

IMAGING OF ARTHRITIS

Mark D. Murphey MD, FACR

Physician-in-Chief and Chief, Musculoskeletal Imaging AIRP
Professor of Radiology Uniformed Services University of the Health Sciences
Staff Radiologist Musculoskeletal Section,
Walter Reed National Military Medical Center, Bethesda, Maryland



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LEARNING OBJECTIVES

- Review inflammatory arthritis imaging appearances
- Radiographic approach
- The “one sentence summary statement for diagnosis”
- Discuss the importance of cross-sectional imaging to guide therapy and why/when it used

RHEUMATOID ARTHRITIS

- More common in women 2-4:1
- Age 25 to 50 years; Equal after age 40
- Incidence 0.2–0.4/1,000 women
- Prevalence 0.5–1.0%; 2.1 million in US
- Genetic influence HLA - DR4, HLA-DRB1
- Smoking – particularly ACPA+; Doubles risk
- Clinical syndrome
 - Multiple disease subsets
 - Inflammatory disease cascades to joint destruction

RHEUMATOID ARTHRITIS

DIAGNOSTIC CRITERIA (1987)

- Morning stiffness – 3 or more joints
- Hand arthritis
- Symmetric arthritis
- Rheumatoid nodules
- Rheumatoid factor positive (30% negative)
(anti-CCP higher specificity)
- Radiographic changes

Four criteria for diagnosis
(only 52% meet criteria at presentation)

RA Diagnostic Criteria ACR/EULAR 2010

1. Joint involvement (0-5)
 - 1 medium to large joint (0)
 - 2 medium to large joints (1)
 - 1-3 small joints (large joints not counted) (2)
 - 4-10 small joints (large joints not counted) (3)
 - >10 ten joints (at least one small) (5)
2. Serology (0-3)
 - Neg RF and Neg ACPA (0)
 - Low + RF or low + ACPA (2)
 - High + RF or high + ACPA (3)
3. Acute Phase Reactants (0-1)
 - Normal CRP and ESR (0)
 - Abnormal ESR or CRP (1)
4. Duration of symptoms (0-1)
 - <6 weeks (0)
 - >6 weeks (1)

RA if ≥ 6 points
OR

Typical erosive
disease on
imaging

Earlier diagnosis of RA

RHEUMATOID ARTHRITIS EROSIONS

- Majority of erosions develop during the first 2 years in RA
- Majority of erosions develop during the first 6 months in patients with aggressive disease
- Presence of erosions in early RA typically requires aggressive treatment
- **Mandatory to magnify your radiographs!!!!!!!!!!**

ROLE OF IMAGING IN RA DIAGNOSIS/MANAGEMENT

- Confirmation and characterization
- Differential diagnosis
- Management
- Evaluating synovitis
 - US and MRI – poor interobserver reliability
 - High NPV of US
- Evaluation of erosions – US and MRI

RHEUMATOID ARTHRITIS

- Symmetric (fusiform) joint swelling
- Diffuse/juxtaarticular osteopenia
- Symmetric joint narrowing
- Subluxations
- Aggressive erosion (marginal) (<20%-25% at presentation)
- No bone formation

RHEUMATOID ARTHRITIS DISTRIBUTION

- PIP/MCP joints-hands (100%)
- MTP joints foot (5th) (80%-90%)
- Carpus/Tarsus may see osseous ankylosis
- Hips (50%) – axial narrowing
- Knees (80%) – all compartments, Baker cyst
- Shoulder (60%) – erosion, RC tear
- C-spine (12%-33%) – atlantoaxial



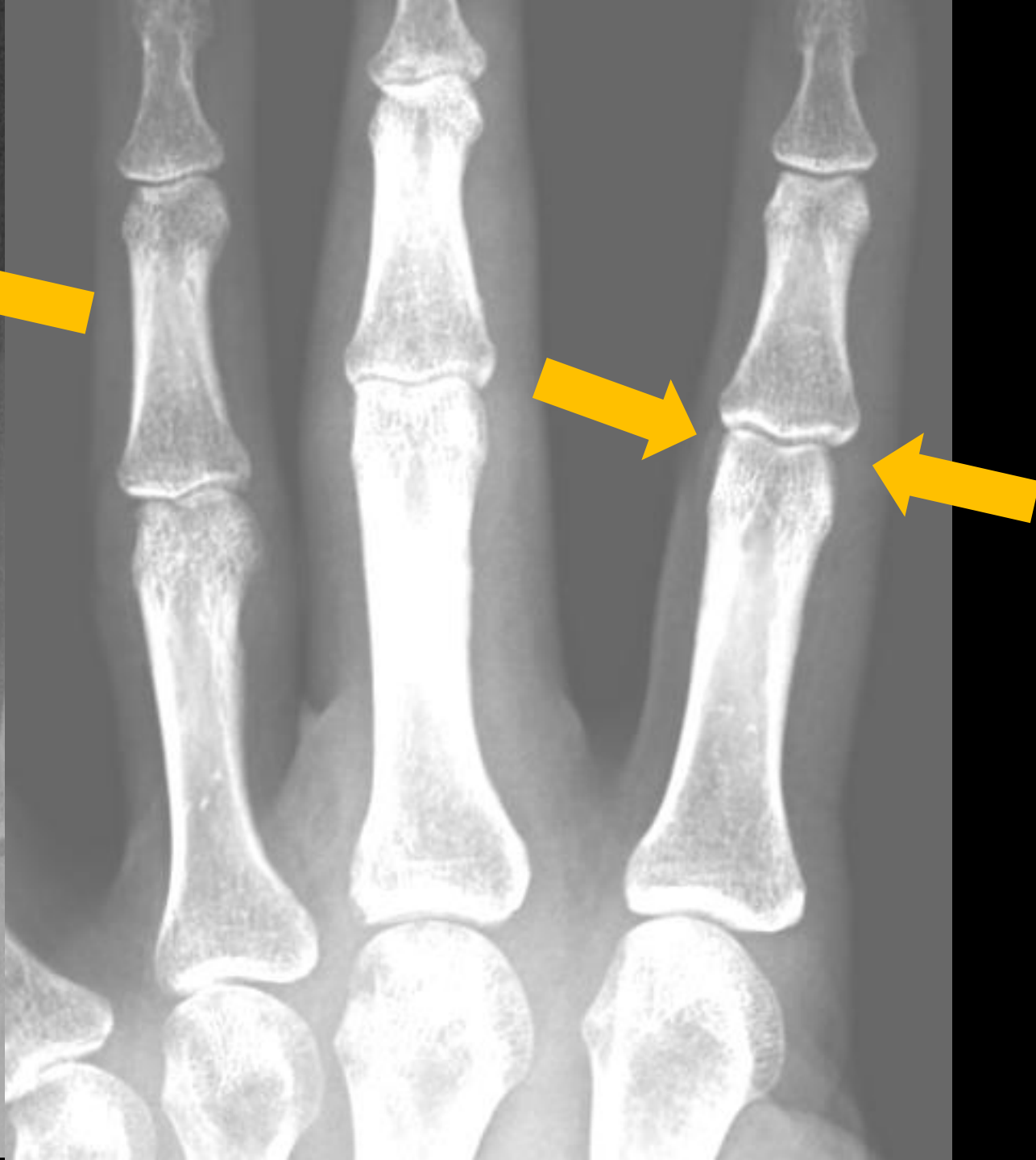


STEVEN SPIELBERG Presents

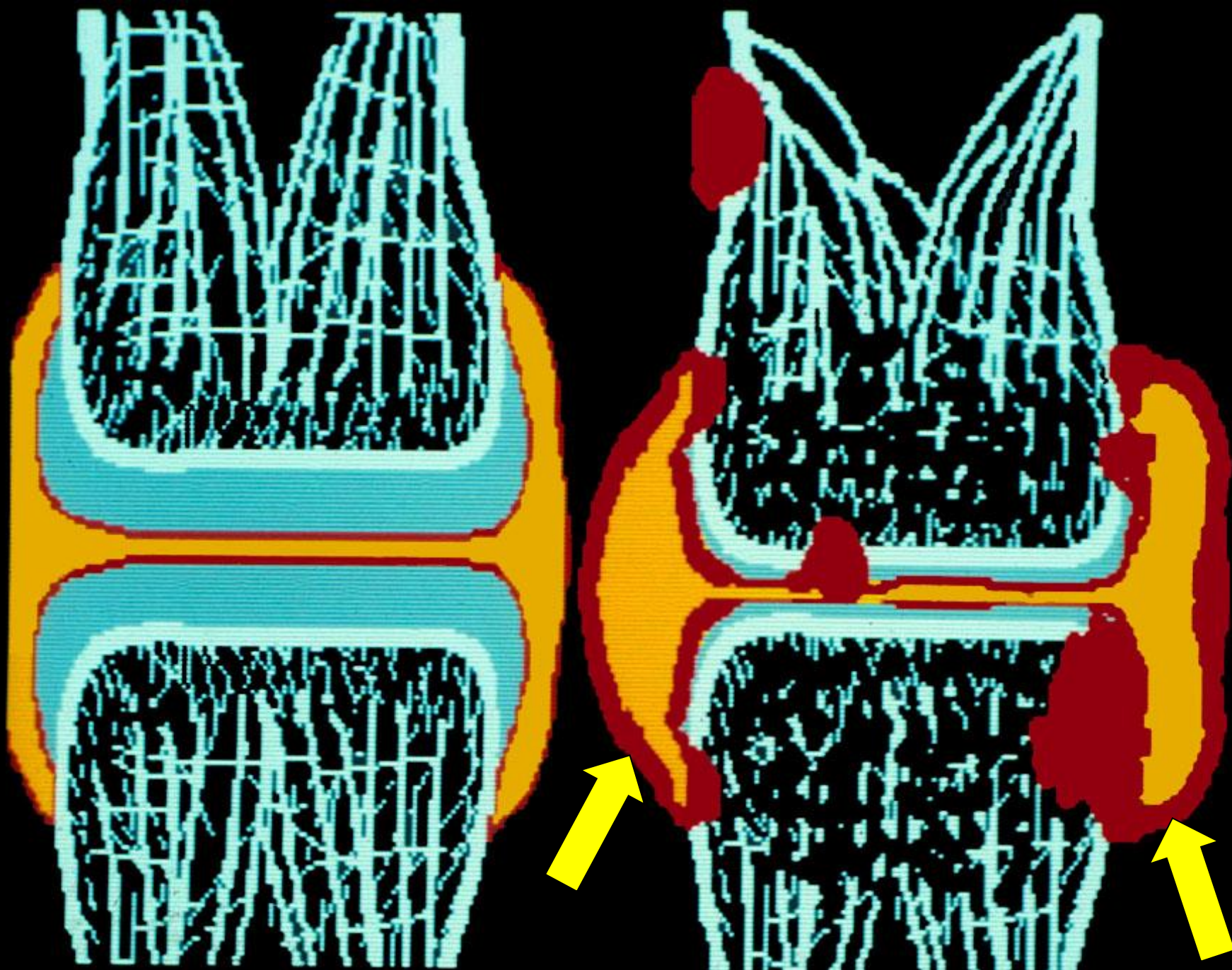
BACK TO THE FUTURE™

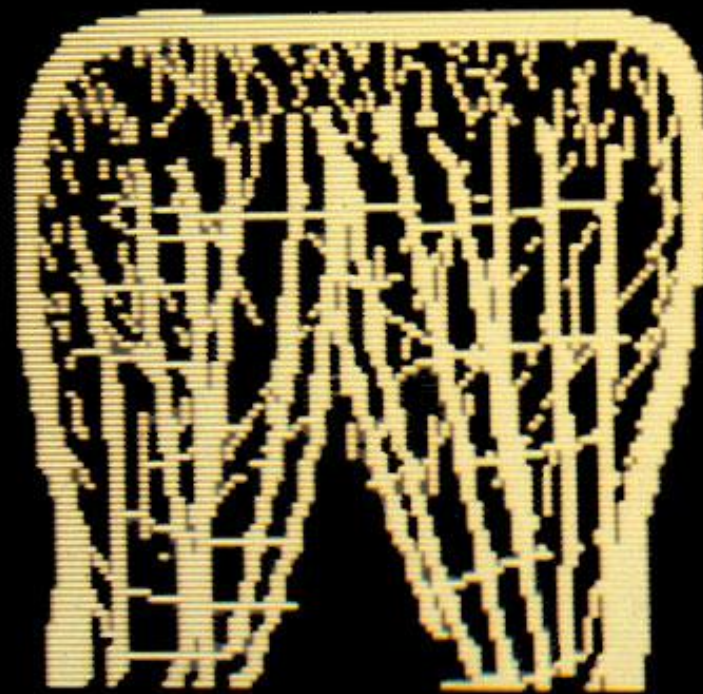
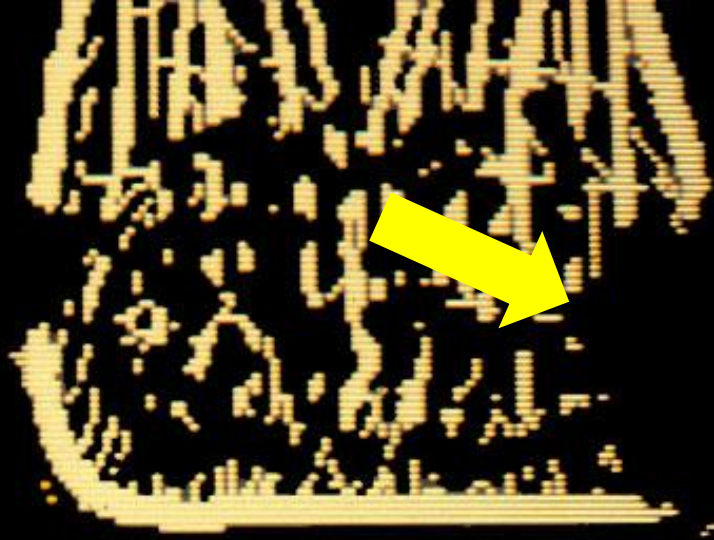




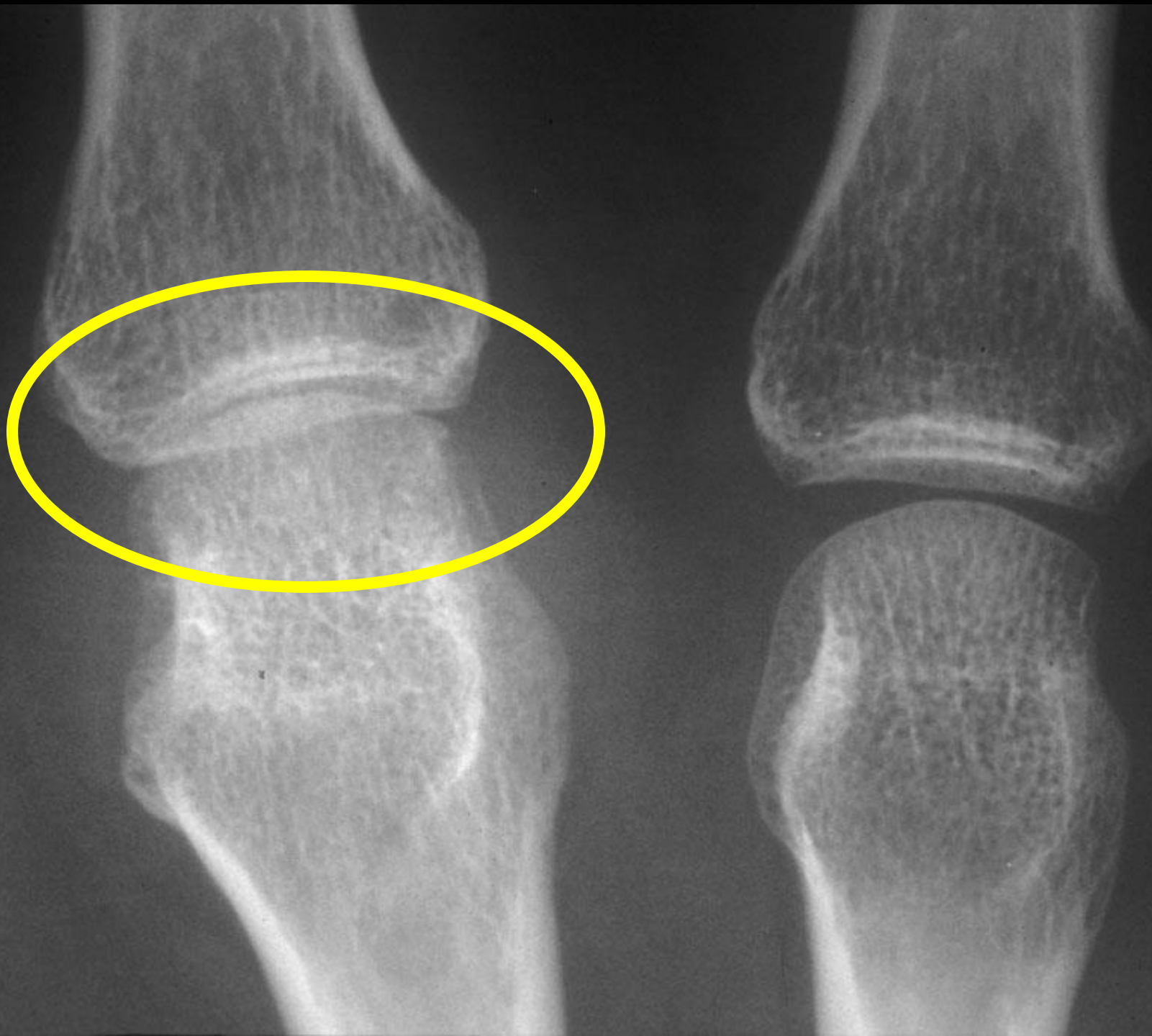




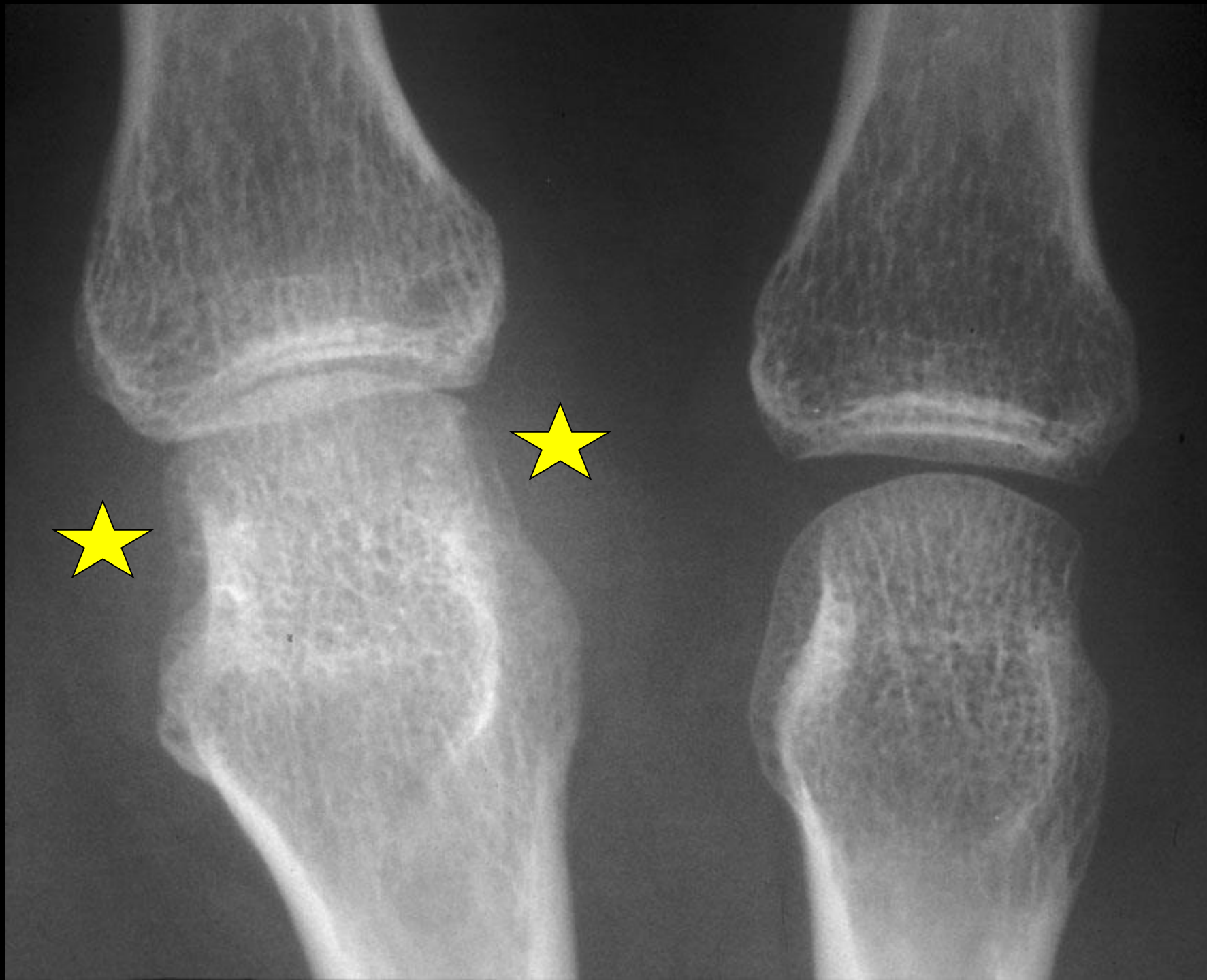


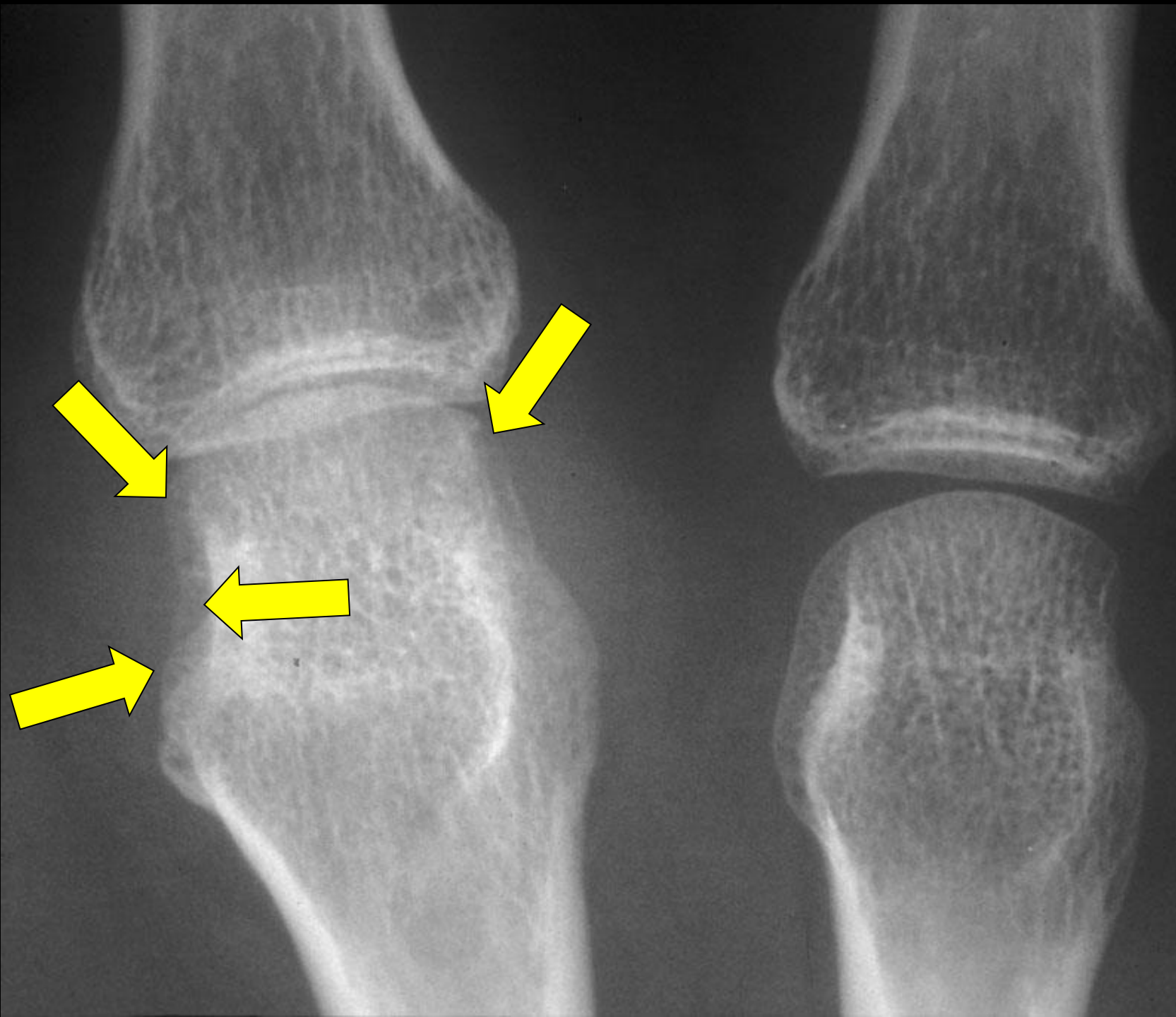


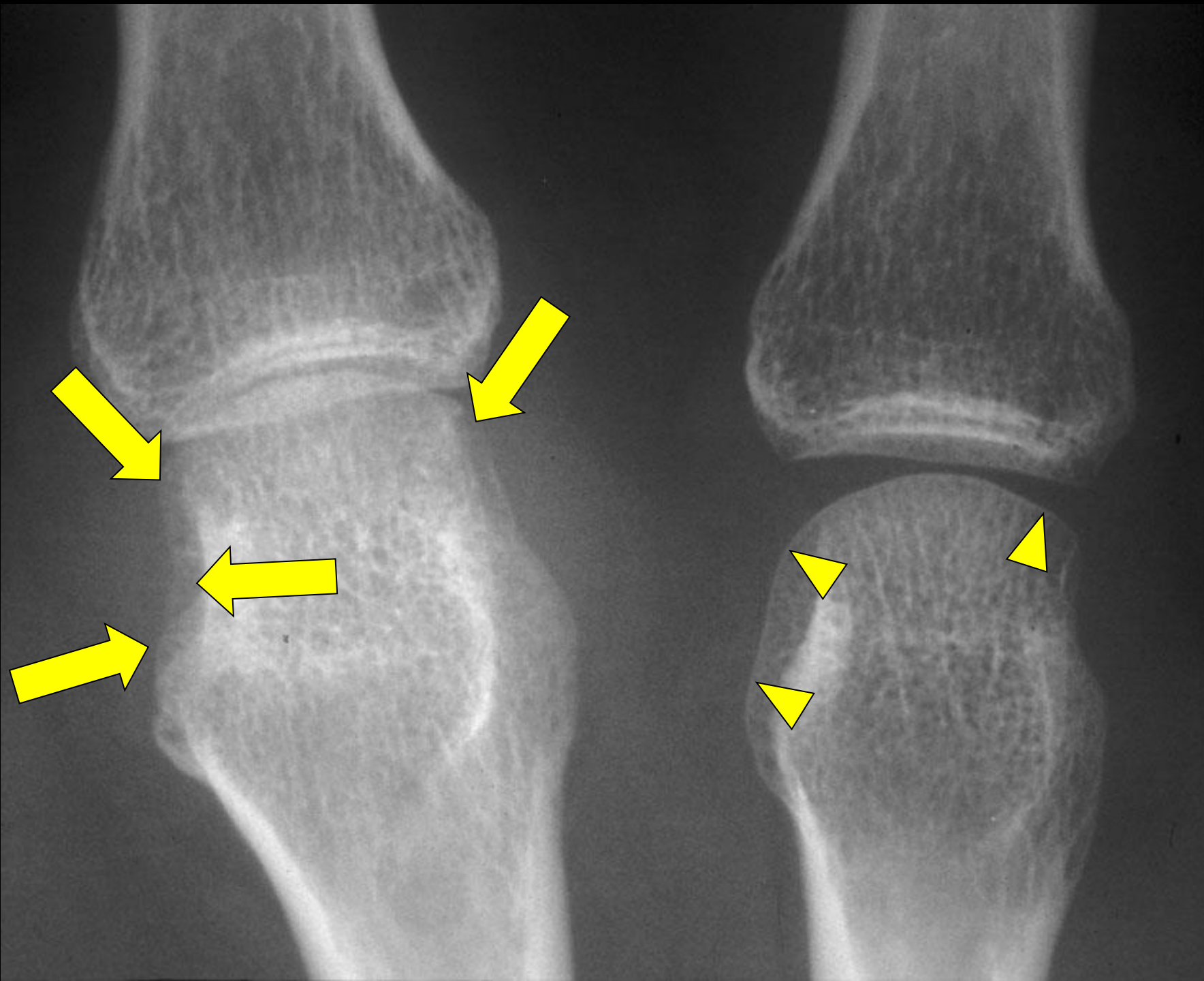


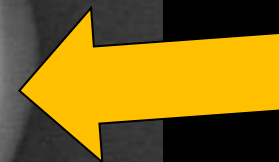
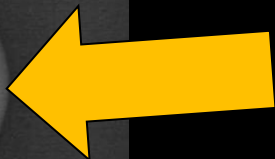




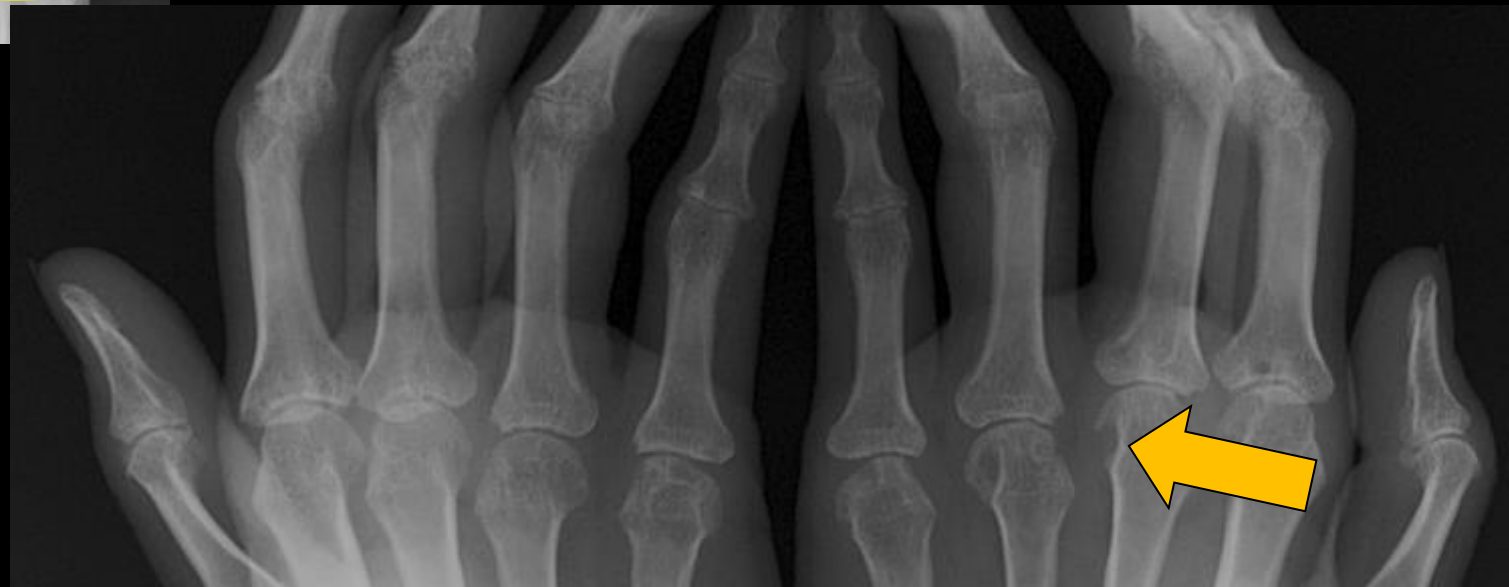
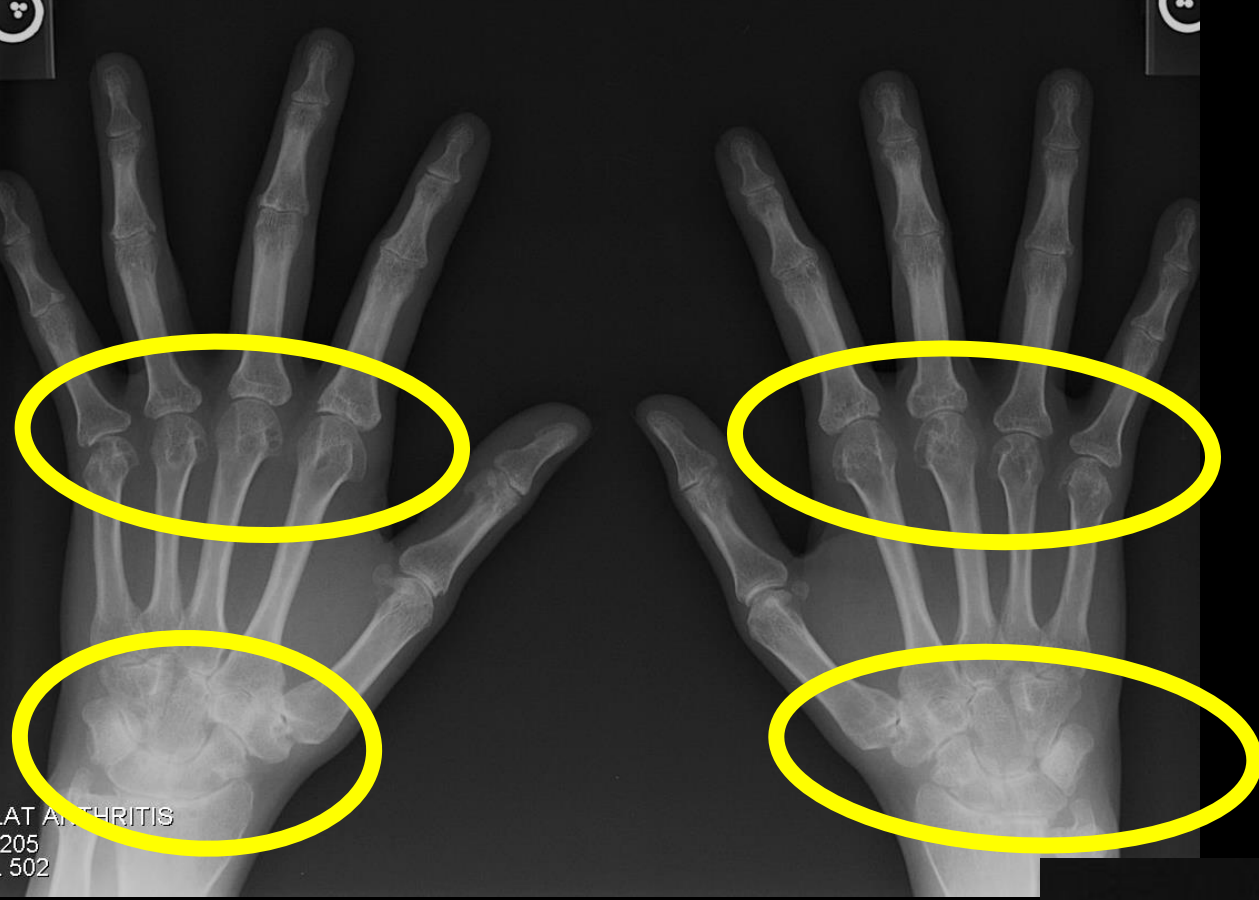






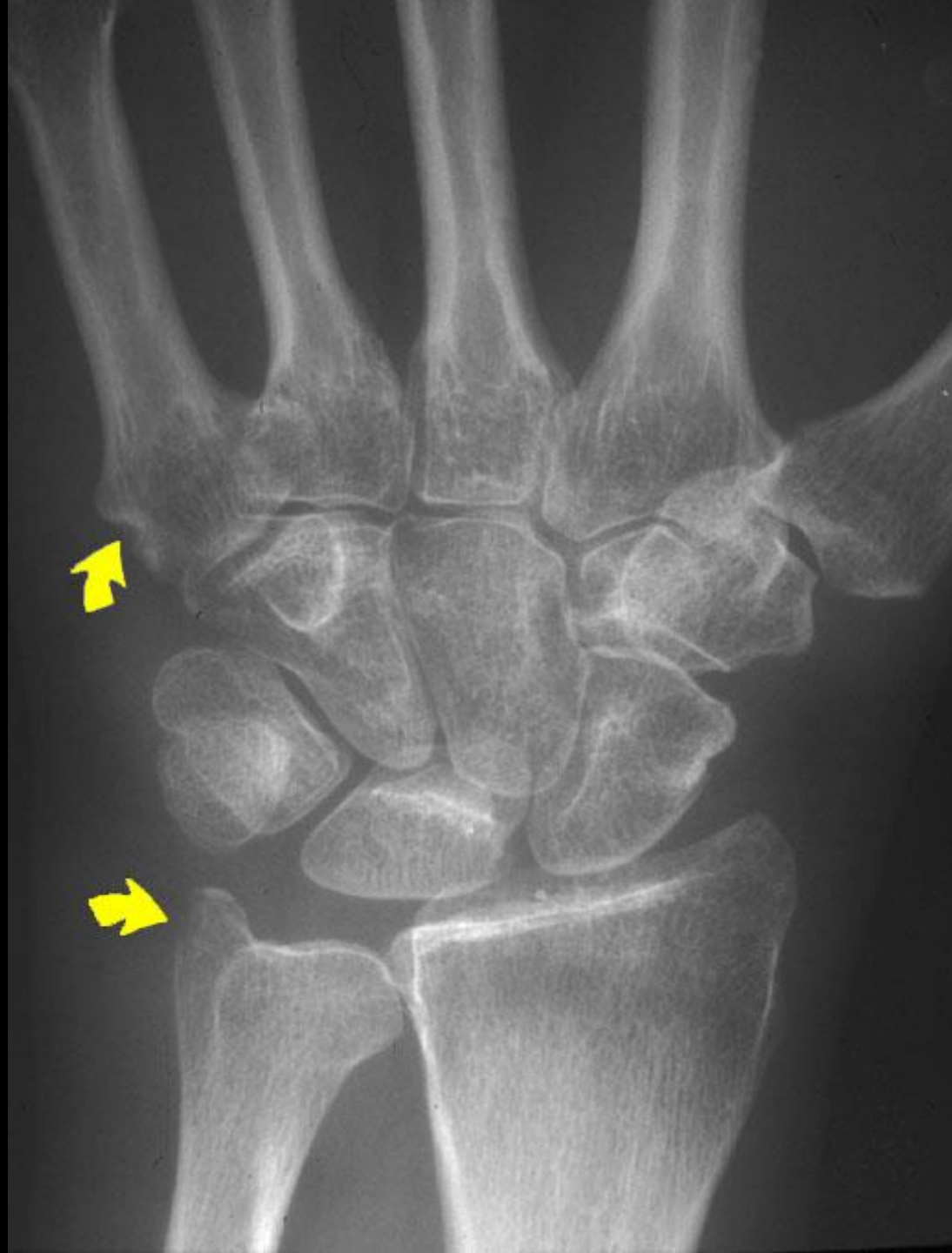


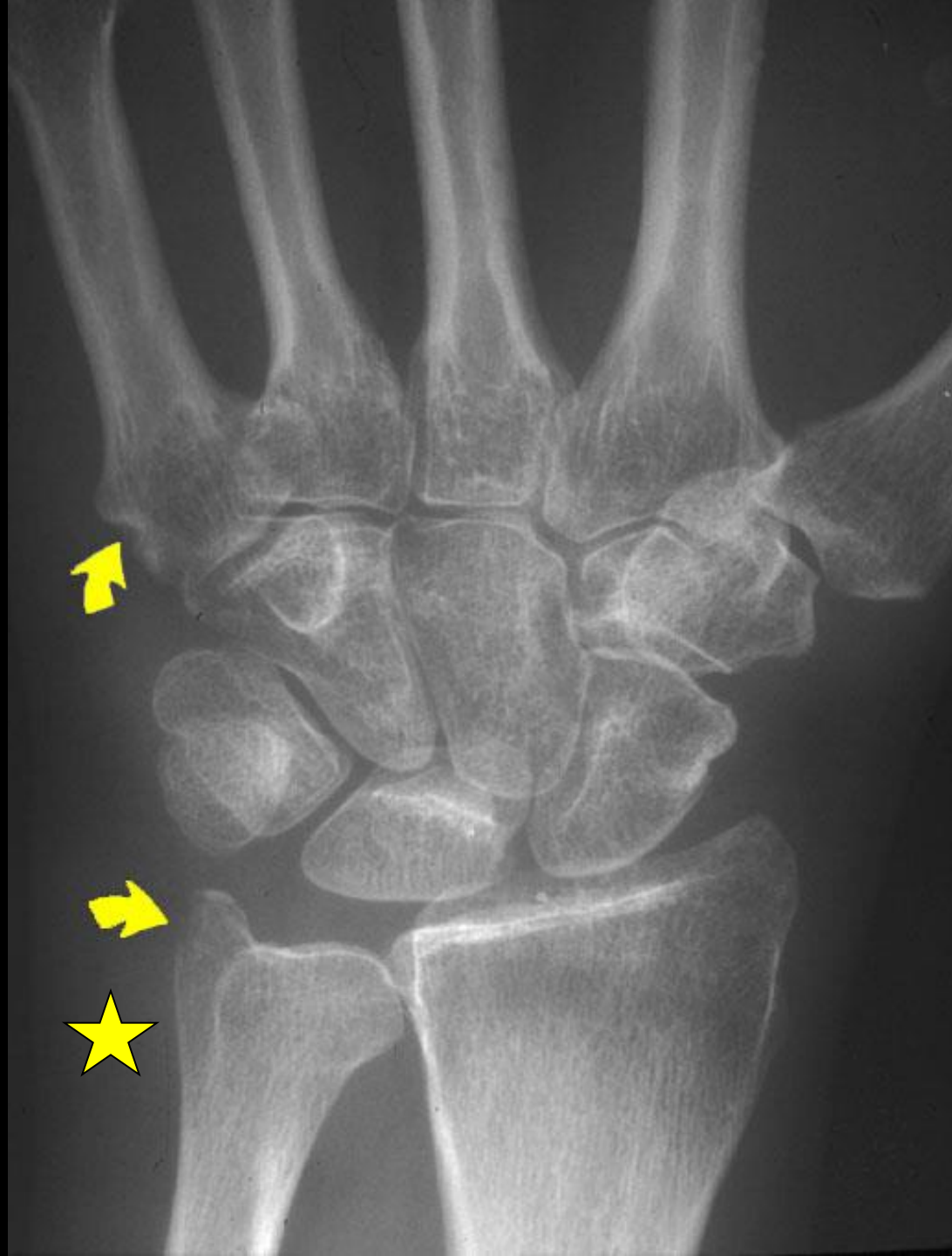




LEARNING OBJECTIVES

- The one sentence summary statement for diagnosis (either radiography or cross-sectional imaging)
- Inflammatory erosive symmetric arthritis involving the MCP, PIP and carpal joints without bone production
- What arthritis am I?





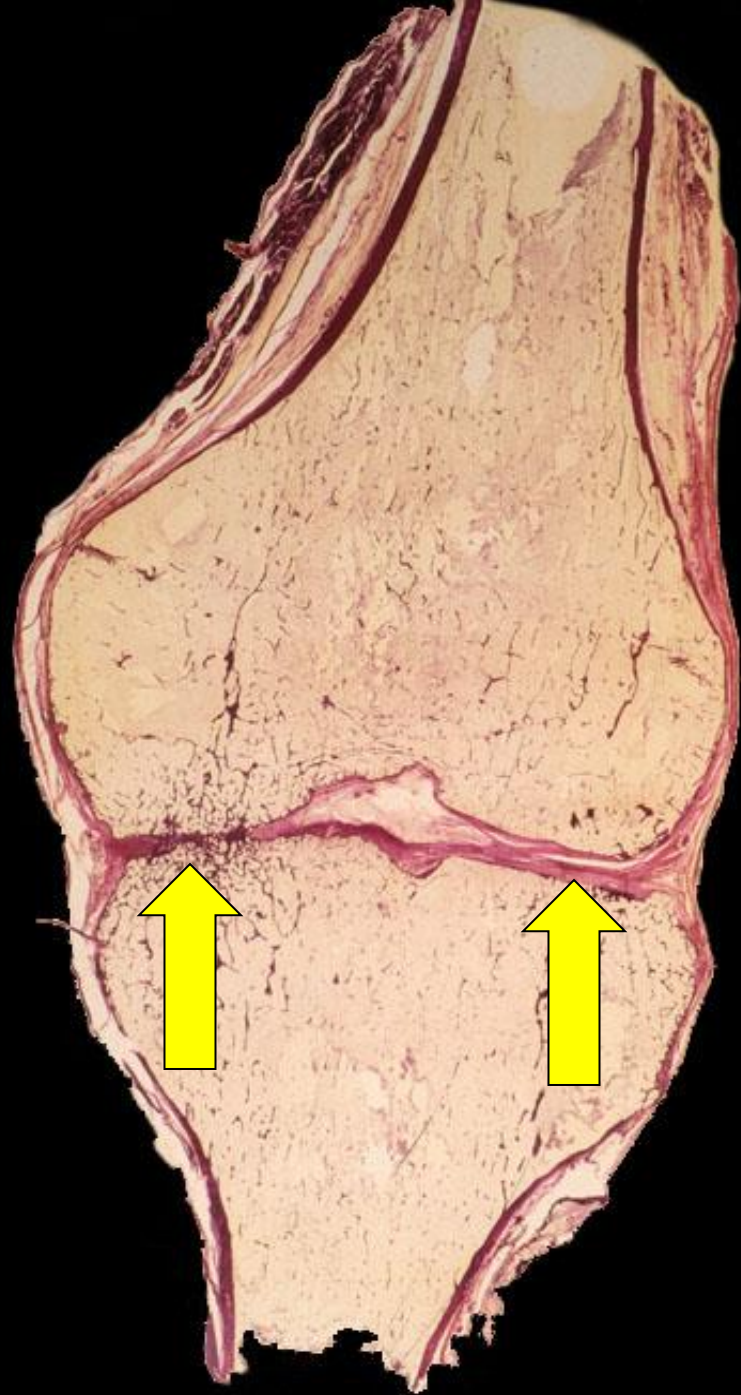




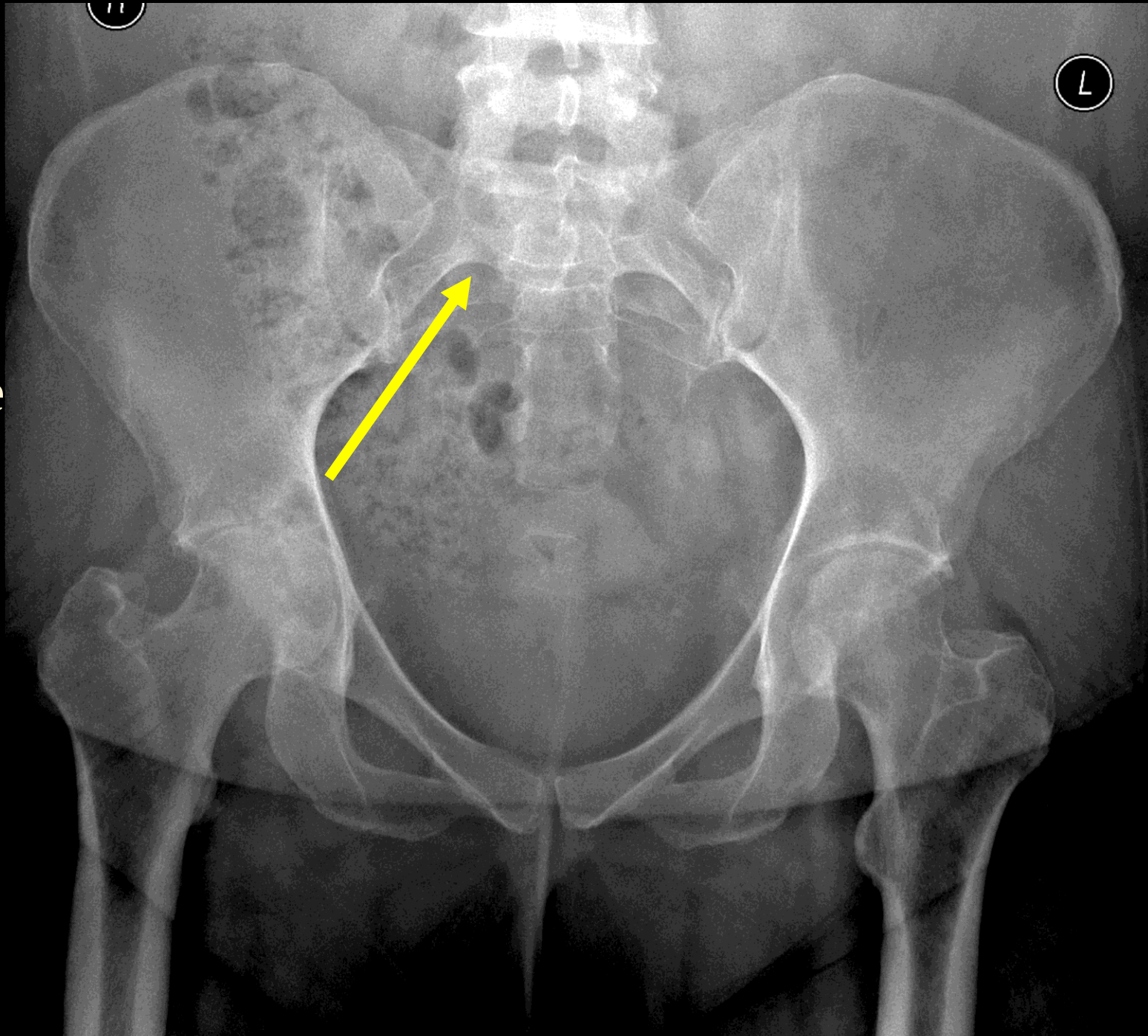








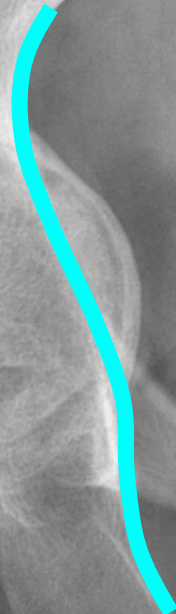
Despite the
advanced
cartilage space
loss, minimal
osteophyte
formation

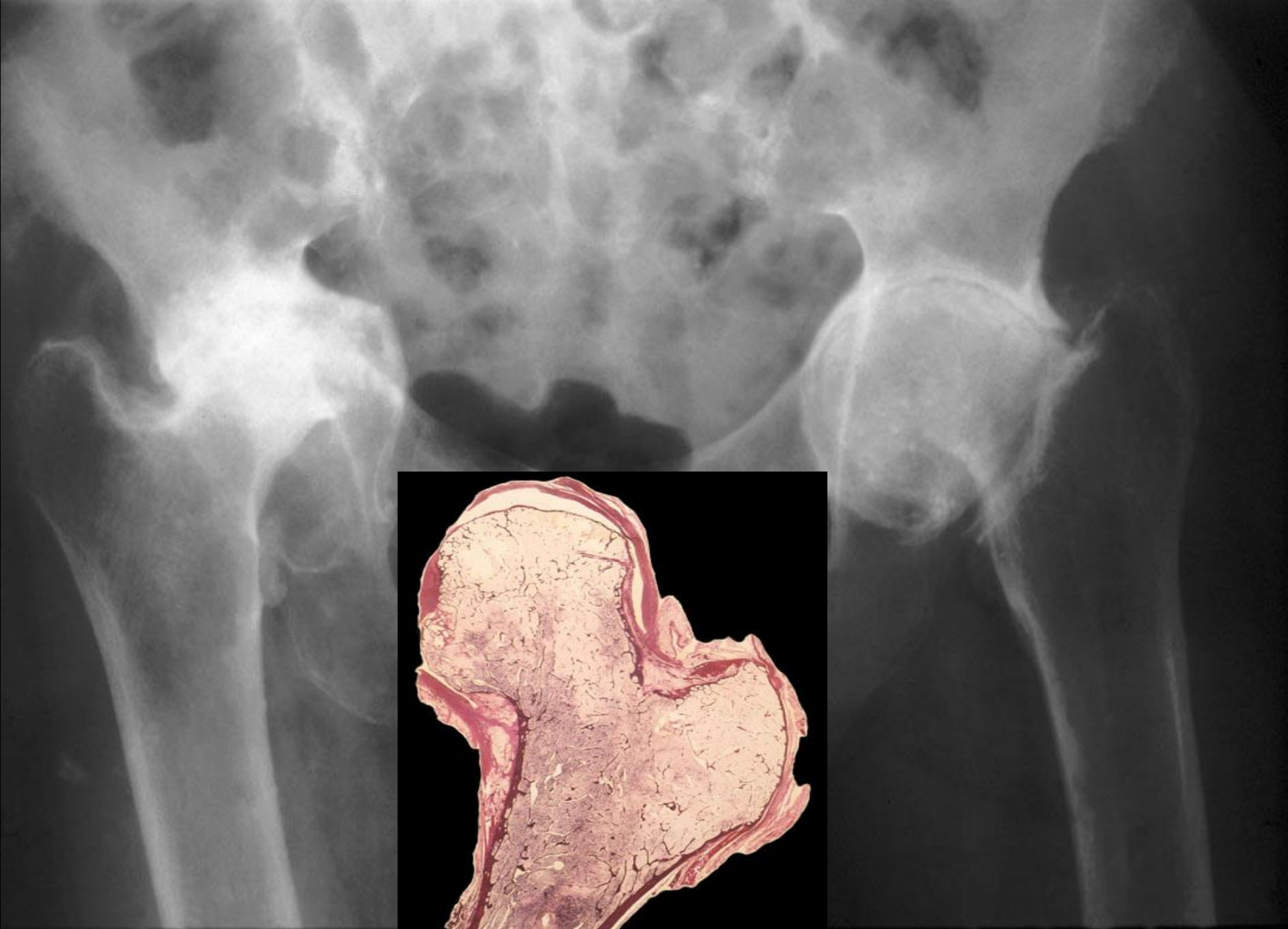


Men >3mm

Women >6 mm

Protrusio acetabulum





RHEUMATOID ARTHRITIS

MR IMAGING

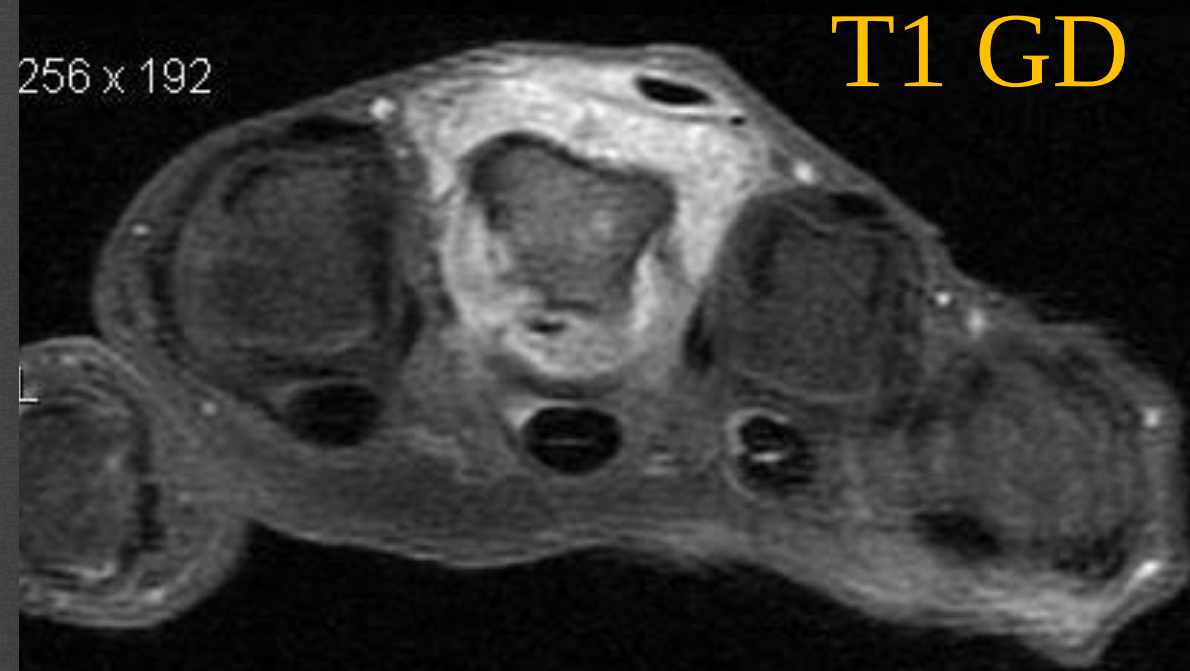
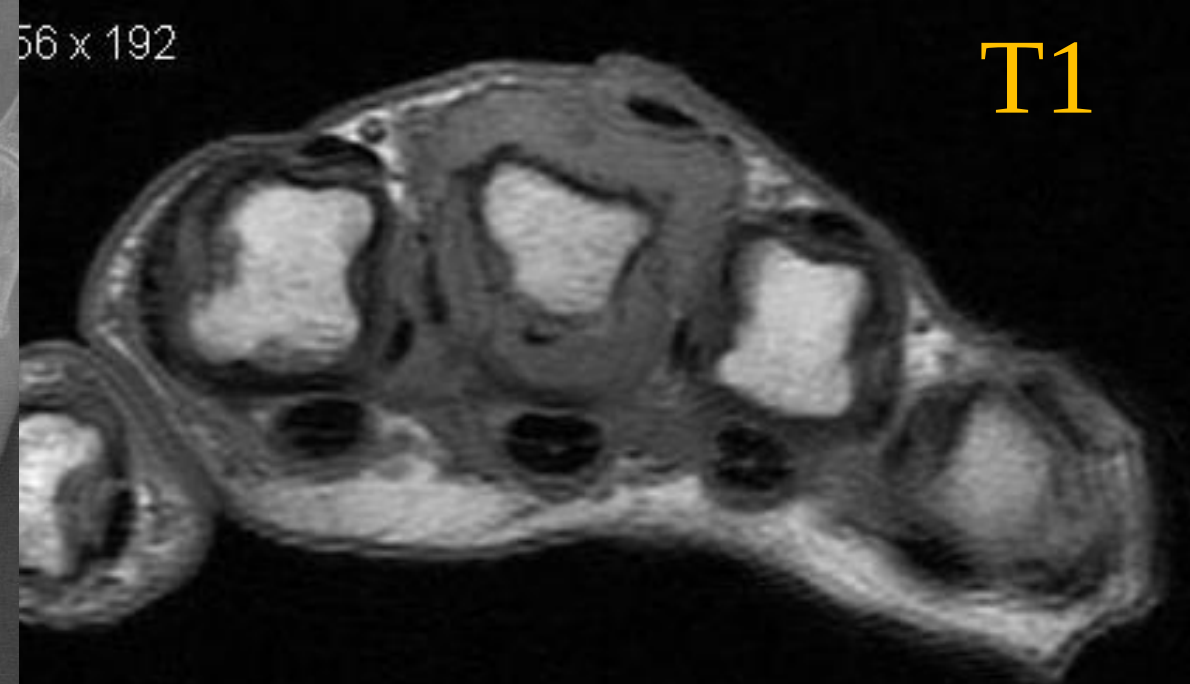
- Synovitis – earliest abnormality with increased volume, water content and enhancement initially
- Acute synovitis/tenosynovitis enhances rapidly (first 5 minutes) after 10 minutes can be difficult to differentiate from joint fluid (effusion common and nonspecific)
- Chronic synovitis hypovascular and lower T2 signal
- Bone marrow edema (39%-75% of early RA) is reversible and overcalled as erosions (forerunner)
- Erosion (MR 45%-72% vs 8%-40% on radiographs early disease); **look for cortical loss broad neck/two planes and T1 images**
- Inclusion of MR increases ACR criteria from 77% to 96%

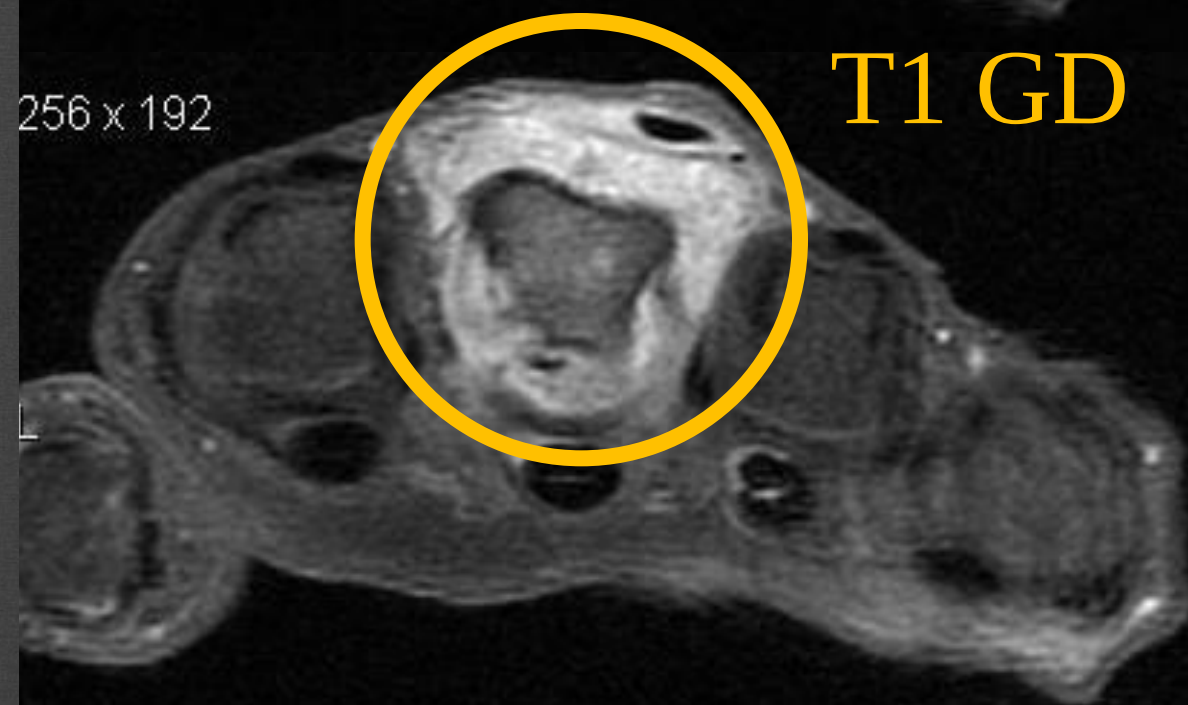
RHEUMATOID ARTHRITIS TREATMENT

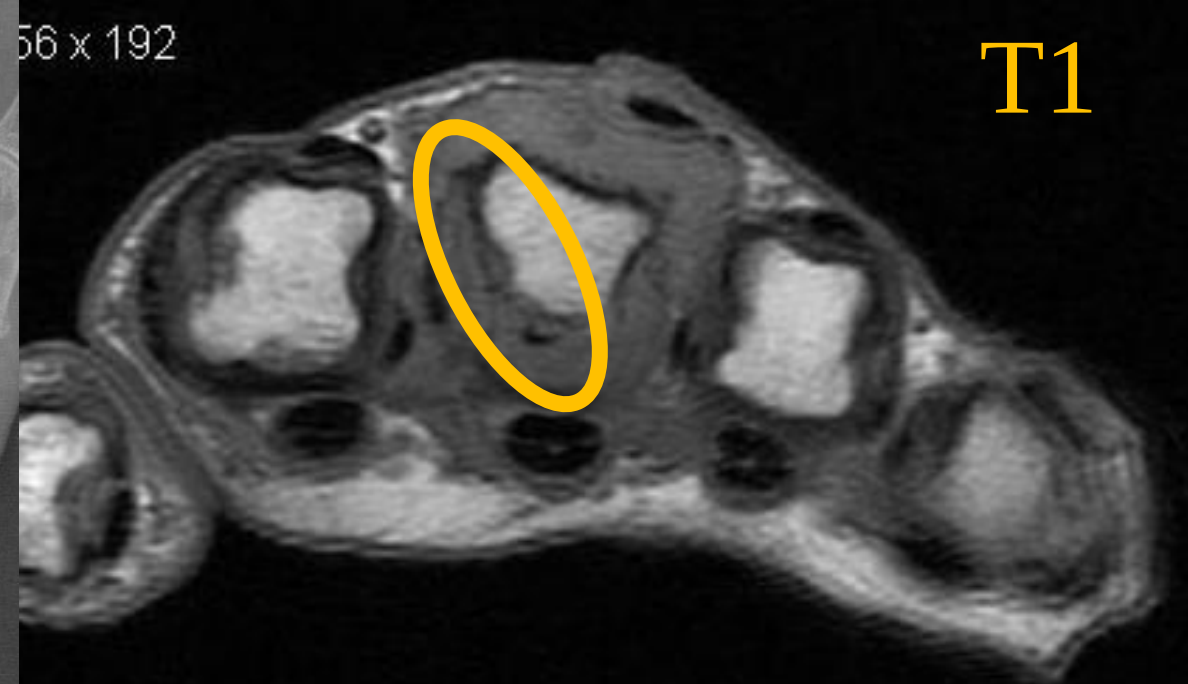
- Current goal is remission - treatment as soon as possible (shorter disease duration correlates with response)
- “Window of Opportunity”
- Steroids for symptomatic relief
- DMARDs (disease modifying anti-rheumatic drugs) – methotrexate, sulphasalazine, leflunomide
- Biologics – rituximab, abatacept and tocilizumab
- Anti – TNF (tumor necrosis factor) – etanercept, infliximab

RHEUMATOID ARTHRITIS TREATMENT COST/COMPLICATIONS

- \$15,000 per year (forever?)
- Immunocompromised with associated infections (TB 4X with TNF blocker) and tumors (lymphoma)

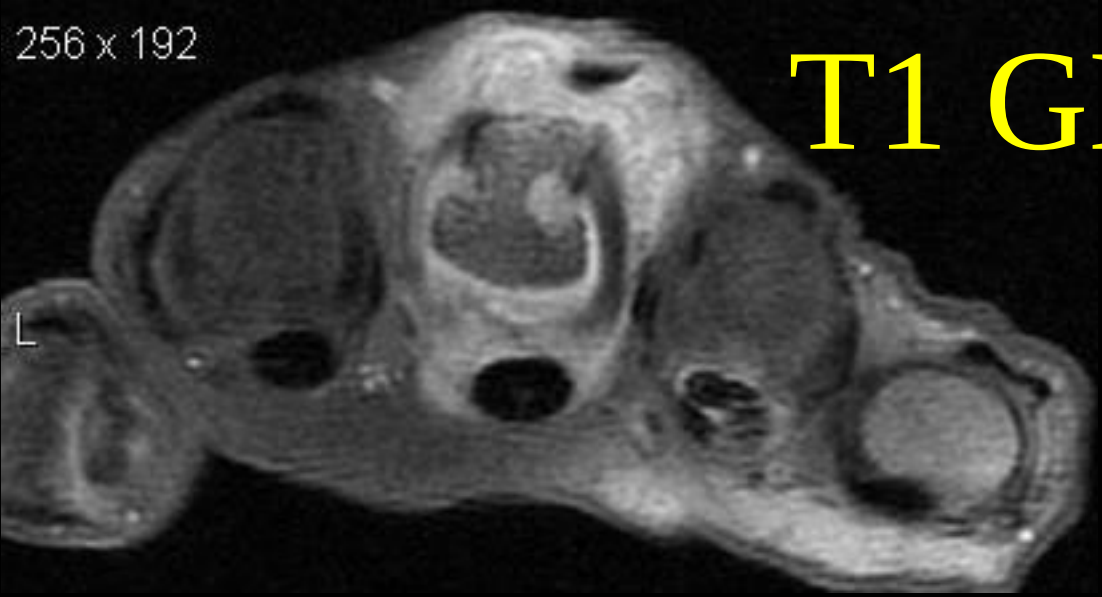




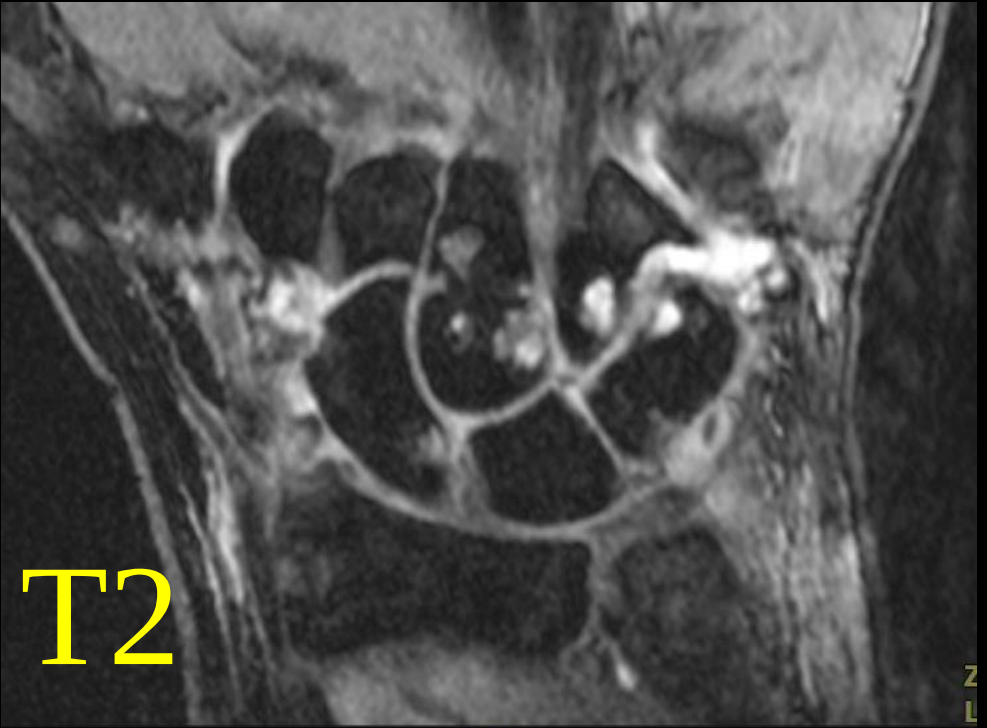


256 x 192

T1 GD



T1



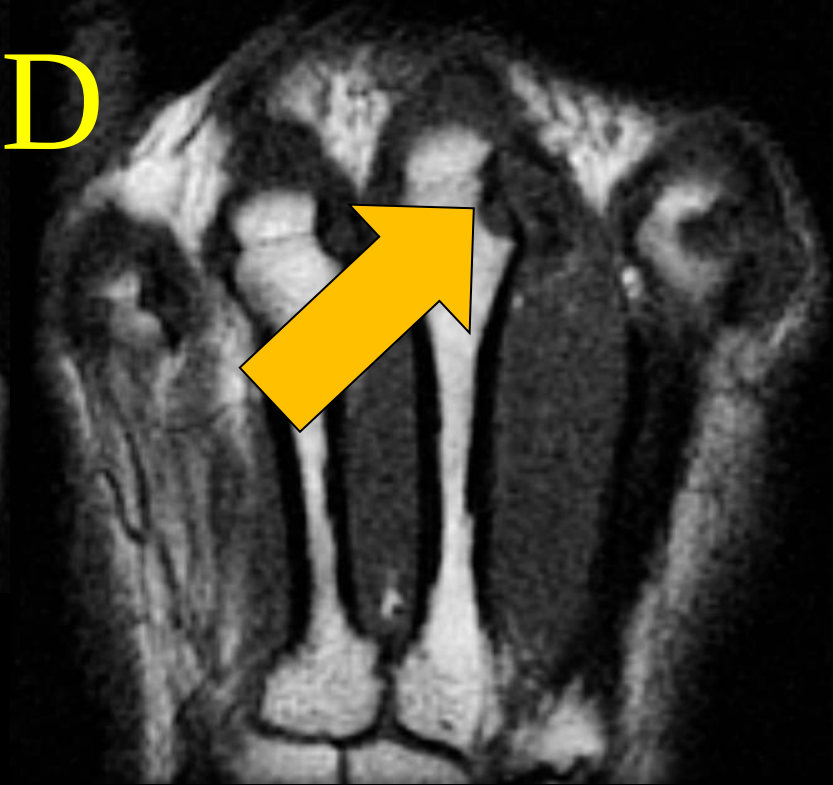
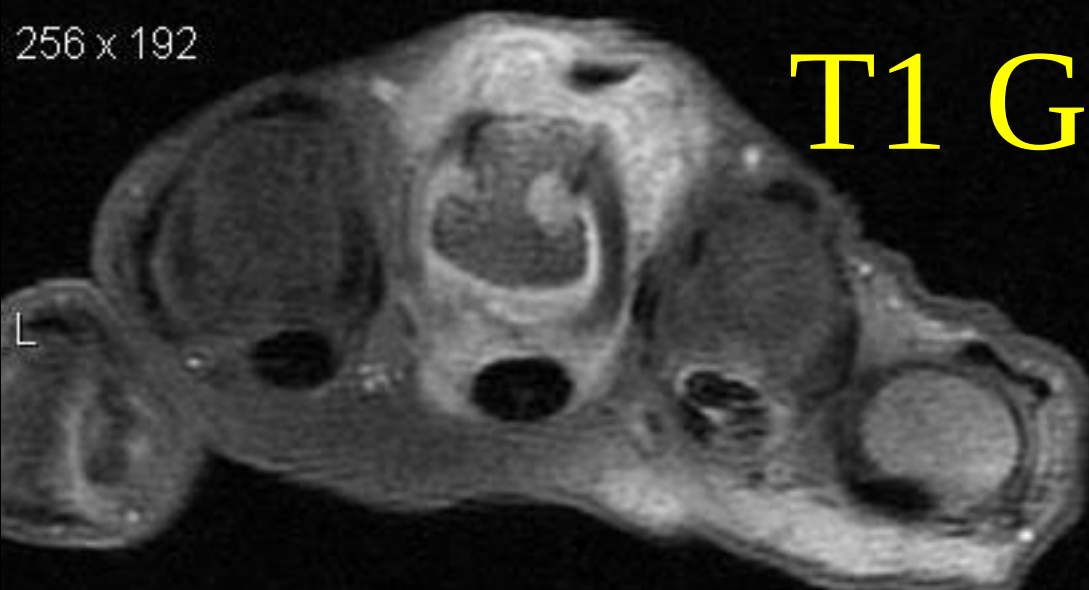
T2

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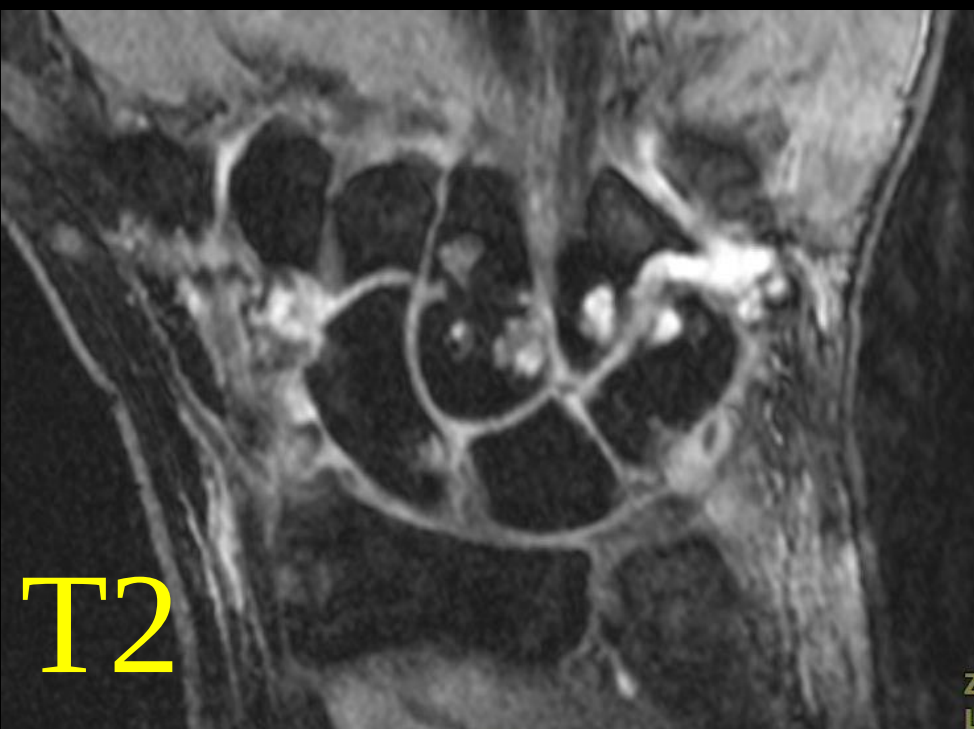
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256 x 192

T1 GD



T1



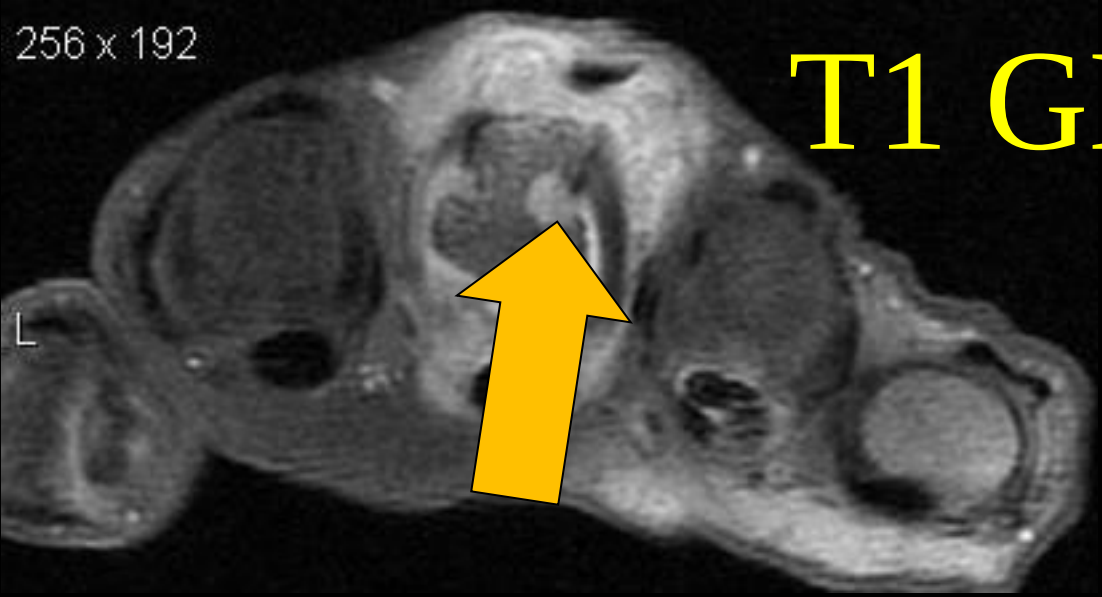
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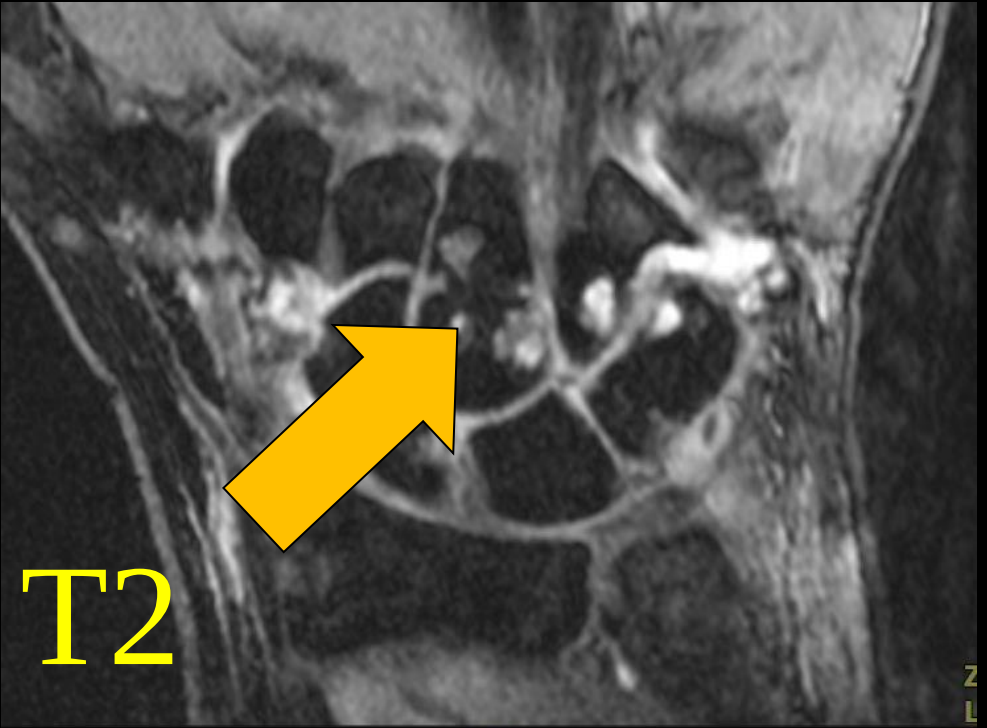
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256 x 192

T1 GD



T1



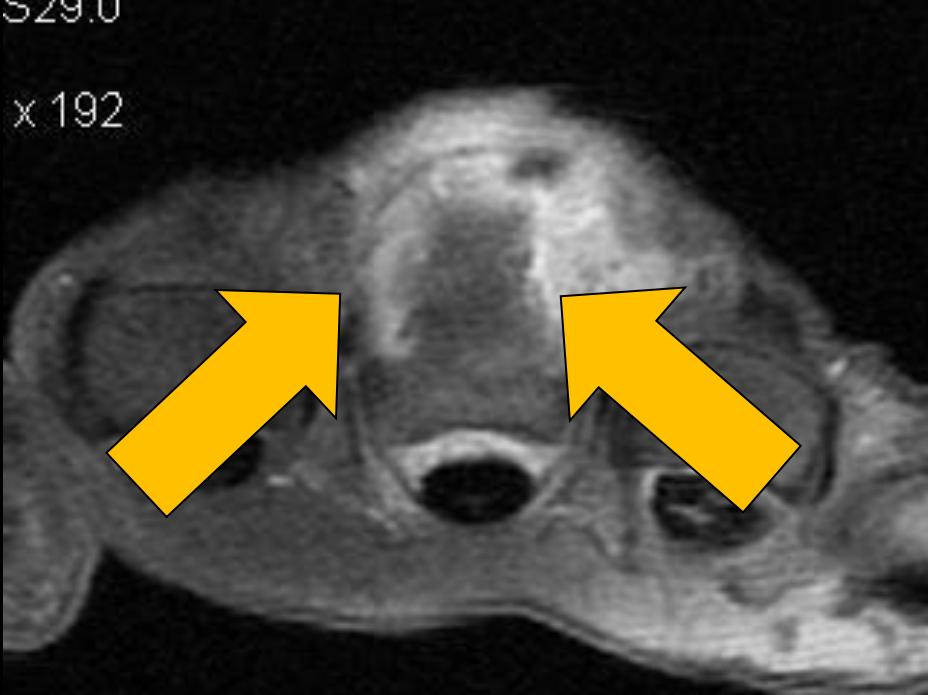
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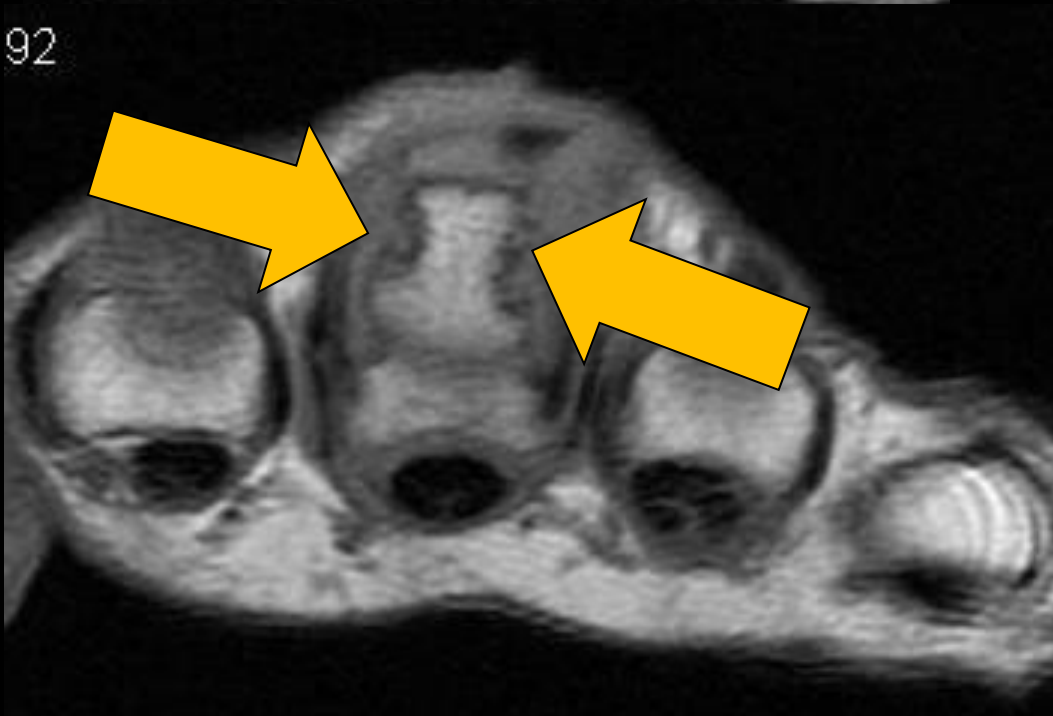
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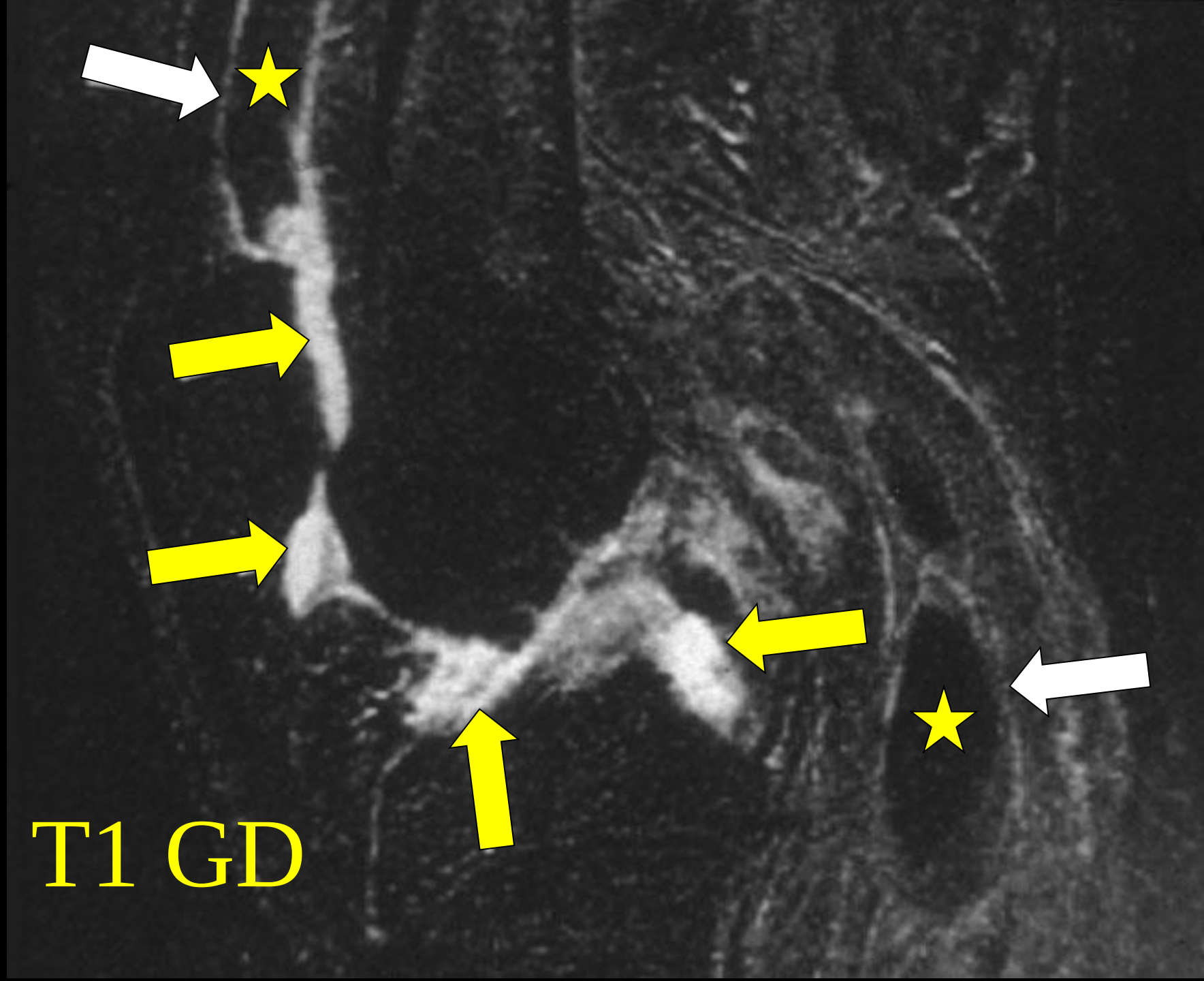
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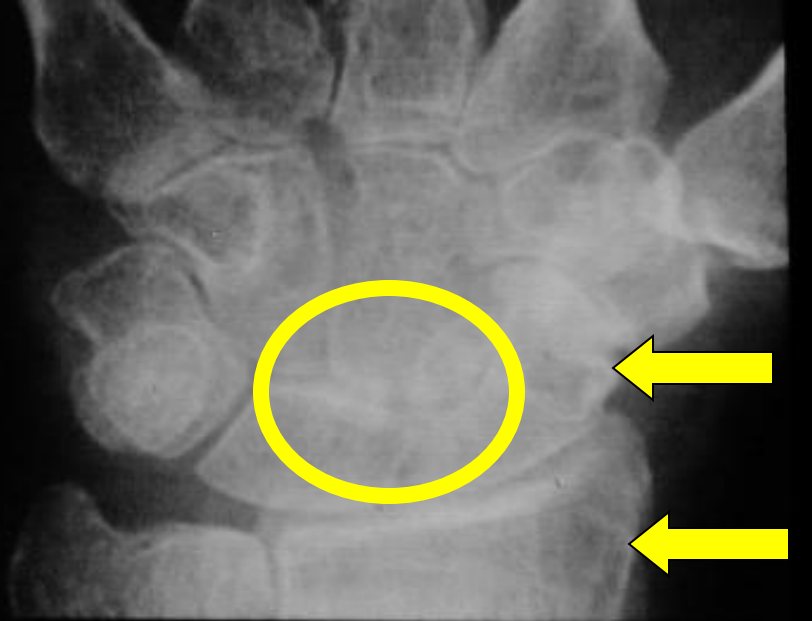
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T1 GD

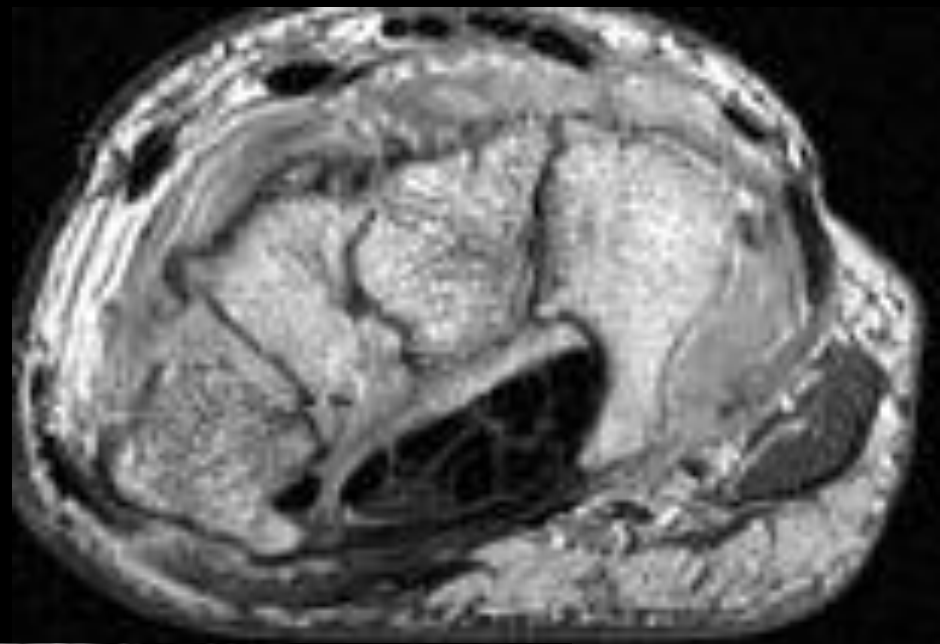
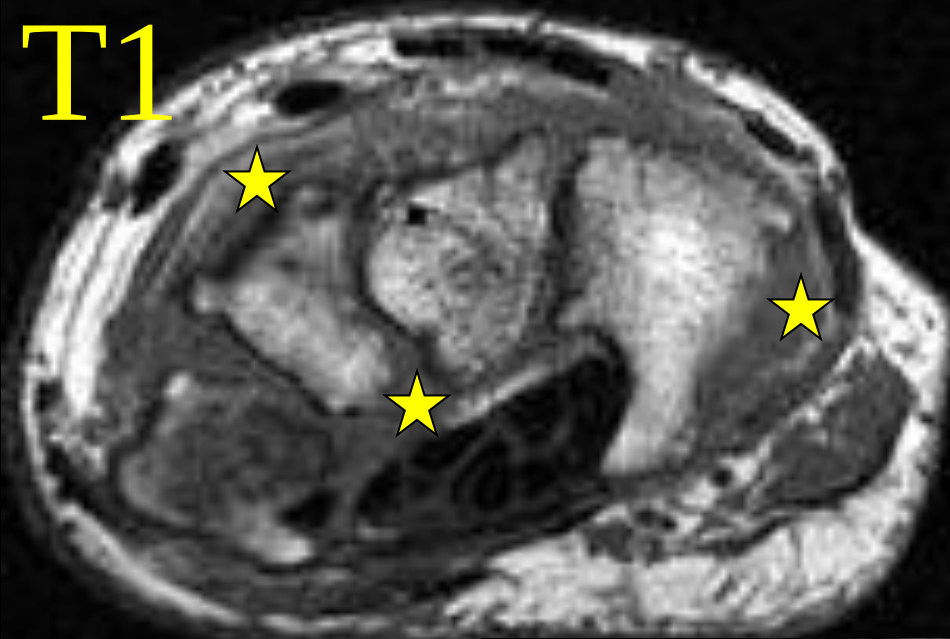








T1



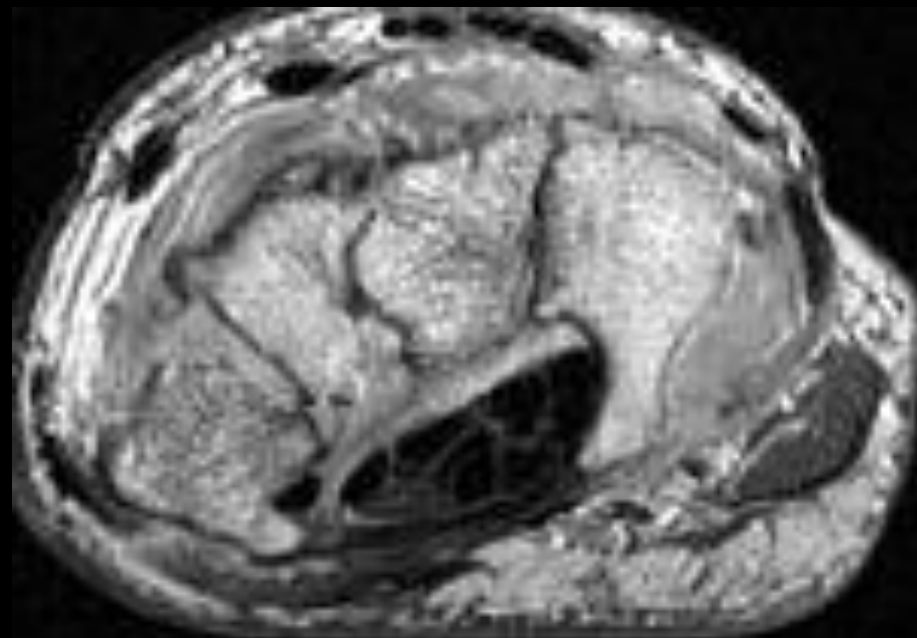
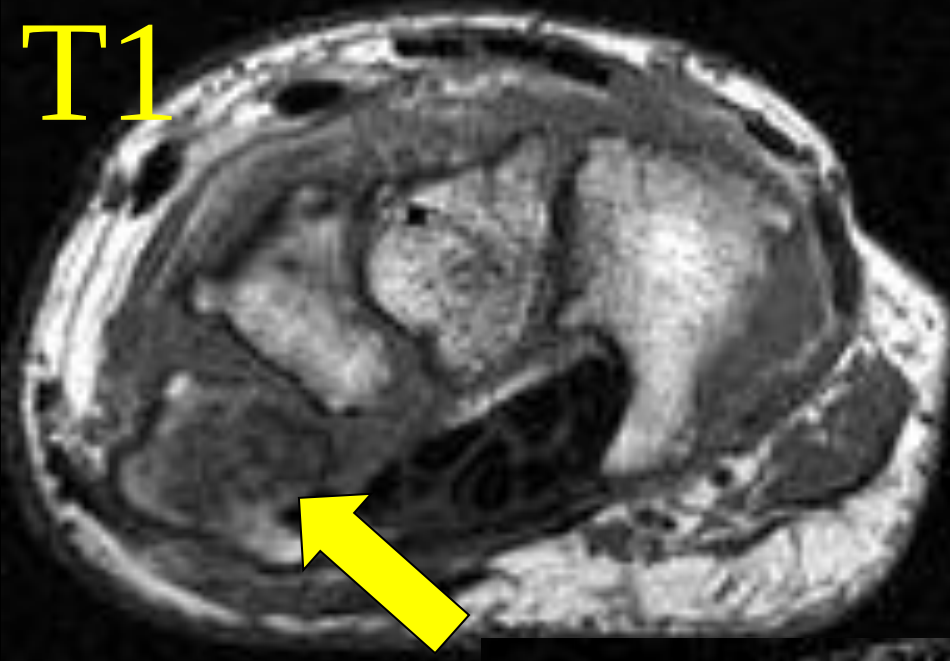
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BASELINE



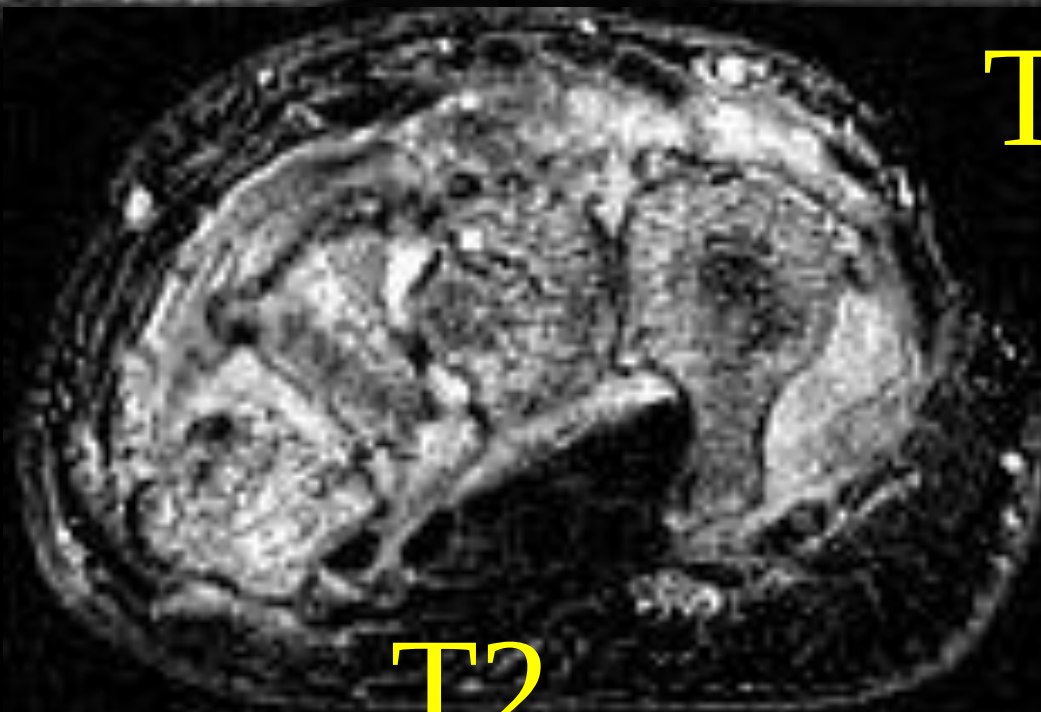
T2

T1



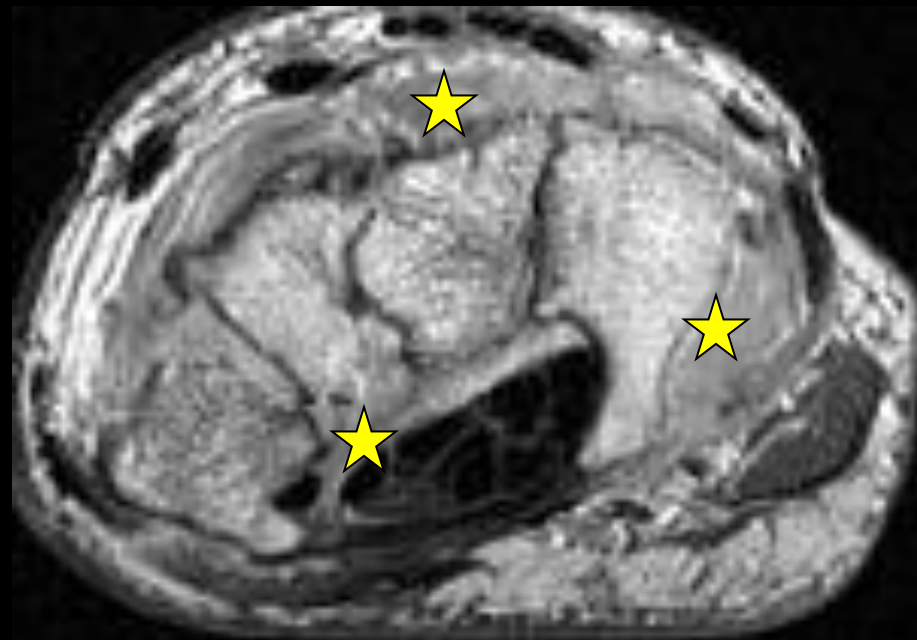
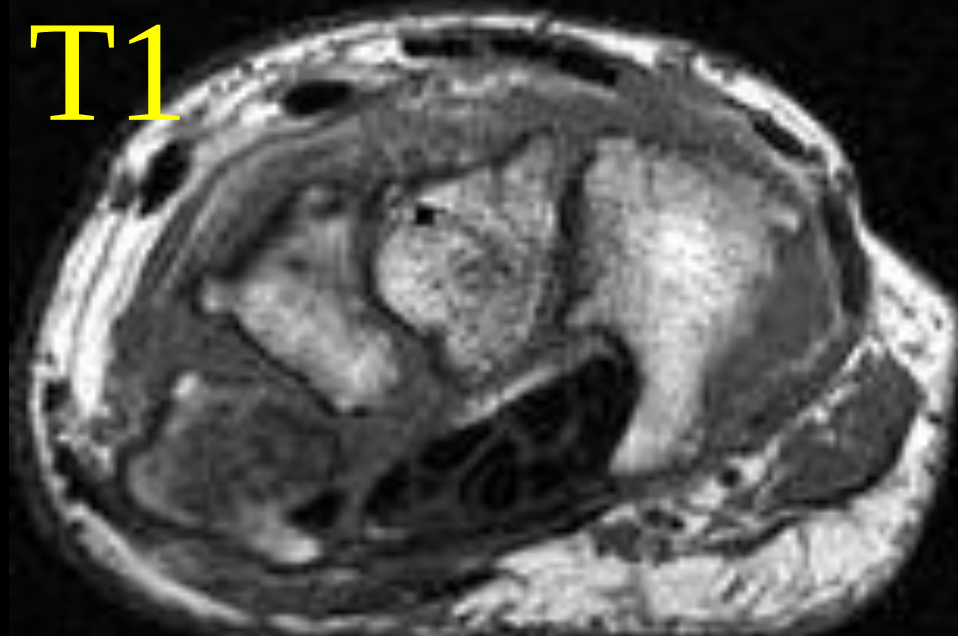
BASELINE

T1 GD



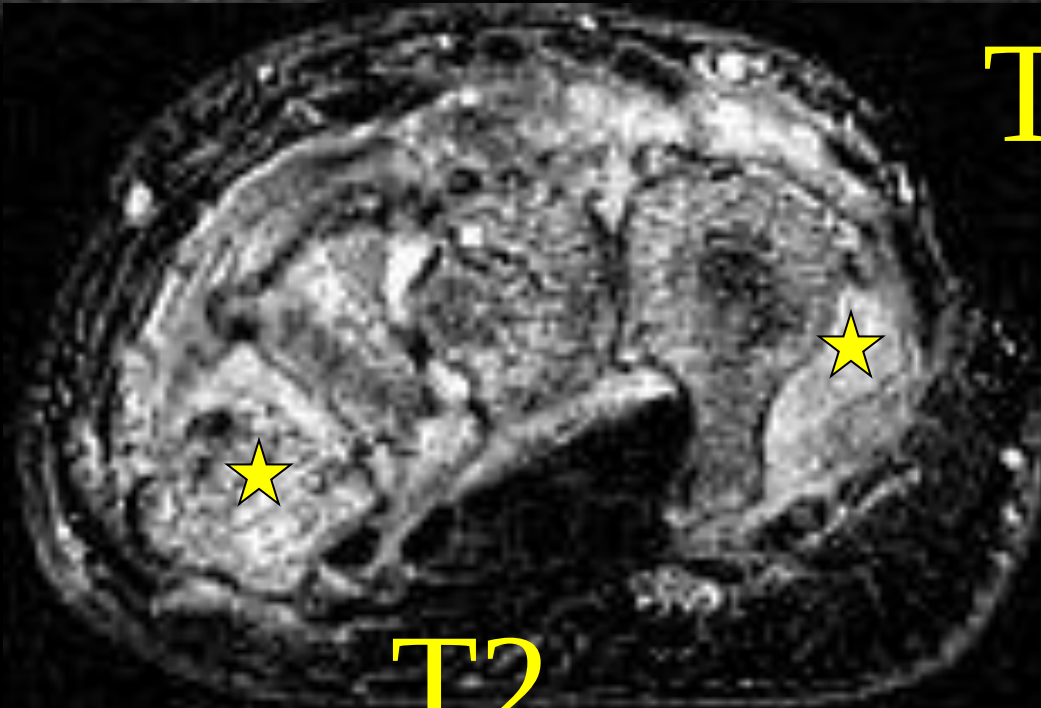
T2

T1



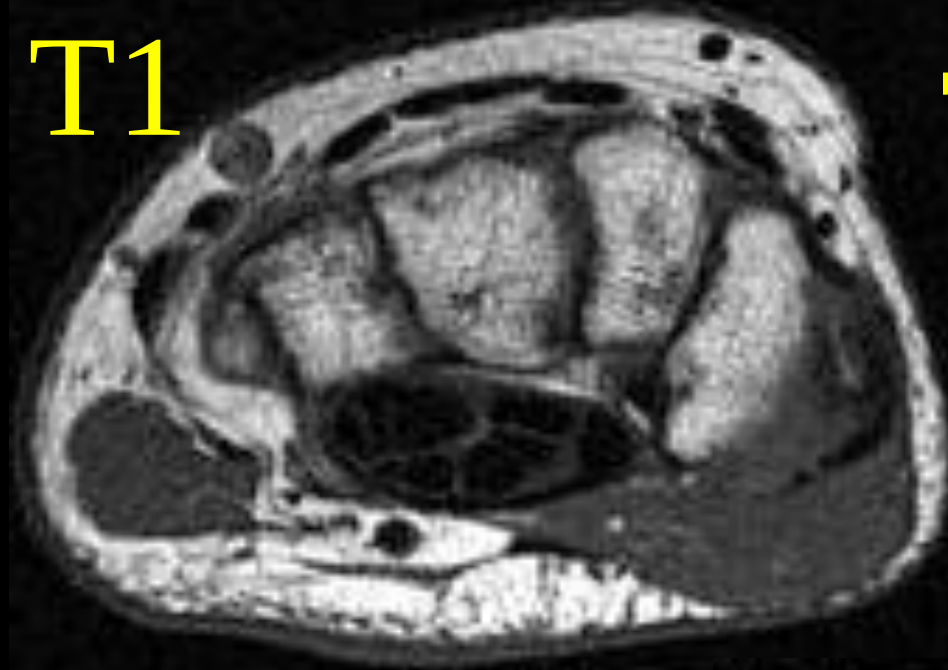
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BASELINE

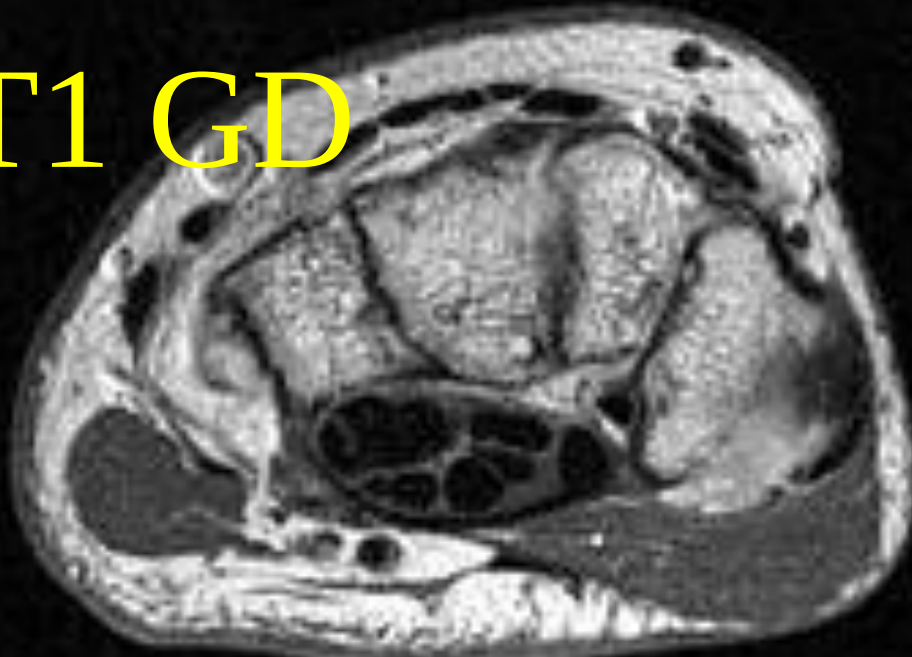


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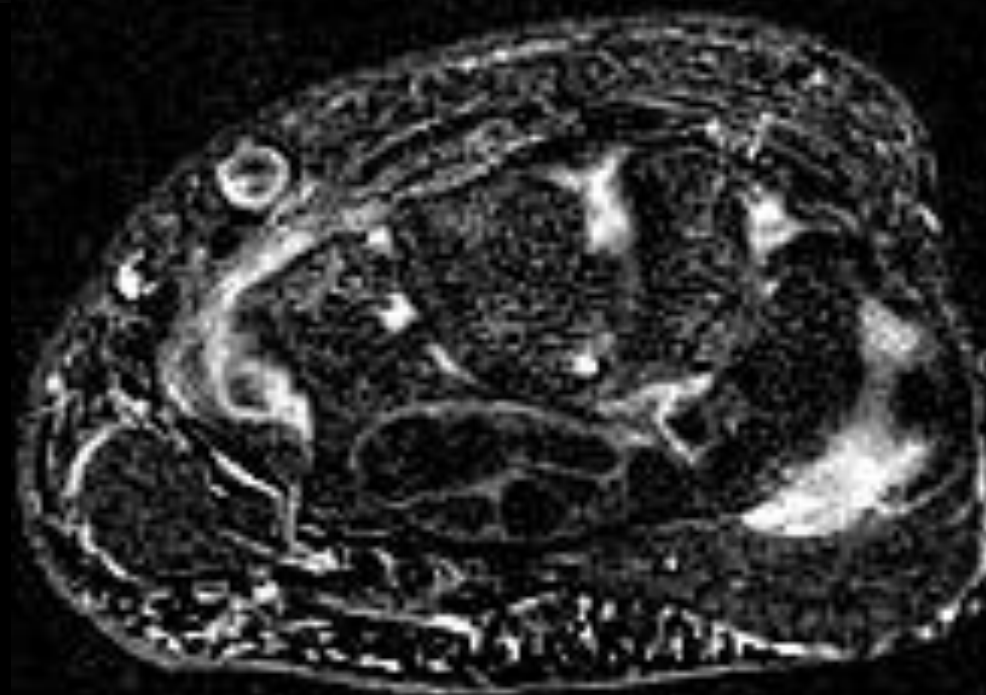
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T1 GD

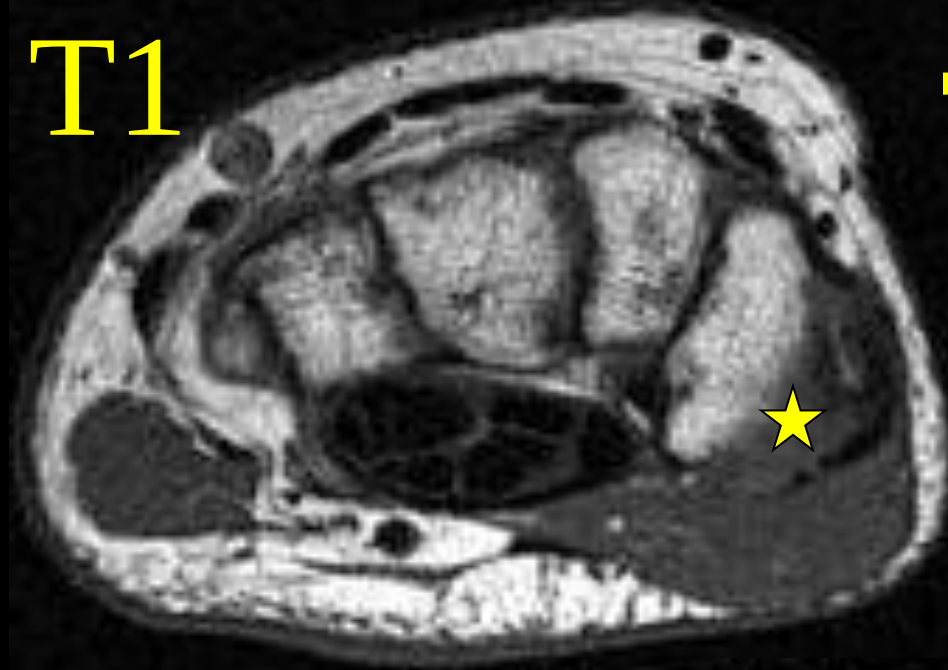


3 MONTHS
AFTER
TREATMENT

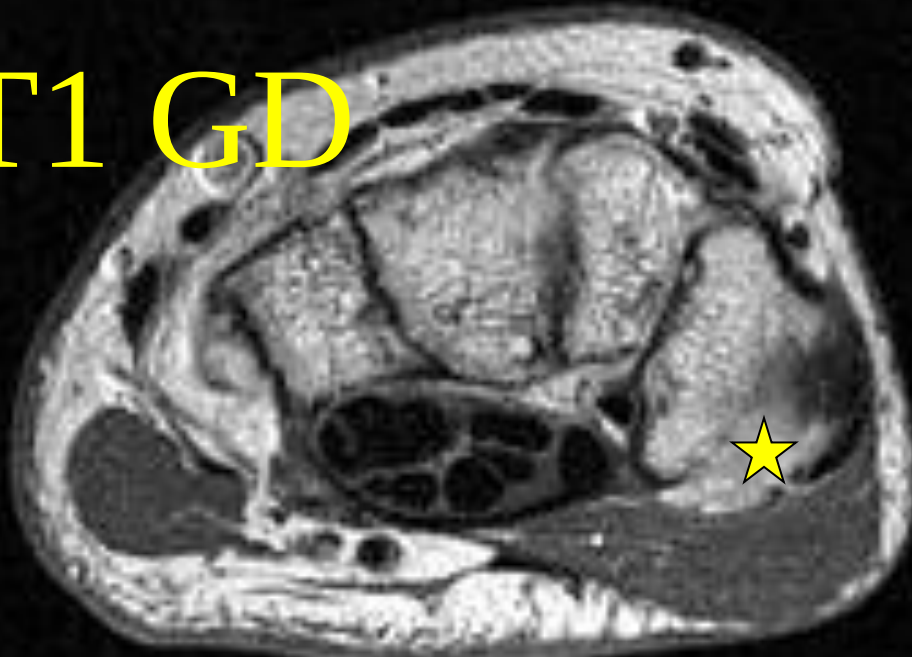


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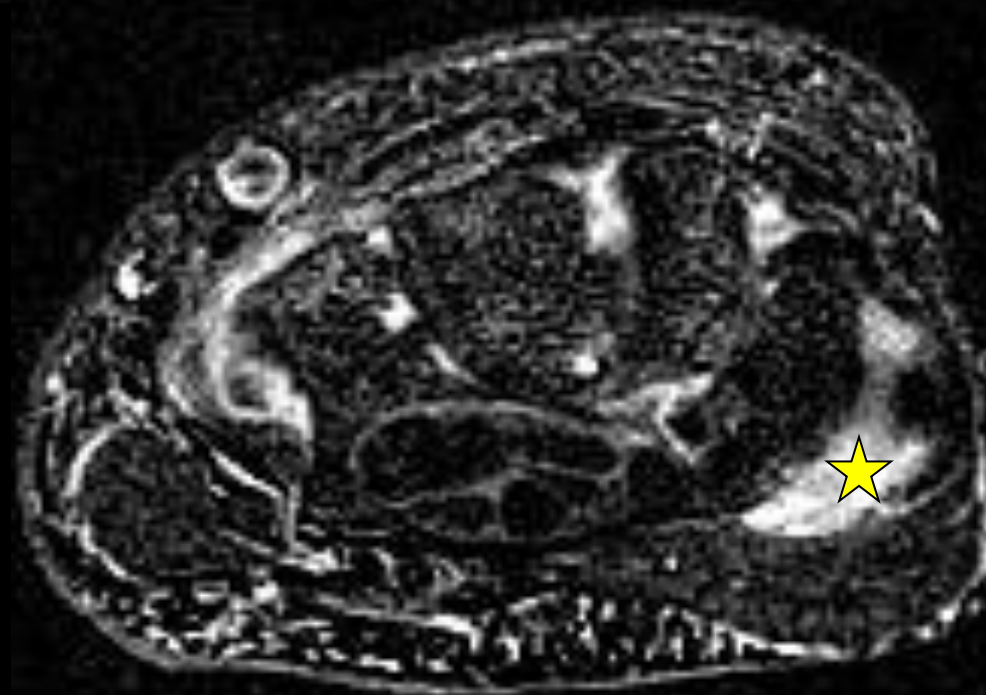
T1



T1 GD

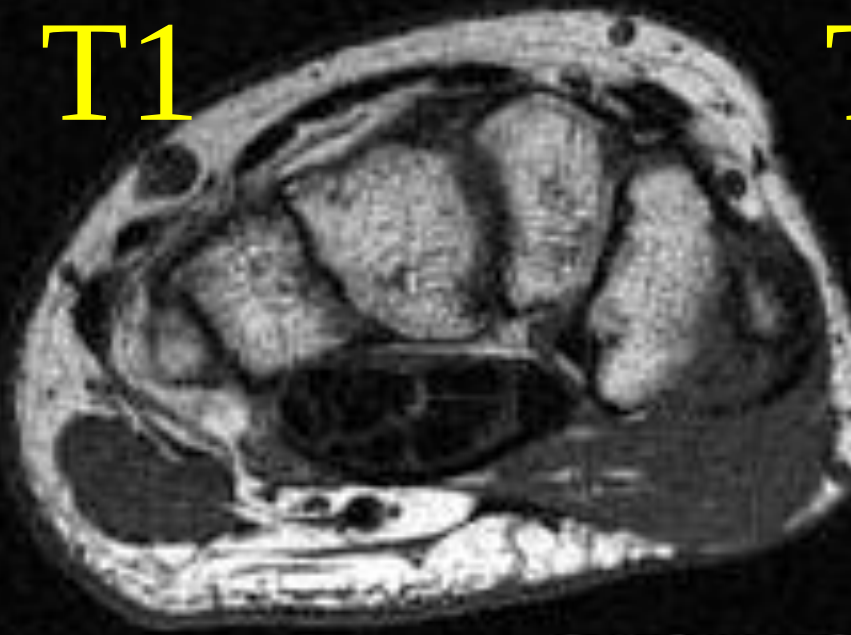


3 MONTHS
AFTER
TREATMENT

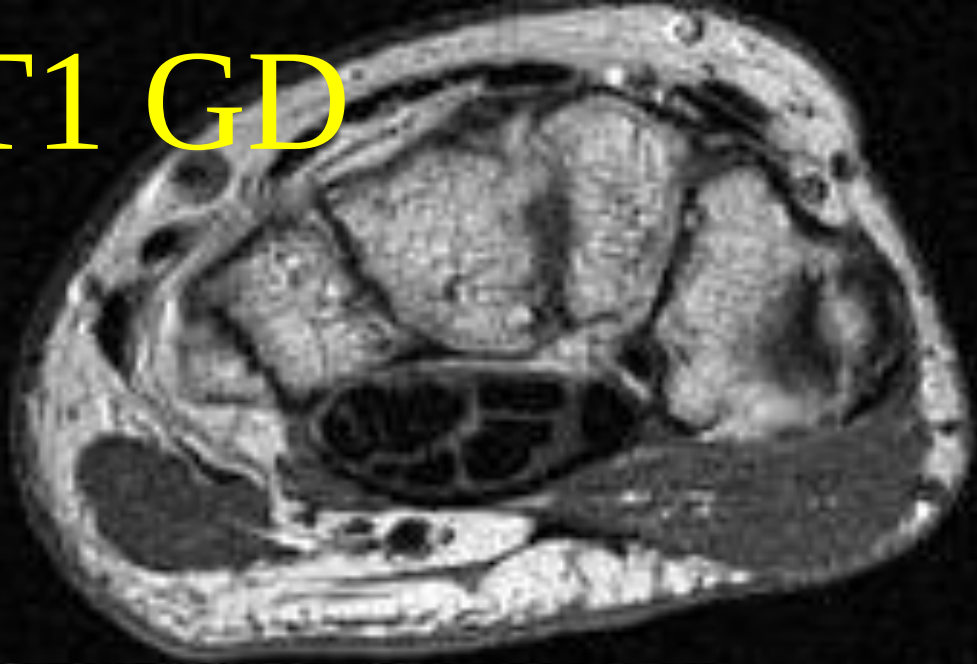


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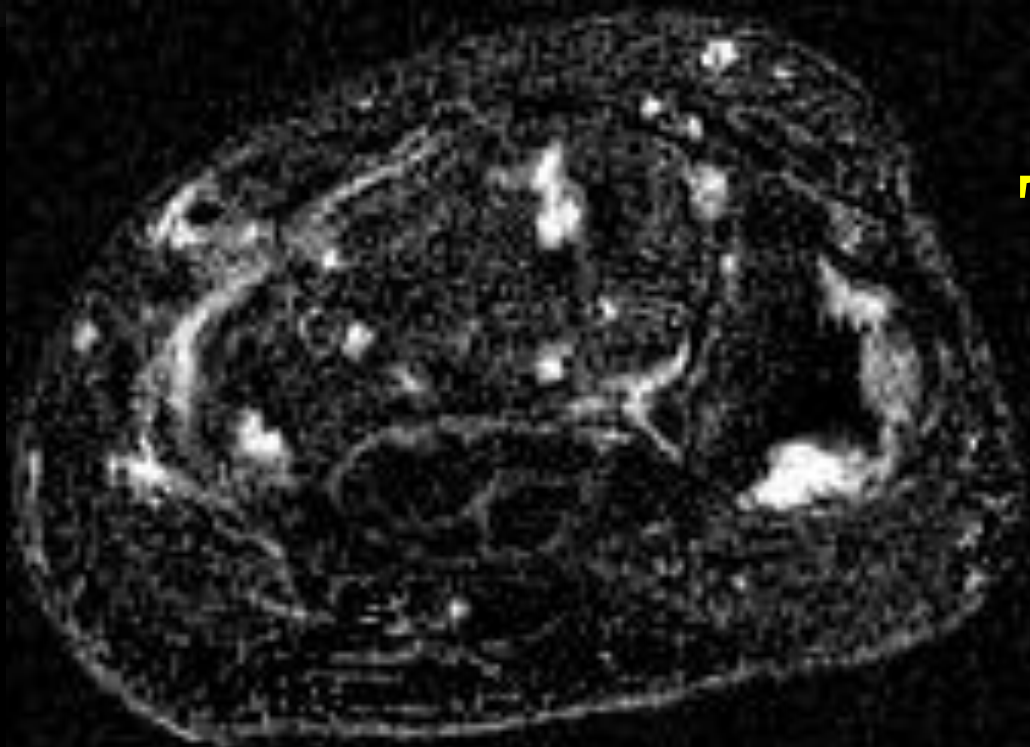
T1



T1 GD



5 MONTHS
AFTER
TREATMENT

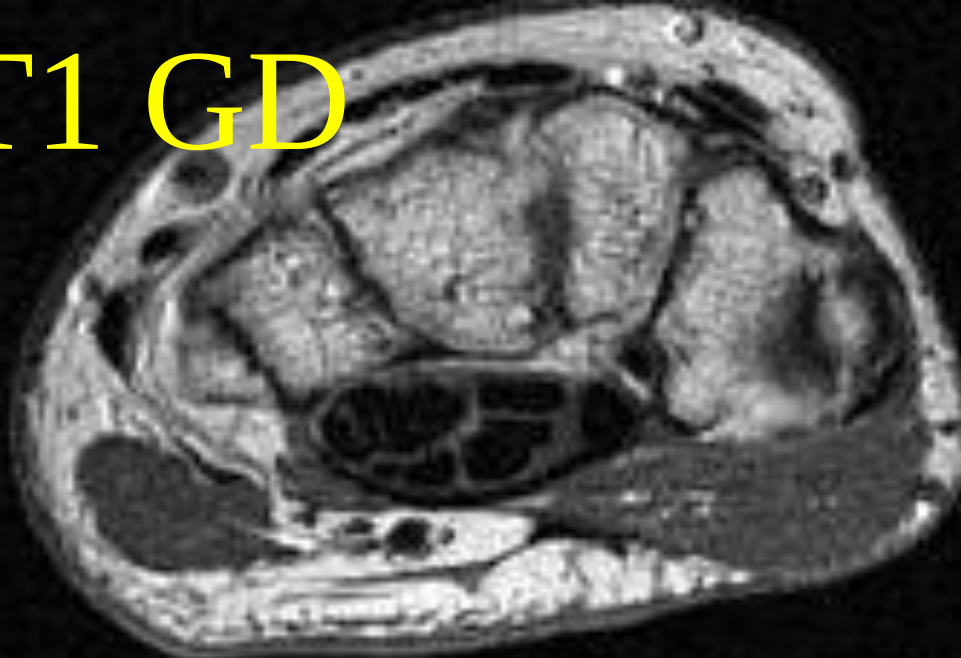


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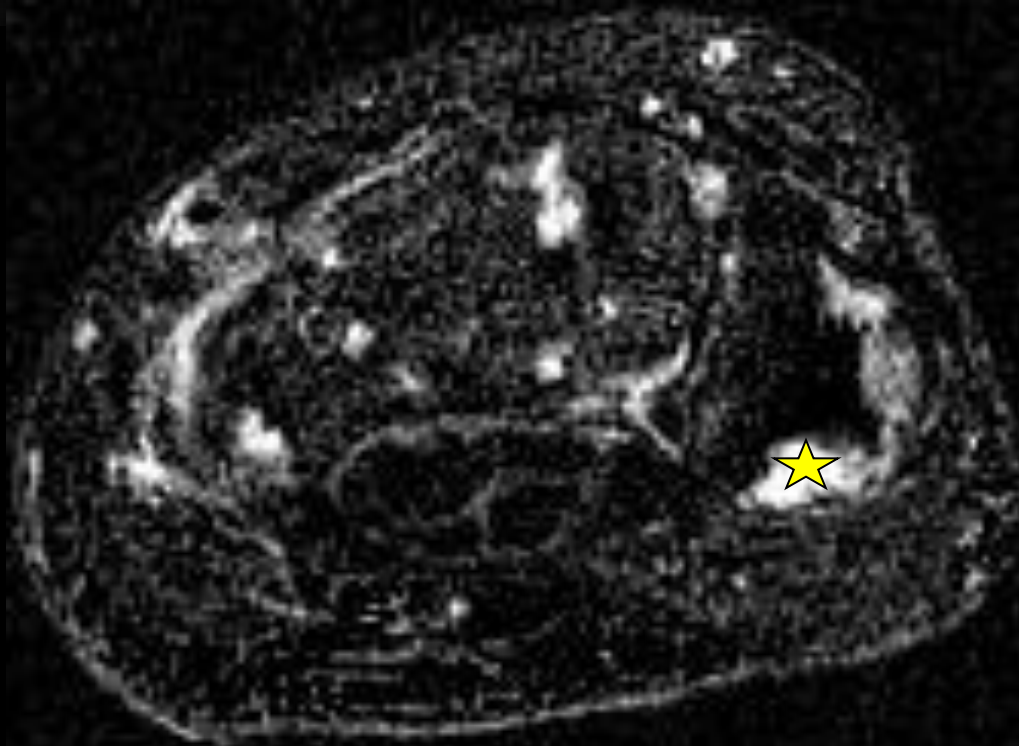
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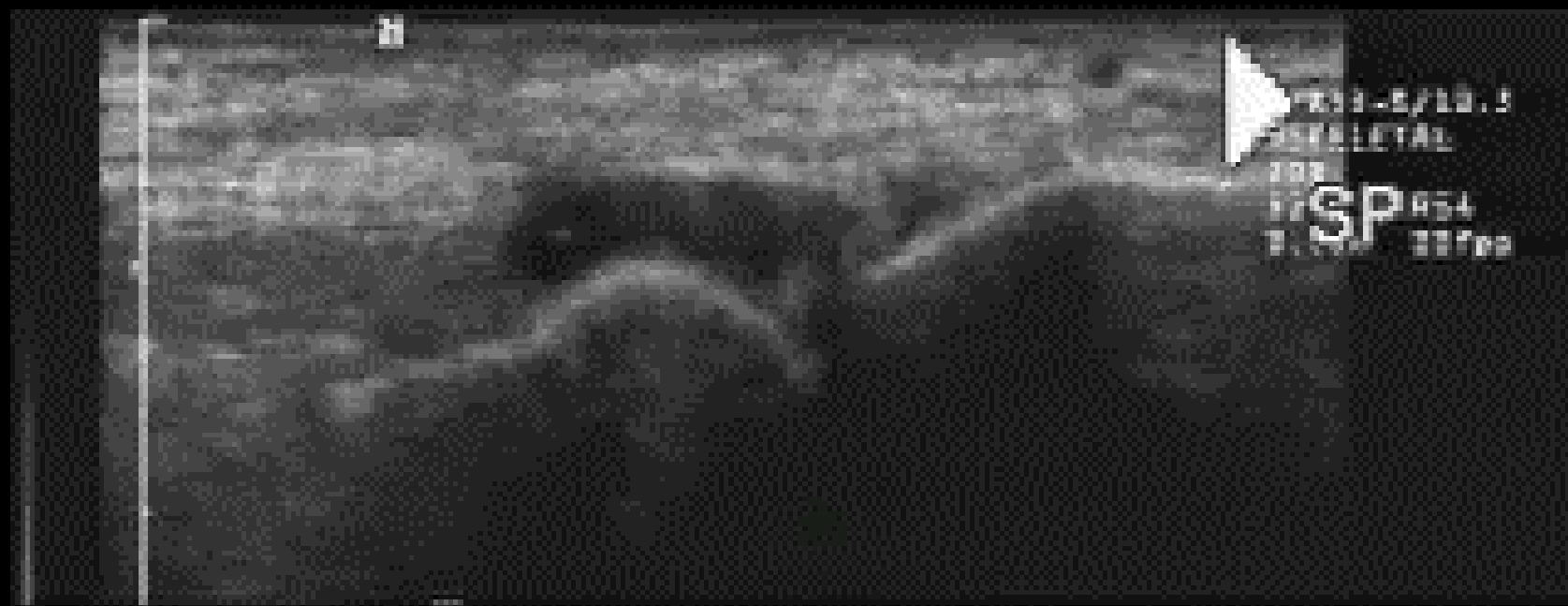
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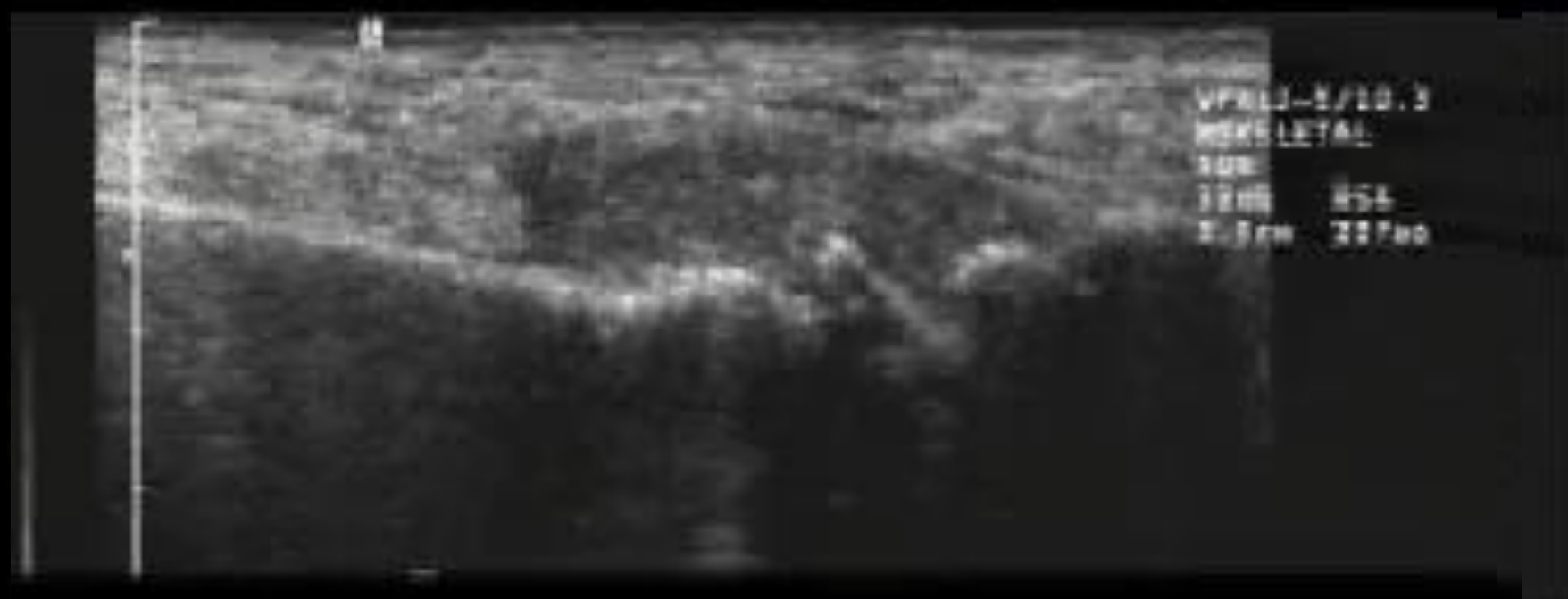
5 MONTHS
AFTER
TREATMENT



T2



effusion does compress

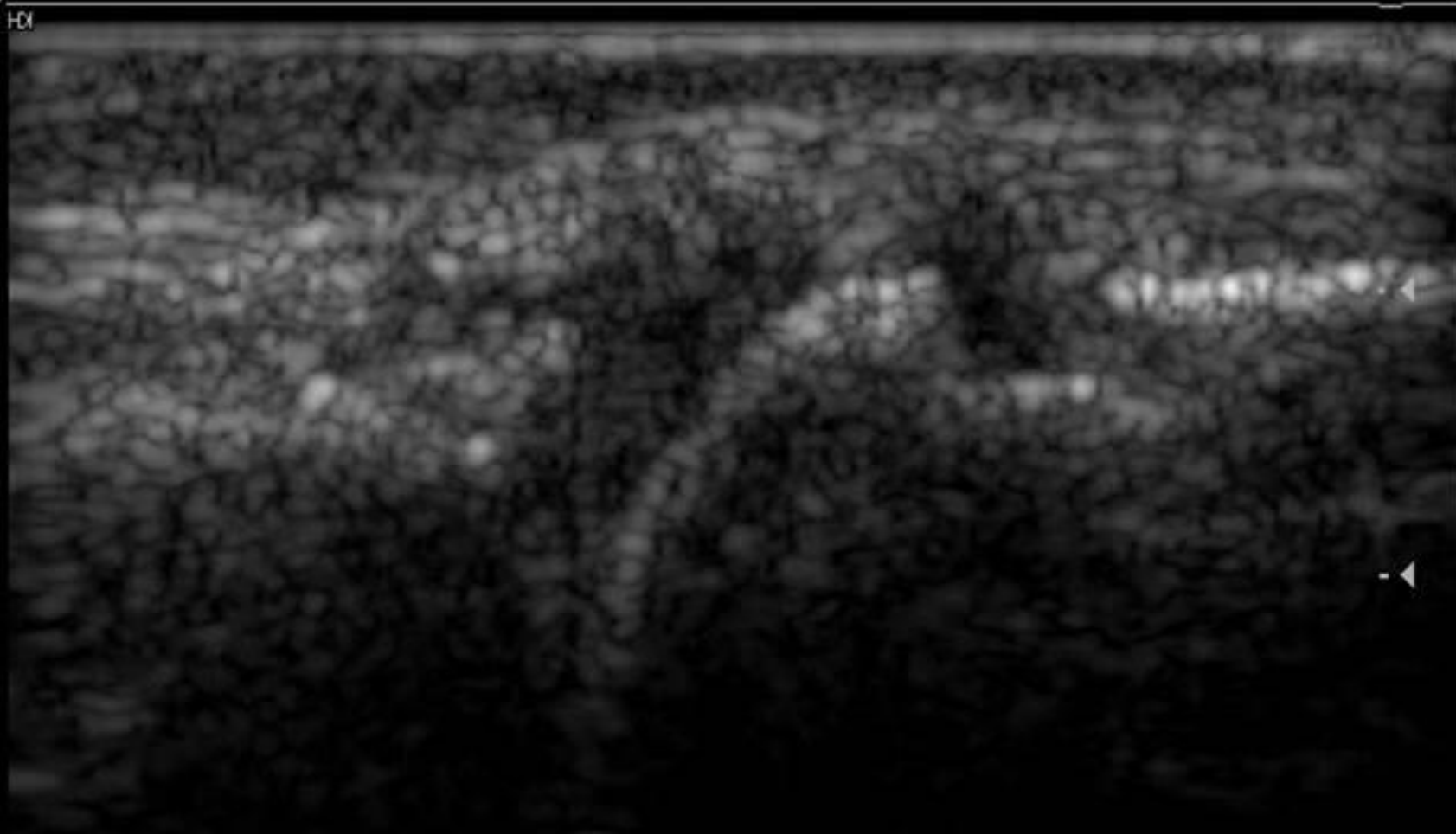


Synovitis doesn't compress

Fr Rate Med

H01

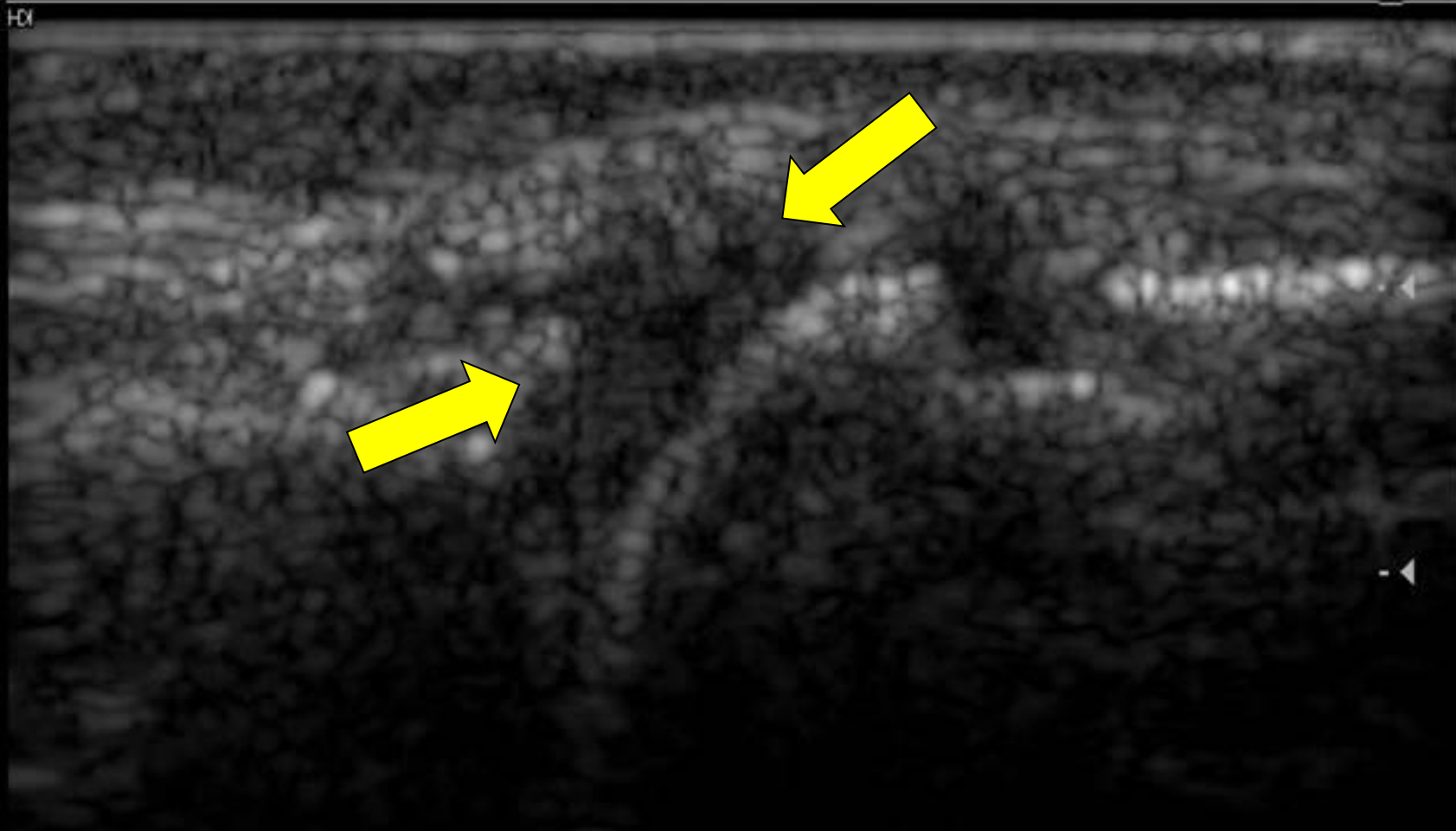
RAD
INDEX
MCP



Fr Rate Med

FDI

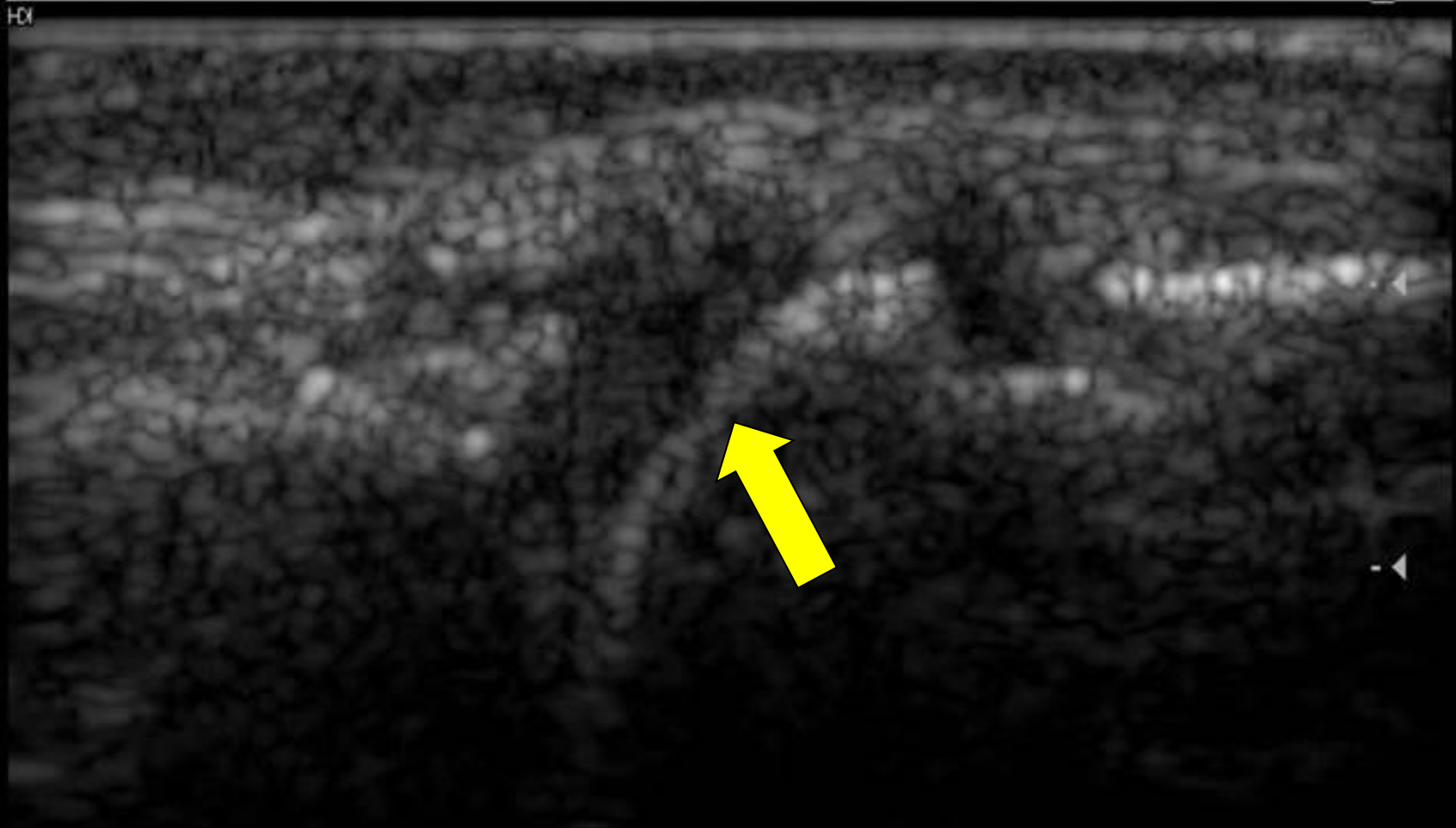
RAD
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Fr Rate Med

H01

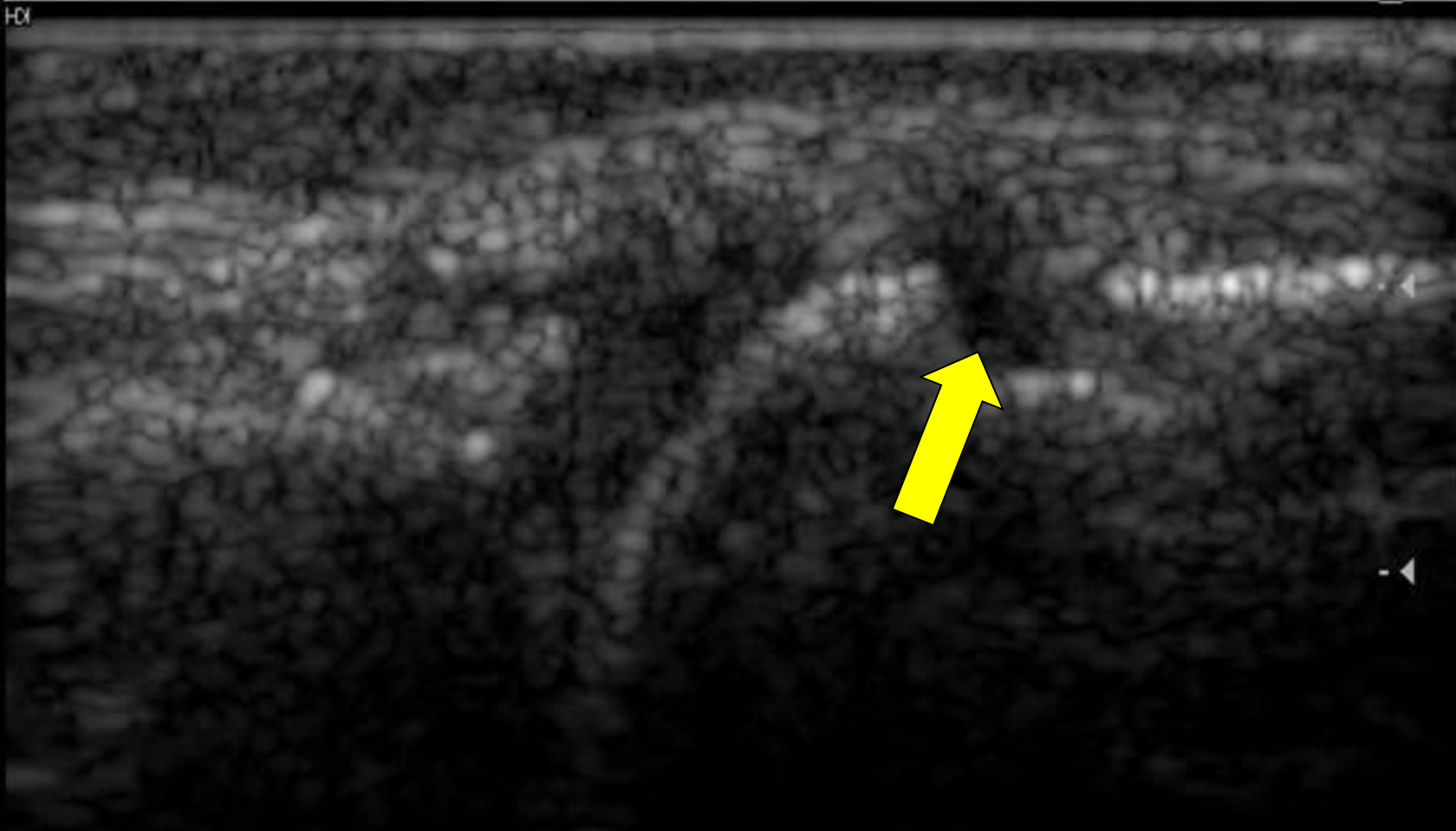
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INDEX
MCP



Fr Rate Med

H01

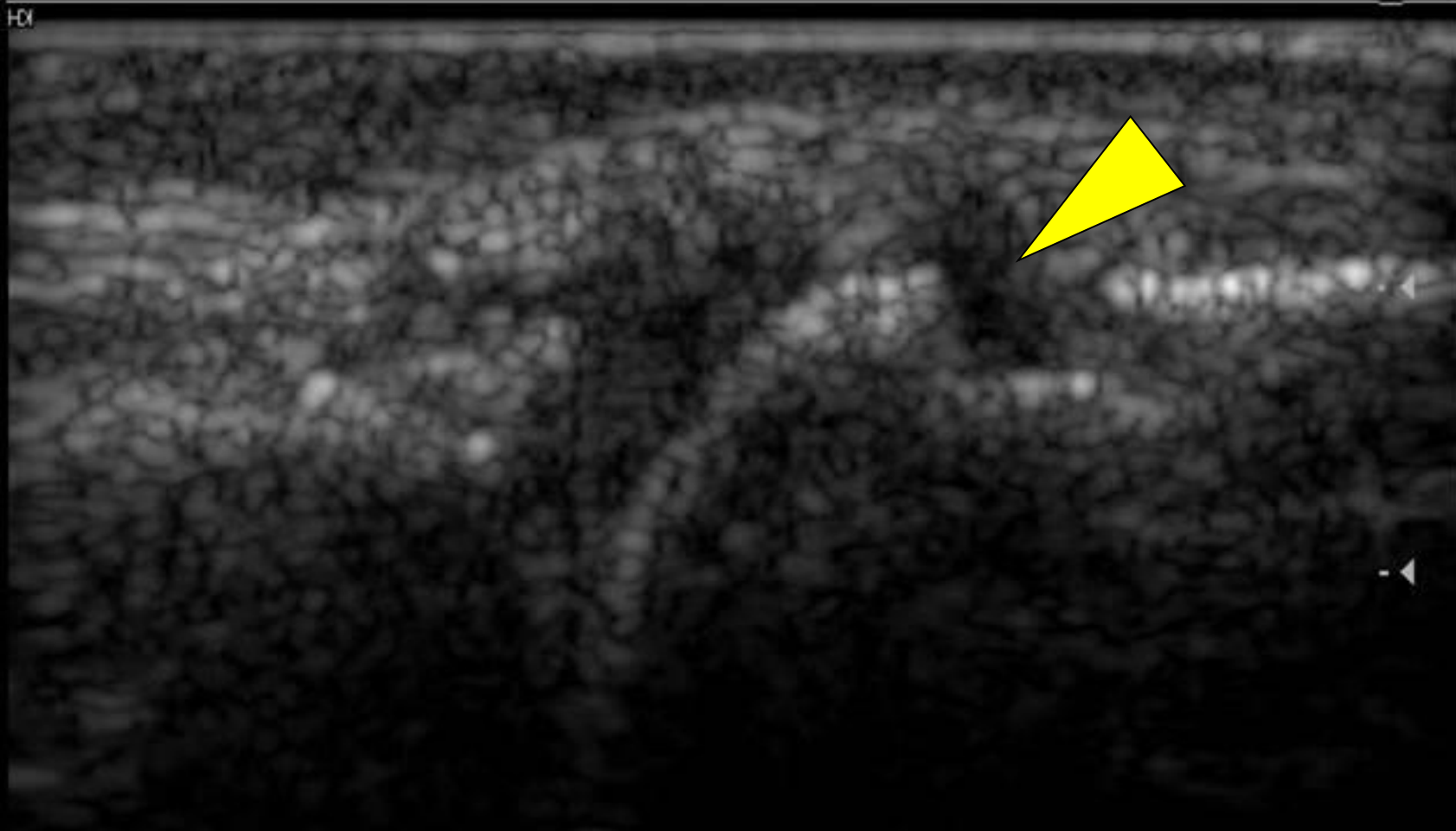
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MCP



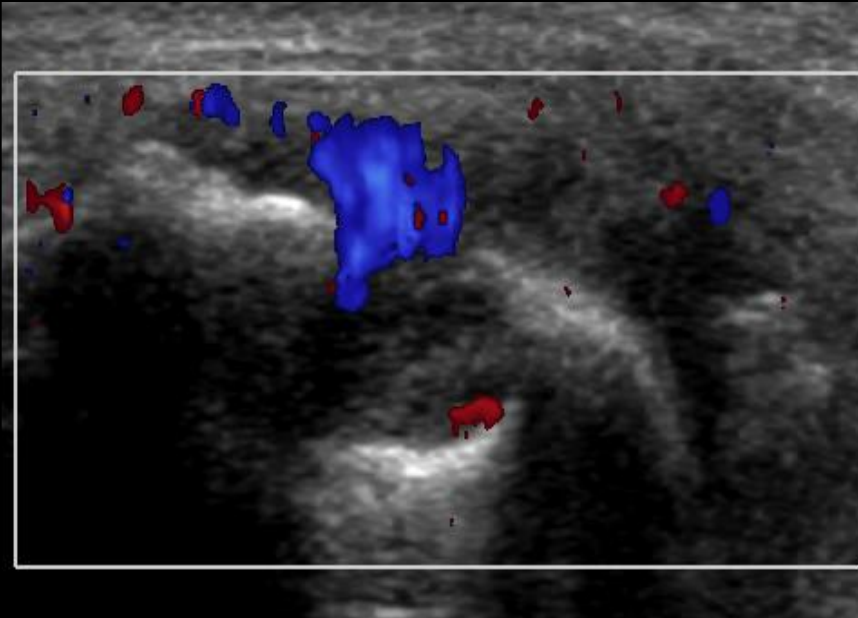
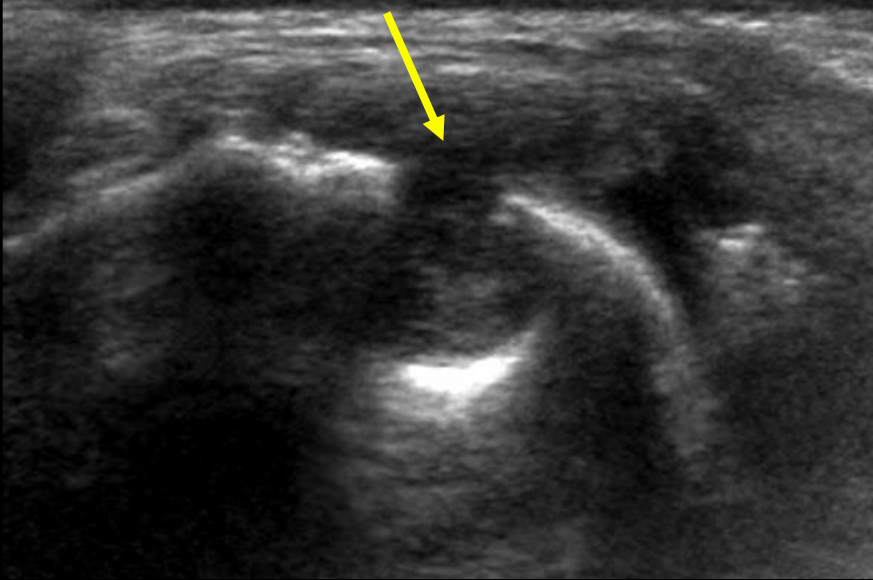
Fr Rate Med

H01

RAD
INDEX
MCP



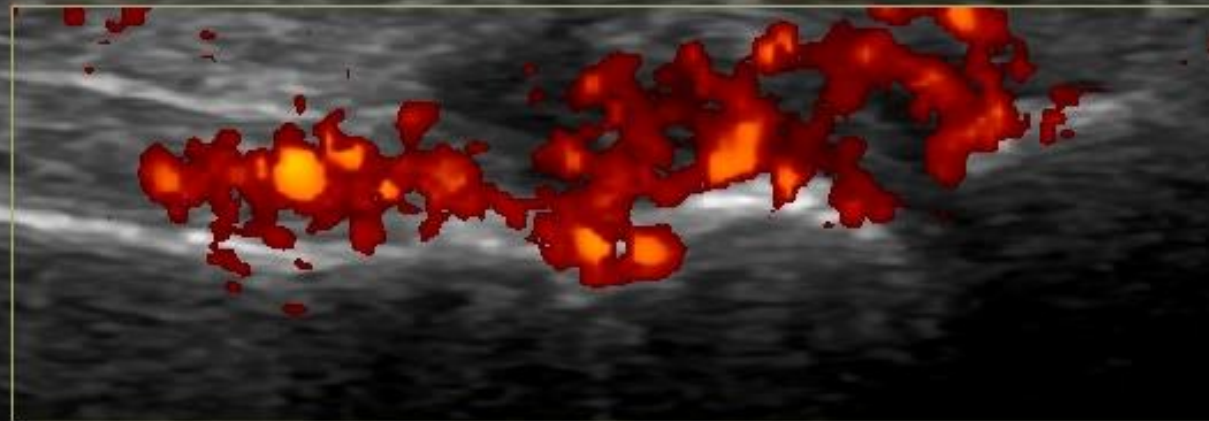
Rheumatoid Arthritis



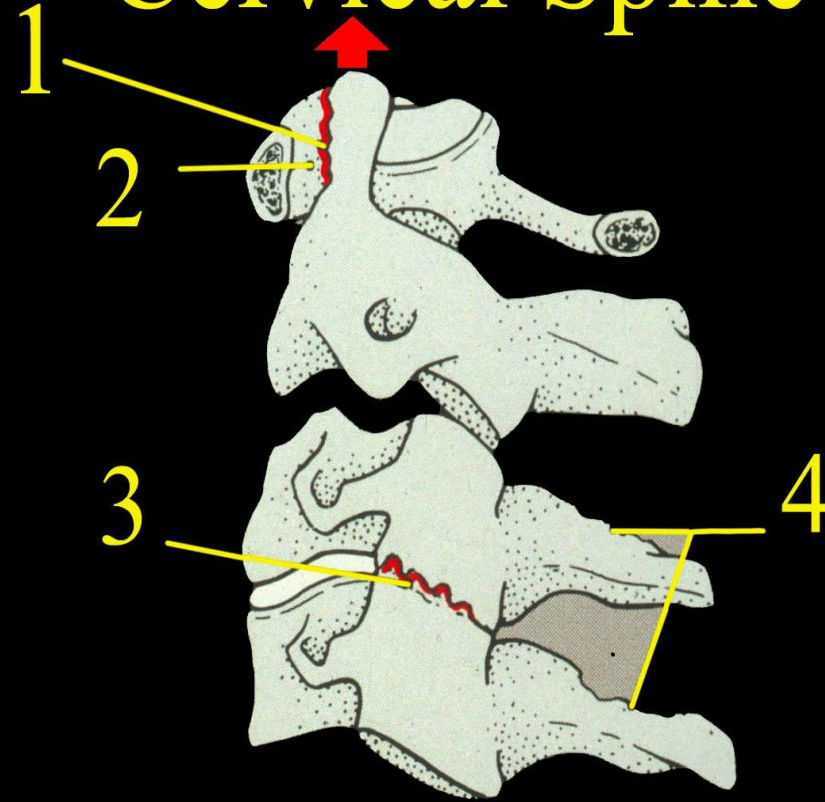
LOGIQ
E9



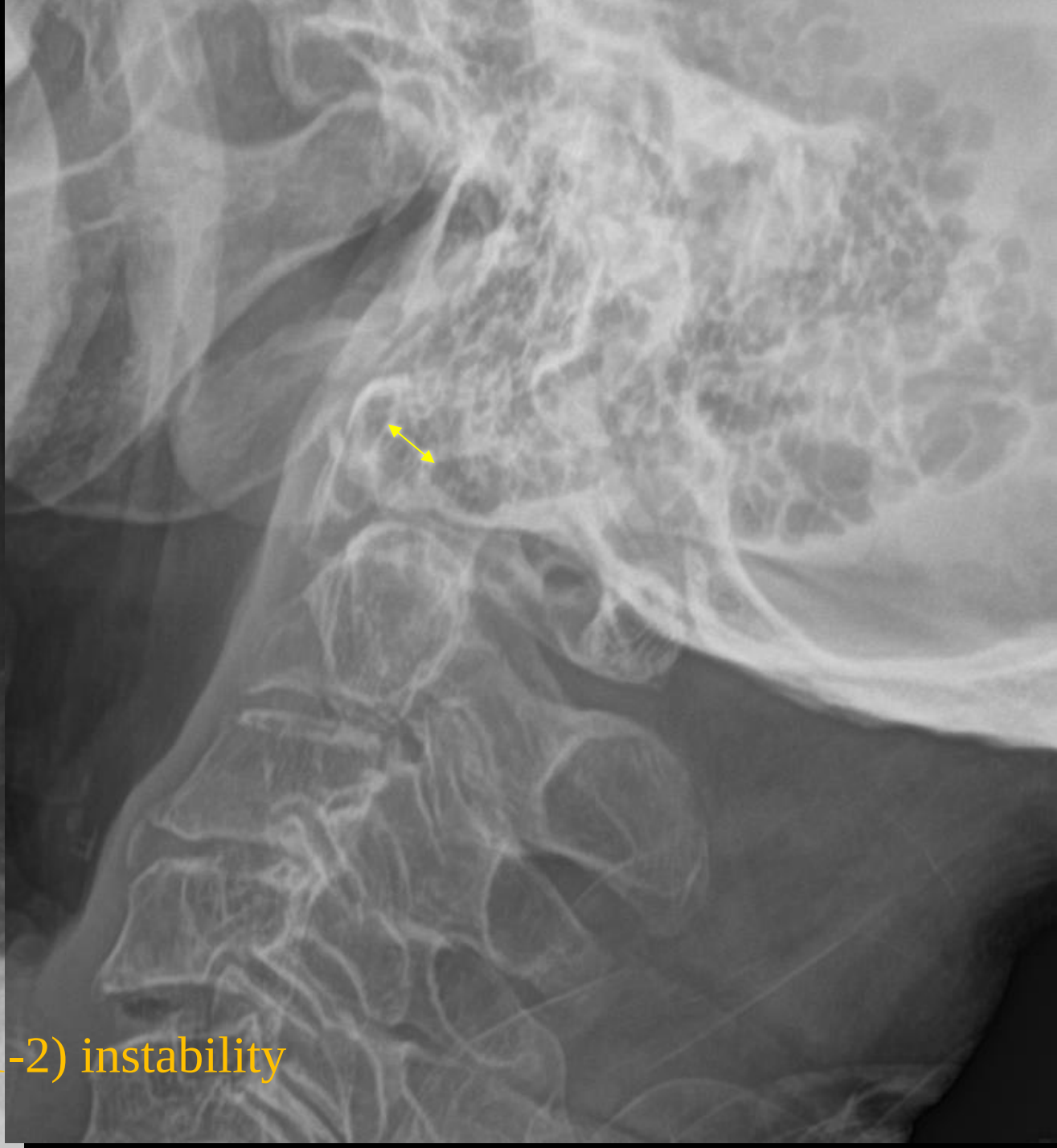
LOGIQ
E9



Cervical Spine - RA

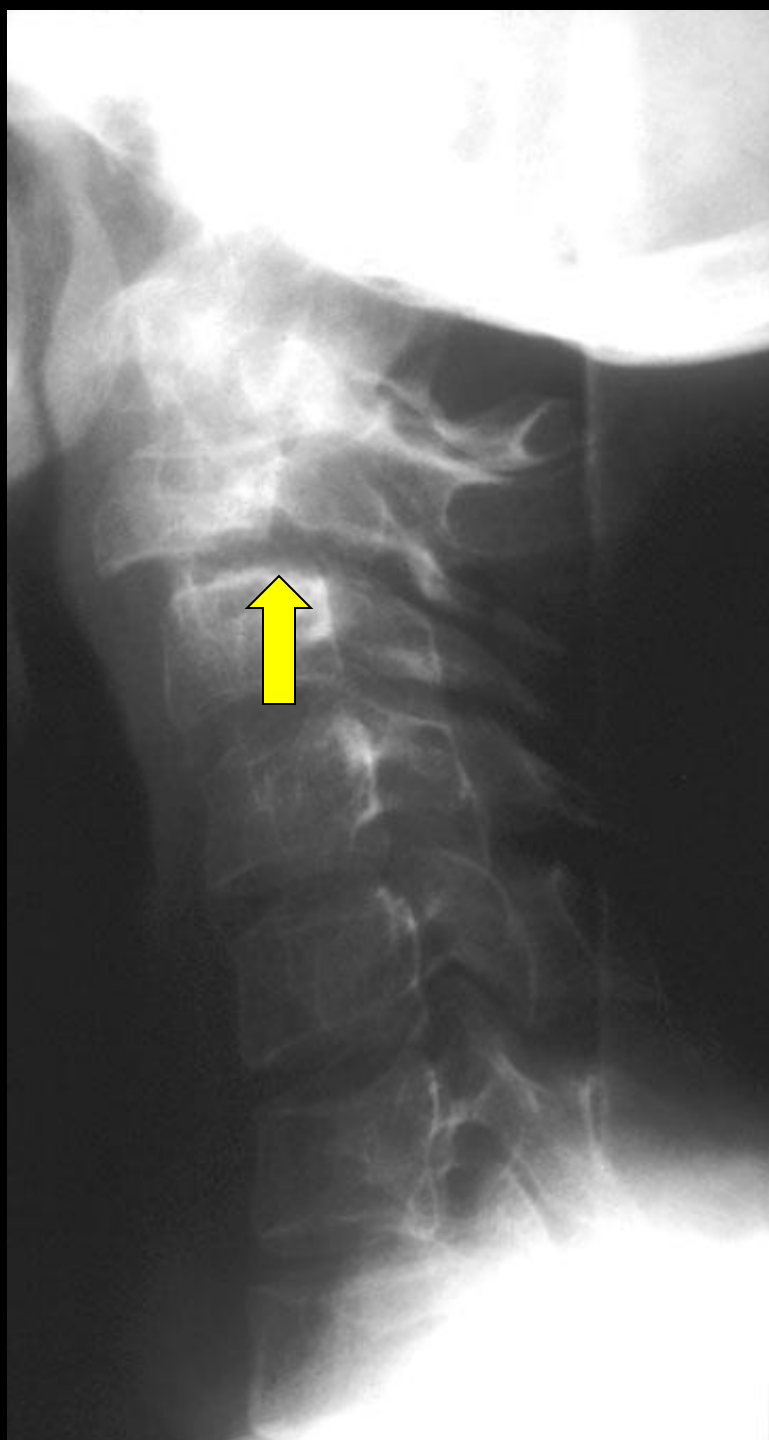


1. EROSION OF THE ANTERIOR ODONTOID
2. ATLANTOAXIAL SUBLUXATION WITH CEPHALAD MIGRATION
3. EROSION AND FUSION OF APOPHYSEAL JOINTS
4. EROSION AND WHITTLED SPINOUS PROCESSES



76 F RA: Anterior (C1-2) instability







T1



T2

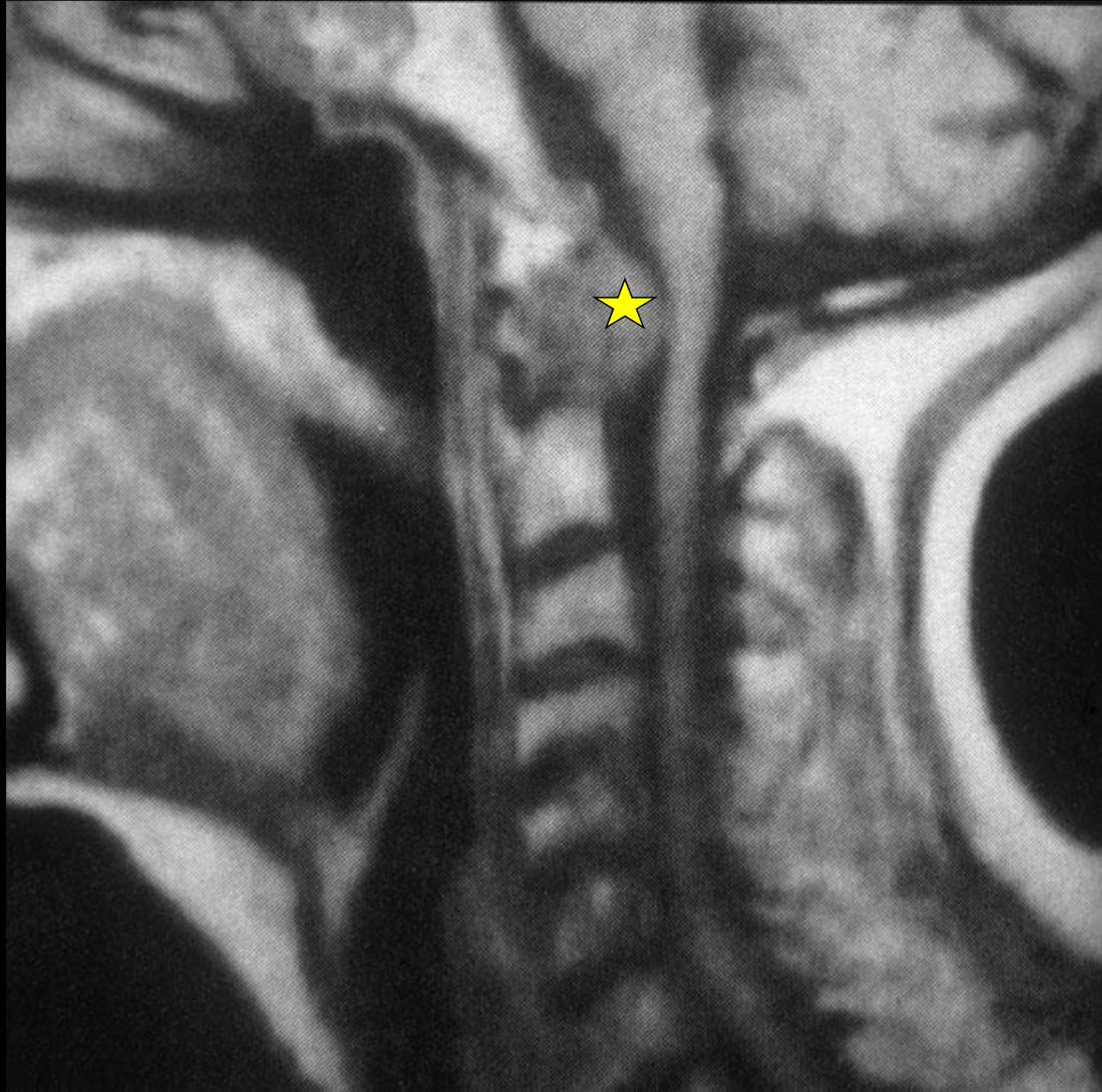




RA pannus and Dens erosion



T1



T1

SERONEGATIVE SPONDYLOARTHROPATHIES “RHEUMATOID VARIANTS”

- Psoriatic arthritis
- Reactive arthritis (Reiter syndrome)
- Ankylosing spondylitis
- Inflammatory Bowel Disease (IBD) - Crohn, Ulcerative Colitis (UC), Whipple disease

HLA B27

- Normal population -USA ~0-8%
- Ankylosing spondylitis - >90%
- Reactive arthritis – 63%-75%
- Psoriasis - not increased without arthritis
 - with peripheral arthritis - 20%
 - with axial arthritis - 50%
- IBD with axial arthritis - 50%

PSORIATIC ARTHRITIS CLINICAL CRITERIA

CASPAR-2006

- Current psoriasis (2)
- Personal history psoriasis (1)
- Family history psoriasis (1)
- Typical nail dystrophy (1)
- Negative RF (1)
- Dactylitis (current or hx) (1)
- X-ray new bone formation (1)

Joint, spine, enthesal
inflammatory disease
and score ≥ 3

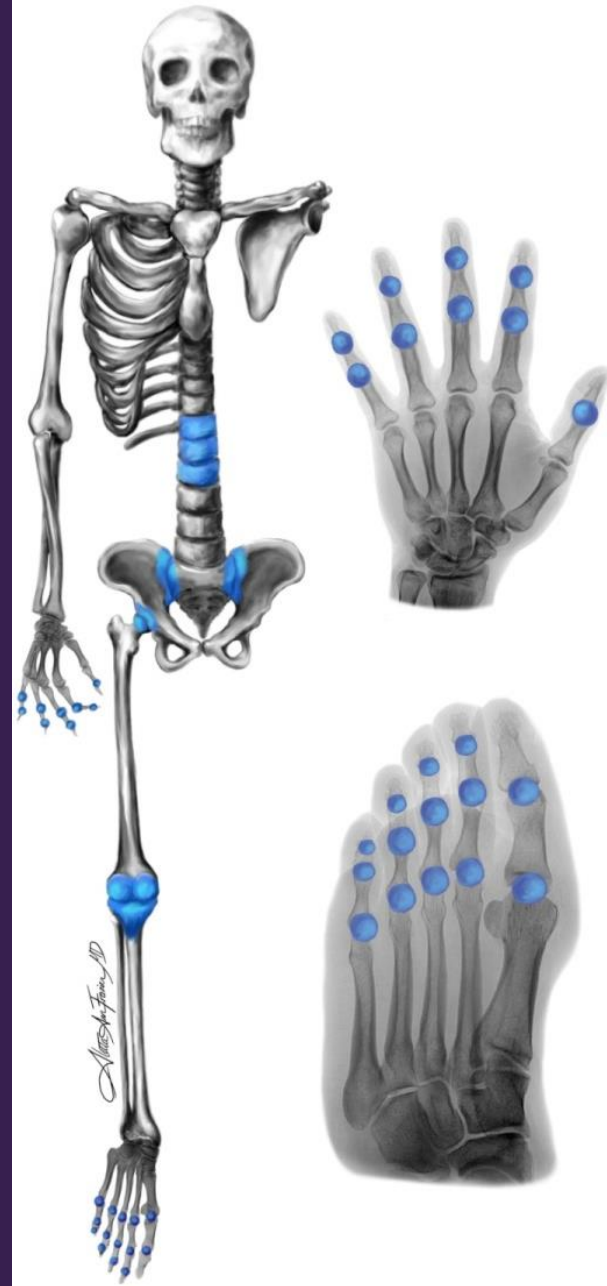
(92% sens/98% spec)

PSORIATIC ARTHRITIS CLINICAL CHARACTERISTICS

- Peak ages 20–40 years, M = F
- Spine/DIP (M>F), symmetric (F>M)
- HLA B 27 – not increased without arthritis
 - Peripheral arthritis 20%; axial arthritis 50%
- Arthritis in 5%-14% with psoriasis
- Skin changes before arthritis – 75% to 80%
- Arthritis before skin changes – 10% to 15%

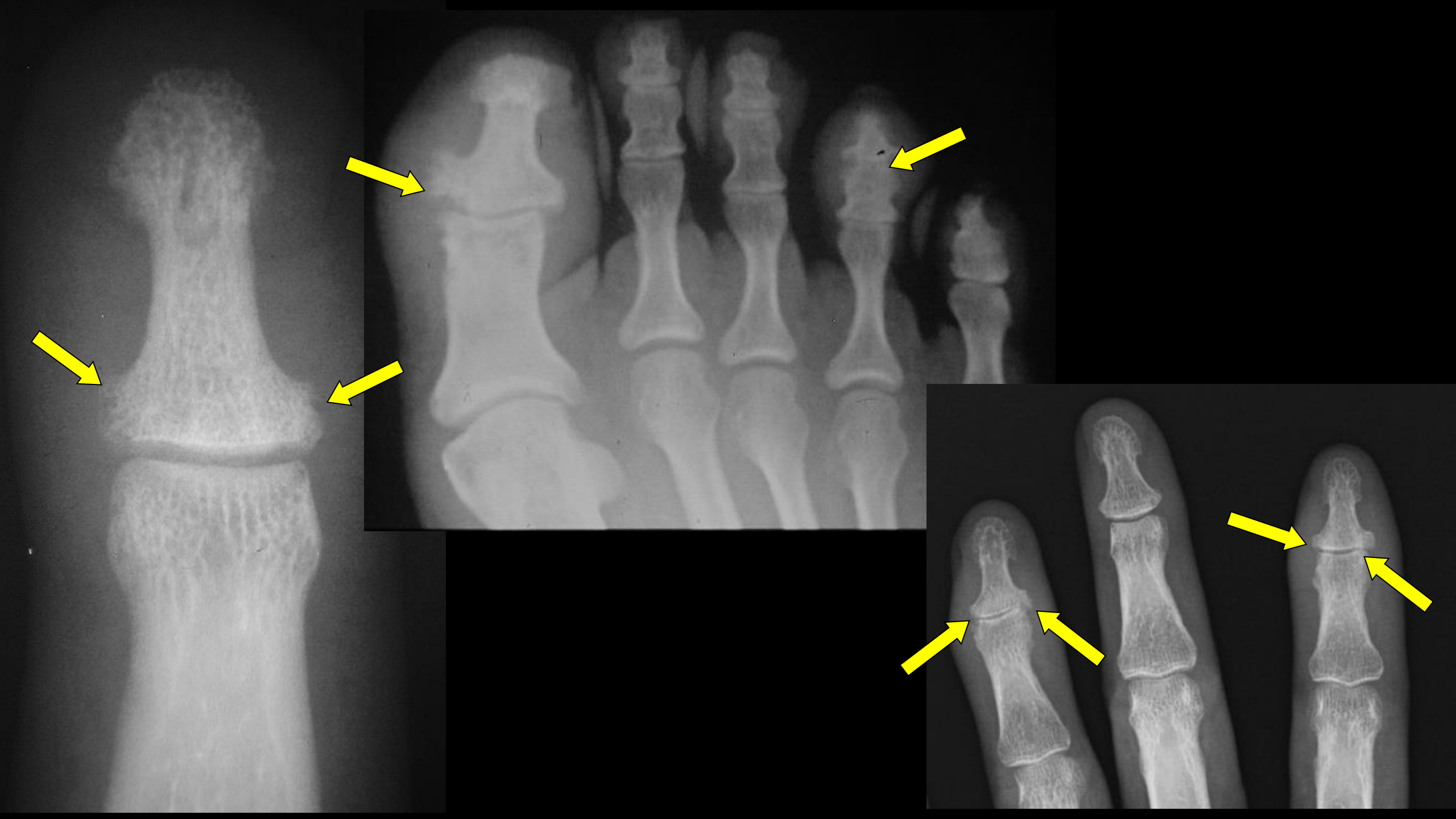
PSORIATIC ARTHRITIS DISTRIBUTION AND PRESENTATION

- DIP/PIP joints
 - Hands (involved in 40%) > feet
- Arthritis mutilans
- Oligoarthritis/ray distribution
- Rheumatoid – like (rare)
- Sacroiliitis (30%-50%); spondylitis(17%)



PSORITIC ARTHRITIS REACTIVE ARTHRITIS

- Normal mineralization
- Fusiform or diffuse soft tissue swelling
- Aggressive marginal erosions
- Bone production
- Joints involved – symmetric narrowing
- Distribution – asymmetric/bilateral



LEARNING OBJECTIVES

- The one sentence summary statement for diagnosis (either radiography or cross-sectional imaging)
- Inflammatory erosive arthritis involving multiple hand/foot DIP/IP joints with bone production
- What arthritis am I?

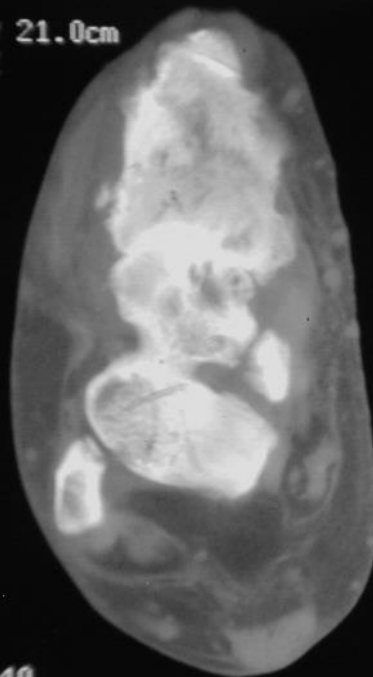


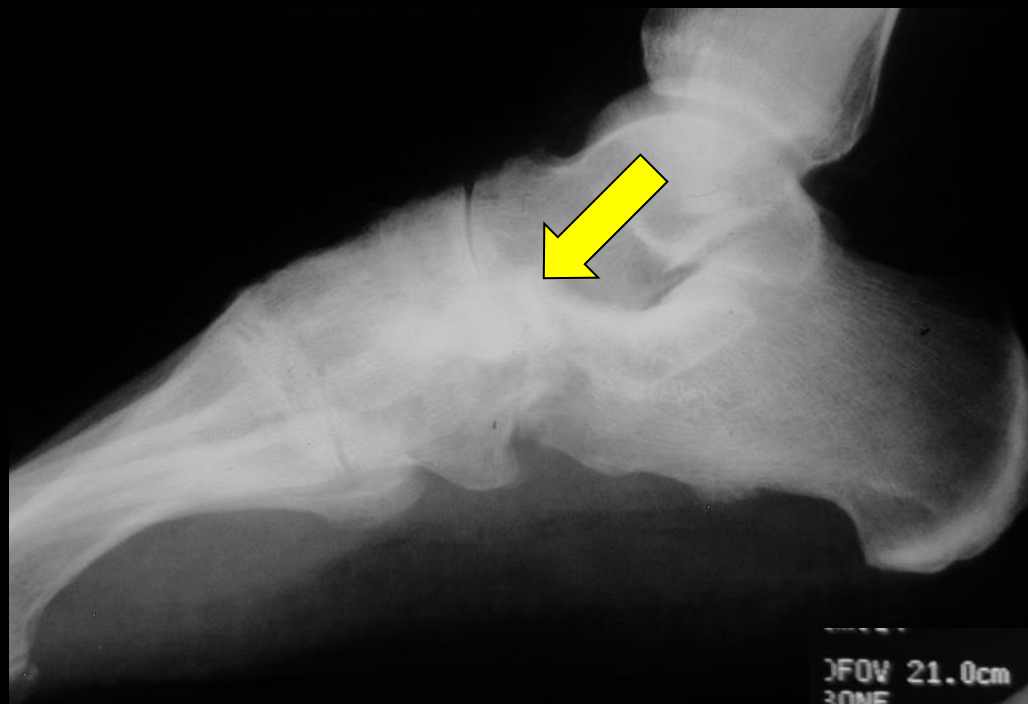
FOV 21.0cm
BONE

R

R

kV 140
mA 190~





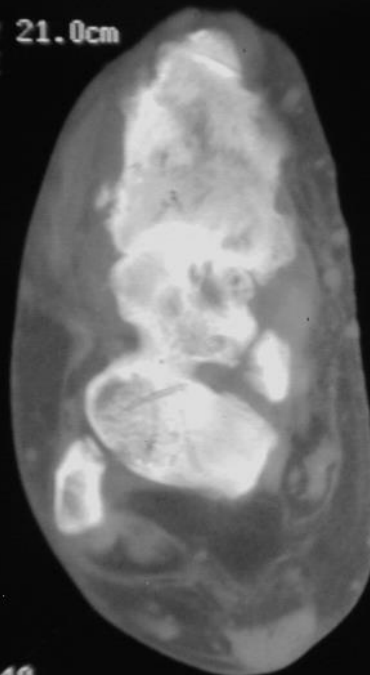


FOV 21.0cm
BONE

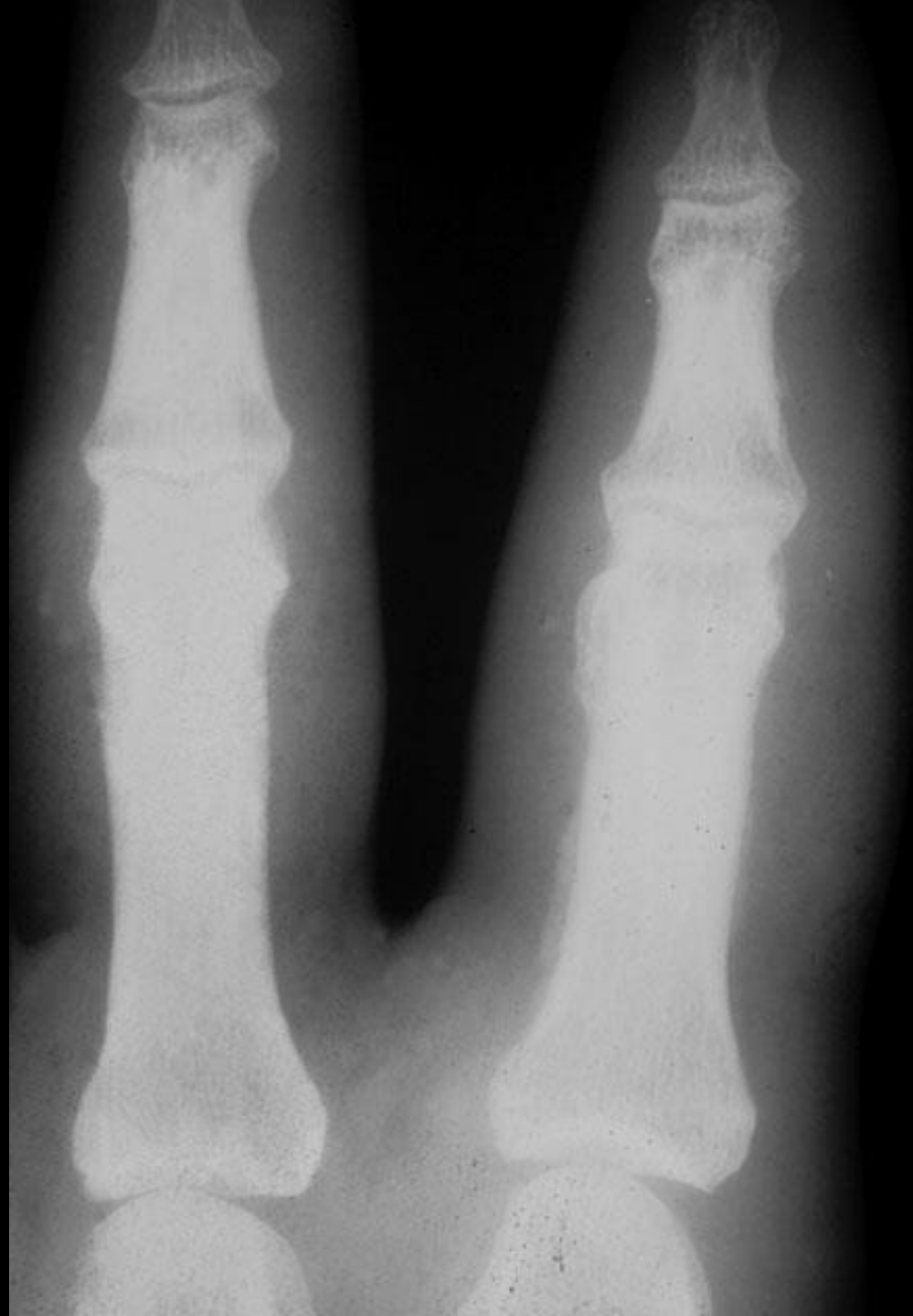
R

R

kV 140
mA 190~









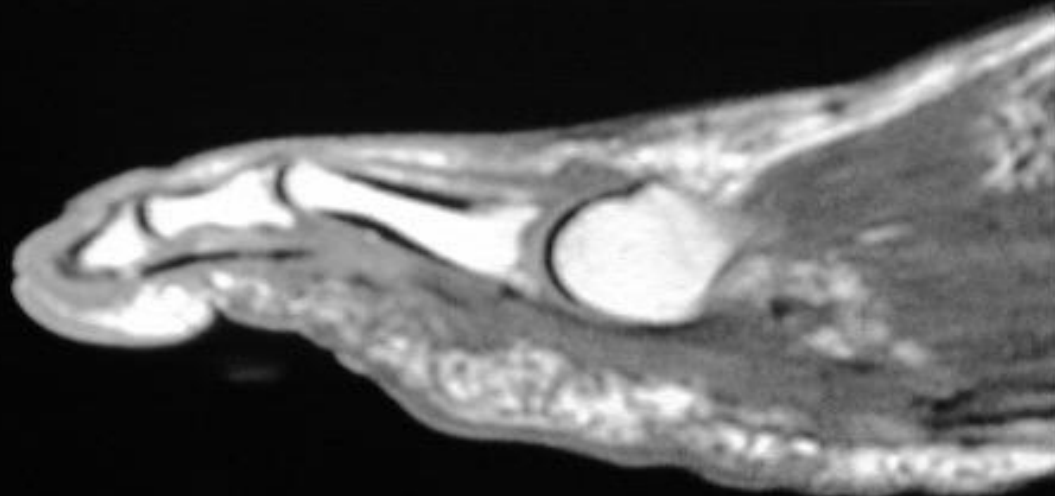




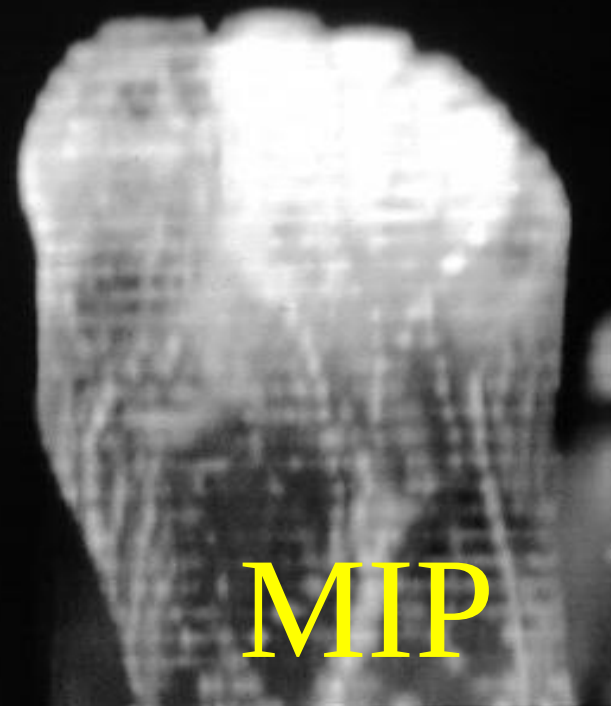
Sausage Digits

PSORIATIC ARTHRITIS REACTIVE ARTHRITIS MR IMAGING

- Flexor tenosynovitis; Nail involvement
- Periarticular/extracapsular/periosteal edema/enhancement; Ray distribution
- Bone marrow edema not predictive of erosions
- More abrupt washout phase with drop in dynamic contrast enhanced studies



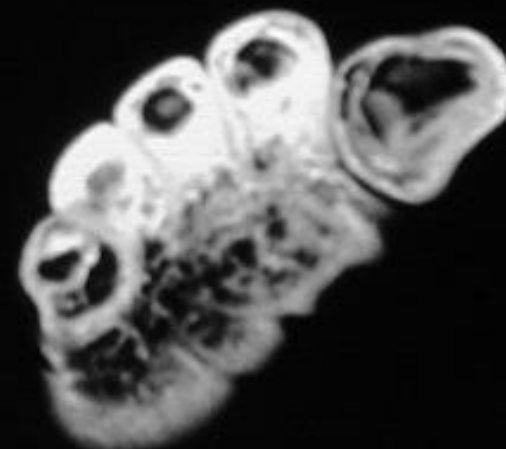
T1



MIP



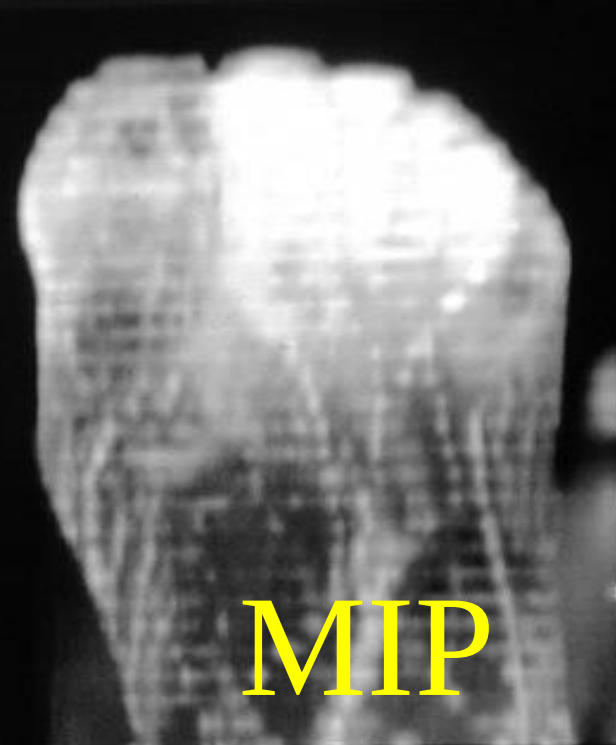
T2



T1 GD



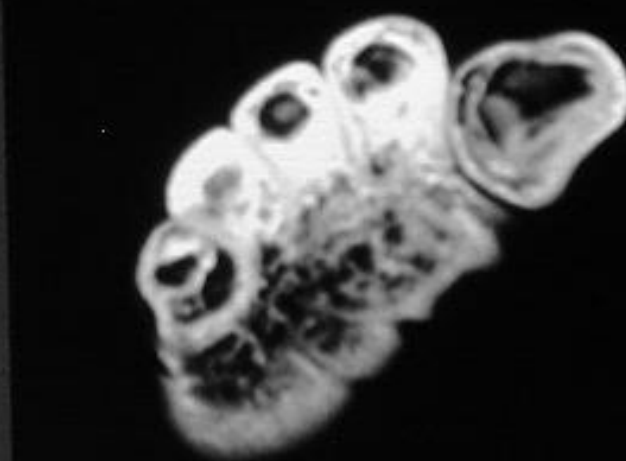
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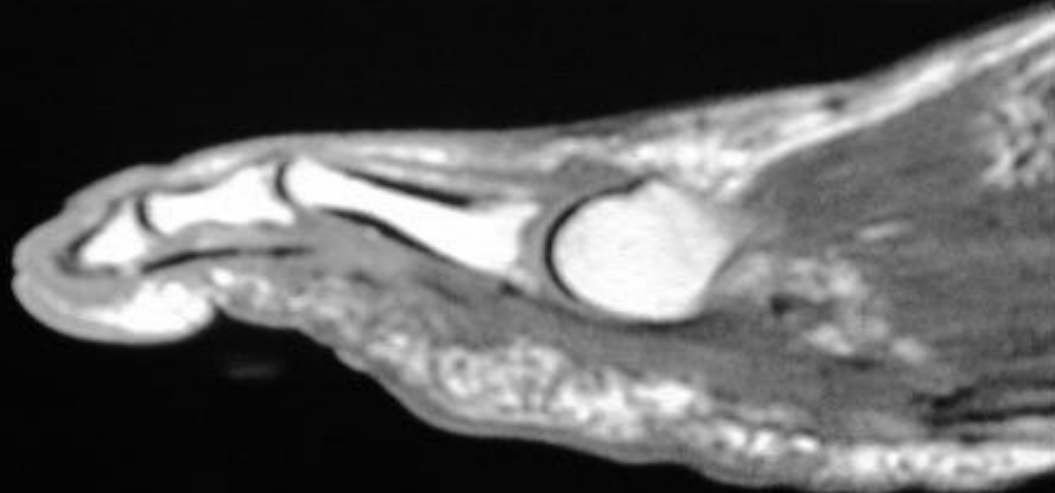
MIP



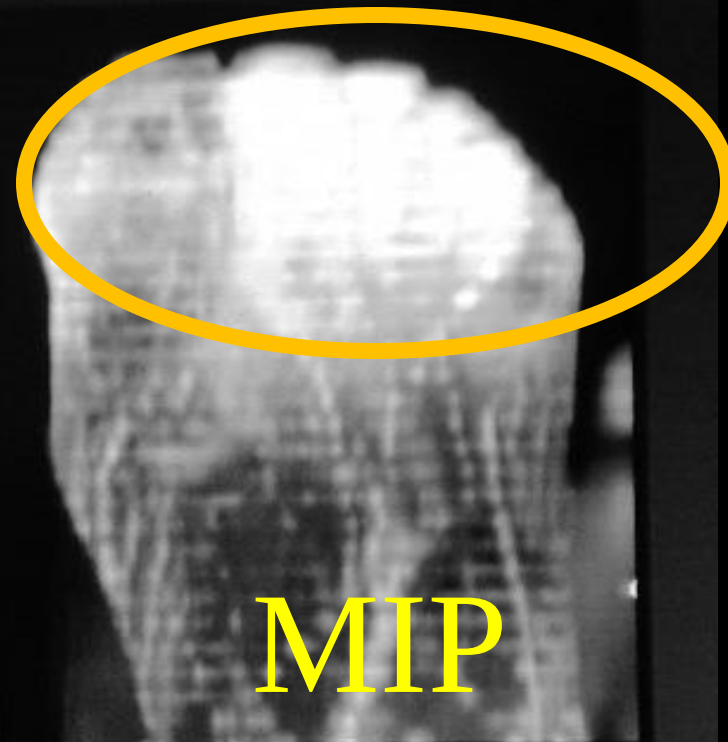
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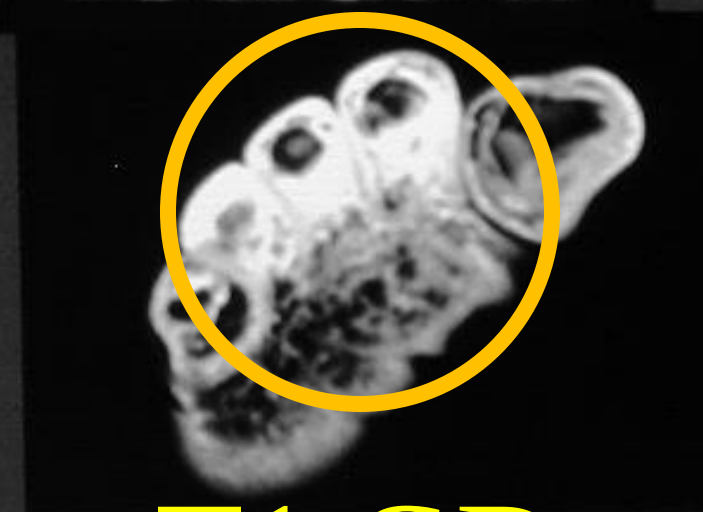
T1



MIP



T2



T1 GD

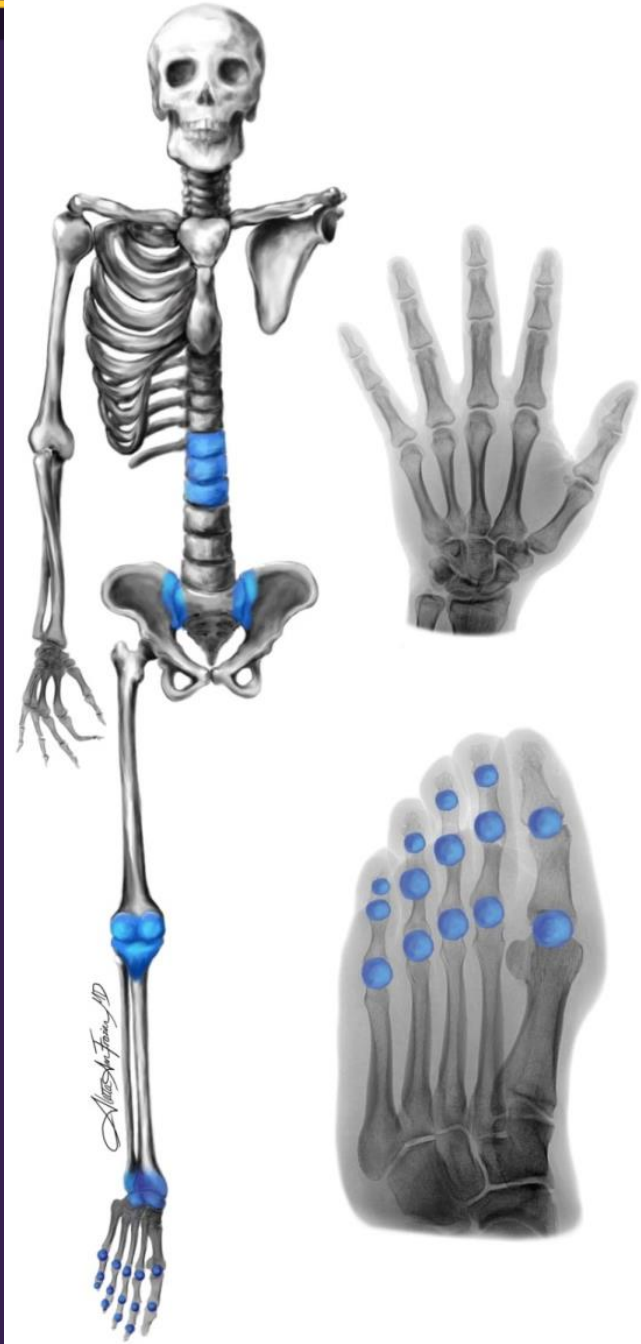
REACTIVE ARTHRITIS

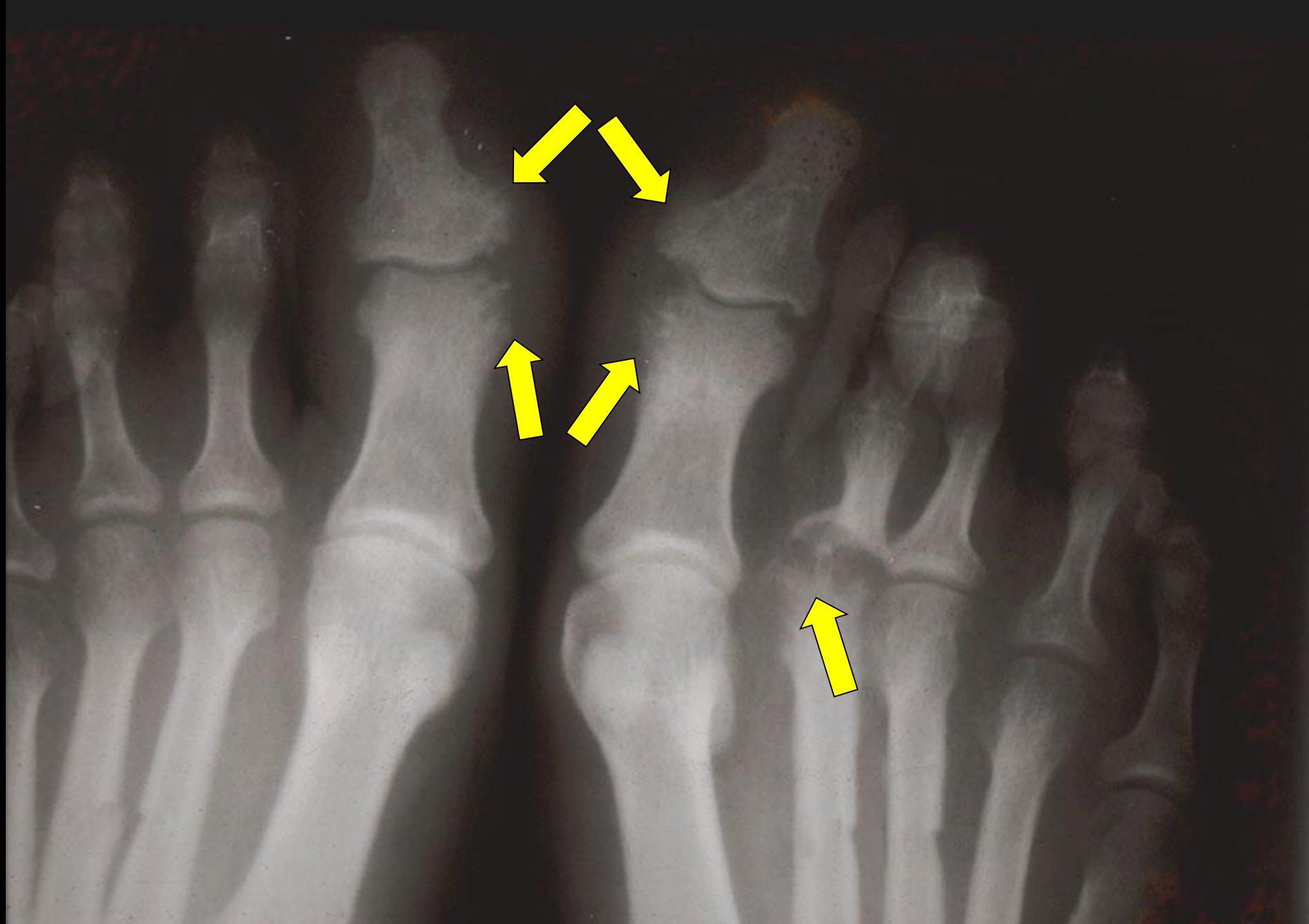
CLINICAL CHARACTERISTICS

- Young adults; M – F; 50 – 1:1
- HLA B27 63%-75%
- Annual incidence: 30–40/100,000
- Often associated with infection
- Urethritis/cervicitis
- Diarrhea – shigella, salmonella, campylobacter

REACTIVE ARTHRITIS DISTRIBUTION

- Feet (40%-55%)
- IP joint great toe
- MTP joints
- Calcaneus (enthesopathy 25%-50%)
- Hands – oligoarticular (10%-30%)
- Knees (25%-40%); Ankles (30%-50%)
- SI joints (40%-75%); Spine (10%-20%)
- Hips – rarely affected









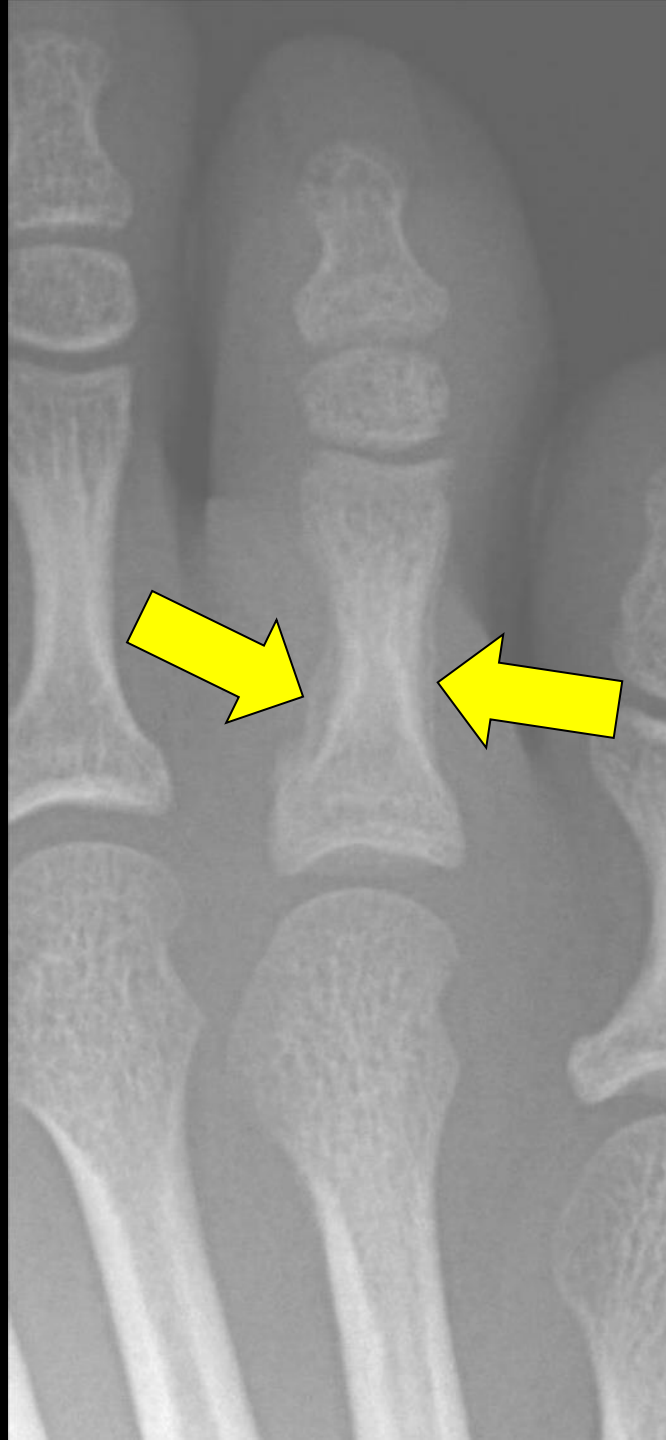




W 088 : L 872
FOOT
Sensitivity: 481
FOOT, BILAT 2 VIEWS

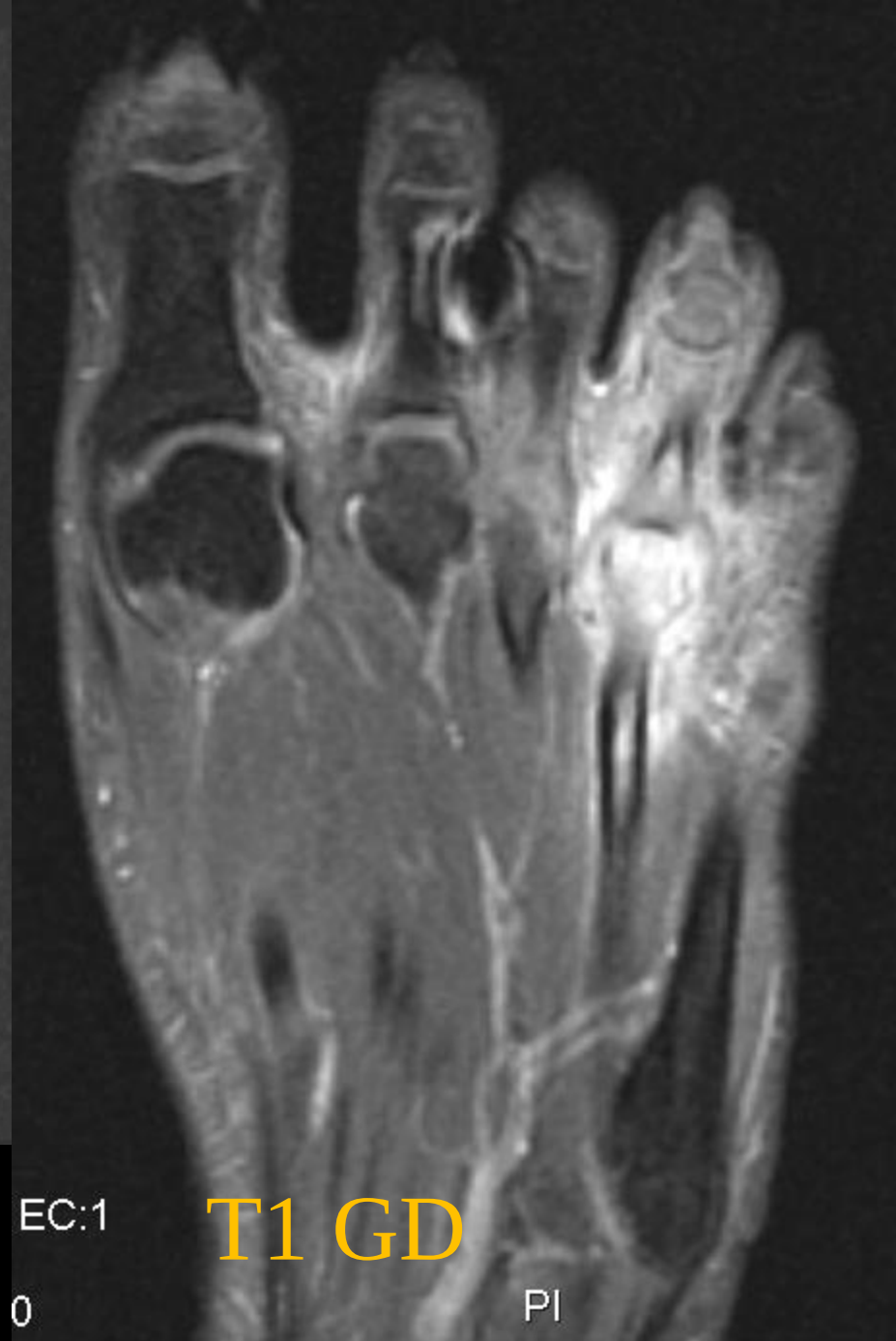


W 088 : L 872
FOOT
Sensitivity: 481
FOOT, BILAT 3 VIEWS



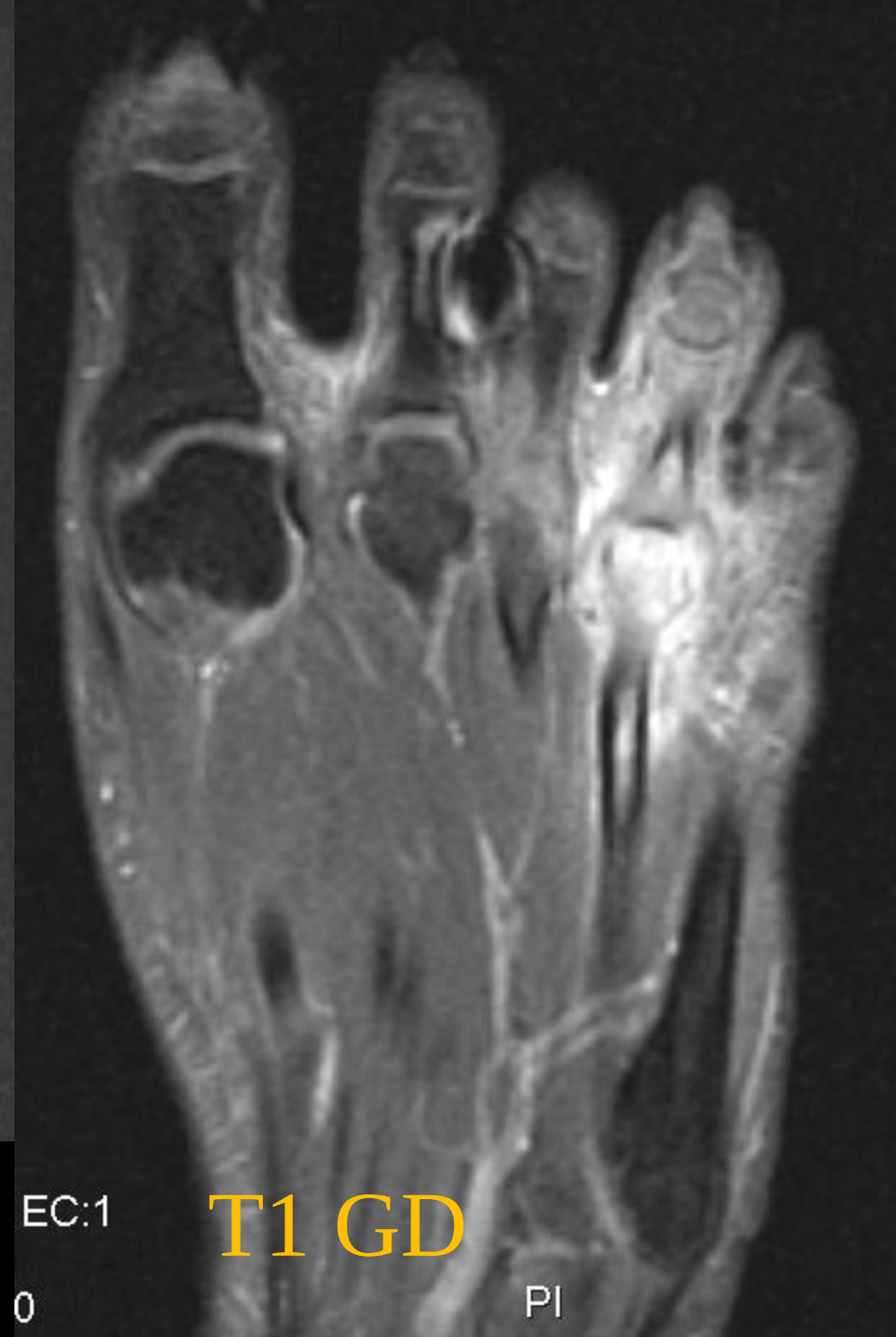


T1





T1



0

SP:

A156

R
S

TR:500
TE:11 EC:1
EXTREM
DFOV:120
3thk/ 3sp

A36

T1

EC:1

T1 GD

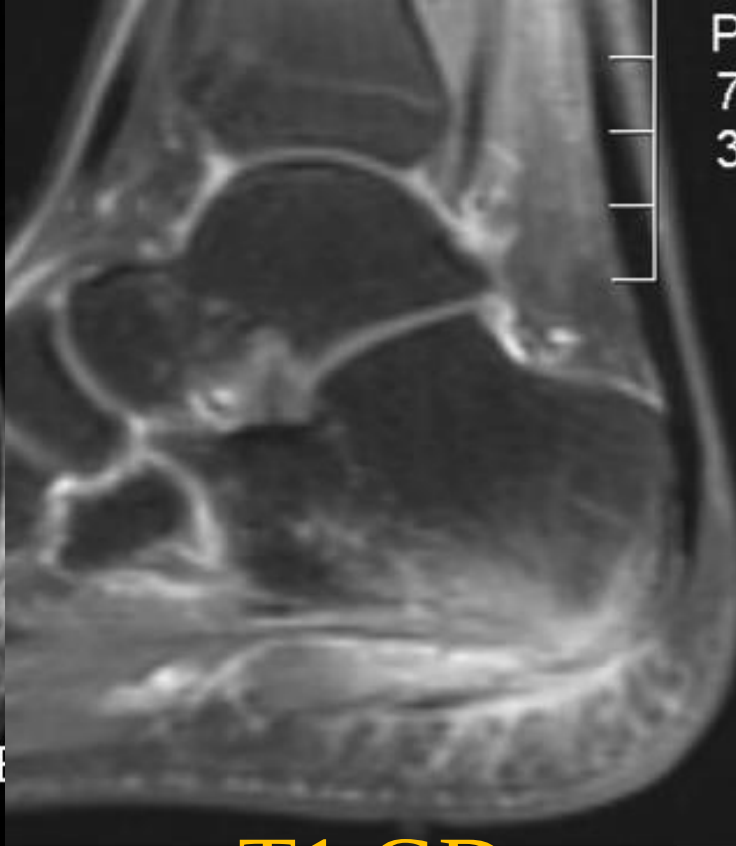
0

PI

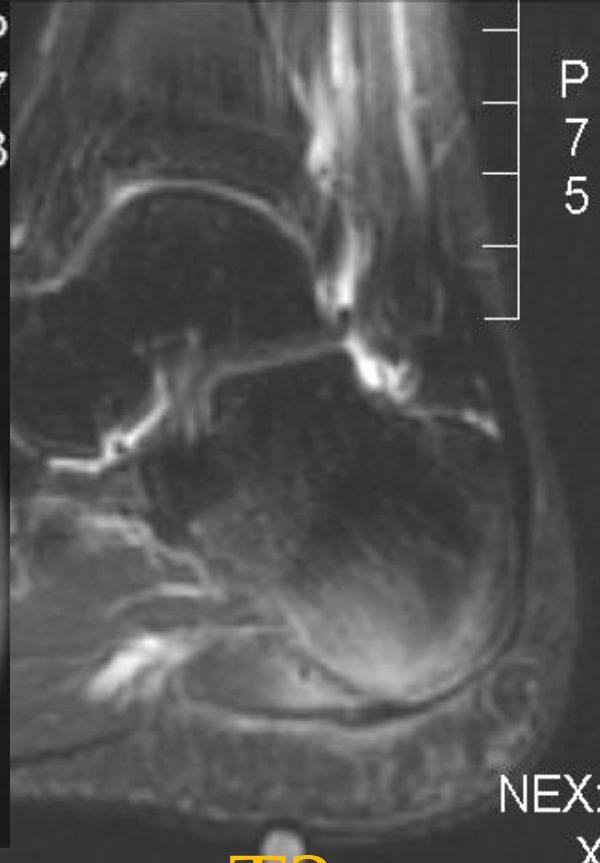




T1



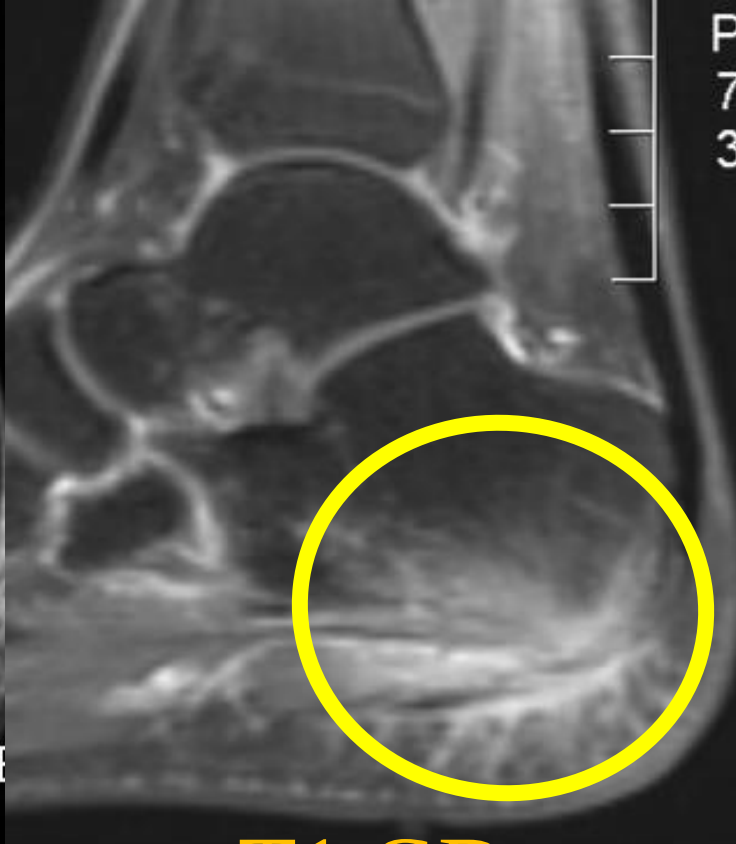
T1 GD



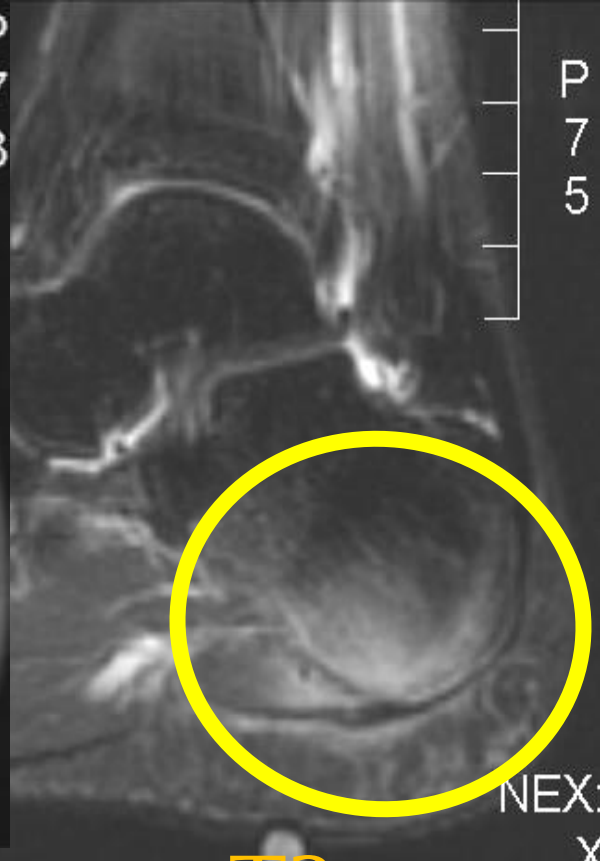
T2



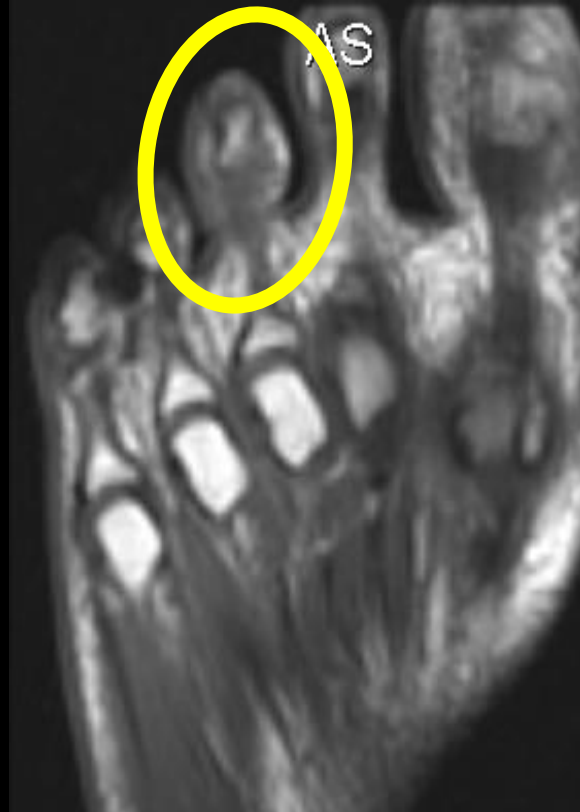
T1



T1 GD



T2



T1



T1 GD



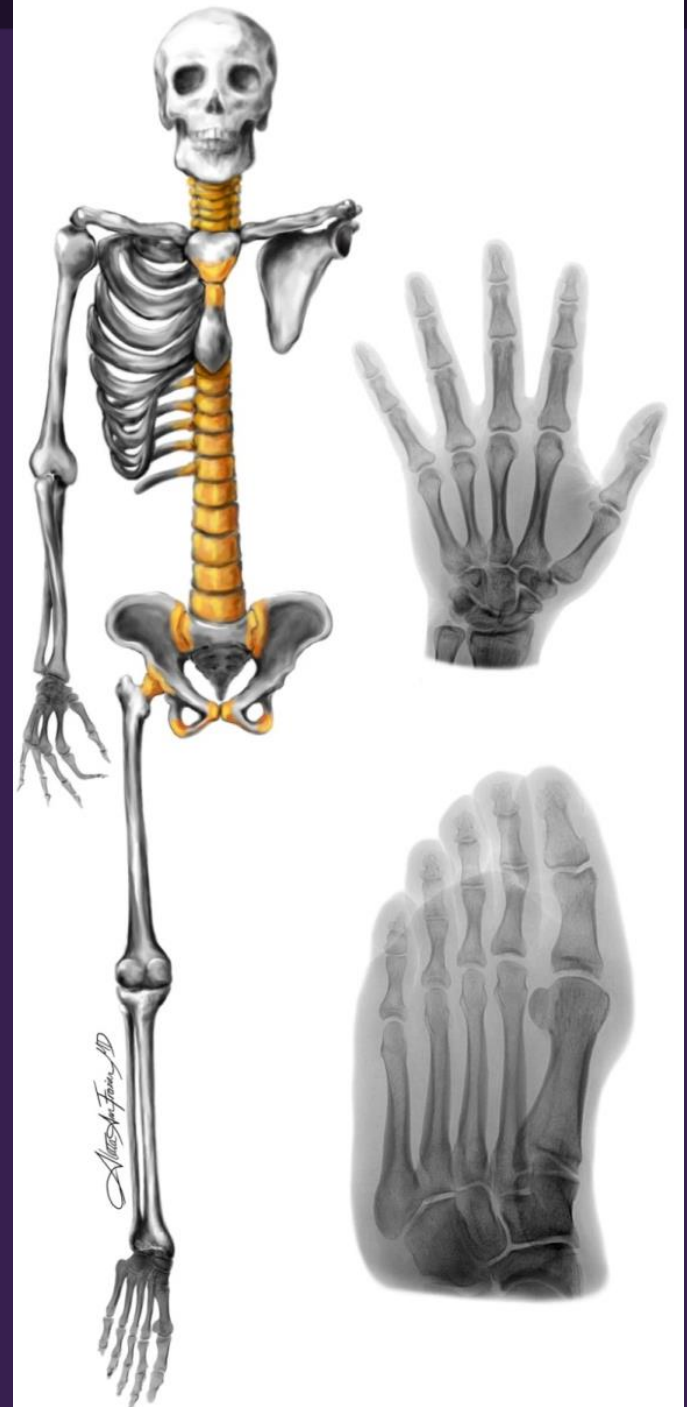
T2

ANKYLOSING SPONDYLITIS CLINICAL CHARACTERISTICS

- Peak age of onset 15–30 years
- M:F 3-5:1
- Incidence 6.6/100,000
- HLA–B27 - >90%
- Rare in blacks
- Predilection axial involvement

ANKYLOSING SPONDYLITIS DISTRIBUTION

- Osseous ankylosis
- Ligament/Tendon ossification
- Spine/SI joints
 - Symmetric
- Pelvis – symphysis, ischium, iliac, hips
- Peripheral changes unusual early (10%-50%)
 - Asymmetric



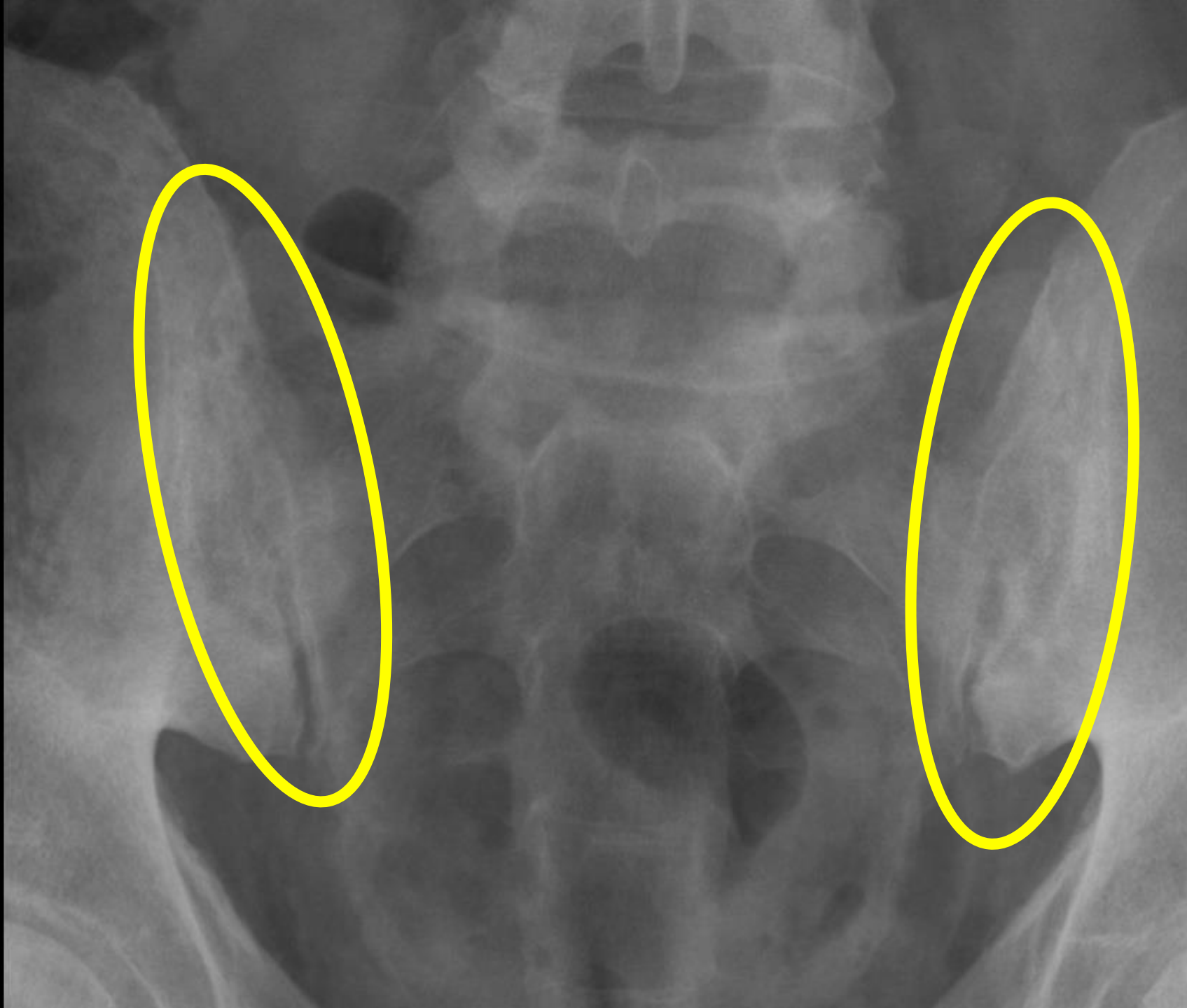
ANKYLOSING SPONDYLITIS RADIOGRAPHIC MANIFESTATIONS

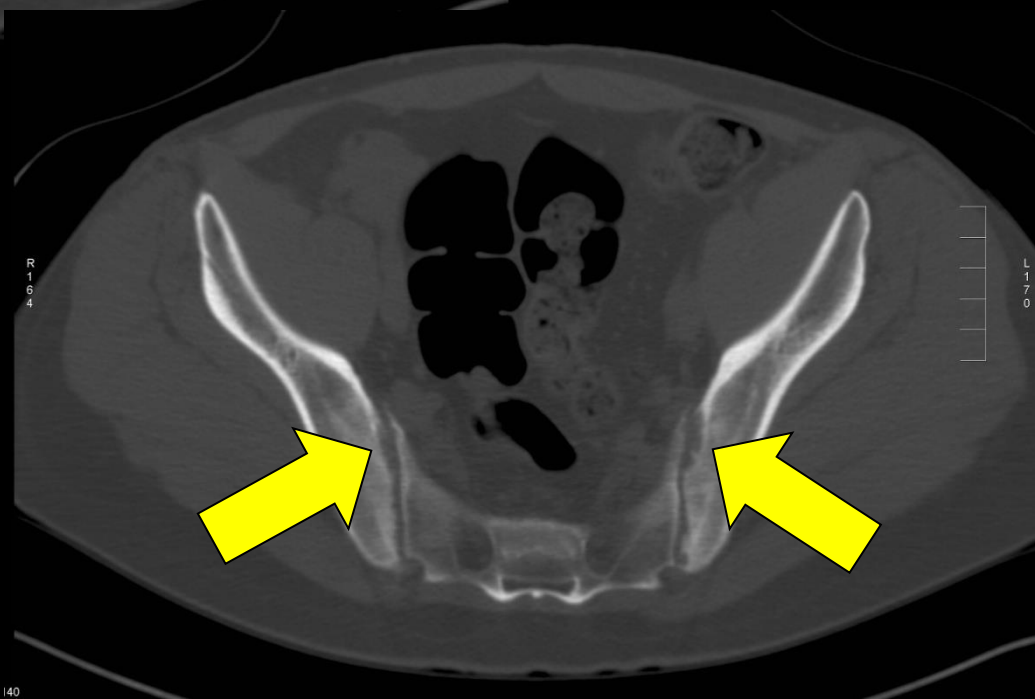
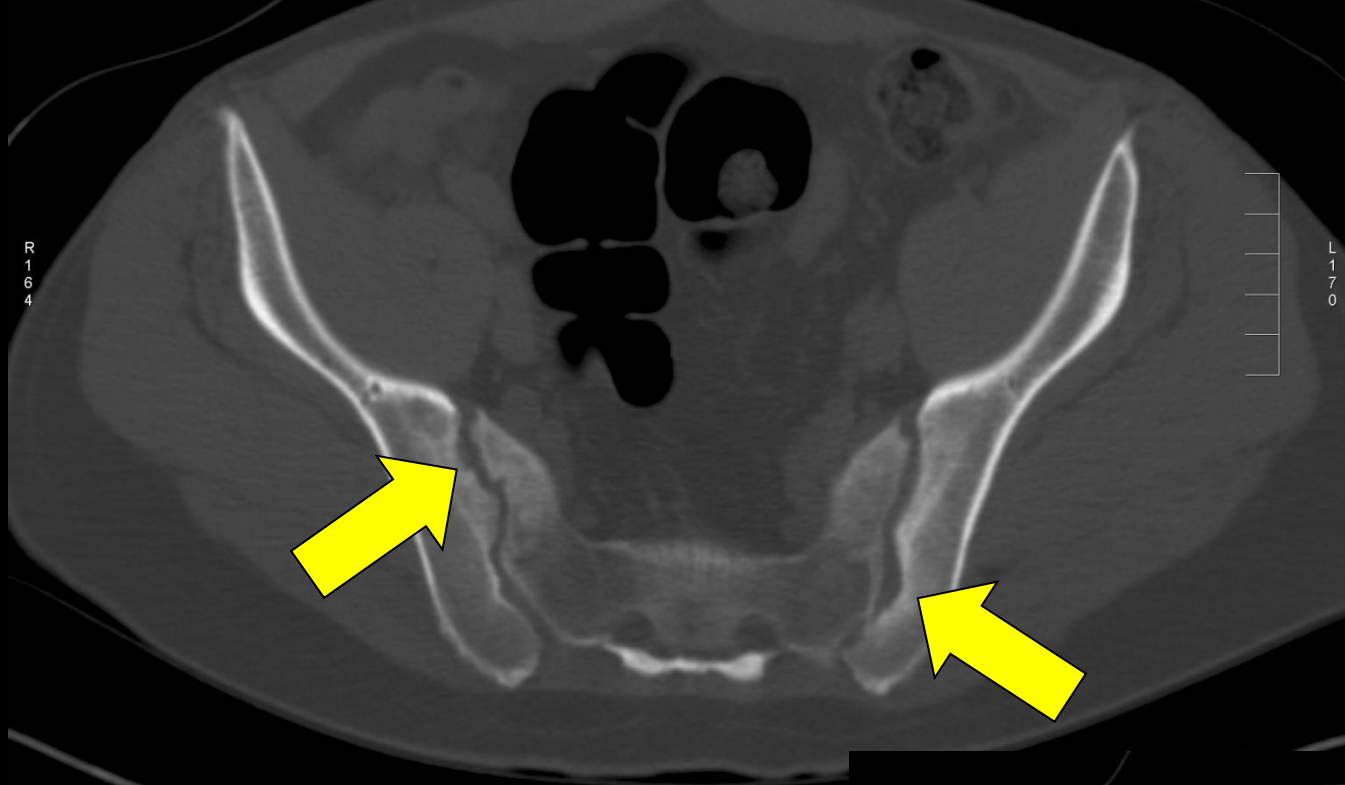
- Sacroiliitis symmetric 86%
- Lumbar predominance in first 20 years of disease; after which equal cervical and lumbar involvement
- Complete spine fusion in 28% in patients with >30 years of disease and 43% with >40 years of disease
- Presence of hip disease strongly associated with more severe spinal disease

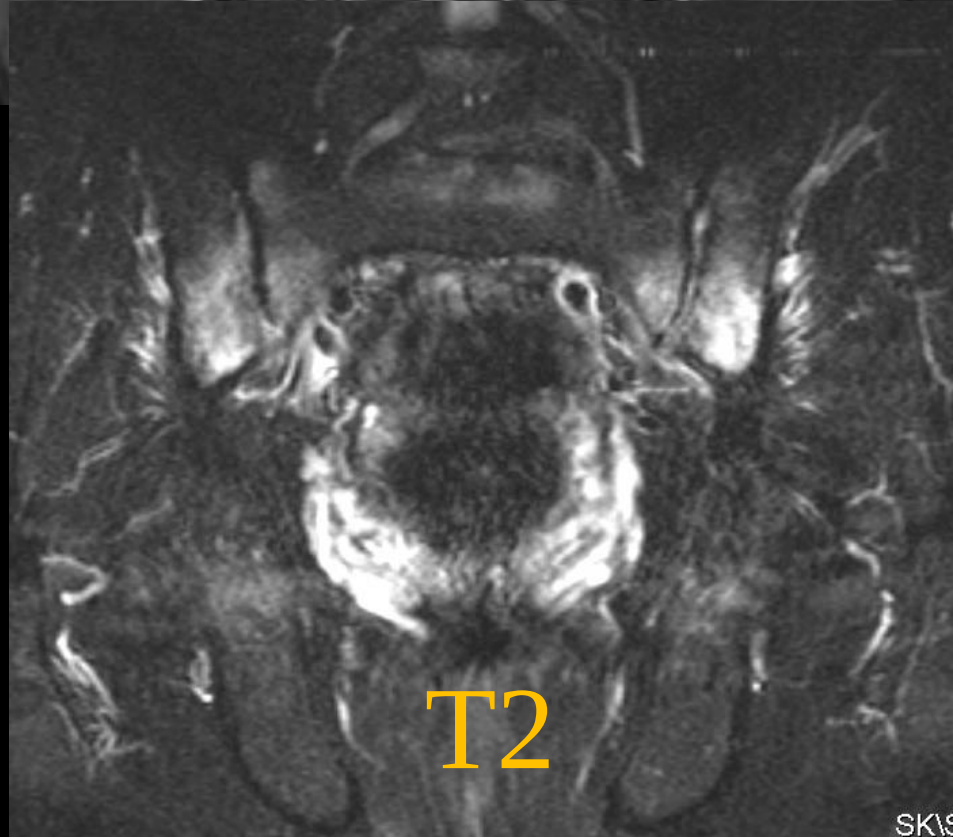
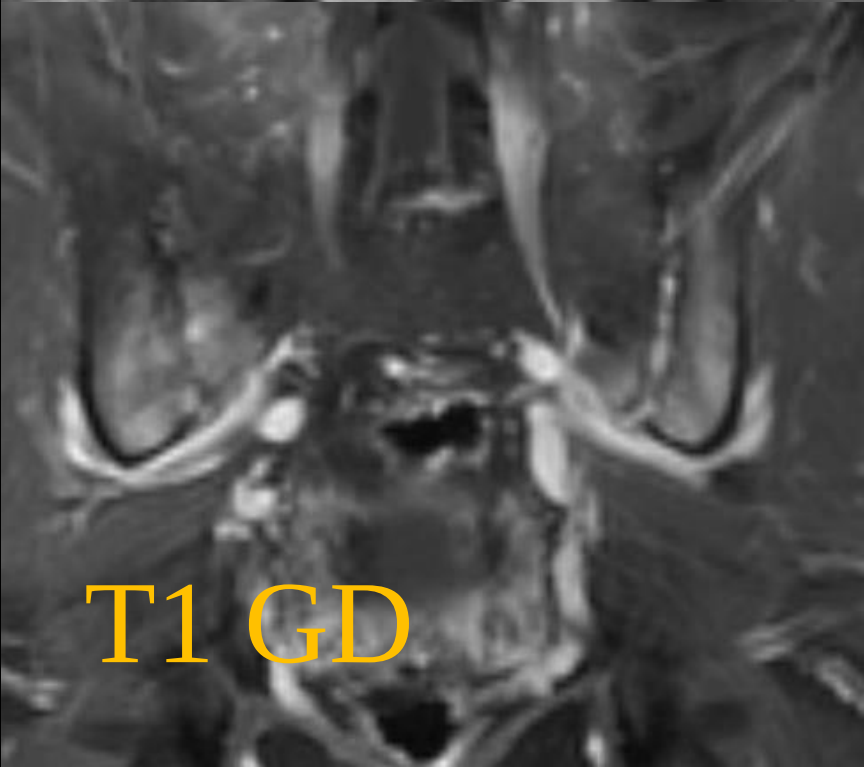
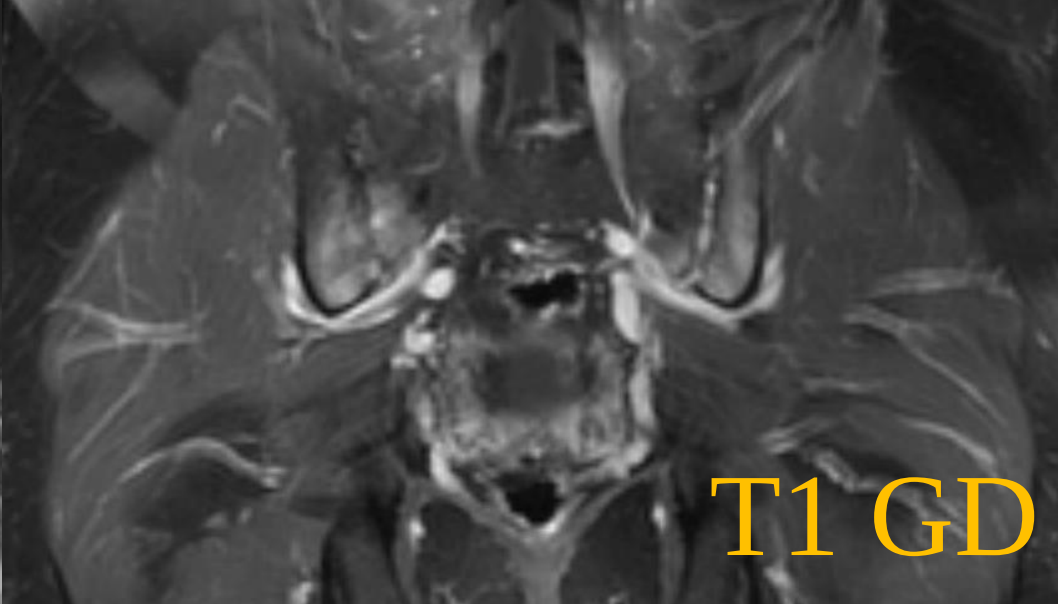
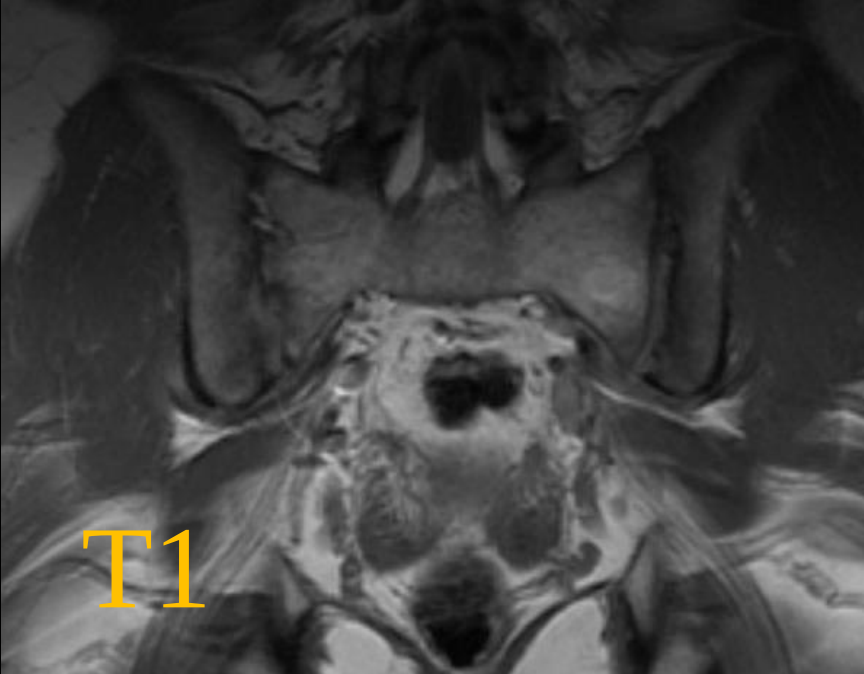


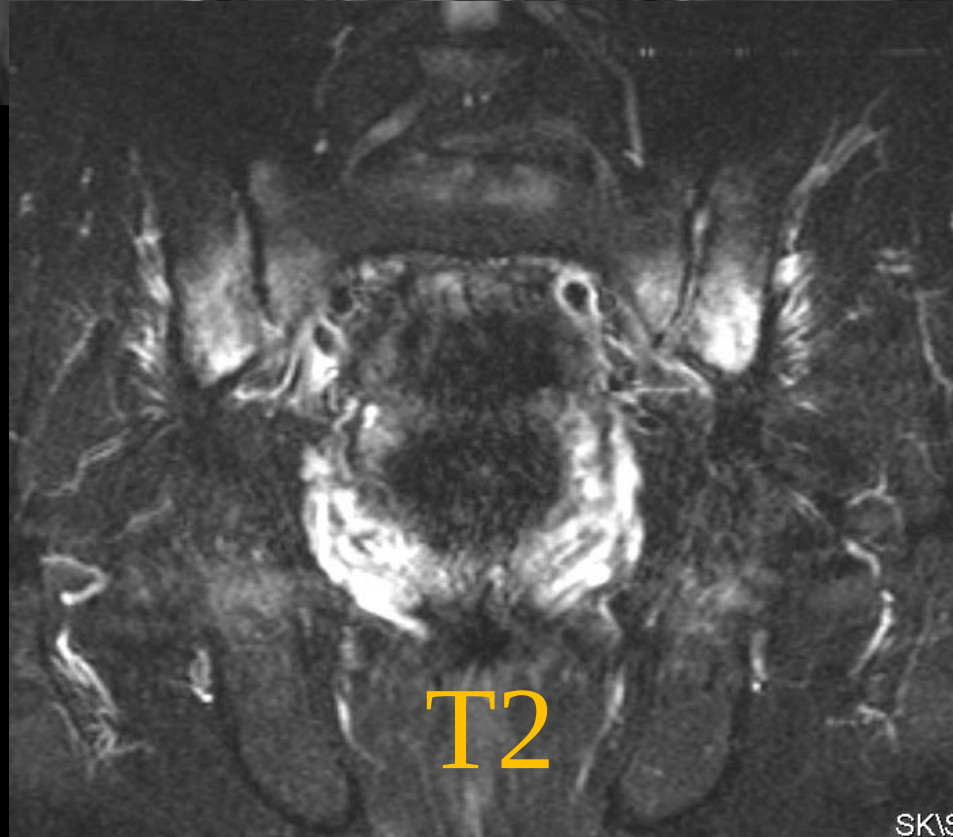
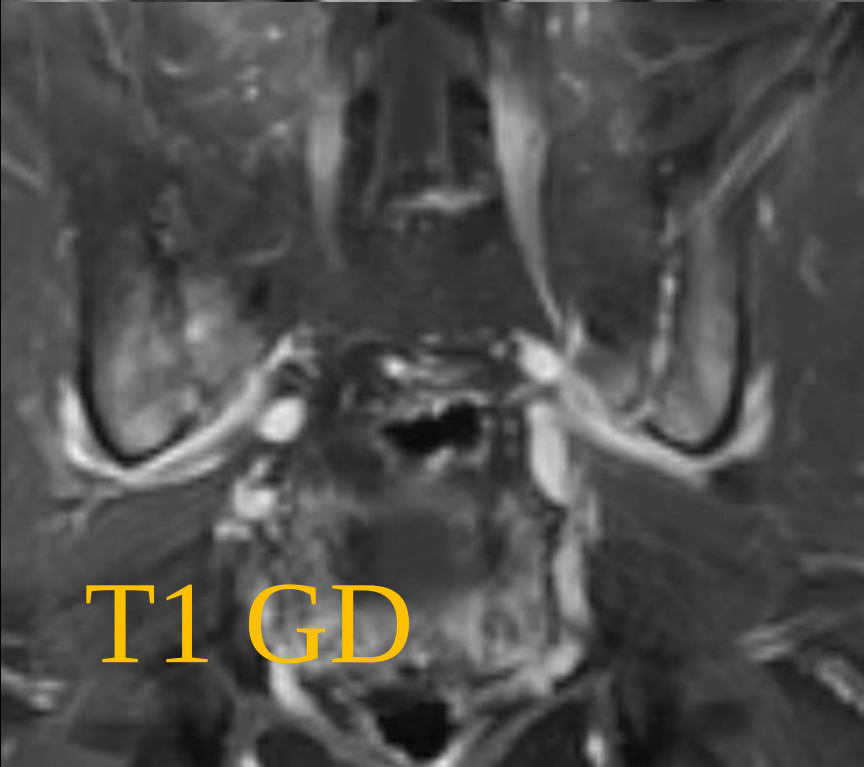
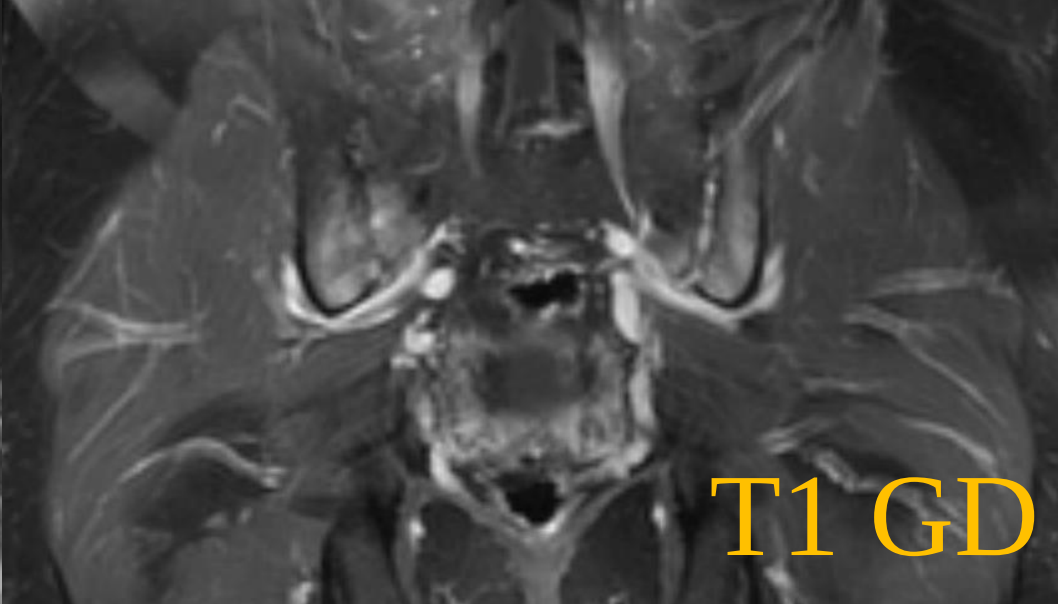
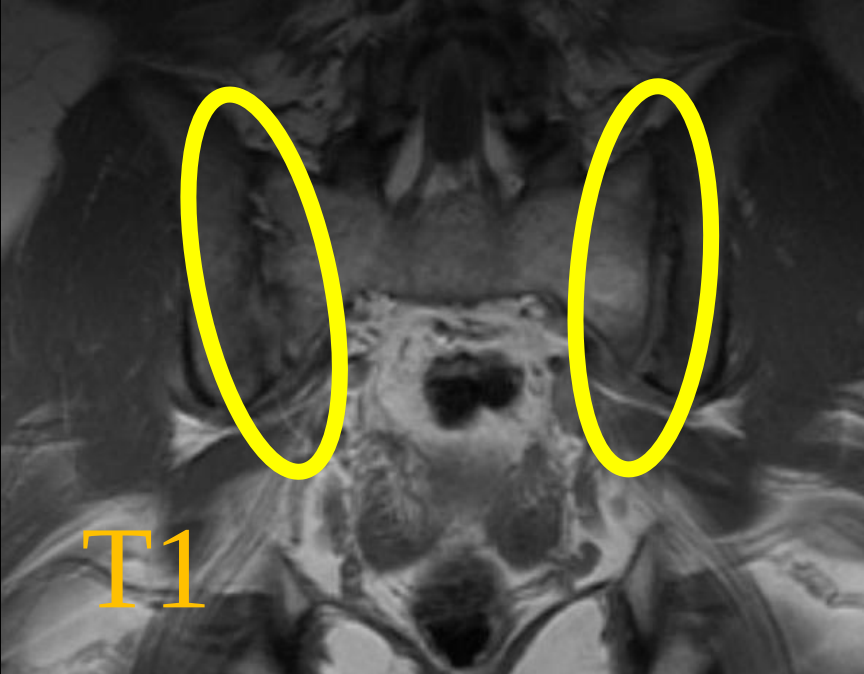


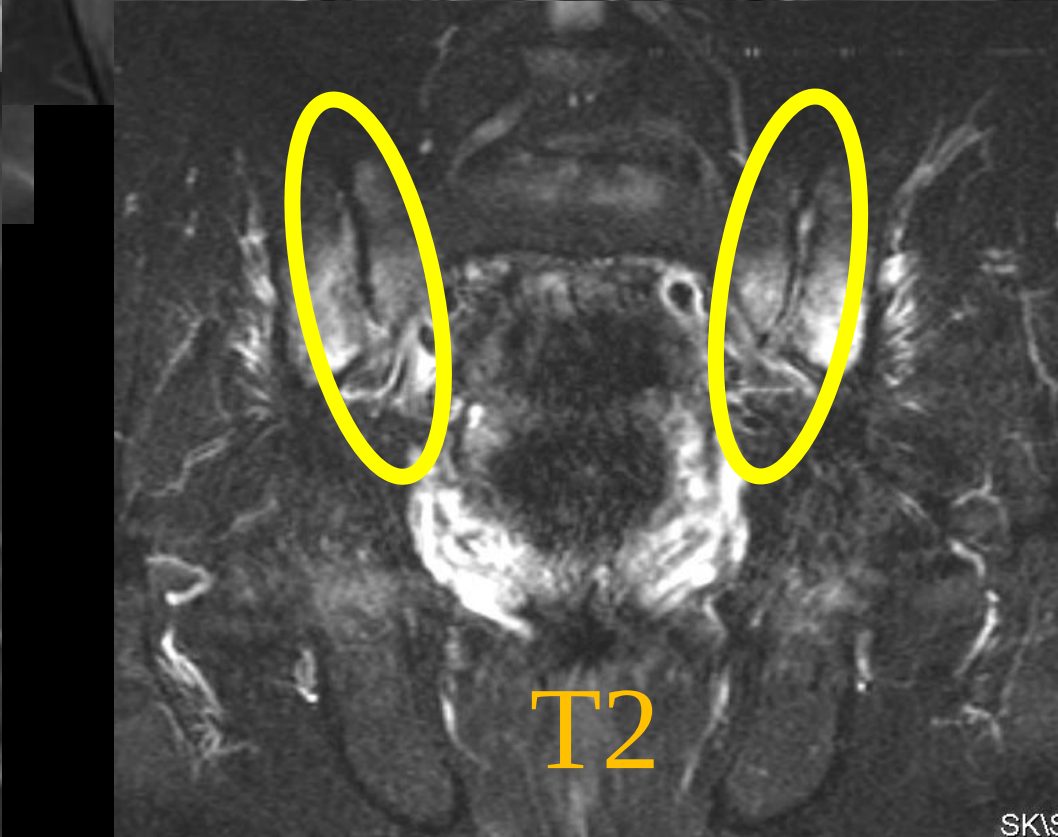
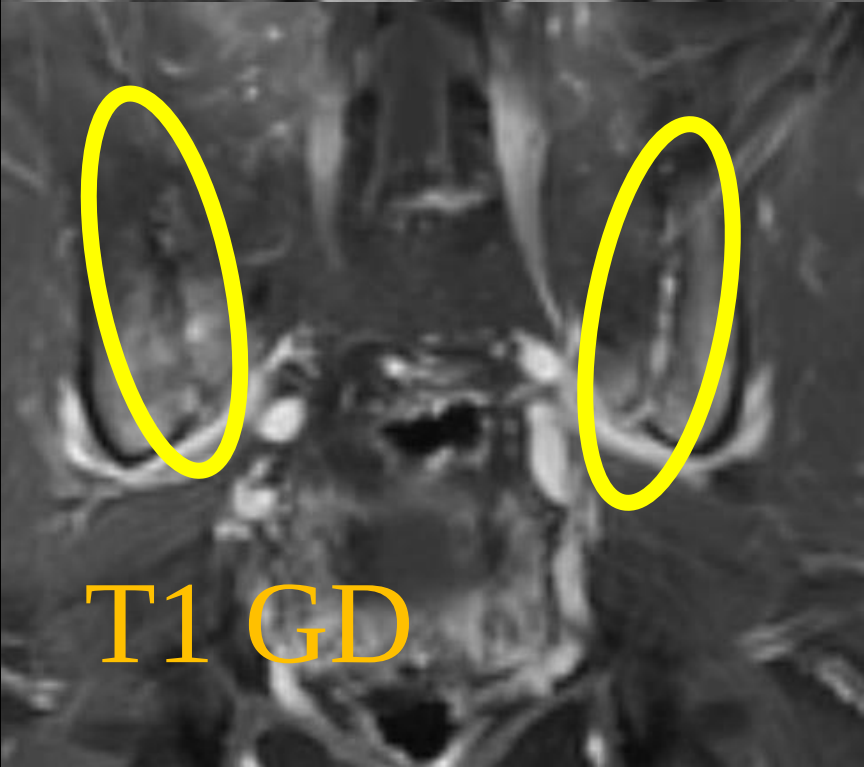
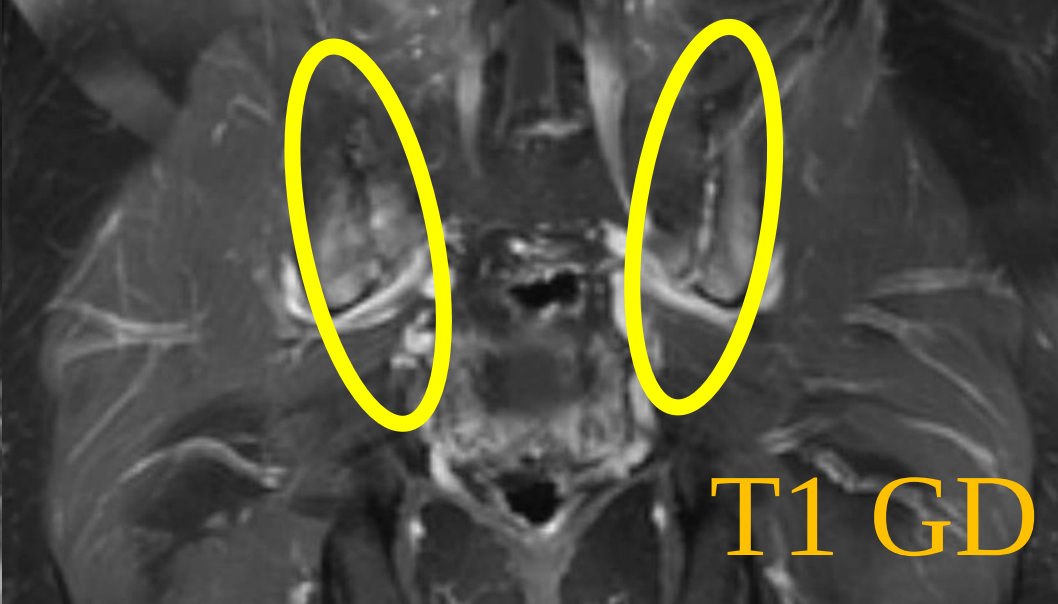
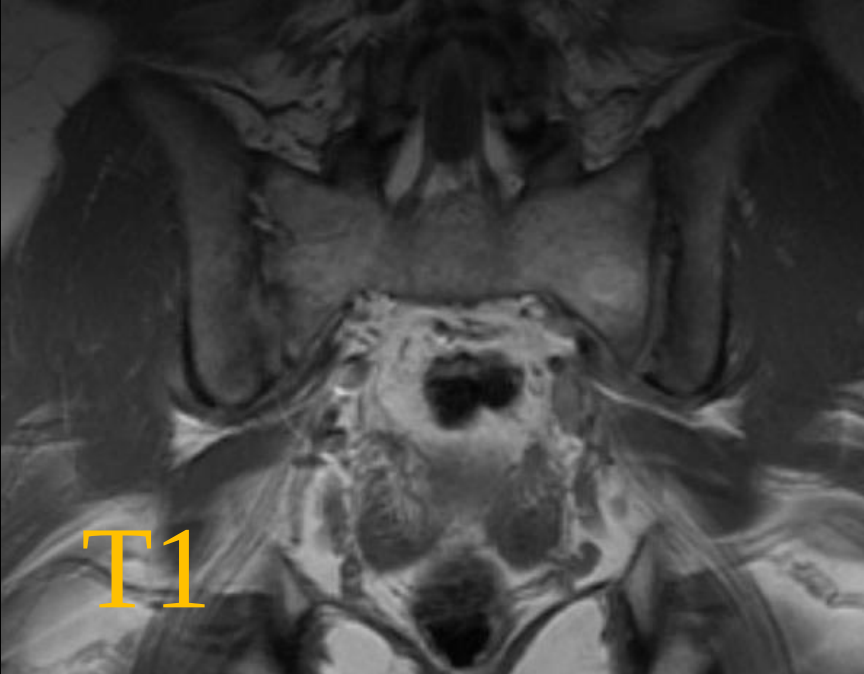




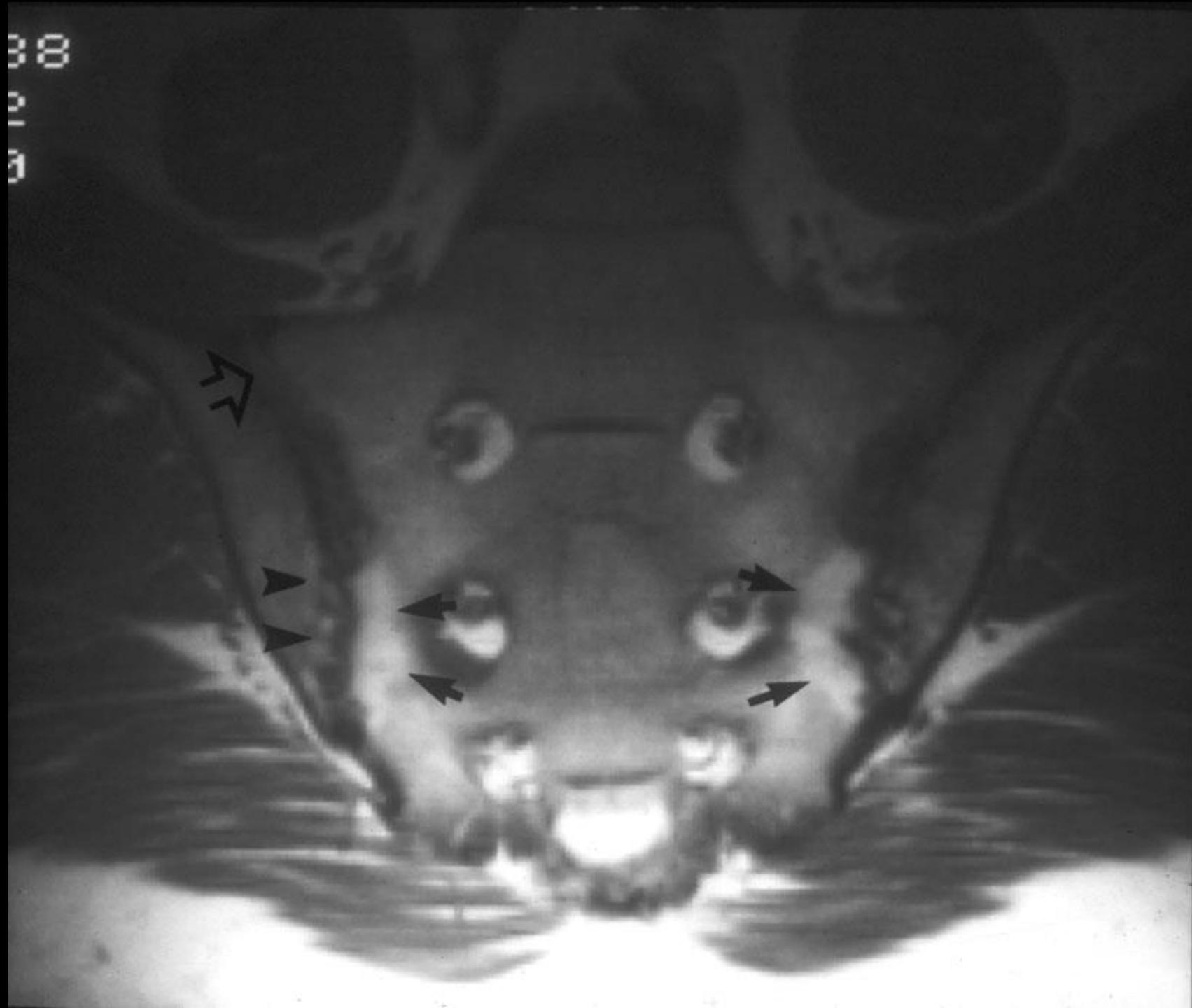


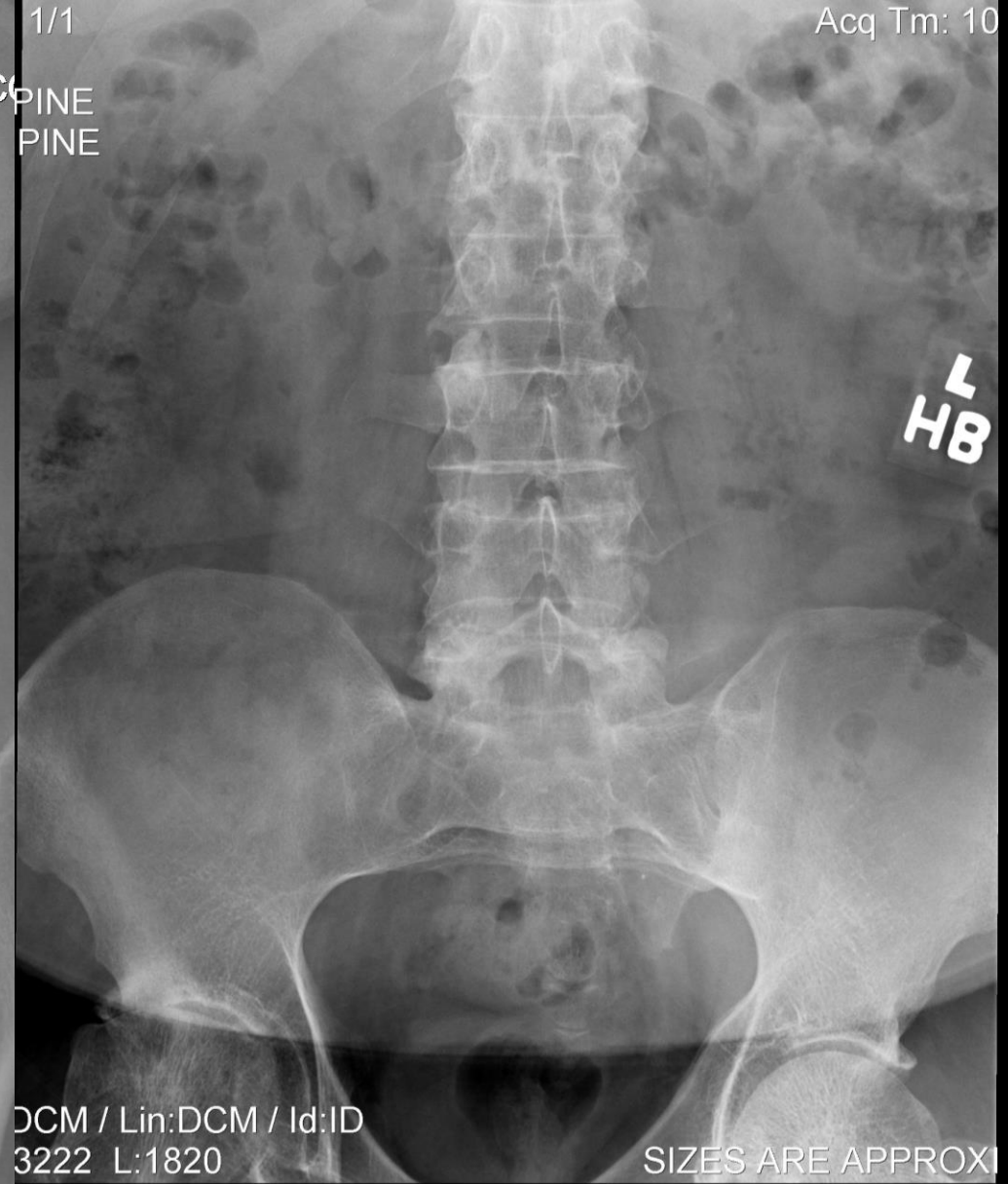


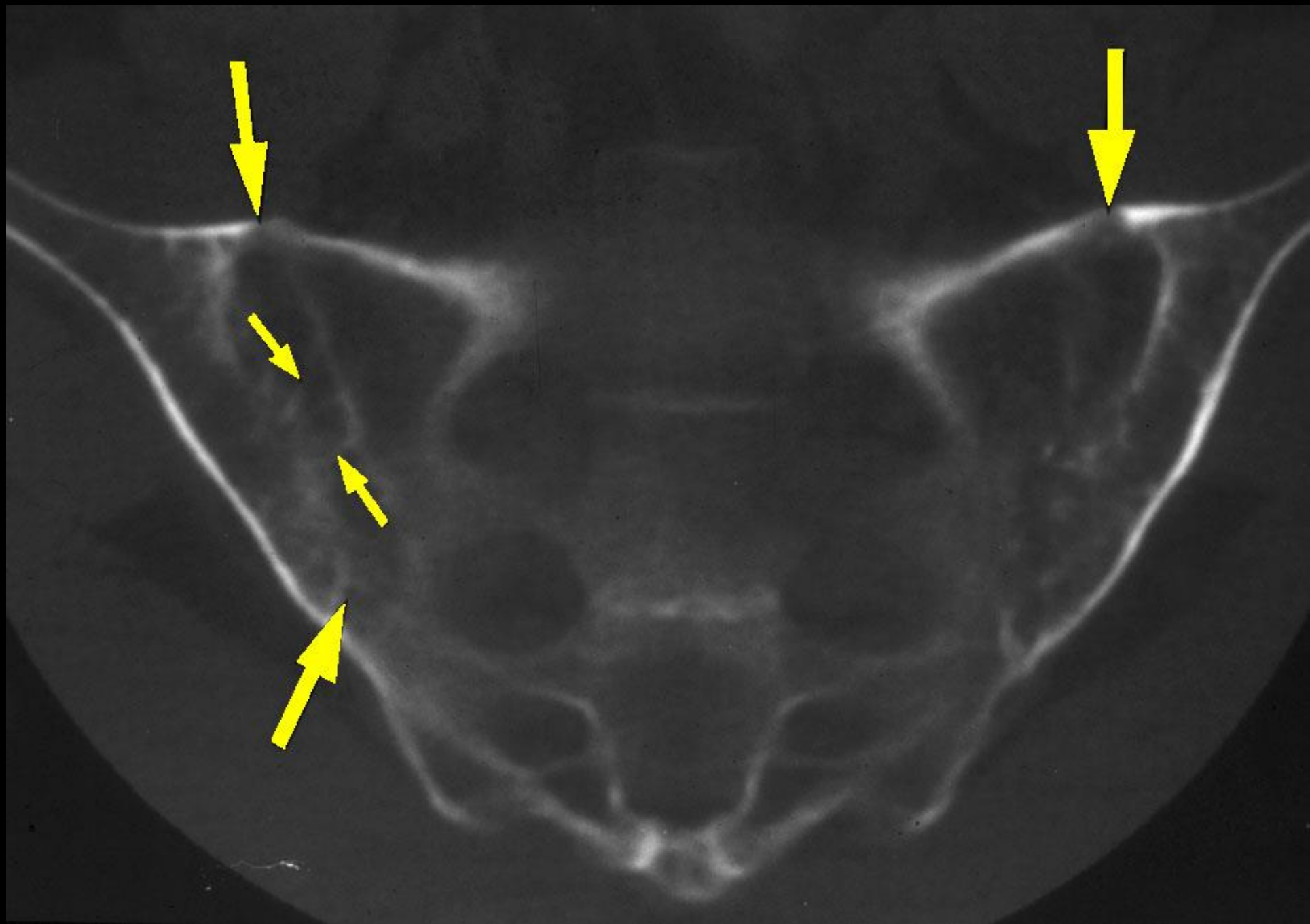




38
2
3







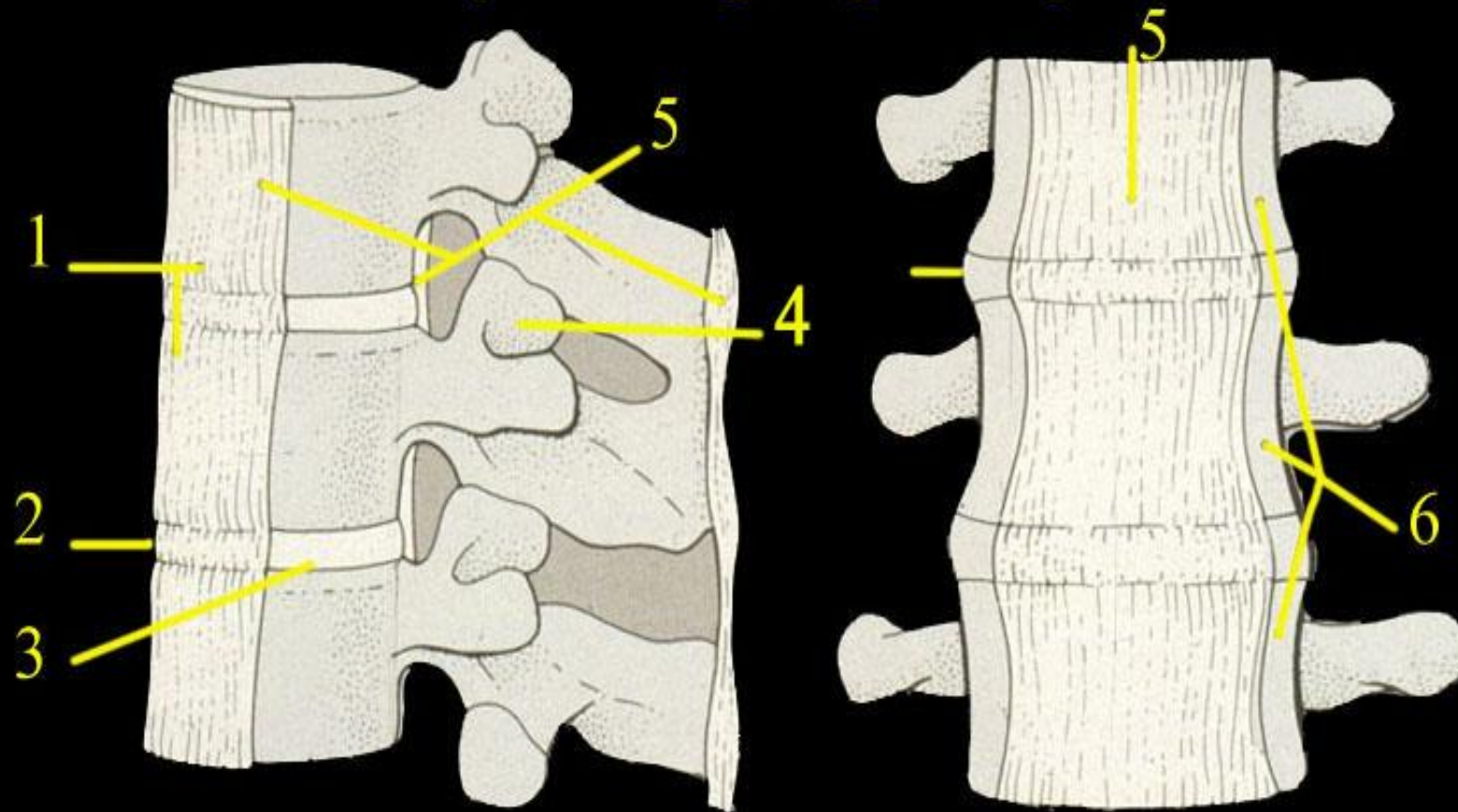


ANKYLOSING SPONDYLITIS

SPINE CHANGES

- Osteitis – “shining corners”
- Squared vertebral bodies
- Syndesmophytes
- Bamboo spine
- Calcified disc, fused facets/interspinous ligaments
- Pseudarthrosis/fractures
- Atlantoaxial disease/Cauda equina syndrome

Ankylosing Spondylitis



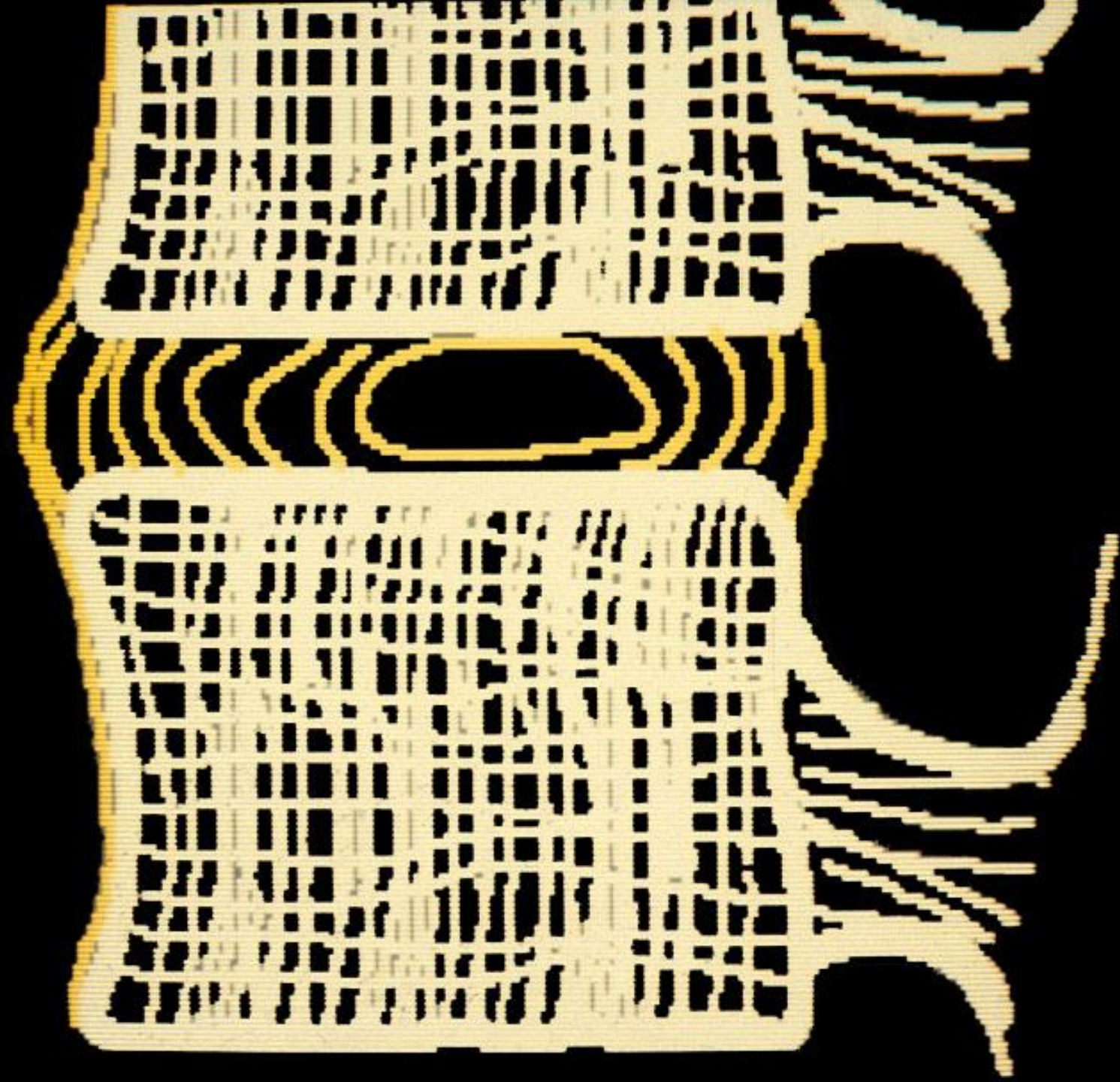
1. Squaring of vertebral bodies 4. Fusion of apophyseal joints

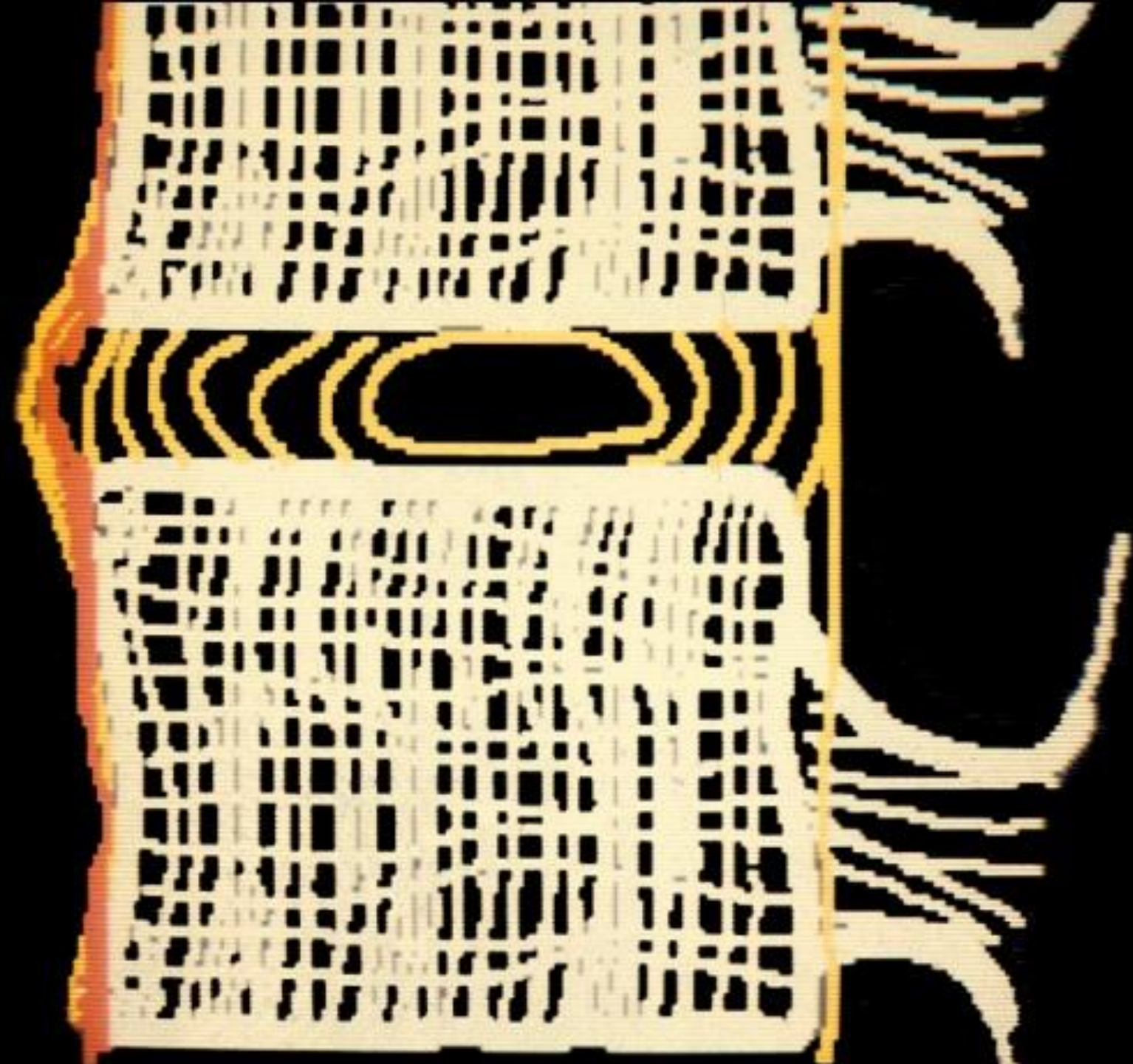
2. Thin syndesmophytes

5. Ossifications of paravertebral ligaments

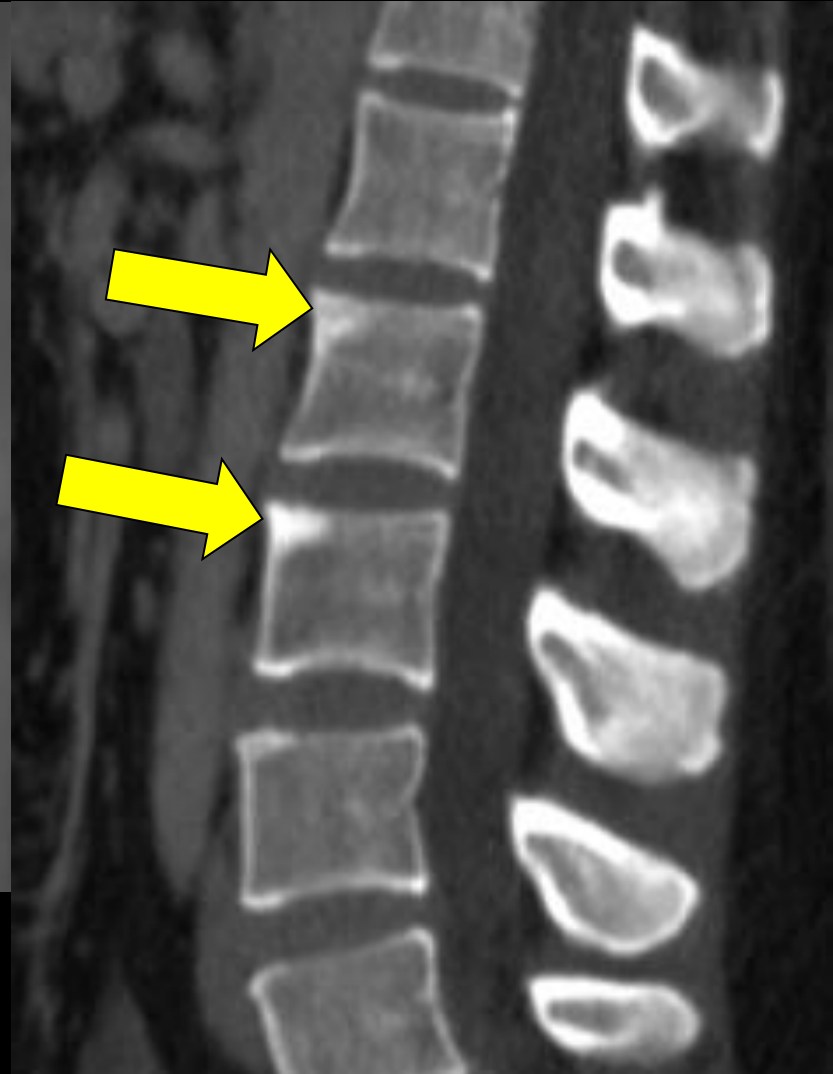
3. Preservation of disk space

6. "Bamboo" spine

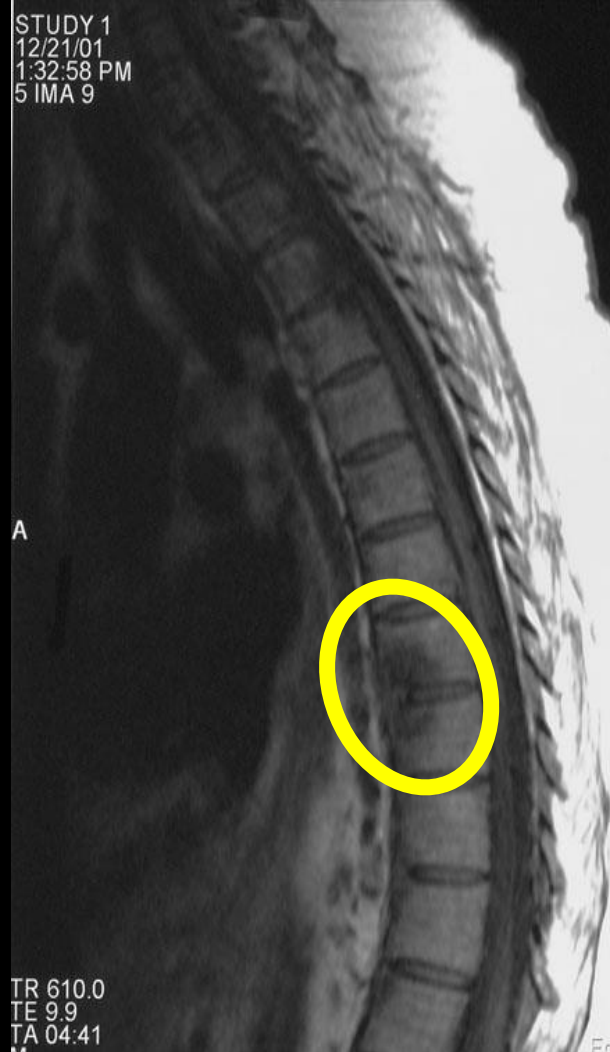








STUDY 1
12/21/01
1:32:58 PM
5 IMA 9



T1



T2



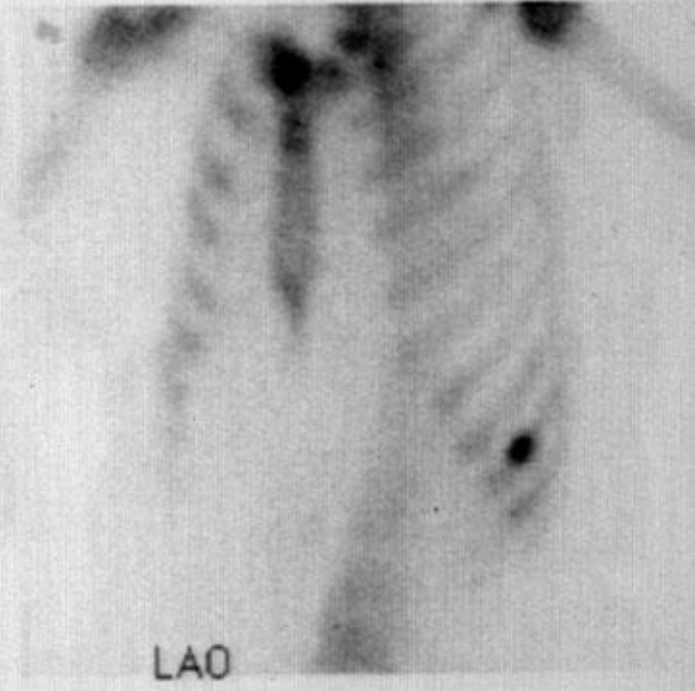
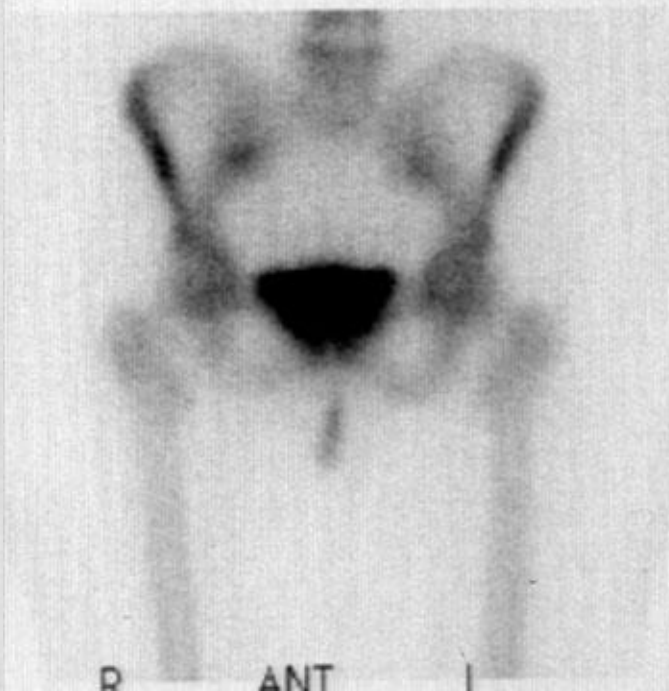
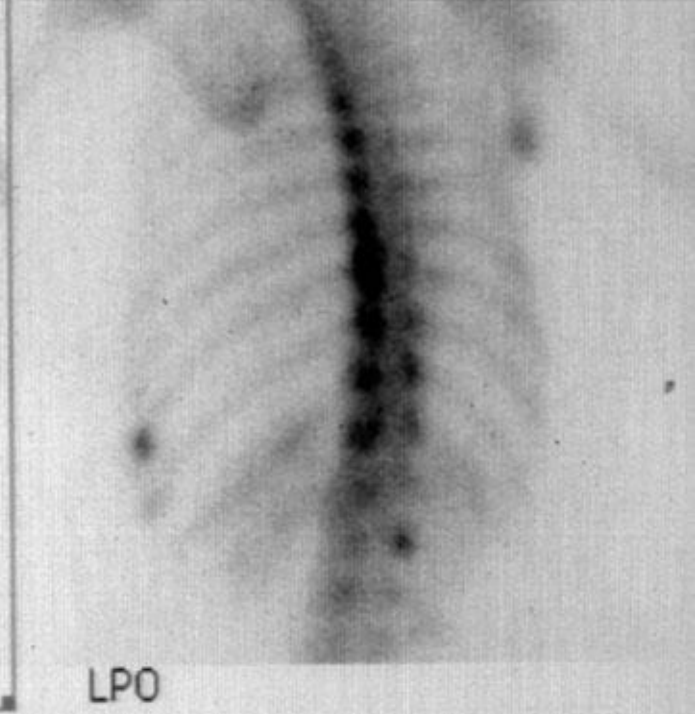
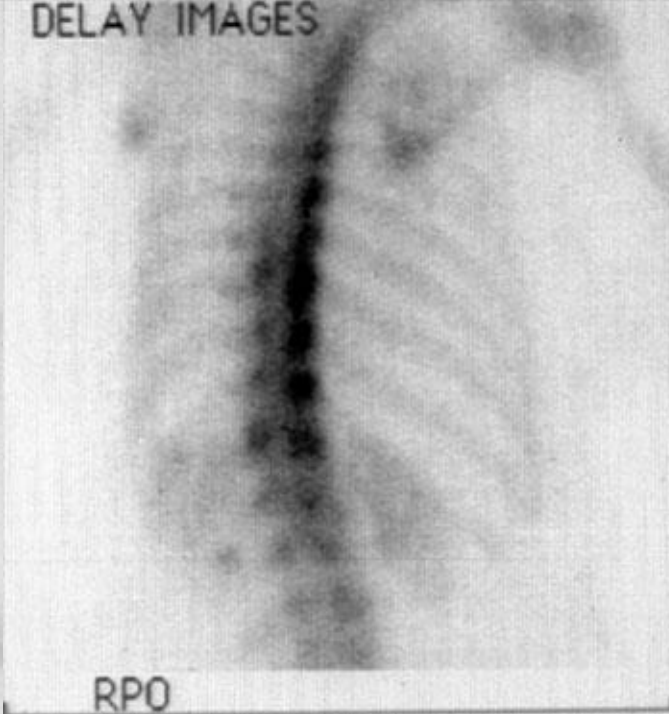
STIR

T2

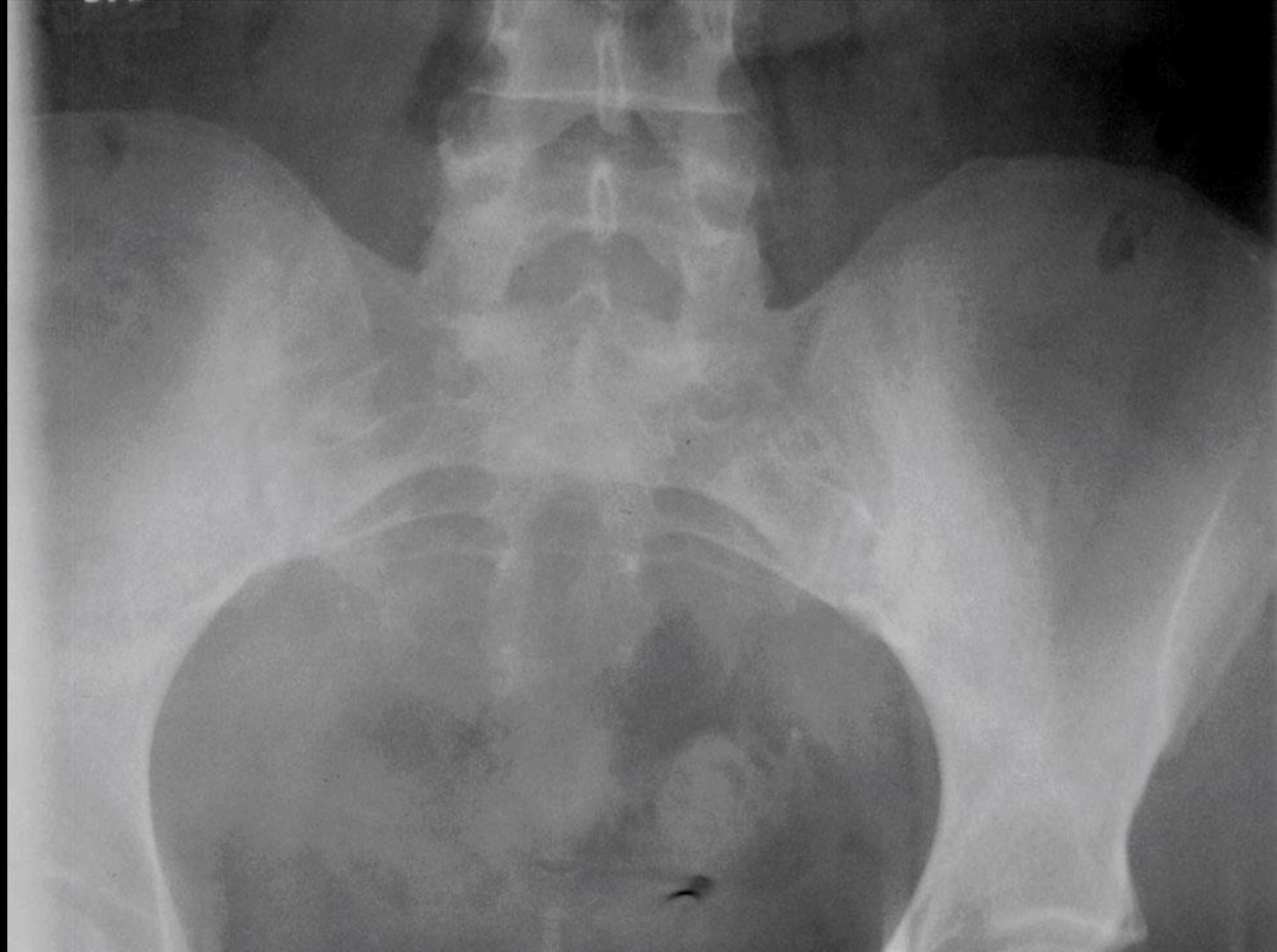
SP
FoV 38
194

TI
SP L
SL
FoV 380*3
194*51
6

DELAY IMAGES







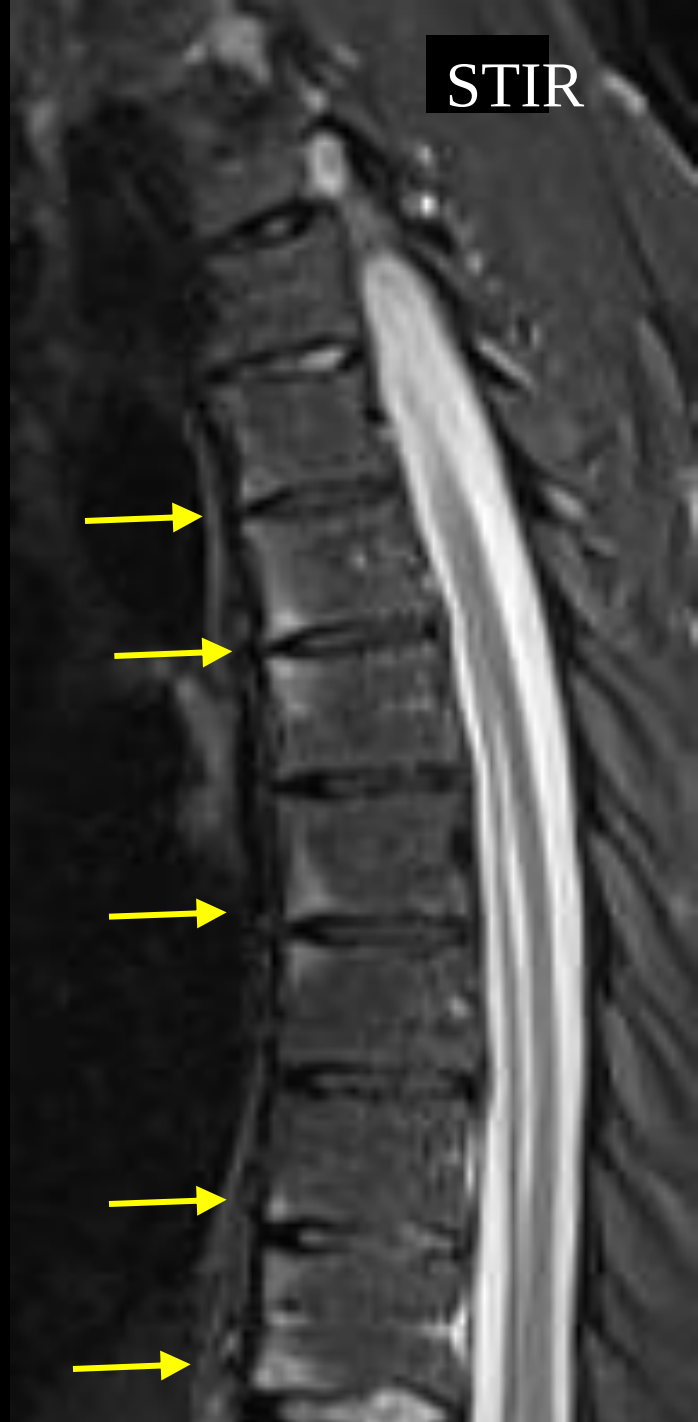
T1

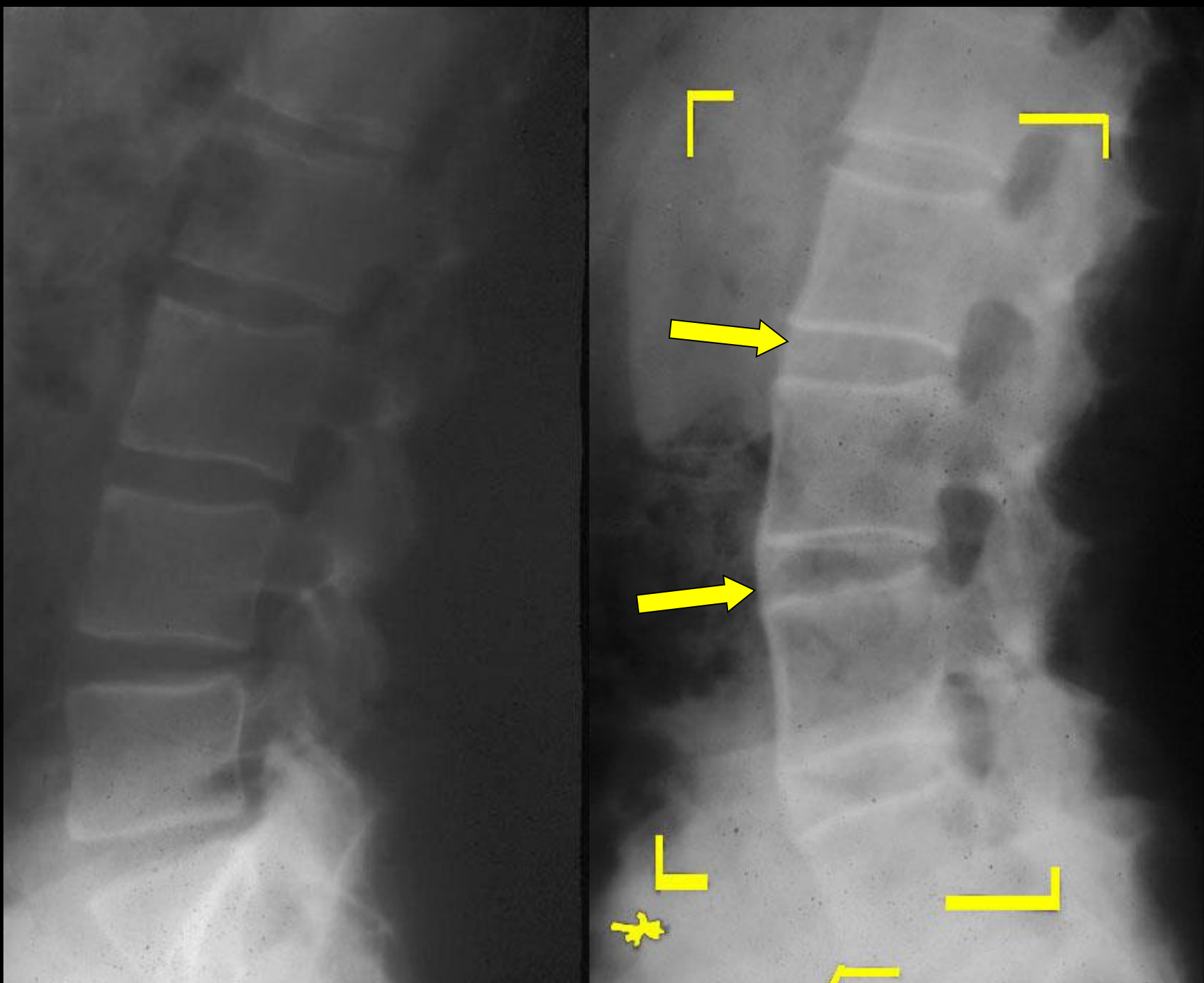


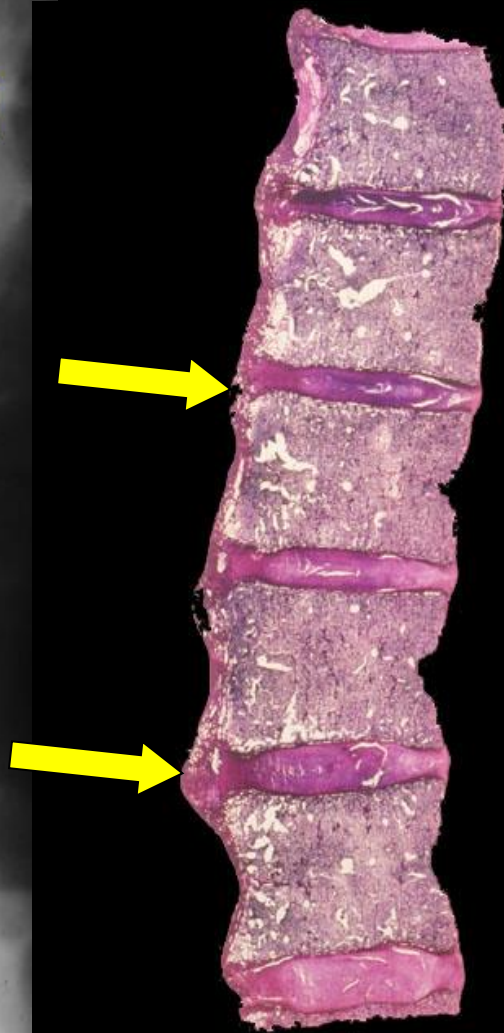
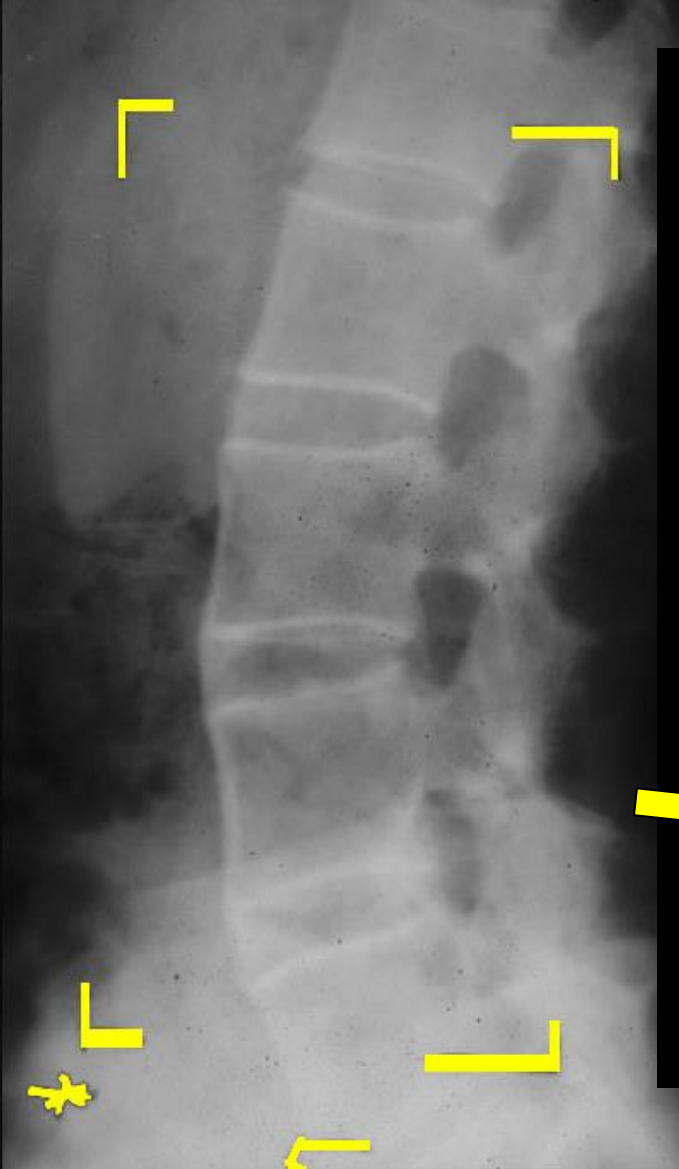
T1FS PG



STIR



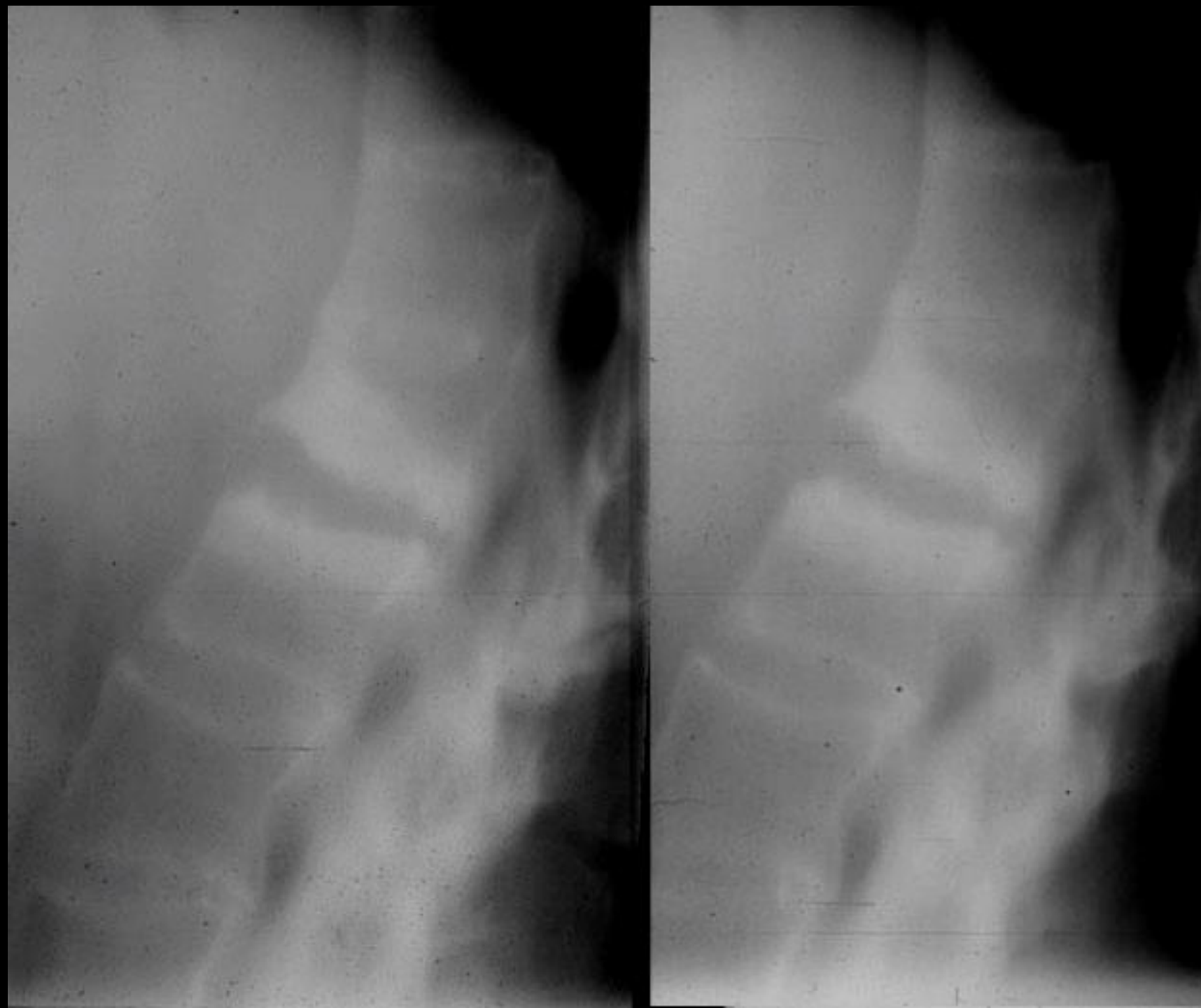


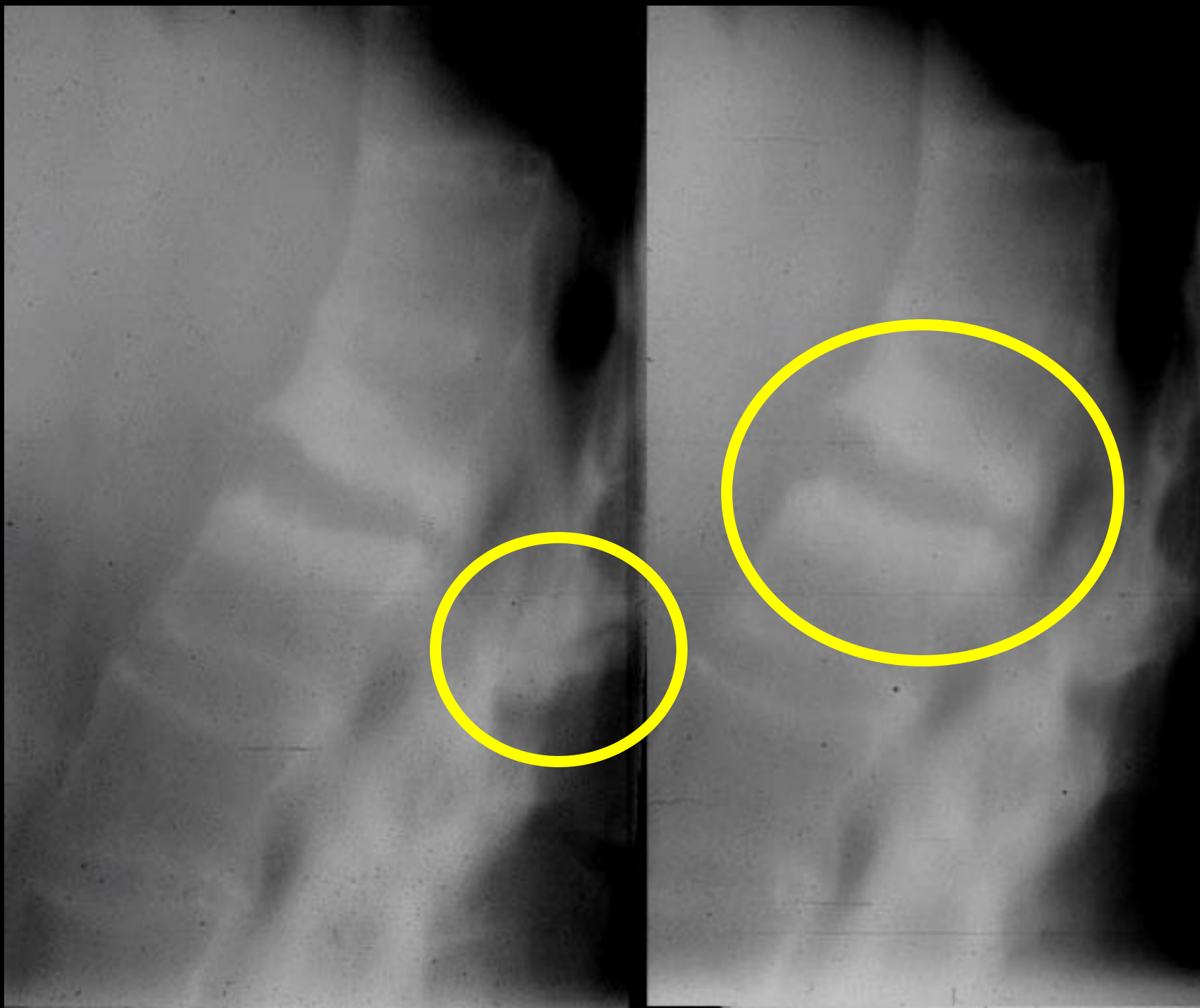


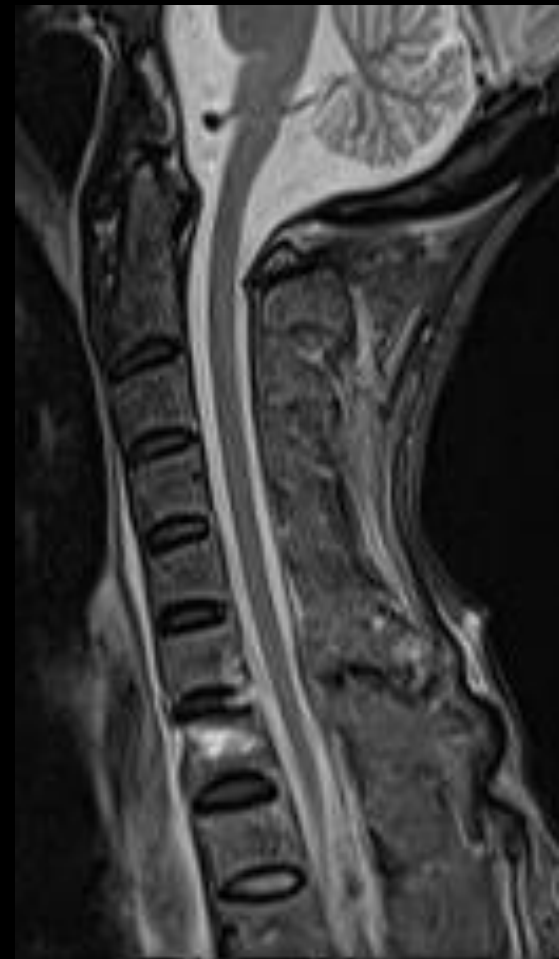






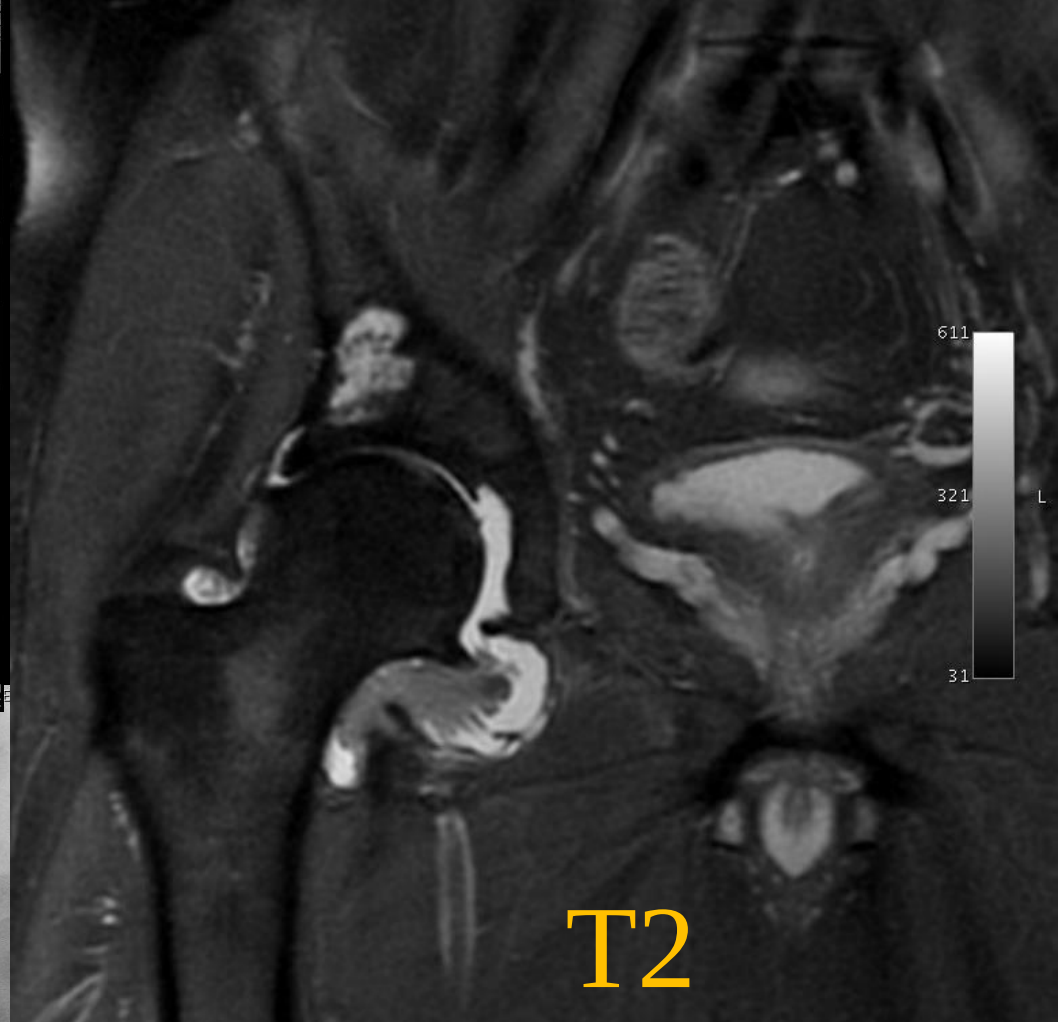
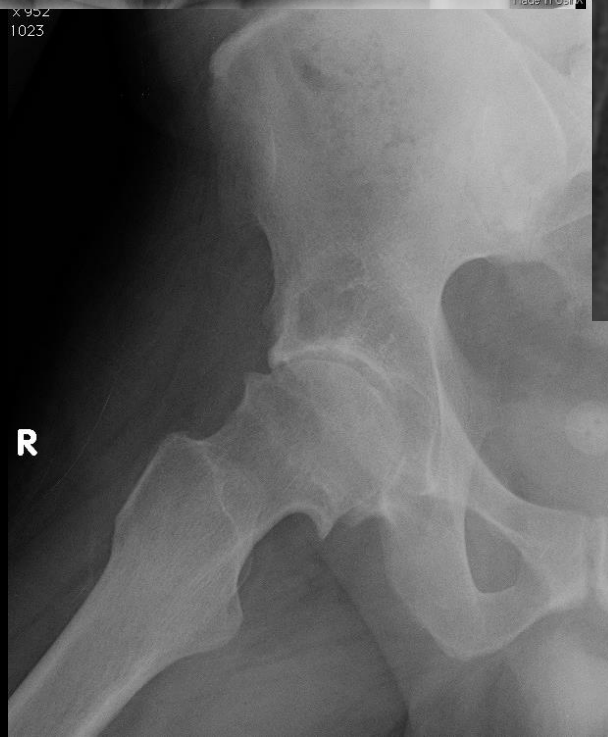




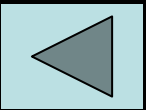
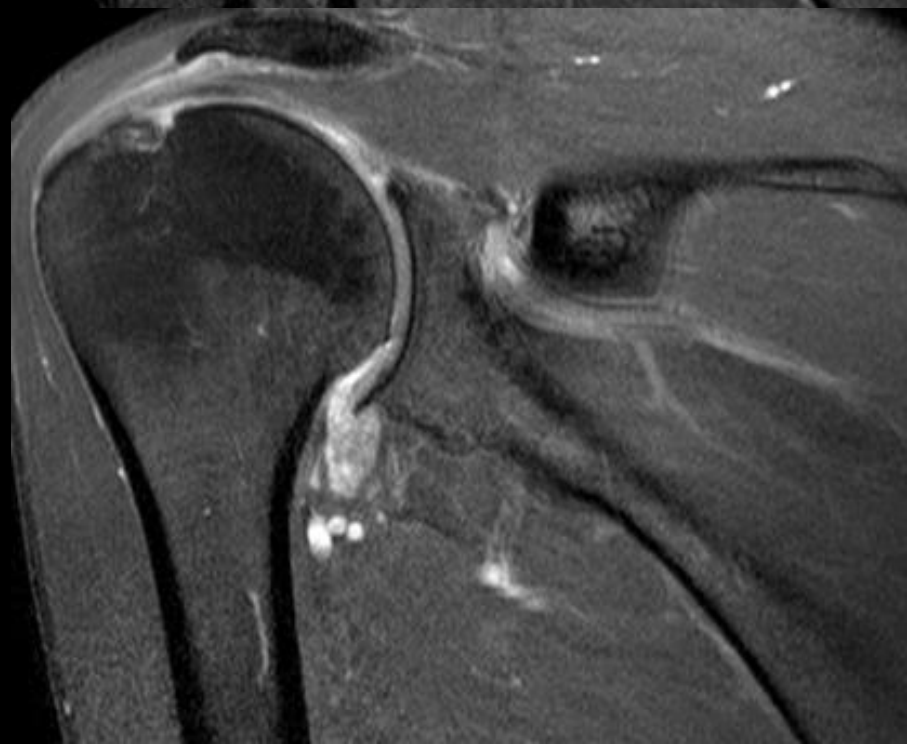
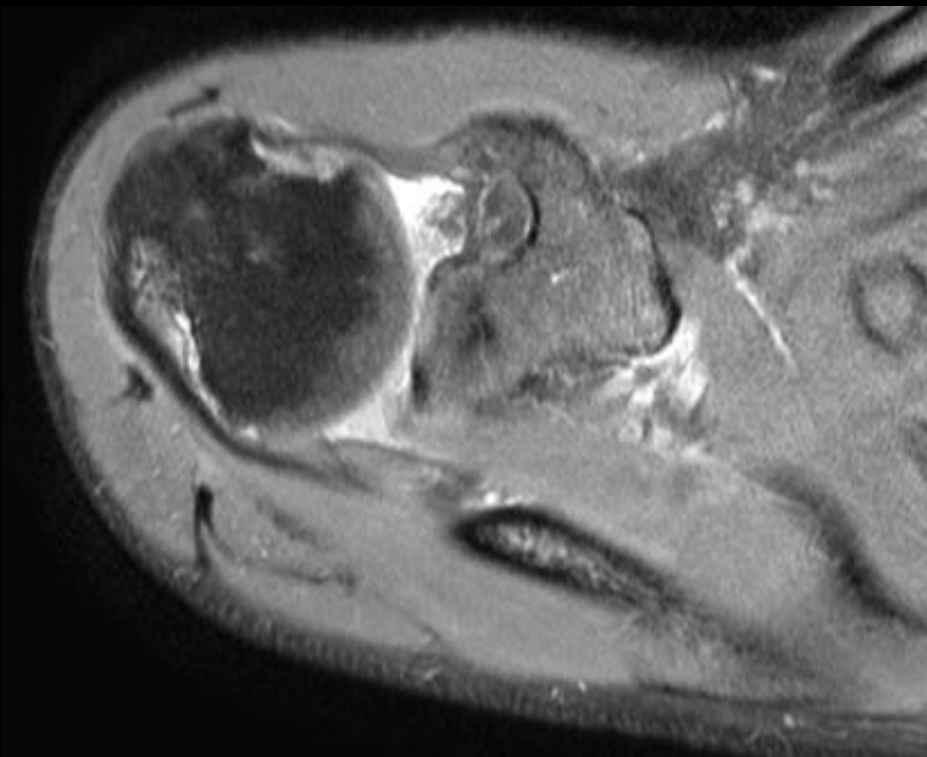
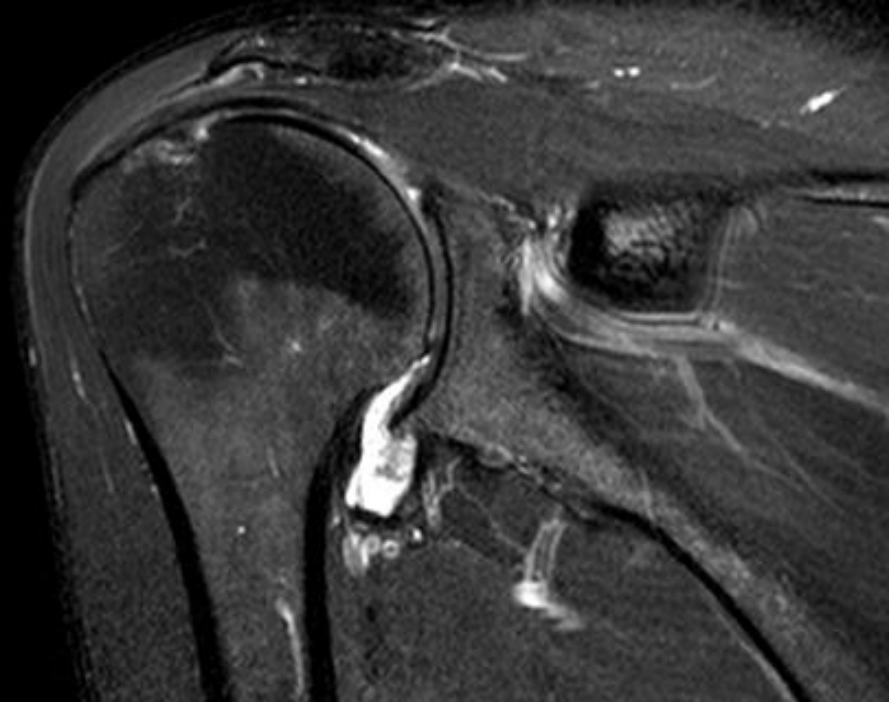


ANKYLOSING SPONDYLITIS RADIOGRAPHIC MANIFESTATIONS

- Hip - most common nonaxial joint involved
 - Bilateral, symmetric with axial narrowing
 - Collar of osteophytes
 - Ankylosis - in young patients
 - Acetabular protrusio
- Shoulder - 30% of patients
 - Hatchet sign



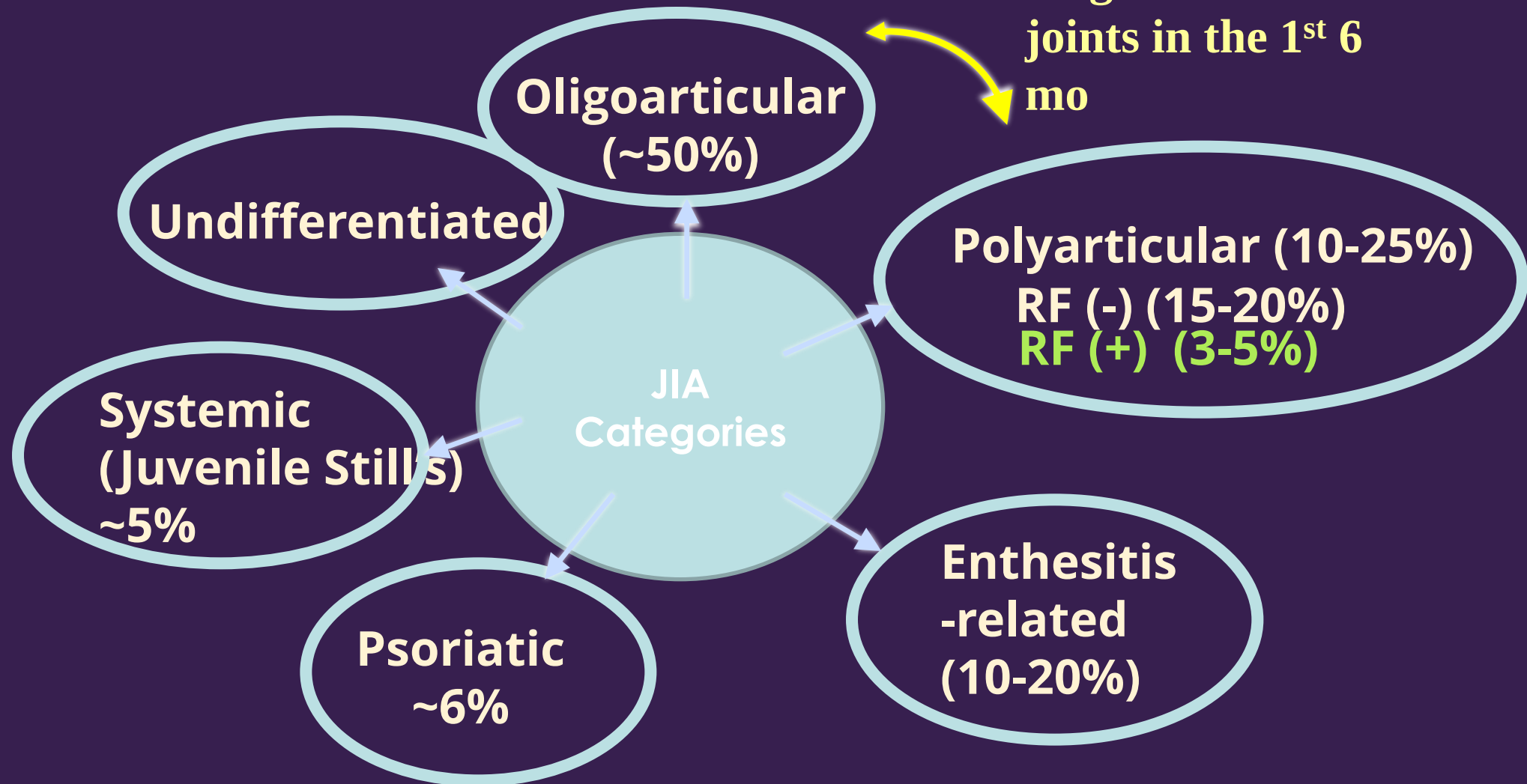




JUVENILE IDIOPATHIC ARTHRITIS (JIA)

JIA is not a single disease

It is all autoimmune arthritides of unknown origin in patients < 16 years old and persisting more than 6 weeks [ILAR 2004].



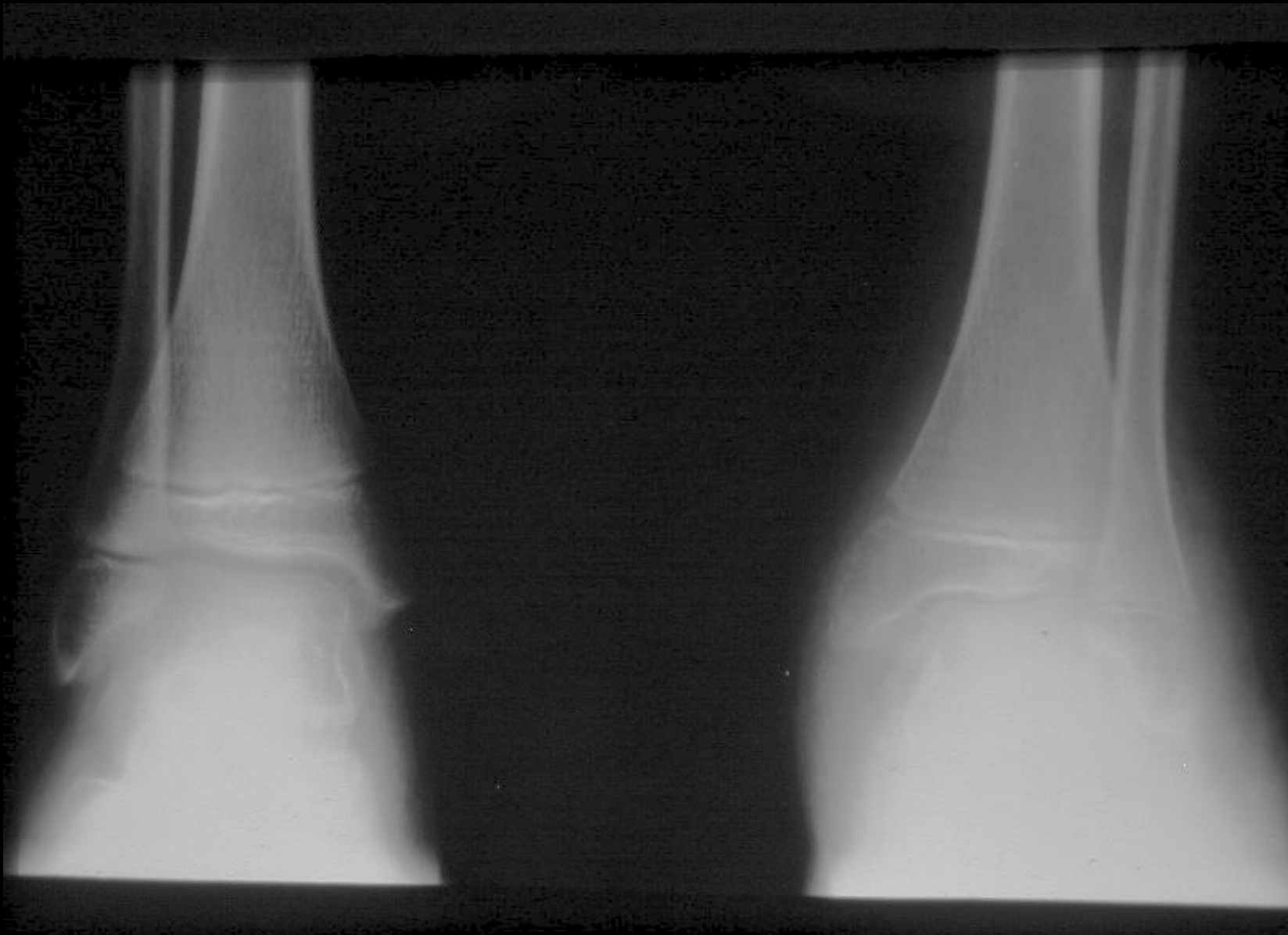
OLIGOARTICULAR JIA (~50%)

- 75% female
- Northern European descent
- Peak 1-4 yrs old
- Inflamm jt sx in 1-4 jts (Oligo)- at least initially
 - Most common in a knee > ankle
- ANA + (70-80%)
 - Other labs generally normal
- **Complication:** Hyperemia produces bone overgrowth, early maturation and limb length discrepancies; Erosions uncommon and late



Need Hx / Labs to differentiate
from hemophilia or infection





Synovitis and soft tissue swelling with overgrowth of the epiphyses

SERONEGATIVE POLYARTICULAR JIA (~15-20%)

- Bimodal: 1-4 years old ; 9-14 years old
- Poly= 5+ joints
- Often: multiple fingers, wrist, knees and ankles, **TMJ jts**, **C-spine**
 - Bilateral
- Seronegative: RF, ACPA, HLA-B27
 - May have mild elevated ESR



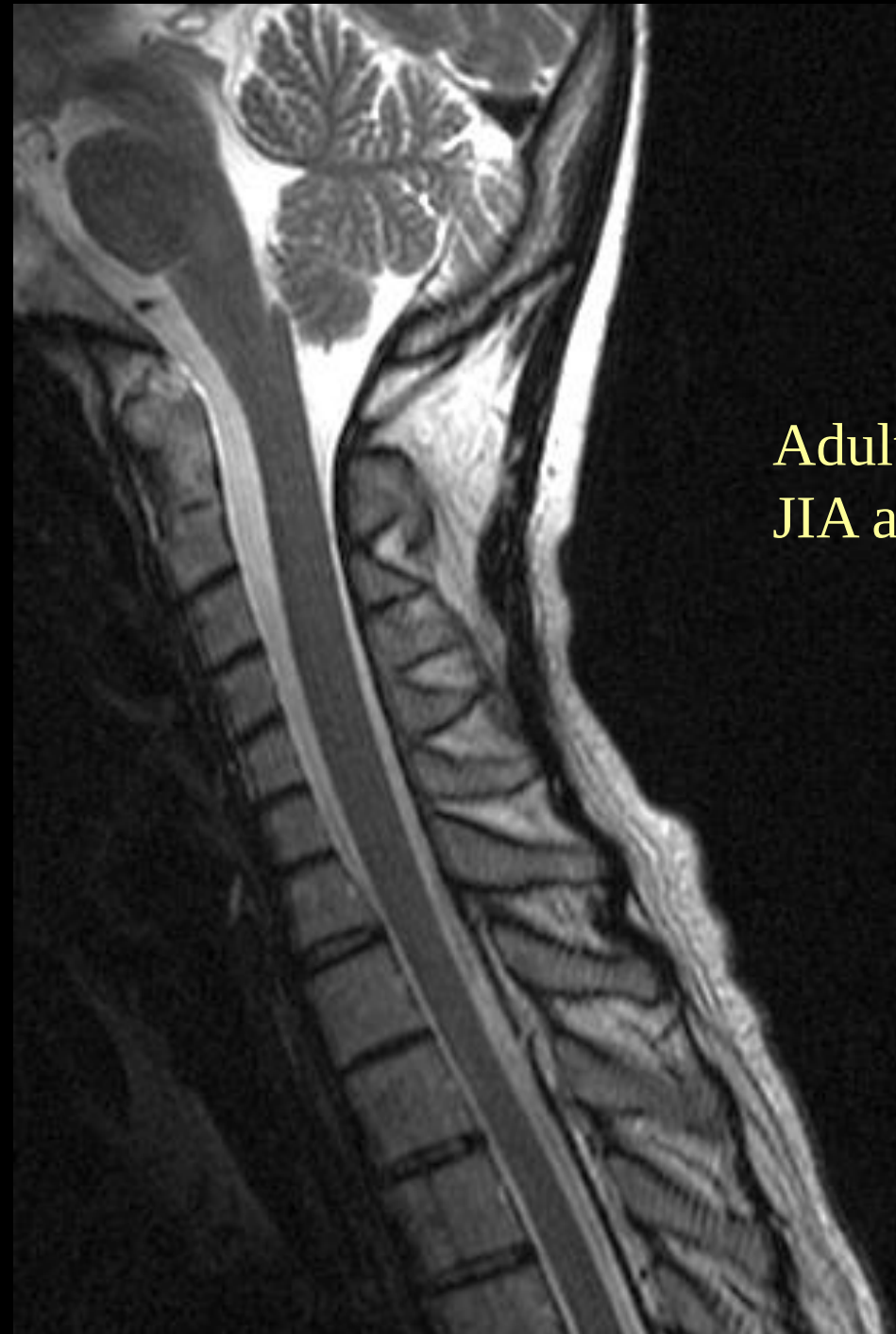
JIA

- Periostitis
 - phalanges, metacarpals, metatarsals
- Accelerated skeletal growth
- Ballooned epiphyses
- Premature visualization of ossification centers
- Premature maturation of epiphyses
- Premature fusion of physes





The growth disturbances
worse earlier inflammation is
before skeletal maturity



Adult with
JIA as a child

SEROPOSITIVE POLYARTICULAR JIA (~3-5%)

- Peak: 12-18 years old; F>M
- Labs: RF and ACPA +; high inflammatory markers
- AGGRESSIVE
 - Pain, erosions and deformities
- Distribution
 - Hand / Feet
 - Spares axial joints

JIA – RF + POLYARTICULAR (ADULT RHEUMATOID LIKE)

- RF positive polyarthritis
 - ACPA (+)
- F>M
- >10 years of age at onset
- Symmetric hands / wrists
- Erosive and destructive (unlike other JIA subtypes)
- Growth disturbances
- Subcutaneous nodules
- Vasculitis



Only 2% achieve long
term remission off meds

PSORIATIC JIA (~7%)

- Bimodal:
 - 2-4 years old and 9-11 years old
 - Asymmetric oligoarthritis
 - Small joints > lg jts (unlike enthesitis-related)
 - Can cause sacroiliitis and enthesitis



JUVENILE PSORIATIC ARTHRITIS

- International league for association of rheumatology (ILAR) classification criteria
 - Onset prior to 16 y/o and for >6 wk
 - Psoriatic rash OR
 - at least 2 minor criteria:
 - Nail pitting, onycholysis or dactylitis (sausage digit)
 - 1st degree relative with psoriasis



ENTHESITIS-RELATED JIA (8-18%)

- M >> F
- Peak 9-12 years
- 50-80% HLA-B27 +
 - FHx SpA 20%
- Oligoarthritis: Large joints + Enthesitis
 - Lower extremity
 - SI joints
- May progress to adult Ankylosing Spondylitis



Inflammatory low back
pain symptoms
beginning at 15 y/o
HLA-B27(+)

SI joint erosions

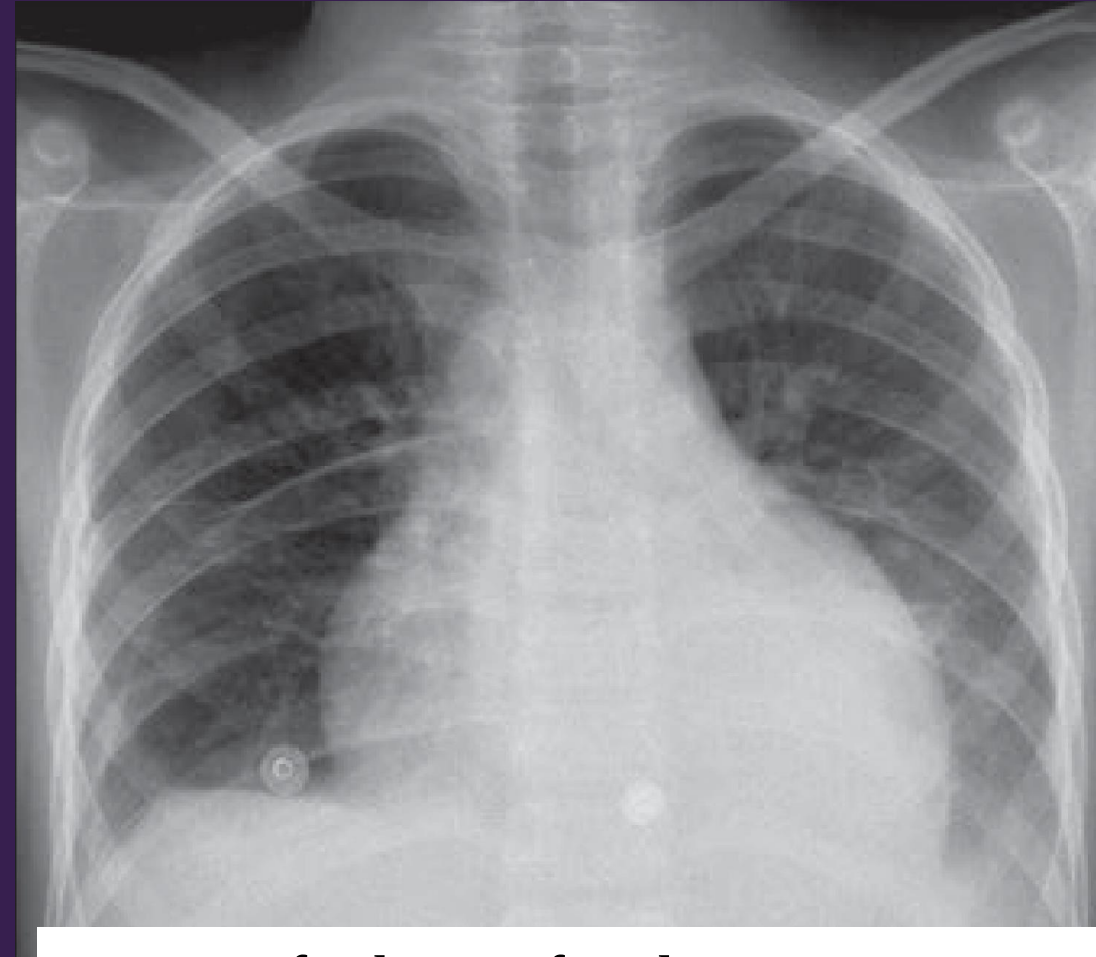
Right Hip axial jt space
loss and erosions

Diagnosis: “Juvenile
Ankylosing Spondylitis”



SYSTEMIC JIA (JUVENILE STILL DISEASE)

- M:F = 1:1
 - Age usually less than 5 years (any age)
- Acute febrile illness (fever of unknown origin)
- Rash
- Generalized adenopathy / hepatosplenomegaly
- Mild joint findings – arthralgias; +/-arthritis (late)
- Pericarditis / serositis
- Interleukin (IL)-1 / IL-6 autoinflammatory disease
 - Effective anti-IL 1 and 6 treatments



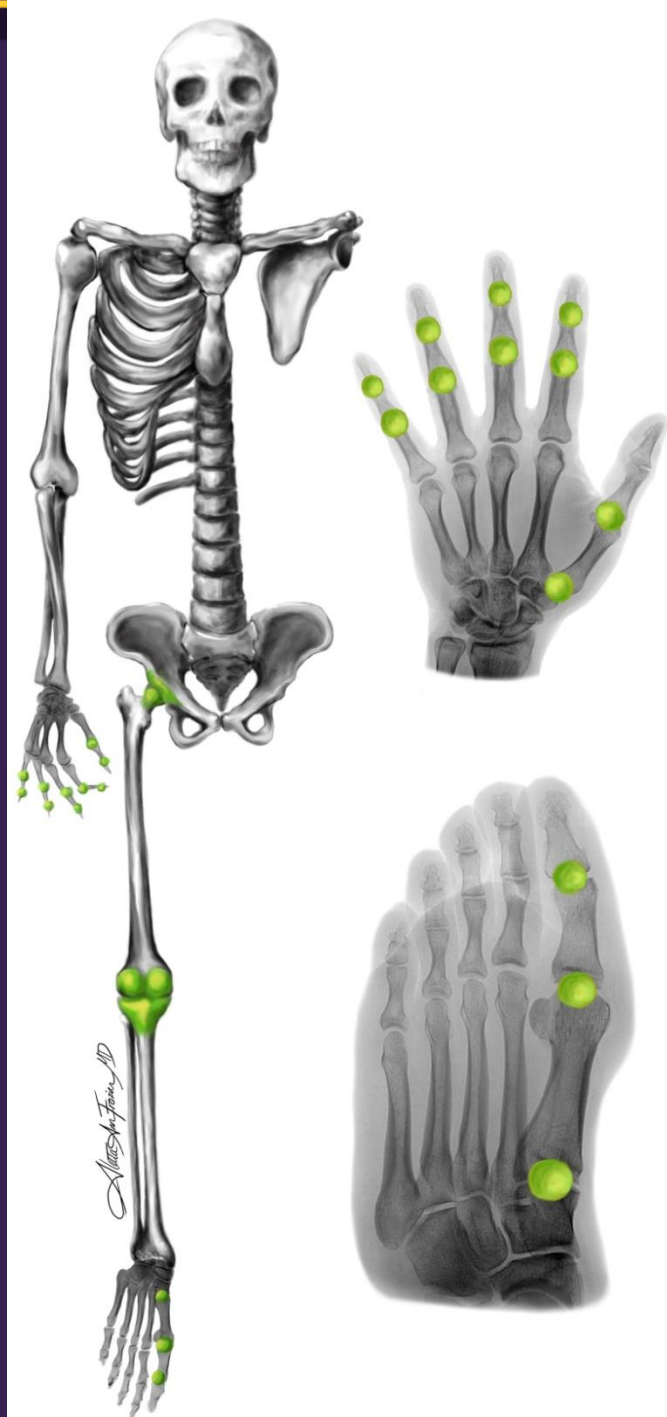
Imaging findings of pediatric Rheumatologic emergencies. AJR 2015; 204:428–439

OSTEOARTHRITIS

- Most common arthropathy (80% > 75 years)
 - >40 million cases/year in the US
- Important cause work disability. Second only to CHD in men > 50 years and older
- Primary – no underlying osseous abnormality
- Secondary – preexisting condition such as trauma, infection, inflammatory arthritis, metabolic, anatomic

OSTEOARTHRITIS COMMON SITES

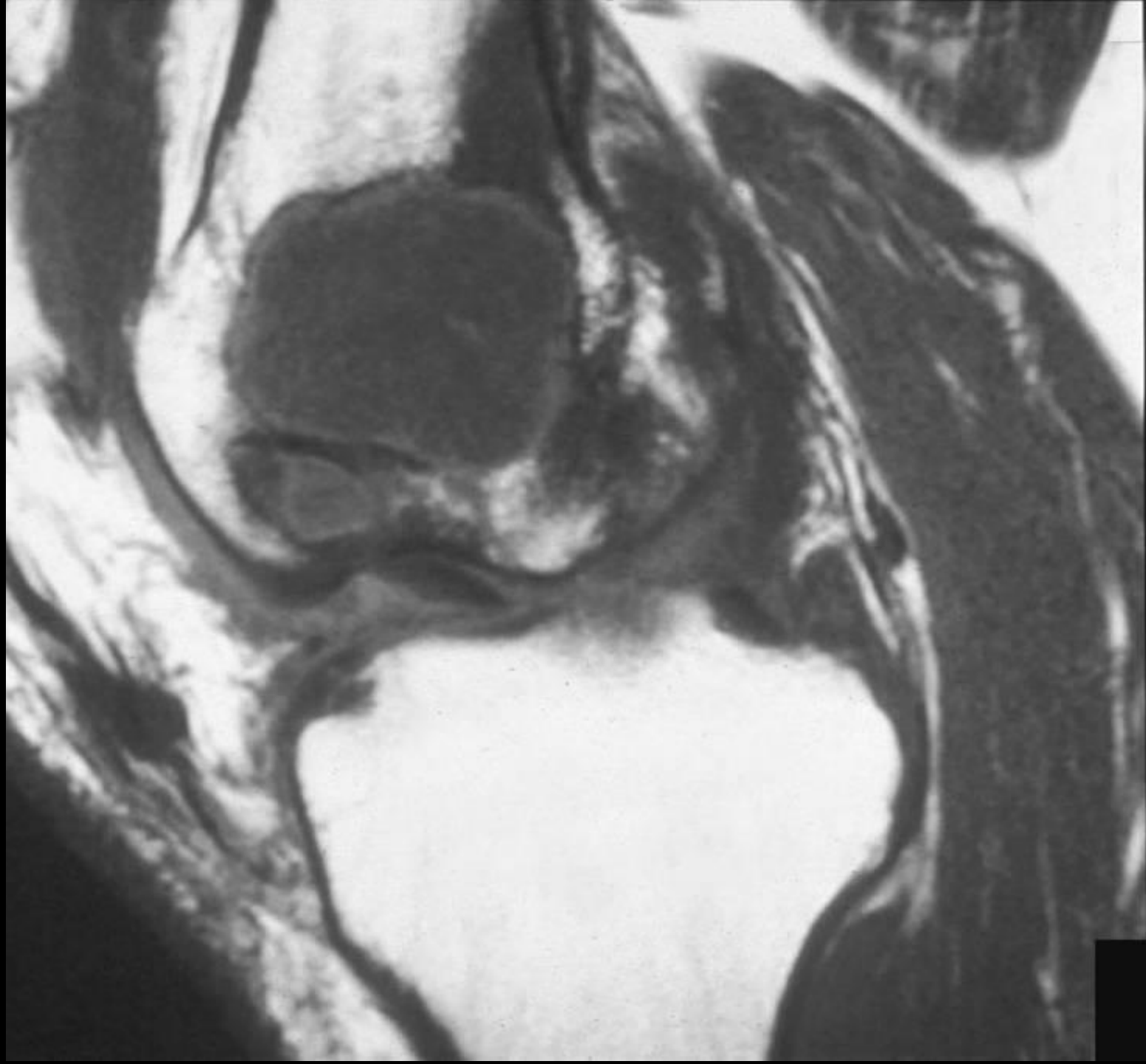
- Hand
- Wrist
- Knee
- Hip
- Foot







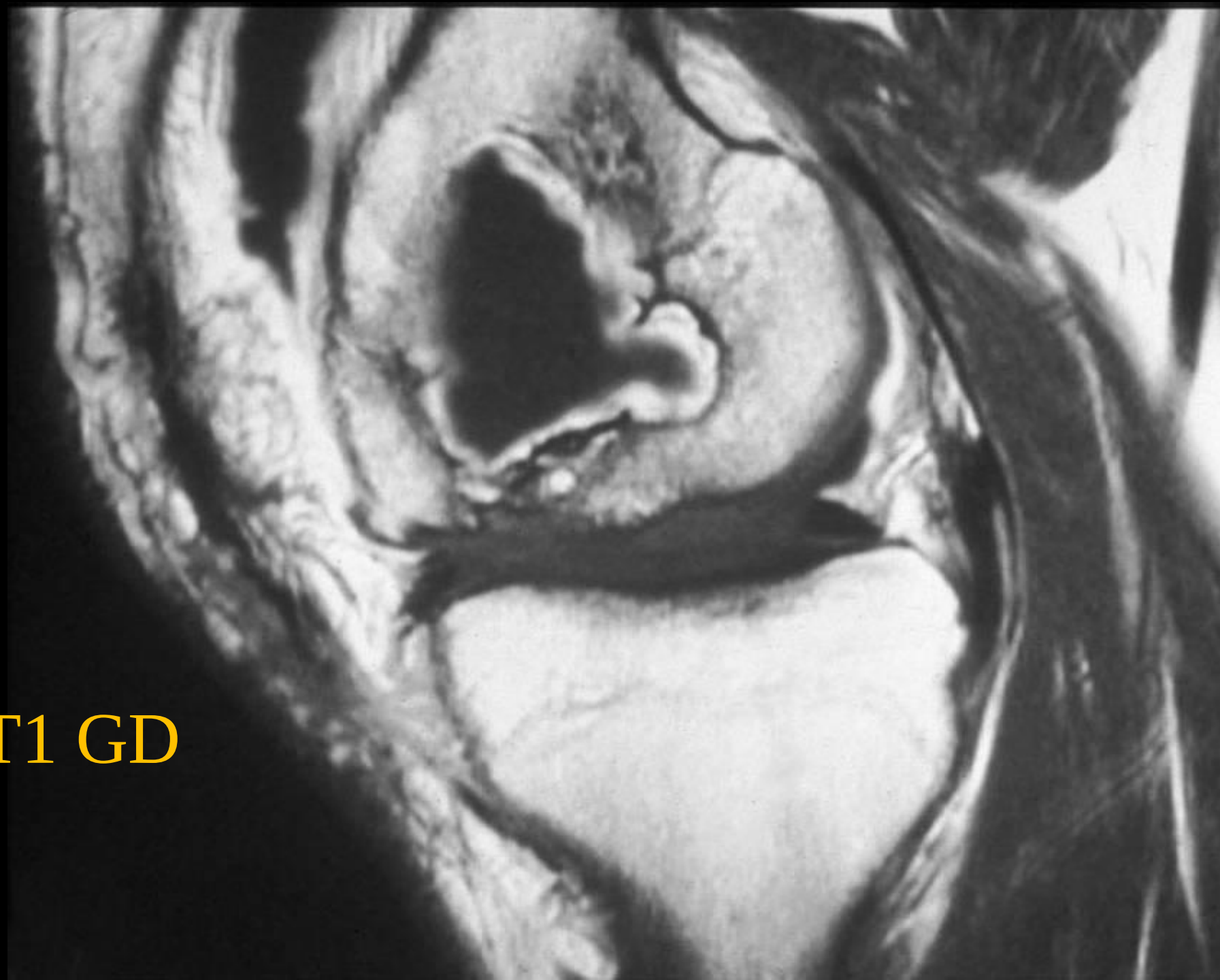
T1



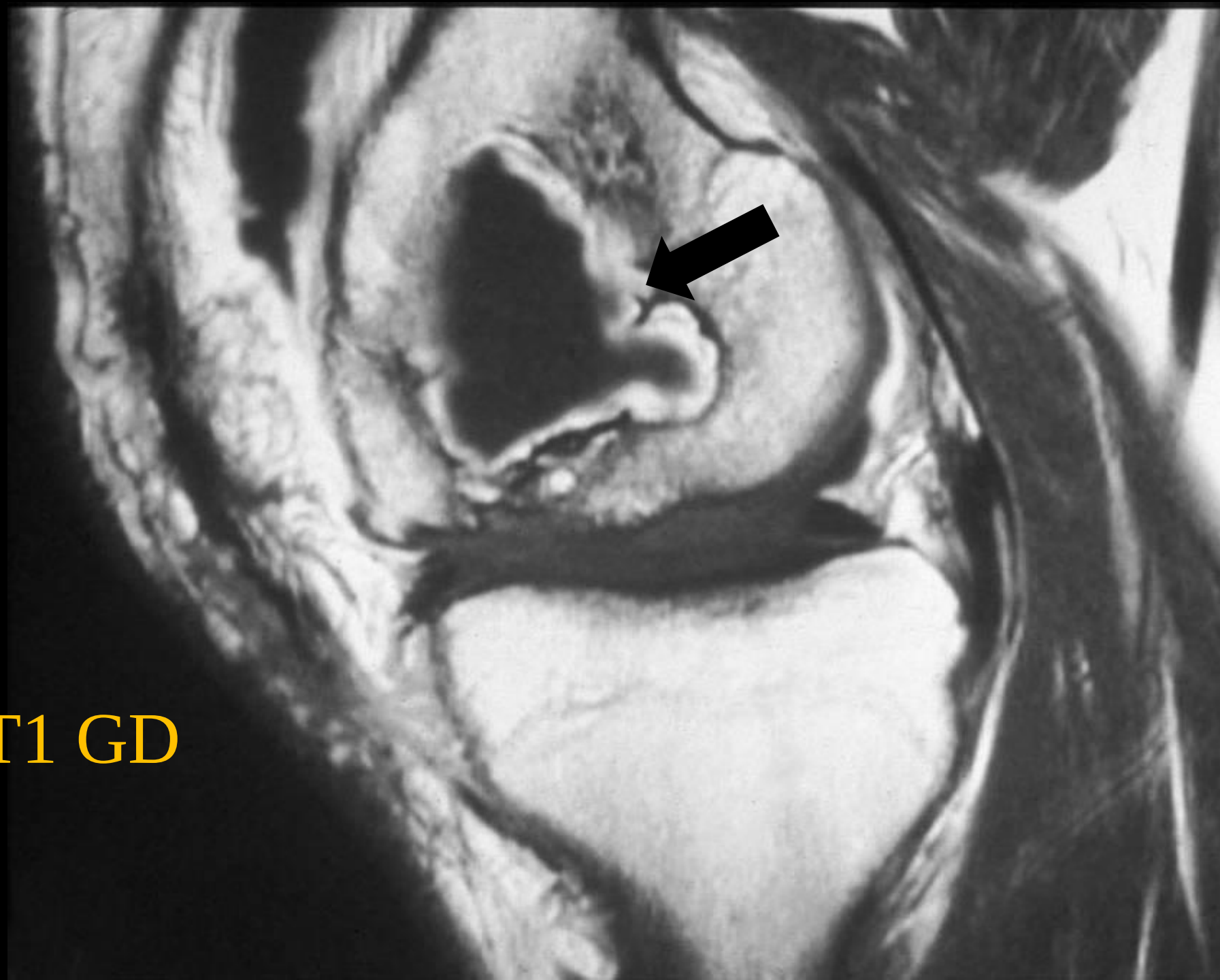
T1



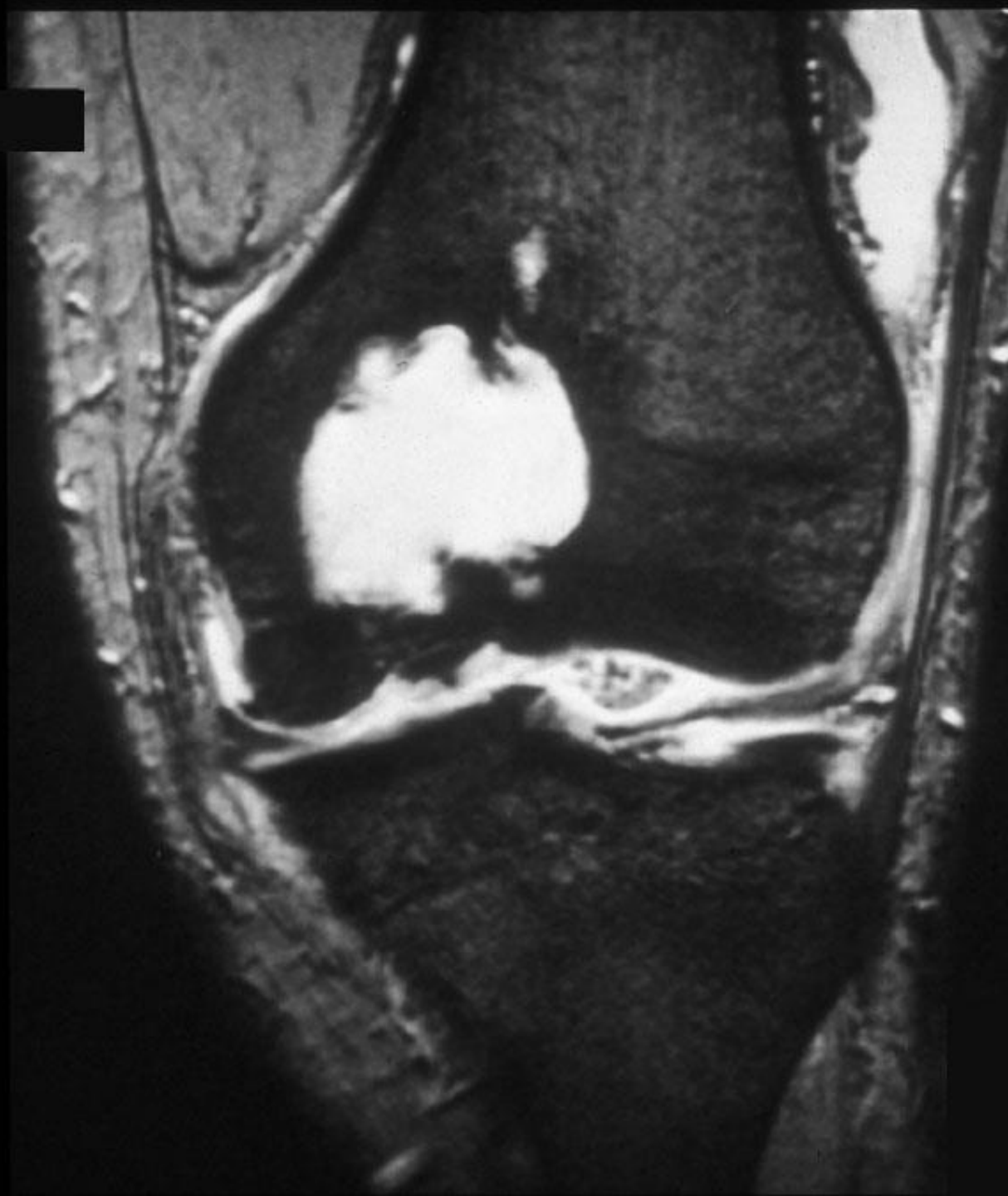
T1 GD



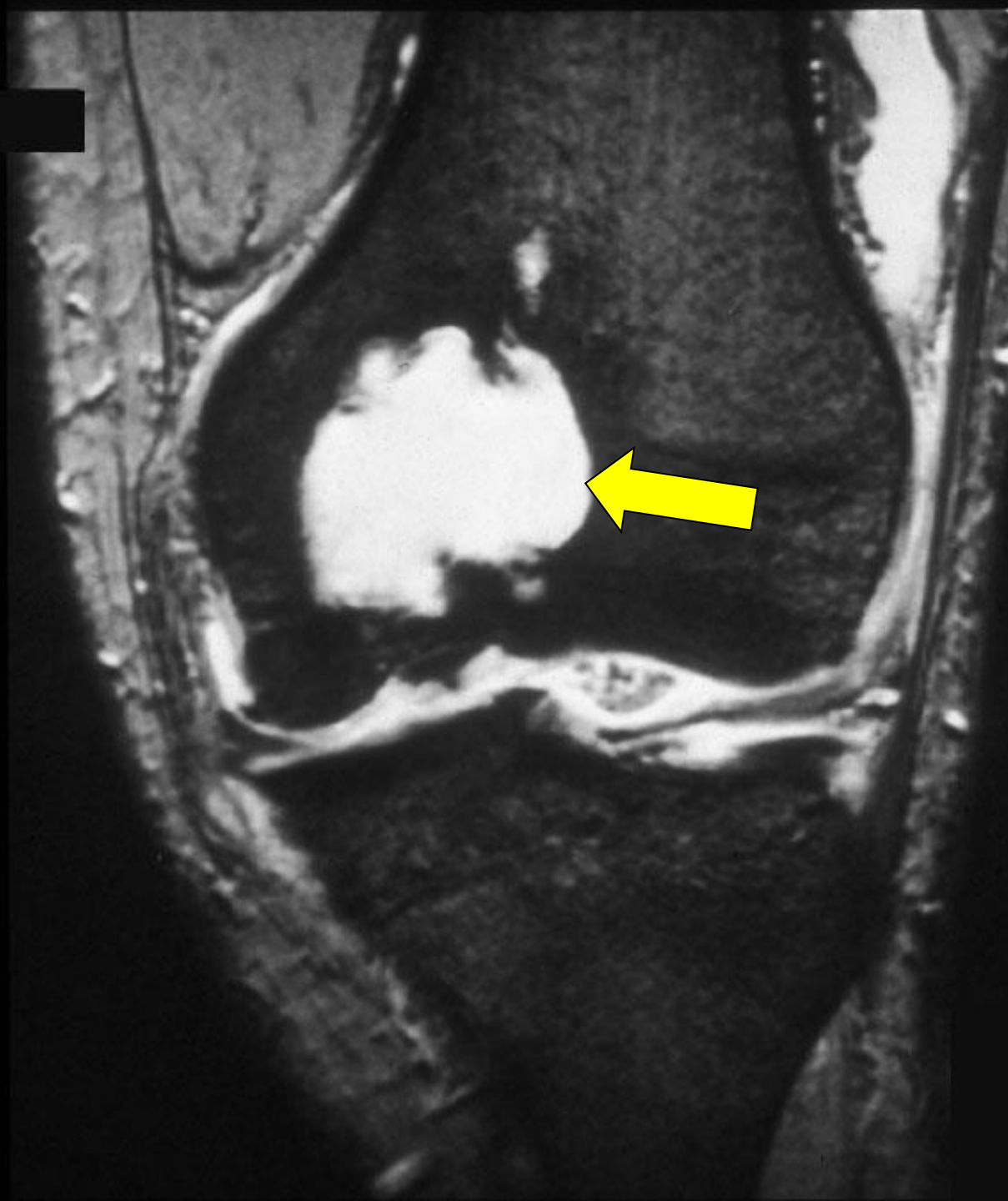
T1 GD



T2



T2





T2



OSTEOARTHRITIS HIP

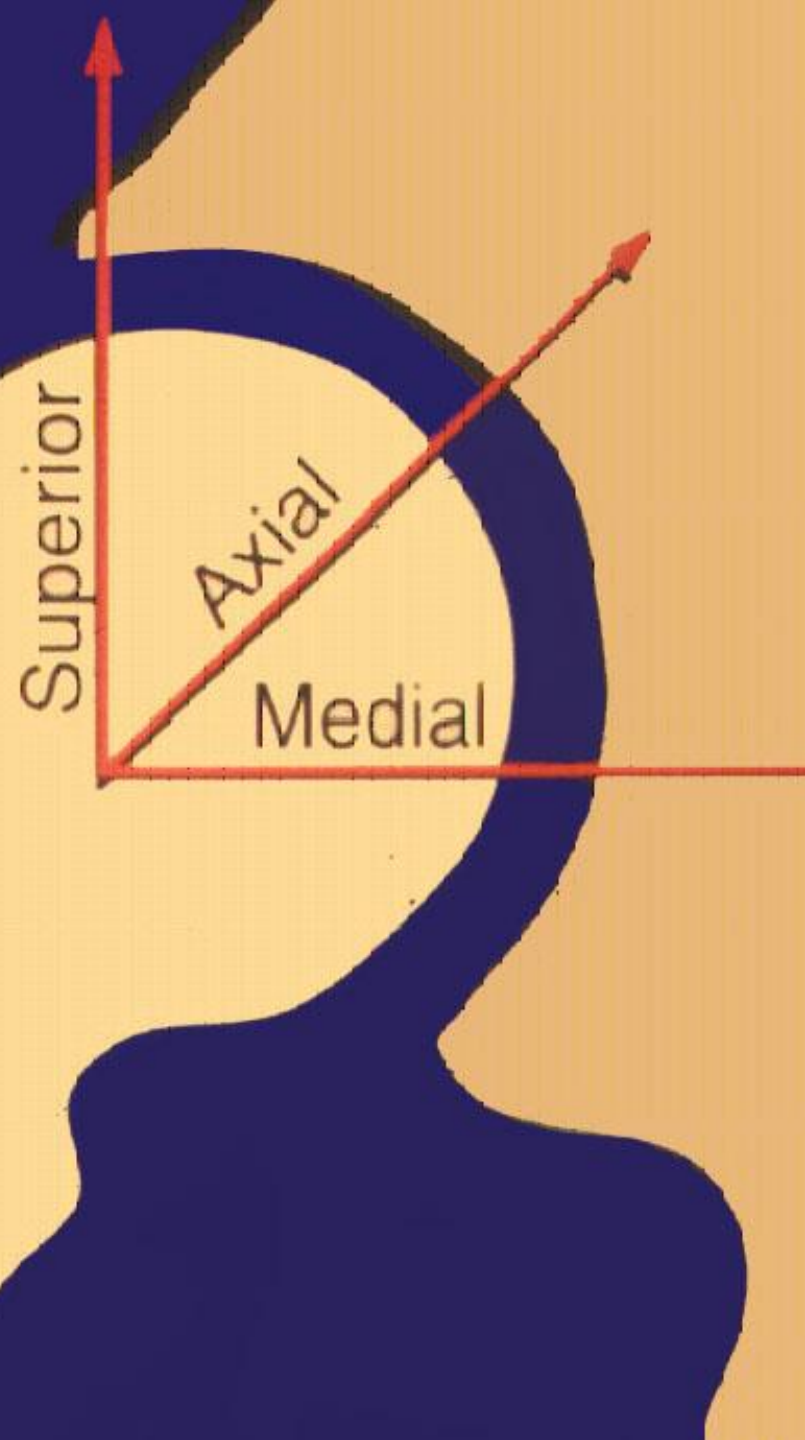
- Superior migration – 60%-80%
 - $M > F$
- Medial migration – 5%-25%
 - $F > M$
- Important to distinguish medial from axial migration:

LOOK AT SUPERIOR JOINT SPACE

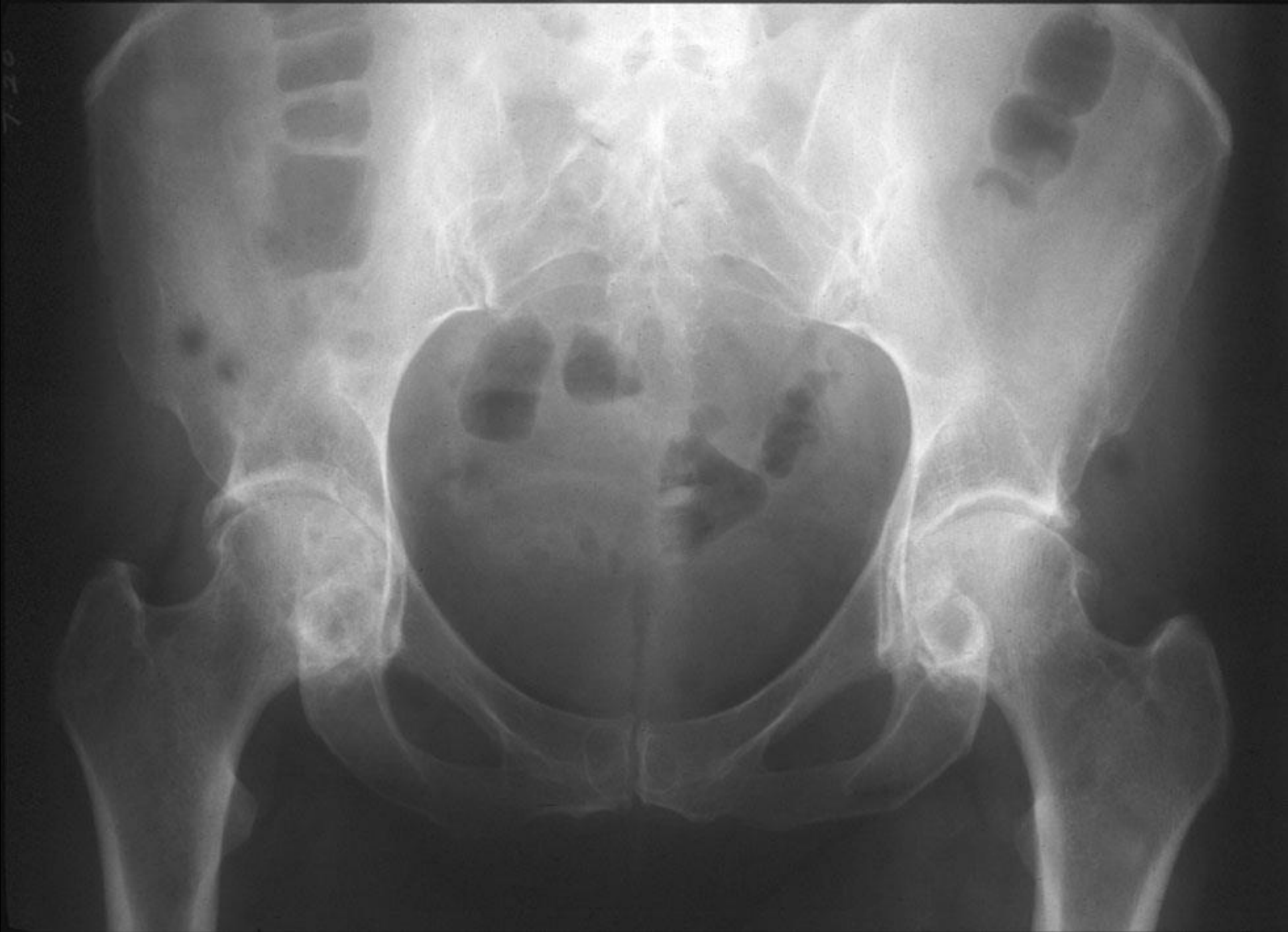
- Equal to or greater than 4mm (nonuniform/OA)
- Less than 4mm (pancompartmental/inflammatory)

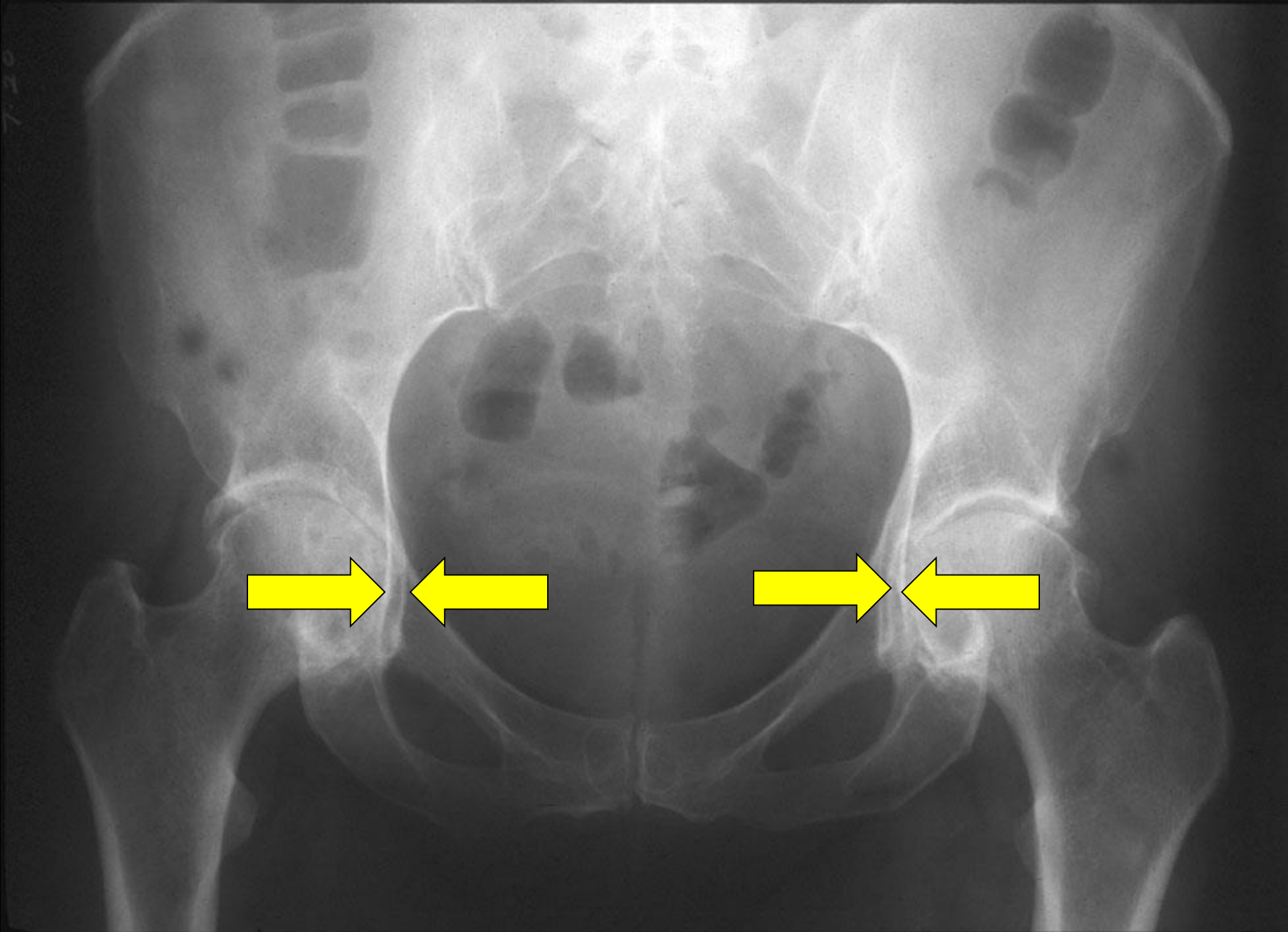
Superolateral	15%
Superomedial	48%
Intermediate	15%

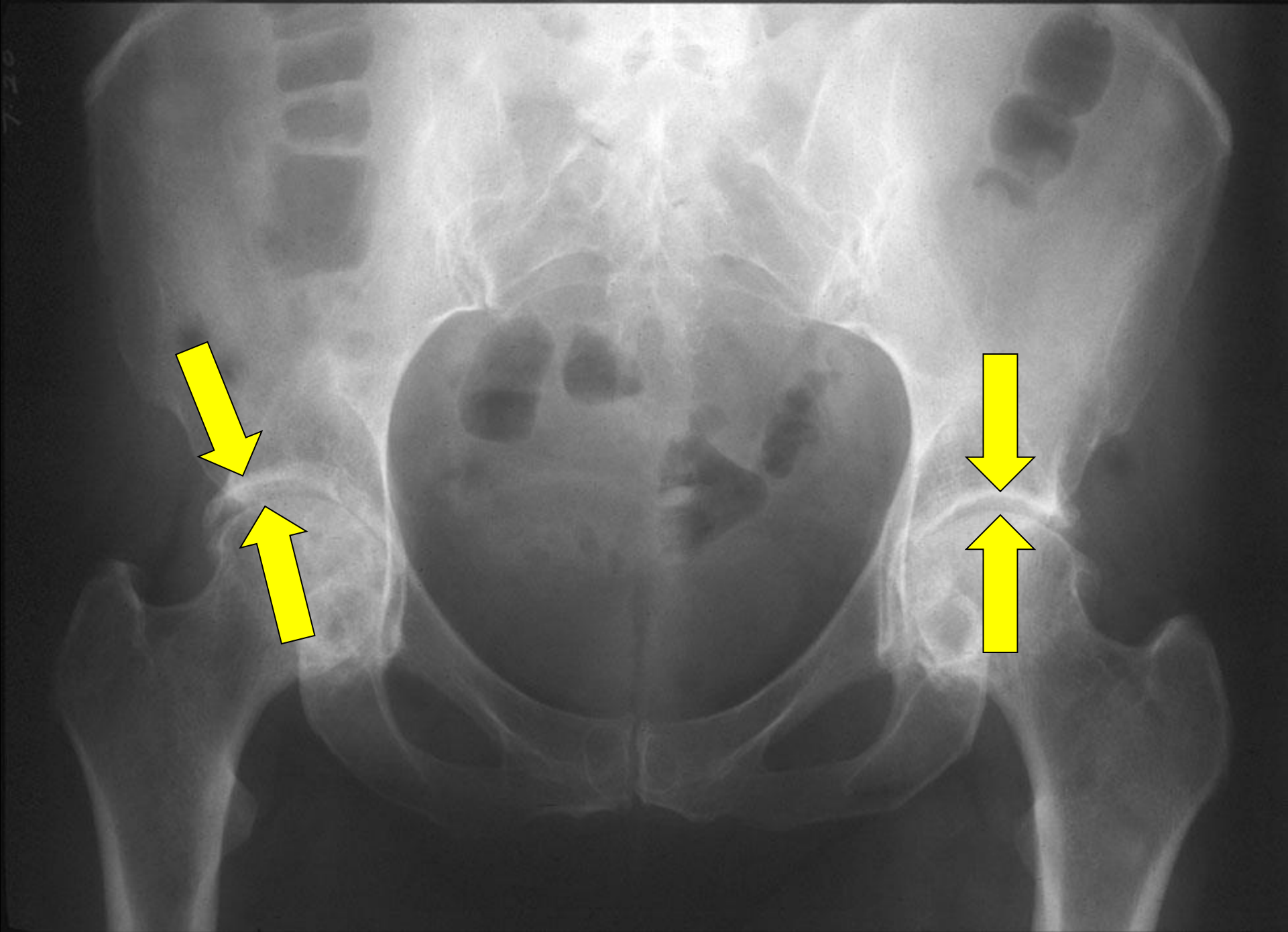
Medial	22%
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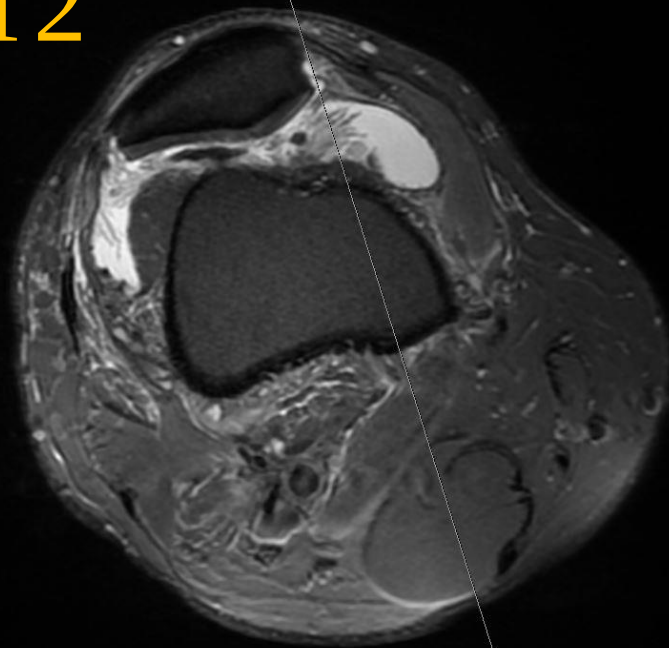




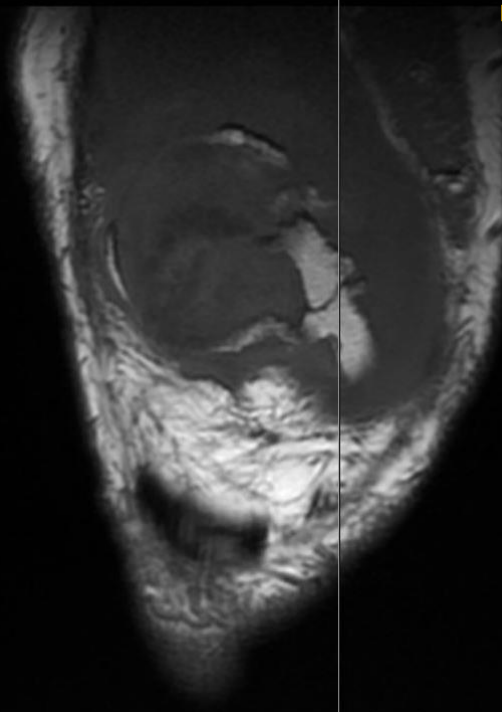




T2



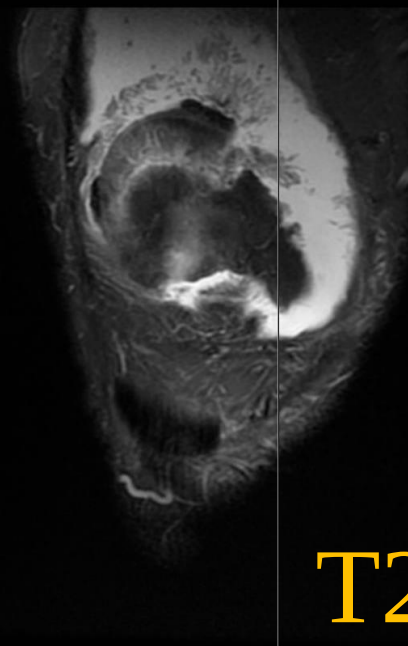
T1



T2



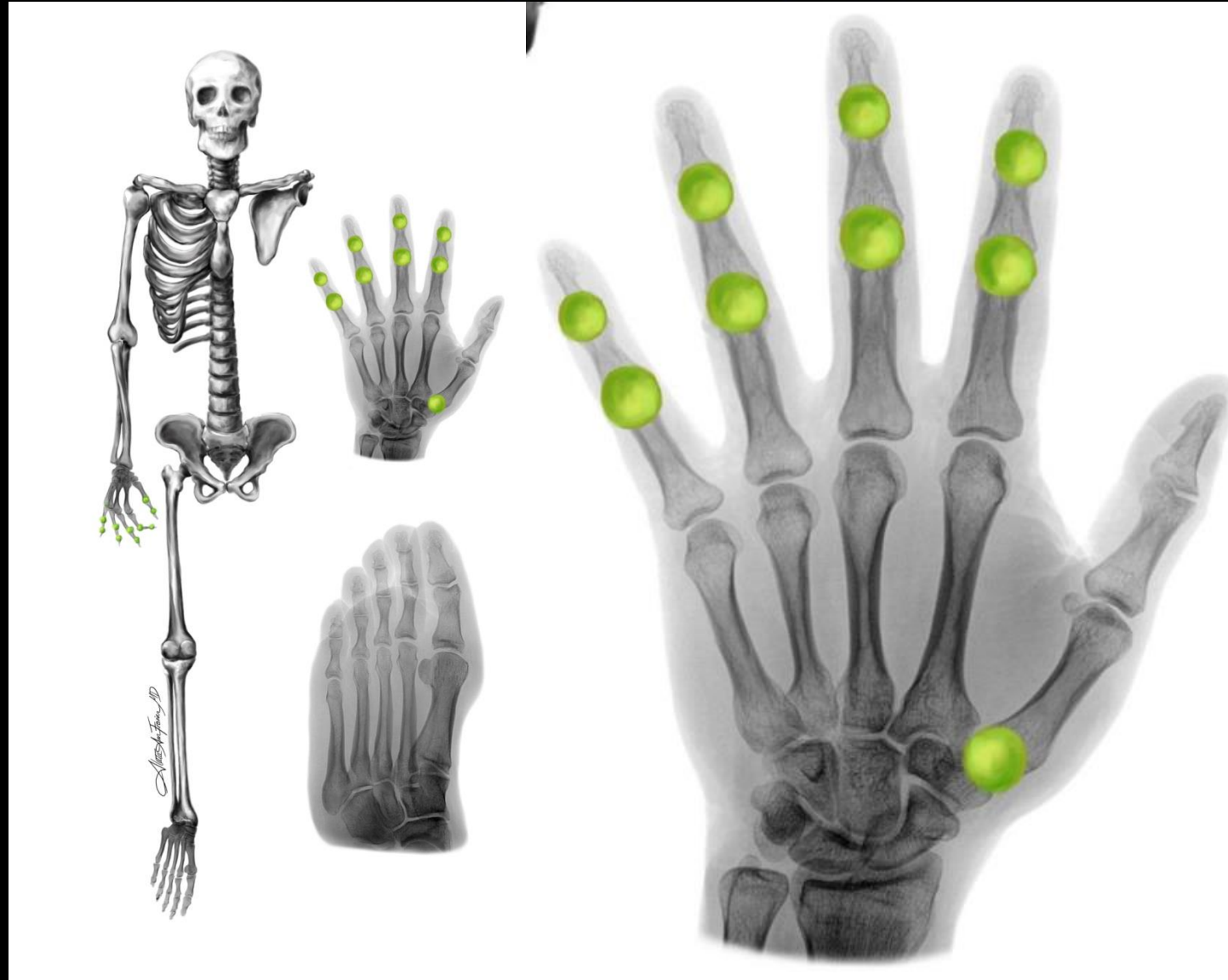
T2



EROSIVE OSTEOARTHRITIS

- Post-menopausal women (90%-95%)
- Inflammatory symptoms – red, swollen, painful
- Inflammatory synovium – similar to RA
- Only hands less commonly feet involved
- Similar distribution to OA – DIP/PIP, rare MCP
 - Also phyttes, normal mineralization, asymmetric narrowing, eburnation

EROSIVE OSTEOARTHRITIS



1. Gull-Wing Erosion
2. Heberden Nodes (Occasionally)
3. Interphalangeal Ankylosis

EROSIVE OSTEOARTHRITIS

- Asymmetric soft tissue swelling
- Osseous ankylosis – 15 % (similar to psoriatic not OA)
- Differential diagnosis is psoriatic arthritis
 - Central erosions (seagull wing) predominate in EOA
 - Marginal erosions predominate in psoriatic
 - Distribution only DIP/PIP in EOA

L49

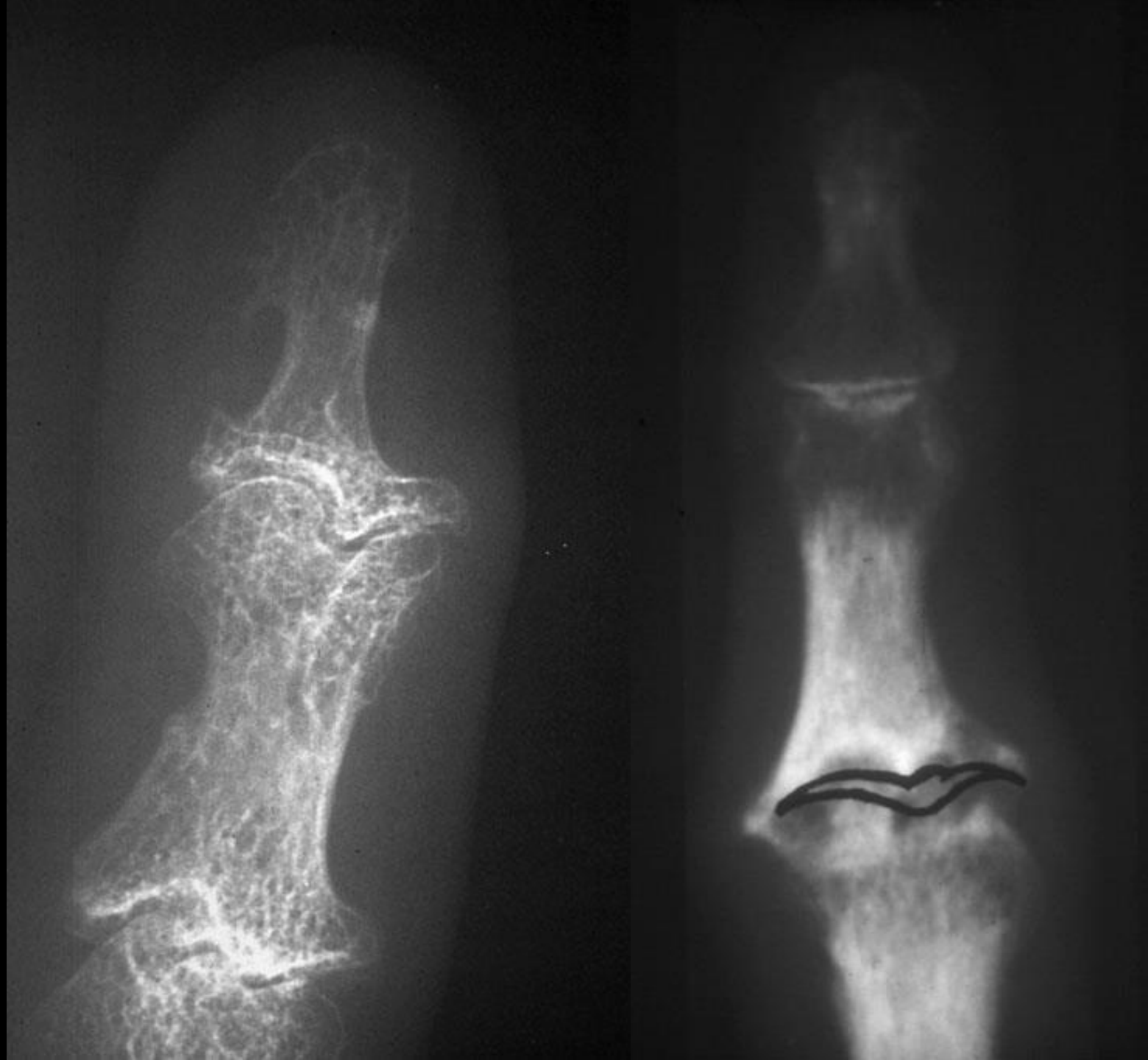


R39









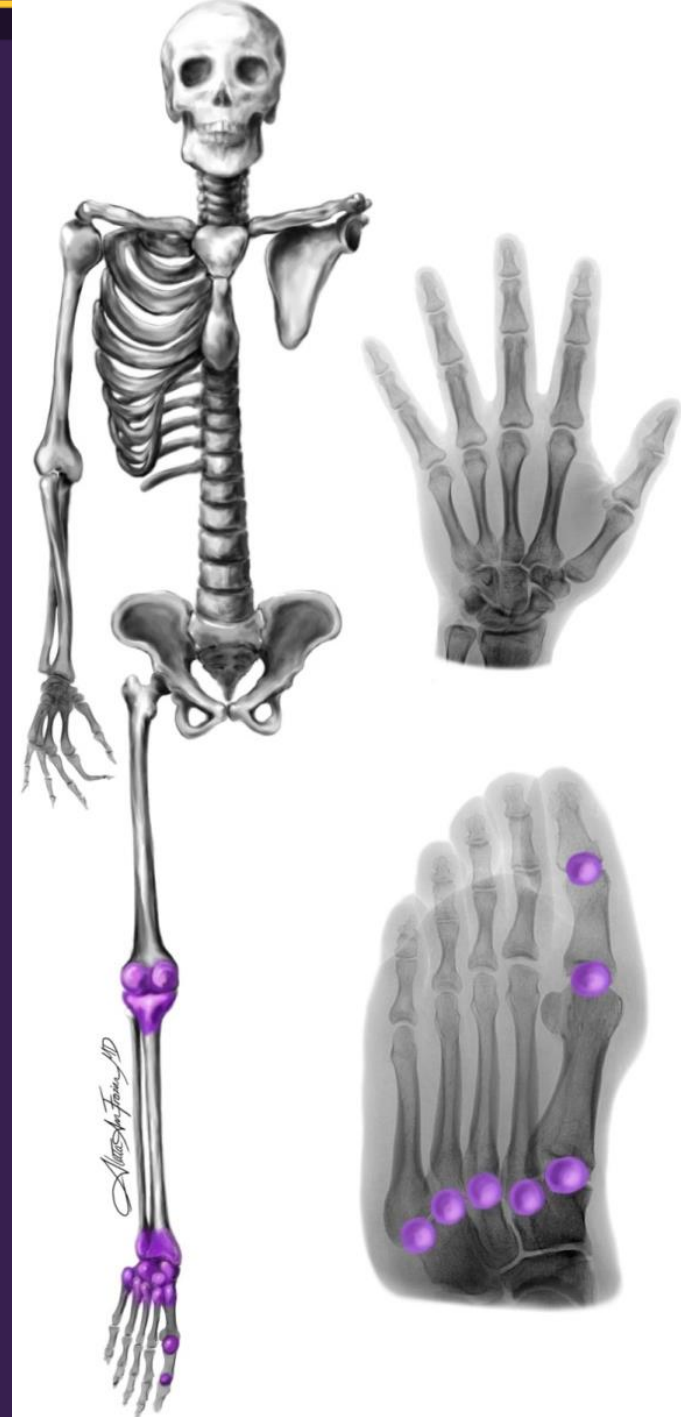
GOUT (PODAGRA) CLINICAL/PATHOLOGY

- Pous – foot; Agra – attack/hunt/trap/seizure
- Common 3% of population (.2->35/1000)
- 5% patients with arthritis
- Primary (male predilection 20:1); 95% secondary
 - Increased production; Decreased excretion
- Caused by monosodium urate crystal deposition
 - Negative birefringence (needle shaped)
- Chronic inflammatory synovitis



GOUT DISTRIBUTION

- Polyarticular – asymmetric
- First MTP joint – 90% initially/ultimately
- Toes
- Tarsometatarsal joints early – unusual in other arthritides
- Ankle ; Hands/CMC joints
- Elbow – olecranon bursitis (bilateral)



GOUTY ARTHRITIS: RADIOGRAPHS

- Soft tissue swelling – lobulated tophi (lumpy bumpy arthritis)
 - Unusual to calcify
 - Not associated with chondrocalcinosis
- Joint spaces/mineralization maintained

GOUTY ARTHRITIS

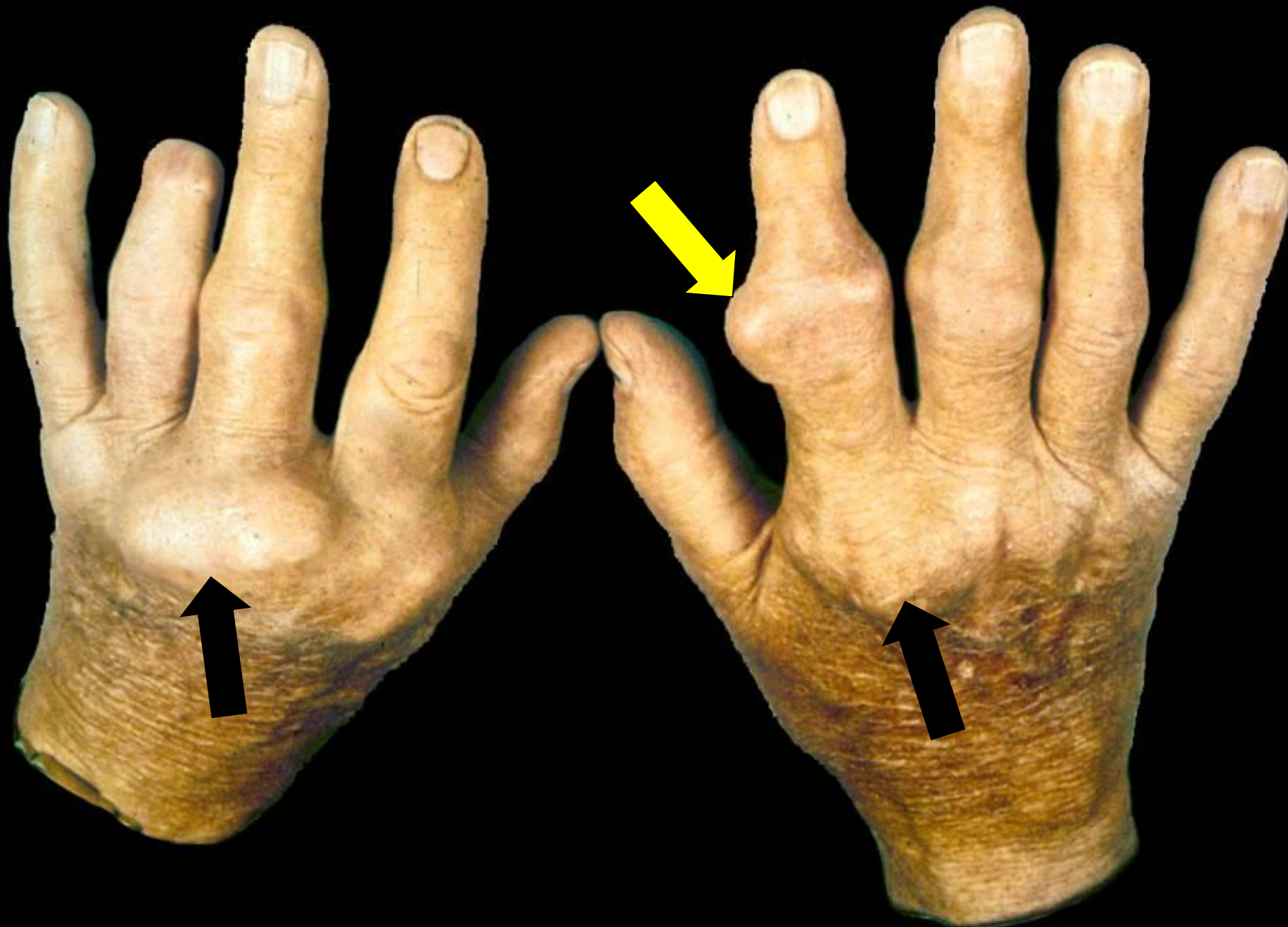
RADIOLOGIC CHARACTERISTICS

- Erosions – punched out predominate dorsally
 - Sclerotic margins; May be extraarticular
 - May demonstrate calcifications (6%)
 - Overhanging edge (40%) represents bone production; must be beyond native cortex
- CT – calcification more frequent; dual energy studies are specific for monosodium urate
- US – hyperechoic (96%); heterogeneous (73%)
- MRI – low/intermediate signal T2W

“LUMPY-BUMPY” ARTHRITIS

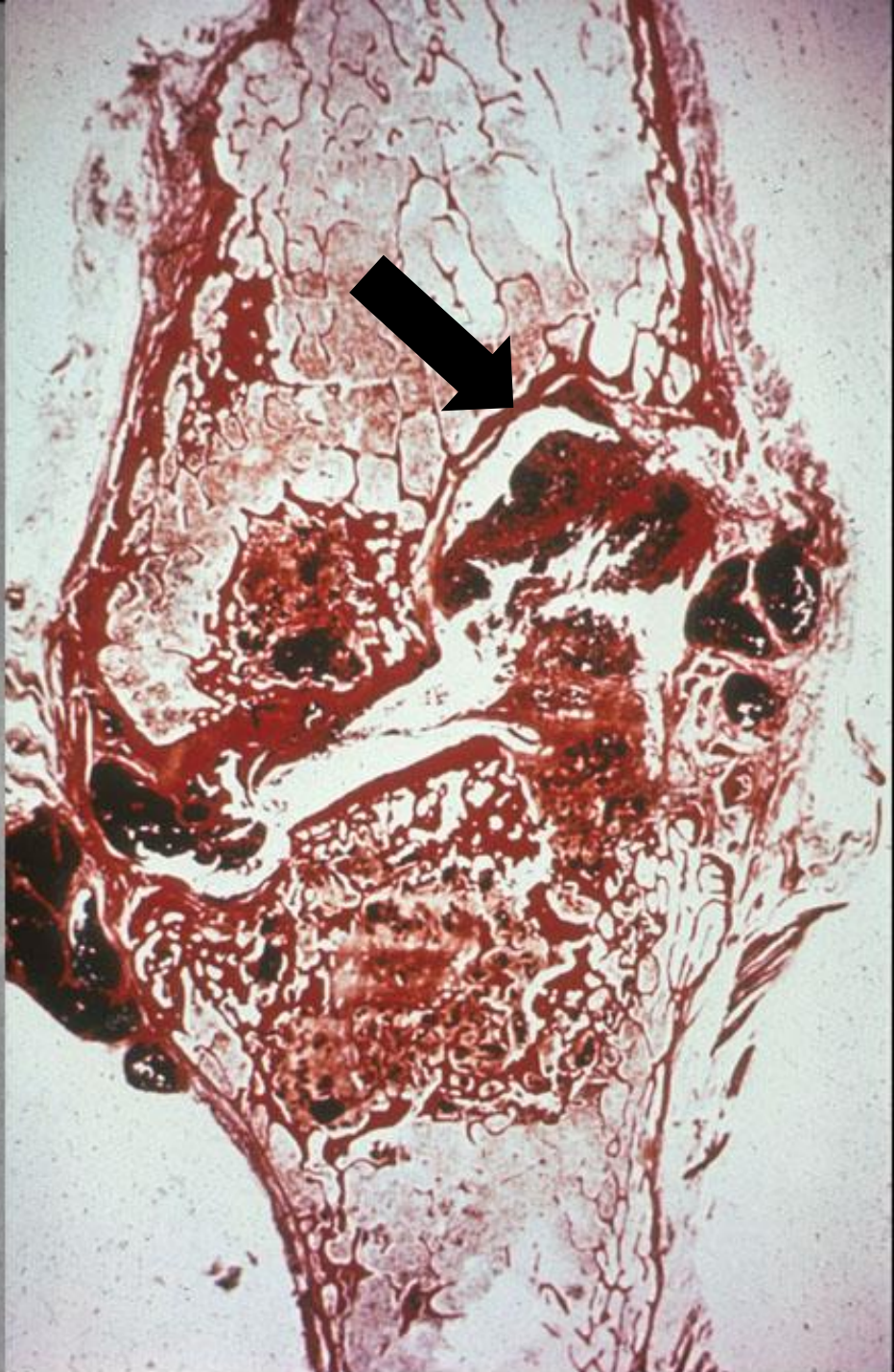
DIFFERENTIAL DIAGNOSIS

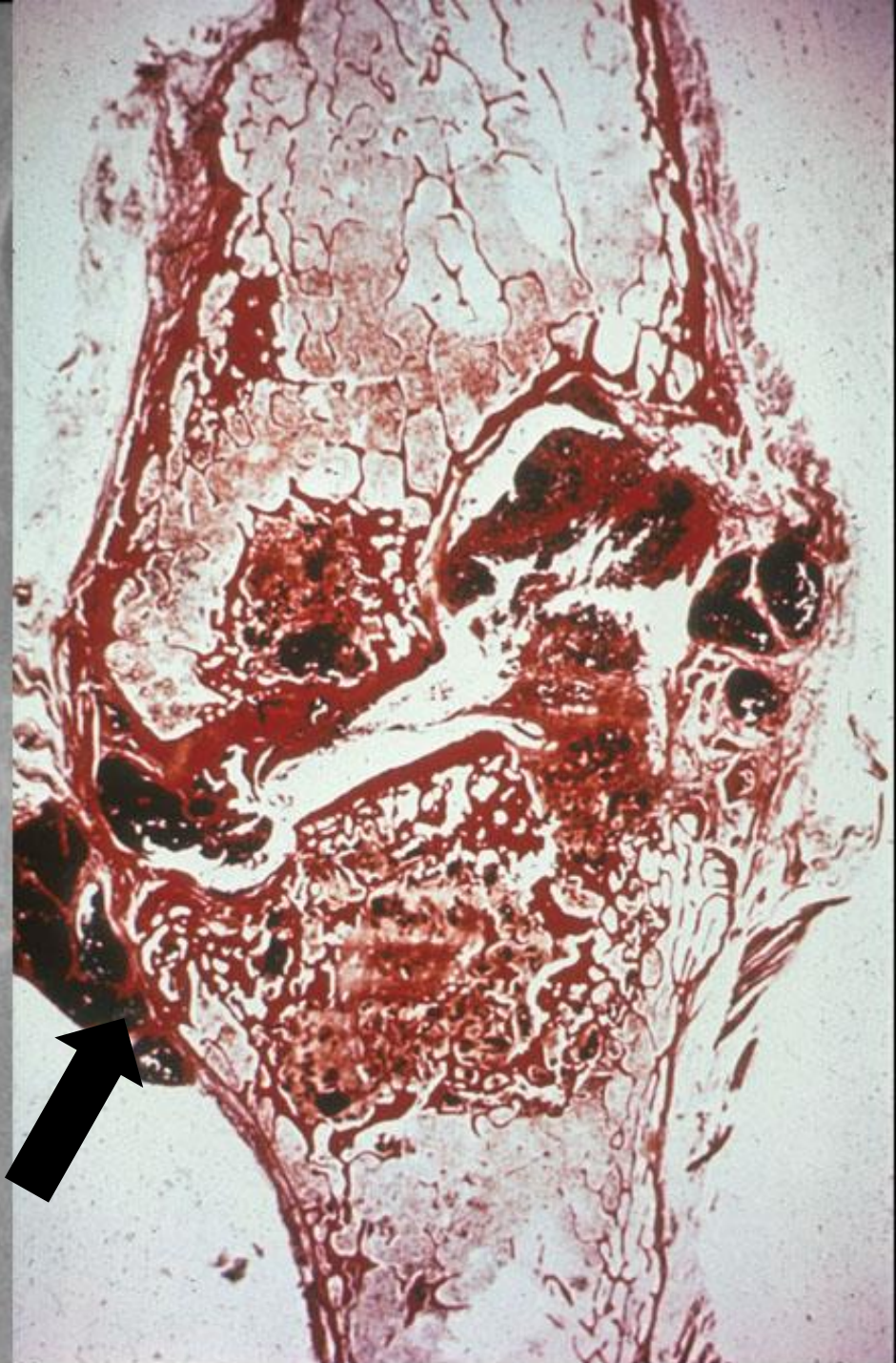
- Gout
- Sarcoid
- Amyloid
- Xanthomatosis
- Multicentric reticulohistiocytosis
- RA (with rheumatoid nodulosis)





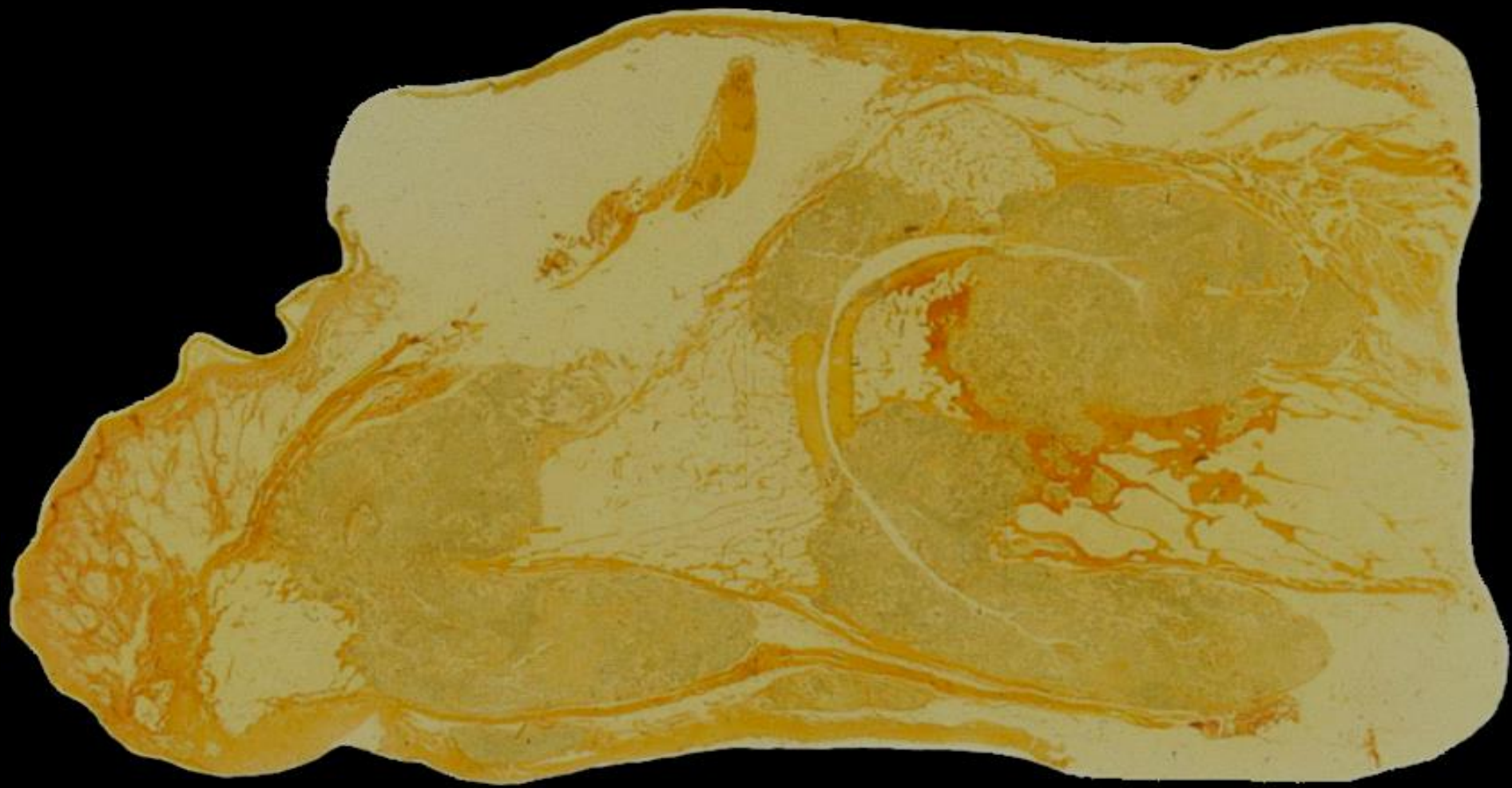


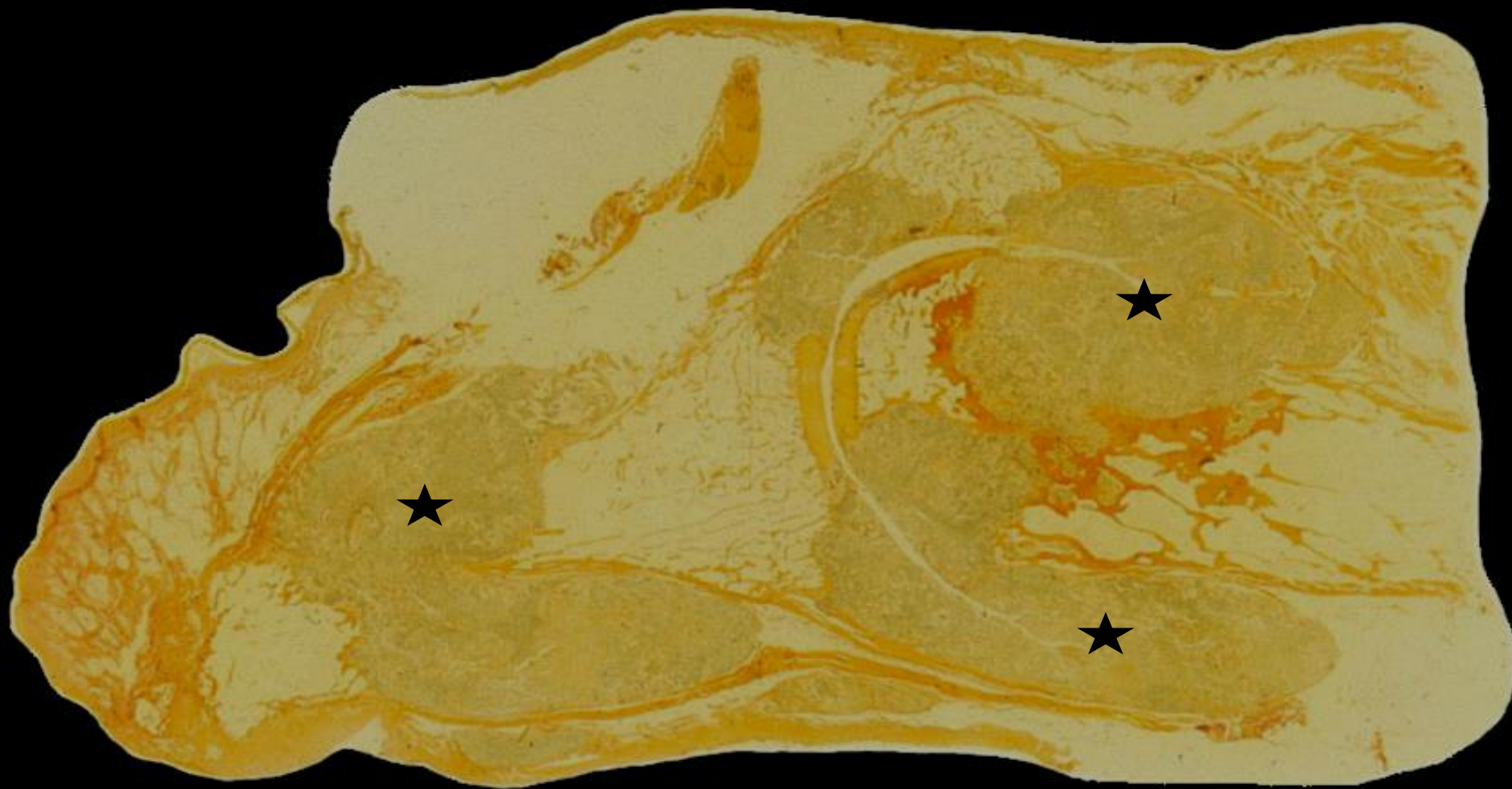


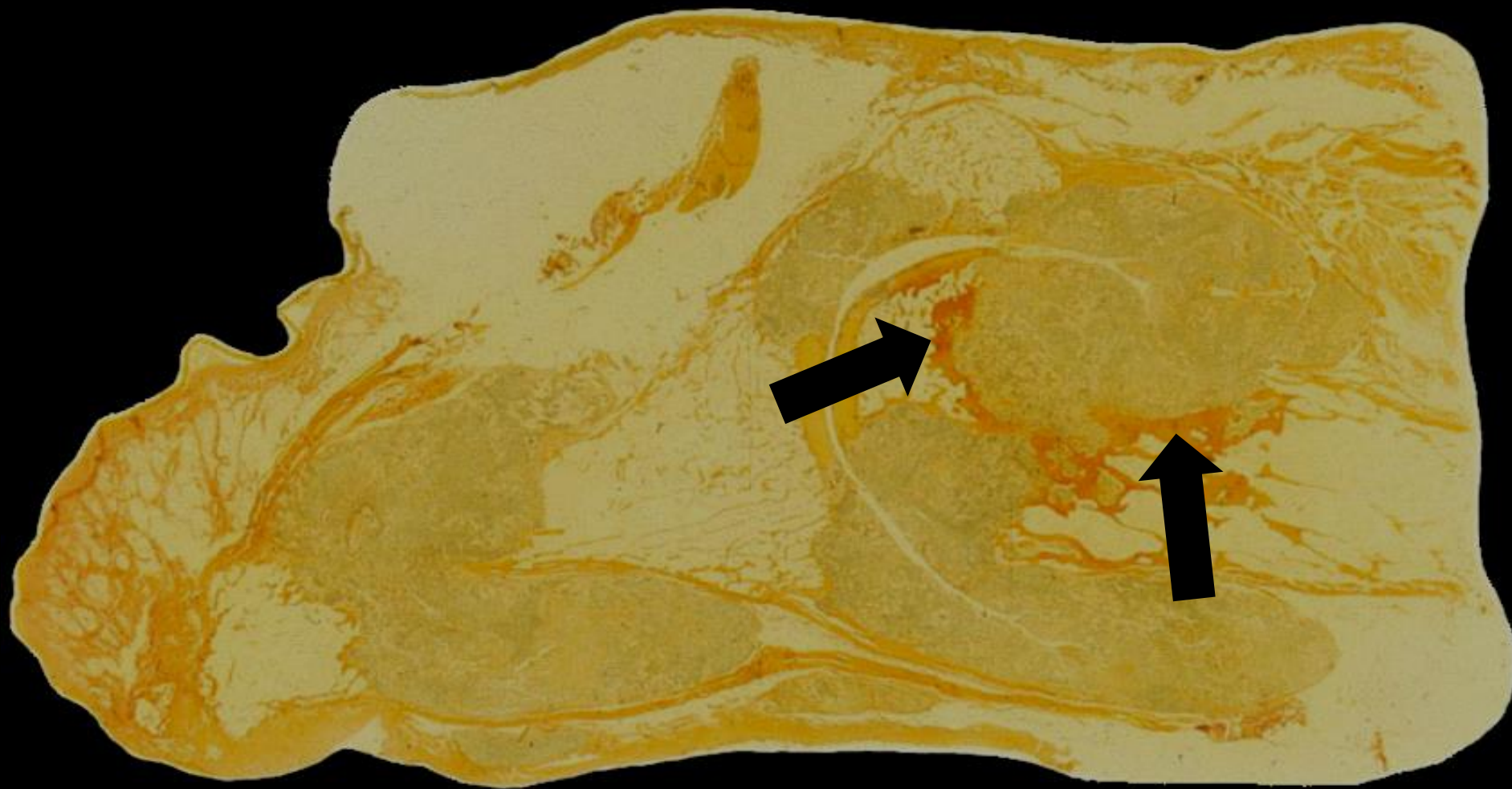














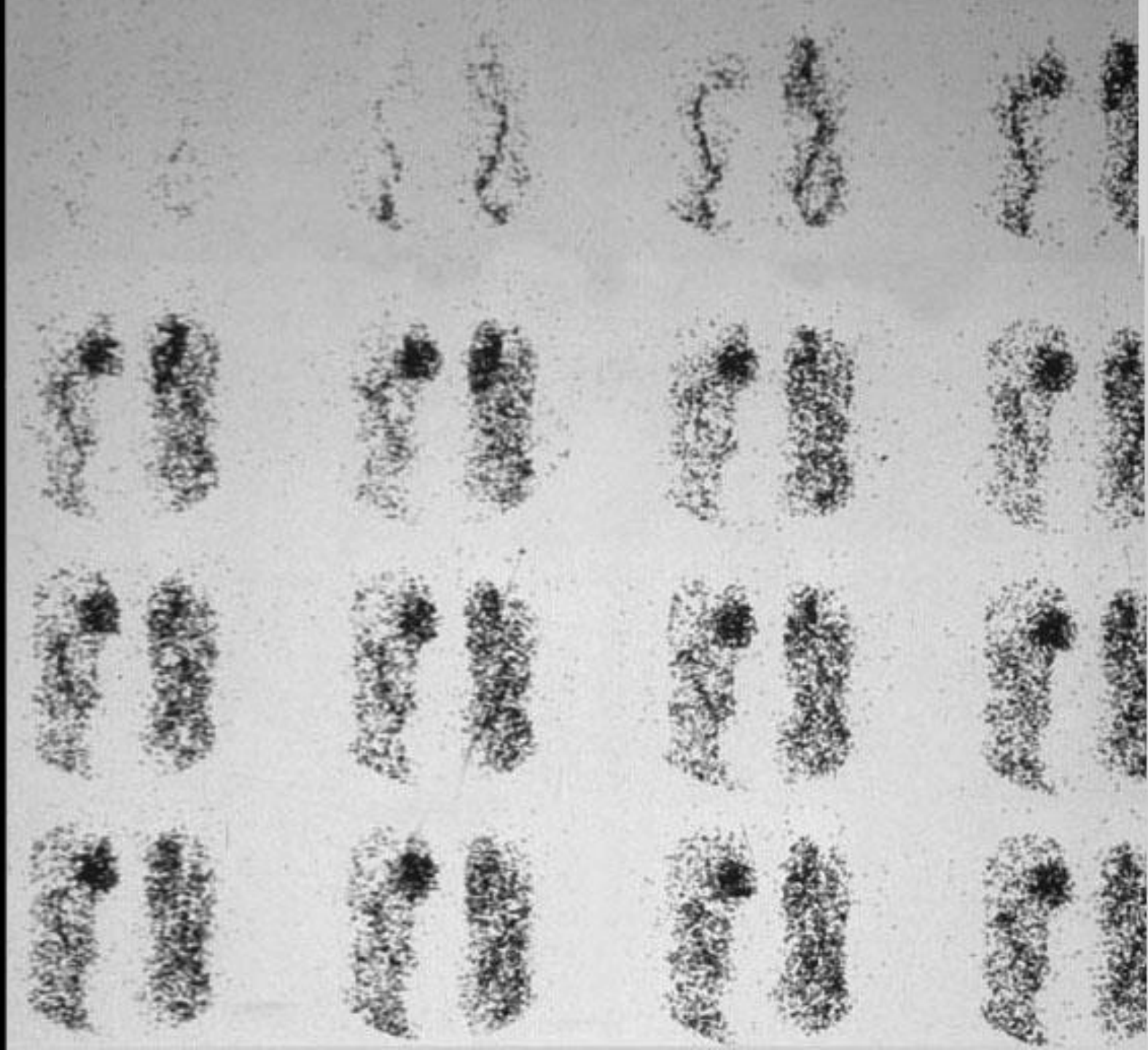


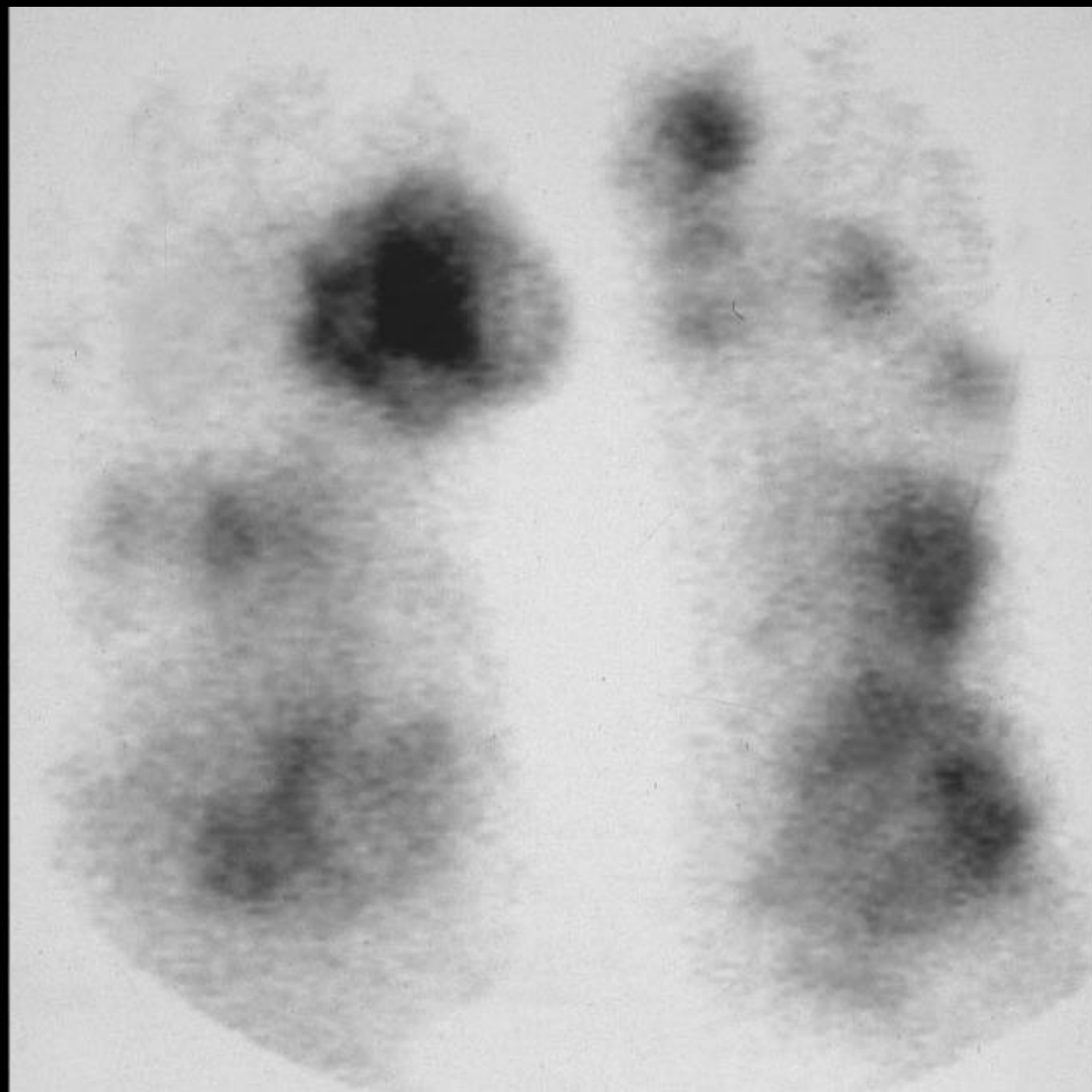


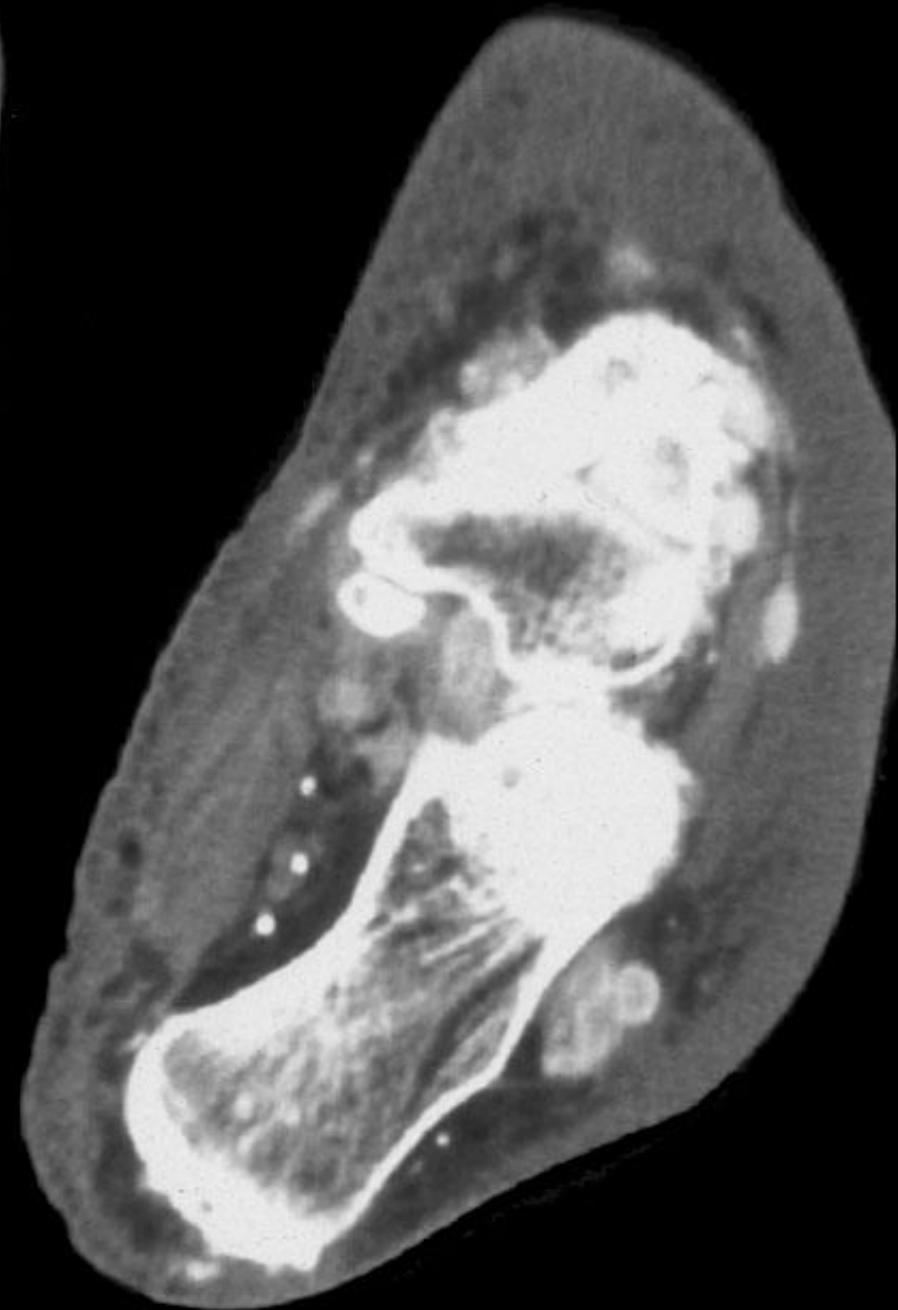


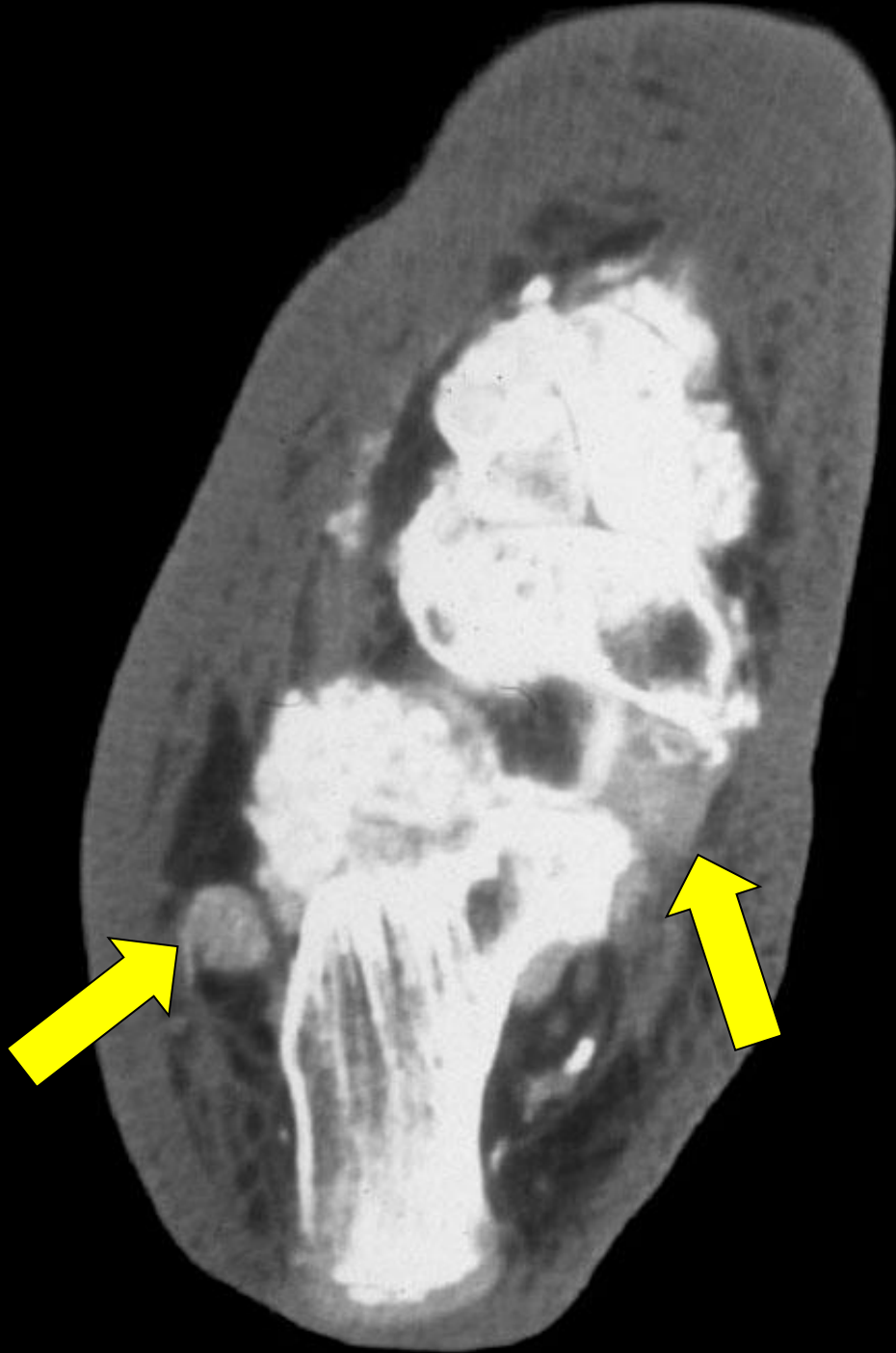


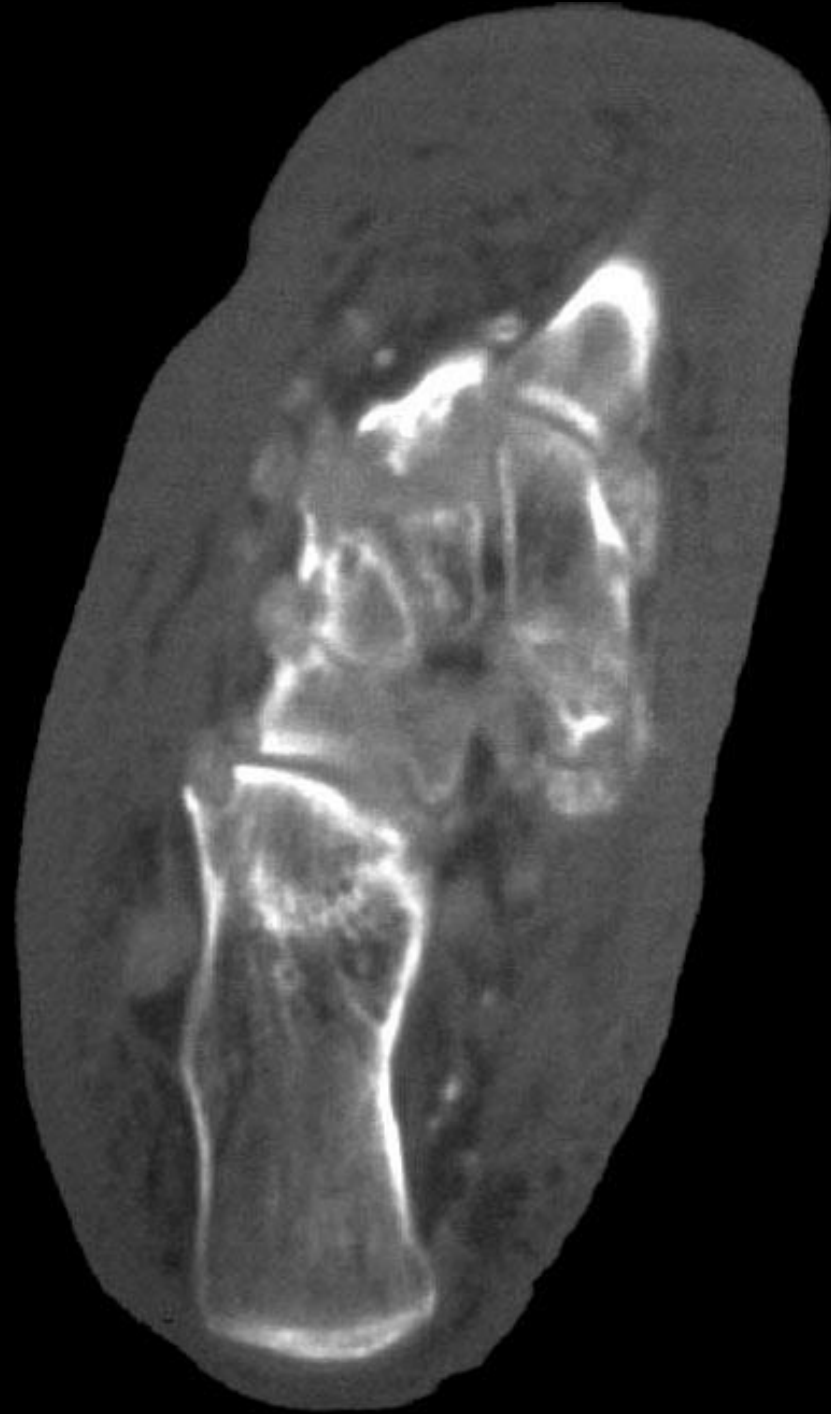


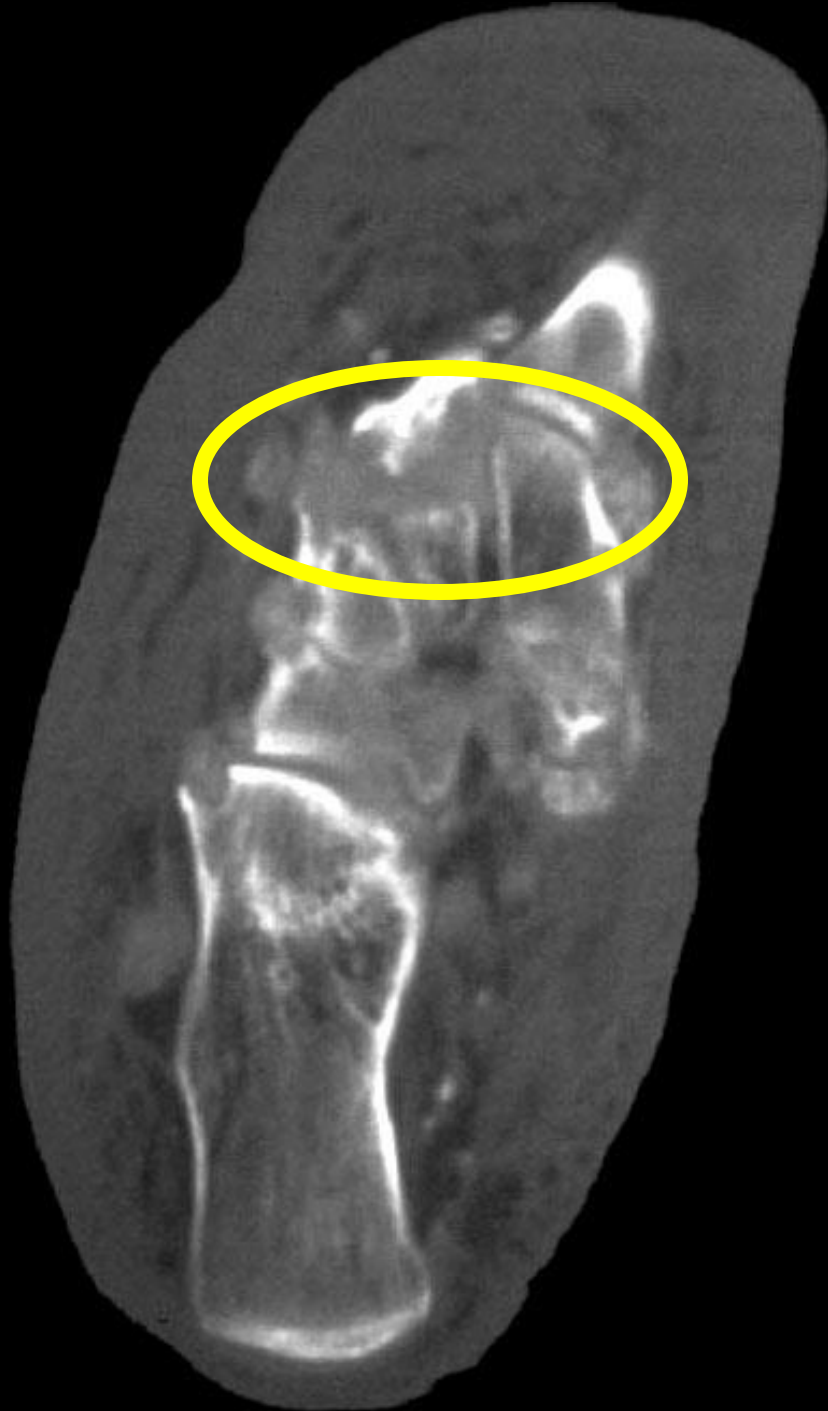




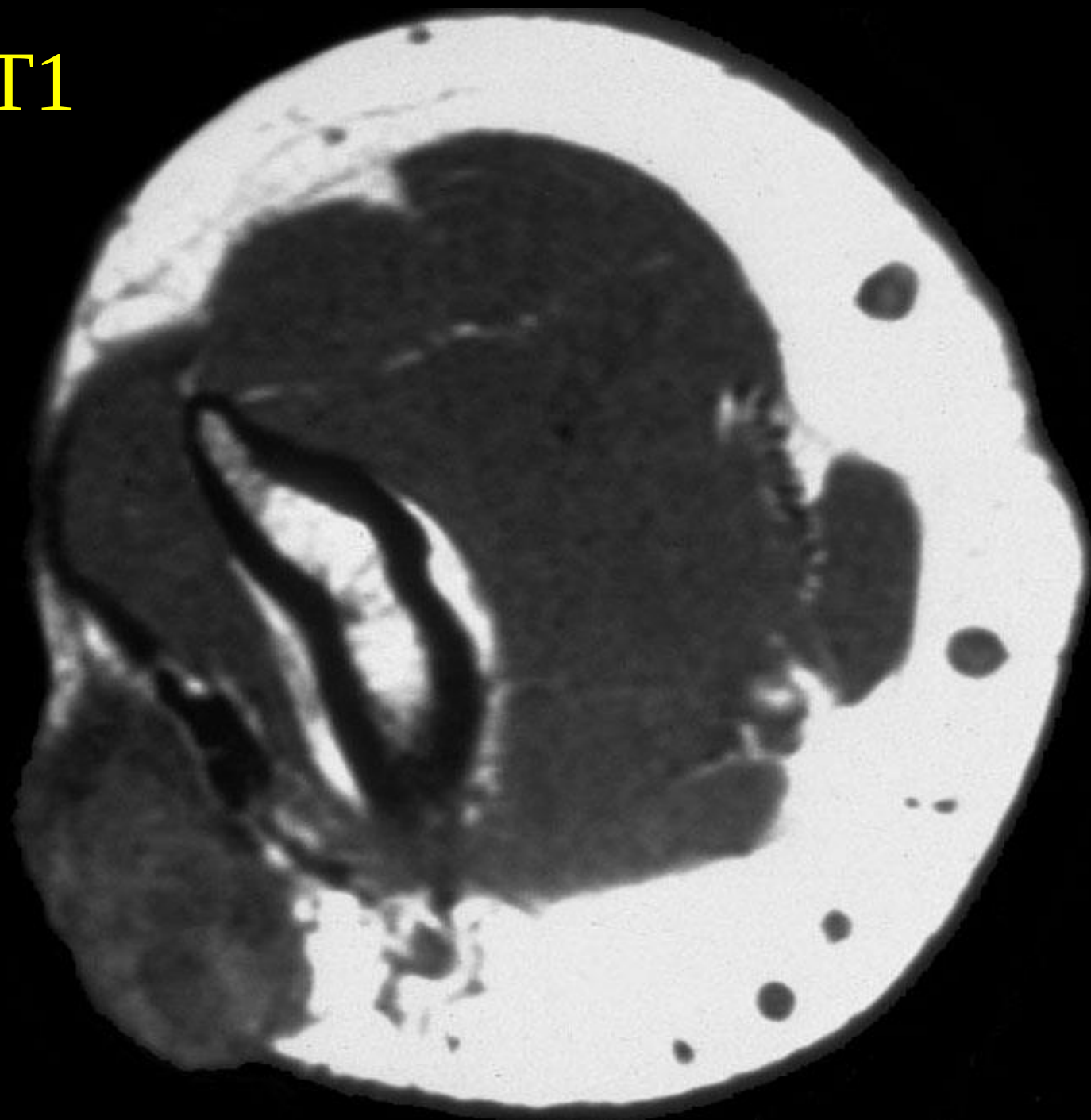




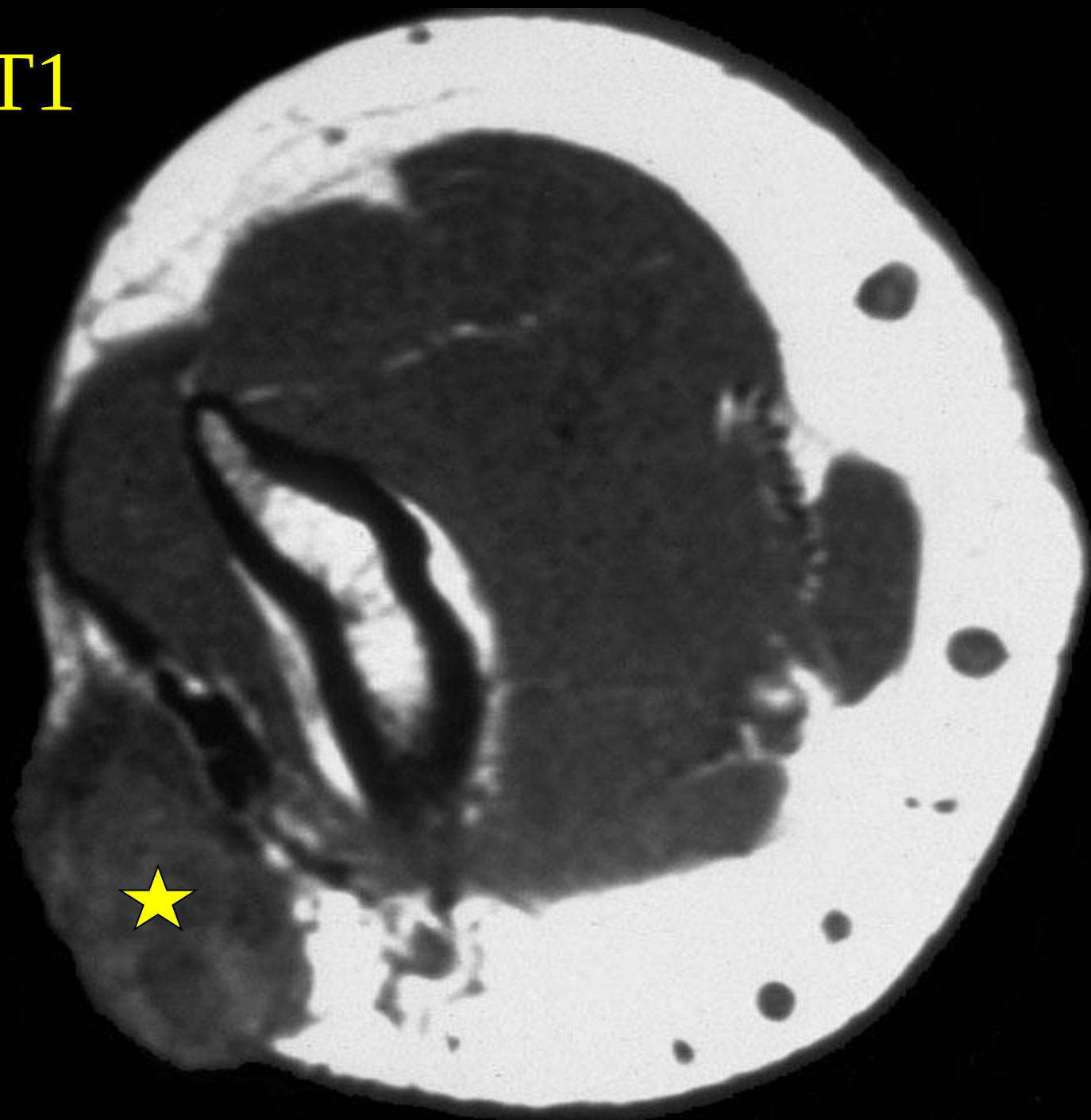




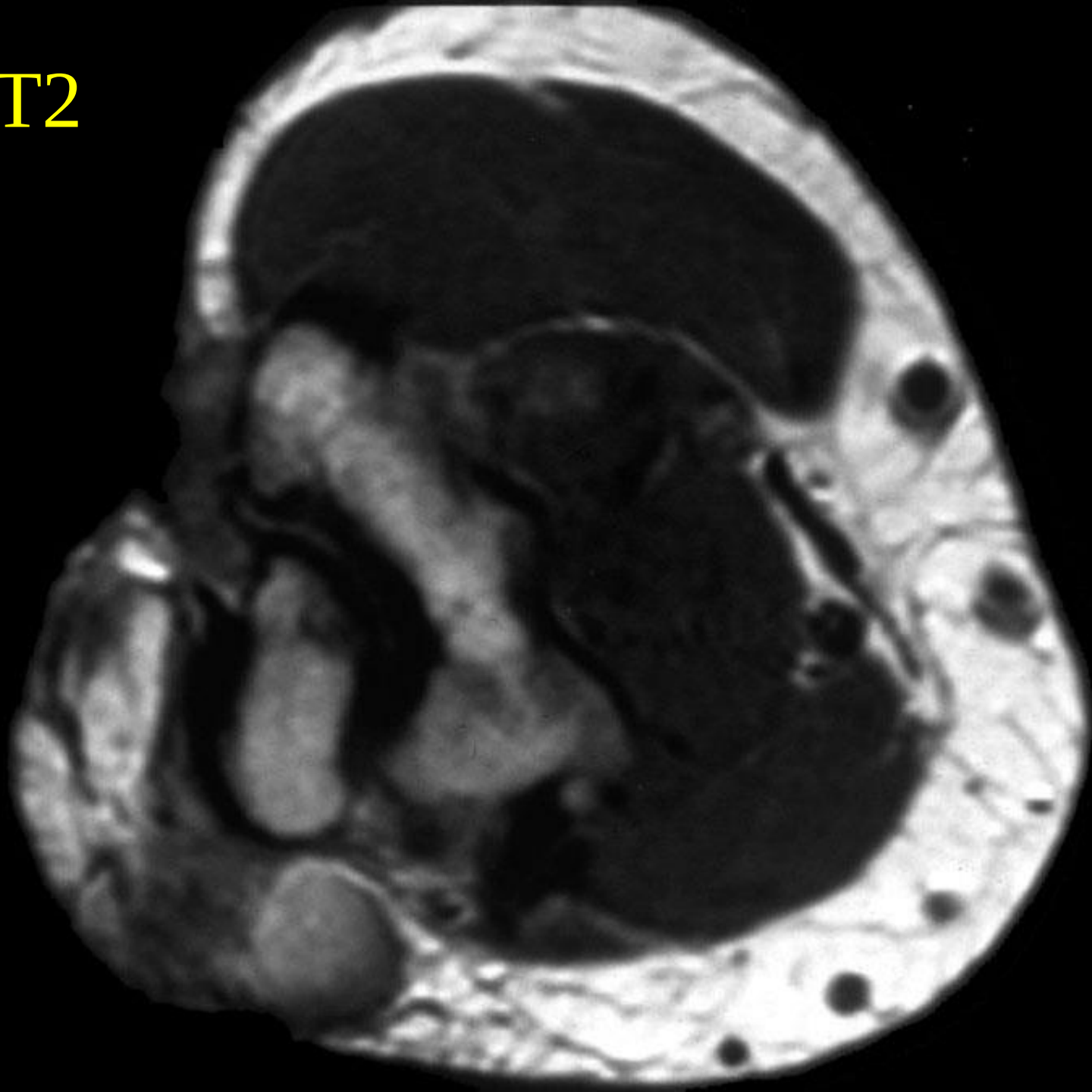
T1



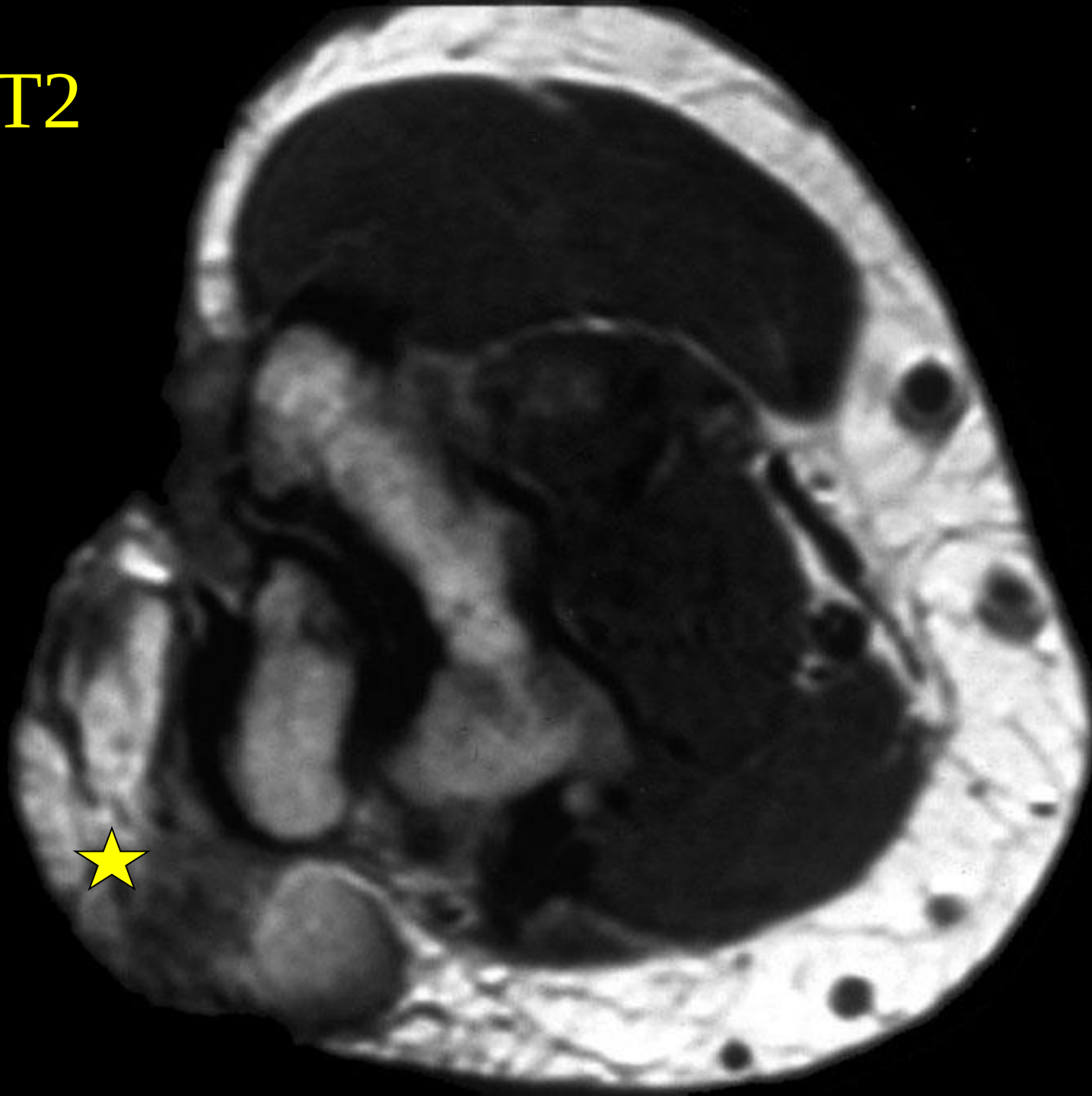
T1

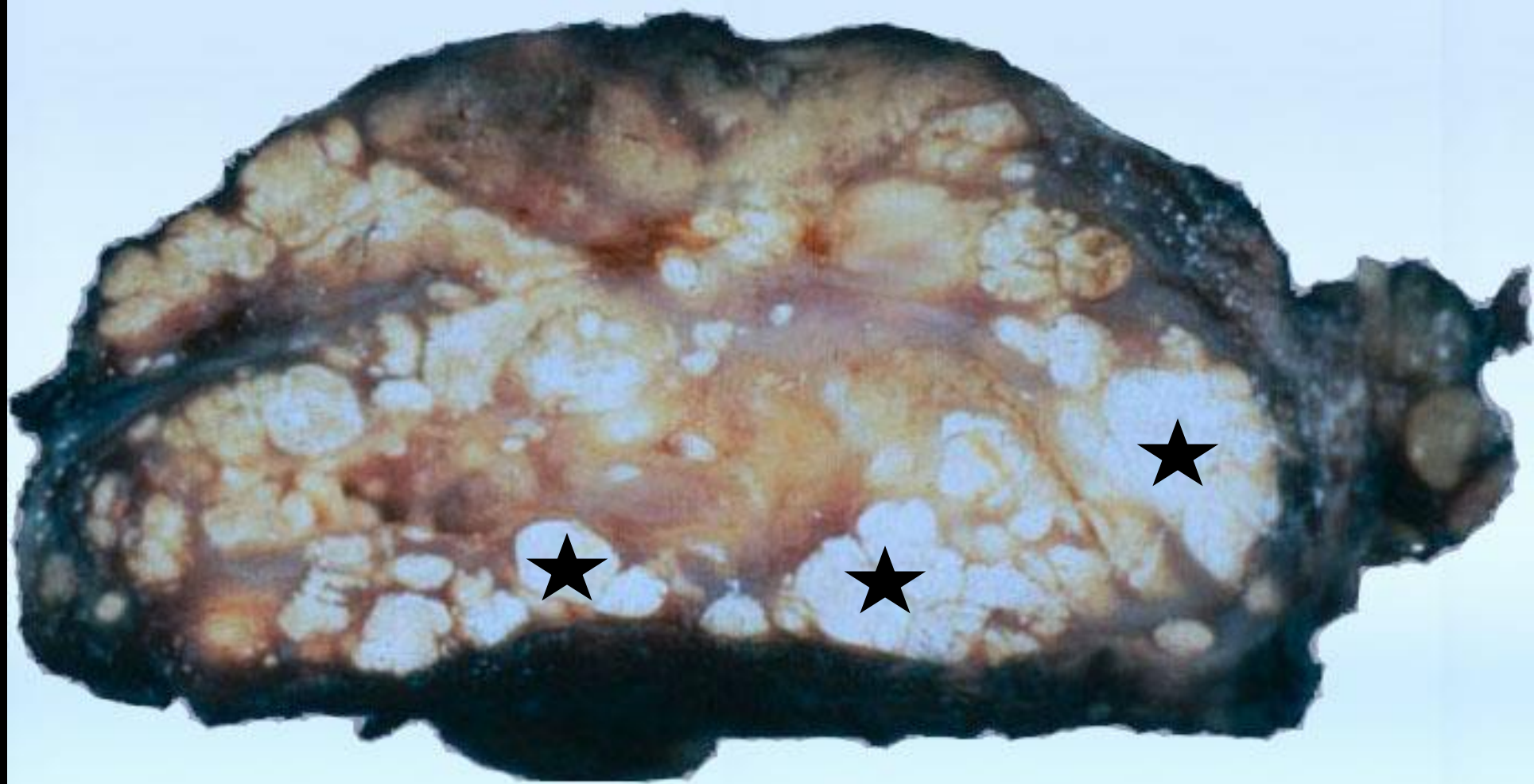


T2



T2





T1



SPR

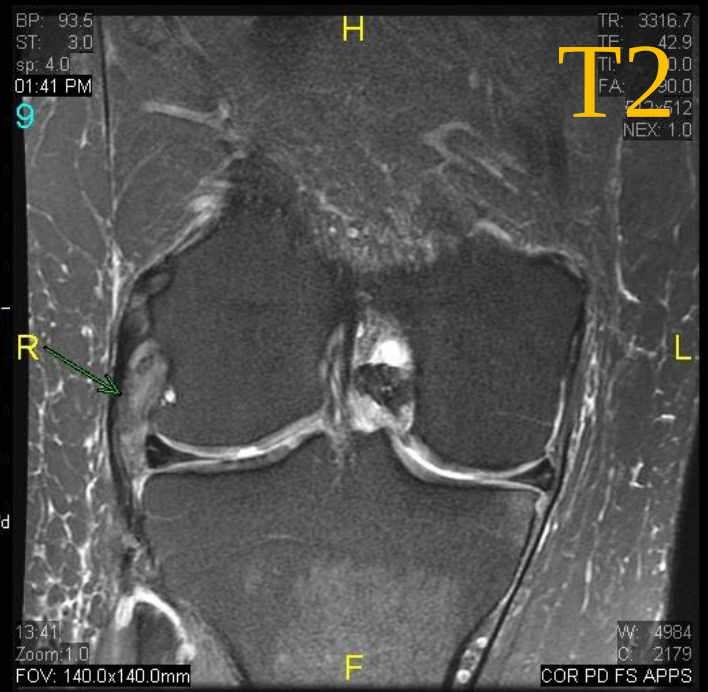
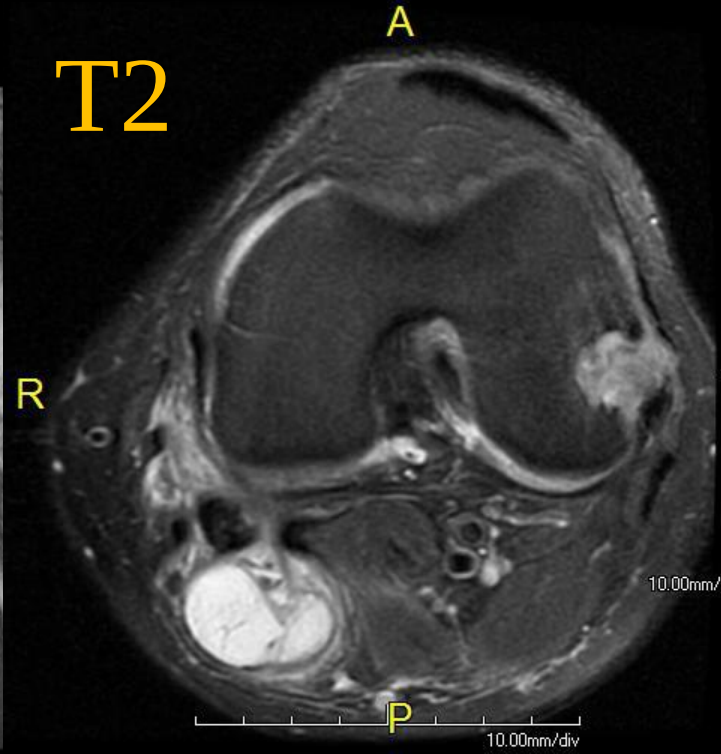
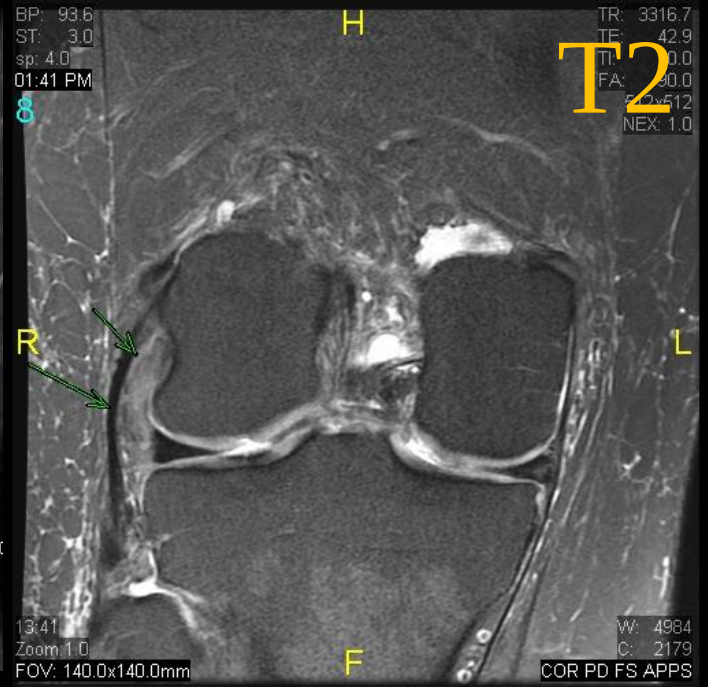
T1

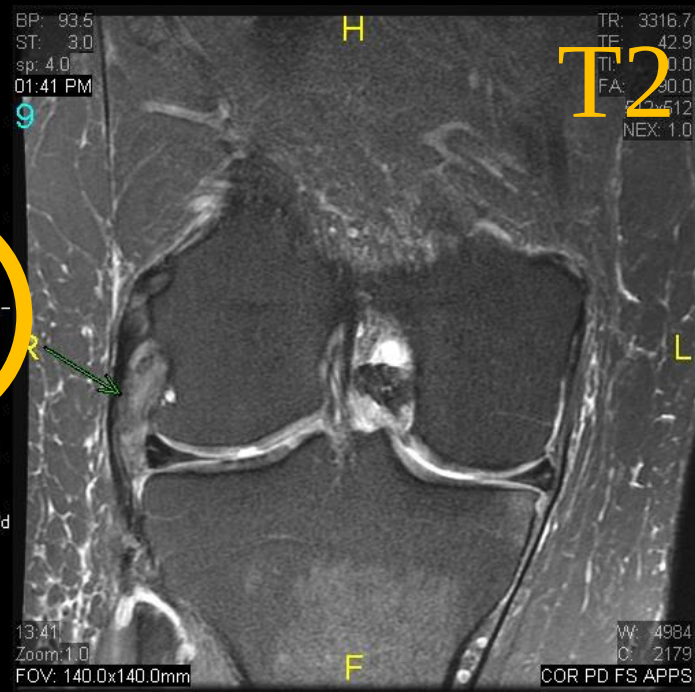
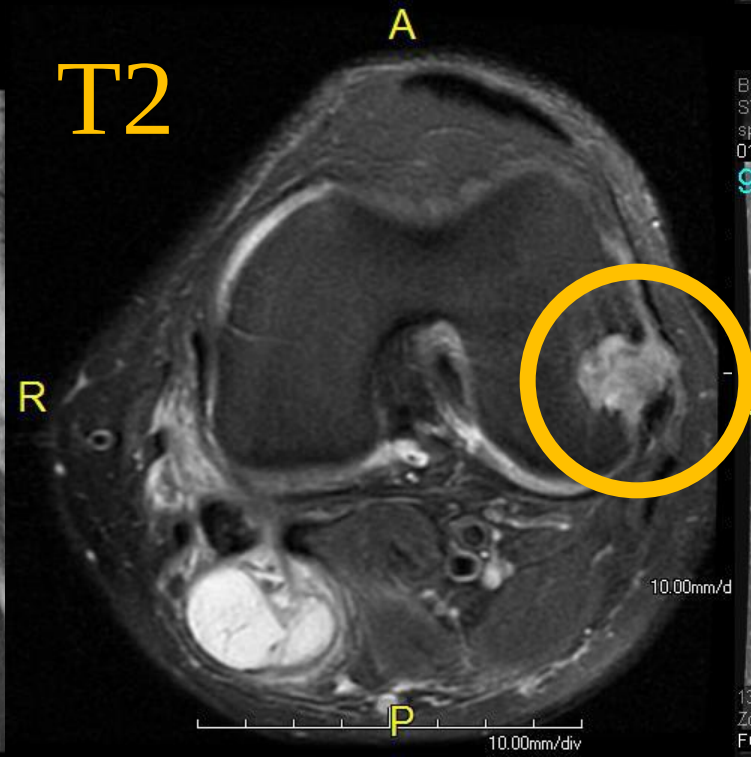
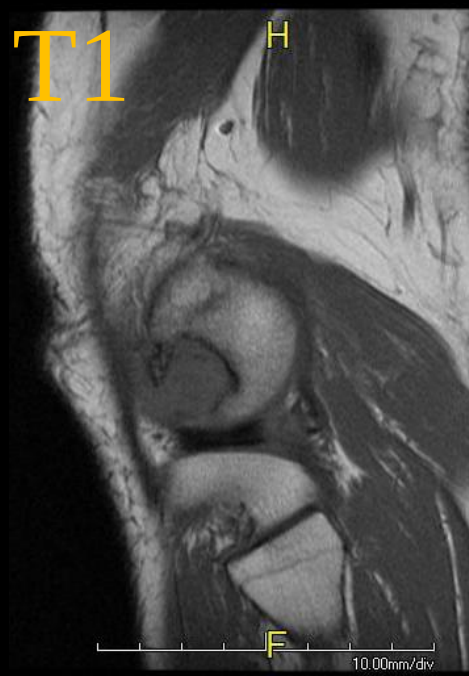
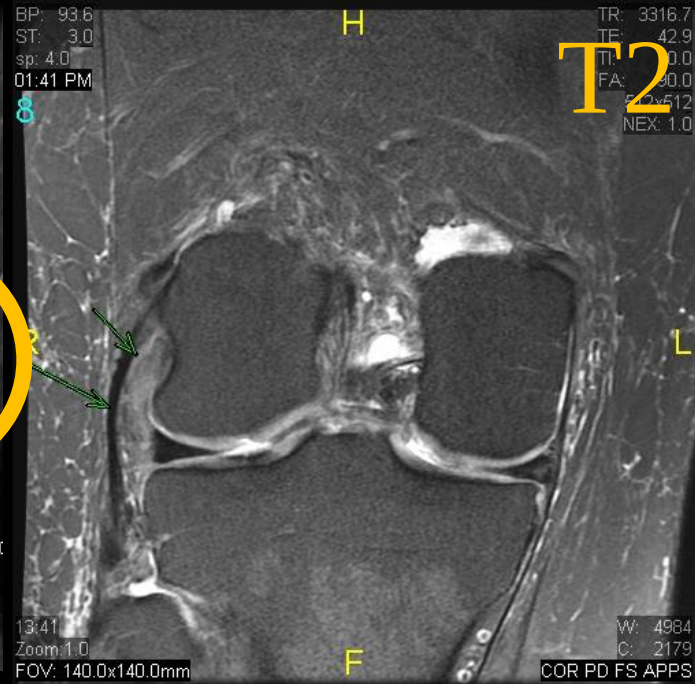
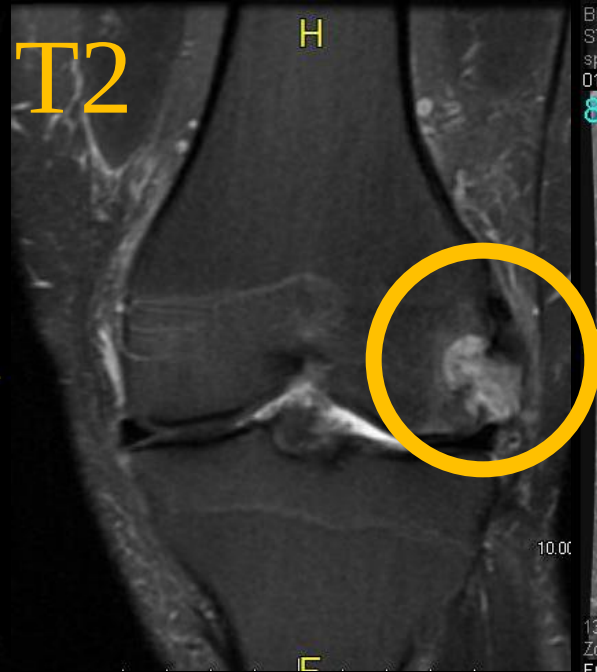
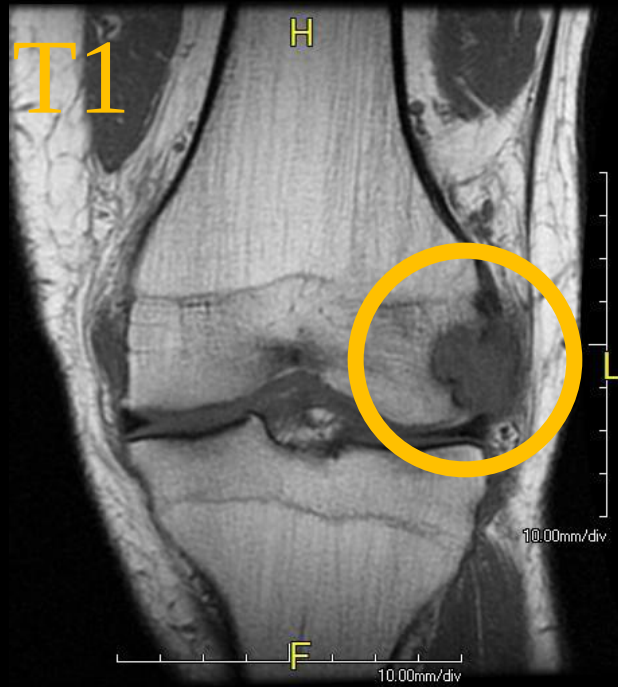


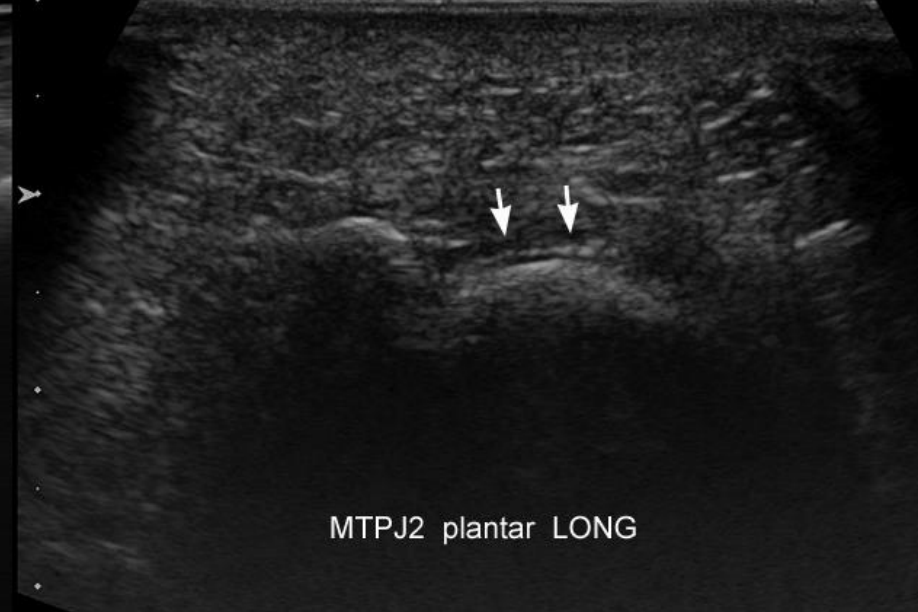
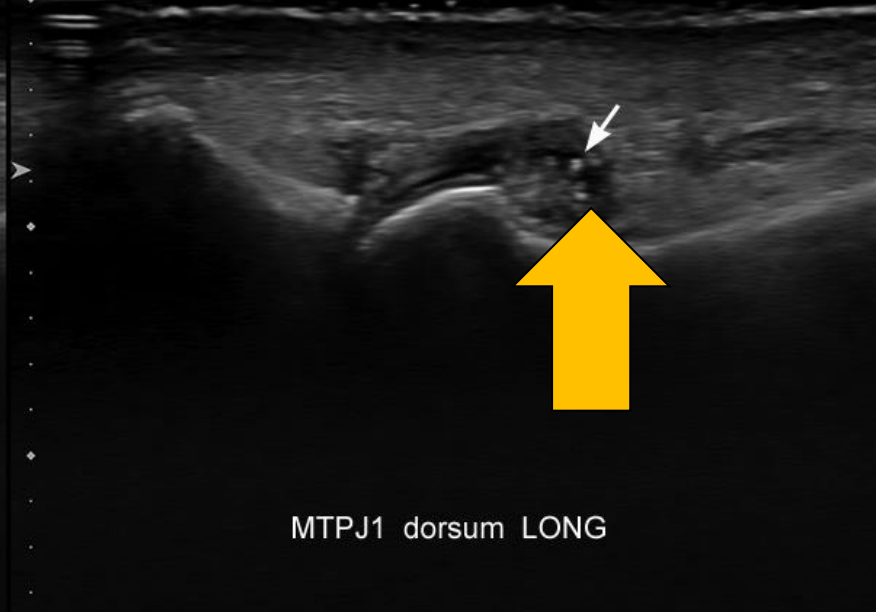
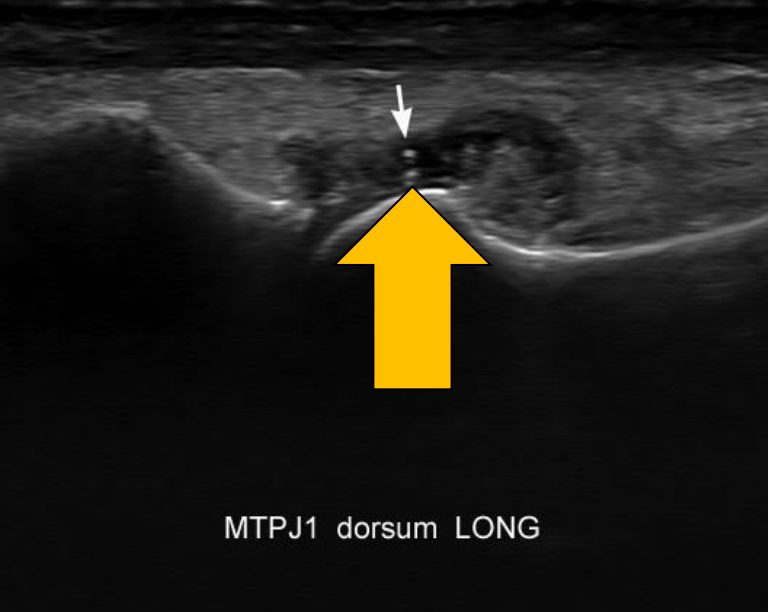
SPR

T1

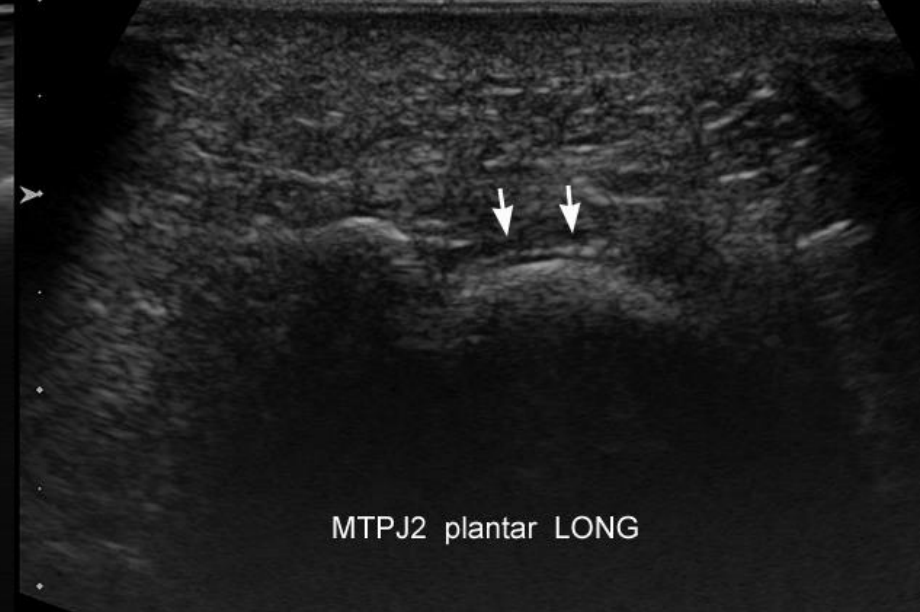
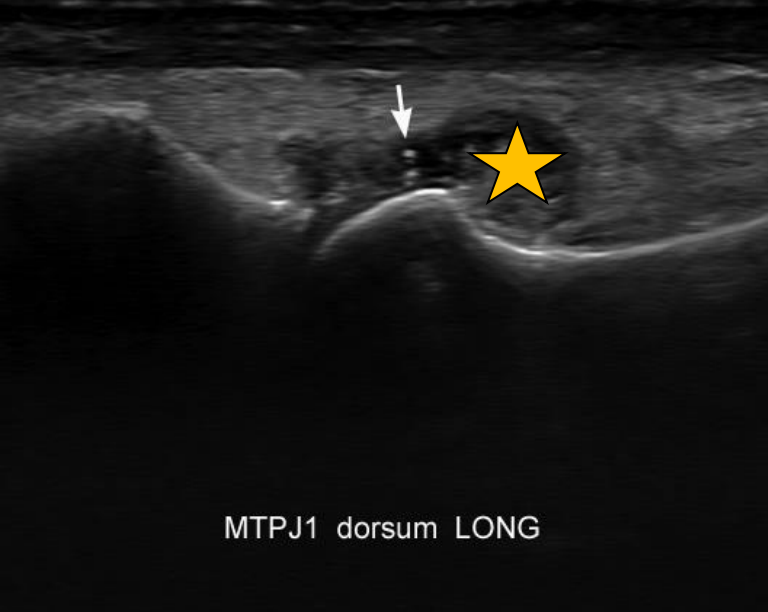




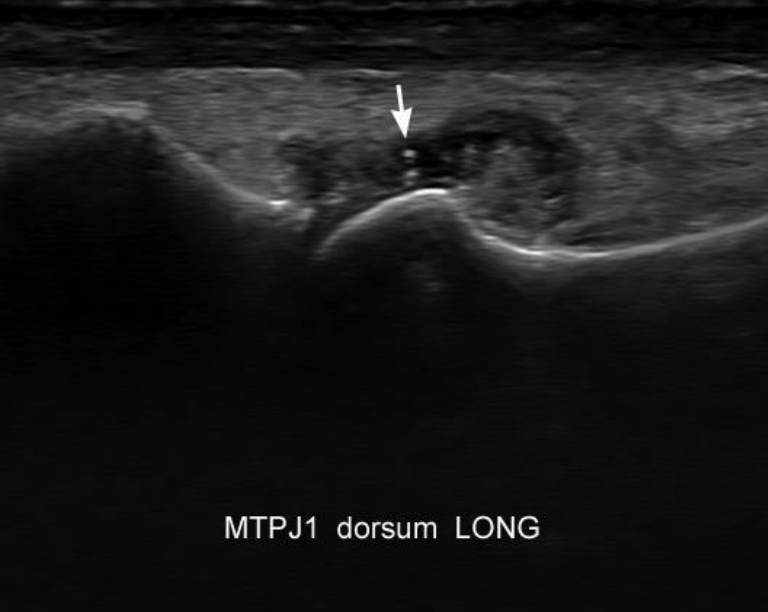




Courtesy Dr. John Read



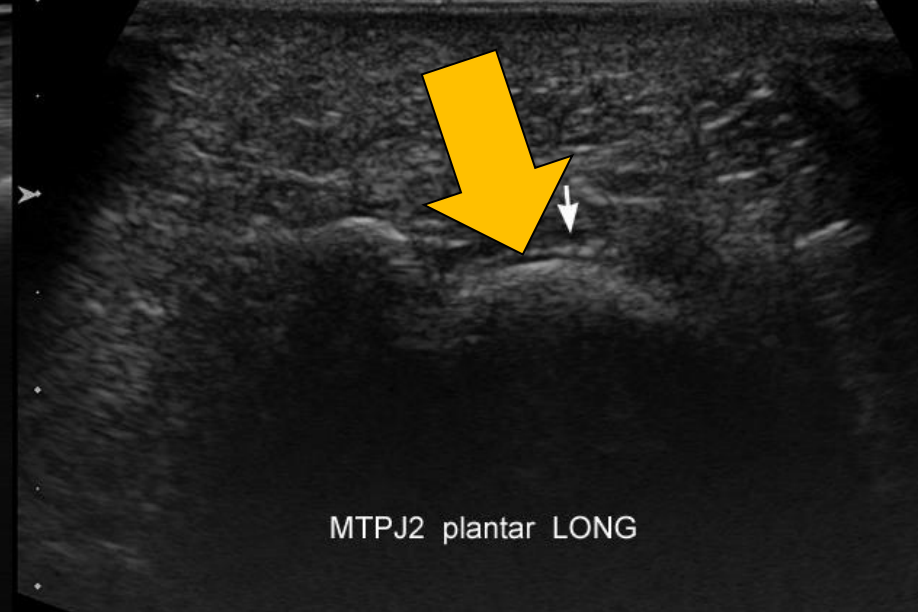
Courtesy Dr. John Read



MTPJ1 dorsum LONG

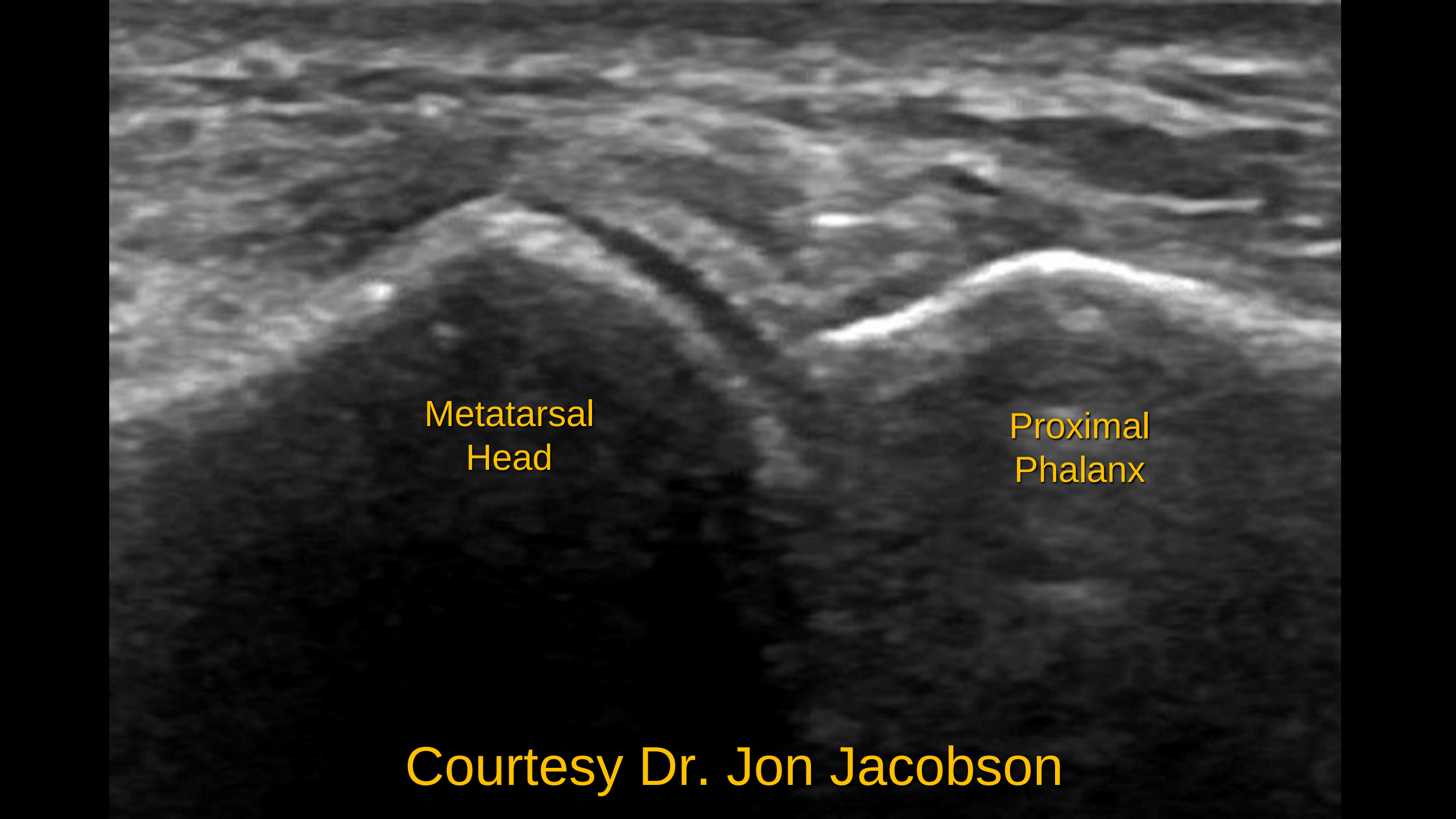


MTPJ1 dorsum LONG



MTPJ2 plantar LONG

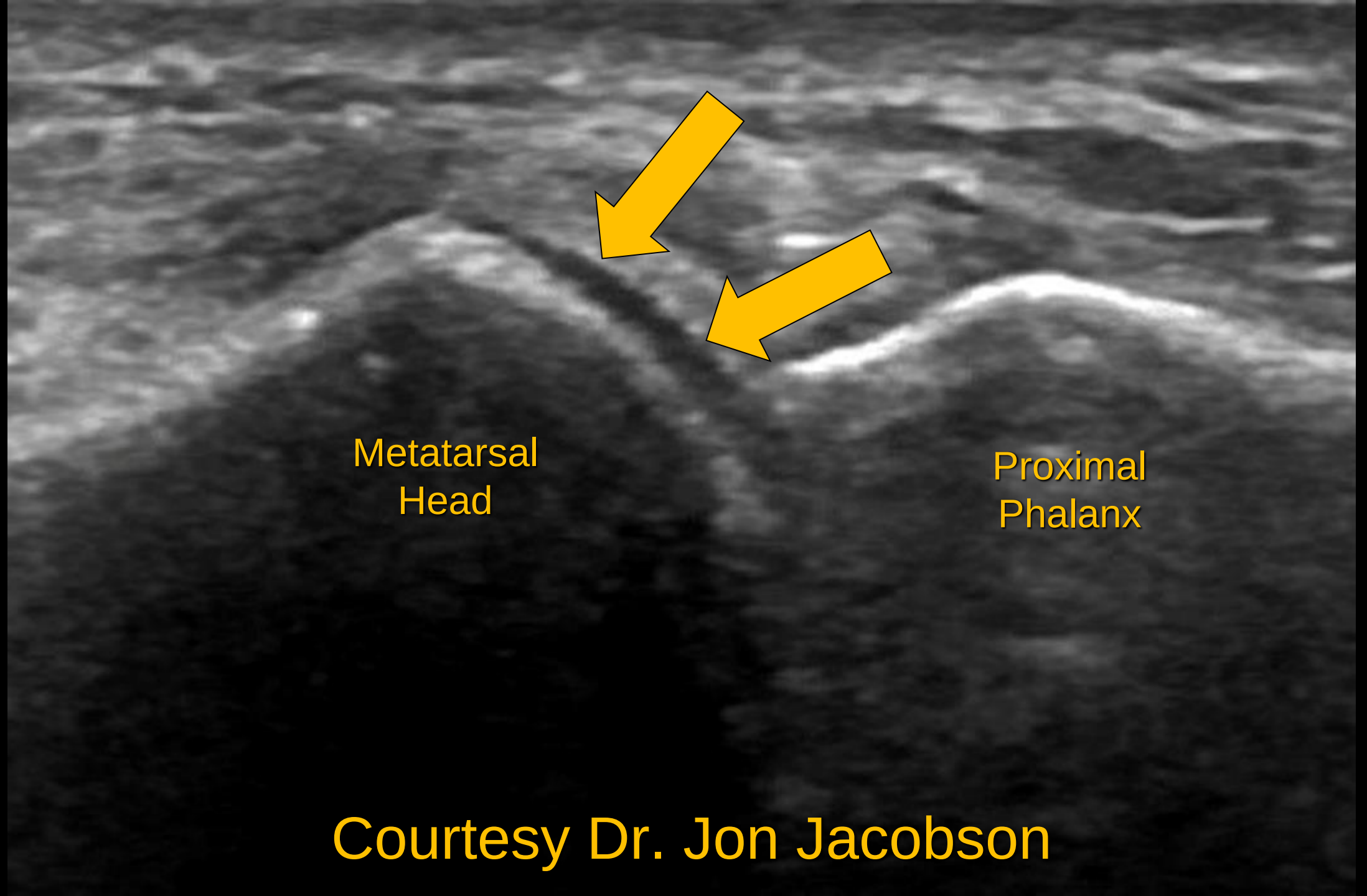
Courtesy Dr. John Read

A grayscale B-mode ultrasound image showing a joint space. Two bright, curved echogenic structures are visible, representing the articular surfaces. The structure on the left is labeled 'Metatarsal Head' and the structure on the right is labeled 'Proximal Phalanx'. The joint space between them is dark, indicating an anechoic fluid-filled area.

Metatarsal
Head

Proximal
Phalanx

Courtesy Dr. Jon Jacobson

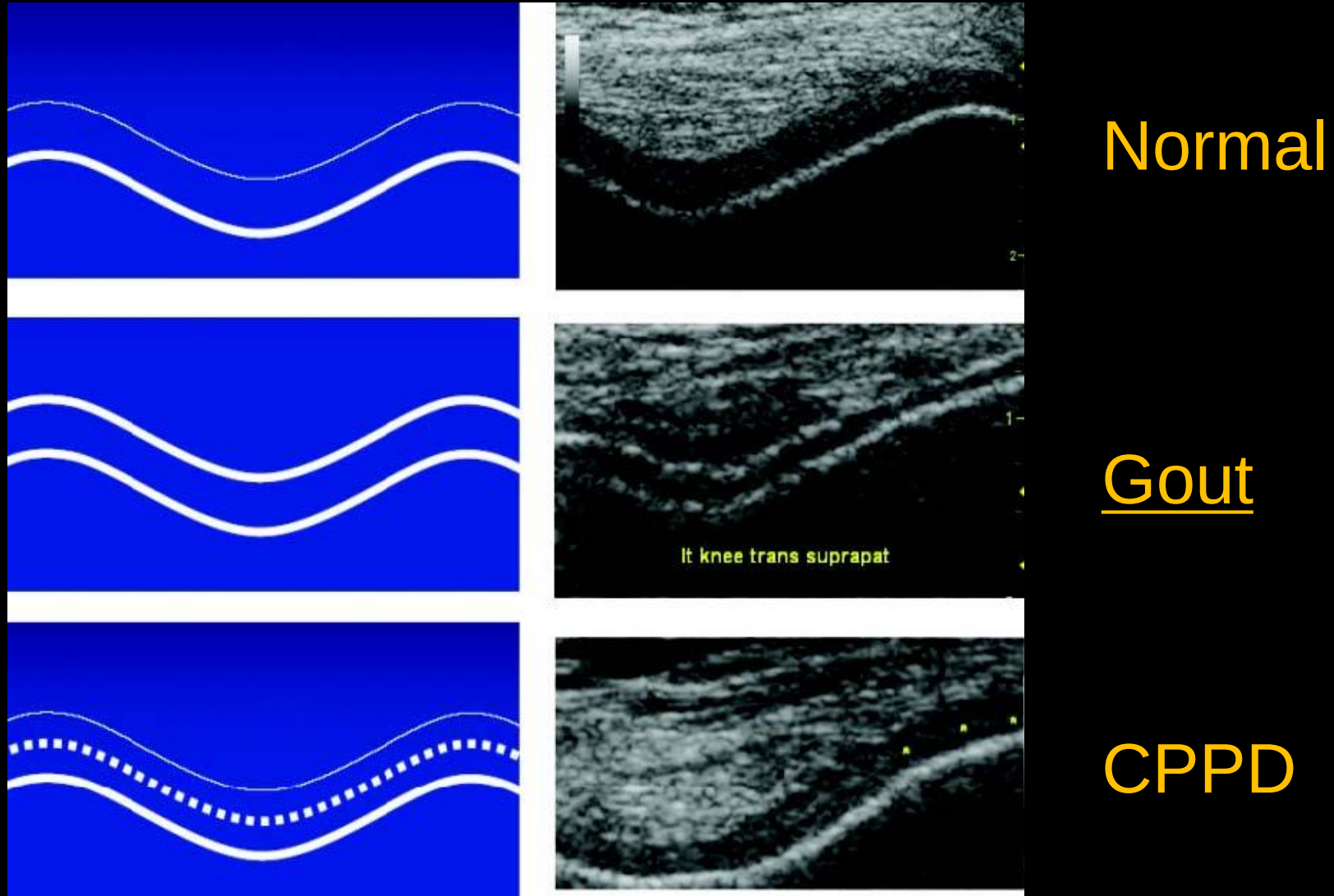


Metatarsal
Head

Proximal
Phalanx

Courtesy Dr. Jon Jacobson

Gout: Double Contour Sign

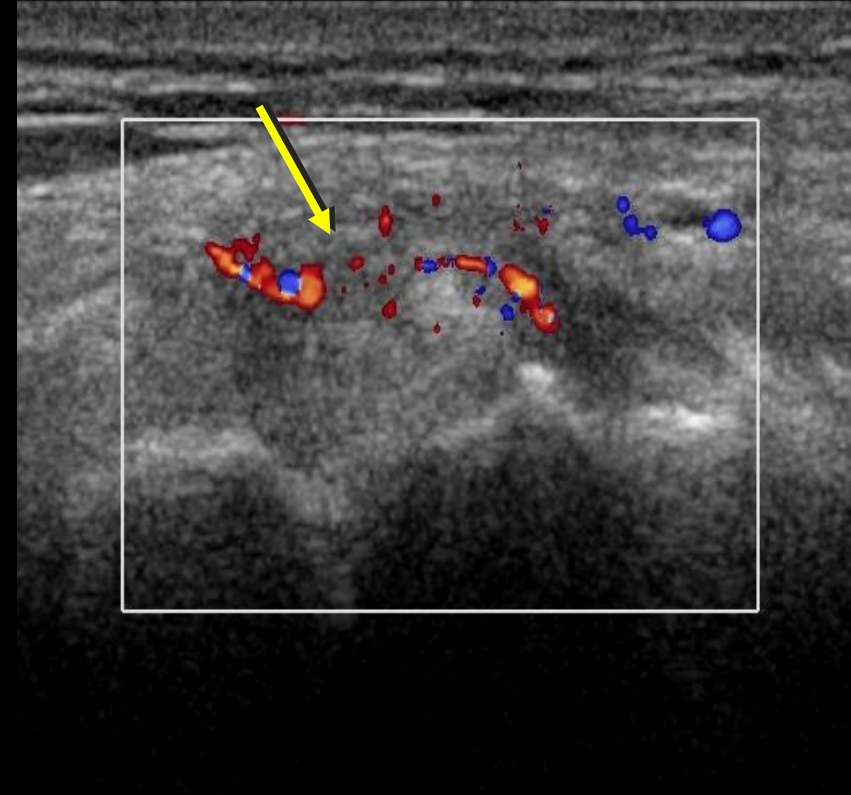


From: Thiele RG, Rheumatology 2007; 46:1116

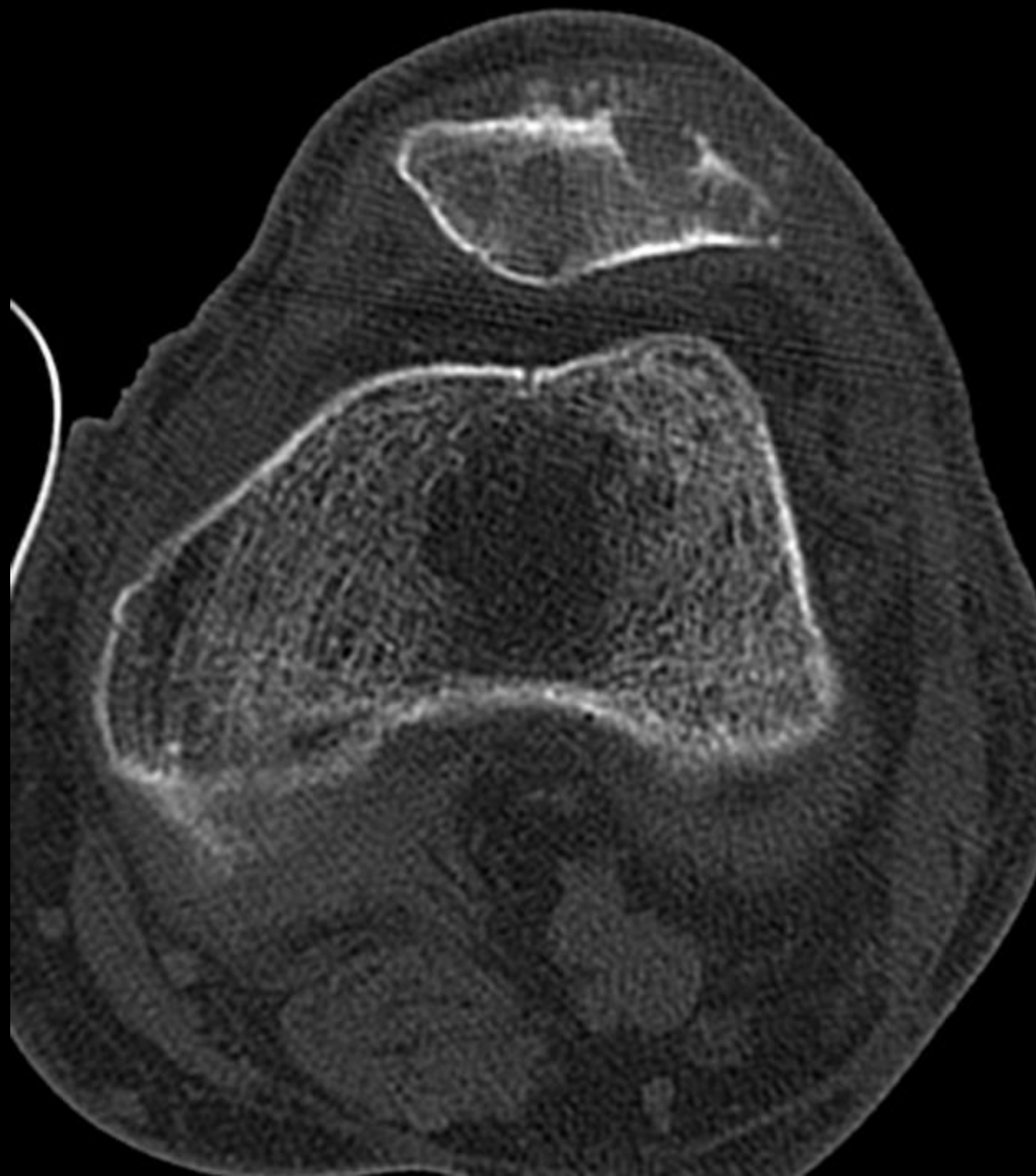
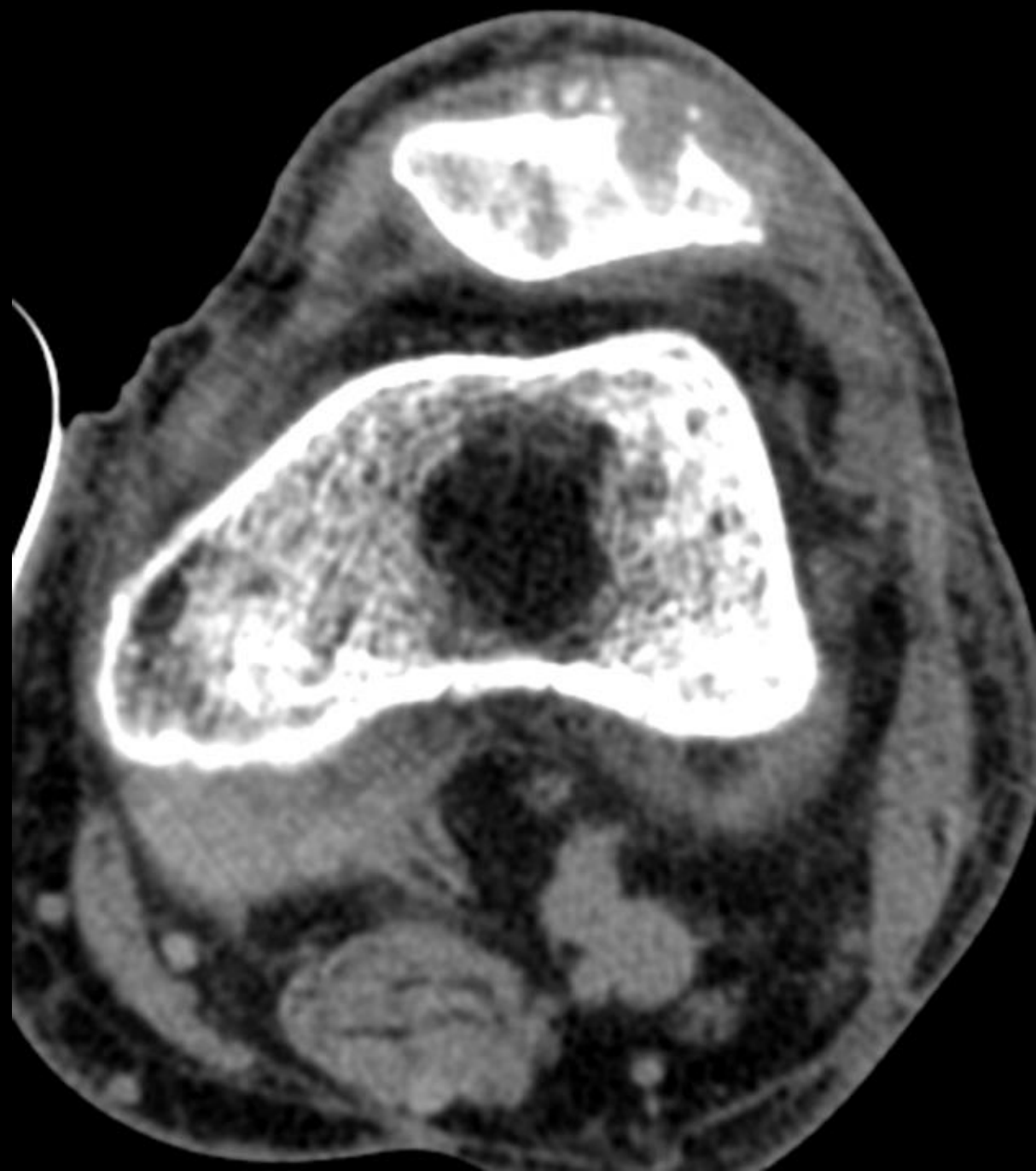
Gouty Tophus: popliteus

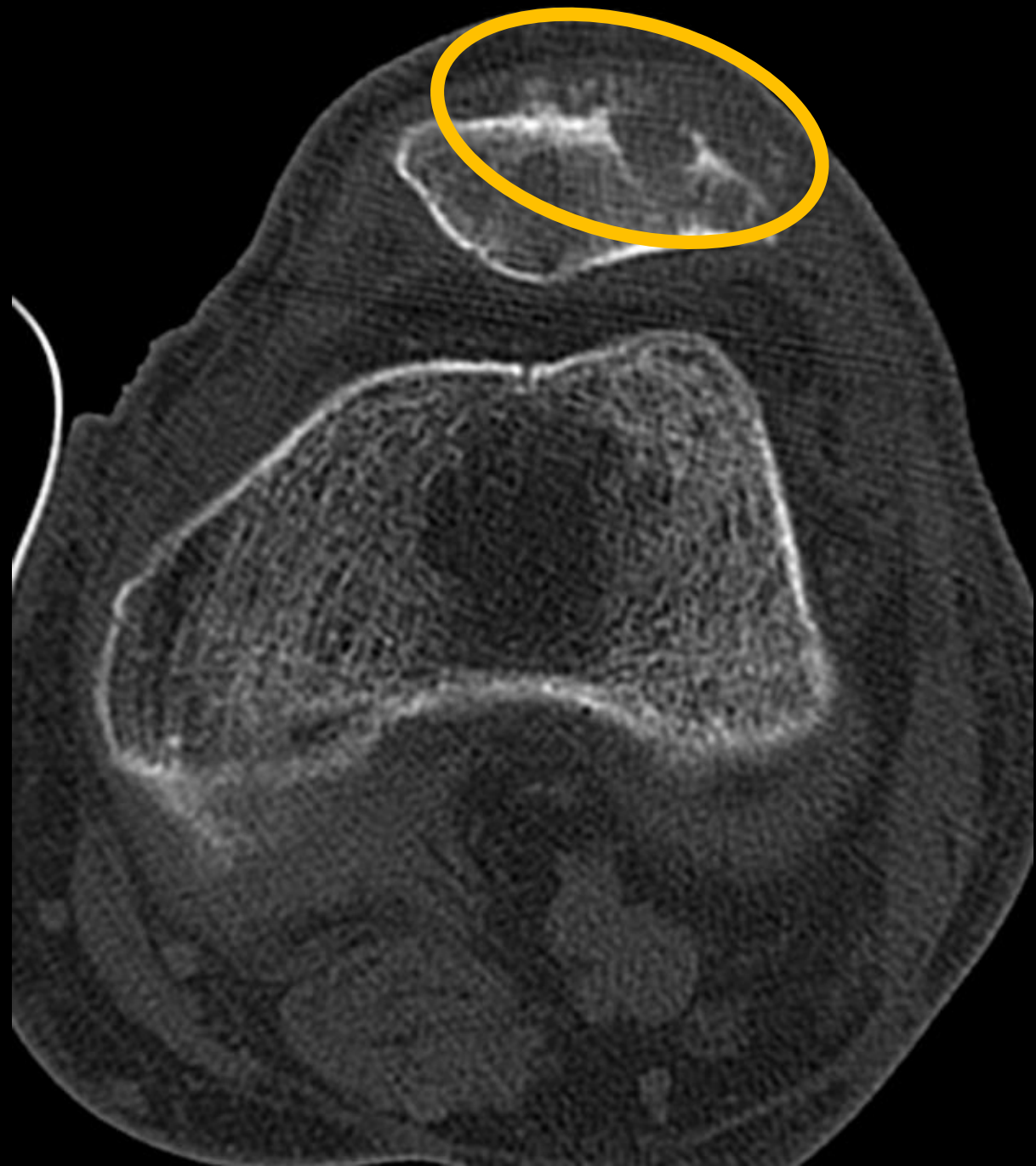


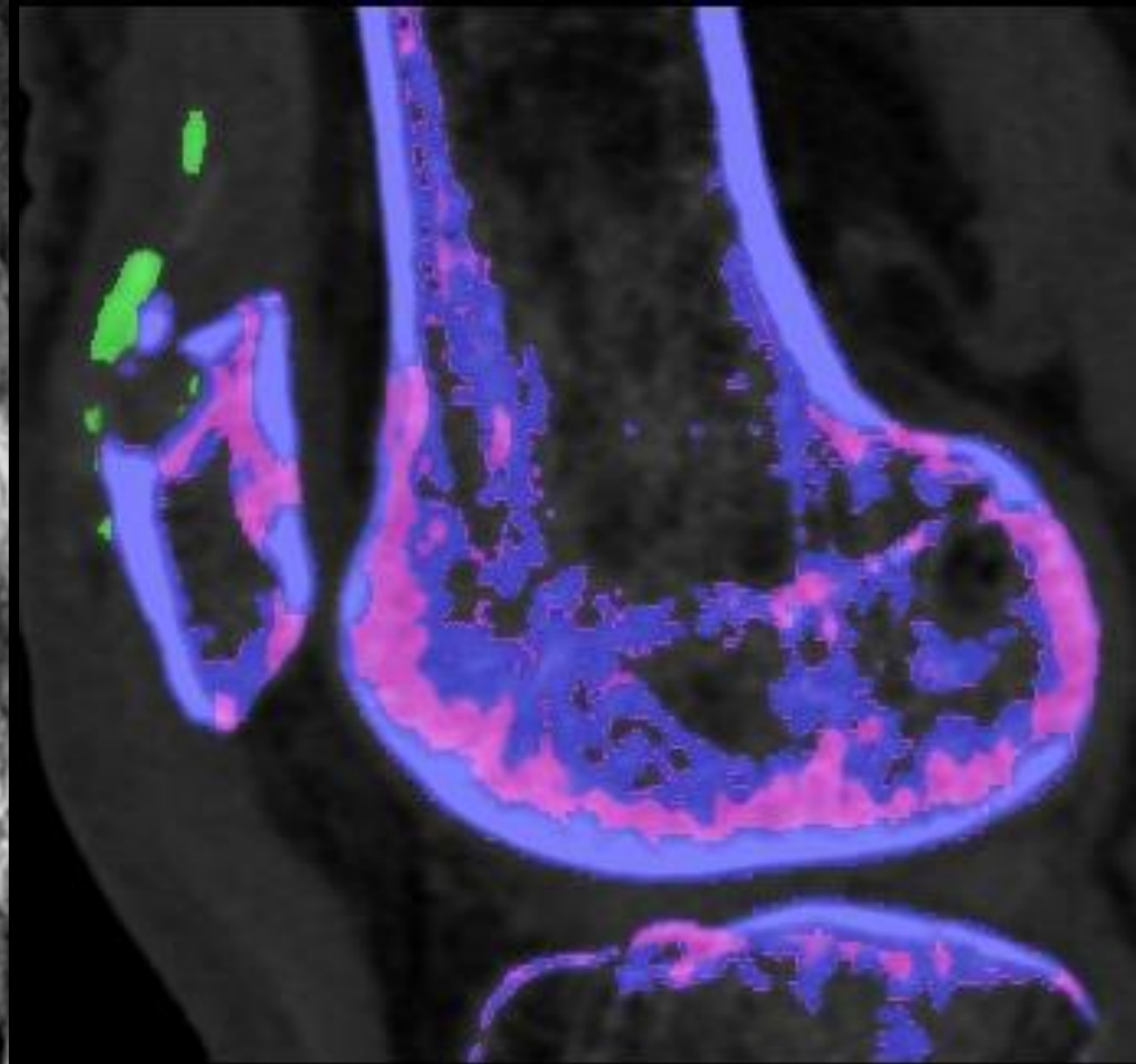
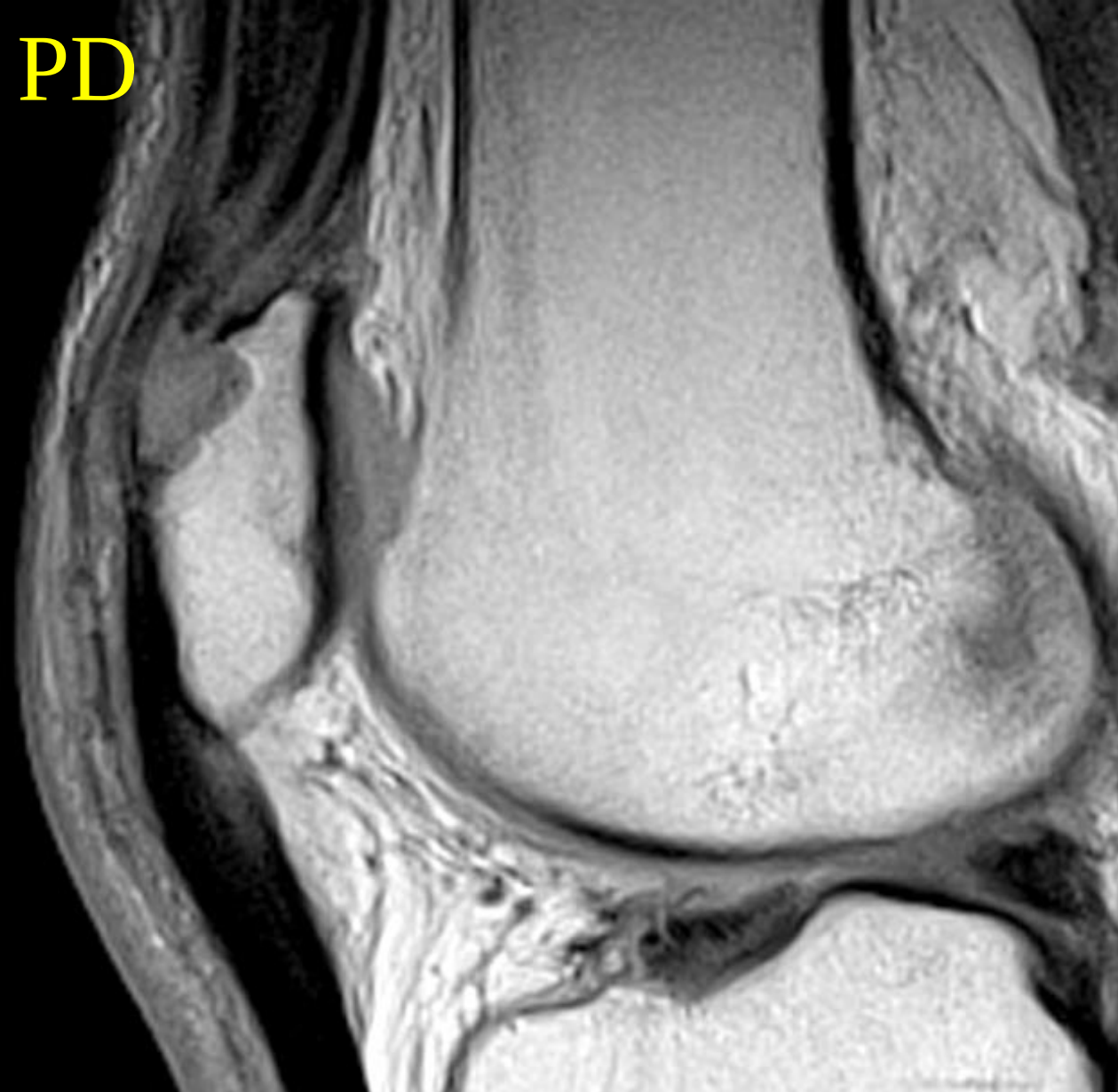
Coronal



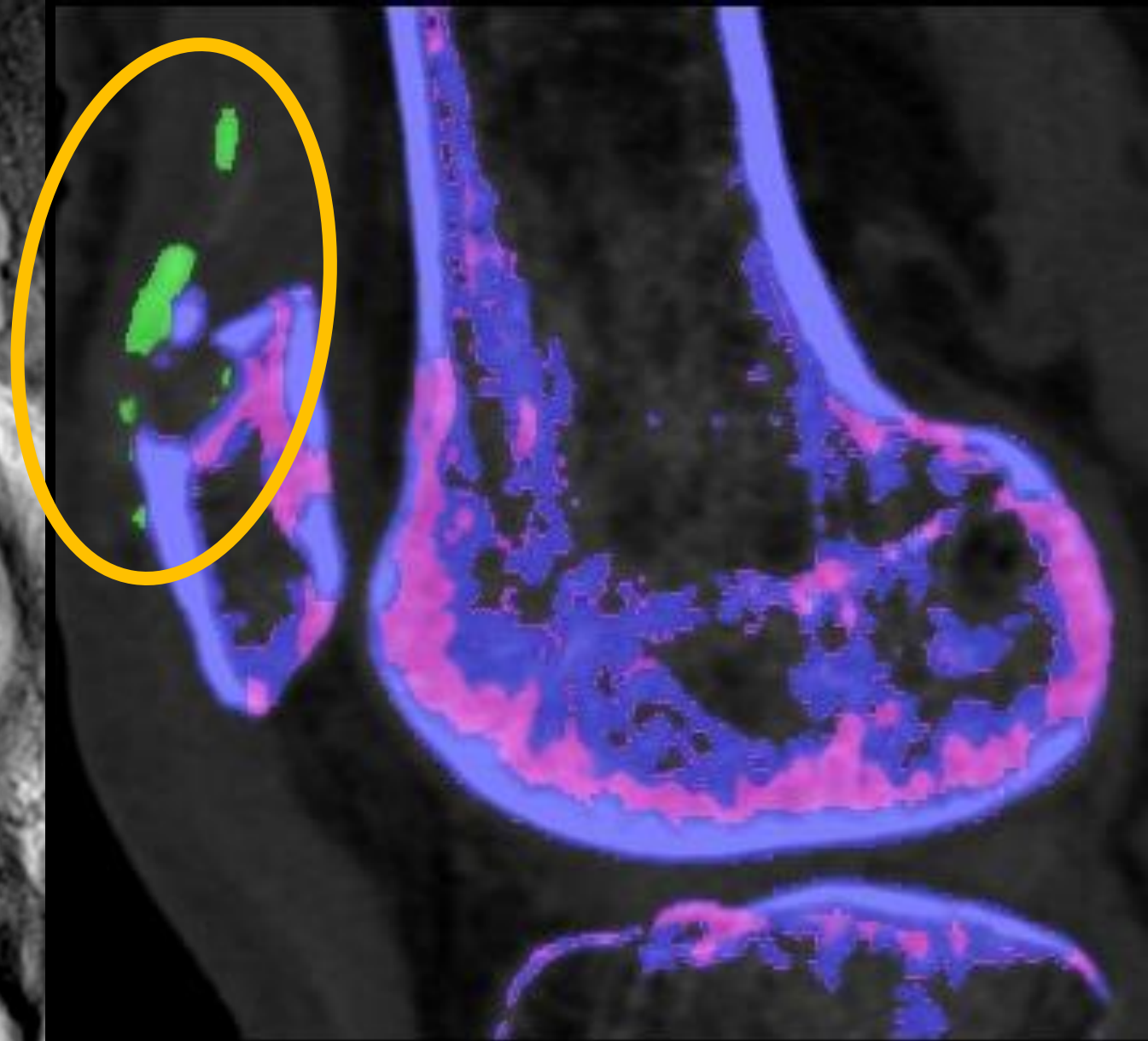
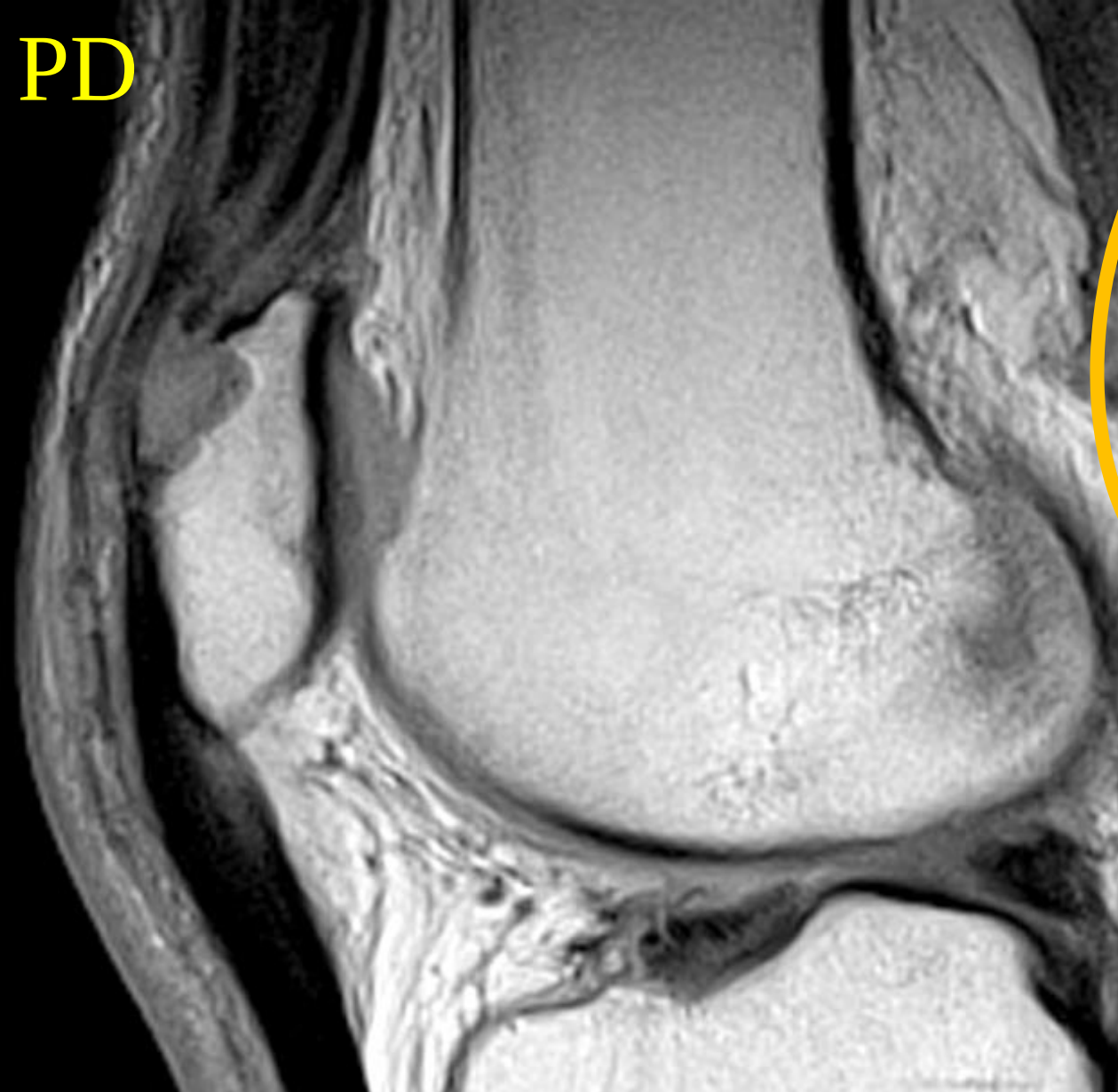
Color Doppler



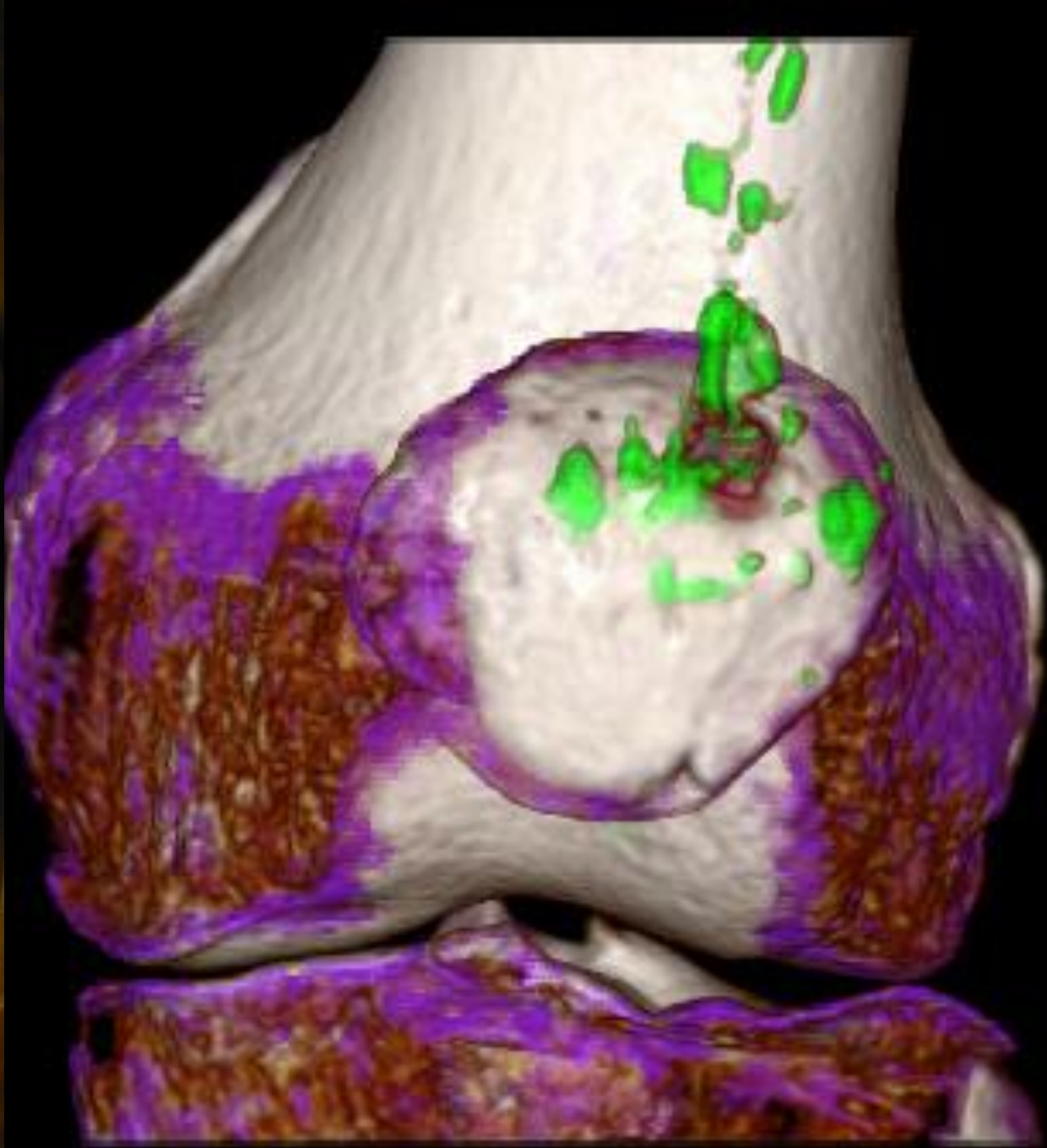
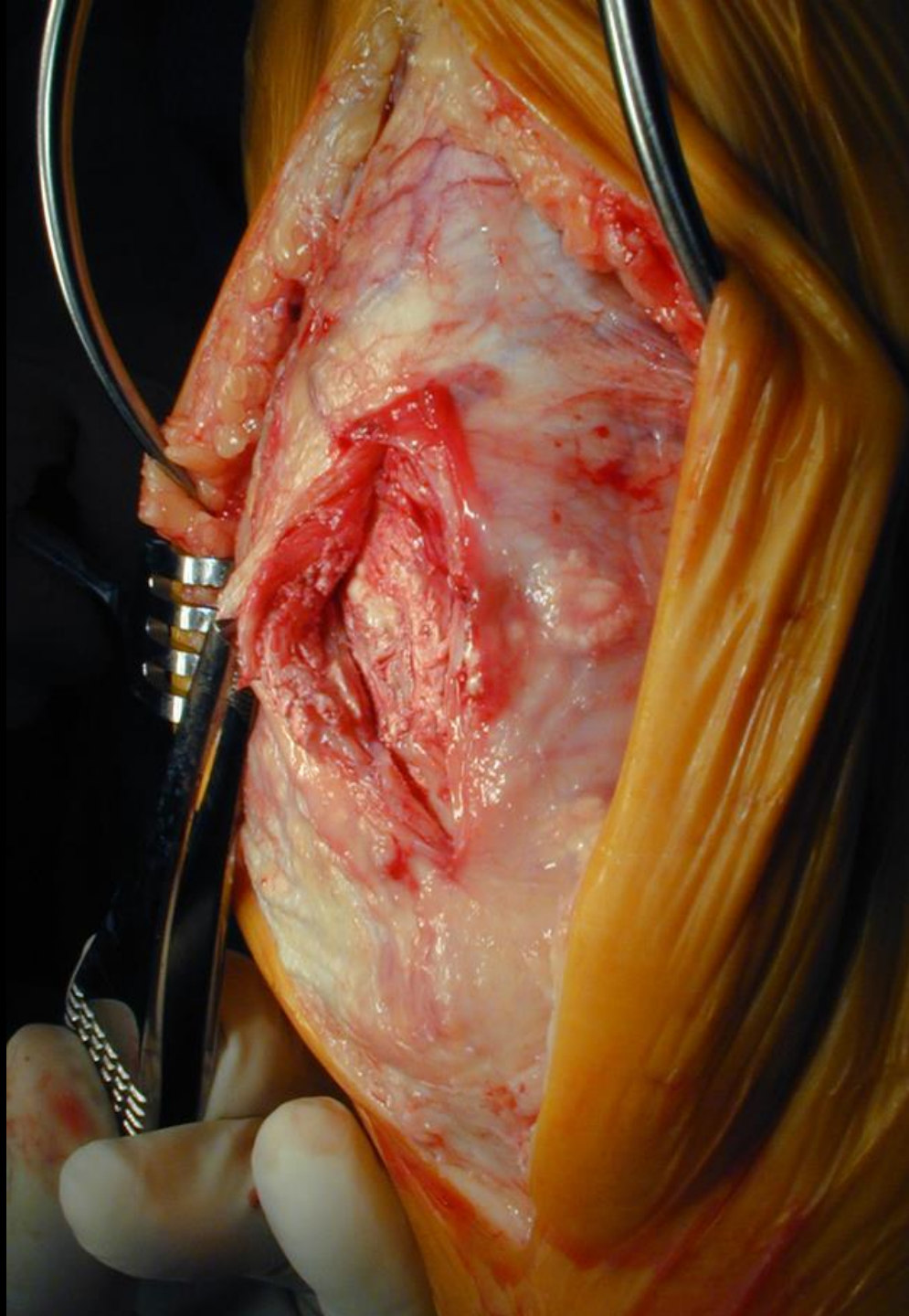




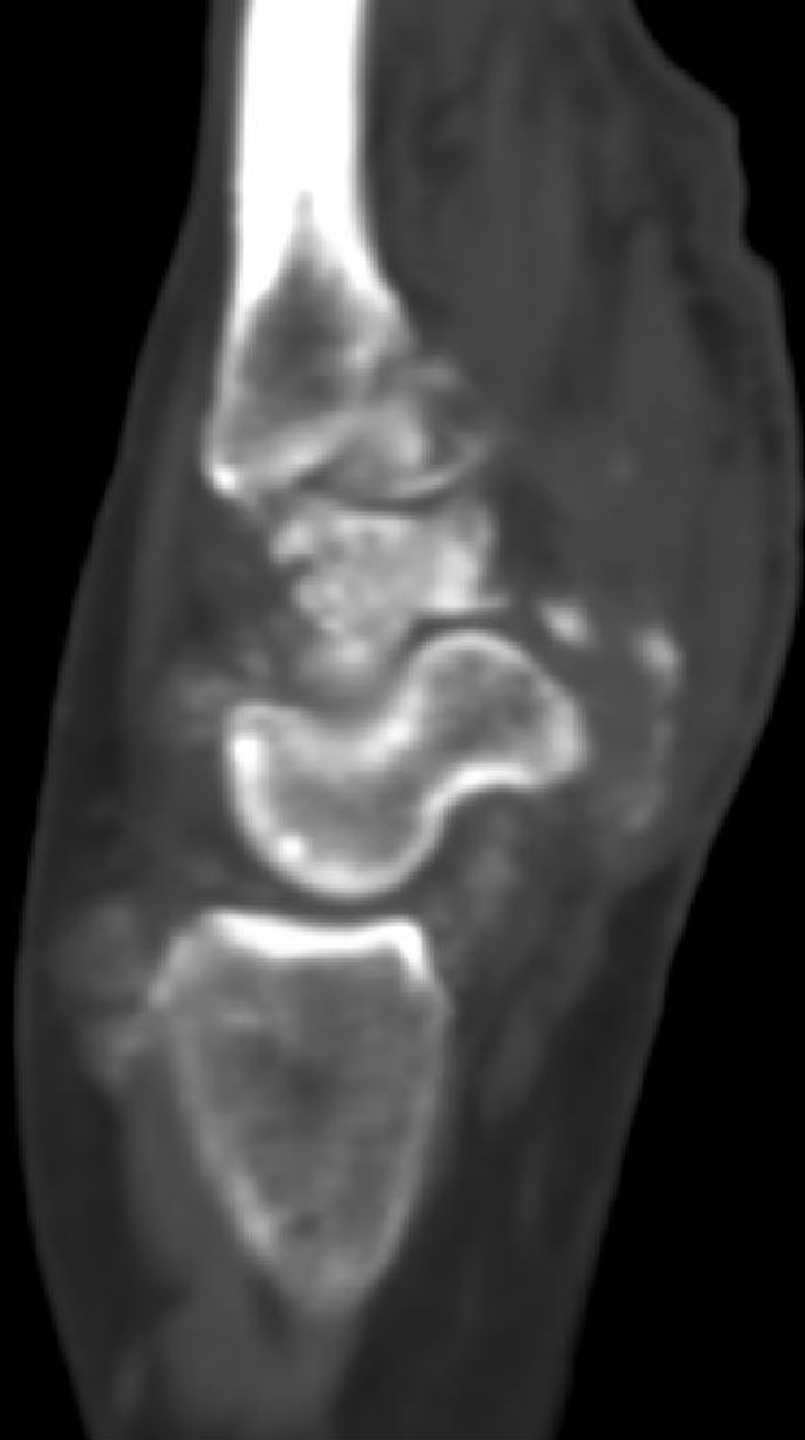
*Urate crystals coded green
on dual energy CT*

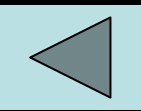
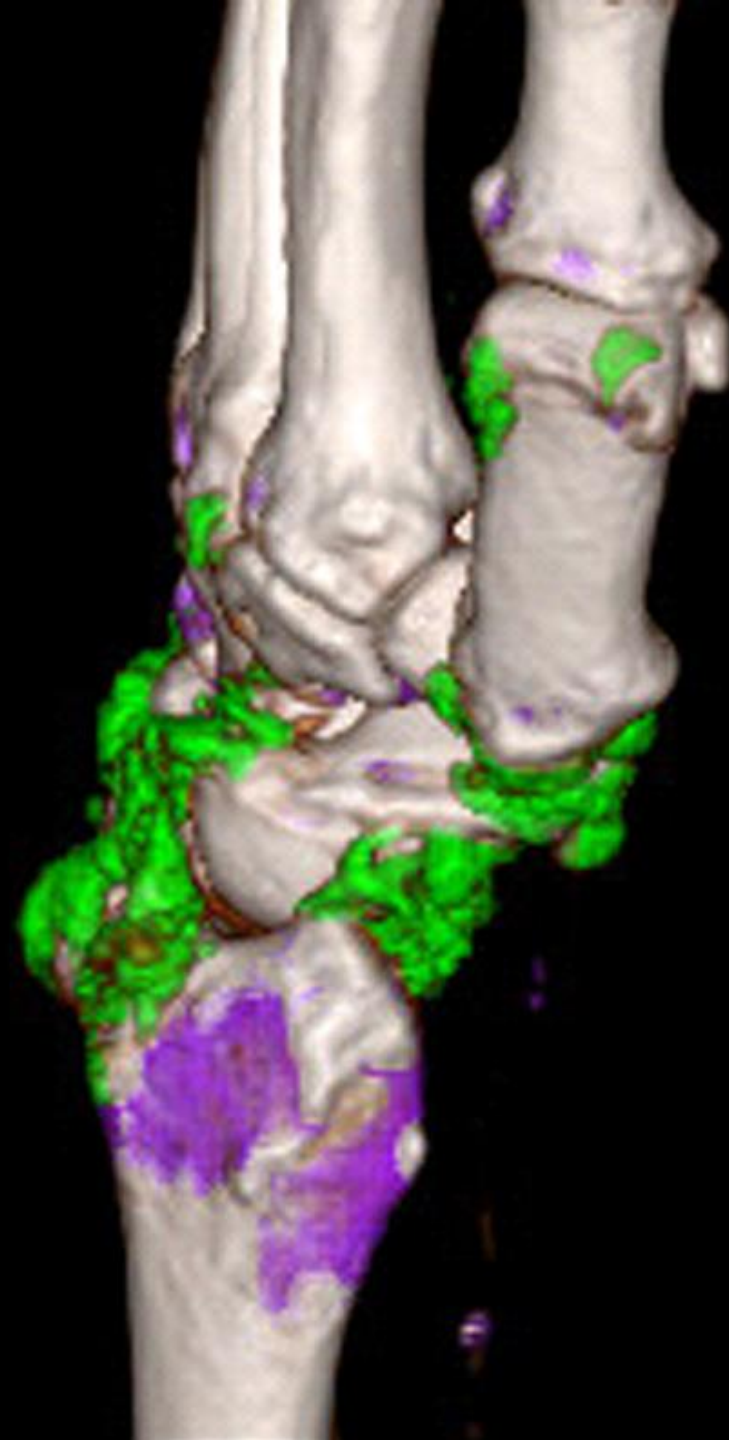
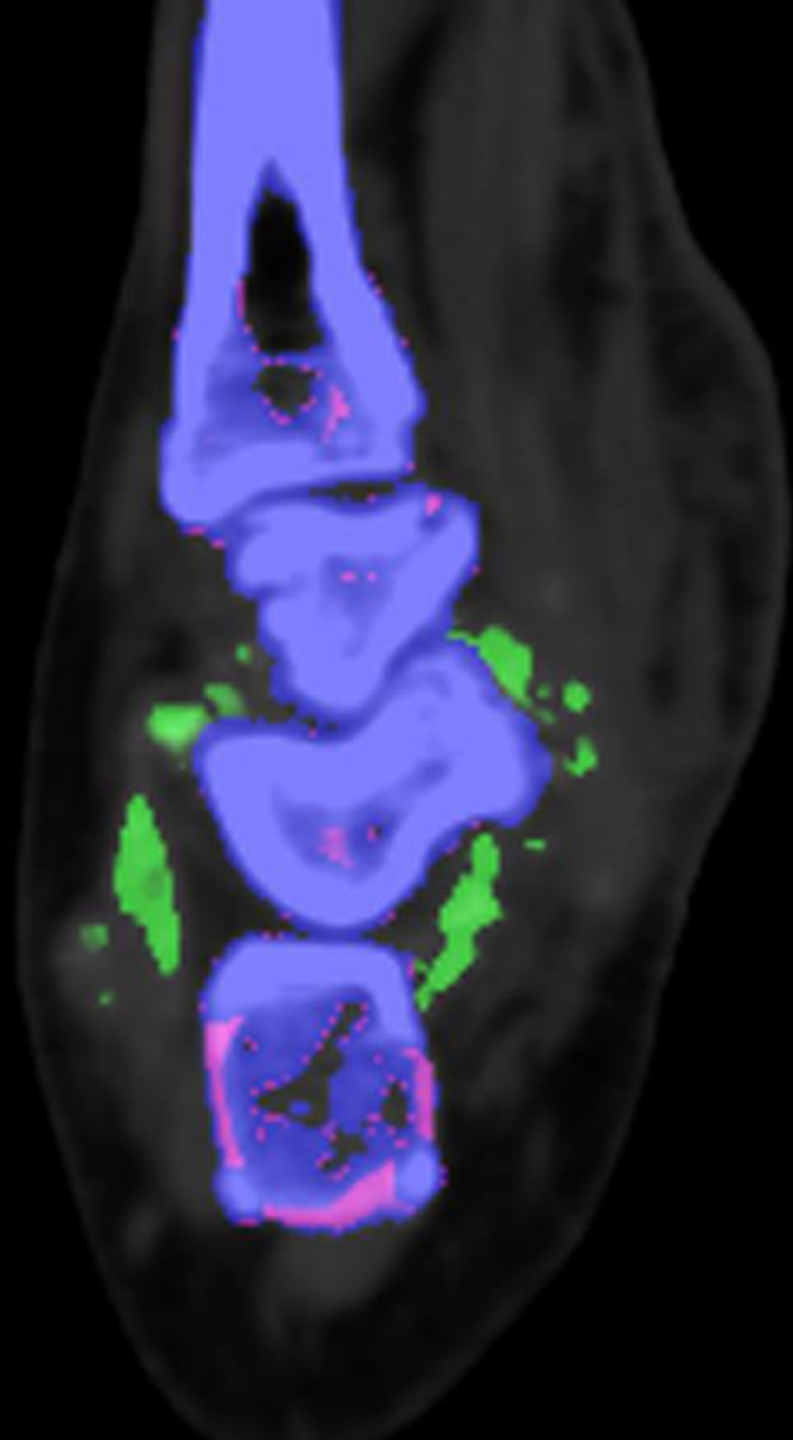


*Urate crystals coded green
on dual energy CT*



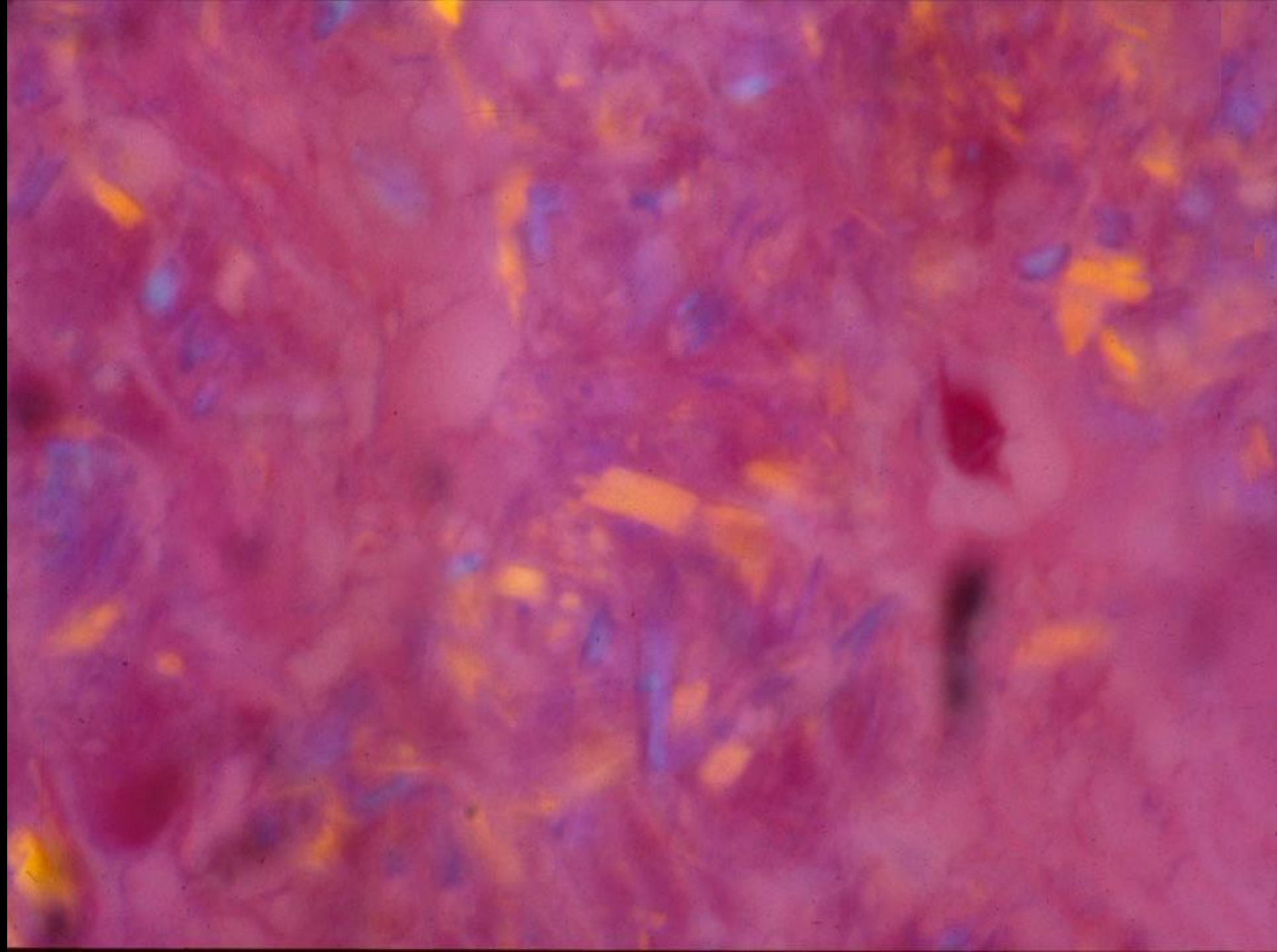






CPPD DEPOSITION DISEASE

- Calcium pyrophosphate dihydrate deposition
- Weakly positive birefringence
- Usually idiopathic
- Rarely hereditary
- Middle aged to elderly
- Common incidence 5%-34%



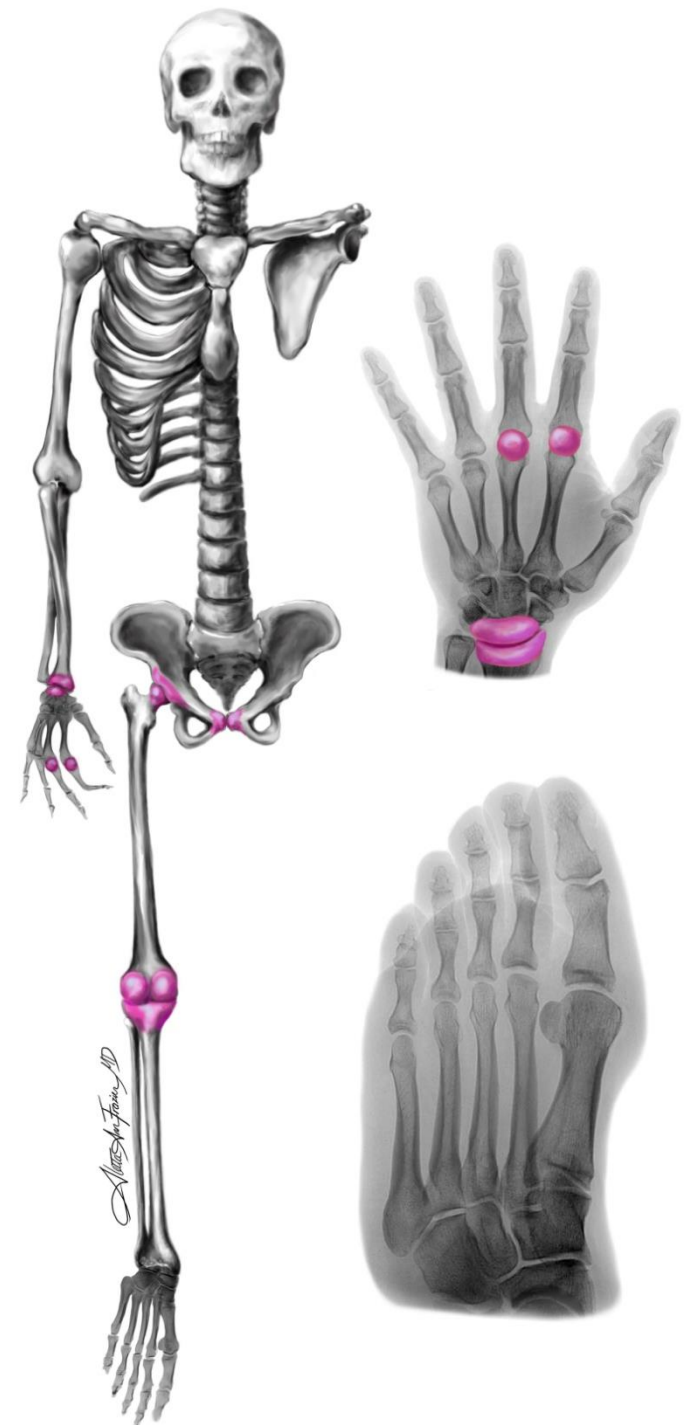
CPPD DISEASE CLINICAL SPECTRUM

- Asymptomatic (10%-20%)
- Symptomatic (80%-90%)
 - Osteoarthritis with or without acute exacerbations (50%-70%)
 - Pseudogout (10%-20%)
 - Rheumatoid arthritis like (2%-6%)
 - Neuropathic (0%-2%)
- Chronic arthritis

PSEUDOGOUT IS NOT A
RADIOGRAPHIC
DIAGNOSIS!

CPPD DEPOSITION DISEASE DISTRIBUTION

- Knee
- Wrist
- MCP's (2&3)
- Hip
- Symphysis



CPPD DEPOSITION DISEASE RADIOGRAPHS

- Calcification – absent in 10%-15%
 - Fibrocartilage (chondrocalcinosis)
 - Hyaline cartilage (chondrocalcinosis)
 - Synovium/joint capsule
 - Tendons/ligaments
 - Bursa/tophi (Tophaceous pseudogout)

CPPD DEPOSITION DISEASE RADIOGRAPHS

- OA-like changes in an unusual anatomic/intraarticular distribution
 - Variable osteophyte formation
 - Prominent subchondral cysts
 - Joint space loss symmetric or asymmetric
- Neuropathic appearance – rare
- MRI may stay low signal T2W

CPPD DISEASE ASSOCIATED DISORDERS

- Hyperparathyroidism
 - More commonly primary
- Hemochromatosis
 - Pericarpitate narrowing
 - Maintain scapholunate space
 - Involvement MCP's 2 - 5
 - Hook like osteophytes

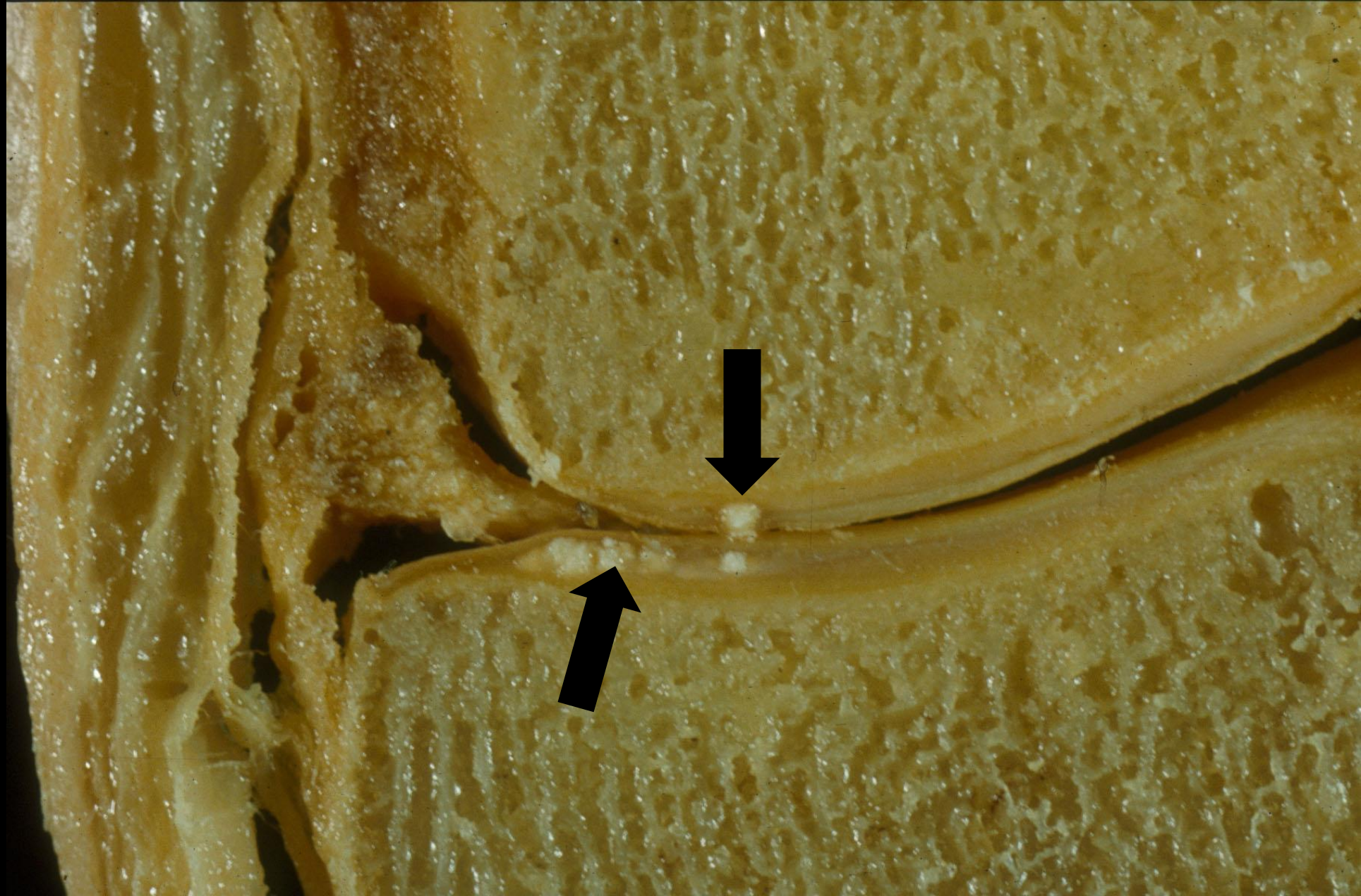
CPPD ARTHROPATHY

KNEE

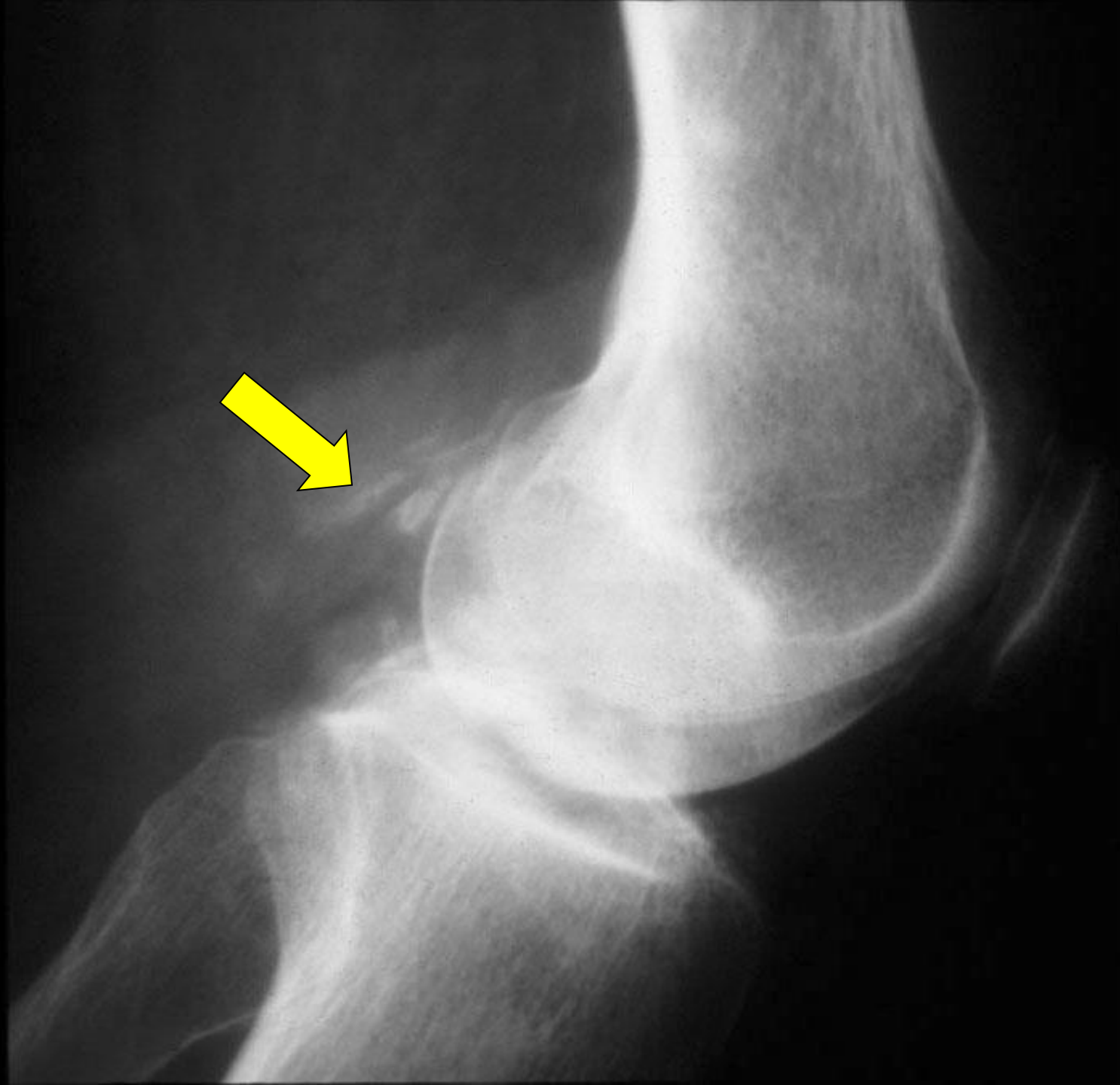
- Calcification (80%-90%) meniscal/hyaline cartilage
- Isolated patellofemoral disease/narrowing
- Medial tibial plateau slanting
- Most common distribution identical to OA
 - Medial tibiofemoral and patellofemoral



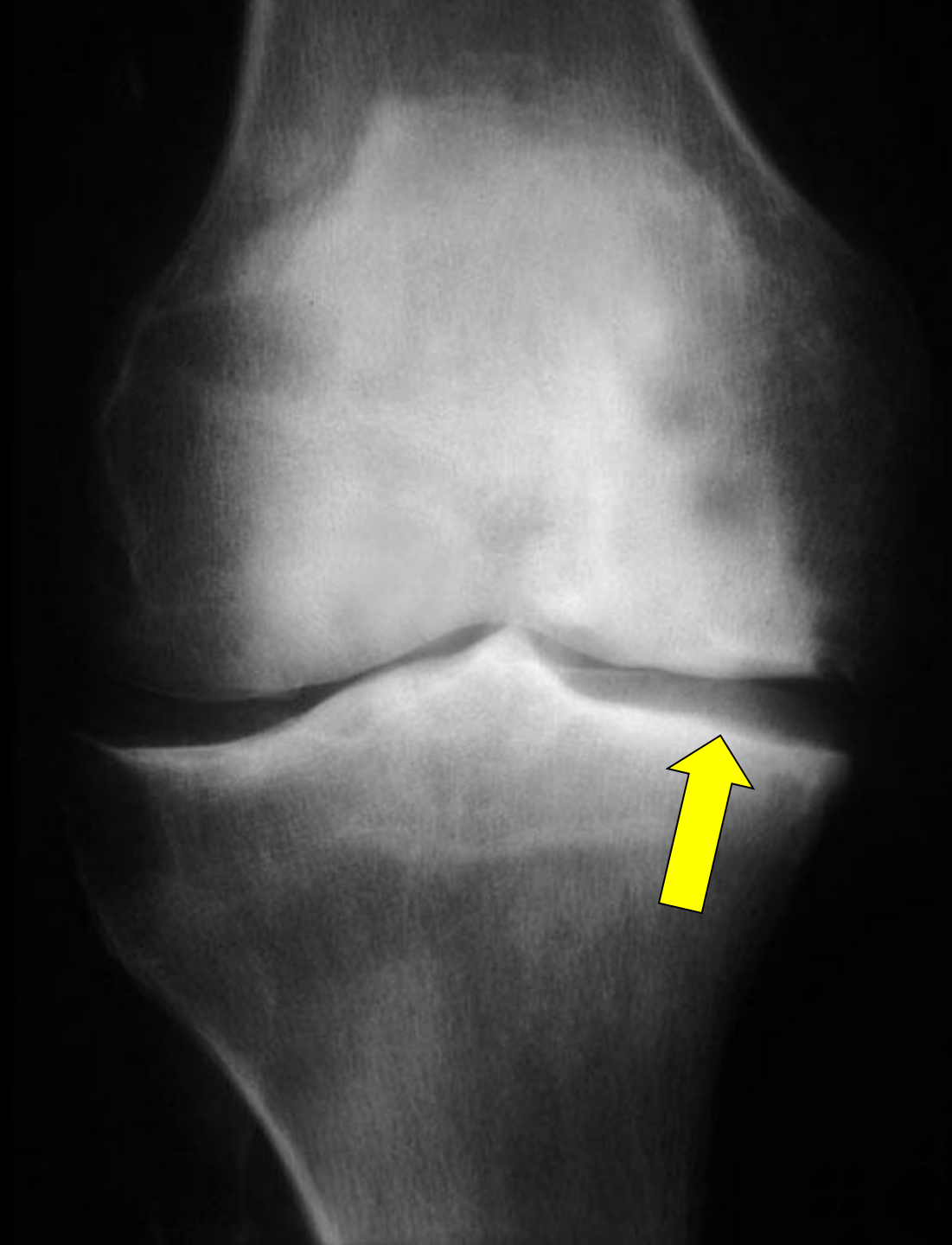












CPPD ARTHROPATHY WRIST/HAND

- Calcification (65%-95%) – lunotriquetral/TFCC – arthropathy 70%
- Radiocarpal narrowing
- Scapholunate widening (SLAC wrist)
- MCP involvement particularly 2nd/3rd
- No erosions







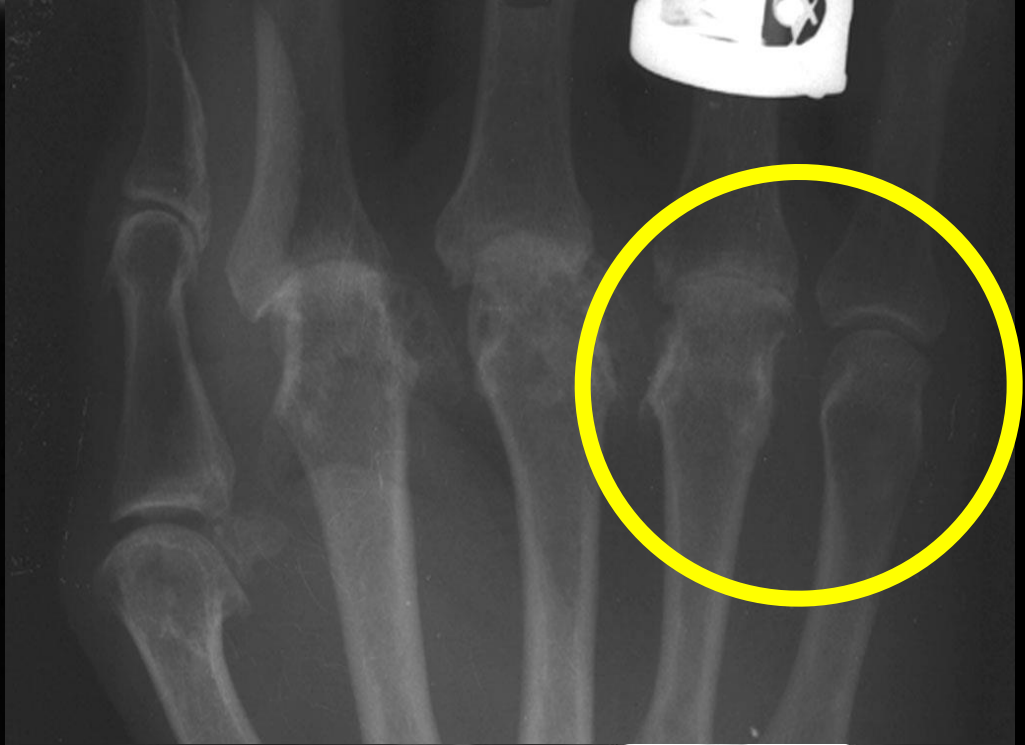








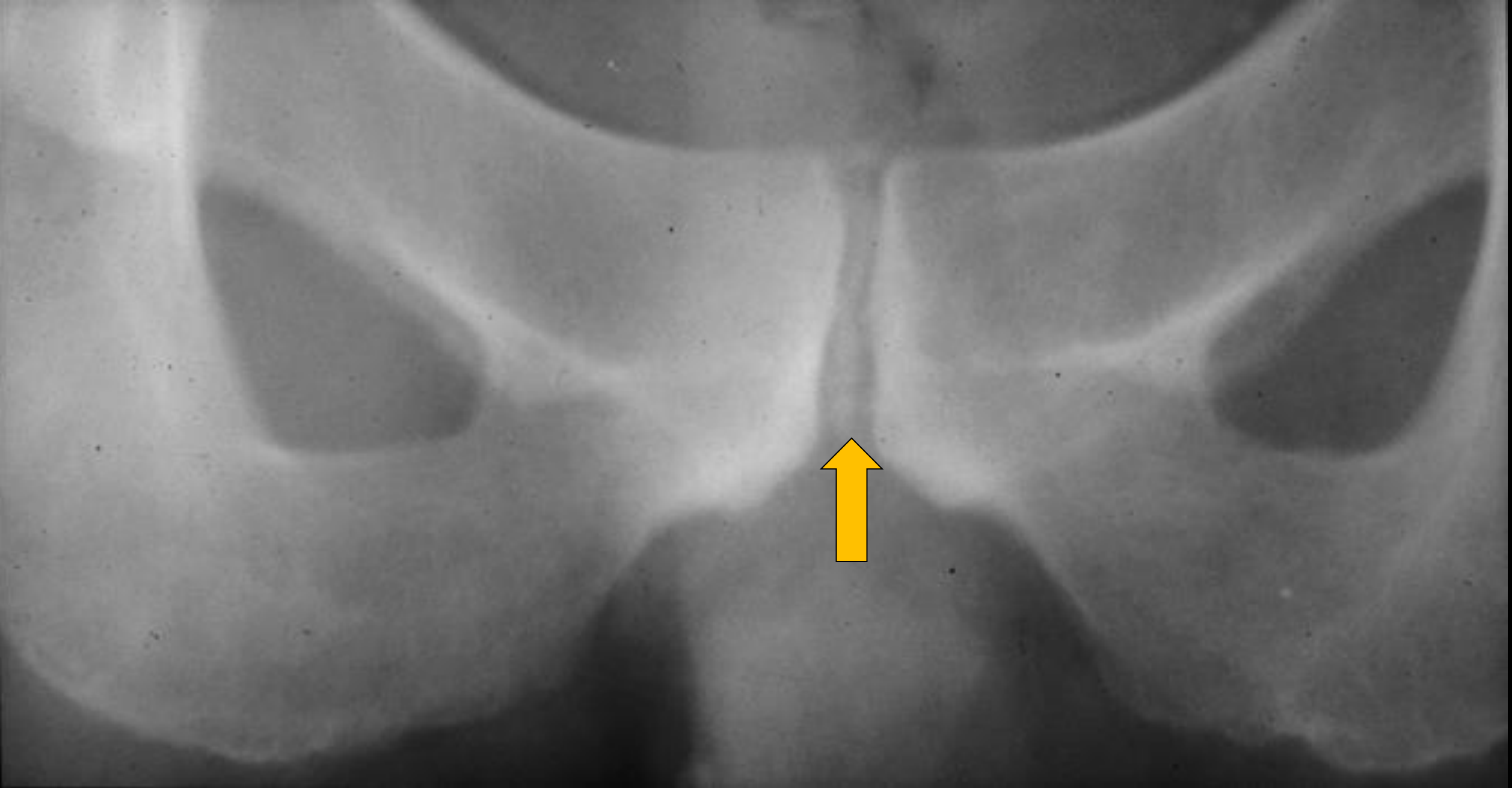




CPPD ARTHROPATHY

OTHER SITES

- Pubic symphysis
 - Chondrocalcinosis – (95%)
- Hip – axial narrowing/chondrocalcinosis (45%)
 - Arthropathy 30%
- Elbow – OA
- Shoulder – glenohumeral OA
- Foot-mid foot OA/neuroarthropathy







T1



T2



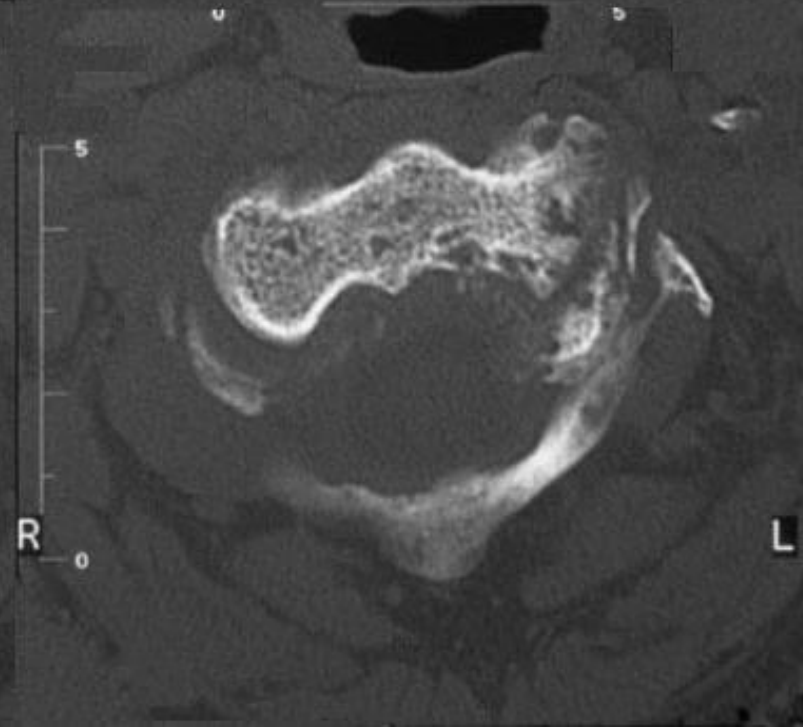
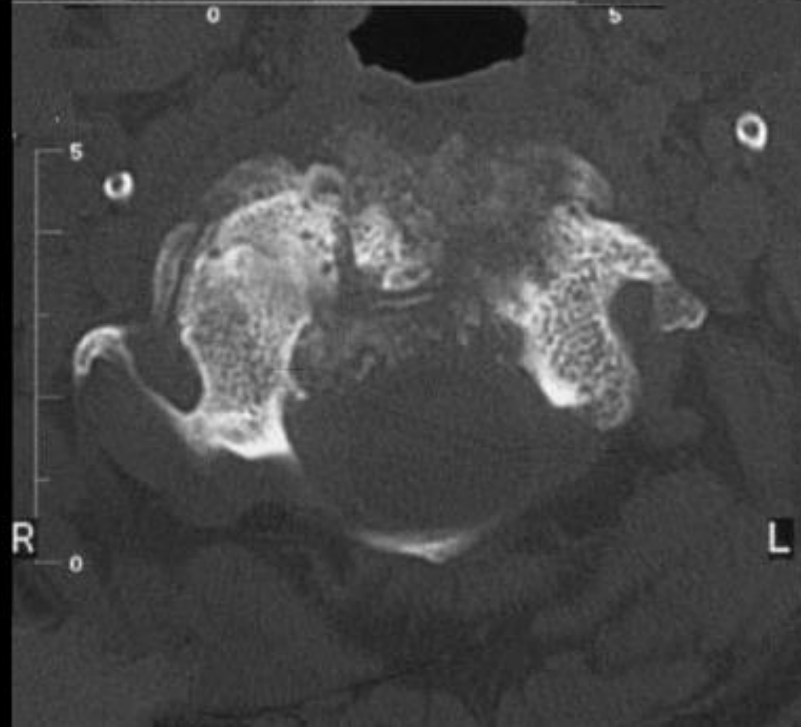
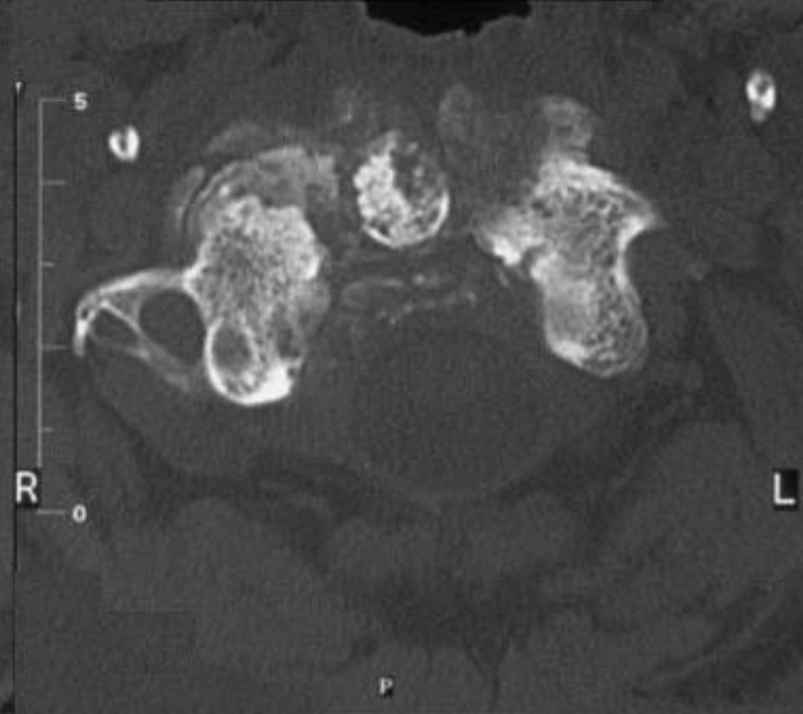
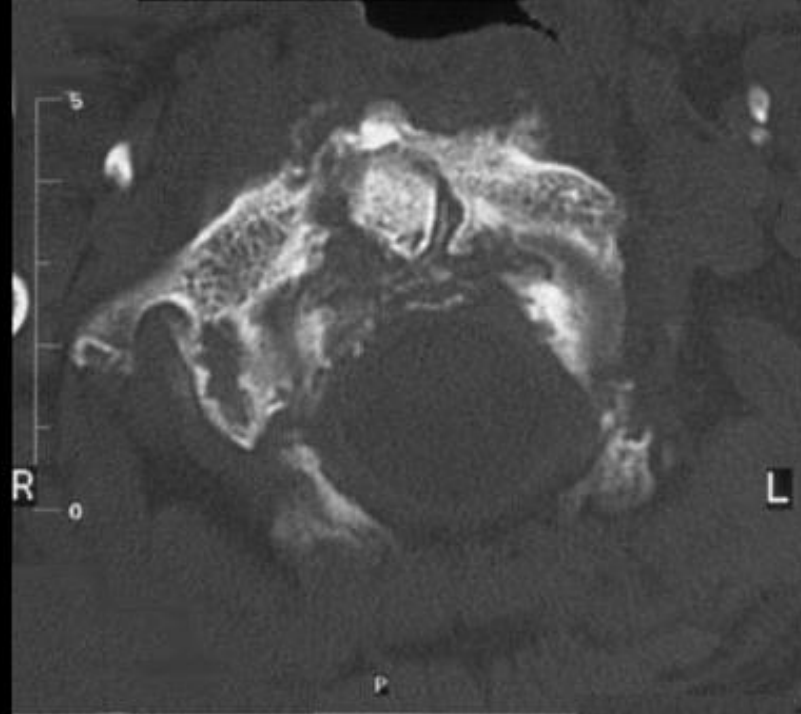
T1

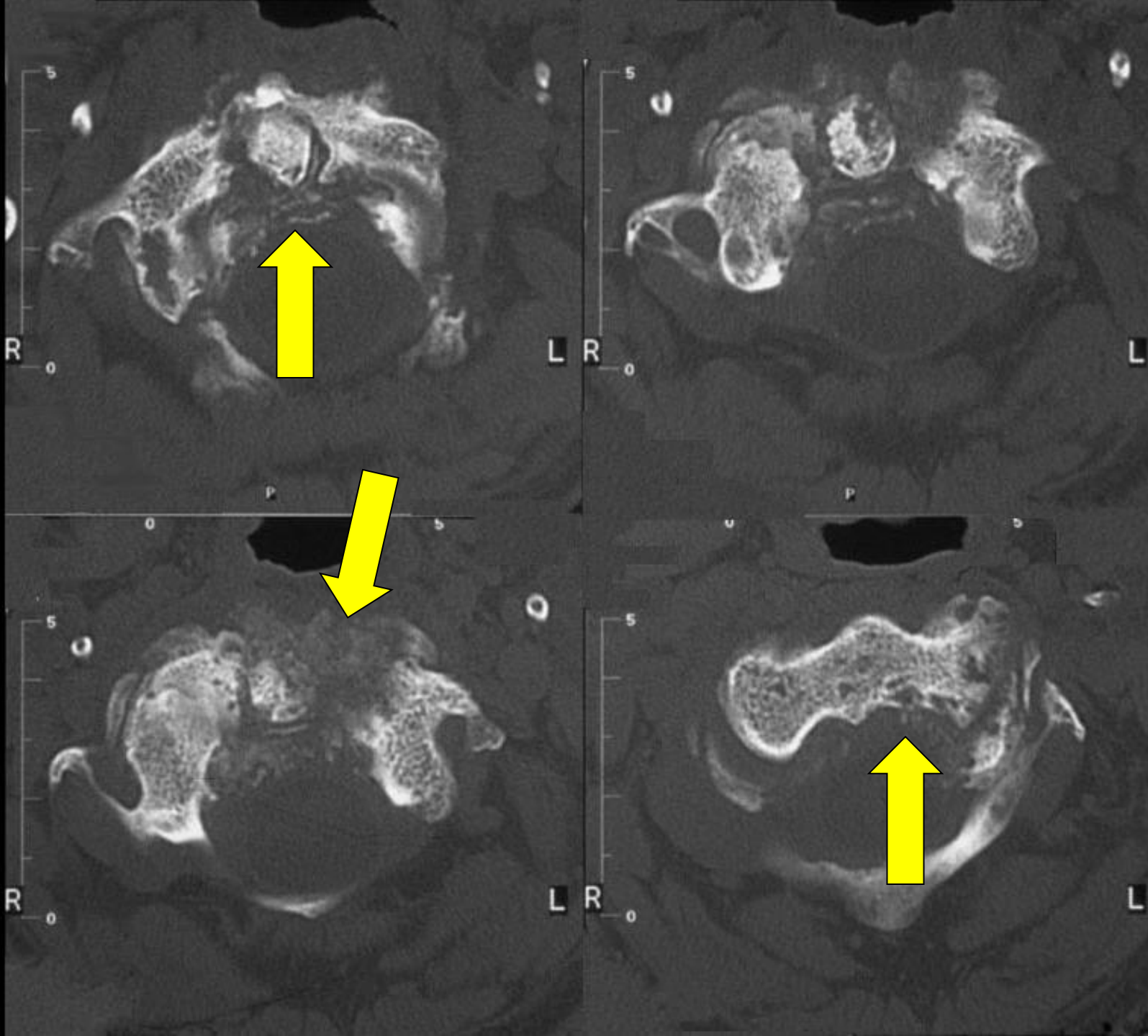


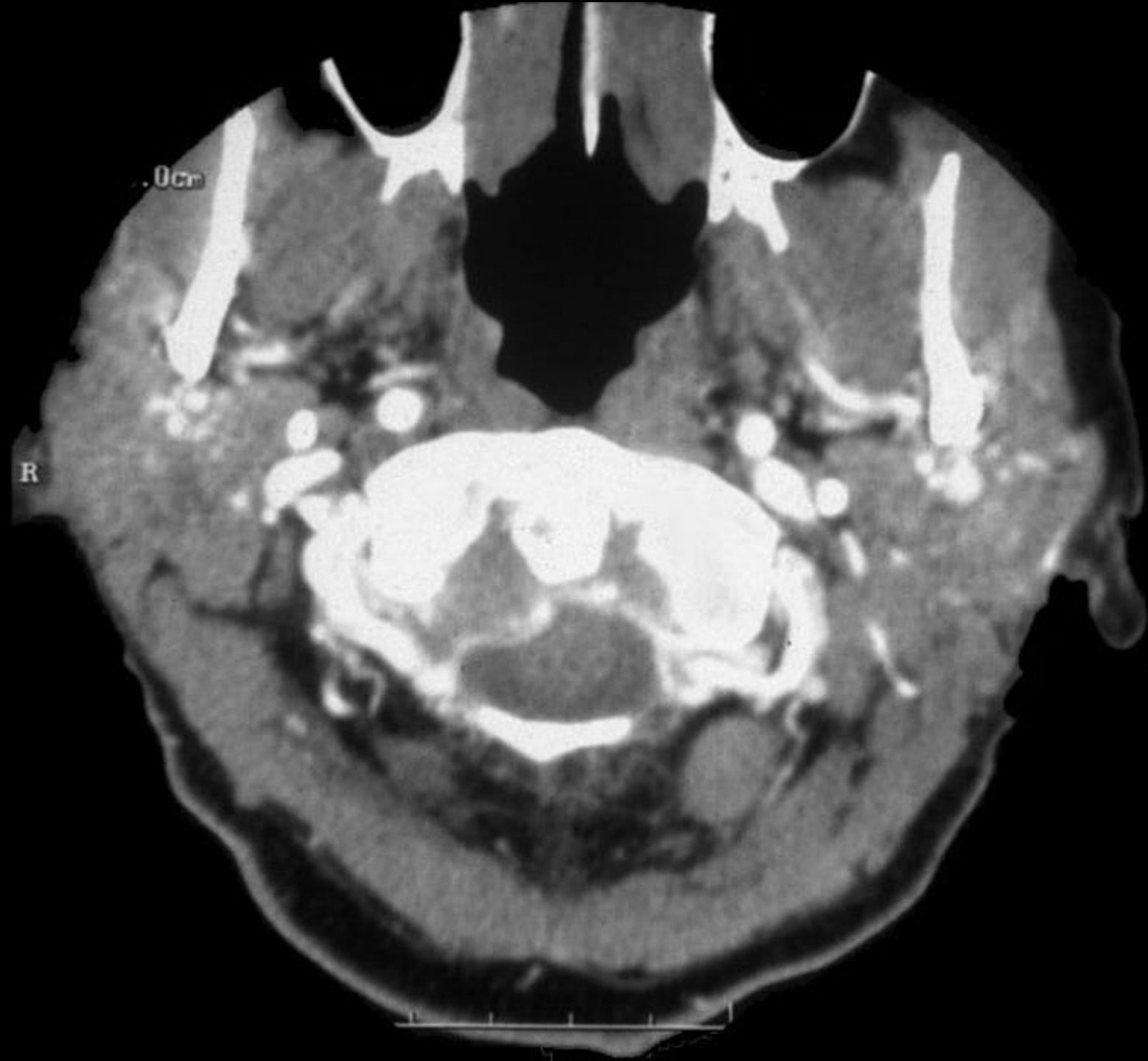
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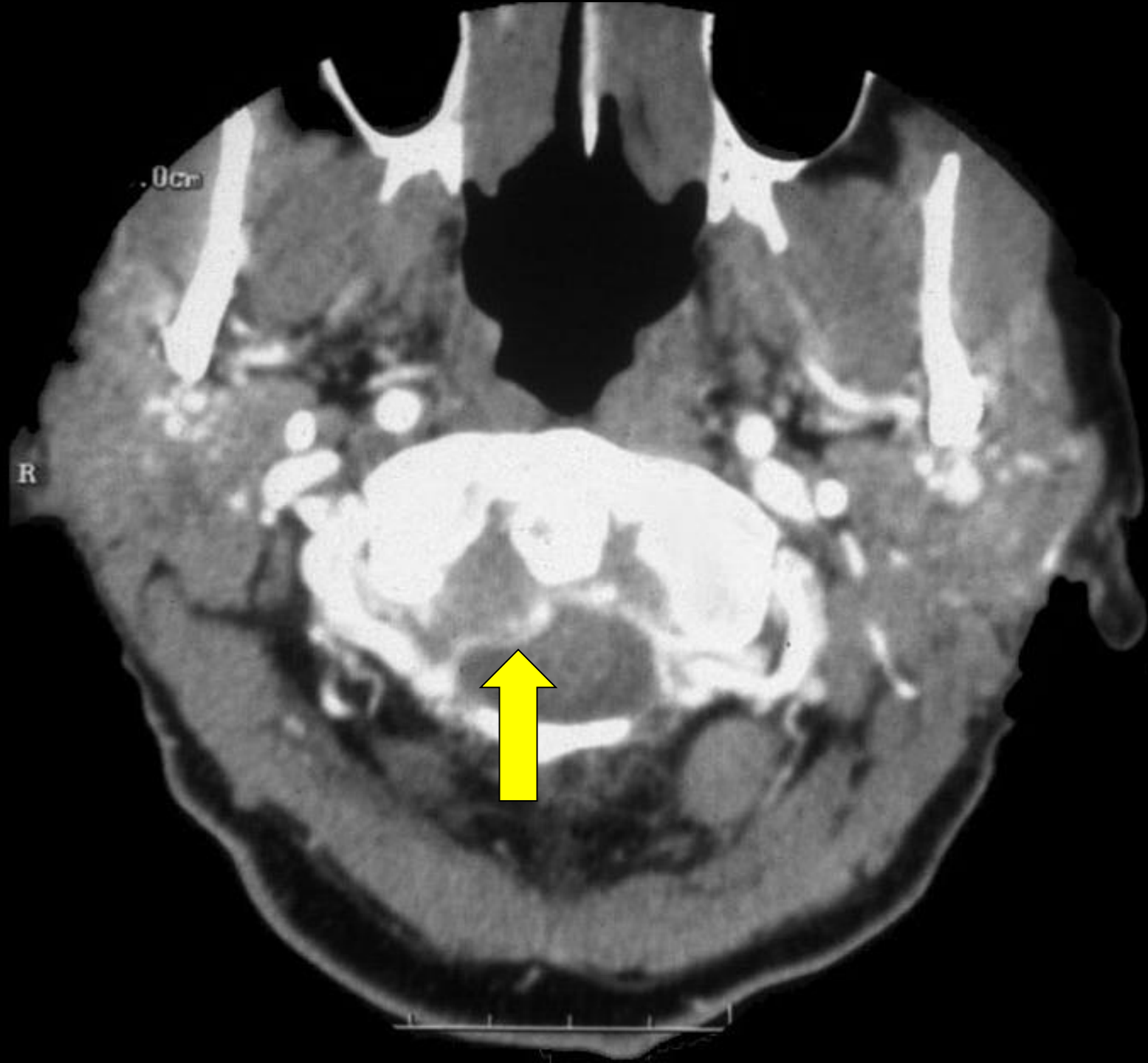
















RT ANTERIOR LT



TC99M HDP

LT POSTERIOR RT



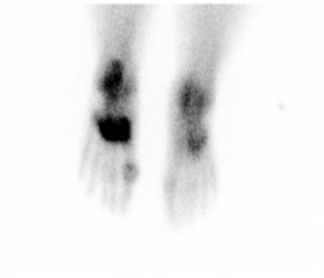
RT ANTERIOR LT



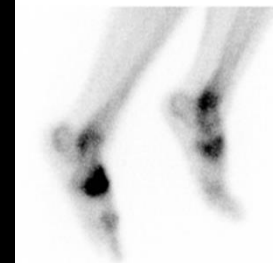
LT POSTERIOR RT



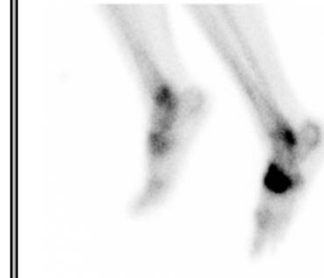
TC99M HDP

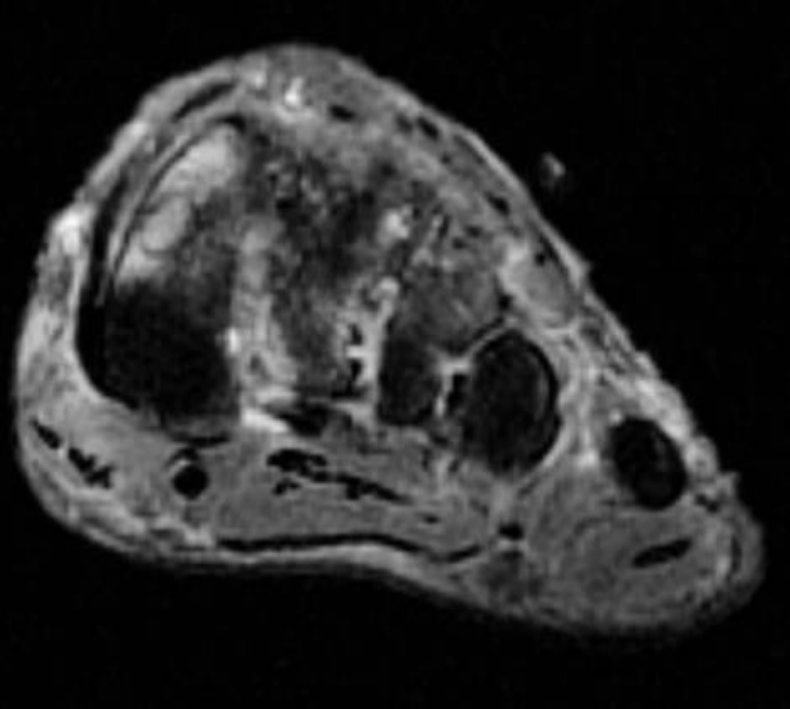
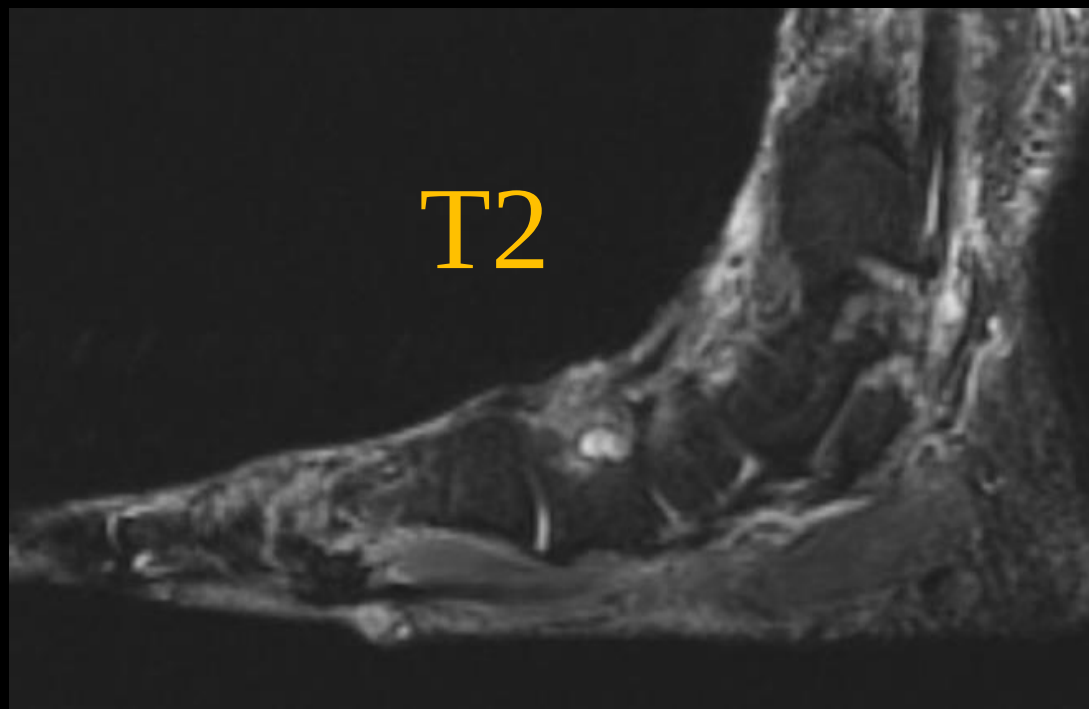
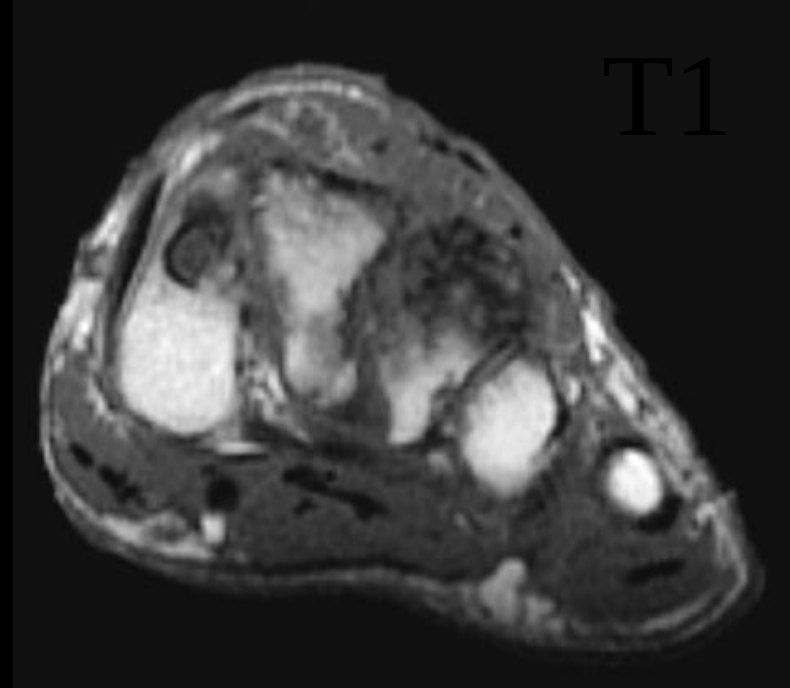
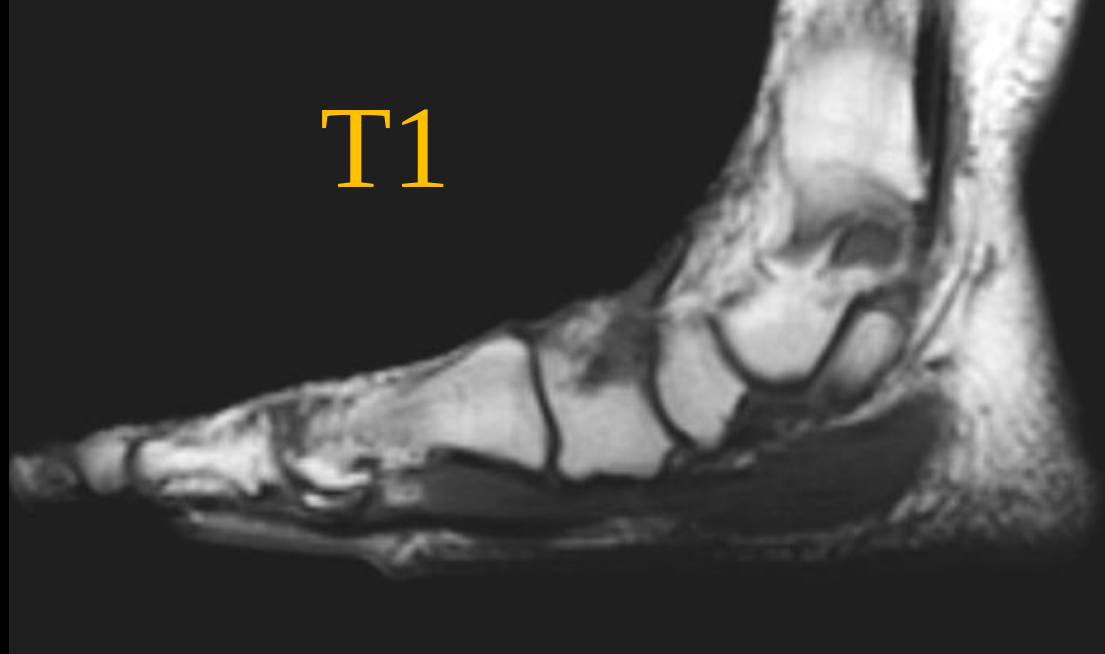


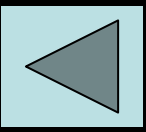
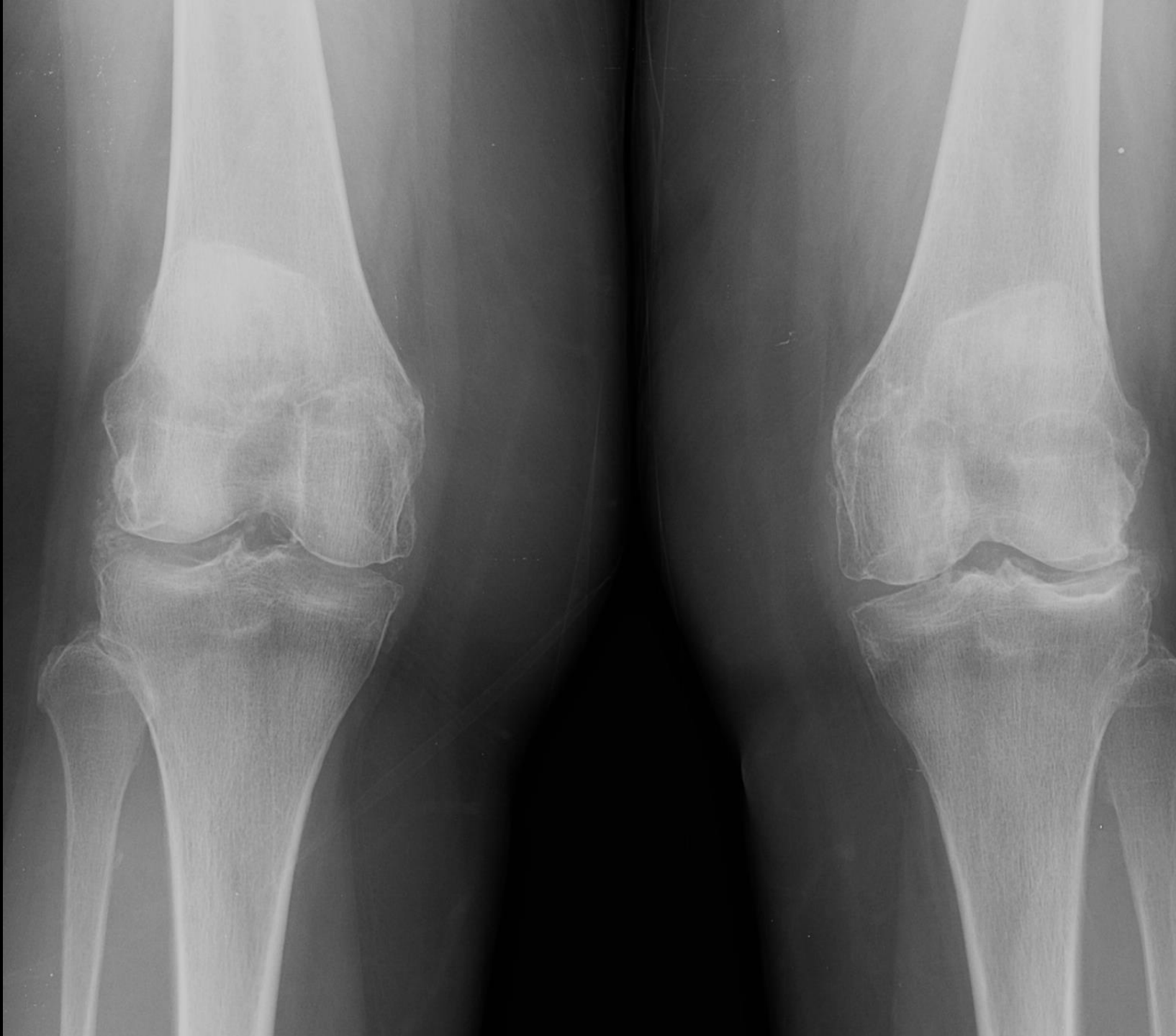
HE2/UC



RT MED LT LAY
42.55 4.90







NEUROARTHROPATHY DISTRIBUTION

- Foot
- Ankle
- Hip
- Shoulder
- Spine



NEUROARTHROPATHY

ETIOLOGY

- Diabetes mellitus (5%-10% of patients) – feet, ankle, spine
- Alcoholism (rare) – foot
- Syringomyelia (20%-25% of patients)
– upper extremity, spine
- Syphilis (5%-10% of patients) spine, hip, knee, ankle
- Leprosy or yaws – hand, foot

NEUROARTHROPATHY

RADIOLOGIC MANIFESTATIONS

- Hypertrophic, atrophic, mixed
 - Destruction (prominent loss of bone, sharp “surgical” margins)
 - Density (increased sclerosis)
 - Debris
 - Distention (effusion)
 - Dislocation
 - Disorganization (both sides of joint)







T1



T2



T1



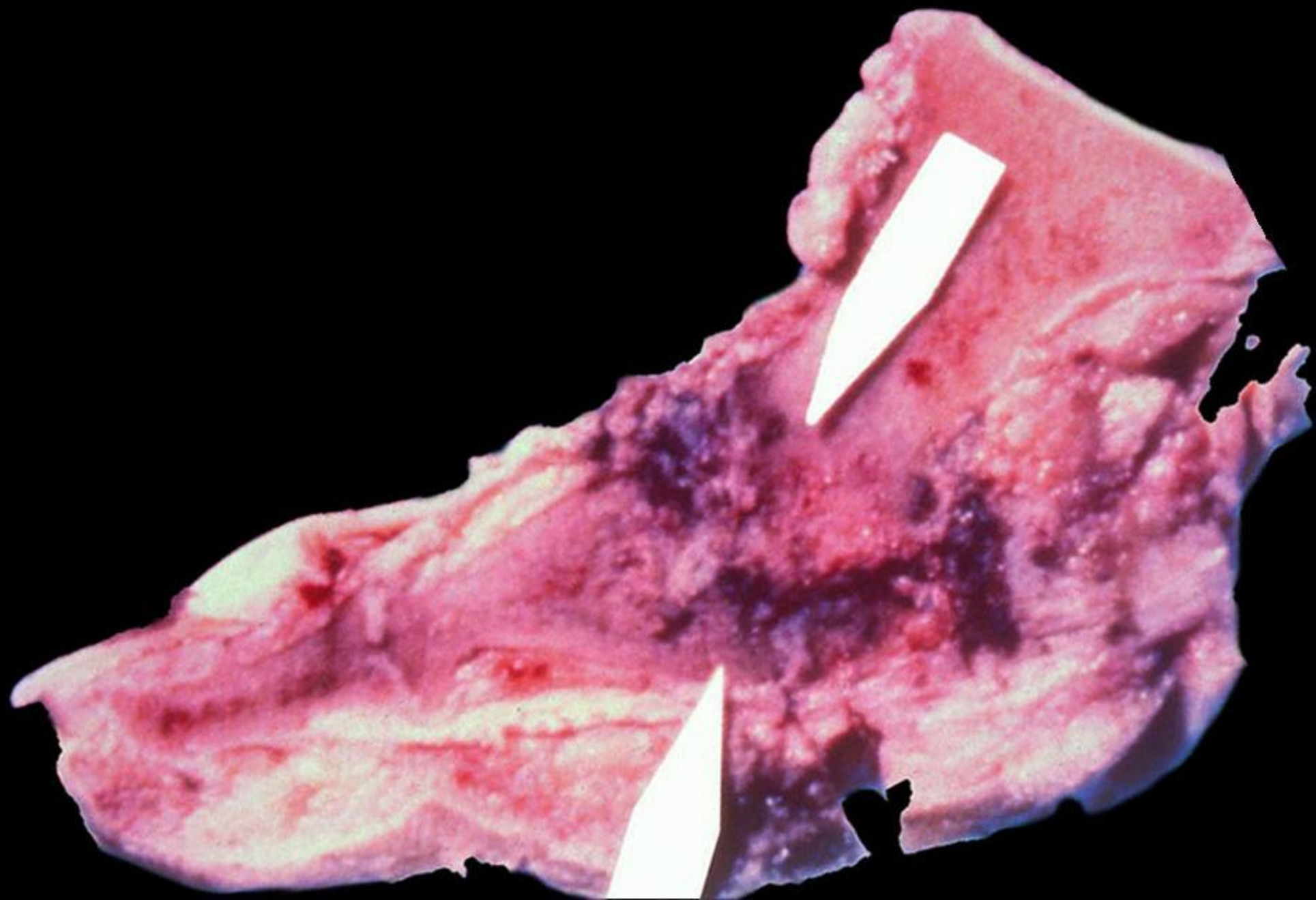
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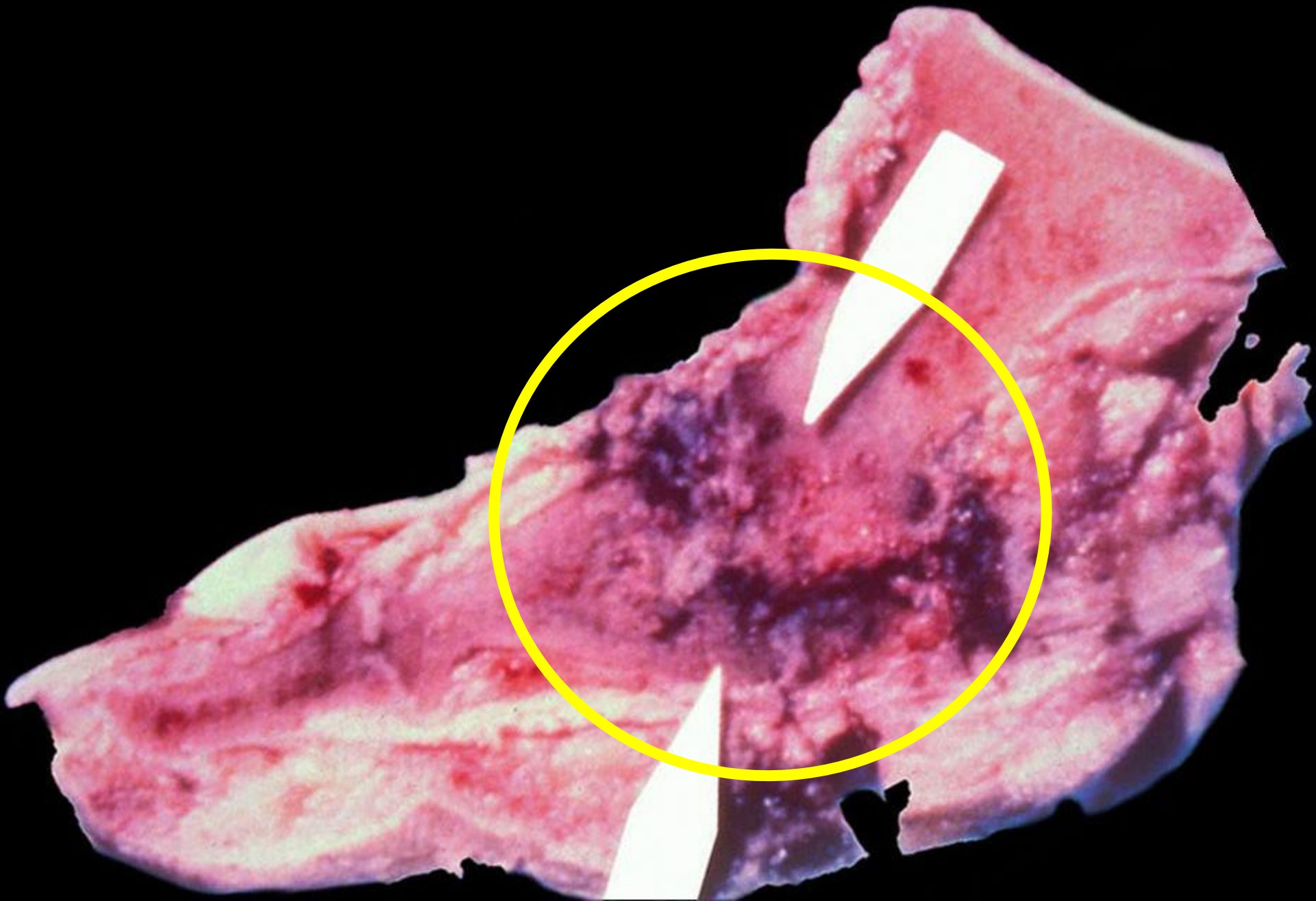


T1

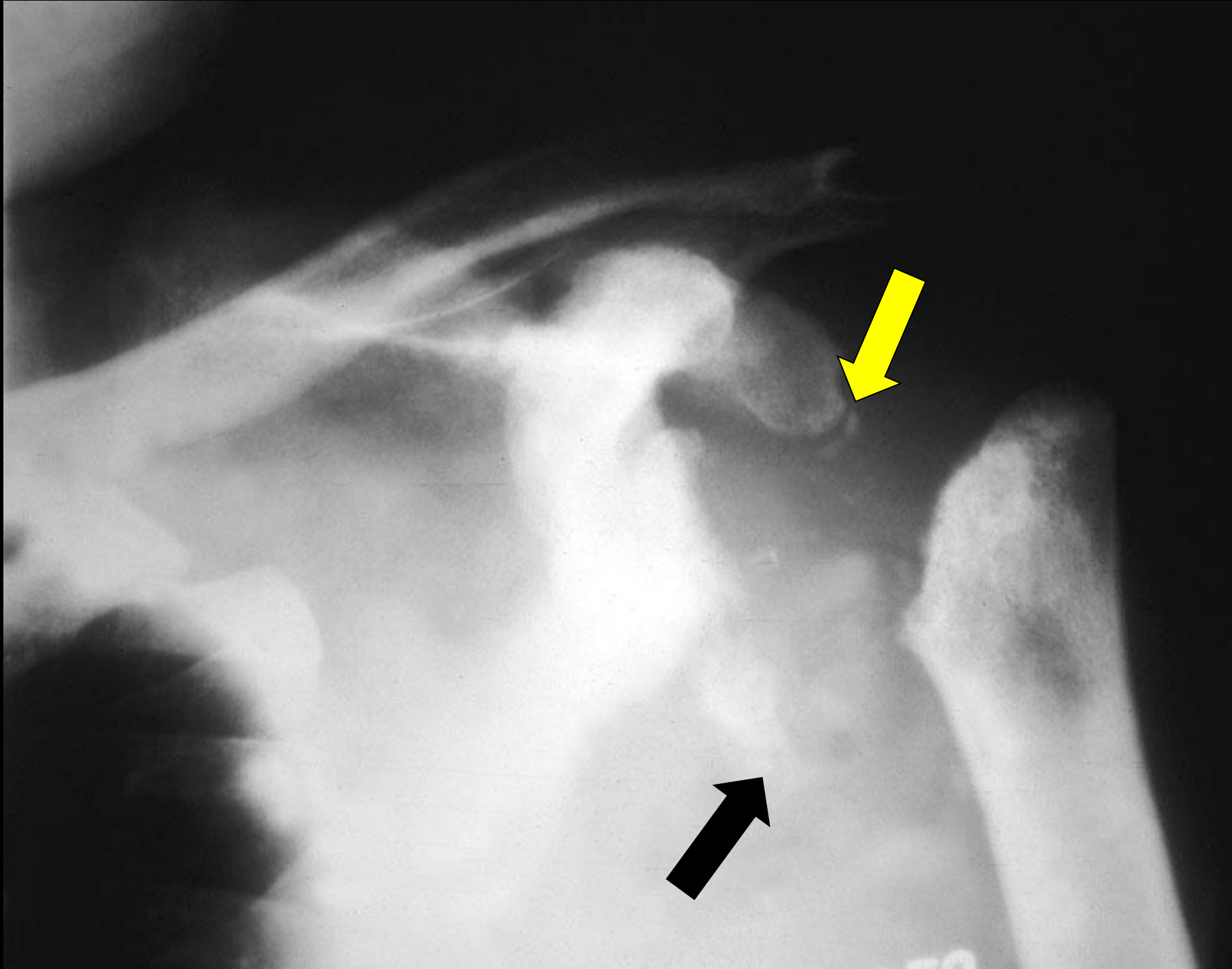


T2





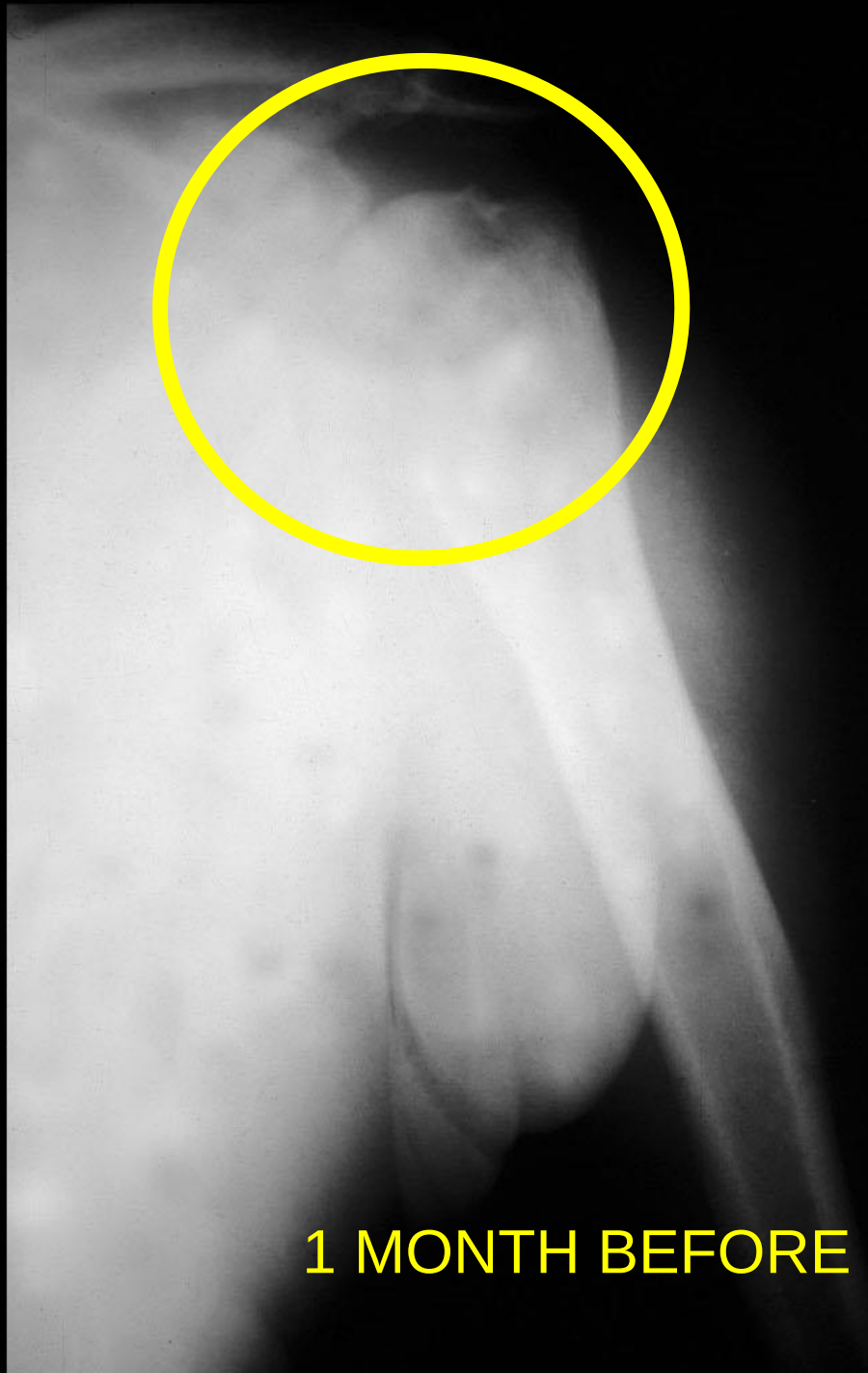








1 MONTH BEFORE FIRST FILMS



1 MONTH BEFORE FIRST FILMS

T1



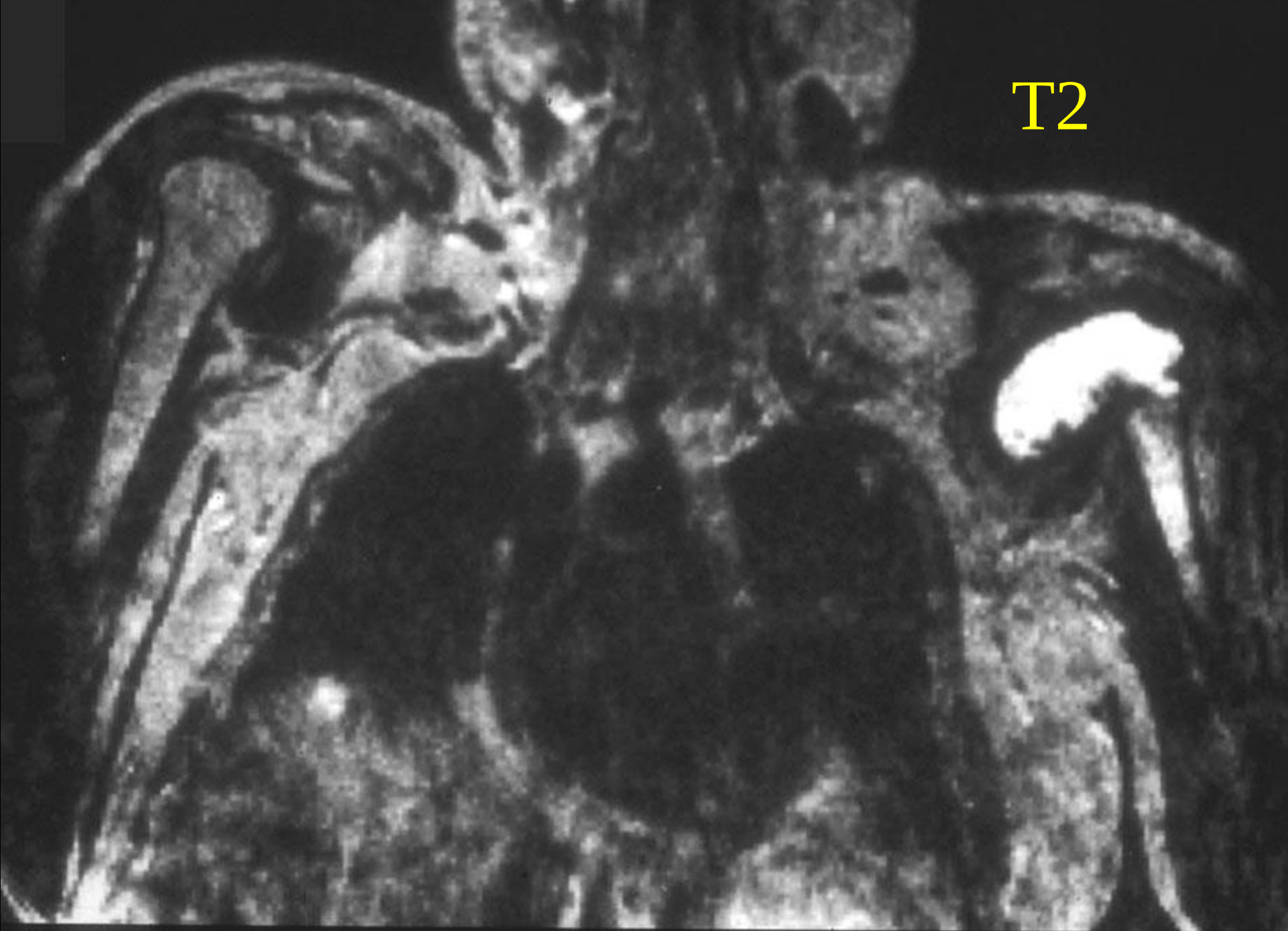
T1



T1



T2





T2



T2

OSTEOMYELITIS VS NEUROPATHIC DIABETES MELLITUS

- Factors favoring infection: Sinus tract (84%/0%); ST replacement (68%/32%); Fluid collection (95%/48%); Extensive marrow abnormality (41%/12%) (+ “ghost” sign)
- Factors favoring neuropathic: Thin rim enhancement of effusion (68%/21%); Presence of subchondral cysts (76%/2%); Intraarticular bodies (53%/12%)

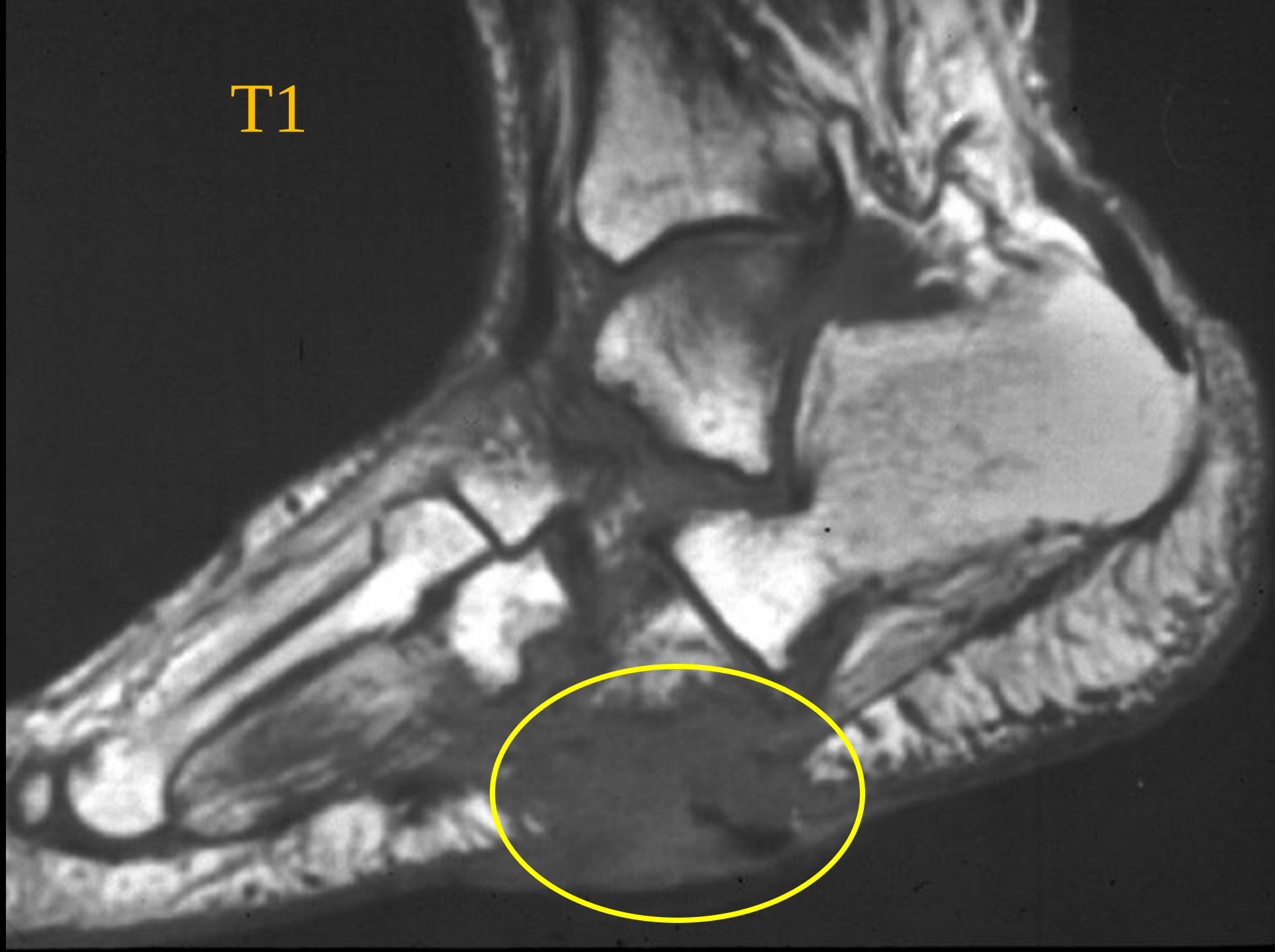




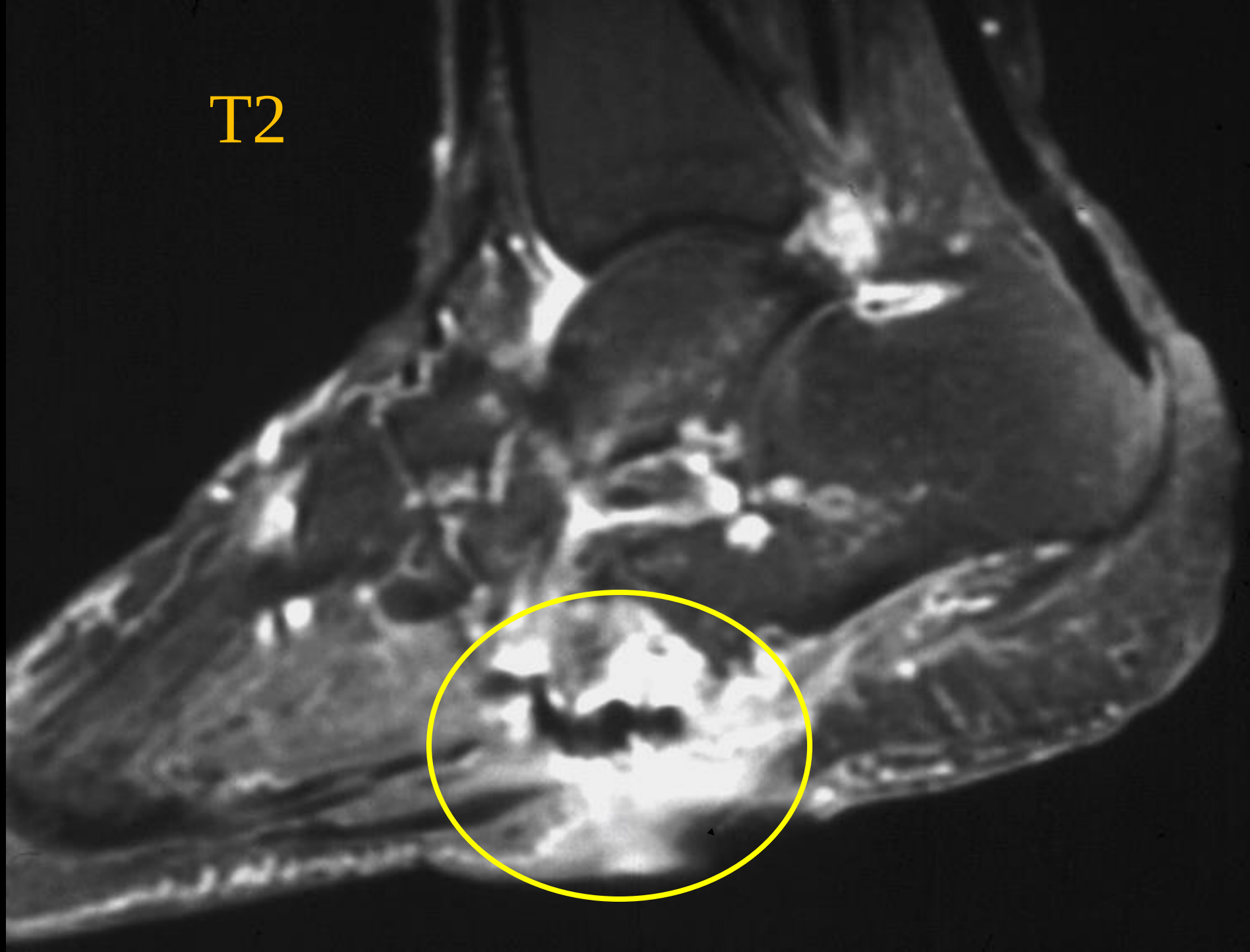
T1



T1



T2



NEUROARTHROPATHY

DIFFERENTIAL DIAGNOSIS

- CPPD arthropathy
- Amyloid (primary or secondary)
- Gorham vanishing bone disease

IMAGING OF ARTHRITIS

CONCLUSIONS

- Extrapolate the cross-sectional imaging of arthritis from the radiographic appearance for diagnosis and differential diagnosis (the one sentence summary statement for diagnosis)
- Use MR to confirm diagnose and detect active disease to direct treatment which is expensive and has significant side effects
- Erosions on MR should be broad based, seen in two planes and look for bone marrow edema



JOINT PUB 1

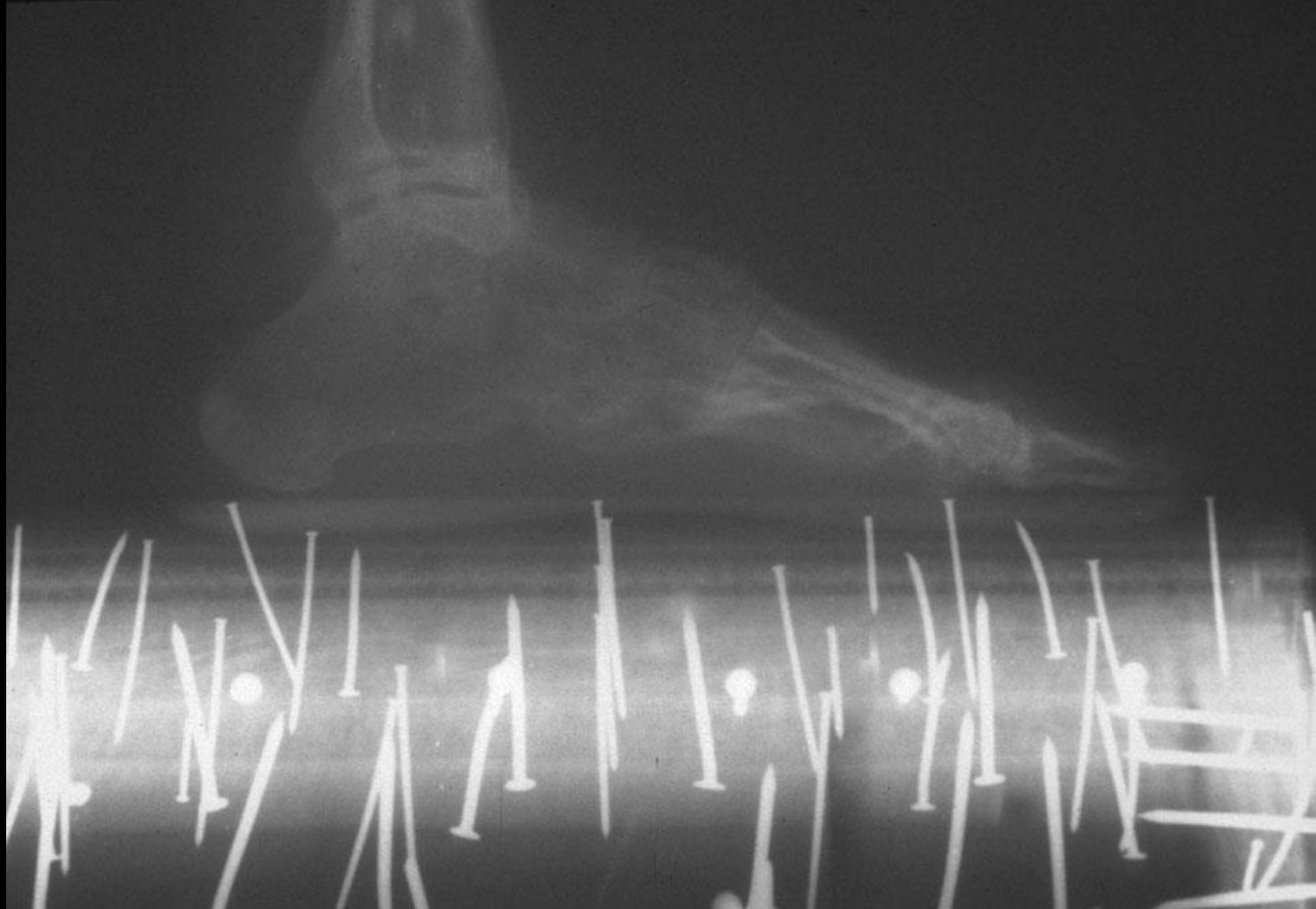


JOINT WARFARE OF THE US ARMED FORCES



*"Joint Warfare
is
Team Warfare"*





IMAGING OF ARTHRITIS

Mark D. Murphey MD, FACR

Physician-in-Chief and Chief, Musculoskeletal Imaging AIRP
Professor of Radiology Uniformed Services University of the Health Sciences
Staff Radiologist Musculoskeletal Section,
Walter Reed National Military Medical Center, Bethesda, Maryland



AFIP



“I brought in our MSK bone specialist to look at your X-rays”