Ankle: Tendons and Ligaments

Suzanne S. Long, MD
William Morrison MD
Adam C. Zoga, MD, MBA
Angela Gopez MD

Sidney Kimmel Medical College
Philadelphia, PA, U.S.A.



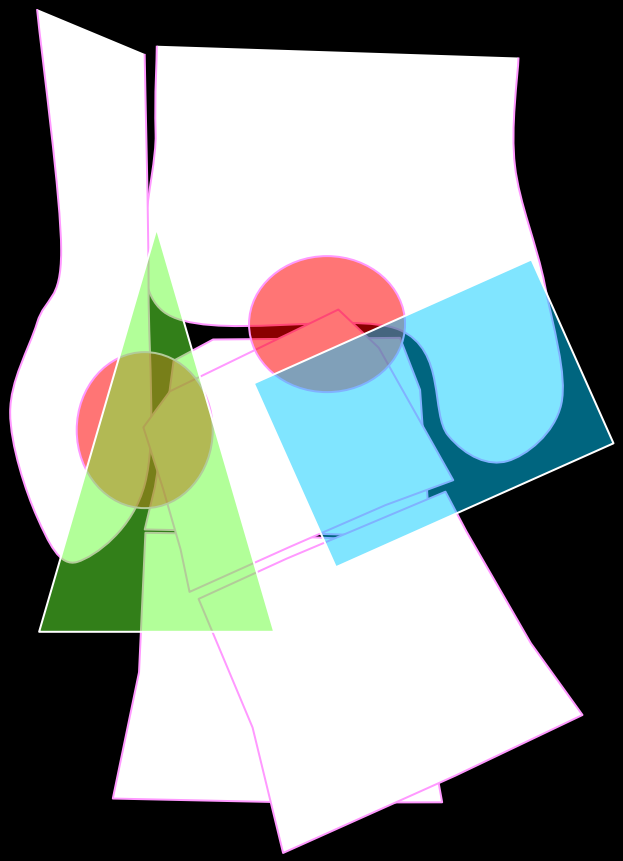


LIGAMENTS

Ankle sprain: most common injury

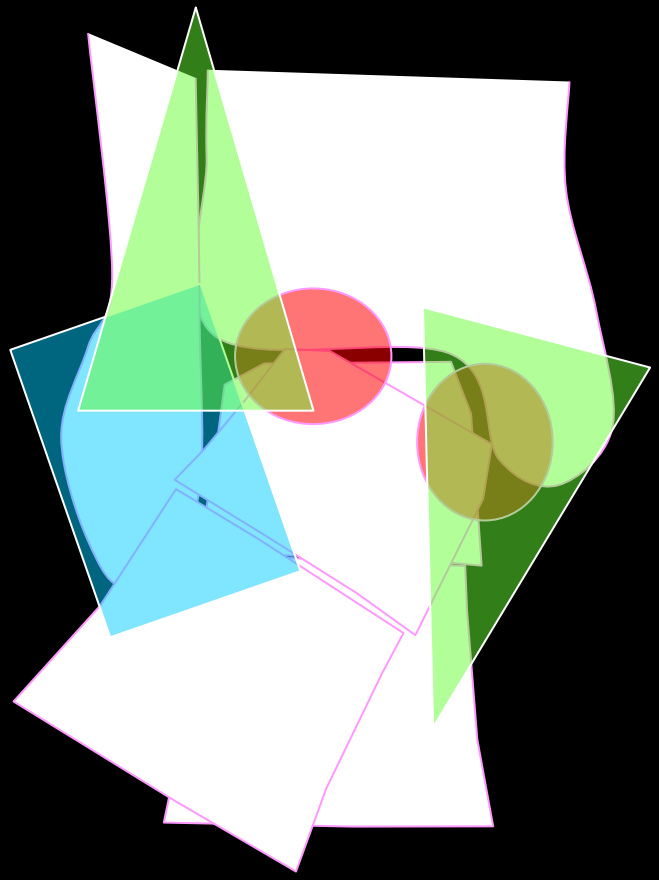
- Ligamentous injury usually self-limited
- Conservative tx
- MRI for chronic pain, can be from:
  - ***Tenosynovitis, esp peroneal***
  - ***Impingement, esp anterolateral***
  - ***Sinus tarsi syndrome***
  - ***OCD***
  - ***Ankle / subtalar instability***

ANKLE SPRAIN



- 85% Inversion Injury
  - aka Supination Injuries
  - Lateral distraction injury
  - Impaction medially
- 15% Eversion
  - aka Pronation Injuries
  - Accompanied by lateral malleolus fracture and/or syndesmosis injury
  - More severe injuries

ANKLE SPRAIN



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  - Lateral distraction injury
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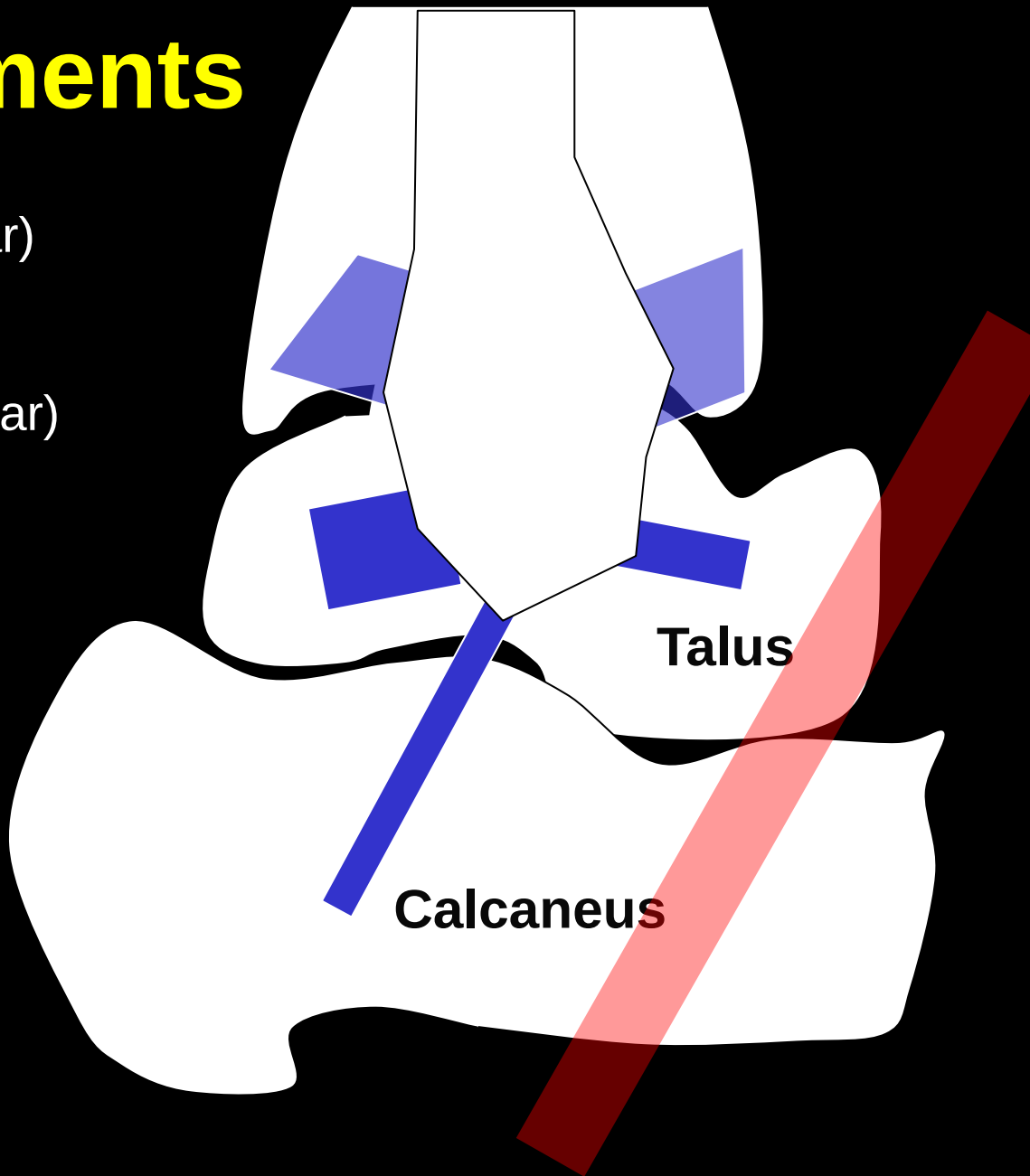
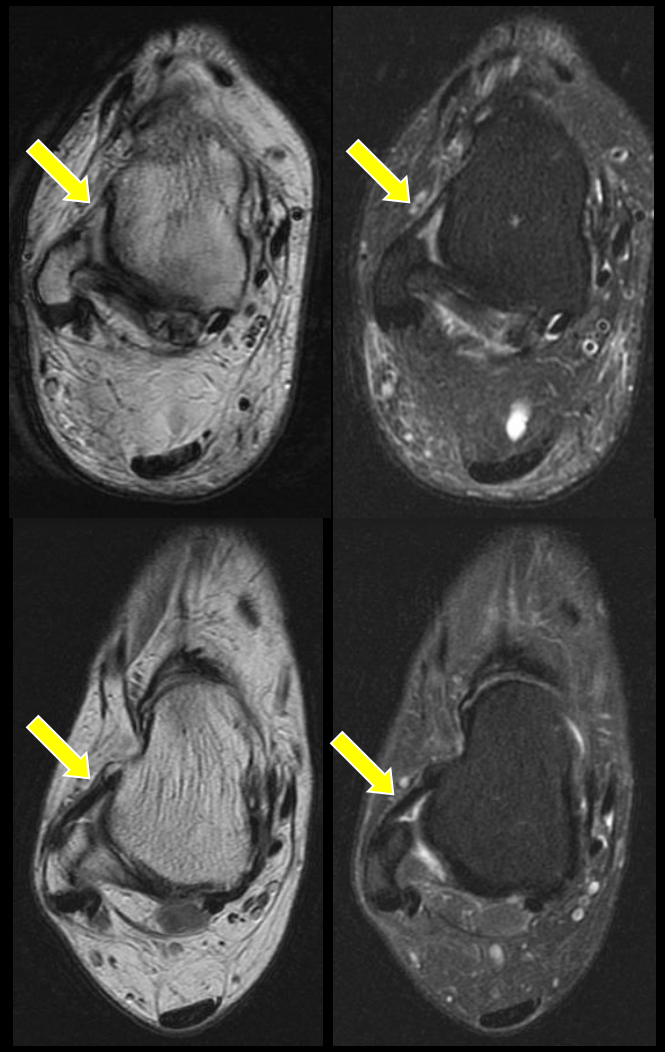
Lateral Ligaments

- ATFL (anterior talofibular)
- CFL (calcaneal fibular)
- Syndesmosis
- PTFL (posterior talofibular)

- Tear in Progression!!



Anterior Talofibular (ATFL)



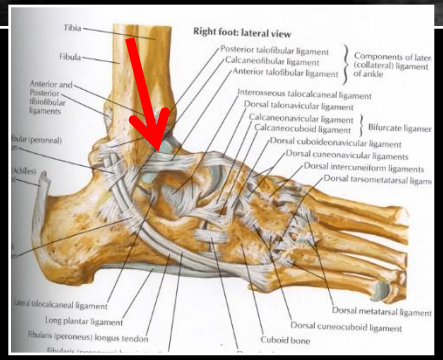
PT #1

PT #2

Ultrasound – normal ligament (ATFL)

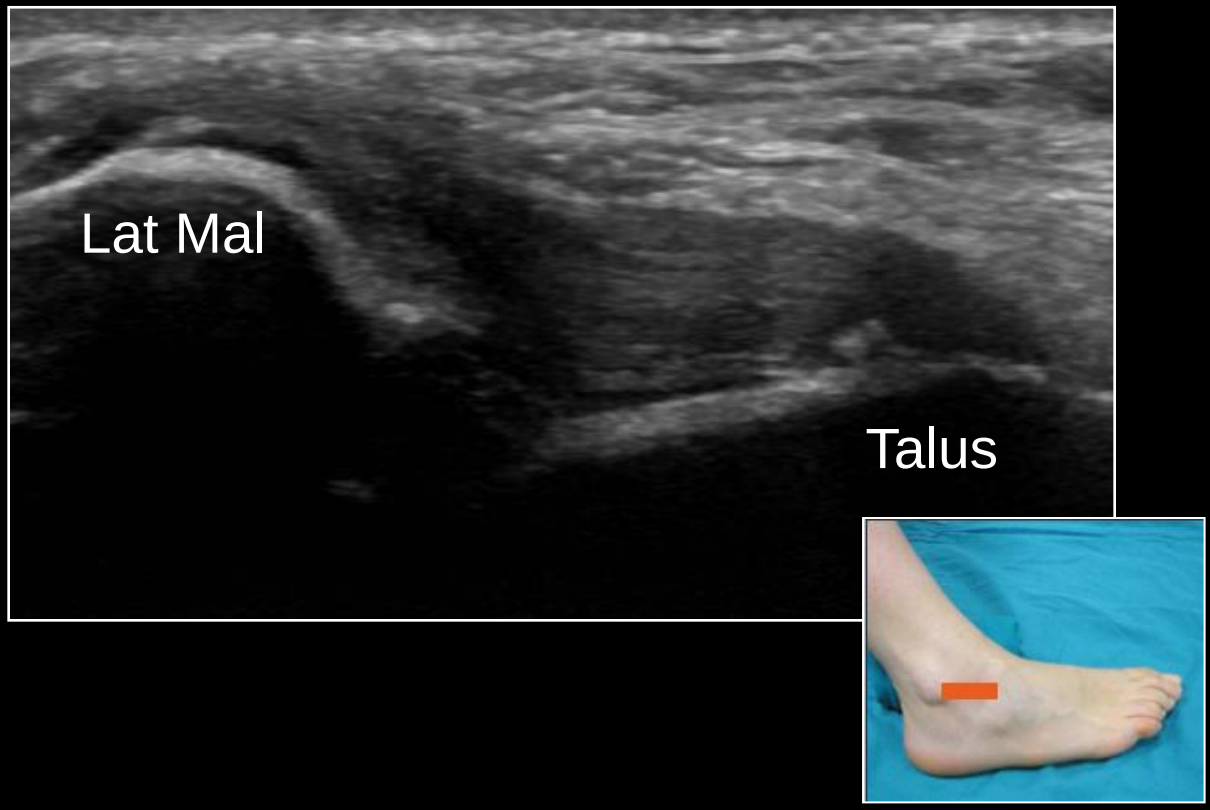
- echogenic
- fibrillar

anterior talofibular ligament (ATFL)



ATFL sprain

- hypoechoic
- +/- thick
- loss of fibrillar pattern



LATERAL LIGAMENT INJURY

Inversion mechanism

Anterior talofibular – first injured

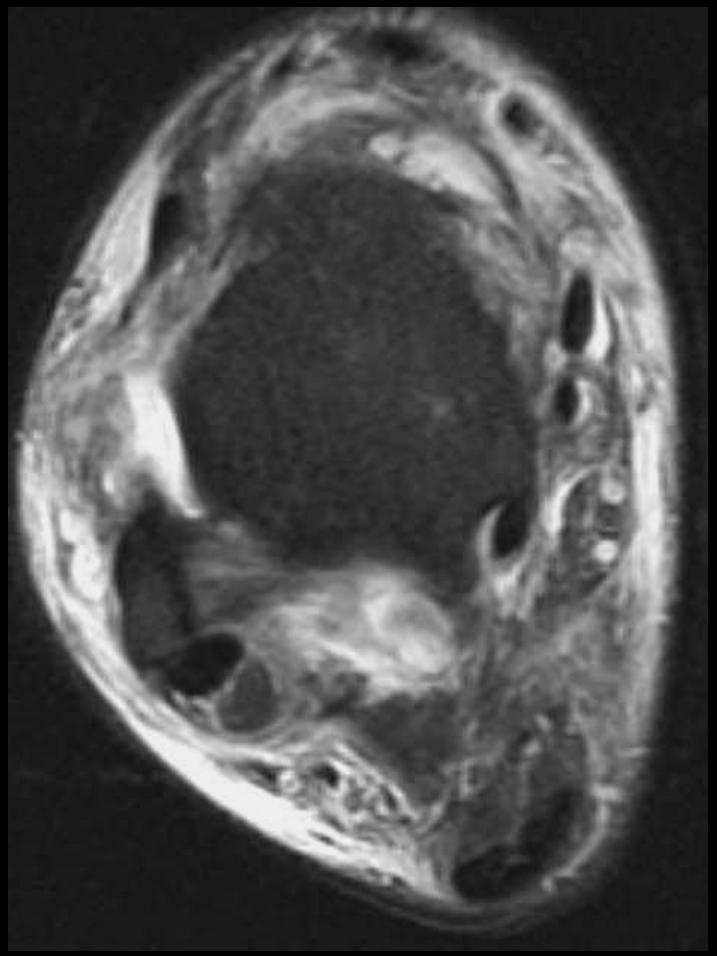
Calcaneofibular – second injured

Syndesmosis – more severe injuries

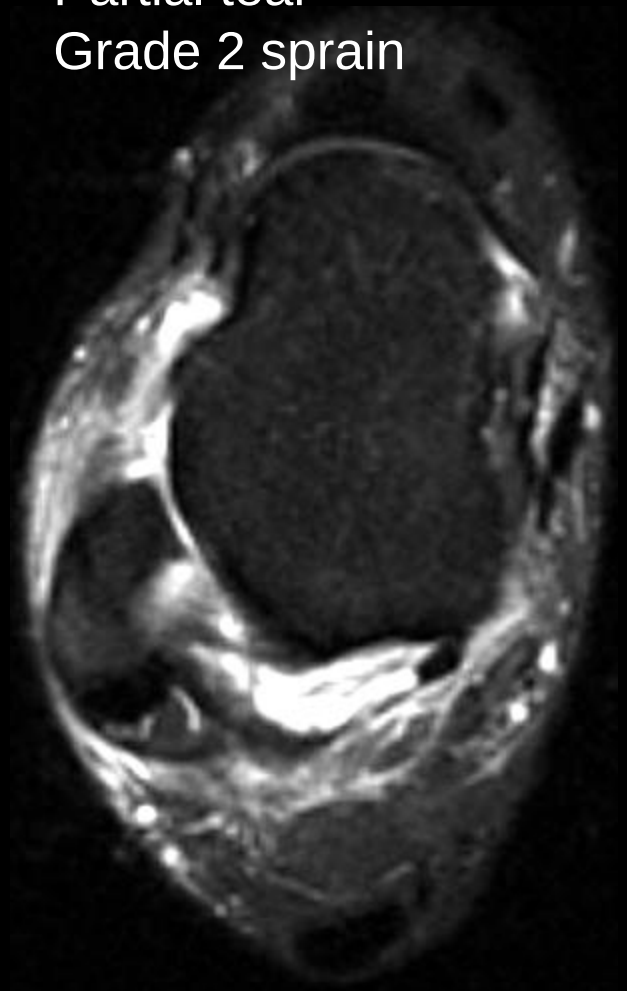
Posterior talofibular - almost never injured

ACUTE SPRAIN GRADING: ATFL

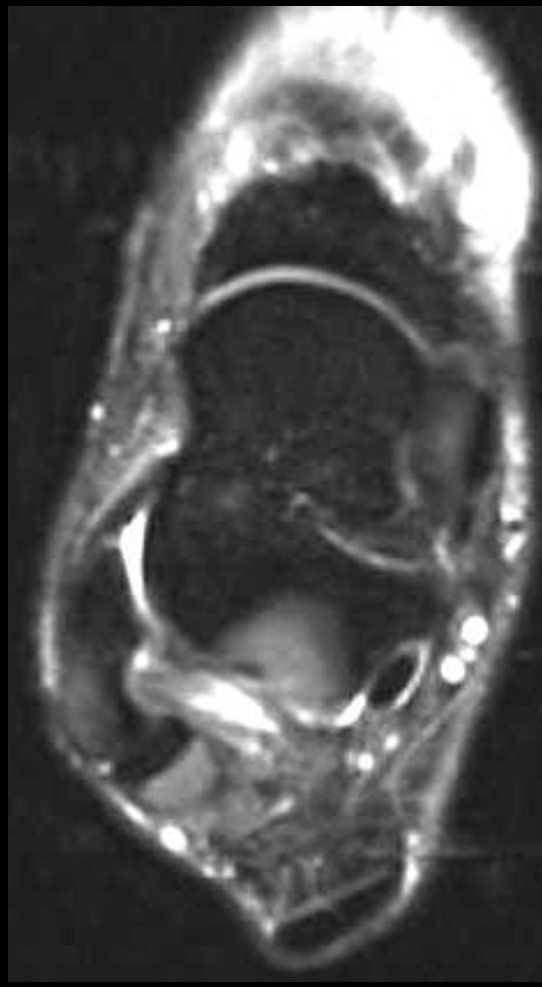
Complete tear – Grade 3



Partial tear -
Grade 2 sprain



Edema -
Grade 1 sprain



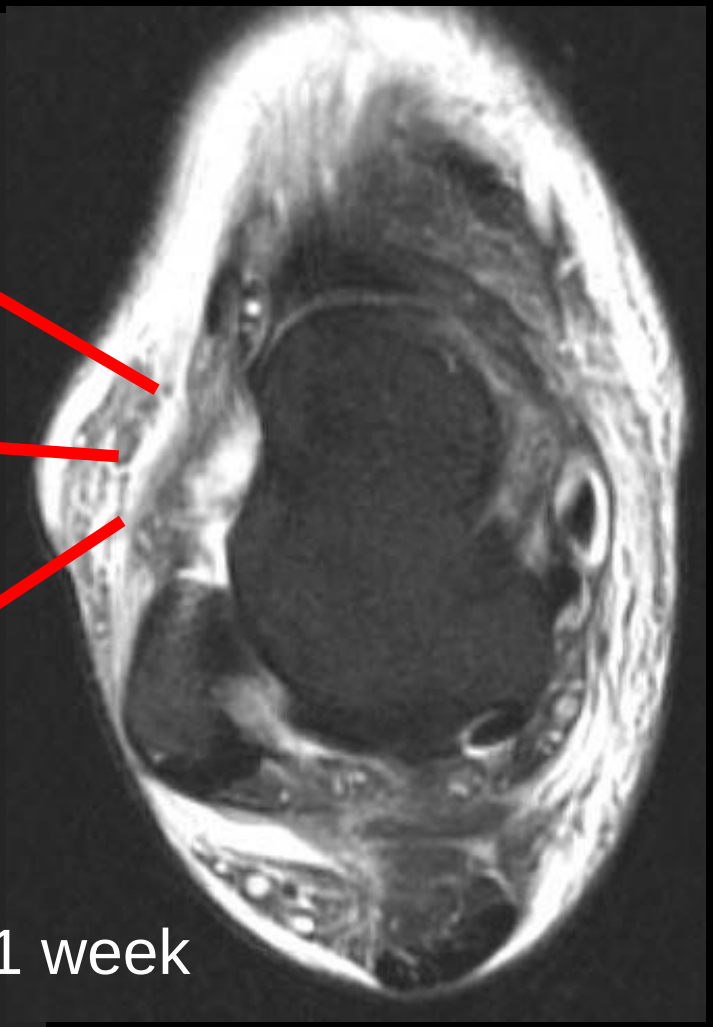
ATFL - SUBACUTE TO CHRONIC INJURY

POSSIBILITIES

Absent

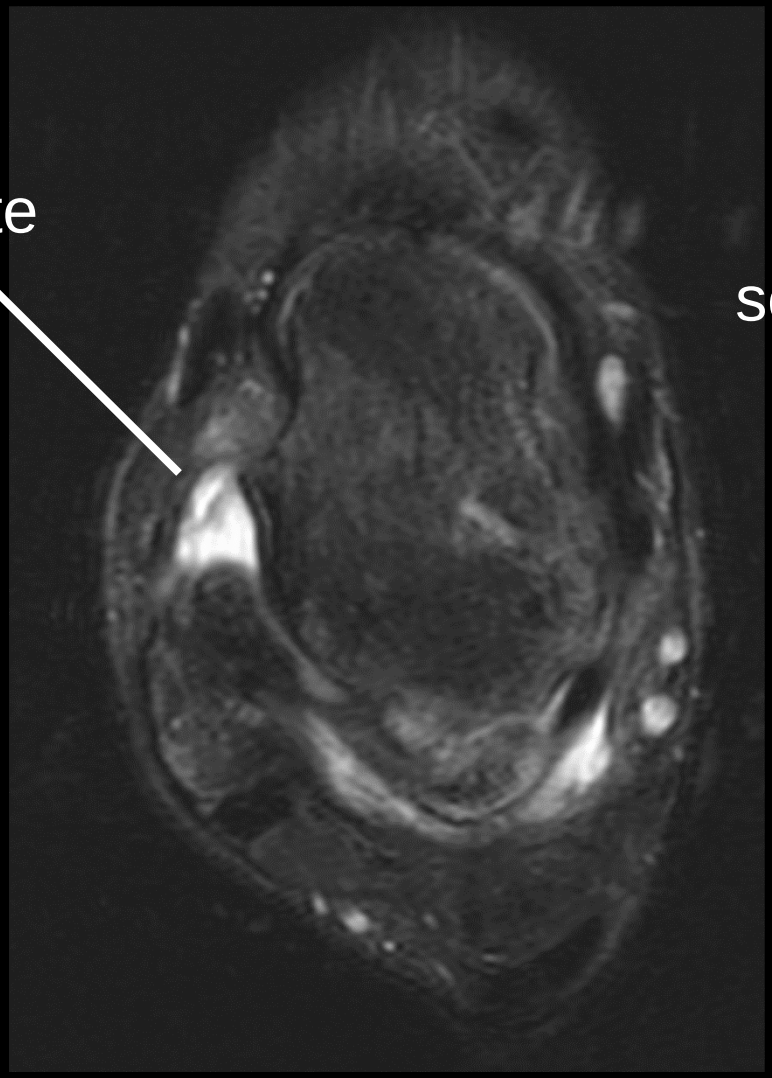
Normal

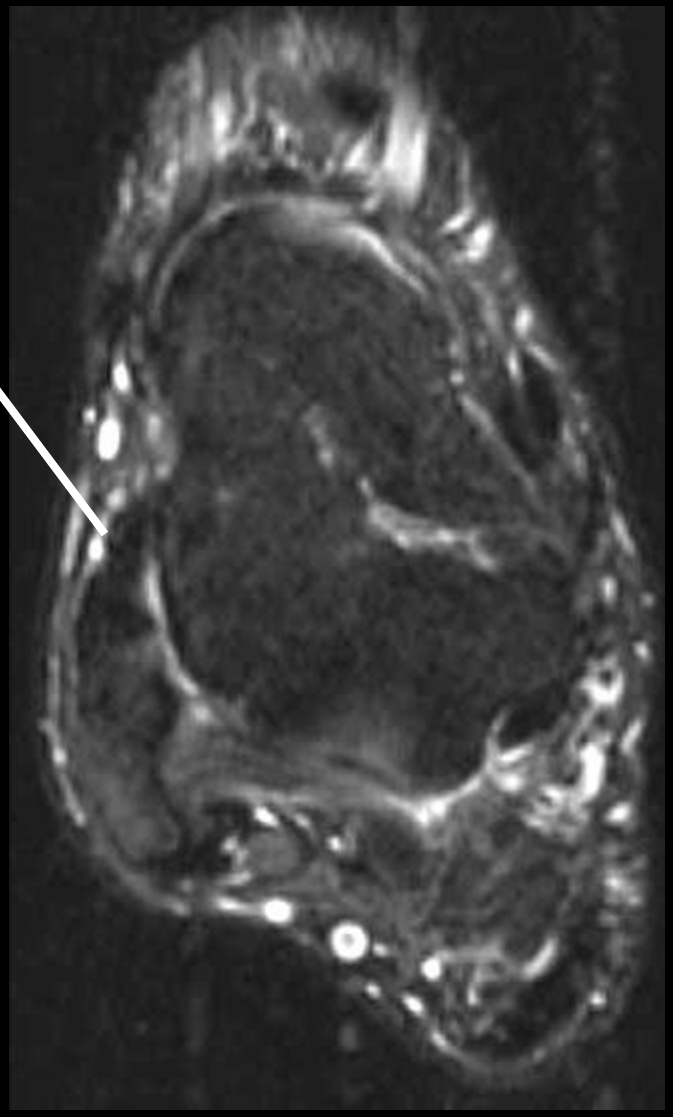
Thickened



1 week

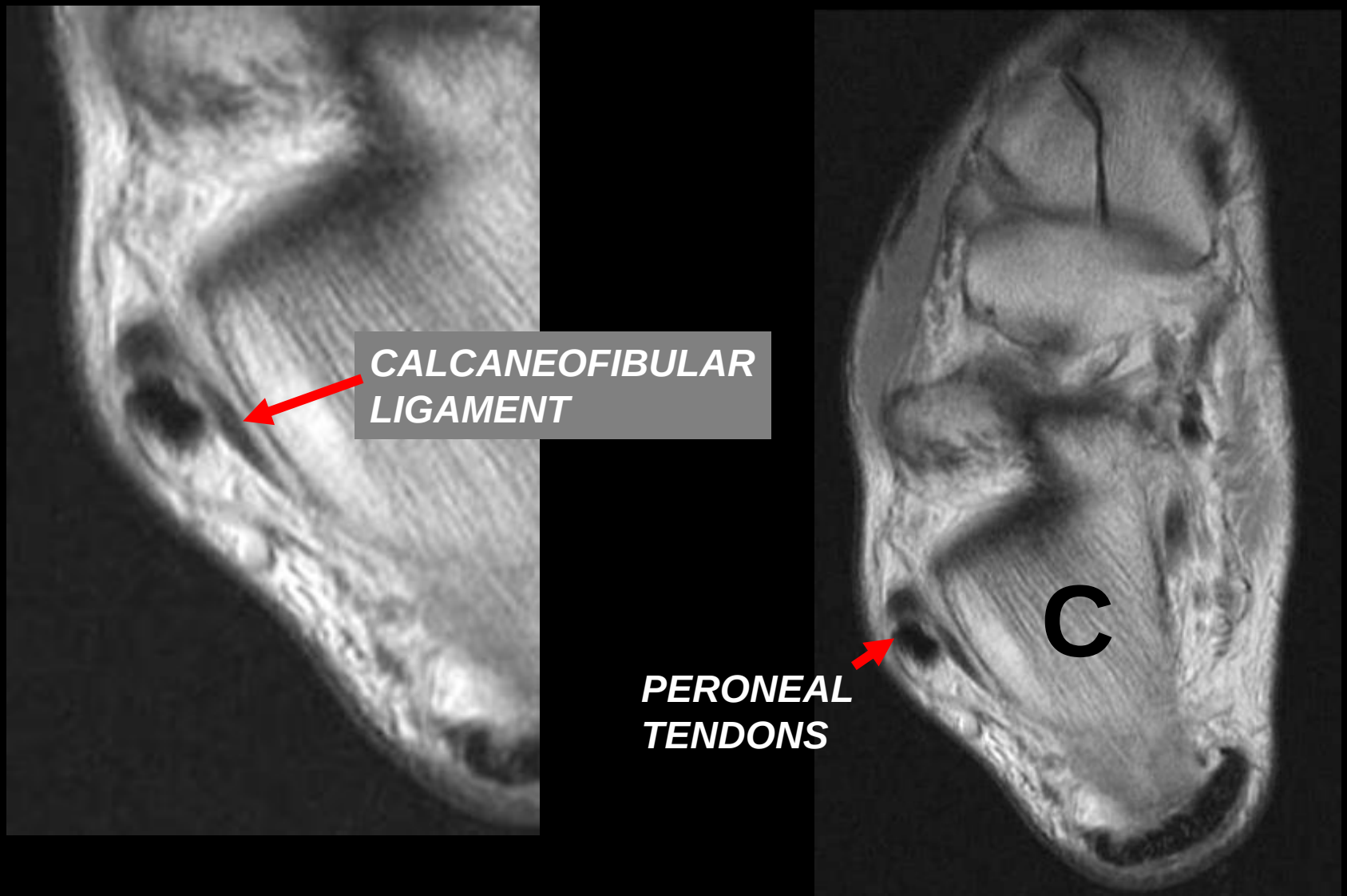
OLD ATFL INJURY



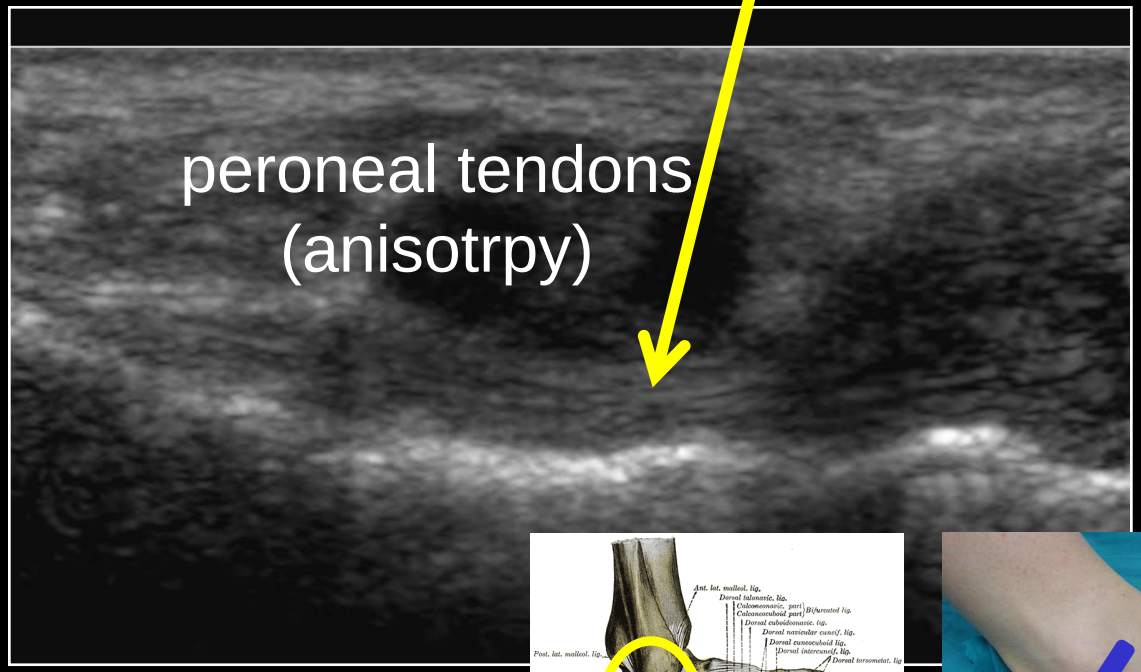


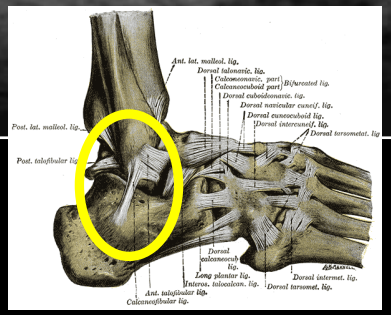
CF LIGAMENT

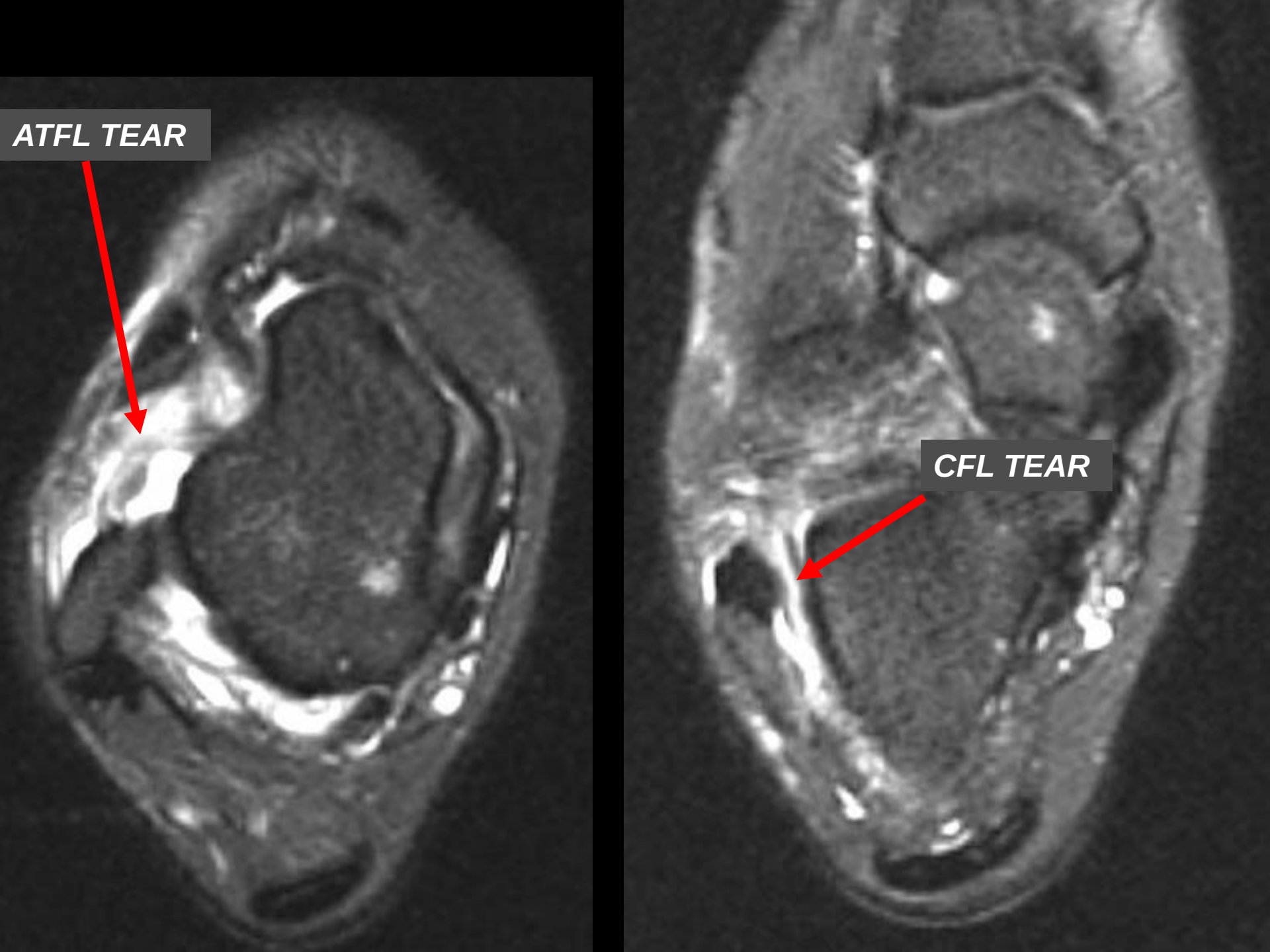
USE OF AXIAL IMAGES



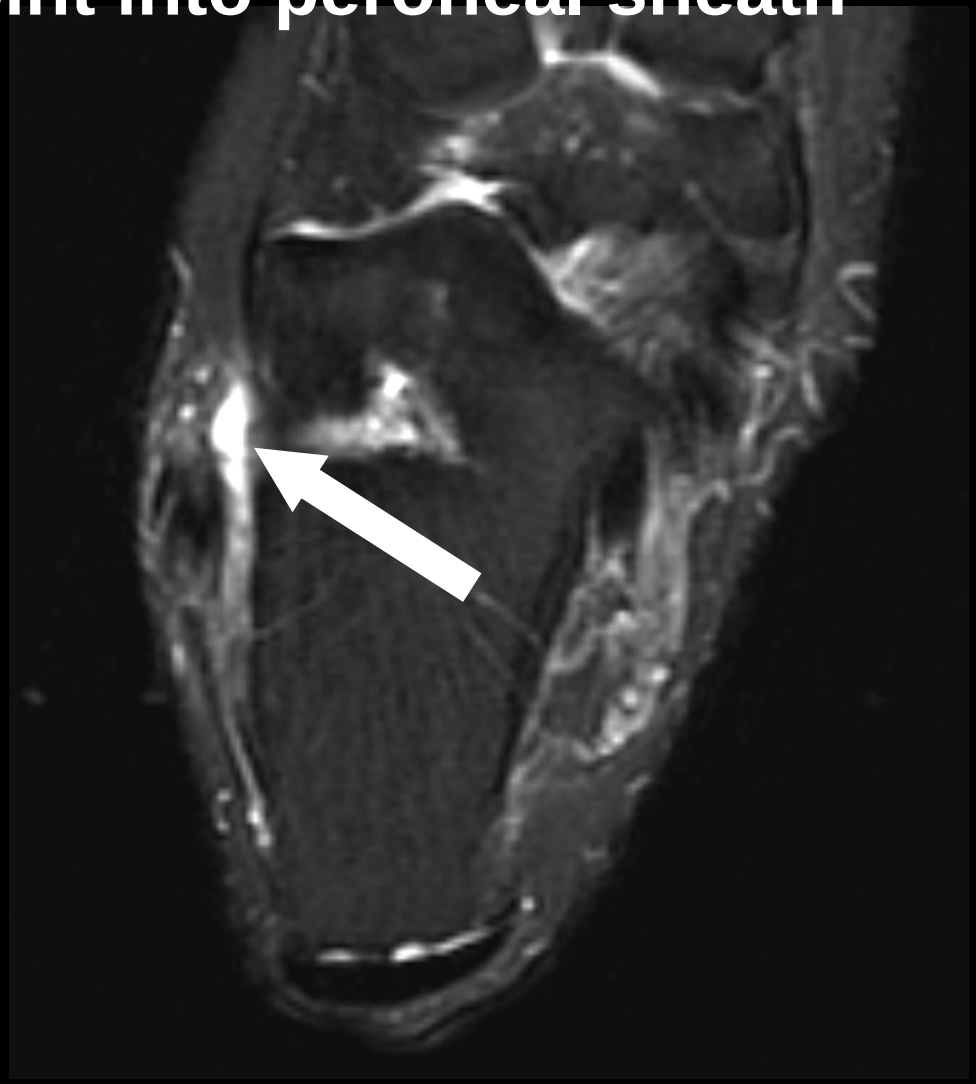
Normal Calcaneofibular Ligament (CFL)



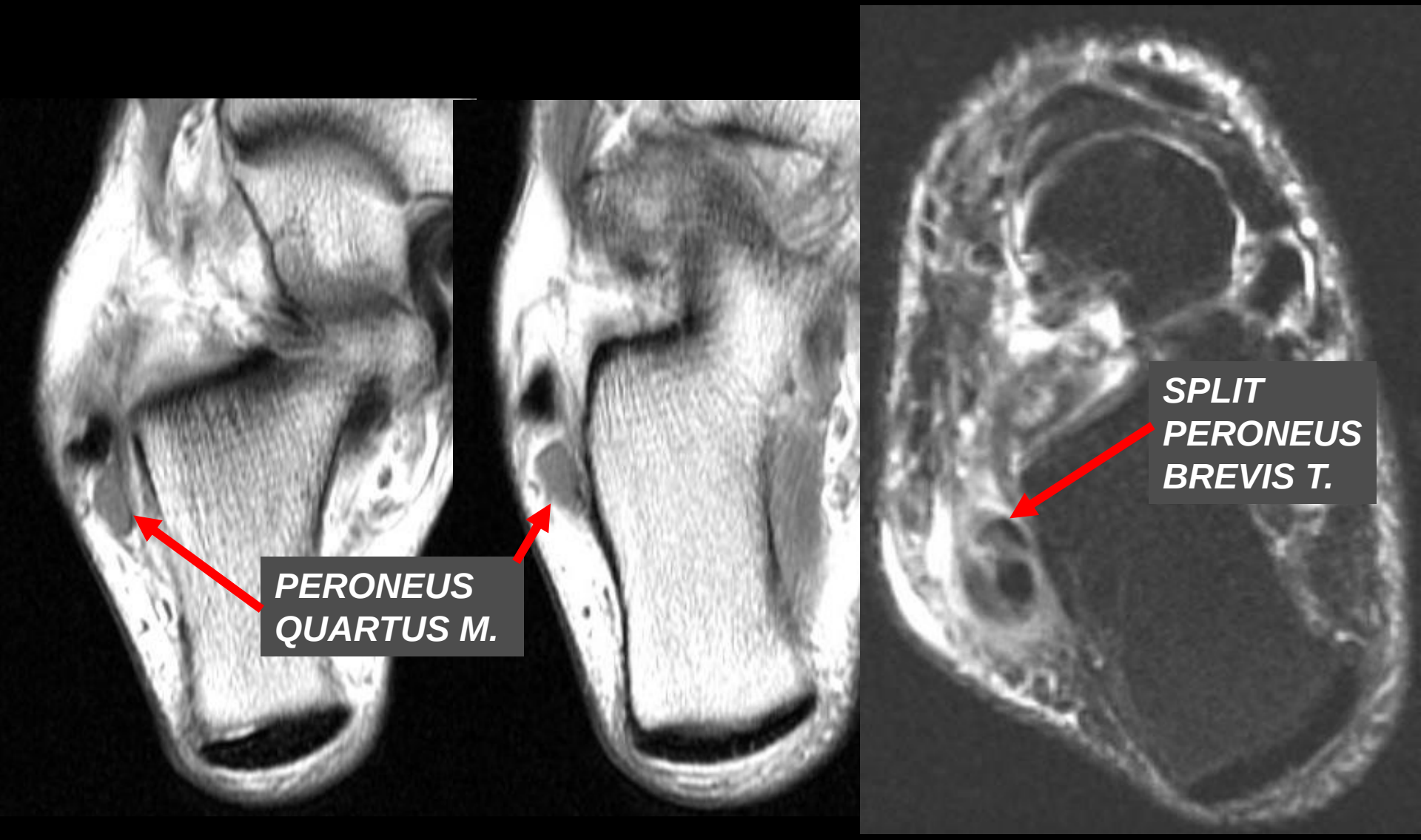



ATFL TEAR
CFL TEAR

Calcaneofibular ligament tear
-fluid extends from joint into peroneal sheath



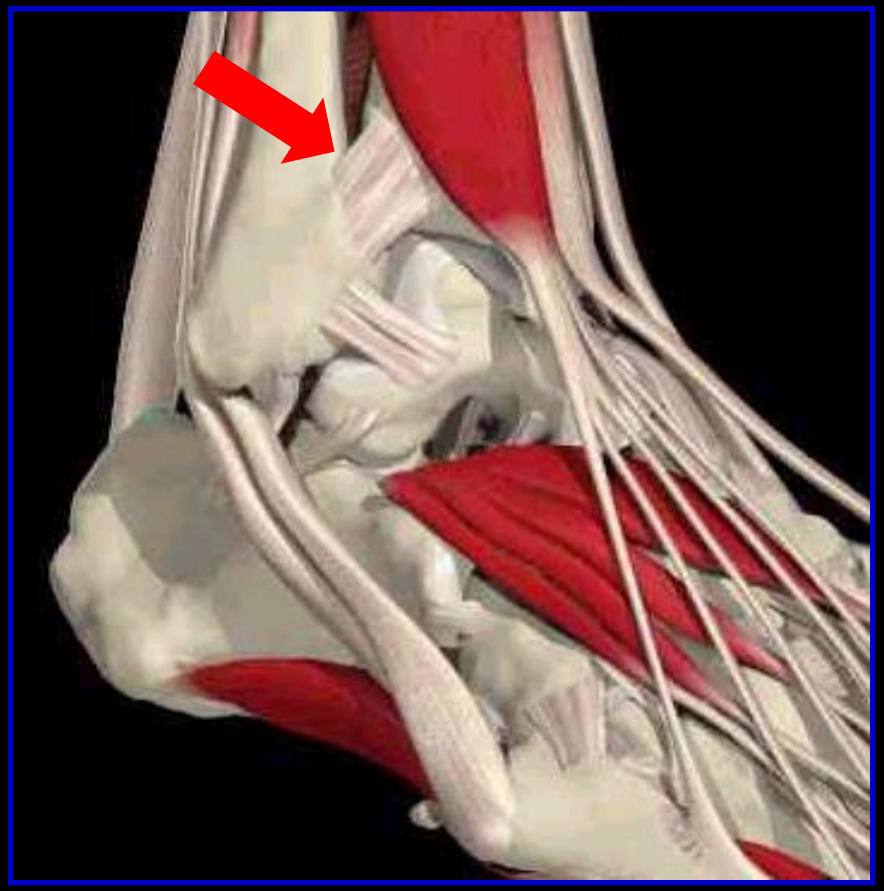
PITFALLS



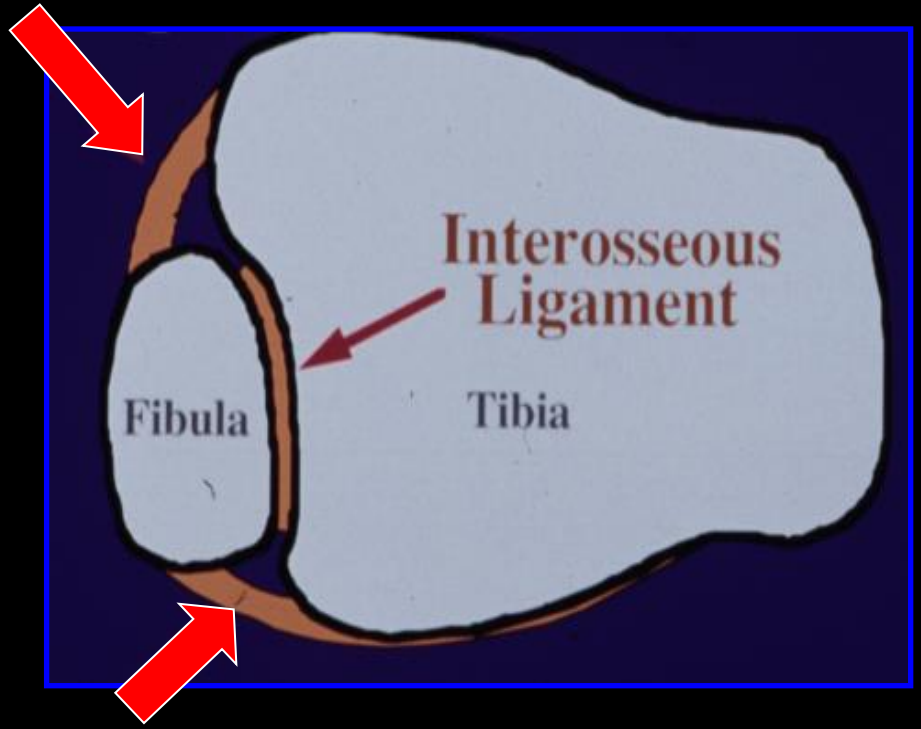
LIGAMENTS

- Syndesmosis (tibiofibular ligaments)
  - More severe ankle sprain
  - Anterior > posterior
  - If unrecognized: chronic pain, instability
  - Late: ossification at tib/fib interval

Tibiofibular Syndesmosis



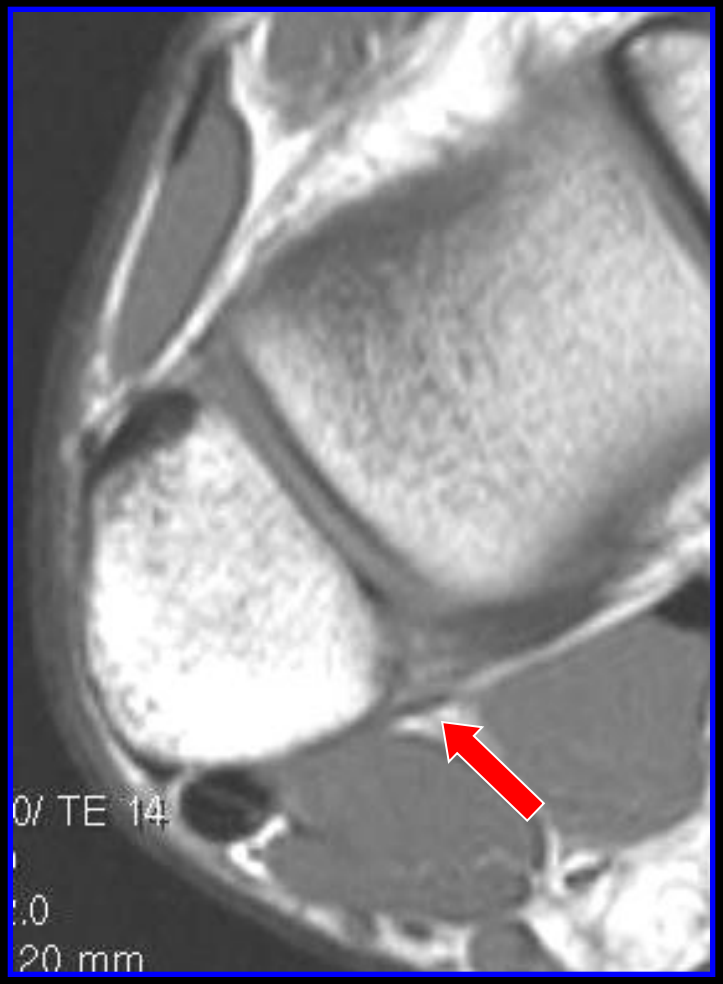
Anterior Inferior Tibiofibular Ligament: *inversion or eversion*



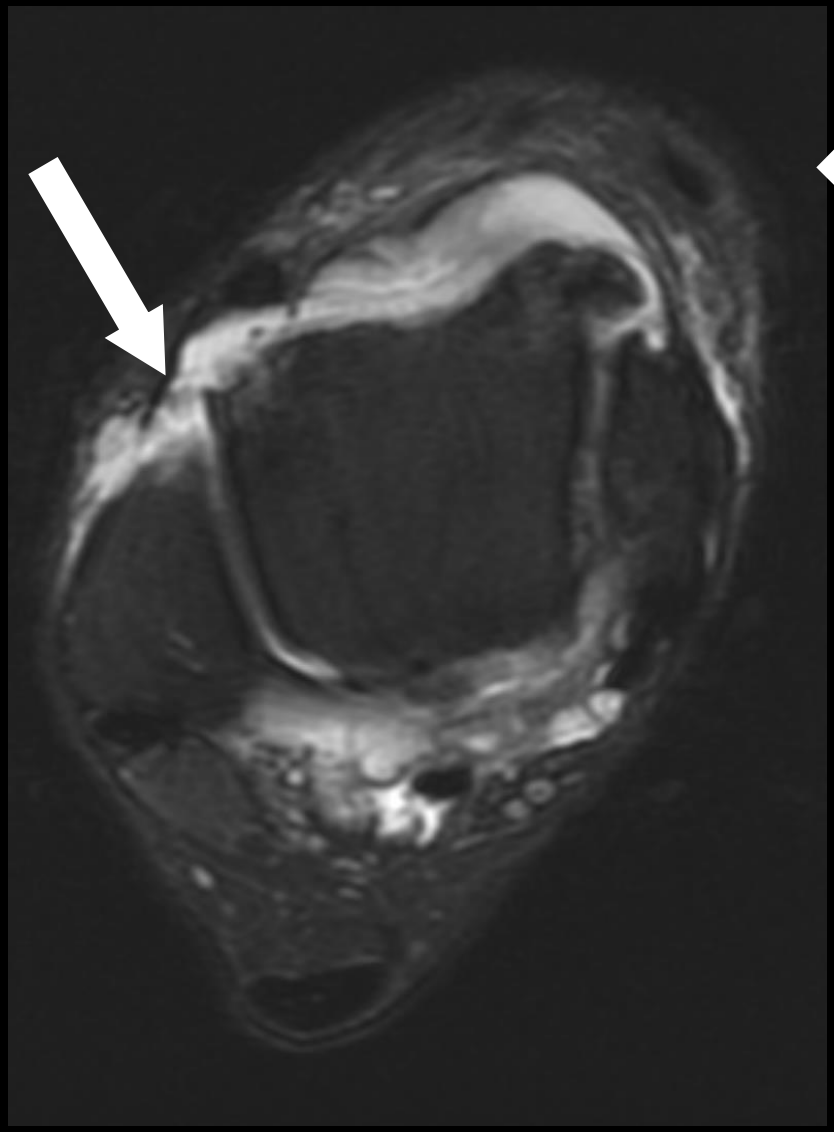
Posterior Inferior Tibiofibular Ligament: *eversion*

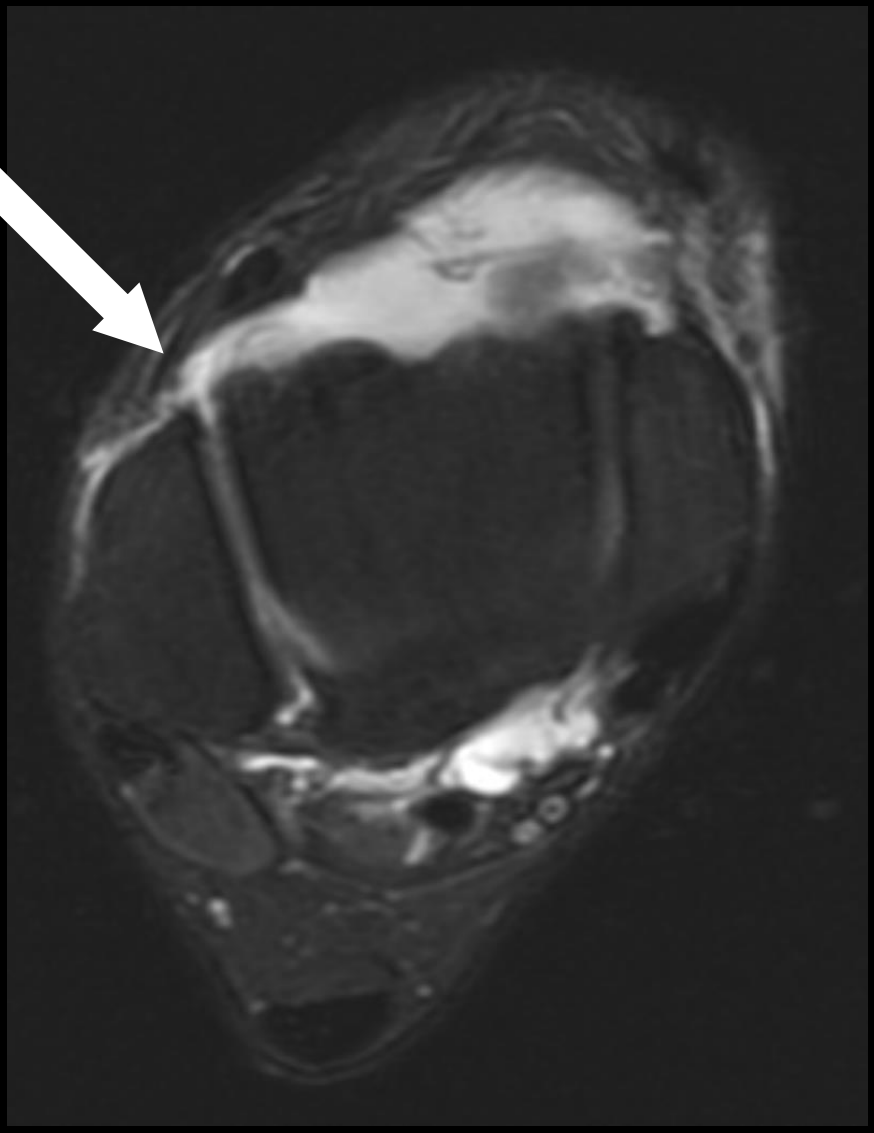
(INFERIOR) TIBIOFIBULAR LIGAMENTS

AITF PITF

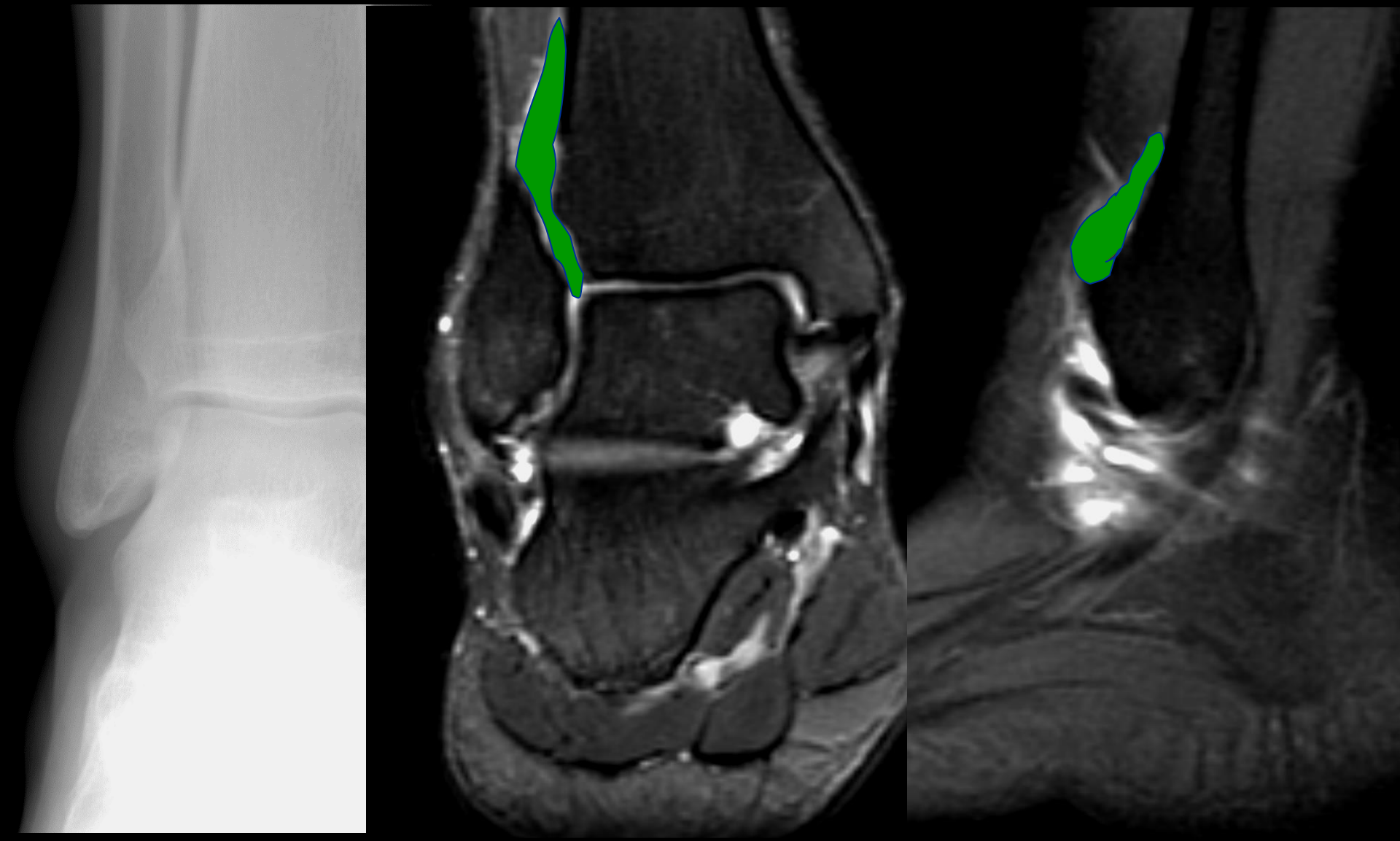


Anterior Syndesmosis Tear

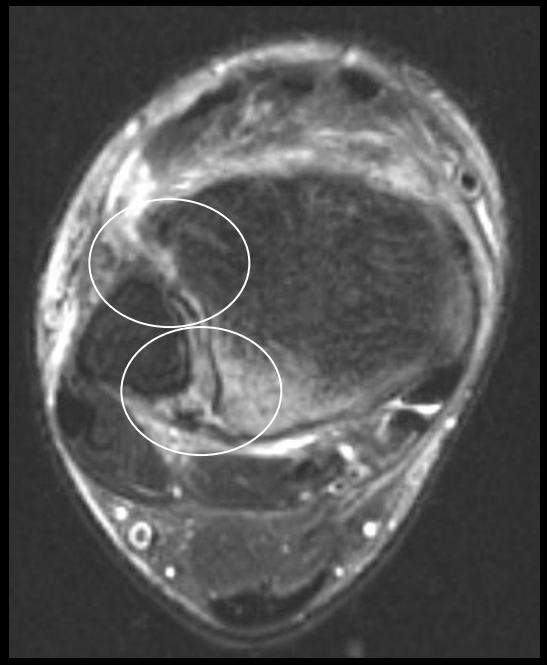


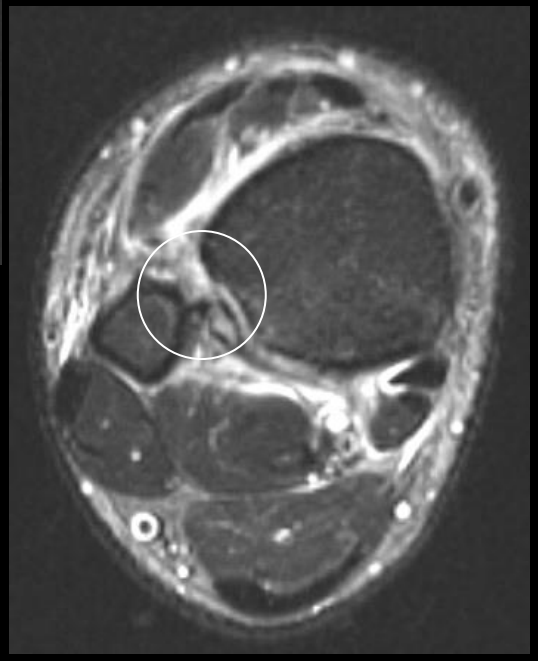


Syndesmosis Injury (“high ankle sprain”)

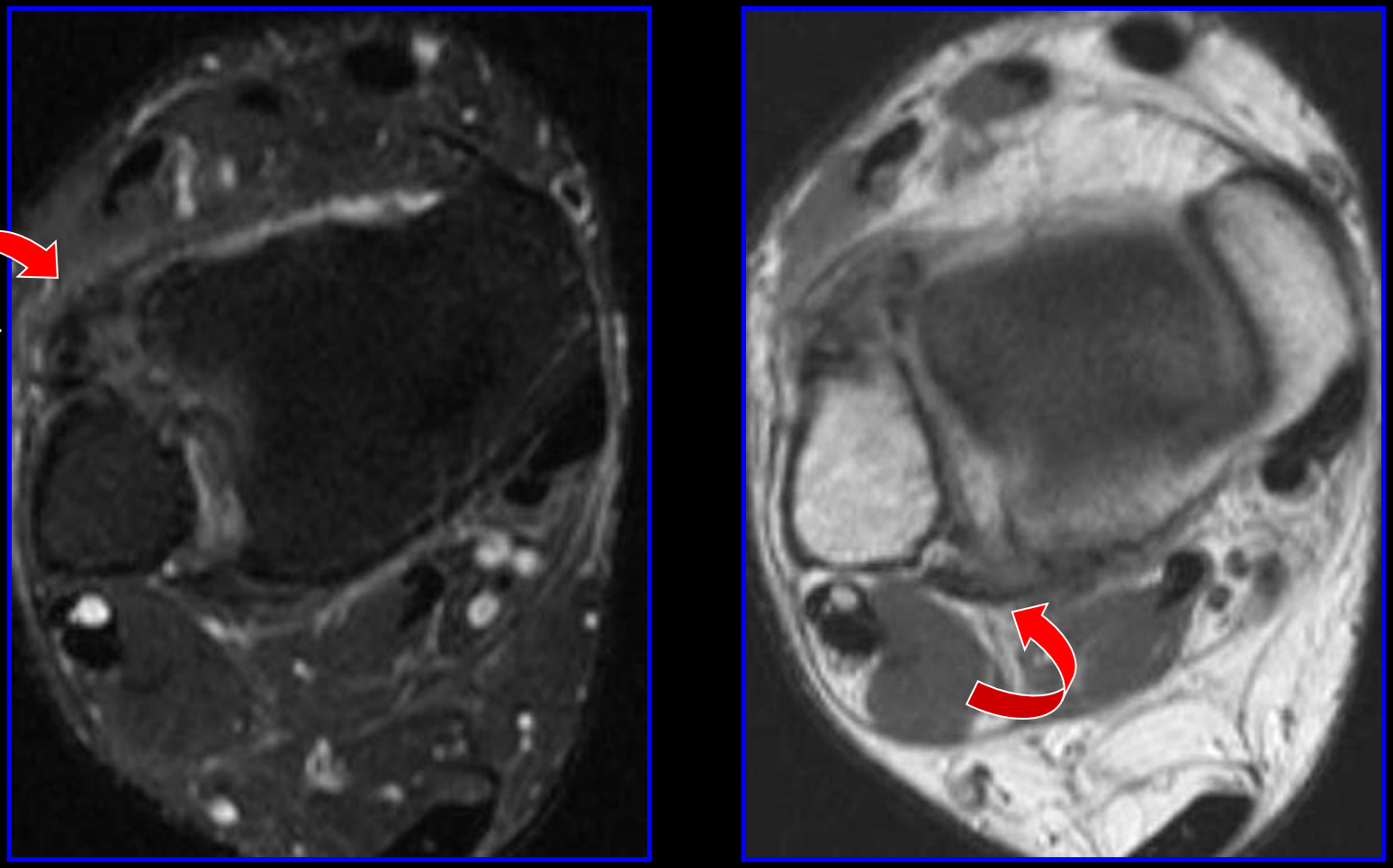


FB player w/ Eversion Injury





Tibiofibular Syndesmosis



Subacute syndesmotic injury

LIGAMENTS

Medial (deltoid) ligament

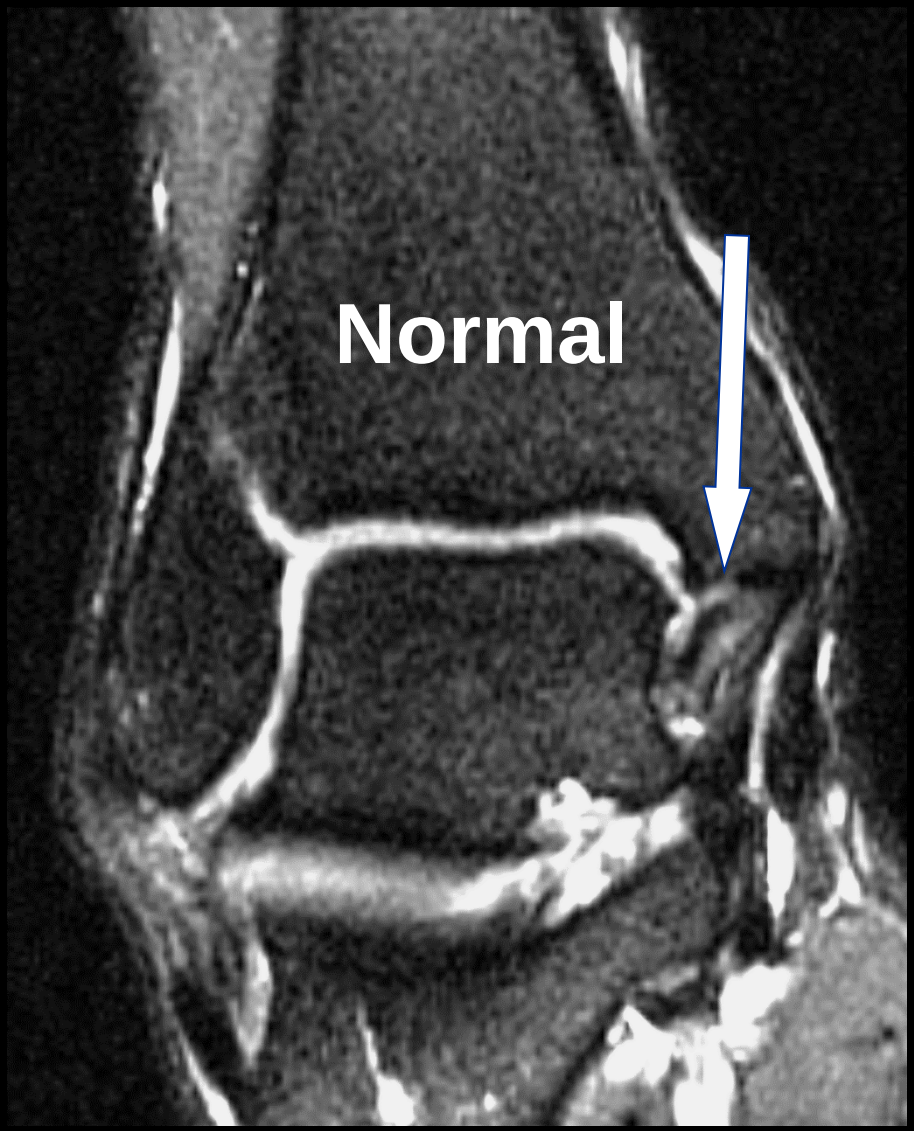
-Strong, thick

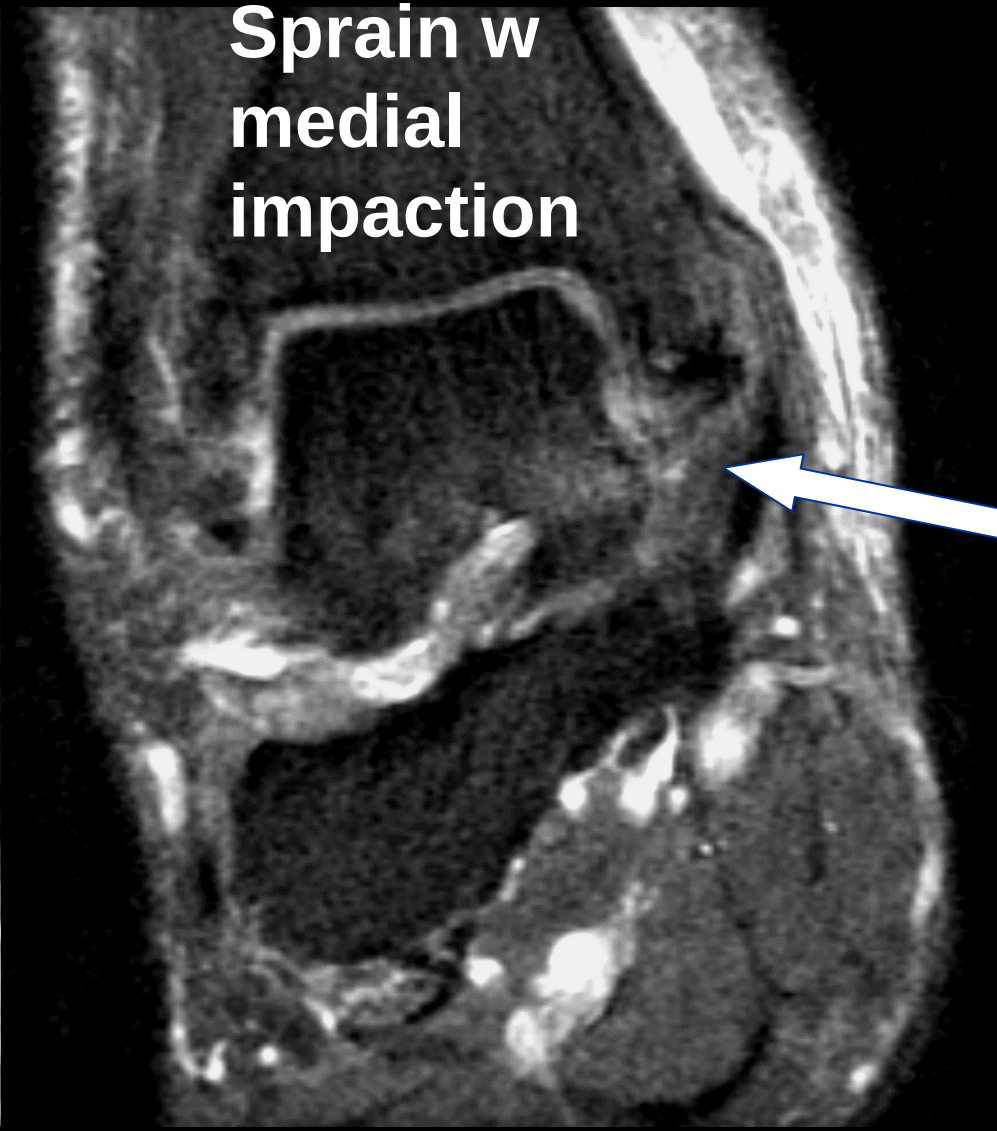
-Superficial and deep portions

-Eversion injury

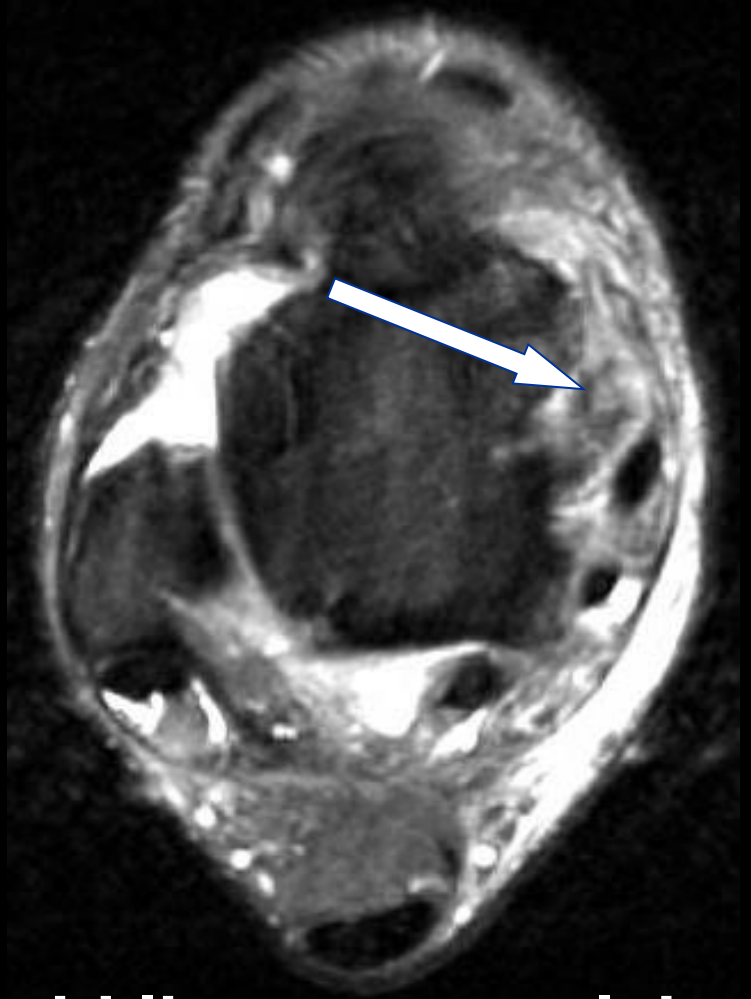
-Usually avulses bone instead of tearing

MEDIAL LIGAMENTS

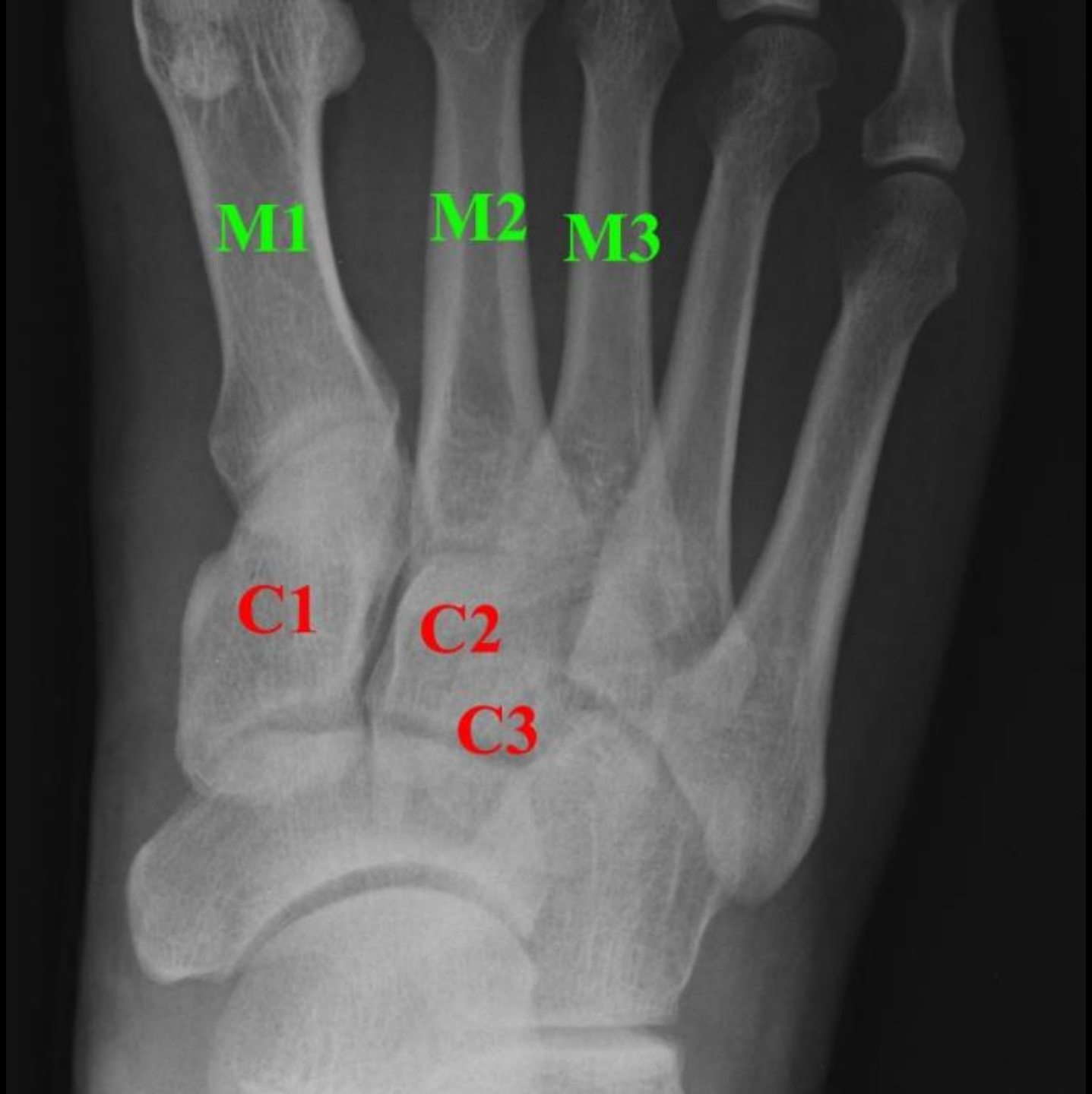

Normal


Sprain w
medial
impaction

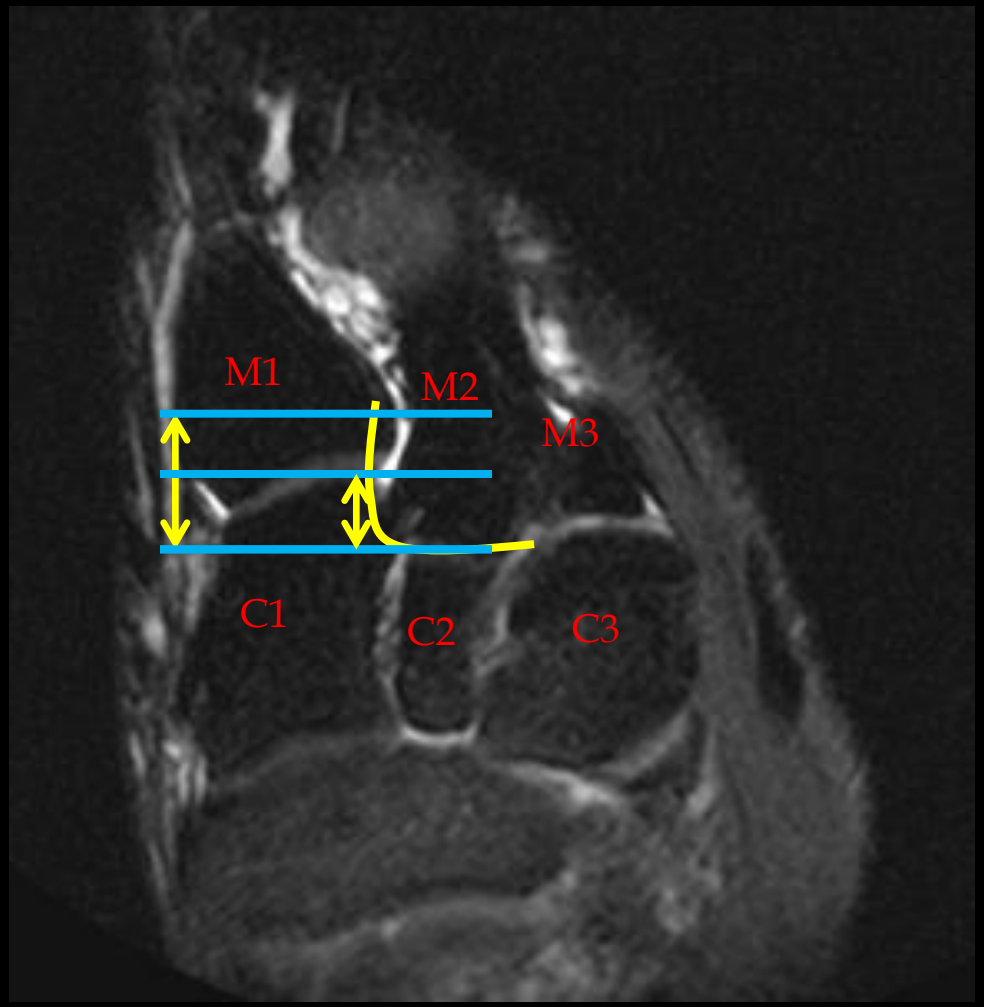
Professional football player
-eversion mechanism



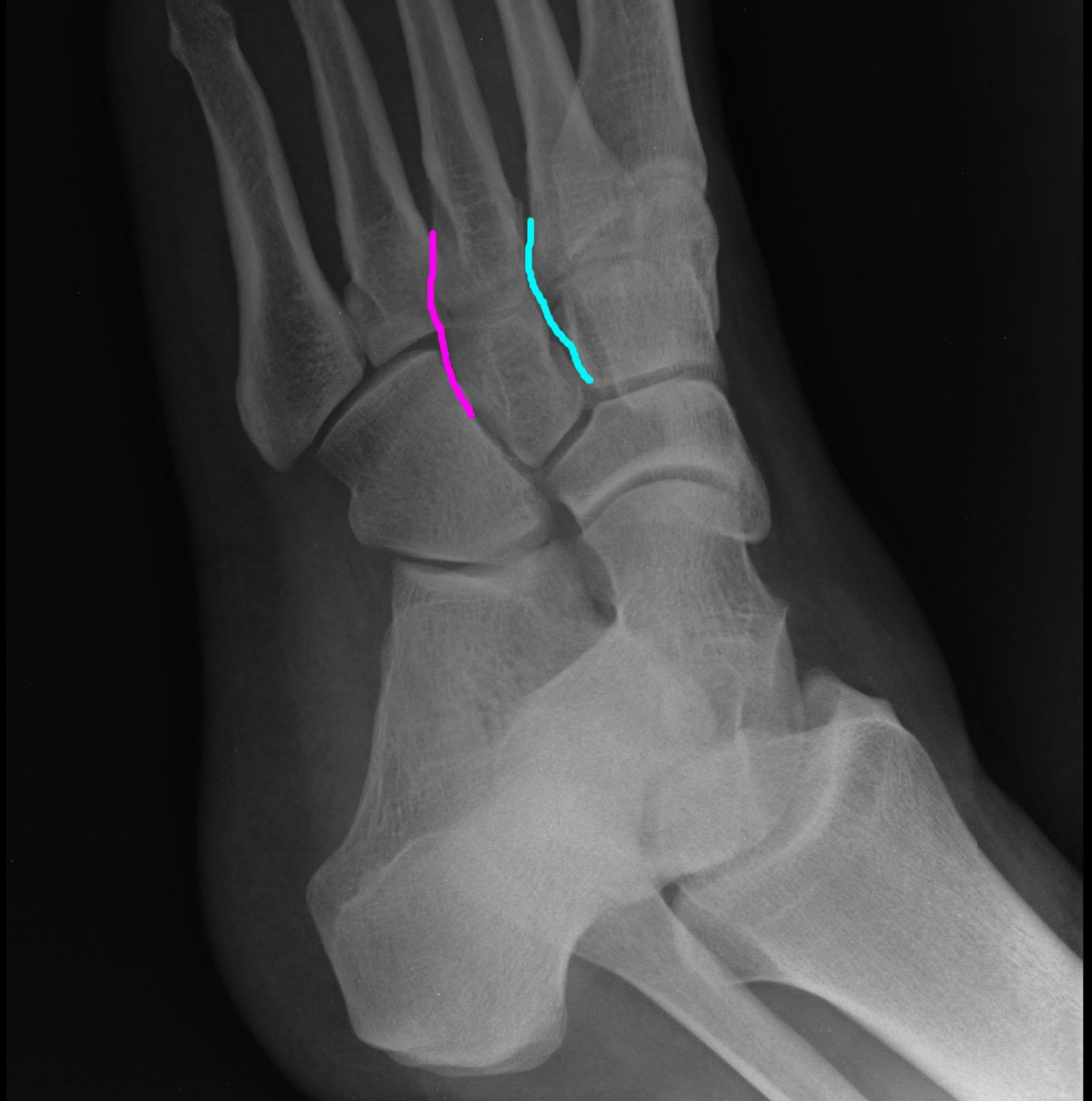
Deltoid ligament avulsion

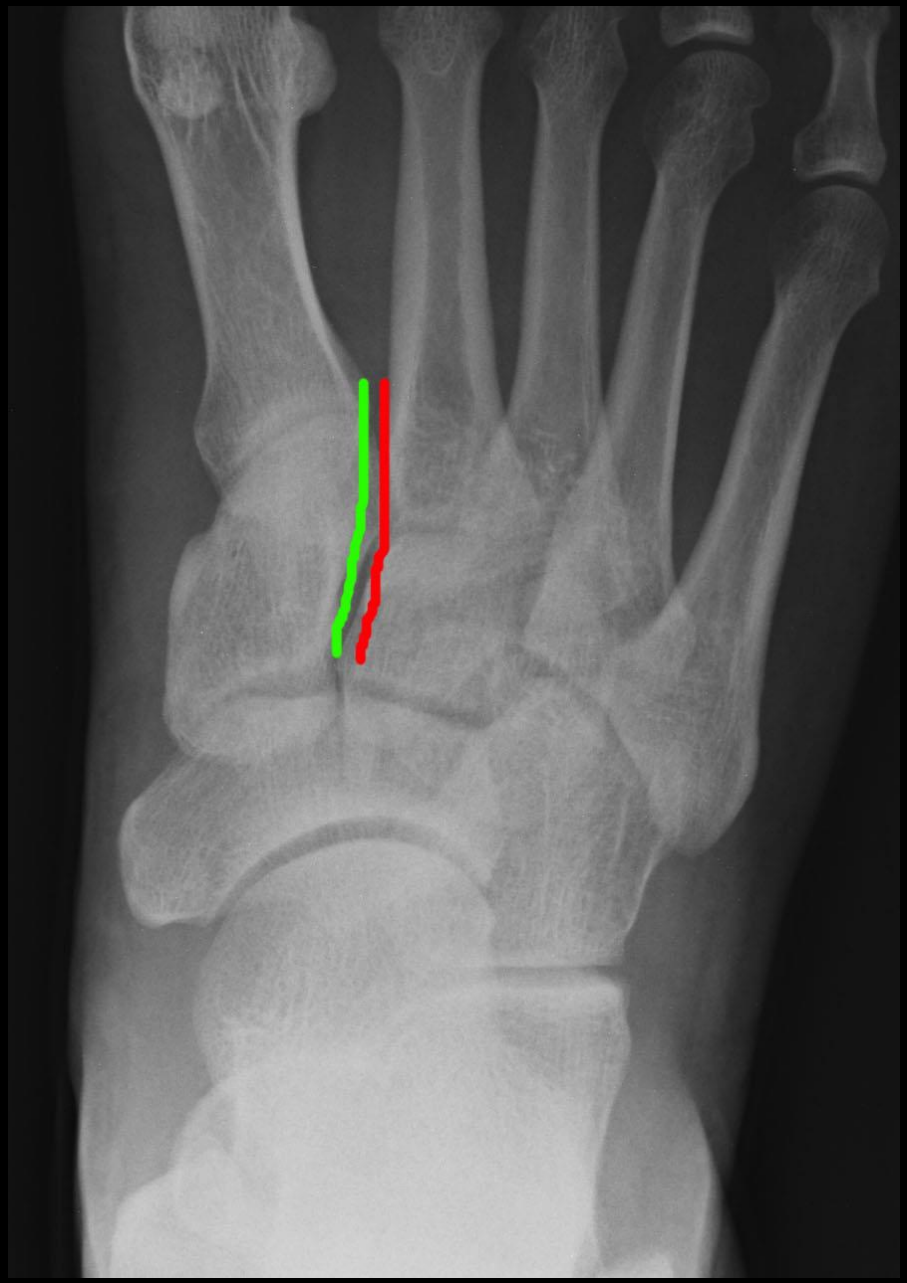

M1
M2
M3
C1
C2
C3

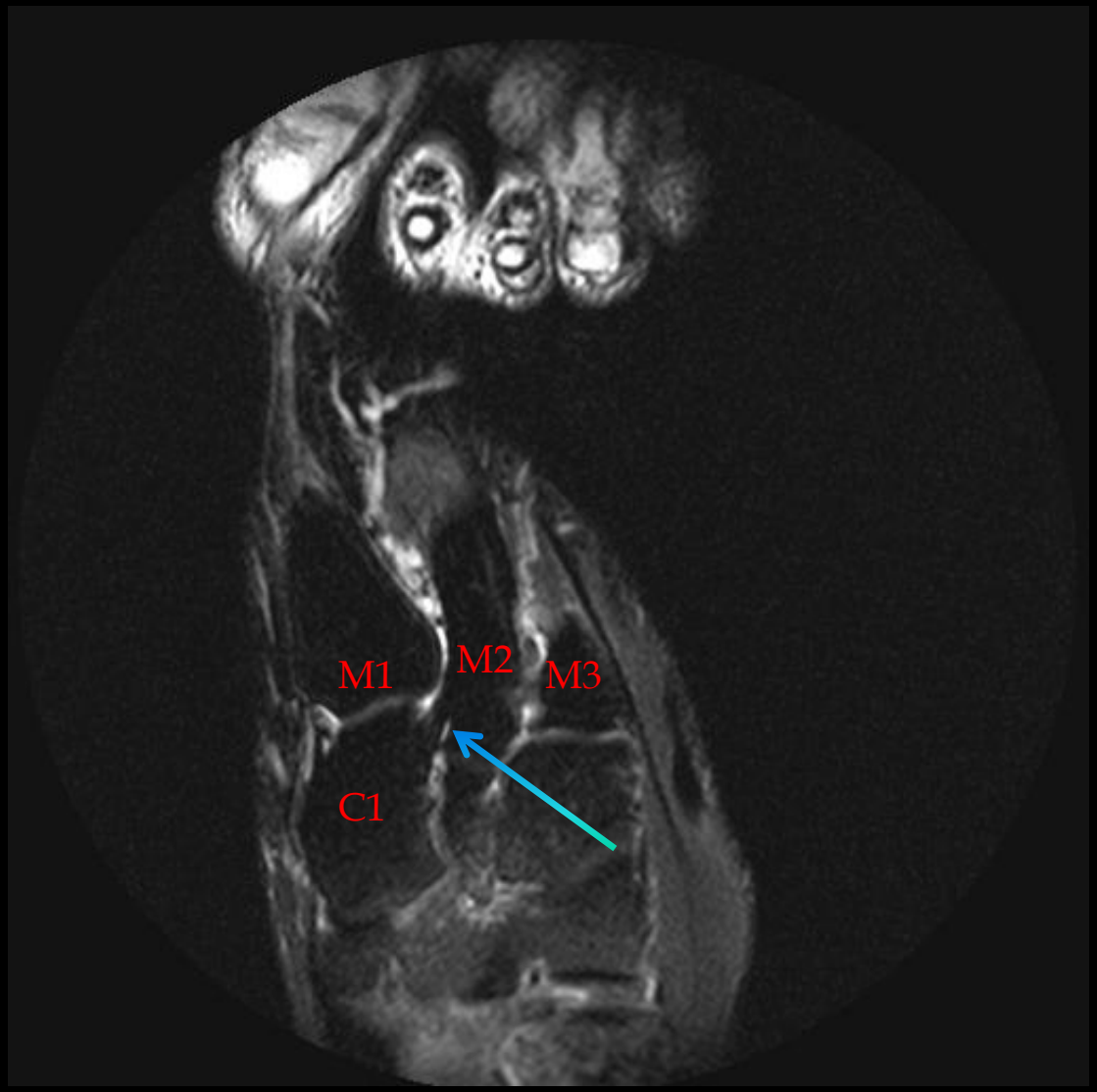
Anatomic Concepts

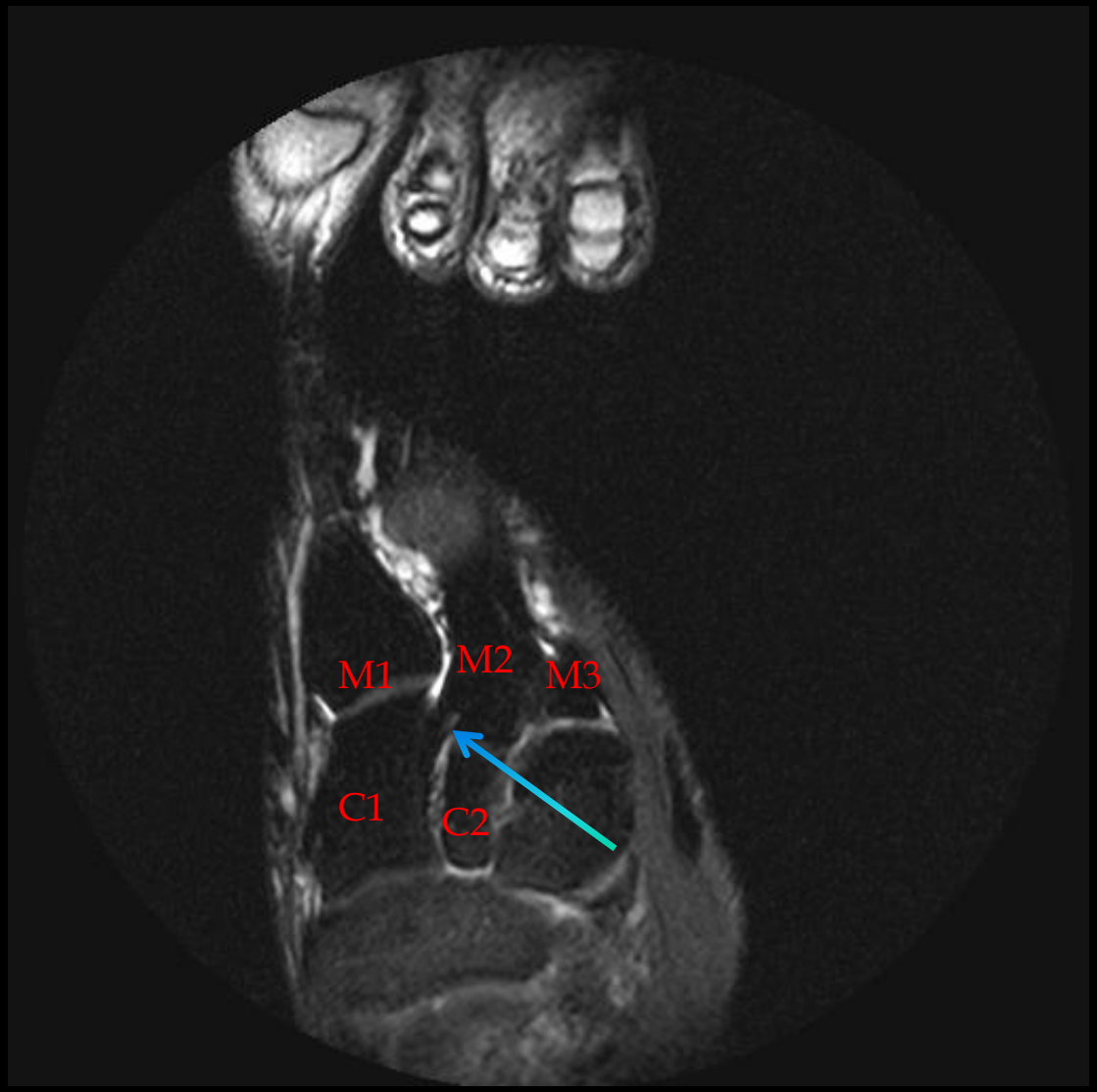


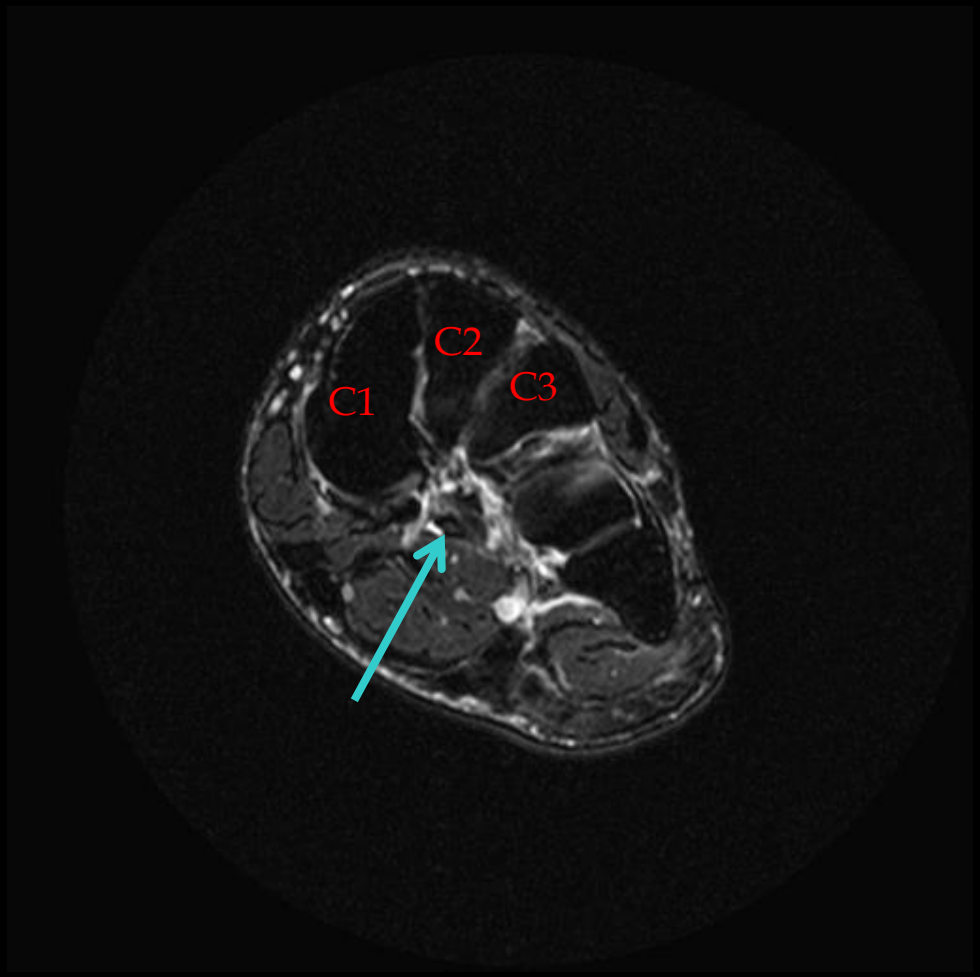

Reminder…

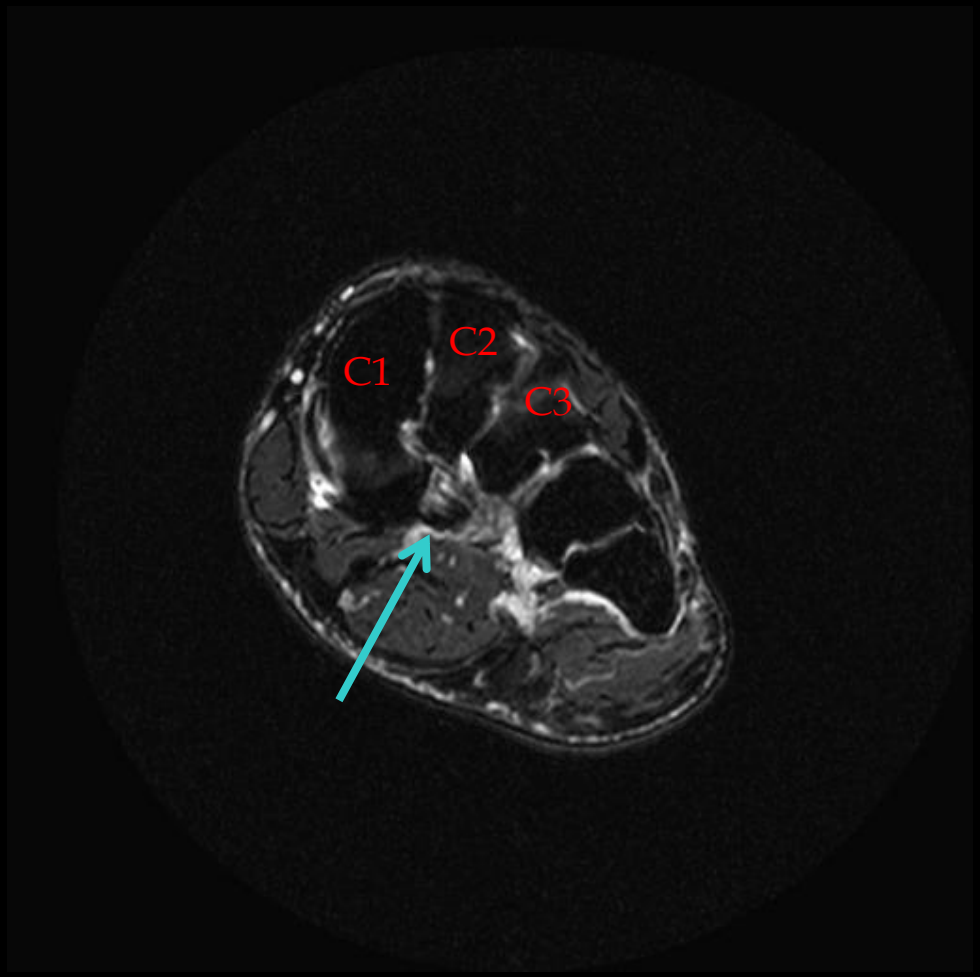


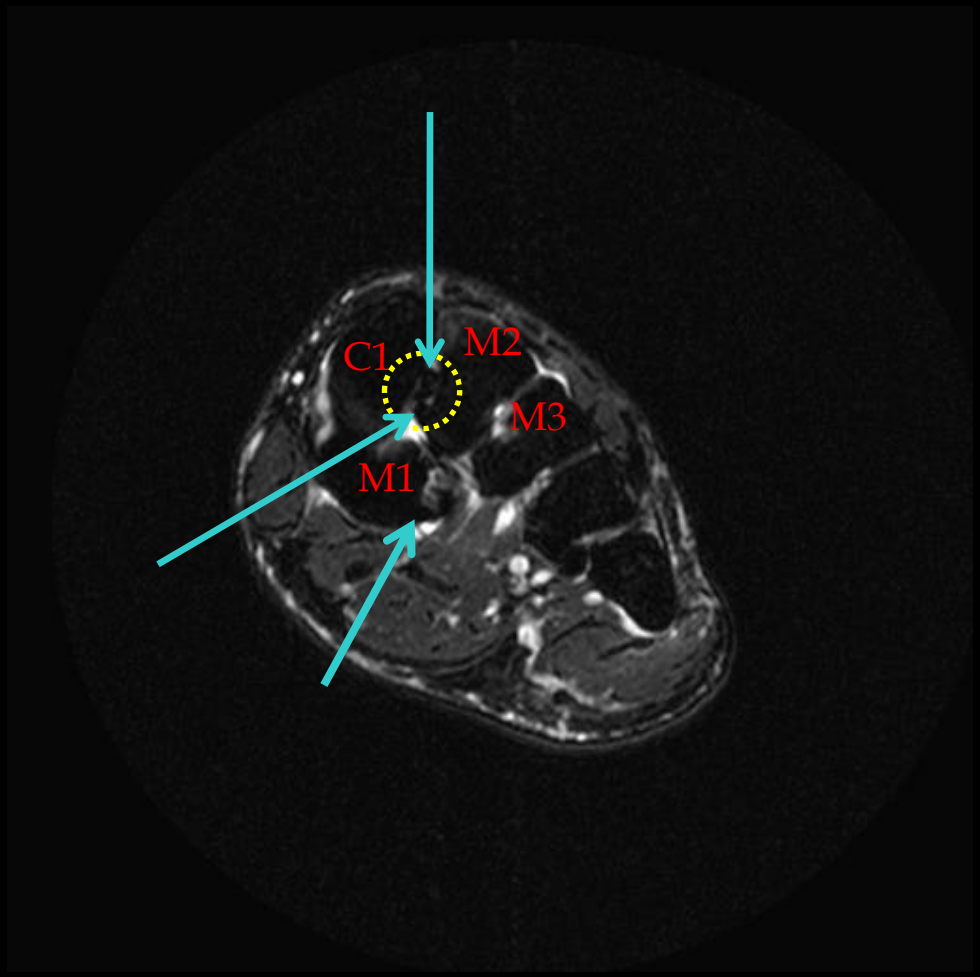



M1
M2
M3
C1


M1
M2
M3
C1
C2


C2
C1
C3

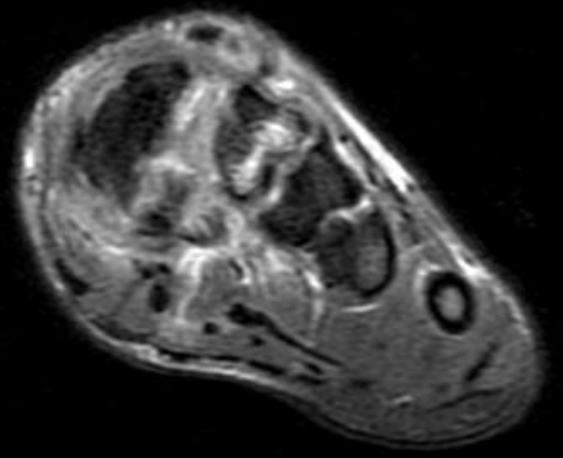

C1
C2
C3


C1
M2
M3
M1

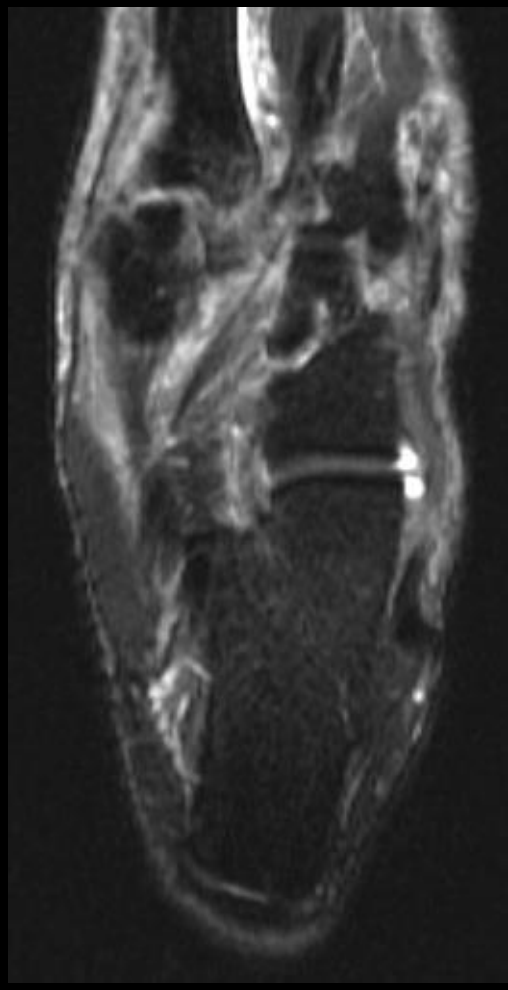
Lisfranc Injuries

- Lisfranc injuries occur with high and low impact trauma
- Tenderness and swelling over their first and second tarsometatarsal joints, unable to bear weight
- Recognition is important because surgical stabilization may be necessary to prevent long term disability

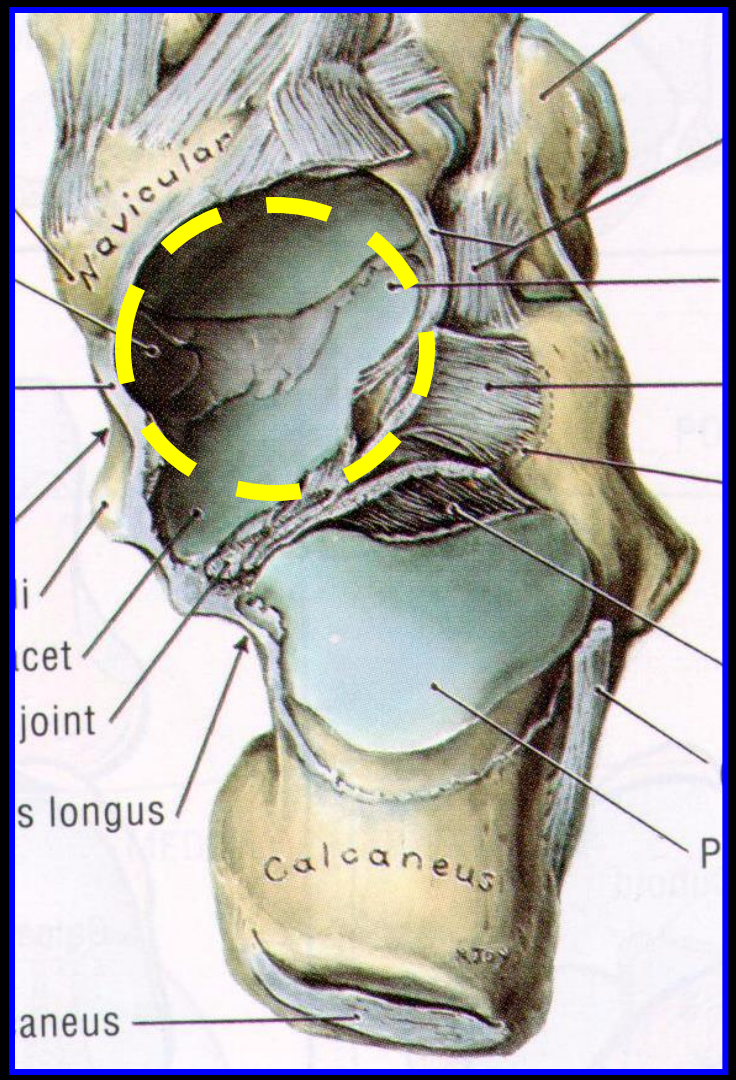
16 y.o. pain after football injury - Lisfranc ligament sprain



Complete (C1-M2M3) disruption → screw fixation

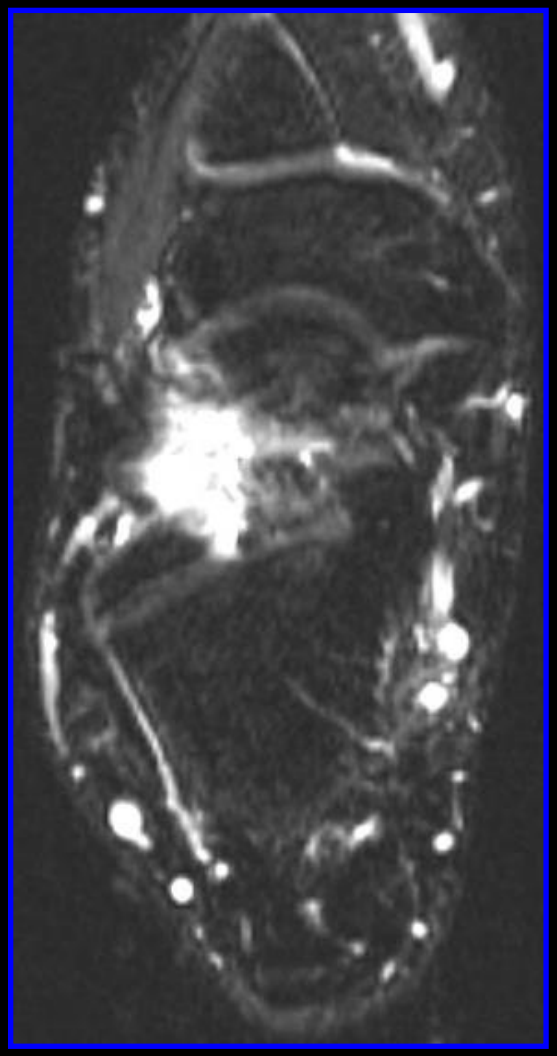


The Sinus Tarsi



- Fat signal is normal
- Contains five ligaments, arterial anastomosis and nerve

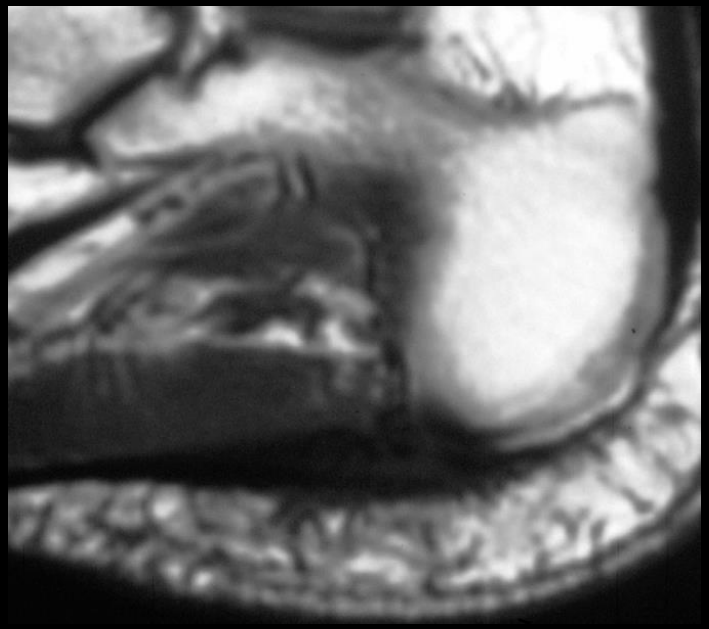
Sinus Tarsi Syndrome

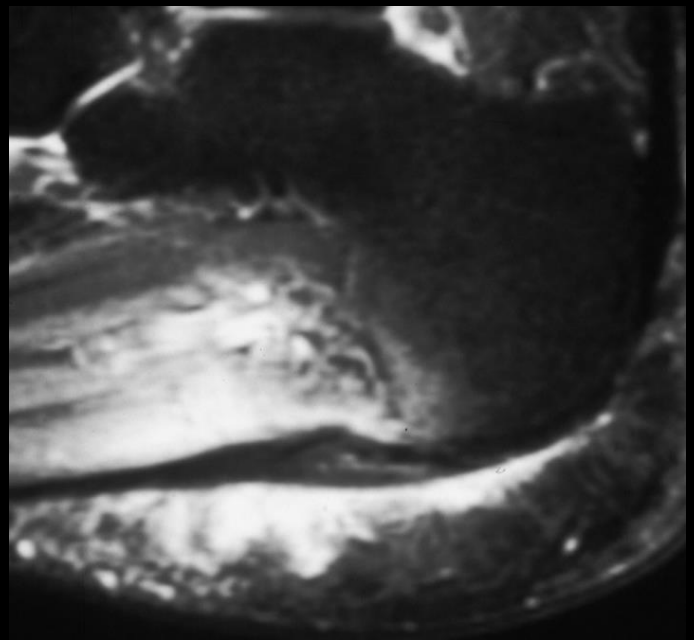


- Lateral pain, tenderness, hindfoot instability
- Association with ankle sprains / lateral ligament injury, tibialis posterior tendon dysfunction

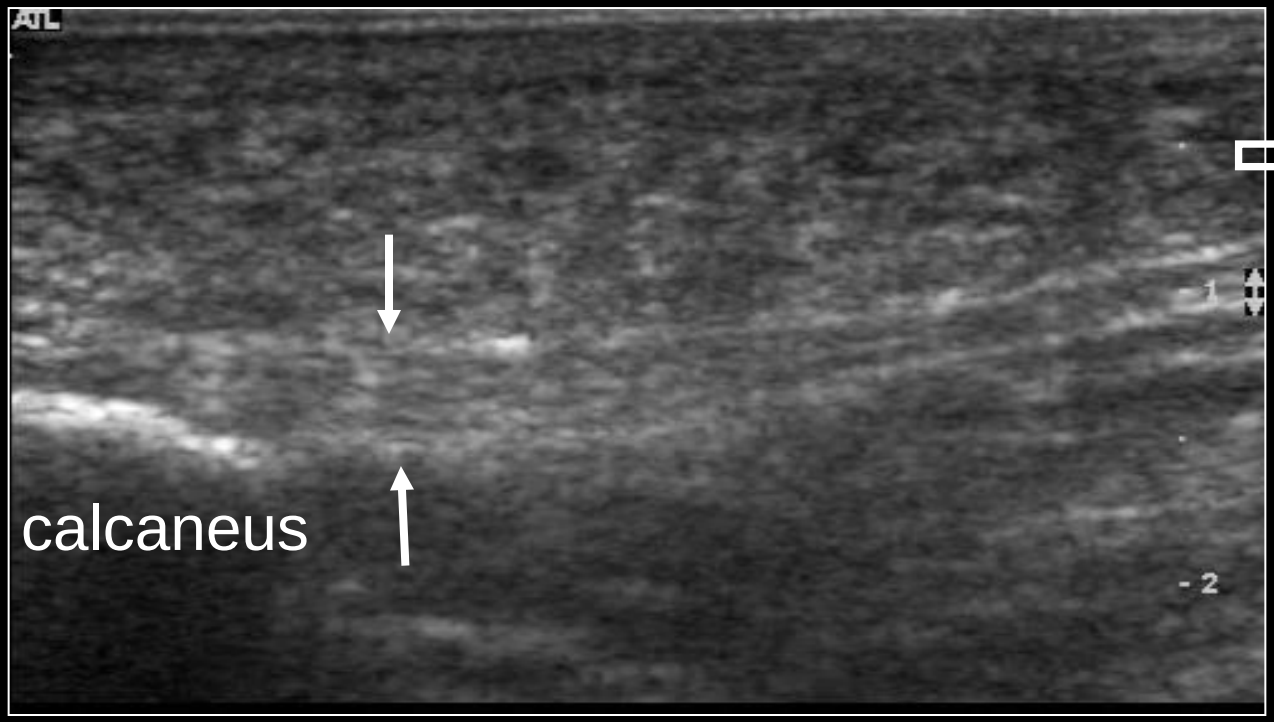
PLANTAR FASCIITIS

-Plantar heel pain (esp medial) upon walking (in am)
-Chronic repetitive trauma with microtears
-Acute: edema around proximal plantar aponeurosis
-Chronic: Dark; diffuse thickening
-If severe / longstanding: stress fracture-like appearance



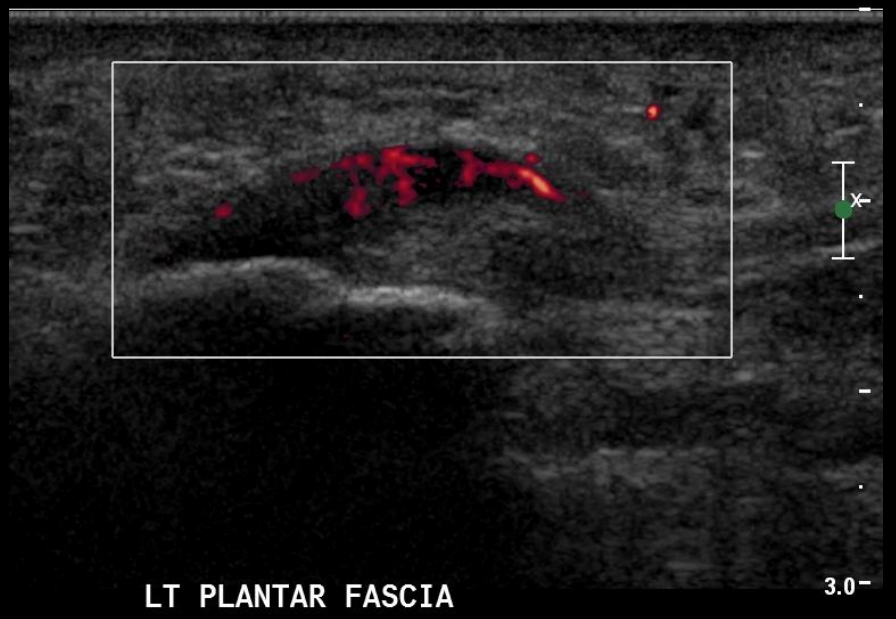


Normal Plantar Fascia Ultrasound



longitudinal

Plantar Fasciitis Ultrasound



- thick plantar fascia (>4mm), tender
- hypoechoic, +/- anechoic interstitial tearing
- +/- vascular flow

TENDONS

TENDON PATHOLOGY

PREDISPOSING FACTORS

- **Following ligament injury**
- **Chronic overuse, age**
- **Metabolic**

  -obesity

  -diabetes

  -chronic renal failure

  -hyperlipidemia

  -collagen vascular diseases

  -steroid / fluoroquinolone therapy

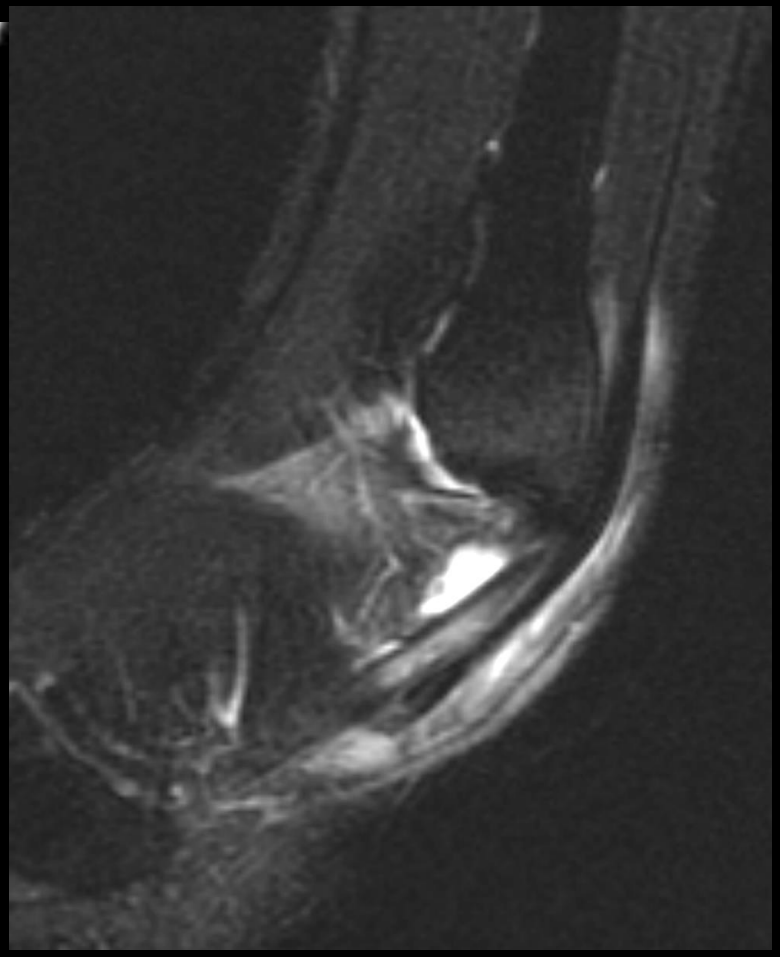
  -gout

PERONEAL TENDONS

Pathology usually associated with recurrent or severe ankle sprains

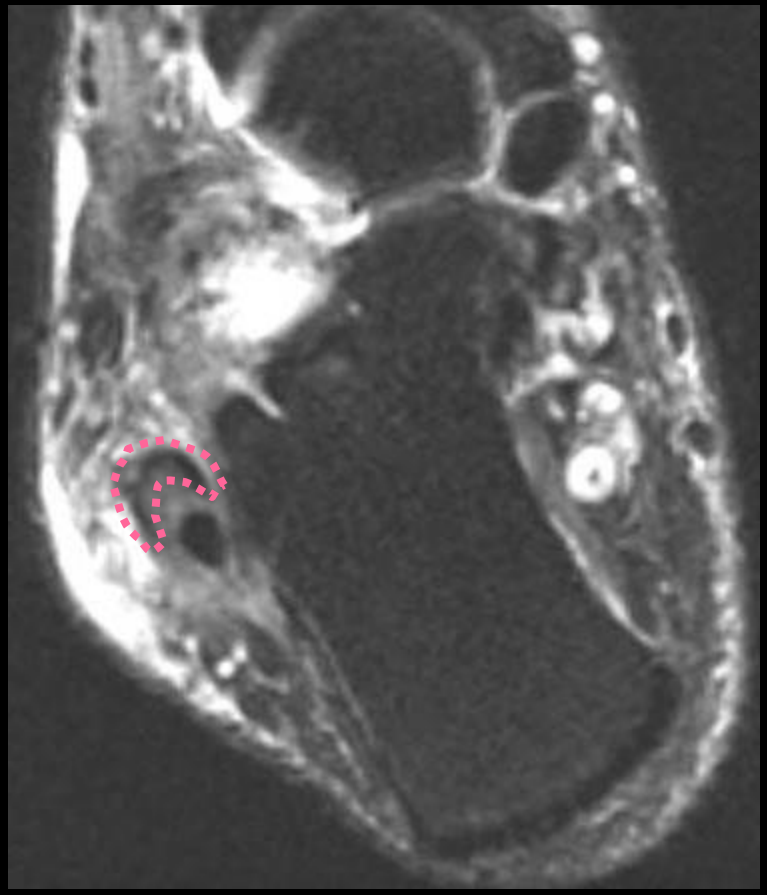
PERONEAL TENOSYNOVITIS

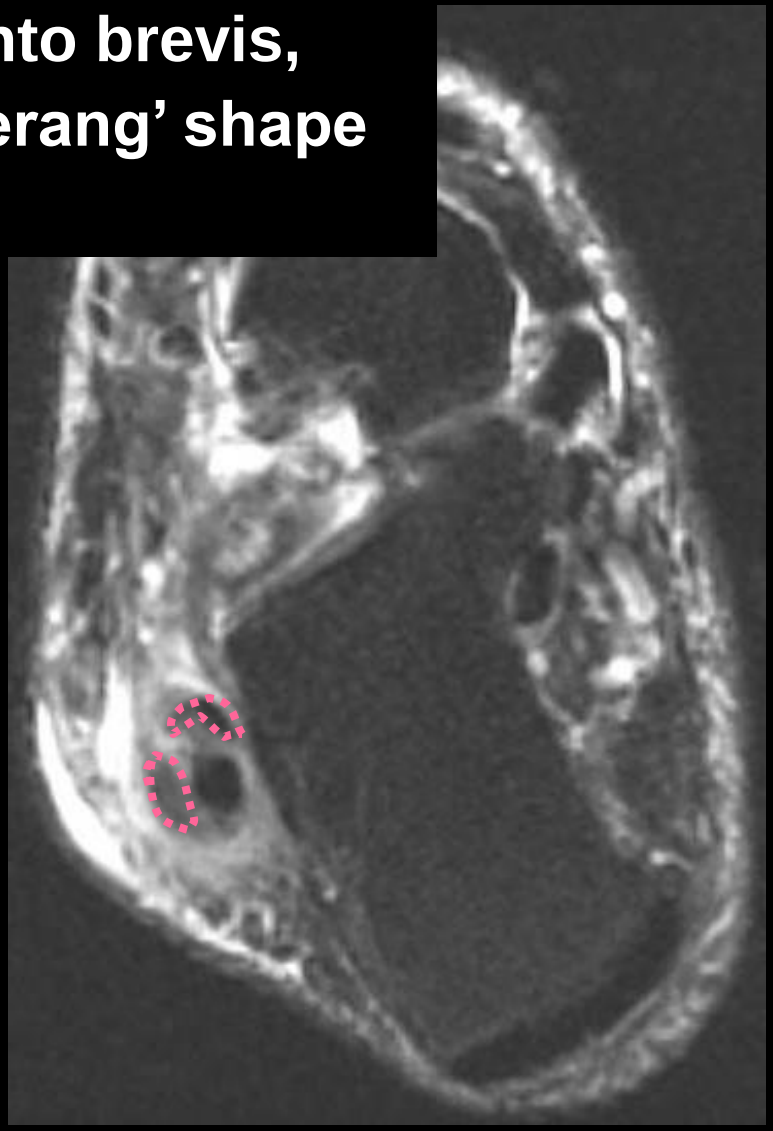
-More fluid than tendon = abnormal
-Synechiae = abnormal



PERONEAL SPLIT

Peroneus longus migrates into brevis, first flattening it with ‘boomerang’ shape finally splitting it

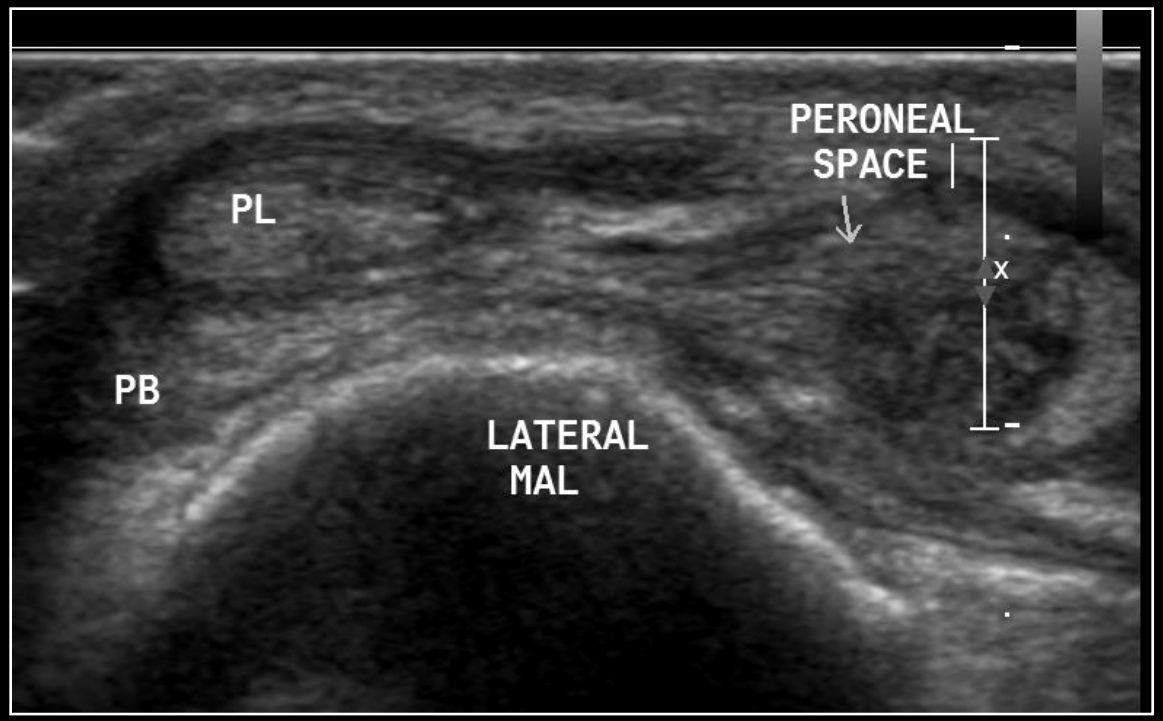




Symptoms: chronic lateral retromalleolar pain / snapping, occasional sx of instability

Split peroneus brevis

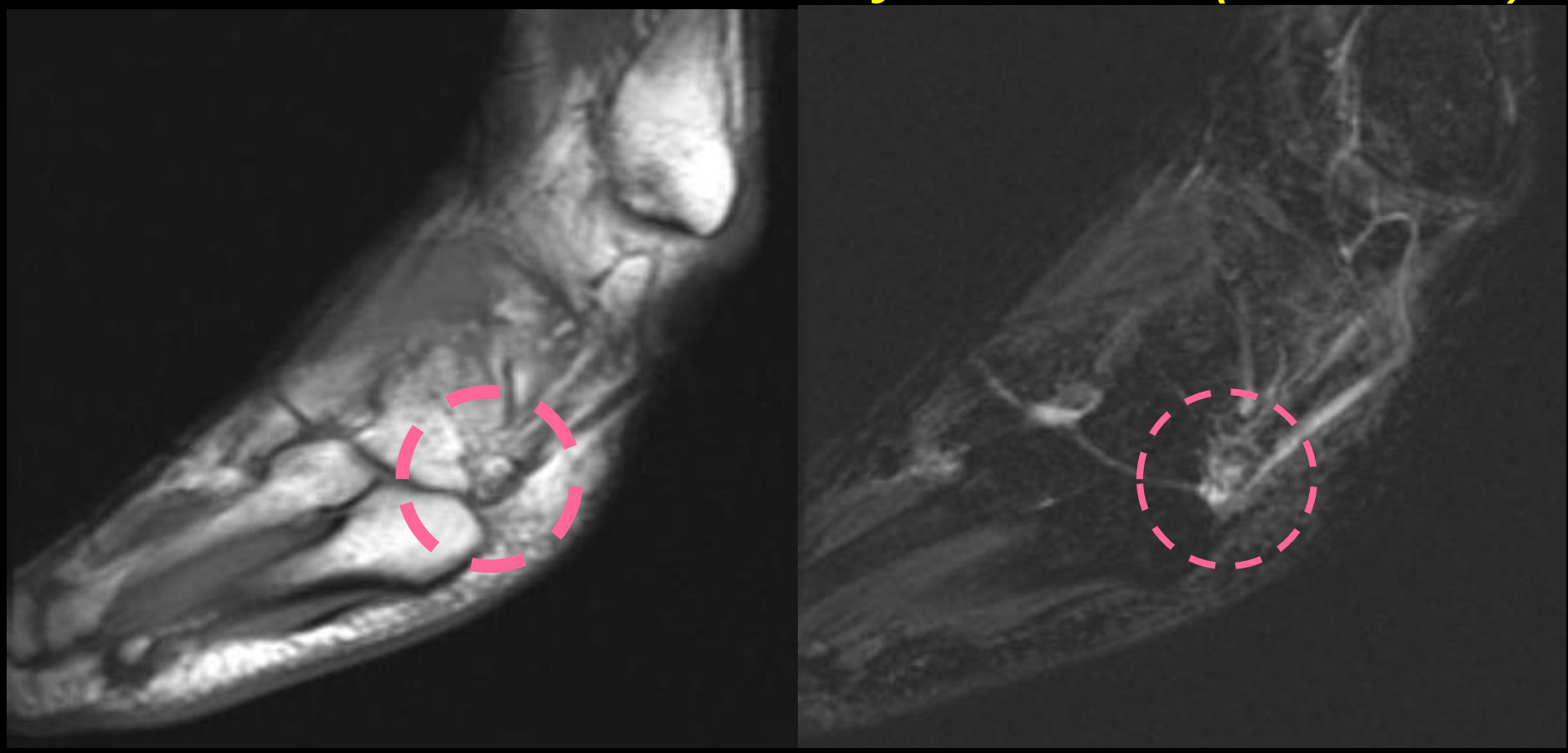
Peroneal Tendon Dislocation



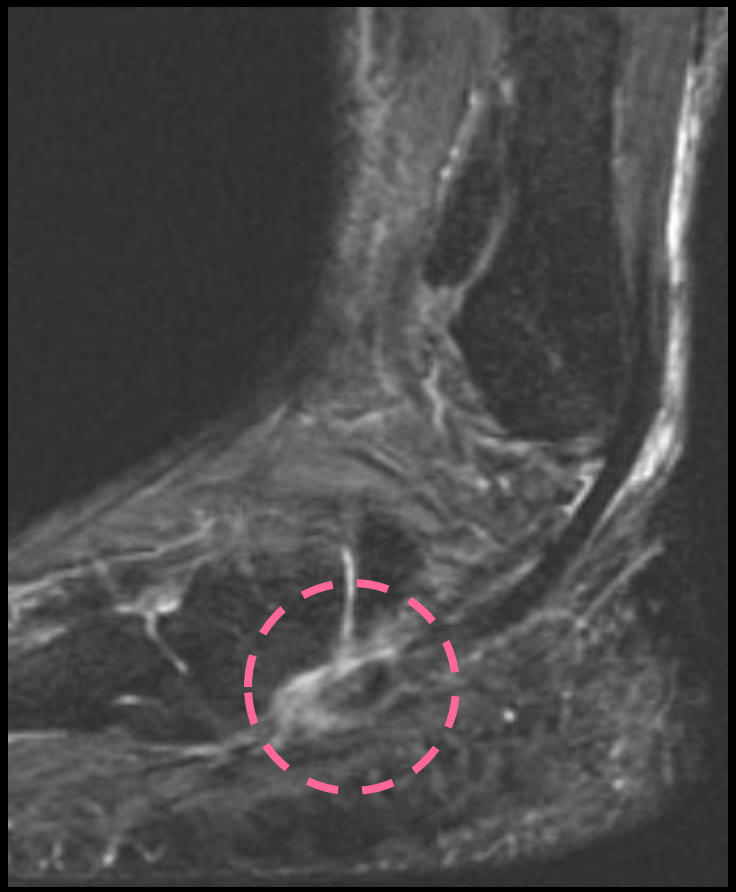
Peroneal Tendon Dislocation / Relocation

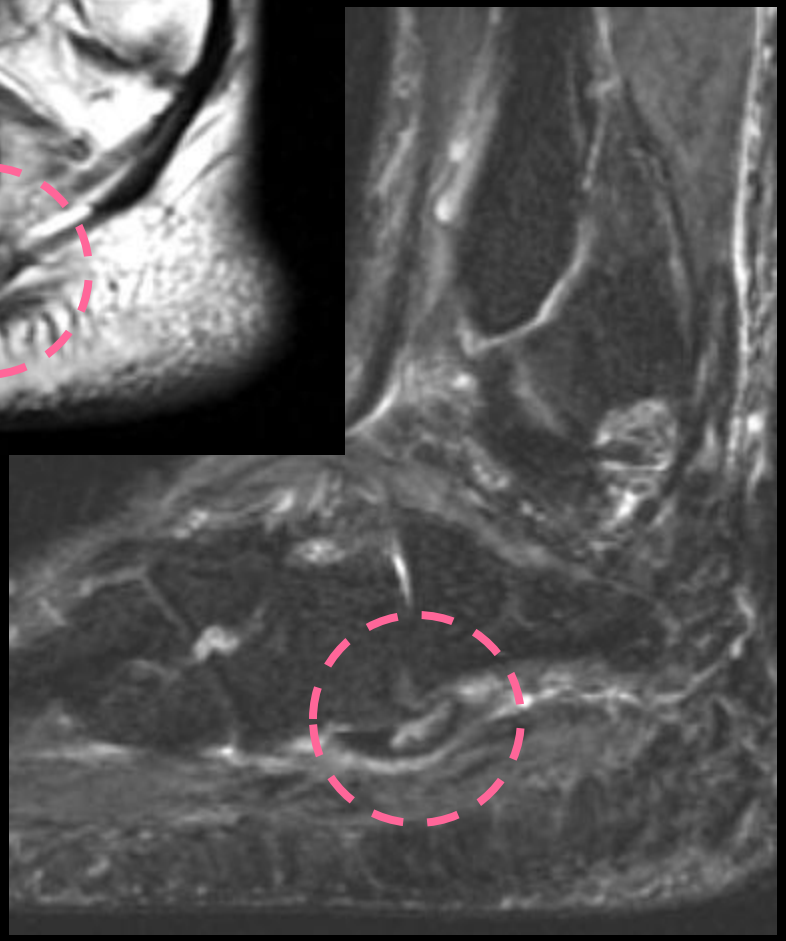
DISTAL PERONEAL PATHOLOGY:

Painful Os Peroneum Syndrome ("POPS")



- Pain, tenderness over cuboid
- Peroneal tenosynovitis / tear (esp distal)
- Edema / necrosis / fragmentation of os peroneum

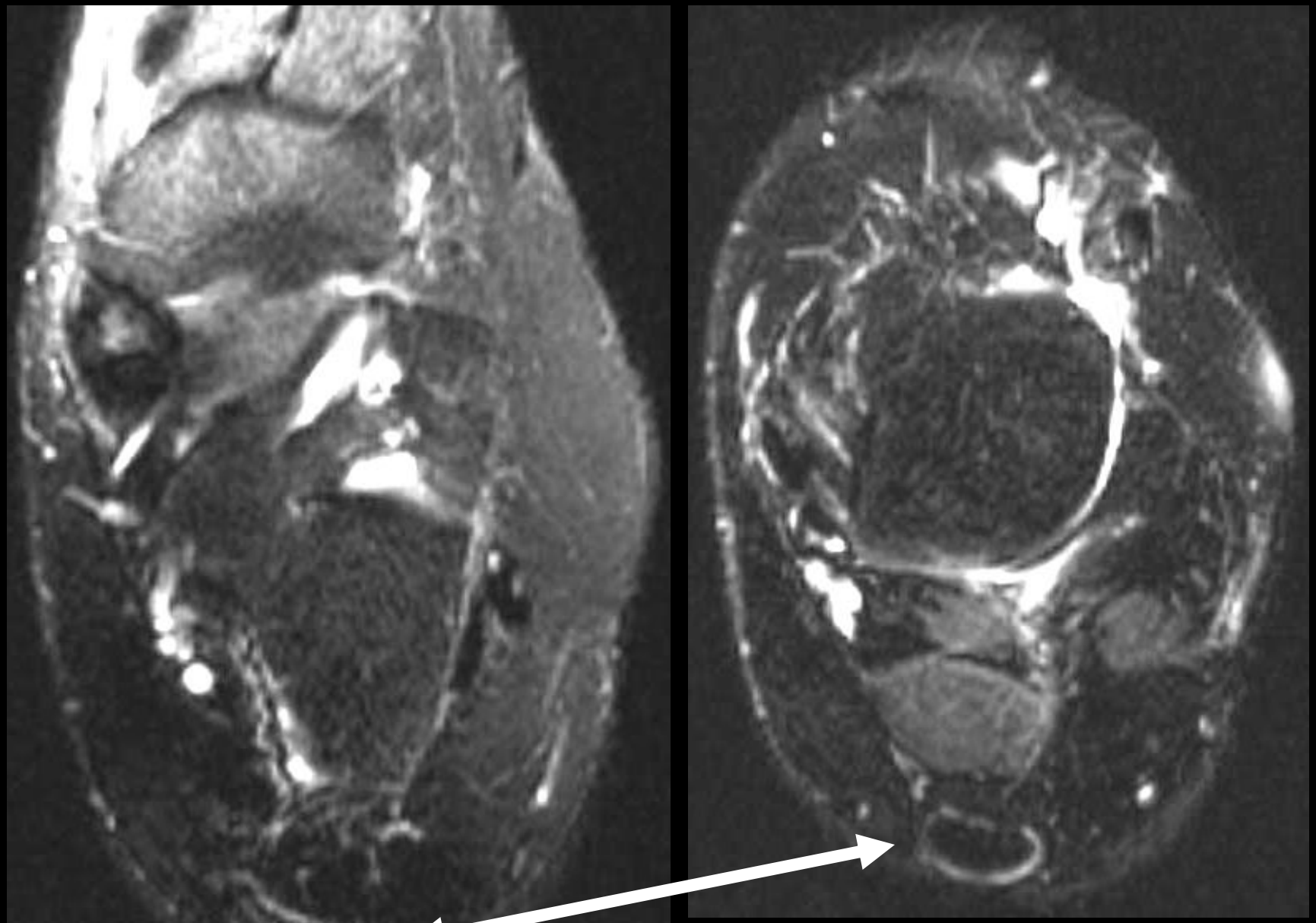




Painful Os Peroneum Syndrome ("POPS")

ACHILLES

- **Peritendinitis**
  - "Acute Achilles tendinitis"
  - Weekend athletes
  - Edema around Achilles tendon
  - Edema in Kager's (pre-Achilles) fat


Peritendinitis

ACHILLES

- Continued stress -> chronic tendinosis

  -Tendon thickened, losing concavity on axial images

  -Low signal: hypoxic

  -Intermediate signal: mucoid
- Tears

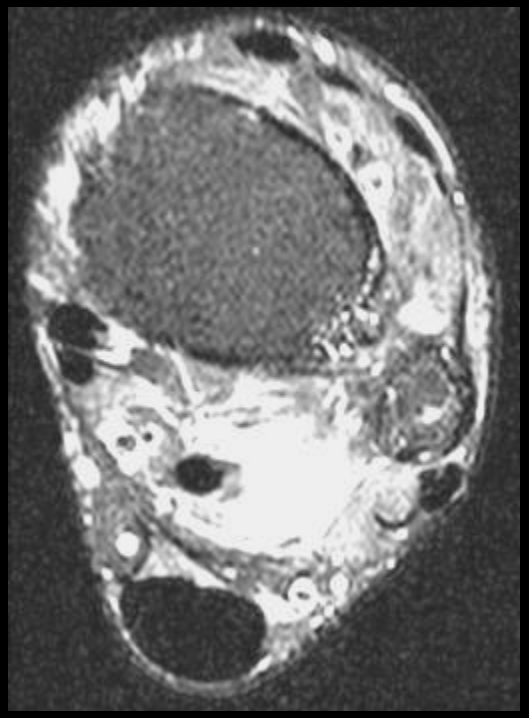
  -Watershed zone (5 cm from insertion)

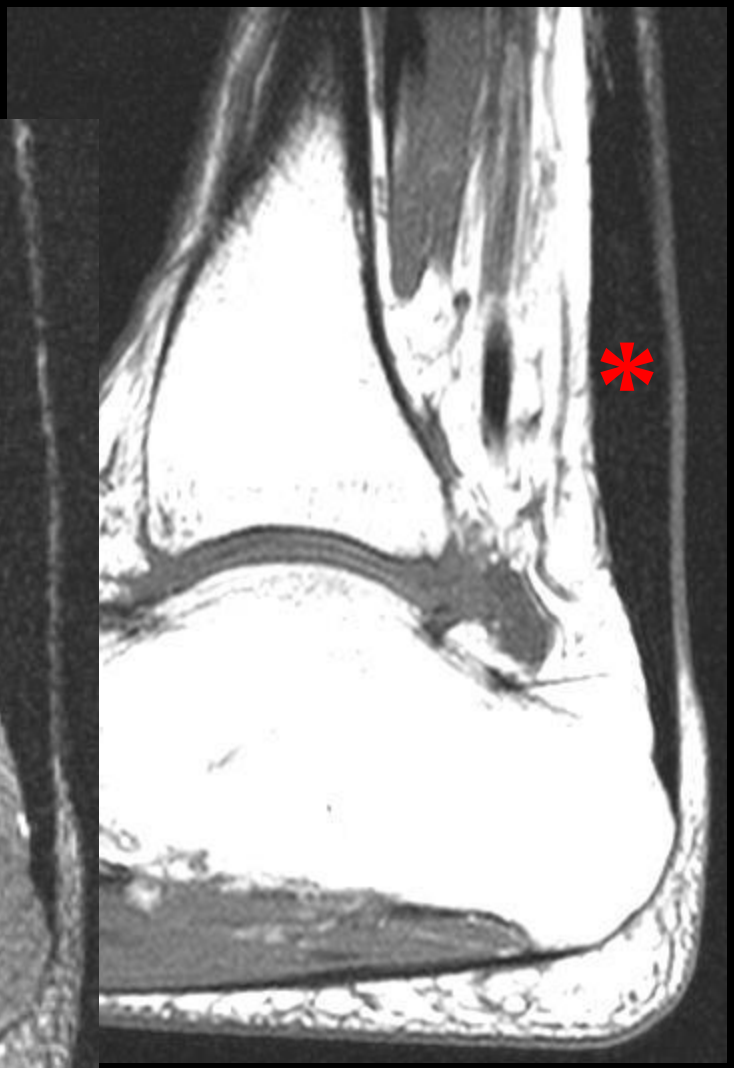
  -Insertional

  -Myotendinous junction

CHRONIC TENDINOSIS

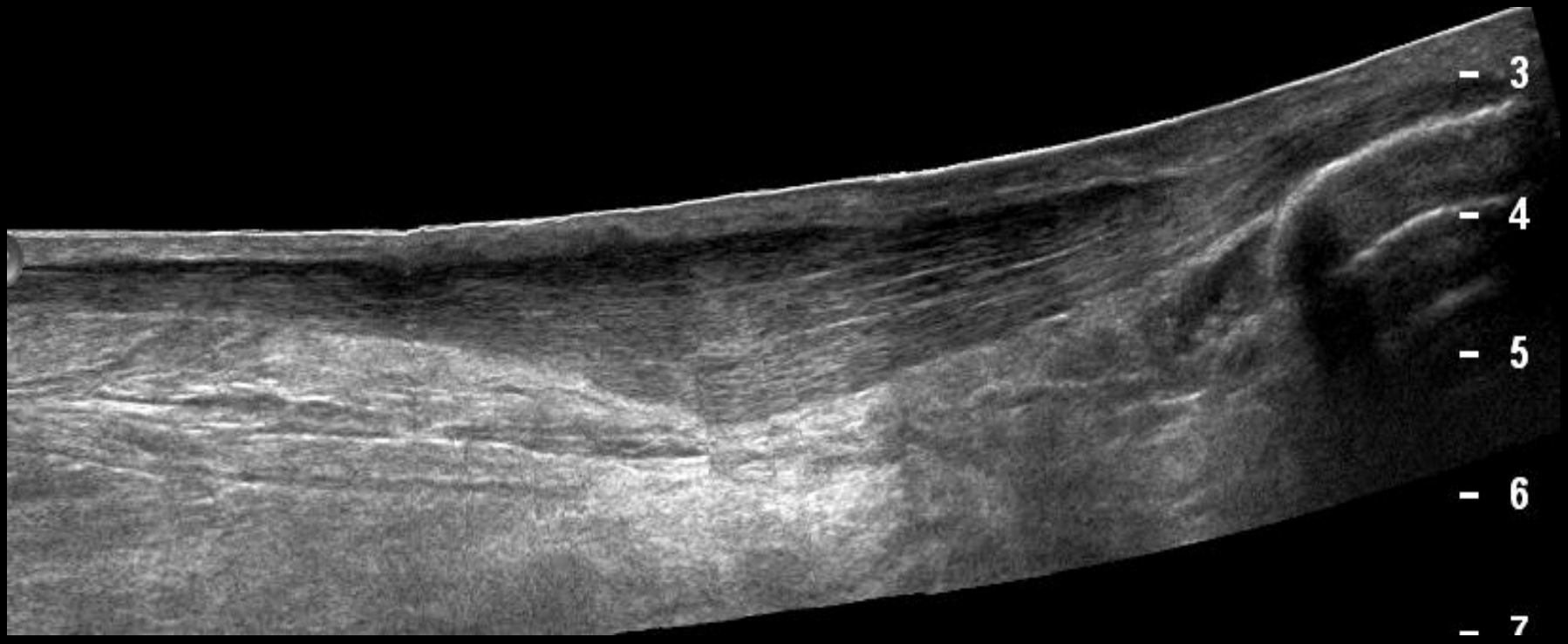
Diffusely low signal: Hypoxic degeneration



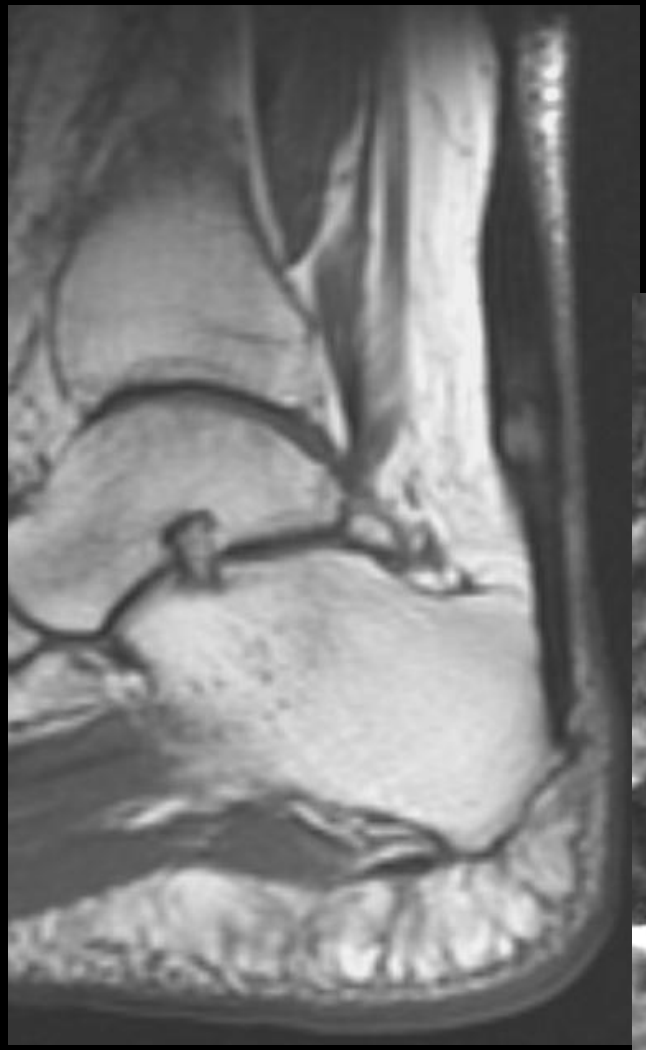


WATERSHED ZONE

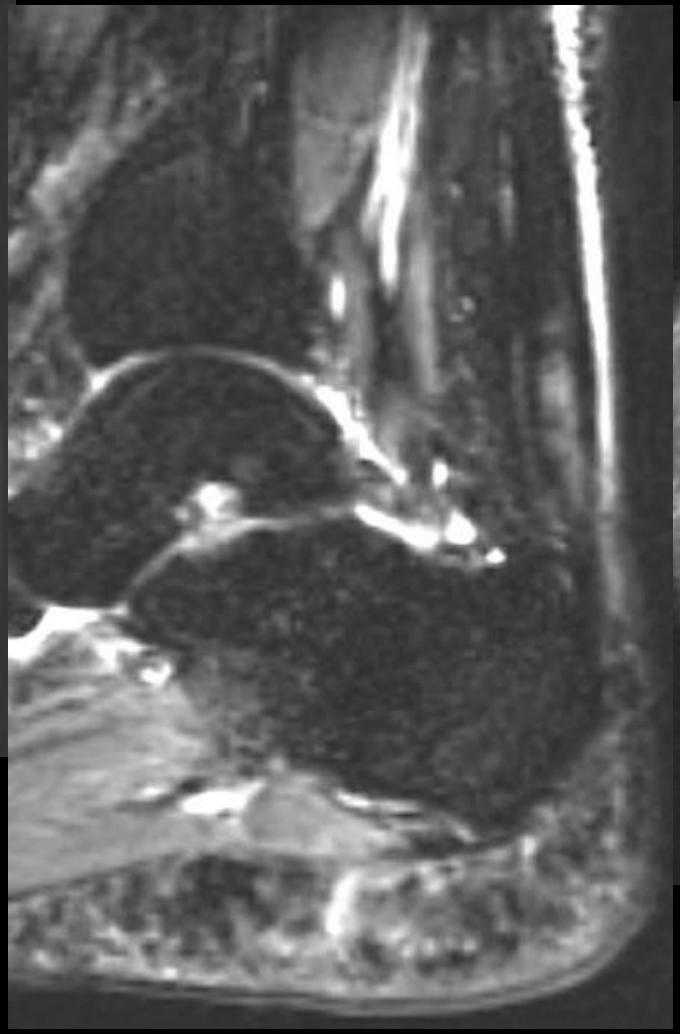
Achilles Tendinosis Ultrasound

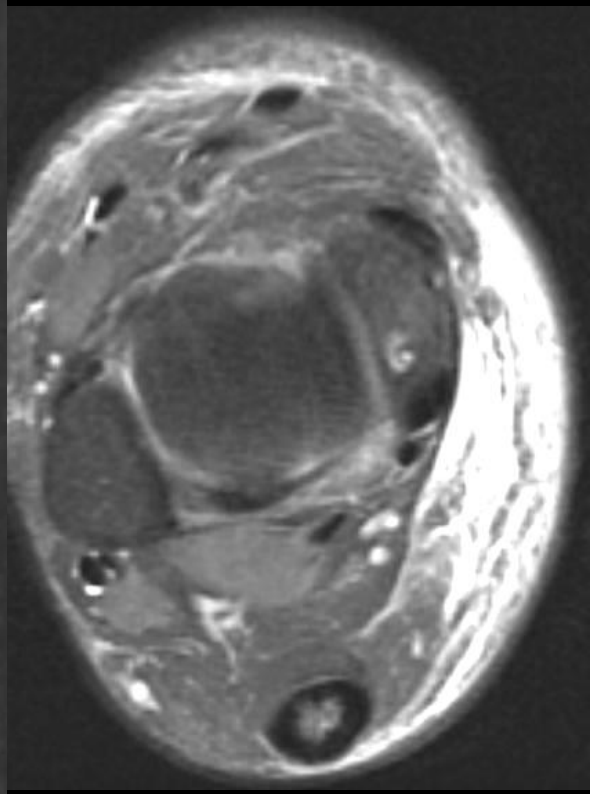


ACHILLES TENDINOSIS

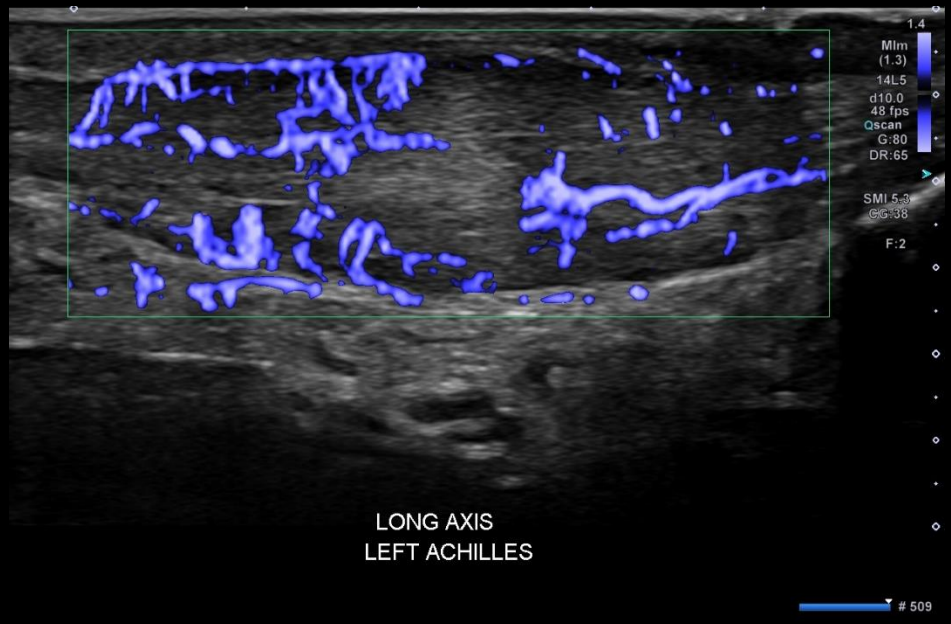


Mucoid degeneration

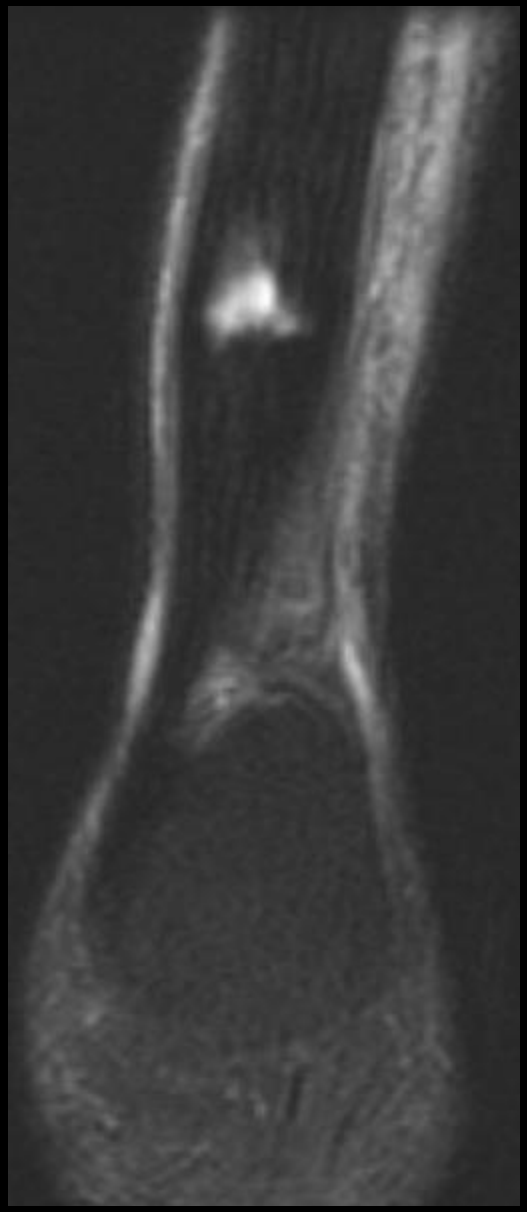




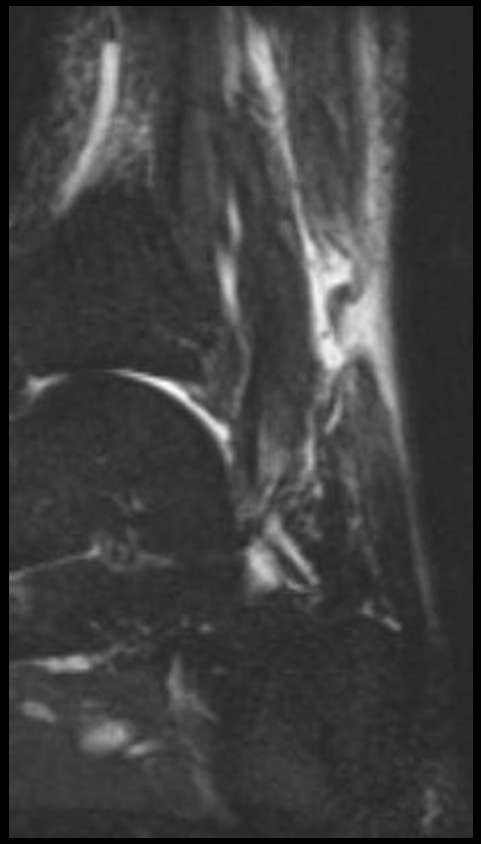
Achilles Tendinosis Ultrasound



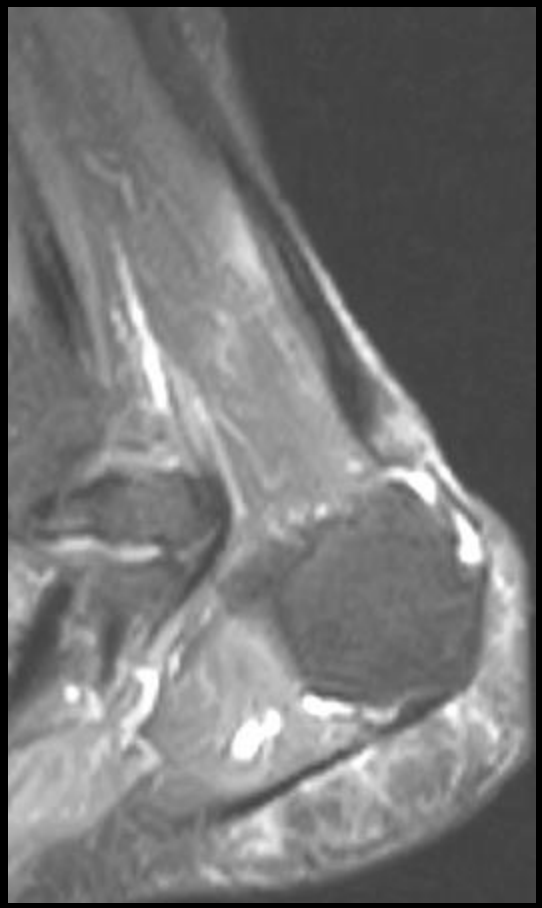
TEAR: LOCATION



Midsubstance (watershed)



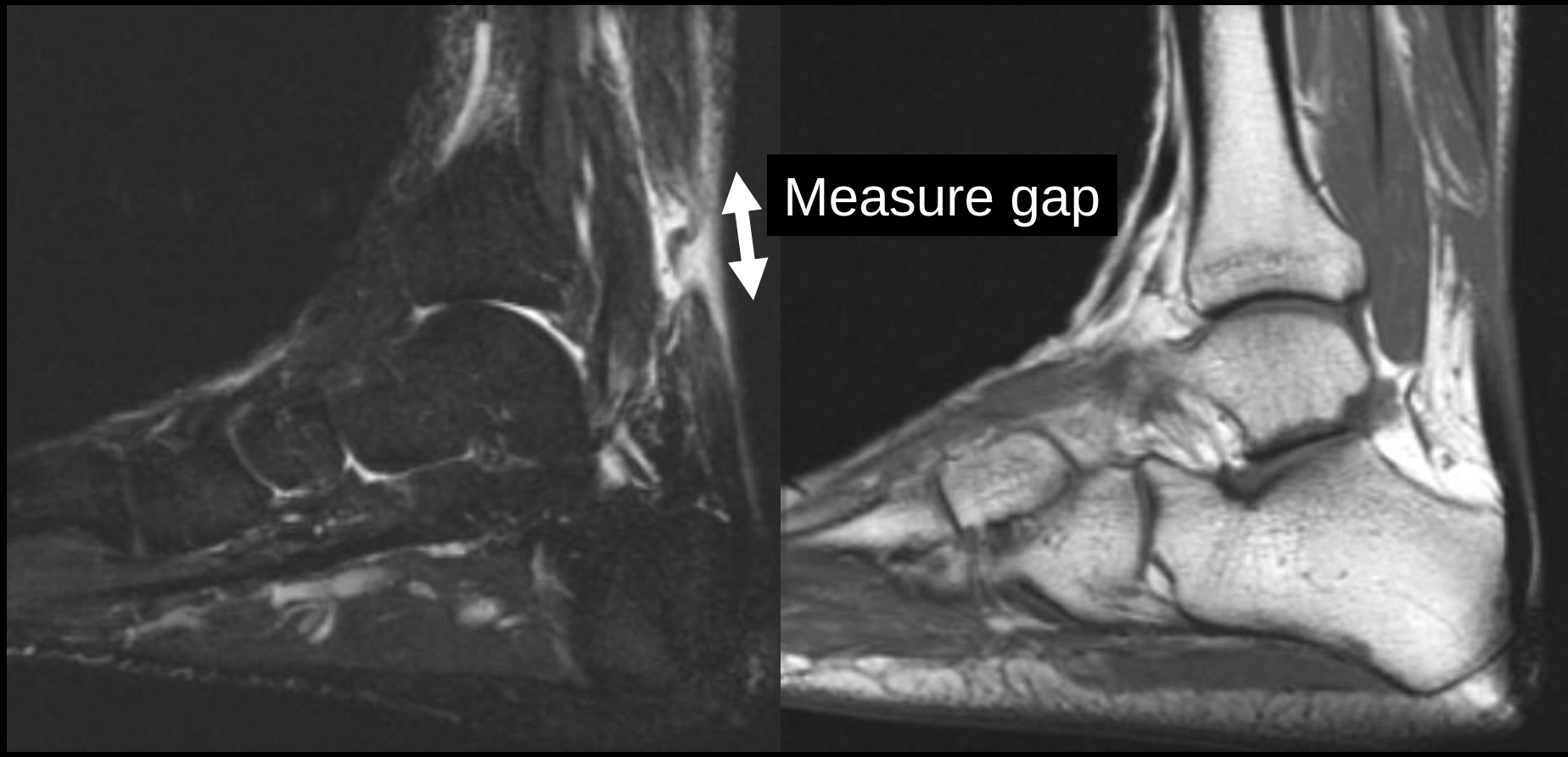
Myotendinous junction



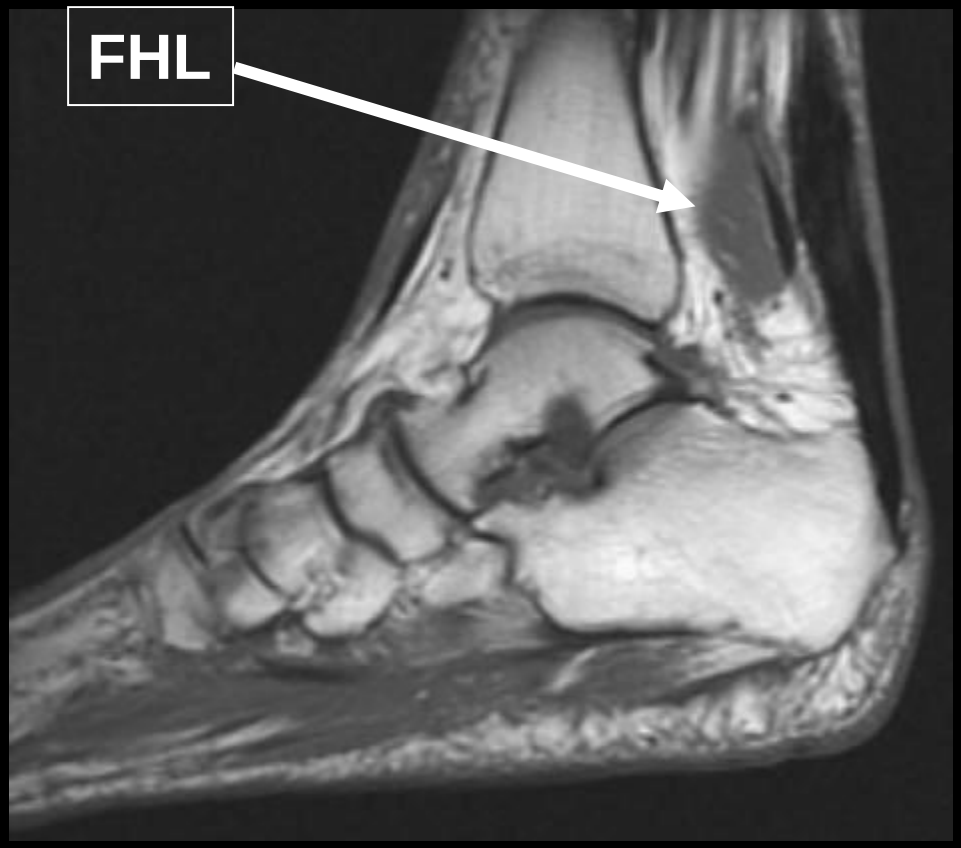
Insertional

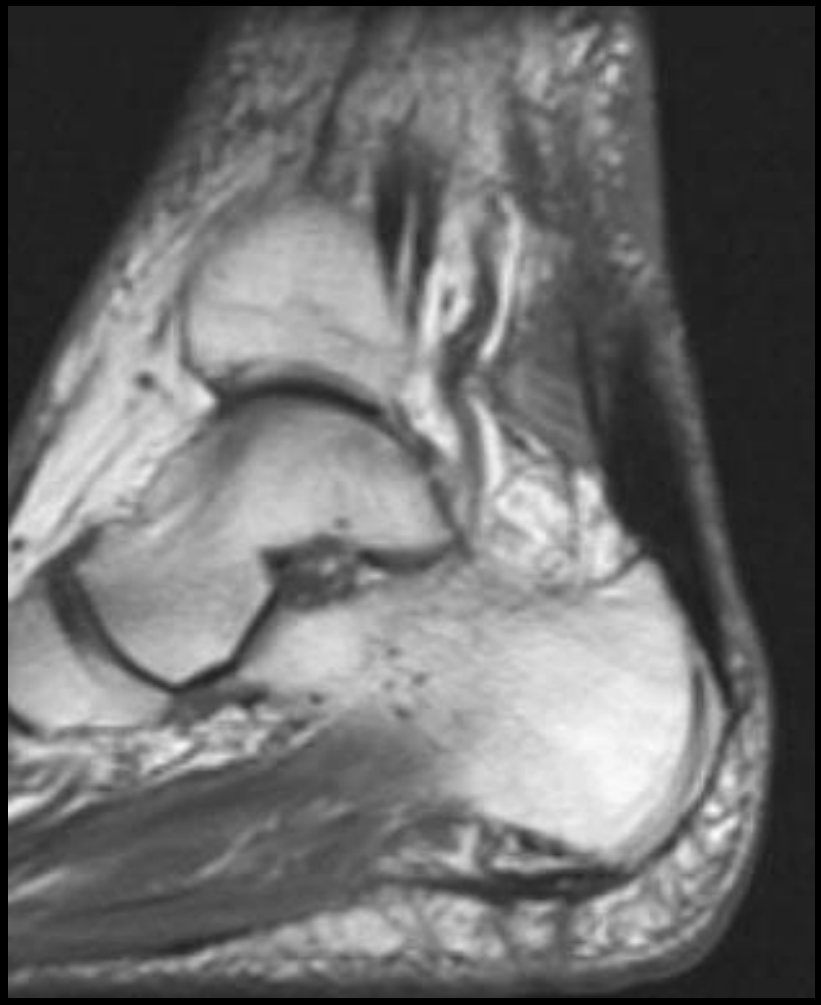
Estimate cross-sectional %

COMPLETE TEAR



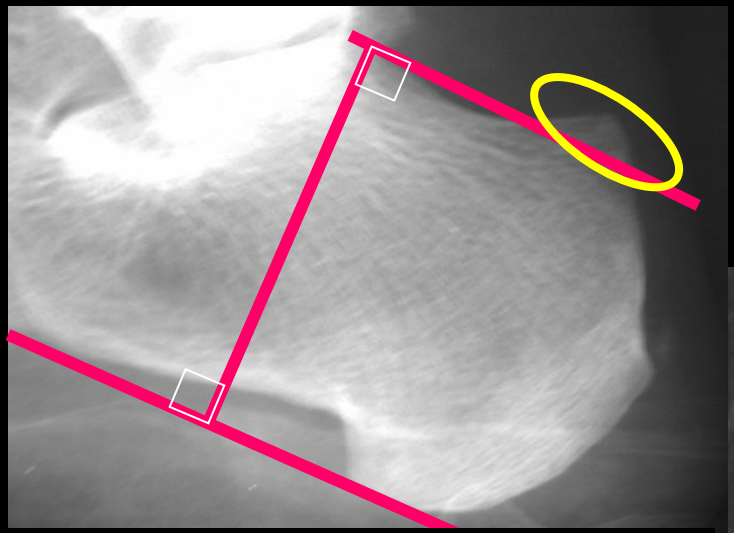
POST-OP ACHILLES



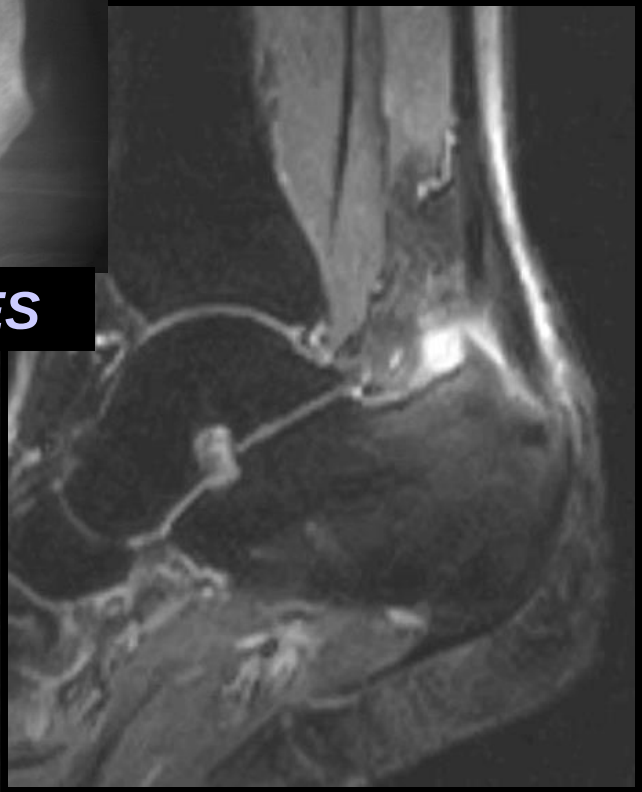


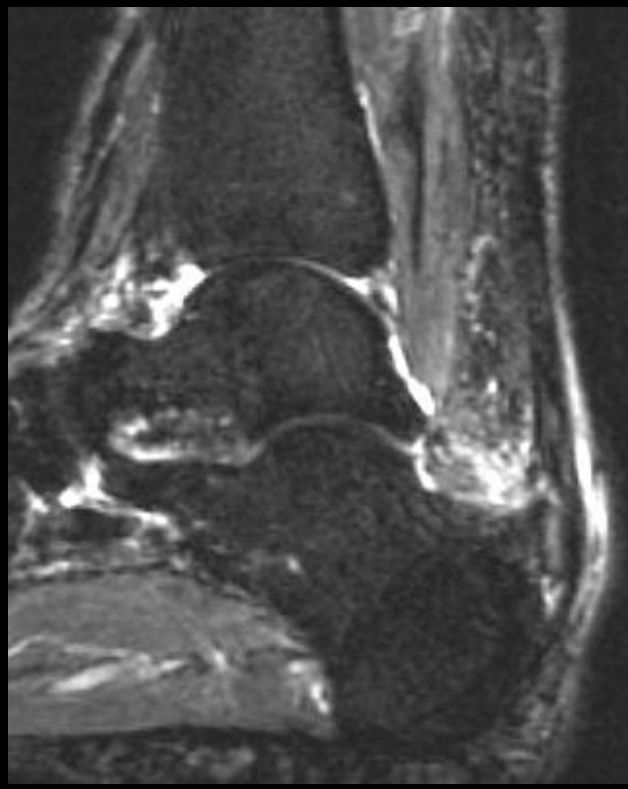
Repair with FHL transfer

HAGLUND SYNDROME



PARALLEL PITCH LINES

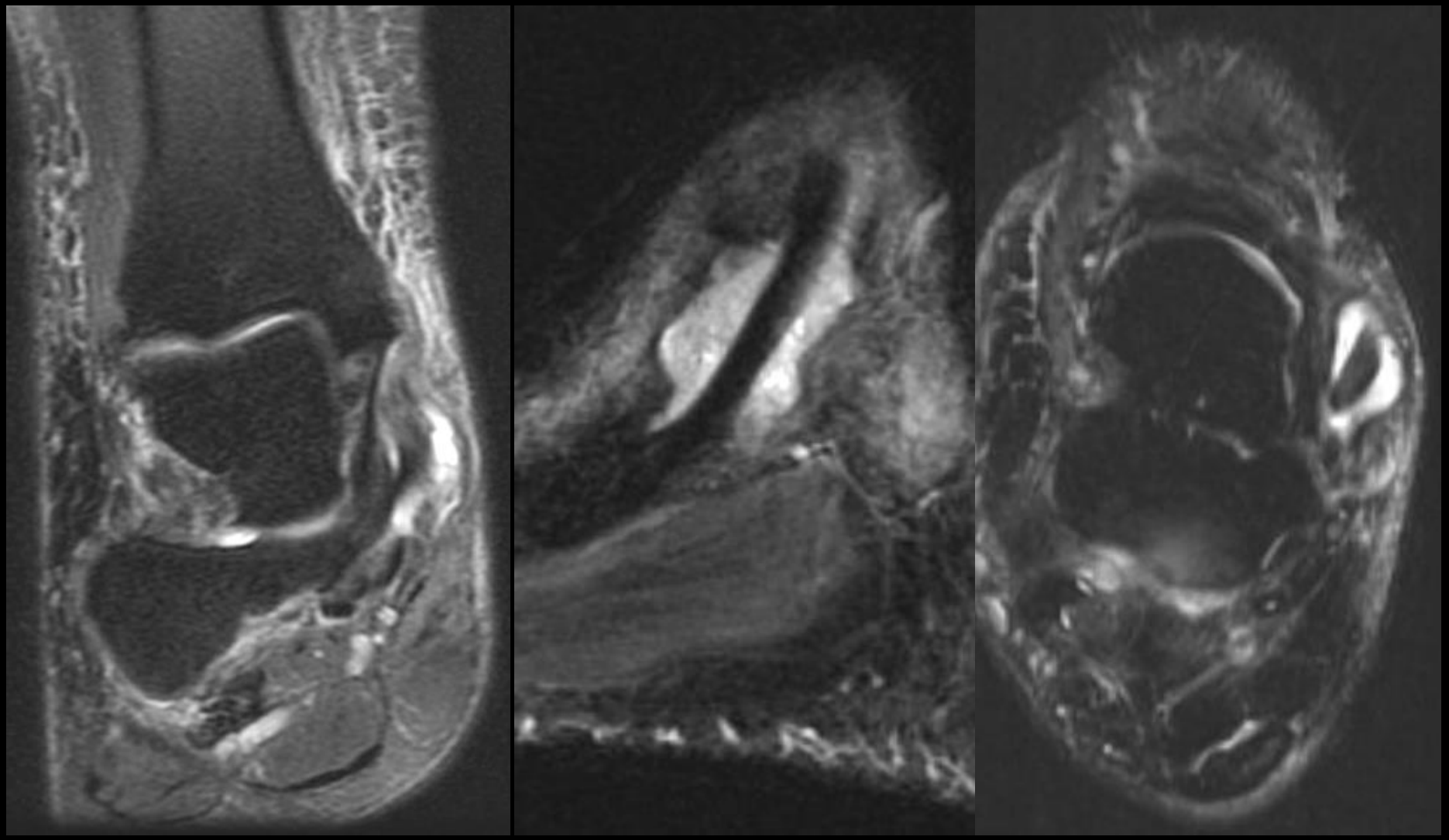




-Upturned post calcaneal tubercle
-Retrocalc bursitis
-Retro Achilles bursitis
-Insertional Achilles tendinosis / tear

Ankle Flexor Tendons

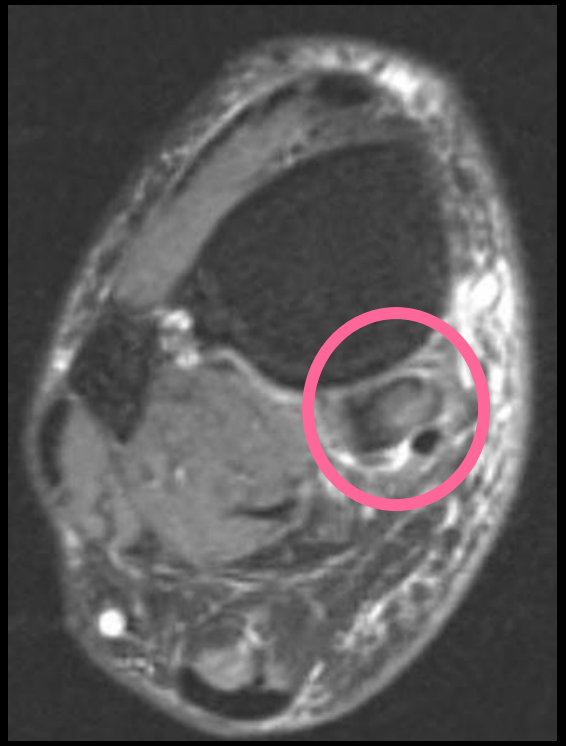
POSTERIOR TIBIALIS TENOSYNOVITIS



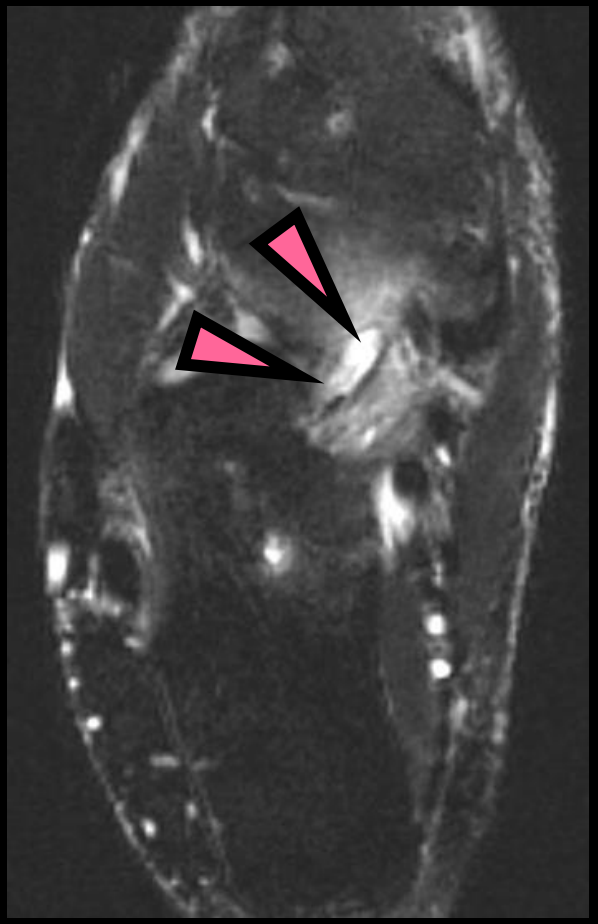
PTT TEAR / DYSFUNCTION

- Typically middle age / elderly females, diabetics
- Painful acquired flatfoot
- MRI: *PTT normally 2 times thickness of adjacent flexor digitorum longus tendon*
  - Thinning or thickening = pathology
  - complete tear uncommon

PTT atrophy



PTT hypertrophy



Spring ligament edema/tear

PTT /spring ligament dysfunction results in deformity

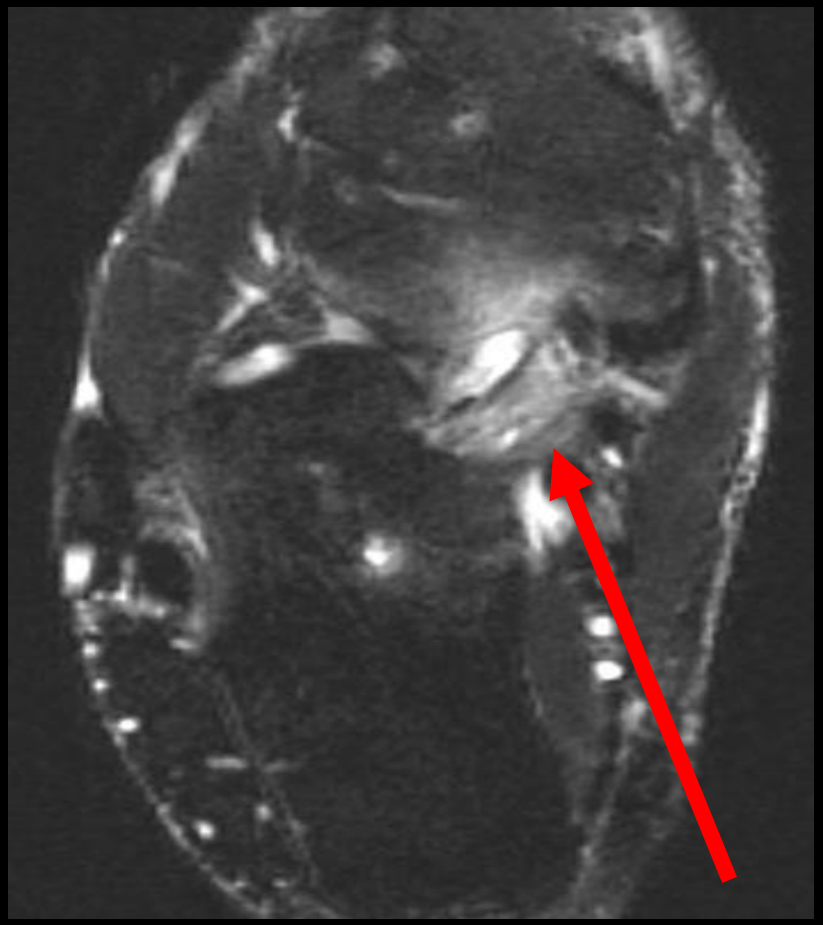
Posterior Tibial Tendon: Dynamic Stabilizer

- **Function**
  - **Support medial arch of the foot**
  - **Invert foot**
  - **Plantarflex ankle**

Posterior Tibial Tendon: Dynamic Stabilizer

- **If torn or stretched: arch collapses**

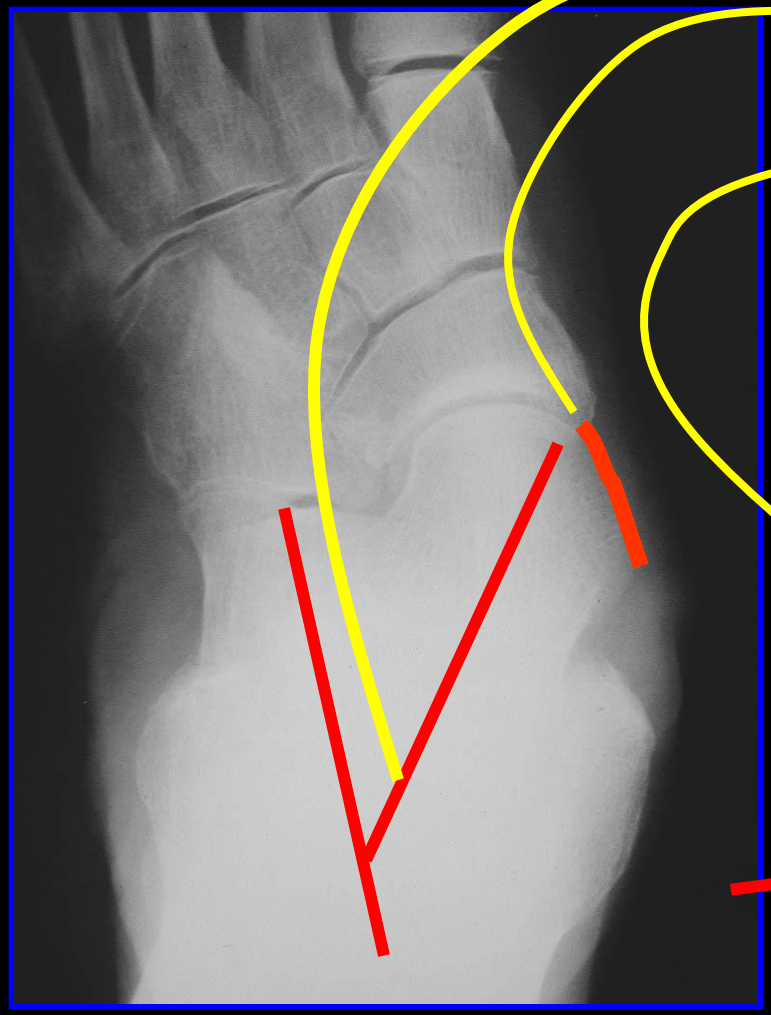
Spring Ligament Tear

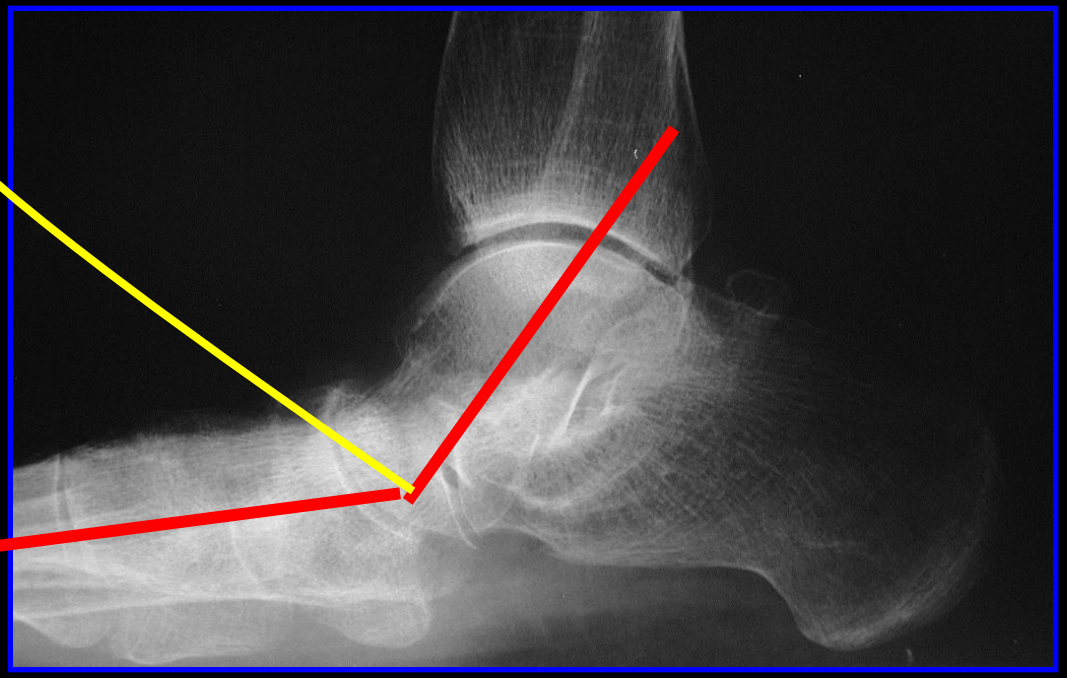


Spring ligament edema / tear

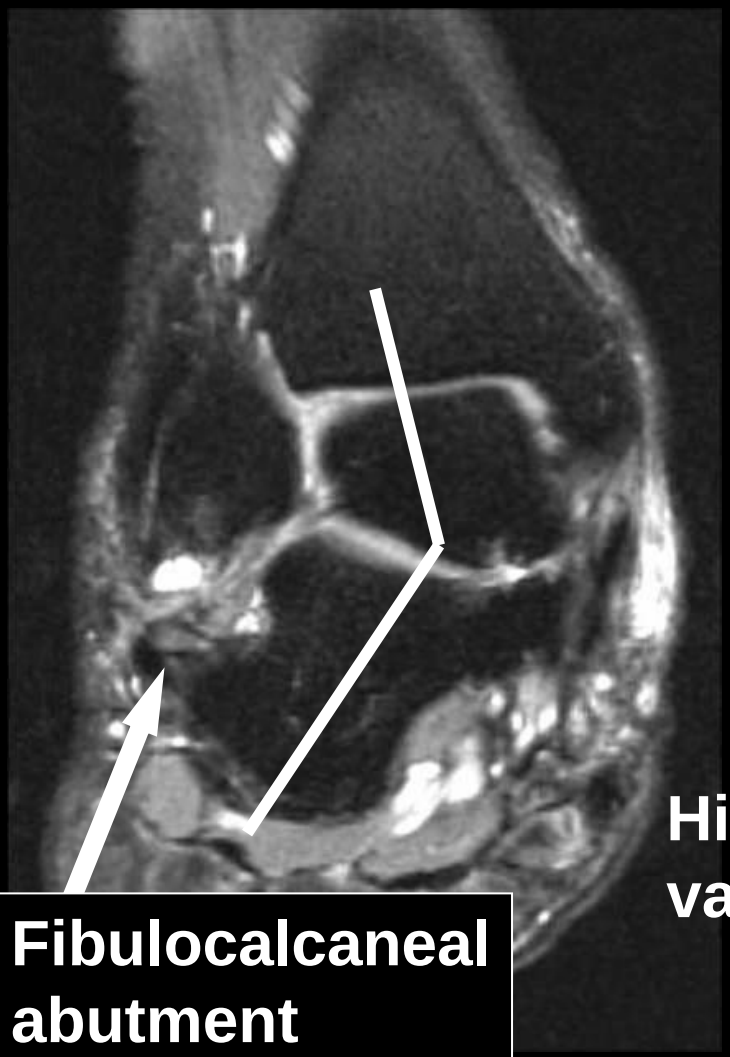
Posterior Tibial Tendon Failure - Radiographs

- Hindfoot valgus
- Overpronation/Forefoot abduction
- Arch collapse
- Pes planus





MR IMAGING SIGNS OF PTT DYSFUNCTION



Fibulocalcaneal abutment

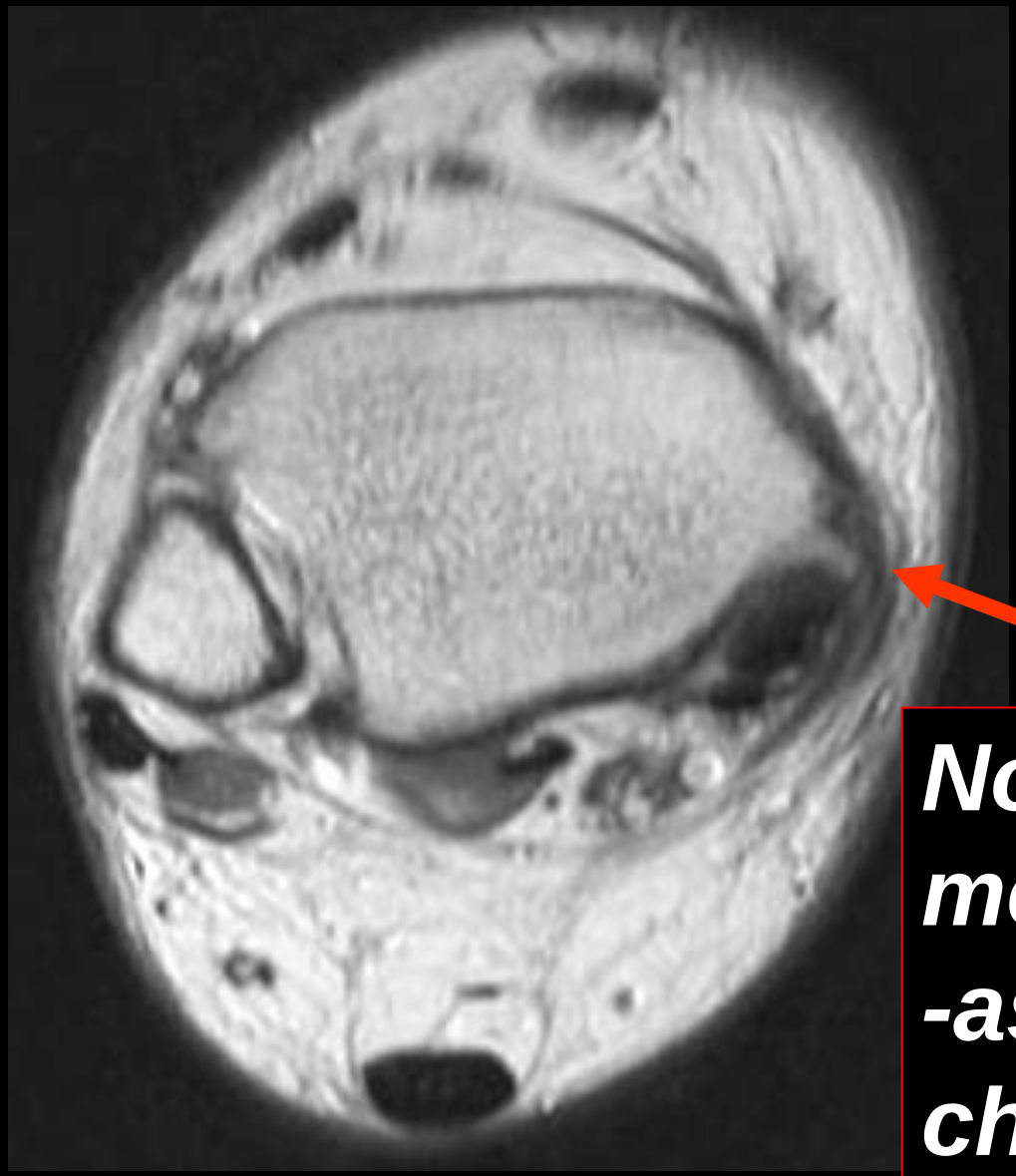
Hindfoot valgus

Uncovering of medial talar head

Also: pes planus, arch collapse

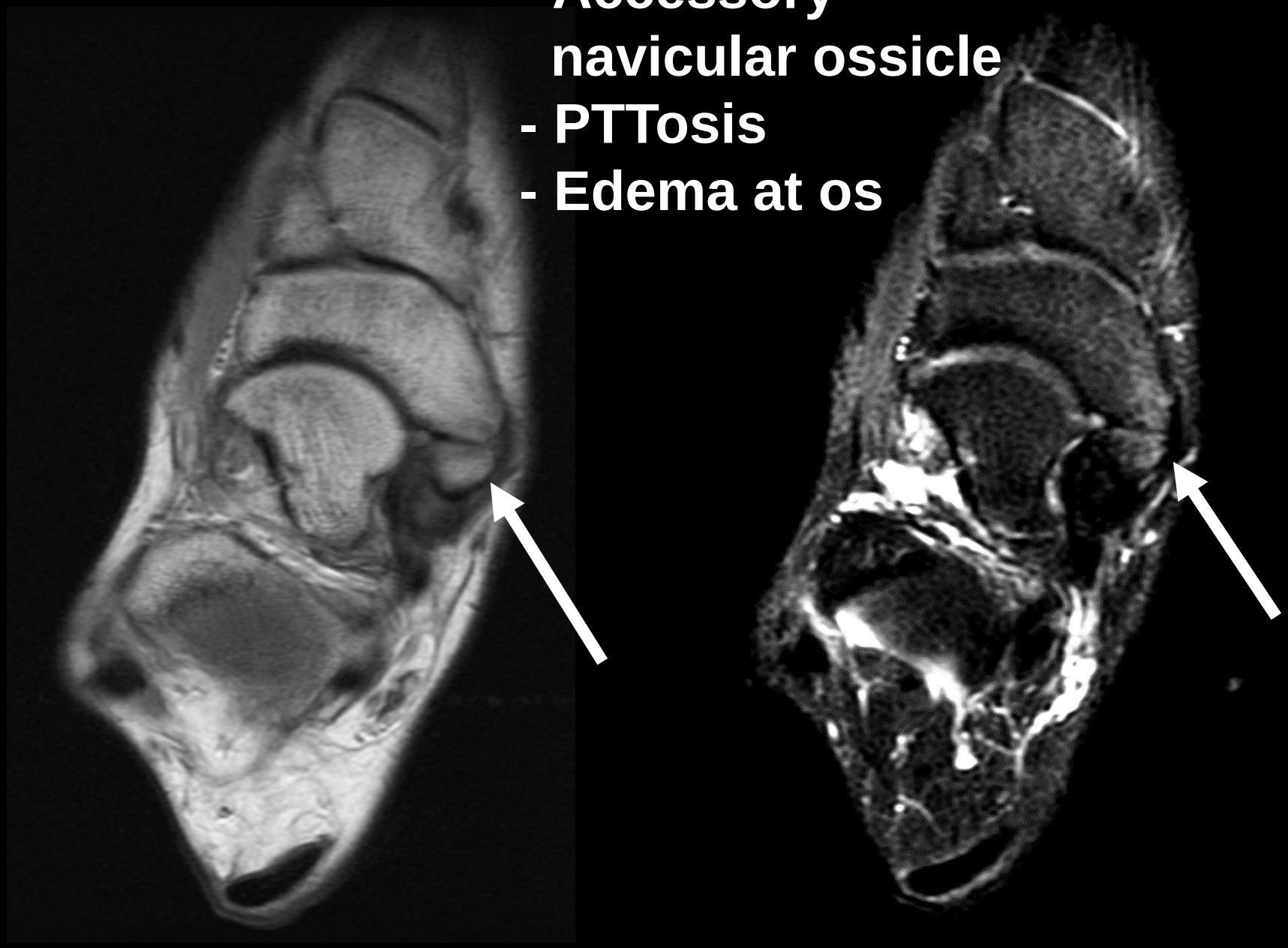
Subtendinous BME

-can be a sign of overlying tendinosis, pain



Non-articular spur medial malleolus -associated with chronic PTTosis

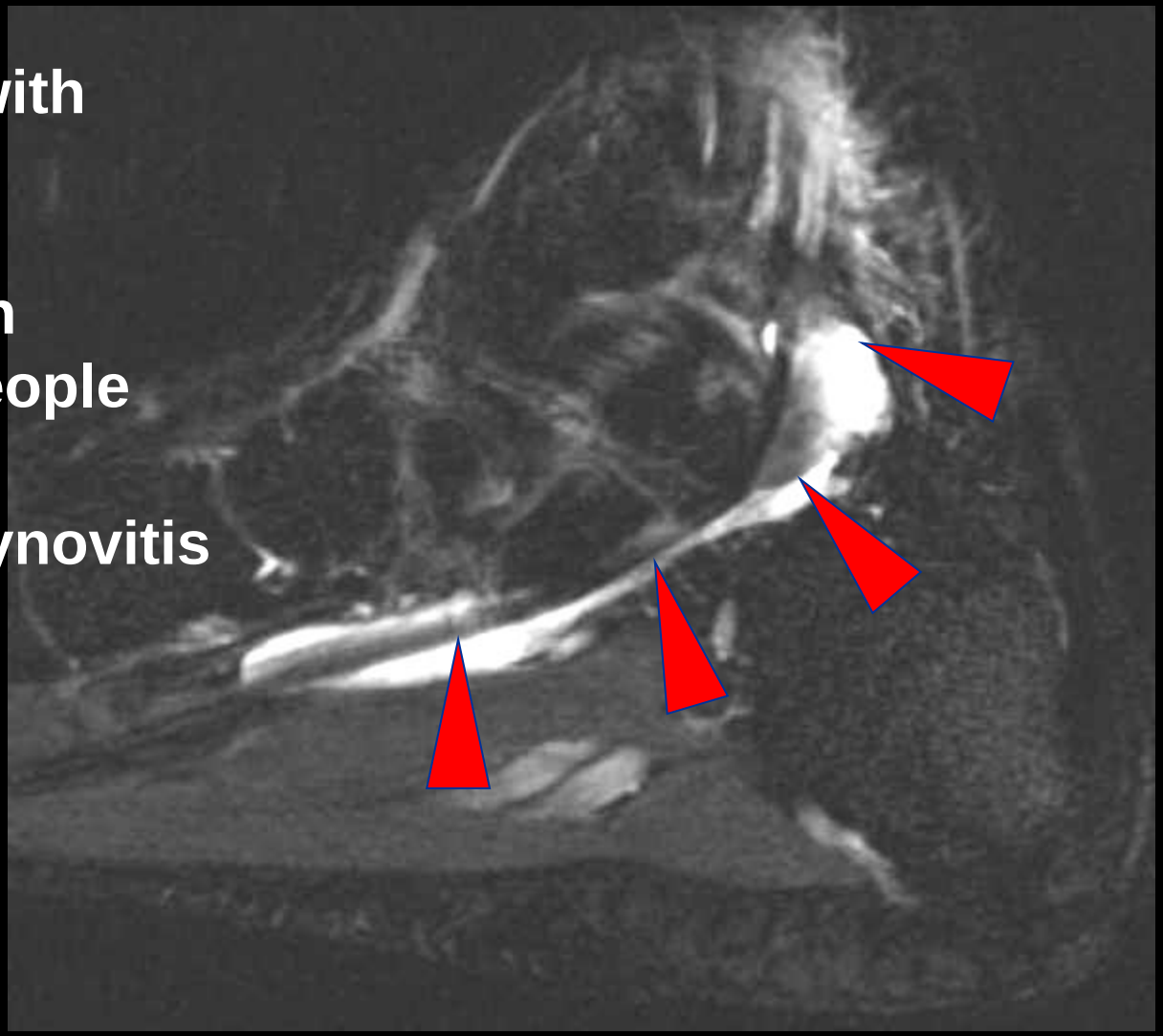
- Accessory navicular ossicle
- PTTosis
- Edema at os



FLEXOR HALLUCIS LONGUS

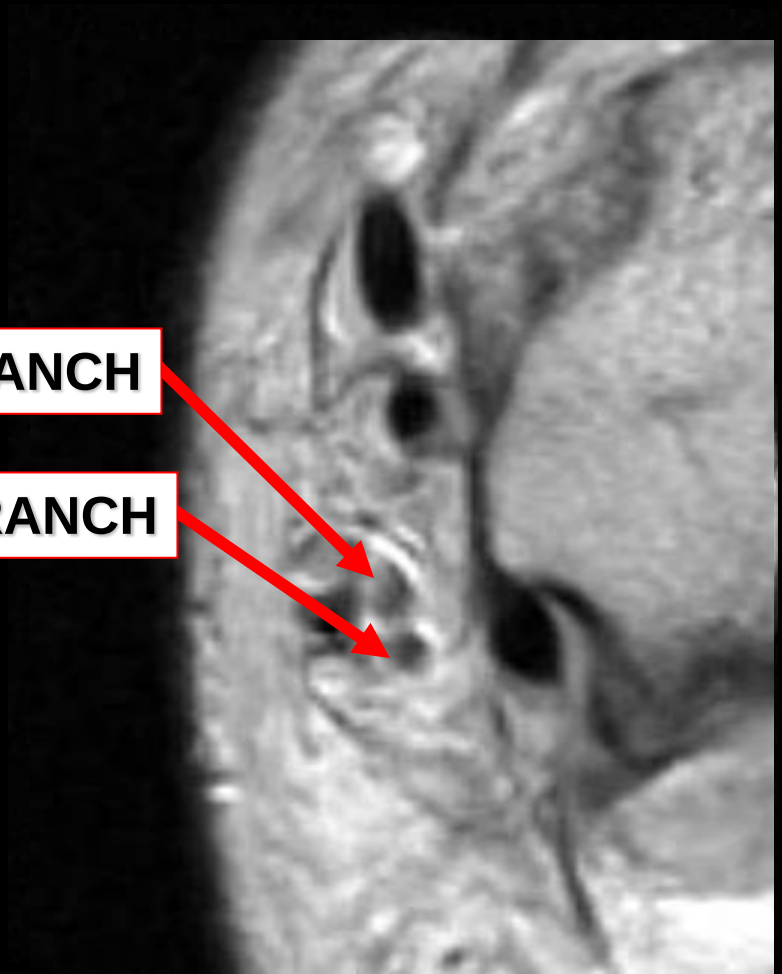
-Communicates with ankle joint
-Can have a large amount of fluid in asymptomatic people

Synechiae = tenosynovitis



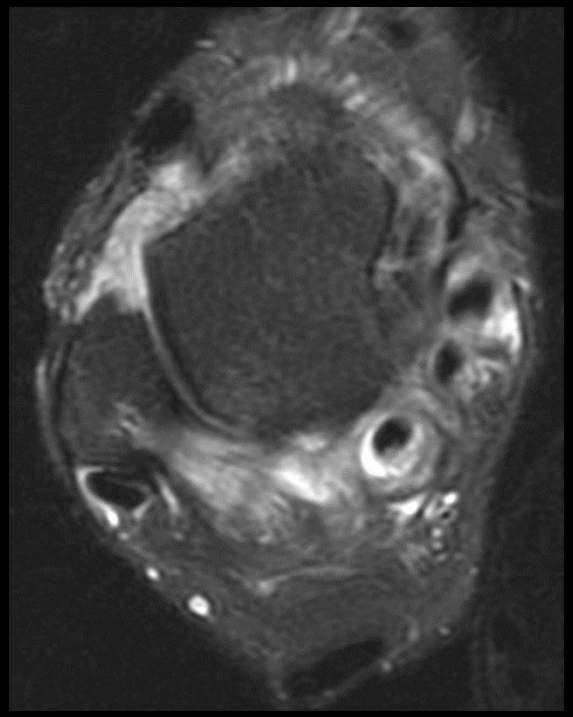
TARSAL TUNNEL SYNDROME

- Fibro-osseous tunnel analogous to carpal tunnel
- Limited by flexor retinaculum
- Mass effect impinges on nerve
  - tenosynovitis
  - ganglion
  - prominent vessels
  - true mass
- Nerve impingement can simulate plantar fasciitis (Baxter's nerve)

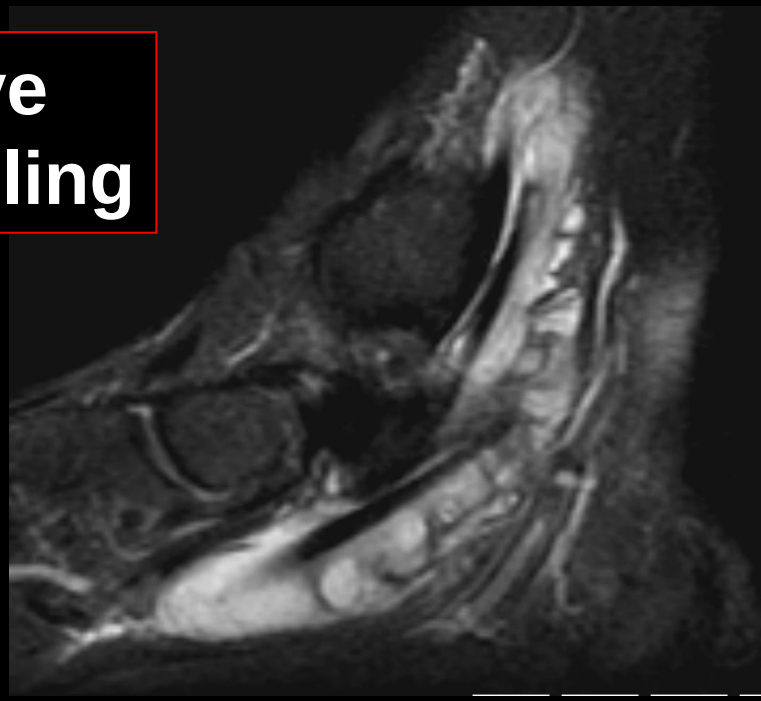


RHEUMATOID ARTHRITIS

Mass effect from synovitis



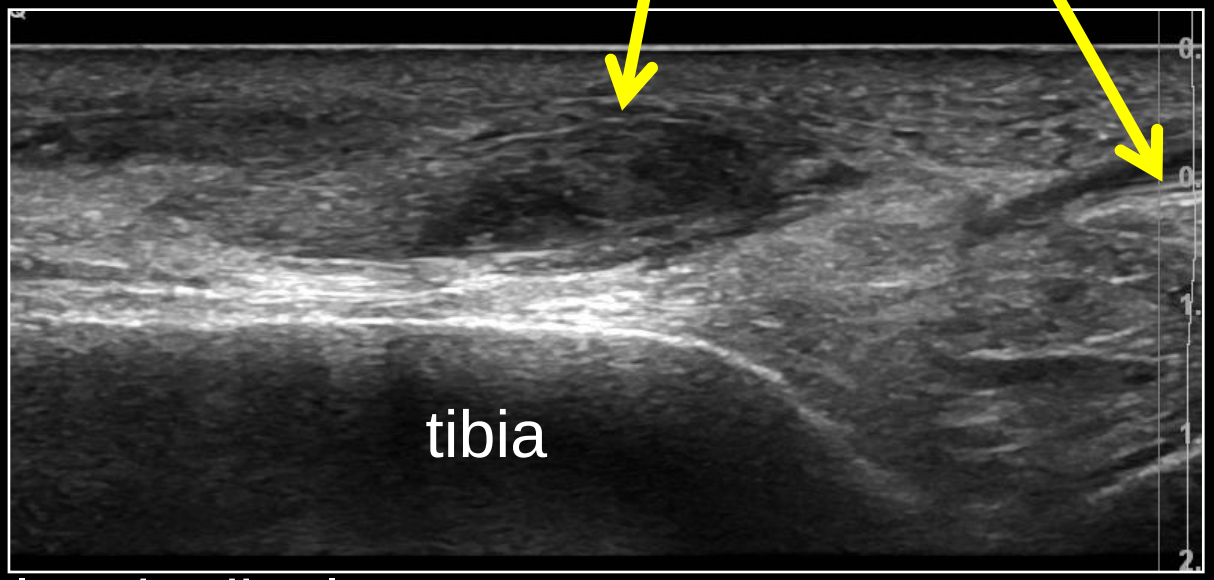
Nerve swelling



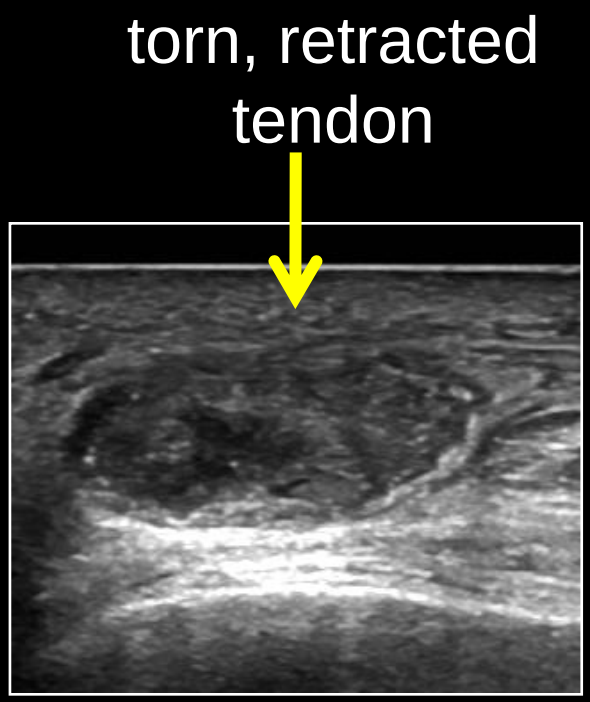
ANTERIOR TIBIALIS TEAR

- Uncommon
- Tibialis anterior functions during swing phase of gait, keeps foot from dragging
- Tears in elderly, also athletes in kicking sports
- Often presents as a tender mass

Tibialis Anterior Tendon Tear (full thickness)

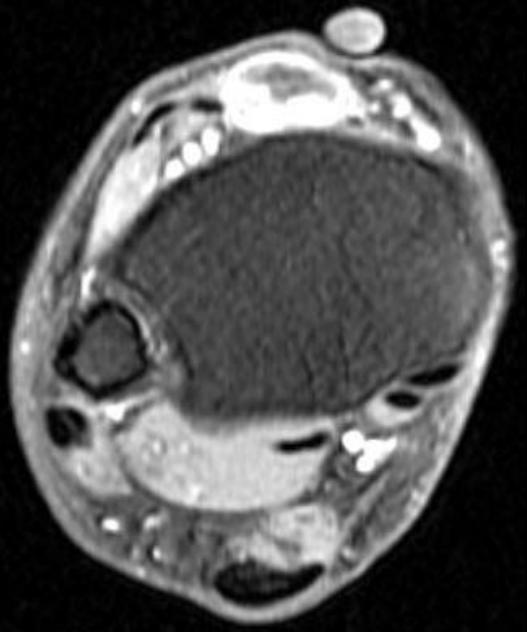


longitudinal

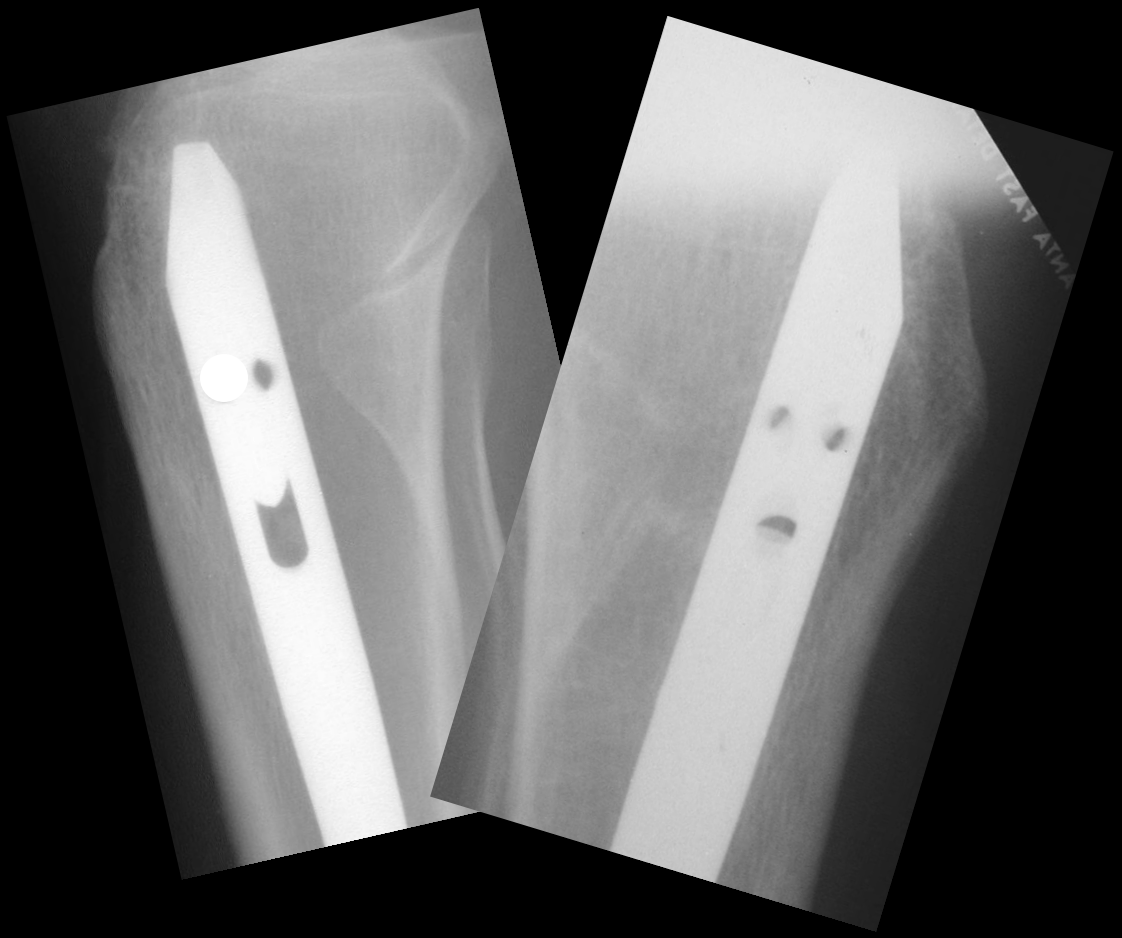


transverse

ATT TEAR



Thank You!



Ankle-Routine

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Sag T1 SE Non FatSat	16-18	256 x 192 1	3/1	400-800	Minimal				16
Sag STIR	16-18	256 x 192 3	3/1	>1500	40	150	90	8	16
Axial PD FSE Non FatSat	14-16	512 x 256 2	4/1	3000	40			8	16
Axial T2 FSE FatSat	14-16	256 x 256 2	4/1	>2000	70-80			8	16
Coronal T2 FSE FatSat	14	256 x 256 3	3/1	>2000	70-80			8	16

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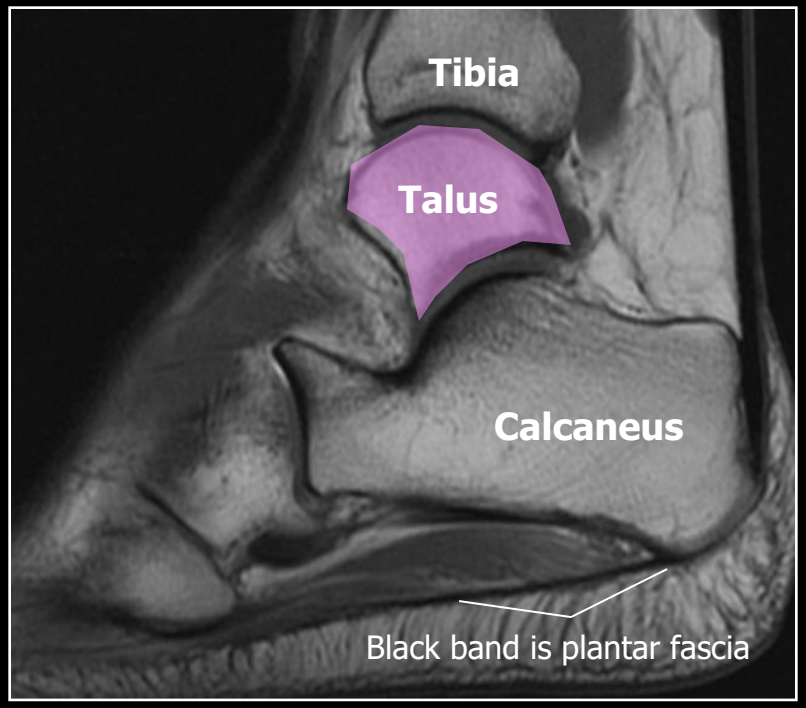
Ankle-Axial Imaging Plane

Relevant Anatomy

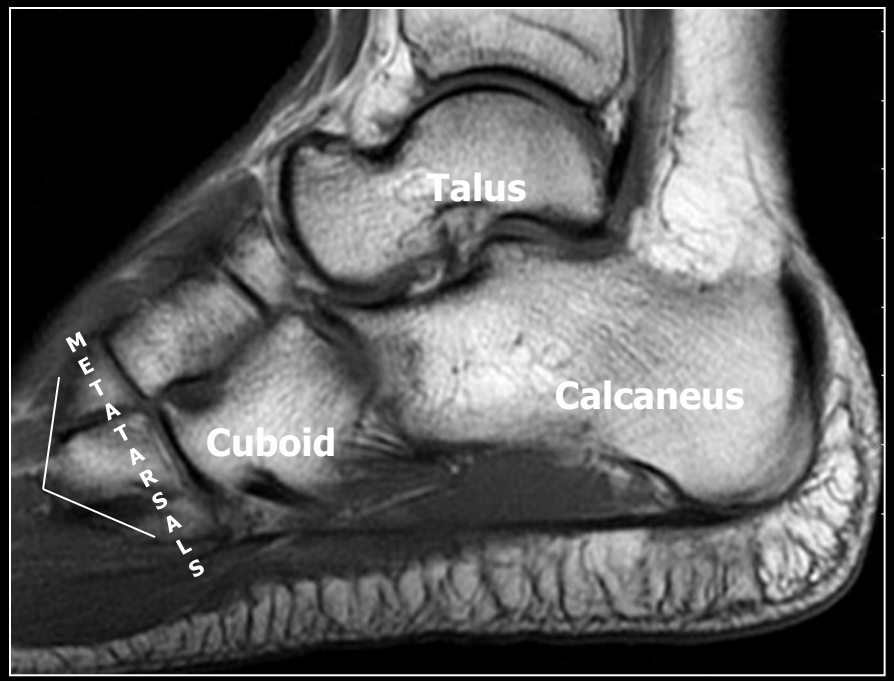


Axial Imaging Plane

Prescribe plane parallel to axis of calcaneus.
Scan ankle from distal tibia through subcutaneous soft tissues (include plantar fascia).

Ankle-Coronal Imaging Plane

Relevant Anatomy

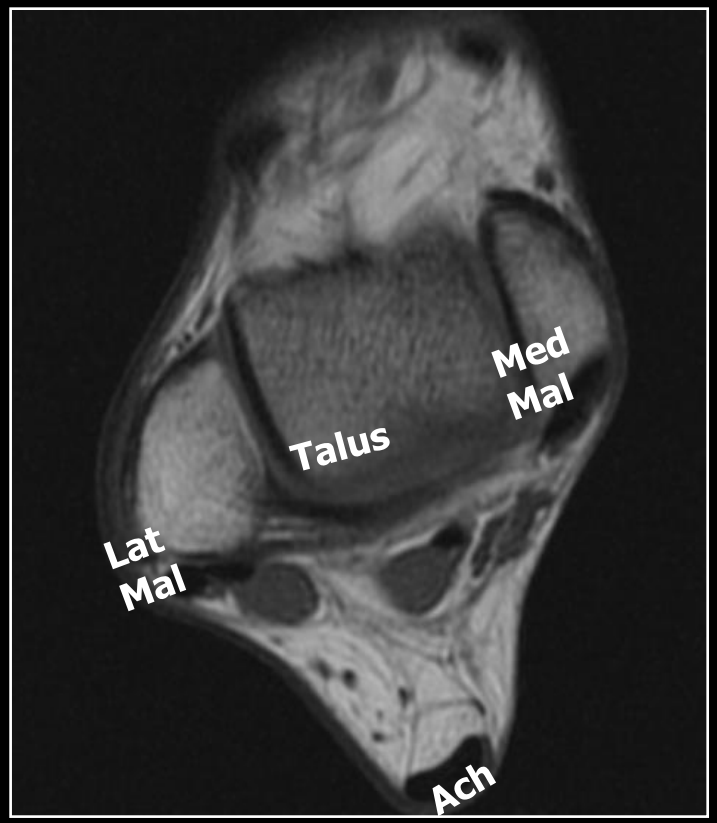


Coronal Imaging Plane

Prescribe plane perpendicular
to axial imaging plane. Scan ankle
from calcaneus through metatarsal bases.

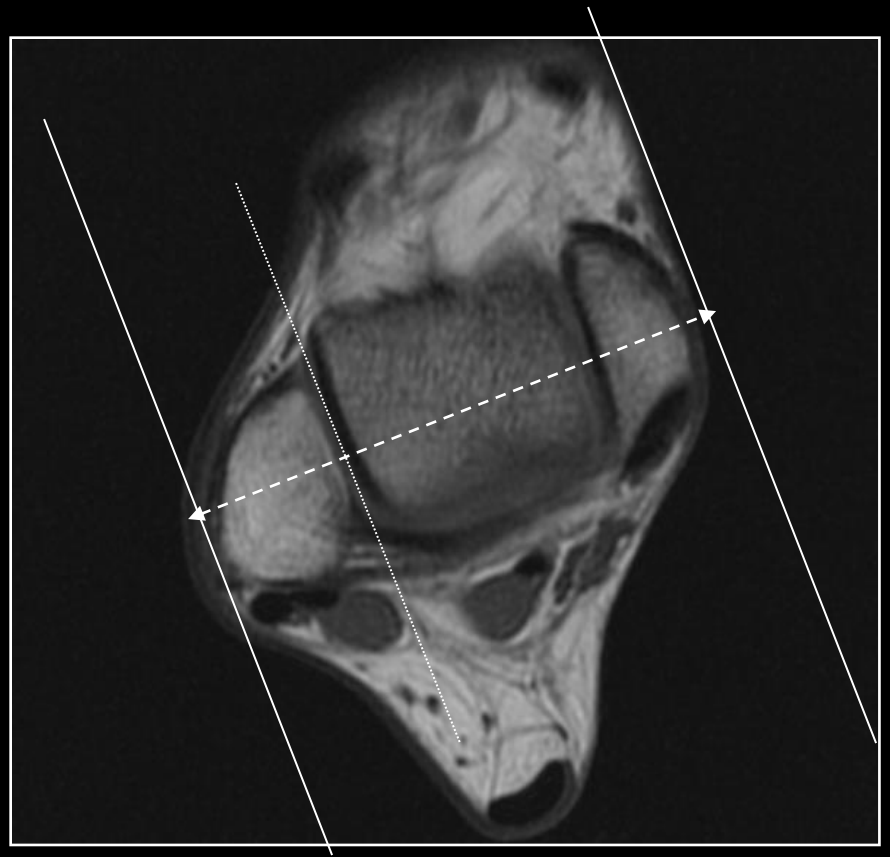
Ankle-Sagittal Imaging Plane

Relevant Anatomy



Sagittal Imaging Plane

Prescribe plane with line parallel to talus. Cover ankle from medial through lateral malleolus.



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