

LEARNING OBJECTIVES

Discuss conditions that are overlooked and misdiagnosed

Demonstrate clinically significant conditions to avoid
morbidity and long-term disability

Discuss imaging protocol

Demonstrate targeted search pattern

Identify pertinent positive findings.

Provide diagnosis or short DDX.

Indicate if additional imaging should be ordered.



EASY TO HARD



DIFFICULTY

EASY: CASES 1-7



DIFFICULTY

CASE 1: 28-YEAR-OLD MALE

Chronic left wrist pain following a FOOSH injury at age of 14.
Subjective findings including pain predominantly with loaded wrist extension activities, feelings of instability and pain over the radial aspect of the dorsal wrist





L



L



CASE 2: 34-YEAR-OLD FEMALE

Traumatic inversion ankle injury

2 weeks ago

Initial evaluation – reported as no indication to image







CASE 3: 23-YEAR-OLD MALE

Tire landed on his right foot while he was crossfit training.

While lifting a tire (600lb), he lost his footing on the left and the tire came down and landed on his right knee pushing his ankle into dorsiflexion

OTTAWA ANKLE EXAM

Cannot take 4 steps

Tenderness over the medial malleolus, and the area of the navicular.

Gentle palpation of the medial malleolus causes pain.

R



R



R



CASE 4: 22-YEAR-OLD FEMALE

Patient reports history of shin splints

Recurrent shin pain

No known trauma during basketball season

Continued to play despite pain

Gradual increase in severity, dull achy and throbbing

Palpable bump mid-tibia



R



CASE 5: 54-YEAR-OLD MALE

Total hip replacement surgery 3 months ago.

R Achilles pain started soon after hip surgery and has stayed the same since onset.

Pain is worse in the AM and with walking

7/10 OPS at worst with aggravating movements (walking down hill or up stairs).

R







CASE 6: 40-YEAR-OLD MALE

Sprained his R wrist numerous times

Recalls FOOSH injury to his right wrist from skateboarding 15 years ago.

Constant Sx near 100% of the day

4/10 current 5/10 worst 4-6/10 average





R



CASE 7: 50-YEAR-OLD MALE

Right-sided low back, buttock and hip pain which seemed to start after a skiing accident several months prior.

Hip pain most pronounced with changes in position.

Case courtesy of Cynthia Peterson, DC, DACBR





REVIEW OF EASY CASES



DIFFICULTY

CASE 1: 28-YEAR-OLD MALE

Chronic left wrist pain following a FOOSH injury at age of 14.
Subjective findings including pain predominantly with loaded wrist extension activities, feelings of instability and pain over the radial aspect of the dorsal wrist





L



L



IMPRESSION

Non-union scaphoid fracture

Osteoarthritis between the distal scaphoid fragment and the radial scaphoid fossa (SNAC stage 1)

It is not uncommon to find nonunion with a remote history of a wrist sprain.

SNAC WRIST (STAGE 1)

the proximal scaphoid fragment usually remains attached to the lunate (which rotate together during extension), while the distal scaphoid fragment rotates into flexion

abnormal contact in the radioscapoid compartment, characterized by early styloid osteoarthritis between the distal scaphoid fragment and the radial styloid process

MRI W/O CONTRAST

Selected Images





POSTSURGICAL

Open reduction, bone graft,
internal fixation w/ bone staple







WHAT ARE THE COMPLICATIONS OF SCAPHOID FRACTURE?

Avascular necrosis in ~30% (range 13-50%), most common involves the proximal portion as a result of arterial supply to the scaphoid entering distally

Non-union in 5-15% of all cases

Scaphoid non-union advanced collapse (SNAC wrist)

Scapholunate advanced collapse (SLAC wrist)

ACUTE SCAPHOID FRACTURE

Diagnosis requires a high index of suspicion,
with a focus on the mechanism of injury and
careful clinical examination.

28-YEAR-OLD MALE

Traumatic wrist pain

Maximal site of pain/tenderness –
anatomical snuffbox



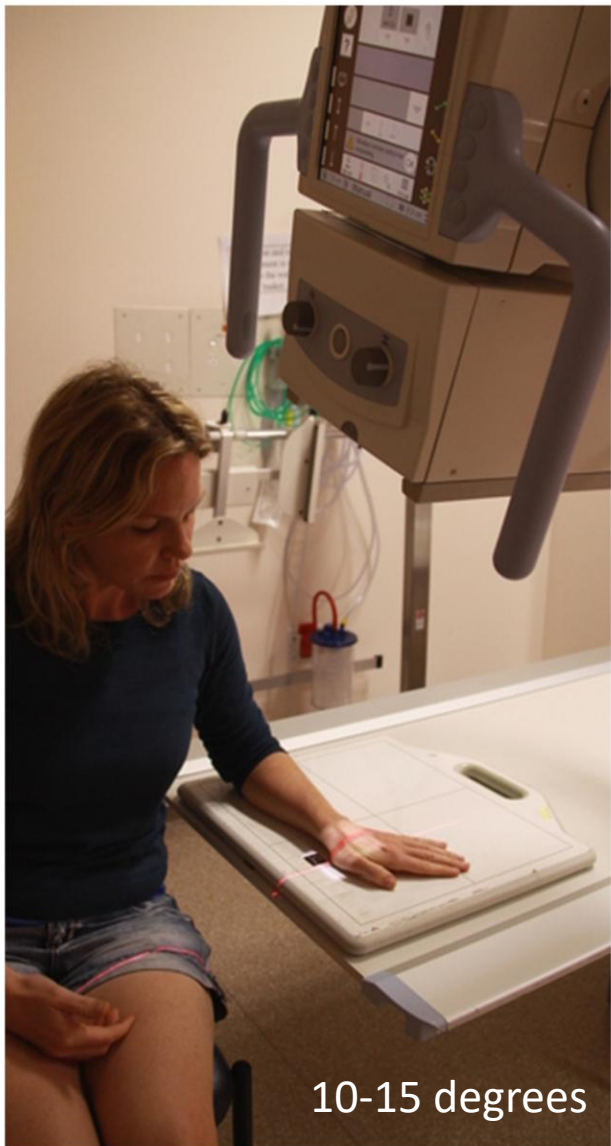


CLINICAL PEARL

Scaphoid fractures may be occult on x-ray. If there is clinical concern for a scaphoid fracture when x-rays are normal the patient may be immobilized for 7-10 days and x-rays repeated.

SCAPHOID SERIES

- Comprised of a posteroanterior, oblique, lateral and angled posteroanterior projection. The series examines the carpal bones focused mainly on the scaphoid. It also examines the distal radiocarpal joint along with the distal radius and ulna.
- Scaphoid fractures are often a result of FOOSH injuries and have a bad prognosis if missed, often if a scaphoid fracture is suspected and not seen on plain film, a follow-up will be requested for 7-10 days time.



10-15 degrees



ADDITIONAL PROJECTIONS

Semisupination oblique view: (pisiform, pisotriquetral view)

pisiform, palmar aspect of triquetrum, palmar ulnar surface of the hamate and pisotriquetral joint are better visualized by this view

carpal tunnel view

used to investigate potential hook of hamate, pisiform and trapezium fractures

clenched fist view

used for suspected scapholunate dissociation

radial deviation view

employed to examine the carpal bones at the ulnar aspect of the wrist

**WHAT MODALITY HAS THE HIGHEST
SENSITIVITY AND SPECIFICITY FOR
DIAGNOSIS OF SCAPHOID FRACTURE?**

Magnetic Resonance Imaging

OTHER CARPAL FRACTURES

Scaphoid fractures are by far the most common of the carpal fractures.

The triquetrum is the second most common carpal fracture.

25-YEAR-OLD MALE

Acute traumatic wrist pain







TRIQUETRAL FRACTURES SYNOPSIS

- Usually occur from forced hyperflexion
 - Avulsion from dorsal radiocarpal ligament
- 2nd most common carpal fracture
- Often only seen on lateral projection
- Often treated with 4 wks immobilization in slight extension
- Minority of lesions undergo painful hypertrophic union or non-union
- Surgical excision utilized in less than 10% of cases

CASE 2: 34-YEAR-OLD FEMALE

Traumatic inversion ankle injury

2 weeks ago

Initial evaluation – reported as no indication to image





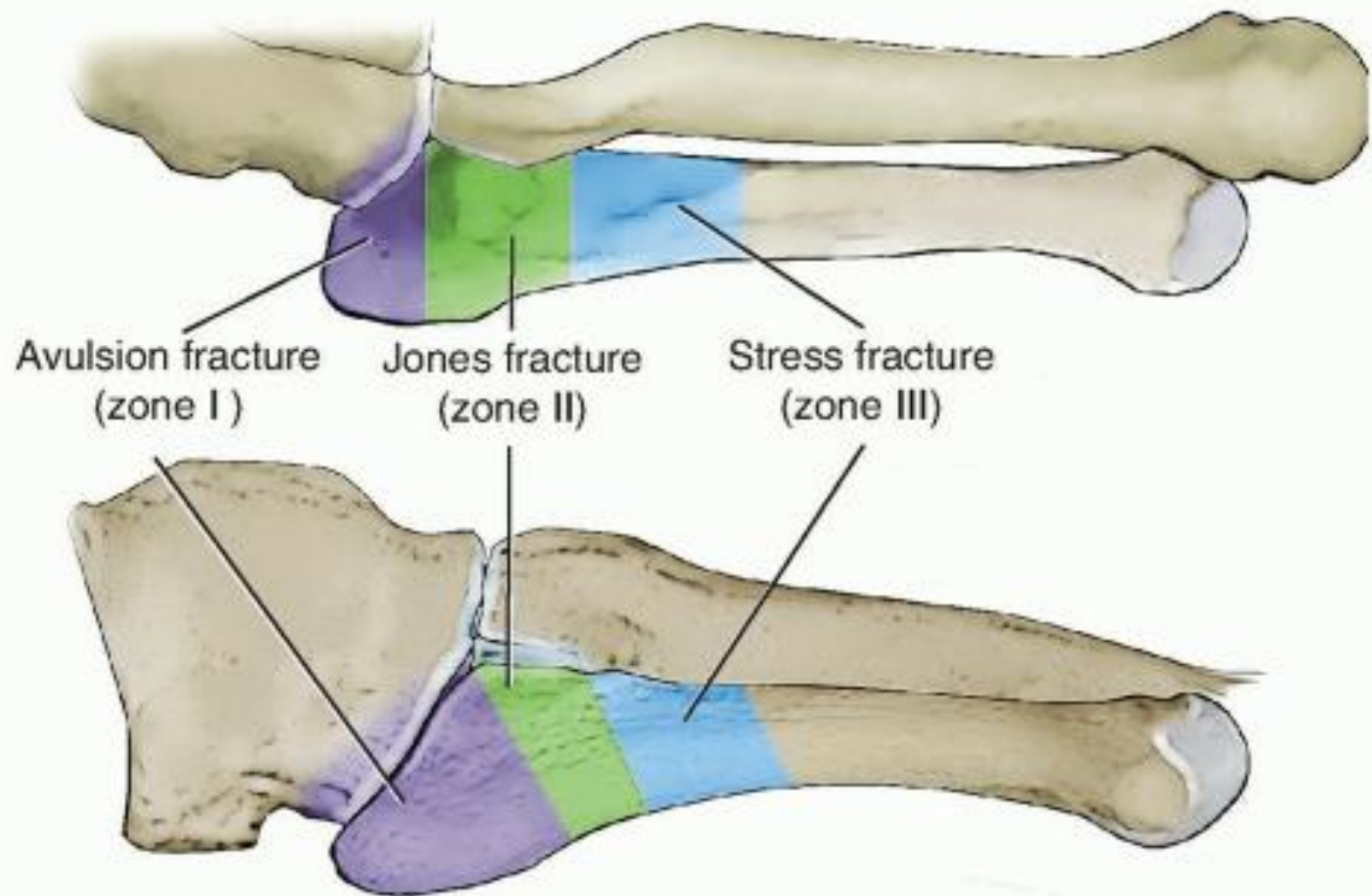






FRACTURE OF PROXIMAL 5TH METATARSAL AT METADIAPHYSEAL JUNCTION (JONES FRACTURE)

Particularly prone to non-union (with rates as high as 30-50%) and almost always take longer than two months to heal



OTTAWA ANKLE RULES (OAR)

Immediately following injury

- Inability to bear weight for four consecutive steps, at time of injury
- Bone tenderness along crest of tibia or fibula within a 6 cm zone proximal to tip
- Bone tenderness at navicular or styloid process of 5th metatarsal

3-7 days following acute injury

- Pain localizes over anterior talus*
- Pain or swelling does not improve or gets worse
- Patient develops inability to bear weight

CASE 3: 23-YEAR-OLD MALE

Tire landed on his right foot while he was crossfit training.

While lifting a tire (600lb), he lost his footing on the left and the tire came down and landed on his right knee pushing his ankle into dorsiflexion

OTTAWA ANKLE EXAM

Cannot take 4 steps

Tenderness over the medial malleolus, and the area of the navicular.

Gentle palpation of the medial malleolus causes pain.

R



R



R



ACUTE MEDIAL MALLEOLUS FRACTURE

Displaced comminuted fracture of the medial malleolus
Associated soft tissue swelling is seen at the ankle.

CLINICAL PEARL

If an isolated medial malleolar injury is present, always look for proximal fibular fracture (to exclude Maisonneuve fracture).

MAISONNEUVE FRACTURE

refers to a combination of a fracture of the proximal fibula together with an unstable ankle injury (widening of the ankle mortise on x-ray), often comprising ligamentous injury (distal tibiofibular syndesmosis, deltoid ligament) and/or fracture of the medial malleolus.

It is caused by a pronation-external rotation mechanism.

CASE 4: 22-YEAR-OLD FEMALE

Patient reports history of shin splints

Recurrent shin pain

No known trauma during basketball season

Continued to play despite pain

Gradual increase in severity, dull achy and throbbing

Palpable bump mid-tibia



R







ANTERIOR CORTEX TIBIAL STRESS FRACTURE

Delayed diagnosis

Less common than the posteromedial ones and are found in jumping and leaping athletes.

CLINICAL PEARL

Progression to complete fracture, delayed union, and non-union are common complications if overloading is continued

23-YEAR-OLD MALE

Patient reports dealing with what feels like shin splints

Onset of pain about 6 months when training track sprint events

Dull pain locally to his middle anterior tibia

Hard and firm mass on the anterior tibia





R

10cr

ANTERIOR CORTEX TIBIAL STRESS FRACTURE

Less common than the posteromedial ones and
are found in jumping and leaping athletes.

CASE 5: 54-YEAR-OLD MALE

Total hip replacement surgery 3 months ago.

R Achilles pain started soon after hip surgery and has stayed the same since onset.

Pain is worse in the AM and with walking

7/10 OPS at worst with aggravating movements (walking down hill or up stairs).

R







HAGLUND SYNDROME

Haglund syndrome is a painful condition of the heel, and its diagnosis requires a combination of clinical and radiological findings.

insertional Achilles tendinopathy, retrocalcaneal bursitis and Haglund deformity (i.e. posterosuperior calcaneal exostosis)

CASE 6: 40-YEAR-OLD MALE

Sprained his R wrist numerous times

Recalls FOOSH injury to his right wrist from skateboarding 15 years ago.

Constant Sx near 100% of the day

4/10 current 5/10 worst 4-6/10 average



R



R

Capitolunate angle
measures 62 degrees

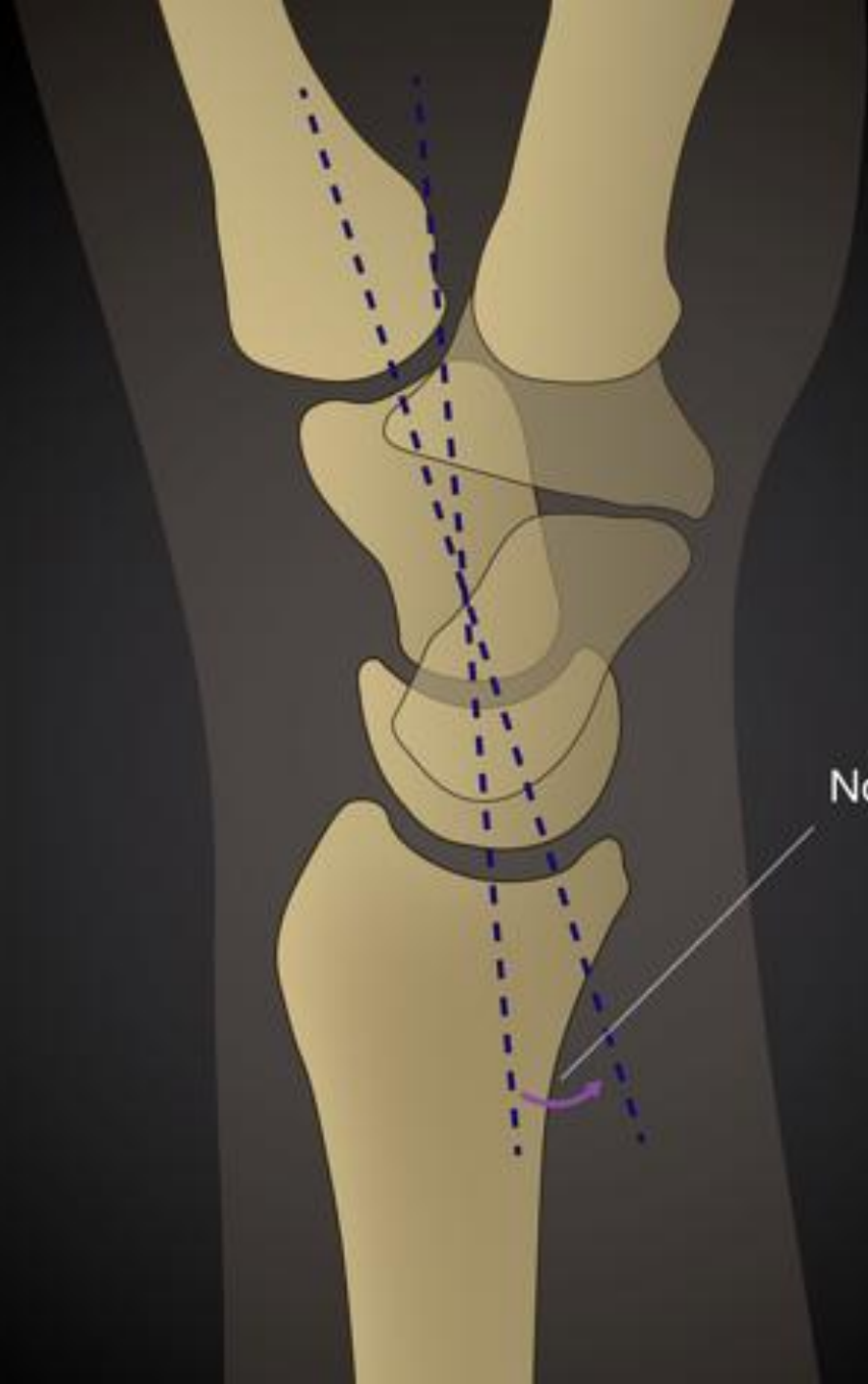


IMPRESSION

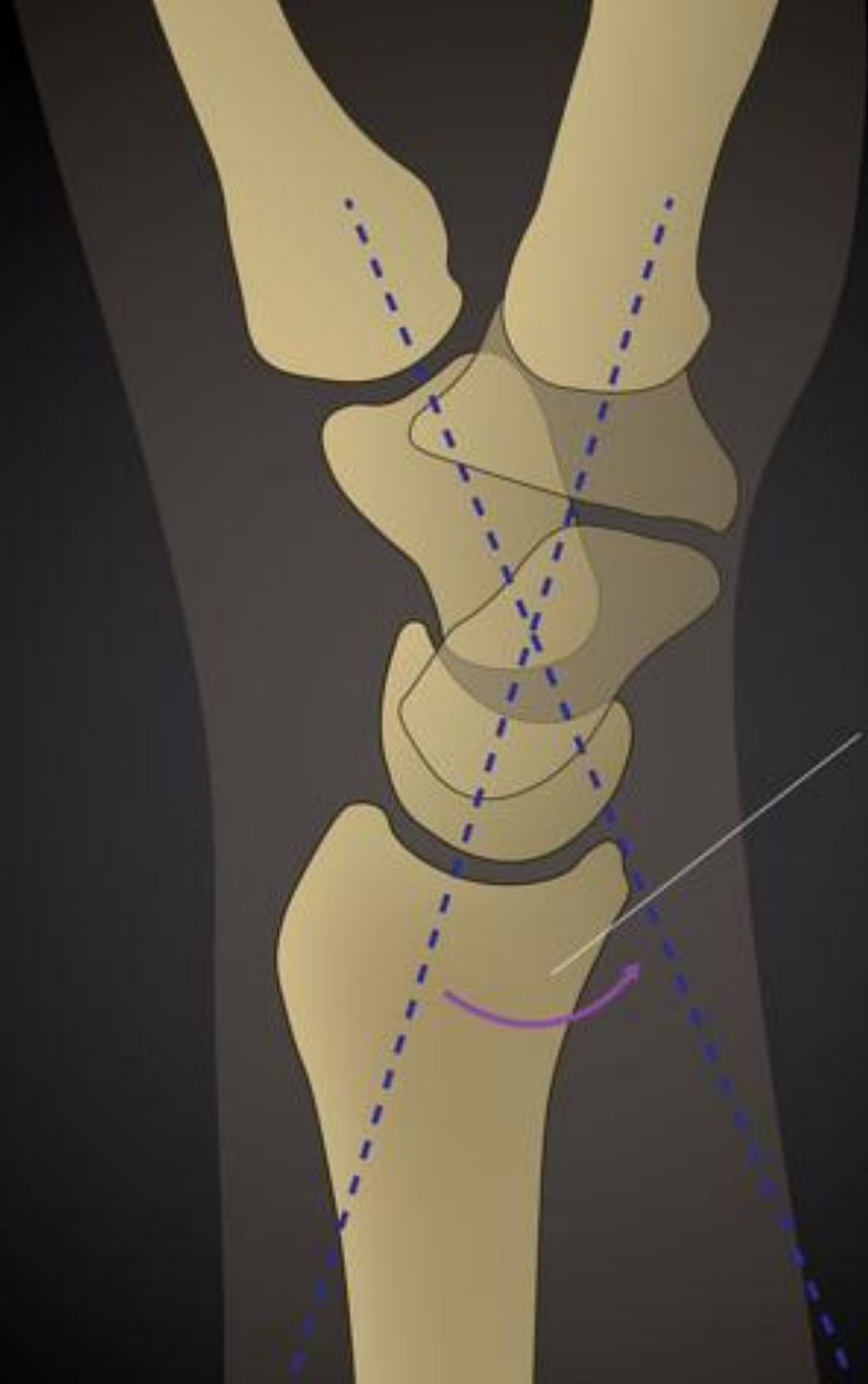
VISI deformity (Volar intercalated segment instability is a type of carpal instability featuring volar tilt of the lunate.)

Widened scapholunate interval

Osseous bone fragments dorsal to capitate



Normal capitulum angle
($<30^\circ$)



Volar intercalated
segmental instability:
capitulate angle
($>30^\circ$)

FOLLOW-UP MRI ARTHROGRAM

Severe tearing and disruption of lunotriquetral ligament with
small focal tear through scapholunate ligament

Tearing of distal ulnar aspect of triangular fibrocartilage complex

VISI and dorsal subluxation of lunate on radius with small fracture
fragment off dorsal lunate

Tearing of radial collateral ligament and ulnar collateral ligament

PROCEDURE

Proximal row carpectomy







DORSAL INTERCALATED SEGMENT INSTABILITY (DISI)

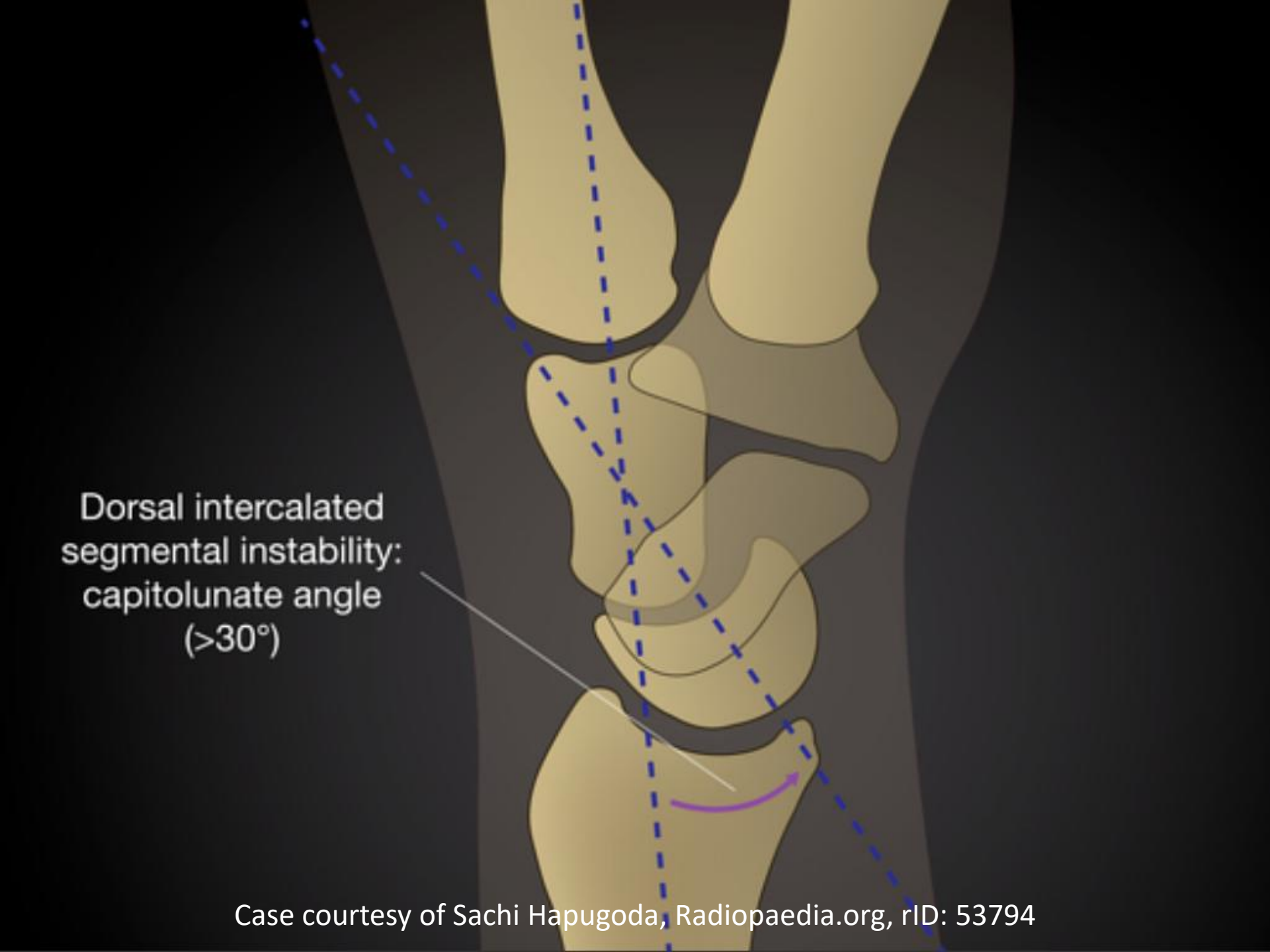
Another form of carpal instability featuring dorsal tilt of the lunate.

Occurs mainly after the disruption of the scapholunate ligament and is more often encountered than volar intercalated segment instability (VISI).



Normal capitulum angle
($<30^\circ$)

This diagram illustrates the normal anatomical relationship between the humerus, radius, and ulna in a sagittal view of the elbow. The humerus is at the top, with the radius and ulna below it. Dashed blue lines are drawn to show the alignment: one line follows the longitudinal axis of the humerus, and another line is tangent to the surface of the capitulum on the ulna. A purple arc indicates the angle between these two lines, which is labeled as the 'Normal capitulum angle (<30°)'. The text is positioned to the right of the joint, with a thin white line pointing towards the angle.



Dorsal intercalated
segmental instability:
capitohamate angle
($>30^\circ$)

CASE 7: 50-YEAR-OLD MALE

Right-sided low back, buttock and hip pain which seemed to start after a skiing accident several months prior.

Hip pain most pronounced with changes in position.

Case courtesy of Cynthia Peterson, DC, DACBR



Large destructive
lesion of right iliac
fossa

Extends to iliac
crest and upper
sacroiliac joint

Narrow zone of
transition

No other
destructive
lesions are seen.

Remaining
osseous structures
are normal.



IMPRESSION

The differential diagnosis is broad for destructive lesions of the pelvis; however, this most likely represents a malignant bone lesion such as metastasis or plasmacytoma/multiple myeloma.

RECOMMENDATION

MRI is indicated as well as an urgent referral to an orthopedic oncologic surgical specialist for further workup including bone biopsy.

MAGNETIC RESONANCE IMAGING

Key images provided



T2W

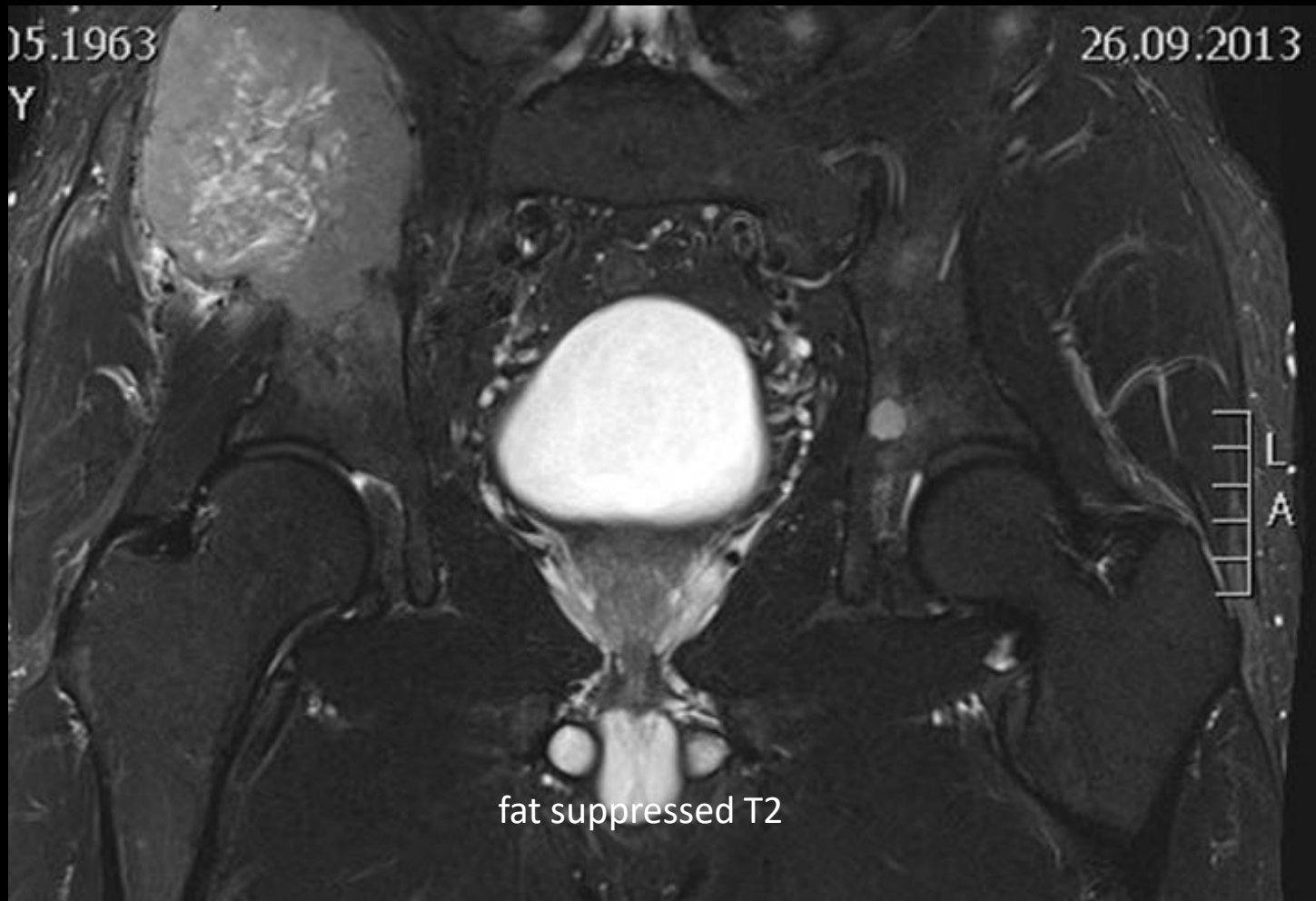
05.1963

Y

26.09.2013

L
A

fat suppressed T2





FOLLOW UP

The biopsy confirmed that this patient has multiple myeloma.
most common bone malignancy in patients over 50 years of age

RISK MANAGEMENT PITFALL

Not reviewing patient's health records
including images

PREVIOUS FILMS

Reported as negative



MALIGNANT LESIONS OF THE PELVIS

Are not uncommon.

*Need to be differentiated from benign lesions and
tumor mimics.*

*Appearances are sometimes nonspecific leading to
consideration of a broad differential diagnosis.*

44-YEAR-OLD MALE

Progressive pelvic pain

Case courtesy of Dr. Savannah Shortz

SRMH Outpatient Imaging

XR Pelvis 1V or 2V

R
ERC

1757 Y: 734 Val: 1998
2048 WW: 1721 [D]



BIOPSY PROVEN

Plasmacytoma

MULTIPLE MYELOMA

common malignancy in patients above 40 (70% of cases are diagnosed between ages 50 and 70)

multiple myeloma and osteosarcoma combined account for approximately 50% of all primary bone malignancies

CLINICAL PRESENTATION OF MULTIPLE MYELOMA

bone pain

initially intermittent, but becomes constant

worse with activity/weight bearing, and thus is worse during the day

anemia

renal failure/proteinuria

MORE CHALLENGING: CASES 1-6



Identify pertinent positive findings.

Provide diagnosis or short DDX.

Indicate if additional imaging should be ordered.



CASE 1: 12-YEAR-OLD FEMALE

Worsening right wrist pain with gymnastics

2 months duration

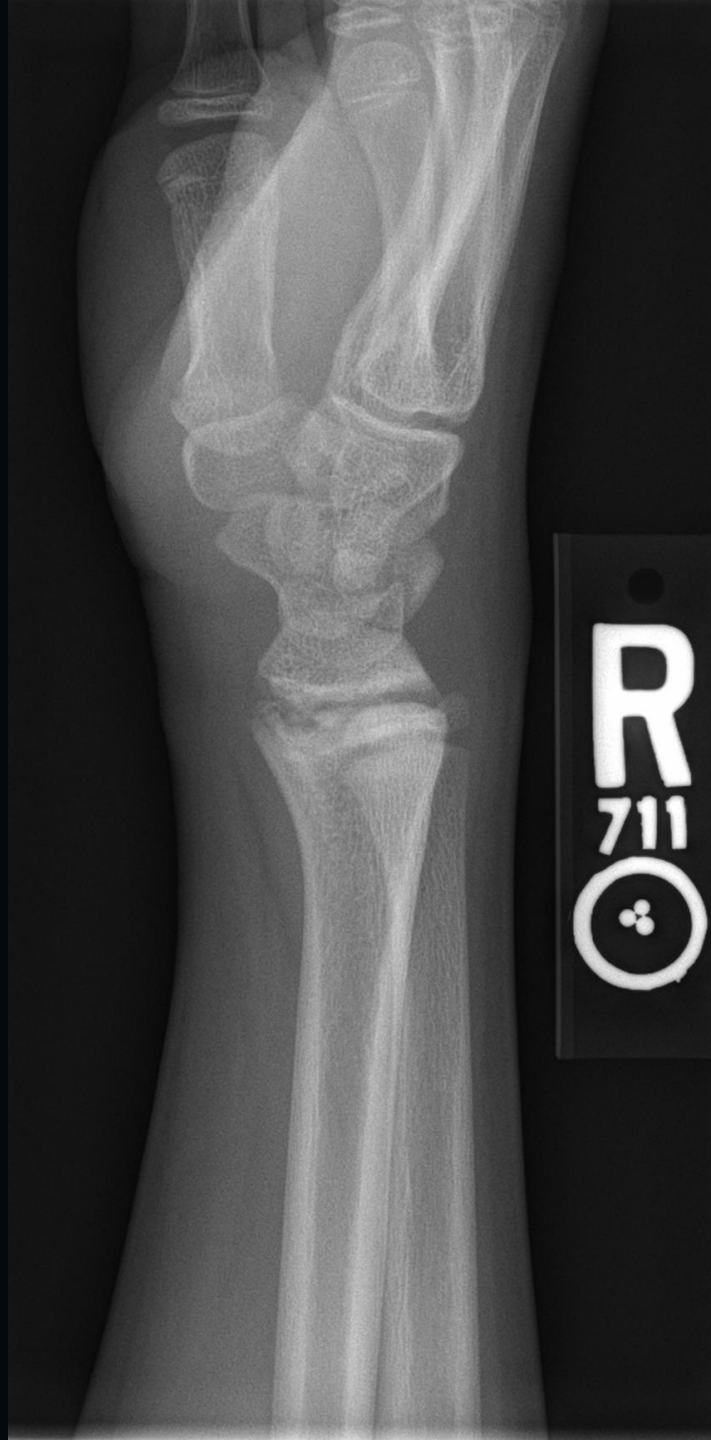
Better with rest

No swelling, redness. Some tenderness with palpation.



9949
17





CASE 2: 28-YEAR-OLD MALE

Fell skateboarding 10 days ago going approximately 25 mph

Walking with limp

Significant soft tissue swelling

Pain at top of foot, medial and lateral malleolus







CASE 3: 22-YEAR-OLD FEMALE

Rolled ankle (inversion) 6 years ago during color guard in high school.

History of repeated re-injury of ankle.

5/10 OPS currently, 7/10 OPS worst, 5/10 OPS avg

R



R





CASE 4: 36-YEAR-OLD FEMALE

Long distance runner

Heel pain



CASE 5: 28-YEAR-OLD FEMALE

Persistent traumatic wrist pain

Sudden onset while playing rugby 4-6 months ago. When tackling she landed on her wrist with her body weight and the other players body weight on it.

No x-rays performed





R

R



CASE 6: 36-YEAR-OLD FEMALE

Non-traumatic left hip pain

Weakness of left hip abductor muscles

Palpable mass

Exam Description: XR HIP BILATERAL

HISTORY: 36-year-old female, curvature and pain

TECHNIQUE:

1. AP view the pelvis, frog leg view both hips

Prior study for review : 15 March 2011

FINDINGS:

Asymmetric transitional anatomy and some sclerosis about the lumbosacral junction to the right of midline. Stable.

No evident pelvic tilt. Normal round contour femoral heads and joint spaces are preserved.

Phleboliths right hemipelvis without other evidence soft tissue abnormality to this technique

IMPRESSION:

1. Asymmetric transitional anatomy lumbosacral junction but there is no pelvic tilt or arthropathy to explain the patient's limb length discrepancy, nonweightbearing examination however





R
ND
17



R

REVIEW OF MORE CHALLENGING CASES



DIFFICULTY

CASE 1: 12-YEAR-OLD FEMALE

Worsening right wrist pain with gymnastics

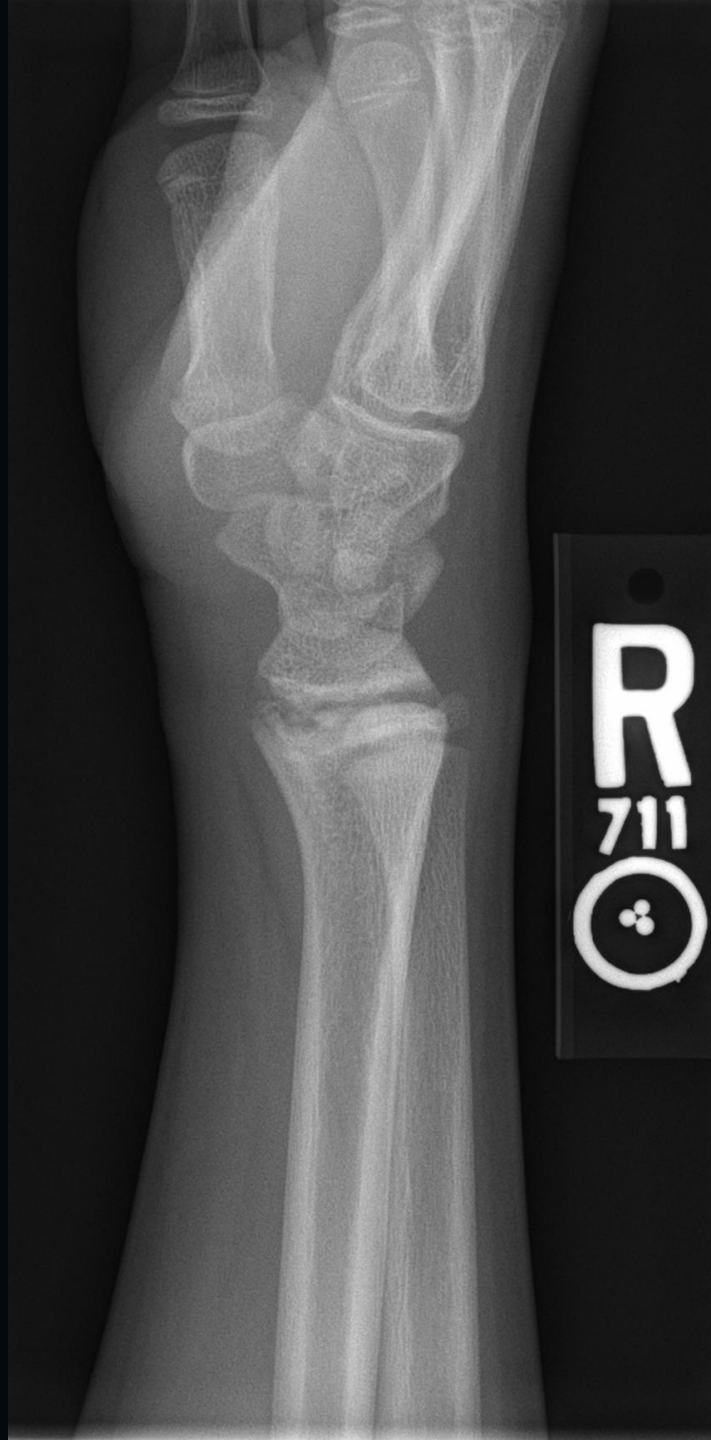
2 months duration

Better with rest

No swelling, redness. Some tenderness with palpation.







IMPRESSION

Findings along the radial side and palmar side distal radius physis and metaphysis are non-specific, though can be seen in the setting of a chronic overuse injury of the wrist (gymnast wrist). Clinical correlation is suggested.

MRI may also be used when radiographs are inconclusive.

MRI can demonstrate the greater detail about the physeal cartilage and edema in the adjacent bones before these changes become visible on radiograph.

GYMNAST WRIST

chronic overuse injuries of the wrist in gymnasts with an immature skeleton

usually manifests as a chronic Salter-Harris type I fracture of the distal radial physis on radiography

CLINICAL PRESENTATION

Pain with gradual onset and exaggeration by weight-bearing activities while the wrist in extension position. Often, range of motion is normal on physical examination, and frequently swelling and tenderness over the distal radius presents

WHAT ARE COMPLICATIONS OF UNTREATED GYMNAST WRIST?

Early physal closure leading to positive ulnar variance
and Madelung-type deformity

TFCC injury

CASE 2: 28-YEAR-OLD MALE

Fell skateboarding 10 days ago going approximately 25 mph

Walking with limp

Significant soft tissue swelling

Pain at top of foot, medial and lateral malleolus











10





NON-DISPLACED FRACTURE OF TALAR BODY

Lack of muscular attachments and absence of a secondary blood supply can lead to subsequent osteonecrosis

Commonly result from high-energy trauma and may lead to complications and long-term morbidity if not recognized and managed appropriately.

TALUS FRACTURE

2nd most common tarsal bone to fracture

Blood supply easily damaged (delay in diagnosis accelerates vascular compromise)

Approximately 40% are missed during initial evaluation

High level of clinical suspicion is required to avoid missing fracture

CLINICAL PEARL

Initial evaluation is with foot and ankle radiographs

CT is often performed to evaluate the extent of the fracture, displacement, comminution, intra-articular extension, and associated injuries.

CLINICAL PEARL

Lack of timely diagnosis escalates the vascular insult, delays timely intervention, and increases morbidity.

CASE 3: 22-YEAR-OLD FEMALE

Rolled ankle (inversion) 6 years ago during color guard in high school.

History of repeated re-injury of ankle.

5/10 OPS currently, 7/10 OPS worst, 5/10 OPS avg

R



R

full flexion



R

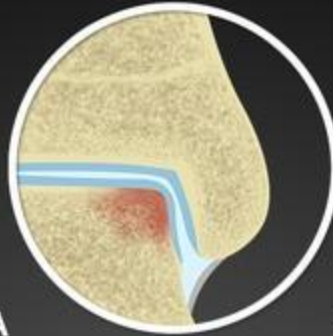




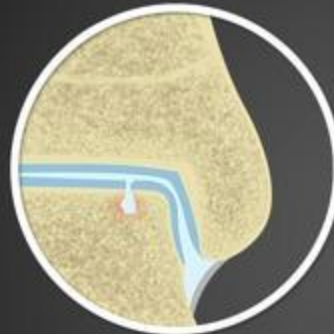
OSTEOCHONDRAL DEFECT

Medial talar dome

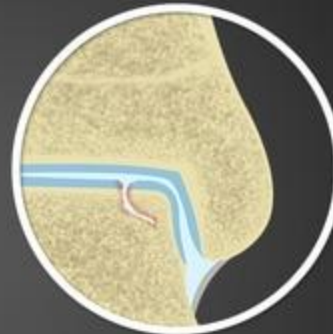
Stage 1



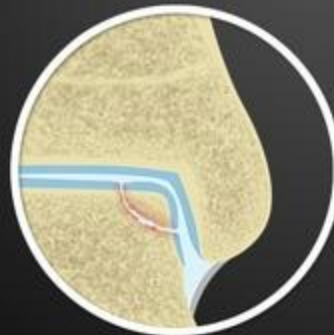
Stage 2A



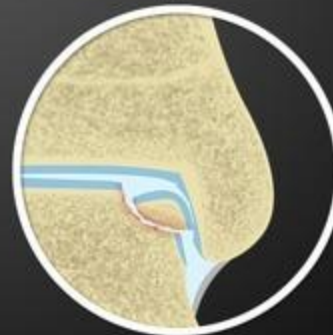
Stage 2B



Stage 3



Stage 4



M. Skalski



CASE 4: 36-YEAR-OLD FEMALE

Long distance runner

Heel pain





CALCANEAL STRESS FRACTURE

Low-risk stress fracture

WHERE ARE THE LOCATIONS FOR HIGH-RISK STRESS FRACTURES OF THE FOOT AND ANKLE?

Medial malleolus, talus, navicular, fifth metatarsal and medial
sesamoid under 1st metatarsal head

FEMALE LONG DISTANCE RUNNER

Persistent ankle pain and effusion

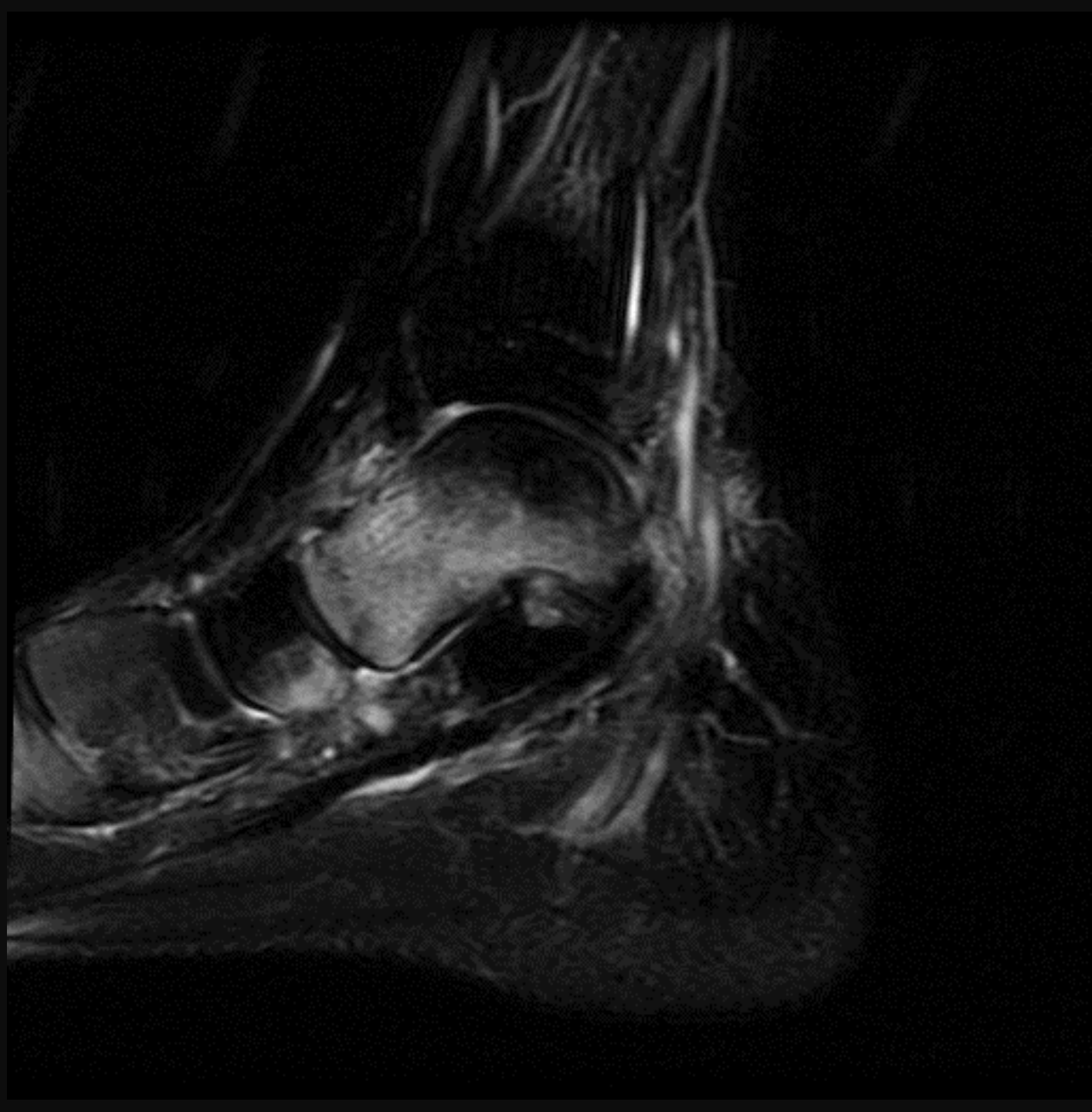
Negative conventional radiographs

Case courtesy of Dr. Terence Perrault.

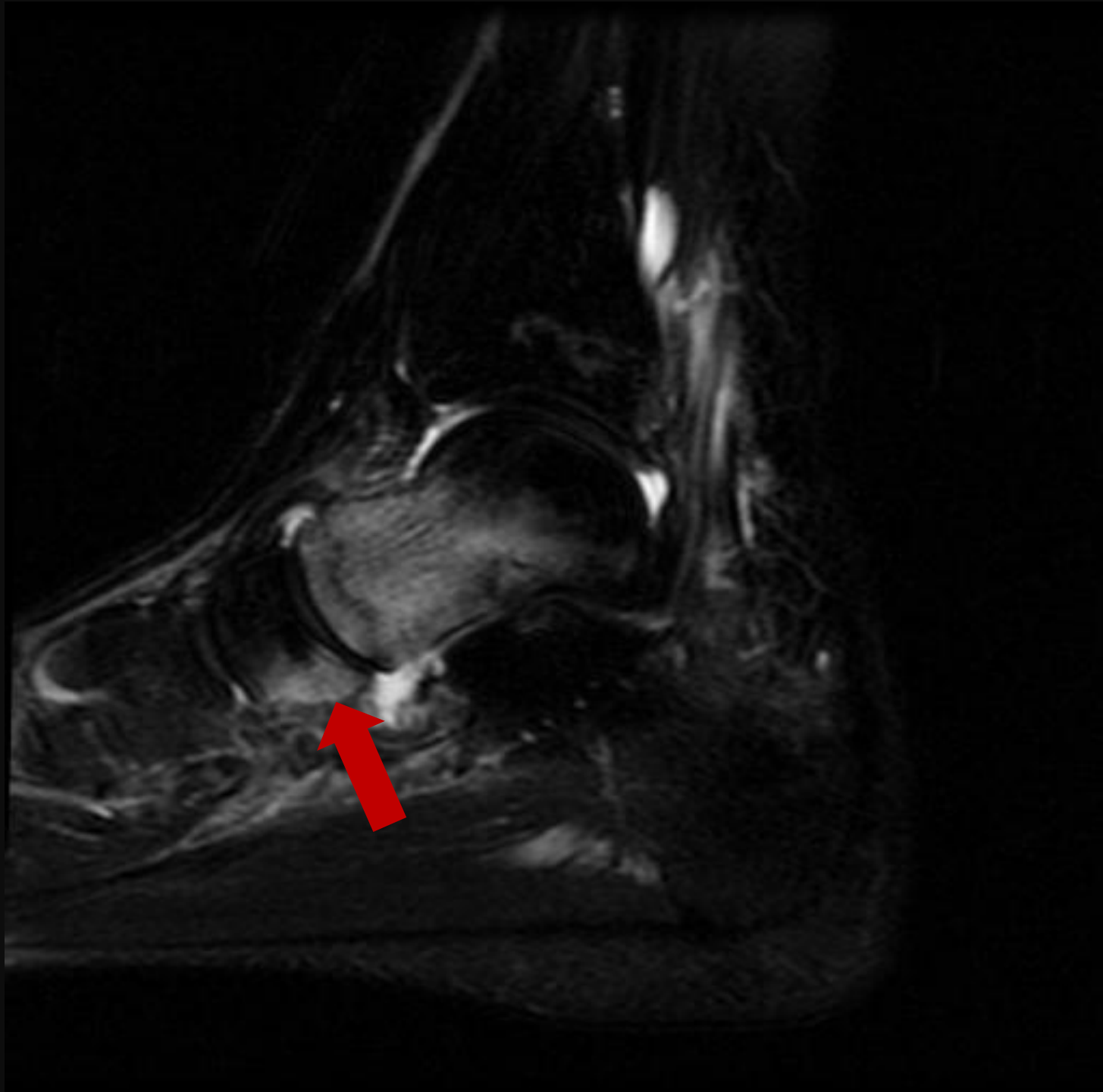
WHAT IS THE NEXT BEST IMAGING CHOICE?

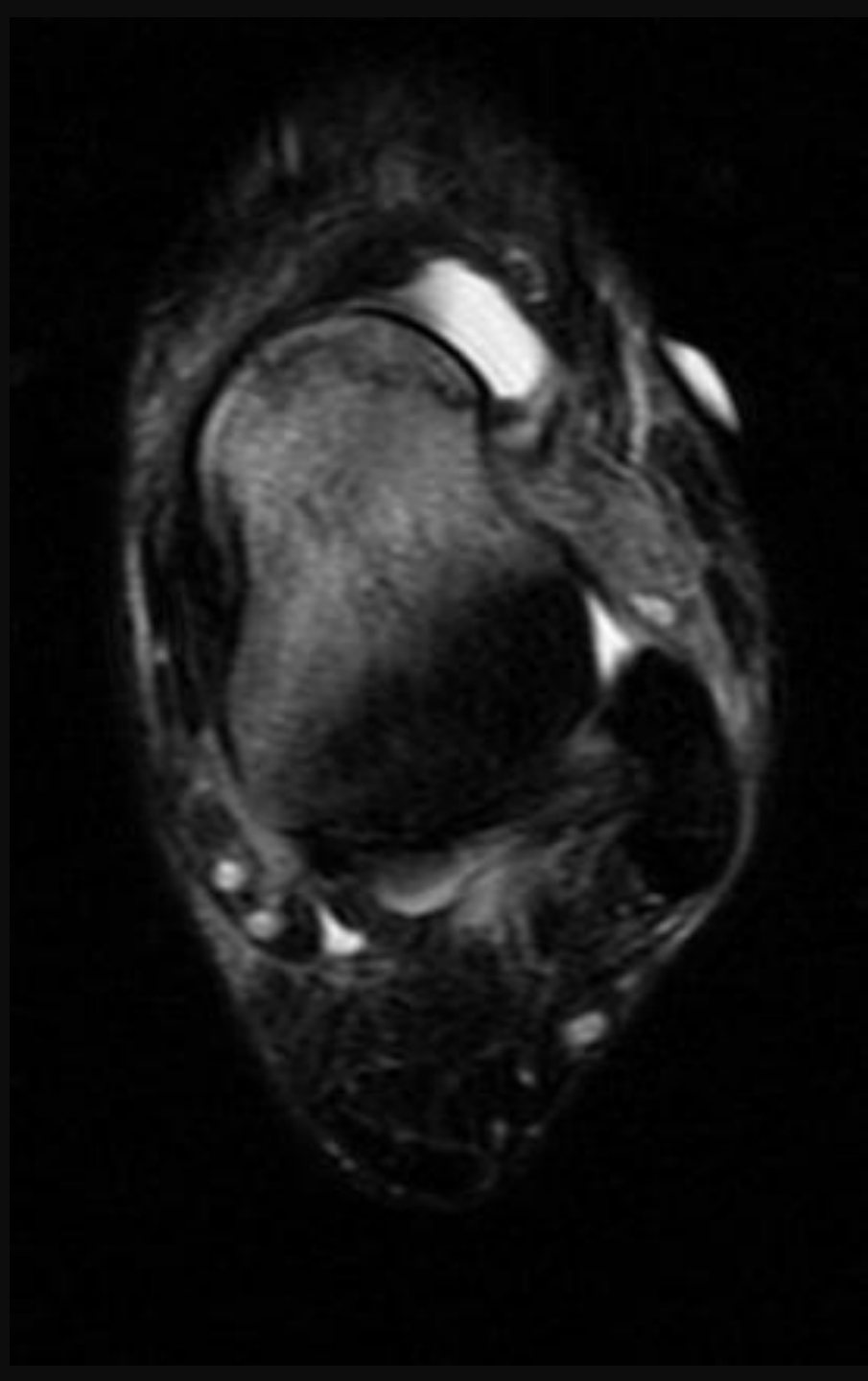
Magnetic resonance imaging











TALAR STRESS FRACTURE

Most common location in the talar head

Talar head injury was associated with
navicular stress injury

Fatigue versus Insufficiency?

CLINICAL PEARL

Earlier the diagnosis, the better the prognosis.

Late identification can be associated with protracted pain and disability and may predispose to non-union, particularly in fractures of hallux sesamoids, the mid-tibial shaft, base of fifth metatarsal, and tarsal navicular.

CASE 5: 28-YEAR-OLD FEMALE

Persistent traumatic wrist pain

Sudden onset while playing rugby 4-6 months ago. When tackling she landed on her wrist with her body weight and the other players body weight on it.

No x-rays performed





R

R







This is a lateral X-ray of the right wrist and forearm. The image shows the distal radius and ulna, the carpal bones, and the proximal metacarpals and phalanges. A small, dark, irregularly shaped object is visible near the base of the third metacarpal, which may represent a foreign body or a bone fragment. The surrounding soft tissue and joint spaces appear normal.

R

IMPRESSION

Triquetral fracture of body (delayed union)

Dorsal cortical fractures

- Most common (accounts for up to 93%)
- Mechanism includes avulsion, shearing force, or impaction

Body fractures

- Second most common

Palmar cortical fractures

- Mechanism includes avulsion or shearing force
- Risk of instability

IMAGING SELECTION

CT: obtain if high suspicion of triquetral fracture

MRI: recommended for palmar cortical fractures due to concern for carpal instability and obtain if concern for extrinsic intercarpal ligament injuries or occult fracture

CASE 6: 36-YEAR-OLD FEMALE

Non-traumatic left hip pain

Weakness of left hip abductor muscles

Palpable mass

Exam Description: XR HIP BILATERAL

HISTORY: 36-year-old female, curvature and pain

TECHNIQUE:

1. AP view the pelvis, frog leg view both hips

Prior study for review : 15 March 2011

FINDINGS:


Asymmetric transitional anatomy and some sclerosis about the lumbosacral junction to the right of midline. Stable.

No evident pelvic tilt. Normal round contour femoral heads and joint spaces are preserved.

Phleboliths right hemipelvis without other evidence soft tissue abnormality to this technique

IMPRESSION:

1. Asymmetric transitional anatomy lumbosacral junction but there is no pelvic tilt or arthropathy to explain the patient's limb length discrepancy, nonweightbearing examination however



There is a large soft-tissue mass most likely involving the abductor musculature.

The soft-tissue mass is uniform in density without evidence of calcification.

Osseous structure are normal.

An incidental lumbosacral transitional vertebra is seen.

There is a large soft-tissue mass most likely involving the abductor musculature.

The soft-tissue mass is uniform in density without evidence of calcification.



Radiographic normal
right frog-leg view.



WHAT IS THE DIAGNOSTIC IMPRESSION?

Large soft tissue mass of abductor musculature, lesions range from nonneoplastic conditions to benign and malignant tumors.

RECOMMENDATION

Magnetic resonance imaging with and without contrast is the modality of choice for the evaluation of soft-tissue masses.

WHAT ARE THE TWO MOST COMMON SOFT TISSUE SARCOMAS IN ADULTS?

undifferentiated pleomorphic sarcoma (malignant fibrous
histiocyoma): commonest type of soft tissue sarcoma

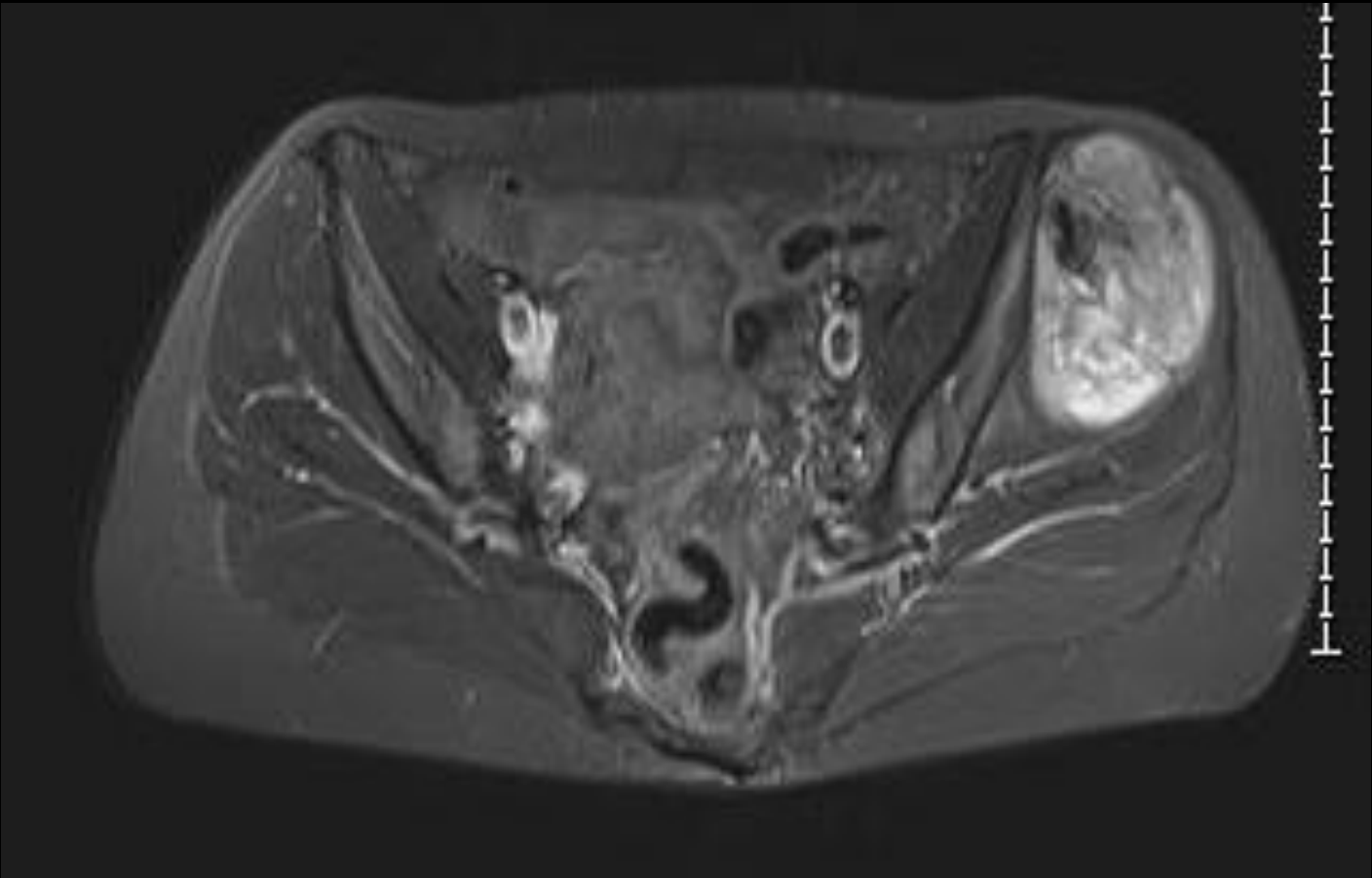
liposarcoma: second most common type

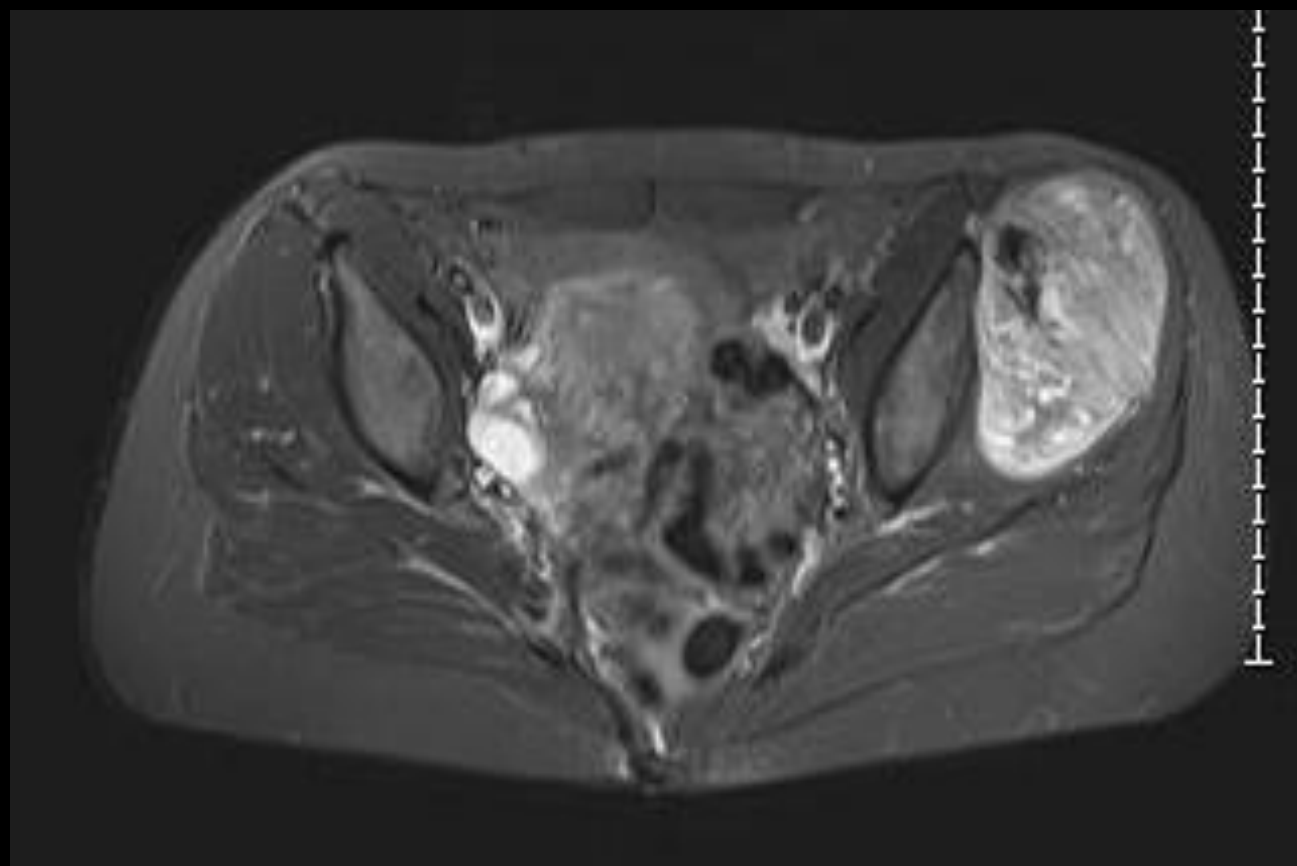
SELECTED IMAGES

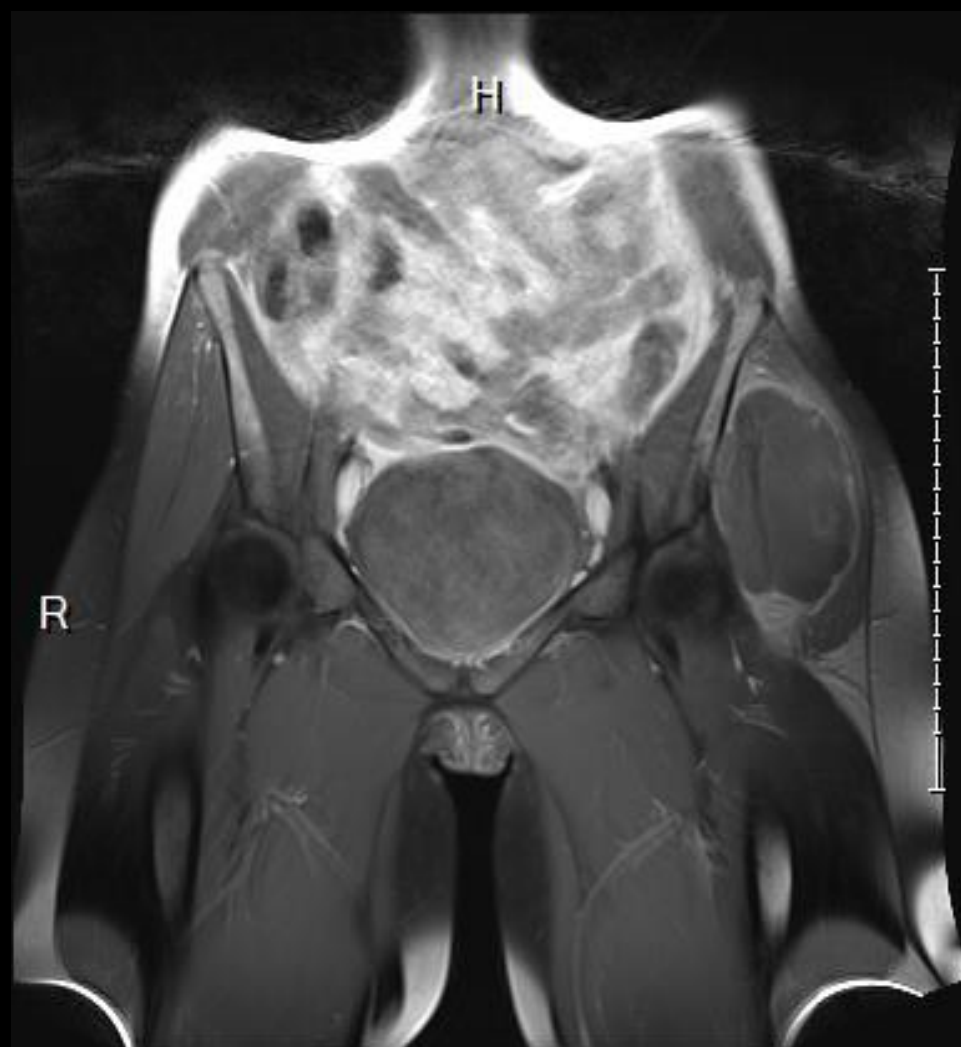
Magnetic Resonance Imaging w/ and w/out contrast





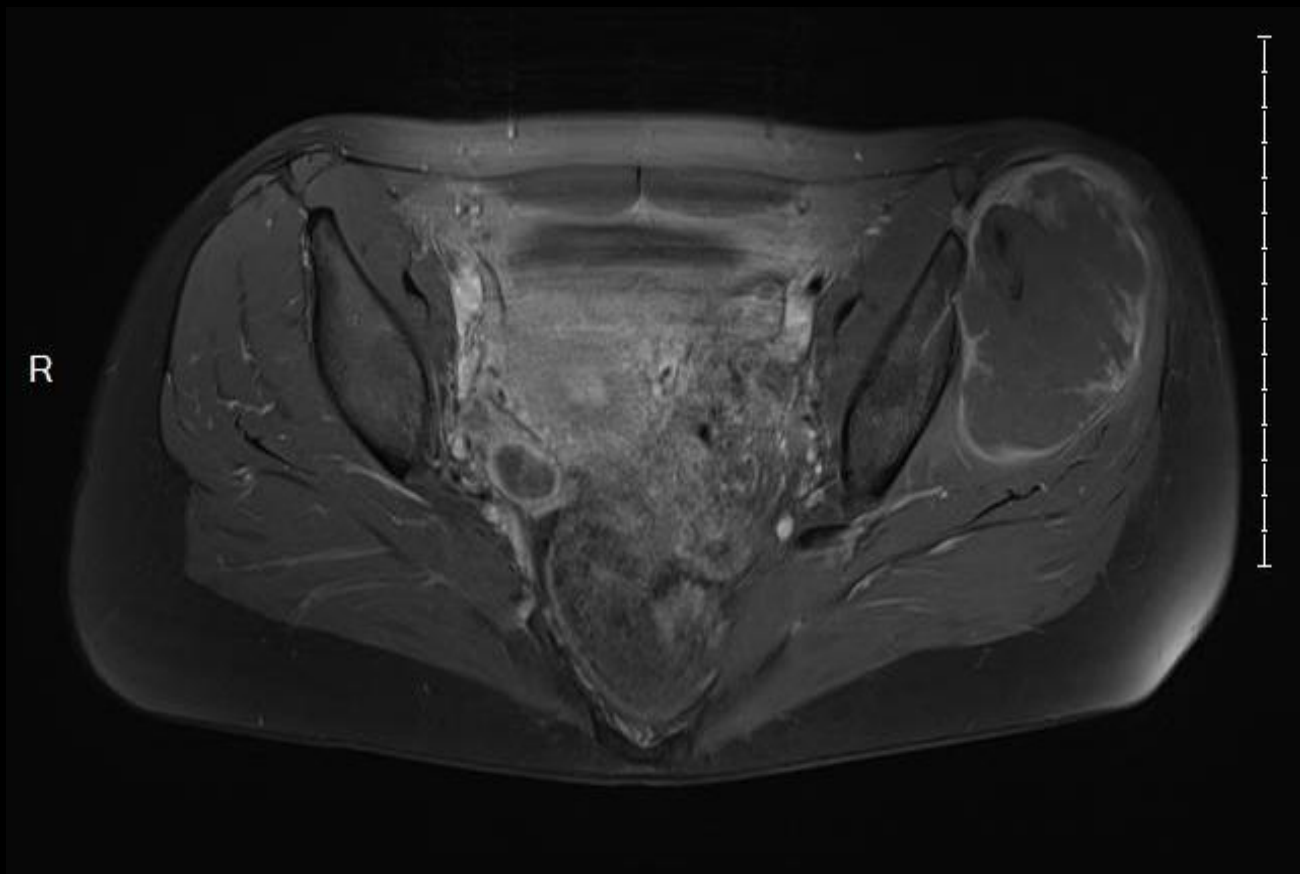












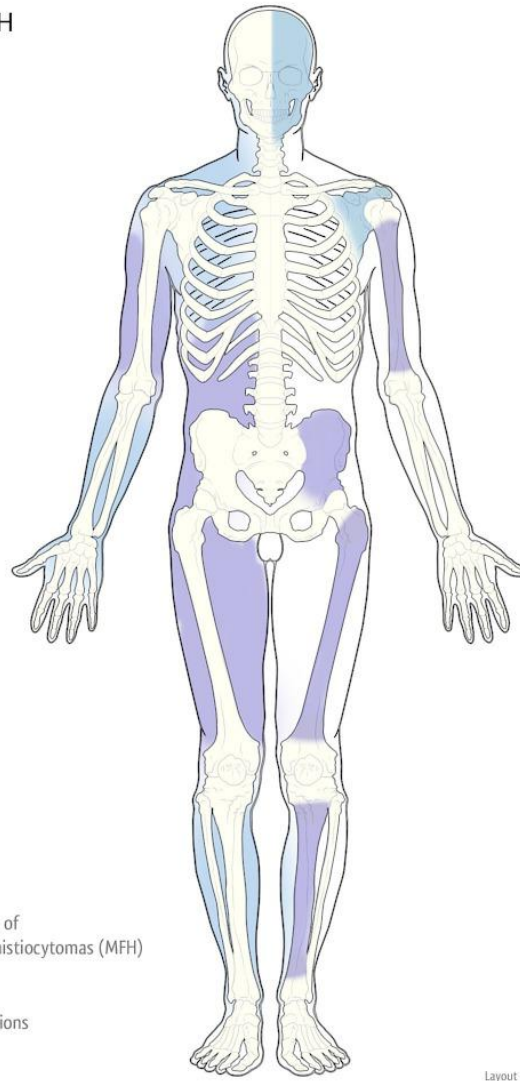
RECOMMENDATION

Referral to a multi-discipline clinic that specializes in bone and soft tissue tumors for further work-up and management.

Please note: The team will consist of oncologists, orthopedic oncology surgeons, musculoskeletal radiologists, radiation oncologists, surgical oncologists, and bone/soft tissue pathologists.

Soft tissue MFH

Bone MFH



Typical distribution of
Malignant fibrous histiocytomas (MFH)



Less common locations

Layout and distribution: Frank Gaillard 2009
Line drawing of skeleton: Patrick Lynch 2006
Radiopaedia.org Creative Commons NC-SA-BY



CLINICIAN BEWARE

This case reinforces how important it is to look at your patient's imaging studies and not just rely on the radiologist report.

What went wrong? inaccurate/misinterpreted

PERCEPTUAL ERRORS

abnormality is simply not seen

Accounts for up to 80% of radiologic errors

MOST CHALLENGING: CASES 1-6



Identify pertinent positive findings.

Provide diagnosis or short DDX.

Indicate if additional imaging should be ordered.



CASE 1: 12-YEAR-OLD FEMALE

Acute low back pain

2 traumatic incidents within one week

Both incidents involved axial MOI (first incident involved a fall from high bar, and the other incident involved having a chair pulled out from under her with direct impact onto buttocks)



R

weight-bearing

R



recumbent



CASE 2: 15-YEAR-OLD MALE

Status post trauma

Radiology report provided

Right ankle, 3 views.

Indication: Ankle injury and pain.

Impression: The distal tibial and fibular physes are prominent. These may be normal for the patient however Salter I injuries cannot be excluded. Otherwise, no definite fracture or dislocation. There is mild soft tissue swelling about the lateral malleolus. Comparison to the contralateral ankle may be helpful for further evaluation.

Impression: Questionable Salter I injuries of the distal tibia and fibula.

table

R
TSG







R
120

X-Table

CASE 3: 25-YEAR-OLD FEMALE

Tripped over cat 3 days ago

Inverted ankle and heard a “pop”

Pain sharp and was unable to bear weight at time of
injury

Edema on lateral aspect of foot

Placed in CAM boot at urgent care



L

□



L

□

L



CASE 4: 25-YEAR-OLD MALE

Left ankle pain

Palpatory pain over medial side of mortise joint

Pain with dorsiflexion and plantar flexion

8 months ago, severe inversion ankle sprain which was swollen for 3 months

History of multiple sprains before but they did not last as long or stay swollen for the same duration.

No NTW in the region. No clicking/popping. No constitutional Sx.





□

L



CASE 5: 38-YEAR-OLD FEMALE

Mountain biking accident

Blunt trauma to shoulder

Lateral shoulder pain

Diminished/painful abduction

Initial radiographic examination was inconclusive

REPEAT RADIOGRAPHIC EXAMINATION

AP external

AP internal

True glenoid AP (Grashey)



R



R



CASE 6: 21-YEAR-OLD MALE

Presents with left shoulder pain

Suspected rotator cuff injury









REVIEW OF MOST CHALLENGING



DIFFICULTY

CASE 1: 12-YEAR-OLD FEMALE

Acute low back pain

2 traumatic incidents within one week

Both incidents involved axial MOI (first incident involved a fall from high bar, and the other incident involved having a chair pulled out from under her with direct impact onto buttocks)



R
weight-bearing

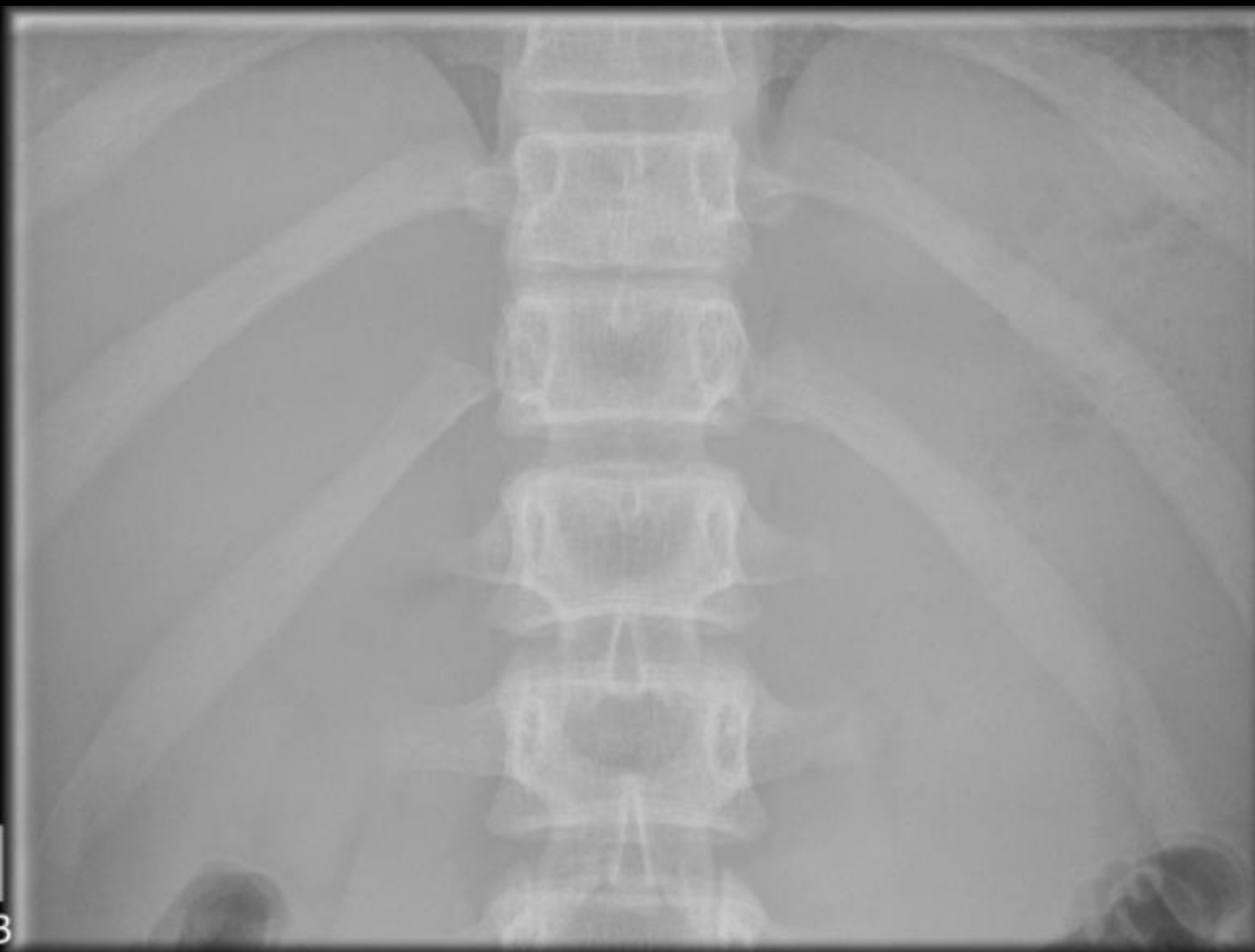
NGS

R





NGS




R

NWB

What are the most significant findings?





What are the most significant findings?

T11-T12 disc space narrowing

Disruption of the
anteroinferior inferior
endplate of T11

If the patient didn't have a
history of an acute traumatic
incident, what would be the
most significant diagnostic
consideration?

Infectious spondylodiscitis



NWB

TRAUMATIC SCHMORL NODE

End-plate fracture

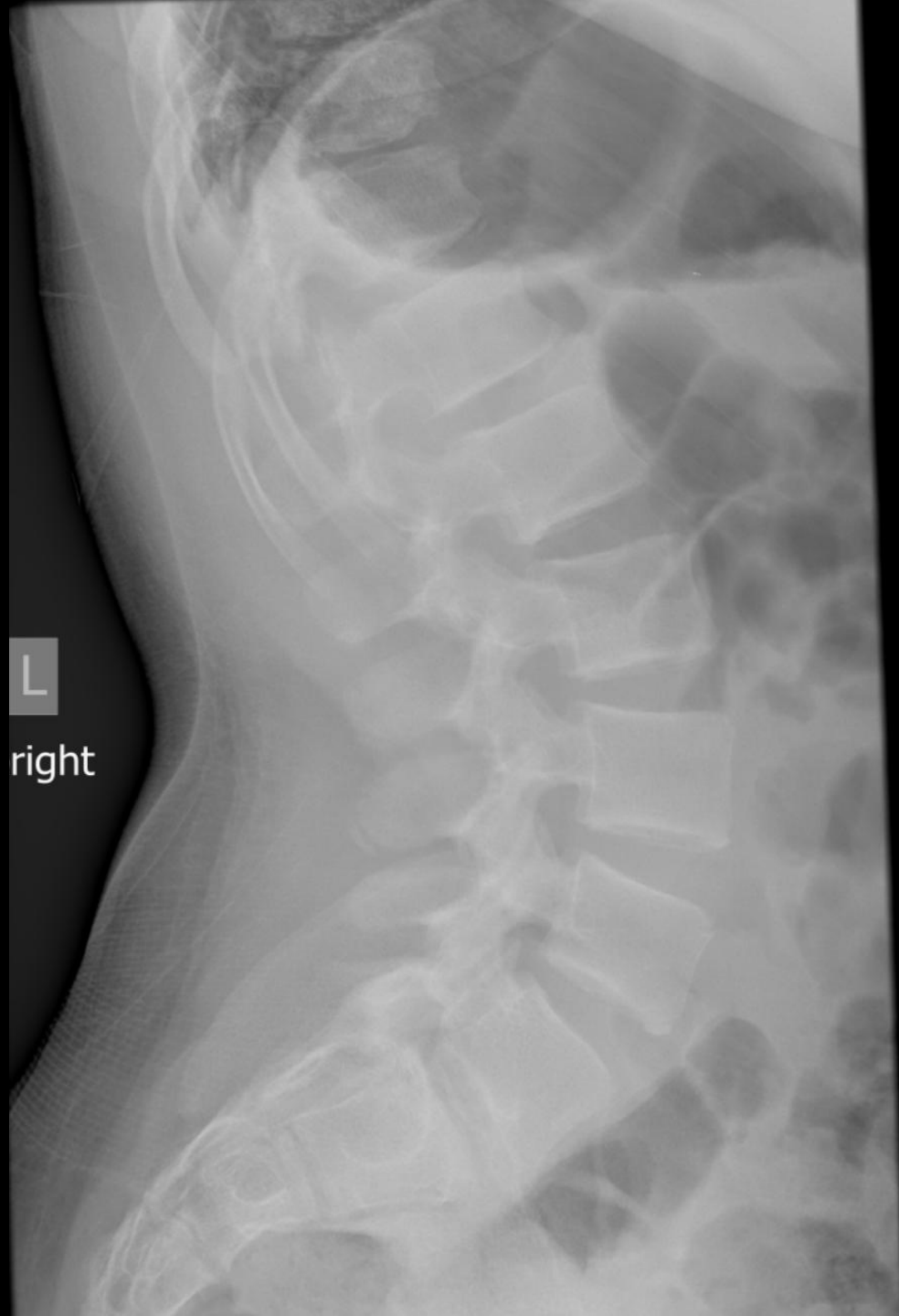
14-YEAR-OLD FEMALE

Gymnast

Sudden onset after falling off bars during routine and landing on buttocks in a flexed position yesterday evening.

Felt the pain immediately, diffuse to entire upper lumbar region - hard to tell if midline or more bilateral.

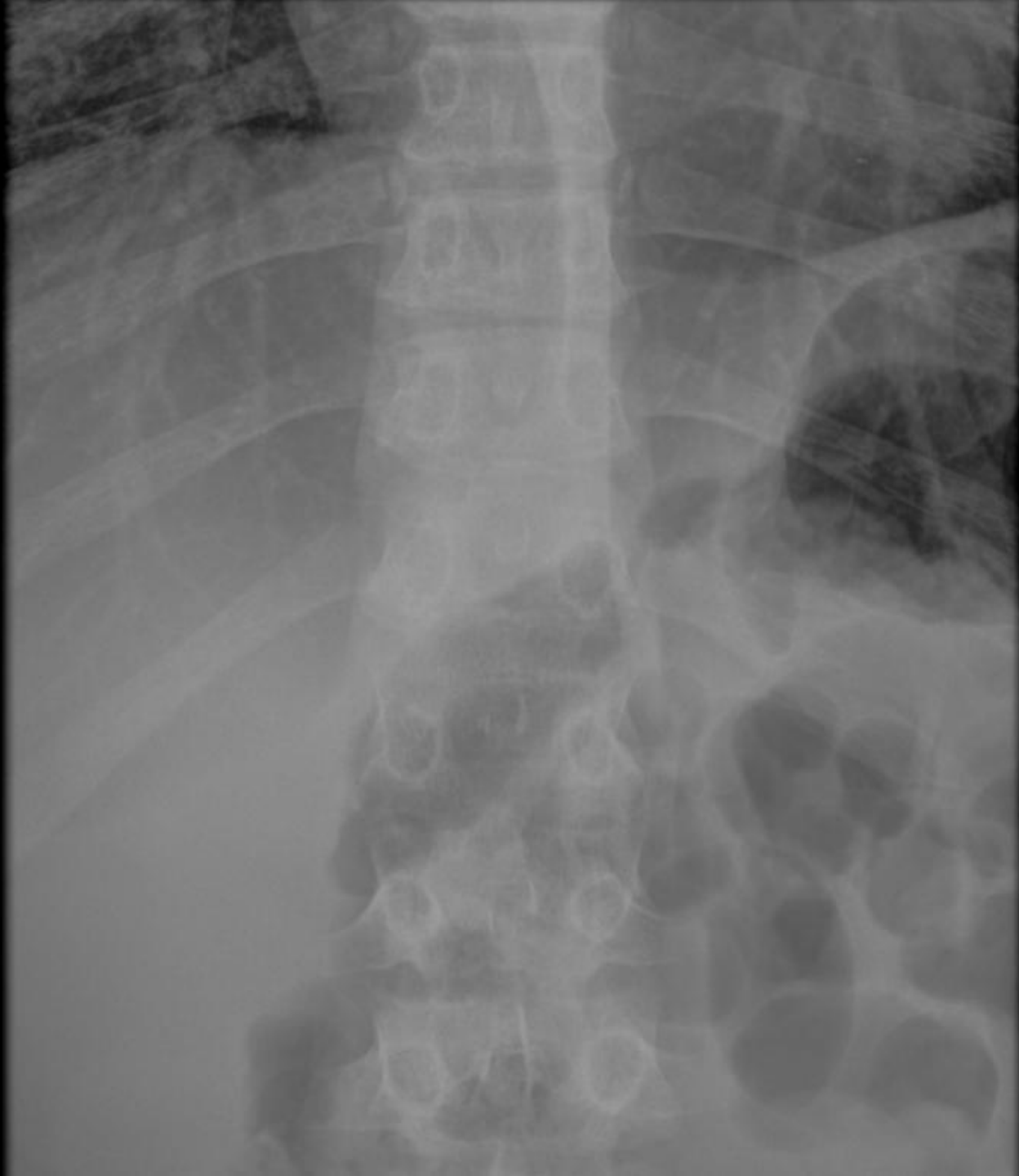
Could not finish gymnastics practice, iced and took it easy for the rest of the evening.



L

right





L

CLINICIAN BEWARE

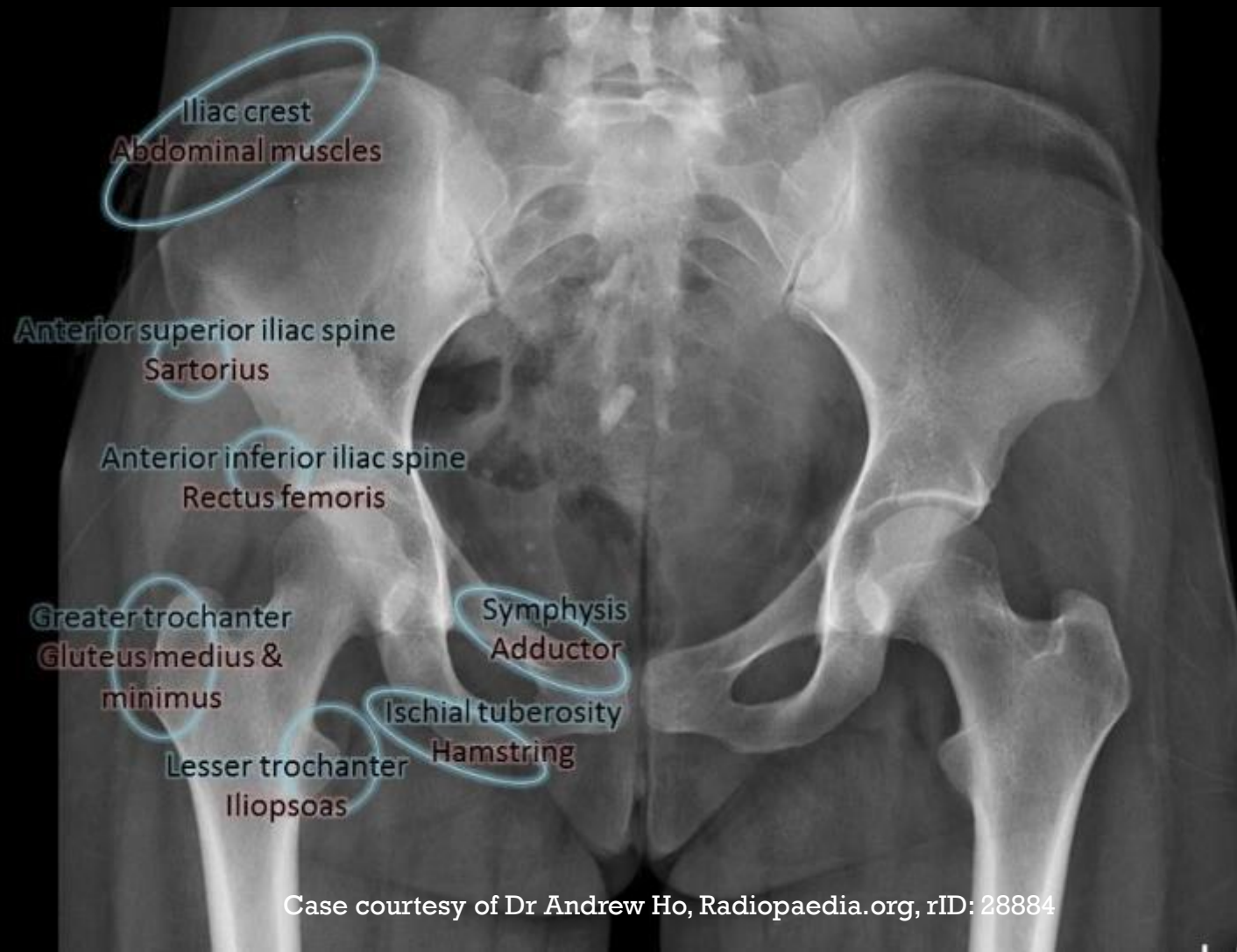
If a patient with a history of axial load trauma presents with persistent low back pain and unremarkable imaging at the time of trauma, consider the possibility of a Schmorl's node

IMAGING SELECTION

Plain radiography of the thoracolumbar spine may be sufficient for the diagnosis, but MRI is more sensitive and can help guide further treatment since it is able to differentiate between symptomatic and asymptomatic SNs.

CLINICAL PEARL

Kids don't sprain they break.



10-YEAR-OLD FEMALE

Chronic ischial tuberosity pain (6 months)

Gymnast



R



ISCHIAL APOPHYSITIS

Associated with avulsion of the common hamstring tendon

The ischial apophyses starts to ossify between the ages of 14 and 16 years and fully fuses by age 18.

Ischial apophysitis is caused by repetitive microtrauma to the ischial tuberosity and by contraction of the hamstring tendons.

15-YEAR-OLD FEMALE

Iliac bone pain in volleyball player



L

NWB



L

NWB

□

ILIAC CREST APOPHYSITIS

Occurs in skeletally immature patients between the ages of 12 and 18.

Higher risk for those with “tight” hip and thigh muscles.

A slightly swollen, warm and tender area along the iliac crest.

Pain with activity especially running, jumping, kicking, and twisting, such as that seen with batting or pitching in baseball.

Usually starts slowly and gradually worsens.

CASE 2: 15-YEAR-OLD MALE

Status post trauma

Radiology report provided

Right ankle, 3 views.

Indication: Ankle injury and pain.

Impression: The distal tibial and fibular physes are prominent. These may be normal for the patient however Salter I injuries cannot be excluded. Otherwise, no definite fracture or dislocation. There is mild soft tissue swelling about the lateral malleolus. Comparison to the contralateral ankle may be helpful for further evaluation.

Impression: Questionable Salter I injuries of the distal tibia and fibula.

table

R
TSG



R
TSG



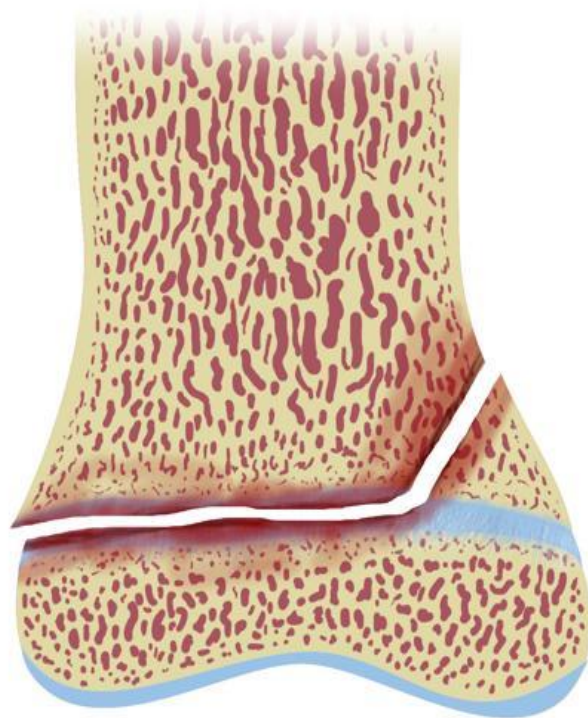




R
120

X-Table

type 2



Drawing courtesy of Dr Matt Skalski, Radiopaedia.org, rID: 27144

8 DAYS LATER...



TYPE II SALTER-HARRIS FRACTURE

- ~ 75% (by far the most common)
- fracture passes across most of the growth plate and up through the metaphysis
- good prognosis
- complications are uncommon
- non-weight bearing cast immobilization

CLINICAL PEARL

Kids don't sprain they break.

CASE 3: 25-YEAR-OLD FEMALE

Tripped over cat 3 days ago

Inverted ankle and heard a “pop”

Pain sharp and was unable to bear weight at time of
injury

Edema on lateral aspect of foot

Placed in CAM boot at urgent care



□



L

□

L



PLAN

- Instructed to continue use of CAM boot
- Advised to wear a compression sock underneath CAM boot (remove while sleeping)
- Advised to elevate foot
- Infrared Class Four (4) laser therapy
- 3x week for 2 weeks
- KT will be added as indicated

10 DAYS LATER

Follow-up radiographic examination

Pain focused mid-tarsal region

WHAT IS THE IMPORTANCE OF THE LISFRANC LIGAMENT?

Lisfranc ligament attaches the medial cuneiform to the 2nd metatarsal base

Key transverse stabilizer of the foot

Crucial to the stability of the Lisfranc joint









□

L

□





Spot View



MAGNETIC RESONANCE IMAGING

Selected images



Nondisplaced
fracture of base of
2nd metatarsal

Lisfranc joint
congruent and
ligament is intact.

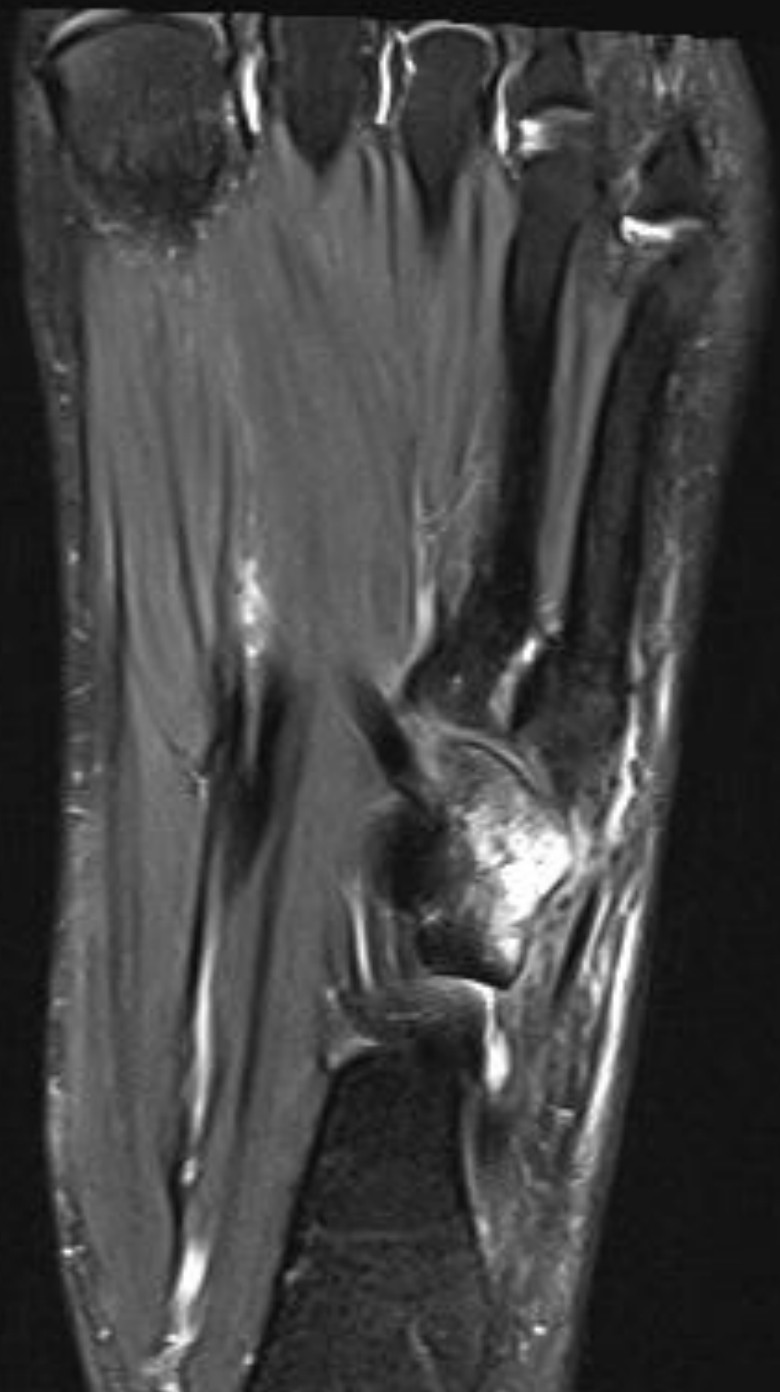
Nondisplaced
fracture of base of
3rd metatarsal

Nondisplaced
fracture of
plantar-medial
aspect of medial
cuneiform



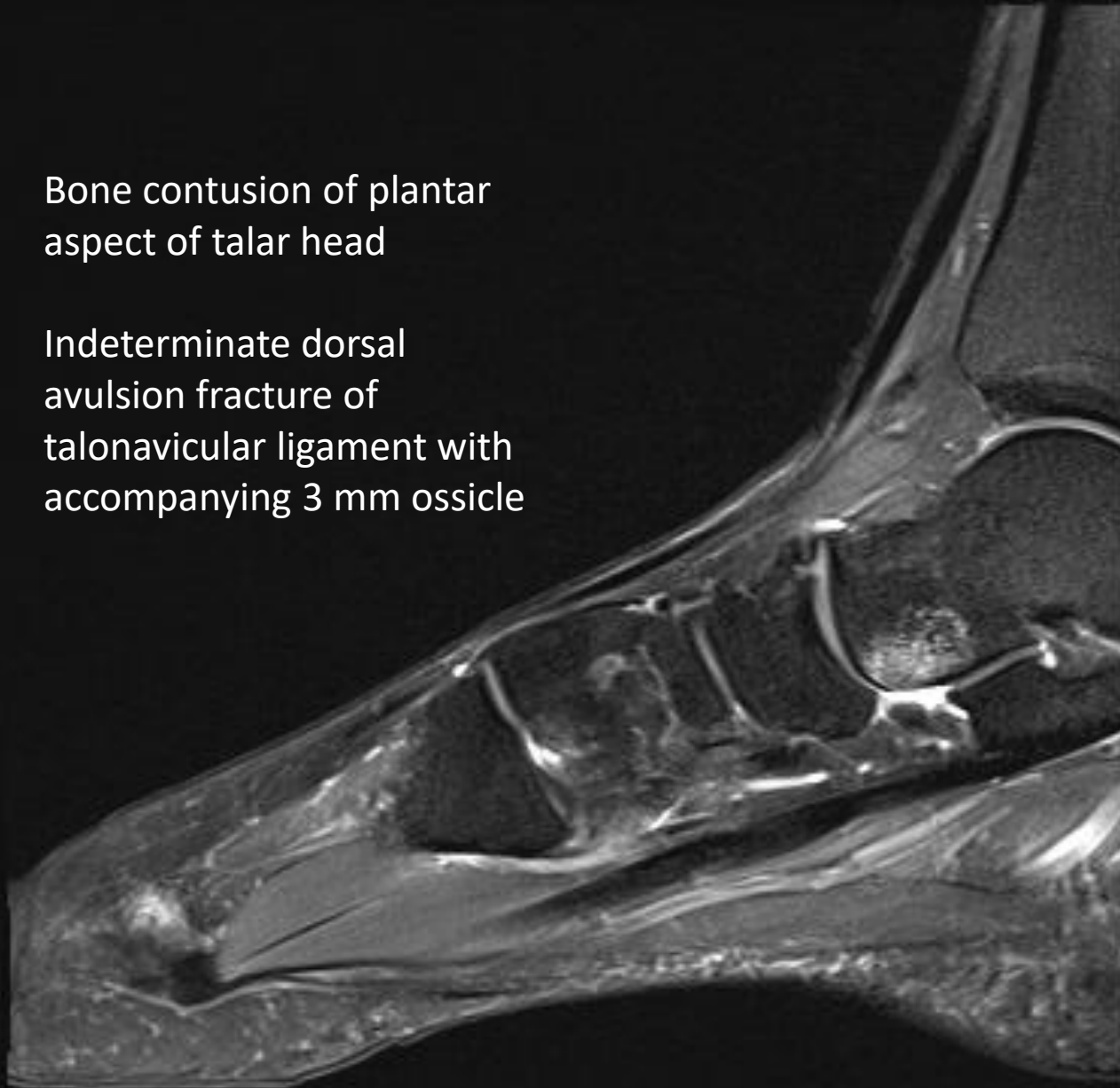
Minimally impacted fracture
of distal-lateral aspect of
cuboid





Bone contusion of plantar
aspect of talar head

Indeterminate dorsal
avulsion fracture of
talonavicular ligament with
accompanying 3 mm ossicle



WHAT MODALITY IS THE MOST SENSITIVE FOR DETECTION OF STRESS FRACTURE?

Magnetic Resonance Imaging is the most sensitive modality for diagnosis of a stress fracture and is an important tool to distinguish high and low-risk fractures

CASE 4: 25-YEAR-OLD MALE

Left ankle pain

Palpatory pain over medial side of mortise joint

Pain with dorsiflexion and plantar flexion

8 months ago, severe inversion ankle sprain which was swollen for 3 months

History of multiple sprains before but they did not last as long or stay swollen for the same duration.

No NTW in the region. No clicking/popping. No constitutional Sx.

A lucent lesion at medial corner of the talar dome, suggestive of an osteochondral lesion.



A lucent lesion at medial corner of the talar dome, suggestive of an osteochondral lesion.



□

L



**WHAT ADDITIONAL VIEWS
MAY BE HELPFUL IN
ESTABLISHING AN
ACCURATE DIAGNOSIS?**

Plantar flexion views

Ossific loose
body, anterior
recess.



plantarflexed



plantarflexed



L

partial
plantarflexion

SUMMARY OF OSTEOCHONDRAL LESIONS OF TALUS

- Focal injuries to the talar dome with variable involvement of the subchondral bone and cartilage which may be caused by a traumatic event or repetitive microtrauma.
- Diagnosis can be made with ankle radiographs.
- MRI studies are helpful in determining the size of the lesion, the extent of bony edema, and identify unstable lesions.
- Treatment can be nonoperative or operative depending on patient age, patient activity demands, lesion size, and stability of lesion.

FOLLOW-UP

Patient surgical repair of osteochondral defect
repair, removal of loose body, lateral ligament
repair, syndesmosis repair, ganglion cyst excision

50-YEAR-OLD FEMALE

Remote history of ankle trauma

Chronic ankle pain/swelling

R









CHRONIC OSTEOCHONDRAL FRACTURE

instability of the osteochondral fragment

secondary degeneration of the joint

orthopedic surgical consult advised

CLINICAL PEARL

MRI is indicated in patients with ankle sprains that do not heal with time.

CASE 5: 38-YEAR-OLD FEMALE

Mountain biking accident

Blunt trauma to shoulder

Lateral shoulder pain

Diminished/painful abduction

Initial radiographic examination was inconclusive

REPEAT RADIOGRAPHIC EXAMINATION

AP external

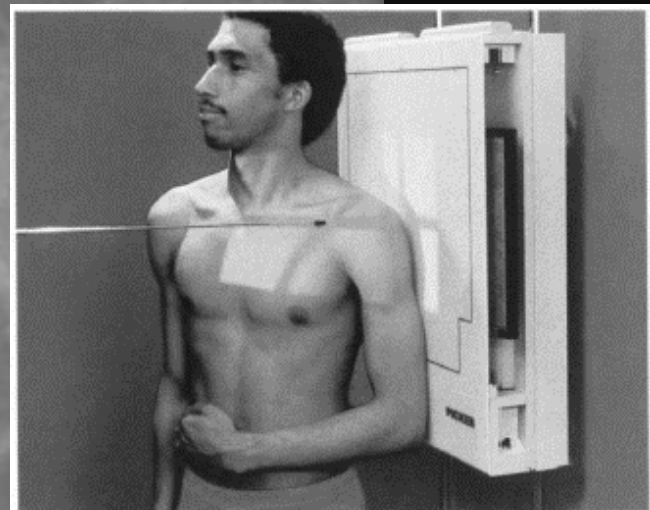
AP internal

True glenoid AP (Grashey)



R





ISOLATED FRACTURE OF GREATER TUBEROSITY

20% of all proximal humeral fractures

Diagnosis frequently missed on plain film

Poor clinical outcome if not detected

Treatment guided by amount of displacement

(up to 60% initially missed)

67-YEAR-OLD FEMALE

Traumatic shoulder pain

Fall while hiking

Limited mobility



H





FOLLOW-UP IMAGES

Conservative management

Short period of sling immobilization (2 weeks)

Followed by passive ROM

Active ROM started at approx. 6 weeks







39-YEAR-OLD MALE

Playing in a championship baseball game 2 days ago, he fell forward while running full speed, caught himself with his R arm

He can't lift his injured shoulder.

He didn't sleep at all the first night after the injury and had to sit up all night d/t throbbing pain lying down.

Initial radiographs at urgent care interpreted as negative for fracture

R



R



R

2/2



CLINICAL PEARL

Poor clinical outcome if not detected

Treatment guided by amount of displacement

Up to 60% initially missed

CASE 6: 21-YEAR-OLD MALE

Presents with left shoulder pain

Suspected rotator cuff injury







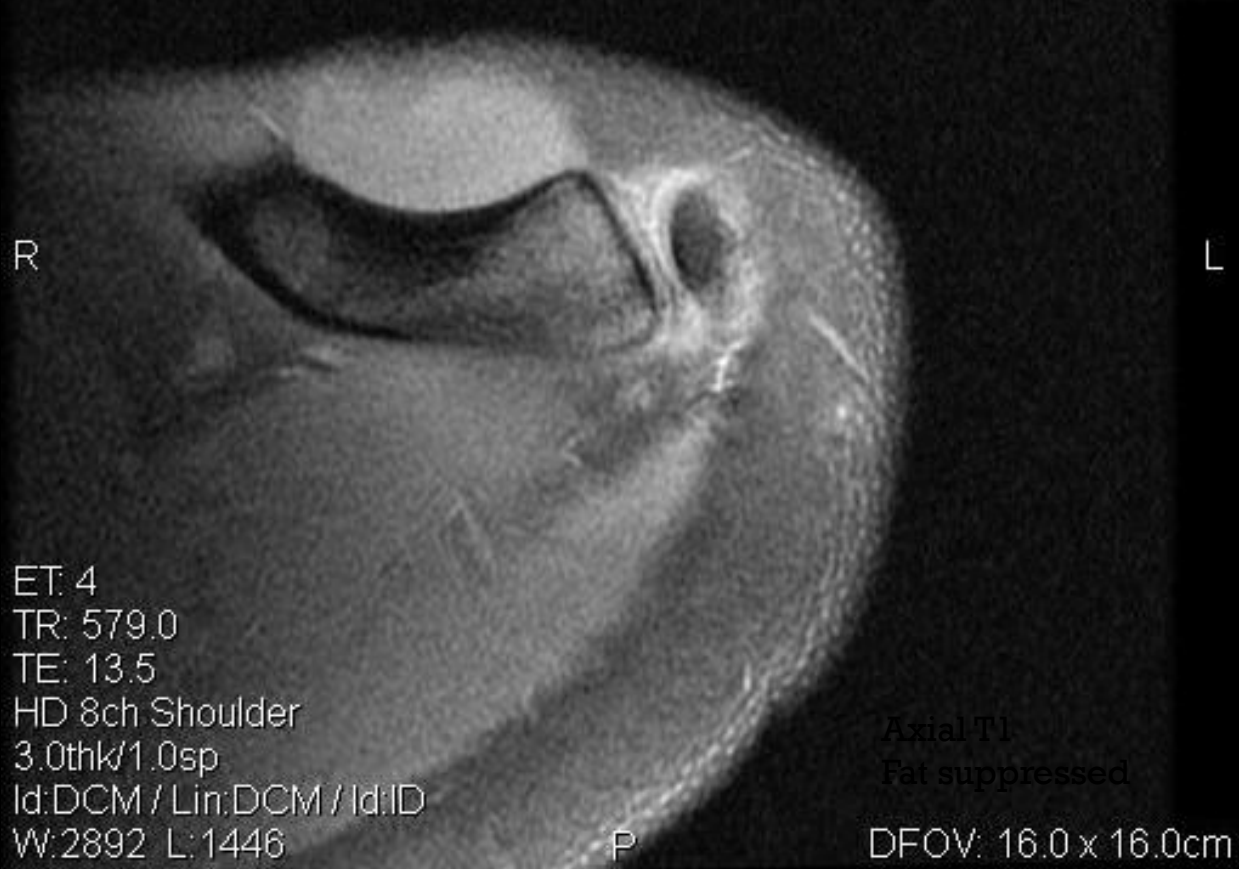
REFERRAL FOR MR ARTHROGRAM

Radiographic findings suggested primary synovial
chondrometaplasia

Se: 4/9
Im: 3/24
Ax: H41.3

2015 Sep 08
Acq Tm: 08:15:35

288 x 224



Se: 4/9
Im: 10/24
Ax: H13.3

2015 Sep 08
Acq Tm: 08:15:35

288 x 224

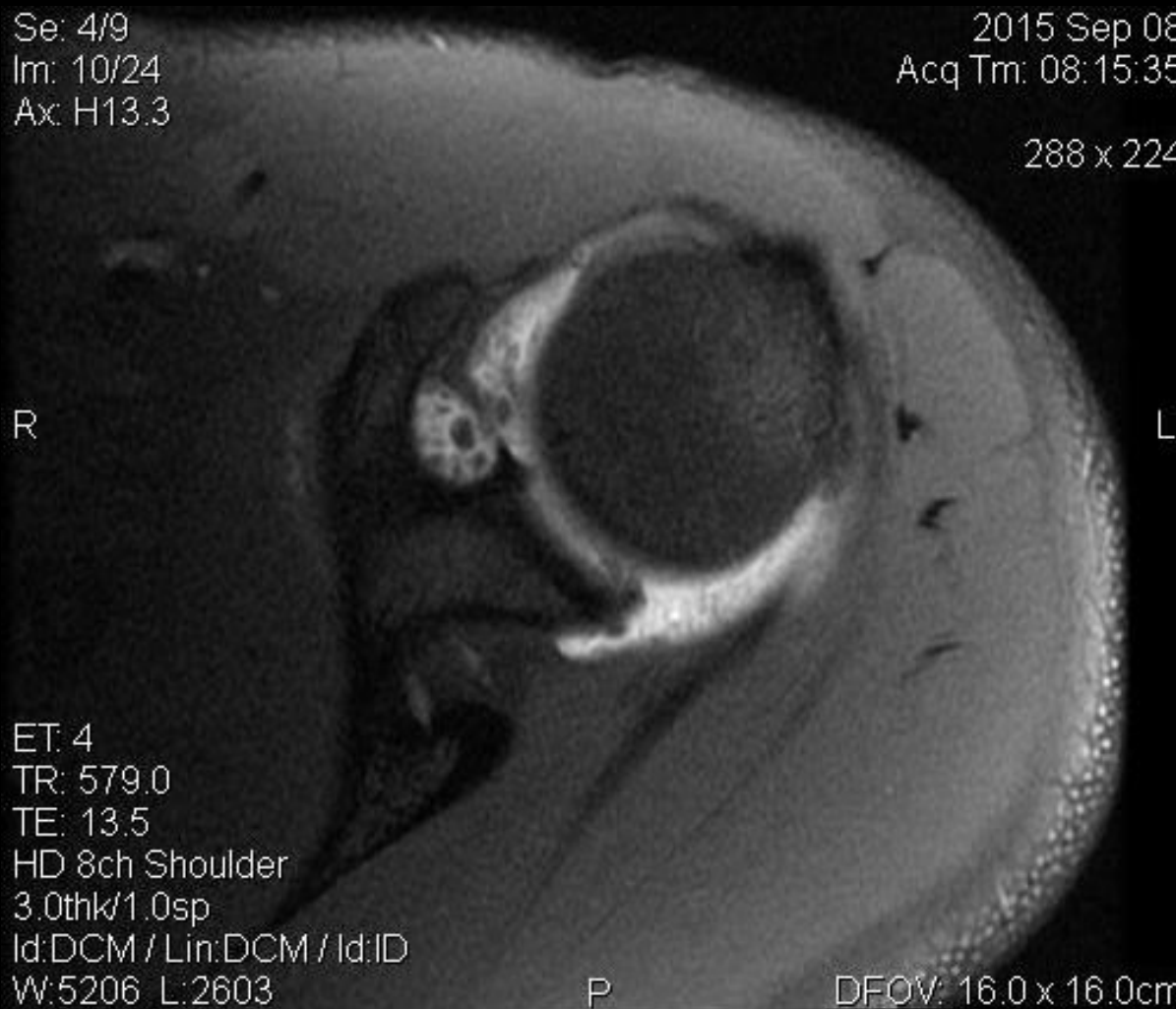
R

L

ET: 4
TR: 579.0
TE: 13.5
HD 8ch Shoulder
3.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:5206 L:2603

P

DFOV: 16.0 x 16.0cm



Se: 4/9
Im: 11/24
Ax: H9.3

2015 Sep 08
Acq Tm: 08:15:35

288 x 224

R

L

ET: 4
TR: 579.0
TE: 13.5
HD 8ch Shoulder
3.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:5782 L:2891

P

DFOV: 16.0 x 16.0cm



Se: 4/9
Im: 13/24
Ax: H1.3

2015 Sep 08
Acq Tm: 08:15:35

288 x 224

R

L

ET: 4
TR: 579.0
TE: 13.5
HD 8ch Shoulder
3.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:7082 L:3541

P

DFOV: 16.0 x 16.0cm



Se: 4/9
Im: 18/24
Ax: F18.7

2015 Sep 08
Acq Tm: 08:15:35

288 x 224

R

L

ET: 4
TR: 579.0
TE: 13.5
HD 8ch Shoulder
3.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:10832 L:5416

P

DFOV: 16.0 x 16.0cm

Se: 5/9
Im: 5/20
Sag: L111.4 (CO)

2015 Sep 08
Acq Tm: 08:19:39

256 x 256

Coronal T1
Fat suppressed

A_r

P_r

ET: 4
TR: 7040
TE: 127
HD Soft Shoulder
3.0mm/1.0mm
Id: DC M / Lin: DC M / Id: ID
W: 3703 L: 1854

F

DFOV: 16.0 x 16.0cm

Se: 59
Im: 9/20
Sag: L124.2 (C0)

2015 Sep 08
Acq Tm: 08:19:39

256 x 256

A_x

P_x

ET: 4
TR: 704.0
TE: 12.7
HD 8ch Shoulder
3.0mm/1.0sp
k:DCM / Lr:DCM / k:ID
W:3943 L:1971

F

DFOV: 16.0 x 16.0cm

Se: 59
Im: 15/20
Sag: L143.3 (C01)

2015 Sep 08
Acq Tm: 03:19:39

256 x 256

A₁

P₁

ET: 4
TR: 704.0
TE: 12.7
HD 8ch Shoulder
3D blk/1 Dsp
k:DCM / Lin:DCM / k:ID
W:4517 L:2408

F

DFOV: 16.0 x 16.0cm



Se: 59
In: 16/20
Sag: L146.5 (C01)

2015 Sep 03
Acq Tm: 03:19:39

256 x 256

A_r

P_r

ET: 4
TR: 704.0
TE: 12.7
HD 8ch Shoulder
3.0mm/1.0sp
k:DCM / Lh:DCM / k:ID
W:4803 L:2404

F

DFOV: 16.0 x 16.0cm

C: 1CC OMNISCAN
Ser: 6/9
Im: 6/20
Sag: L114.7 (COI)

Acc: 1793563
2015 Sep 08
Acq Tm: 08:23:21

320 x 256

A_L

P_R

ET: 16
TR: 3788.0
TE: 66.6
HD 8ch Shoulder
3.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:5733 L:2866

F

DFOV: 16.0 x 16.0cm

Se: 6/9
Im: 9/20
Sag: L124.3 (COI)

2015 Sep 08
Acq Tm: 08:23:21

320 x 256

A_L

P_R

ET: 16
TR: 3788.0
TE: 66.6
HD18ch Shoulder
3.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:6279 L:3139

F

DFOV: 16.0 x 16.0cm

Se: 6/9
Im: 10/20
Sag: L127.4 (COL)

2015 Sep 08
Acq Tm: 08:23:21

320 x 256

A_L

P_R

ET: 16
TR: 3788.0
TE: 66.6
HD 8ch Shoulder
3.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:5332 L:2666

F

DFOV: 16.0 x 16.0cm

Se: 6/9
Im: 18/20
Sag: L153.0 (COI)

2015 Sep 08
Acq Tm: 08:23:21

320 x 256

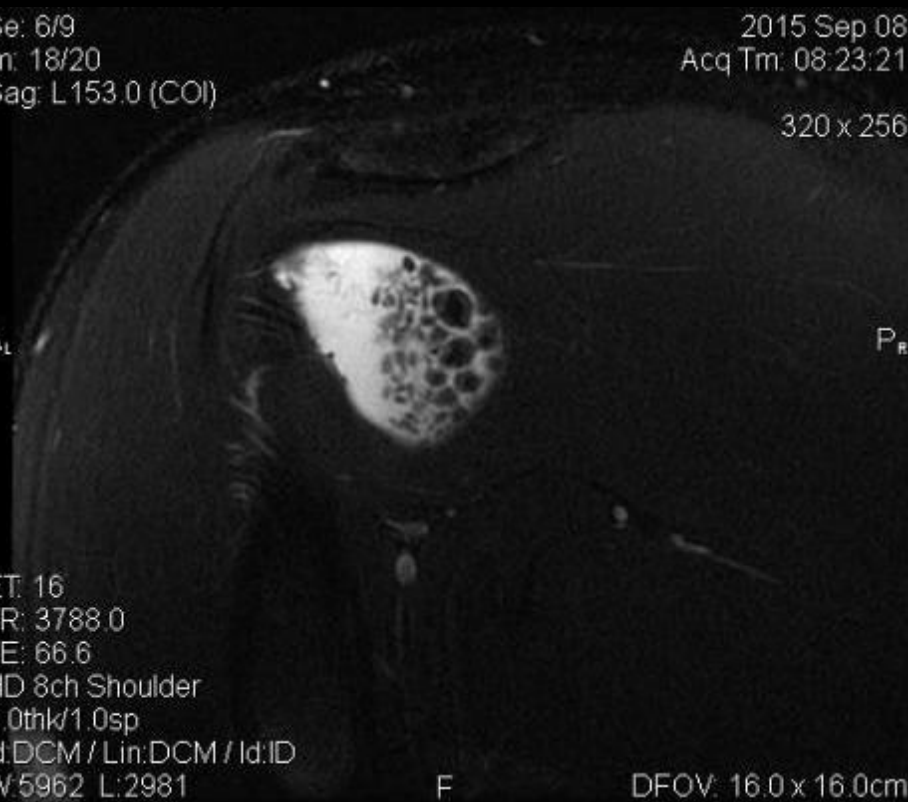
A_L

P_R

ET: 16
TR: 3788.0
TE: 66.6
HD 8ch Shoulder
3.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:5962 L:2981

F

DFOV: 16.0 x 16.0cm



Se: 8/9
Im: 5/22
Cor: P6.4 (COI)

2015 Sep 08
Acq Tm: 08:30:58

288 x 224

R_A

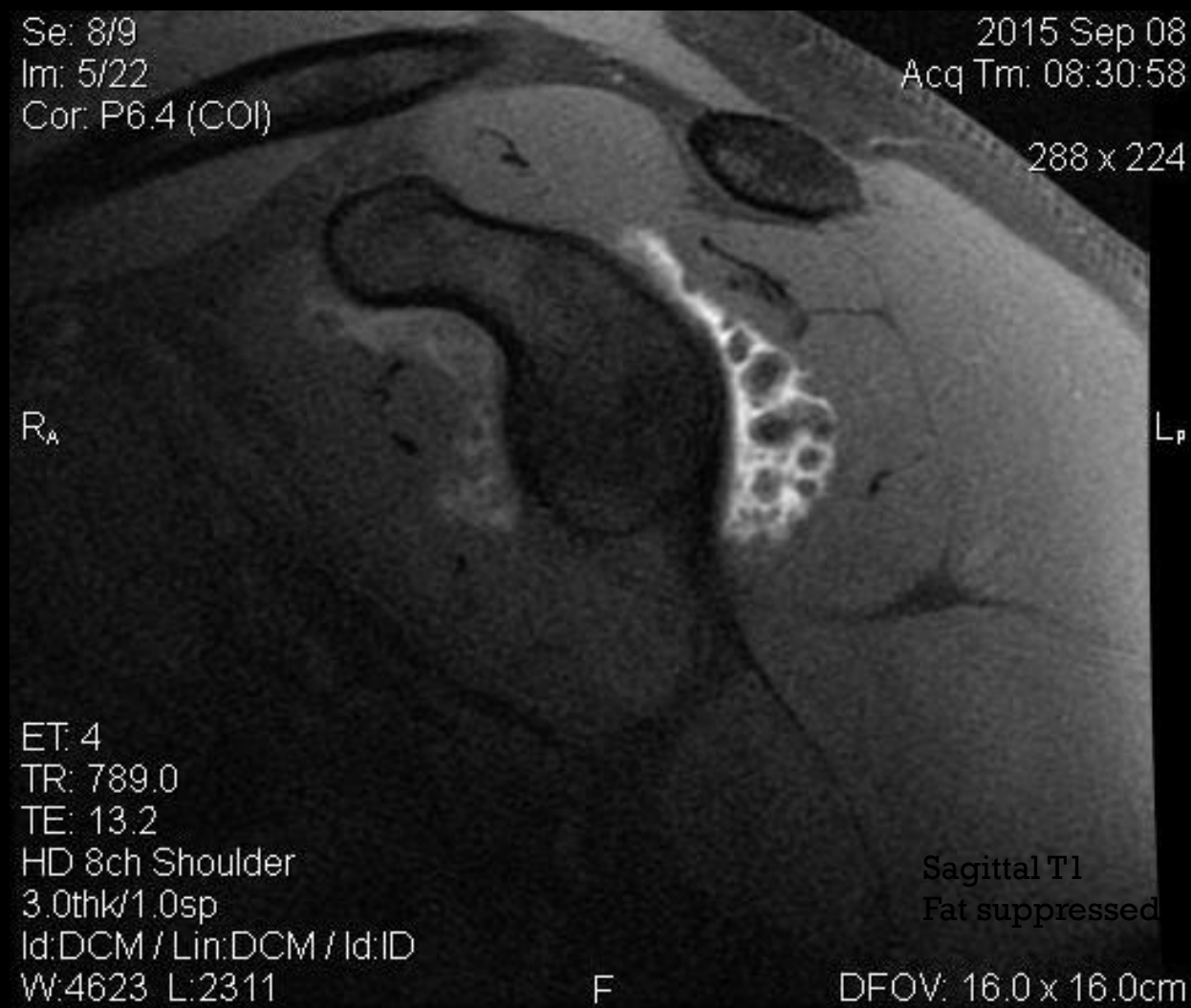
L_P

ET: 4
TR: 789.0
TE: 13.2
HD 8ch Shoulder
3.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:4623 L:2311

Sagittal T1
Fat suppressed

F

DFOV: 16.0 x 16.0cm



Se: 8/9
Im: 6/22
Cor: P3.0 (COL)

2015 Sep 08
Acq Tm: 08:30:58

288 x 224

R_A

L_P

ET: 4
TR: 789.0
TE: 13.2
HD 8ch Shoulder
3.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:4653 L:2326

F

DFOV: 16.0 x 16.0cm

Se: 8/9
Im: 7/22
Cor: A0.4 (COI)

2015 Sep 08
Acq Tm: 08:30:58

288 x 224

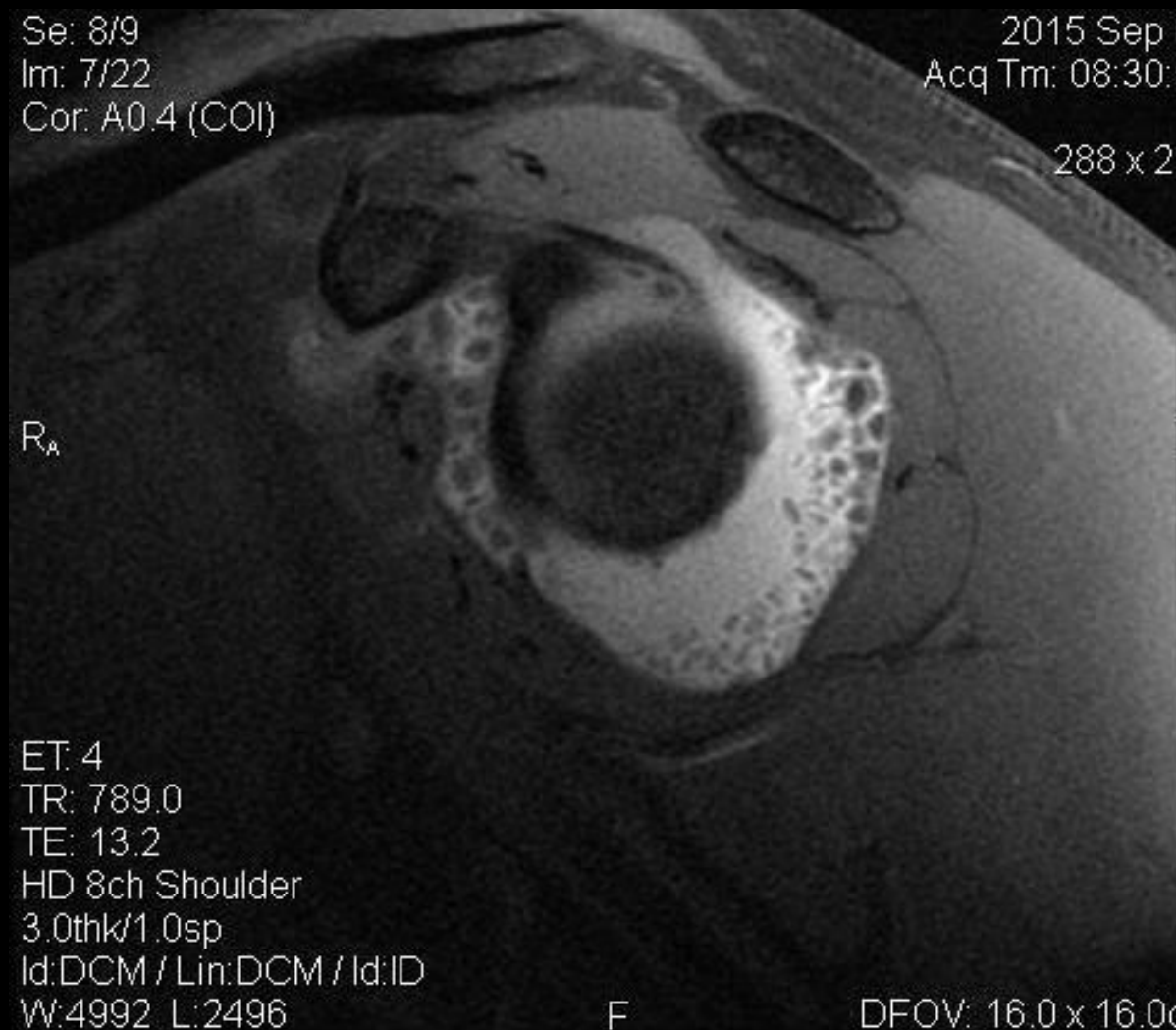
R_a

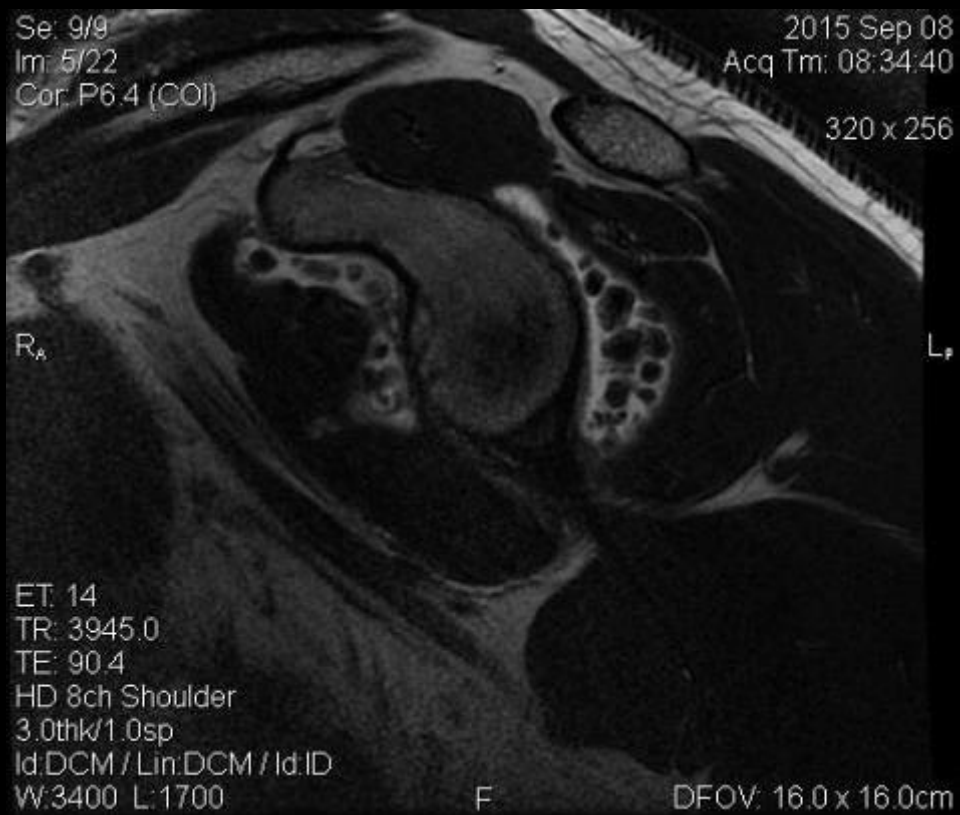
L_p

ET: 4
TR: 789.0
TE: 13.2
HD 8ch Shoulder
3.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:4992 L:2496

F

DFOV: 16.0 x 16.0cm





Se: 9/9
Im: 5/22
Cor: P6.4 (COI)

2015 Sep 08
Acq Tm: 08:34:40

320 x 256

R

L

ET: 14
TR: 3945.0
TE: 90.4
HD 8ch Shoulder
3.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:3400 L:1700

F

DFOV: 16.0 x 16.0cm

Se: 9/9
Im: 7/22
Cor: A0.4 (COI)

2015 Sep 08
Acq Tm: 08:34:40

320 x 256

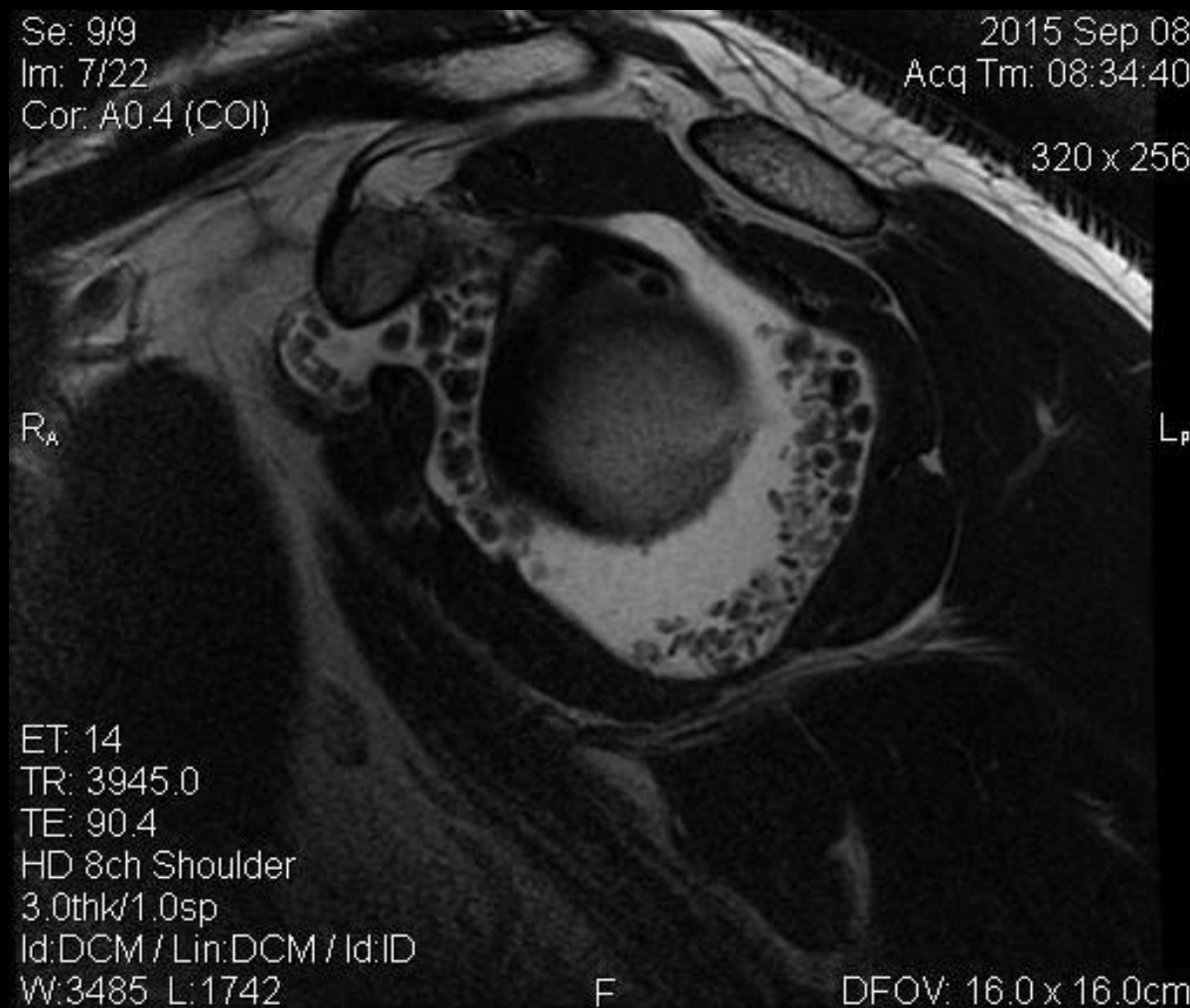
R_A

L_P

ET: 14
TR: 3945.0
TE: 90.4
HD 8ch Shoulder
3.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:3485 L:1742

F

DFOV: 16.0 x 16.0cm



PRIMARY SYNOVIAL CHONDROMATOSIS

- Uncommon condition characterized by the primary formation of cartilaginous intra-articular and periarticular loose bodies as a result of synovial metaplasia
- Shoulder is one of the least common joints affected
- Malignant degeneration is rare, but has been reported (Davis et al. ~5%)
- Recurrence in up to 30%
- Treatment of choice is removal of loose bodies with or without synovectomy

10-YEAR-OLD FEMALE

Recurrent left knee pain and swelling

Gymnast

2 view knee radiographic study



L
22
08
⊙



WHAT IS THE MOST LIKELY DIAGNOSIS?

Primary synovial osteochondromatosis

WHAT IS THE TREATMENT FOR PRIMARY SYNOVIAL (OSTEO)CHONDROMATOSIS?

Treatment of synovial chondromatosis usually consists of removal of the intra-articular bodies with or without synovectomy, but local recurrence is not uncommon.

WHAT IS THE TYPICAL CLINICAL PRESENTATION?

Patients usually present with pain, swelling, and limitation of motion, which often progresses slowly for several years. Joint effusions are common as there is a restricted range of motion.

WHERE IS THE MOST COMMON LOCATION?

Usually, the condition is monoarticular affecting any joint, but the large joints are preferentially affected:

knee (up to 70%)

hip (20%)

FOLLOW-UP

Arthroscopic surgery

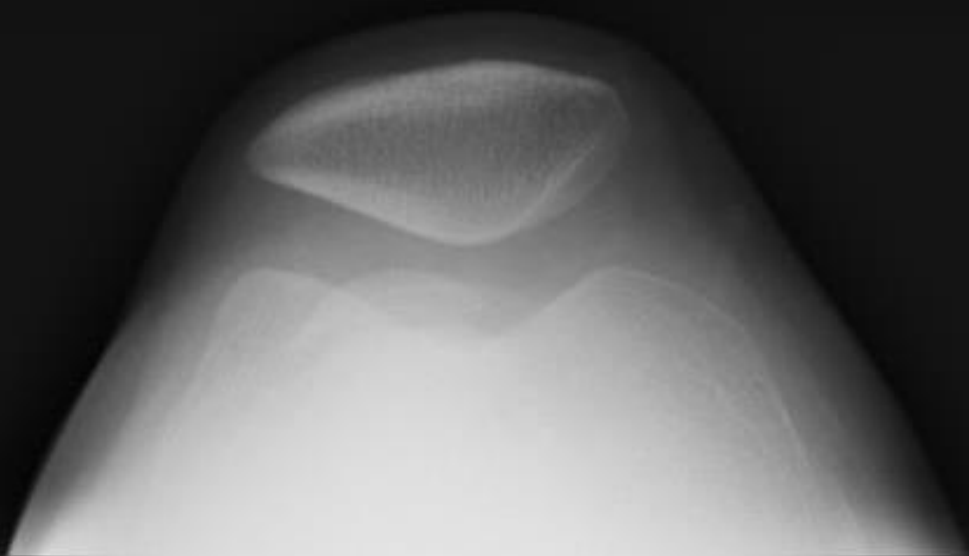


7²⁸

STANDING



182



Cases 1 - 5

You've got to be kidding...



Identify pertinent positive findings.

Provide diagnosis or short DDX.

Indicate if additional imaging should be ordered.



CASE 1: 12-YEAR-OLD MALE

Traumatic ankle pain

Football incident

ED physician reported radiographs as negative for fracture

Next day, consult with chiropractor







CASE 2: 39-YEAR-OLD FEMALE

Left ankle pain and swelling following boogie
board incident







CASE 3: 31-YEAR-OLD FEMALE

FOOSH injury

Pain and swelling over right hypothenar region

Self-referred to urgent care for radiographic
evaluation







R
JA

CASE 4: 22-YEAR-OLD MALE

Chronic ankle pain and swelling

Ankle inversion injury approximately 2 months ago

HISTORY: Injury. 2 Month chronic pain.

RIGHT ANKLE XRAY

HISTORY: Injury.

There is a 7mm cortical fragment immediately inferior to the lateral malleolus. This is probably an avulsion fragment from previous injury. The ankle mortise and subtalar joints are maintained in normal alignment. The surrounding soft tissues are unremarkable. There may be some mild generalized swelling around the ankle.







R

CASE 5: 4-YEAR-OLD MALE

Fell onto outstretched arm

Severe elbow pain



L





Review of Cases

You've got to be kidding...



CASE 1: 12-YEAR-OLD MALE

Traumatic ankle pain

Football incident

ED physician reported radiographs as negative for fracture

Next day, consult with chiropractor



There is widening and haziness of the lateral physis of the distal tibia.



A subtle lateral displacement of the tibial epiphysis is also noted.



WHAT POSITIONING METHOD WILL IMPROVE VISUALIZATION OF SUSPECTED FRACTURE?

Radiography should include a view in external rotation. In case of non-diagnosed persistent pain at 7-day reassessment, early CT examination is recommended



KIDS DON'T SPRAIN, THEY BREAK.

The Salter-Harris Classification of Growth Plate Injuries



SALTER-HARRIS TYPE II FRACTURE OF DISTAL TIBIA

- Ankle fractures are the second most common cause of physeal injuries in children, second only to distal radius fractures.
- Closure of the distal tibial physis starts centrally, continues medially, and proceeds laterally.
- Salter-Harris type II (SH-II) injuries are the most frequent, accounting for up to 40% of all distal tibia fractures.
- The distal physis contributes 50% toward longitudinal growth of the tibia, and injuries may result in premature physeal closure (PPC) and angular deformity.

CASE 2: 39-YEAR-OLD FEMALE

Left ankle pain and swelling following boogie
board incident









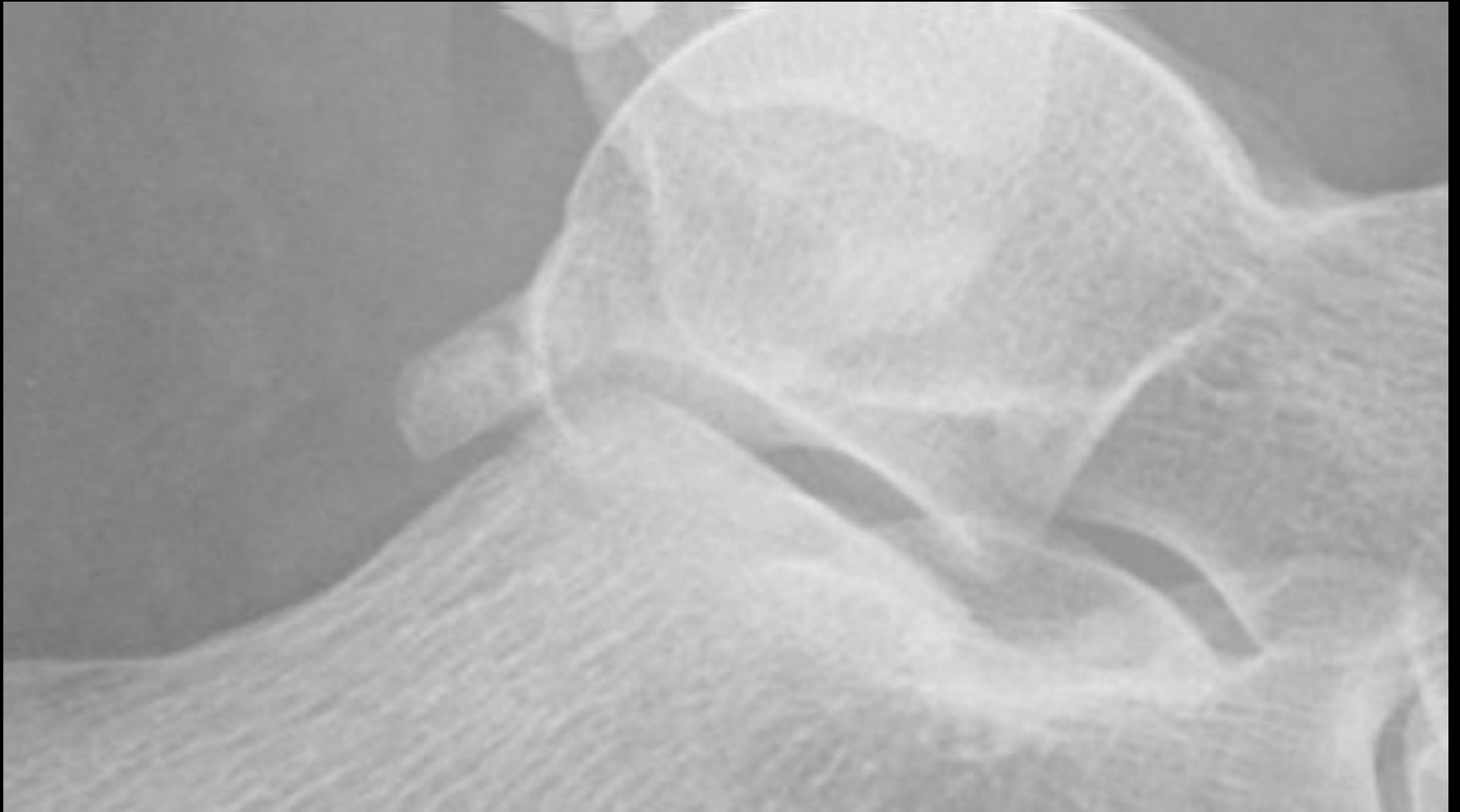
**NON-DISPLACED ACUTE FRACTURE OF
ELONGATED LATERAL TUBERCLE OF
POSTERIOR PROCESS OF TALUS (STIEDA
PROCESS)**

Continued clinical and radiologic monitoring

Non-displaced (<2mm) SLC 6 weeks

ISOLATED STIEDA PROCESS FRACTURE

Follow-up



2 weeks



CLINICAL PEARL

Include in clinical data for
radiologist site of maximal pain
and tenderness.

26-YEAR-OLD MALE

Injured his ankle after stepping into a pothole

He reports difficulty walking after the injury.

Currently able to bear weight with pain in the region of the lateral malleolus.

L





L



**NON-DISPLACED ACUTE FRACTURE OF
ELONGATED LATERAL TUBERCLE OF
POSTERIOR PROCESS OF TALUS (STIEDA
PROCESS)**

Continued clinical and radiologic monitoring

POSTERIOR IMPINGEMENT SYNDROME

Predisposing anatomical factors:

Stieda process

fracture involving lateral tubercle of the posterior process of the talus

os trigonum

prominent superior surface of calcaneal tuberosity (Haglund exostosis)

any abnormal calcification/ossification posterior to the ankle

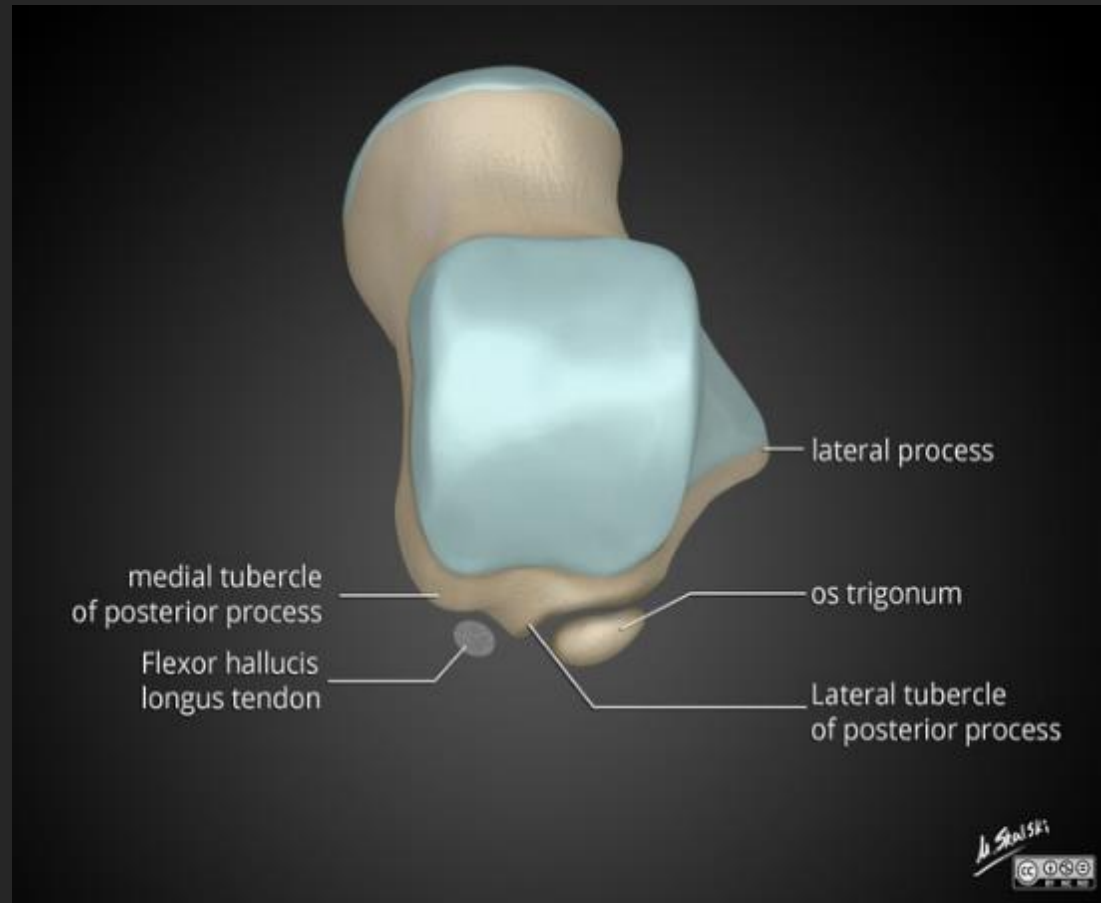


OS TRIGONUM SYNDROME

Injuries usually caused by repetitive plantar flexion of ankle or
acute trauma

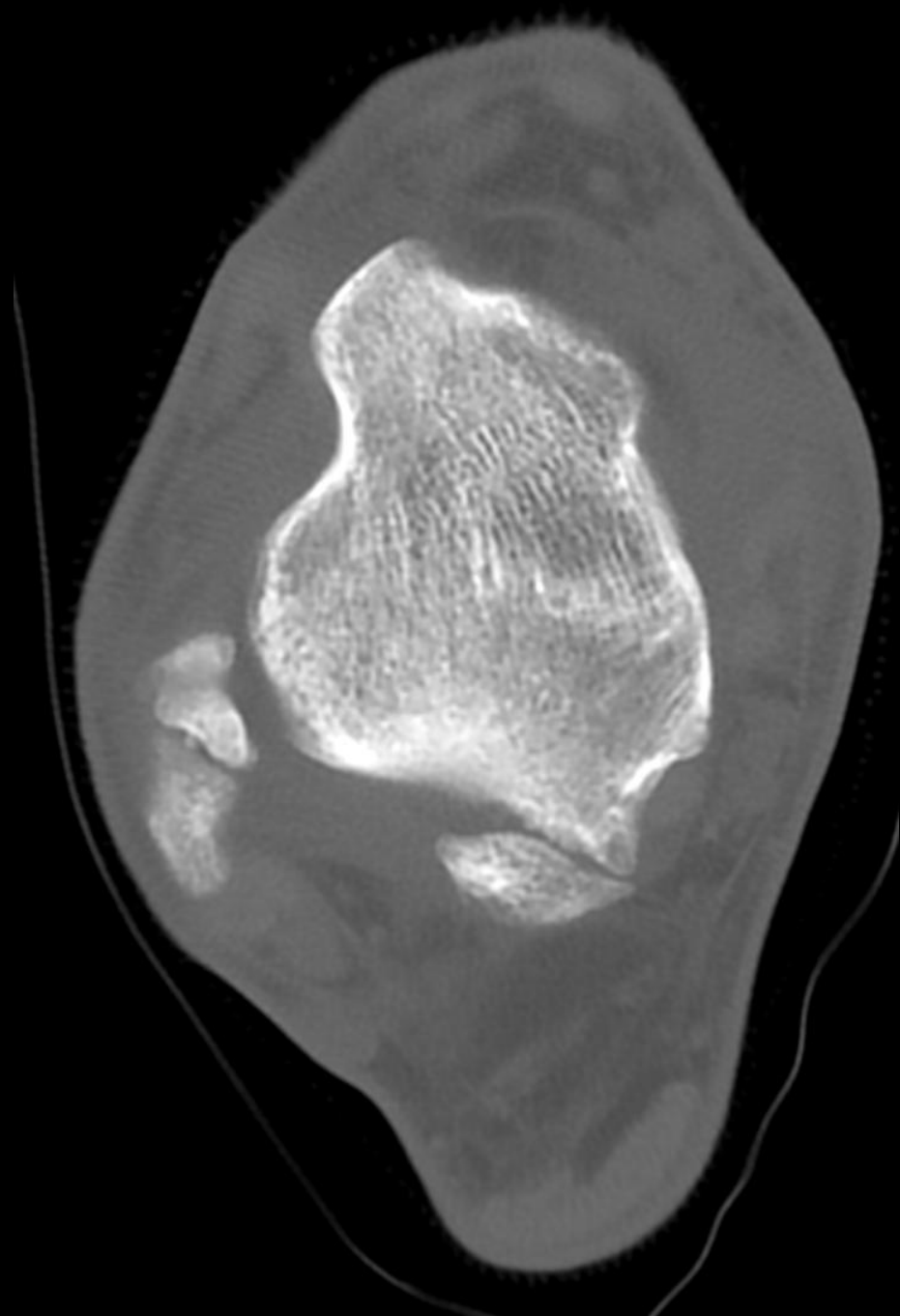
Dancers and athletes in kicking sports

DDX Achilles tendon and flexor hallucis longus tendon



Case courtesy of Dr Matt Skalski, Radiopaedia.org, rID: 31891





CASE 3: 31-YEAR-OLD FEMALE

FOOSH injury

Pain and swelling over right hypothenar region

Self-referred to urgent care for radiographic
evaluation





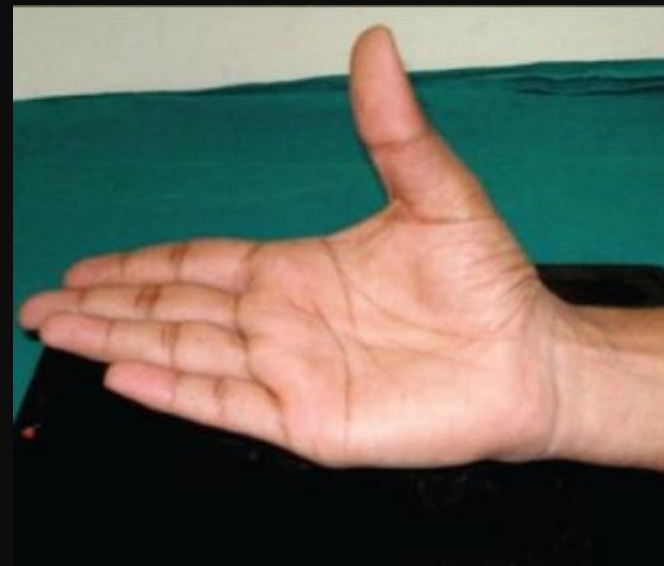


R
JA

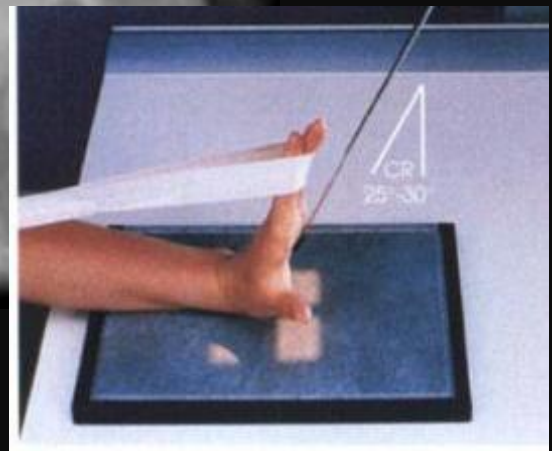
WHAT ADDITIONAL VIEWS NEED TO BE ORDERED?

Dorsal oblique

Carpal tunnel









WHAT IS THE NEXT BEST IMAGING MODALITY TO ORDER AND WHY?

Acute fracture of pisiform seen on additional views

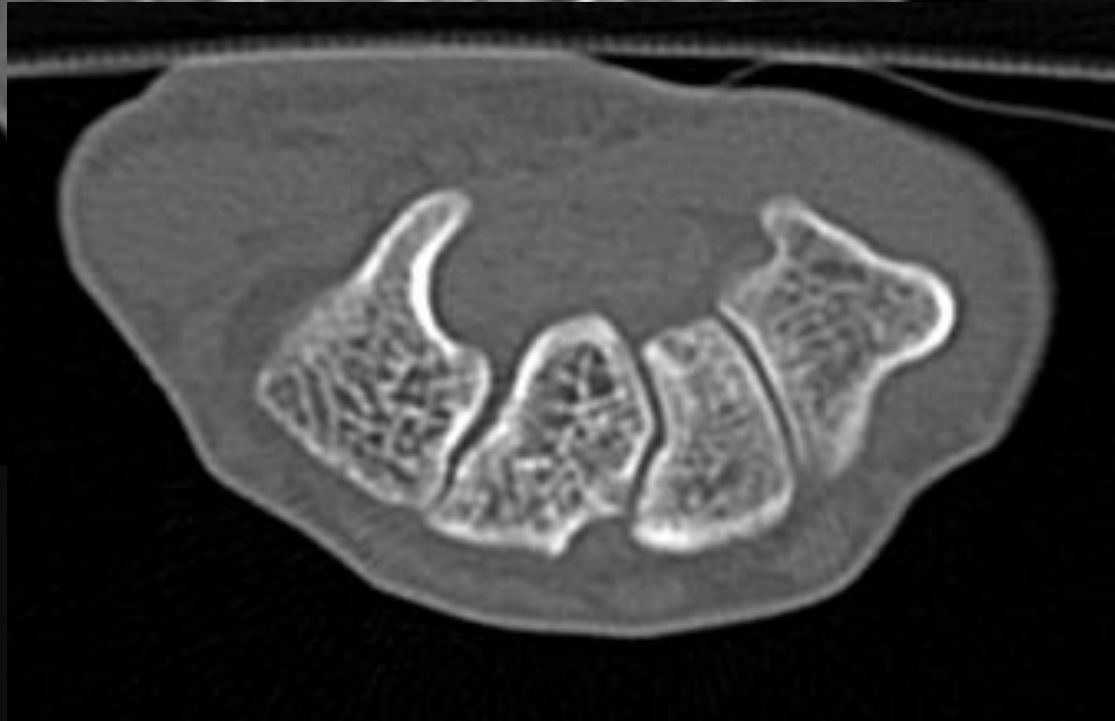
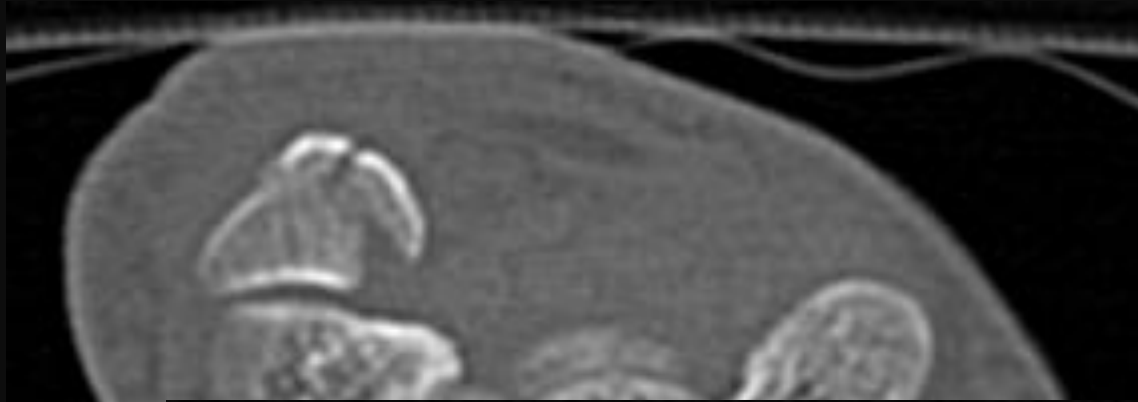
Pisiform fractures are uncommon carpal fractures

Up to 50% have additional fractures in the wrist

CT of wrist recommended to evaluate for occult fracture

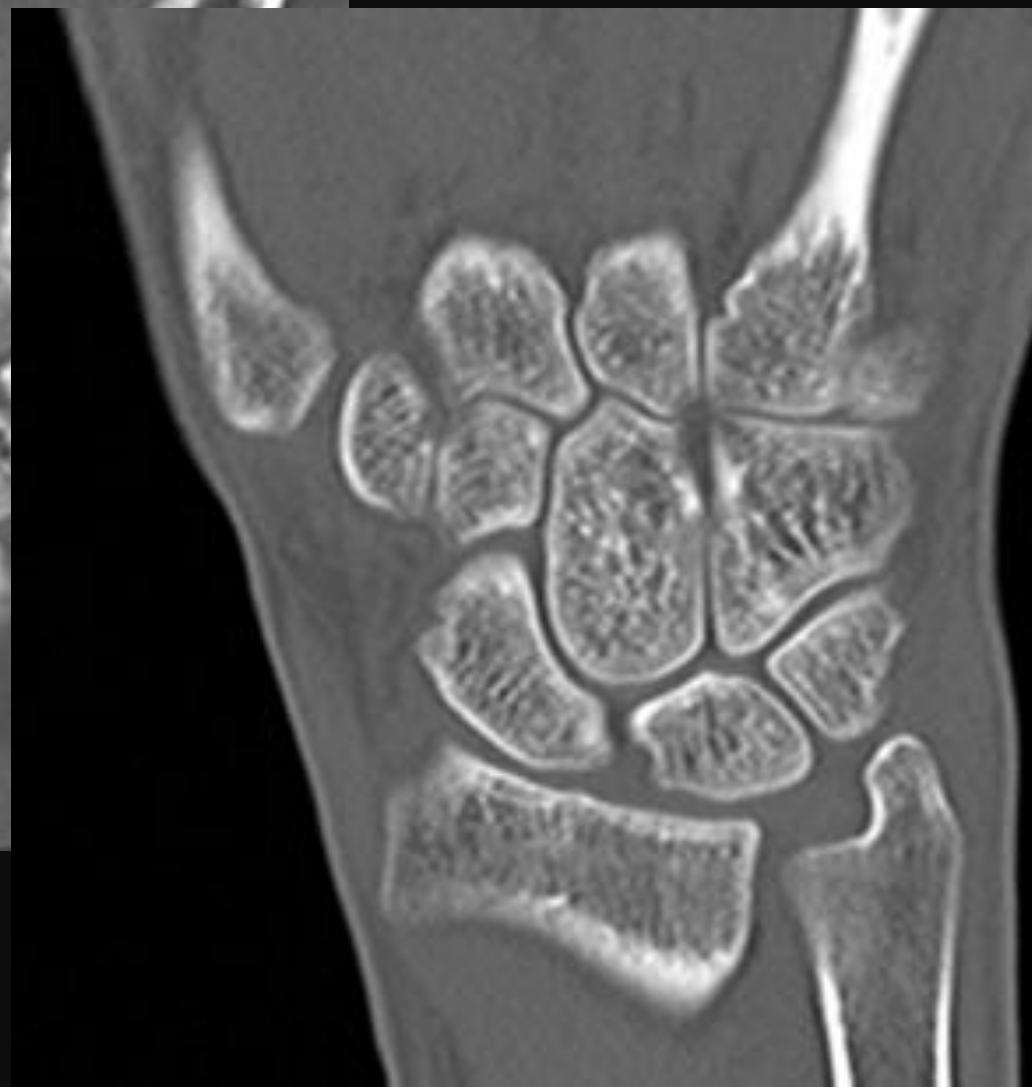
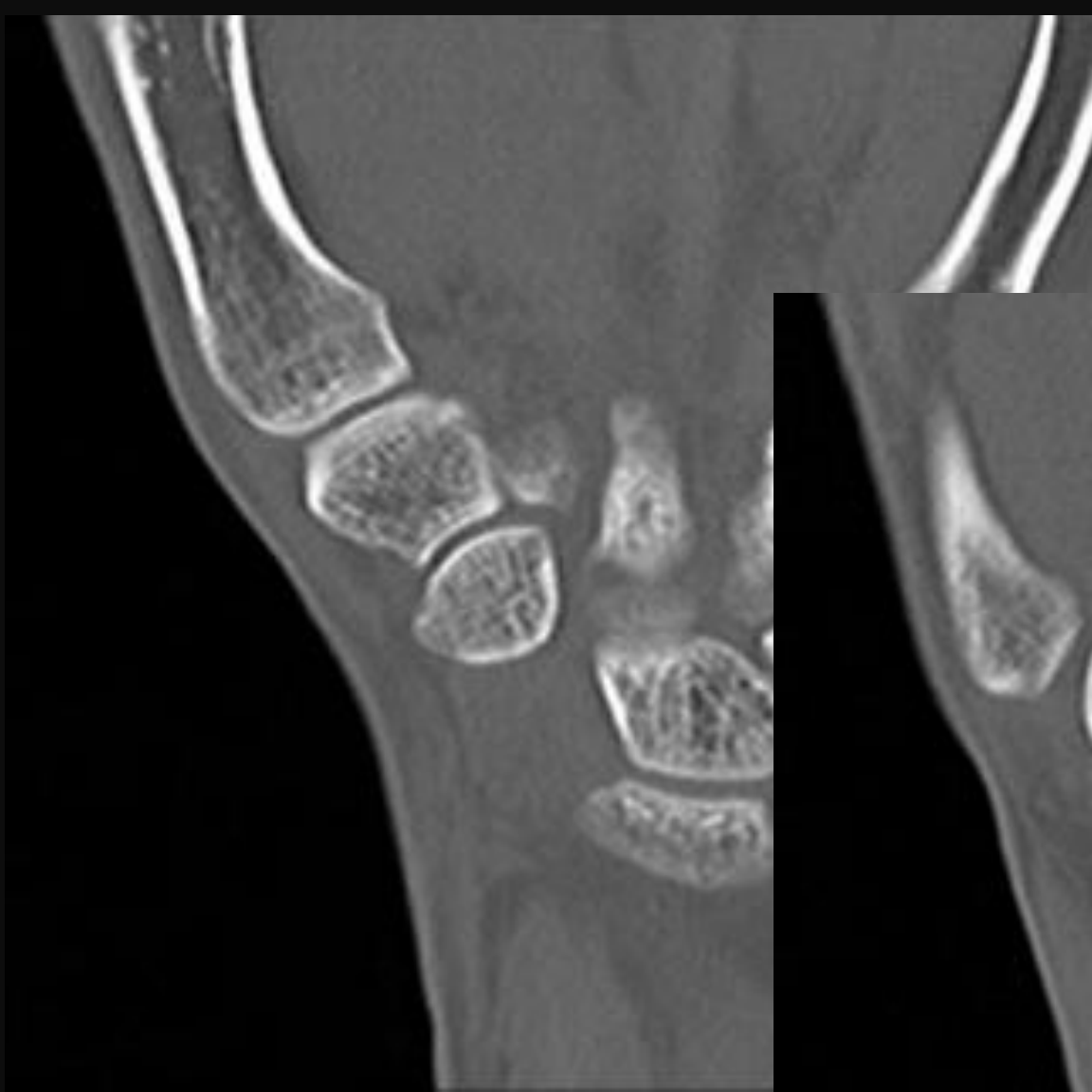


Coronal images



axial images





DIAGNOSIS

Comminuted pisiform fracture with minimal
displacement of fragments

No other fractures noted on CT



FOLLOW-UP

Patient was placed in a specialized splint for
six weeks

She reports complete resolution of symptoms

No pain or dysfunction with activities

CLINICAL PEARL

Order radiographic study
consistent with clinical suspicion.

37-YEAR-OLD MALE

Wrist pain following direct impact of baseball,
speed approx. 88 mph

Bruising on ulnar-side of wrist

Severe pain over ulnar-side of wrist





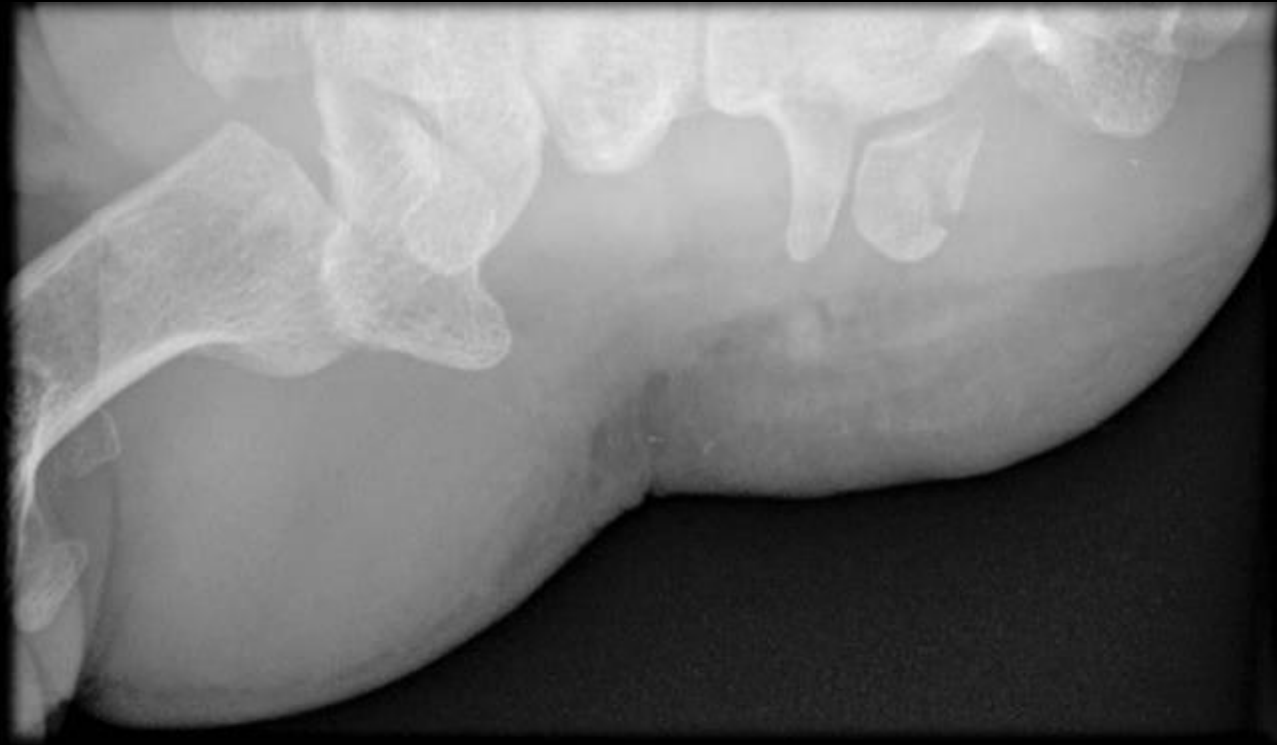
R



WHAT ADDITIONAL VIEWS WILL BETTER VISUALIZE THE ULNAR SIDE OF WRIST?

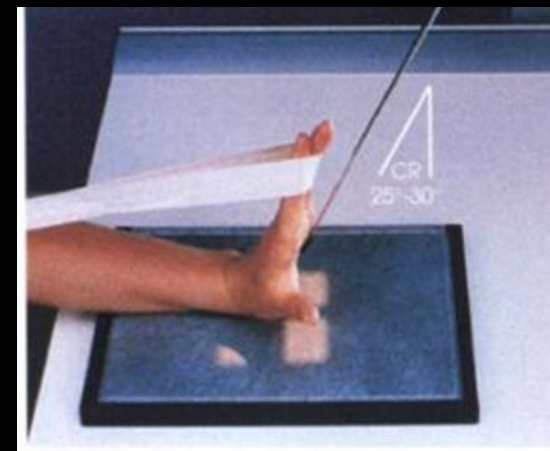
Dorsal oblique

Carpal tunnel



R

carpal tunnel 30 degrees



IMPRESSION

Acute, comminuted fracture of the
pisiform

CLINICAL PEARL

uncommon type of fracture involving the carpal bones

Approximately 50% occur in association with other carpal fractures.

Early diagnosis is important as missed diagnosis or delayed treatment may result in non-union.

WHAT VIEWS BEST DEMONSTRATE THE PISOTRIQUETRAL JOINT?

The pisotriquetral joint is best seen in the lateral view with 30 degrees supination and/or using the carpal tunnel view.

WHAT IS THE CLINICAL PRESENTATION OF A PATIENT WITH A NON-UNION PISIFORM FRACTURE?

chronic wrist pain, grip weakness or
restriction of wrist movement

CASE 4: 22-YEAR-OLD MALE

Chronic ankle pain and swelling

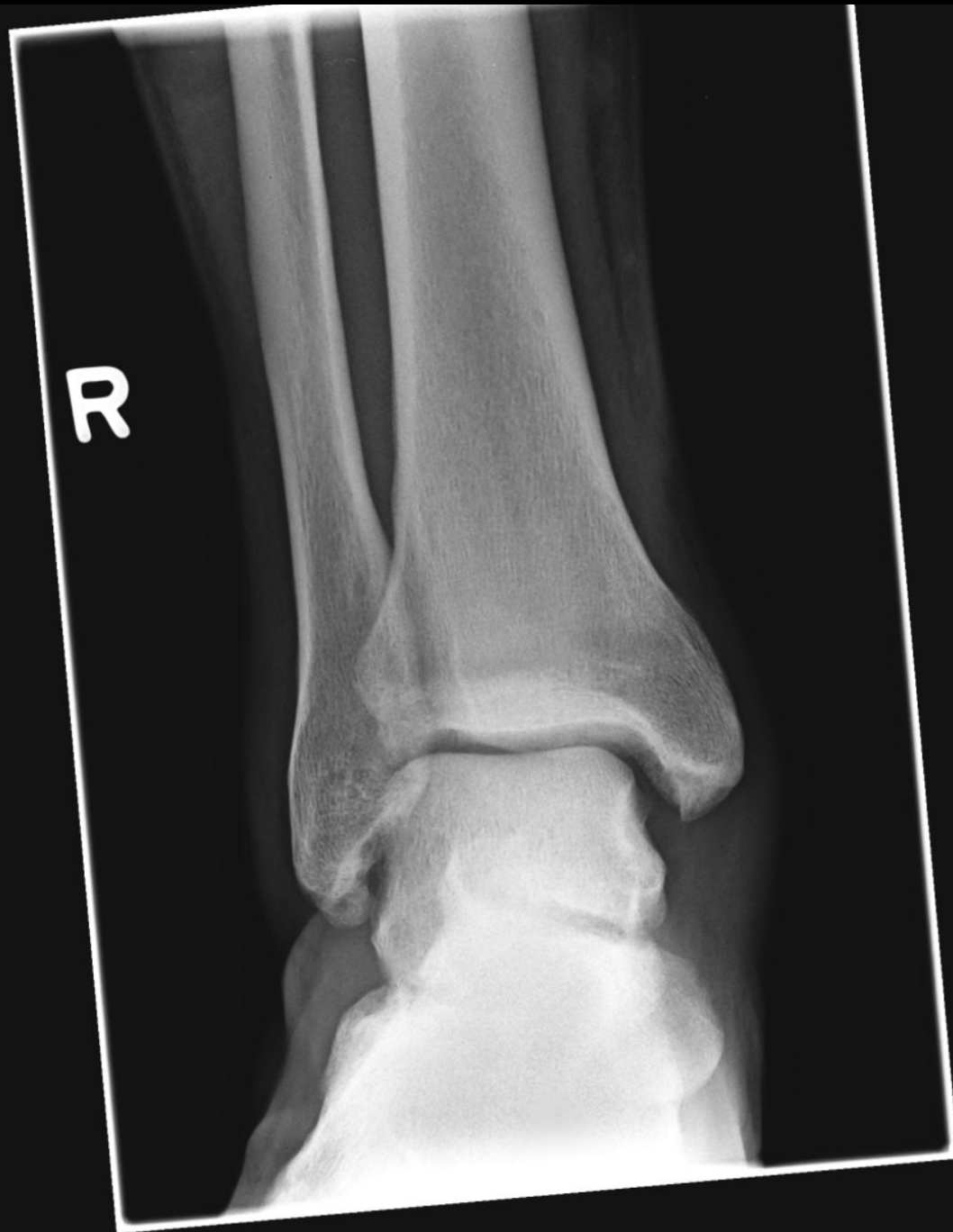
Ankle inversion injury approximately 2 months ago

HISTORY: Injury. 2 Month chronic pain.

RIGHT ANKLE XRAY

HISTORY: Injury.

There is a 7mm cortical fragment immediately inferior to the lateral malleolus. This is probably an avulsion fragment from previous injury. The ankle mortise and subtalar joints are maintained in normal alignment. The surrounding soft tissues are unremarkable. There may be some mild generalized swelling around the ankle.







R

CLINICAL PEARL

Clinician managing patients need to be aware
of the imaging pitfalls.

Standard radiographic series poor diagnostic
sensitivity especially in patients with medial
retromalleolar pain

CLINICAL PEARLS

Consider high-energy trauma (trauma in hyperextension and hyperflexion) as exceptions to the OAR rules

Lateral view with the foot in slight external rotation will identify the fibula behind the posterior margin of the tibia

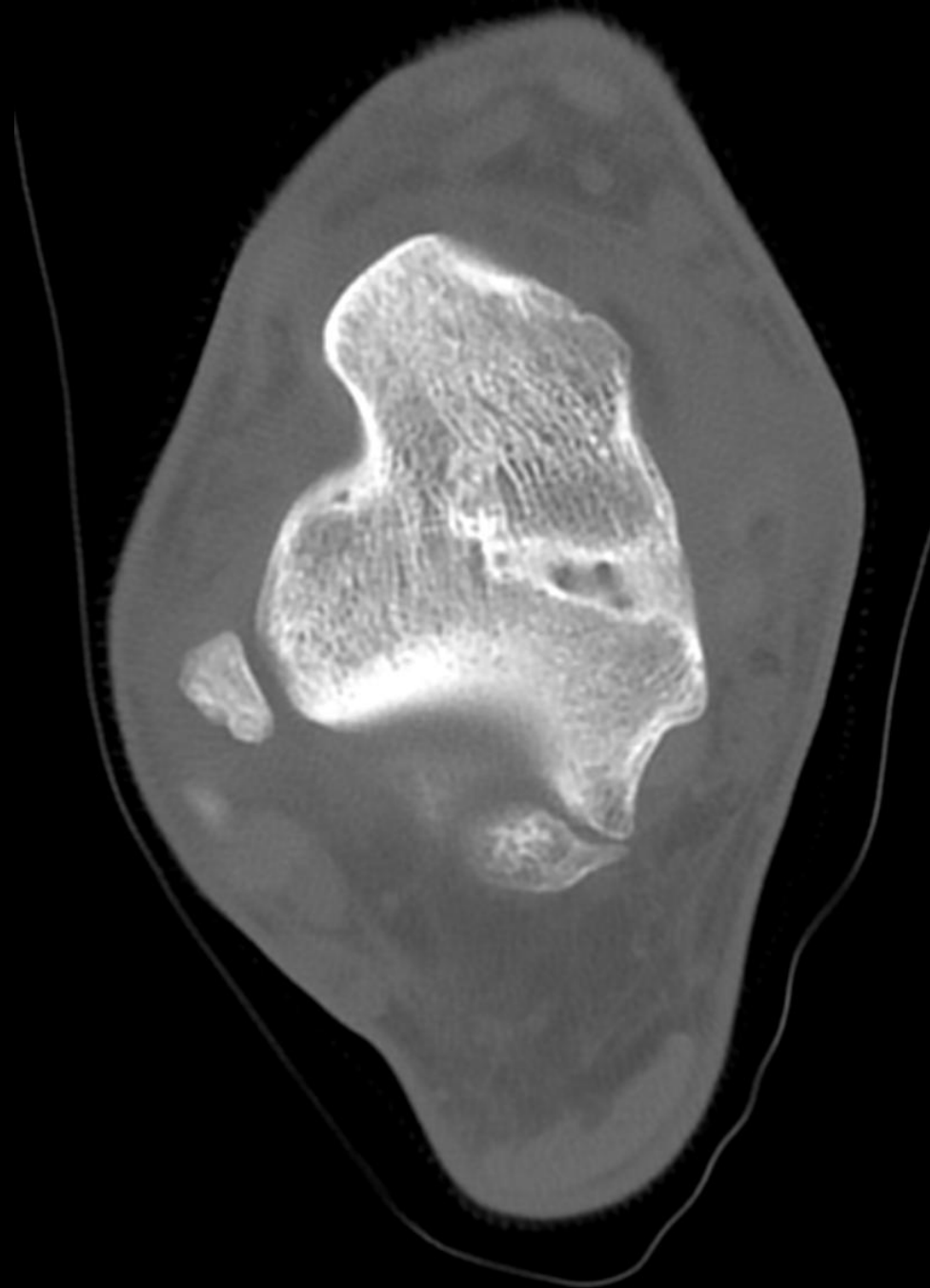
COMPUTED TOMOGRAPHY

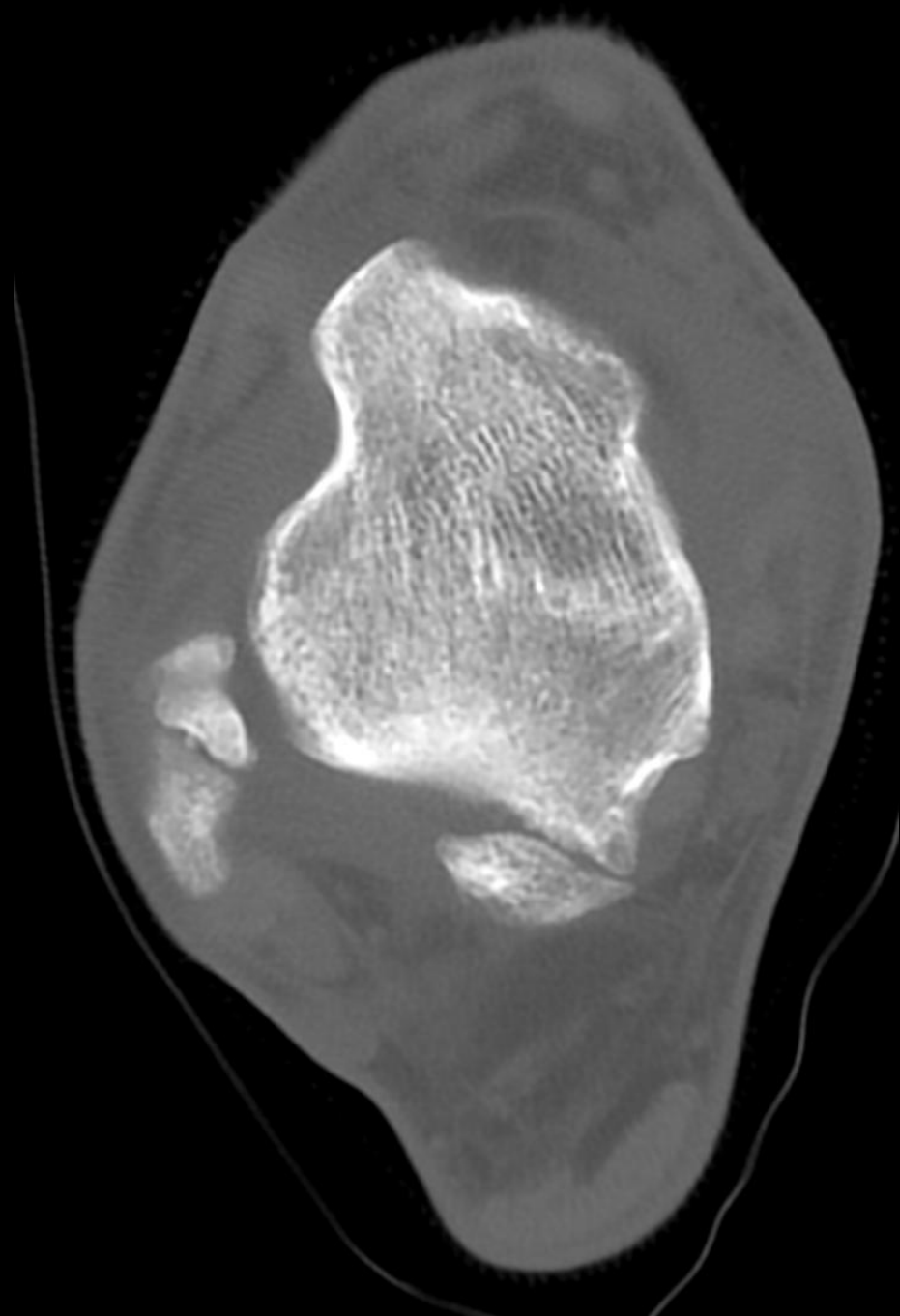
Good depiction of bony structures of
ankle and hindfoot

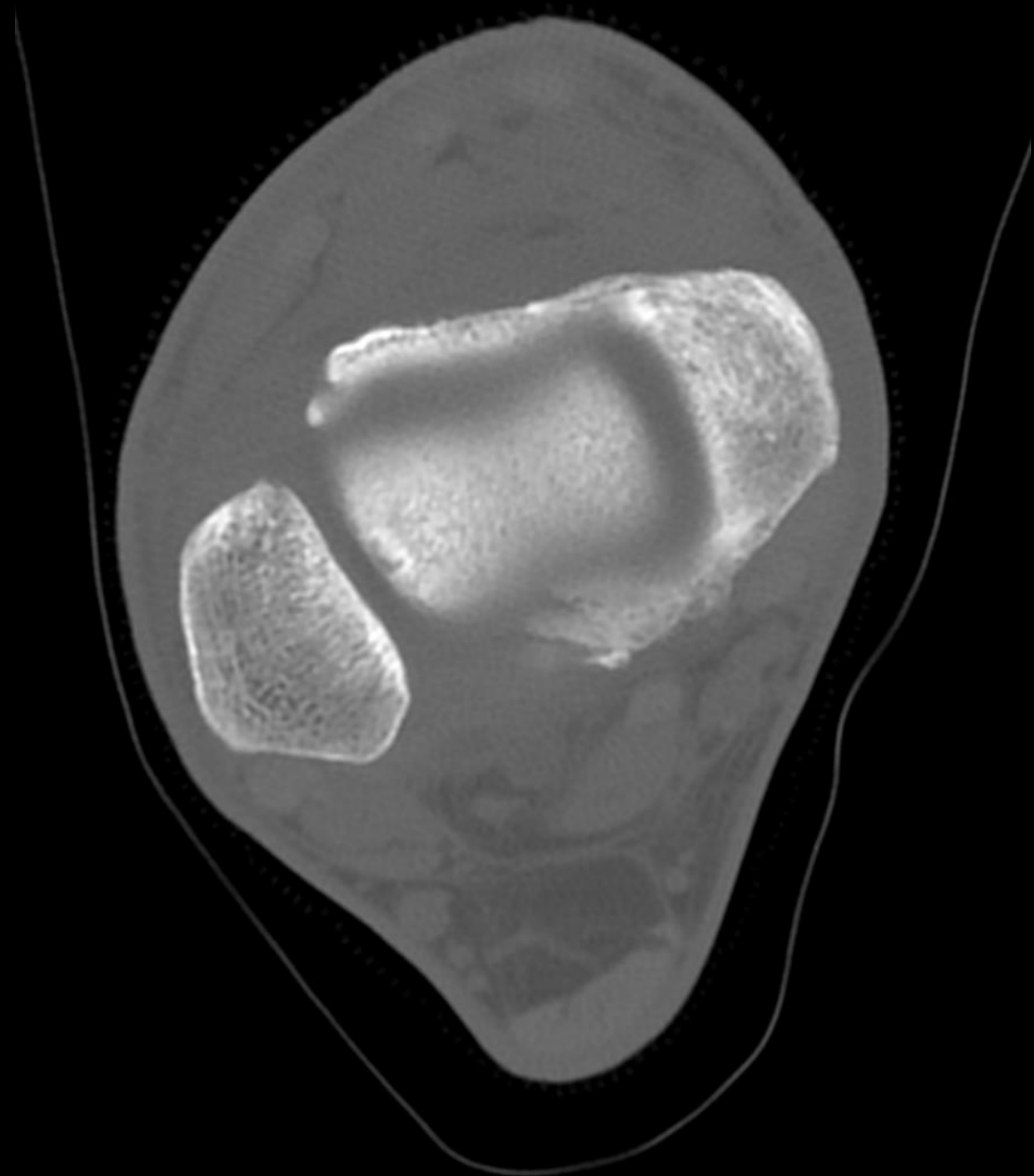
Precise classification of fractures

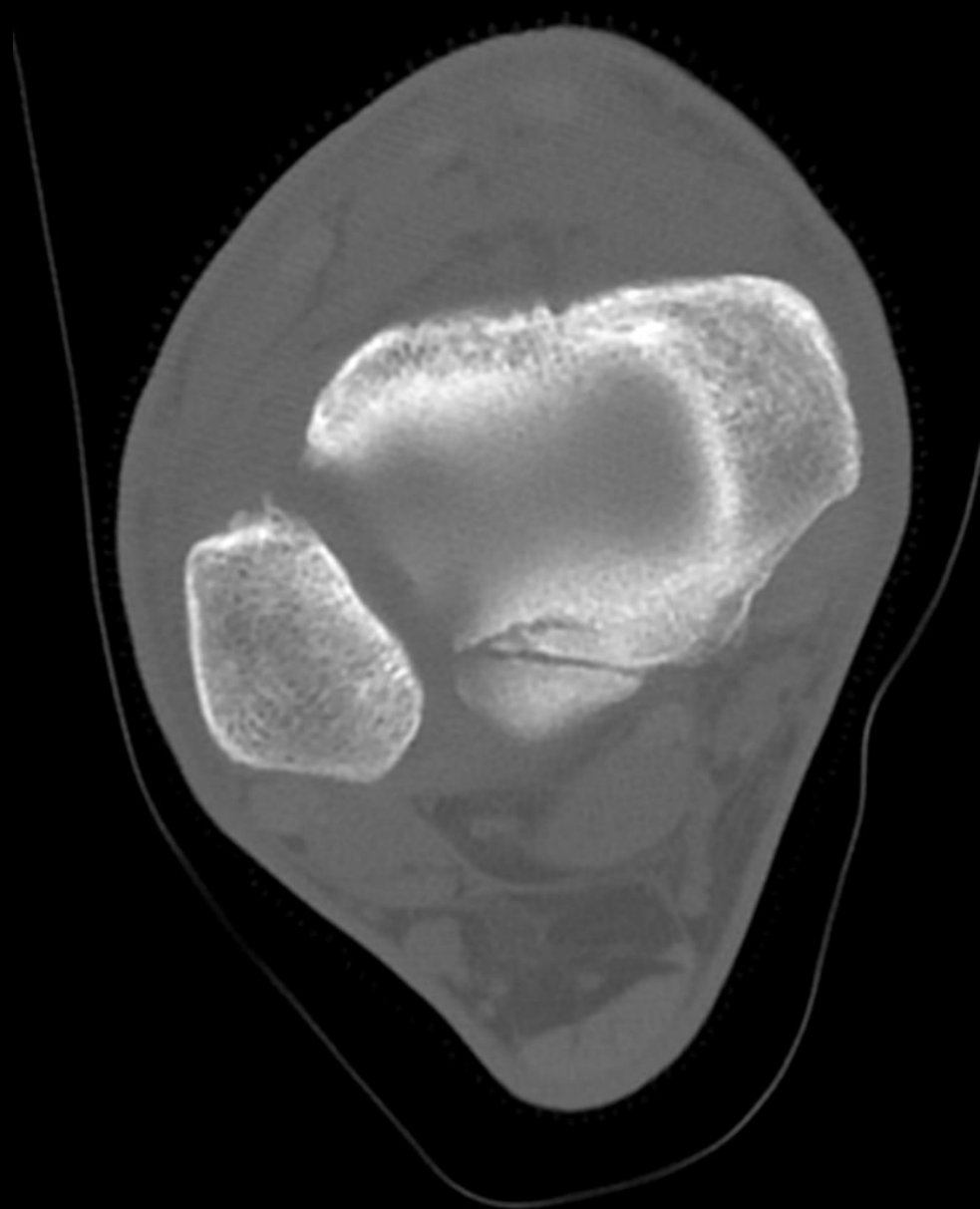


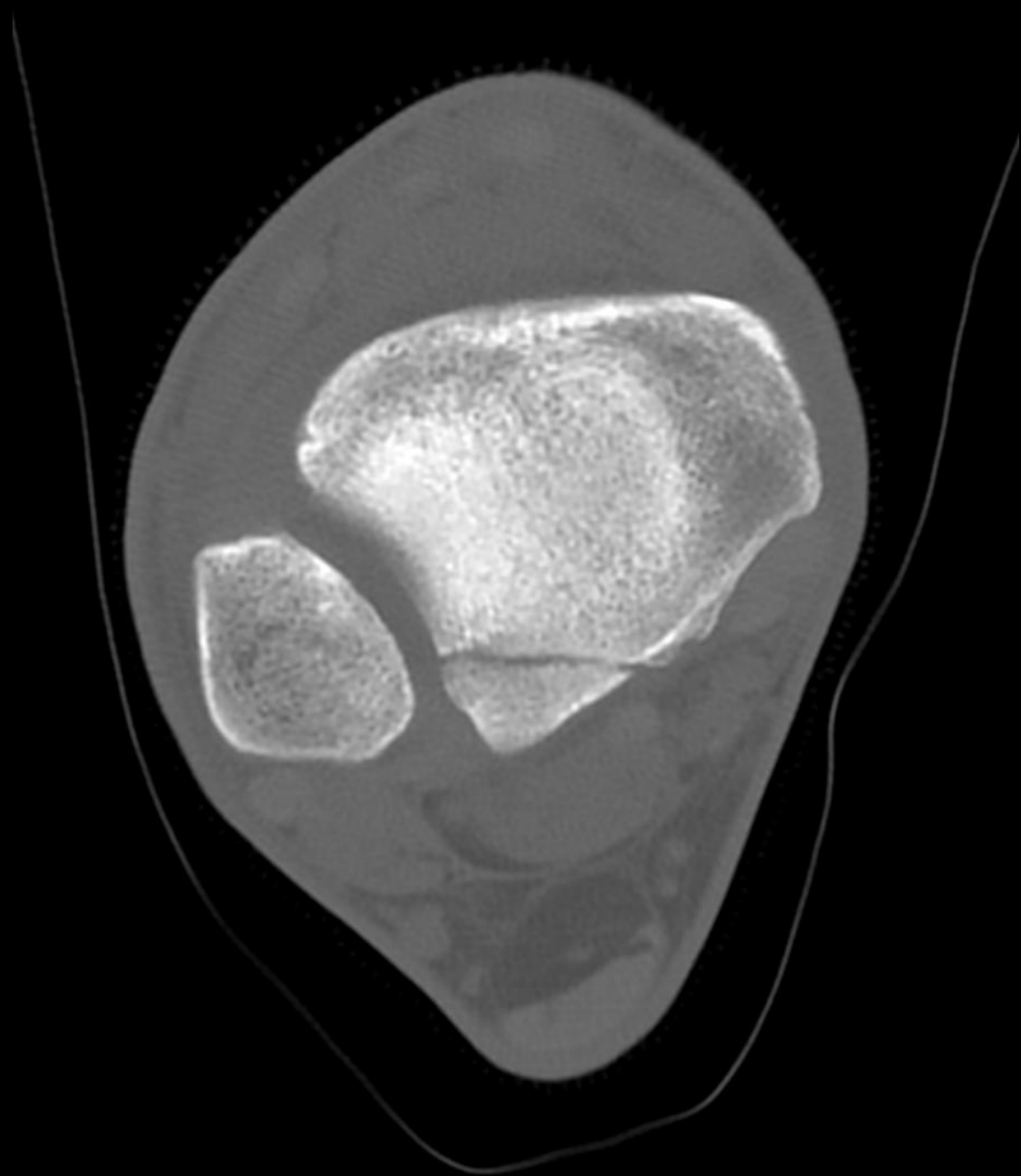


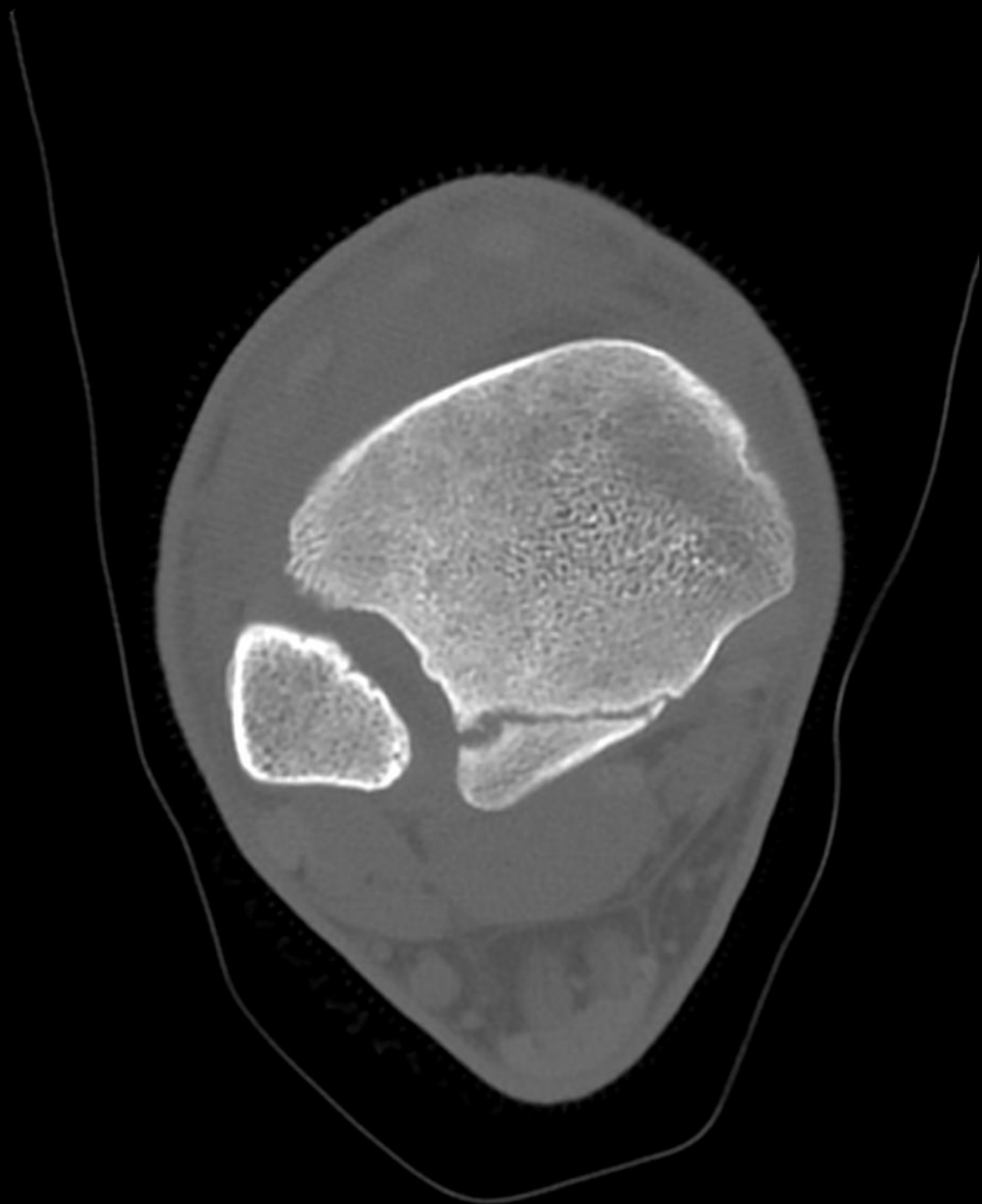
















5c1







5c1

INTRA-ARTICULAR POSTERIOR MALLEOLUS FRACTURE

Delayed in diagnosis

CLINICAL PEARLS

Initial clinical examination will not meet Ottawa Ankle Rules

Consider high-energy trauma (trauma in hyperextension and hyperflexion) as exceptions to the OAR rules

Lateral view with the foot in slight external rotation will identify the fibula behind the posterior margin of the tibia

ISOLATED FRACTURE OF POSTERIOR MALLEOLUS

Can be a sign of a more complex injury.

Can be associated with other ligamentous and syndesmotic injuries or other lower leg fracture

Can easily be missed on plain radiographs.

Diagnostic work-up of an isolated posterior malleolar fracture includes a CT scan

If diagnosed and treated properly, it has a good long-term functional outcome.

CASE 5: 4-YEAR-OLD MALE

Fell onto outstretched arm

Severe elbow pain









ACUTE LATERAL CONDYLAR FRACTURE

The fracture line almost always extends into the unossified epiphyseal cartilage (Salter-Harris type 4 fractures).

Considered to be an orthopedic urgency.

CLINICAL PEARLS

Fracture can be underestimated on plain films and may be seen as a small sliver of bone adjacent to the proximal border of the capitellum.

The best view to see the lateral condyle fracture is an internal oblique because the fracture usually lies posterolaterally

THE PEDIATRIC ELBOW

Must know order of ossification centers and approximate
age of appearance

Order of ossification and approximate age of appearance

Mnemonic **CRITOE**

- Capitellum (age 1)
- Radial head (age 3)
- Internal epicondyle (age 5)
- Trochlea (age 7)
- Olecranon (age 9)
- External epicondyle (age 11)

Secondary Growth Centers of the Elbow

Capitellum

Radial Head

Internal Epicondyle

Trochlea

Olecranon

Lateral Epicondyle



Secondary Growth Centers of the Elbow

Capitellum
Radial Head
Internal Epicondyle
Trochlea
Olecranon
Lateral Epicondyle

6-year-old



6-year-old

Secondary Growth Centers of the Elbow

Capitellum
Radial Head
Internal Epicondyle
Trochlea
Olecranon
Lateral Epicondyle



Secondary Growth Centers of the Elbow

Capitellum
Radial Head
Internal Epicondyle
Trochlea
Olecranon
Lateral Epicondyle

10-year-old

R



10-year-old

R

Secondary Growth Centers of the Elbow

Capitellum
Radial Head
Internal Epicondyle
Trochlea
Olecranon
Lateral Epicondyle



**WHAT ARE FOUR
IMPORTANT
QUESTIONS TO
ASK WHEN DOING
A REVIEW OF
RADIOGRAPHIC
STUDY?**

Is there a sign of joint effusion? After trauma this almost always indicates the presence of hemarthrosis due to a fracture (either visible or occult).

Is there a normal alignment between the bones? In children, dislocations are frequent and can be very subtle.

Are the ossification centers normal? Look especially for the position of the radial epiphysis and the medial epicondyle.

Is there a subtle fracture? Some of the fractures in children are very subtle

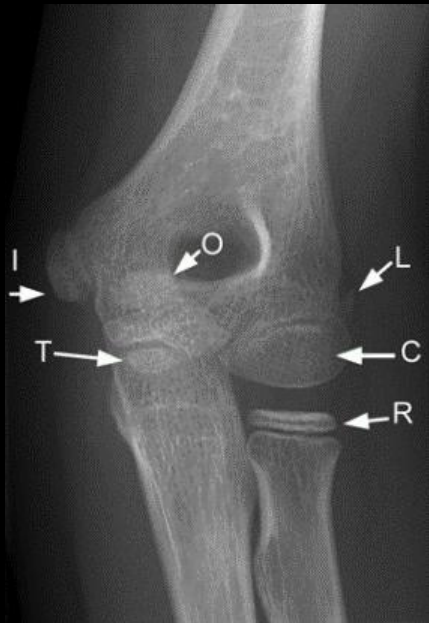
Supracondylar	>60%
Lateral condyle	10-20%
Medial epicondyle	10%
Radial neck	
Olecranon	

COMMON PEDIATRIC ELBOW FRACTURES

4-YEAR-OLD MALE

Fell onto outstretched arm





1-3-5-7-9-11



LATERAL CONDYLAR FRACTURE

The fracture line almost always extends into the unossified epiphyseal cartilage (Salter-Harris type 4 fractures) and are orthopedic urgencies.



IMPORTANT NOTES...

- We often see patients after they have been examined and “cleared” by other health professionals.
- Your patient requires a thorough history and physical examination.
- Additional or repeat imaging may be necessary.
- We should also always attempt to review the previous films and report regardless of their source and date.





5-YEAR-OLD MALE

FOOSH injury

Im: 1/1
Se: 1

10/1/2011 M
KAISER SUNNYSIDE
43760.1
CR FOREARM RIGHT AP AND LATERAL
AP

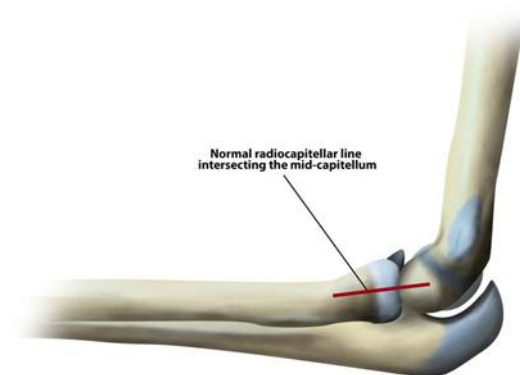
WL: 2048 WW: 4096 [D]

5/22/2017 11:05:32 AM



Im: 1/1
Se: 2

Normal lateral elbow in the skeletally immature patient



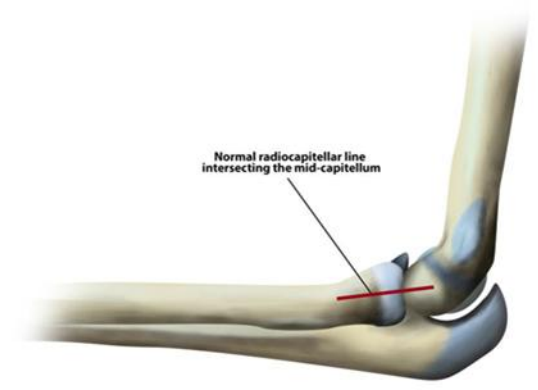
M. Spelski
Radiopaedia.org

R
SGW



R
1387

Normal lateral elbow in the skeletally immature patient




Radiopaedia.org

MONTEGGIA FRACTURE-DISLOCATION

fracture of the ulnar shaft with concomitant dislocation of the
radial head

ulnar fracture usually obvious, whereas the radial head
dislocation can be overlooked

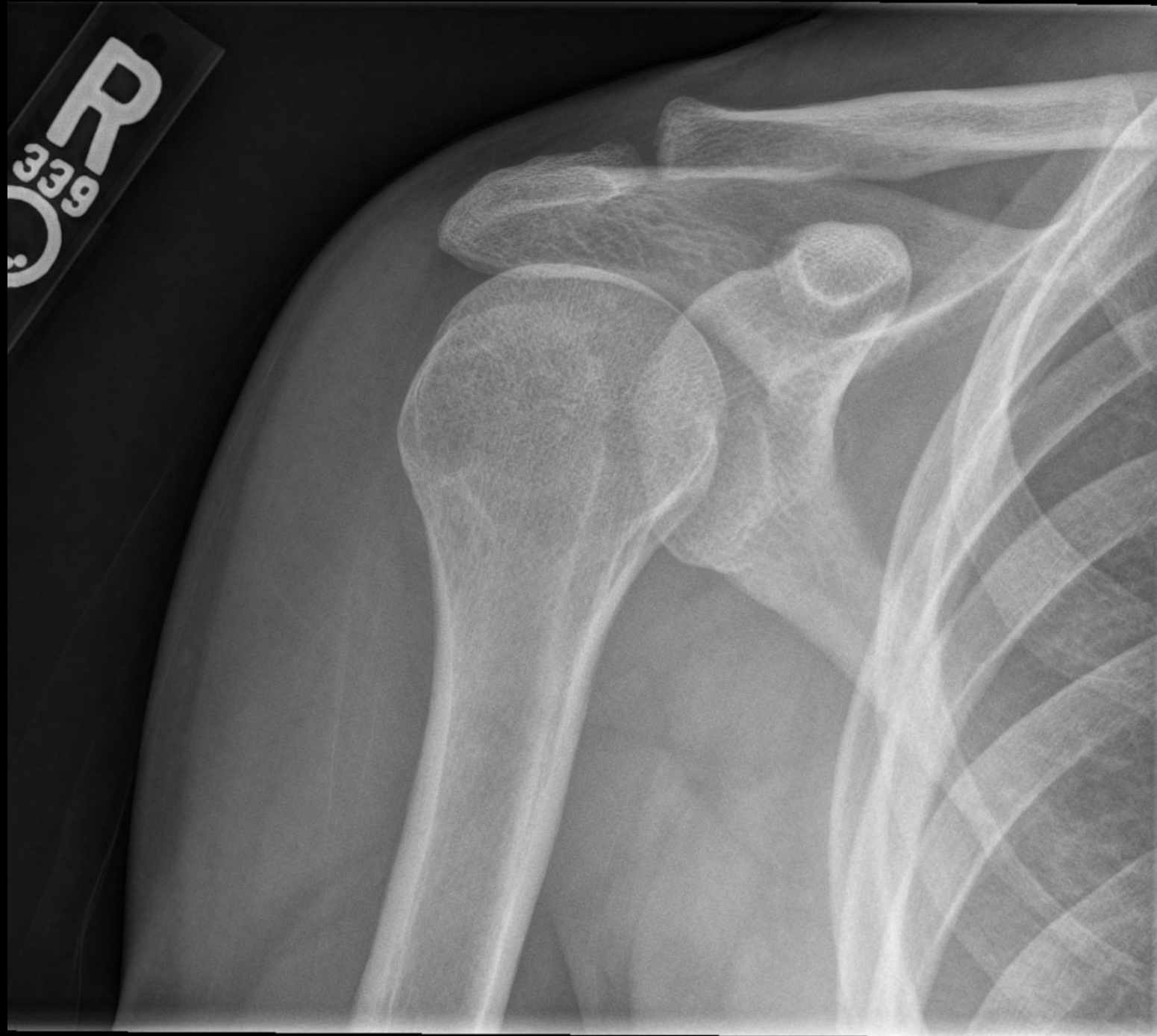
children (peak incidence at ages 4-10 years) and rarely in
adults

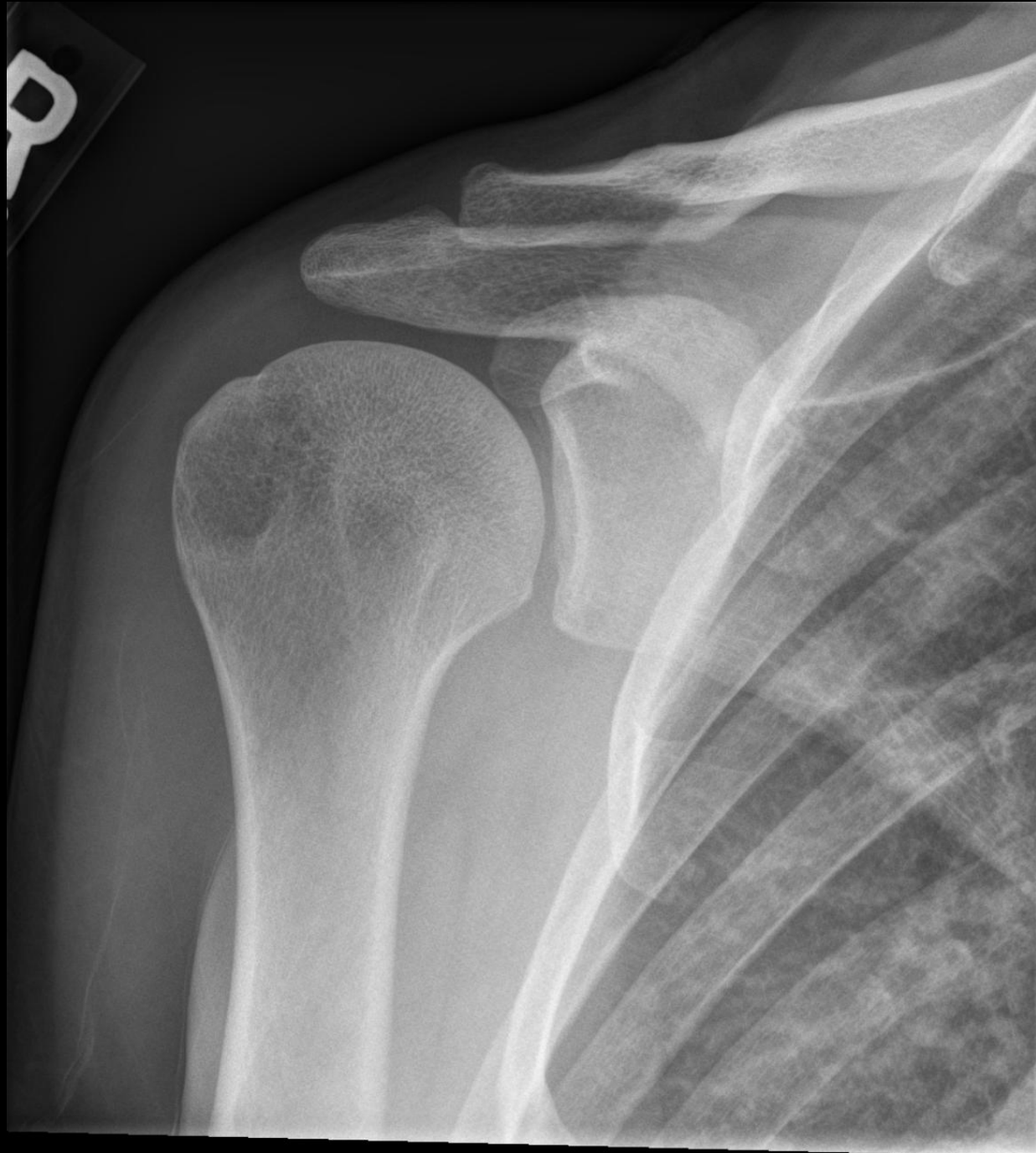


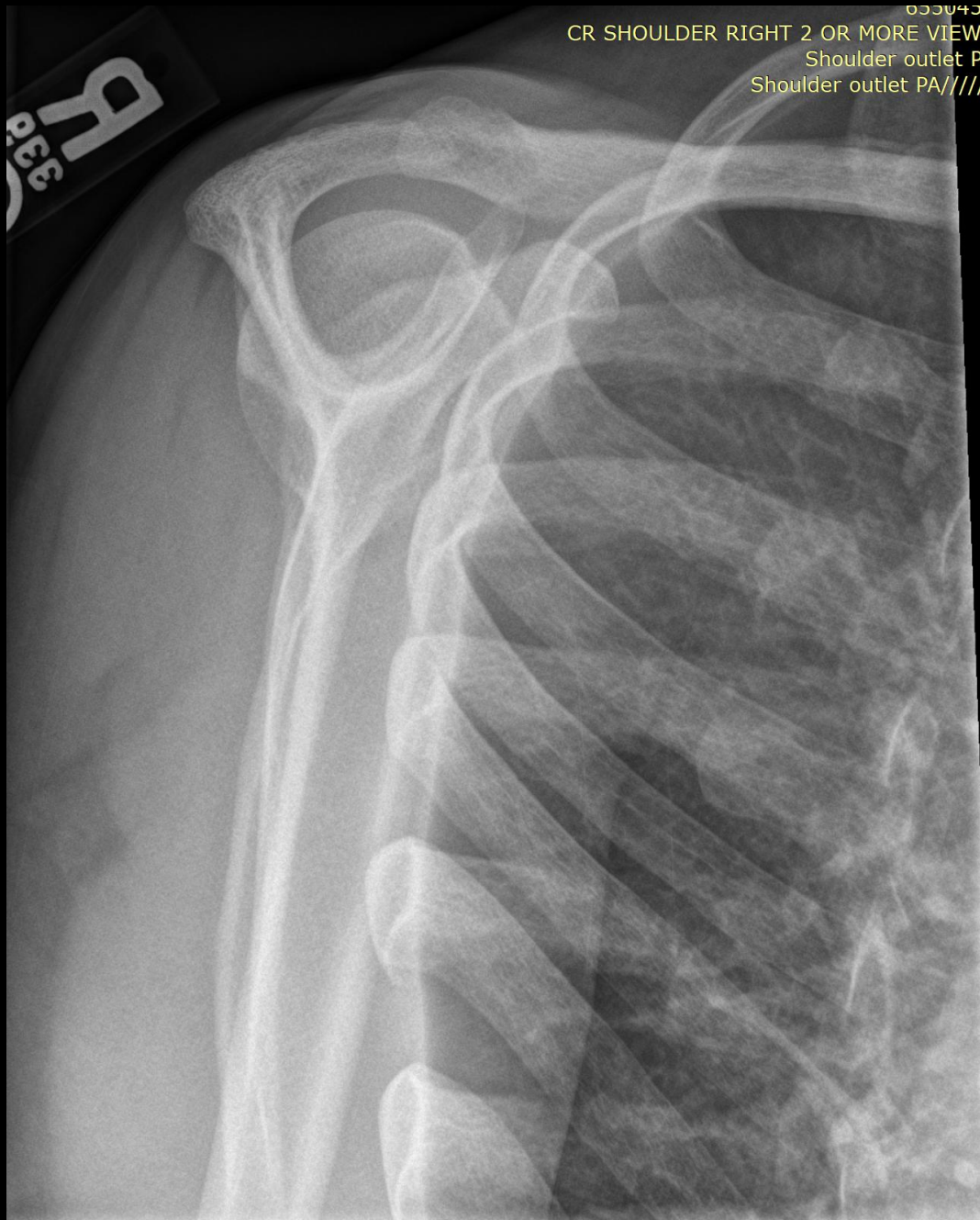
38-YEAR-OLD FEMALE

Right shoulder pain in a rock climber

Infraspinatus muscle atrophy





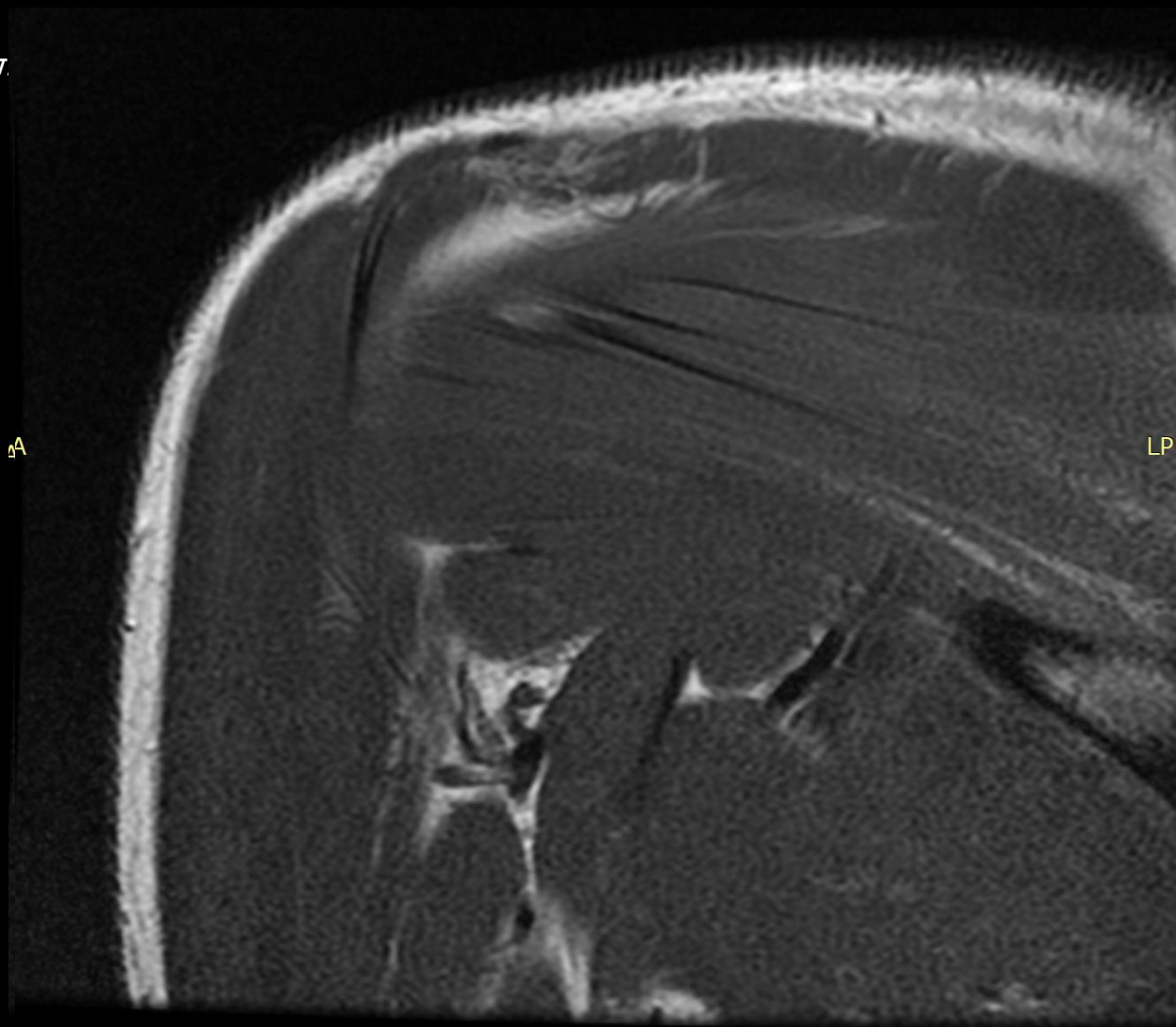


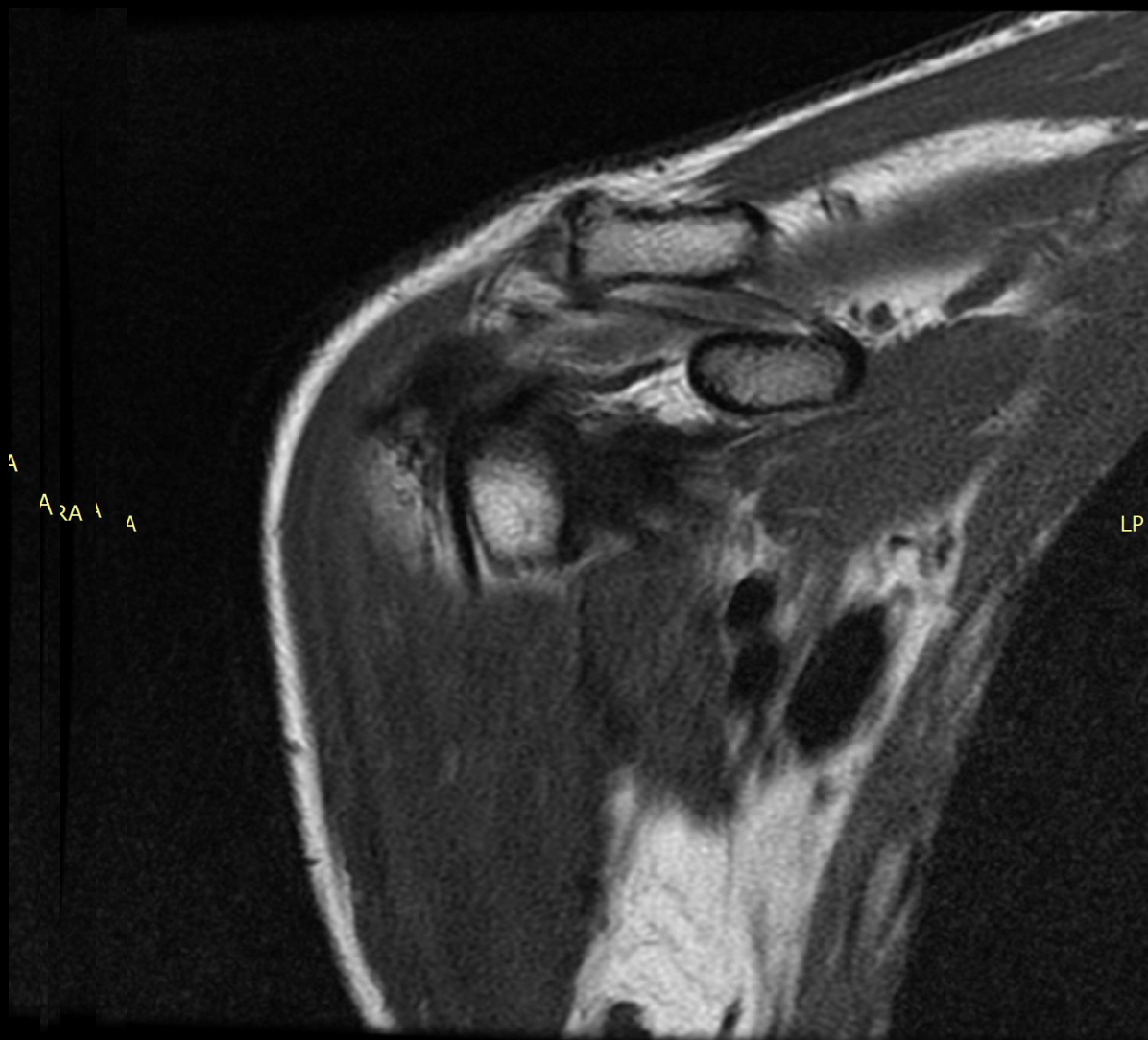
0330435
CR SHOULDER RIGHT 2 OR MORE VIEWS
Shoulder outlet P/
Shoulder outlet PA/////

IMPRESSION

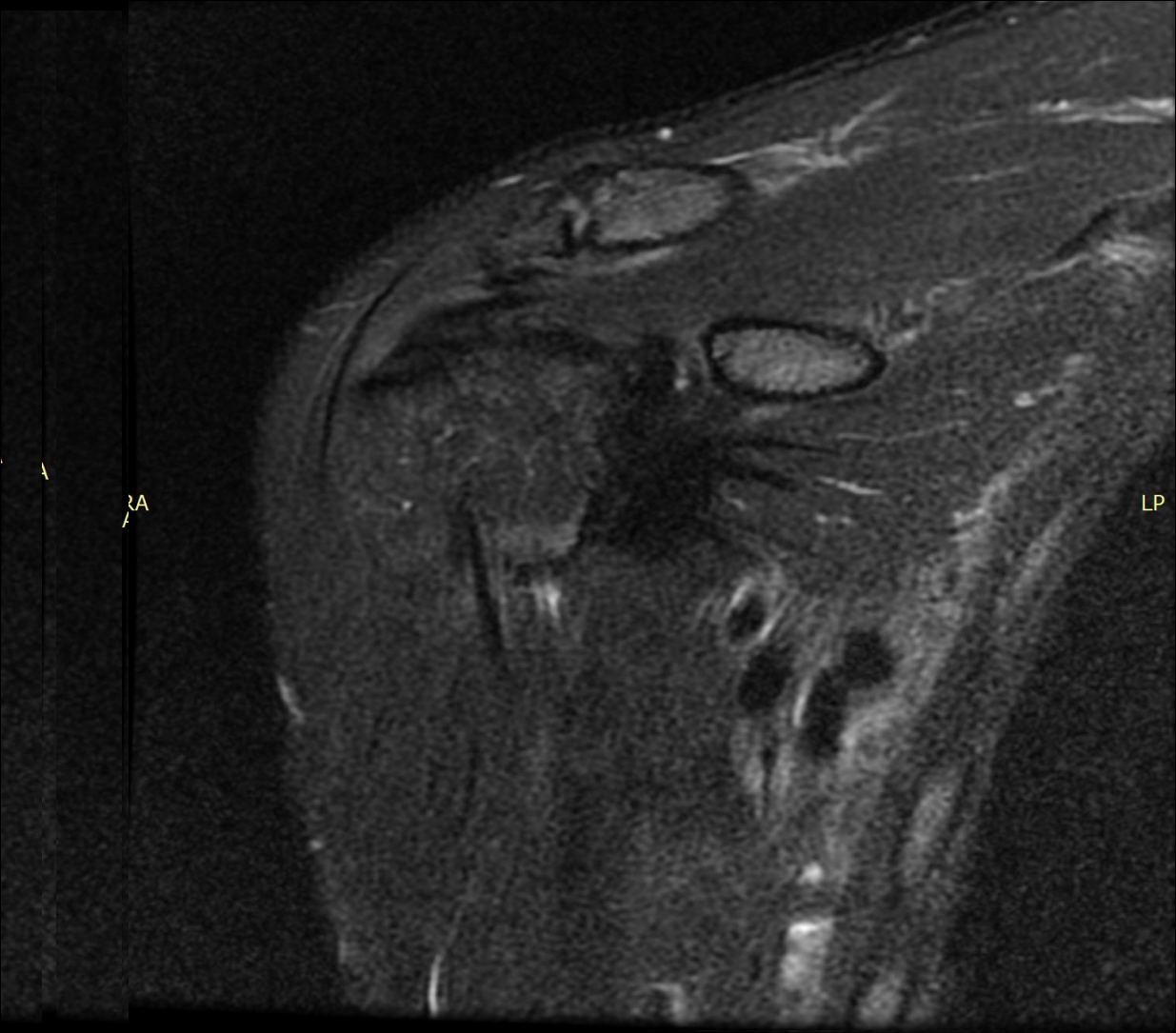
Radiographic negative examination of the
shoulder

Coronal PD w
contrast

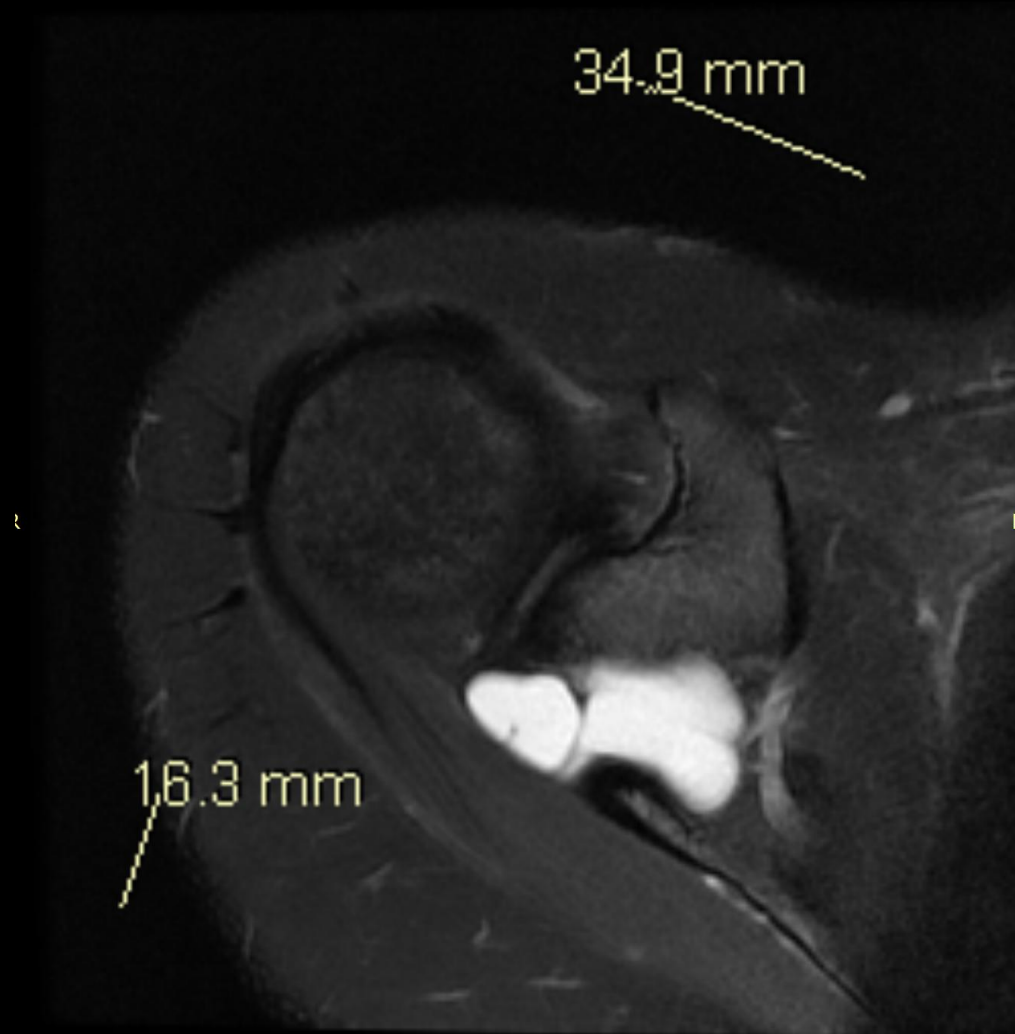




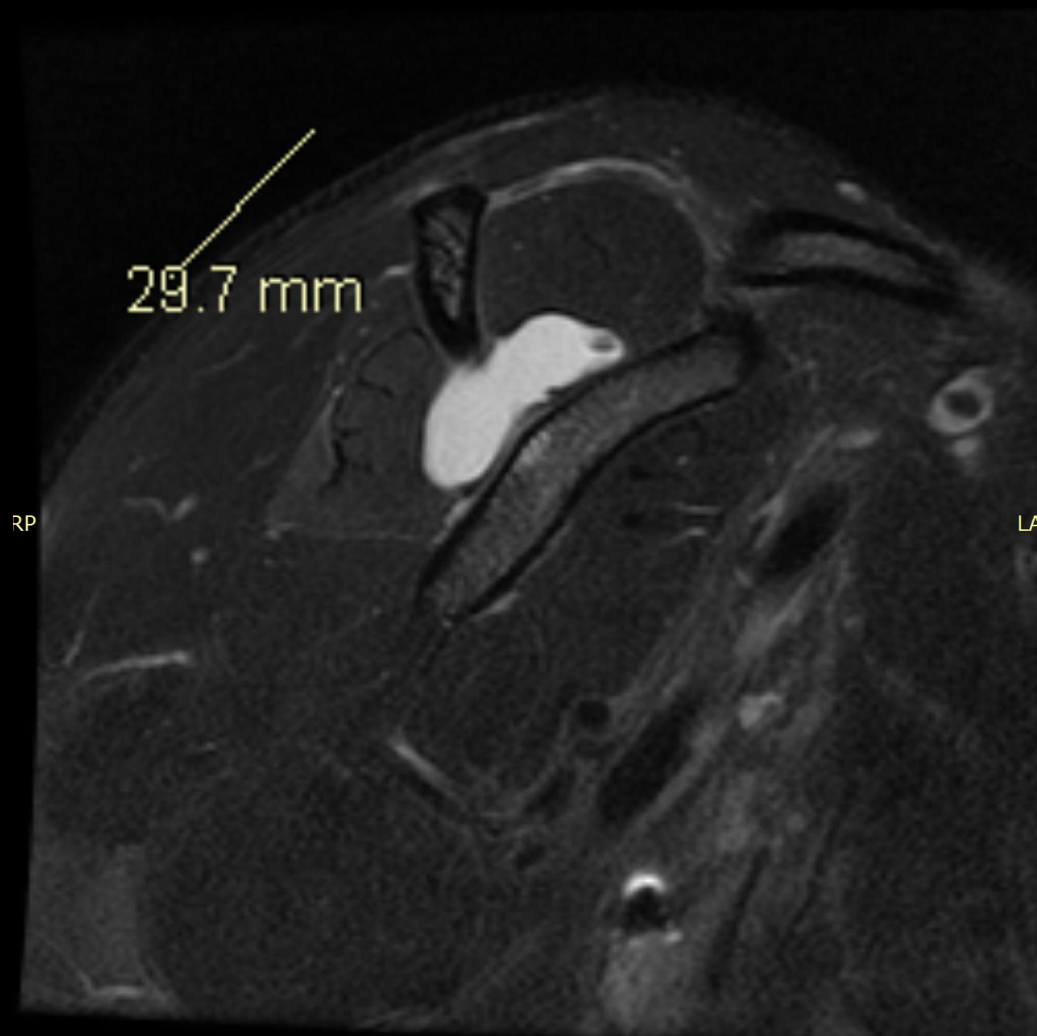
Coronal T2 FS



AX T2 FS



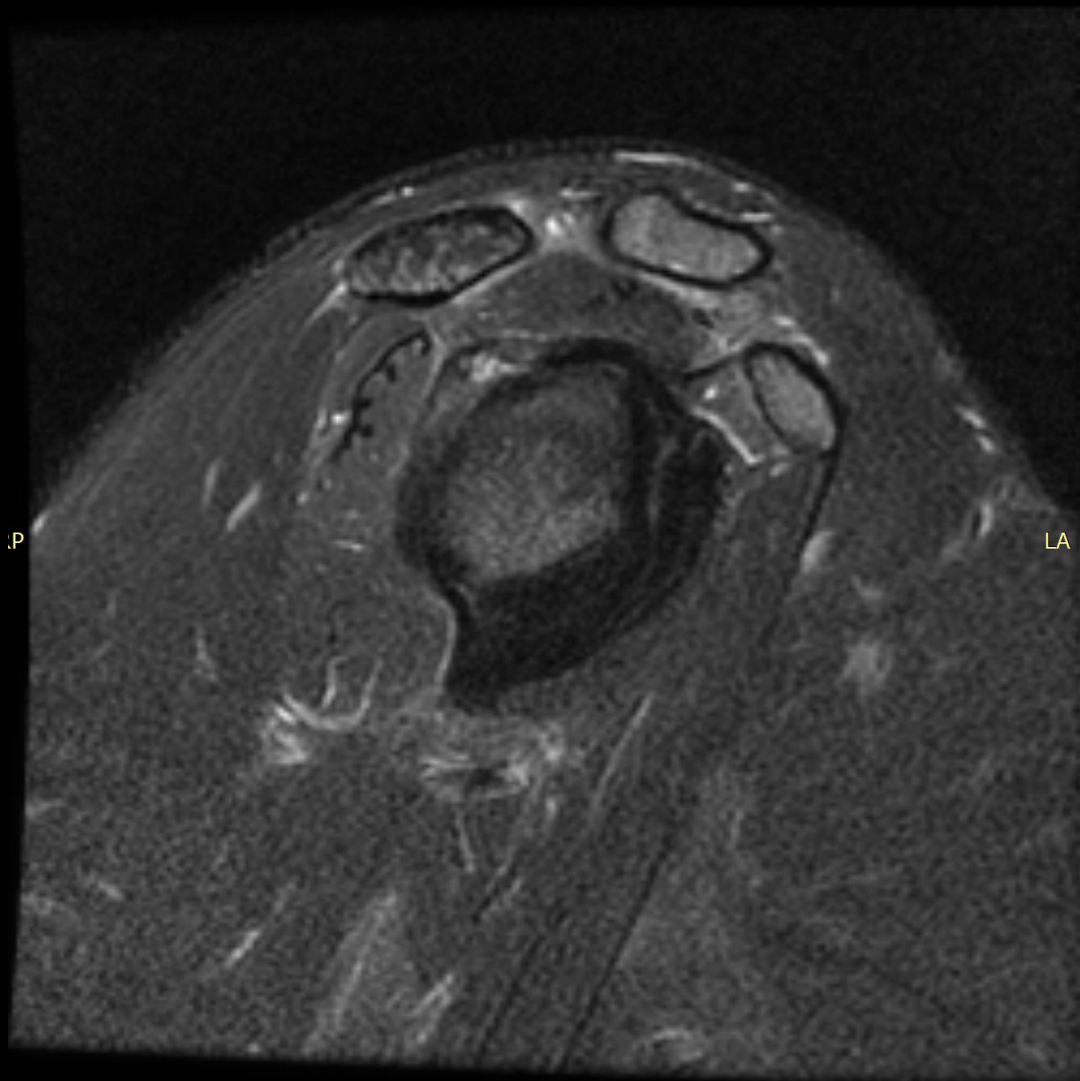
SAG T2 FS



29.7 mm

RP

LA



IMPRESSION

Posterosuperior and likely superior labral tear with large paralabral cyst formation extending into spinoglenoid notch

Diffuse muscle belly edema without fatty infiltrate of infraspinatus

**WHAT IS NEXT BEST
IMAGING TO ORDER?**

MR arthrogram



30-YEAR-OLD MALE

Left anterior knee pain that started approximately 3 months ago while running a trail race. He had to stop due to pain.

No recent major traumas, injuries, or illnesses.

Modifying factors: Better with rest and worse with going down stairs



L

NWB

There is a large, well-defined osteolytic lesion with a thin, sclerotic margin of the distal femur.

It is eccentric in location and is located within the metaphysis.

The matrix of the lesion appears hazy.

There is no evidence of bony expansion.

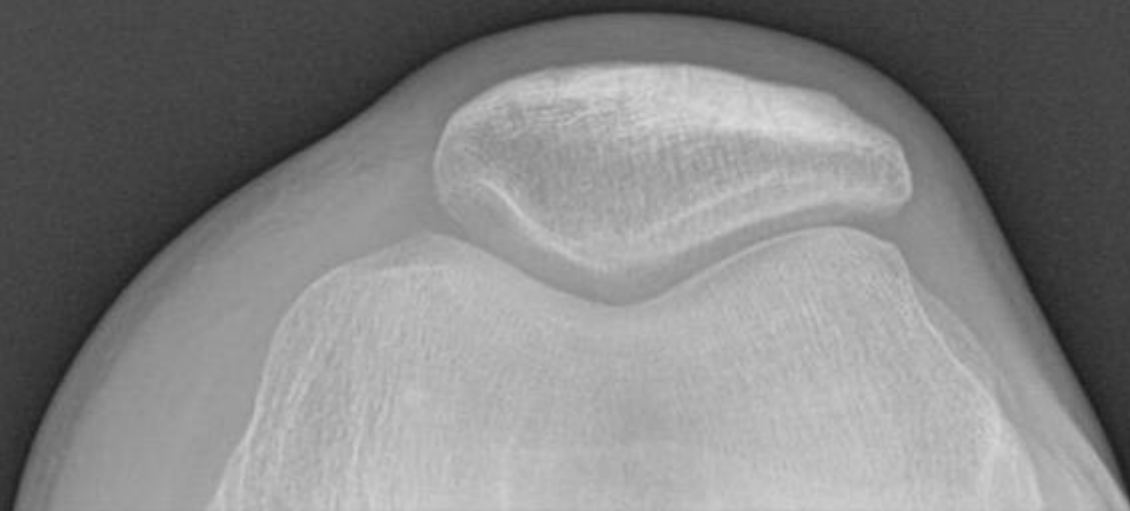
There is no evidence of cortical breakthrough or soft tissue mass.

No periosteal reaction is seen.





L





**WHAT IS THE MOST LIKELY DIAGNOSIS OF THE DISTAL
FEMUR BONE LESION?**

NON-OSSIFYING FIBROMA

DDX Fibrous Dysplasia

NON-OSSIFYING FIBROMA

diagnosis of non-ossifying fibromas is mainly based on characteristic radiographic or imaging features They are considered as 'do not touch' or 'leave me alone lesions.'

NON-OSSIFYING FIBROMAS

- very common in children and adolescents and are considered the most common benign tumor
- The true incidence of non-ossifying fibromas is not known because most lesions are not detected due to the absence of clinical symptoms and the benign natural history of the lesions.
- They are usually not seen beyond the age of 30 as they heal spontaneously after puberty and ossify gradually.
- Due to their benign self-limiting natural history, they do not require biopsy or follow-up in the setting of characteristic imaging features.
- Larger tumors can have an impact on the biomechanical properties of the affected bone and cause pain.
- Non-ossifying fibromas might cause a pathological fracture if large.

PATIENT REFERRED FOR MRI OF KNEE

Review of key images



Normal lateral meniscus



Normal medial
meniscus



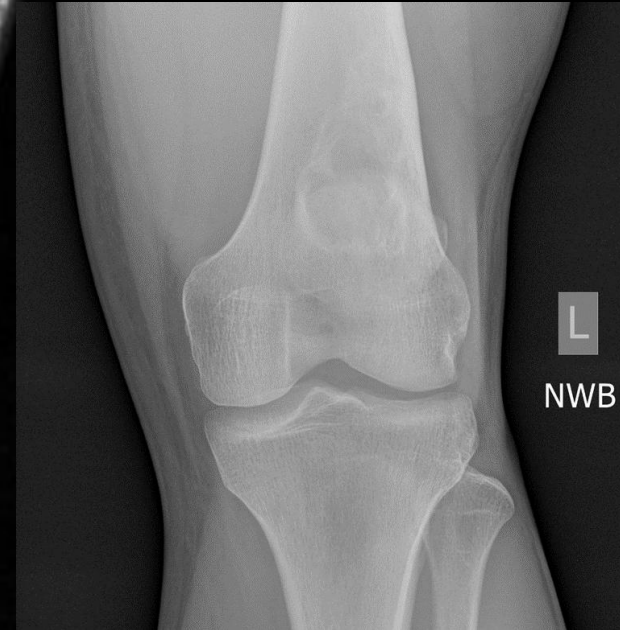
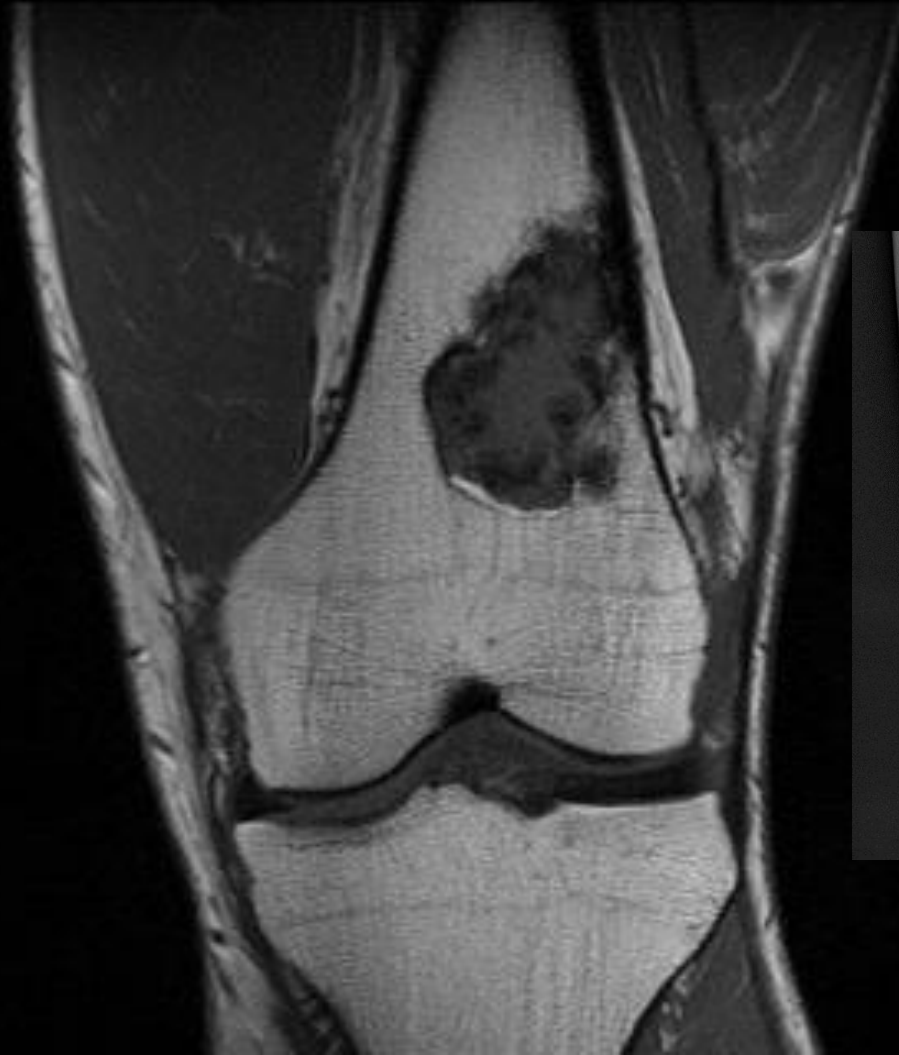
Normal ACL

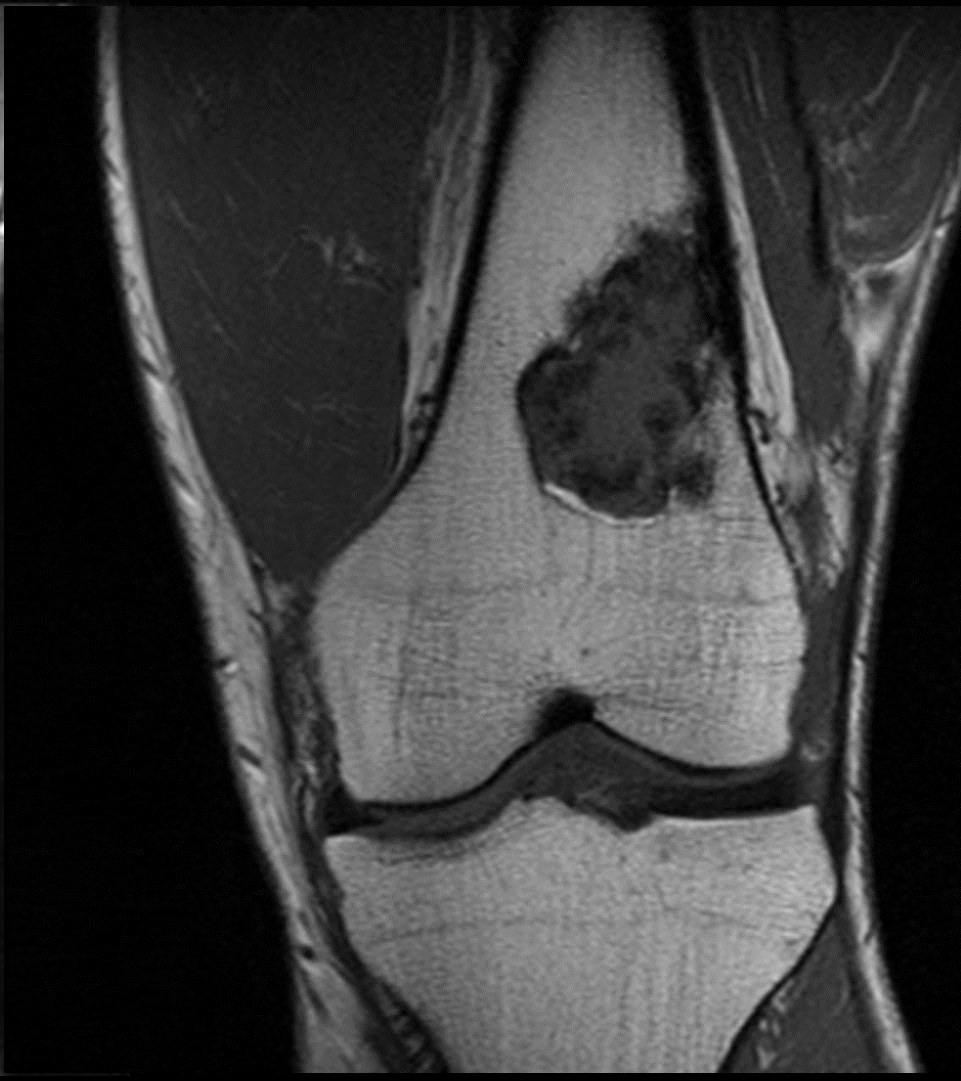
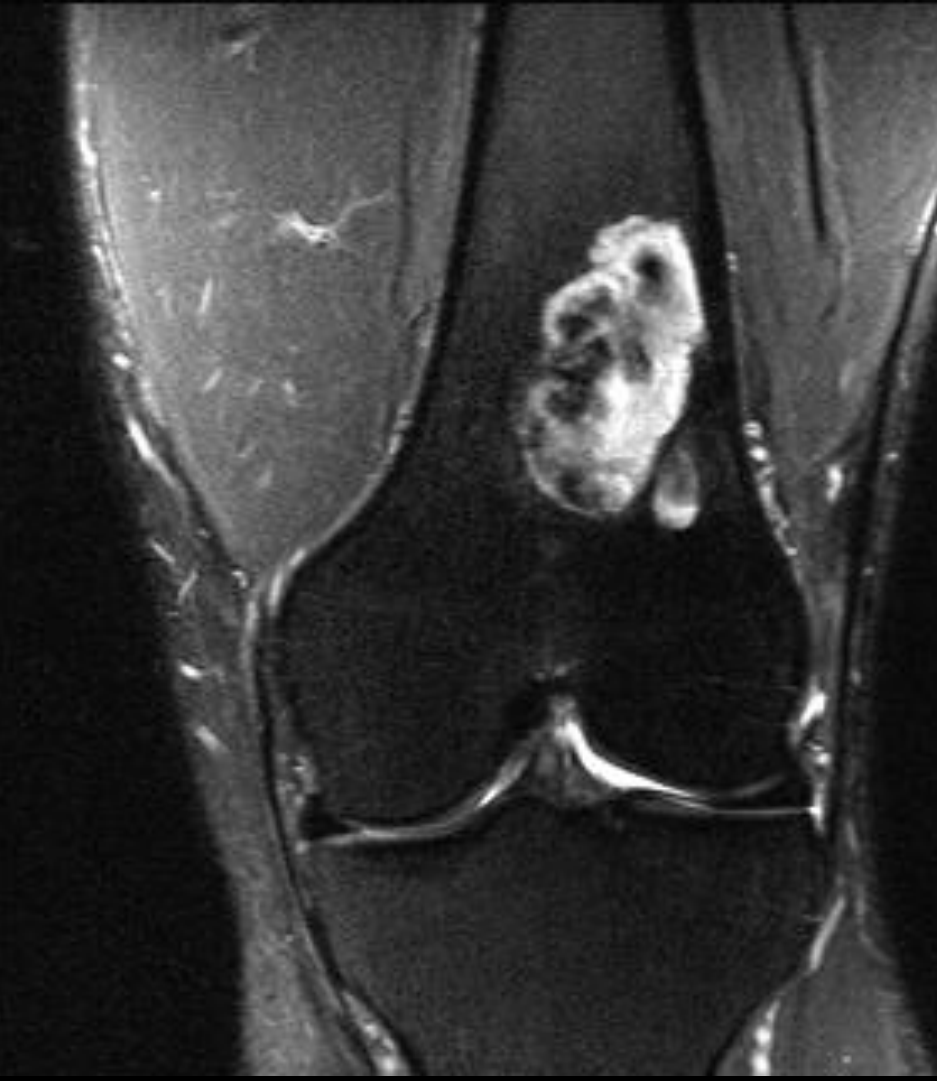


Normal femoral insertion of PCL



Normal remainder of PCL



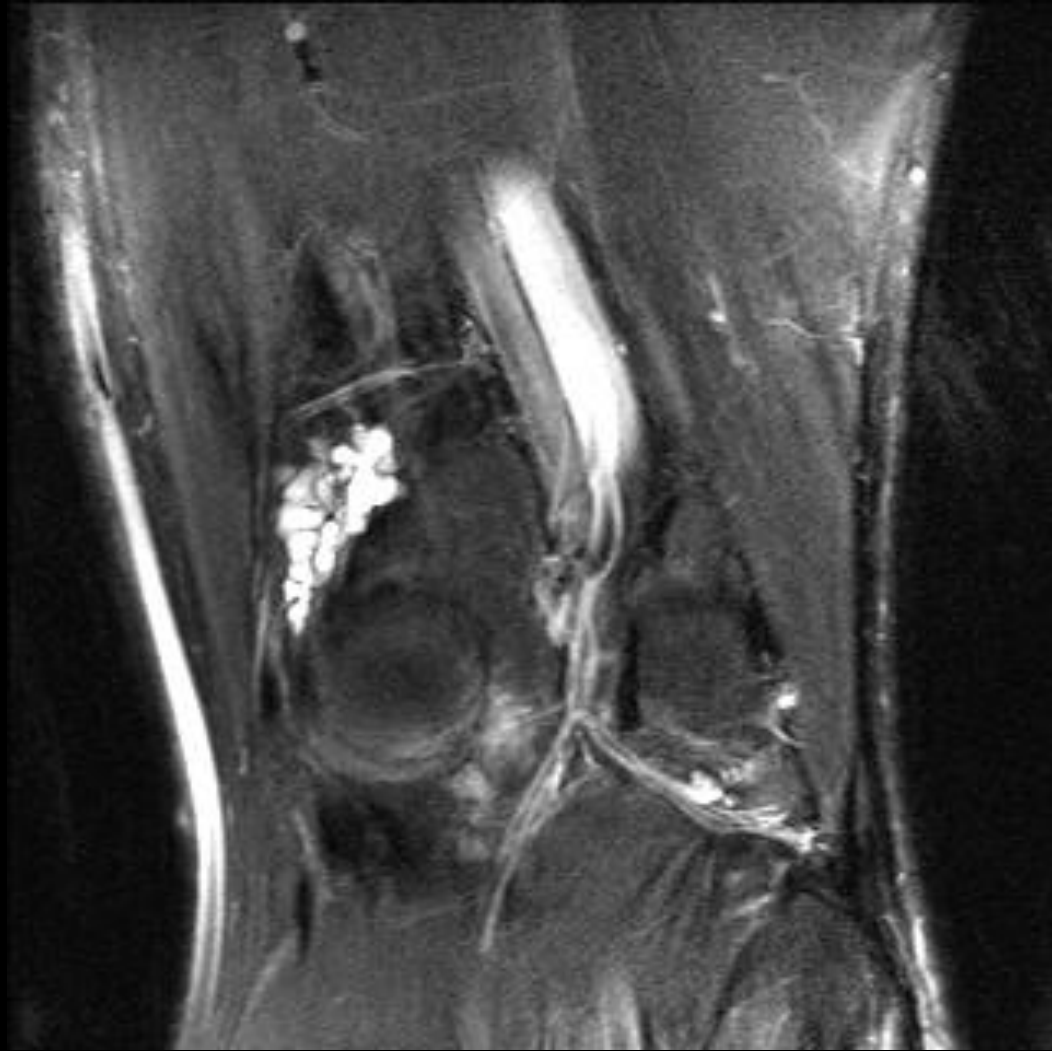


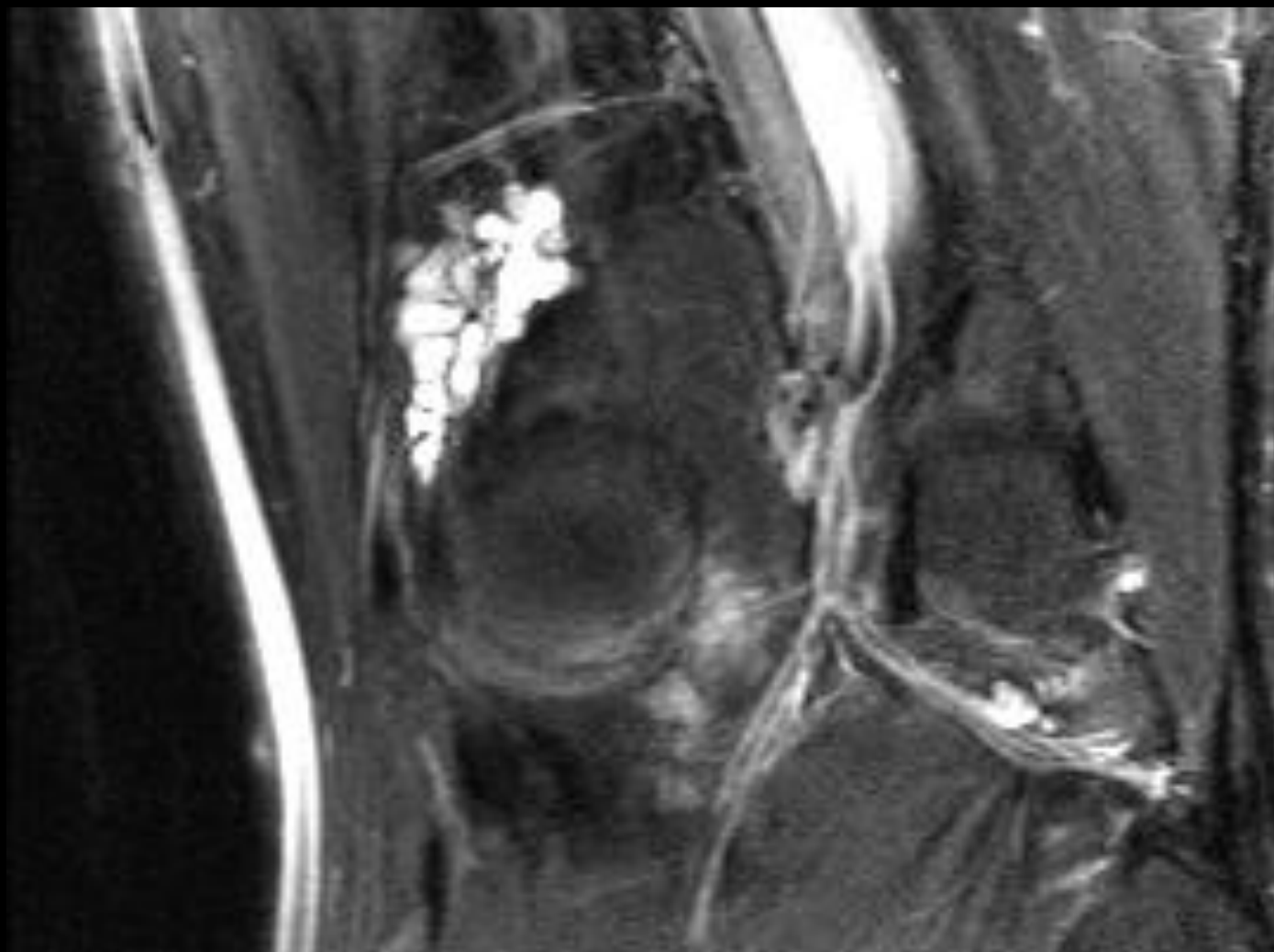


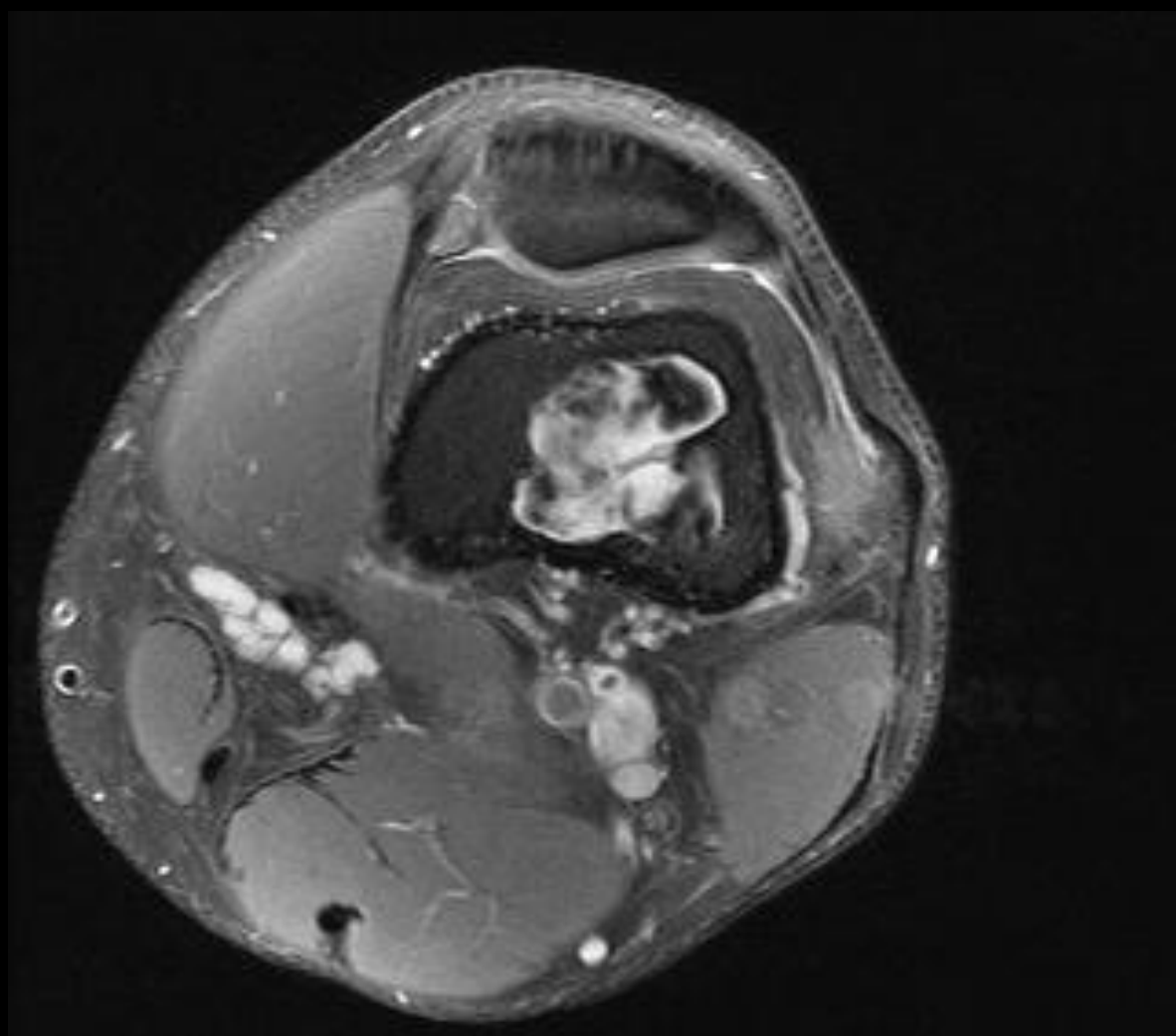


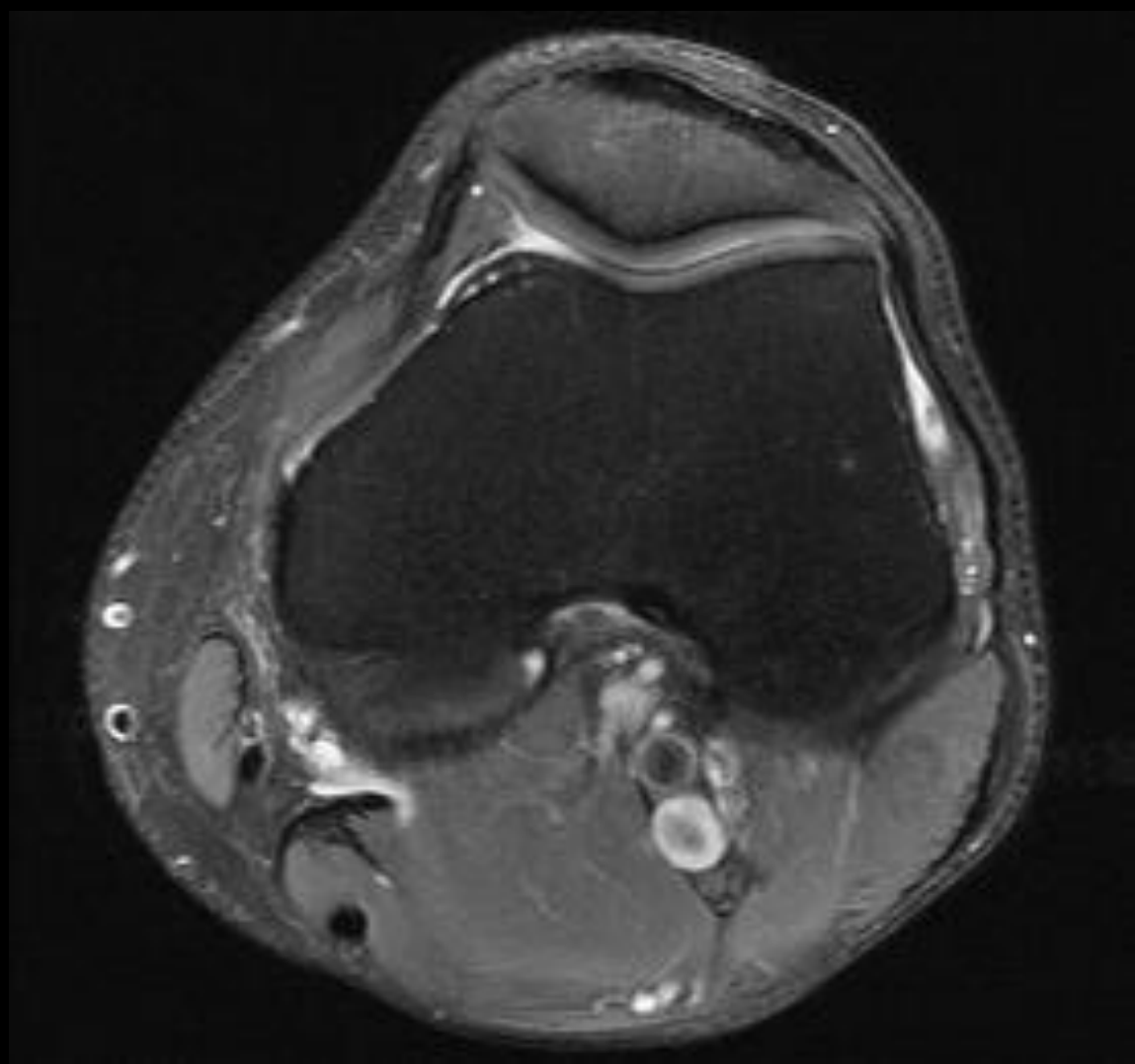


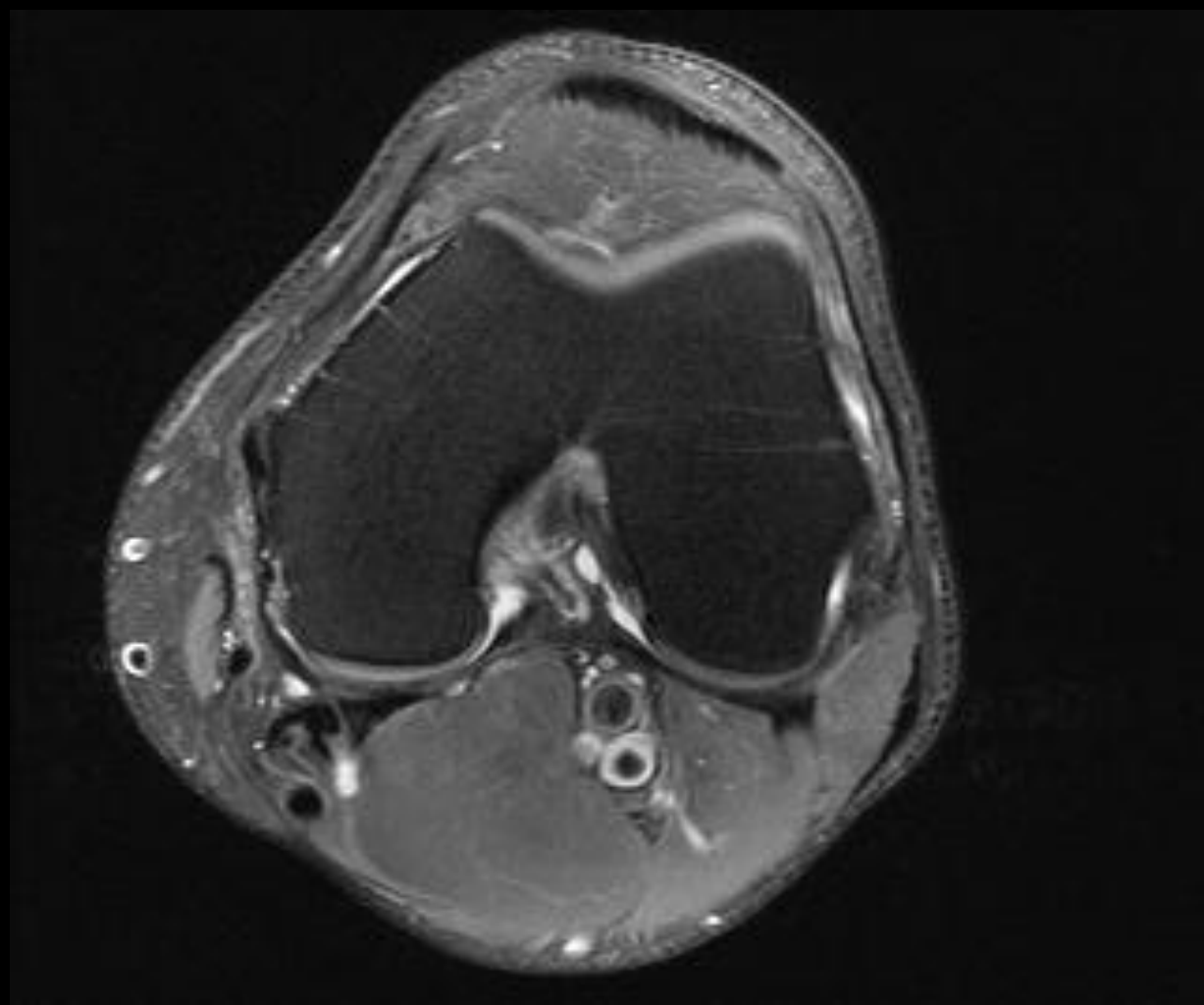












MRI RESULTS

Findings consistent with fibroxanthoma. No fracture identified.

Polylobulated popliteal cyst measuring 41mm in craniocaudal dimension



**IS THE PATIENT'S KNEE GANGLION LIKELY A PAIN GENERATOR?
IF SO, HOW DO YOU DETERMINE IF THE GANGLION IS A PAIN
GENERATOR?**



IS THE PATIENT'S NOF (FIBROXANTHOMA) LIKELY A PAIN GENERATOR?

MANAGEMENT REGARDING NOFS

Clinicoradiologic correlation is always needed.

As long as biomechanical stability is not affected NOFs
do not require treatment.

FINAL DIAGNOSIS

Patellofemoral pain syndrome

