Foot & Ankle Injuries

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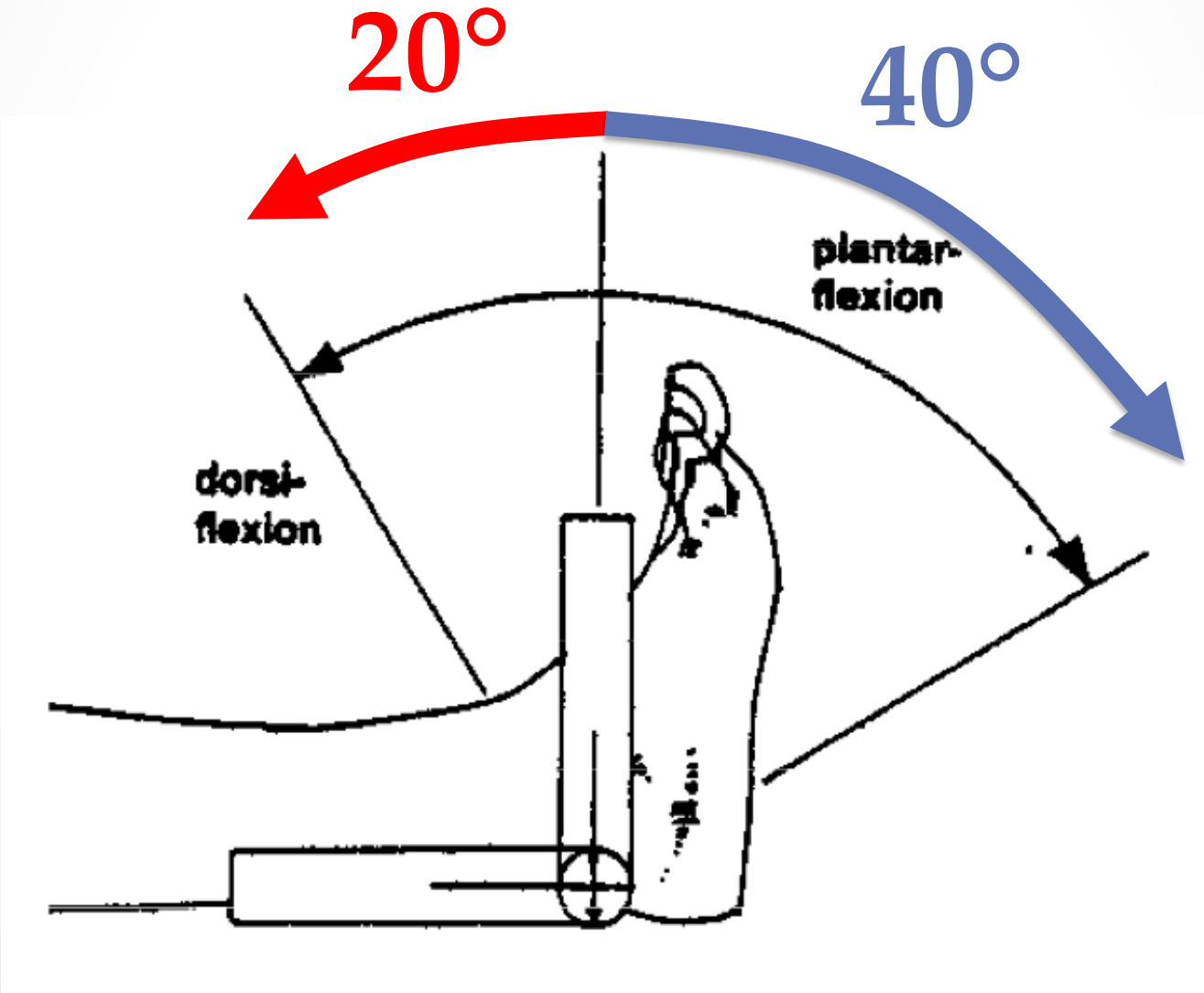
Basic Physical Exam

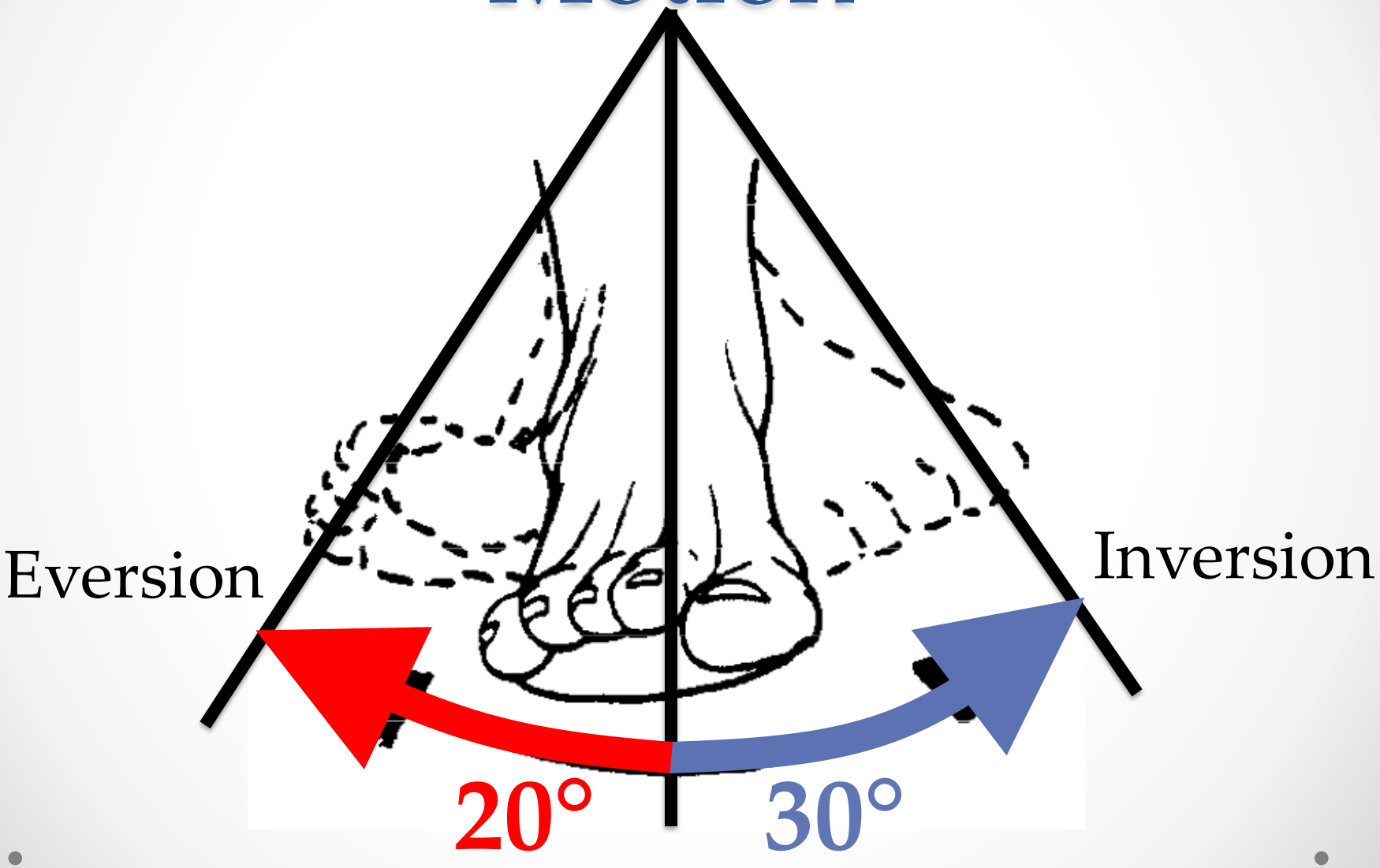
- **Inspection:**
  - Swelling, Ecchymosis, Deformity
- **Range of Motion:**
  - Dorsiflexion, Plantarflexion
  - Inversion and Eversion
- **Strength**
- **Palpation:**
  - Medial and Lateral Malleolus
  - Base of 5th Metatarsal
  - Achilles Tendon
  - Midfoot
  - Proximal Fibula
- **Assess neurovascular status**

Normal Ankle Range of Motion



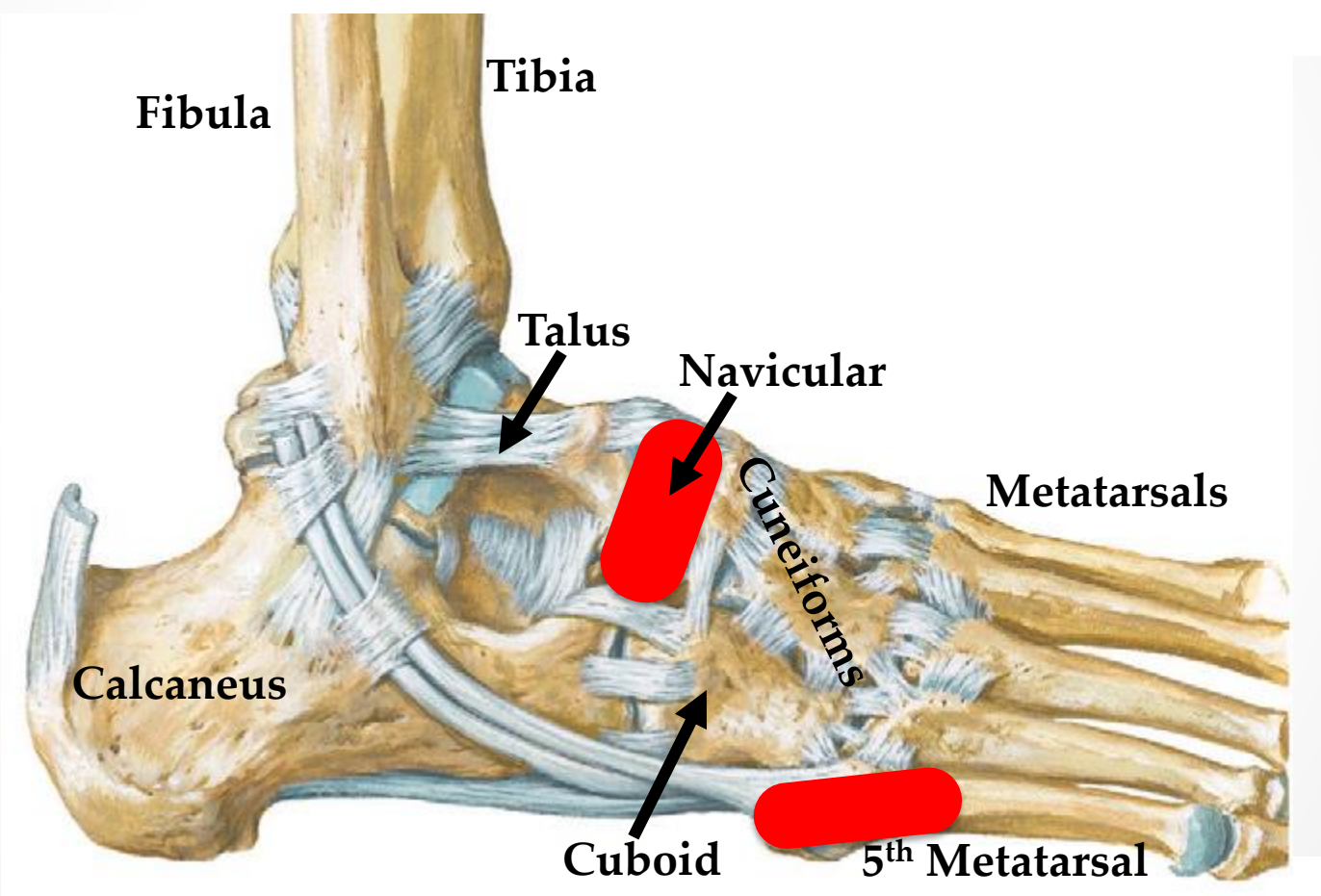
http://www.dshs.wa.gov/

Normal Ankle Range of Motion

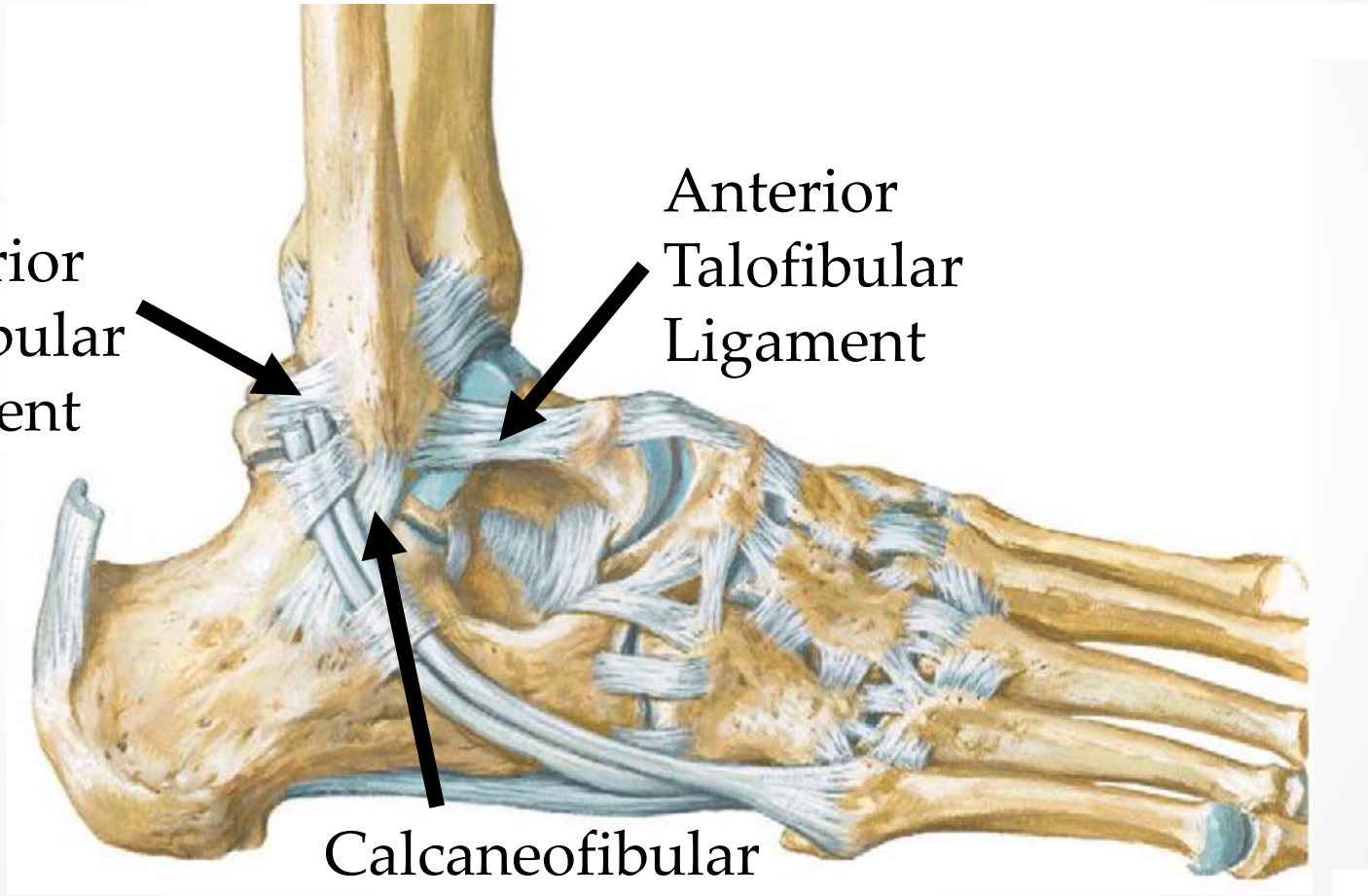


http://www.dshs.wa.gov/

Bones of Lateral Ankle

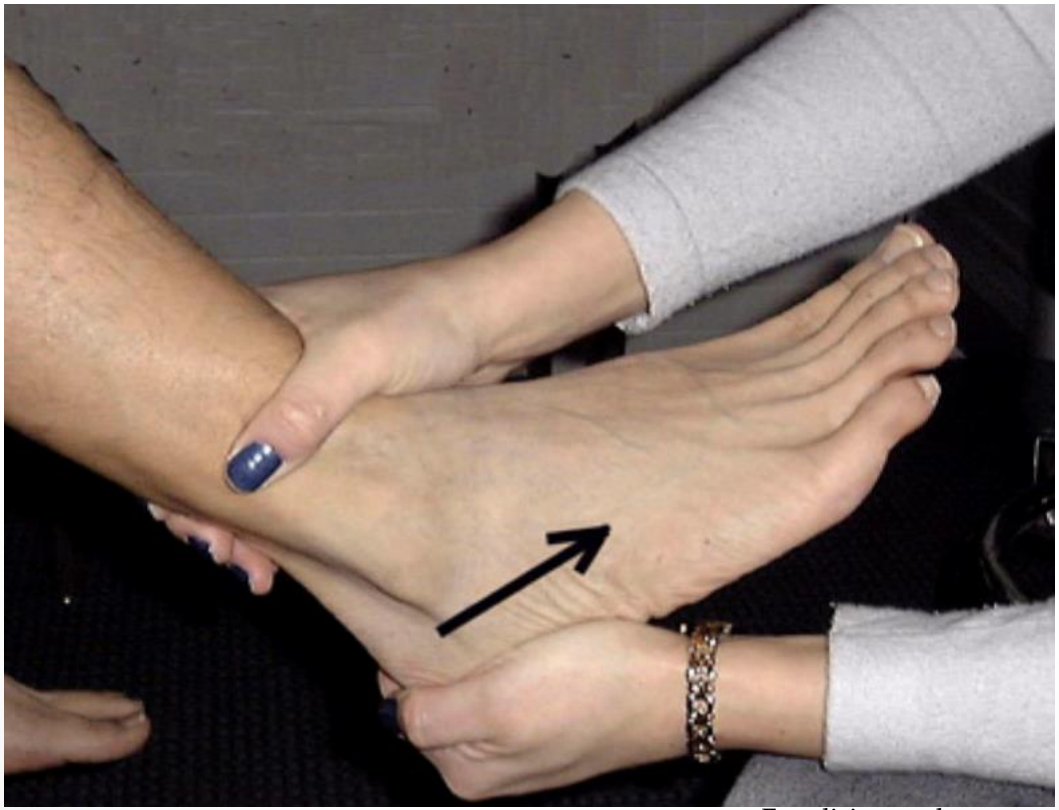


Ankle Ligaments



Anterior Drawer

- Tests integrity of anterior talofibular ligament



Emedicine.medscape.com

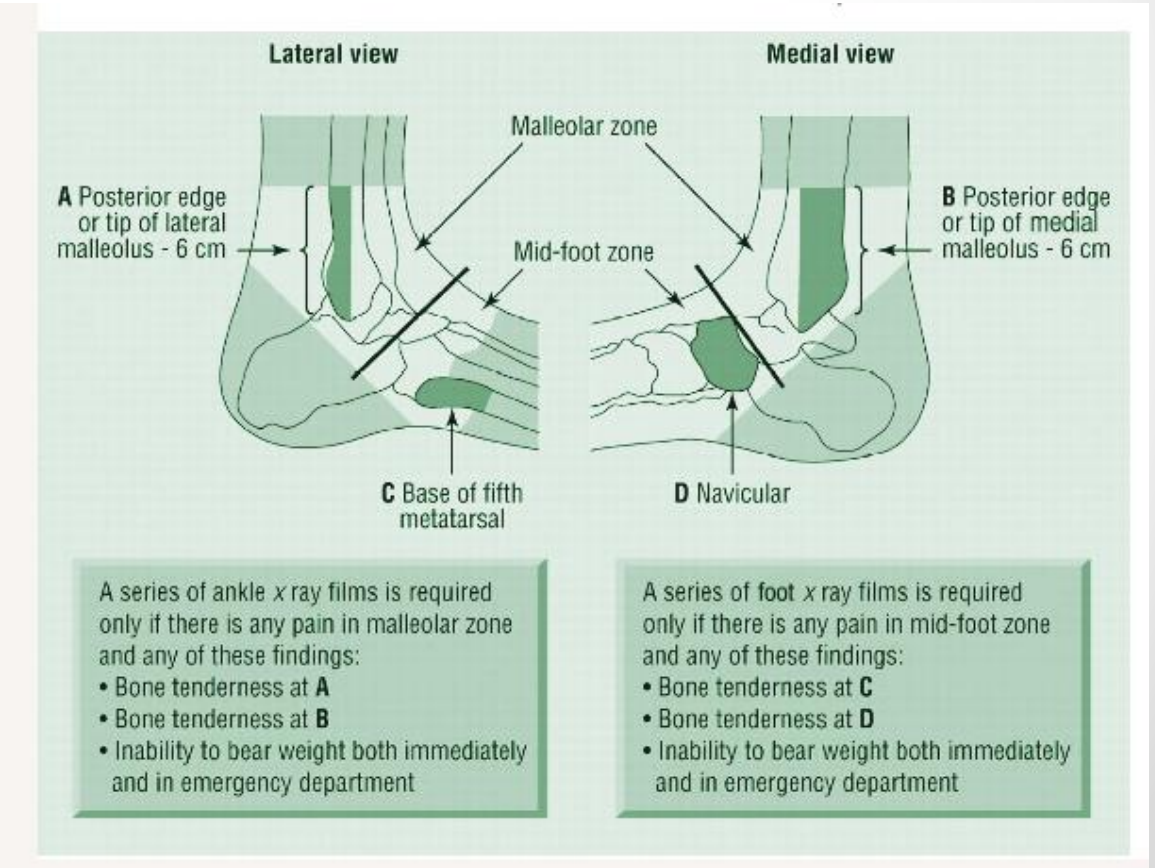
Talar Tilt Test

- Tests integrity of anterior talofibular ligament and calcaneofibular ligament

Emedicine.medscape.com

Ottawa Rules: When to Image

- Ottawa Ankle Rules: 98% sensitivity for fracture, decrease radiographs
- Validated in ED and PCP Office
- Do **not** apply rules if:
  - Age < 18 yo
  - Pregnancy
  - Multiple painful injuries
  - Compromised sensation



http://www.mdcalc.com/ottawa-ankle-rules/

Case 1

- 35 year old woman sustained an ankle inversion injury while playing soccer. Able to bear weight after the injury and currently. Pain is localized to the lateral ankle.
  - No bony tenderness
  - Significant swelling of lateral ankle
  - Good end point on anterior drawer and talar tilt test
  - TTP over ATFL
  - Neurovascularly intact

Diagnosis

Ankle Sprain of ATFL

West Point Sprain Grading System				
	Tearing	Swelling	Joint Instability	Weight Bearing
Grade I	microscopic	minimal	none	fully / partial
Grade II	partial	moderate / severe	mild / moderate	unable
Grade III	complete rupture	severe	moderate / severe	unable

Staging initially established for different treatment plans, but now regardless of staging all complete the same treatment plan--functional rehabilitation.

Management of Ankle Sprain

- **Neuromuscular ankle training**
  - Increased strength
  - Improved proprioception—balance exercises

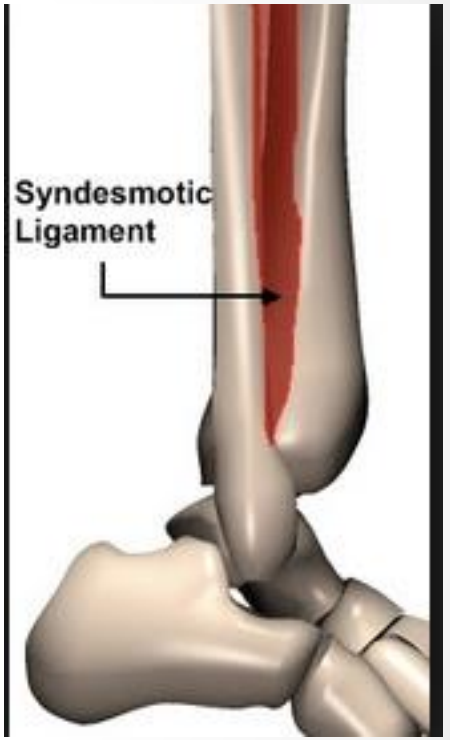
- Air Splint initially (additional lateral stability)
  - Boot only if think more severe diagnosis on differential
- Crutches for Pain—weight bearing as tolerated with heel to toe walking
- RICE—Rest, Ice, Compression, Elevation
- Emphasize early range of motion exercises
  - Write ABCs with foot

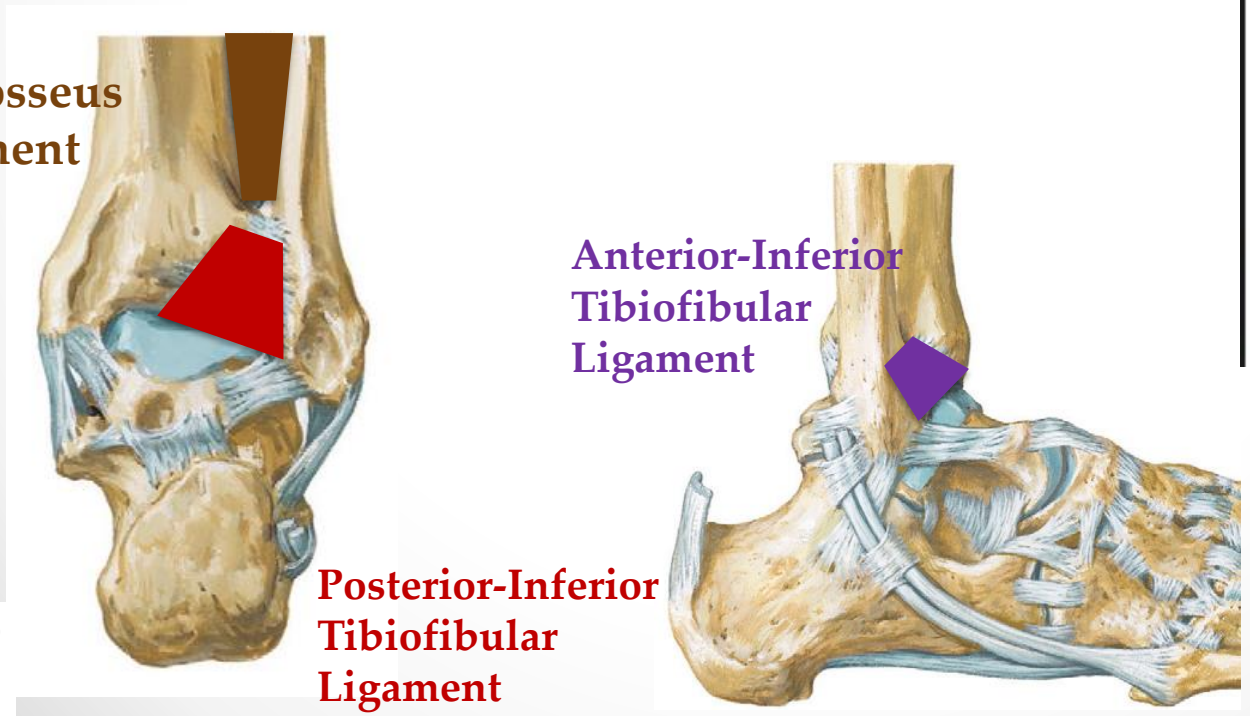
Case 2

- 23 year old male with anterior ankle pain. Was playing intramural touch football yesterday and was pushed back by another player while his foot was planted. Able to bear weight since injury but with pain.
  - Minimal ankle swelling
  - Pain with bearing weight
  - Difficulty rising on toes
  - Limited dorsiflexion secondary to pain
  - Positive Squeeze Test
  - Neurovascularly intact

Syndesmotic Injury

- "High Ankle Sprain" of ligaments between tibia and fibula
- Associated with rotational injury
  - Pushed back on planted foot





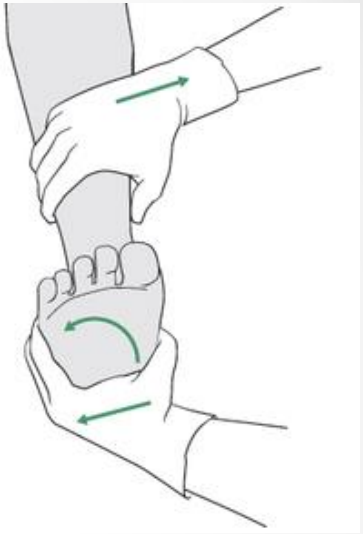
Squeeze Test

- Compression of the mid tibia and fibula with reproduction of pain in the ankle
  - Indicates High Ankle Sprain—pain from syndesmotic injury

http://step.nl/enkelverzwikking-enkeldistorsie-inversietrauma-enkelbrace-proprioce

Syndesmotic Injury

Physical Exam:



- Pain with External Rotation Test
  - Separates tibia from fibula
- Tenderness between tibia and fibula
- Positive Squeeze test
- Limited dorsiflexion
- Pain with weight bearing and rising up on their toes

Imaging:

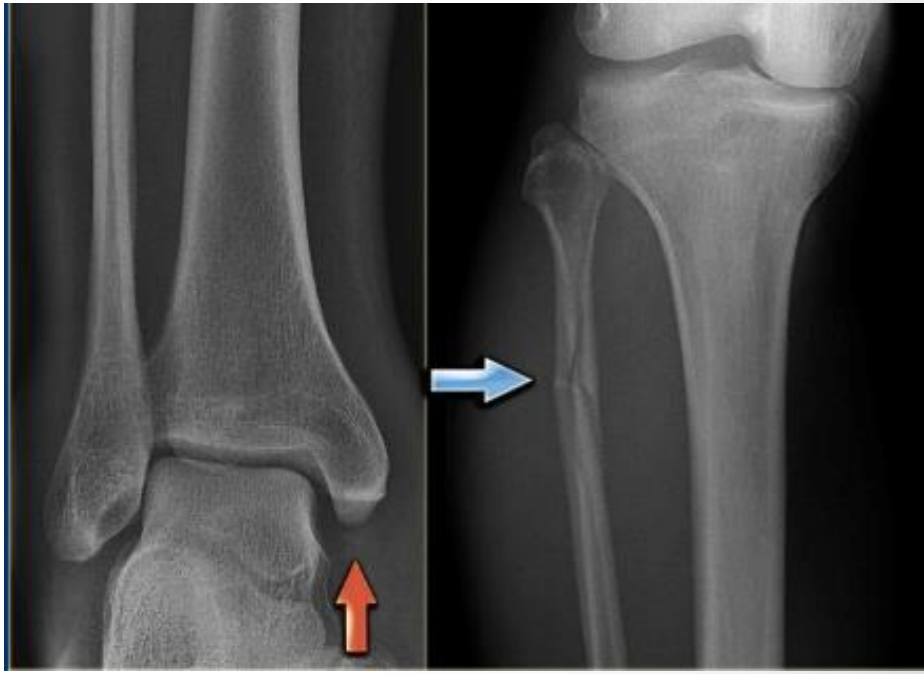
- X-Ray –Possible widening of the space between tibia and fibula

Treatment of High Ankle Sprain

- Boot as needed—if severe pain
- Functional Rehab
  - Strengthening, early ROM
  - Similar to ankle sprain
- Takes twice as long to recover as compared to ankle sprain
- Widening with fracture may require Ortho referral for surgical repair

Do Not Miss…

- **Maisonneuve Fracture:**
  - Proximal Fibula Fracture that occurs with:
    - Avulsion fracture of medial malleolus
    - Rupture of deltoid ligament
  - Palpate proximal fibula on all ankle injuries



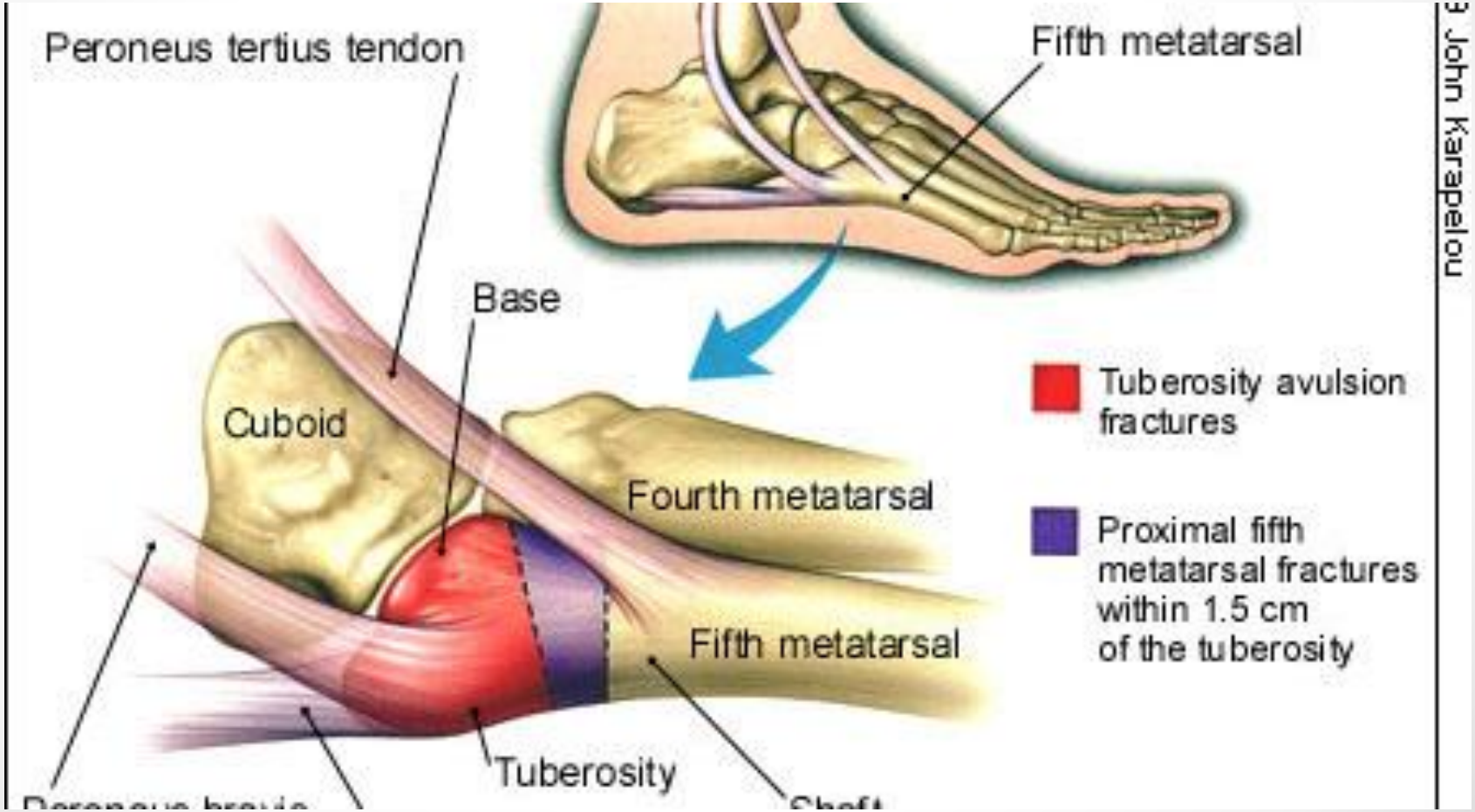
⚠ CAUTION

http://www.radiologyassistant.nl/en/p50335f3cb7dc9/ankle-special-fracture-cases.html

Case 3

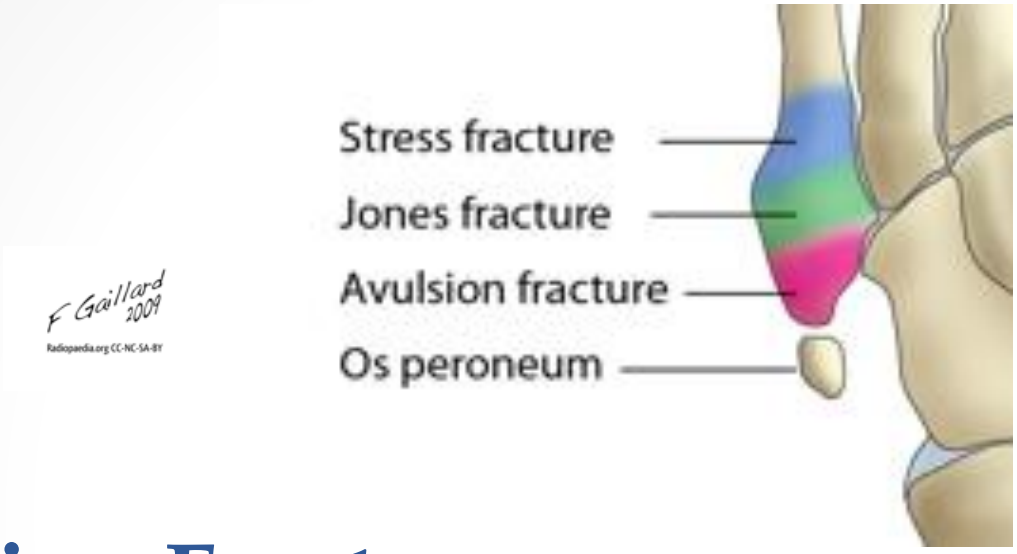
- 65 year old woman who sustained an inversion injury of her ankle while stepping off a curb yesterday. Localizes pain to foot and lateral ankle. Unable to bear weight at the time of the injury, but can now.
  - Significant swelling of lateral ankle
  - TTP over the base of the 5th metatarsal
  - Neurovascularly Intact

5th Metatarsal Fracture



Strayer et al. Fractures of the proximal fifth metatarsal. *Am Fam Physician.* 1999 May 1;59(9):2516-2522.

5th Metatarsal Fractures



Avulsion Fracture:

-**No** fracture line present in the space between 4th and 5th metatarsal= DIFFERENT from Jones fracture

-**Treatment:**

-Weight bearing as tolerated

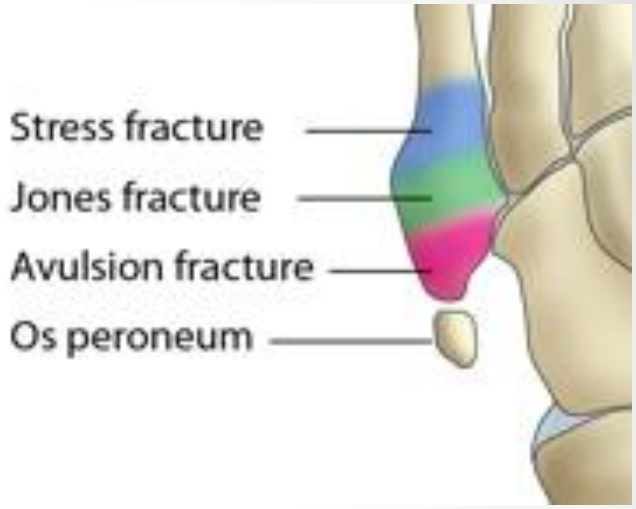
-Hard soled shoe

-Rarely, surgical repair

If large, displaced intra-articular fragments

5th Metatarsal Fractures

- **Jones Fracture:**
- **The Don't Miss Fracture**
  - See in sprinters, jumpers
  - Watershed Region/Poor blood flow
    = Poor healing, risk of nonunion
  - **Treatment:**
    - Referral to Orthopedics or Podiatry
    - Splint in ER and make Non-weight bearing
    - Non-weight bearing with cast for 4-6 weeks followed by 4-6 weeks in walking boot
    - ~ 75% heal with non-operative treatment
    - If athlete, often orthopedic pinning required
    - 30-50% will re-fracture



Jones Fracture X-Ray

http://radiopaedia.org/cases/jones-fracture-4

Case 4

- 27 year old male lacrosse player presents after an ankle injury. Occurred yesterday when his foot was caught in a divot in the field and he fell forward. Seen in an Urgent Care yesterday with normal ankle X-Ray. Discharged with walking boot and crutches.
  - Significant swelling and ecchymosis of the midfoot
  - Neurovascularly intact
  - Tenderness over tarsometatarsal joints
  - Pain with weight-bearing and unable to stand on tiptoes
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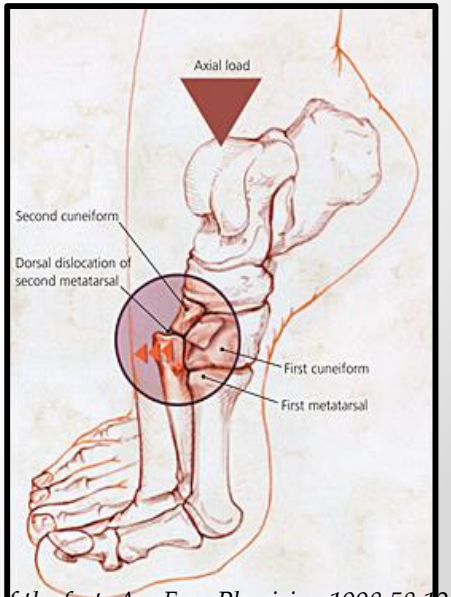


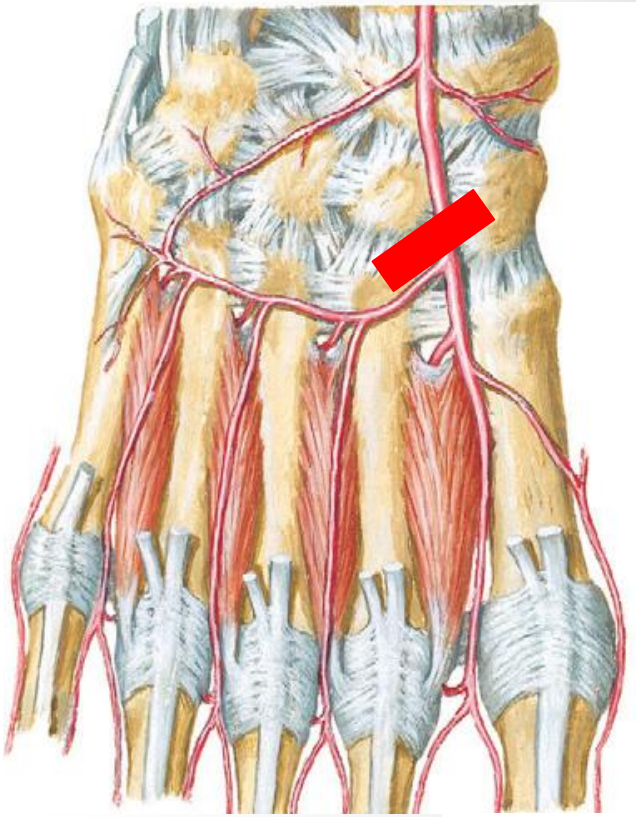
K Burroughs, C Reimer , K Fields. Lisfranc injury of the foot. Am Fam Physician 1998;58:121

Lisfranc Injury

- **Lisfranc Ligament:**

Base of 2nd Metatarsal → Medial Cuneiform

-Injury causes separation of the base of the 1st and 2nd metatarsals leading to forefoot instability



Lisfranc Injury

- Injury is referred to as a Lisfranc if there is any disruption of the tarsometatarsal joint complex
  - Injury can range from sprain of the Lisfranc ligament to dislocation (due to ligament tear) to fracture

- Why is this area of the foot prone to injury?
  - Transverse ligaments connect the bases of the four lateral metatarsals
    - No transverse ligament exists between the 1st and 2nd metatarsal bases
      - Minimal support = increased risk of injury

Imaging

(Left) In this non-weightbearing x-ray, the Lisfranc injury does not show any abnormal widening (arrow). **(Right)** The tear of the Lisfranc ligament is more evident in this weightbearing stress x-ray, showing a widening of the joint.

- **X-Ray—Weight-bearing:** AP and lateral, +/- oblique
- -Tell radiology what diagnosis you are concerned about

- **Lisfranc Injury XR Evaluation:**
  - Look for widening of space between 1st and 2nd metatarsal
  - Look for fracture at base of 2nd metatarsal
  - XR findings very subtle. If have midfoot pain and negative XR, still possibly a Lisfranc and needs follow up

http://orthoinfo.aaos.org/topic.cfm?topic=A00162

Lisfranc Injury

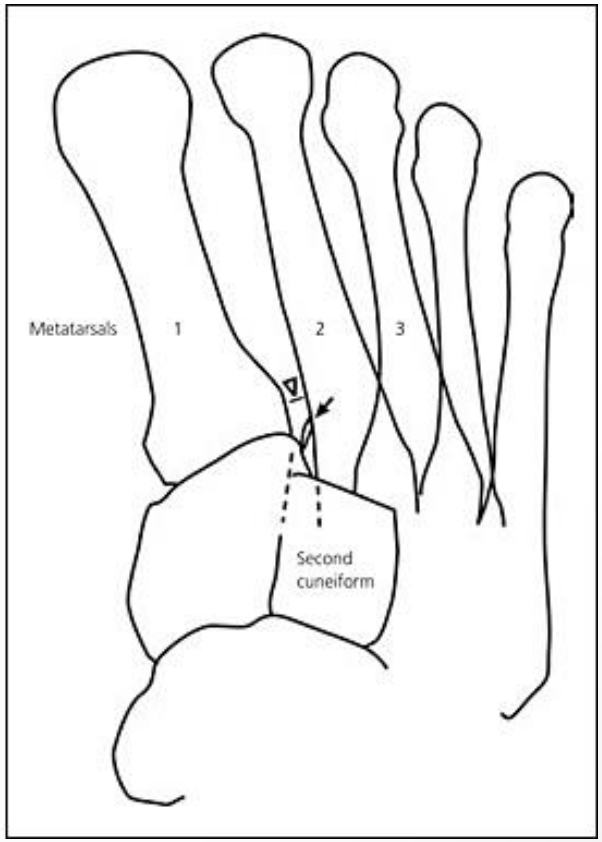
- **Weight Bearing** View:

  Widening > 2mm between 1st and 2nd metatarsal bases
  Indicates at least ligamentous injury present

http://orthoinfo.aaos.org/

Lisfranc Injury

- **Fleck Sign:** Avulsion off base of 2nd metatarsal. Represents rupture of Lisfranc Ligament



http://orthoinfo.aaos.org

Lisfranc Treatment

- **Clinical Diagnosis:**

  Midfoot pain (Tarsometarsal pain) + Injury + Pain with Weight Bearing = Lisfranc

  - Get weight bearing XR

- **Treatment:**
  - Prompt Orthopedic referral and follow up
  - Boot or splint and make non-weight bearing
  - Treatment usually almost always surgical

- **Diagnose early as delayed treatment causes:**
  - Chronic pain
  - Foot dysfunction and arthritis

Case 5

- 42 year old woman presents with persistent heel pain for the last several month. No injury to the area. Pain is worse in the morning and improves throughout the day. Increased pain with activity.
  - Tenderness at the base of the calcaneus
  - Neurovascularly intact
  - No swelling or ecchymosis

Plantar Fasciitis

=Overuse injury of the plantar fascia

Risk Factors:

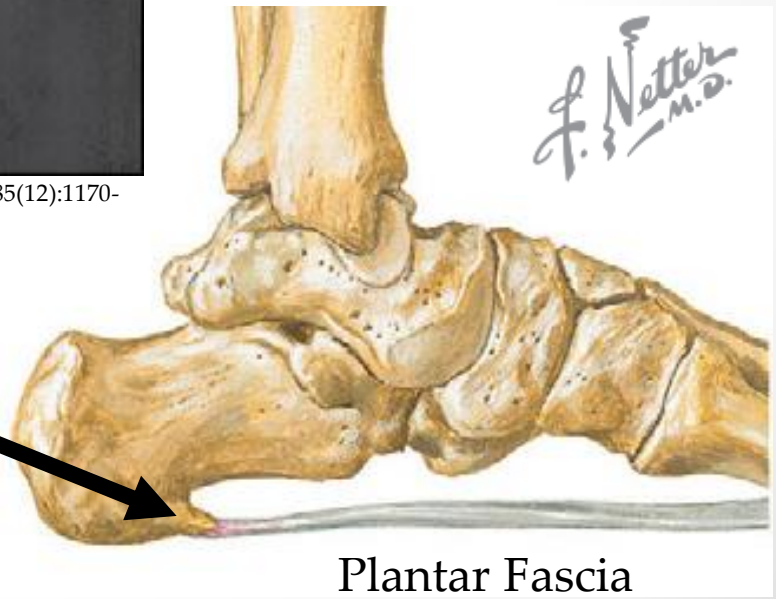
- Flat foot (pes planus)
- High arch (pes cavus)
- Leg length discrepancy
- Tightness of Achilles tendon and intrinsic foot muscles
- Obesity (BMI > 30)
- Sedentary lifestyle
- Prolonged standing/walking at work
- Excessive running
- Poor arch support shoes

Heel Spur?

Timestra, Jeffrey. Update on Acute Ankle Sprains. *Am Fam Physician*. 2012 Jun 15;85(12):1170-1176.

Calcaneal Enthesophyte

Calcaneal spurs are a SIGN of the problem, not the source of the pain!



Plantar Fascia

Plantar Fasciitis

Diagnosis:

- History and Physical

Treatment:

- Foot Strengthening
  - Pick up pencils or marbles with toes
- Calf/Achilles stretching
- Icing
- Massage
- Arch supports
- Weight loss
- Avoidance of unsupportive shoes, barefoot walking
- NSAIDs

Case 6

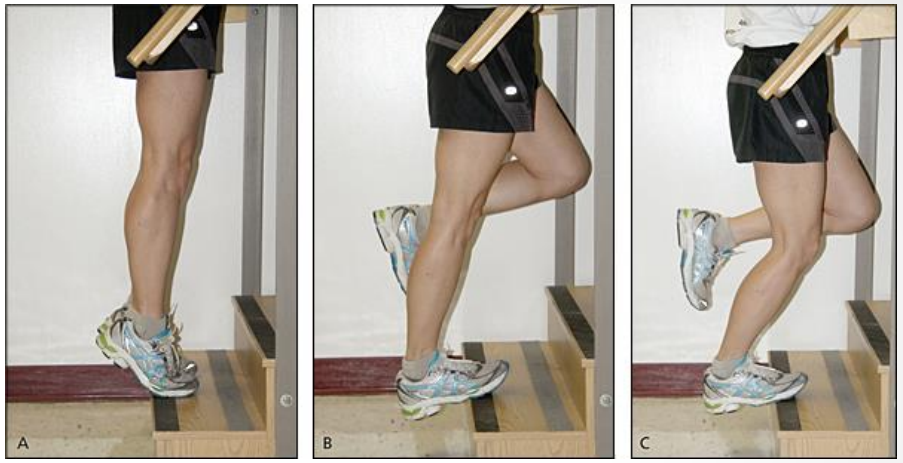
- 37 year old male presents with slow onset of pain in his posterior heel. He is an avid runner and is currently training for a half marathon. Recently transitioned from running shoes to minimalist shoes because he wants to strengthen the muscles in his feet.
  - No swelling or ecchymosis
  - TTP over Achilles tendon
  - No bony TTP
  - Pain increased with dorsiflexion
  - Neurovascularly intact

Achilles Tendinopathy

- Overuse injury of the Achilles tendon
- Thickening and inflammation of the peritendinous tissue

- **Risk Factors:**
  - Increased activity (distance, speed, terrain)
  - Reduced recovery time
  - **Change** in footwear
    - Not as much type of footwear
  - Flat feet
  - Calf tightness

Achilles Tendinopathy



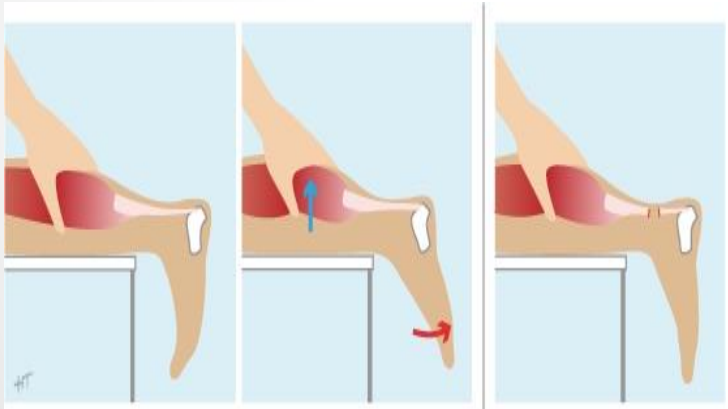
M Childress, A Beutler. Management of Chronic Tendon Injuries. *Am Fam Physician.* 2013 Apr 1;87(7):486-490.

Treatment:

- Ice
- Stretching
- Orthotics
  - Heel lift
- Achilles Exercises
  - Initially with an extended knee
  - Quick rise, slow drop
  - Repeat with flexed knee
- •Physical Therapy

Posterior Heel Pain

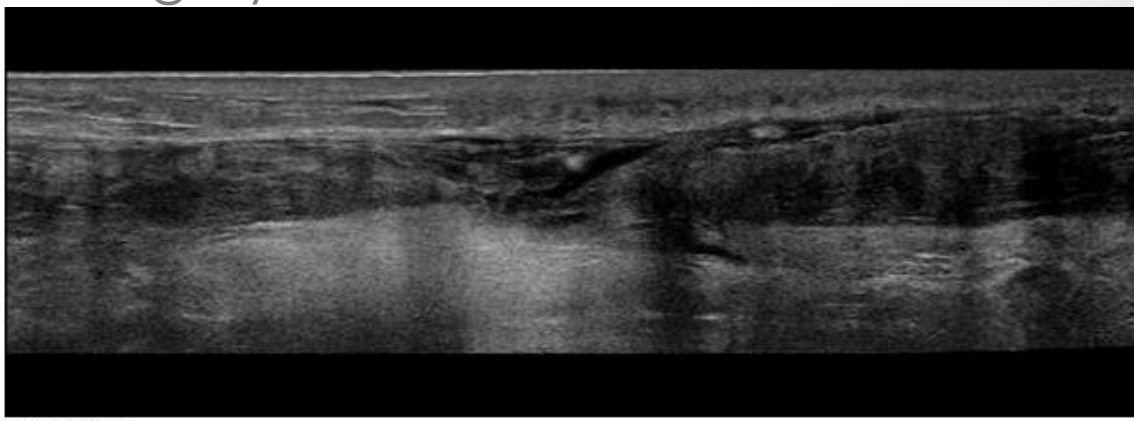
- **Achilles Rupture:**
  - Sudden pain in heel
  - Primarily men 30-40 years old—weekend athletics
  - Cause is forceful dorsiflexion
  - Positive Thompson test



Thompson Negative | **Thompson Positive**

http://www.dgu-online.de/

- **Diagnosis:** Ultrasound
- **Treatment:** Orthopedic Referral. Make NWB and splint. Debate between Plantarflexion Casting or Surgery



Longitudinal

Case 7

- 18 year old male presents with left great toe pain that occurred while playing football this morning. Was pushing off on turf when toe jammed and developed sudden pain. Pain increases with running.
  - Neurovascularly intact
  - Swelling at 1st toe MTP
  - TTP at plantar aspect of 1st toe MTP
  - Weakness of great toe compared to contralateral great toe
  - Increased pain with hyperextension of the 1st MTP

Turf Toe

- **Sprain of the first metatarsophalangeal joint**
  - Caused by forced hyperflexion of the MTP
  - See in football linemen
- **Diagnosis:** Clinical
- **Imaging:** XR usually normal—use to rule out fracture
- **Treatment:** Rest, Ice, NSAIDs, taping, stiff shoe/orthotic, Foot and Ankle follow-up

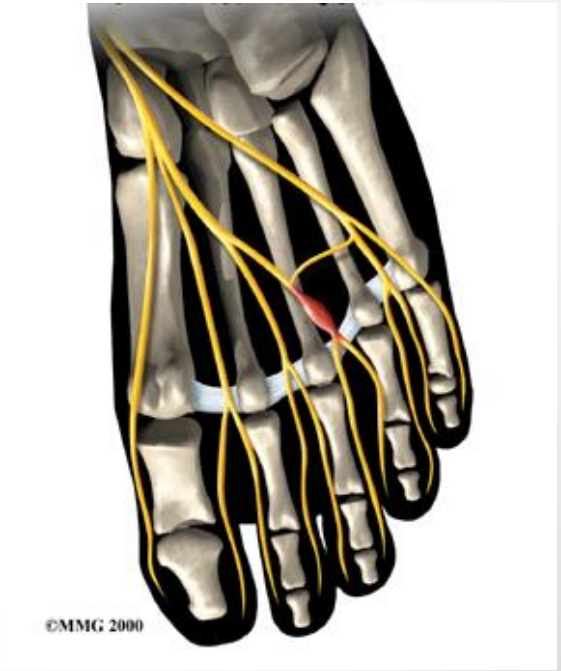
Case 8

- 40 year old female with month of burning pain of foot. Pain radiates into toes at times. Feels like there is a "rock in my shoe," but there isn't one. Pain is worse with running and narrow shoes.
  - Plantar TTP between 3rd and 4th metatarsal head
  - Neurovascularly intact

Morton's Neuroma

- Impingement/Compressive Neuropathy of Interdigital Nerves as they divide at metatarsal head
- Chronic Irritation (compression, tension) of nerves as they transverse metatarsal ligament
- More common in women (9:1)
- Pain radiating into toes
- Parasthesias in 40%
- Plantar TTP at metatarsal joint
- Most common between

  between 3rd and 4th metatarsal head

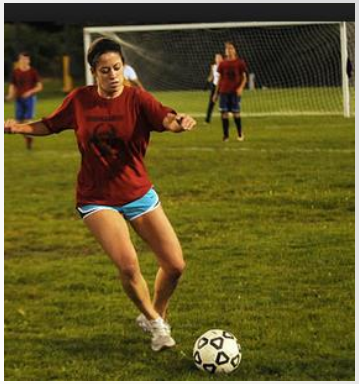


Morton's Neuroma

- **Positive Mulder's Sign:** Squeezing the forefoot from lateral to medial while palpating web space and feel click
- **Imaging:** X-Ray normal, Ultrasound
- **Treatment:** STOP wearing high heels, wide toe box shoes, NSAIDs, steroid injections
  - Surgical excision if chronic and not improved with conservative treatment

A Case Outside of the Box…

Case 9



- 24 year old female presents with right knee pain. Was playing intramural soccer yesterday when another player grazed the outside of her knee. Pain developed on medial knee after the game. She has been able to bear weight since the injury. No popping or locking of the knee.
  - Inspection: Mild Knee Effusion
  - ROM: Full passive and active extension/flexion
  - Strength: 5/5 knee flexion and extension
  - Neurovascularly intact
  - Palpation: No bony TTP, mild TTP over MCL
  - Special Testing: No laxity with varus or valgus stress, negative Lachman, negative Anterior and Posterior Drawer, negative McMurray and able to squat
- without pain

MCL Sprain

- MCL Sprain—Grade 1
  - Mild TTP over MCL
  - Force to lateral knee
  - No laxity
  - Normal ROM
  - Mild severity
- Knee Immobilizer?

Knee Immobilizer

- **Indications For Use:**
  - Instability of Knee
    - Multiple ligaments
    - If this diagnosis is made, should be consulting Ortho
  - Fracture
  - Patella Dislocation
  - Extensor Mechanism Injuries= Ortho Consult
    - Patellar Tendon
    - Quadriceps Tendon
  - Bucket Handle Meniscus Tears
    - Unable to fully extend
  - Extreme Pain
    - Consider if you are missing something
    - Should arrange follow-up prior to discharge
  - +/- ACL Tear
    - BRIEF rest period—then early ROM and pre-op PT

Knee Immobilizer

- **NOT Indications For Use:**
  - Osteoarthritis with Effusion
  - Unsure of knee injury
    - Should be pretty confident why it is being provided
  - "Internal Derangement of Knee"
  - Knee Sprain
    - LCL or MCL

Knee Immobilizer

- Reasonable to provide Knee Immobilizer for acute knee rest and to decrease inflammation after injury

- Problem is the patient wears knee immobilizer continuously until follows up
  - Days to Weeks to Never Following Up
  - Significant decreased ROM, weakness, atrophy and stiffness develop
    - Patient education is key—take it off frequently, ROM, early follow-up

- Most Orthopedic Surgeons will not operate until effusion resolves and many will start "prehab" PT prior to surgery to improve strength
  - Aids in post-op recovery
  - Improved outcomes

AAFP Guidelines

- Complete immobilization of the knee for an extended period is generally contraindicated because of the prolonged stiffness, muscle atrophy, and chronic pain that result
- Indications for the use of a knee immobilizer include the acute (or presurgical) management of:
  - Quadriceps rupture
  - Patellar tendon rupture
  - Medial collateral ligament rupture
  - Patellar fracture or dislocation
  - Limited number of other acute traumatic knee injuries

Questions?

Resources

D Judd, D Kim. Foot Fractures Frequently Misdiagnosed as Ankle Sprains. *Am Fam Physician*. 2002 Sep 1;66(5):785-795.

K Burroughs, C Reimer , K Fields. Lisfranc injury of the foot. *Am Fam Physician* 1998;58:121

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P Tu, J Bytomski. Diagnosis of Heel Pain. *Am Fam Physician*. 2011 Oct 15;84(8):909-916.

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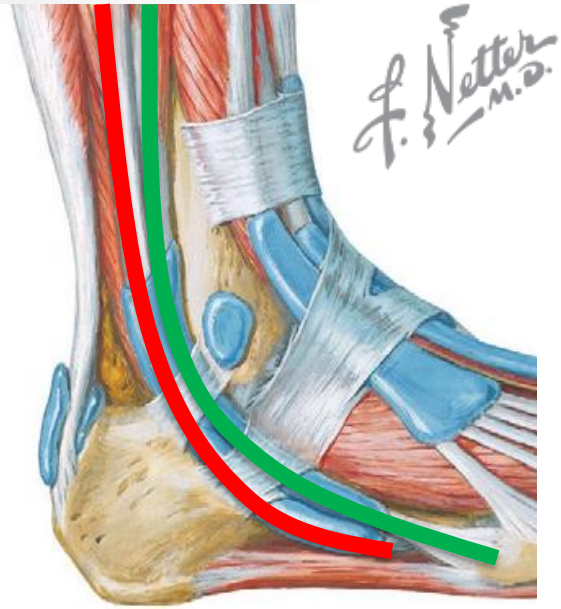
Brunkner, Peter; Khan, Karim; et al. Clinical Sports Medicine. McGraw-Hill: Australia, 2006. Print.

Madden, Chris. Netter's Sports Medicine. Saunders Elsiever. 2010.

Case 5

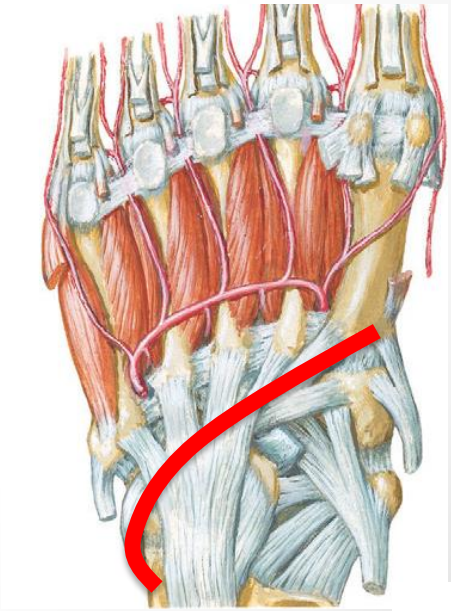
- 40 year old male sustained an inversion injury of his ankle while playing sand volleyball 2 weeks ago. Presents today with persistent pain in lateral lower ankle. Diagnosed with ankle sprain immediately after by his PCP and had normal X-Ray.
  - Had ecchymosis and pain inferior to lateral malleolus
  - No longer has ecchymosis or swelling
  - TTP inferior to lateral malleolus
  - Pain reproduced with resisted eversion
-

Peroneal Tendon Injury



Peroneus longus:

- Proximal lateral fibula → plantar surface of the proximal 1st metatarsal
- Eversion and plantarflexion



Peroneus brevis:

- Lateral fibula → base of the 5th metatarsal
- Eversion

Peroneal Tendon Injury

Examination:

- TTP of peroneal tendons as they pass posterior to the lateral malleolus
- Pain with resisted eversion
- Pain with passive inversion
- Tendon snapping with resisted eversion and dorsiflexion

Imaging:

- Ultrasound

Management:

- Ice, rest, and NSAIDS
- Walking boot for 2-4 weeks to allow for rest
- Tendon dislocation/subluxation may require Ortho operative management

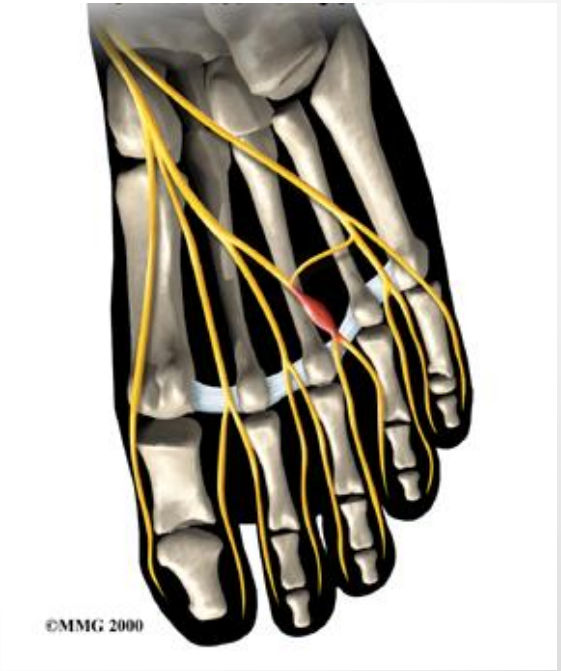
Case 6

- 40 year old female with month of burning pain of foot. Pain radiates into toes at times. Feels like there is a "rock in my shoe," but there isn't one. Pain is worse with running and narrow shoes.
  - Plantar TTP between 3rd and 4th metatarsal head
  - Neurovascularly intact

Morton's Neuroma

- Impingement/Compressive Neuropathy of Interdigital Nerves as they divide at metatarsal head
- Chronic Irritation (compression, tension) of nerves as they transverse metatarsal ligament
- More common in women (9:1)
- Pain radiating into toes
- Parasthesias in 40%
- Plantar TTP at metatarsal joint
- Most common between

  between 3rd and 4th metatarsal head



Morton's Neuroma

- **Positive Mulder's Sign:** Squeezing the forefoot from lateral to medial while palpating web space and feel click
- **Imaging:** X-Ray normal, Ultrasound
- **Treatment:** STOP wearing high heels, wide toe box shoes, NSAIDs, steroid injections
  - Surgical excision if chronic and not improved with conservative treatment

Case 10

- 24 year old female runner training for a marathon with one month of heel pain. Initially, only had pain with running, now having pain with walking.
  - Pain increased with weight bearing
  - Tenderness over the medial-lateral calcaneus
  - Pain with calcaneal squeeze testing

www.medscape.com

Imaging

- Start with Radiographs—Lateral and Heel X-ray
- If X-Rays are normal and clinical suspicion remains high, consider CT or MRI

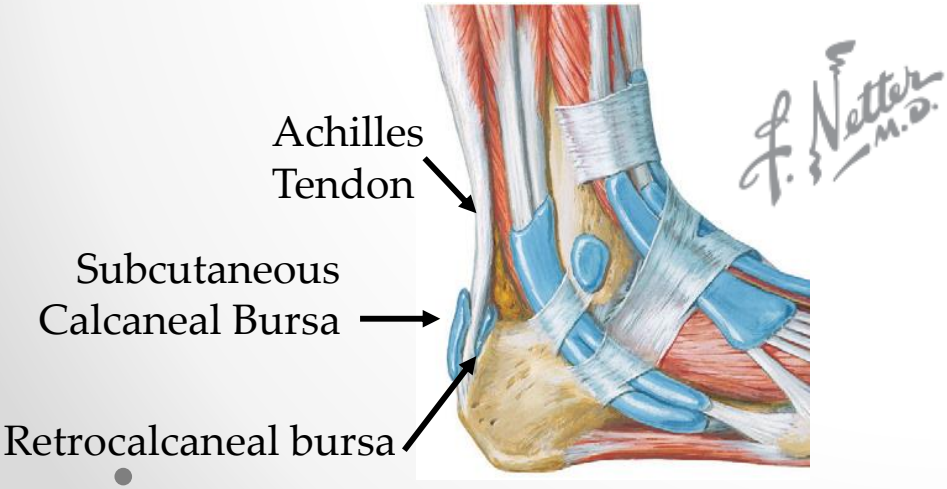
N Dobson, E Dobson, P Shromoff. Imaging Imaging Strategies for Diagnosing Calcaneal and Cuboid Stress Fractures. Clinics in Podiatric Medicine and Surgery, 2008-04-01, Volume 25 (2), 183-201.

Management of Calcaneal Stress Fracture

- Reduction in activity to pain free activity
  - If pain with walking, may need to be non-weight-bearing until pain free with walking
  - Slow progression back into activity, again reducing impact if pain returns
  - Addition of heel cushions or orthotics if needed
  - Assessment of calcium and vitamin D status
- Full healing usually takes 2-3 months

Posterior Heel Pain

- **Haglund's Syndrome (Retrocalcaneal Bursitis)**
  - Insidious onset of pain in posterior heel
  - Due to swelling of bursa between Achilles and calcaneus
  - Better when barefoot or in open-backed shoes
  - Associated with Haglund's deformity
    - Normal variant – posterolateral calcaneal prominence
  - **Treatment:** RICE, NSAID, heel cord stretching, PT



T Tu, J Bytomski. Diagnosis of Heel Pain. *Am Fam*

Case 11

- 35 year old woman sustained an inversion injury of her ankle while playing basketball. Came down on another players foot after jumping for a rebound
  - Diagnosed with ankle sprain
  - Persistent pain in the anterior ankle after 6 weeks
  - Intermittent ankle swelling
  - Feels ankle catching and locking

Talar Osteochondral Defect

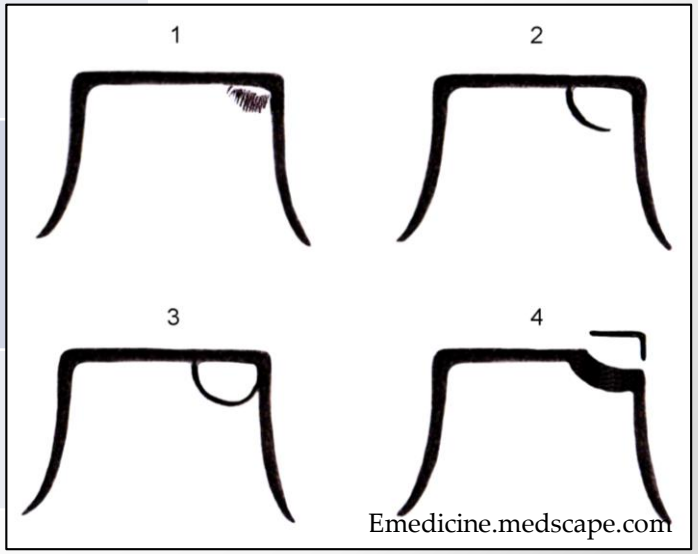
- Ankle sprains with associated compressive forces (landing from a jump)
- Often with inversion injury, but many after no trauma
- Most commonly in the superomedial dome

- **Symptoms/Exam:**
  - Swelling, pain, catching and locking
  - TTP over Talus and not over ligament
- **Imaging:**
  - X-Ray: May see on Mortis View
  - CT
  - MRI
- **Treatment:**
  - Non-Op: Short Leg Cast and NWB x 6 weeks
  - Operative: Arthroscopy

D Judd, D Kim. Foot Fractures Frequently Misdiagnosed as Ankle Sprains. *Am Fam Physician*. 2002 Sep 1;66(5):785-795.

Talar Osteochondral Defect

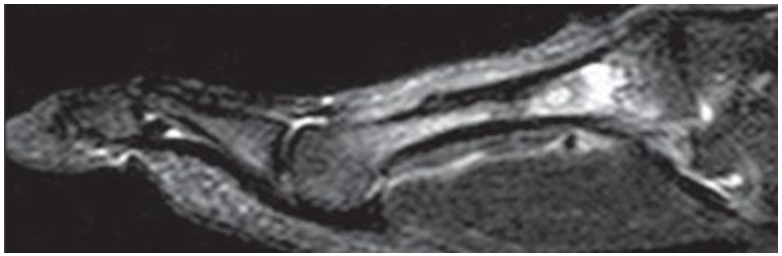
	Defect	Management
Grade I	Articular cartilage injury only	Conservative
Grade II	Articular cartilage injury with underlying fracture	Conservative (Joint motion w/out loading –bike)
Grade III	Detached, but not displaced fragment	Potentially Surgical
Grade IV	Displaced fragment	Surgical



Case

- 17yo ballet dancer presenting with increasing pain in her forefoot with dancing. No pain with walking. Pain improved some with a week of rest, but returned when she started dancing again.

derness over the 2nd metatarsal



Metatarsal Stress Fractures

- Risk Factors
  - High arches
  - Repetitive impact activity (running, marching, dancing)
- Avoidance of painful weight-bearing
  - Non-weight-bearing with crutches if pain with walking
- Slow return to normal activity when pain free with walking and to palpation over the stress injury
  - May need orthoses to help prevent future injury

DDx of Heel Pain

- Calcaneal stress fracture/traumatic fracture
- Plantar fasciitis
- Fat pad atrophy
- Achilles tendinopathy
- Achilles Bursitis (Haglund deformity)

DDx Ankle Pain

- Ankle Sprain
- Syndesmotic injury (High Ankle Sprain)
- 5th metatarsal fracture
- Navicular fracture
- Peroneal Tendon Injury
- Fractures
  - Fibula
  - Tibia
  - Talus
  - Calcaneus
- Achilles tendon injury

Posterior Heel Pain

- **Sever's disease—Calcaneal Apophysitis**

  =Painful inflammation of calcaneal growth plate

  - #1 cause of posterior heel pain in kids 9-14 years old
  - Increased pain with growth spurt—changing biomechanics
  - **Risks:** Microtrauma with running (soccer), decreased Achilles and Hamstring flexibility
  - **Positive Sever's Test:** Heel pain aggravated by standing on tip toes
  - Improved with rest, heel lifts, stretching, ice, NSAIDs, out grow

Tenderness over normal appearing physis = apophysitis

Plantar Fascia Injection

Risks:

- Painful procedure
- High Complications
- Problem returns if cause not addressed
- Plantar fascia rupture
- Fat pad atrophy
- Skin hypopigmentation

A Tallia, D Cardone. Diagnostic and Therapeutic Injection of the Ankle and Foot. *Am Fam Physician.* 2003 Oct 1;68(7):1356-1363.