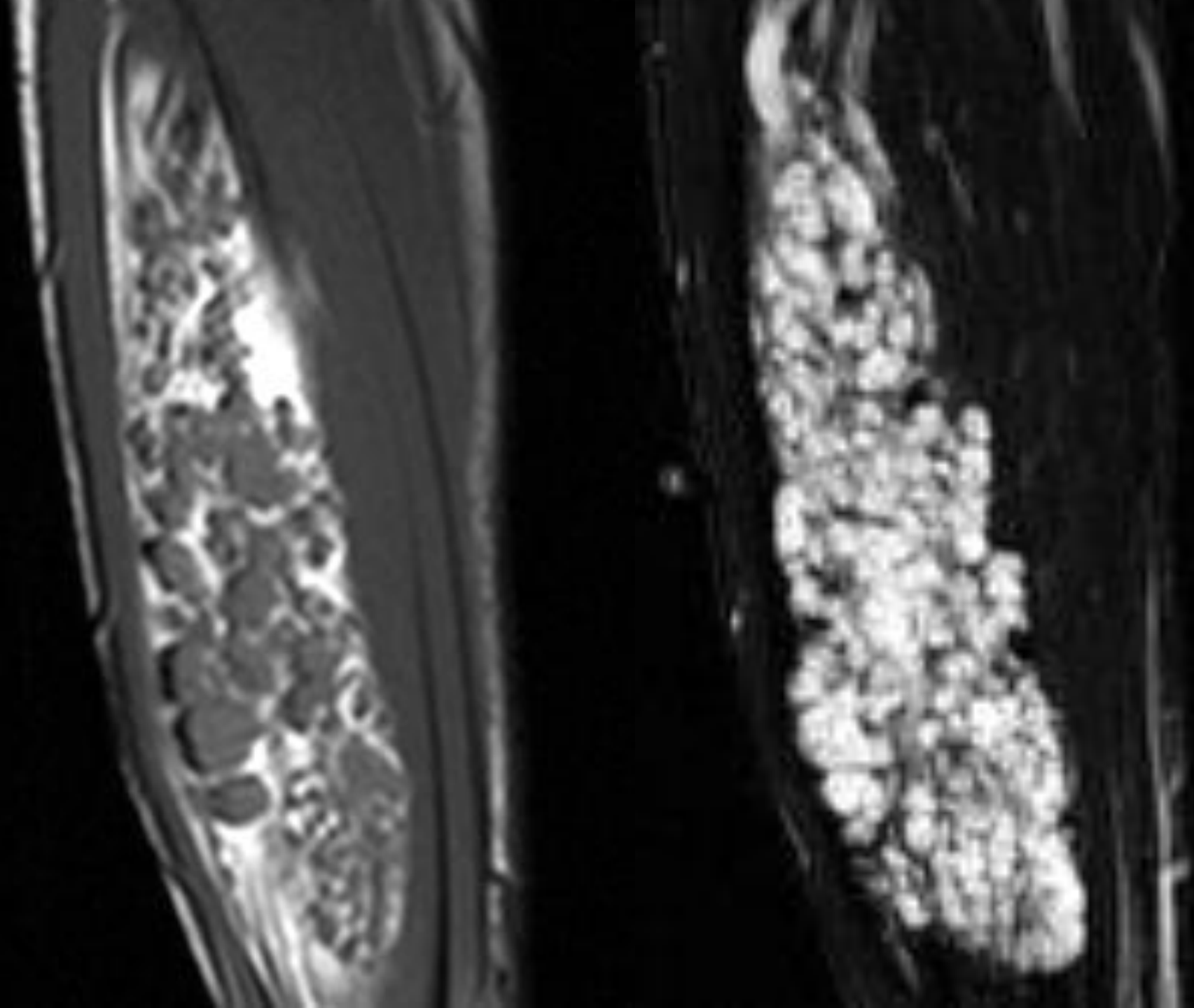
MIP

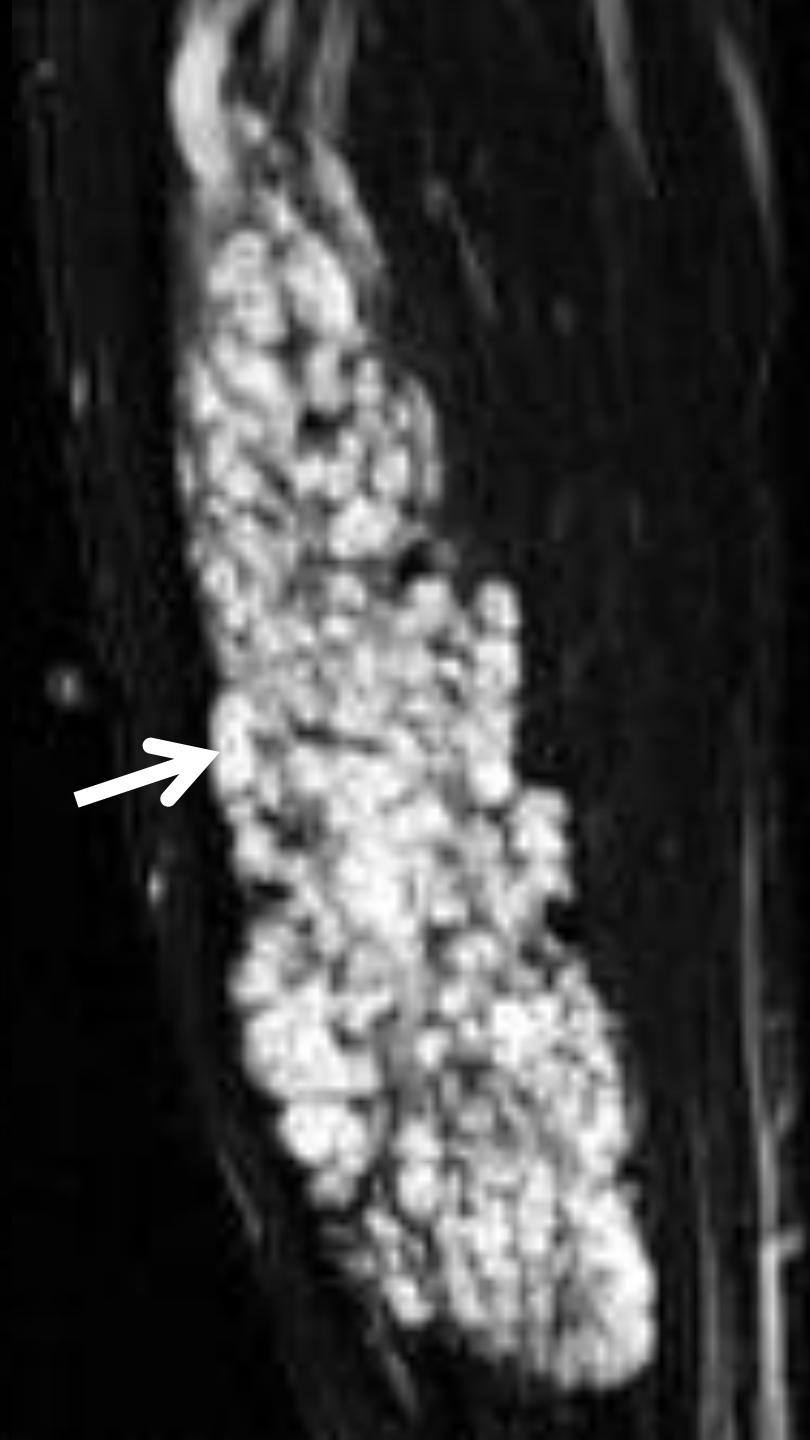


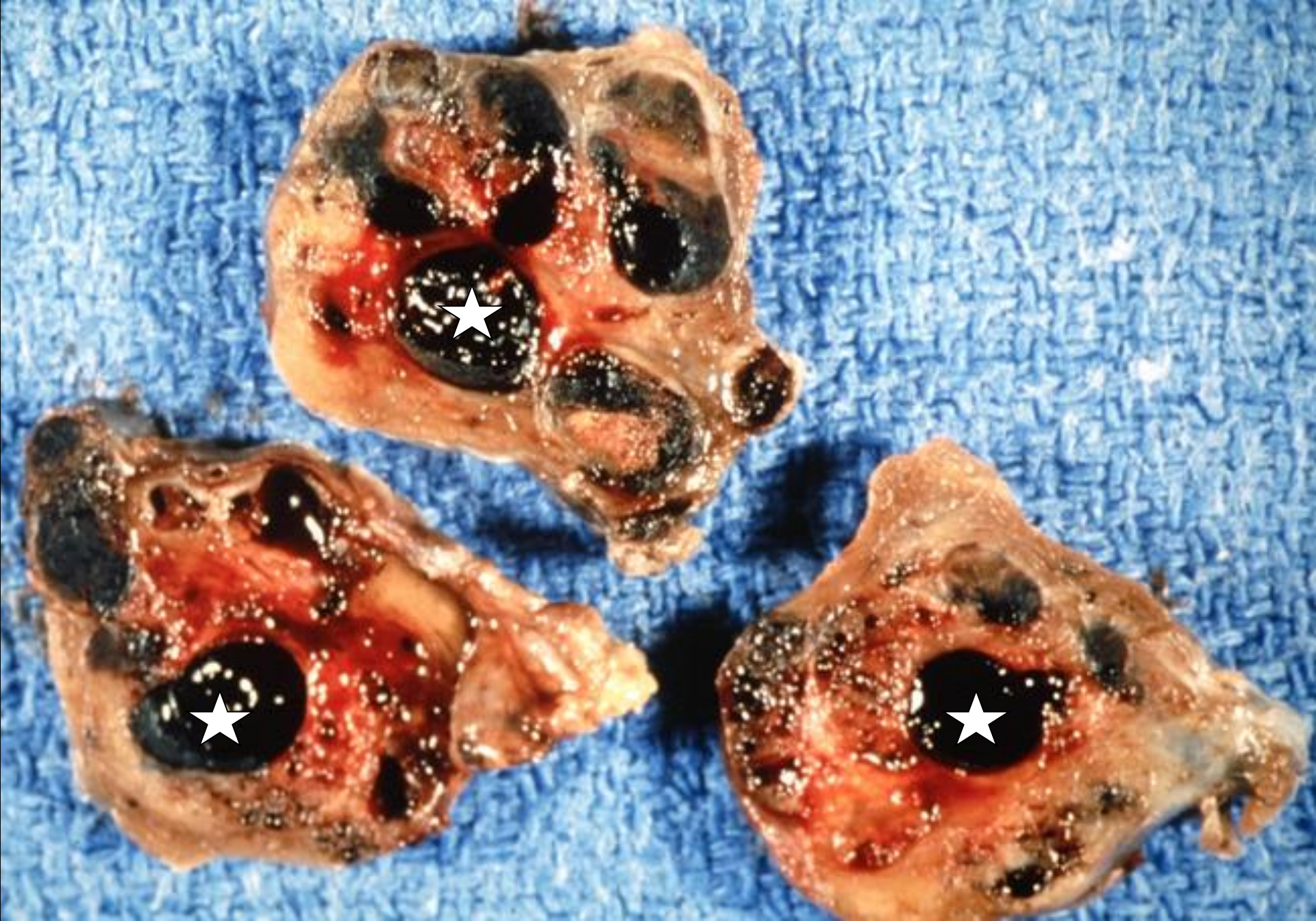
PET

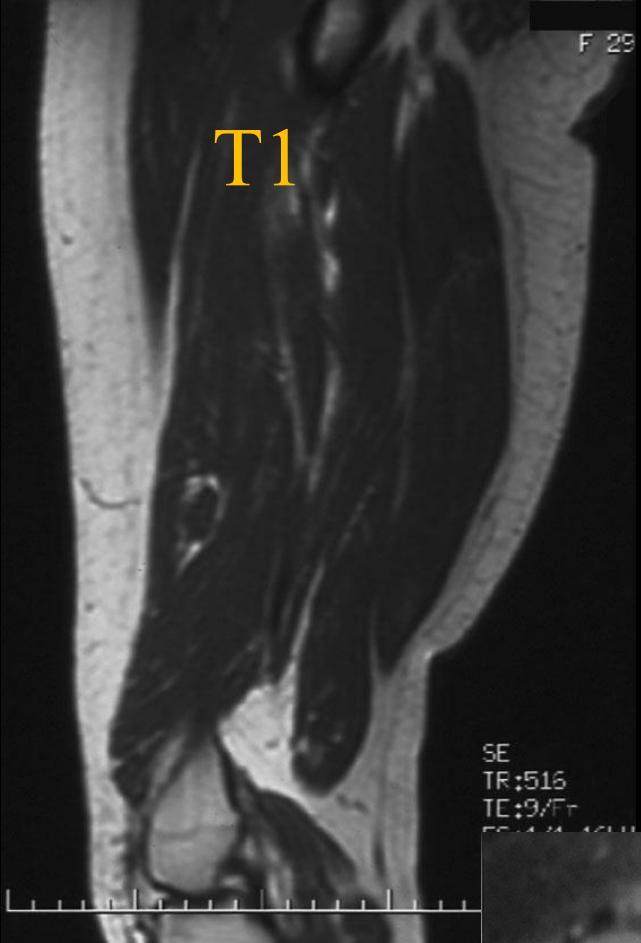




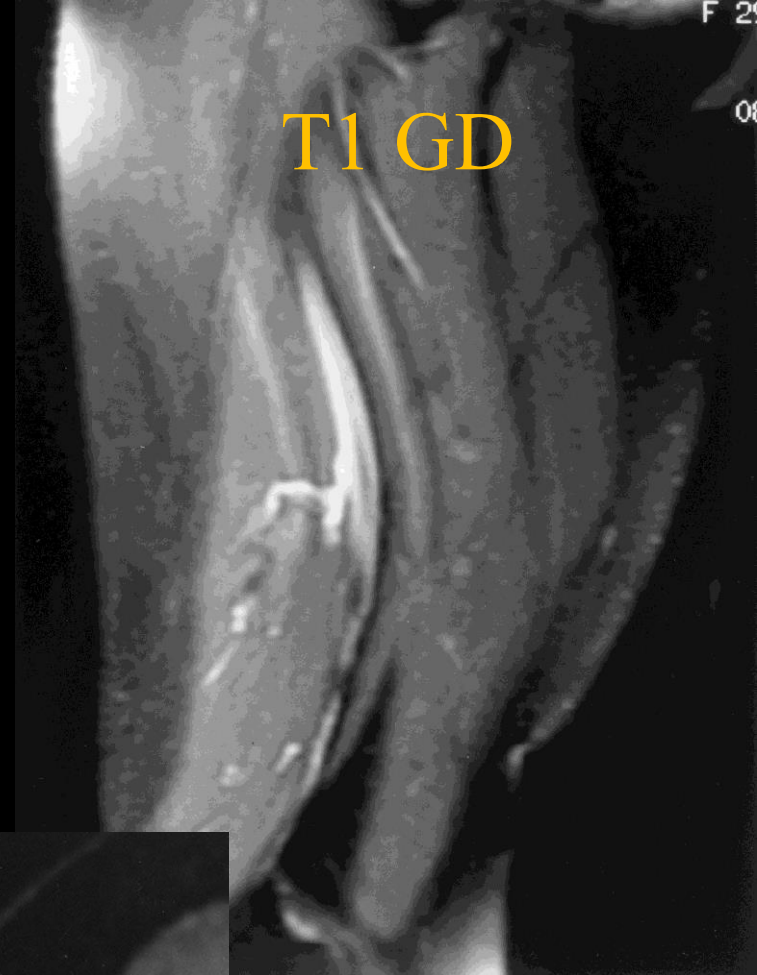




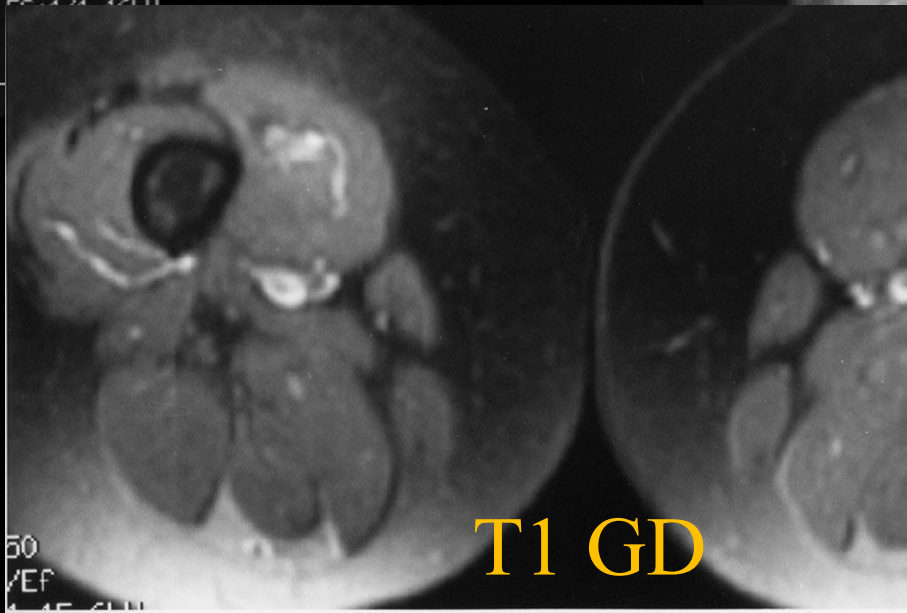




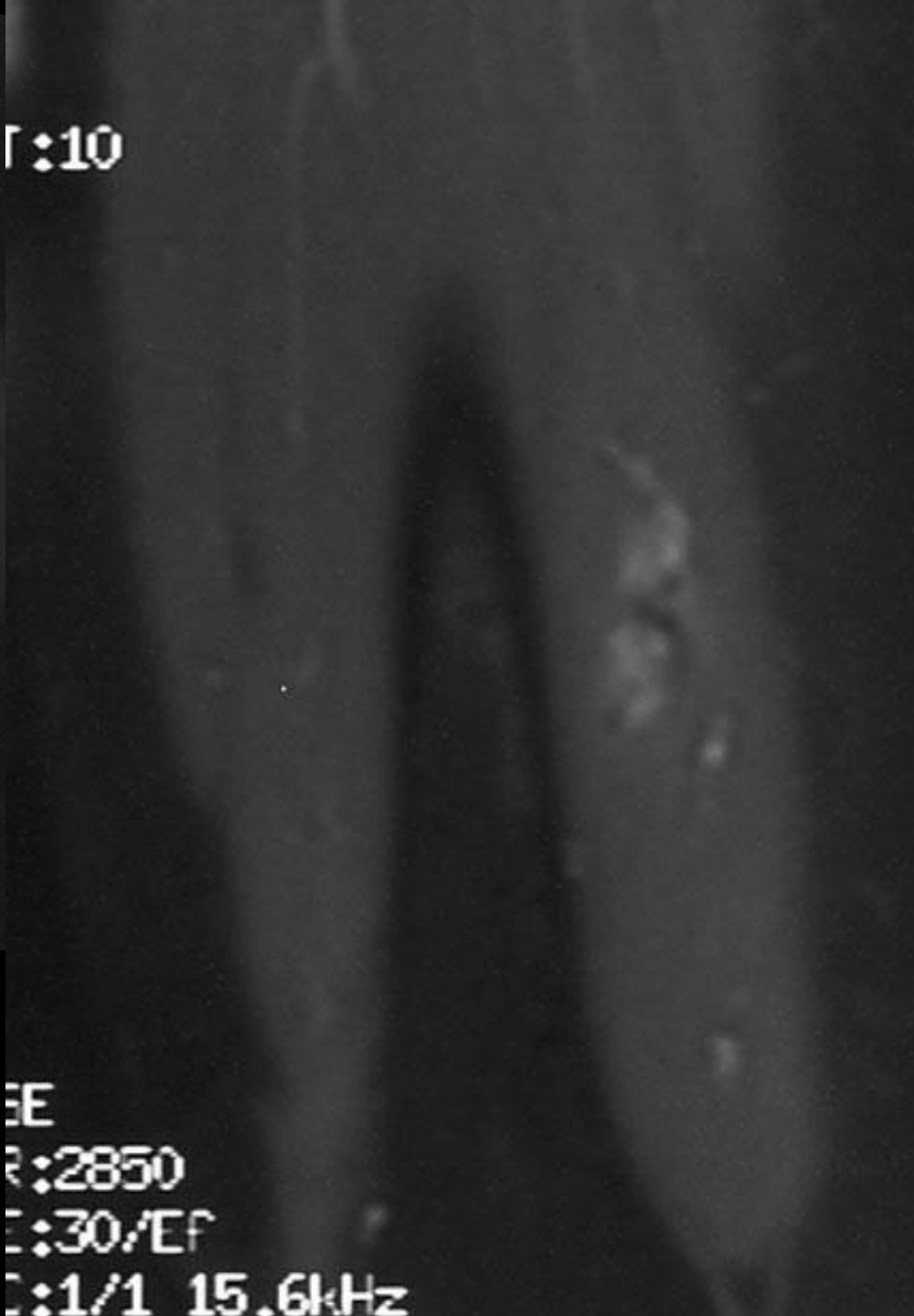
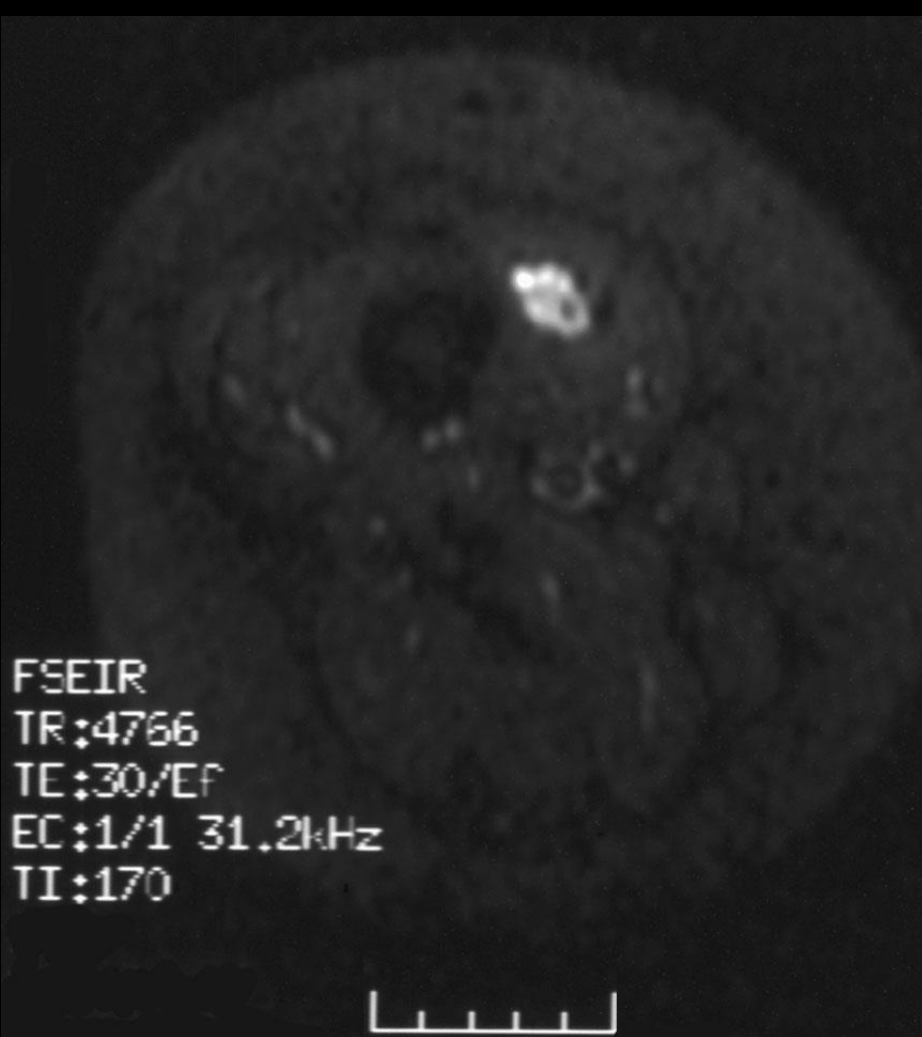
T1



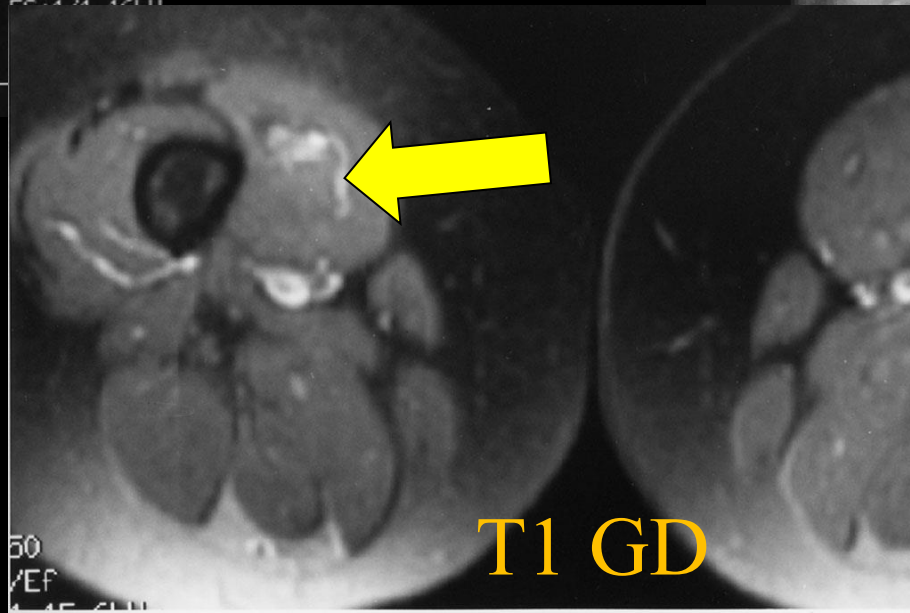
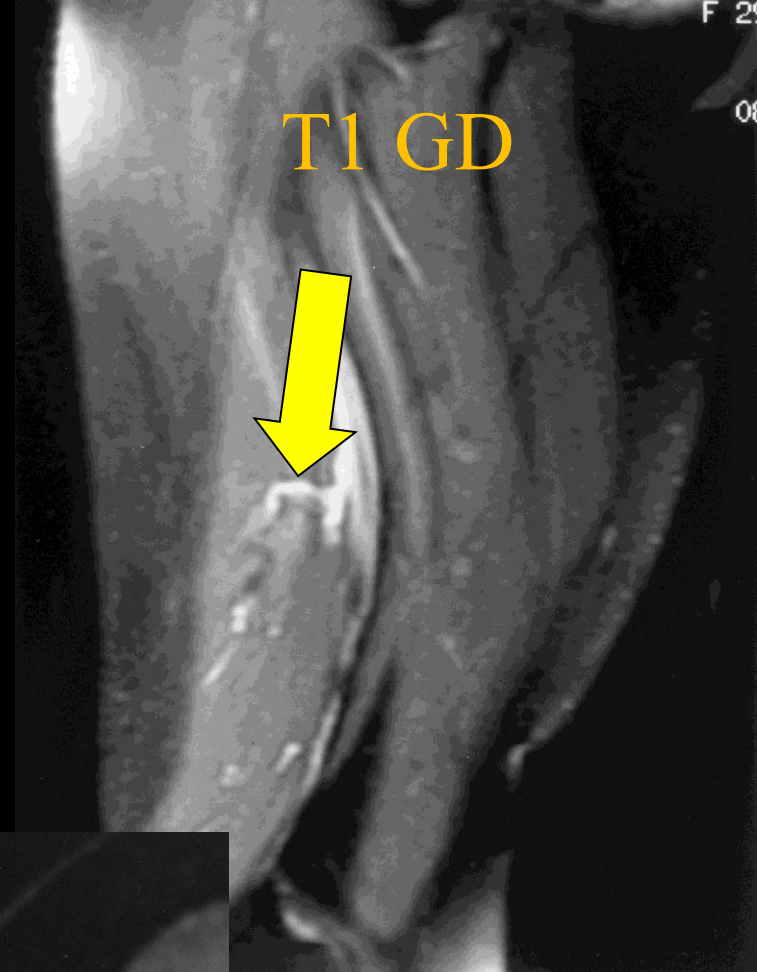
T1 GD

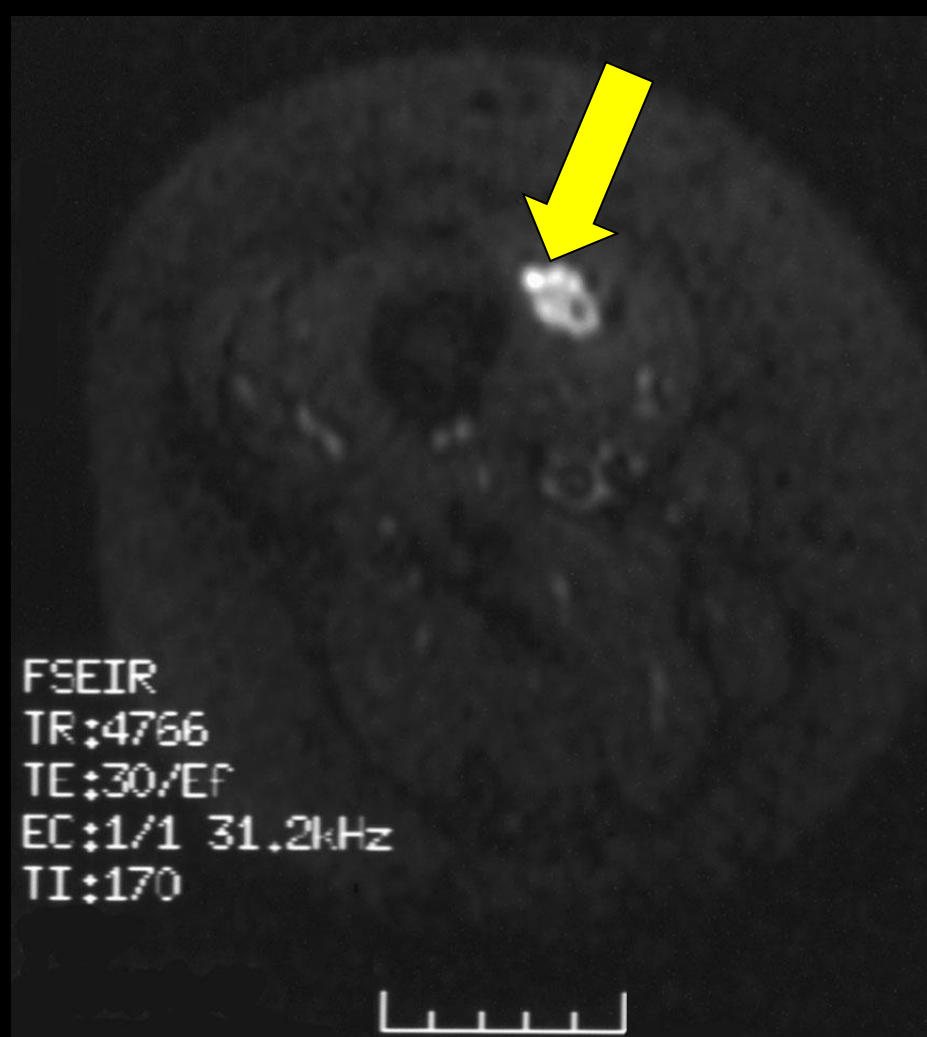


T1 GD



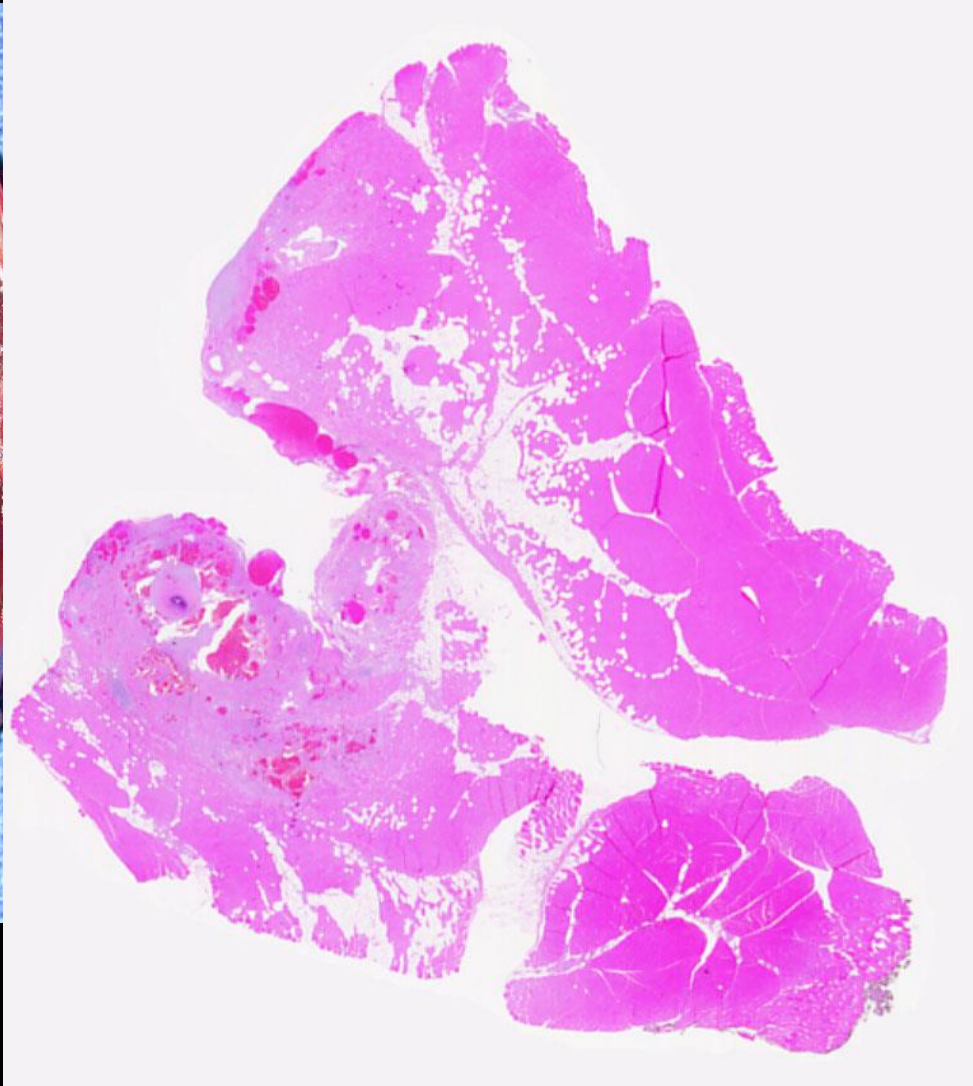
T2/STIR

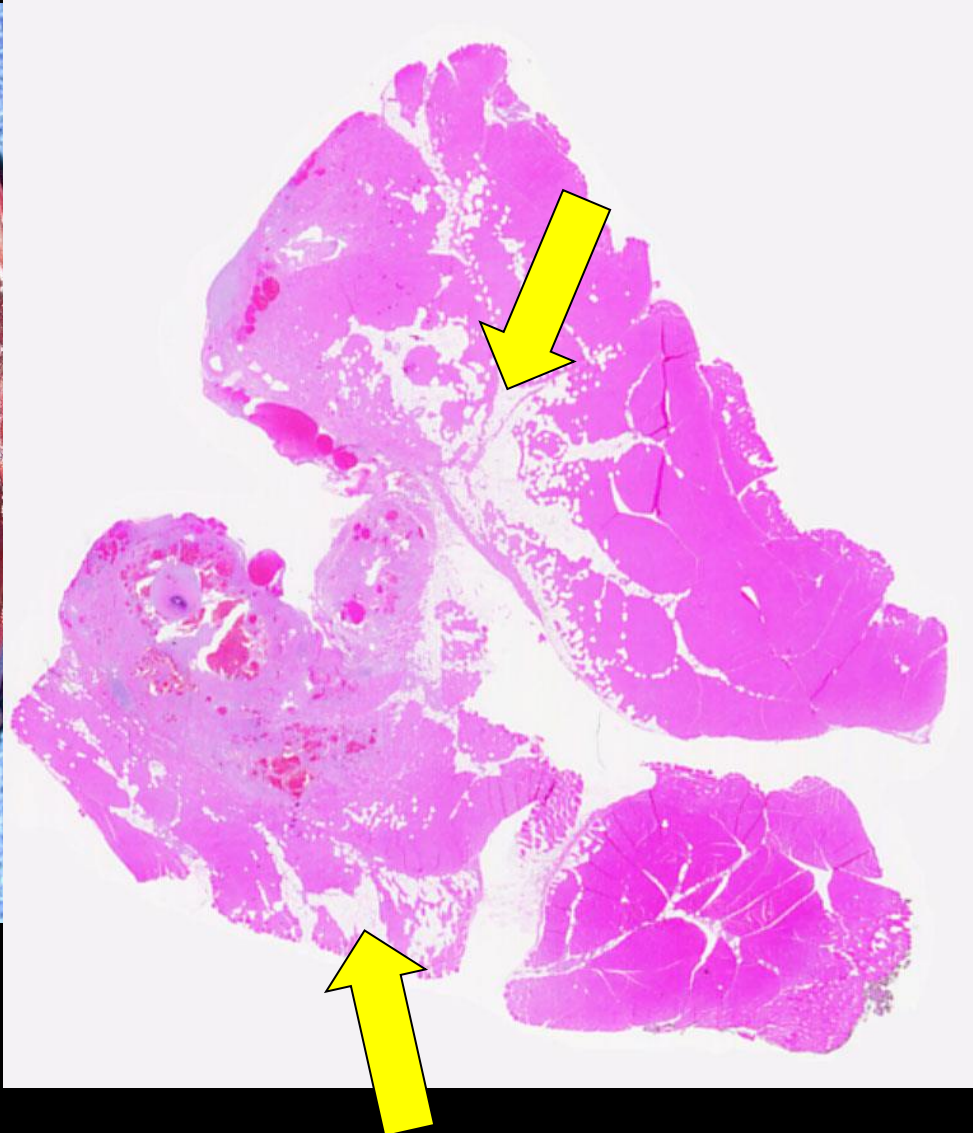
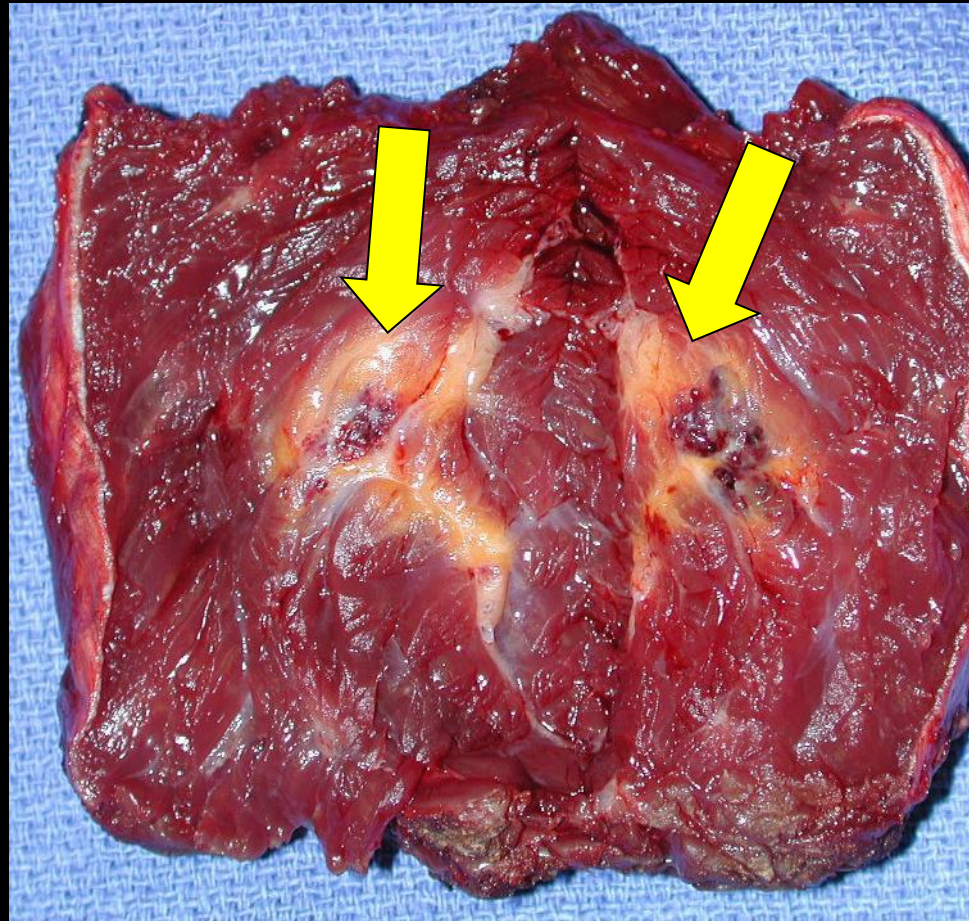


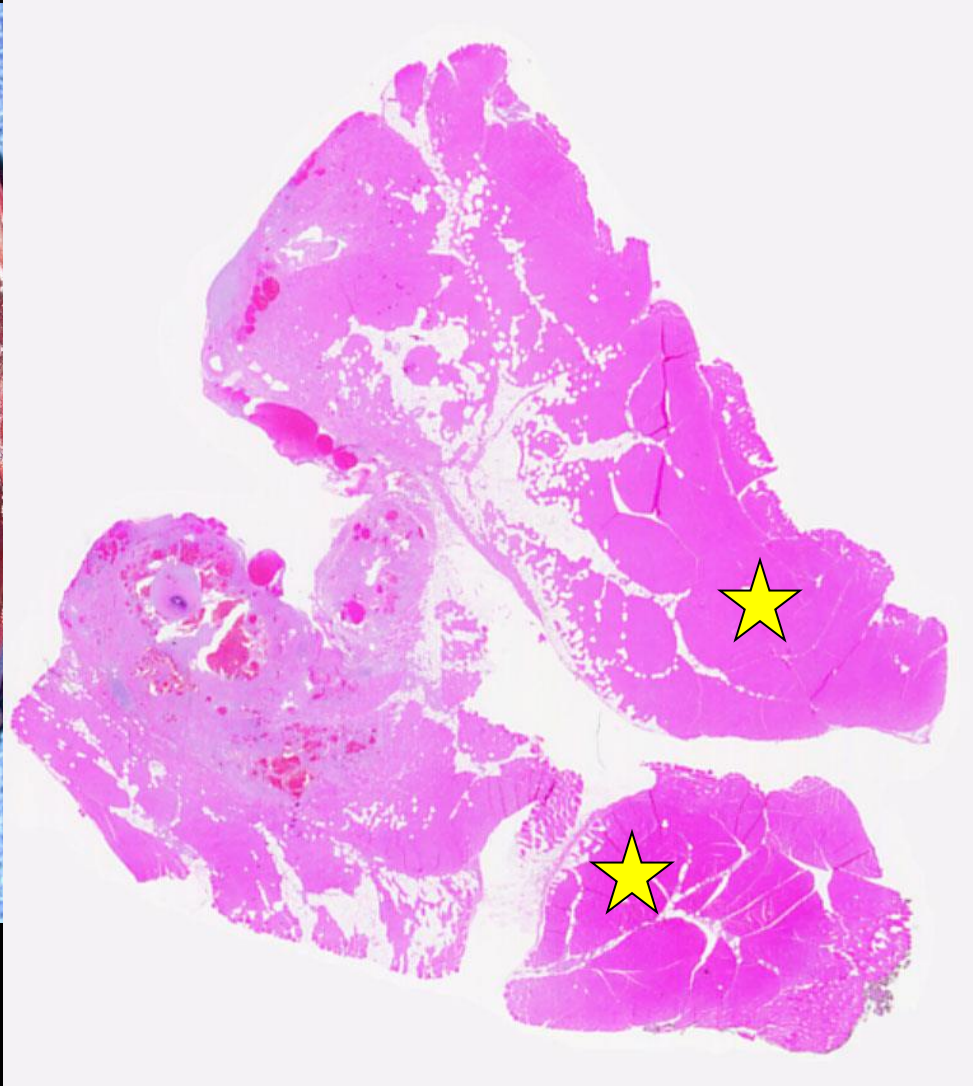
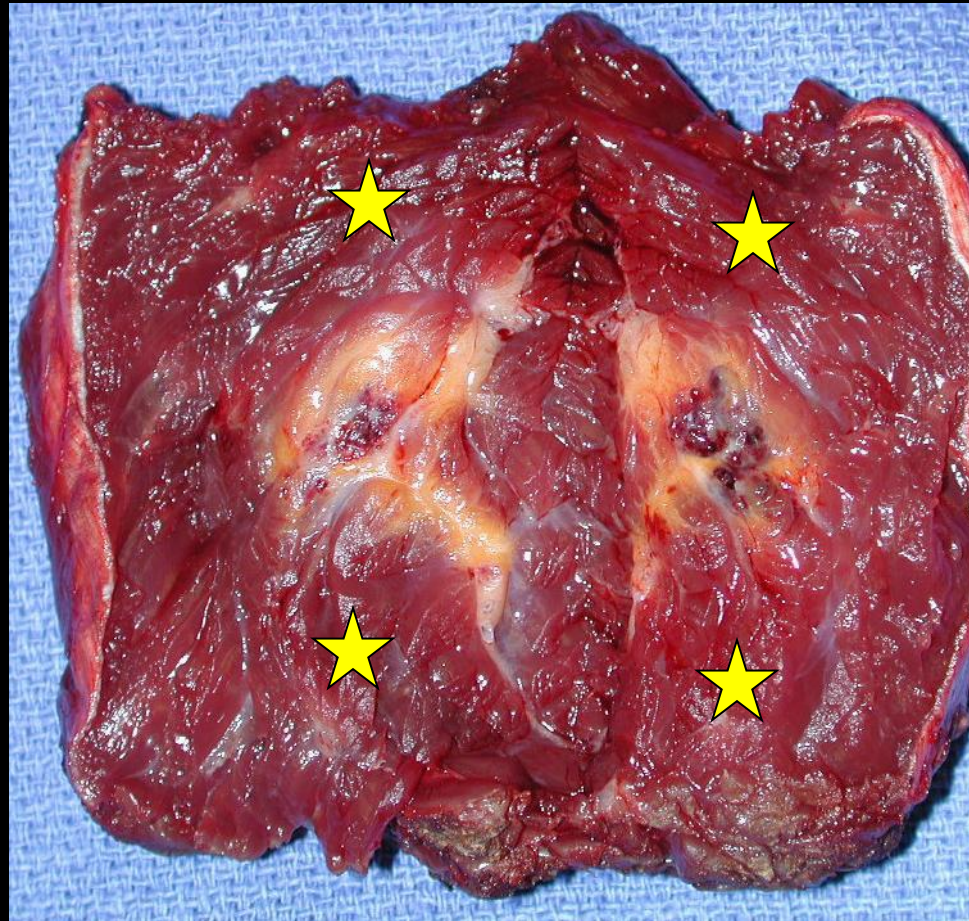


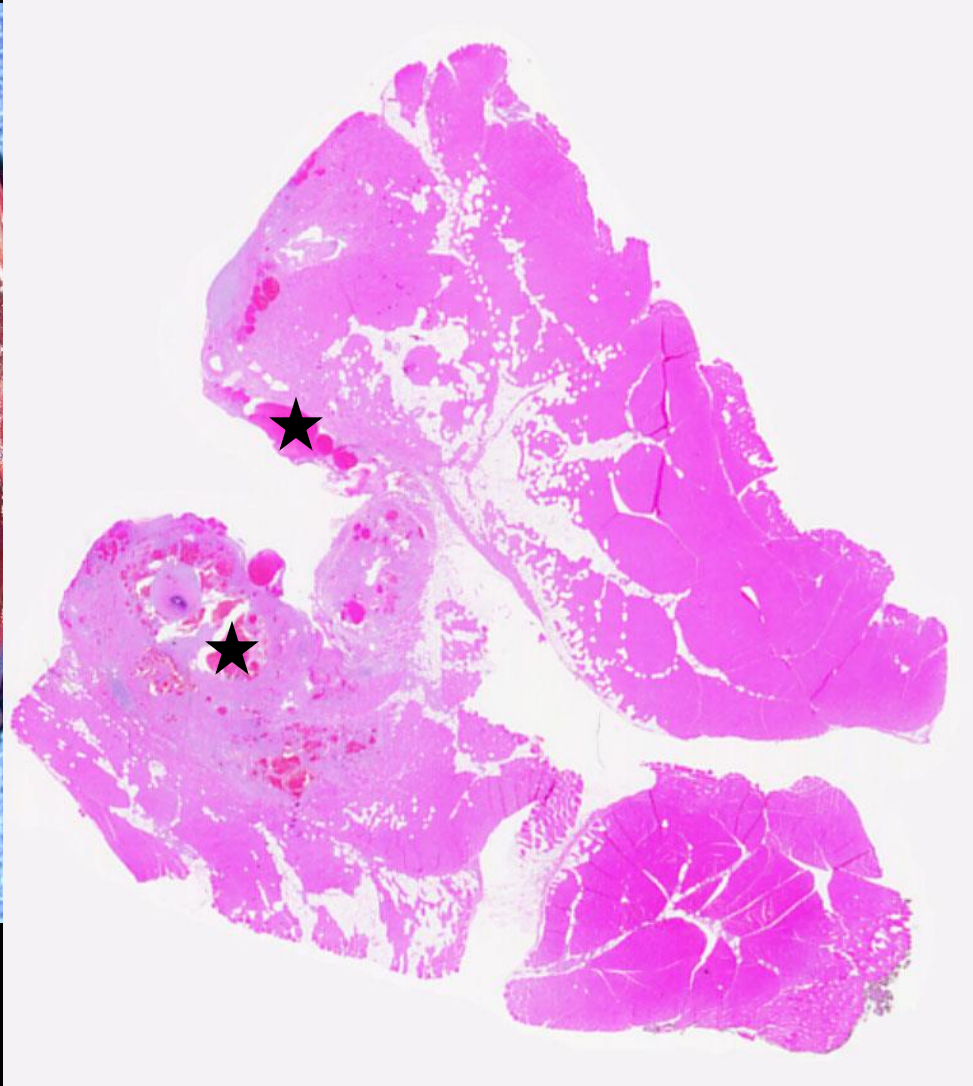
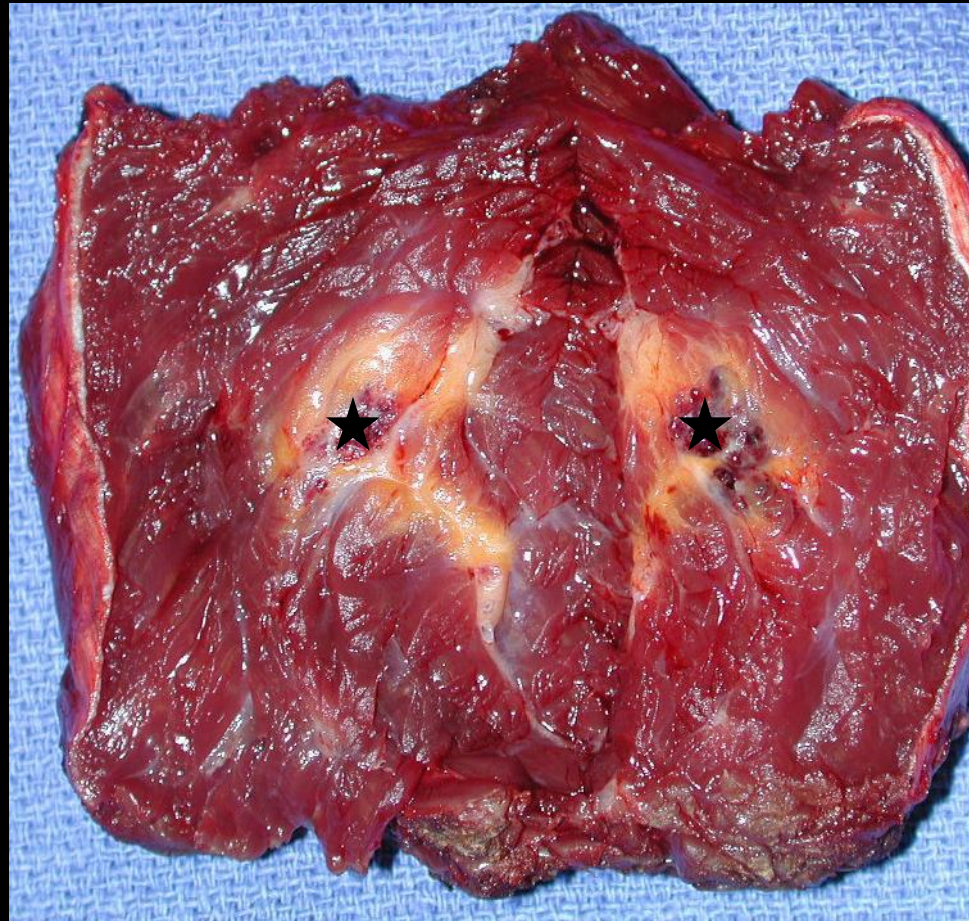
T2/STIR



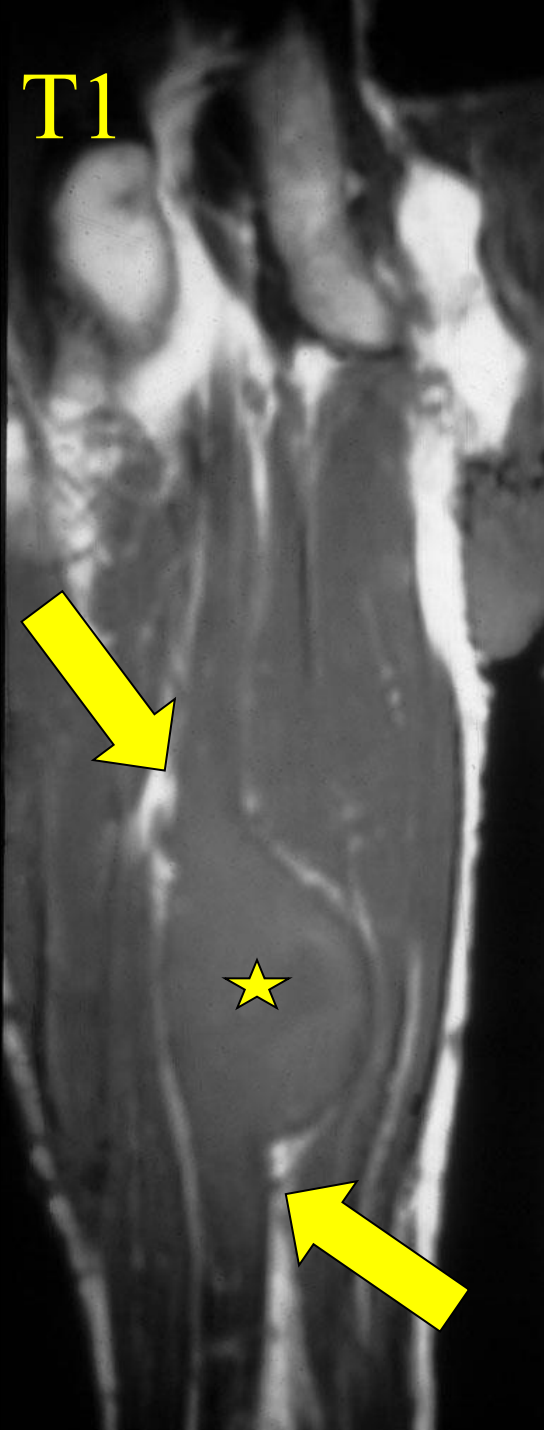




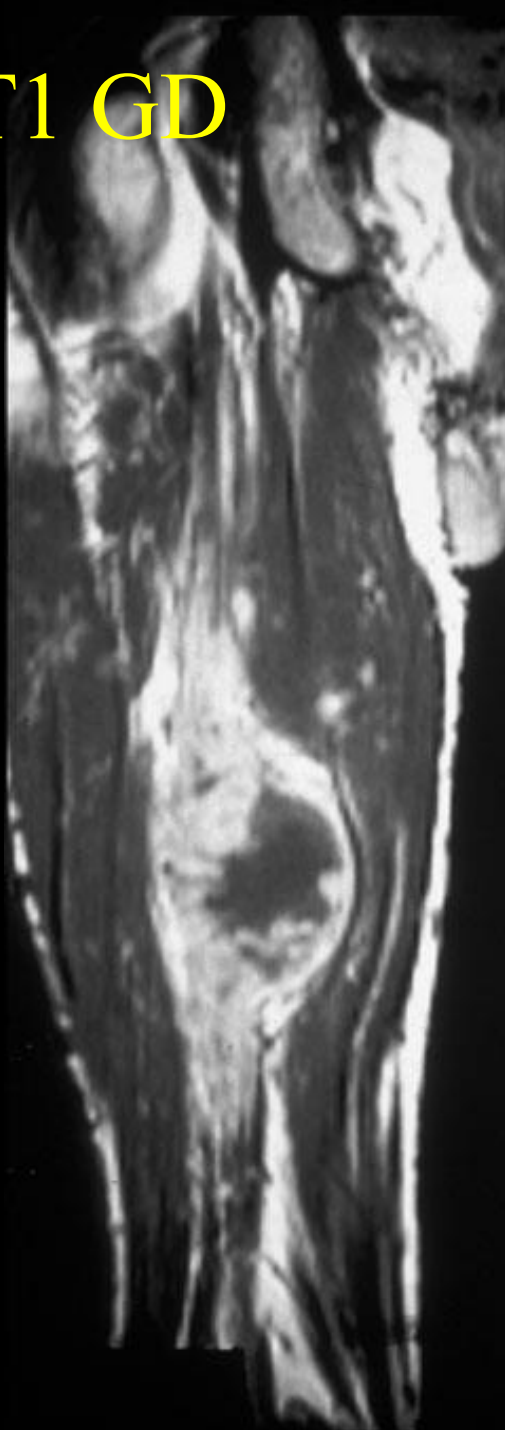




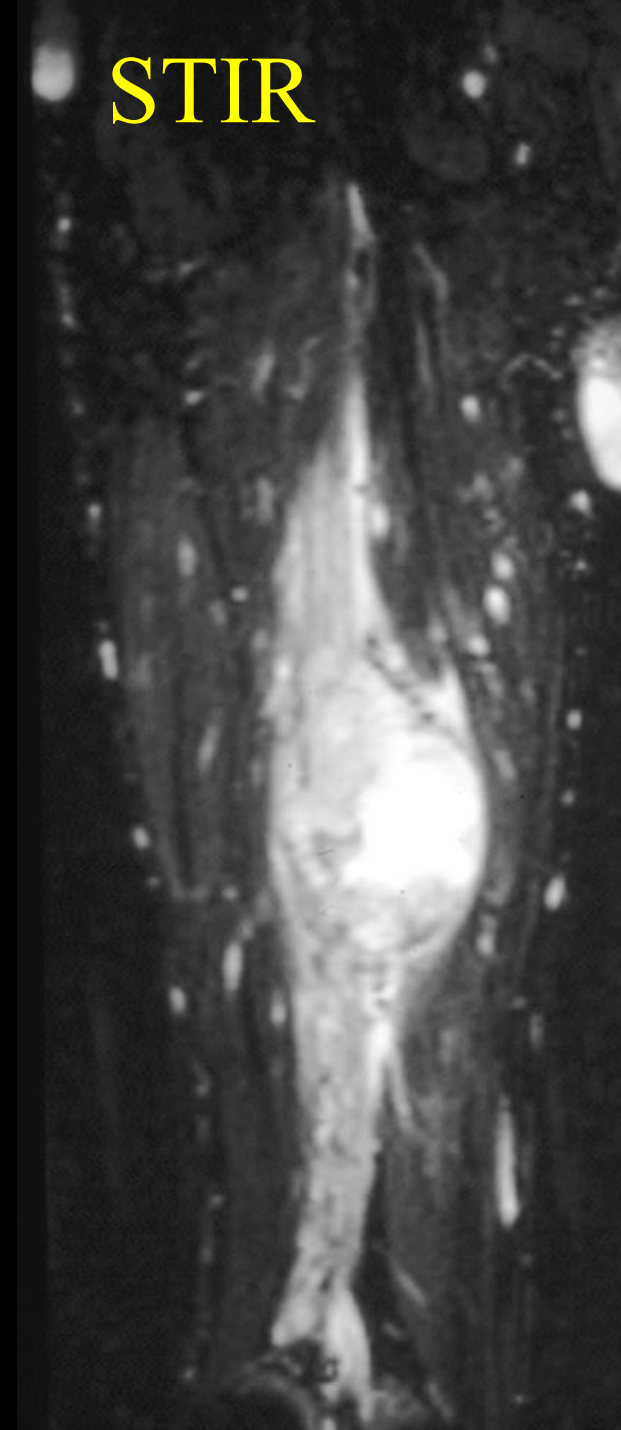
T1



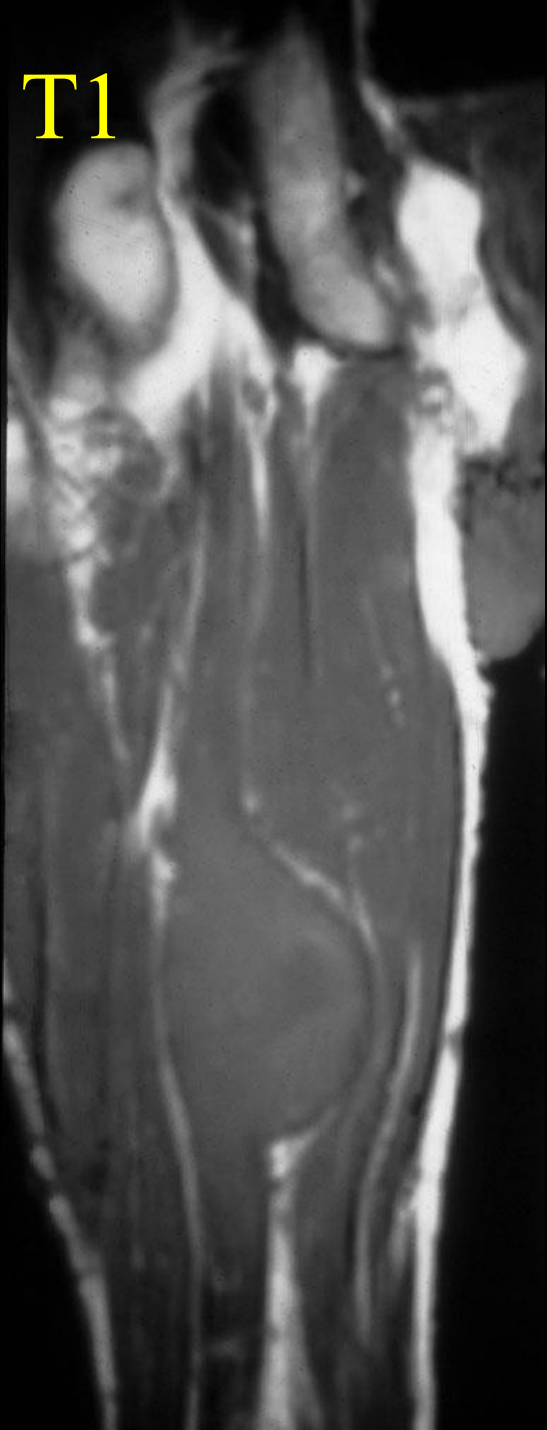
T1 GD



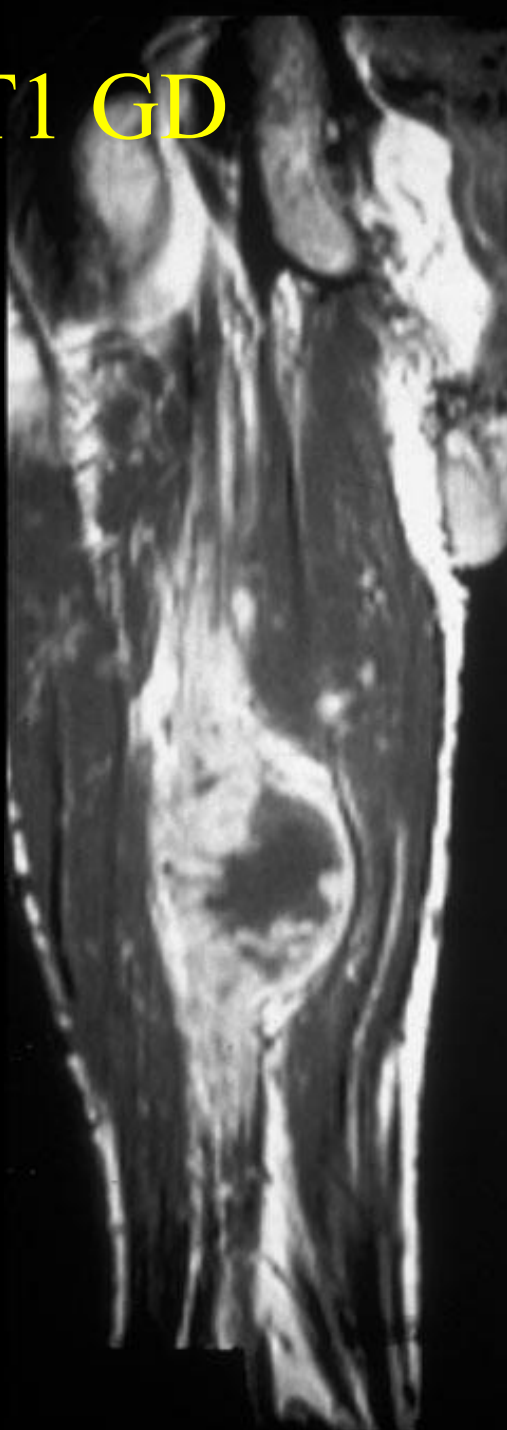
STIR



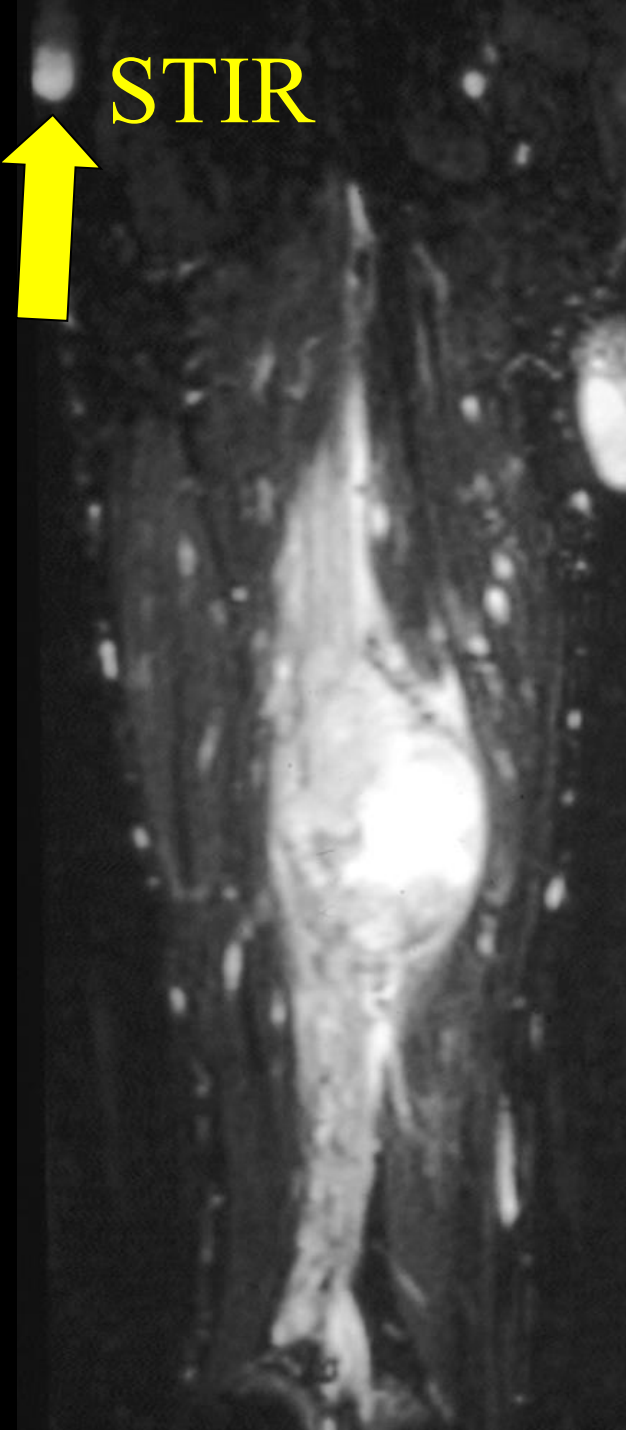
T1



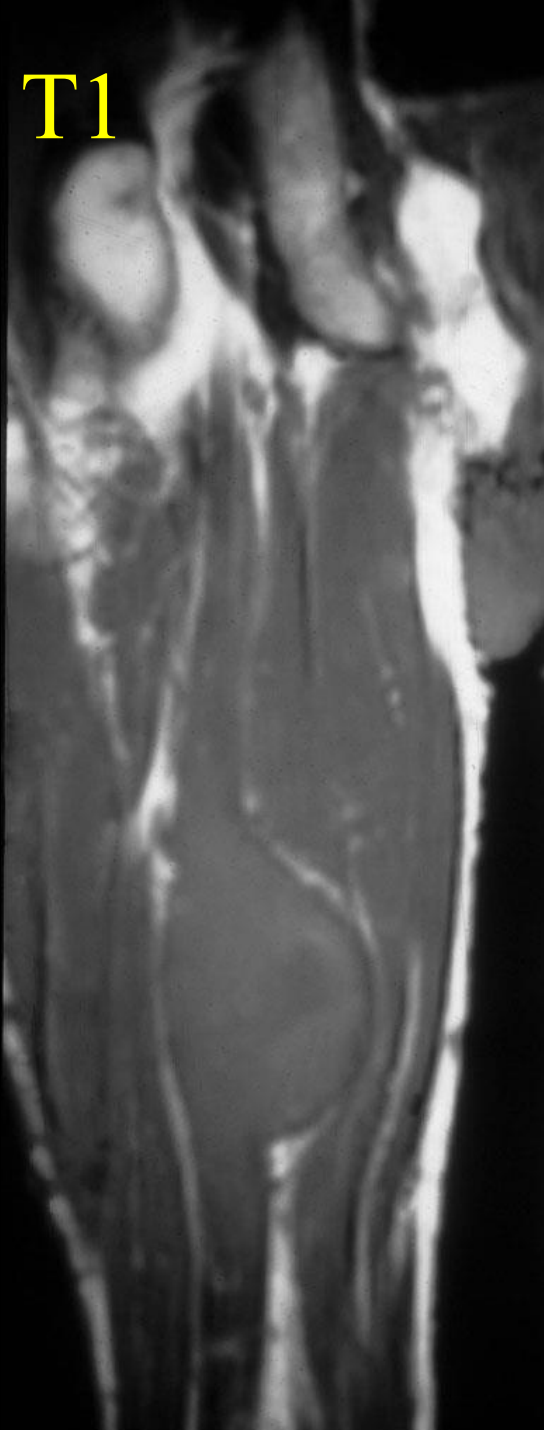
T1 GD



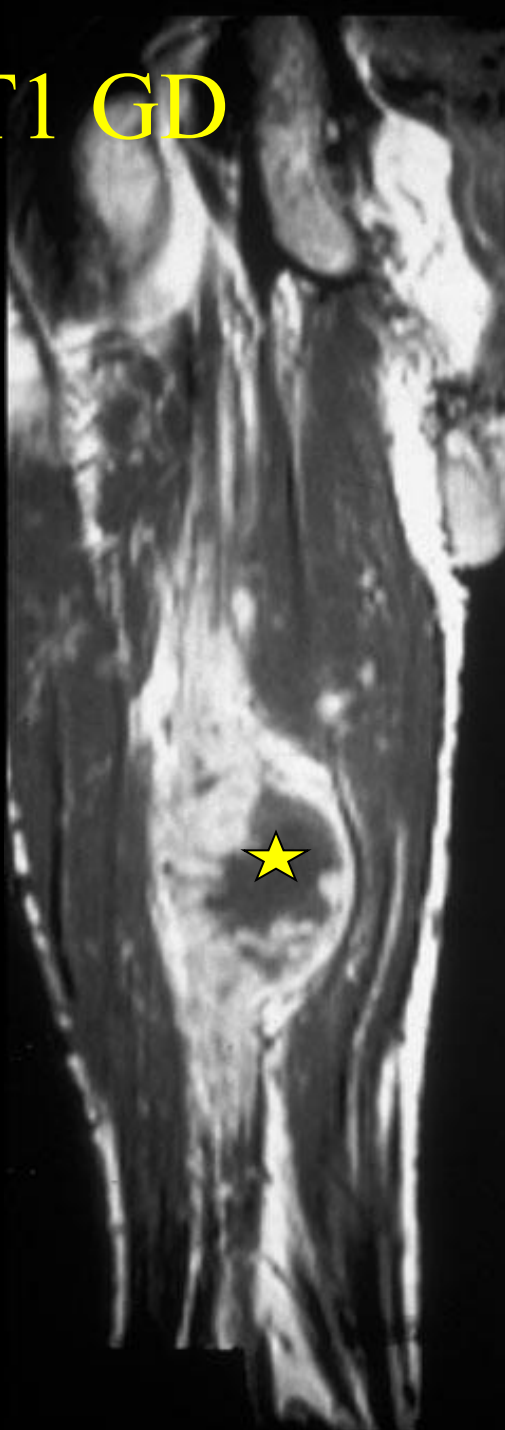
STIR



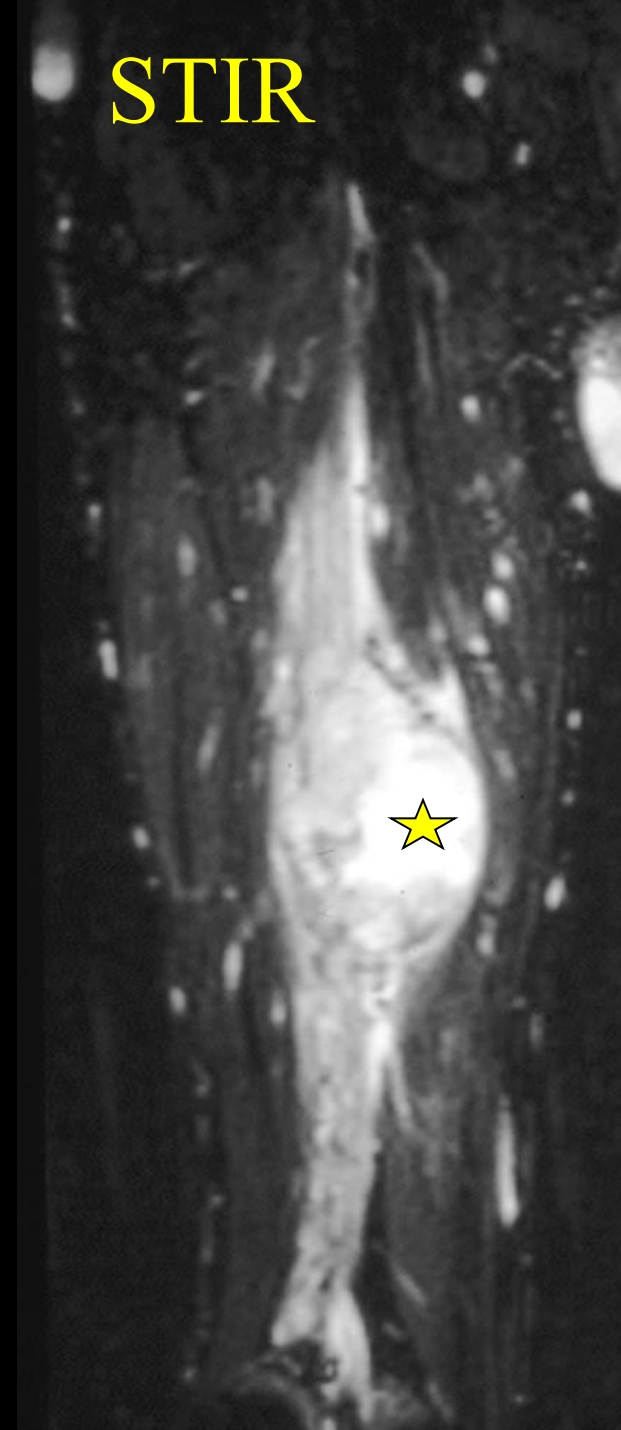
T1



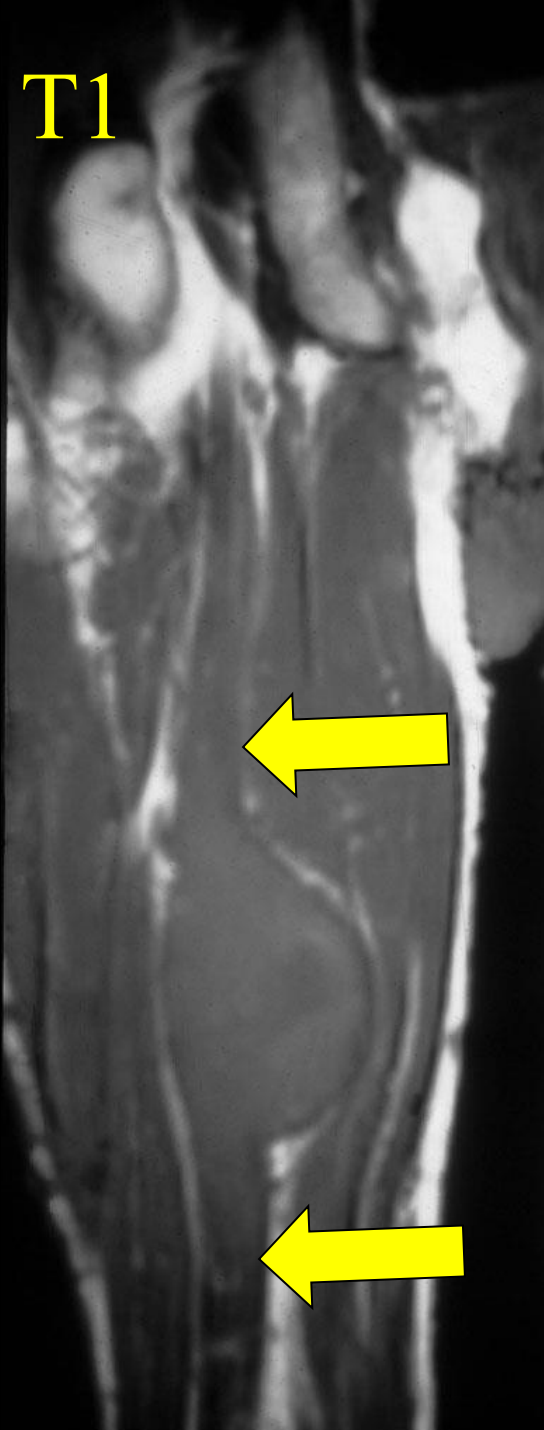
T1 GD



STIR



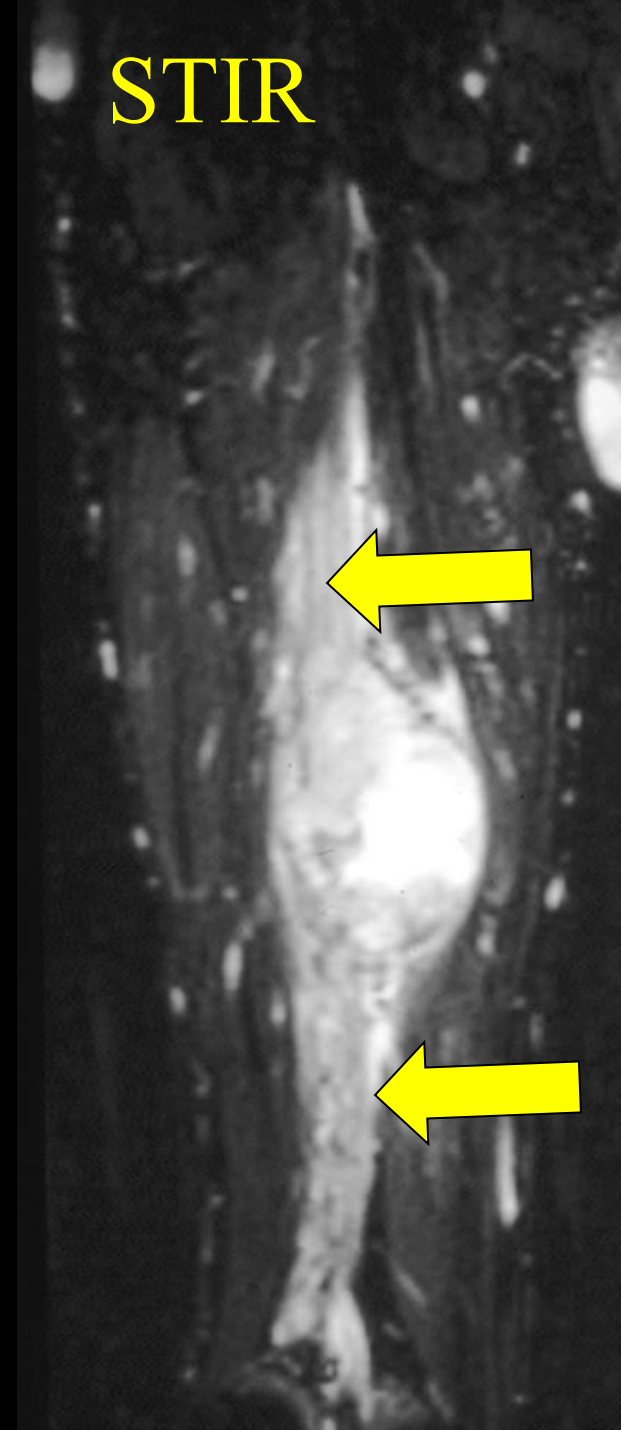
T1

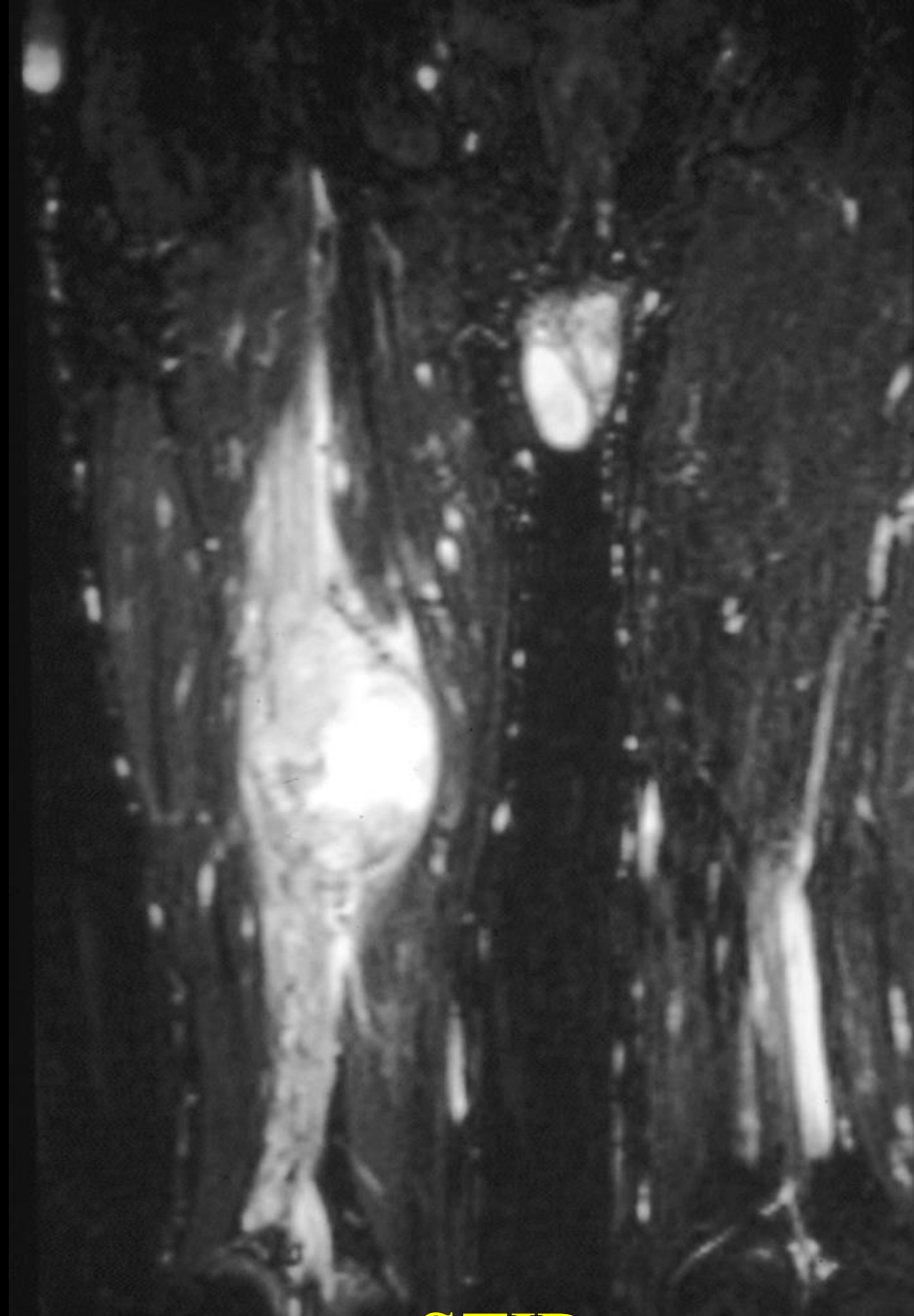


T1 GD

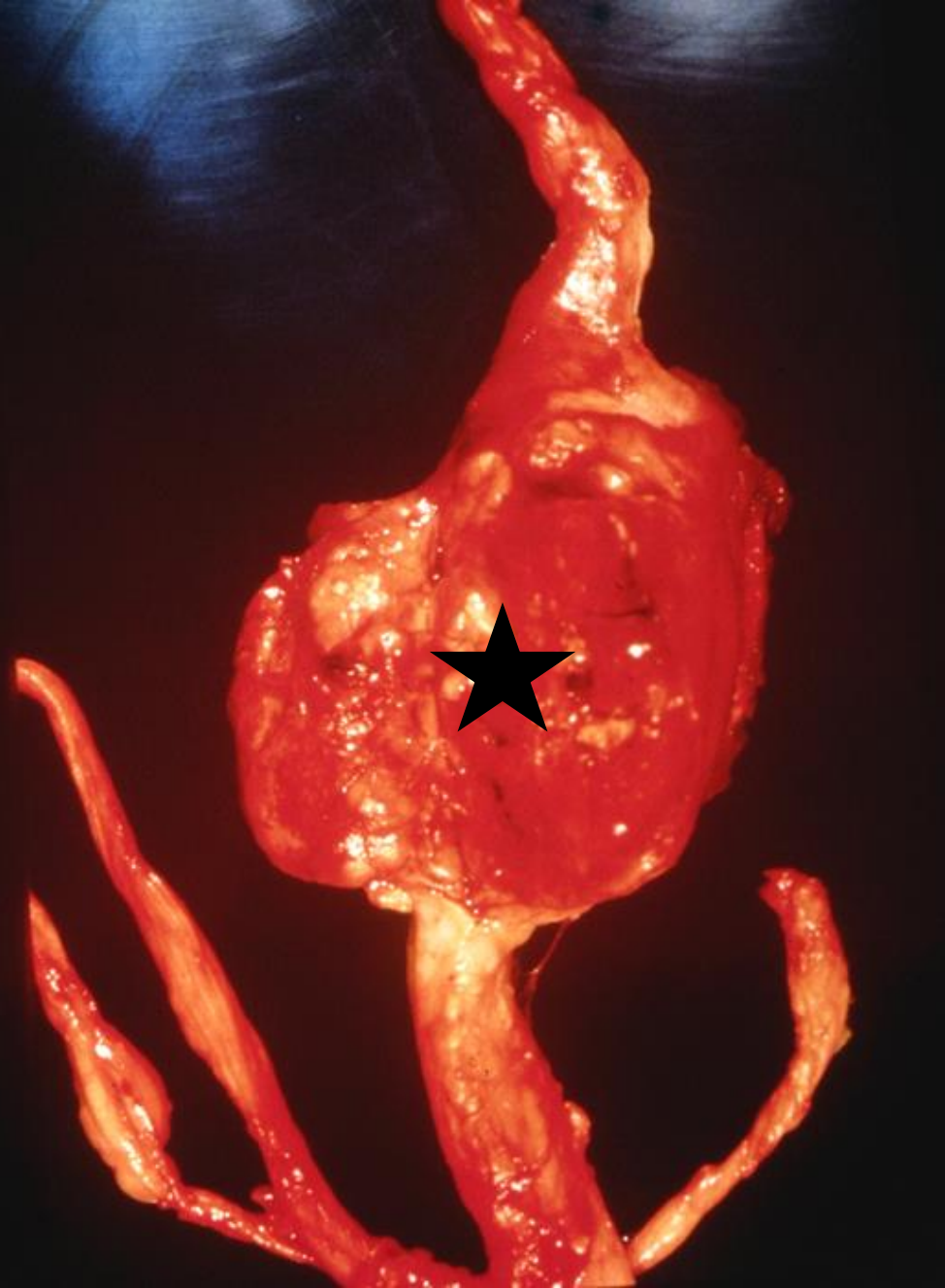


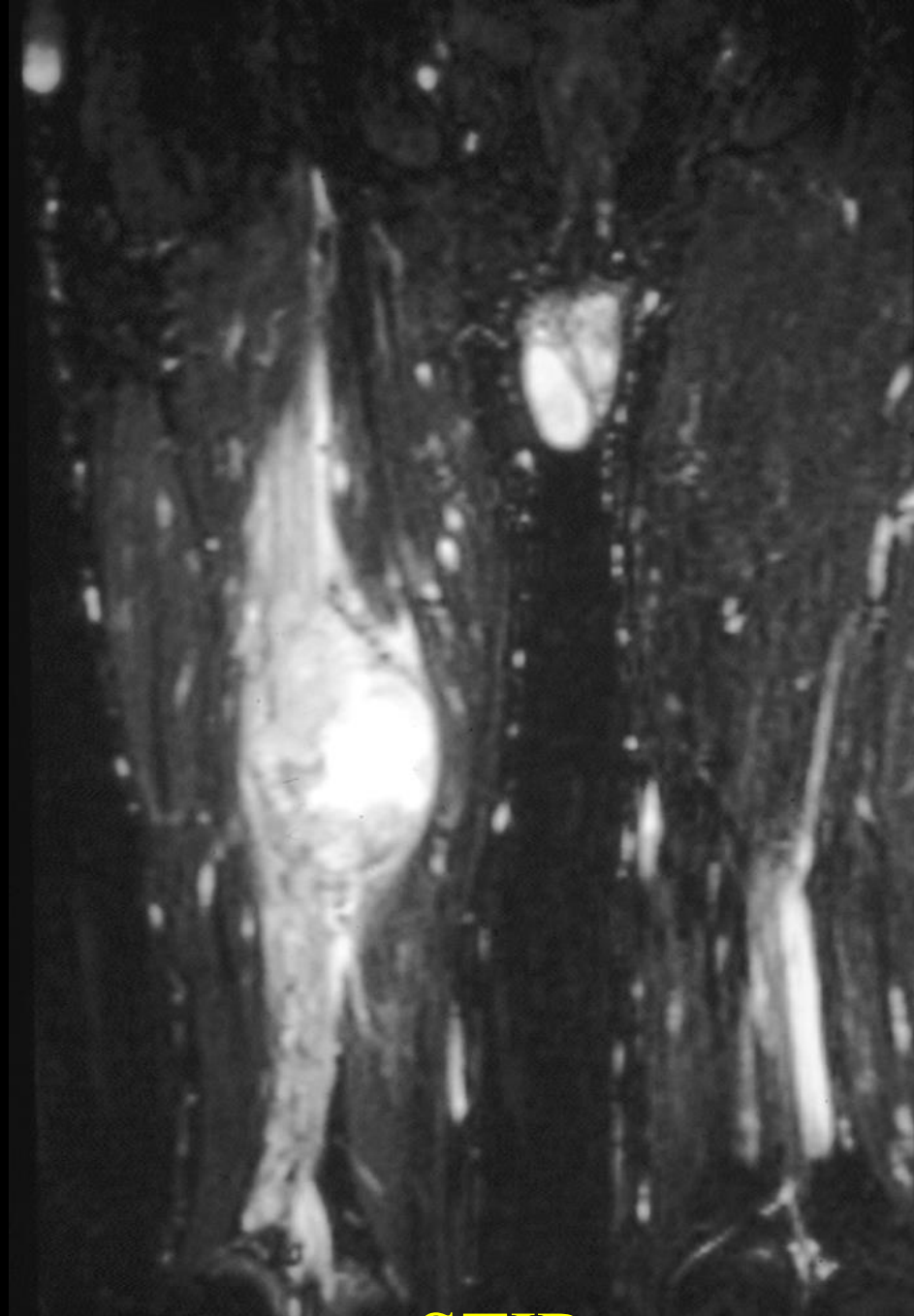
STIR



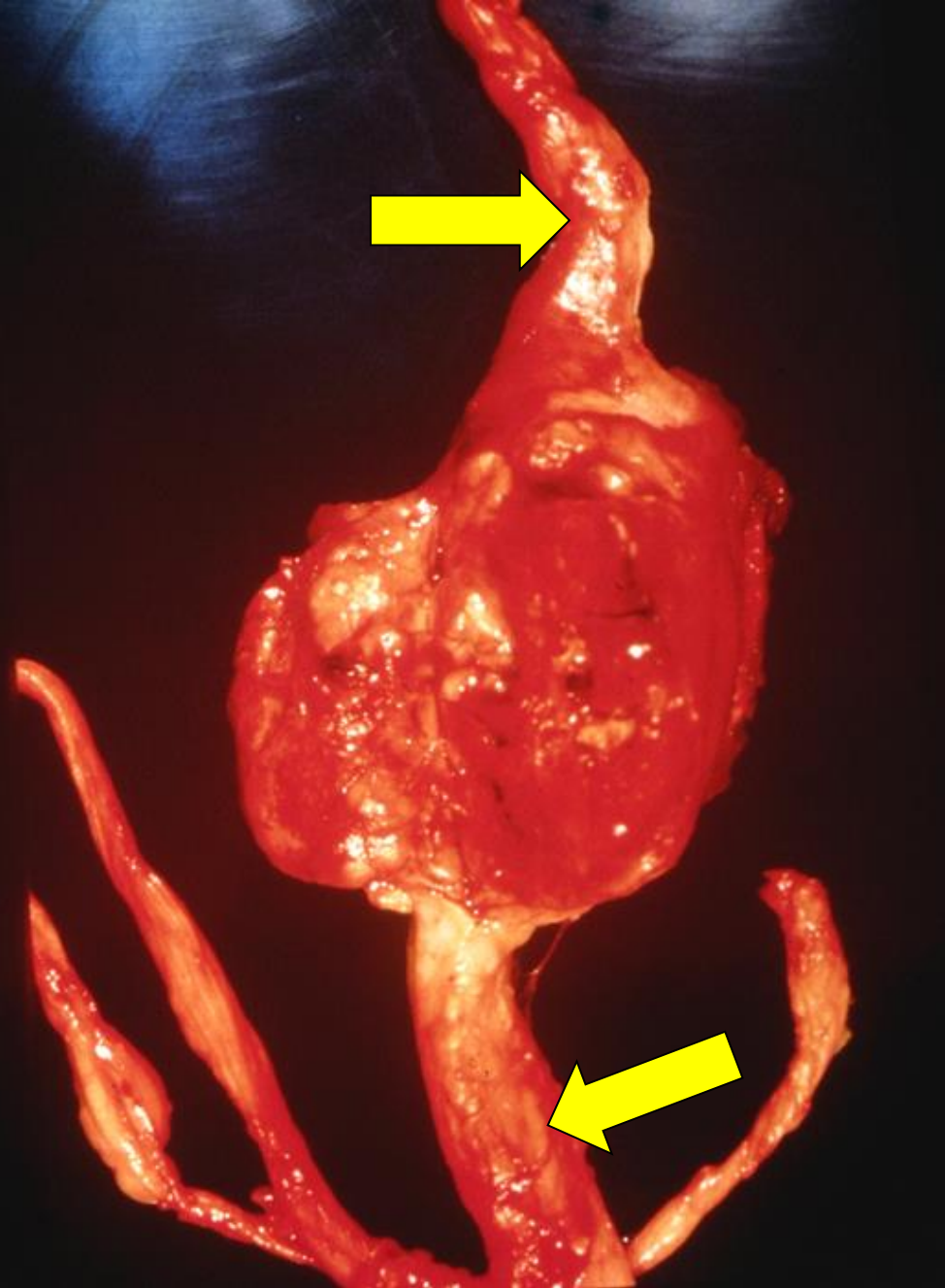


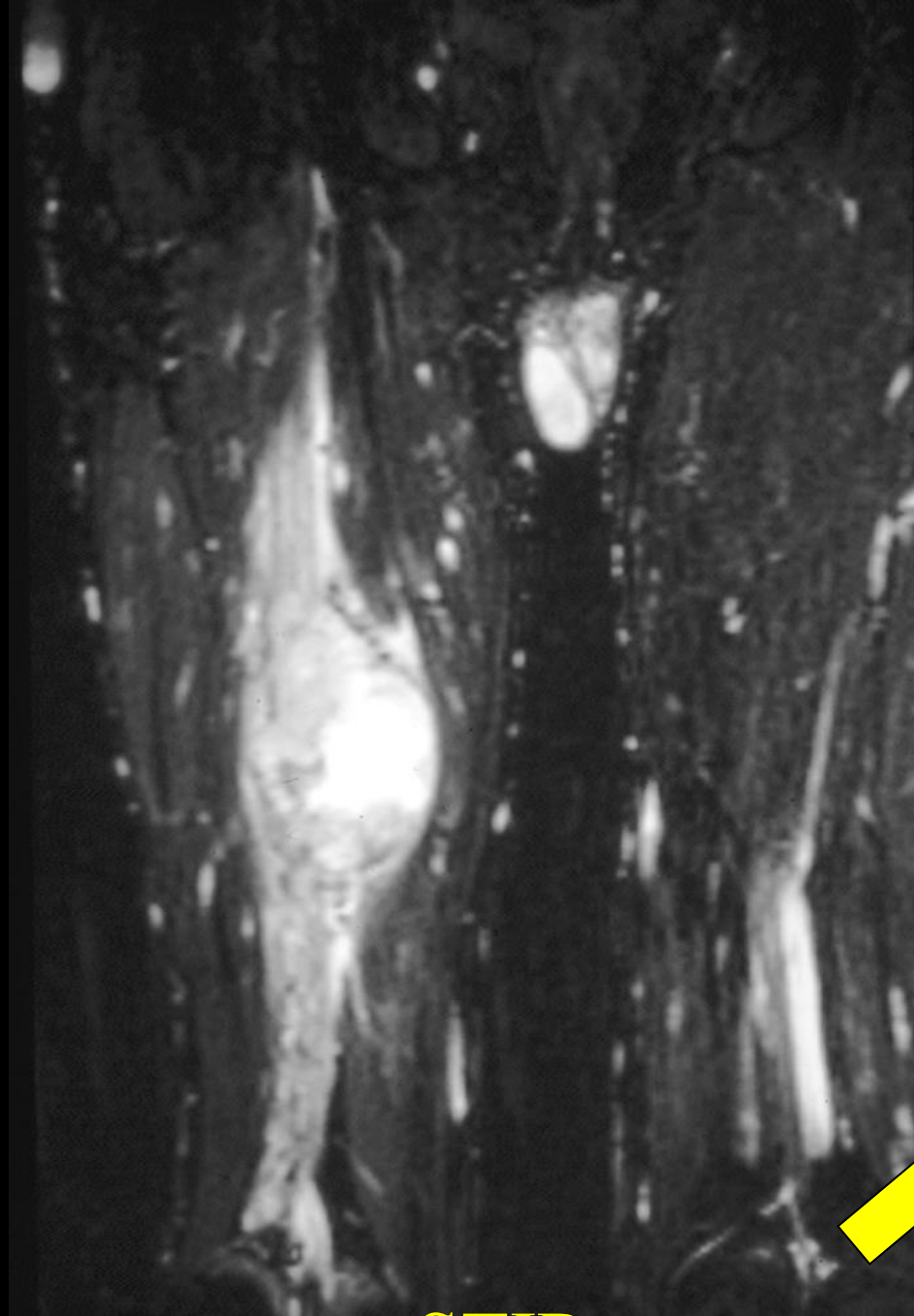
STIR



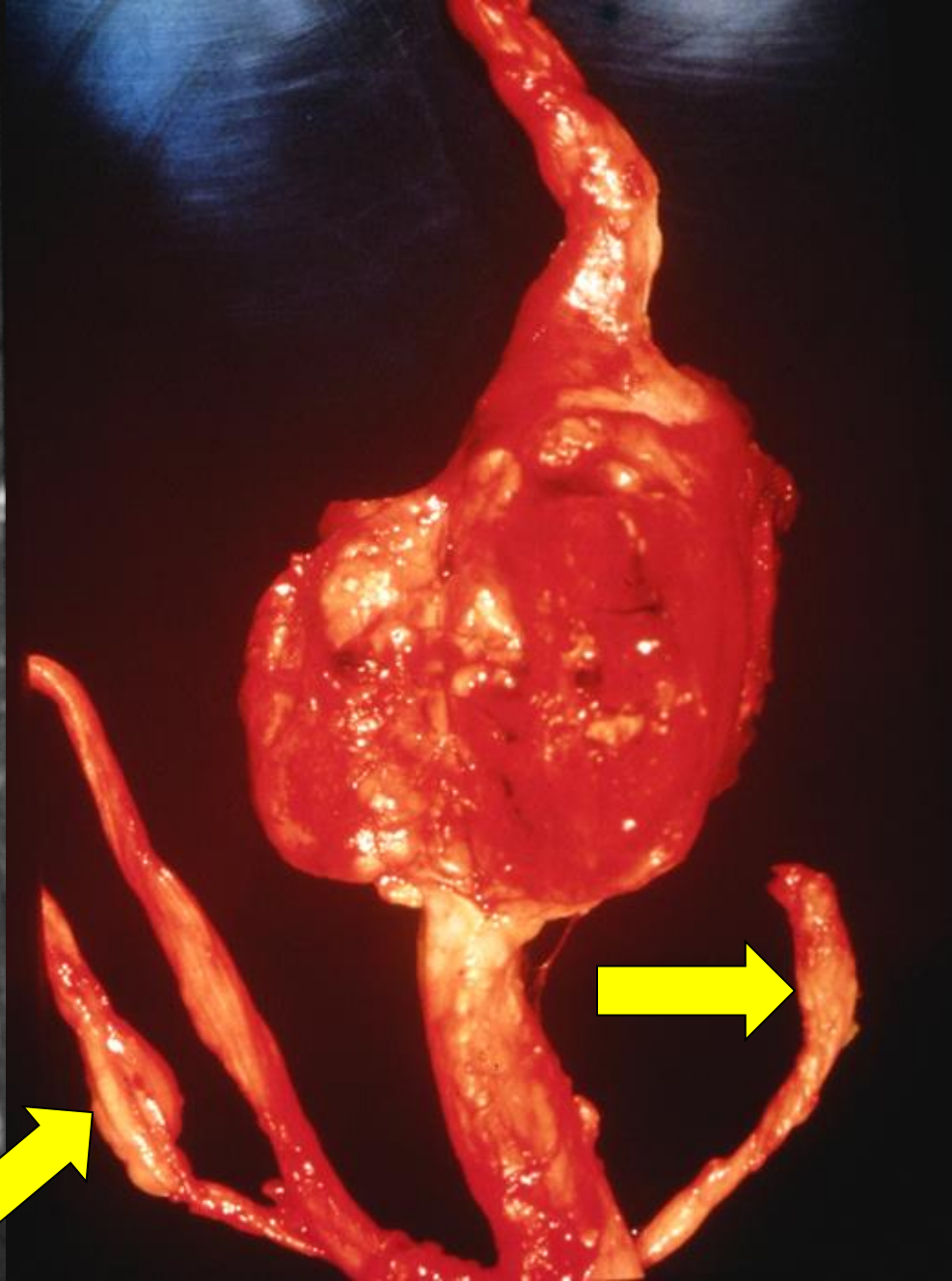


STIR

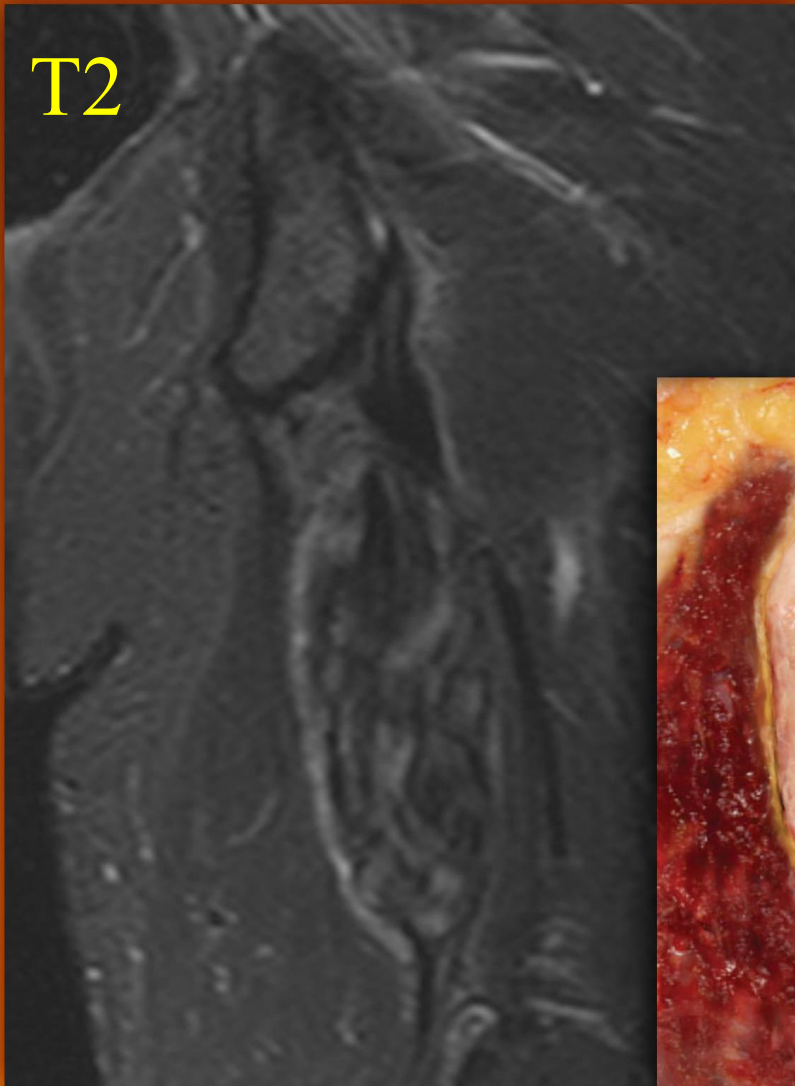




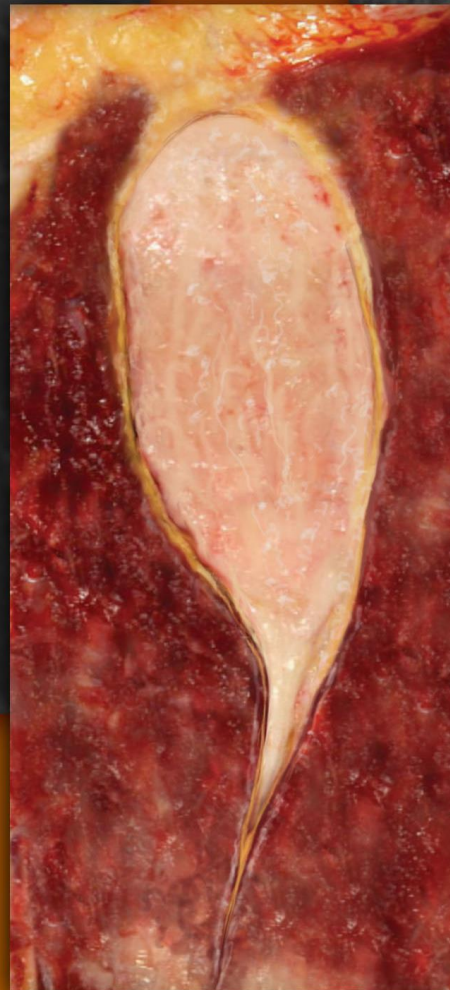
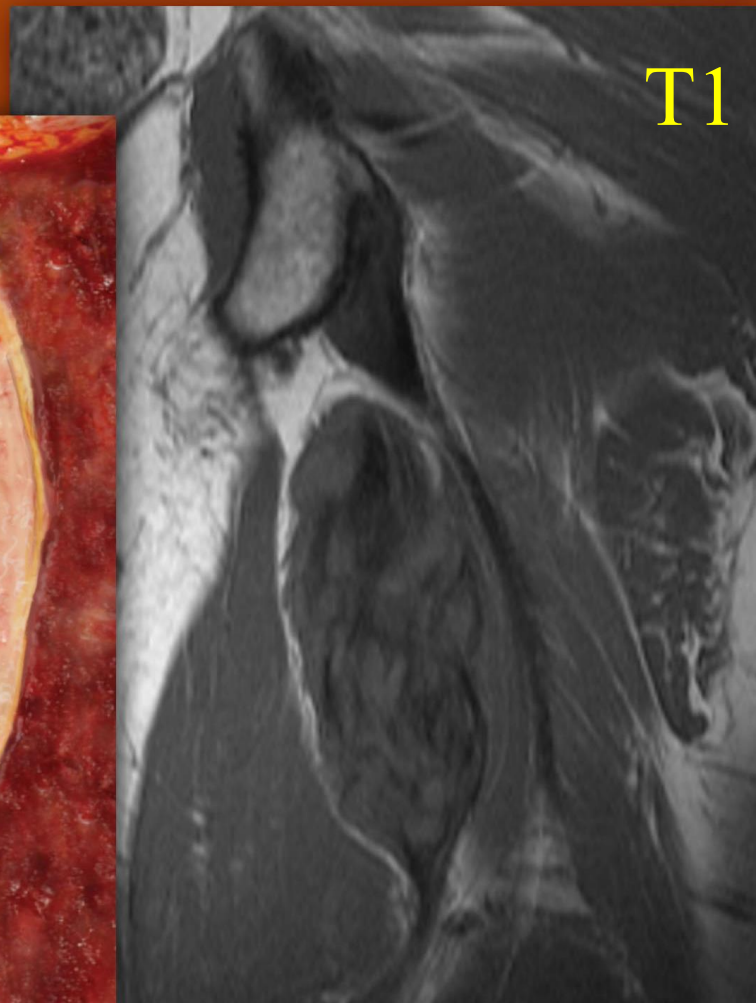
STIR



T2

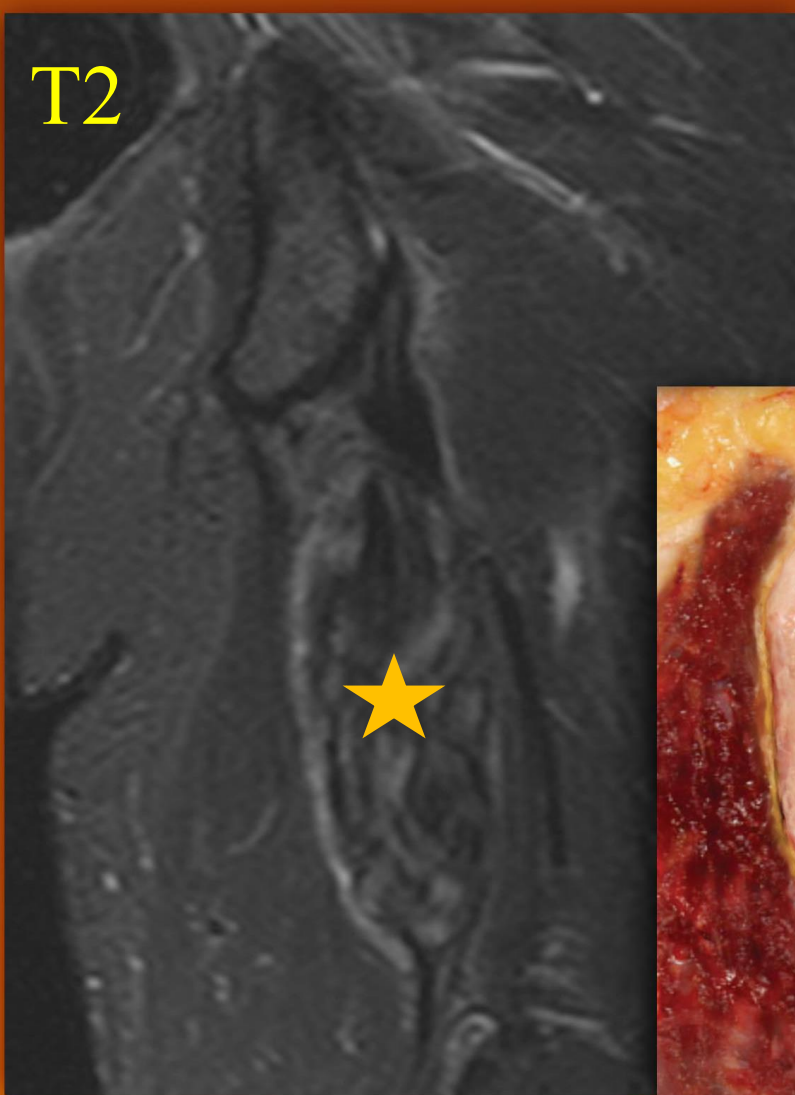


T1

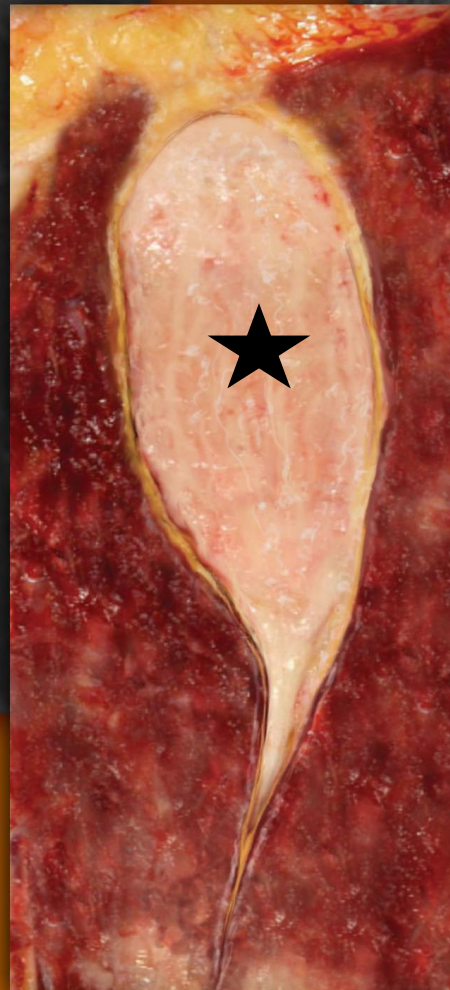
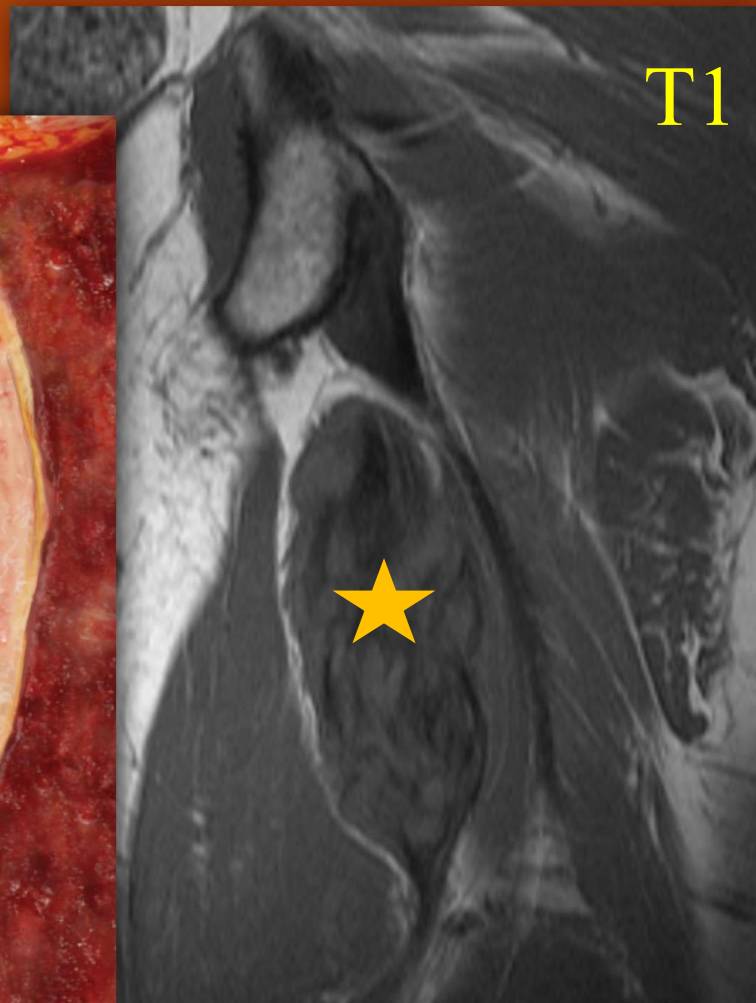


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T2

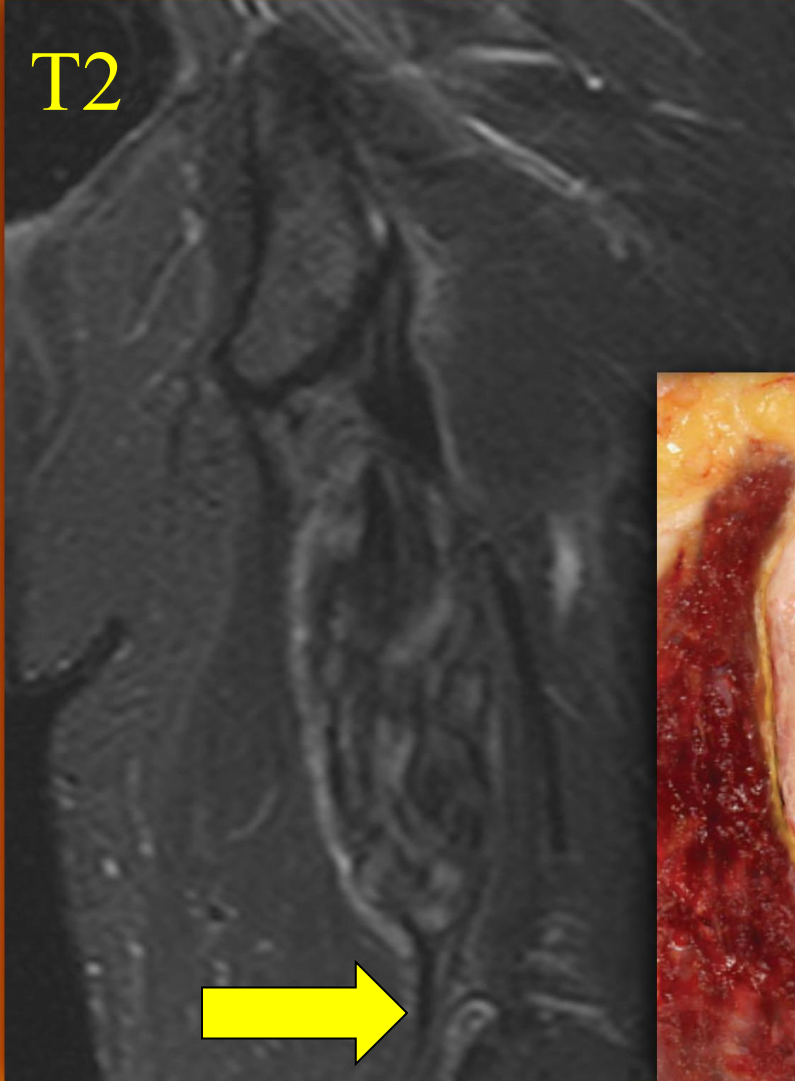


T1

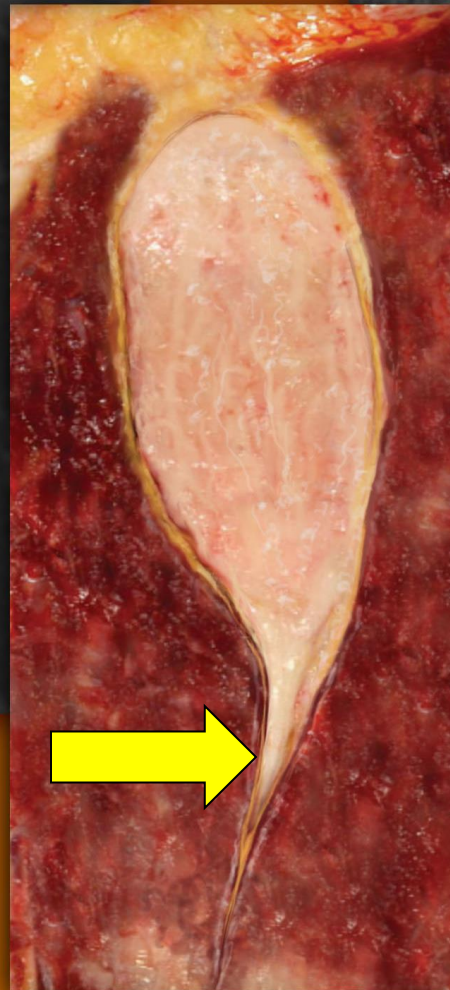


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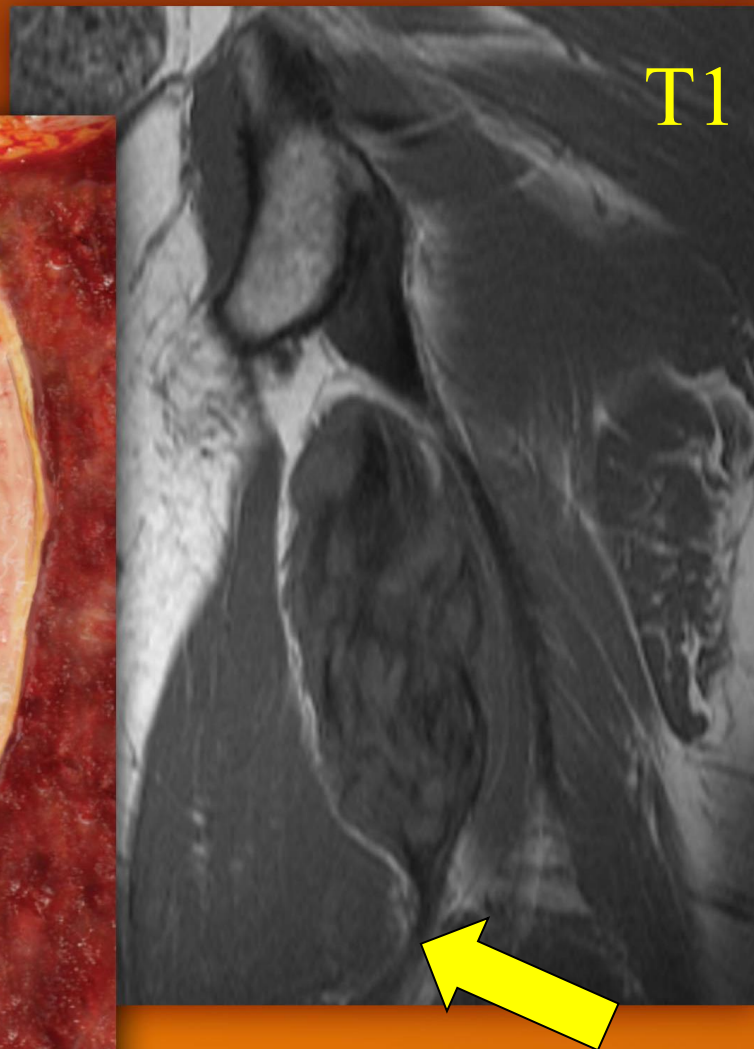
T2



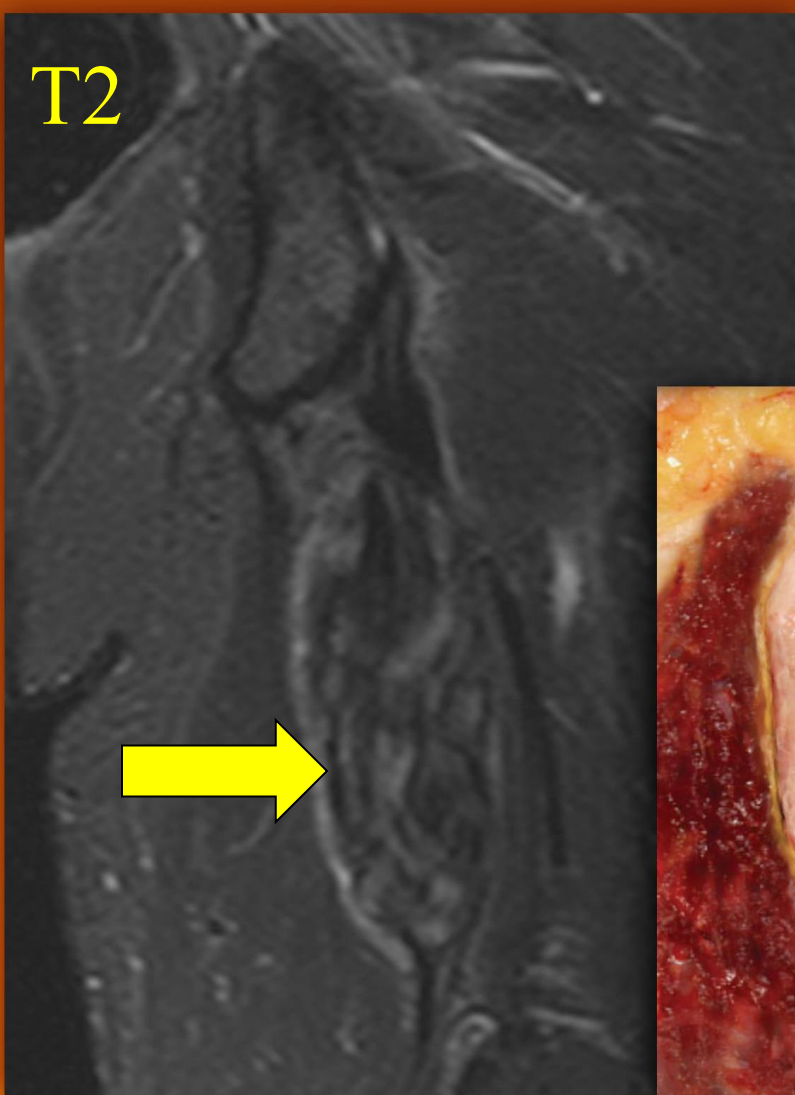
Alotta Am Frazier MD



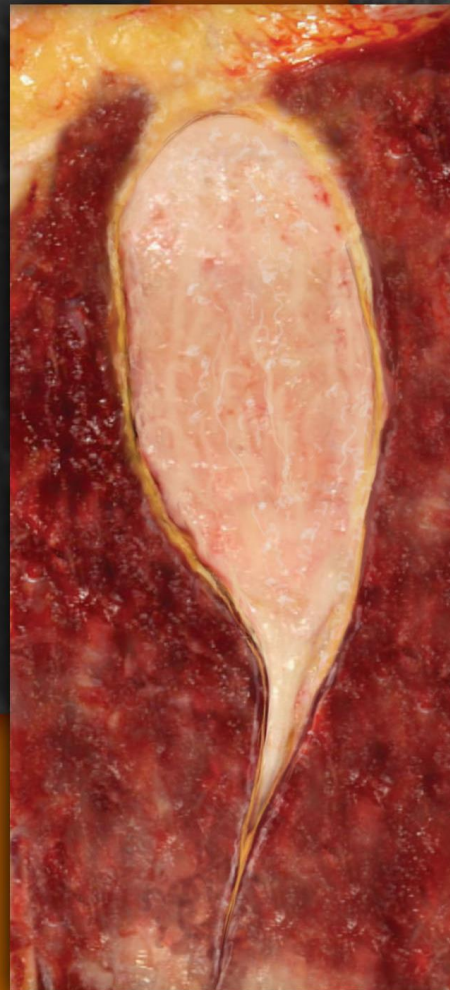
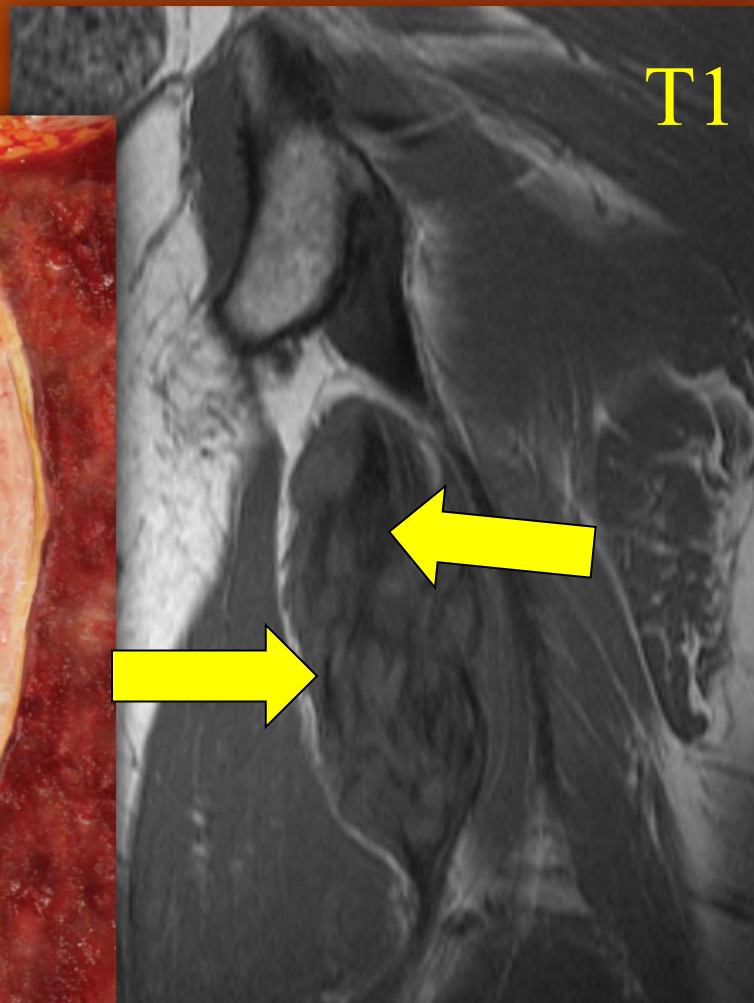
T1



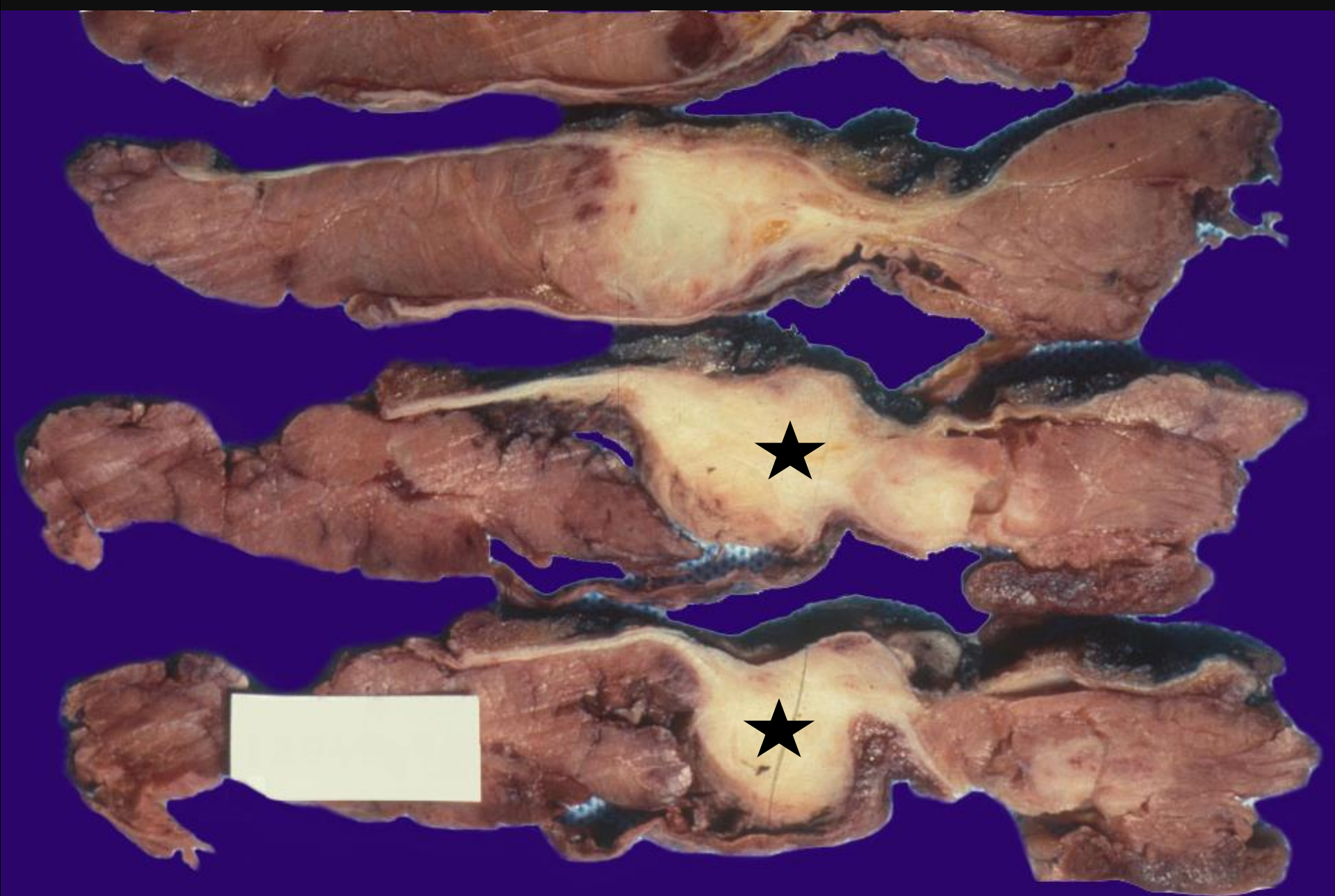
T2

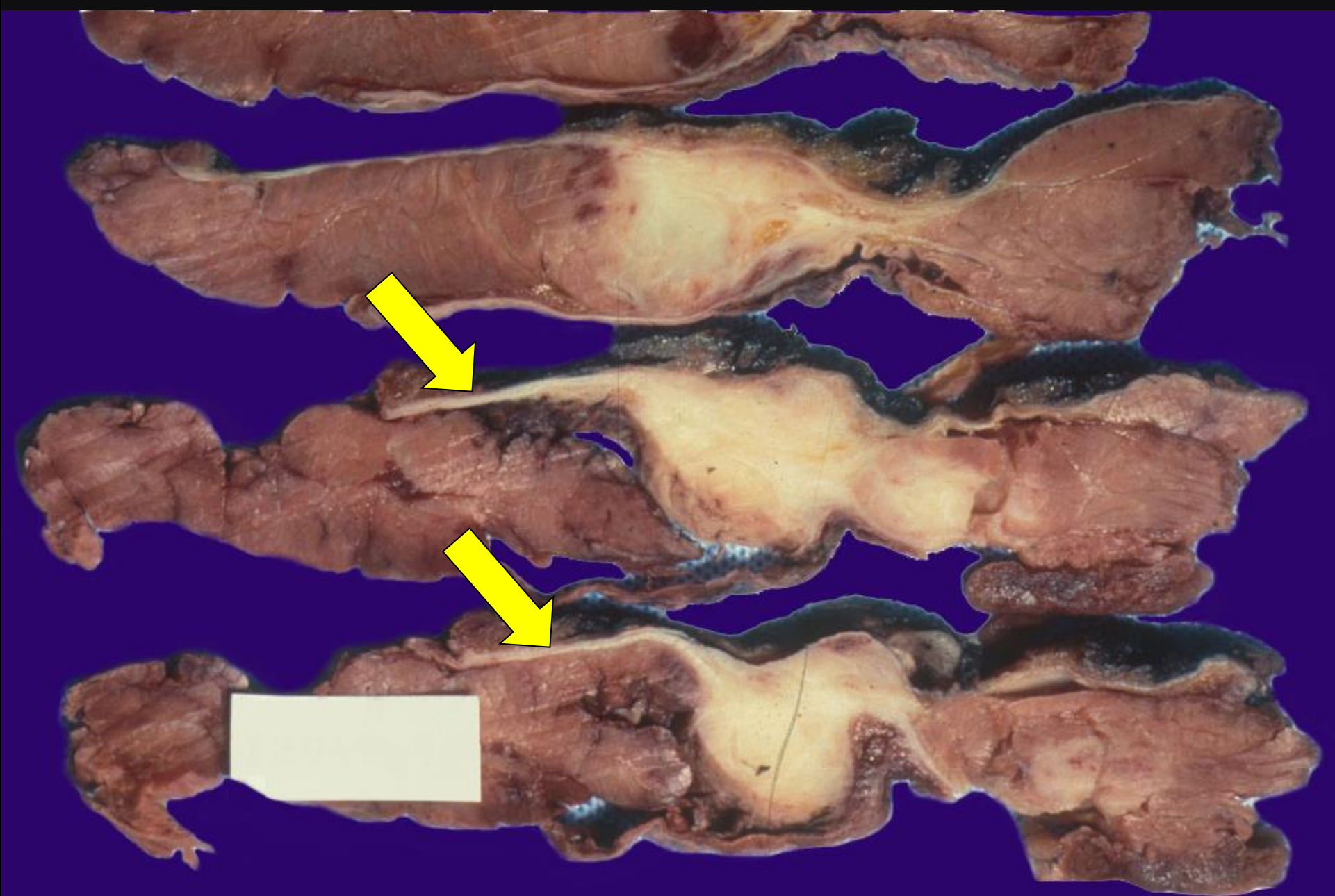


T1



Alotta Am Frazier MD





DAx S6.4

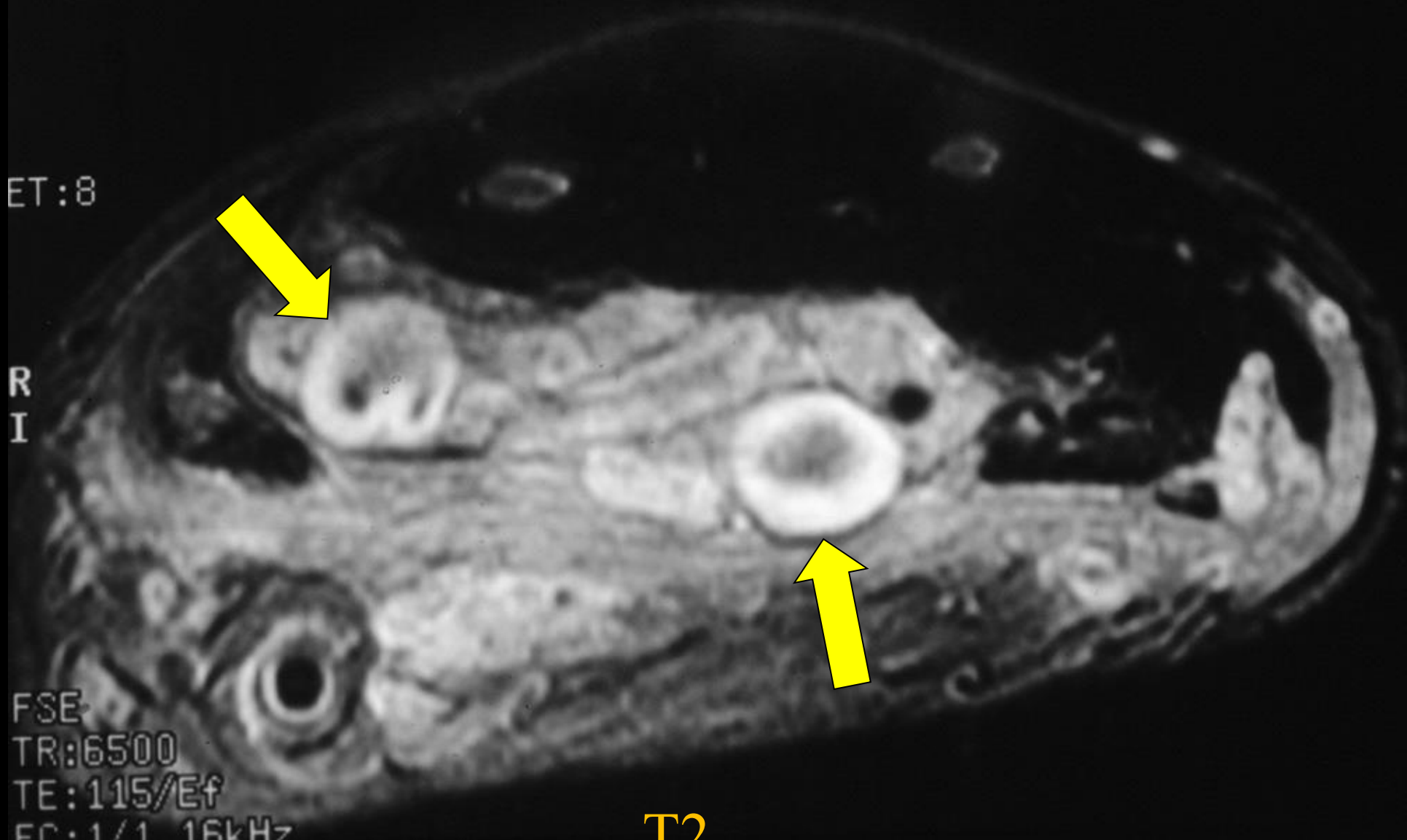
MF: 1

ET:8

R
I

FSE
TR:6500
TE:115/ef
FO:1/1 16kHz

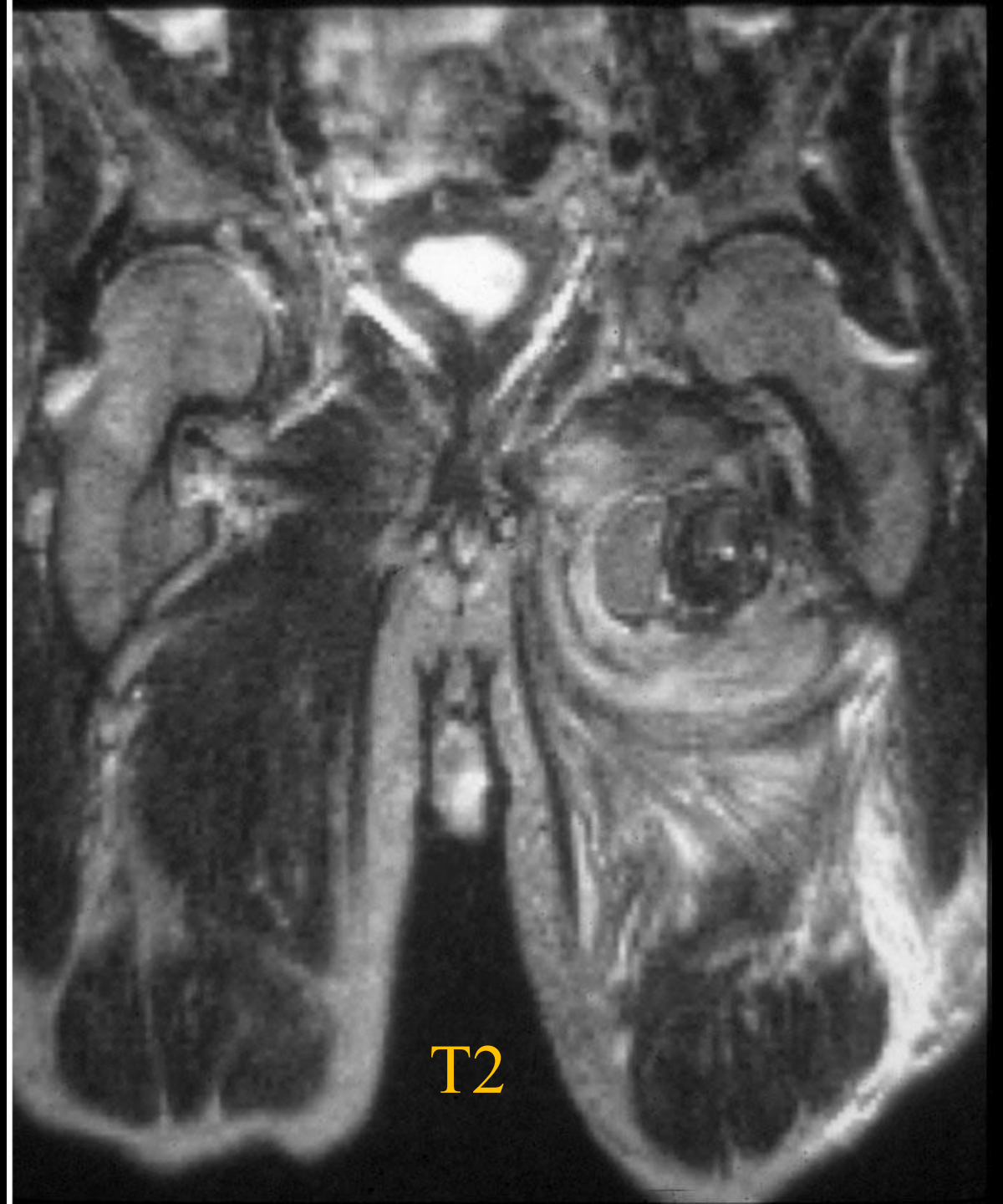
T2

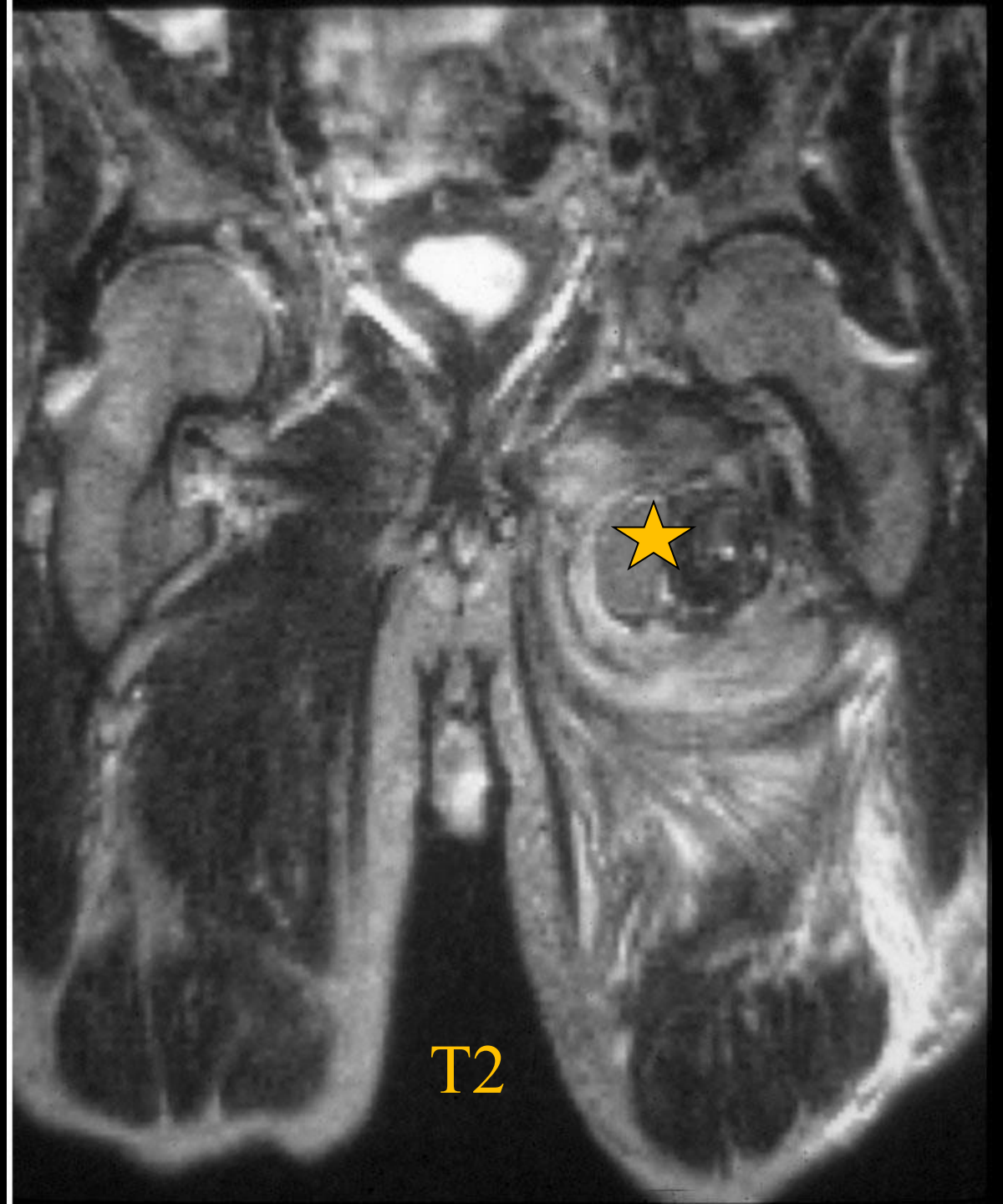


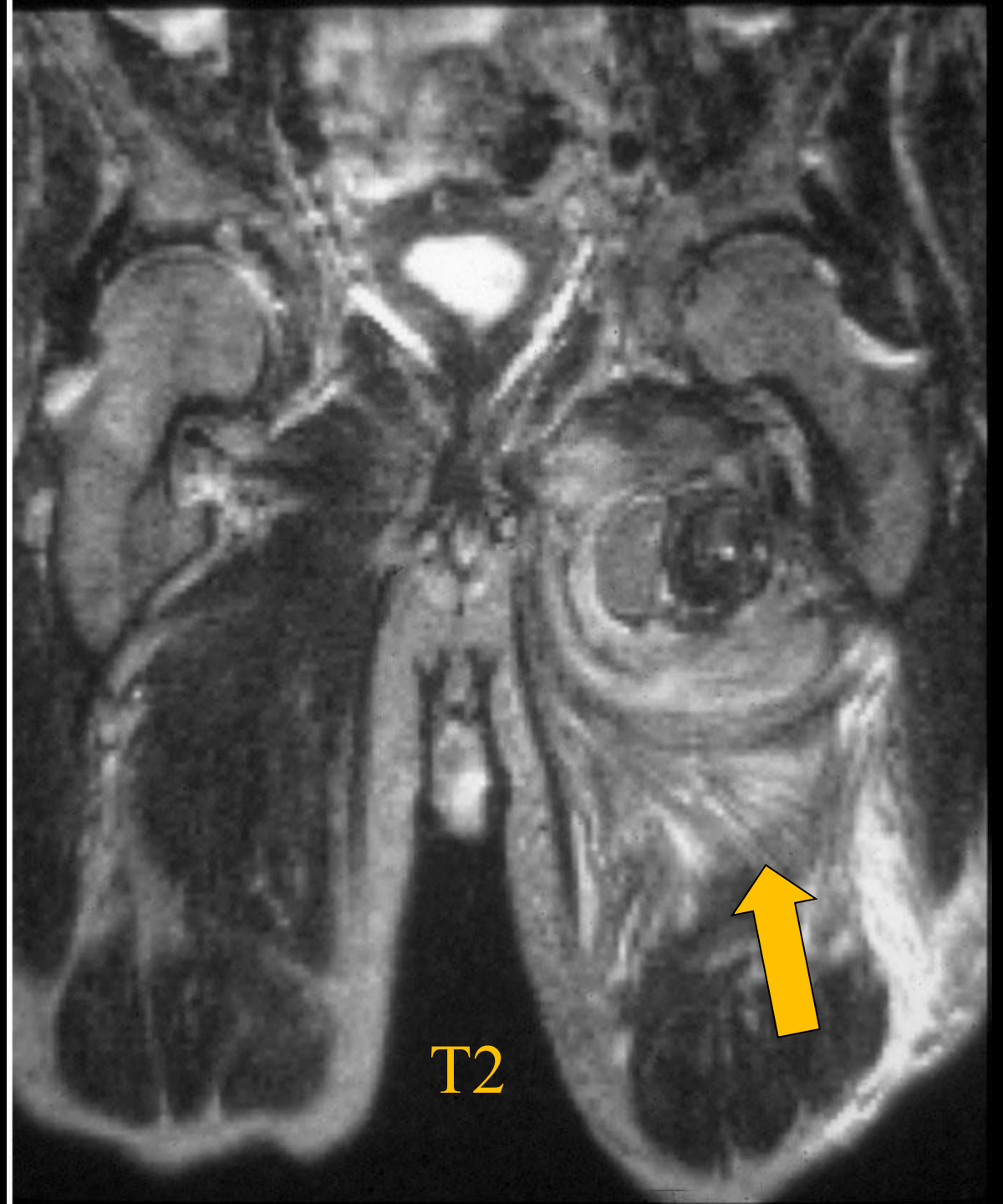
MRI EVALUATION OF SOFT TISSUE TUMORS

3. HOW TO STAY OUT OF TROUBLE!!

LOCATION FOR GENERAL DIFFERENTIAL
DIAGNOSIS; MORPHOLOGY/INTRINSIC
CHARACTERISTICS/SIGNS FOR SPECIFICITY







MRI EVALUATION OF SOFT TISSUE TUMORS

4. HOW TO STAY OUT OF TROUBLE!!

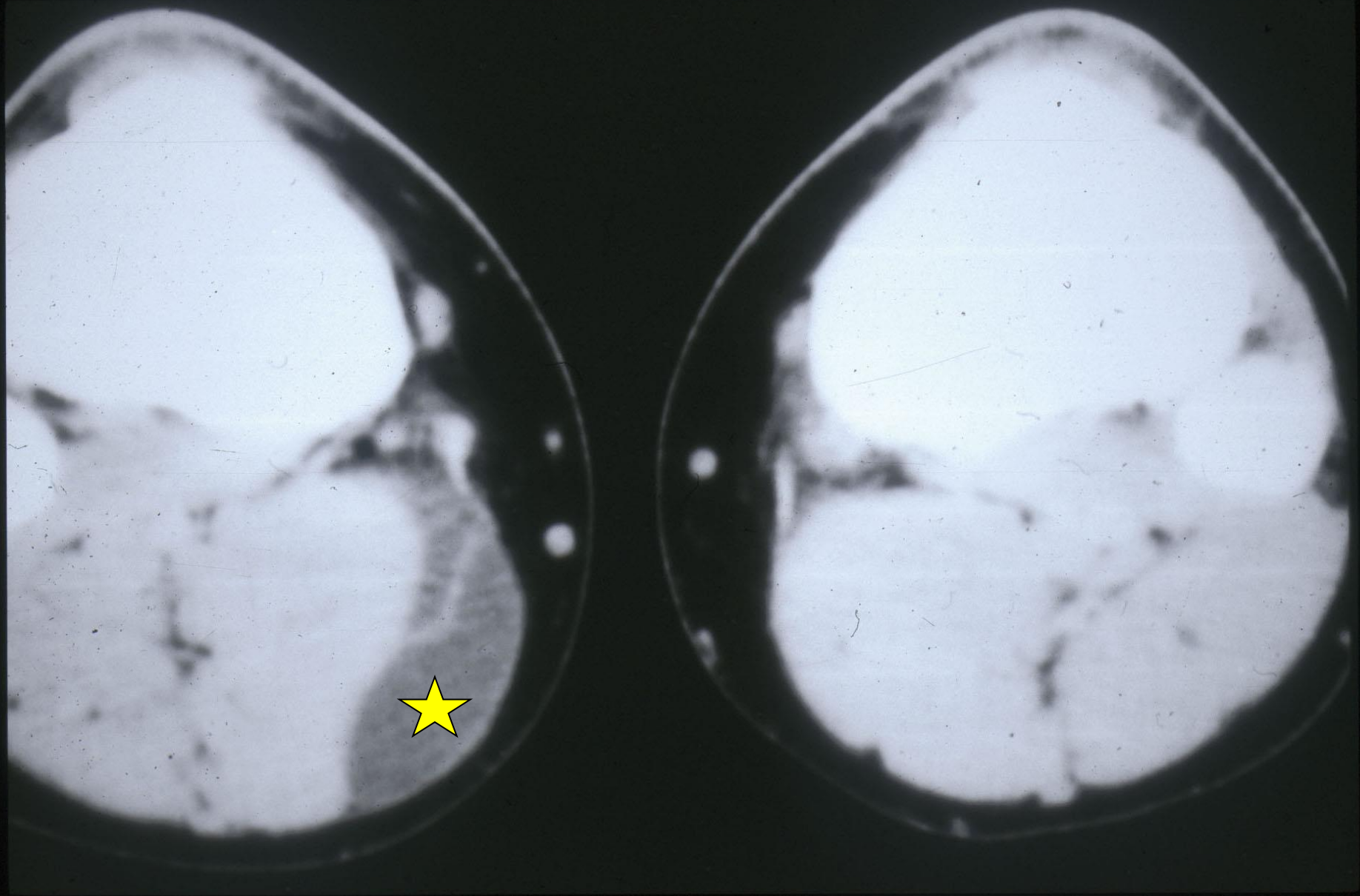
**PROMINENT EDEMA ABOUT A SOFT TISSUE
MASS SUGGESTS TRAUMA/REACTIVE
PROCESSES NOT NEOPLASM**

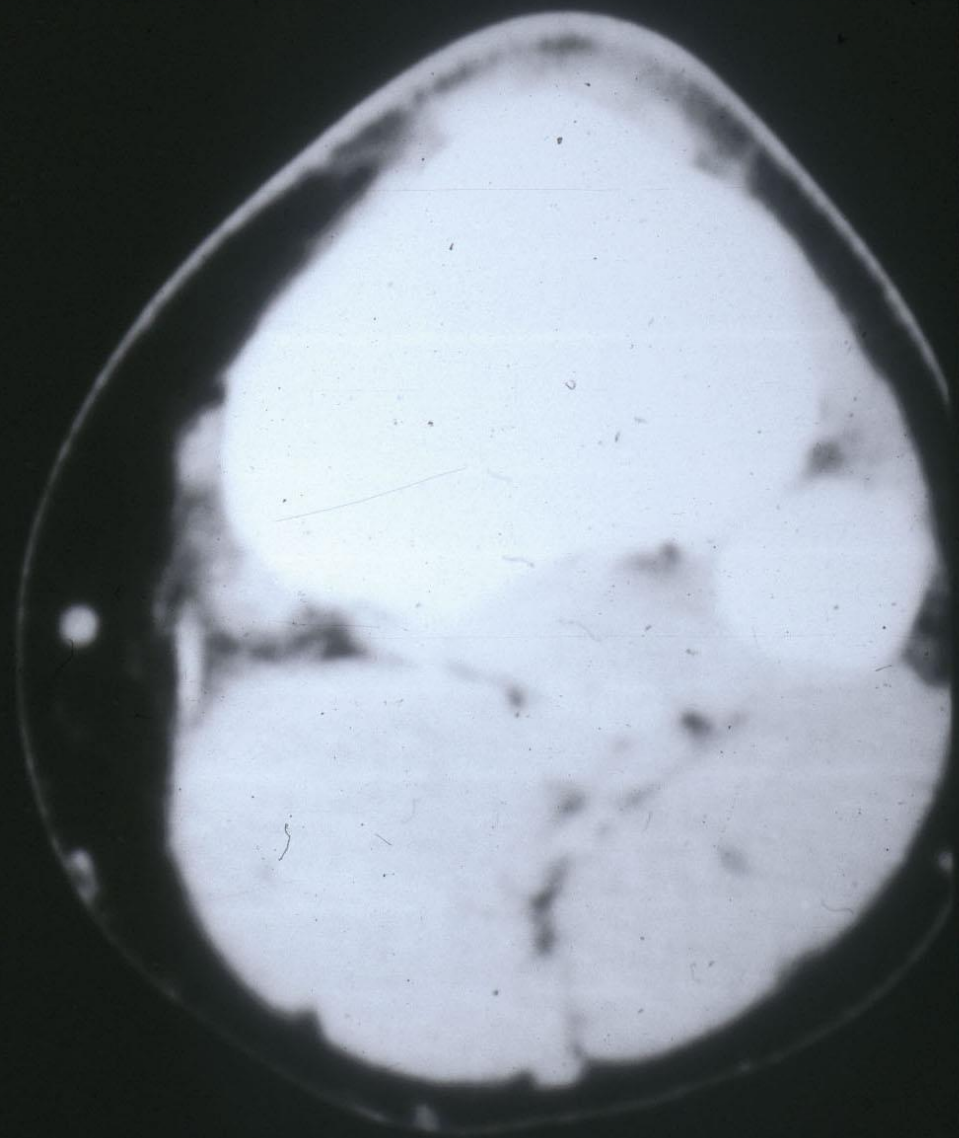
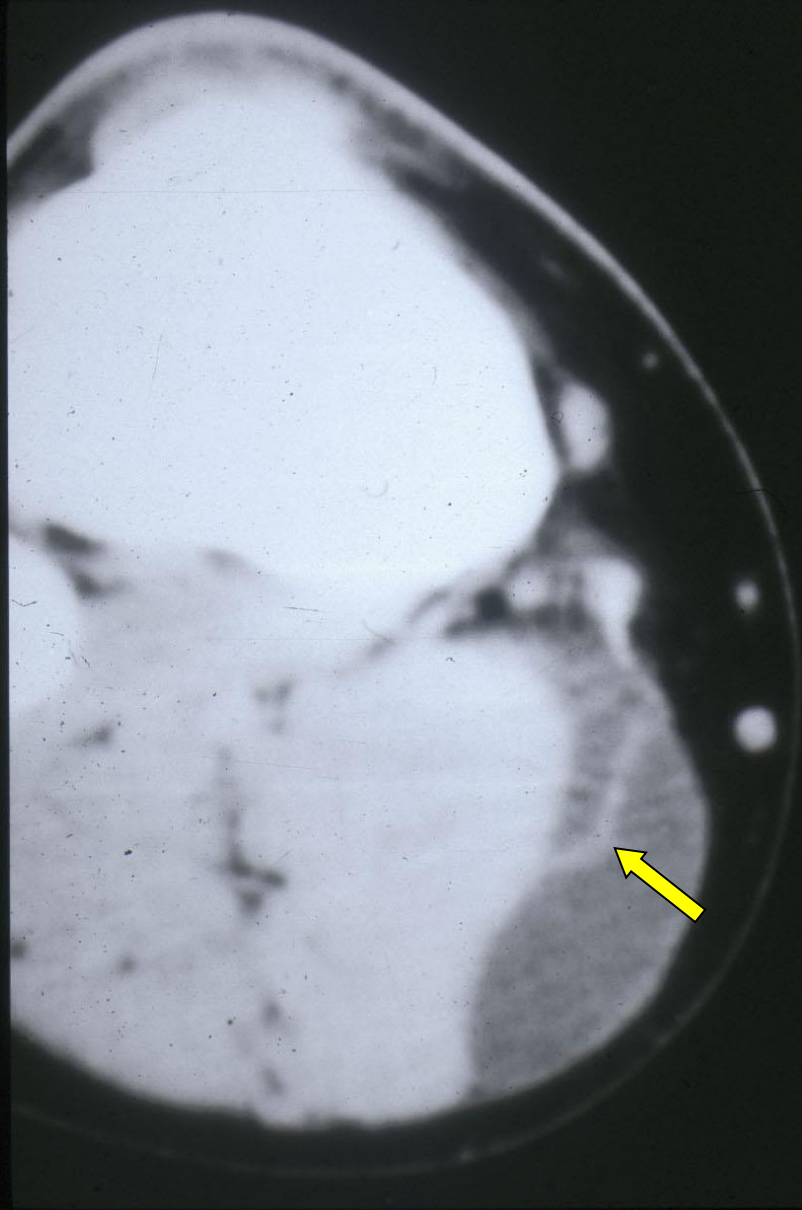
SOFT TISSUE TUMOR: “CYSTIC” LESION

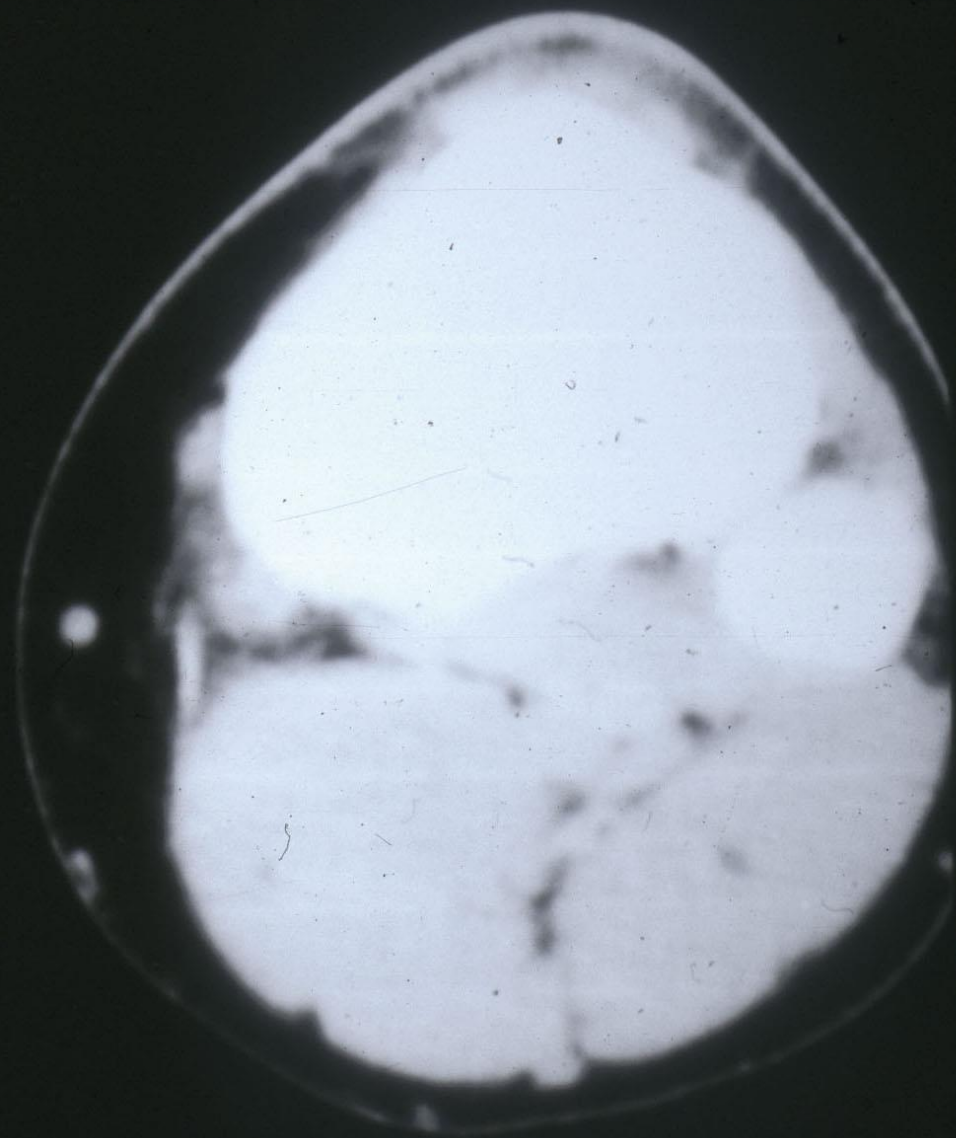
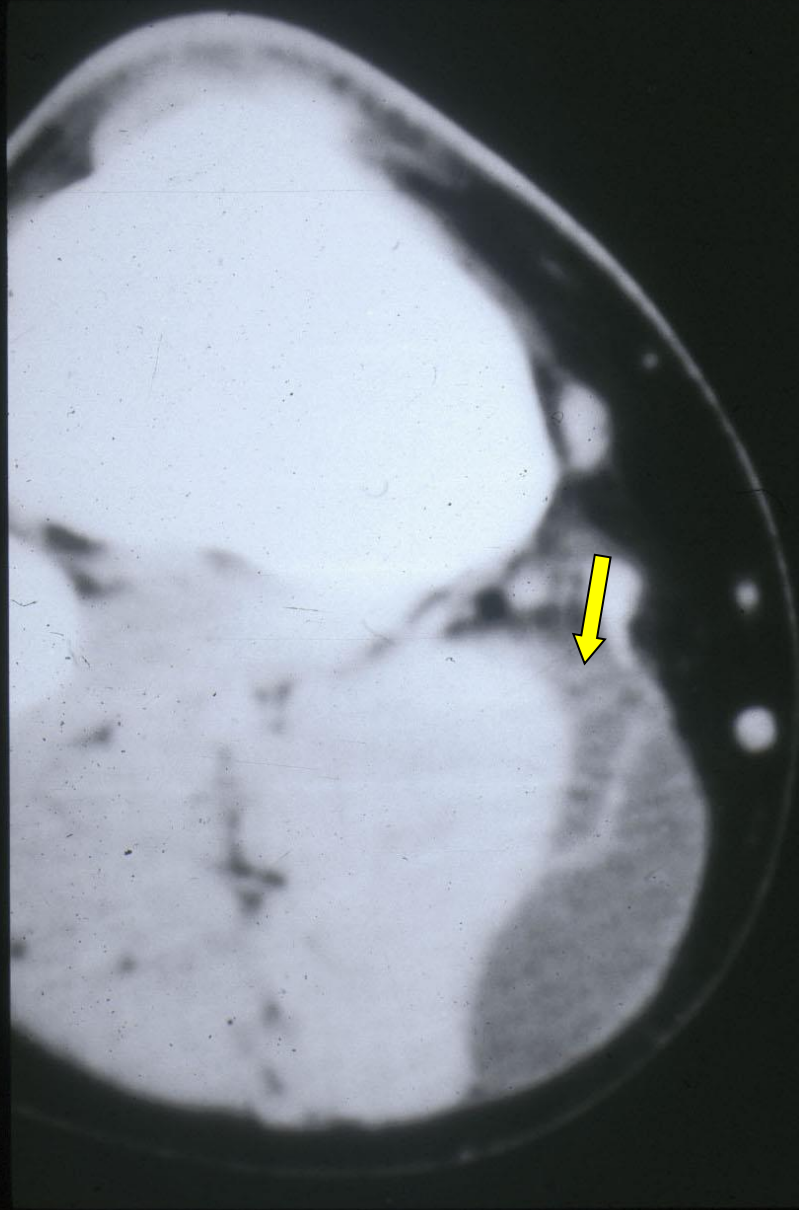
- Ganglion
- Bursa, synovial/perilabral/meniscal cyst
- Abscess
- Hematoma
- Myxoid tumor – myxoma, myxoid liposarcoma (subtle fat >90%), myxofibrosarcoma (myxoid MFH), neurogenic neoplasm, extraskeletal chondrosarcoma

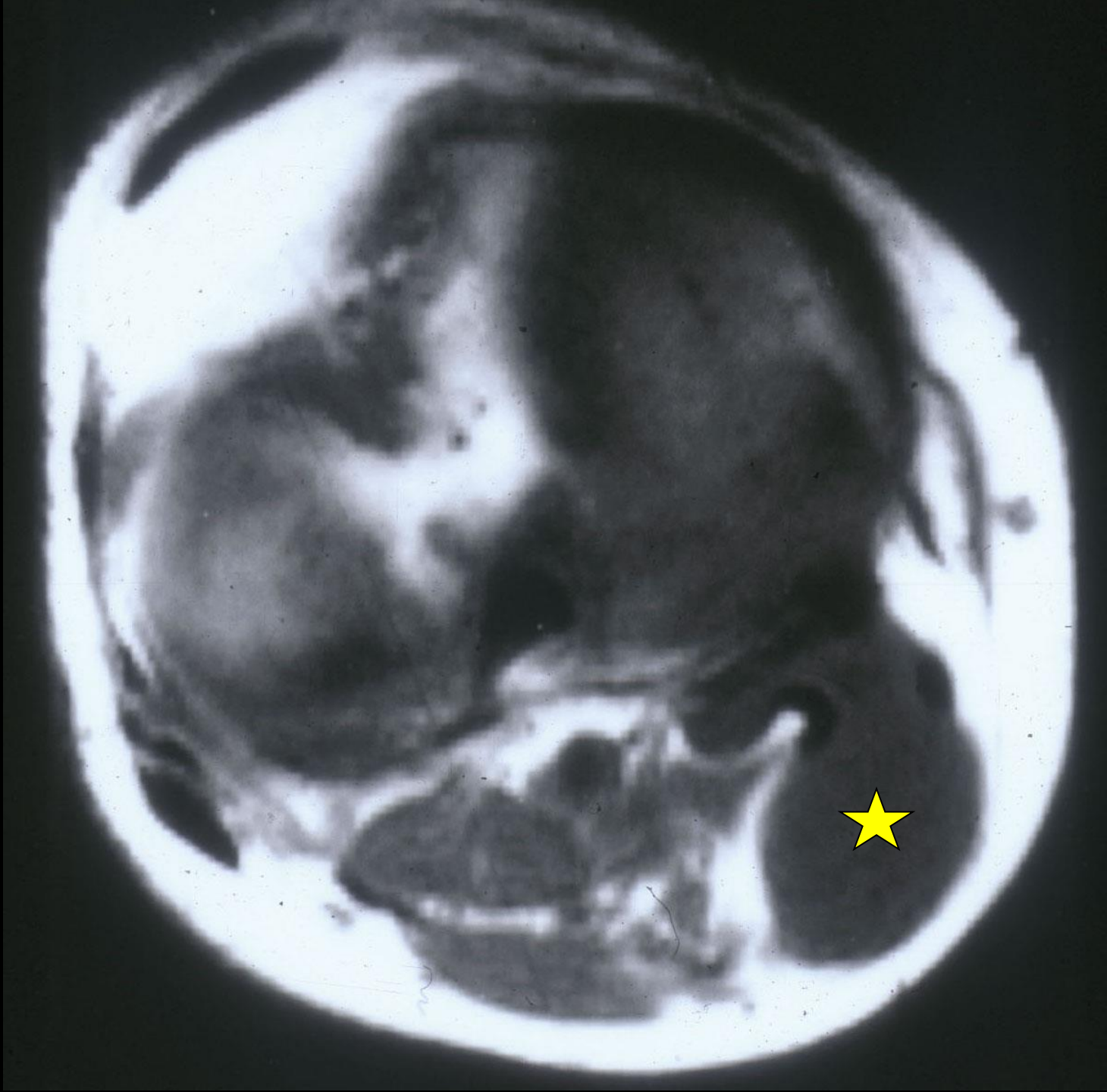
SOFT TISSUE TUMOR: “CYSTIC” LESION

- Gadolinium very helpful – not always easy on T1W/T2W to differentiate true cyst vs. myxoid tumor if lesion not in expected location
 - Thin peripheral/septal enhancement (“cyst”)
 - Nodular often peripheral enhancement (not cyst)
- Sonography also helpful
 - Does it meet criteria for cystic collection

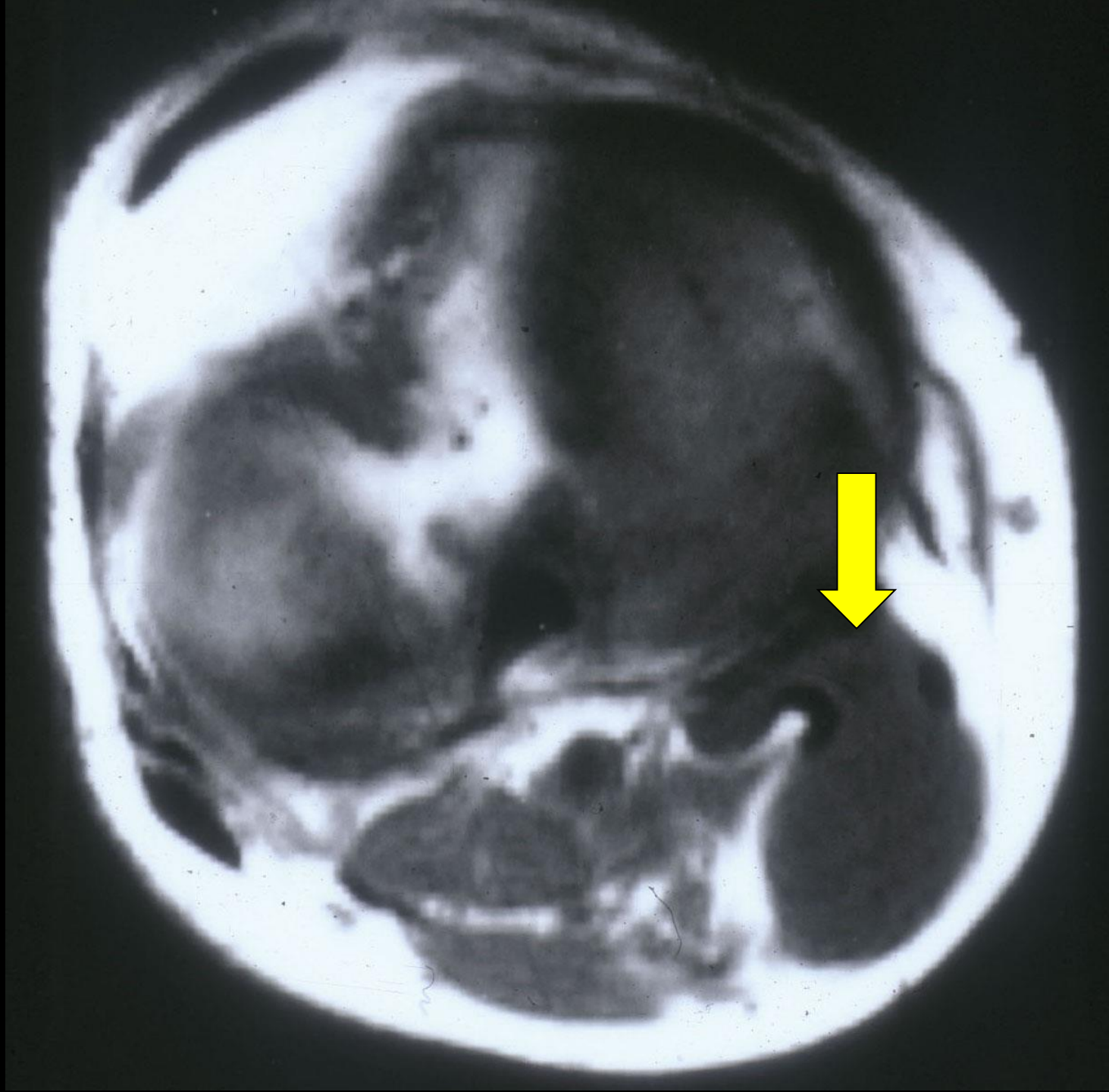




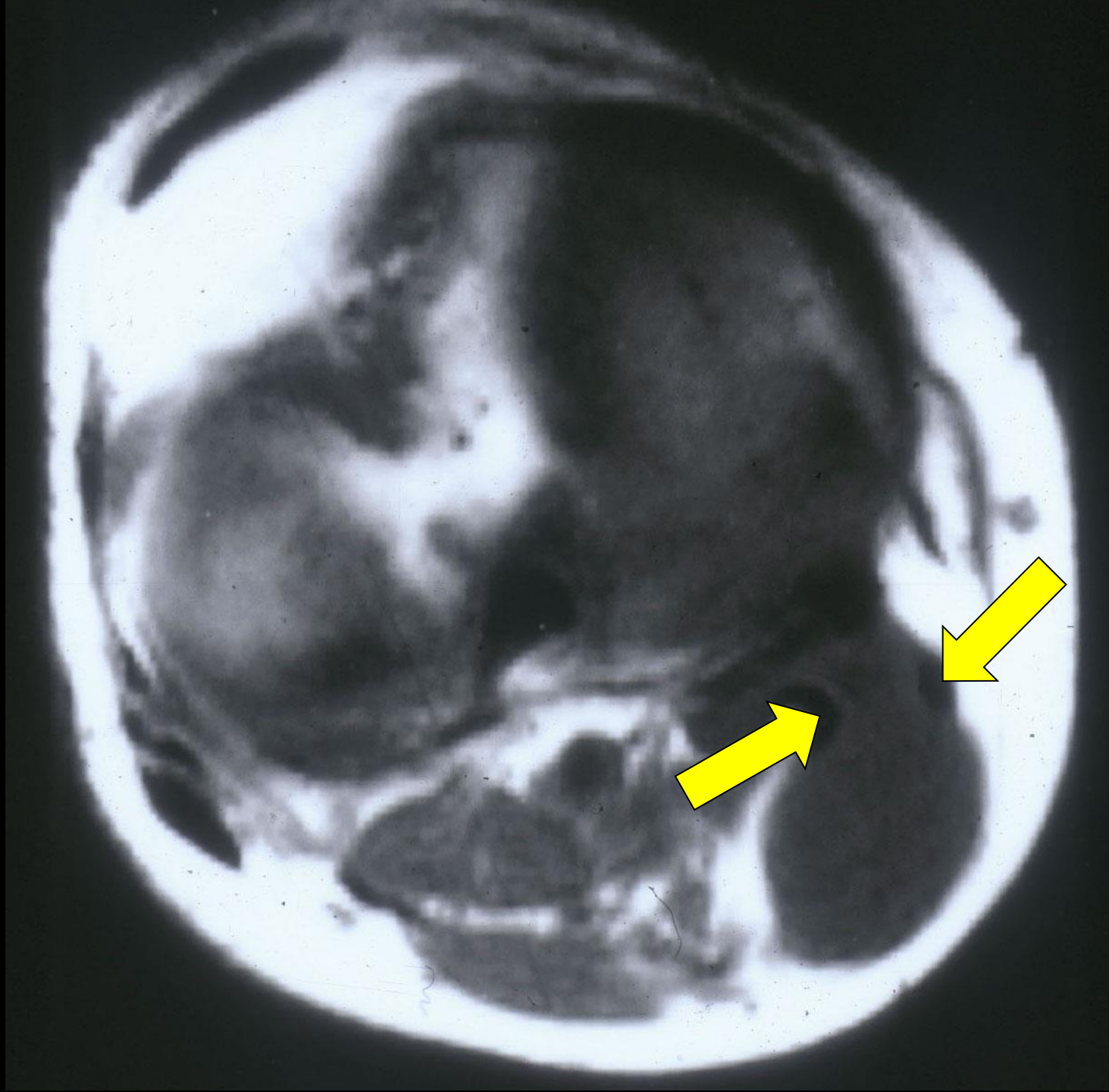




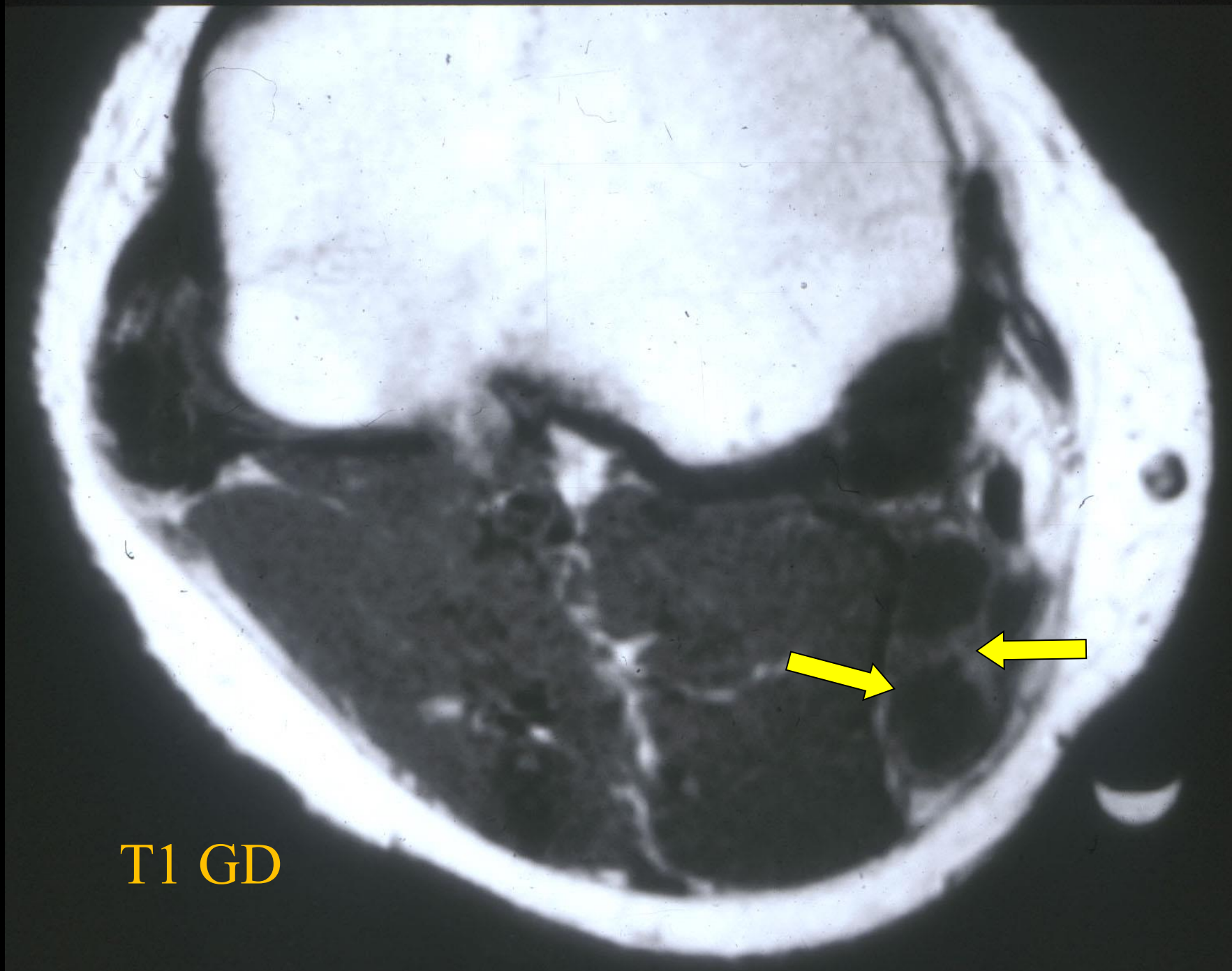
T1



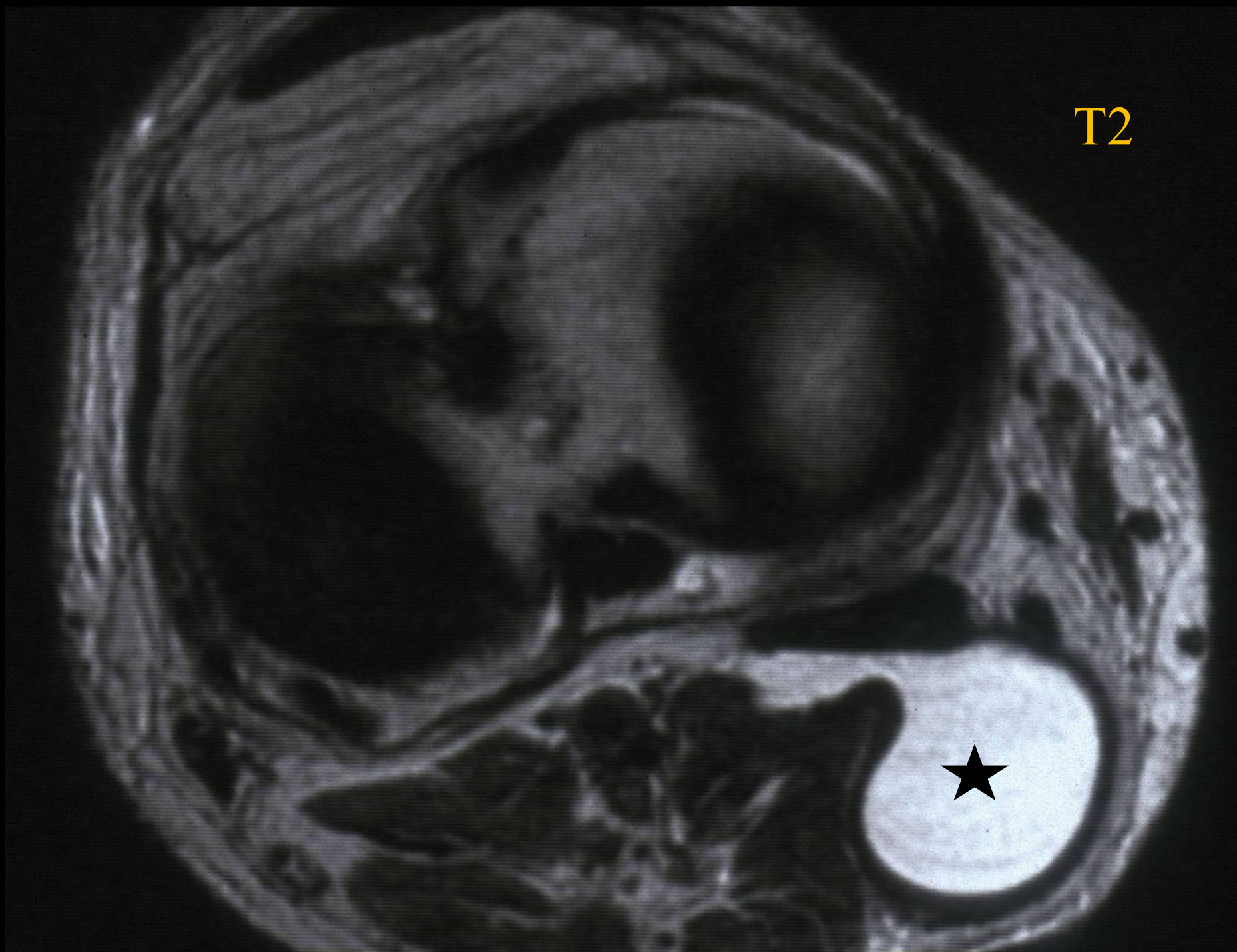
T1



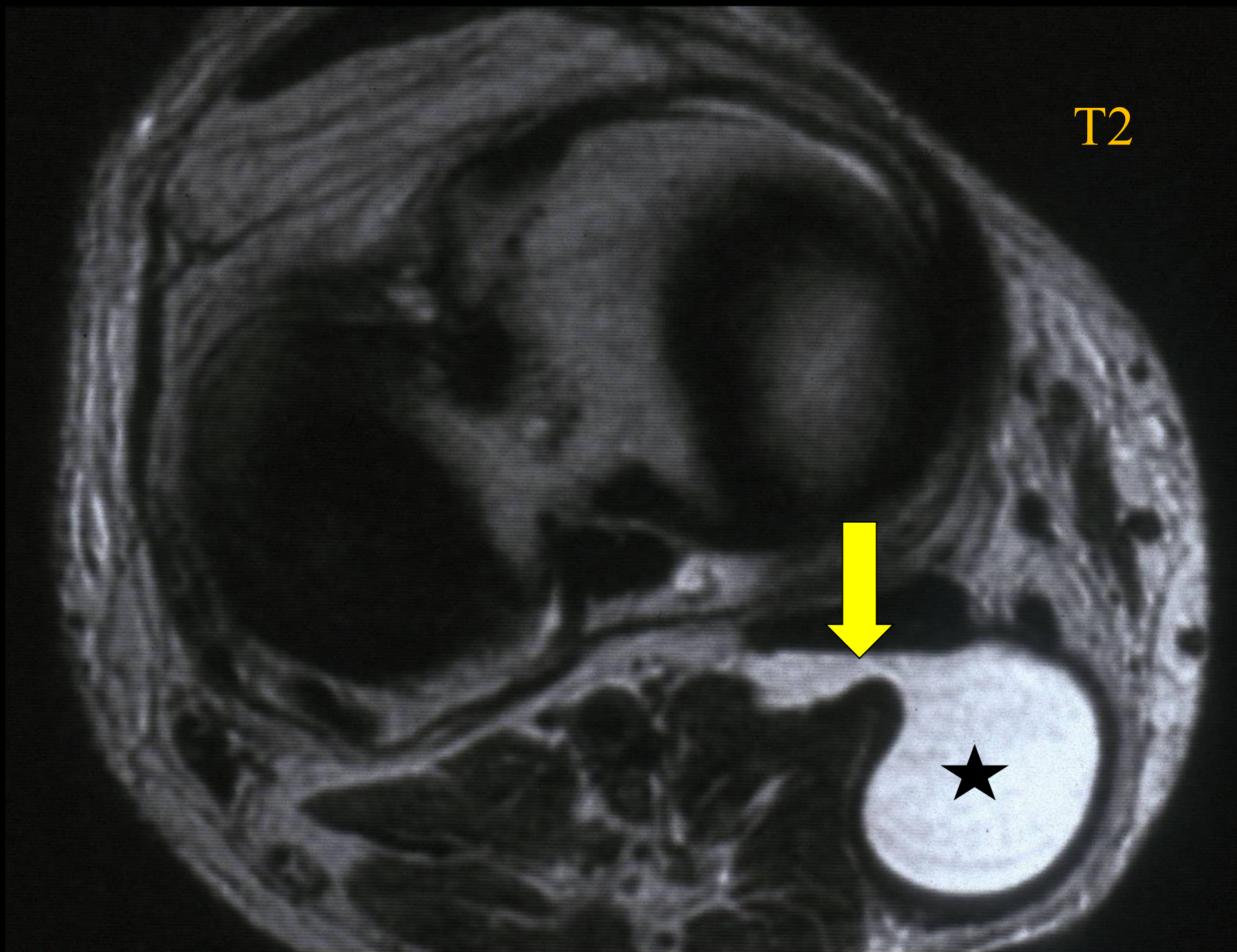
T1



T1 GD

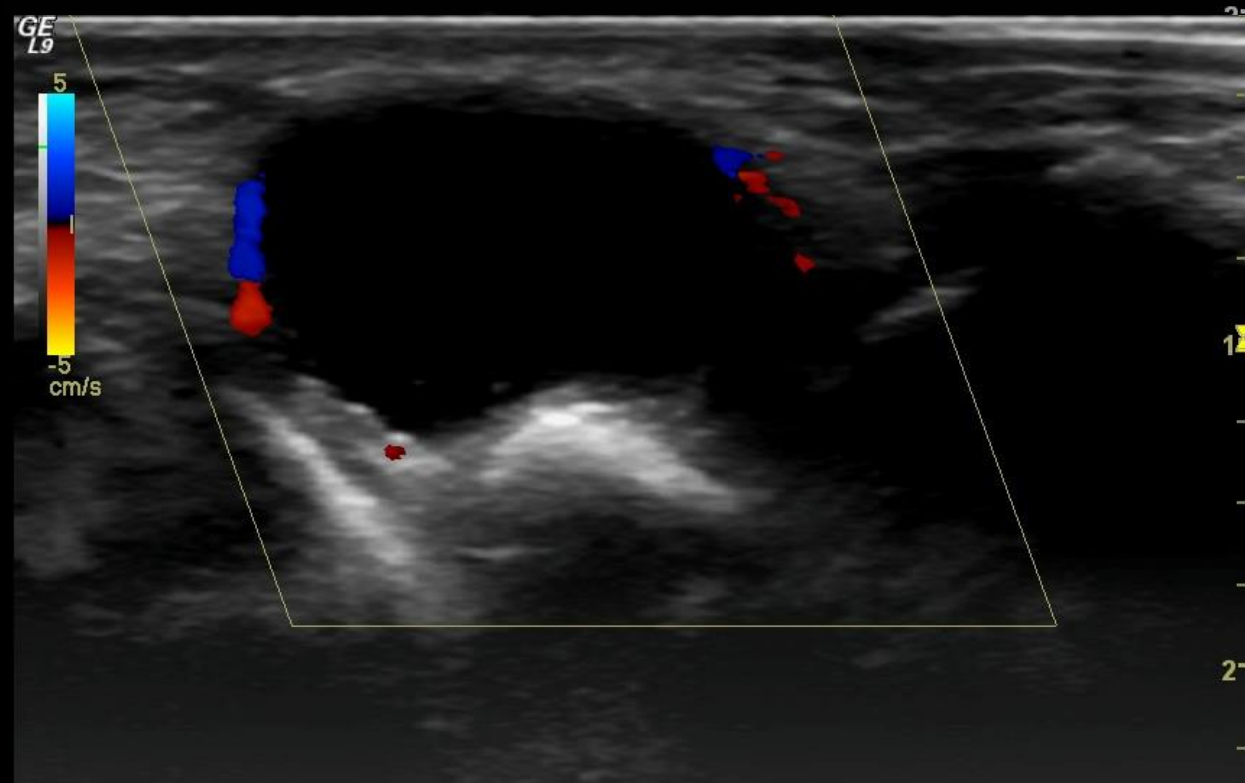
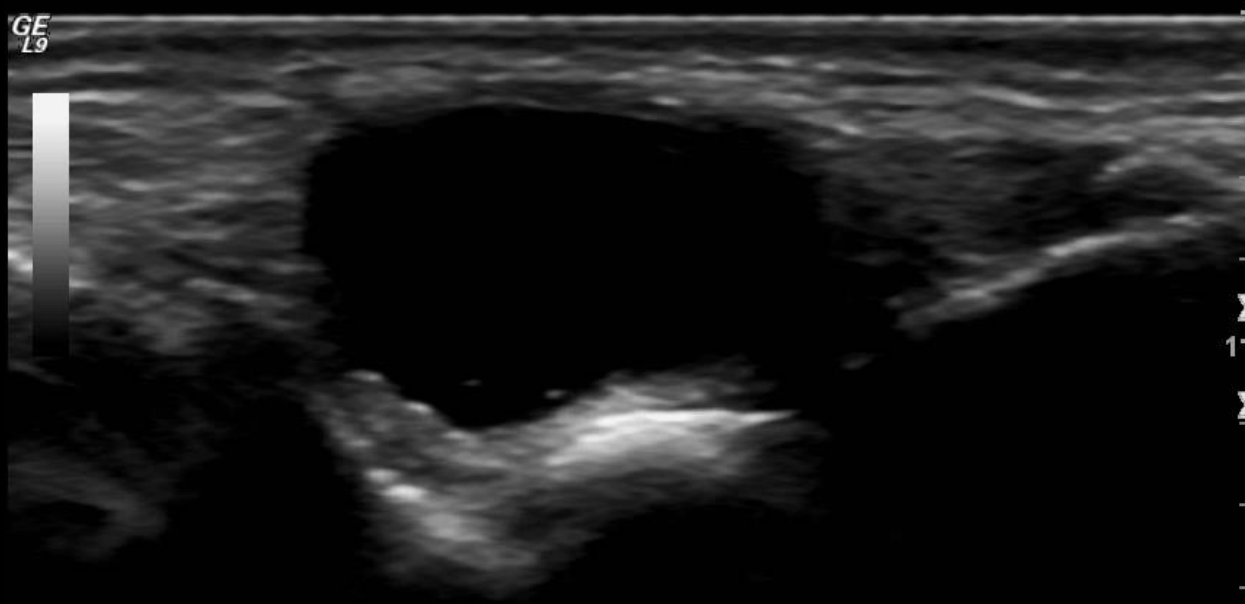


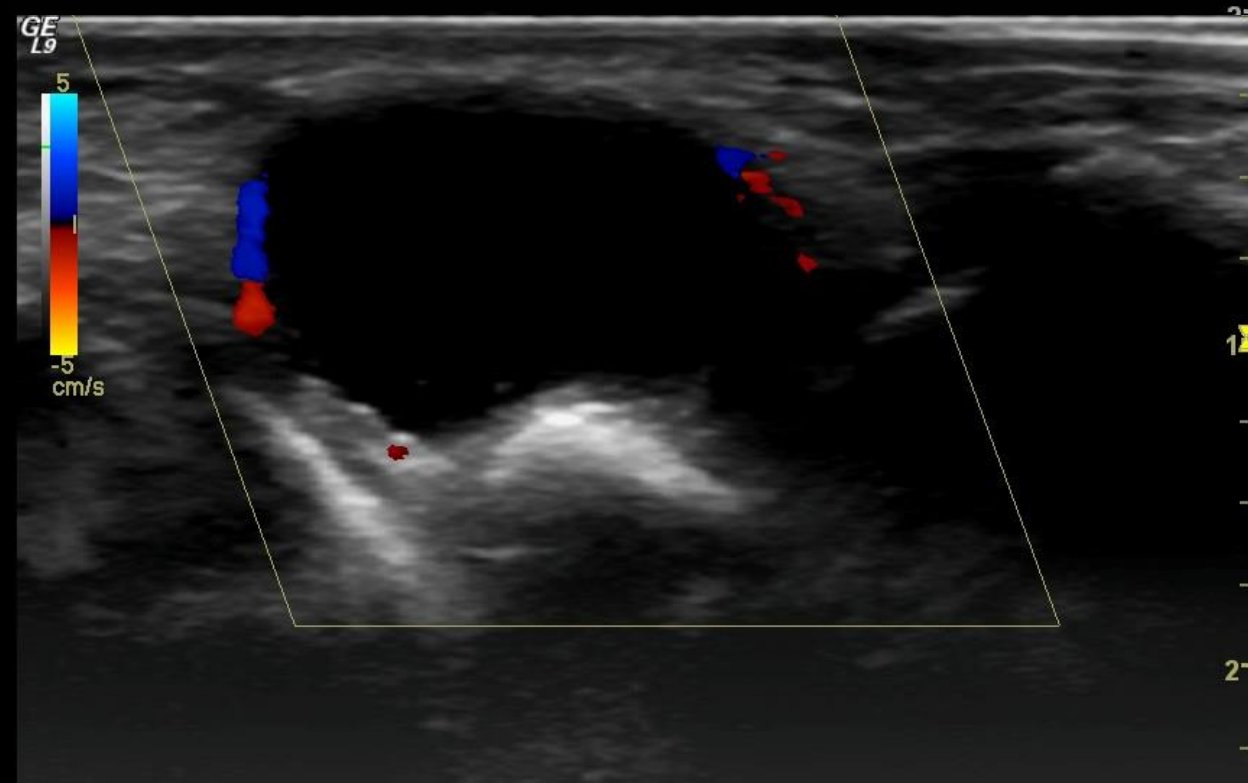
T2

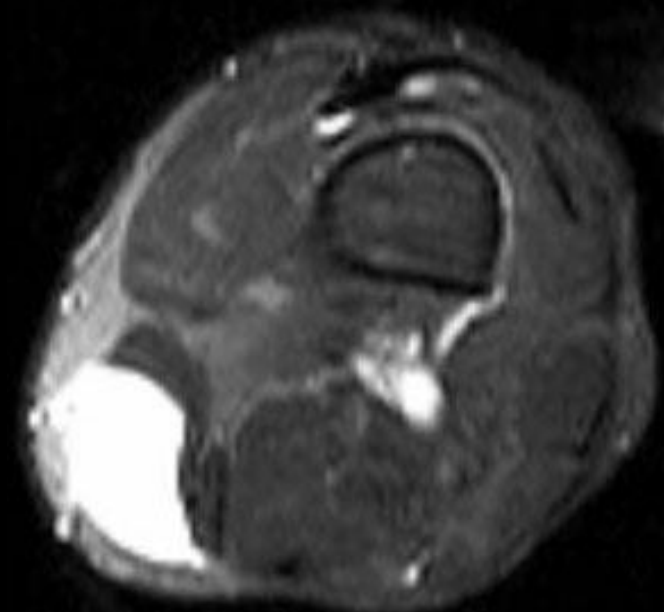
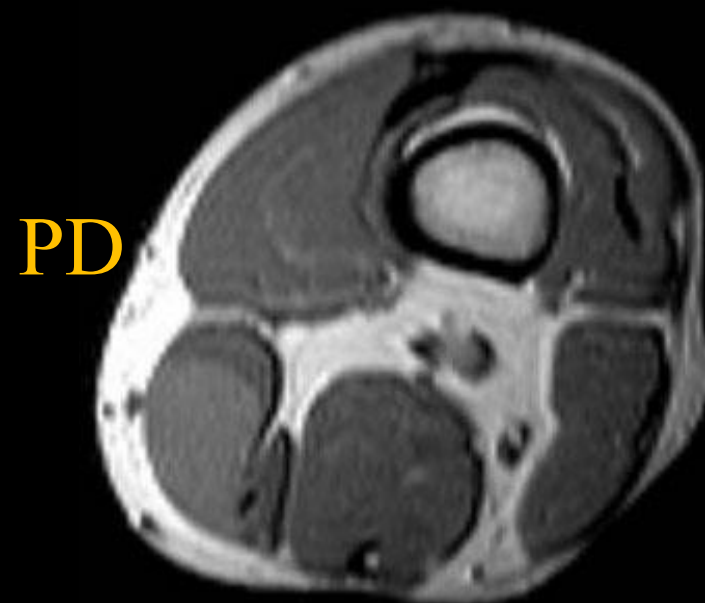
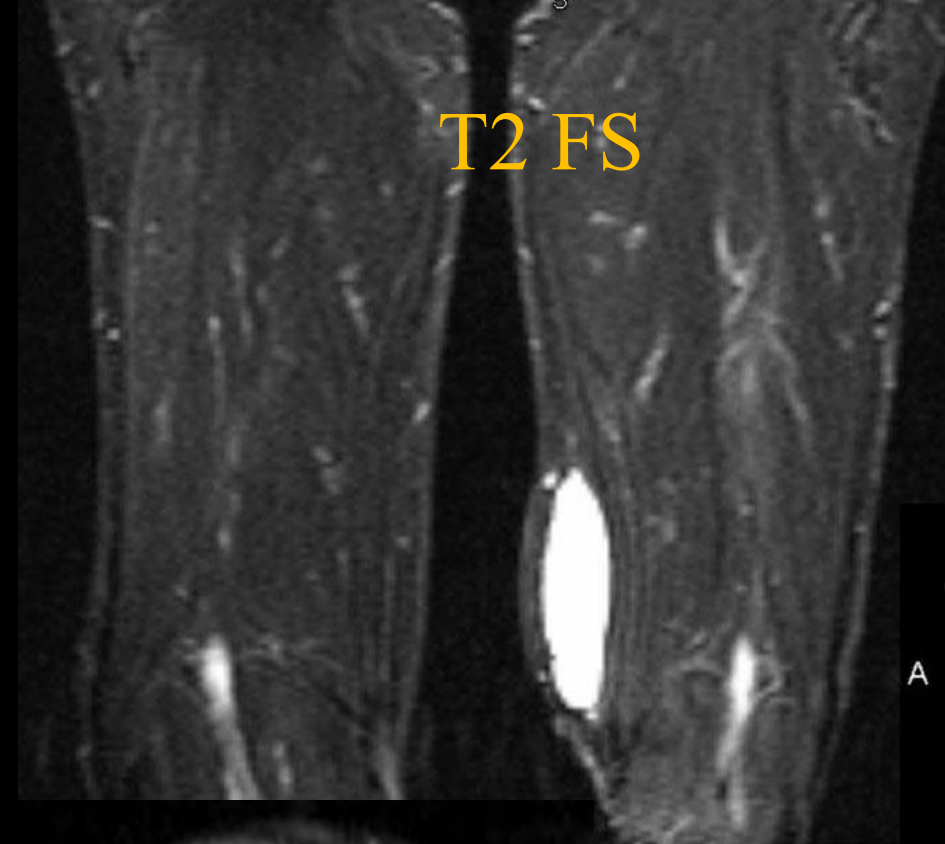


T2

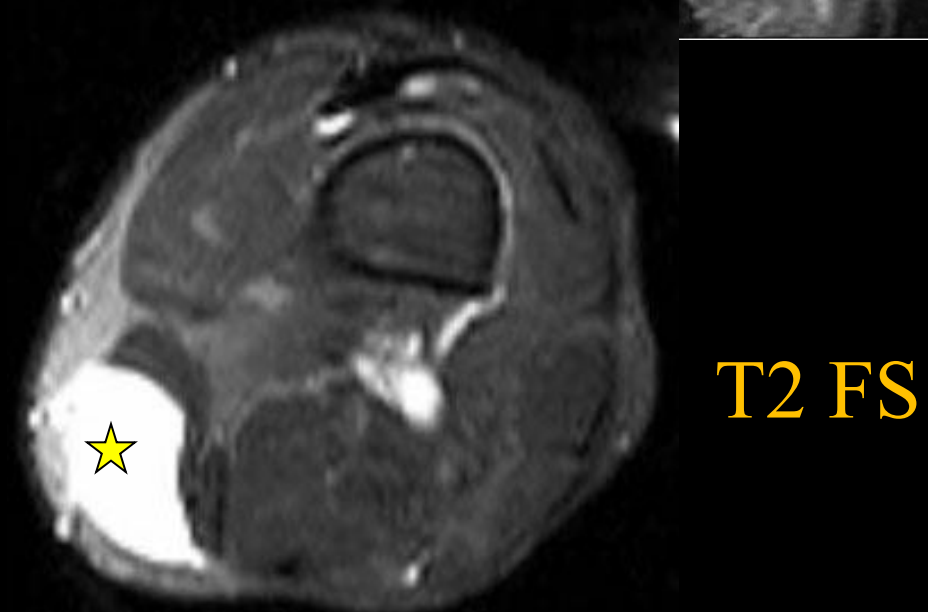
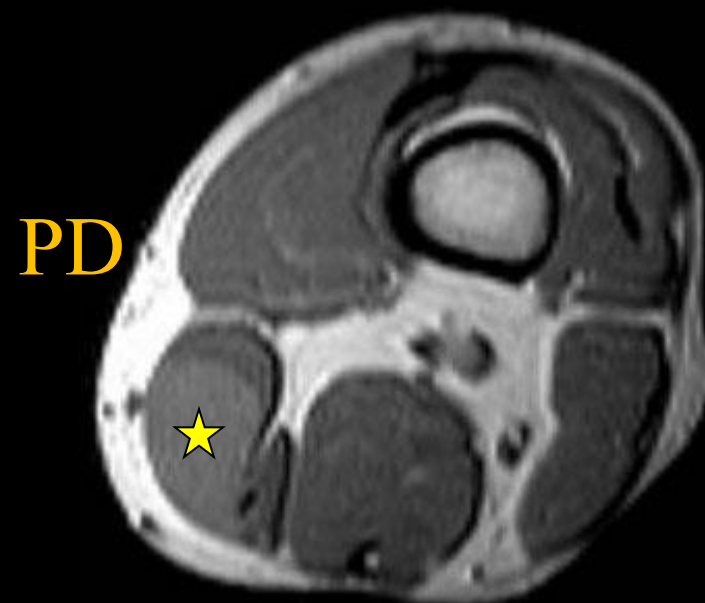
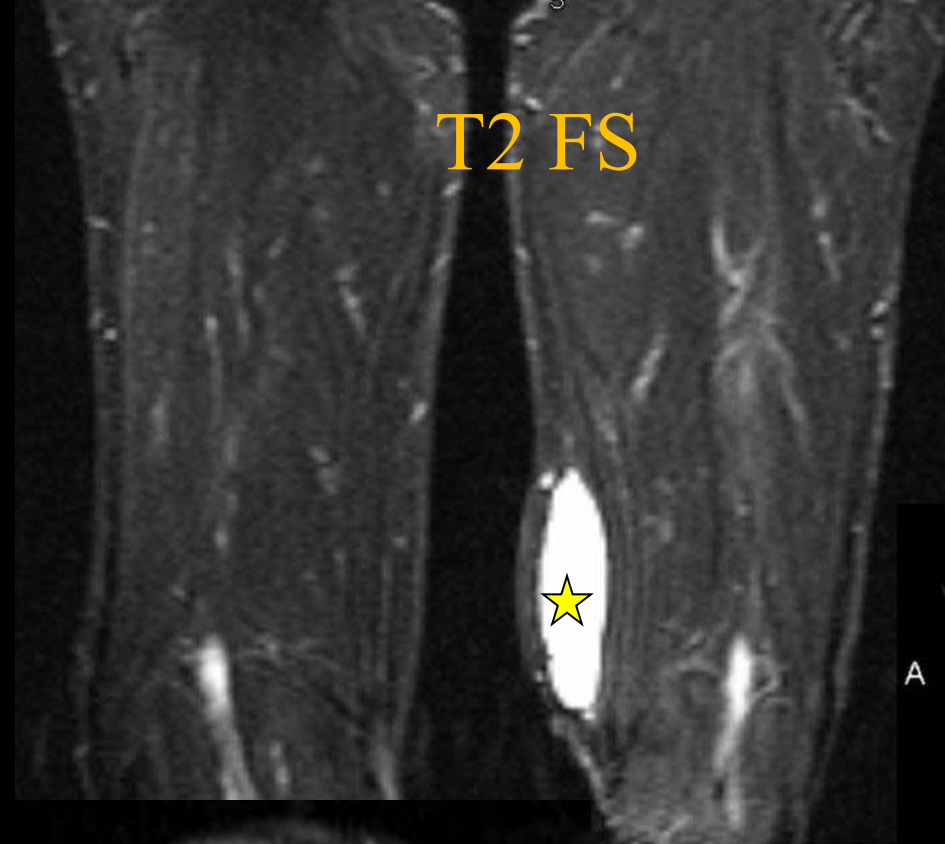
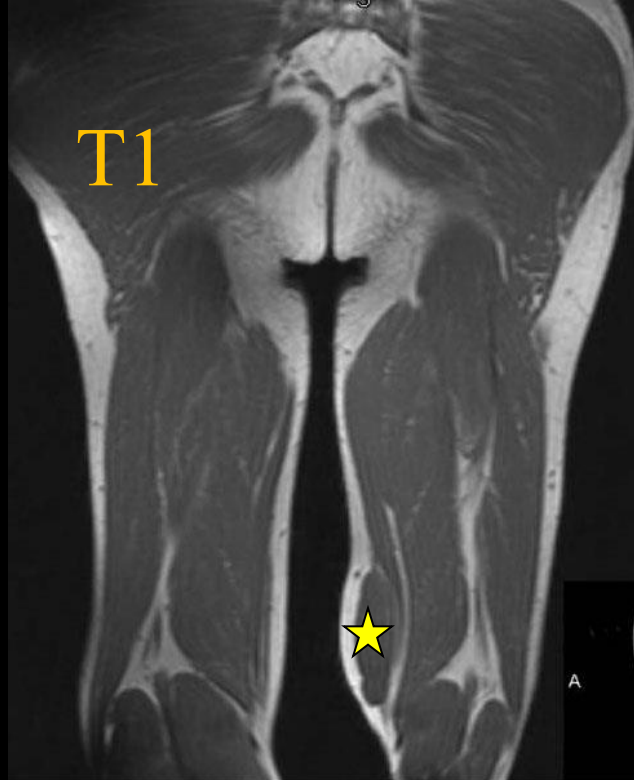








T2 FS



T1 FS PRE GD



T1 FS POST GD

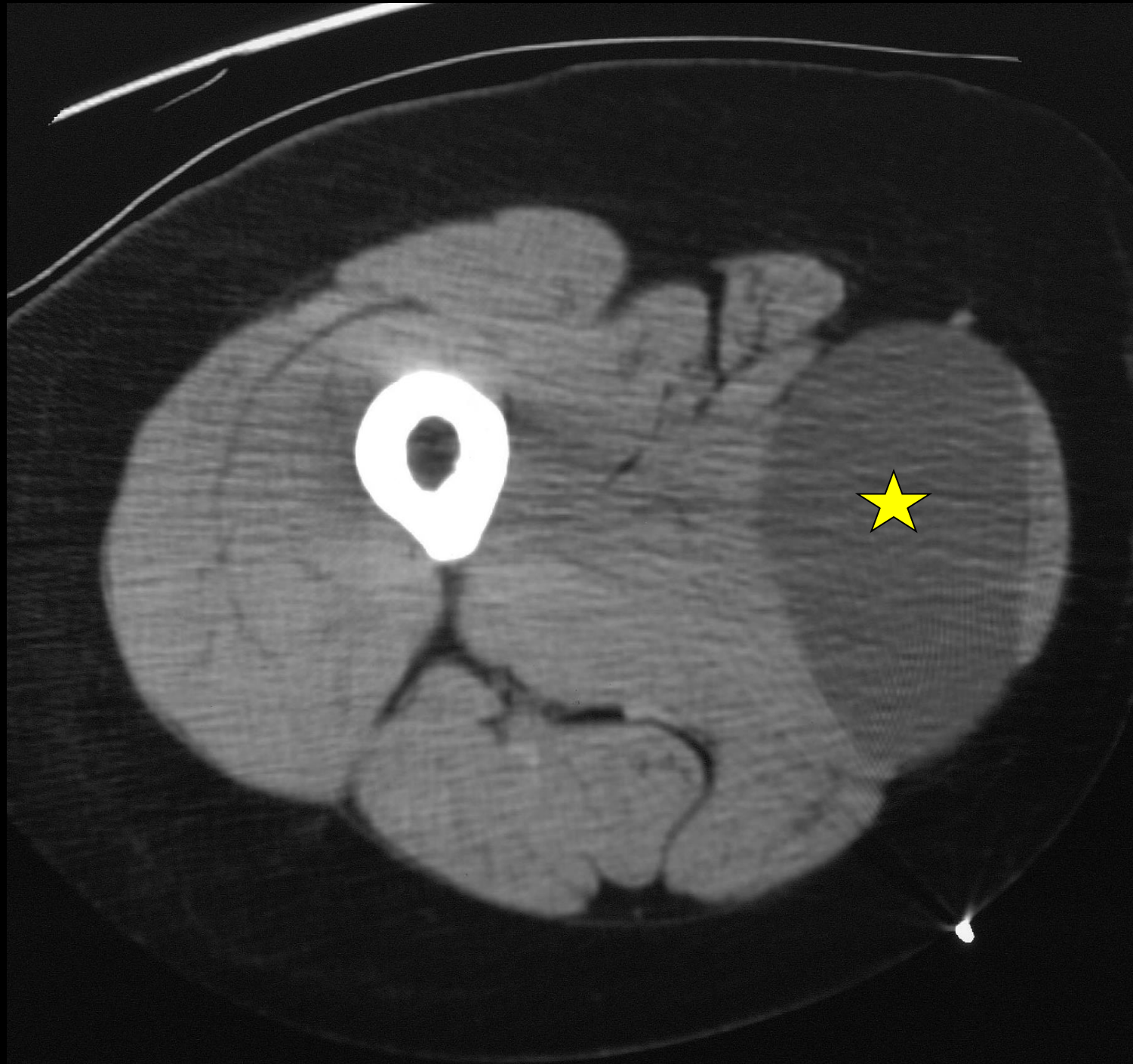


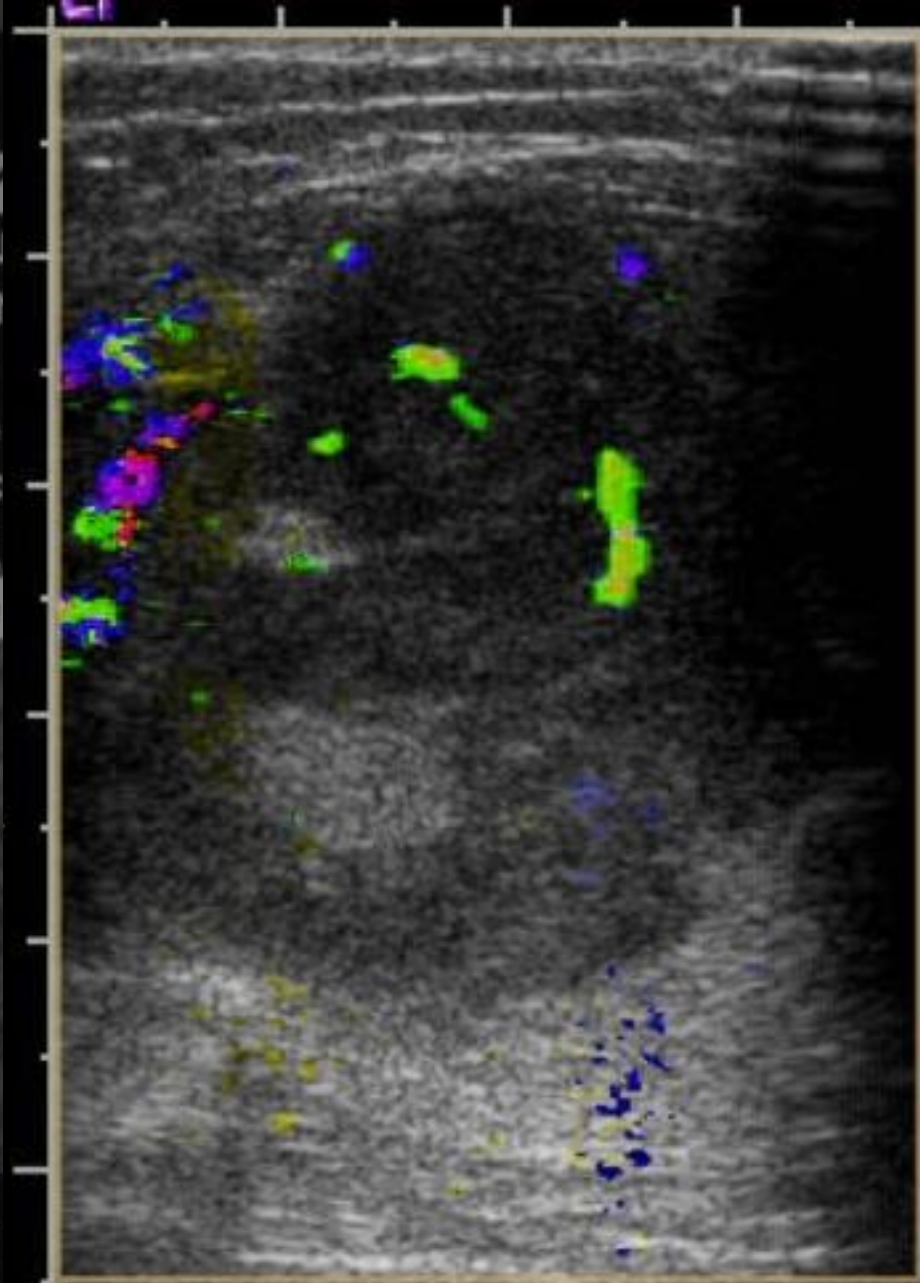
T1 FS PRE GD



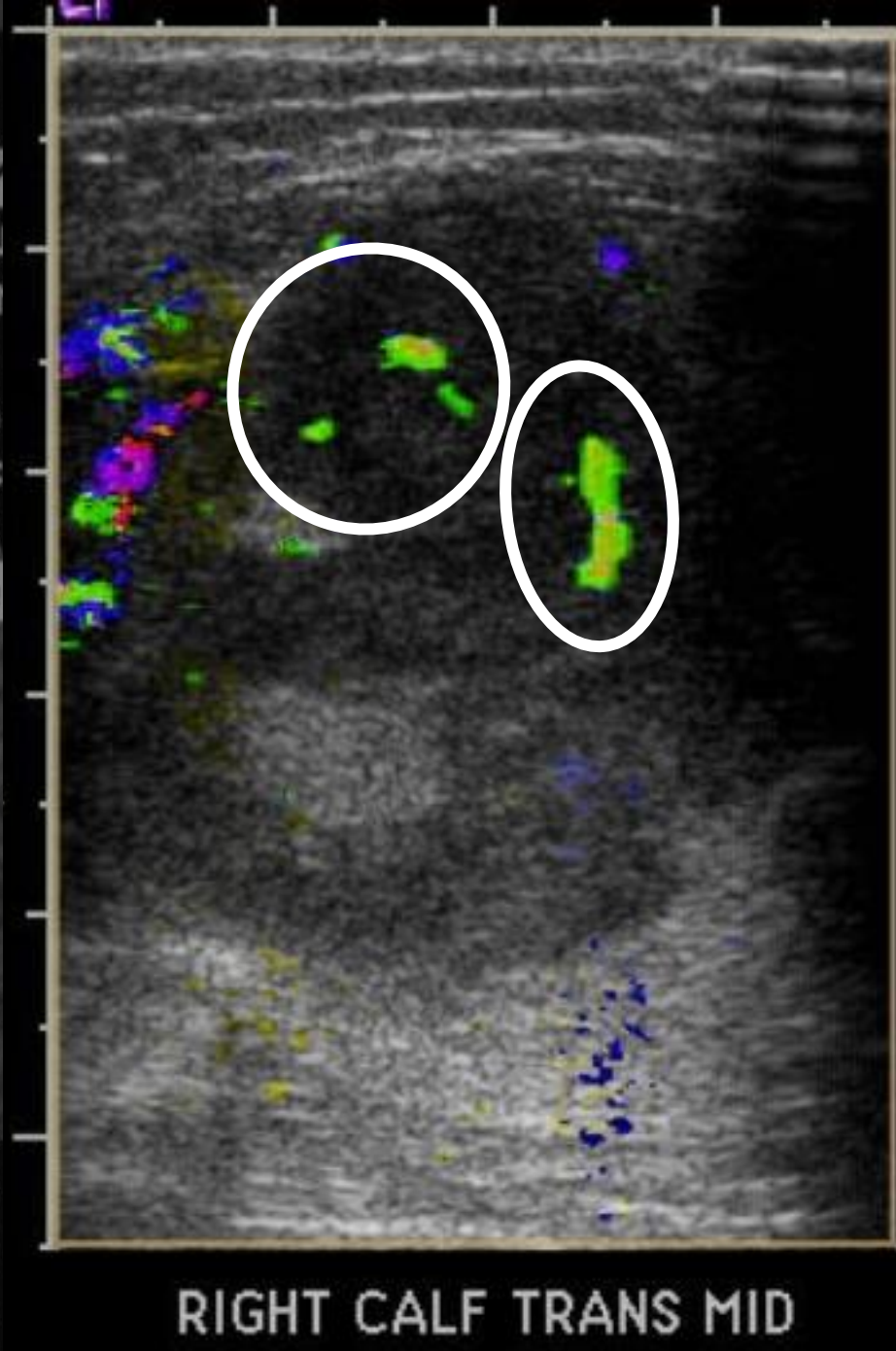
T1 FS POST GD







RIGHT CALF TRANS MID





MRI EVALUATION OF SOFT TISSUE TUMORS

5. HOW TO STAY OUT OF TROUBLE!!

IF IT LOOKS LIKE A “CYST” ON STANDARD
T1/T2 BUT IS NOT QUITE RIGHT FOR ANY
REASON YOU MUST PROVE IT’S NOT A
CYST MIMICKER!!!!!!!!!!!!!!

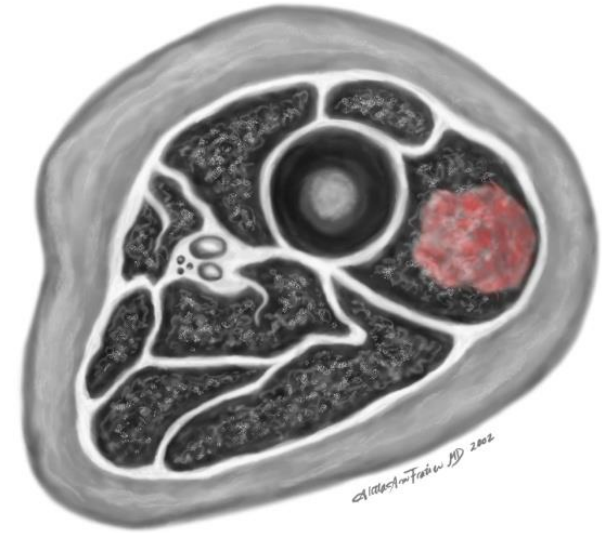
SOFT TISSUE TUMOR: SIZE AND MARGIN

- Important factors for staging – MRI > CT (contrast/multiplanar)
 - Lesion size/extent (>5cm) **GIVE ANATOMIC LANDMARK !!!**
 - Cross major fascial plane (multicompartment)
 - Bone/neurovascular/joint involvement
- Regional metastases – osseous/lymph node
- Can be helpful to direct biopsy
 - **Always perform in consultation with orthopod**
 - Done in institution of definitive procedure

Stage I. Histologically low grade (G_1); well differentiated; few mitoses; moderate nuclear atypia. Tends to recur locally. Radioisotope uptake moderate

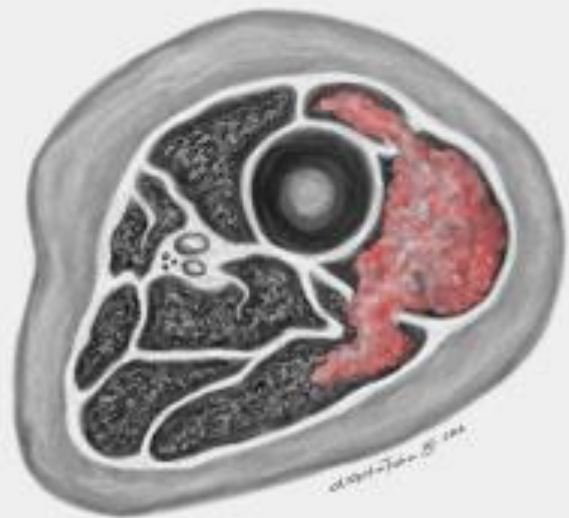
IA

Intraosseous or
intracompartmental



IB

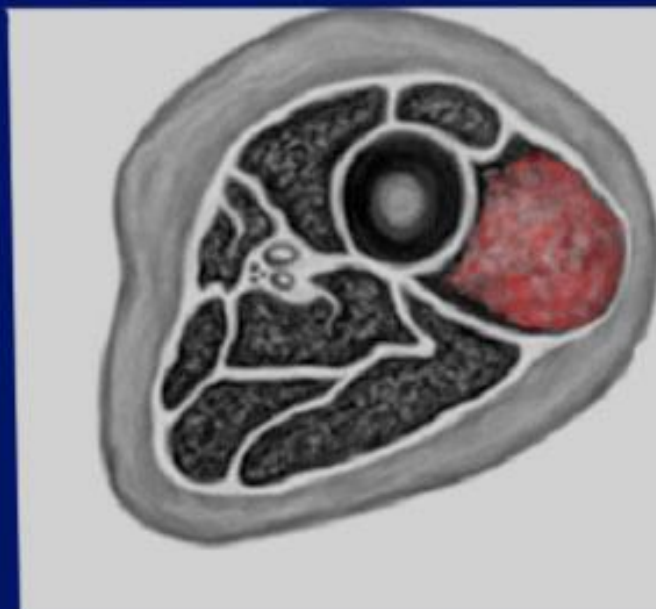
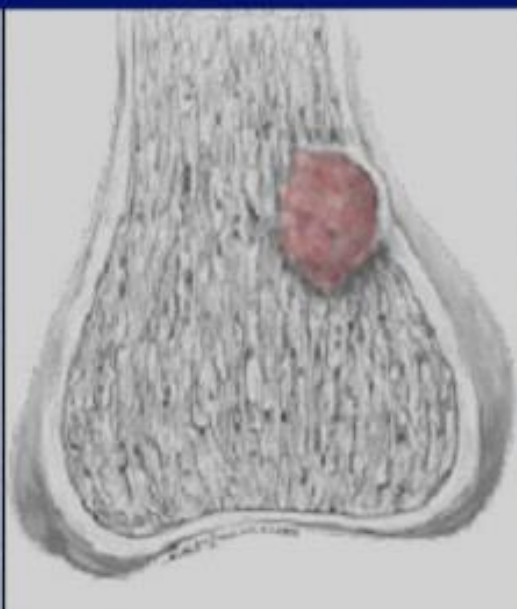
Extraosseous or
extracompartmental:
penetrates cortex or
compartment boundaries



Stage II. Histologically high grade (G_2); poorly differentiated; high cell-to-matrix ratio; many mitoses; much nuclear atypia, necrosis, neovascularity; permeative. Radioisotope uptake intense. Higher incidence of metastases

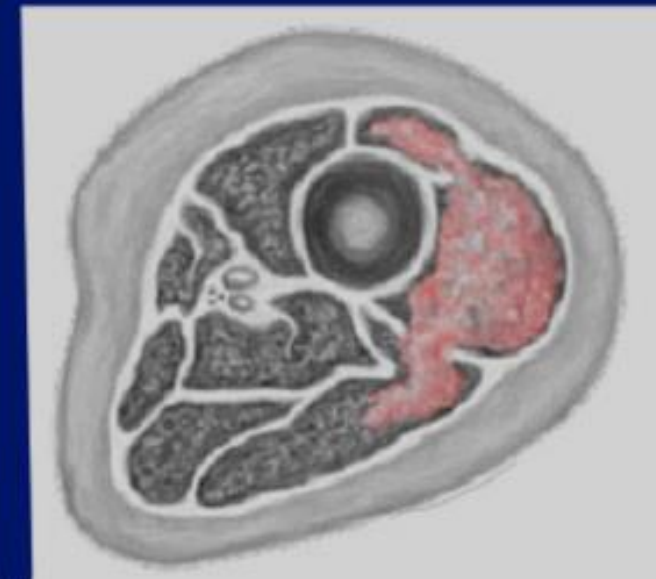
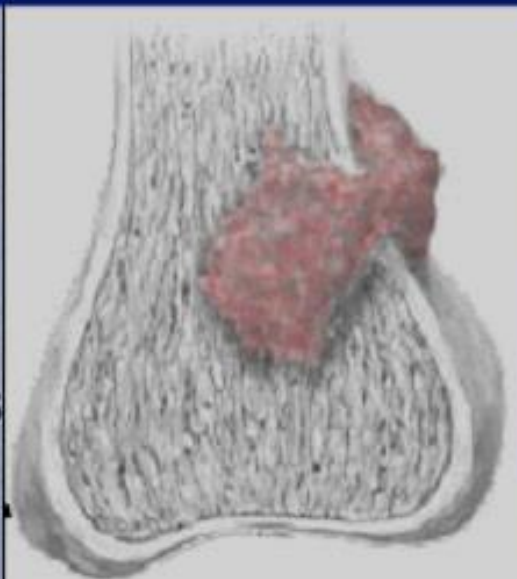
IIA

Intraosseous or
intracompartmental



IIB

Extraosseous or
extracompartmental:
penetrates cortex or
compartment boundaries



AMERICAN JOINT COMMISSION STAGING PROTOCOL FOR SARCOMA OF SOFT TISSUE* (2017)

- **Histologic grade (G)**
 - G1 total FNLCC differentiation score of 2/3
 - G2 total FNLCC differentiation score of 4/5
 - G3 total FNLCC differentiation score of 6-8
- **Primary Tumor (T)**
 - T1 tumor 5cm or less in greatest dimension
 - T2 tumor more than 5cm but less than 10cm in greatest dimension
 - T3 tumor more than 10cm but less than 15cm in greatest dimension
 - T4 tumor more than 15cm in greatest dimension
- **Regional lymph nodes (N)**
 - N0 no regional lymph node metastasis; N1 regional lymph node metastasis
- **Distant metastasis (M)**
 - M0 no distant metastasis; M1 distant metastasis

AMERICAN JOINT COMMISSION STAGING PROTOCOL FOR SARCOMA OF SOFT TISSUE* (2017)

Stage	G	T	N	M
1A	1/X	1	0	0
1B	1/X	2/3/4	0	0
II	2/3	1	0	0
IIIA	2/3	2	0	0
IIIB	2/3	3/4	0	0
IV (ext)	Any G	Any T	1	0
IV (ext/retro)	Any G	Any T	Any N	1

FNCLCC

Tumor differentiation

- | | |
|----------|--|
| Score 1: | Sarcomas closely resembling normal adult mesenchymal tissue (eg, well-differentiated liposarcoma) |
| Score 2: | Sarcomas for which histologic typing is certain (eg, myxoid liposarcoma) |
| Score 3: | Embryonal and undifferentiated sarcomas, sarcomas of doubtful type, synovial sarcomas, osteosarcomas, PNET |

Mitotic count

- | | |
|----------|--------------------------|
| Score 1: | 0–9 mitoses per 10 HPF+ |
| Score 2: | 10–19 mitoses per 10 HPF |
| Score 3: | ≥20 mitoses per 10 HPF |

Tumor necrosis

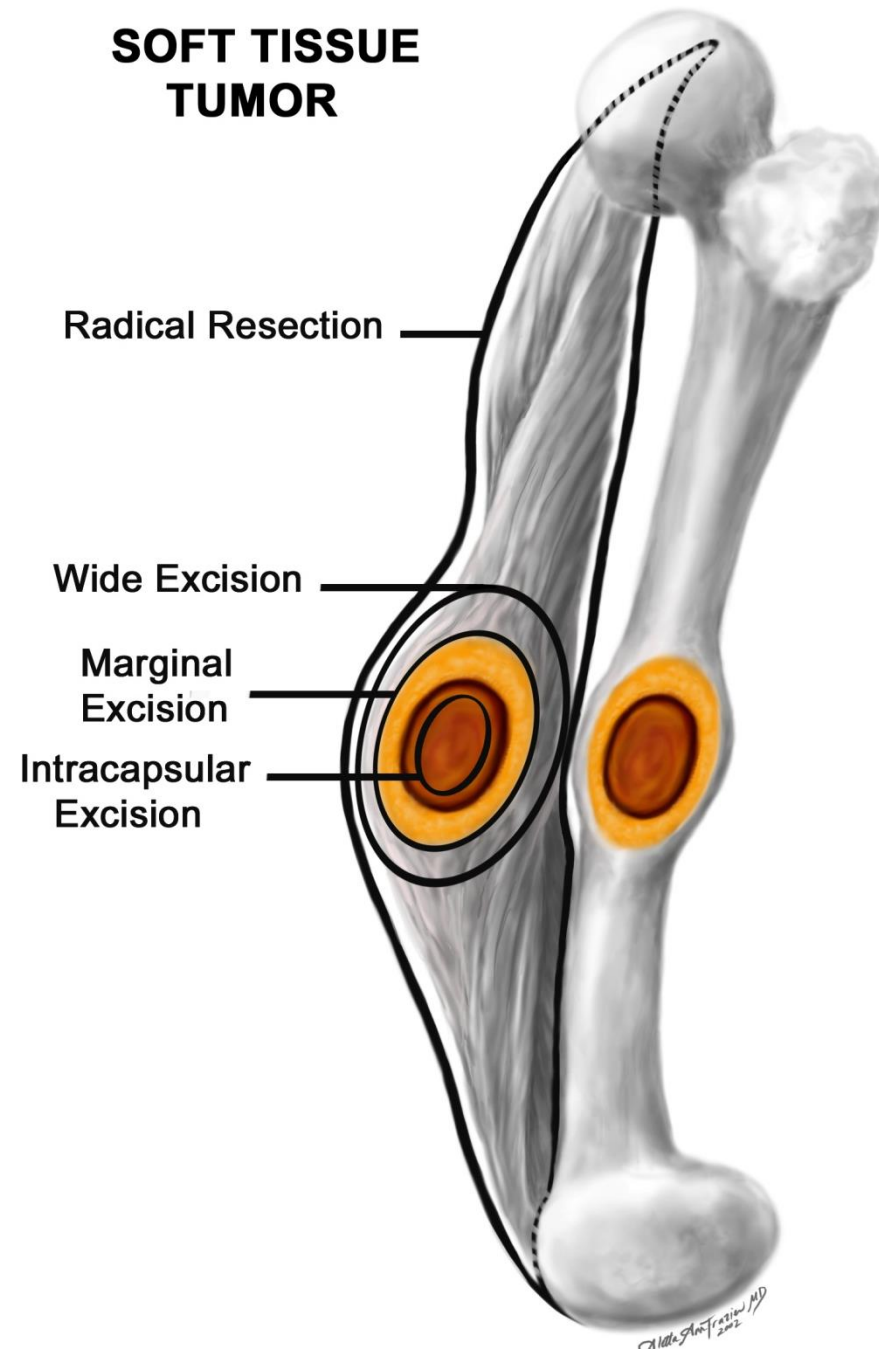
- | | |
|----------|---------------------|
| Score 0: | No necrosis |
| Score 1: | <50% tumor necrosis |
| Score 2: | ≥50% tumor necrosis |

Histologic grade

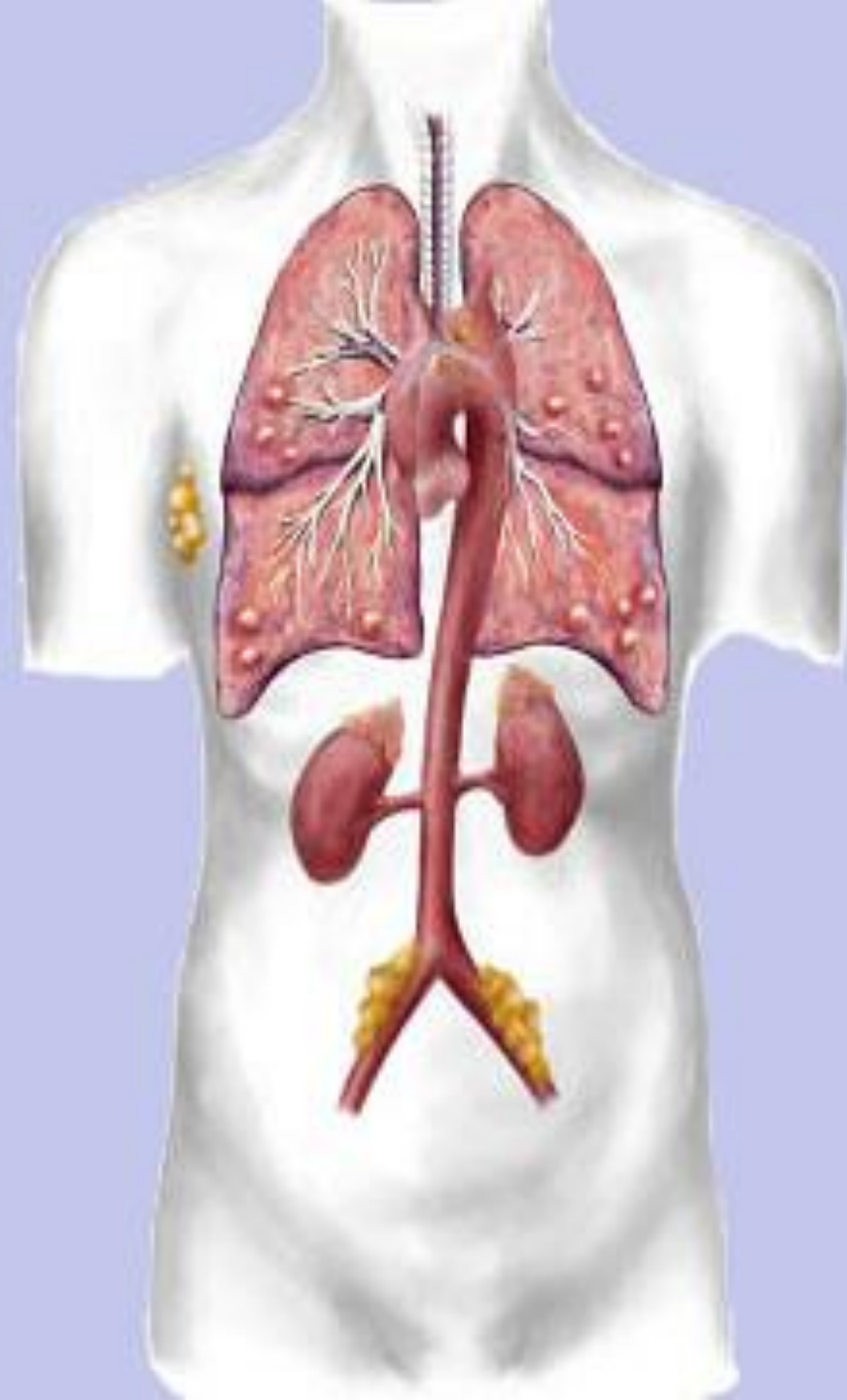
- | | |
|----------|---------------------|
| Grade 1: | Total score 2, 3 |
| Grade 2: | Total score 4, 5 |
| Grade 3: | Total score 6, 7, 8 |

Limb-Salvage Procedure

SOFT TISSUE TUMOR

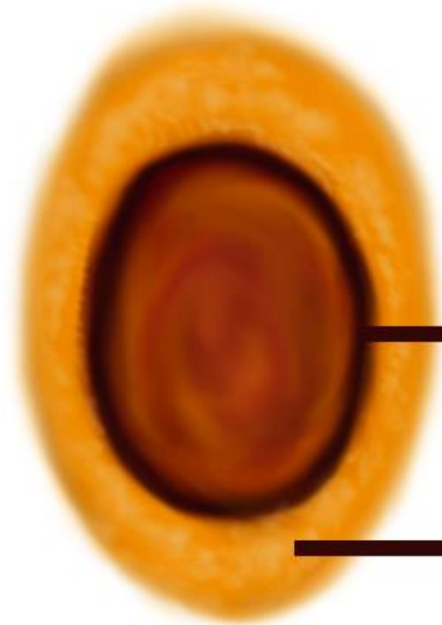


Stage III. Metastases;
regional or remote
(visceral, lymphatic,
or osseous)



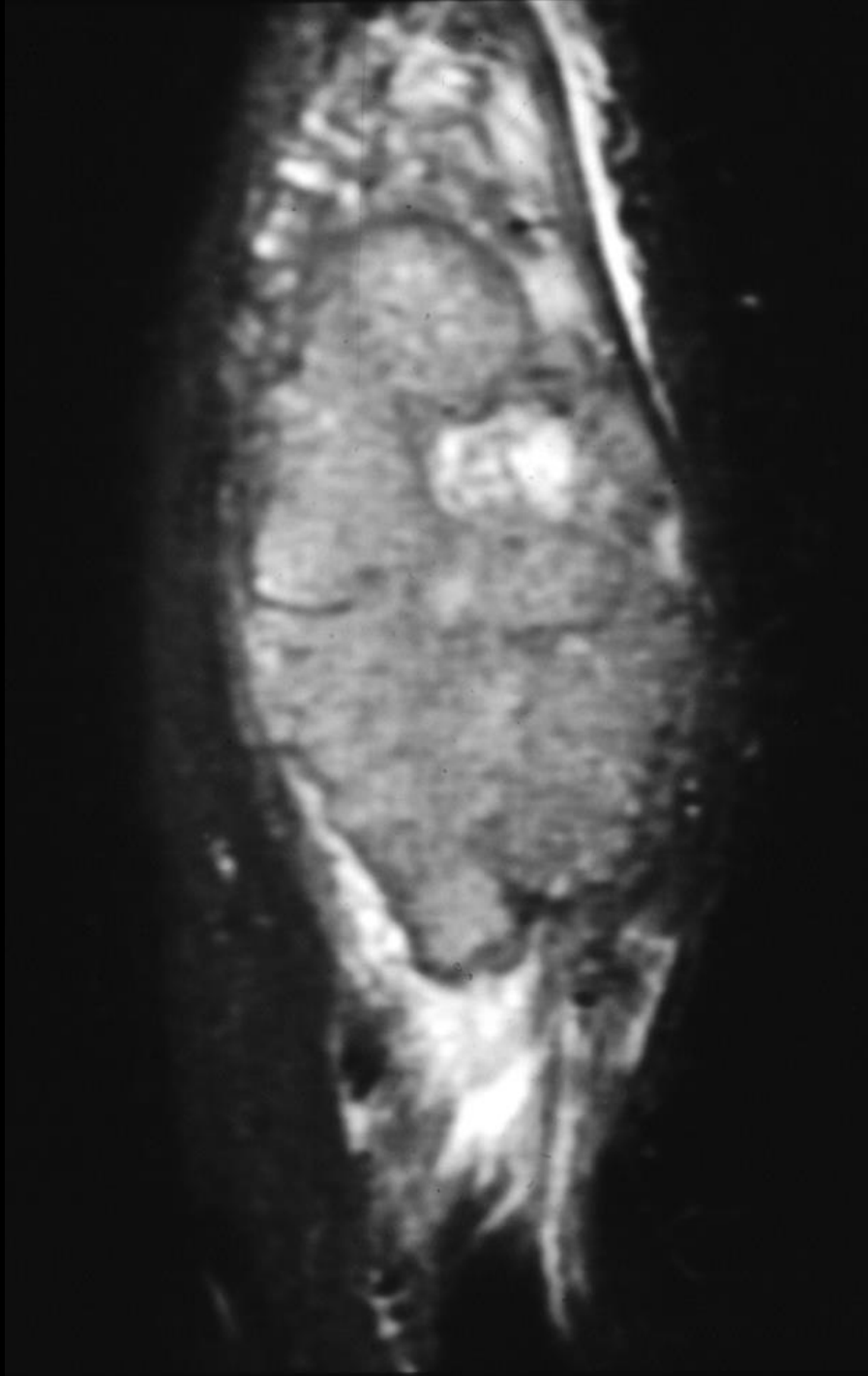
Musculoskeletal Tumors:

Surgical / Pathologic Zones



PSEUDOCAPSULE

REACTIVE ZONE



T2



T2

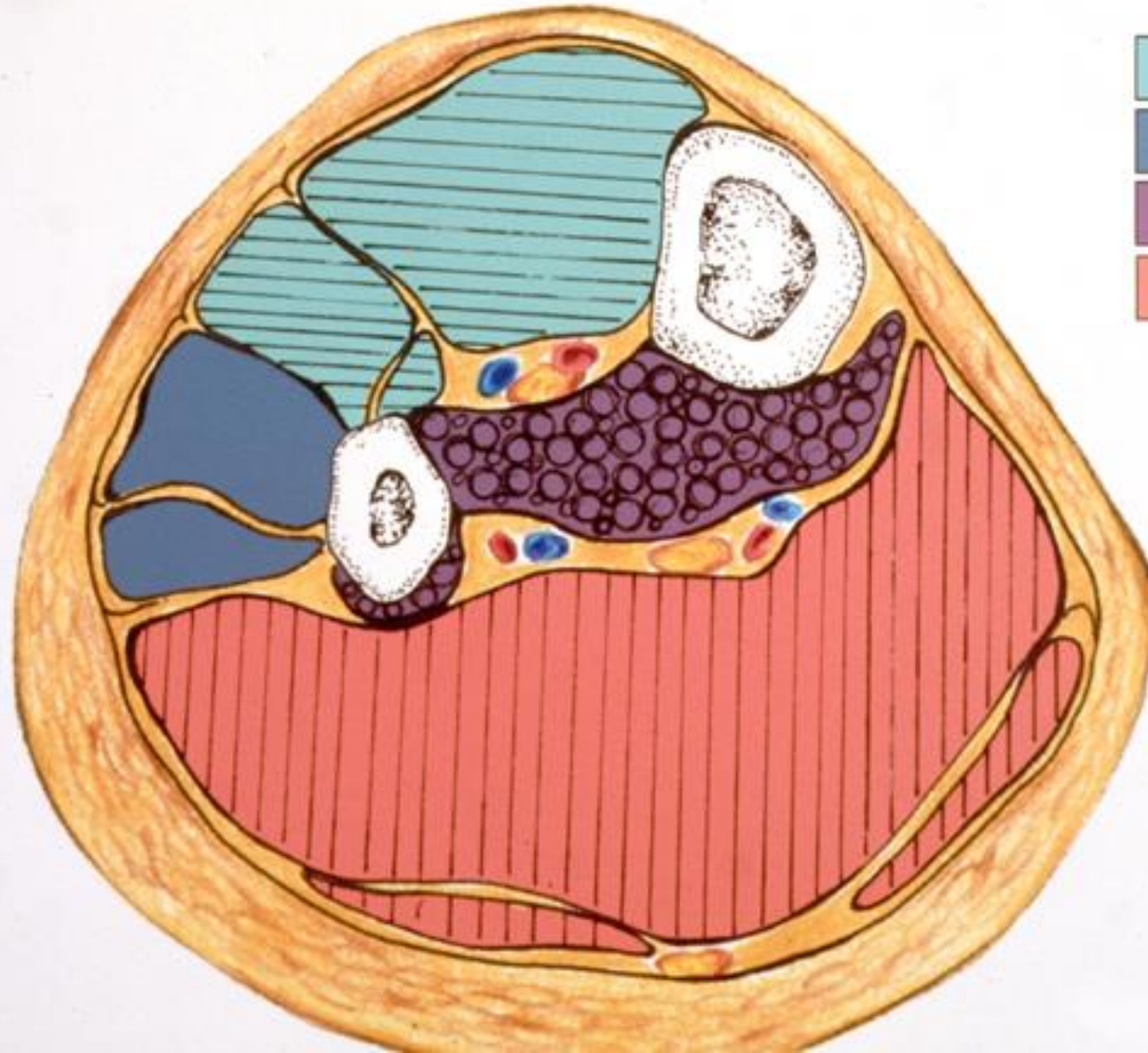


T2



T2

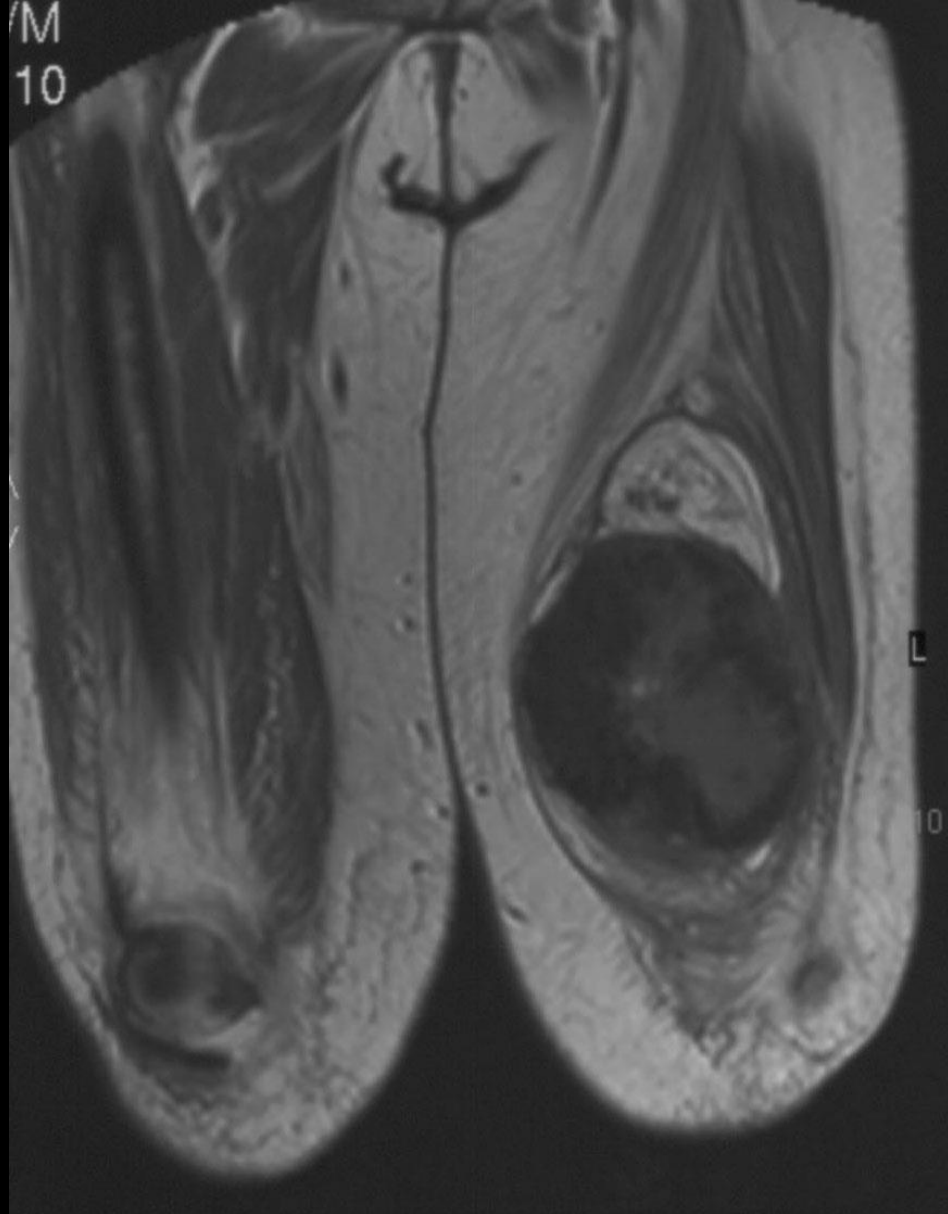
Mid Calf



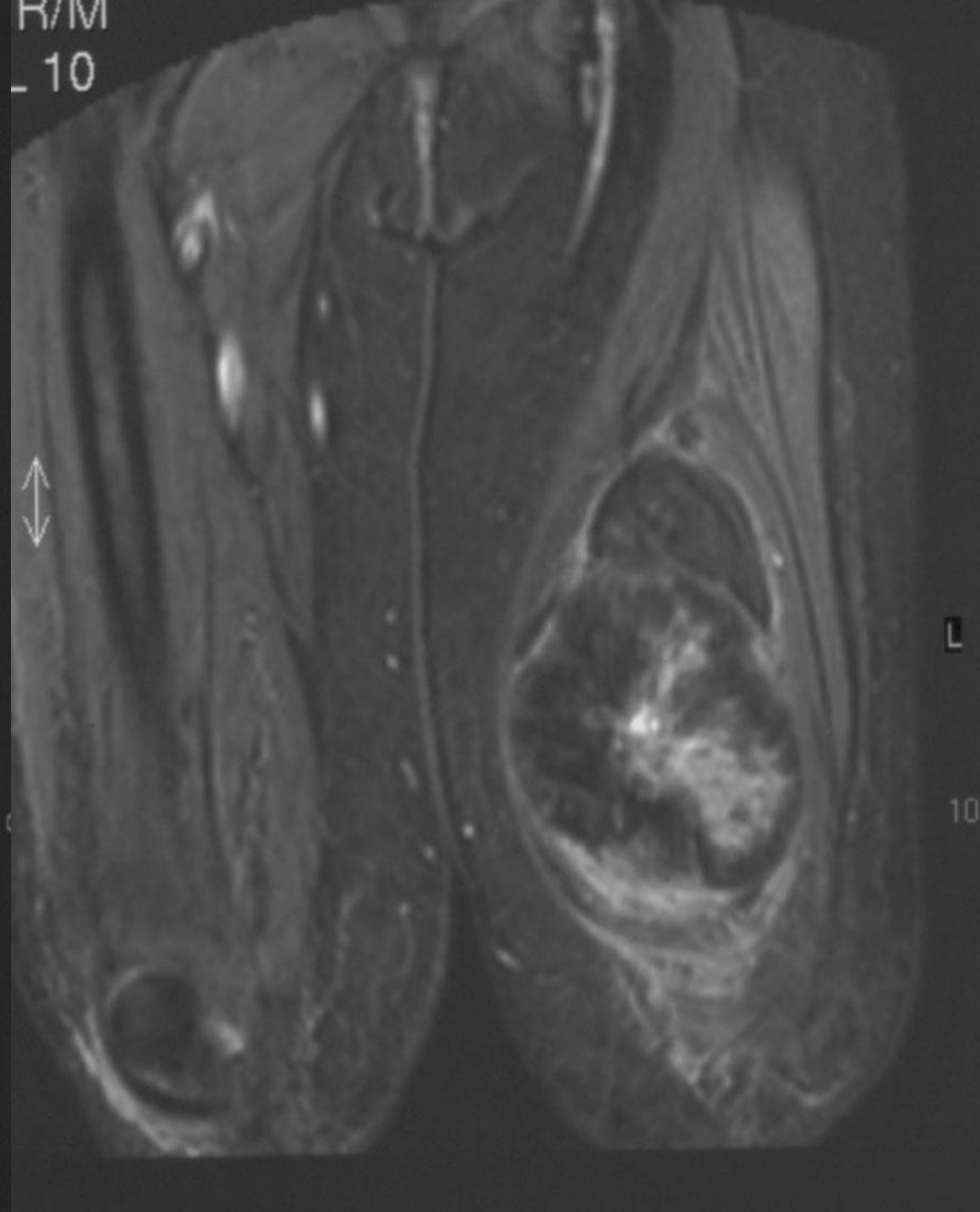
- Anterior
- Lateral
- Deep Posterior
- Posterior

SOFT TISSUE MASS: INTRINSIC HETEROGENEITY

- Often portion of lesion cystic/necrotic/hemorrhagic
- Direct biopsy away from these areas
 - Sonography or contrast enhanced MRI/CT
- May need to biopsy several areas if solid regions of differing intrinsic characteristics (different histology)
 - Particularly if large lesions



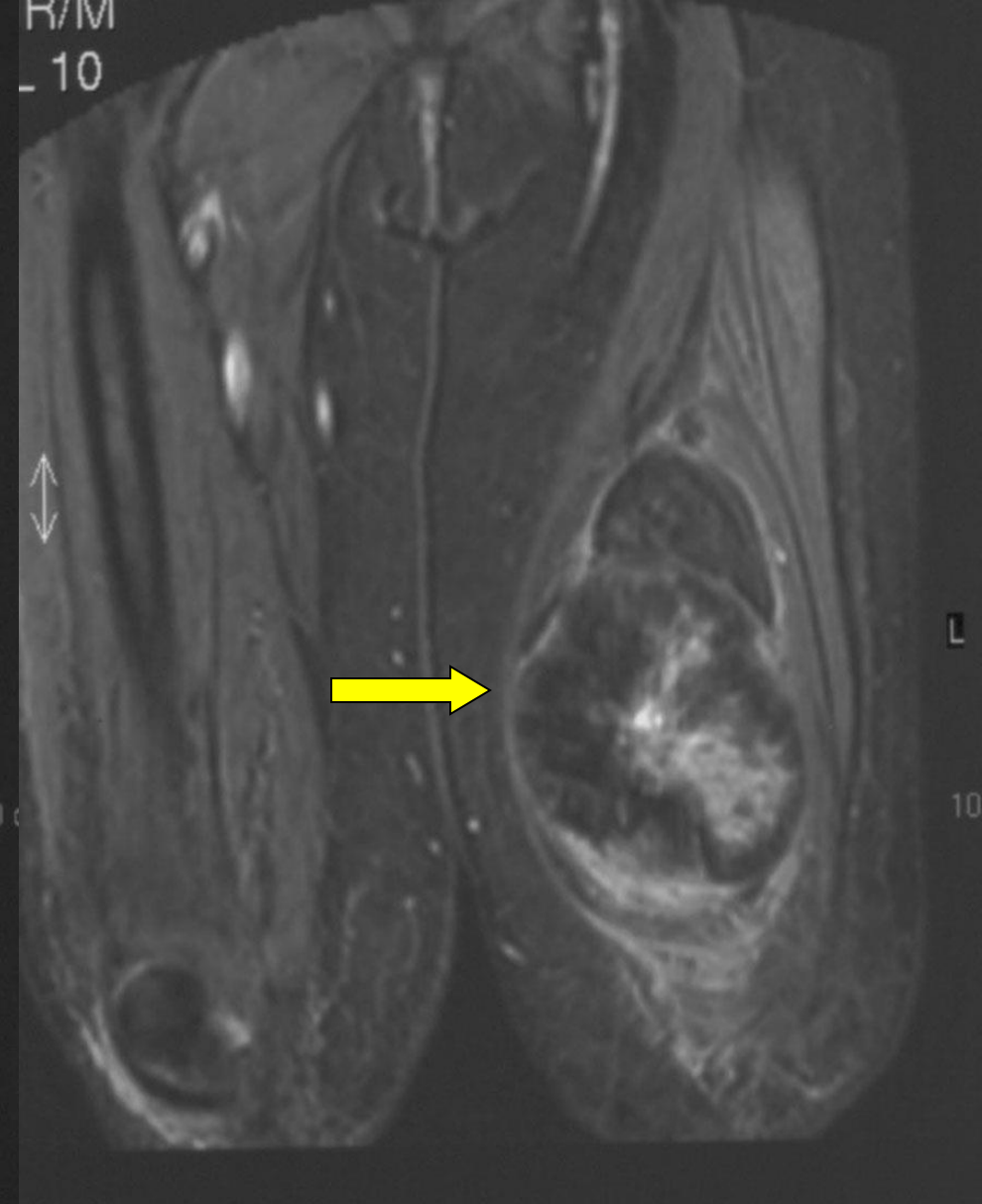
T1



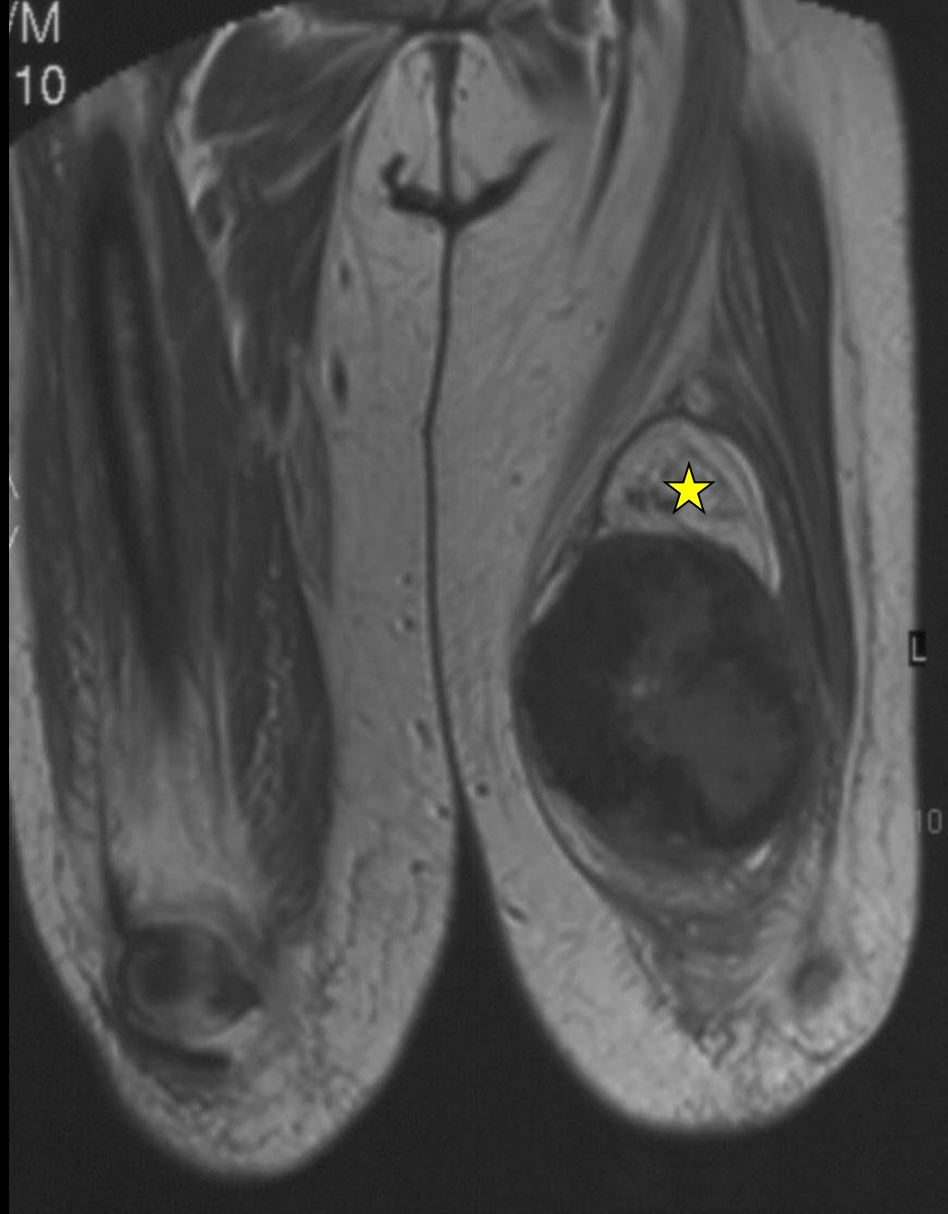
STIR



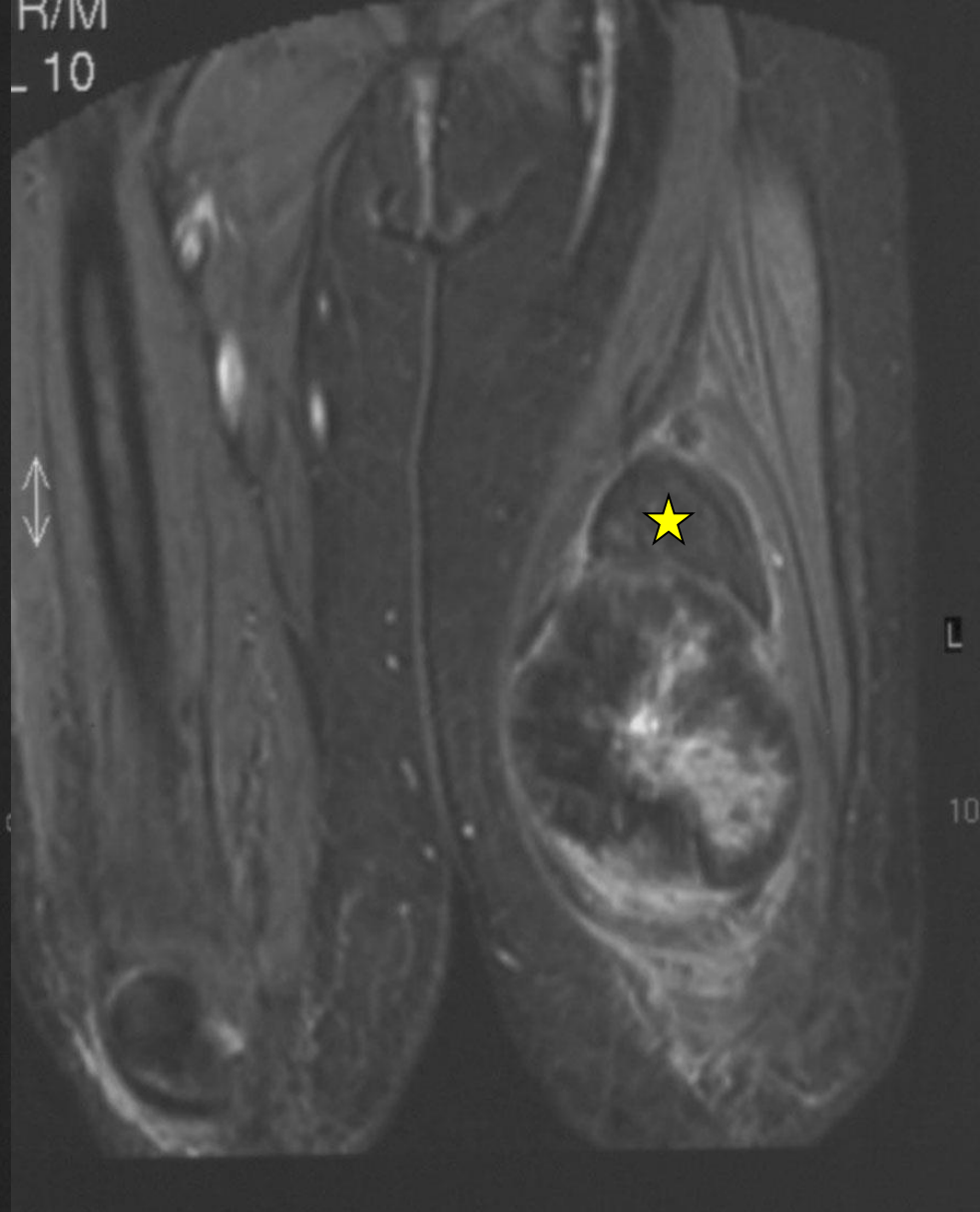
T1



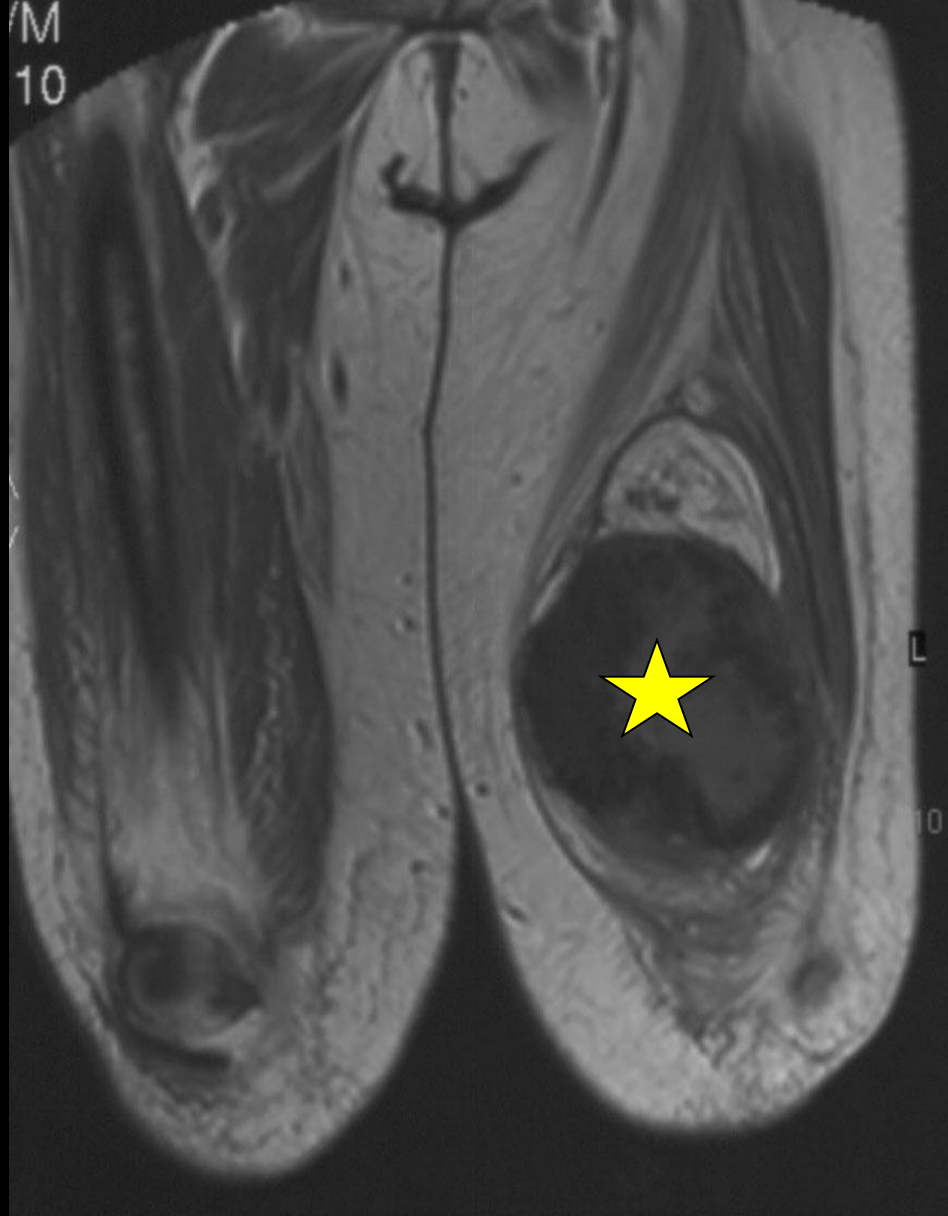
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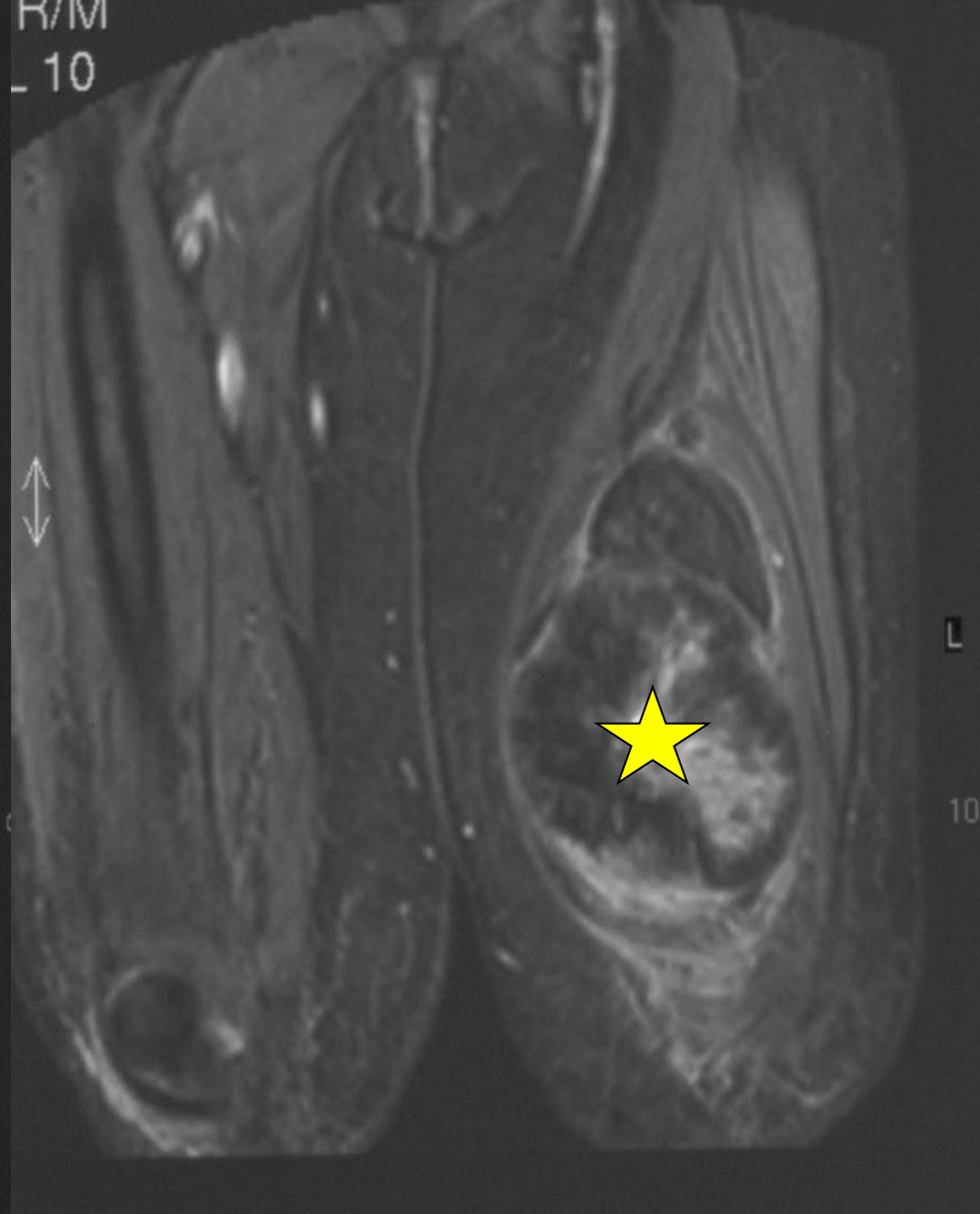
T1



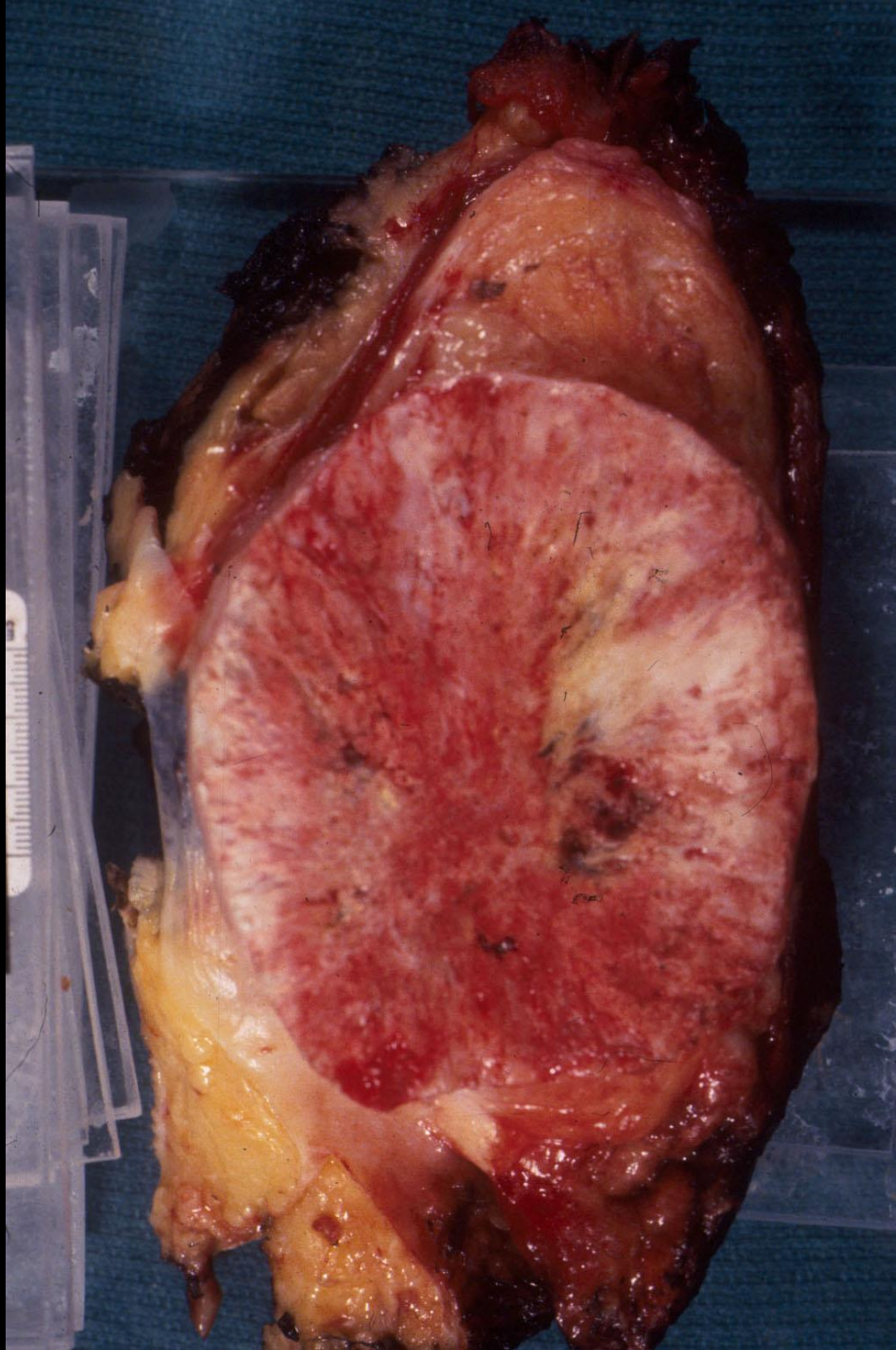
STIR

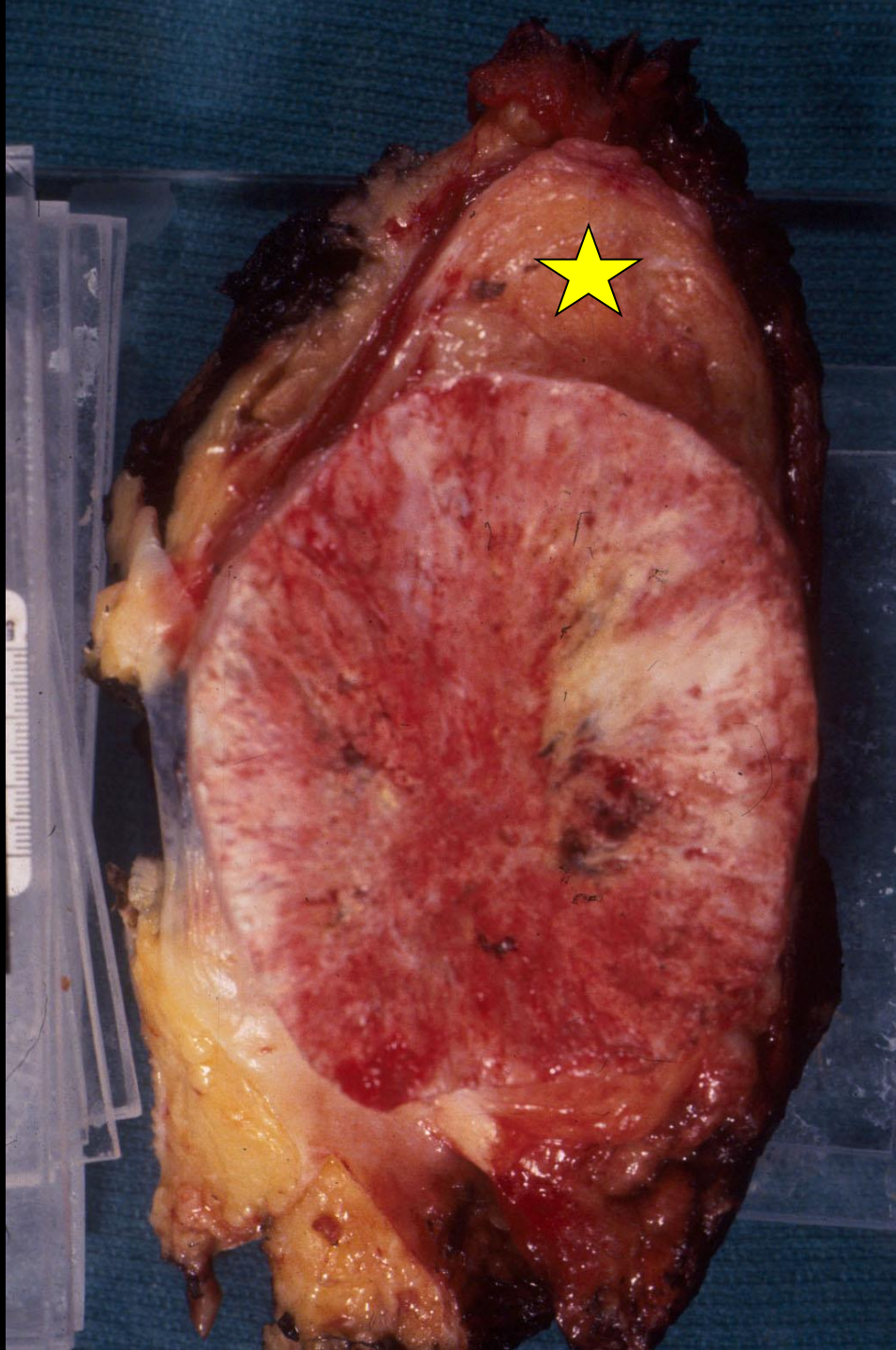


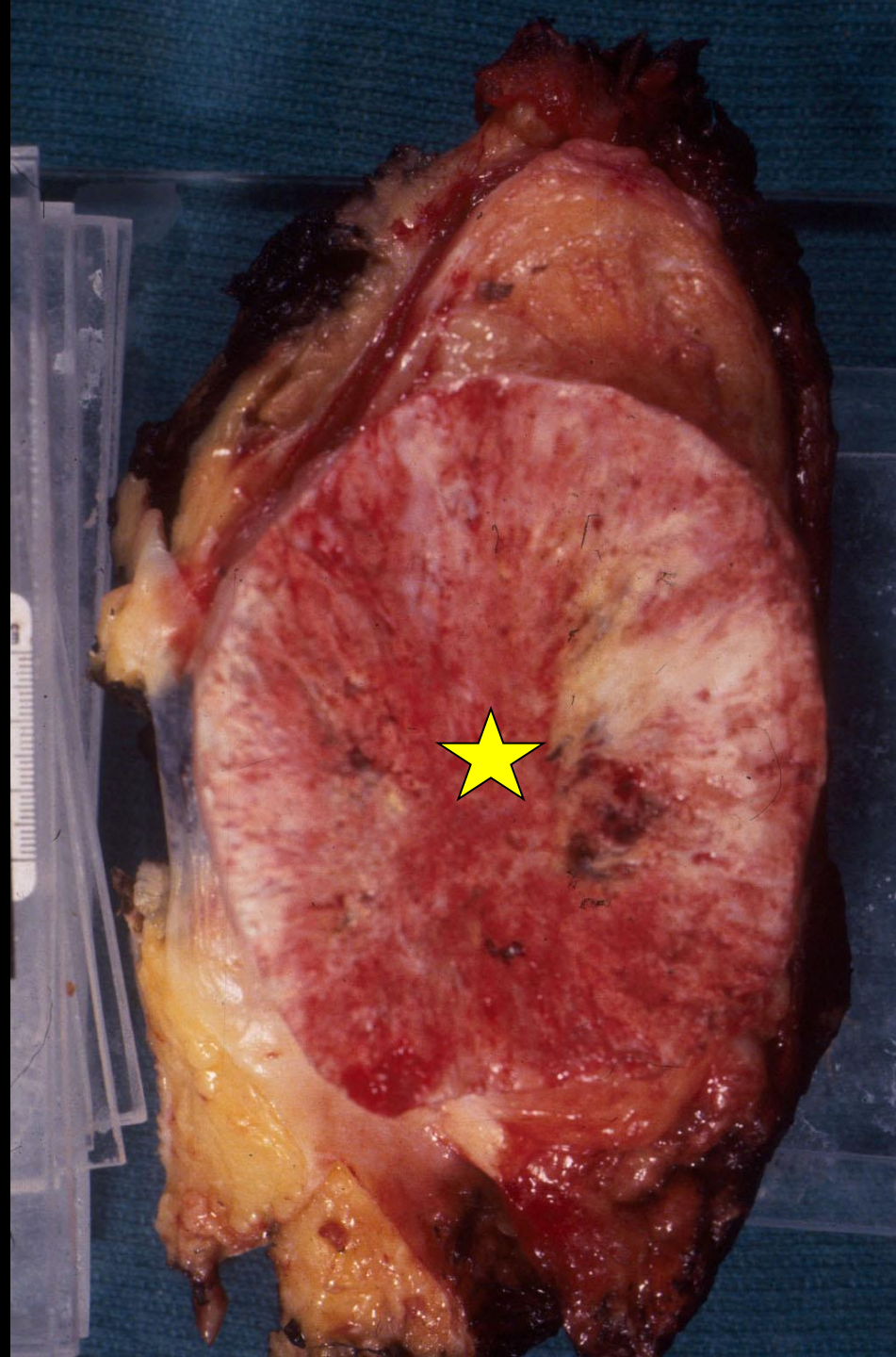
T1



STIR







MRI EVALUATION OF SOFT TISSUE TUMORS

6. HOW TO STAY OUT OF TROUBLE!!

**IF THERE ARE SOLID AREAS OF DIFFERING
SIGNAL BOTH REGIONS NEED BIOPSY AND
STAY AWAY FROM HIGH WATER CONTENT
FOCI**

SOFT TISSUE MASSES: DIAGNOSES WITH IMAGING ALONE

- MRI 20%-50% of cases in literature
 - Potentially 70%-85% in my opinion
- MRI > CT (contrast, multiplanar)
 - Lipomatous lesions
 - Angiomatous lesions
 - Neurogenic tumors
 - Elastofibroma and fibromatosis
 - Ganglion, synovial cysts, myxoma
 - PVNS, GCTTS

IMAGING NONSPECIFIC SOFT TISSUE MASS: BENIGN CHARACTERISTICS

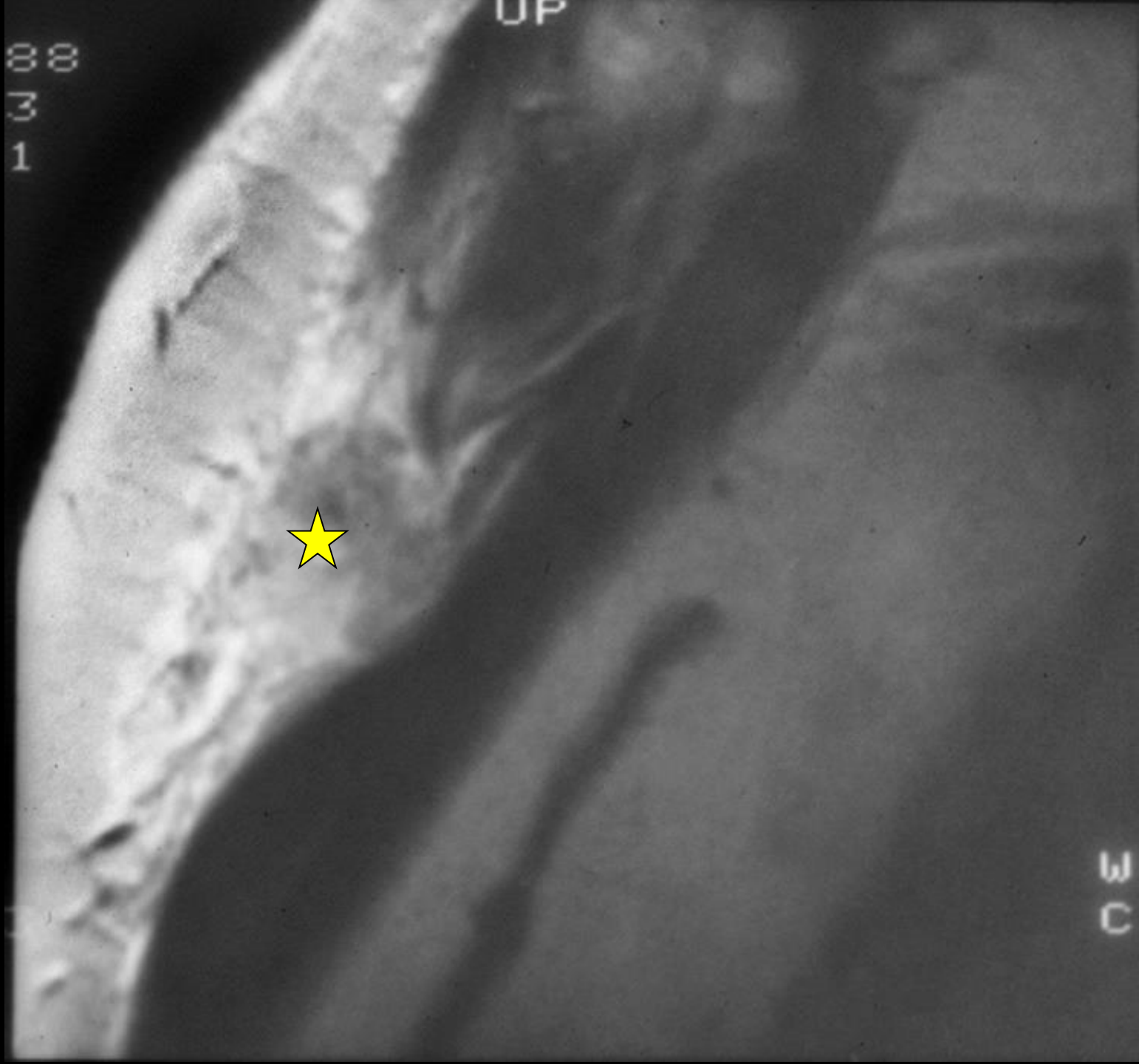
- Small size (< 5cm)
- Well marginated
- Homogeneous signal intensity
- No neurovascular encasement
- Enhancement pattern dynamic MRI (late, slow, diffuse/none)

IMAGING NONSPECIFIC SOFT TISSUE MASS: MALIGNANT CHARACTERISTICS

- Large size (< 5cm)
- Poorly marginated
- Heterogeneous
- Neurovascular or bone involvement
- Central necrosis
- Enhancement pattern dynamic MRI (early, rapid, peripheral)

SOFT TISSUE MASSES: MISINTERPRETED ON MRI BENIGN VS. MALIGNANT

- Diabetic muscle ischemia
- Hematoma
- Fibromatosis
- Reactive L.N., Abscess, Bursitis
- Myositis ossificans (heterotopic bone)
- Synovial sarcoma
- Myxoid liposarcoma

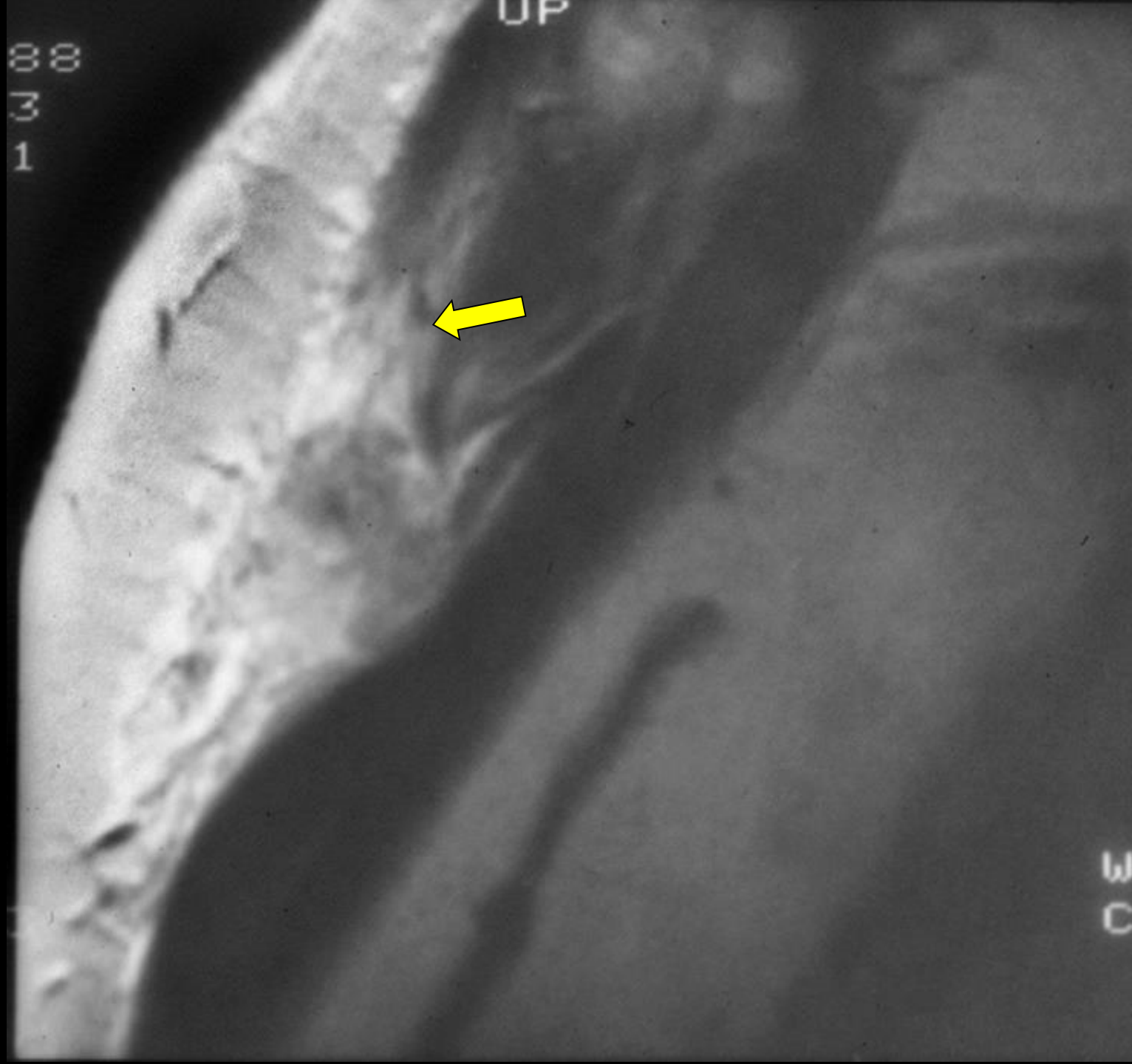


88
3
1

UP

30

T2



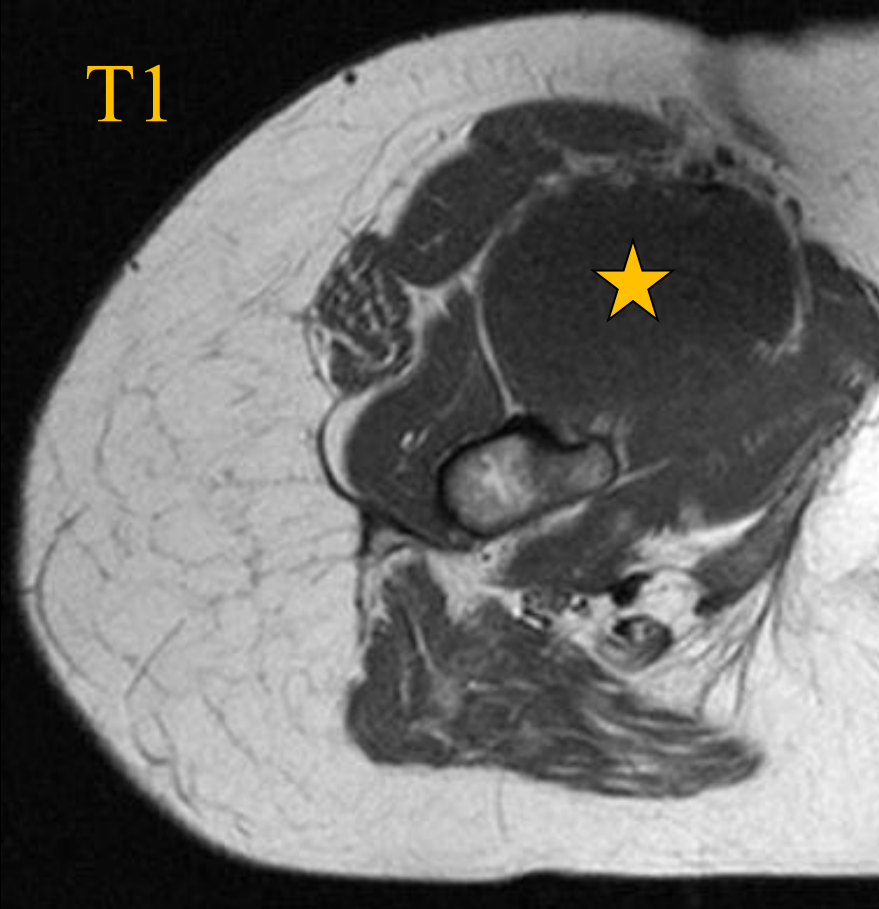
T2

50
30

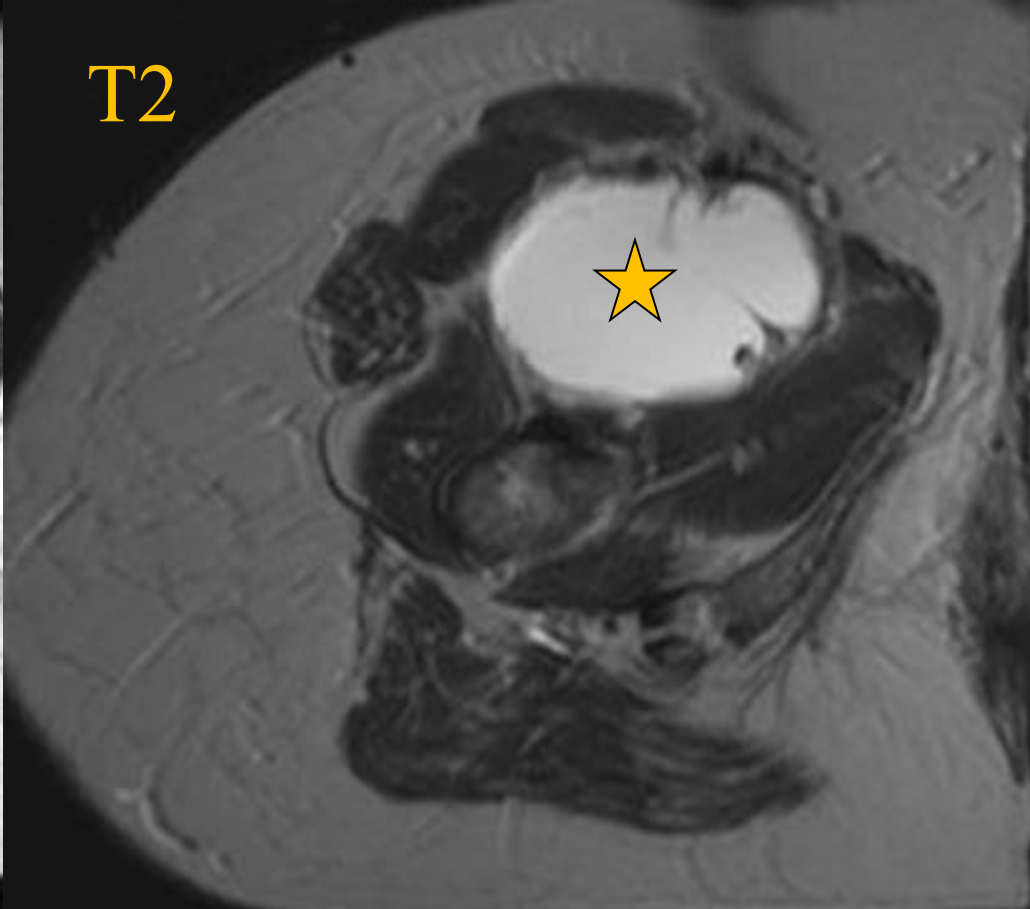


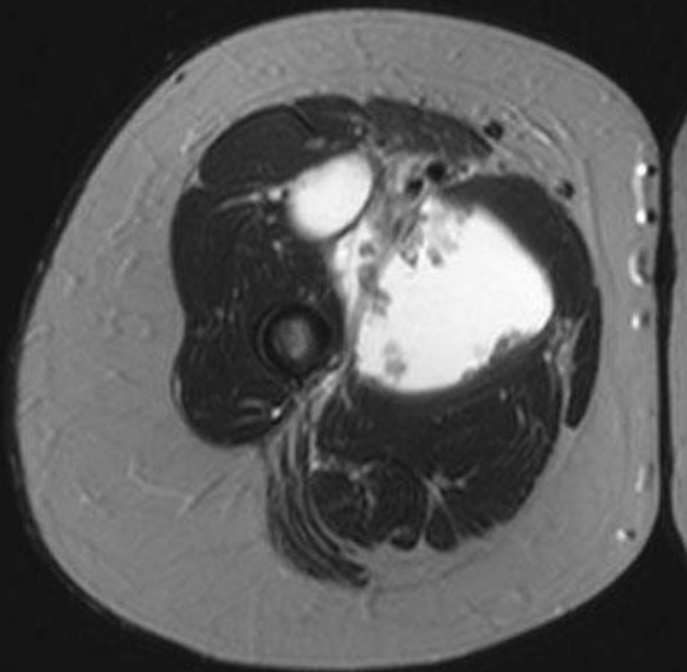
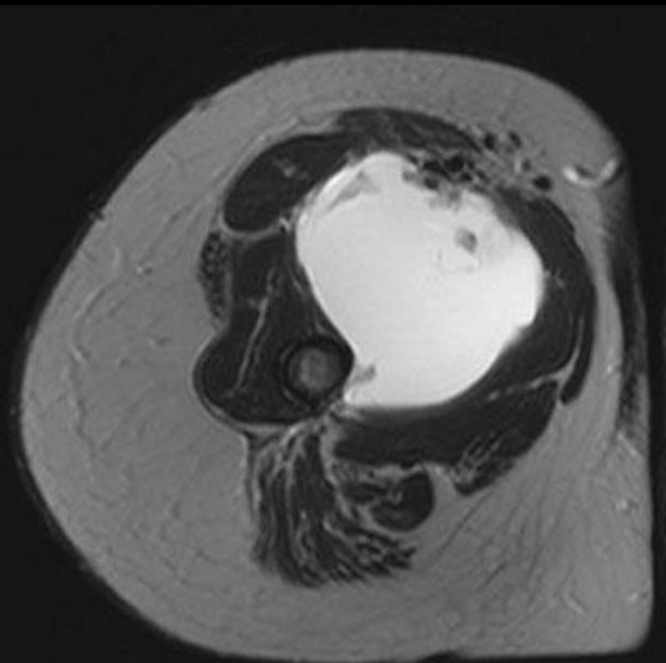
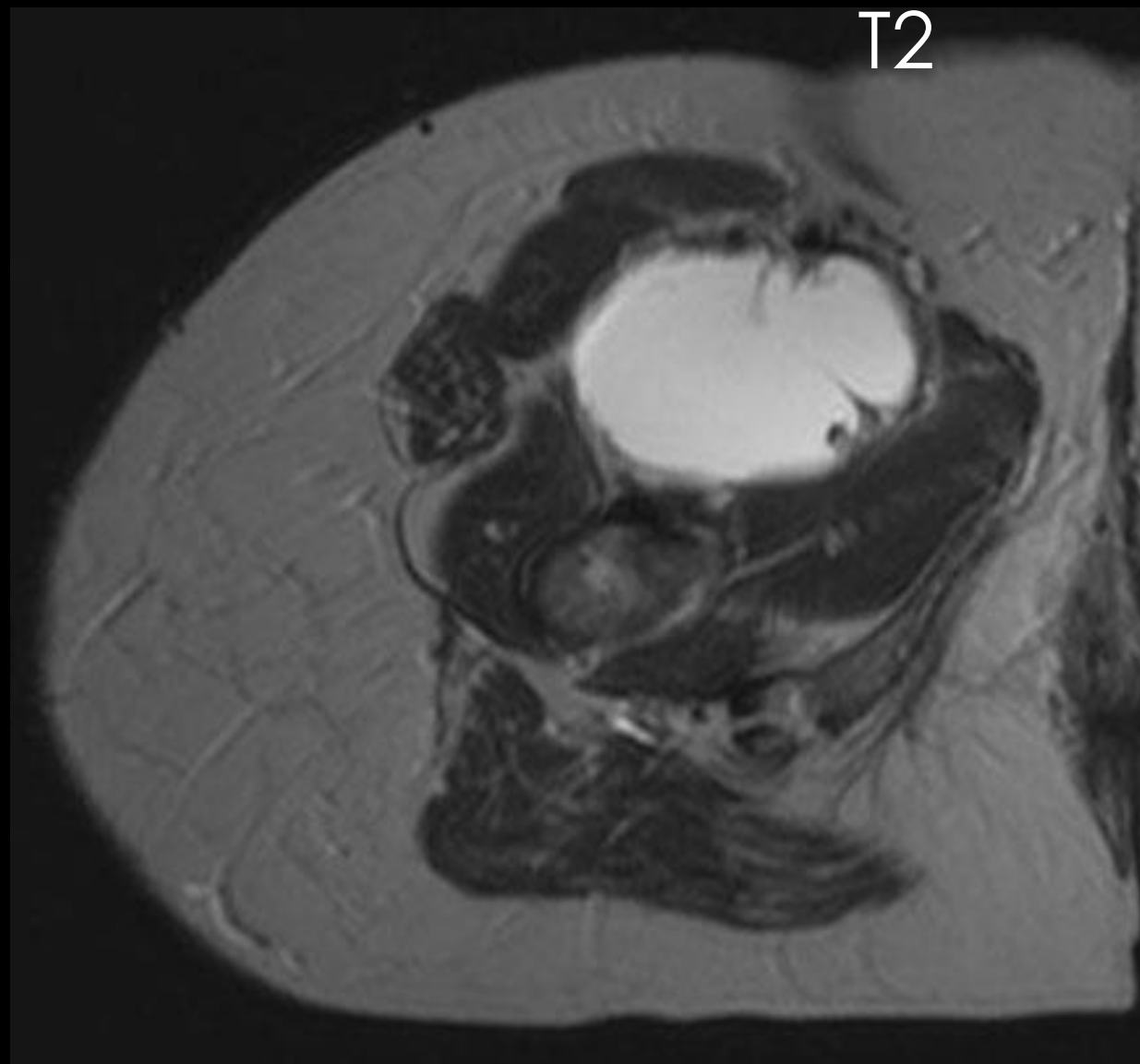
L

T1



T2





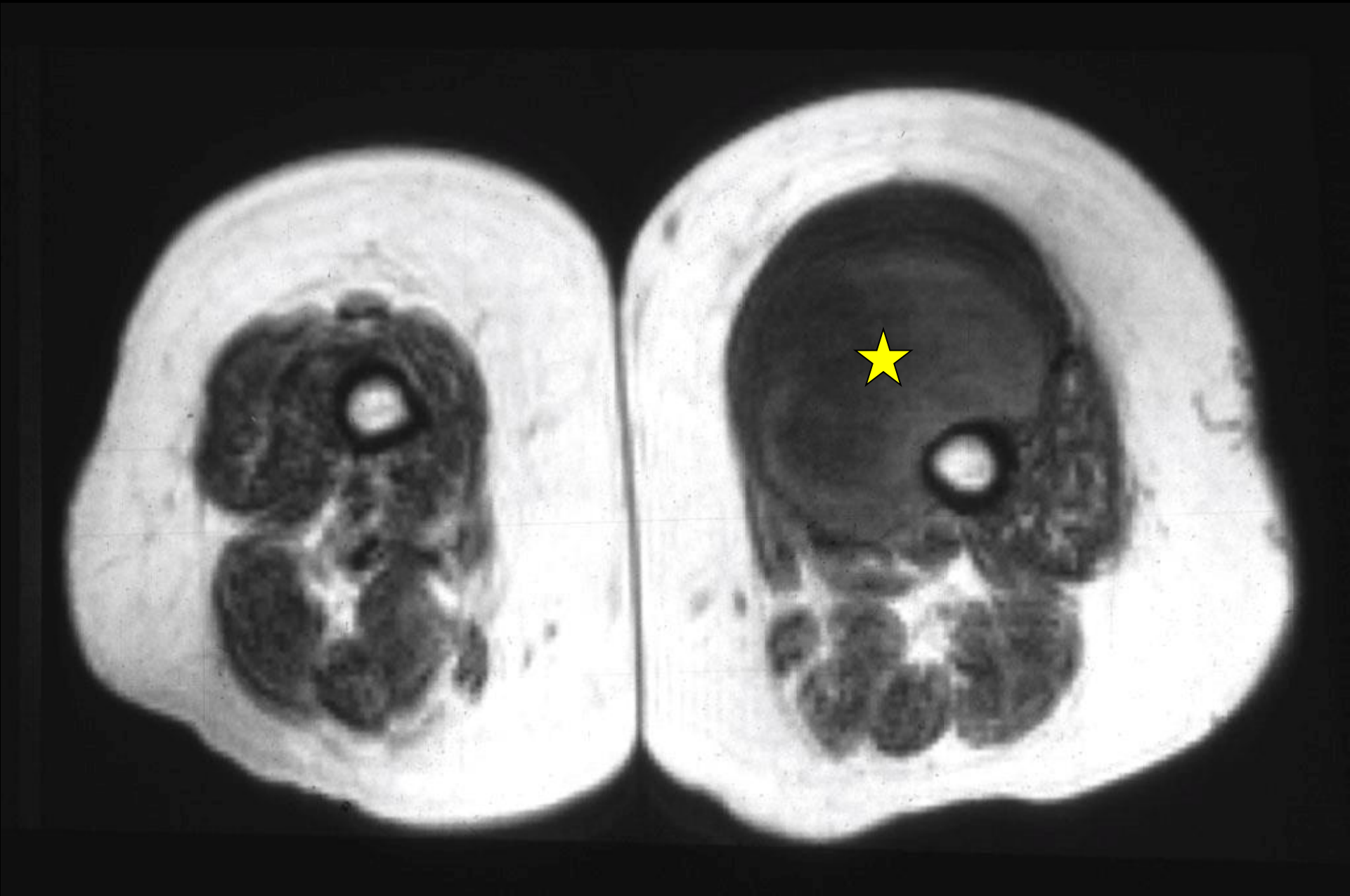
MRI EVALUATION OF SOFT TISSUE TUMORS

7. HOW TO STAY OUT OF TROUBLE!!

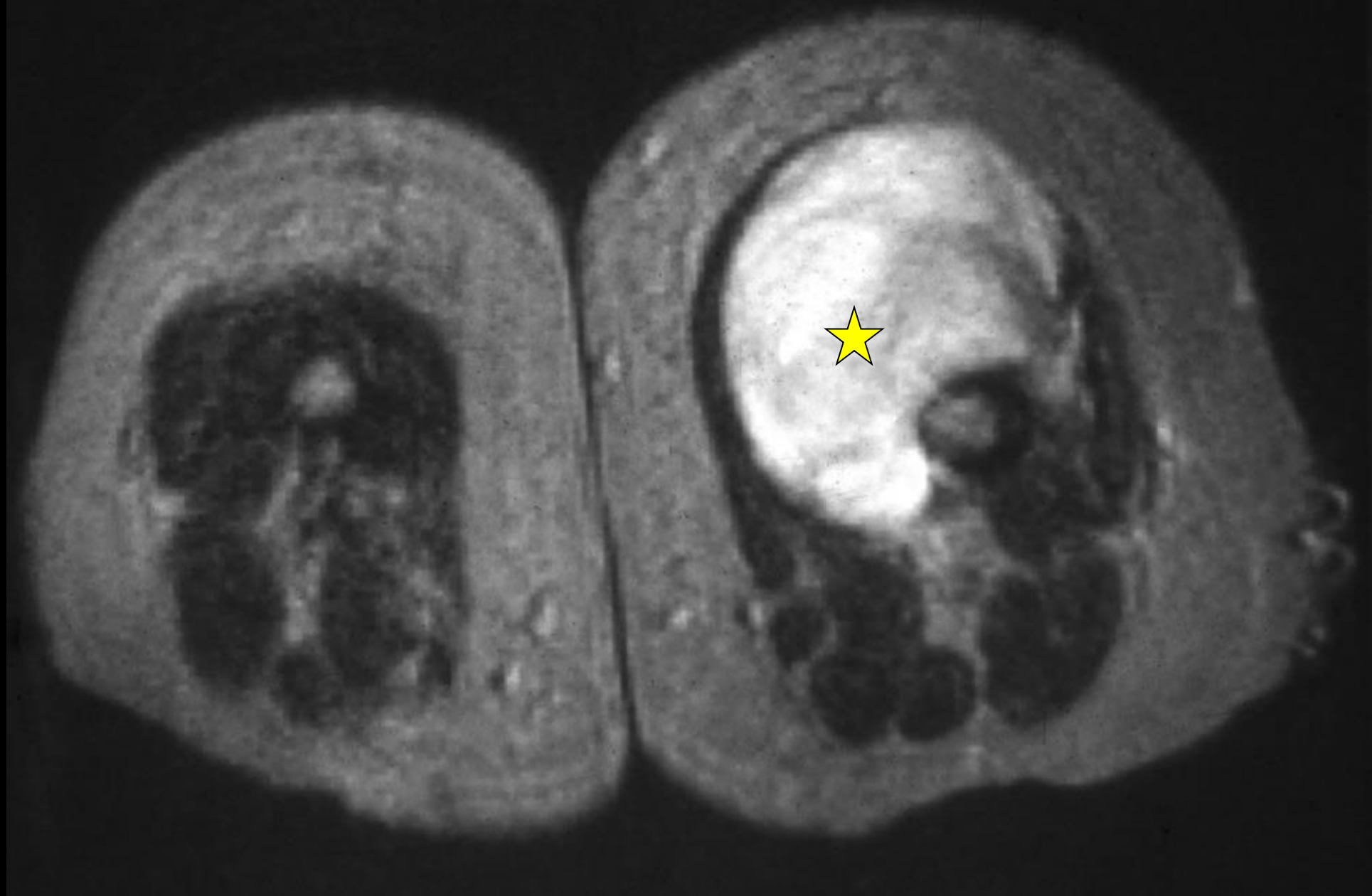
IN AN INDIVIDUAL CASE, MRI IS NOT ACCURATE TO PREDICT WHETHER A NONSPECIFIC (BY INTRINSIC CHARACTERISTICS) SOFT TISSUE MASS IS BENIGN OR MALIGNANT AND THE LESION NEEDS BIOPSY!!!

MUSCULOSKELETAL NEOPLASM: USE OF MRI WITH GADOLINUM

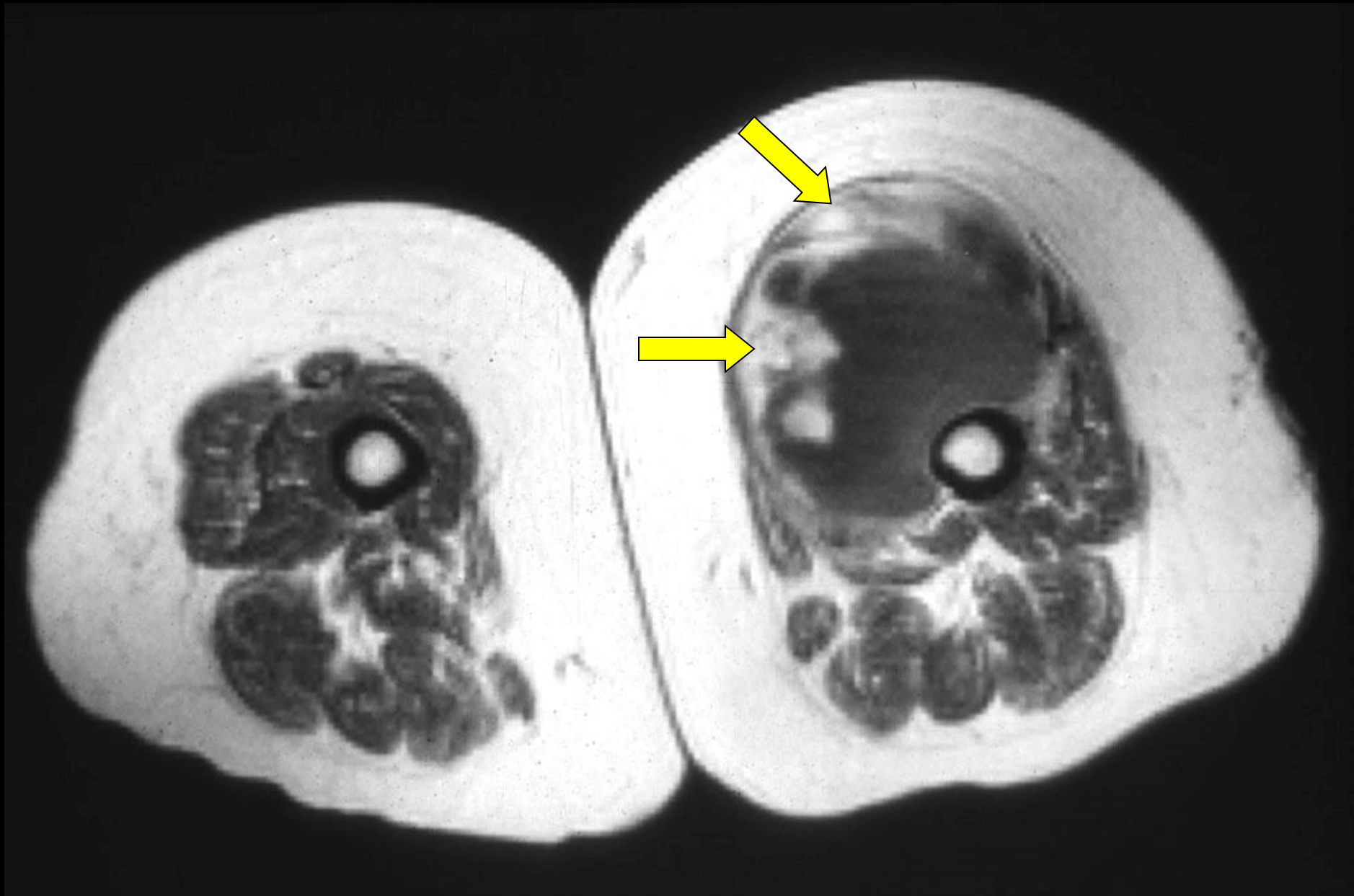
- Does not increase lesion conspicuity
- Tumor, edema, inflammation and fibrosis all enhance
- Help differentiate cyst/hemorrhage – direct biopsy to viable tumor (sonography)
- Helpful in post-op cases to show nodular enhancement with recurrence



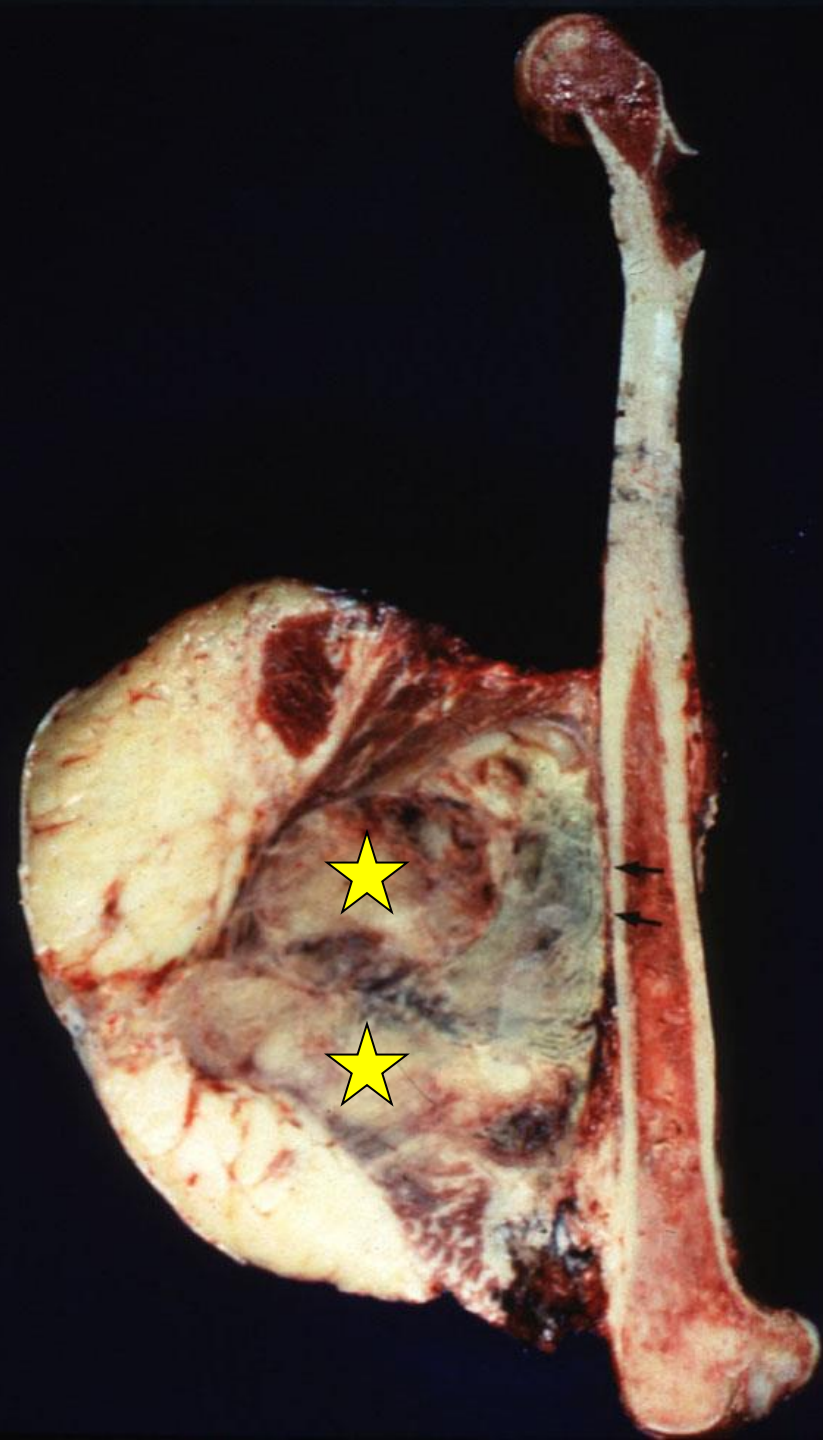
T1

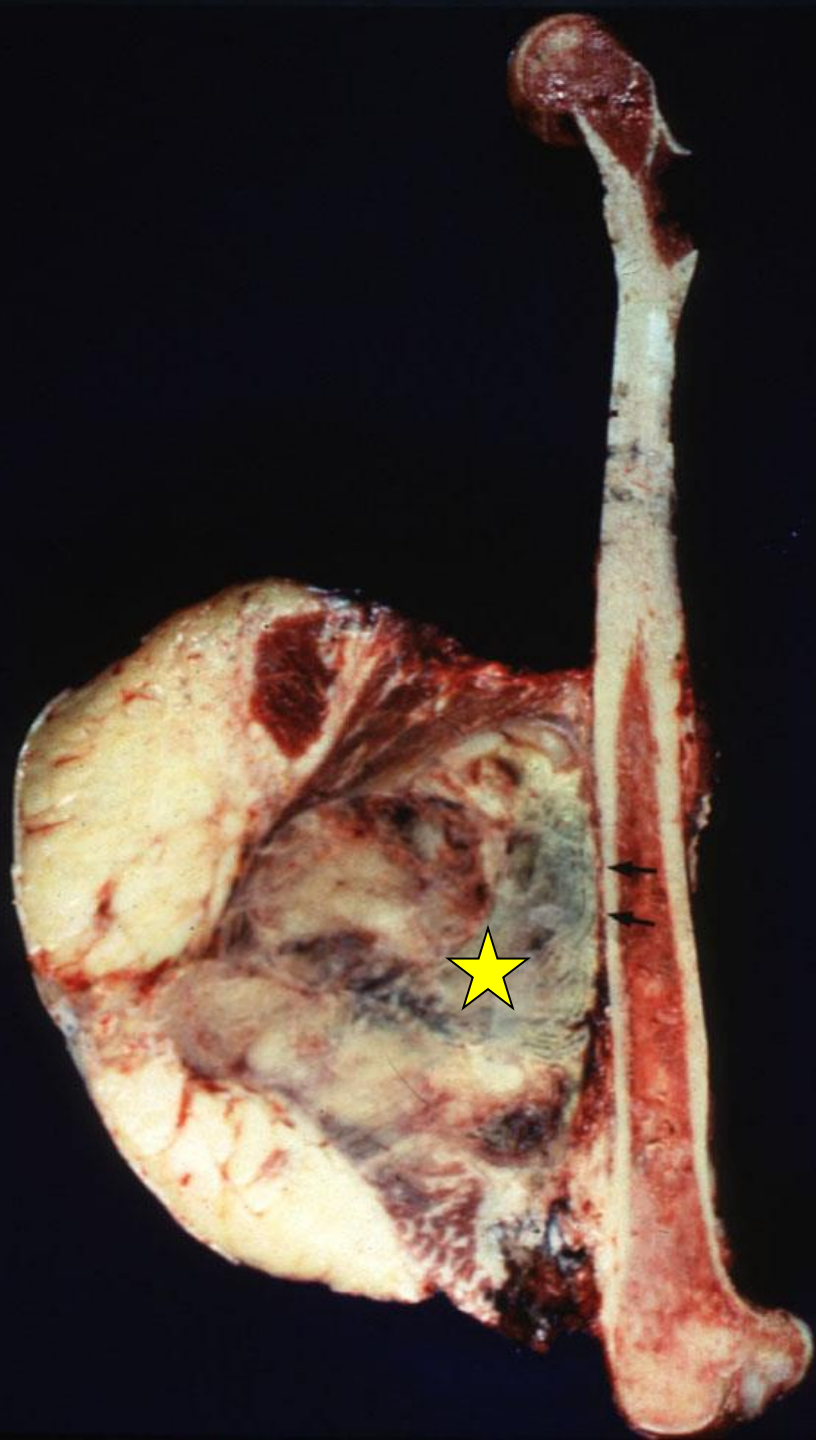


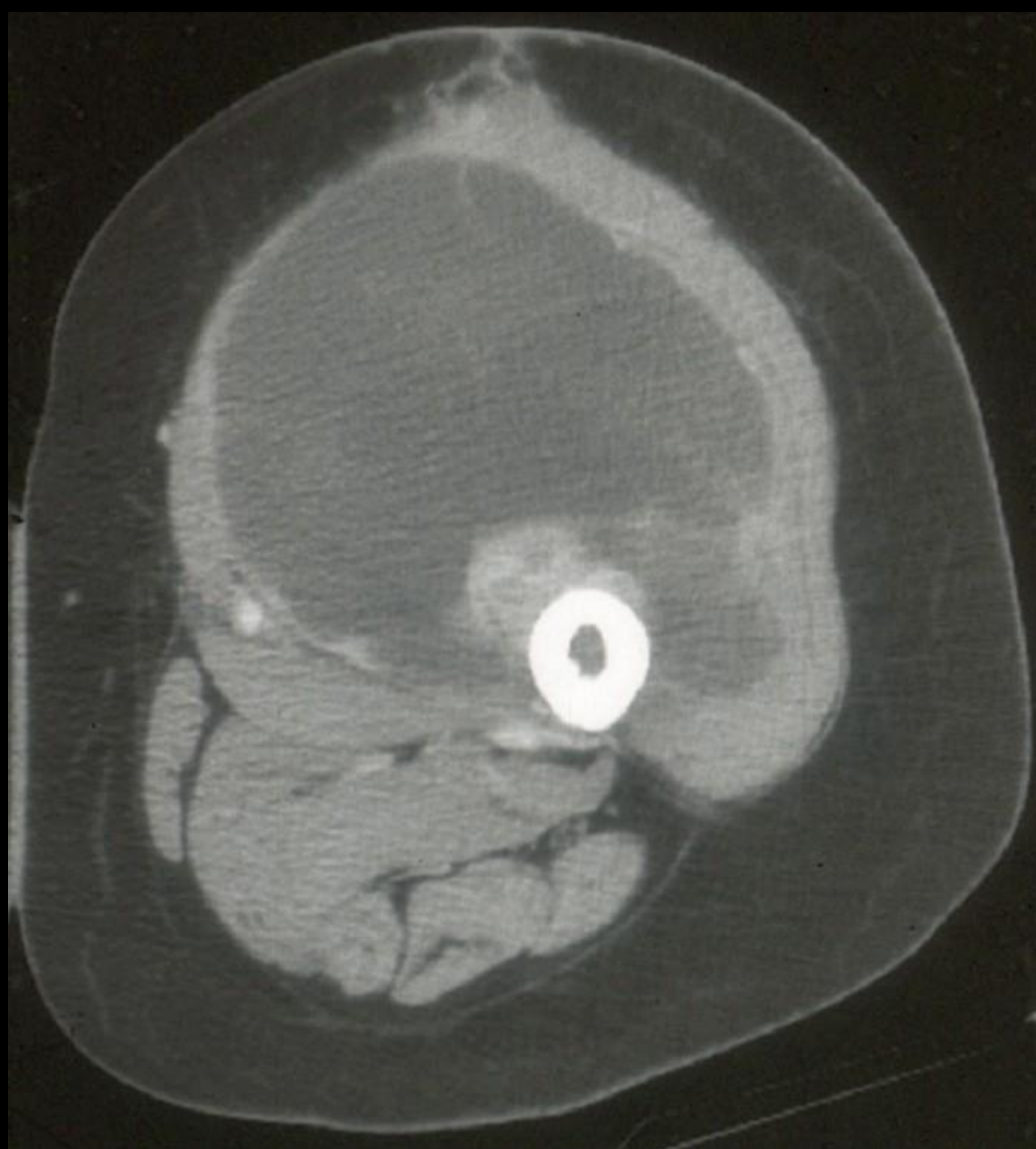
T2

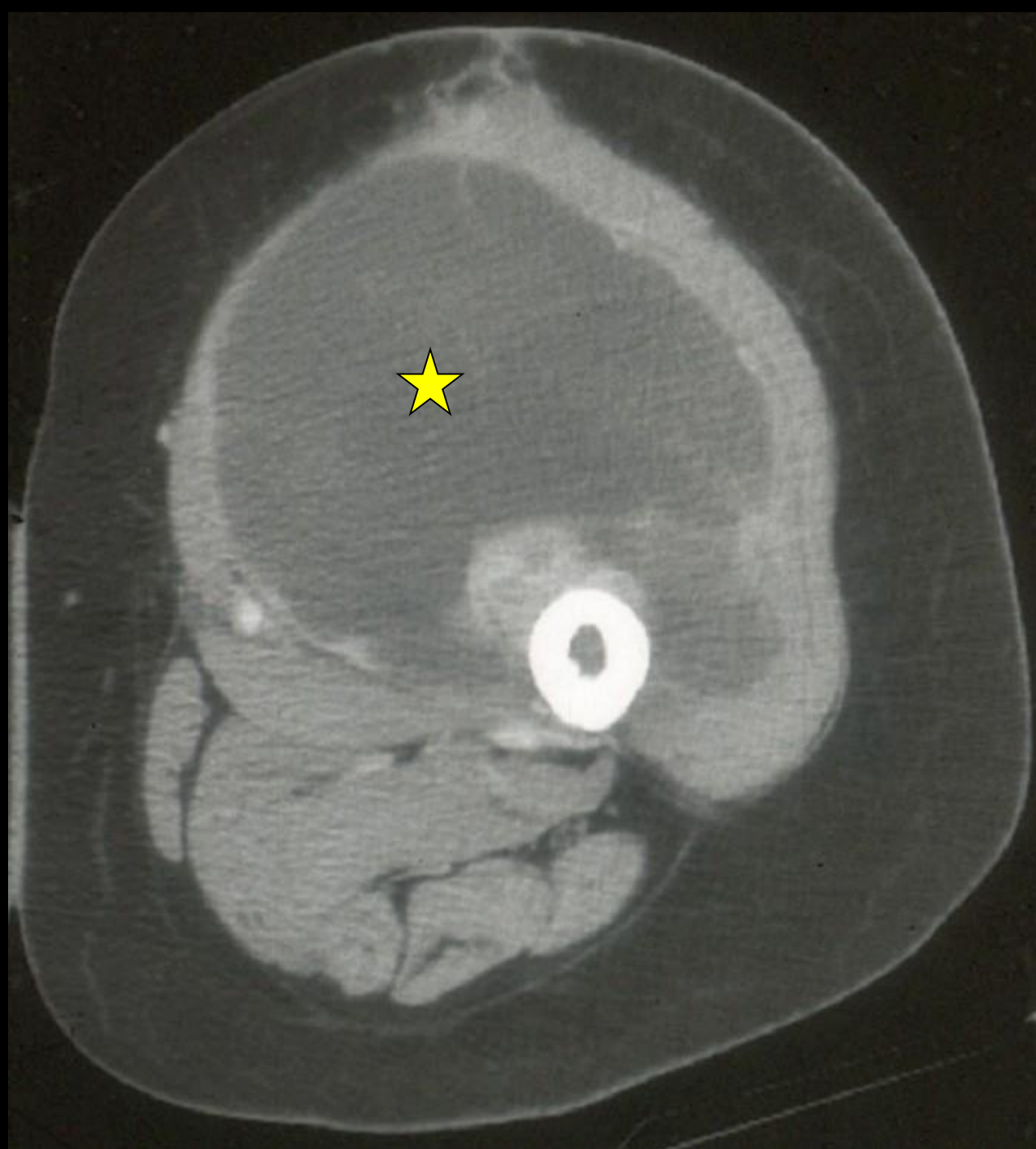


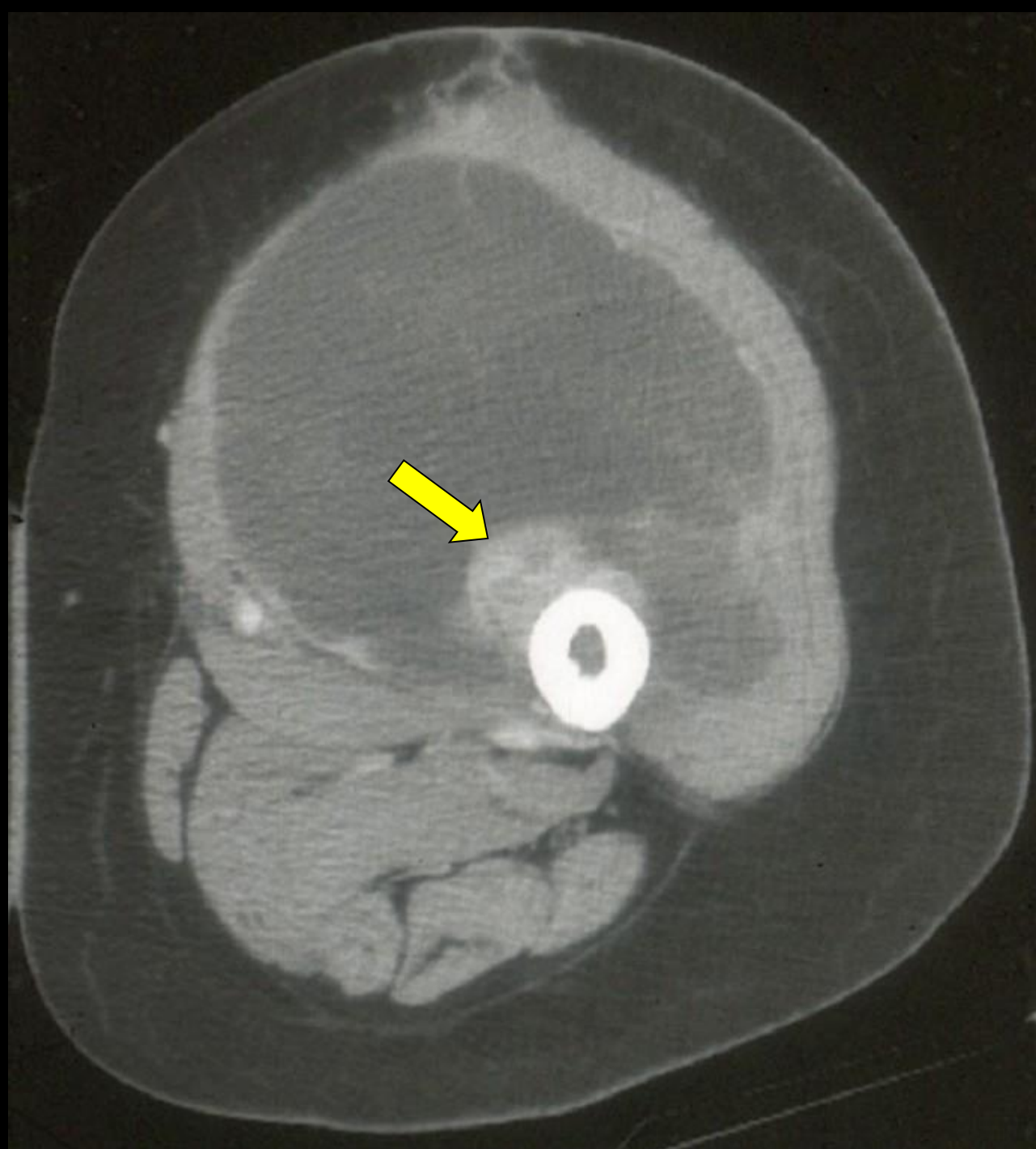
T1 GD

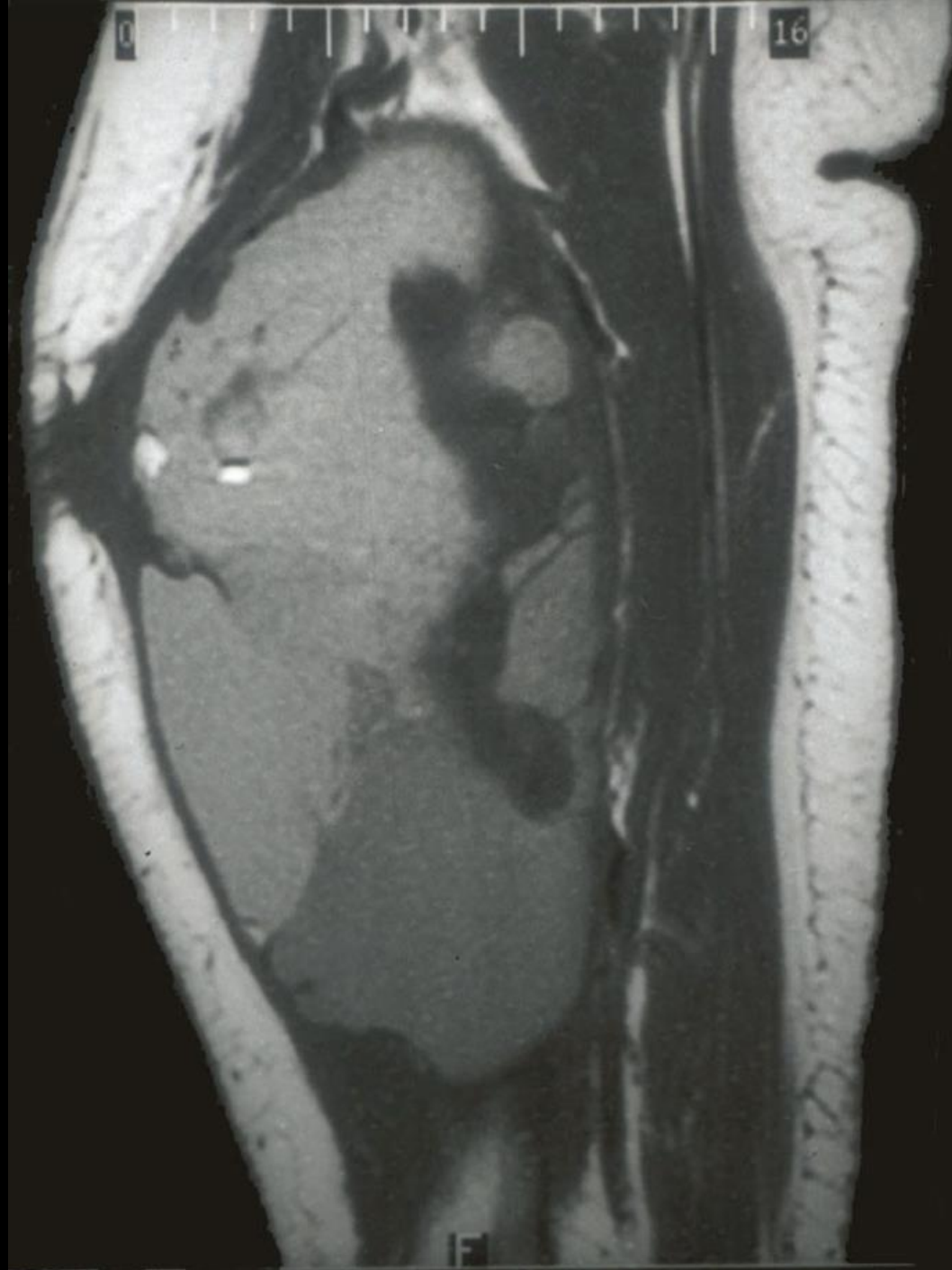




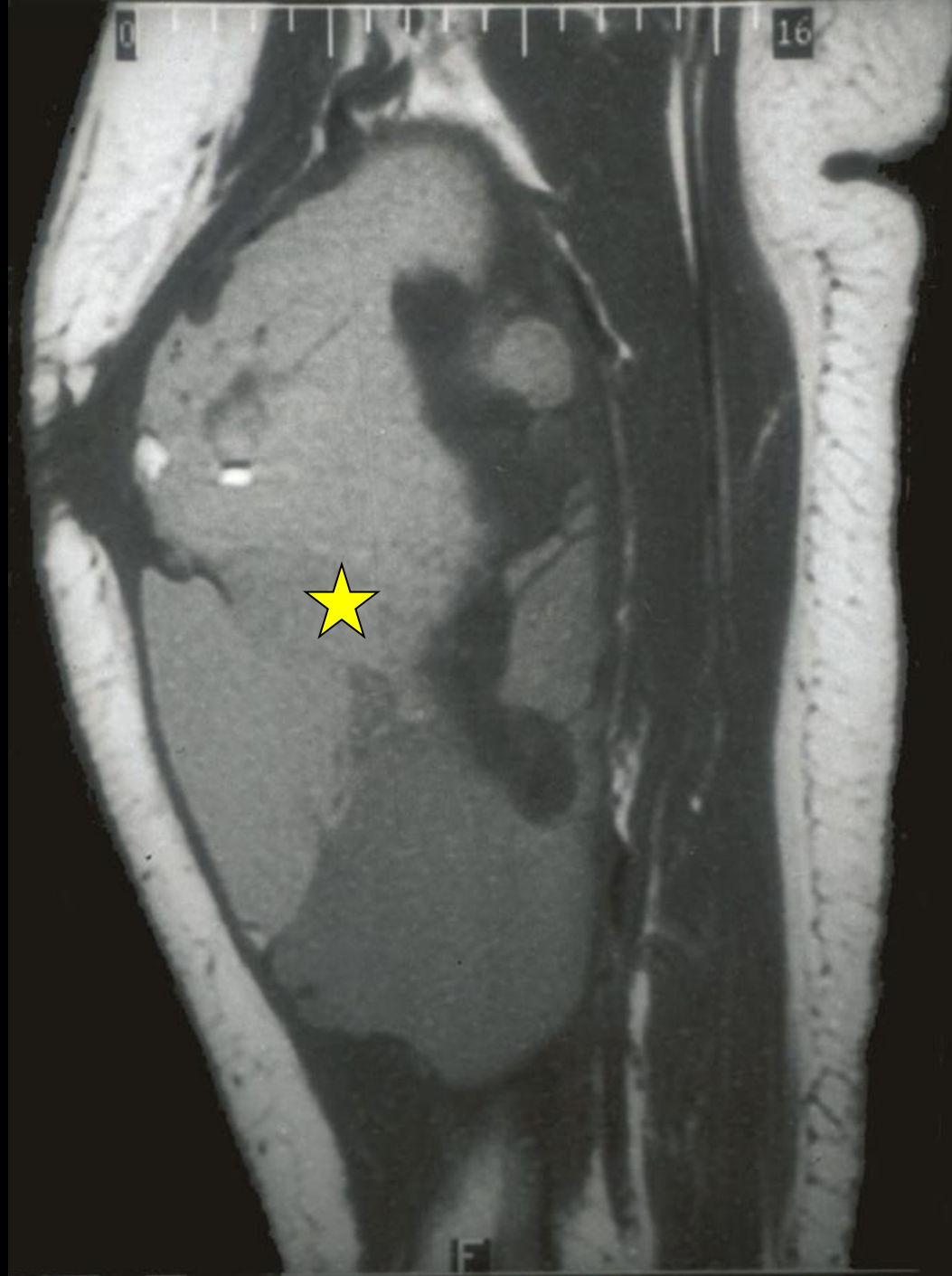




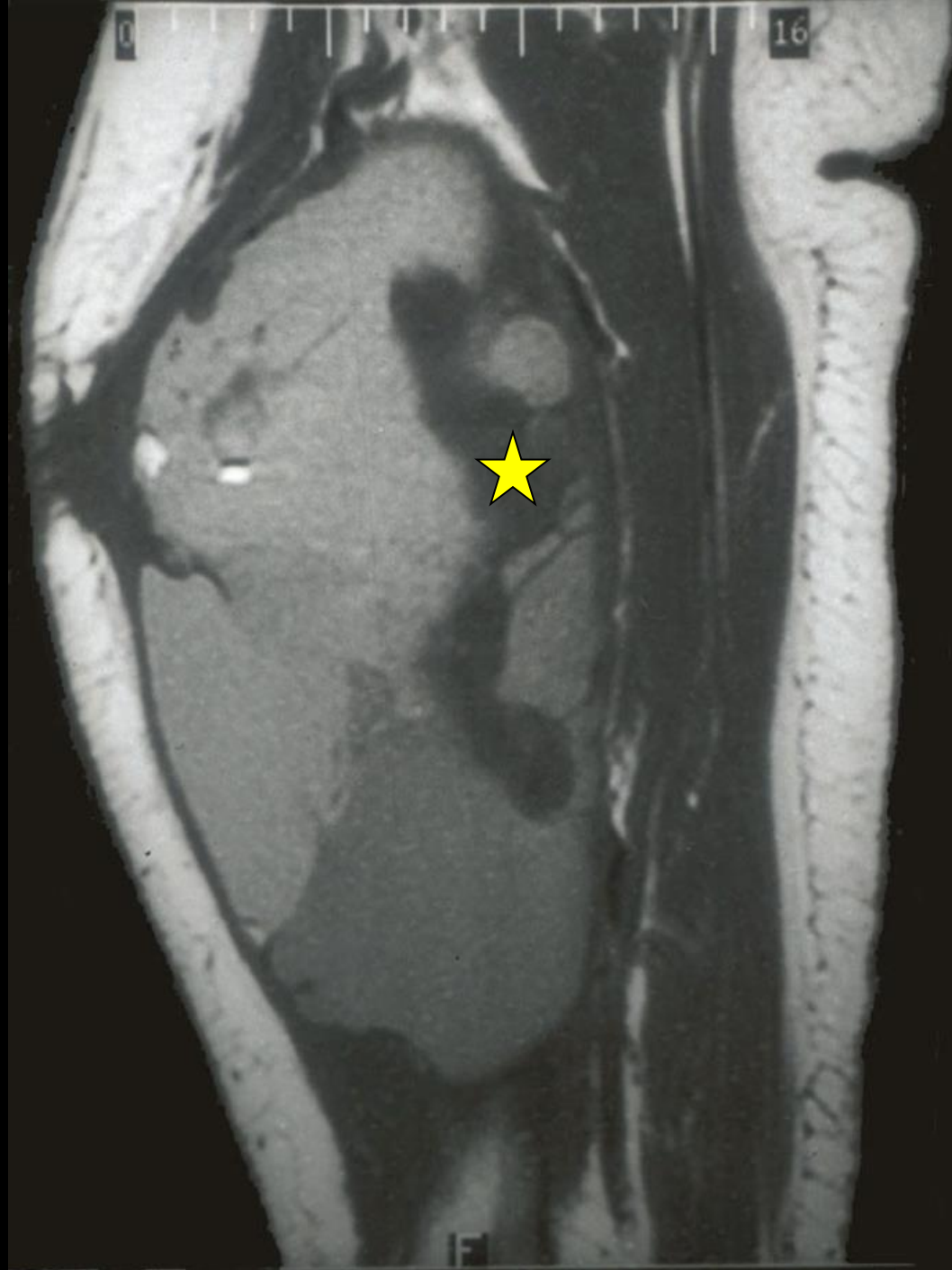




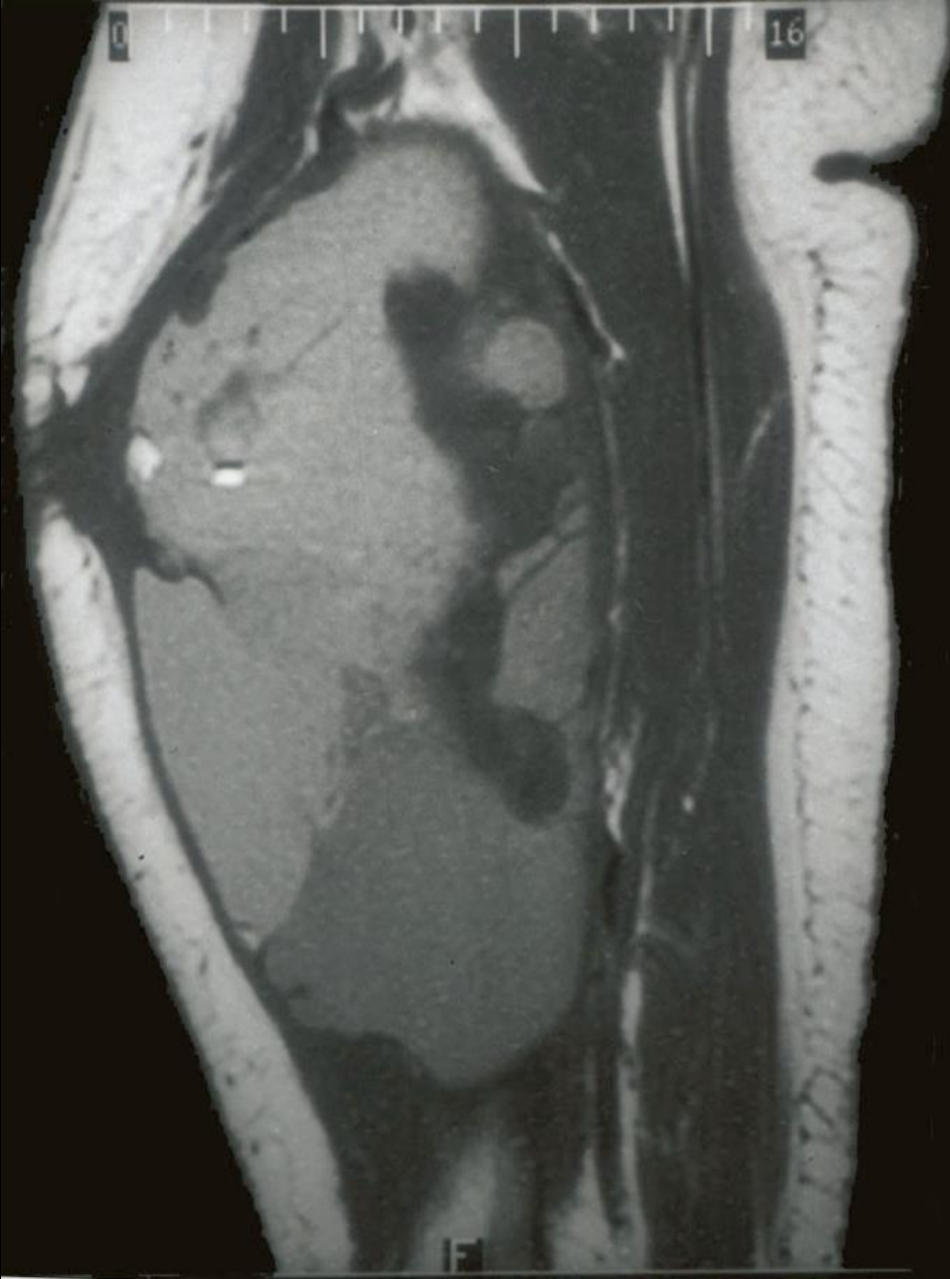
T1



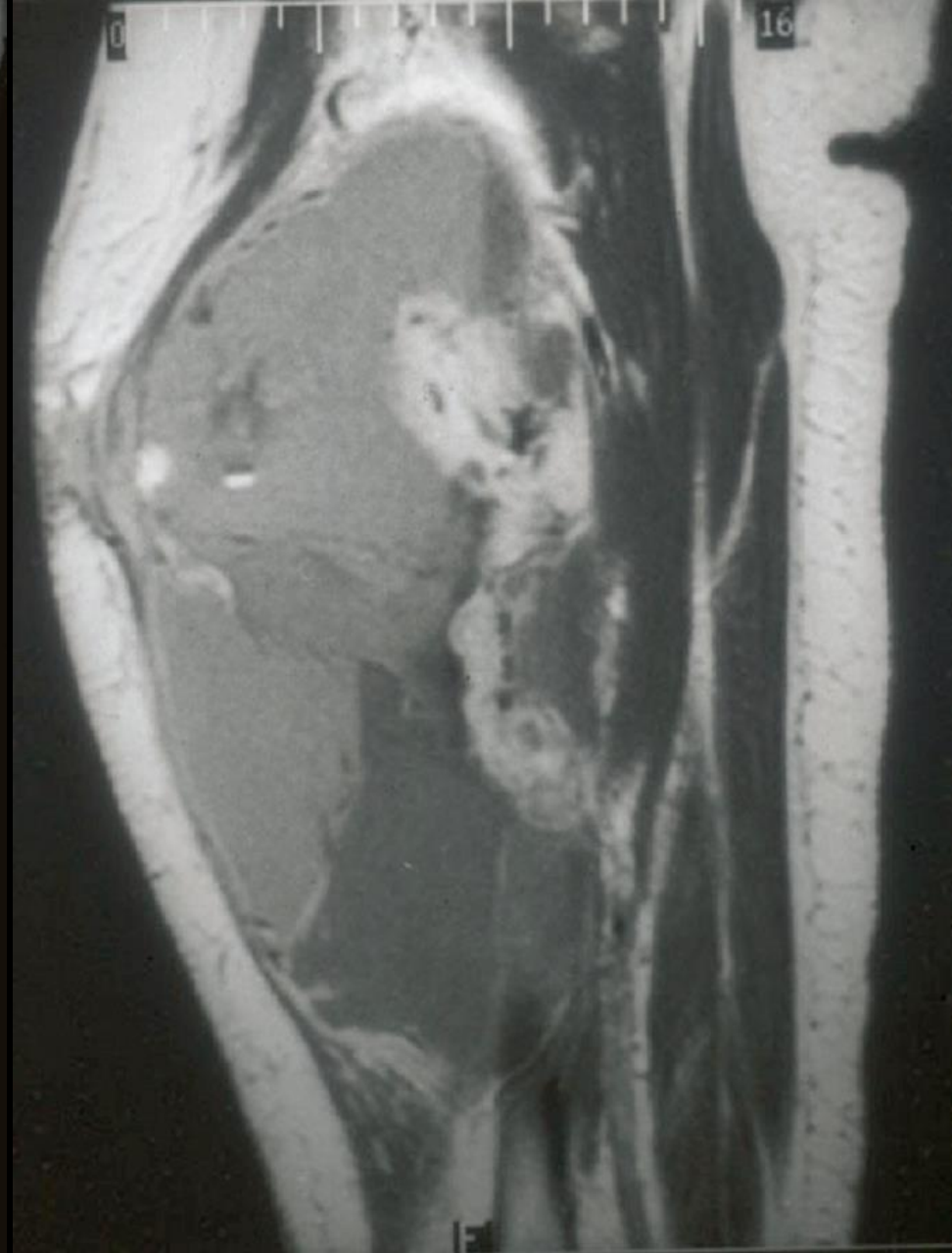
T1



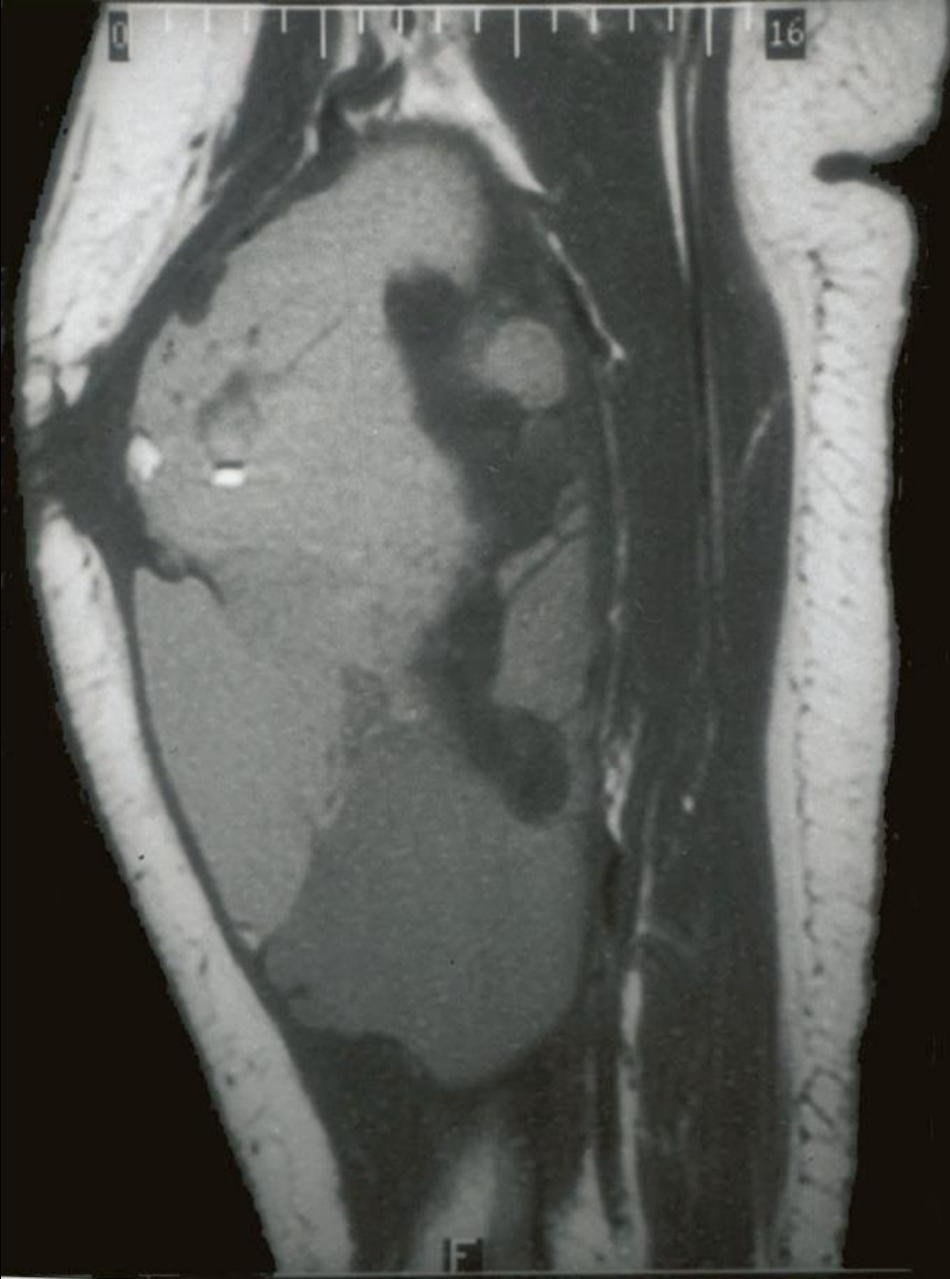
T1



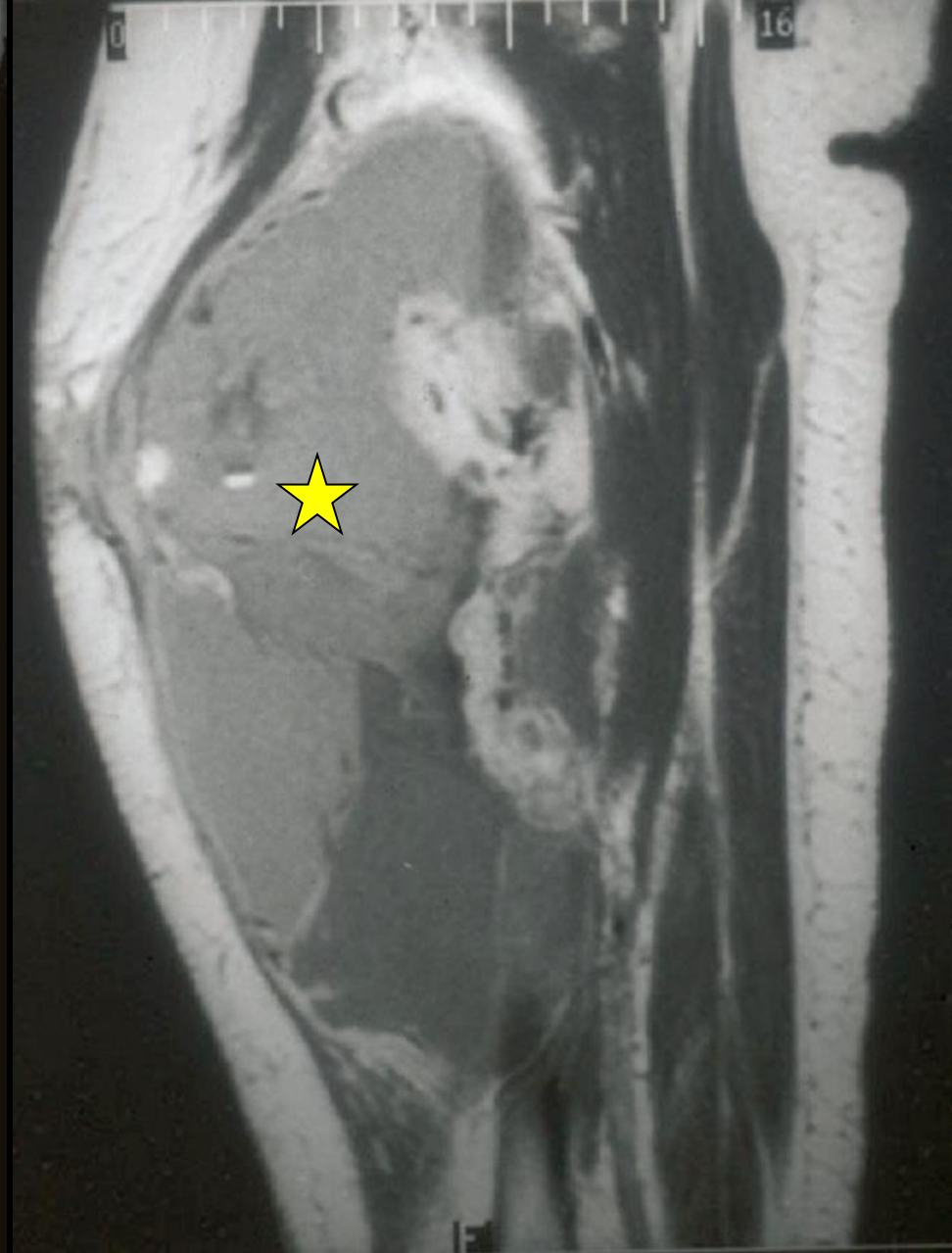
T1



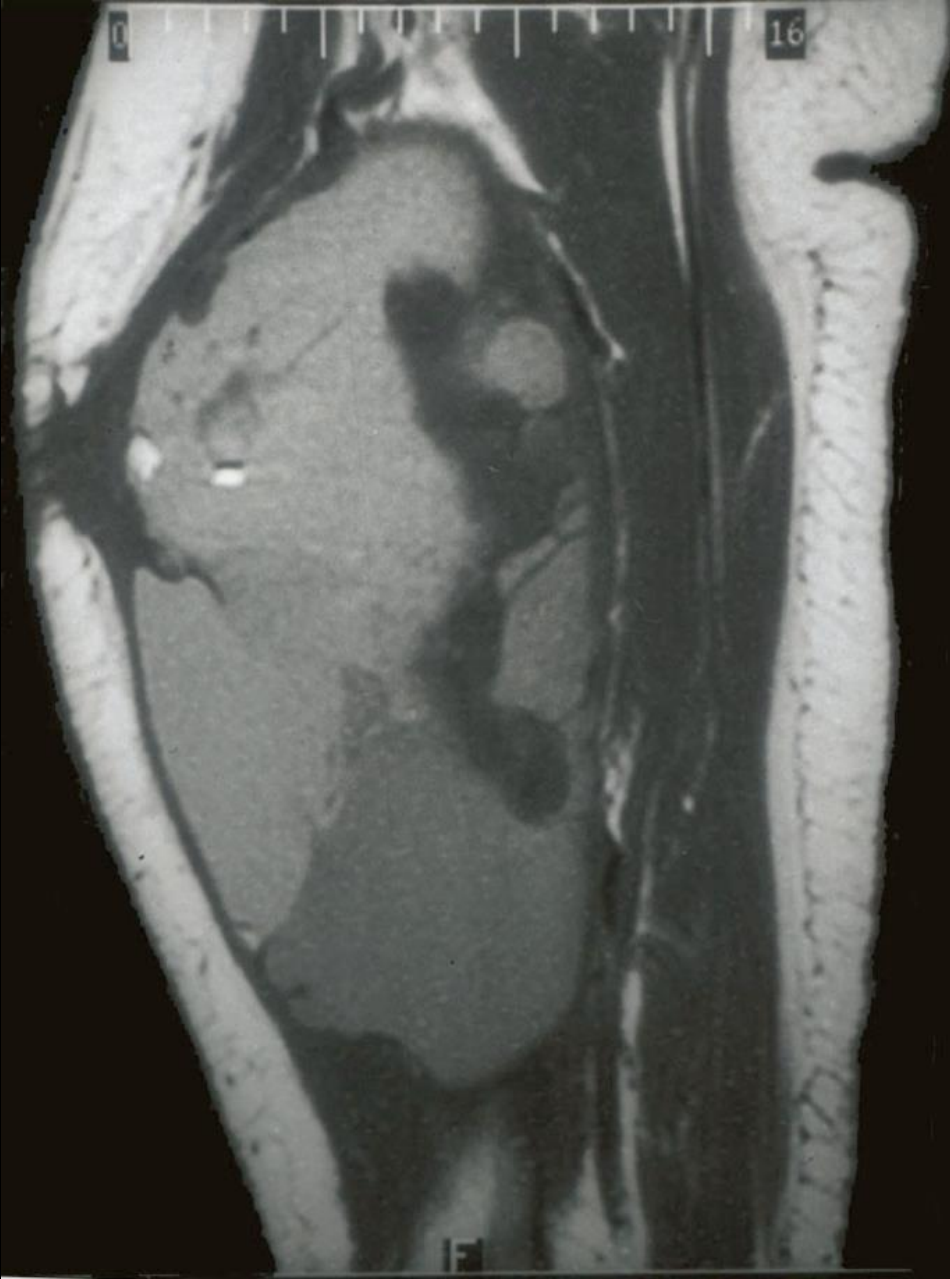
T1 GD



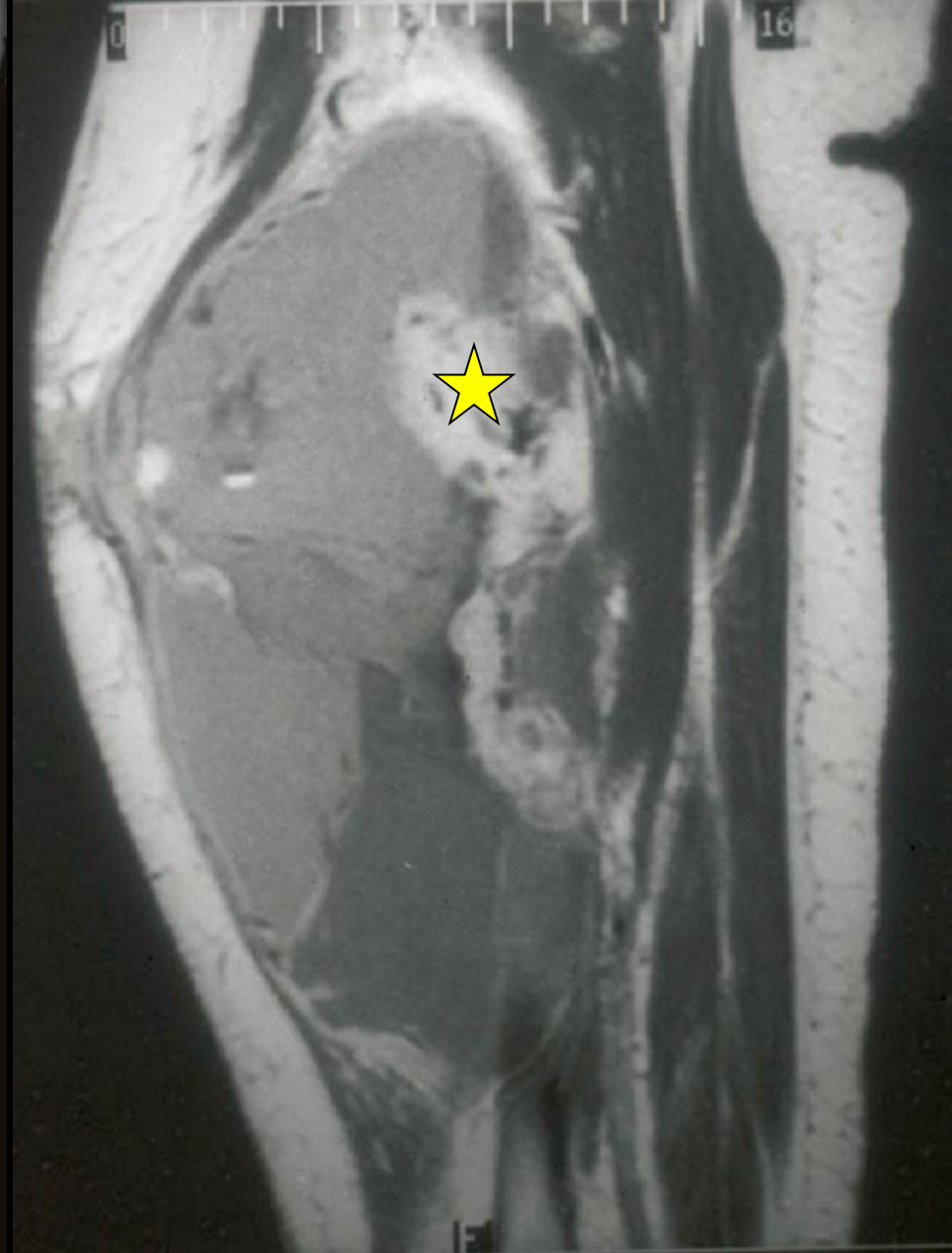
T1



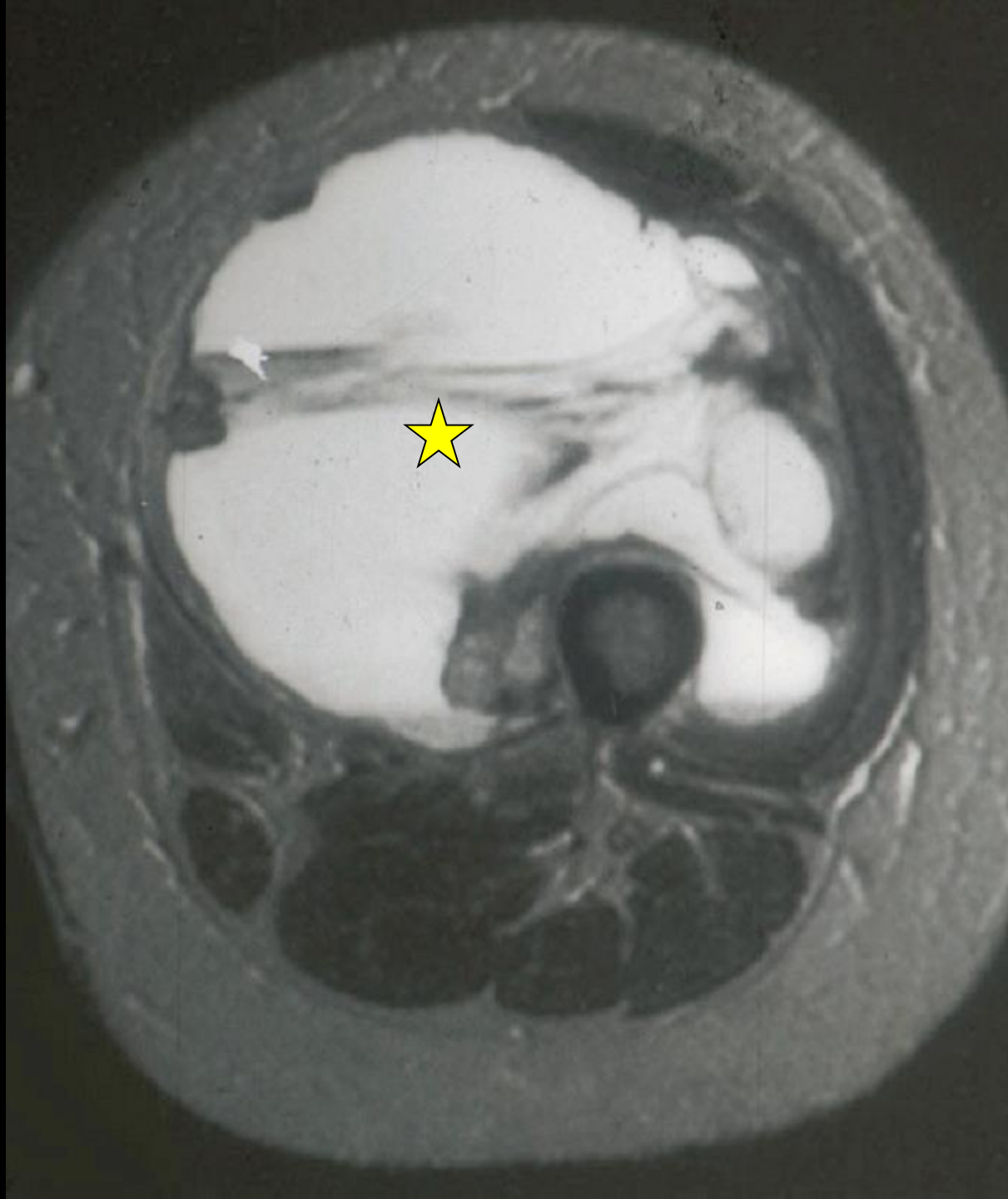
T1 GD



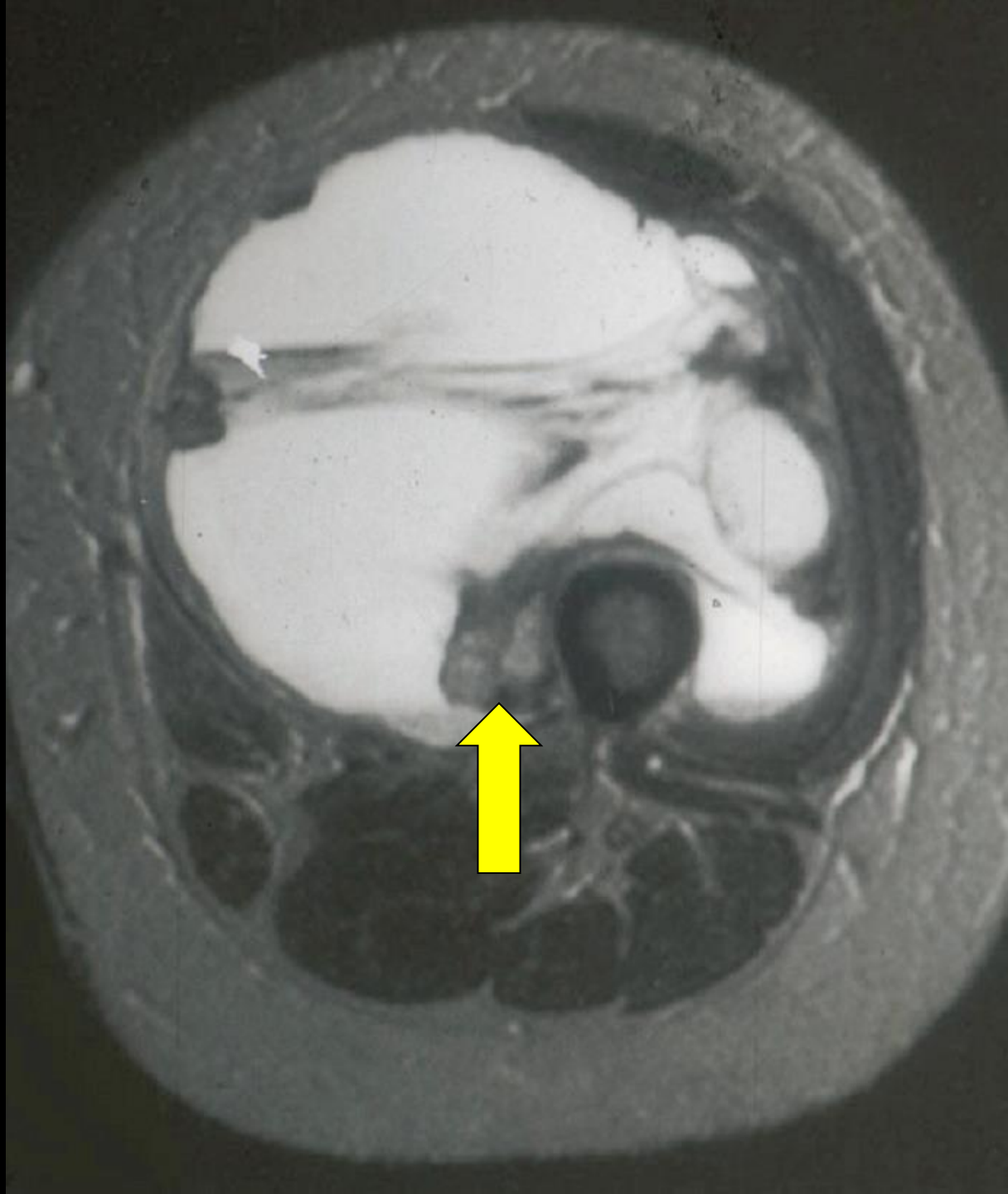
T1



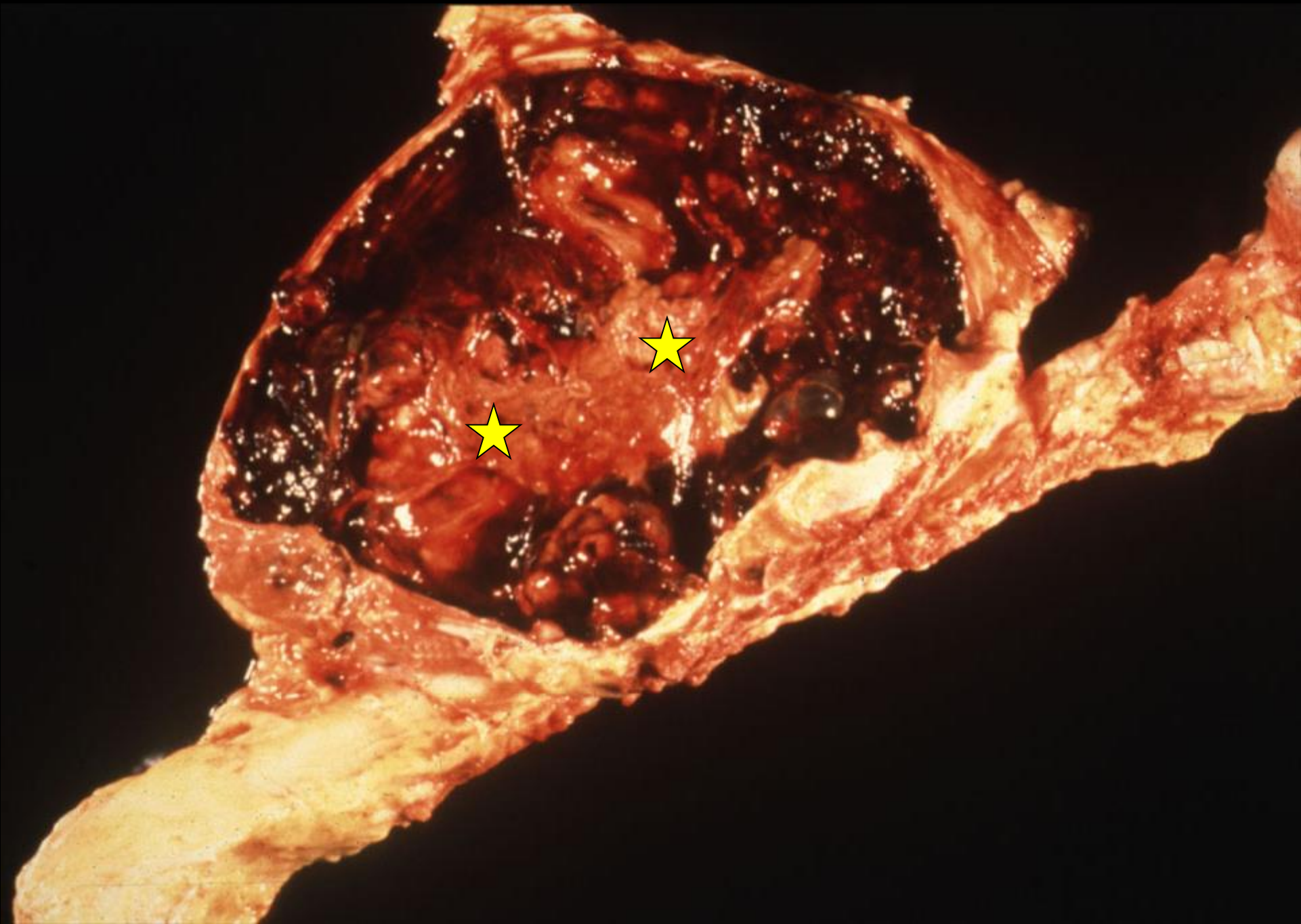
T1 GD

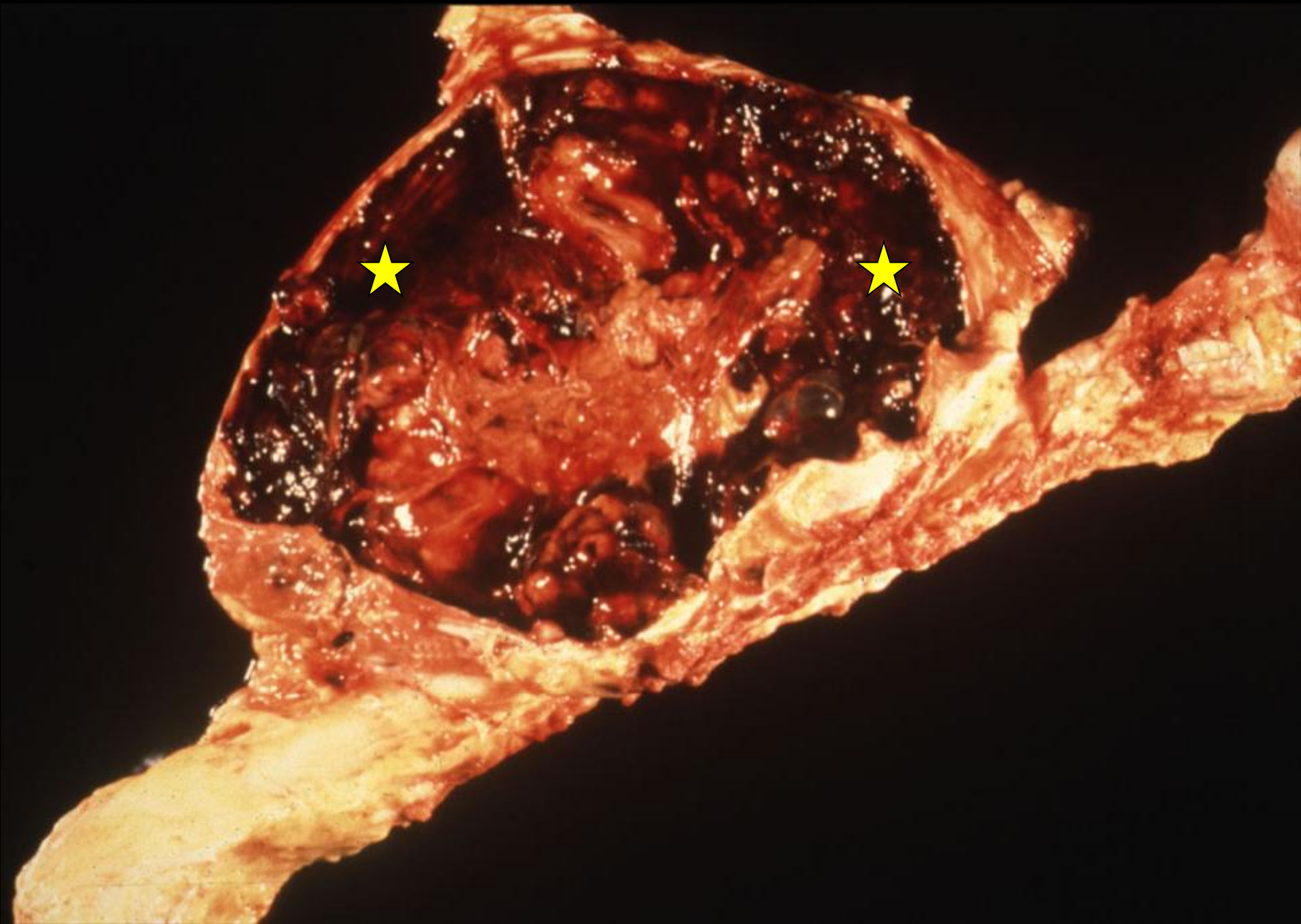


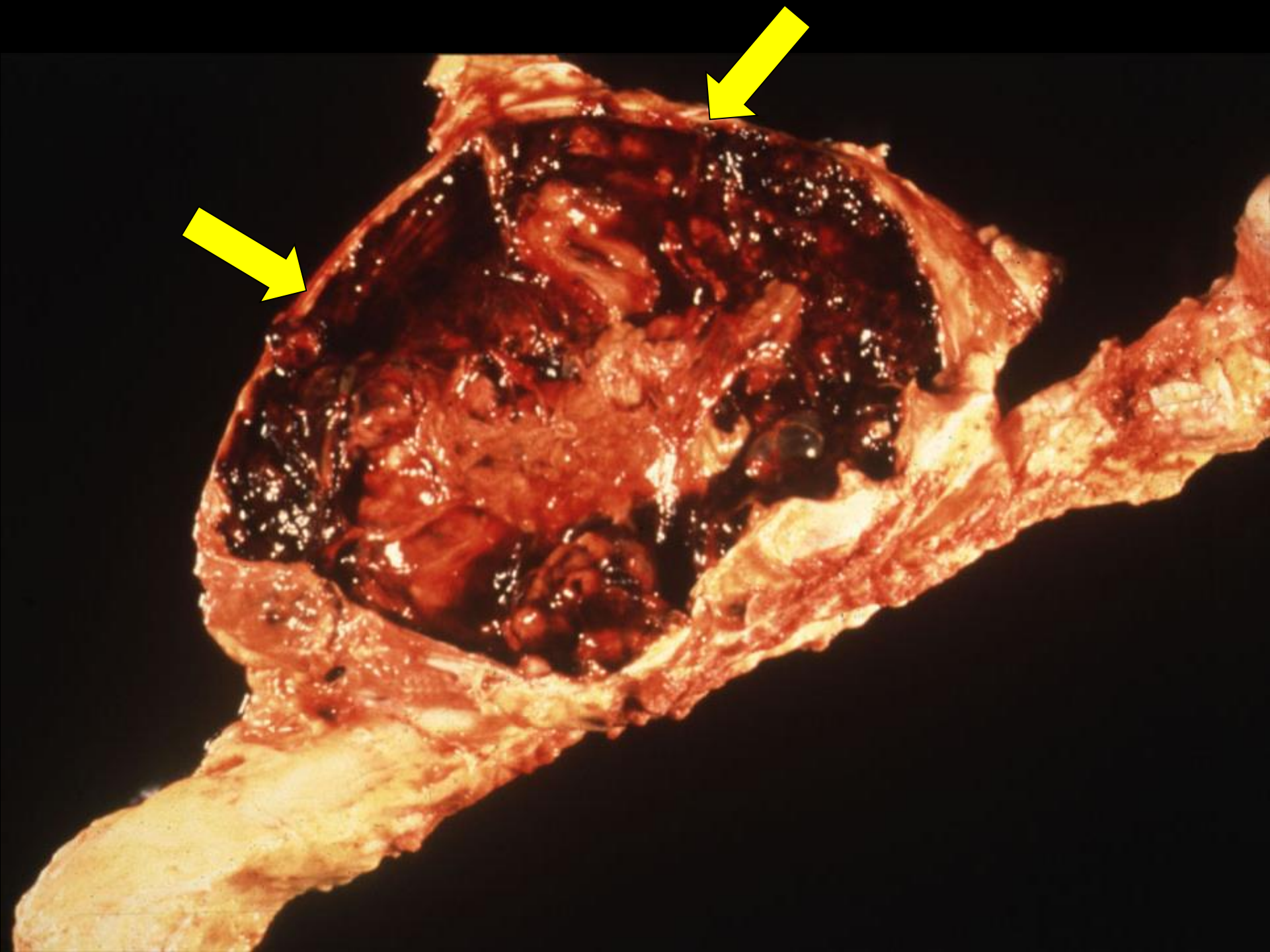
T2



T2







DIFFERENTIATION NEOPLASM VS. HEMATOMA CAN BE VERY DIFFICULT

HEMATOMA

- Hx-trauma or anticoagulants
- Surrounding edema
- Thicker nonnodular wall
- Rim enhancement
- Hemosiderin in wall

TUMOR

- Spontaneous
- No surrounding edema, nodular wall
- Solid nodular enhancing areas
- No hemosiderin in wall

**MAY NEED BIOPSY OR
FOLLOW-UP MRI IF UNCERTAIN**

MRI EVALUATION OF SOFT TISSUE TUMORS

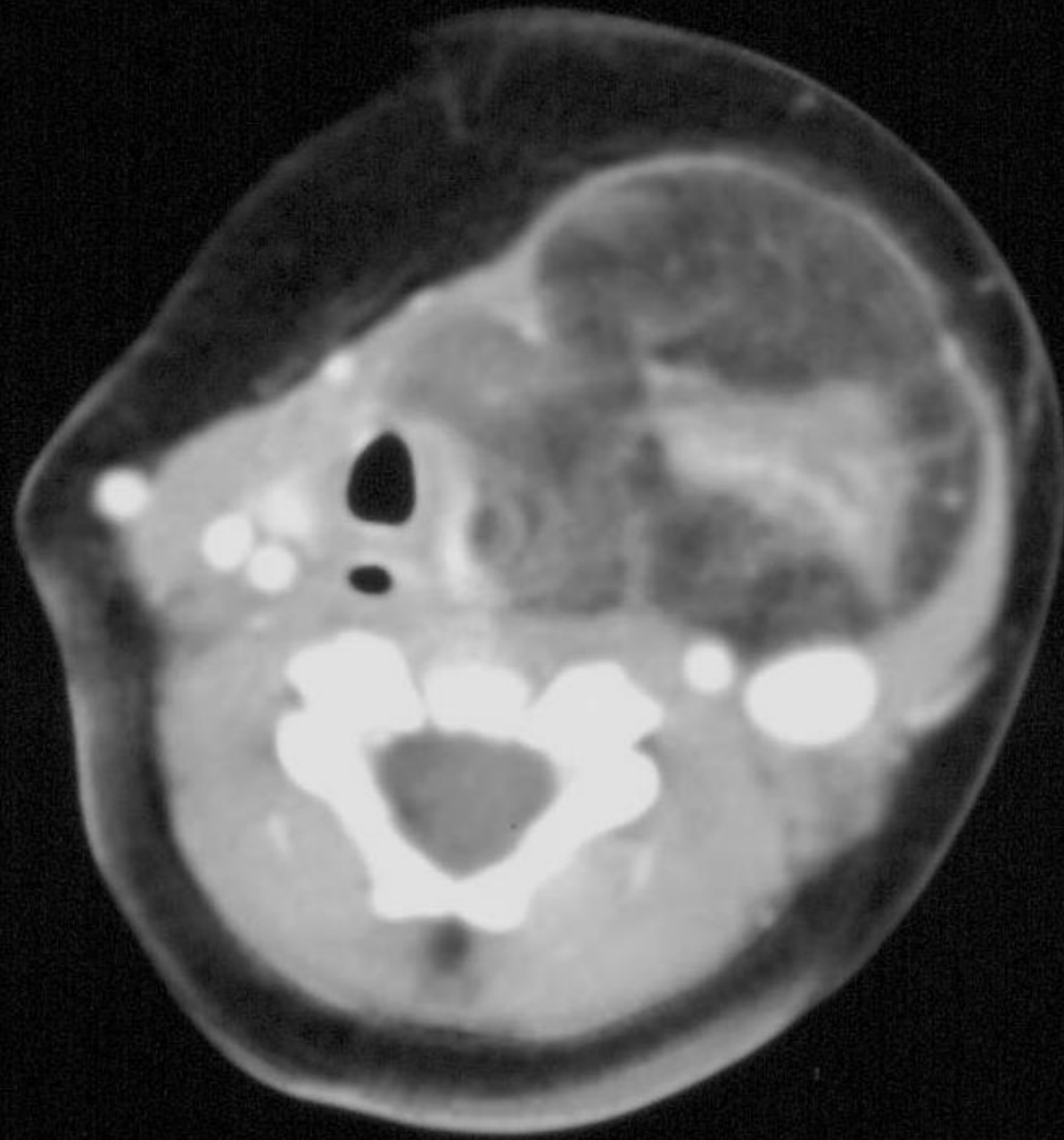
8. HOW TO STAY OUT OF TROUBLE!!

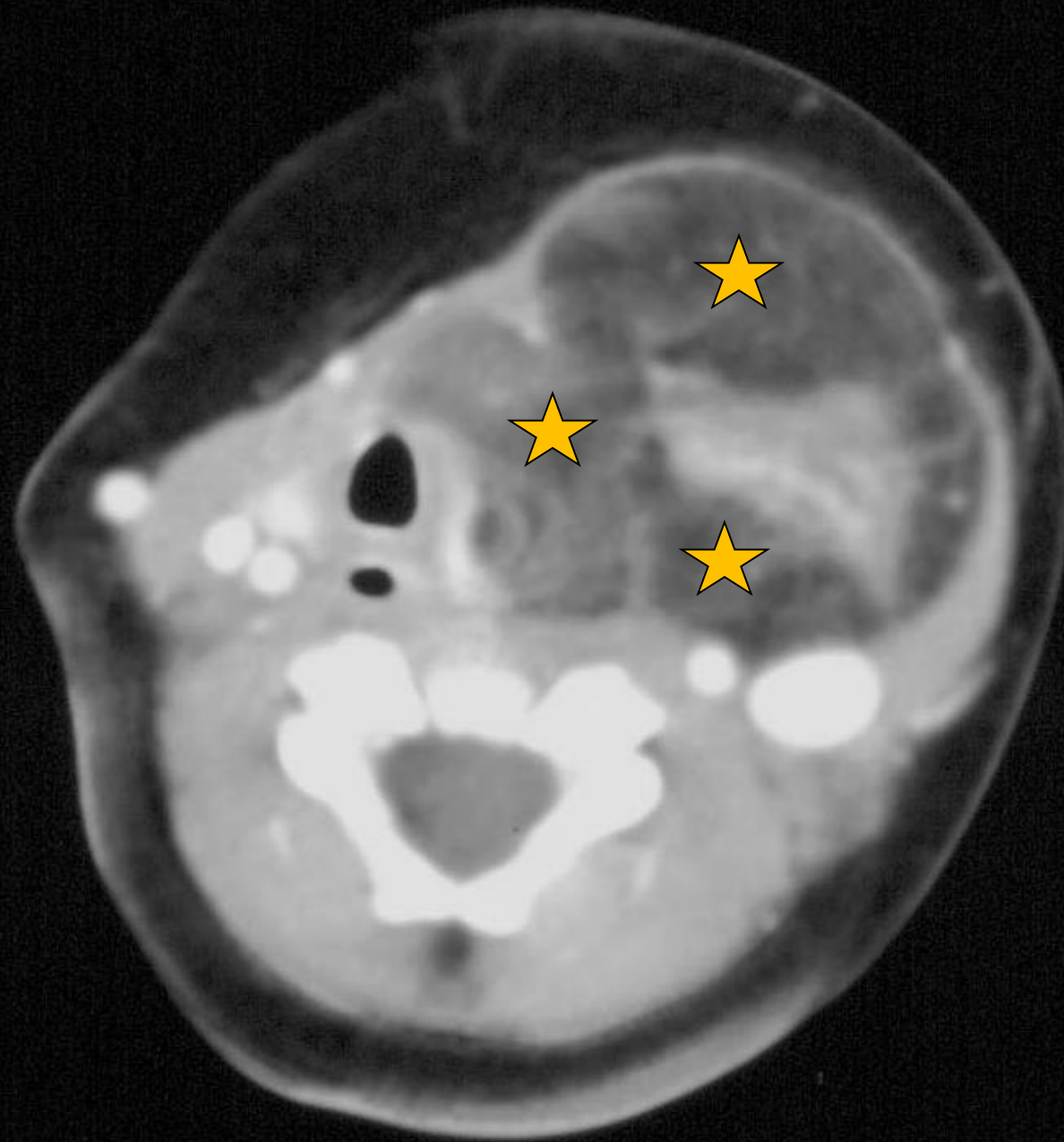
THE DIFFERENTIATION OF NEOPLASM VS. HEMATOMA CAN BE VERY DIFFICULT: a) SPONTANEOUS HEMATOMA HISTORY; b) SOLID ENHANCING AREAS OR NODULAR WALL; c) NO SURROUNDING EDEMA

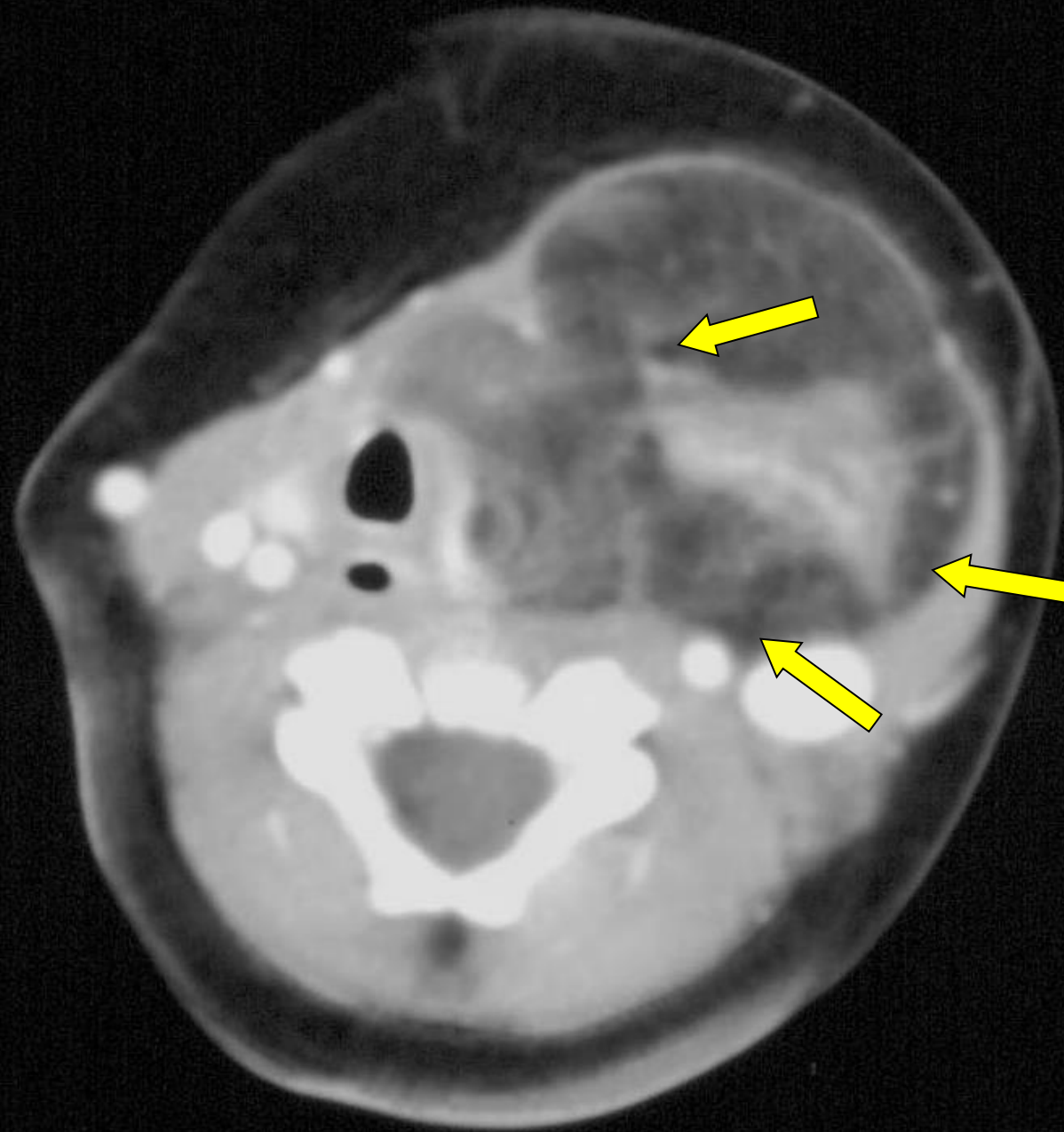
MAY NEED BIOPSY OR FOLLOW-UP MRI IF UNCERTAIN

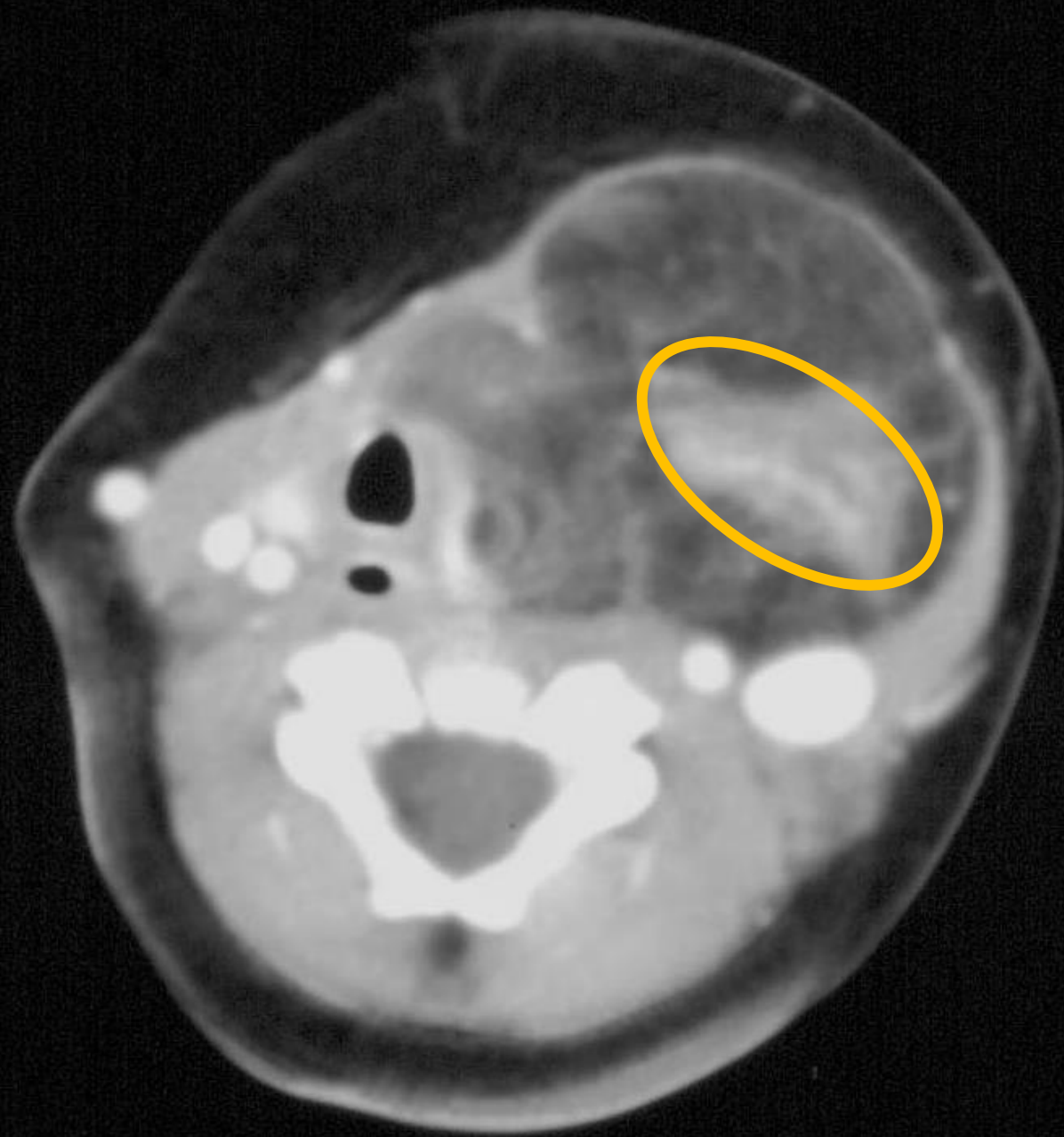
SOFT TISSUE TUMOR: WHERE, WHAT, WHEN

- Where is the lesion?
 - Location, location, location (just like bone tumors!!!)
 - Subcutaneous, Intermuscular, Intramuscular, Intraarticular/Periarticular
- What are the intrinsic imaging characteristics, lesion size and margin?
- When? (patient age)

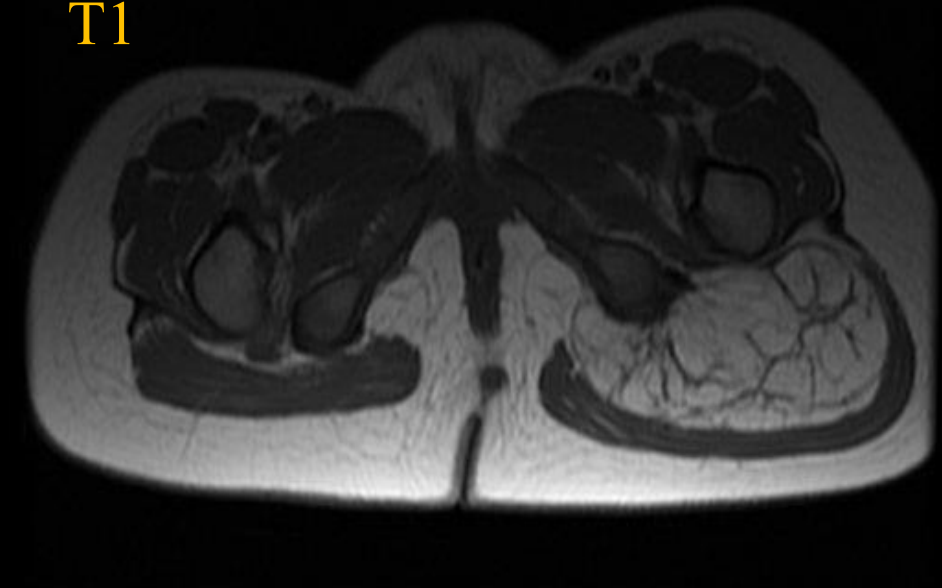




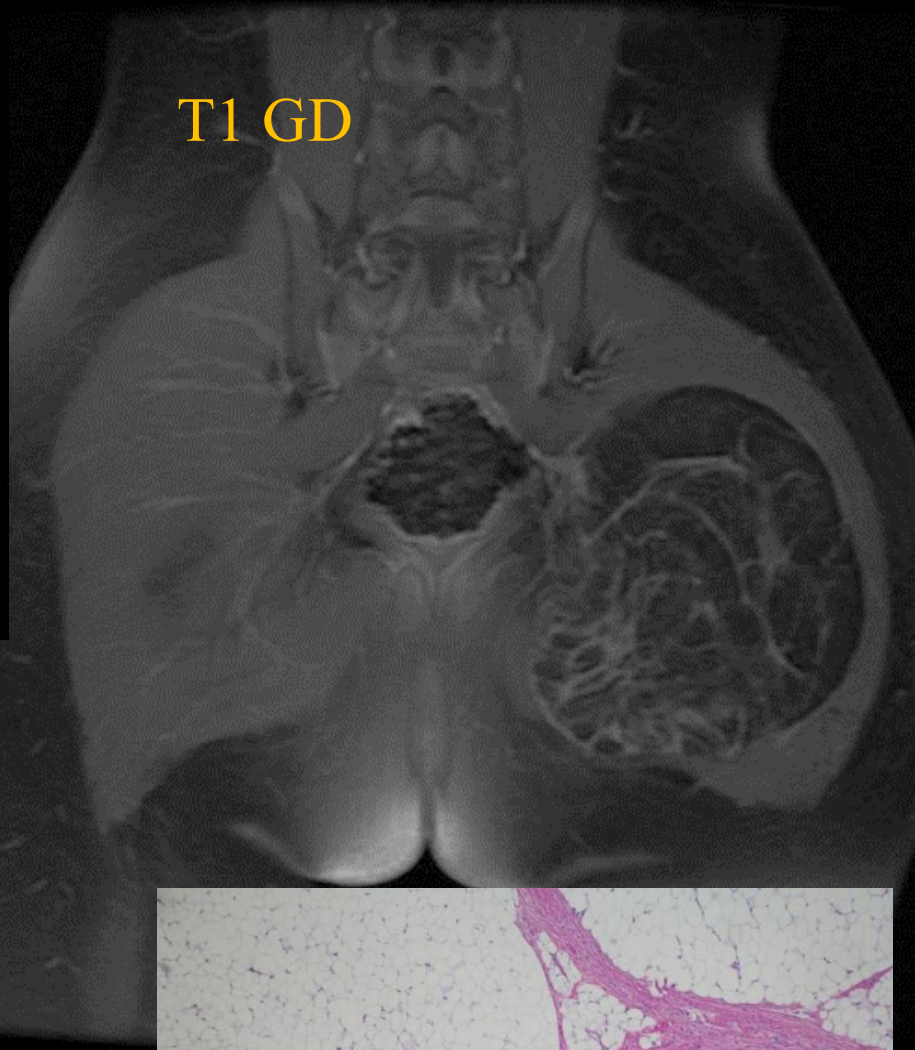




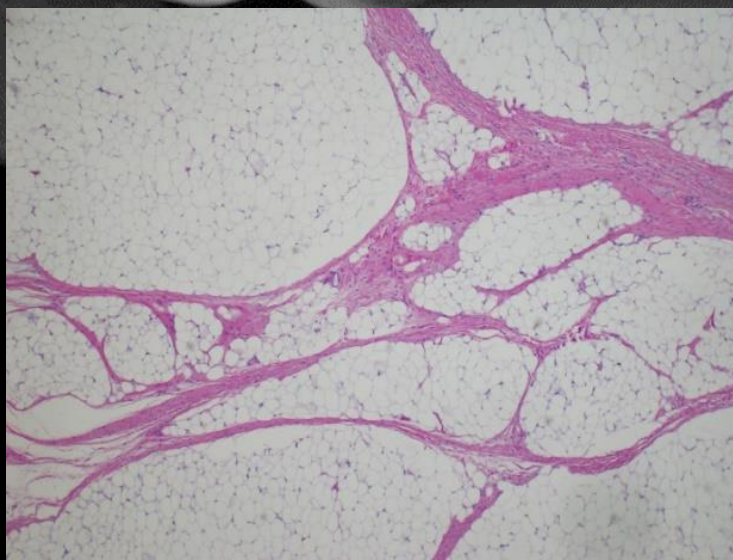
T1



T1 GD



T2



SOFT TISSUE TUMOR DIFFERENTIAL BY AGE: CHILD (<16 YEARS)

- Benign
 - Hemangioma/Vascular malformation
 - Fibromatosis
 - Fibrous histiocytoma
 - Granuloma annulare

SOFT TISSUE TUMOR DIFFERENTIAL BY AGE: CHILD (< 16 YEARS)

- Malignant
 - Fibrosarcoma/(UPS)MFH
 - Synovial sarcoma
 - Rhabdomyosarcoma
 - MPNST

SOFT TISSUE TUMOR DIFFERENTIAL BY AGE: YOUNG ADULT (16-45 YEARS)

- Benign
 - Ganglion
 - Fibrous histiocyctoma
 - Nodular fasciitis
 - Neurogenic neoplasm (Neurilemoma, neurofibroma)
 - Lipoma
 - Hemangioma/Vascular malformation

SOFT TISSUE TUMOR DIFFERENTIAL BY AGE: YOUNG ADULT (16-45 YEARS)

- Malignant
 - UPS (MFH)/Fibrosarcoma
 - Liposarcoma
 - DFSP
 - Synovial sarcoma
 - MPNST

SOFT TISSUE TUMOR DIFFERENTIAL BY AGE: OLDER ADULT (46 YEARS AND UP)

- Benign
 - Ganglion
 - Lipoma
 - Neurogenic neoplasm
 - Fibrous histiocytoma
 - Nodular fasciitis
 - Myxoma

SOFT TISSUE TUMOR DIFFERENTIAL BY AGE: OLDER ADULT (46 YEARS AND UP)

- Malignant
 - UPS (MFH)/Fibrosarcoma
 - Liposarcoma
 - Leiomyosarcoma
 - MPNST
 - DFSP

SOFT TISSUE TUMORS: CONCLUSIONS

- Radiographs and MR imaging is characteristic
- Allowing specific diagnosis 20% - 50% (or 70%-85% my opinion) of soft tissue tumors
- Systematic approach with 3W's
 - WHERE – Subcutaneous, Intermuscular, Intramuscular, Intraarticular/Periarticular, Multifocal/Extensive
 - WHAT – Intrinsic characteristics, effect on surrounding structures, size
 - WHEN – Patient age
 - WHY?

SOFT TISSUE TUMORS: CONCLUSIONS

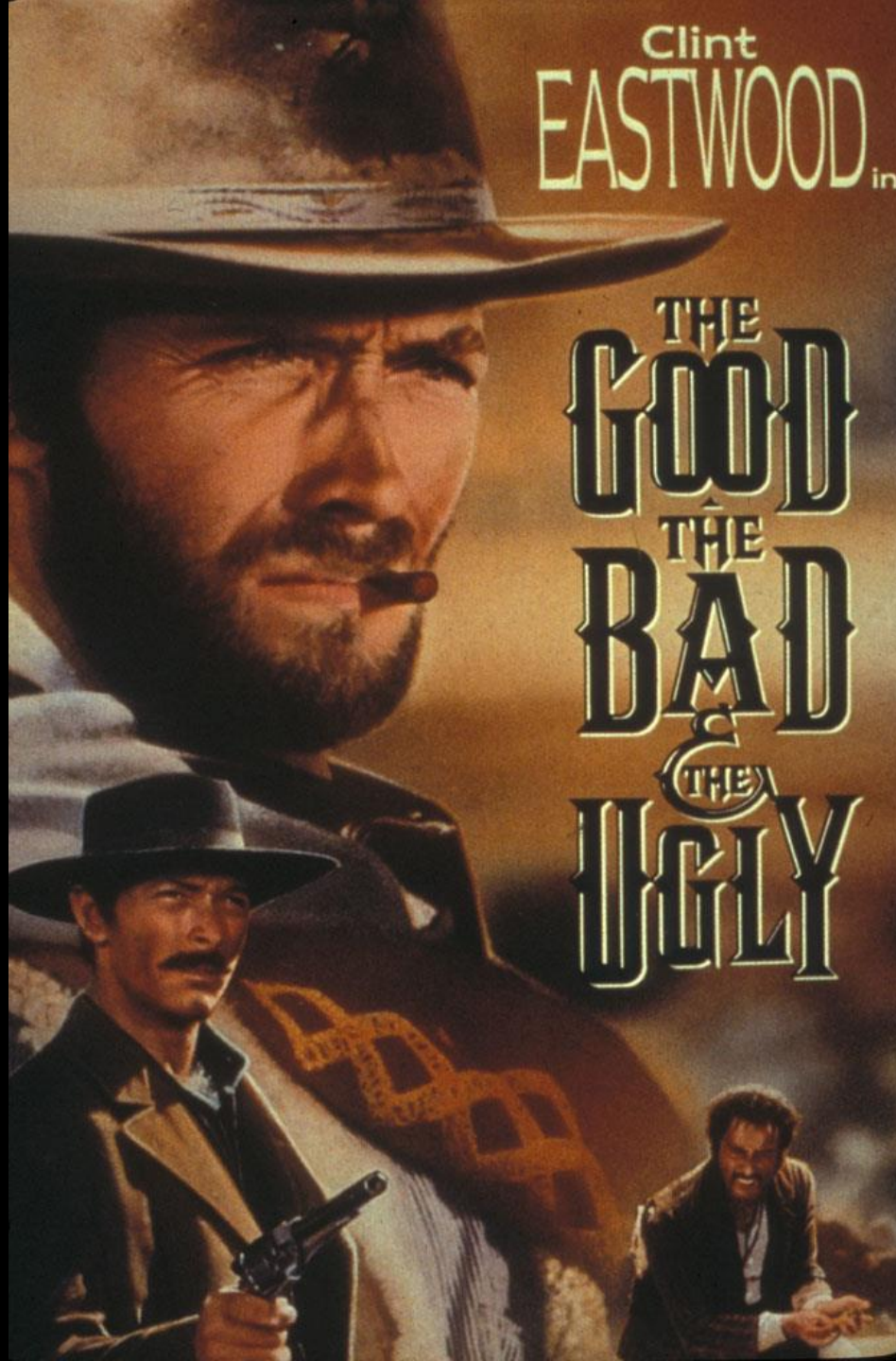
- Nonspecific solid soft tissue mass
 - DELINEATE WITH CONFIDENCE!
 - DIAGNOSIS (BENIGN VS. MALIGNANT)

WITH CAUTION (NEEDS BIOPSY) !

CONCLUSIONS

- Signs
- Intrinsic characteristics
- Morphology
- Patient age
- Location
- Extent

KEEP IT SIMPLE !!!



MRI EVALUATION OF SOFT TISSUE TUMORS

HOW TO STAY OUT OF TROUBLE!!

IMAGING OF SOFT TISSUE TUMORS: A SYSTEMATIC APPROACH

Mark D. Murphey MD, FACR

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Professor of Radiology Uniformed Services University of the Health Sciences
Staff Radiologist Musculoskeletal Section,
Walter Reed National Military Medical Center, Bethesda, Maryland

