

Review of Lower Extremity Foot & Ankle

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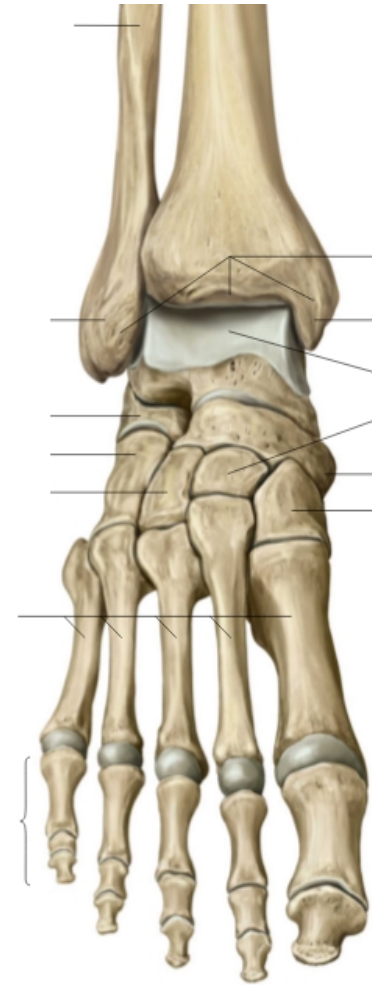


Overview

- Review of Ankle & Foot Anatomy
- Injuries/Pathology & Differential Diagnosis by Region

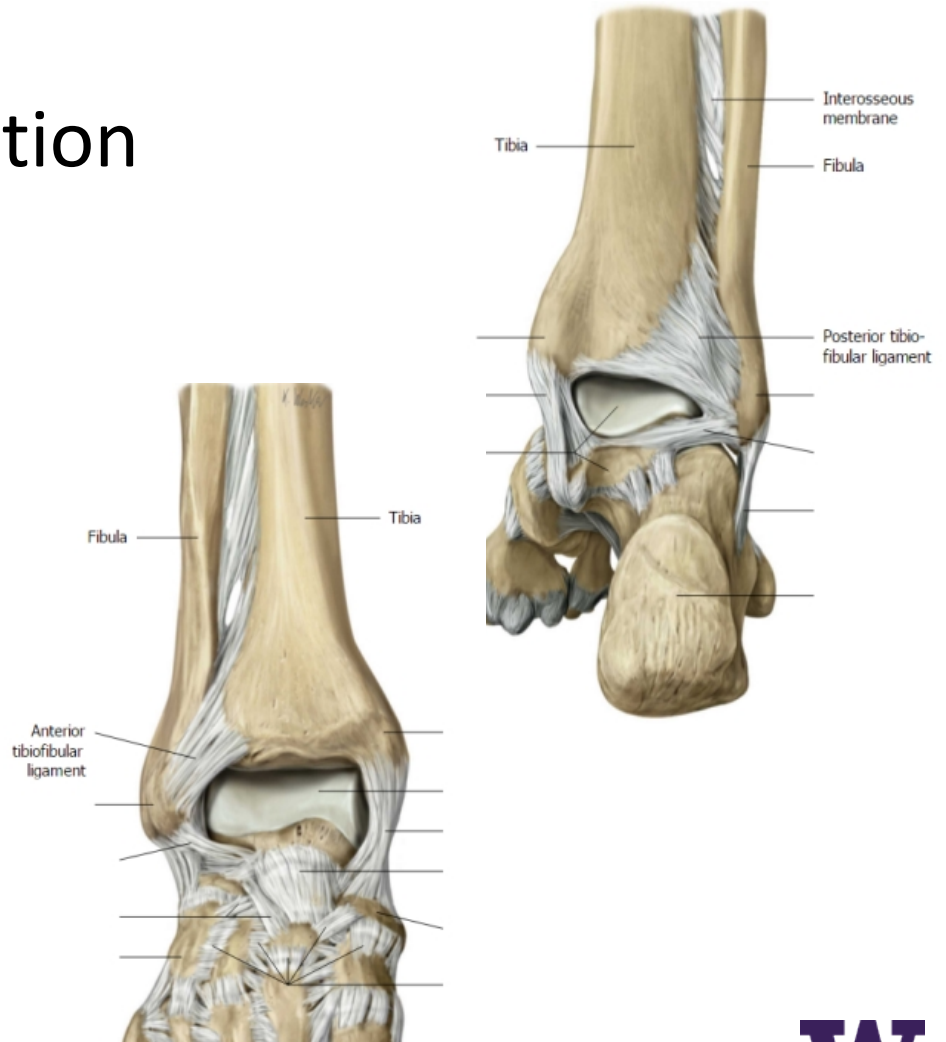
Ankle Anatomy

- Two Joints
 - Distal tibiofibular (syndesmosis)
 - Talocrural (tibiotalar, mortise)



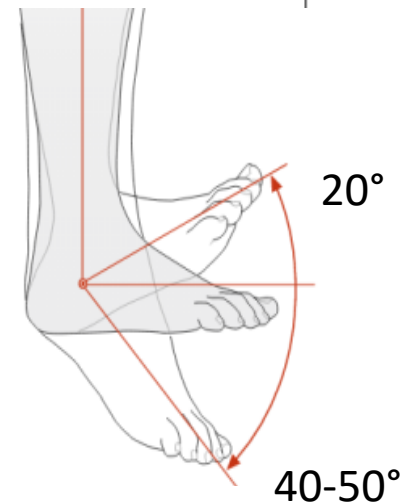
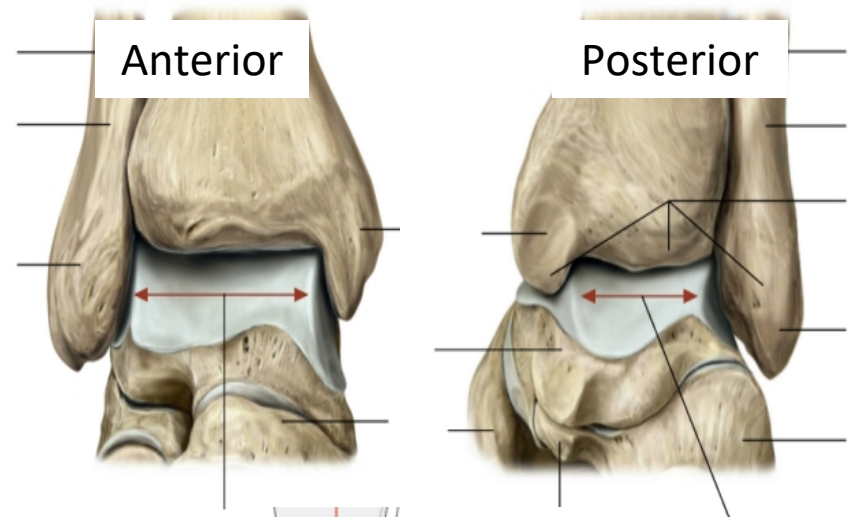
Distal Tibiofibular Joint

- Small amount of rotation
- Syndesmosis
 - Anterior tibiofibular ligament
 - Posterior tibiofibular ligament



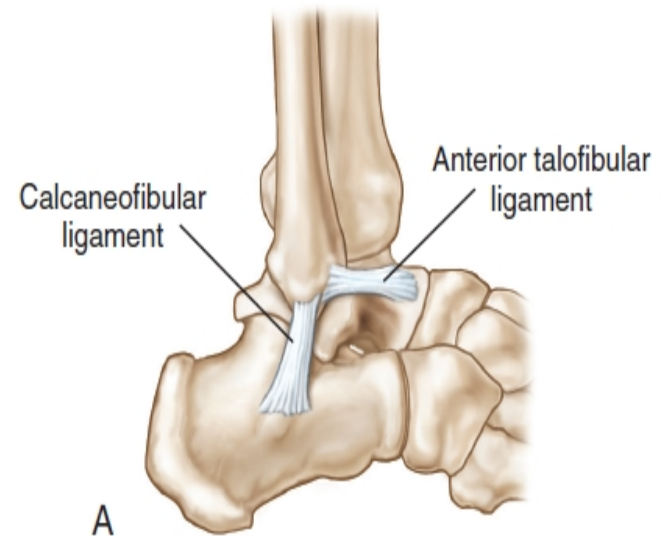
Talocrural Joint

- Stability
 - Primary: bones
 - Secondary: ligaments
- Most stable in dorsiflexion
- Least stable in plantarflexion
 - More prone to injuries



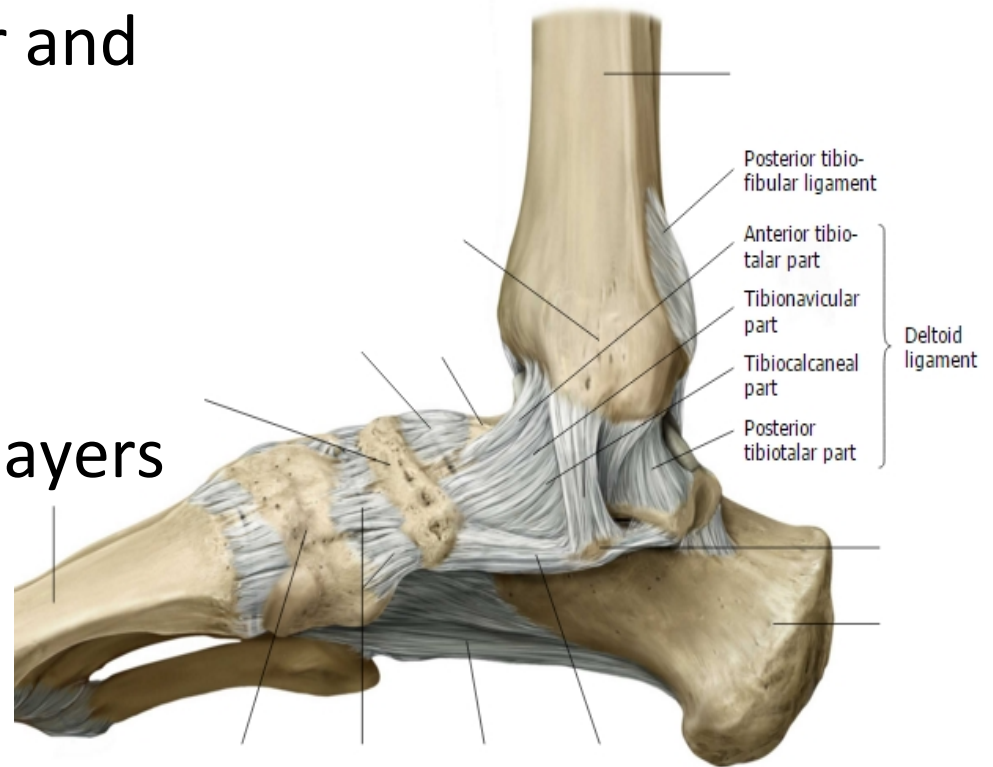
Talocrural Joint Ligaments - Lateral

- Anterior Talofibular Ligament
 - Tight in plantarflexion
 - Resists anterior displacement of talus
- Calcaneofibular ligament
 - Tight in dorsiflexion
 - Resists excessive supination
- Posterior talofibular ligament
 - Tight in extreme dorsiflexion
 - Resists inversion and internal



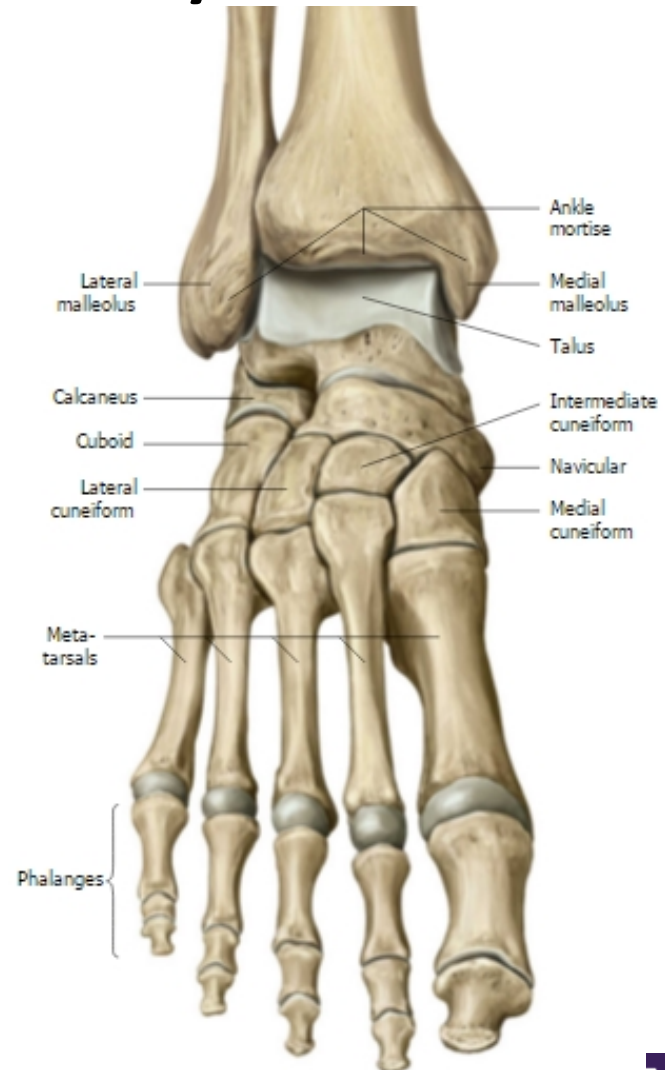
Talocrural Joint Ligaments - Medial

- Deltoid Ligament
 - Tibiotalar (anterior and posterior)
 - Tibionavicular
 - Tibiocalcaneal
- Deep and superficial layers
- Injured infrequently



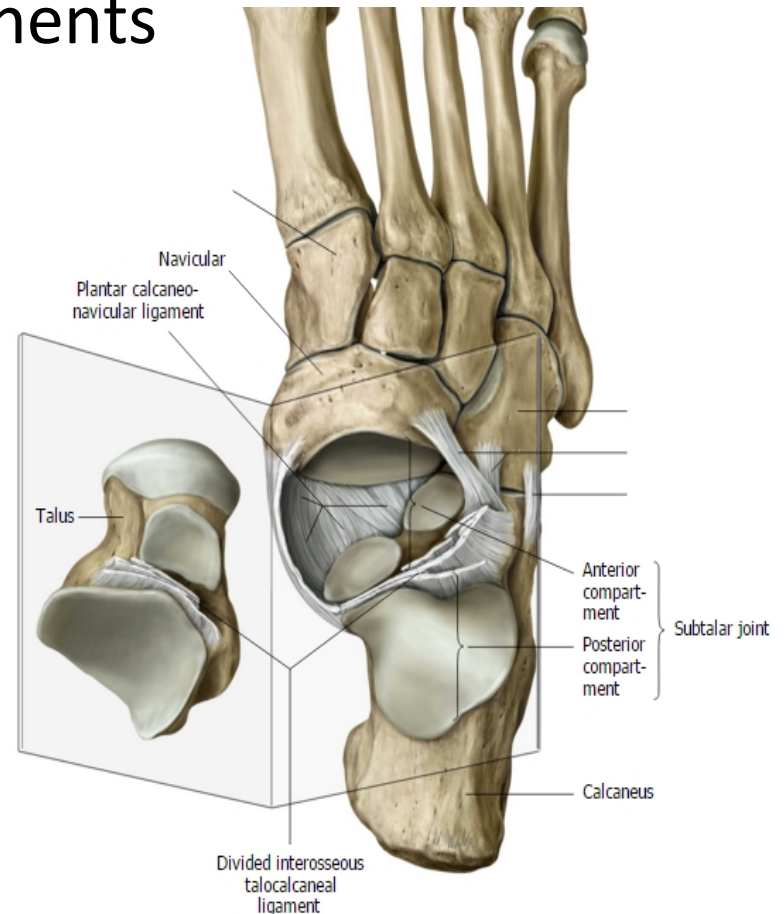
Foot Anatomy

- Hindfoot
 - Talus, Calcaneus
- Midfoot
 - Tarsals
- Forefoot
 - Metatarsals, Phalanges



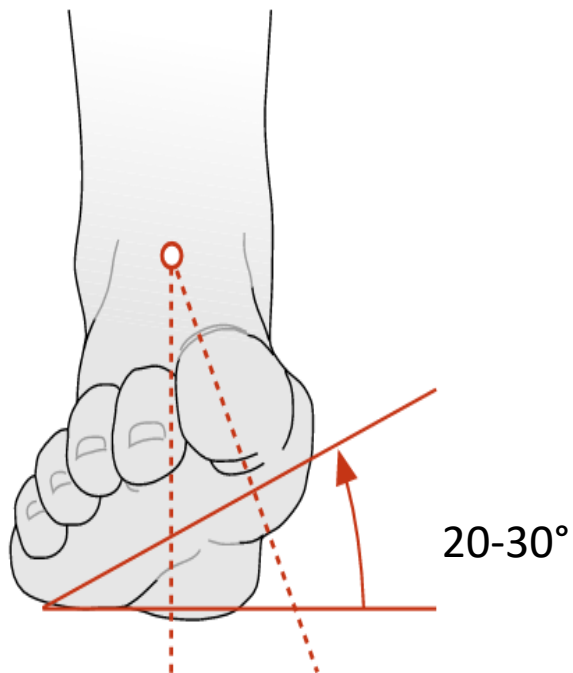
Subtalar Joint

- Anterior & Posterior Components
- Separated by sinus tarsi
- Function:
 - Shock absorption
 - Accommodate to uneven surfaces

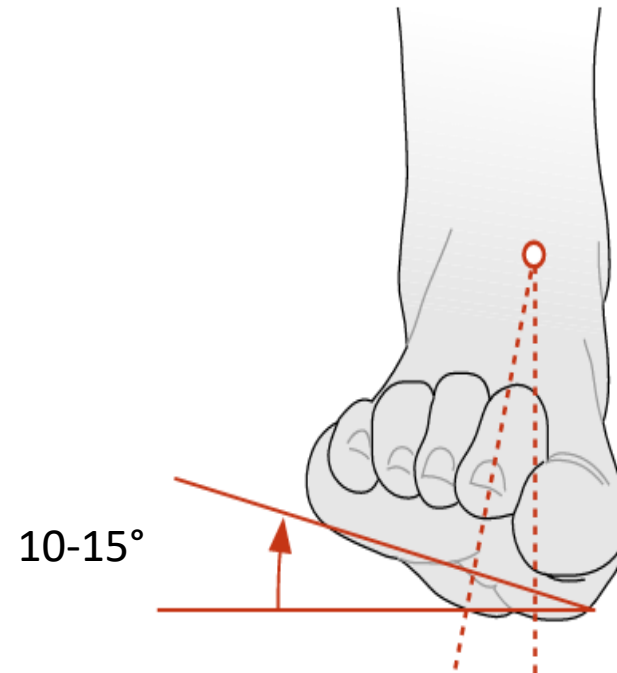


Subtalar Joint Movements

- Inversion

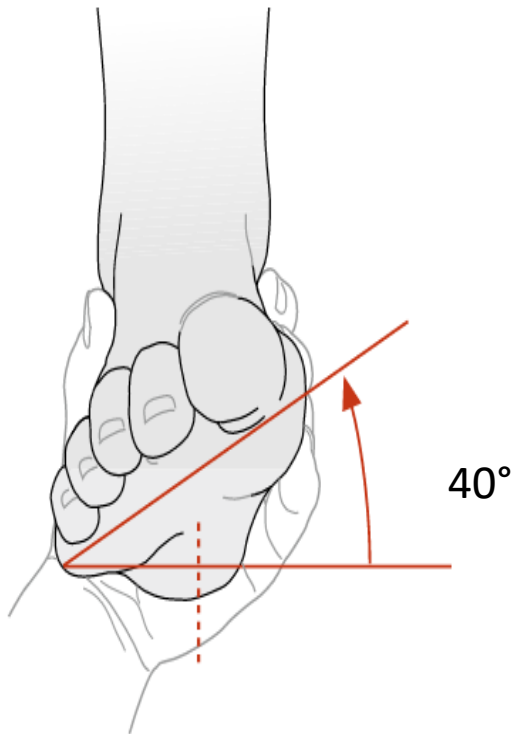


- Eversion

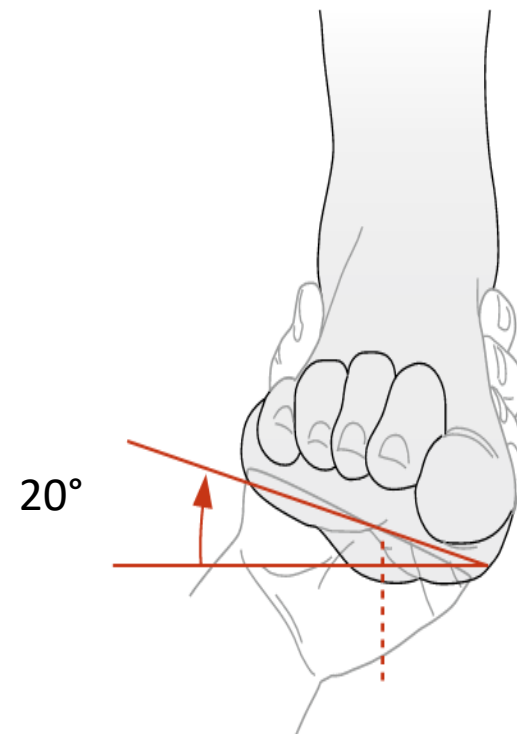


Transverse Tarsal Movements

- Inversion



- Eversion



Combined Foot & Ankle Movements

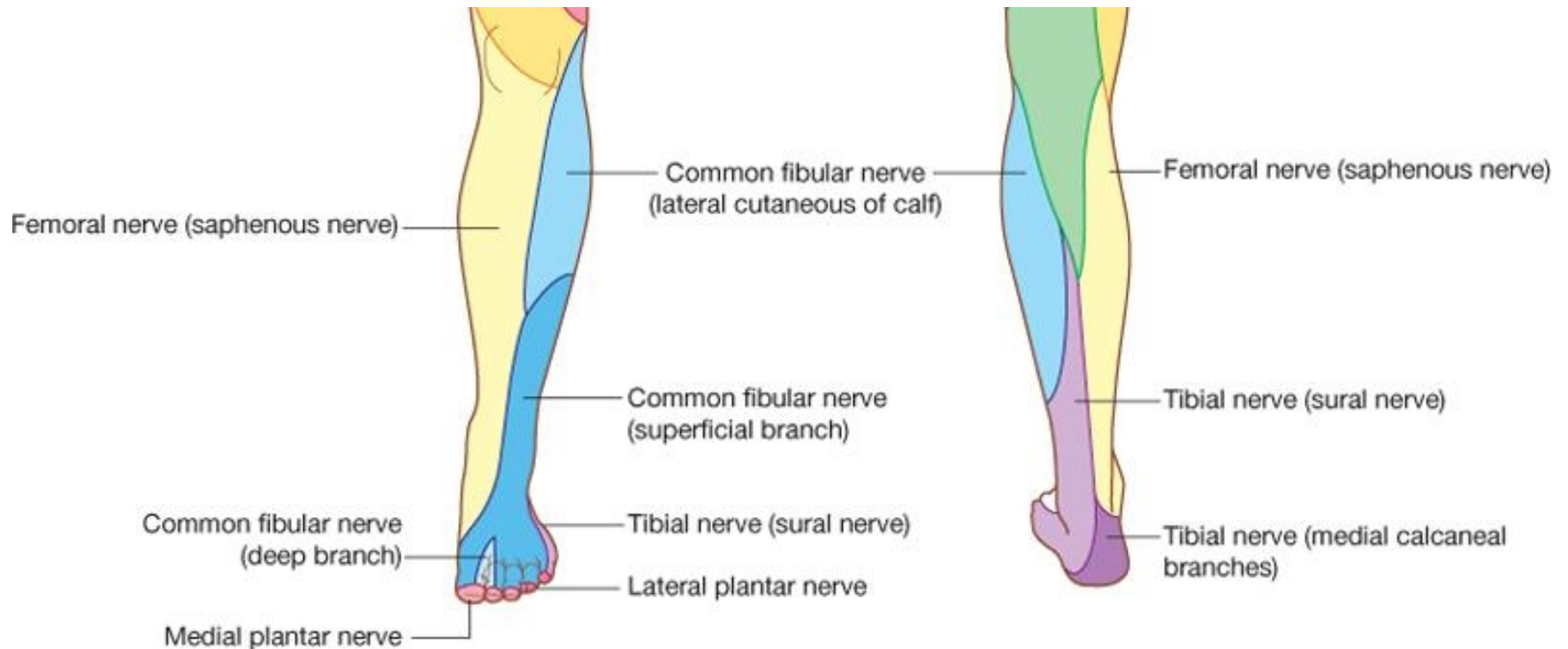
- Pronation:
 - Ankle dorsiflexion
 - Subtalar eversion
 - Forefoot abduction
- Supination:
 - Ankle plantarflexion
 - Subtalar inversion
 - Forefoot adduction



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Sensory Nerve Distributions



Drake: Gray's Anatomy for Students, 2nd Edition.

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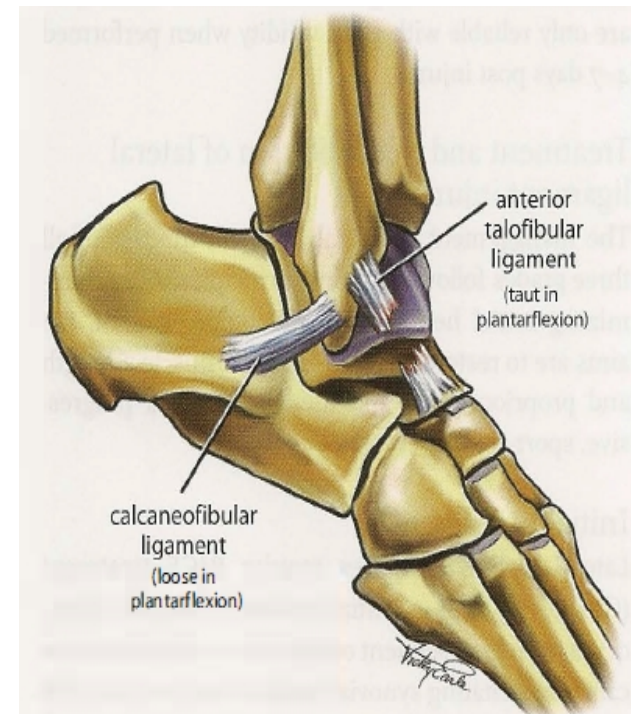
Lateral Ankle Pain

Differential Diagnosis

- Lateral Ankle Sprain
- Fibularis Tendinopathy
- Osteochondral Injury
- Lateral Impingement
- Sinus Tarsi Syndrome
- Fractures
- S1 Radiculopathy

Lateral Ankle Sprain

- Mechanism: Inversion + plantarflexion
- ATFL injured before CFL
- Grades:
 - I: ligament stretch without tear
 - No laxity on exam
 - II: partial ligament tear
 - Laxity on exam
 - III: complete ligament tear
 - Laxity, no end point on exam
 - ATFL only 65%
 - ATFL + CFL 20%



Brokner & Khan

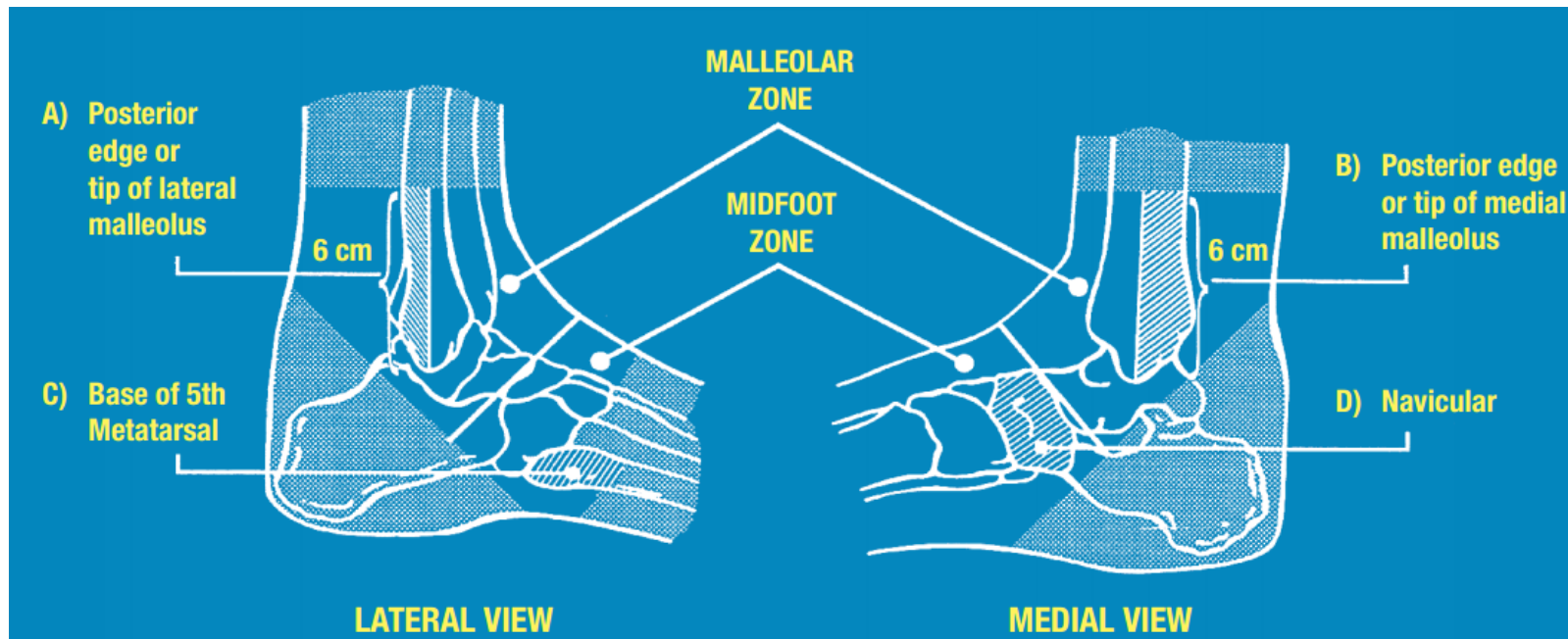
Lateral Ankle Sprain - Exam

- Palpate for tenderness
- Special Tests (most valid 4-7 days post-injury)
 - Anterior Drawer (evaluates ATFL)
 - Talar Tilt (evaluates CFL)



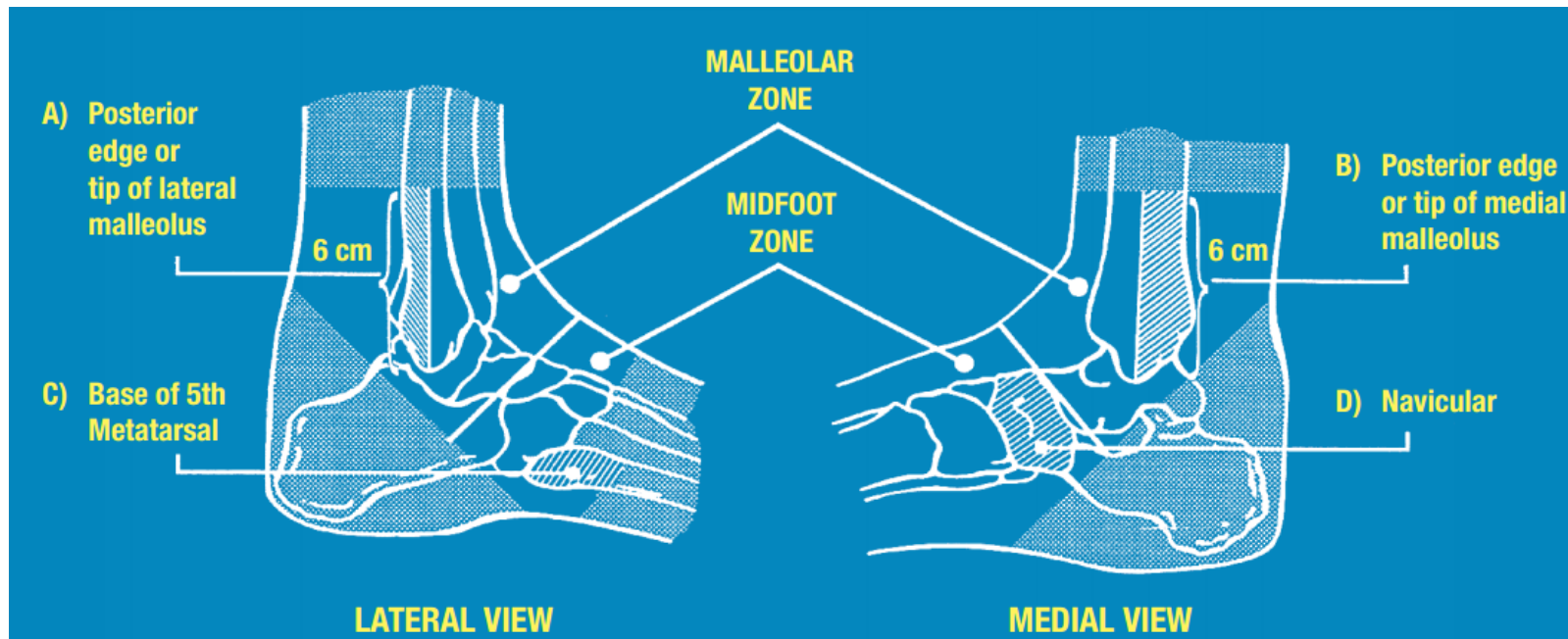
Ottawa Ankle Rules

- Indications for Ankle X-rays
 - Tenderness over distal 6cm of posterior medial (B) or lateral (A) malleolus
 - Inability to take 4 steps at time of injury and in ED



Ottawa Foot Rules

- Indications for Foot X-rays
 - Tenderness over base of 5th metatarsal (C)
 - Tenderness over navicular (D)
 - Inability to take 4 steps at time of injury and in ED



Lateral Ankle Sprain - Treatment

- Initial Treatment
 - Goal: reduce pain and swelling
 - Analgesics or NSAIDs as needed
 - **P**rotection, **R**est, **I**ce, **C**ompression, **E**levation
 - Protection:
 - Air splint if needed
 - Weight bearing as tolerated (crutches if needed)

Lateral Ankle Sprain - Treatment

- Rehabilitation
 - Restoring ROM
 - Restoring neuromuscular control
 - Especially fibularis longus/brevis
 - Strengthening
 - Isometrics then isotonics
 - Proprioception
 - Single leg and wobble board exercises

Lateral Ankle Sprain - Treatment

- Functional Training:
 - Plyometrics, agility drills
- Return to Sport
 - Consider bracing for up to 12 months
- Surgery
 - Indicated if recurrent instability or persistent pain despite appropriate rehab

Chronic Pain after Ankle Sprain

- Inadequate rehabilitation
- Fractures
 - Anterior process calcaneus
 - Lateral process talus
 - Posterior process talus (or os trigonum)
 - Base 5th Metatarsal
- Osteochondral lesion
- Chronic synovitis
- Impingement
 - Anterior, Posterior, Anterolateral
- Tendon Injury
 - Fibularis longus/brevis
 - Tibialis posterior
- Sinus tarsi syndrome
- Complex regional pain syndrome

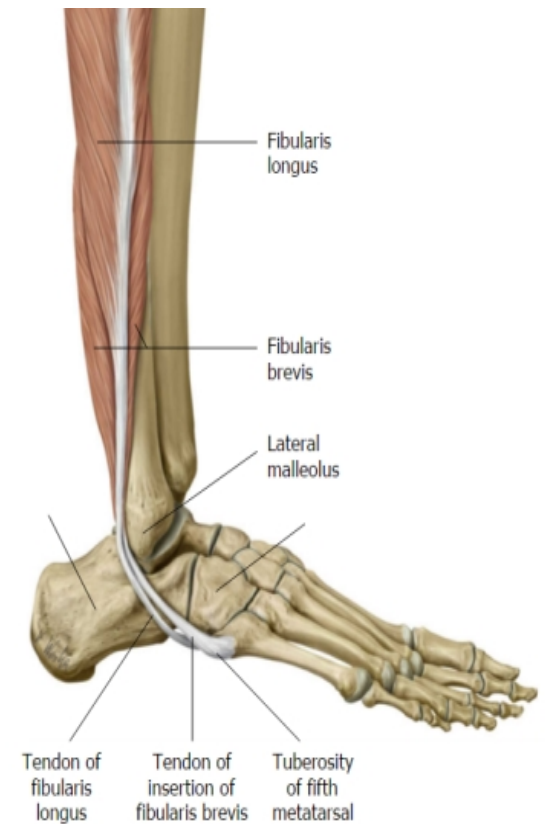
Osteochondral Lesion – Talar Dome

- Due to compression by tibial plafond
- Most commonly superomedial corner
- Symptoms: aching, locking/catching
- Exam: tender over talus
- Imaging:
 - X-ray may reveal lesion
 - MRI best
- Treatment:
 - Conservative: small stable lesions
 - Surgical: large lesions, loose bodies, failed conservative treatment



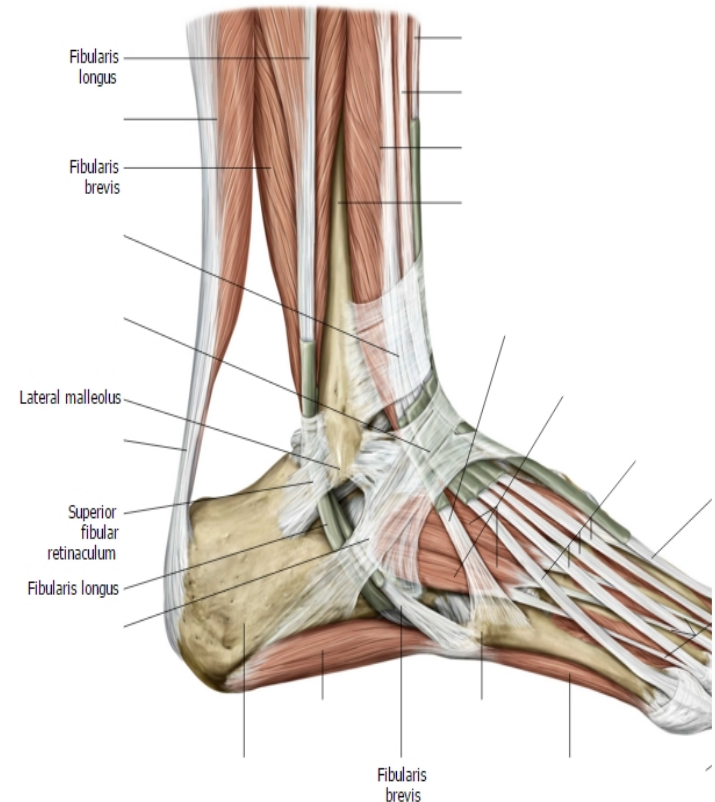
Fibularis Tendinopathy

- Most cases fibularis brevis
- Etiology: repetitive inversion injury or overuse
- Pain walking on uneven surfaces
- Exam: pain with resisted eversion, passive inversion
- MRI or Ultrasound to diagnose
- Treatment: rehabilitation, orthoses



Fibularis Subluxation

- Superior fibular retinaculum torn from lateral malleolus
- Tendons sublux anteriorly over lateral malleolus
- Etiology: forceful passive dorsiflexion
- X-rays may show fracture
- Treatment: often surgical



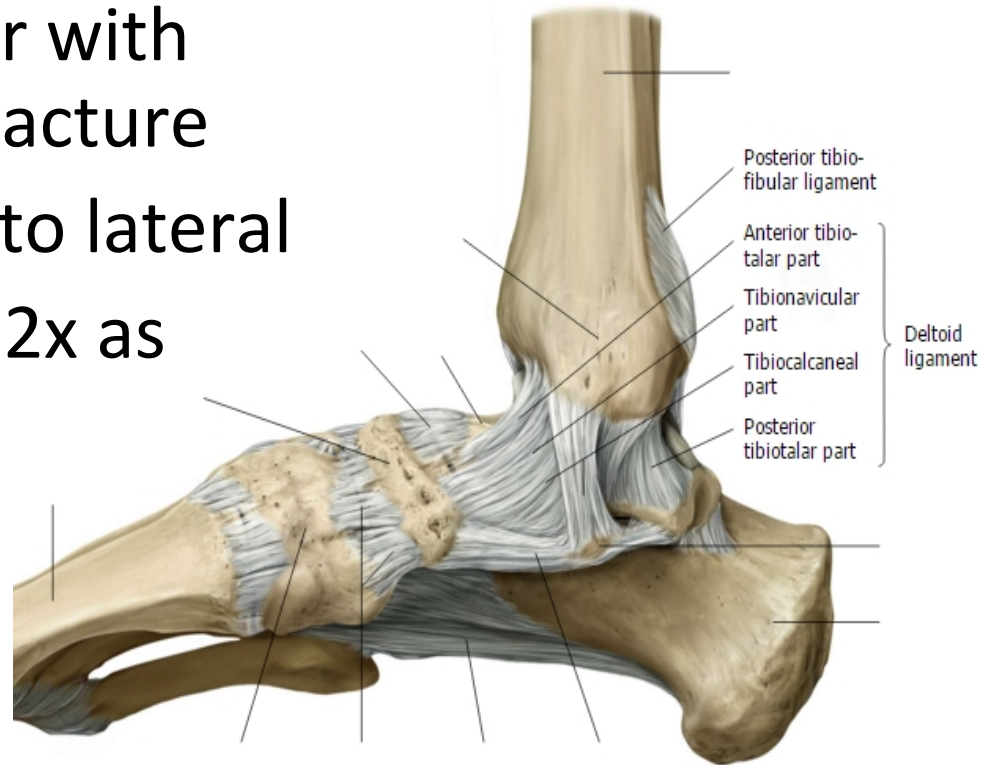
Medial Ankle Pain

Differential Diagnosis

- Medial Ankle Sprain
- Tibialis Posterior Tendinopathy
- Flexor Hallucis Longus Tendinopathy
- Tarsal Tunnel Syndrome
- L4 Radiculopathy

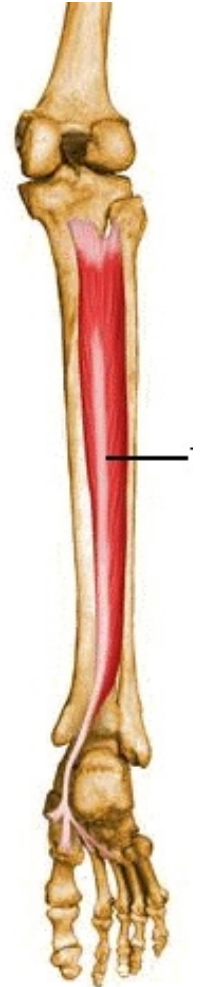
Medial Ankle Sprain

- Mechanism: eversion
- More likely to occur with medial malleolus fracture
- Treatment: similar to lateral
- Rehab takes about 2x as long (or more)



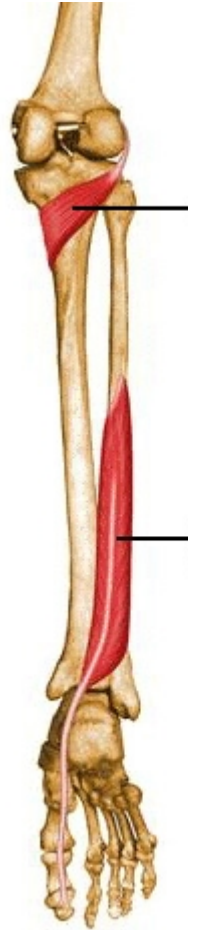
Tibialis Posterior Tendinopathy

- Etiology:
 - Overuse, such as running or walking
 - Excessive subtalar pronation
 - Restricted ankle ROM
- Symptoms:
 - Medial ankle pain
 - Pain may radiate along tendon
 - Dropped medial arch/pes planus
 - Pain with resisted inversion, heel raise
- MRI or Ultrasound to confirm diagnosis
- Treatment: ice, strengthening, orthotics



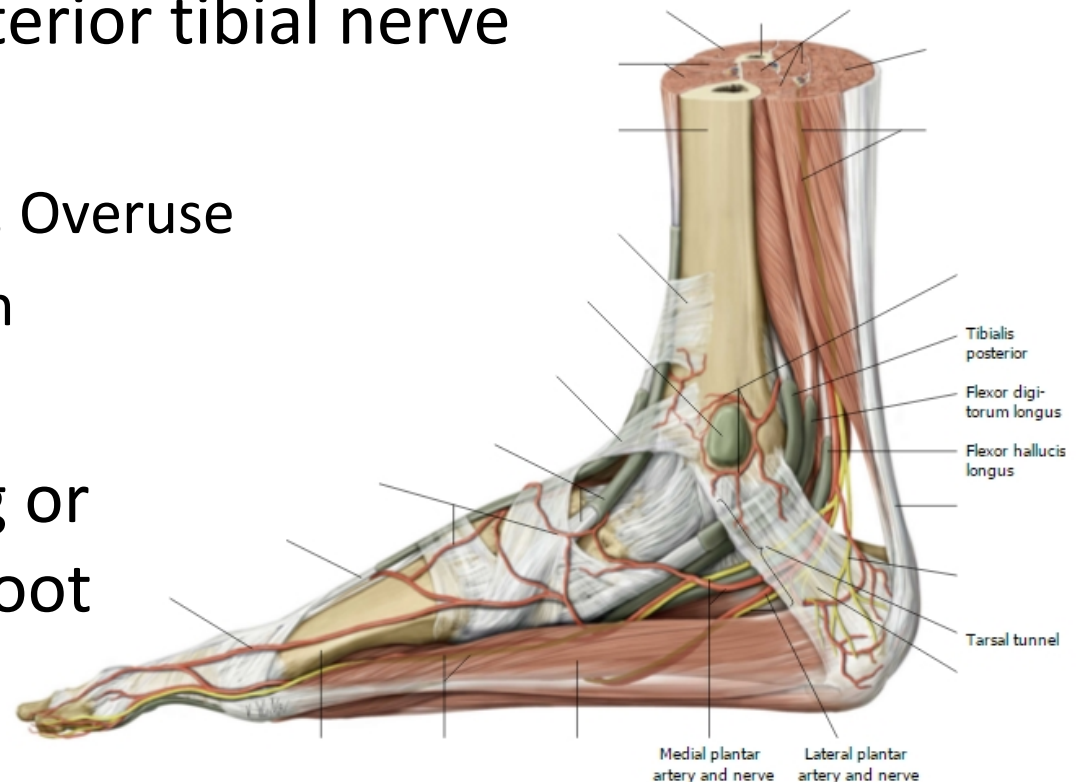
Flexor Hallucis Longus Tendinopathy

- Often seen in ballet dancers
- Symptoms:
 - Posteromedial ankle pain
 - Pain with toe-off or forefoot weight-bearing
 - Pain with resisted flexion or stretch into dorsiflexion
- MRI or Ultrasound to confirm diagnosis
- Treatment: ice, rest, stretching/strengthening exercises, subtalar mobilization, correcting technique



Tarsal Tunnel Syndrome

- Entrapment of posterior tibial nerve
- Etiology:
 - Idiopathic, Trauma, Overuse
 - Excessive pronation
 - Pes planus
- Symptoms: burning or tingling in plantar foot
- NCS to evaluate
- Treatment: depends on etiology



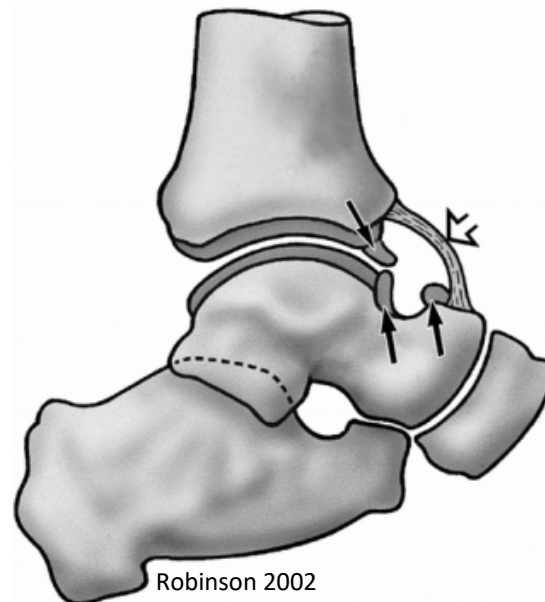
Anterior Ankle Pain

Differential Diagnosis

- Anterior Ankle Impingement
- High Ankle Sprain
- Tibialis Anterior Tendinopathy
- Extensor Hallucis Longus Tendinopathy
- Osteochondral Injury
- L5 Radiculopathy

Anterior Ankle Impingement

- Entrapment of bony or soft tissue
- Occurs during dorsiflexion
- More common in soccer, ballet
- Symptoms: ankle stiffness, pain, reduced dorsiflexion



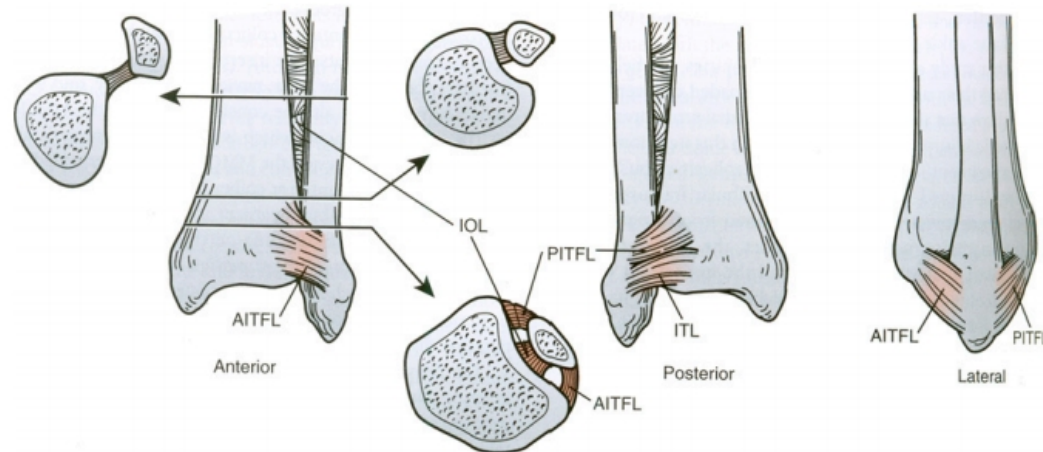
Anterior Ankle Impingement

- Evaluate with x-rays, MRI if necessary
- Treatment: rest, heel lift, NSAIDs, PT in mild cases
 - May require surgical excision of exostosis



Syndesmosis “High Ankle” Sprain

- Mechanism: dorsiflexion with external rotation
 - Stepping in a hole
 - Landing on someone’s foot
- AITFL injured before PITFL
- Complete rupture associated with other injuries:
 - Deltoid ligament, fracture of fibula or posterior and medial malleoli



Syndesmosis “High Ankle” Sprain

- Exam:
 - Marked medial swelling and pain
 - + external rotation test
 - + squeeze test
 - Palpate proximal fibula
- Imaging:
 - MRI best for ligaments
 - X-rays to evaluate stability



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Syndesmosis “High Ankle” Sprain

- X-rays:
 - Widening of medial clear space (C) – Normally \leq tib/talar space
 - Widening of tibiofibular clear space (B) – Normally $< 6\text{mm}$
 - Decrease in tibiofibular overlap (A) – Normally $> 6\text{mm AP}$, 1mm mortise



Van Heest 2014



drchiodo.com

Syndesmosis “High Ankle” Sprain

- Treatment:
 - Stable (Grade I/II): conservative
 - Initial NWB boot
 - Early mobilization at 3-6 weeks
 - Begin with ROM, progress to strengthening
 - Unstable (Grade II/III): surgery for stabilization
- Up to 20% have chronic symptoms
- Increased risk of post-traumatic OA

Maisonneuve Fracture

- Proximal fibula fracture
- Occurs with distal tib-fib joint sprain and medial malleolus fracture or deltoid ligament injury
- Treatment: surgical repair of syndesmosis; non-op management of fibula



TA & EHL Tendinopathy

- Etiology: overuse (downhill running), direct pressure
- Pain, swelling, stiffness – increase with activity
- Imaging: Ultrasound or MRI
- Treatment: eccentric strengthening, correction of biomechanics



Posterior Ankle Pain Differential Diagnosis

- Posterior Ankle Impingement
- Achilles Tendinopathy
- Achilles Rupture
- Retrocalcaneal Bursitis
- Accessory Soleus
- S1 Radiculopathy
- Sever's Disease

Posterior Ankle Impingement

- Impingement of posterior bony or soft tissues between talus and posterior tibia
 - Can have prominent lateral talar process (Stieda) or os trigonum
 - Seen in ballet dancers, gymnasts, soccer players
 - Due to extreme plantarflexion
- Symptoms: pain and tenderness posterior ankle
- Pain with passive ankle plantarflexion

Posterior Ankle Impingement

- Imaging: X-ray, MRI
- Treatment: rest, NSAIDs, mobilization, technique correction, steroid injection if needed
 - May require surgery



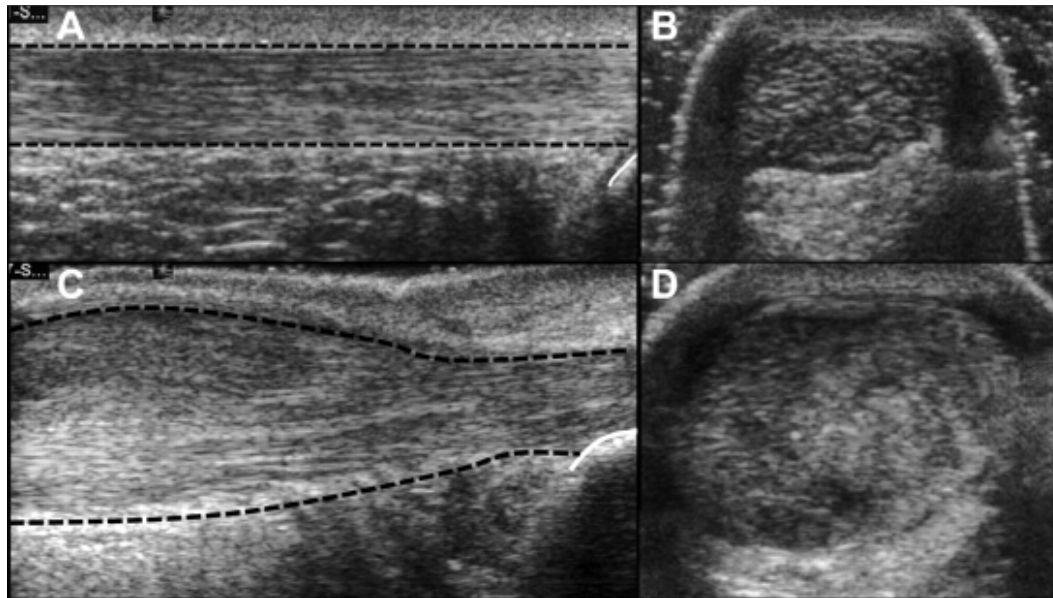
Robinson 2002

Achilles Tendinopathy

- Non-inflammatory degeneration
- Most common 2-6 cm proximal to insertion
- Risk Factors: abnormal biomechanics, calf weakness or tightness, male, obesity, menopause, diabetes, years of running
- Contributing Factors: reduced recovery time, change in training or footwear
- Pain worse with activity

Achilles Tendinopathy

- Exam: swelling, crepitus, tenderness, \pm nodule
- Imaging: MRI or Ultrasound



Arya 2010



Maffulli 2004

Achilles Tendinopathy

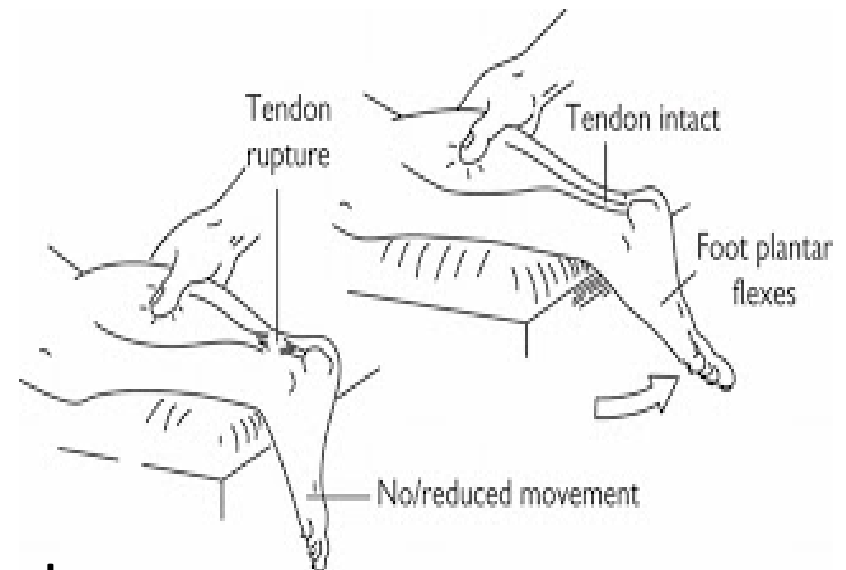
- Treatment:
 - Rest, immobilization, ice, NSAIDs or analgesics
 - Physical therapy: Eccentric exercises or heavy slow resistance training
 - Modified for insertional vs mid-portion
 - Correct biomechanical factors
 - Nitroglycerin patches
 - Injections/percutaneous procedures if needed
 - Surgery for Haglund's deformity (spur)



Alfredson 1998

Achilles Tendon Rupture

- Occurs during activity
- Feel a “hit” or “kick” to back of leg
- Difficulty walking
- Exam:
 - Palpable defect
 - + Thompson test
- Treatment:
 - Often surgical
 - Can consider non-surgical



theultrasoundsite.co.uk

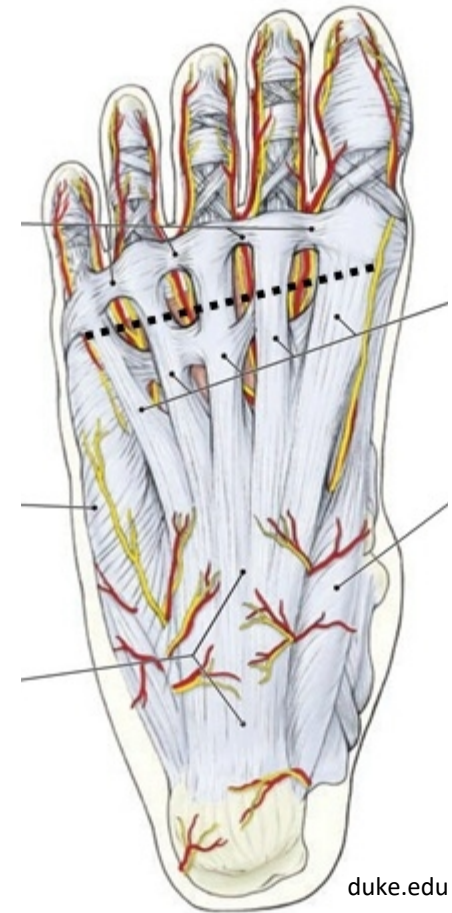
Heel (Rearfoot) Pain

Differential Diagnosis

- Plantar fasciitis
- Calcaneal stress fracture
- Fat pad contusion
- Nerve
 - Tarsal tunnel syndrome
 - Medial calcaneal nerve entrapment

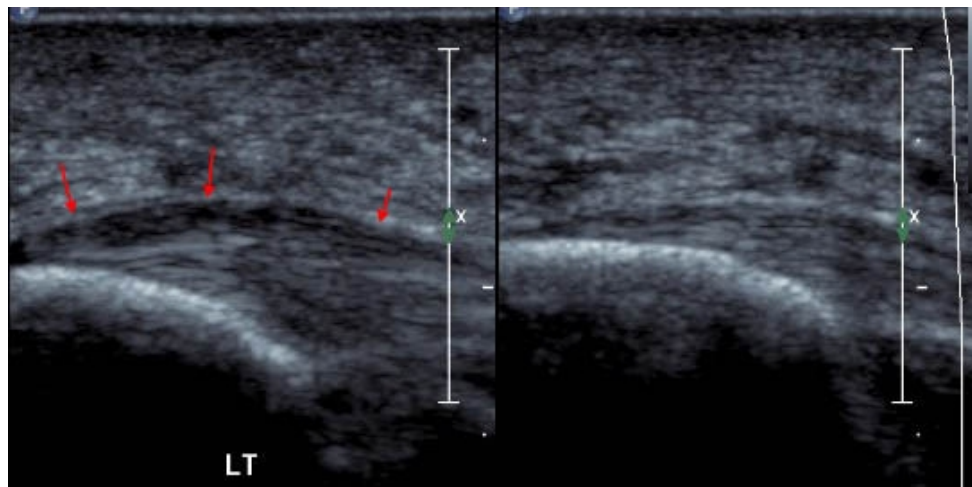
Plantar Fasciitis/Fasciosis

- Forms longitudinal arch of foot
- Insidious onset of pain due to overuse (running, dancing, walking)
- Risk Factors: pes planus or cavus, poor footwear, obesity, calf tightness, excessive standing
- Pain worse in the morning or after inactivity
- Tender at medial process of calcaneal tuberosity (plantar fascia origin)



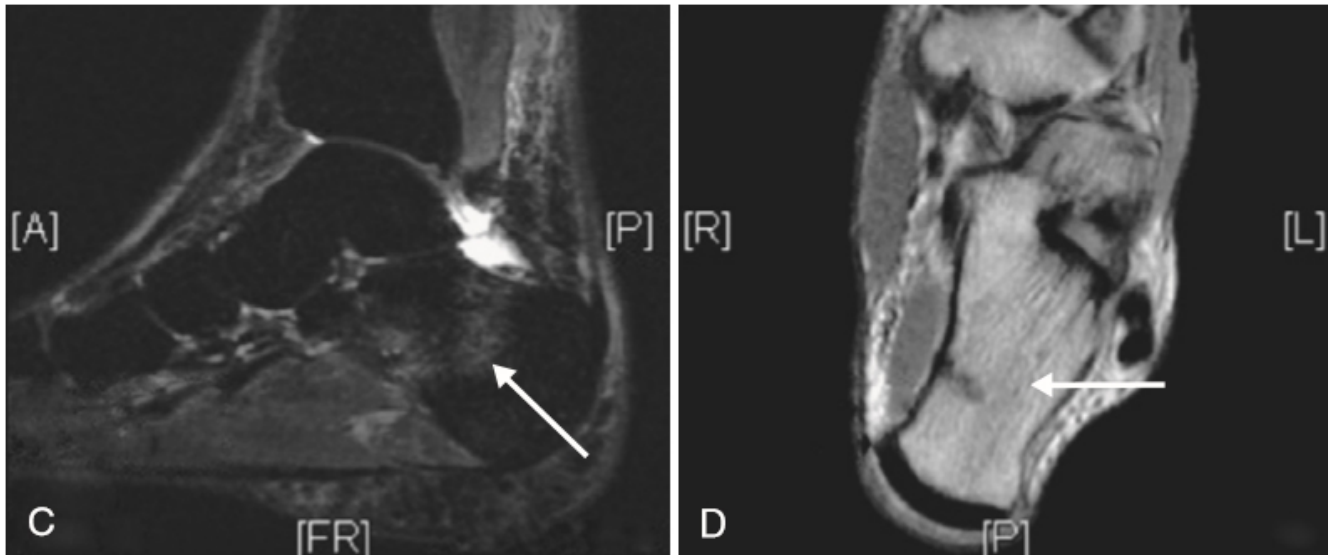
Plantar Fasciitis/Fasciosis

- X-ray may reveal calcaneal spur
- Ultrasound: thickening of fascia
- Treatment: ice, stretching, massage, NSAIDs, gel heel pad, strengthening, night splint, supportive footwear
- Steroid or PRP injections or surgery if needed



Calcaneal Stress Fracture

- Due to overuse, heavy landing, over-striding, poor cushioning
- Worse with weight-bearing
- X-rays may be negative, MRI better
- Treatment: NWB if needed, gradual increase in weight-bearing activity, soft heel pads



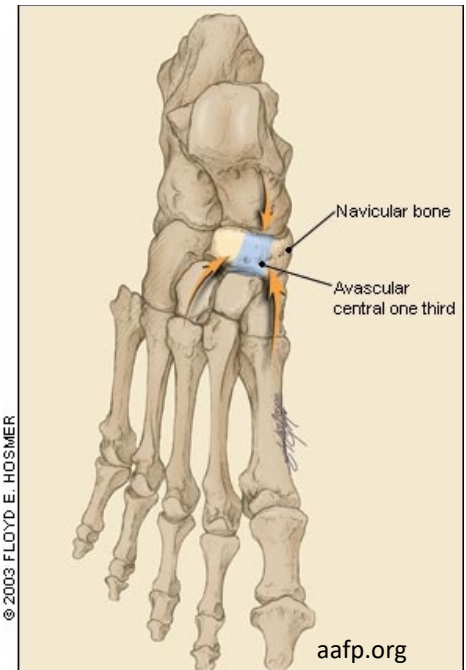
Midfoot Pain

Differential Diagnosis

- Navicular stress fracture
- Lisfranc joint injury
 - Sprain, dislocation, fracture
- Extensor tendinopathy
- Midtarsal joint sprain
- Tarsal coalition

Navicular Stress Fracture

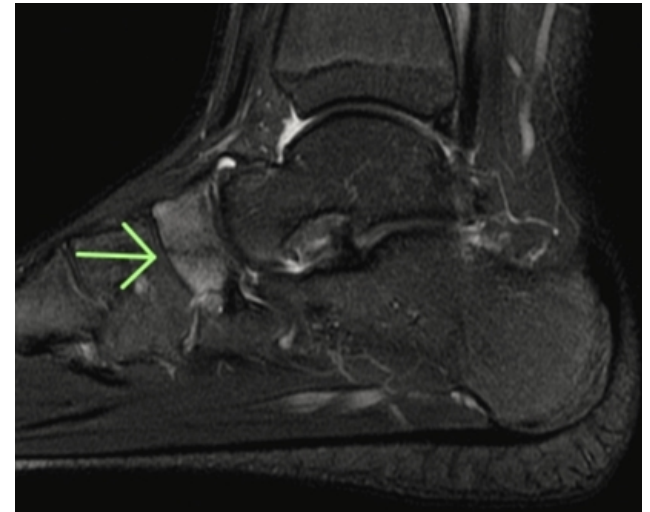
- Sprinters, jumpers, hurdlers
- Most commonly middle 1/3 (avascular)
- Pain with activity, weightbearing
- Vague/diffuse midfoot pain
- Tender to palpation on exam
- Imaging: MRI or bone scan + CT
- **High risk** of nonunion or AVN



Navicular Stress Fracture

Treatment

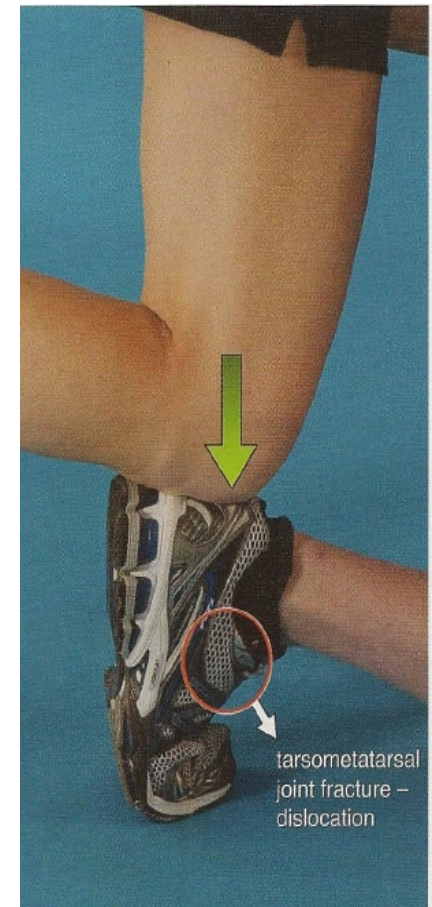
- Stress Reaction:
 - Rest until pain free, boot, gradual return to play
- Stress Fracture:
 - 6-8 weeks strict NWB in cast
 - Gradual rehab over 6 weeks
 - Surgical referral for delayed or nonunion



sportsmedicinephysiotherapy.com

Lisfranc Injury

- Lisfranc ligament between medial cuneiform and 2nd metatarsal
- Etiology: direct or indirect
- Midfoot pain with weightbearing
- Bruising/swelling dorsal midfoot
- Imaging:
 - X-ray & MRI
- Grading/Treatment:
 - I: non-displaced – NWB cast x 6+ weeks
 - II & III: displaced – surgery



Brukner & Khan

Lisfranc Injury



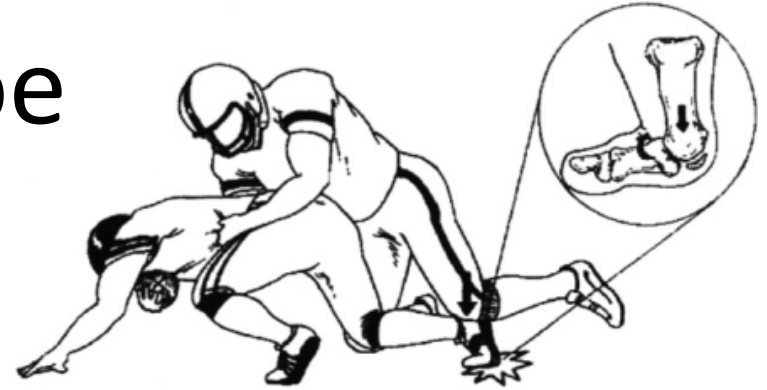
B

Forefoot Pain

Differential Diagnosis

- First MTP sprain (turf toe)
- Morton's neuroma
- Sesamoiditis/stress fracture
- Metatarsal stress fracture
- Metatarsalgia
- Hallux valgus
- Hallux rigidus

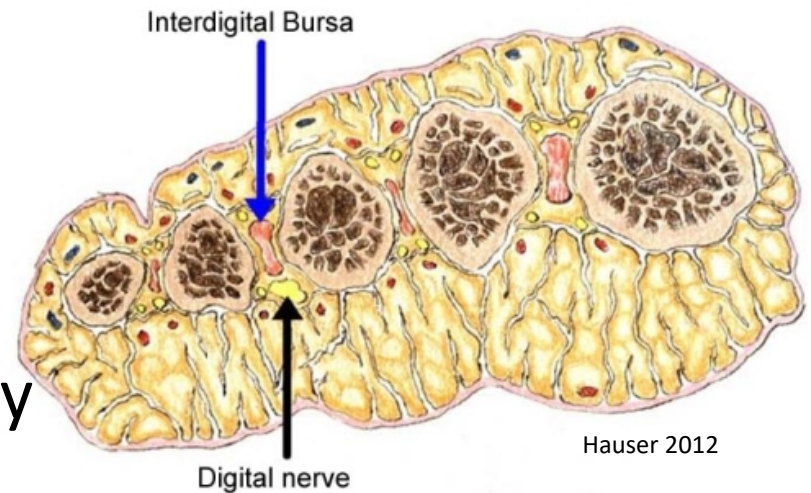
Turf Toe



- 1st MTP joint sprain
- Involves plantar capsule and ligaments
- Mechanism: forced hyperextension
- X-ray may show avulsion; MRI more detailed
- Grading/Treatment:
 - I: sprain of ligaments; symptomatic
 - II: partial rupture; walking boot, crutches
 - III: complete rupture; boot/cast or surgery

Morton's Neuroma

- Swelling of interdigital nerve and bursa
- Most common between 3rd and 4th MTs
- Pain can radiate into toes
- “Pebble in shoe”
- Exam: Mulder’s sign/click
- Treatment: metatarsal padding, strengthening, orthotics, ± injection, surgery



Sesamoiditis & Sesamoid Stress Fractures

- Usually involves medial sesamoid
- X-rays with sesamoid view for fracture
- MRI to detect early bone stress
- **High risk** of delayed or nonunion
- Treatment:
 - Up to 6 weeks NWB short leg cast
 - May require surgery (sesamoidectomy)



Burge 2012

Metatarsal Stress Fractures

- Most common: Neck 2nd MT
 - Higher risk if 2nd MT longer than 1st MT
 - Treat with relative rest, gradual return to activity
- Base 2nd MT
 - 4+ weeks NWB in short-leg cast
 - High Risk
- Jones Fracture: Proximal diaphysis 5th MT
 - 6-10 weeks NWB cast or screw fixation
 - High Risk



Higher Yield for Exams

- Anatomy
- Physical exam special tests
- Ottawa foot/ankle rules
- Common injuries/pathology
- High risk stress fractures

Questions?



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