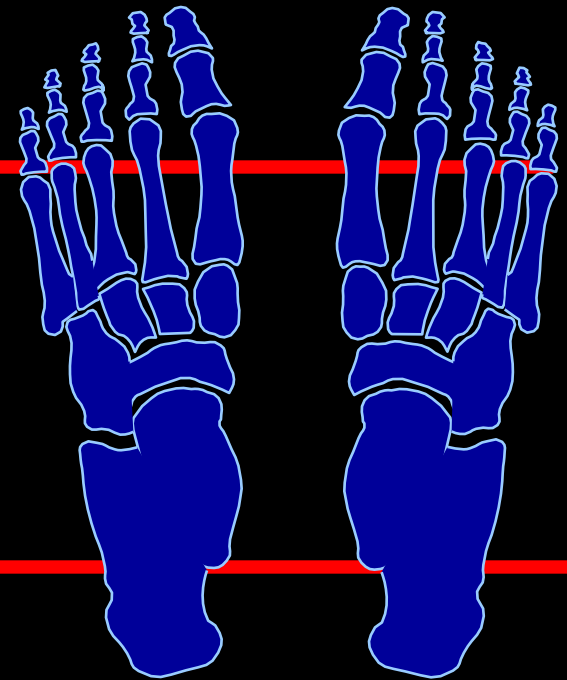


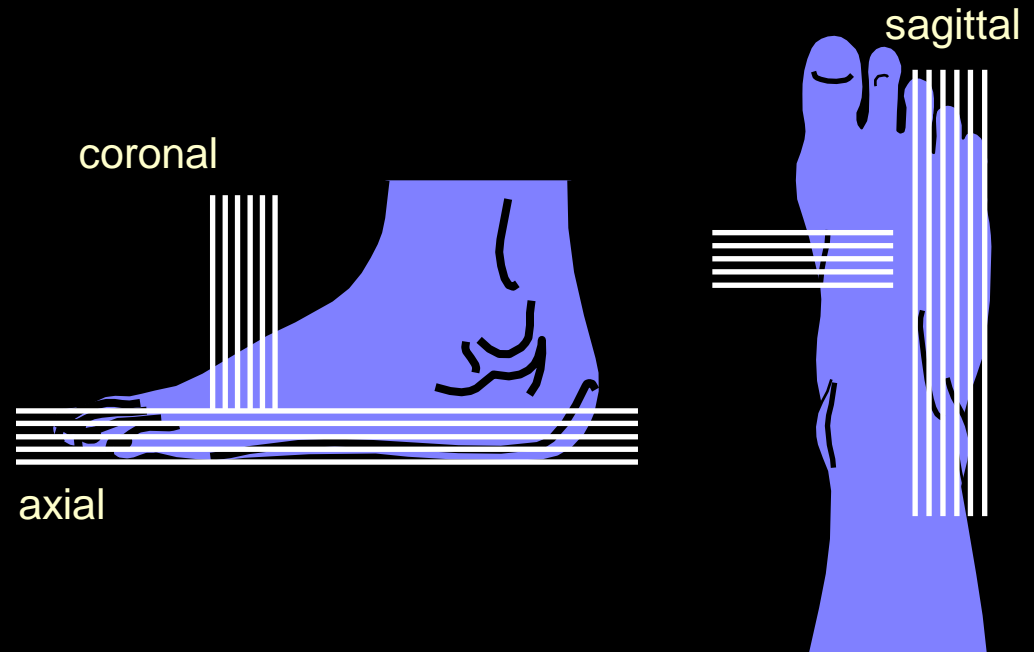


MR Imaging of the Ankle and Foot

Dr. Tudor H. Hughes M.D., FRCR
Department of Radiology
University of California School of Medicine
San Diego, California



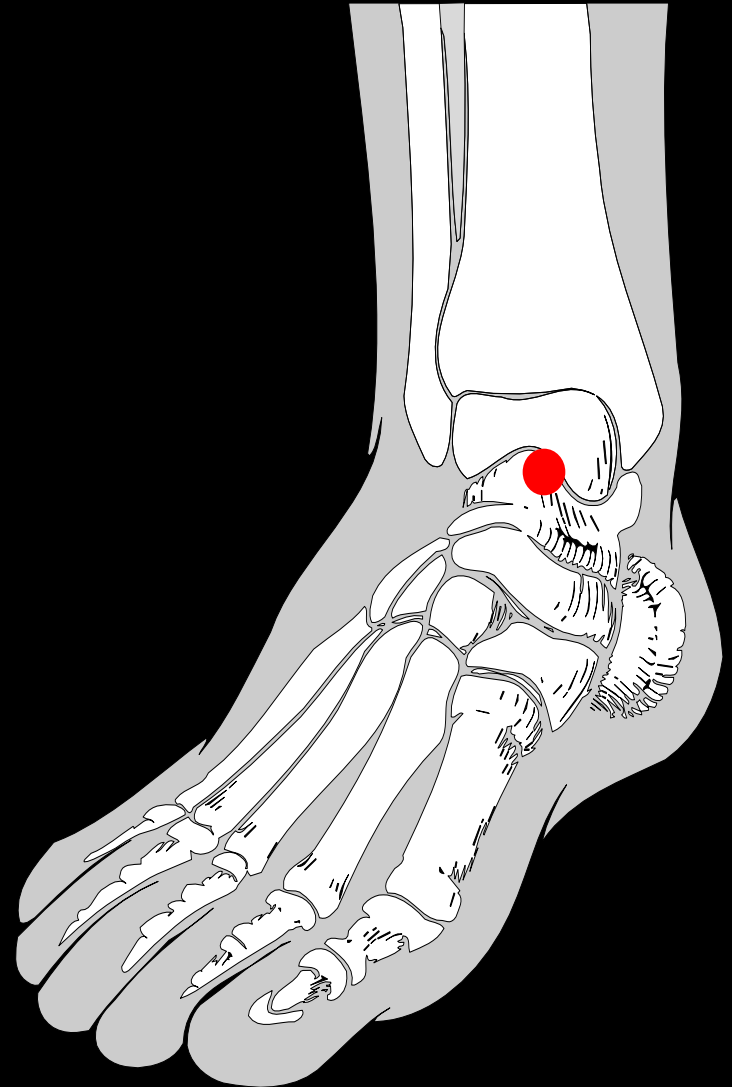
- Supine in extremity coil
- Padding for immobilization
- Saturation pads for good fat sat
- Unilateral imaging with small FOV
- Focus on hindfoot or forefoot whenever possible
- 3 planes of imaging



-
- Osteochondritis dissecans of the talus
 - Intraarticular body
 - Ligament or syndesmosis tear

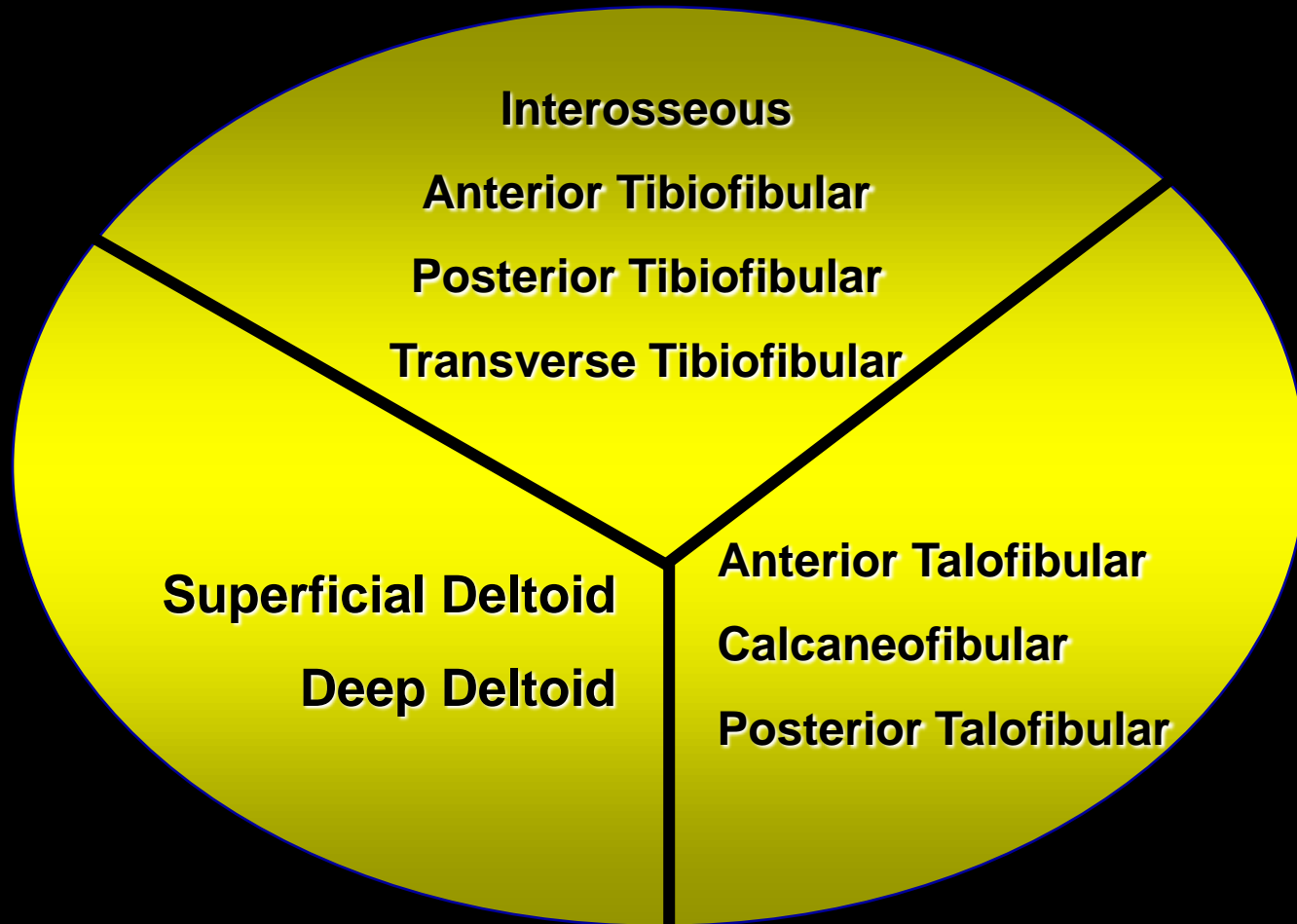


-
- Local anesthesia
 - Anterior approach using fluoroscopic guidance into tibiotalar joint
 - Placement confirmed with 1 cc of iodinated contrast
 - Injection of 2-4 cc of Gd-DTPA



Ligaments

Syndesmotic

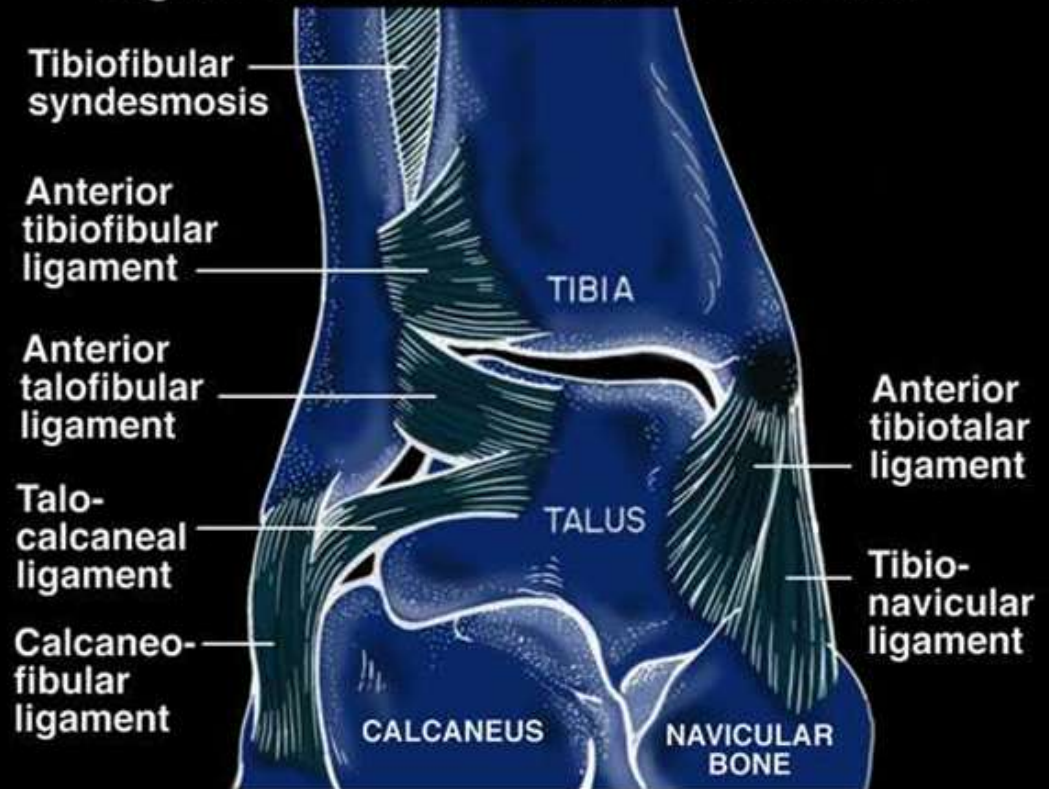


Med

Lat

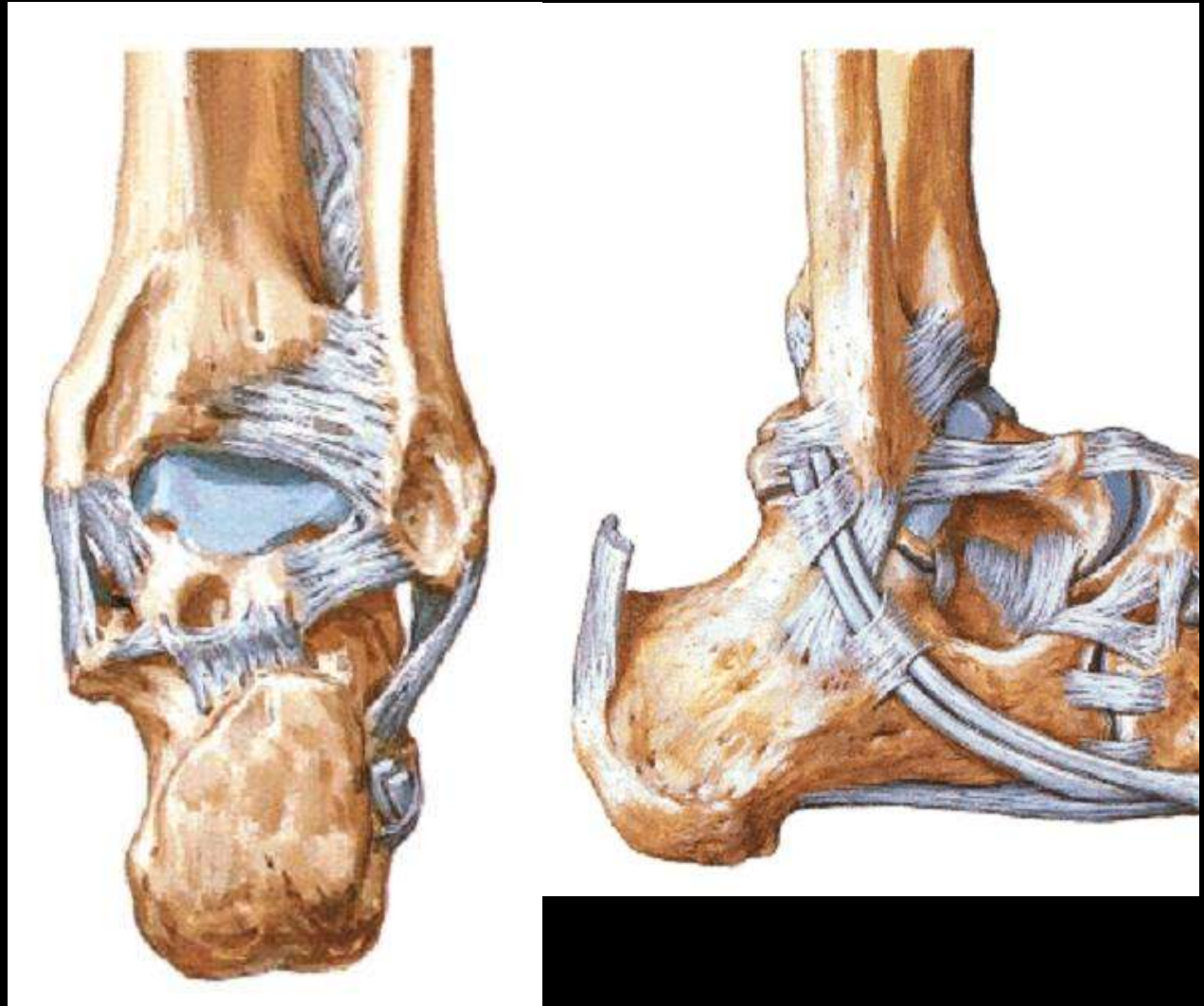
Ligaments of the Ankle, Anterior View

- Interosseous
 - Tibiofibular
- Lateral
 - Fibula to foot
- Medial
 - Tibia to foot



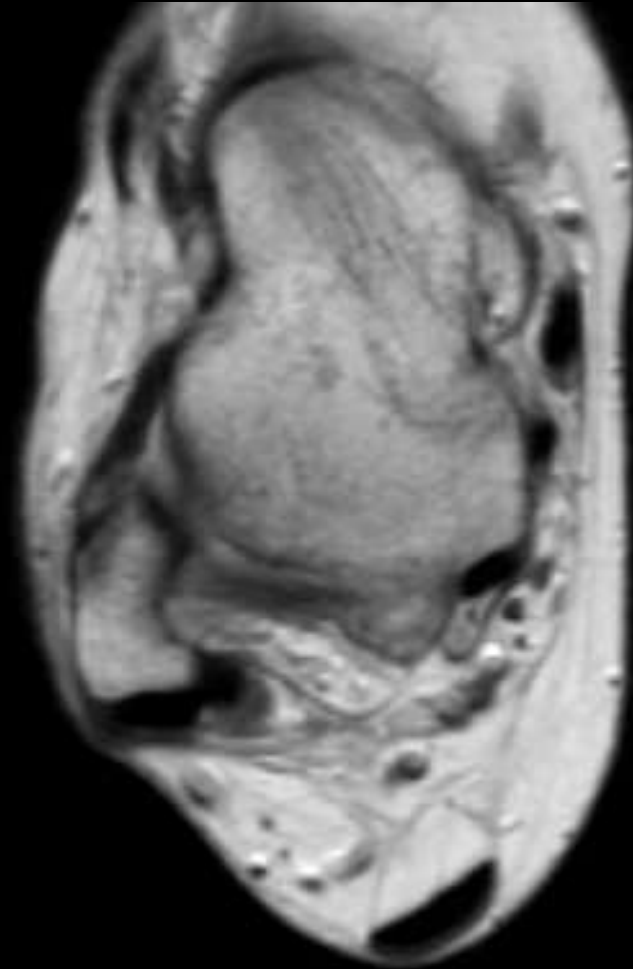
- Tibiofibular ligaments and syndesmosis

- Talofibular and calcaneofibular ligaments

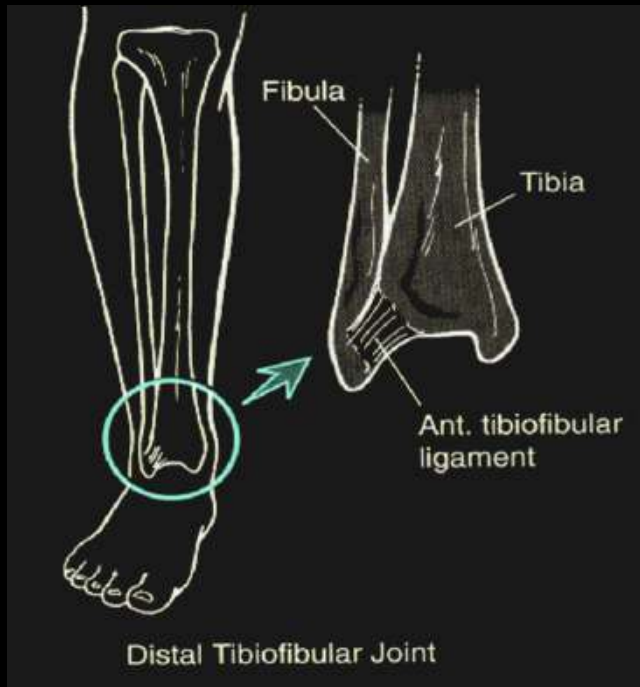




-
- Overlying edema
 - Fluid extravasation from joint
 - High signal within substance
 - Focal disruption
 - Retraction
 - Thickening of ligament



-
- Anterior tibiofibular
 - Interosseous membrane
 - Posterior tibiofibular

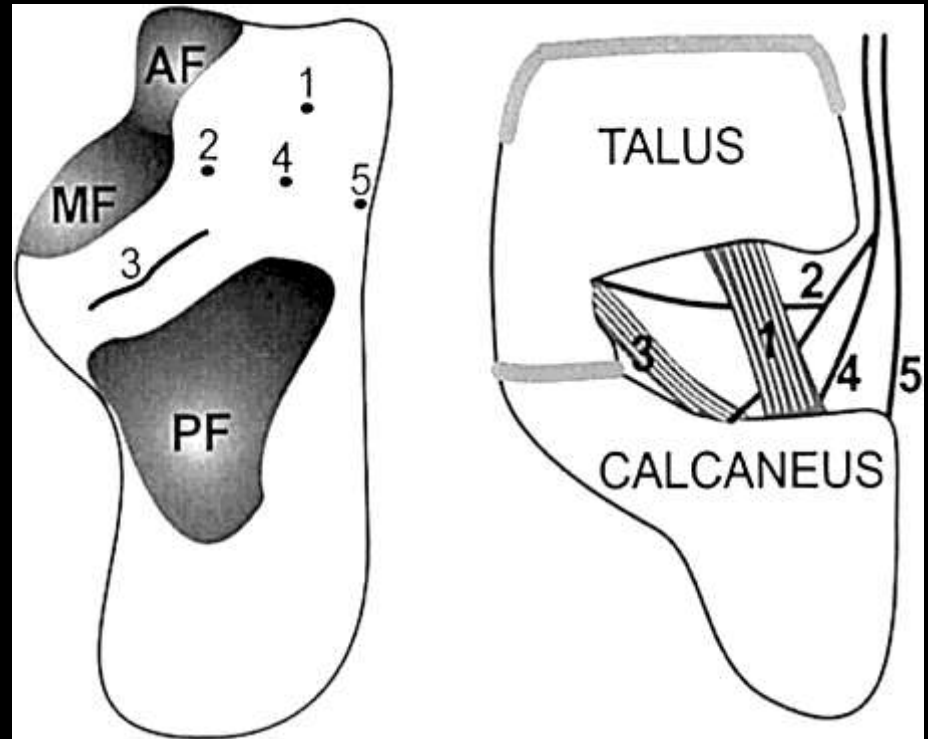


- Anterior talofibular ligament tears first
- Calcaneofibular next
- Posterior talofibular rarely torn



-
- Complication of ligament injury
 - Entrapment and impingement of soft tissue in anterolateral gutter of ankle
 - Fibrotic mass anterior to fibula
 - Nonvisualization of ligament
 - Sensitivity of MR low without effusion

- Fatty cone of tissue between anterior talus and calcaneus
- Contains cervical and interosseous ligament



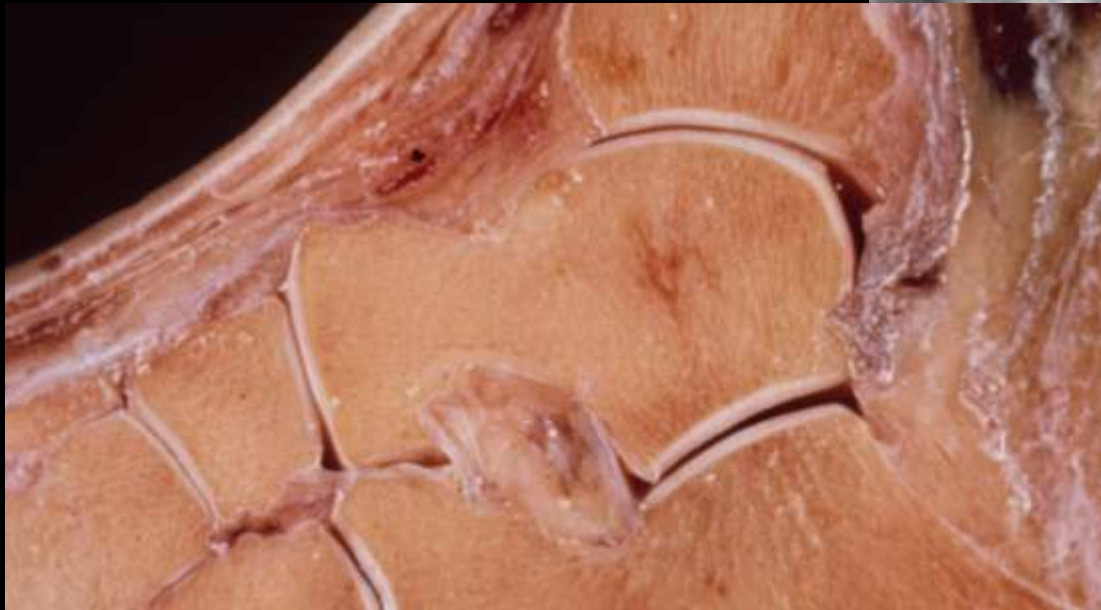
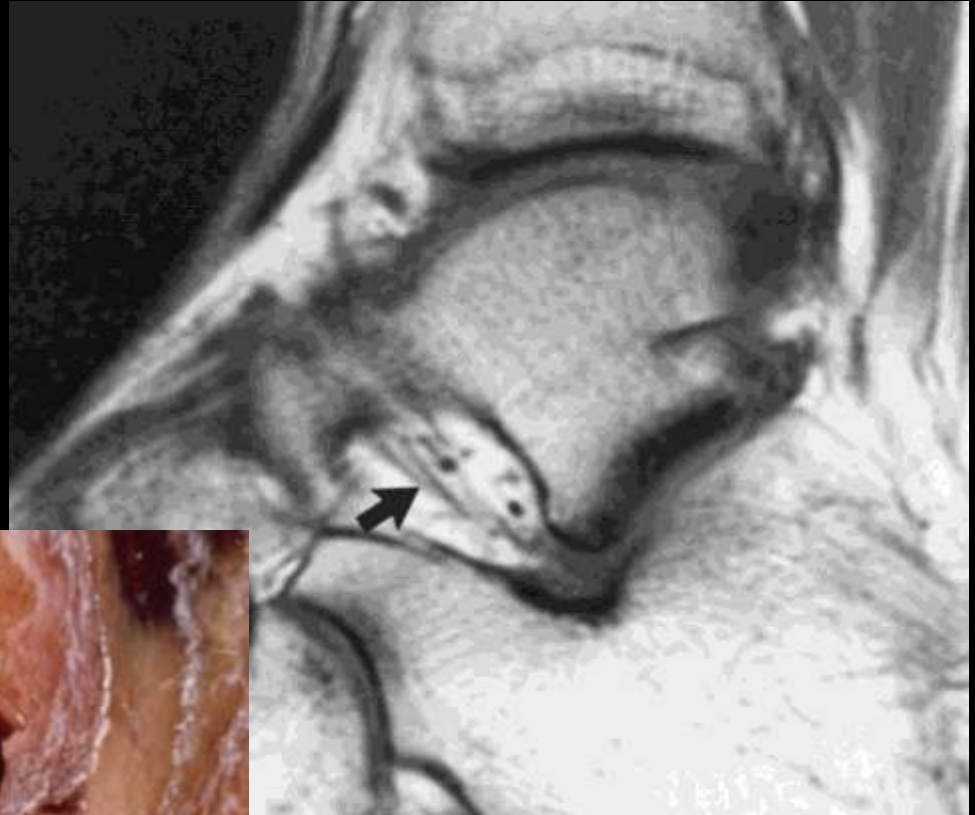
Cervical ligament (1)

Interosseous talocalcaneal ligament (3)

Medial (2), Intermediate (4) and lateral (5) roots of the inferior extensor retinaculum.

AF =anterior facet, MF = medial facet, PF = posterior facet.

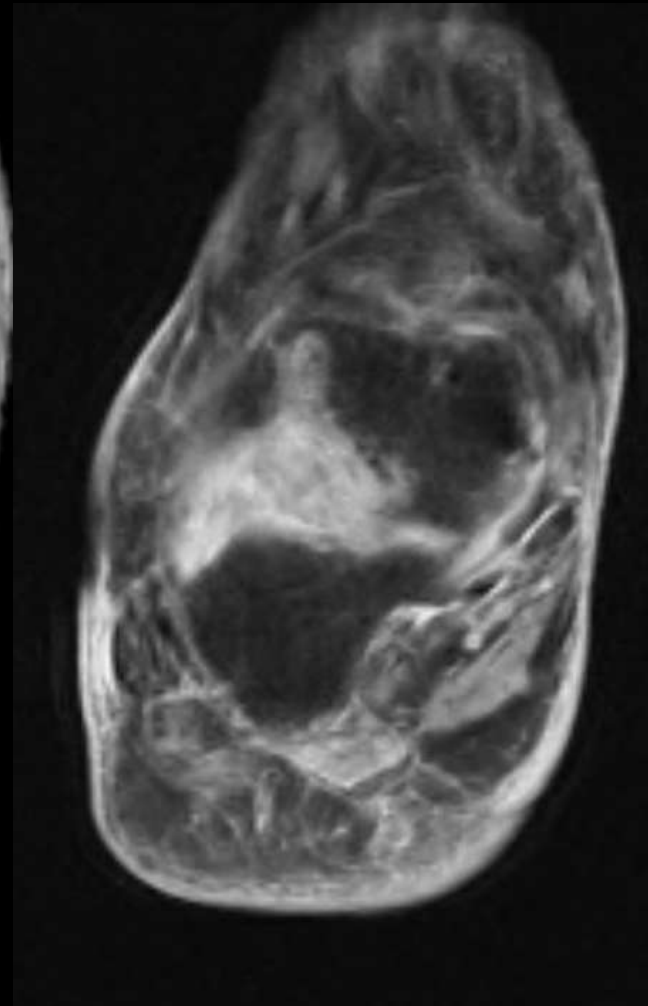
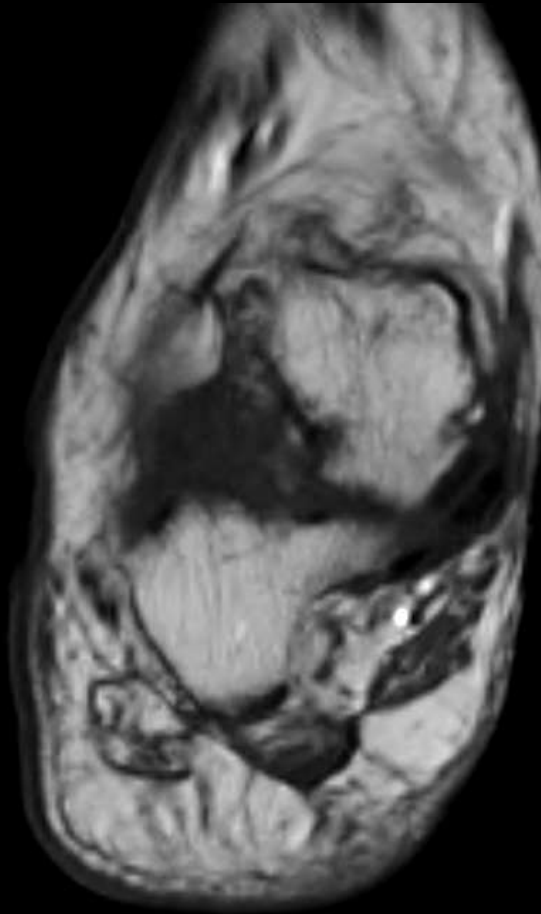
-
- Appears high signal on T1-w images
 - Linear ligaments and vessels within fatty cone



-
- Trauma, inflammatory arthritis, foot deformity
 - Lateral hindfoot pain and sensation of hindfoot instability



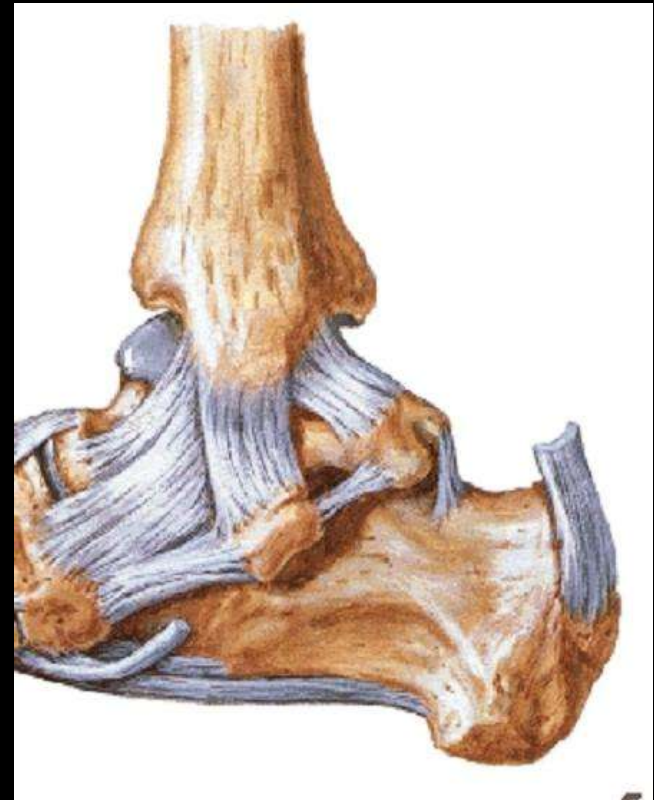
-
- Inflammation, synovial proliferation and scarring in tarsal sinus
 - May have bursal distention as well
 - Typically responds to steroid injection

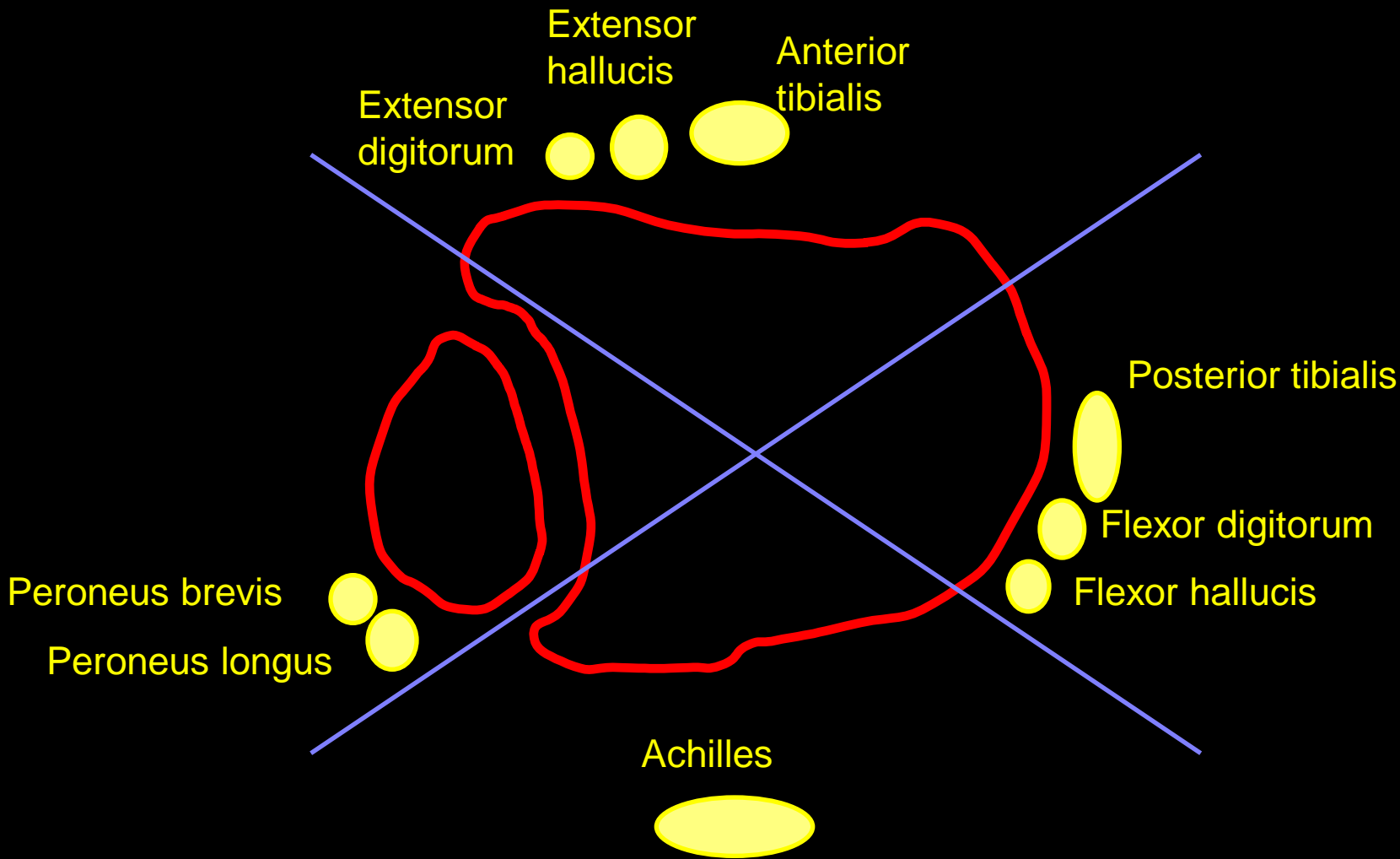




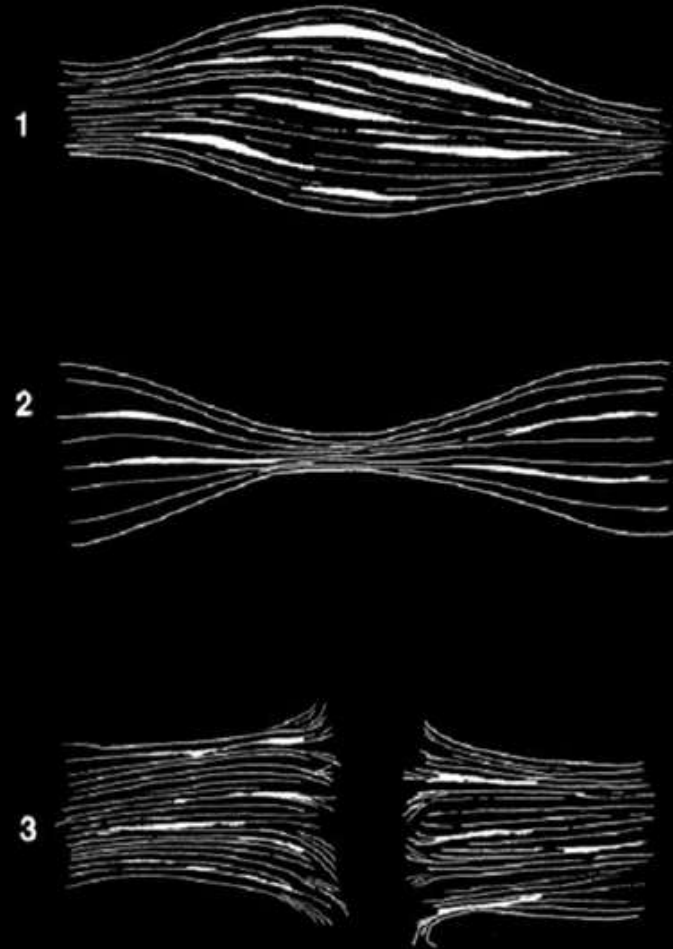
© 2001 Floyd E. Hosmer

-
- Fan-shaped ligament
 - Several distinct bands





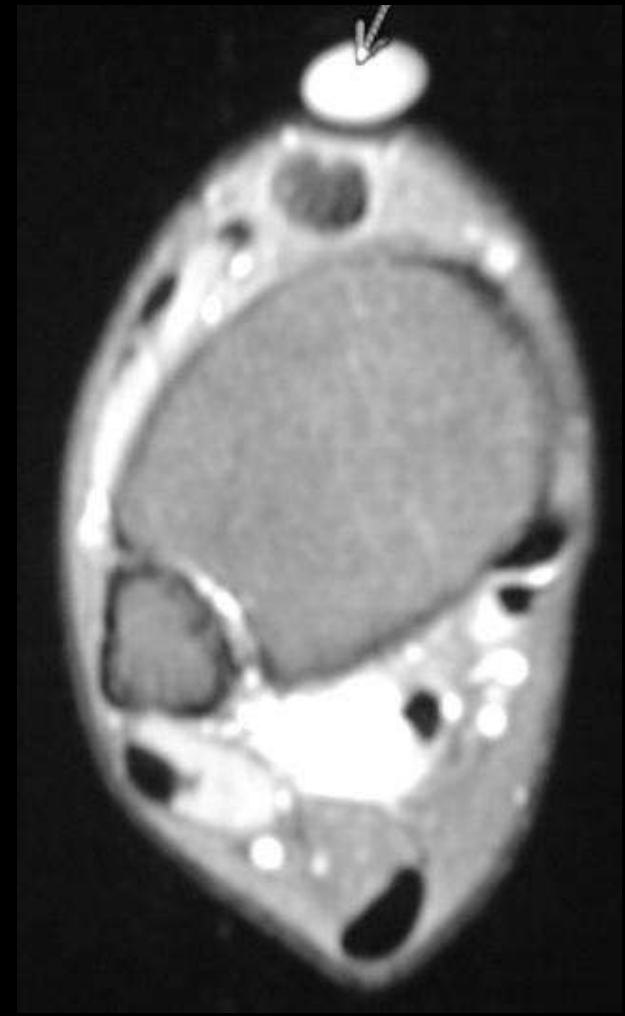
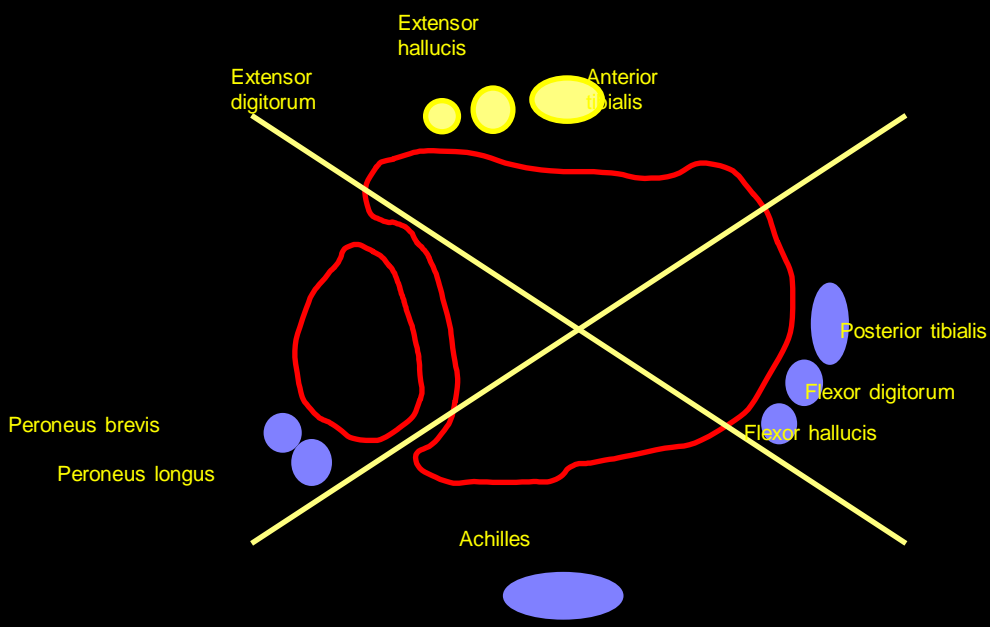
-
- Type 1
 - Hypertrophic tear
 - Type 2
 - Atretic tear
 - Type 3
 - Complete tear with gap



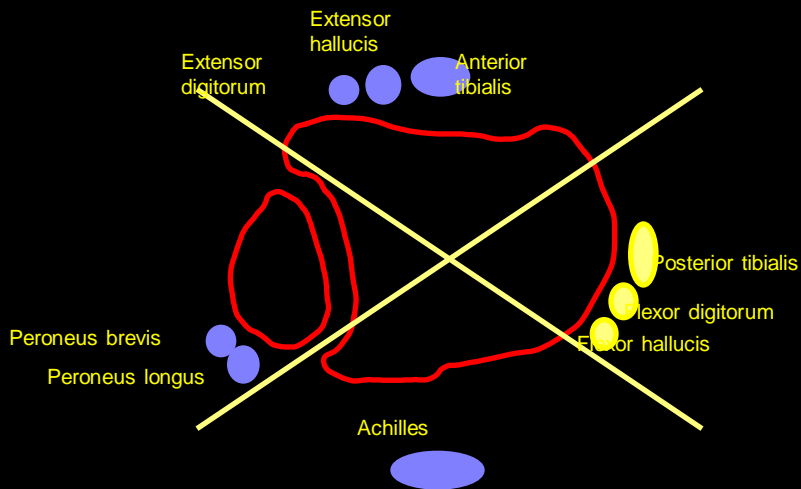
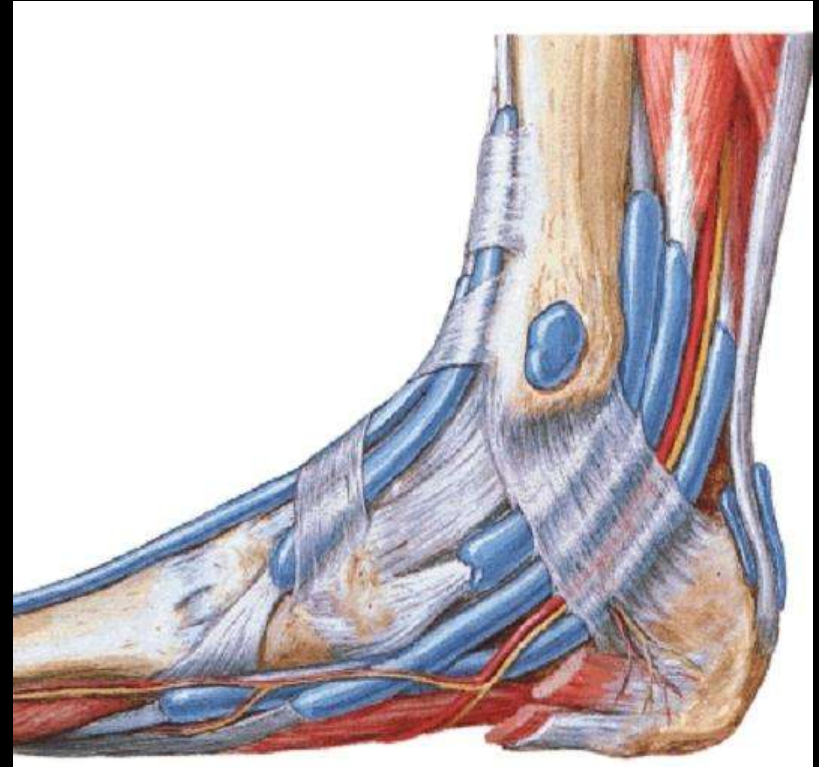
-
- Dislocation
 - Tenosynovitis
 - Hypertrophy
 - Atresia
 - Tear



- Tenosynovitis
- Tendinopathy
- Tear of tibialis anterior (rare)



- Tenosynovitis
- Partial tear
 - Hypertrophic
 - Atretic
- Complete tear



-
- Normally communicates with ankle joint
 - Ankle effusion distends tendon sheath
 - Fluid in isolation due to tenosynovitis



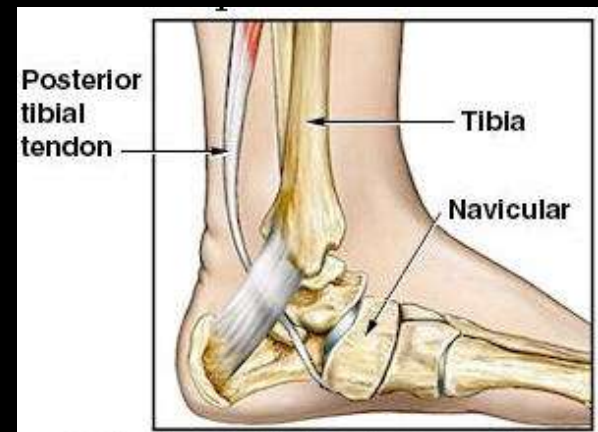
-
- Compression of posterior talus or os trigonum
 - Caused by repetitive or acute forced plantar flexion (e.g.. ballet dancers)
 - Posterior ankle pain



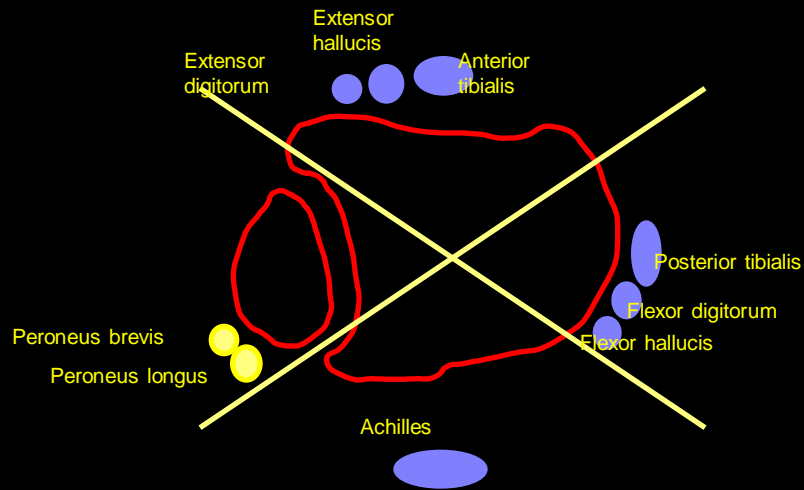
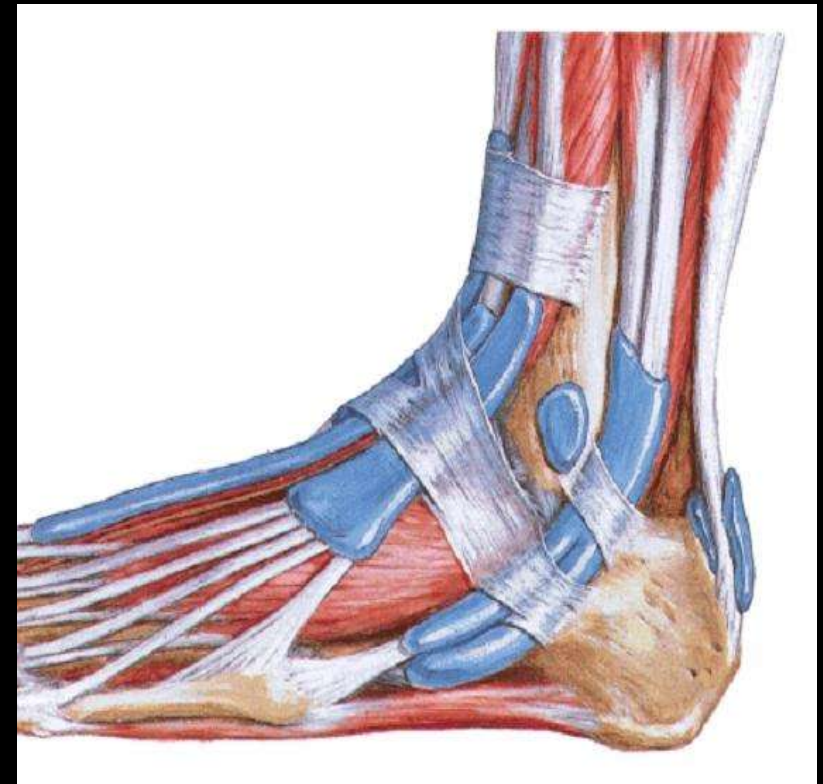
-
- Bone marrow edema
 - Distention of posterior joint with fluid
 - Tenosynovitis of FHL tendon
 - Os trigonum common



- Normal function is to support medial arch
- Insufficient tendon results in pain, sagging of midfoot and flatfoot deformity
- Tears most common just distal to medial malleolus



- Tenosynovitis
- Tendon dislocation
- Partial tear
 - Split biceps tendon
- Complete tear



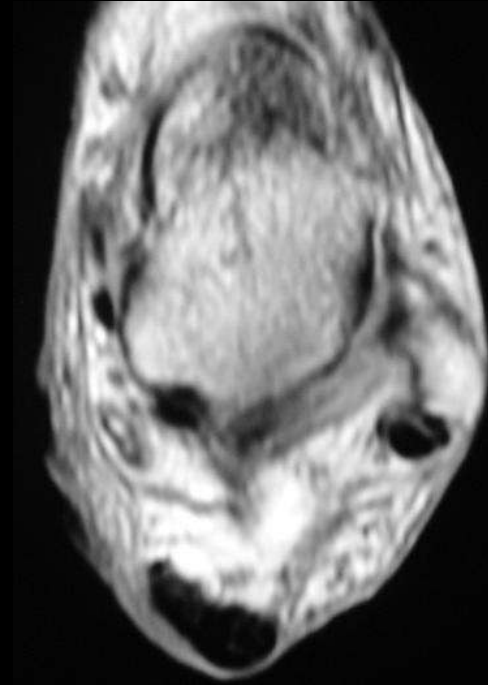
- Peroneus quartus muscle and tendon
- Normal variant
- Seen in up to 20%
- Typically asymptomatic
- May crowd peroneals and increase risk of tear



-
- Normal tendons lie posterior and medial to lateral fibular border
 - Contained by peroneal retinaculum
 - Subluxation or dislocation



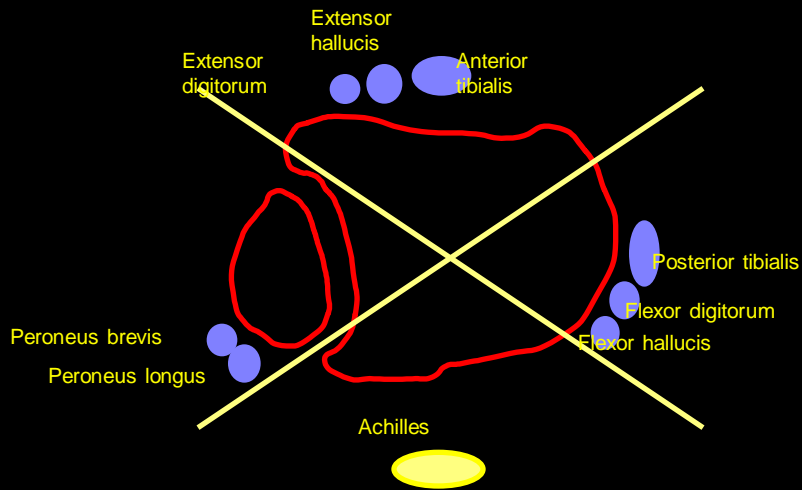
-
- Normally, peroneus brevis is a C-shaped tendon
 - Lies anterior to peroneus longus tendon
 - Chronically rubbed from behind by peroneus longus
 - Longitudinal splitting tear



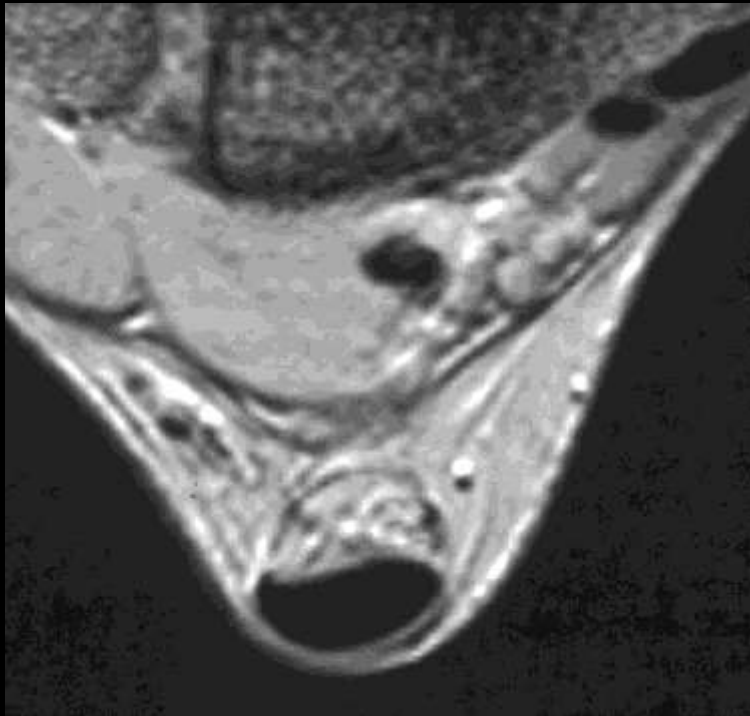
-
- Passes behind fibula, under peroneal tubercle and then under the cuboid to insert on plantar aspect medial cuneiform and 1st metatarsal
 - Tears uncommon



-
- Tendinopathy
 - Linear tear within substance
 - Partial tear
 - Complete tear



-
- Uniform width
 - Low signal
 - Anterior border flat or concave (kidney bean)



Degenerative process

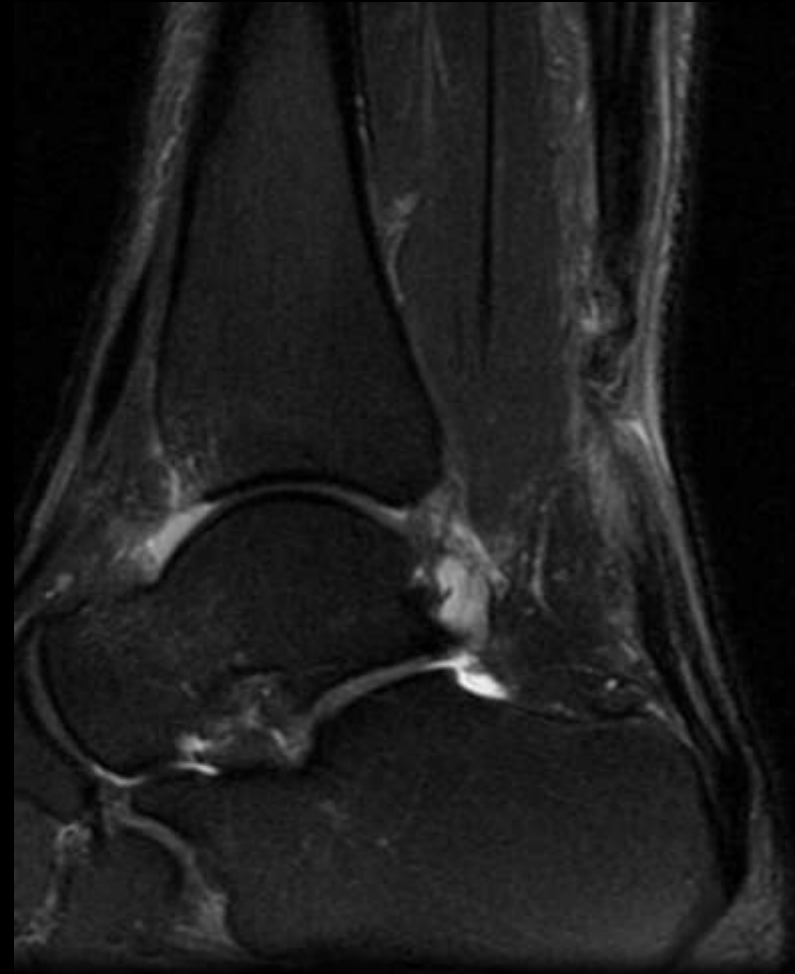
Tendon enlarged, normal signal on T2-weighted images



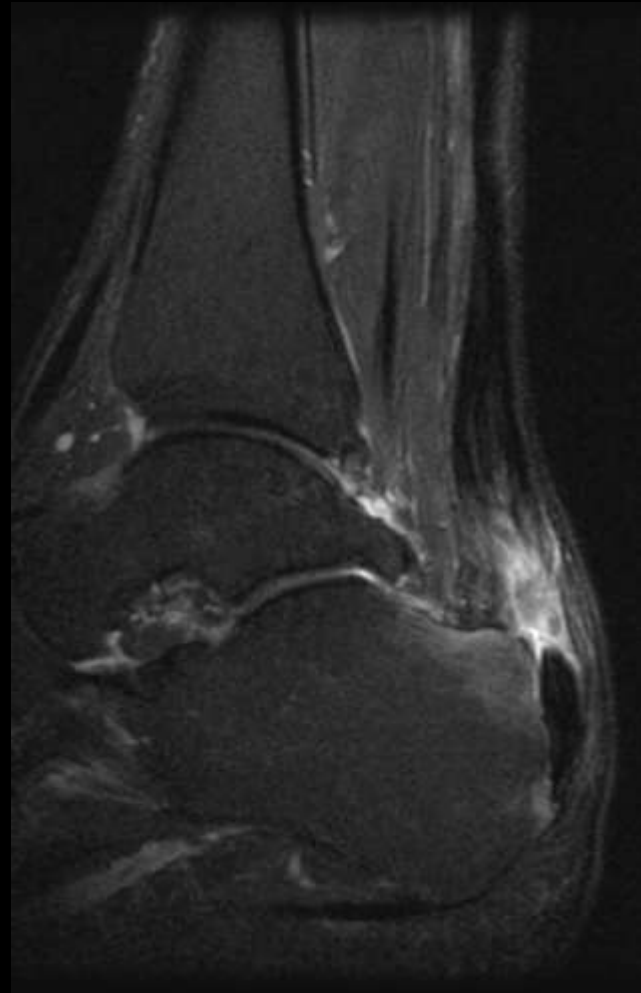
-
- Myotendinous junction is at midcalf level
 - Tears most common 6-10 cm proximal to insertion



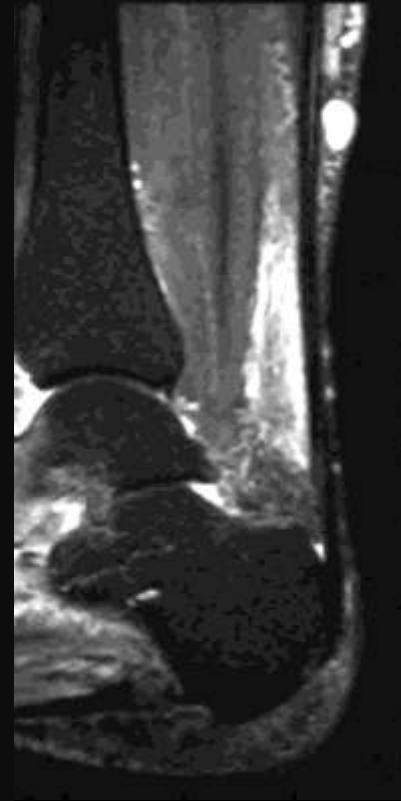
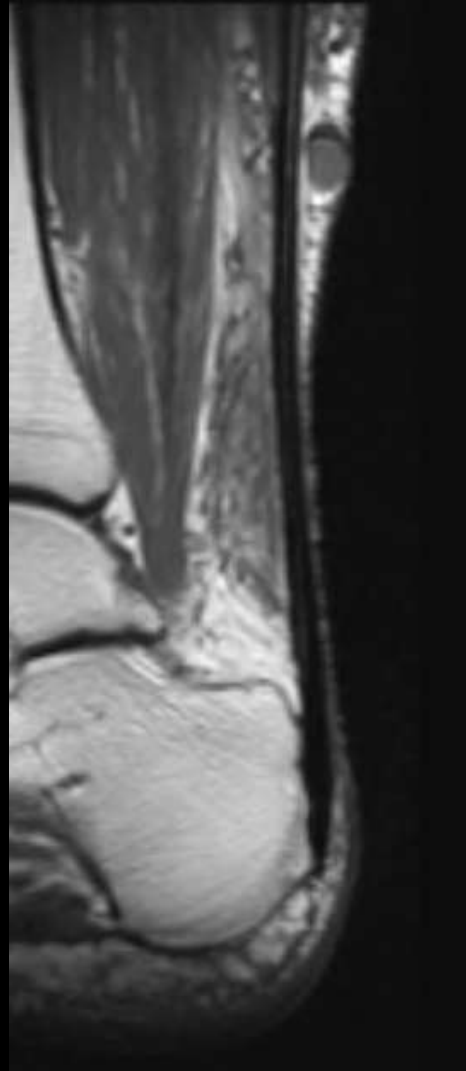
-
- Location
 - Extent
 - Size of gap
 - Quality of underlying tendon



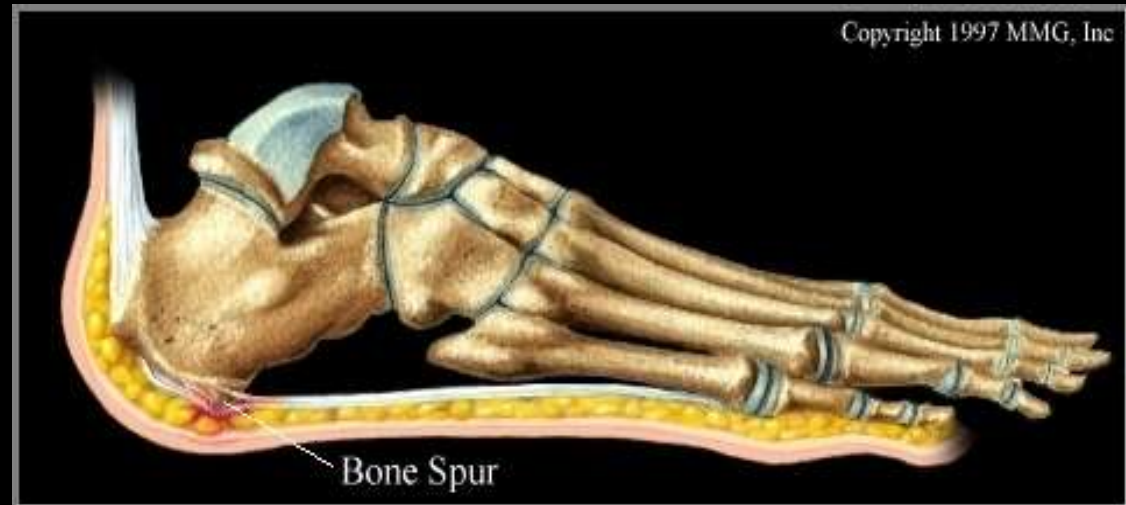
-
- Tears can occur at insertion of Achilles at calcaneus
 - Typically due to underlying tendinopathy



-
- Achilles tendon has no sheath
 - Soft tissue inflammation in fat pad anterior to Achilles known as peritendinitis



-
- Achilles tendon
 - Bursitis
 - Heel spur
 - Plantar fasciitis
 - Calcaneal fracture
 - Heel fat pad



- Distension of bursa between tendon and superior calcaneal tuberosity
- Frequently seen as part of “pump bump” syndrome



-
- Enthesophyte at plantar fascia attachment
 - Often asymptomatic

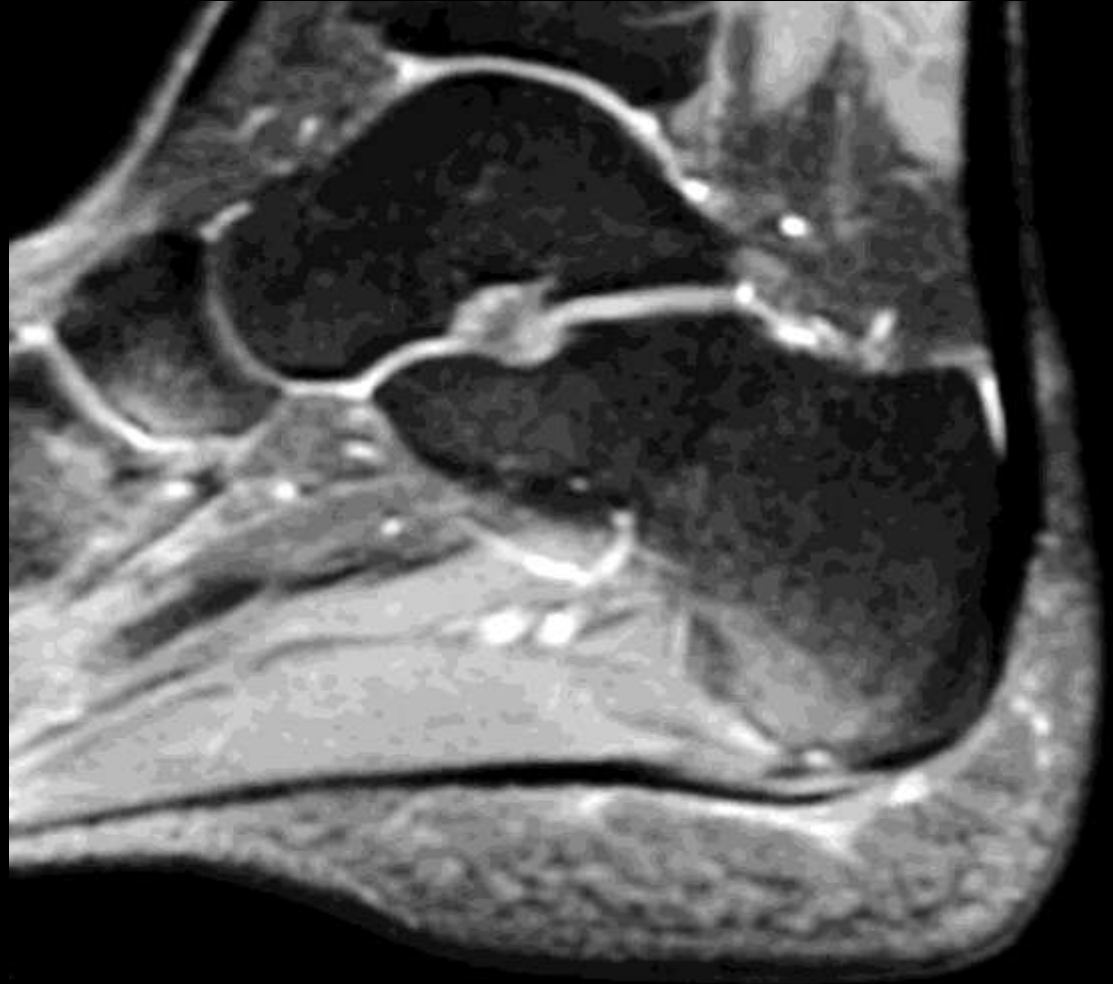


- Bone pain
- Irritation of plantar fascia
- Inflammation of overlying fat pad
- Adventitial bursa
- May be large and irregular in patients with inflammatory arthritis

-
- Multilayered fibrous aponeurosis
 - Normal fascia is uniform low signal
 - 3-4 mm thickness



-
- Thickening of plantar fascia
 - High signal within fascia
 - Fluid surrounding fascia
 - Edema in calcaneus adjacent to insertion

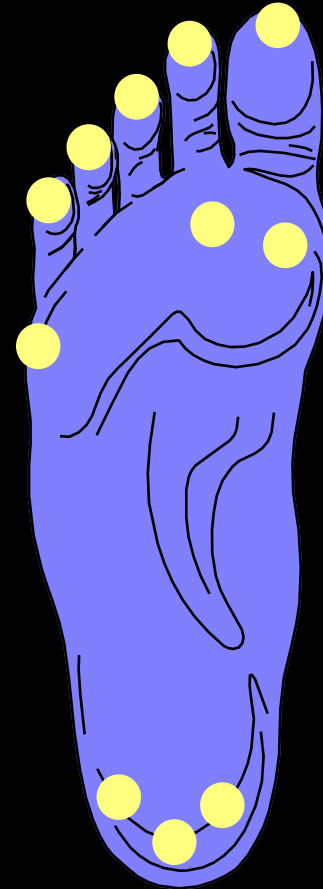


-
- Uncommon injury
 - Athletes
 - Acute onset of plantar pain



-
- Vascular insufficiency
 - Soft tissue atrophy
 - Ulceration
 - Osteomyelitis
 - Neuroarthropathy

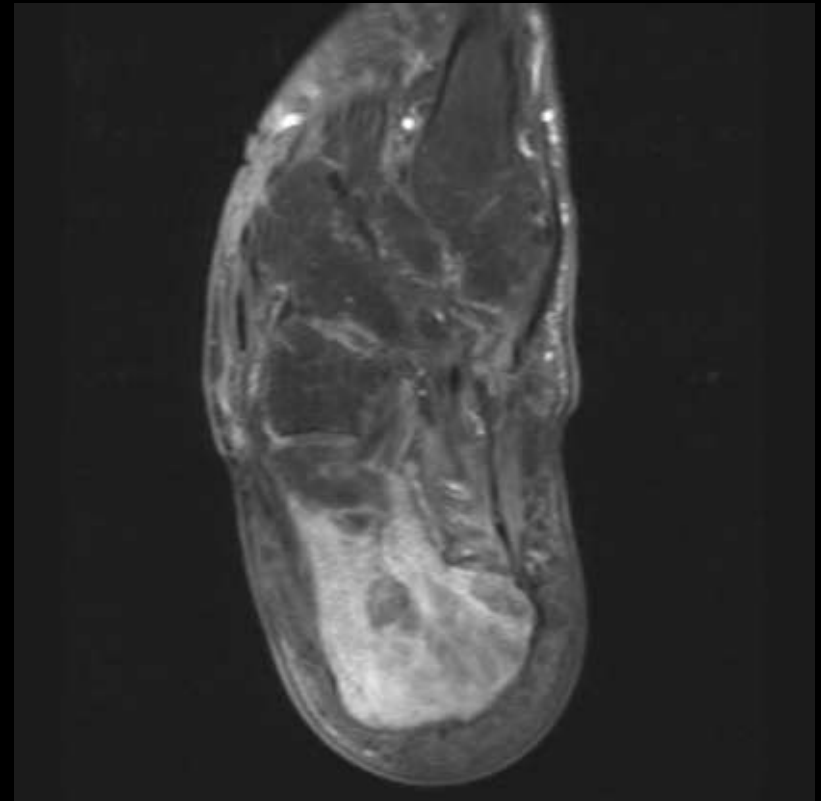
-
- Superficial ulceration leads to deep infection
 - Ultimately, bone is involved
 - Osteomyelitis occurs at typical pressure points



-
- Used combination of T1-w SE, T2-w FSE fatsat, post Gd-DTPA
 - 82% sensitivity
 - 80% specificity
 - MR useful for delineating extent of disease



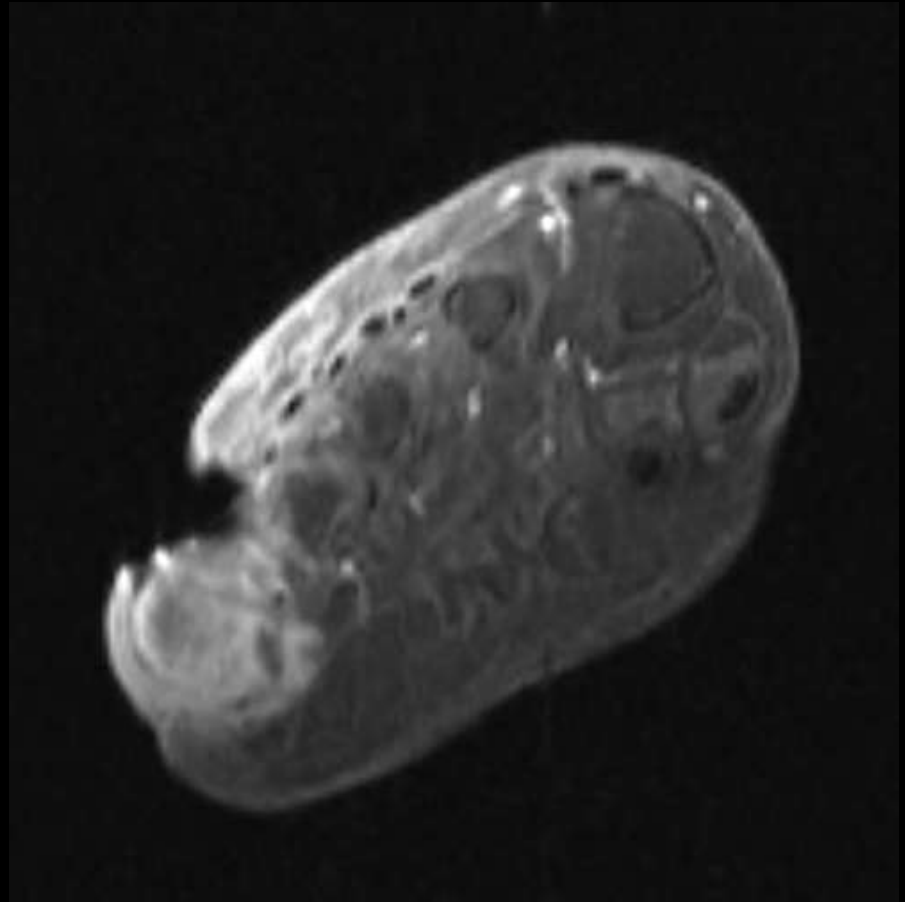
-
- Loss of marrow signal on T1-w
 - Increased marrow signal on STIR and T2-w
 - Enhancement with Gd-DTPA



0827955

post-Gd T1 fat sat,

-
- Morphologic changes in periosteum and cortex
 - Overlying alterations in soft tissues



-
- Ulcers develop over pressure points
 - Nonhealing ulcers may develop
 - 33% of patients with nonhealing ulcer develop osteomyelitis
 - 95% of diabetics with foot osteomyelitis have an overlying associated skin ulcer



-
- Cortical interruption
 - Rim-enhancing abscess within bone
 - Sequestrum formation
 - Sinus track from bone to skin
 - Cellulitis adjacent to osseous abnormality



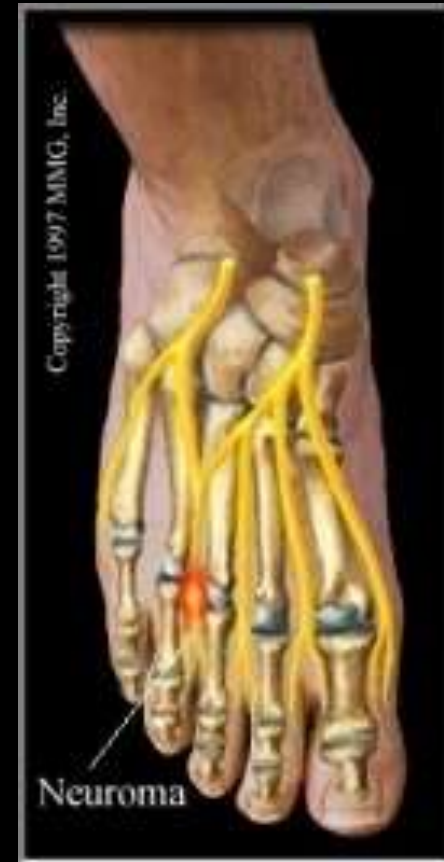
-
- Metastases
 - Primary benign
 - Lipoma
 - Chondroblastoma
 - Giant cell tumor
 - ABC
 - Primary malignant
 - Ewing's sarcoma
 - Lymphoma

-
- Bunion
 - Ganglion
 - Plantar fibroma
 - Plantar fibromatosis
 - Morton's neuroma
 - Synovial cell sarcoma
 - Lipoma

-
- Firm, nontender superficial plantar mass
 - Below midportion of first metatarsal
 - Superficial to flexor hallucis longus tendon
 - Often adherent to plantar fascia
 - Up to 50% bilateral

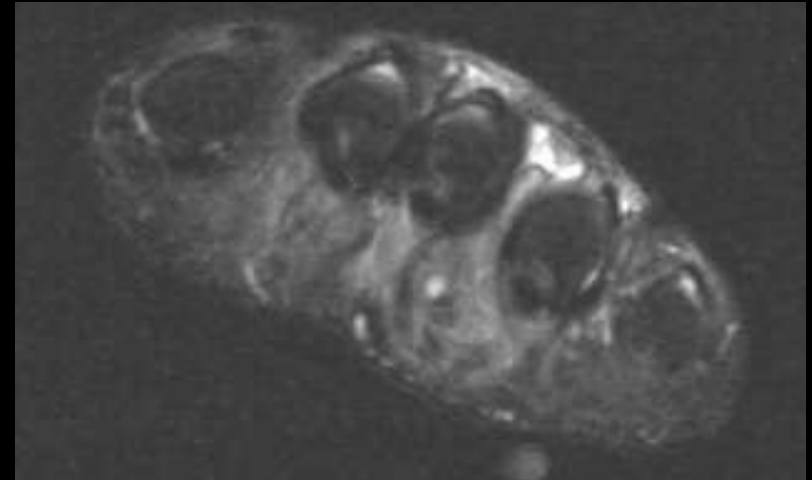


- Middle aged females
- Focal posttraumatic thickening of interosseous nerve at level of metatarsal heads
- Most common in 3rd and 2nd interspaces
- Frequently bilateral or multiple neuromas
- Painful

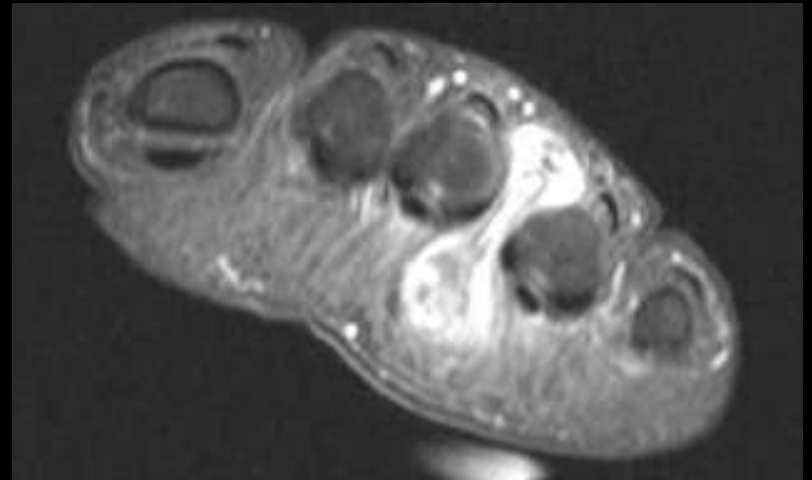


-
- Focal thickening of nerve
 - 2 mm to 1 cm nodule
 - Extends into interosseous plantar fat
 - Low signal on all sequences
 - Mild to moderate enhancement with Gd

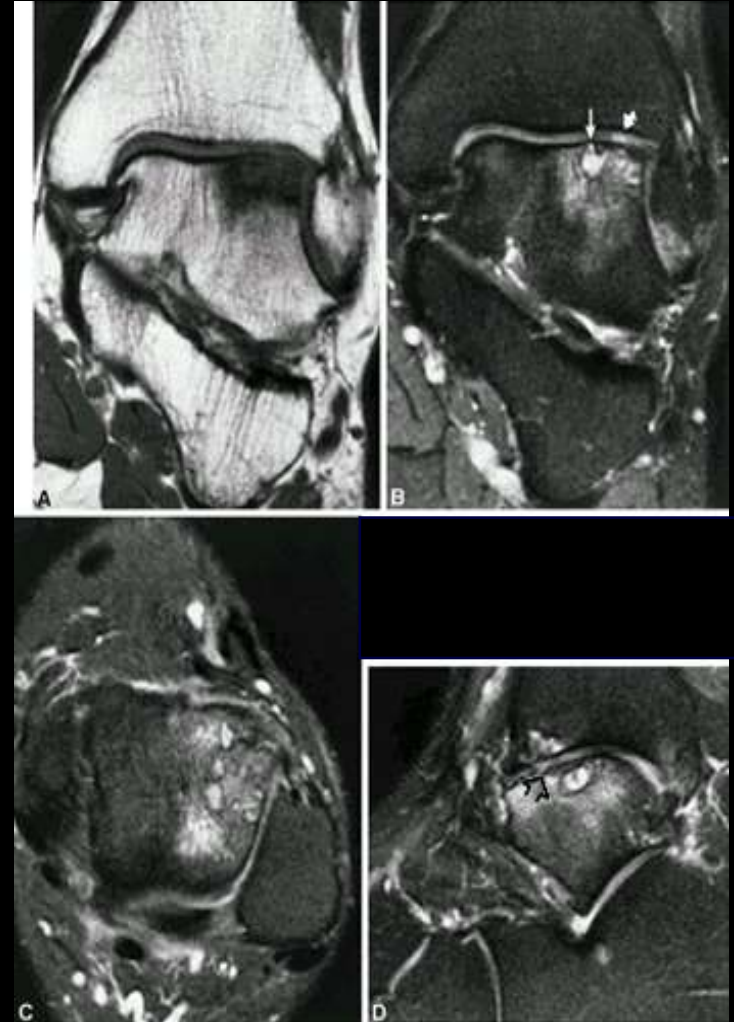




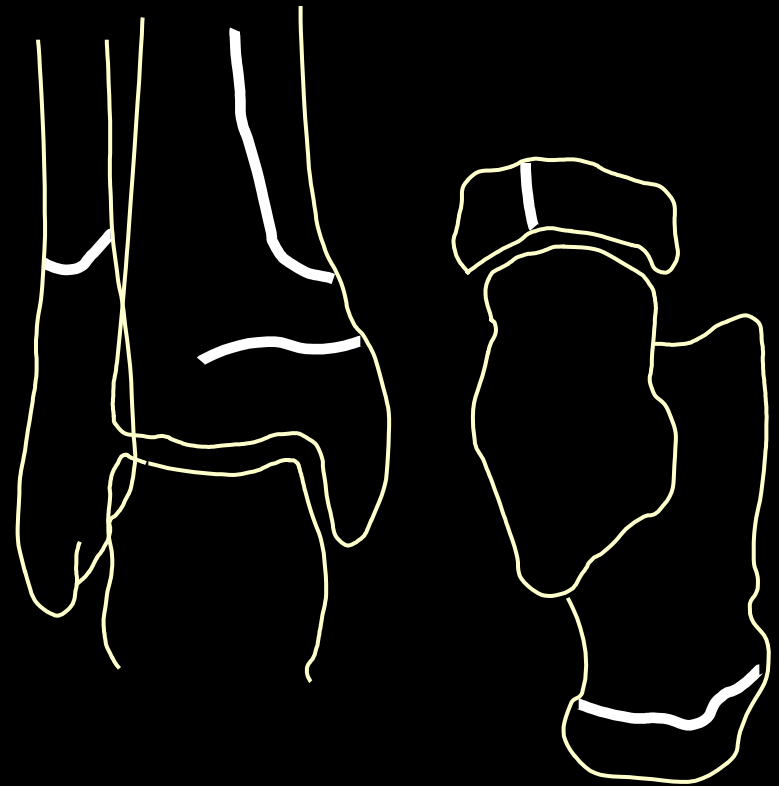
- Low signal mass on T1 and T2
- Gadolinium enhancement



- Intact cartilage, subchondral lesion
- Partial disruption of cartilage with hinge or flap
- Loose, complete cartilage disruption, bone undisplaced
- Loose, displaced



-
- **Fatigue**
 - Overuse
 - Weekend athlete
 - Toddlers
 - **Insufficiency**
 - Metabolic bone disease
 - Neuroarthropathy
 - Immobilization



-
- Common in elderly
 - Typically due to walking or running
 - Involve posterior tuberosity
 - Linear band with surrounding edema

