



Common Foot and Ankle Problems

Cindy J. Chang, MD, FACSM, FAMSSM

Professor Emeritus, UCSF Primary Care Sports Medicine
Chief Medical Officer, National Women's Soccer League
Past President, AMSSM (2011-2012)
Past Member, Board of Trustees, ACSM (2016-2019)



Disclosure

- NWSL: Chief Medical Officer
- USRowing: Team Physician, Medical and Sports Science Committee
- NFL: Research and Innovations Committee
- AMSSM Foundation: Board Member
- Wu Tsai Human Performance Alliance: Sports Advisory Council
- Korey Stringer Institute: Medical and Science Advisory Board
- Baseline Global: Medical Advisory Board
- Agency for Student Health Research: Medical Advisory Board

The views presented are my own and not reflective of any of the organizations for whom I consult or provide services.

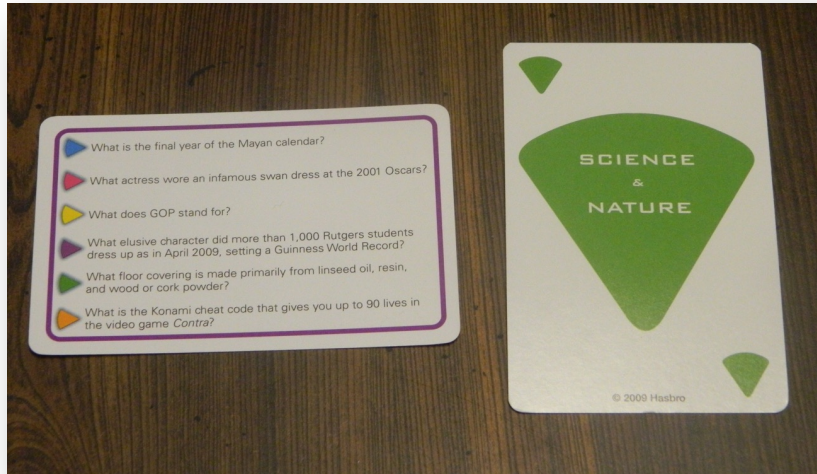
Objectives

- Explain the associated *physical exam findings* for common foot and ankle problems
- Develop *evidence-based treatment plans* for common foot and ankle problems
- Identify indications on *when to refer* foot and ankle problems for subspecialty care



How Many Bones are in the Foot?

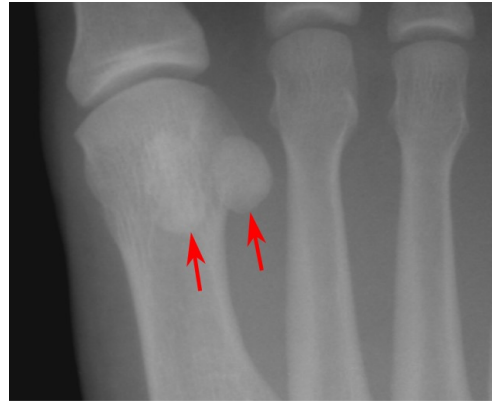
- A. 22
- B. 24
- C. 26
- D. 28
- E. 30



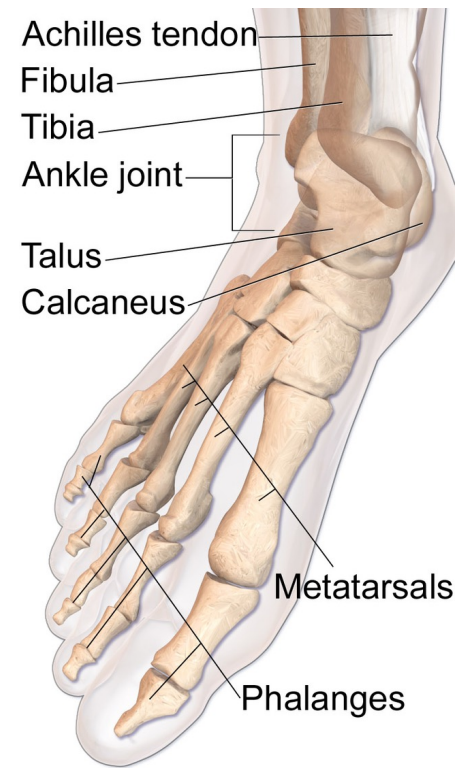
How Many Bones are in the Foot?

C. **28**

- 7 tarsal bones
 - talus, calcaneus, cuboid, navicular, and 3 cuneiforms
- 5 metatarsals
- 14 phalanges
- 2 sesamoids



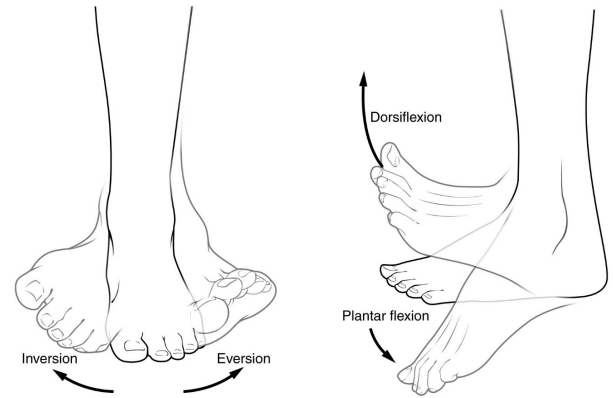
[File:Sesamoidbone.png](#)



Lower Leg and Foot

It's a complex joint

- 28 bones, 33 joints, 112 ligaments, 13 extrinsic and 21 intrinsic muscles
- Can be *rigid or flexible* when needed
 - support body weight
 - provide balance and shock absorption
 - transfer ground reaction forces
 - compensate for proximal malalignment
 - substitute hand function



Case #1

- 16 yo playing in pick-up basketball game and turned ankle inwards after a rebound when coming down on another foot
- Felt a pop; unable to bear weight
- Immediate swelling on the outside and front of ankle
- Able to limp into your exam room the next day; points to lateral ankle as area of most pain

Which of the following is an indication to order XRays?

- A. Feeling or hearing a pop
- B. Inability to walk for 4 steps immediately after the injury
- C. Any bruising along the lateral and/or medial malleolus
- D. Tenderness on palpation along posterior edge of medial malleolus
- E. Numbness around the area of swelling

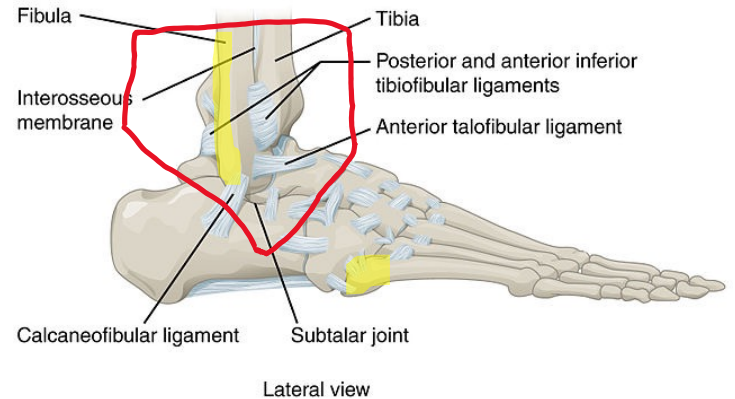
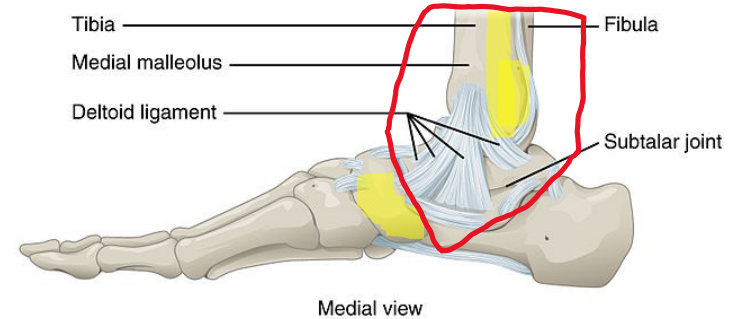
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Ottawa Ankle and Foot Rules

- Inability to weight bear immediately **and** in the emergency / office (4 steps)
- Any pain in the malleolar zone and bone tenderness at the distal 6 cm of posterior edge of the medial or lateral malleolus (Obtain **Ankle Series**)
- Any pain in the midfoot zone and bone tenderness over the navicular or base of the fifth metatarsal (Obtain **Foot Series**)

Sens 97%, Spec 31-63%, NPV 99%, PPV <20%



Bachmann LM et al BMJ 2003

Anatomy & Physiology, Connexions Web site.
<http://cnx.org/content/col11496/1.6/>, Jun 19, 2013.

Ottawa Ankle and Foot Rules + Bedside MSKUS

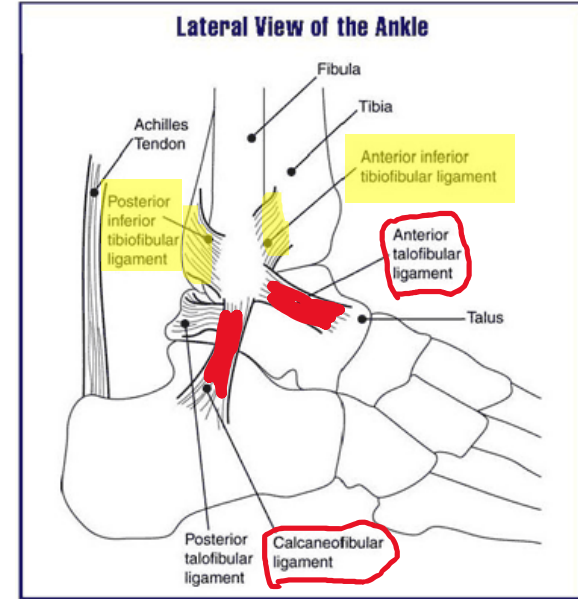
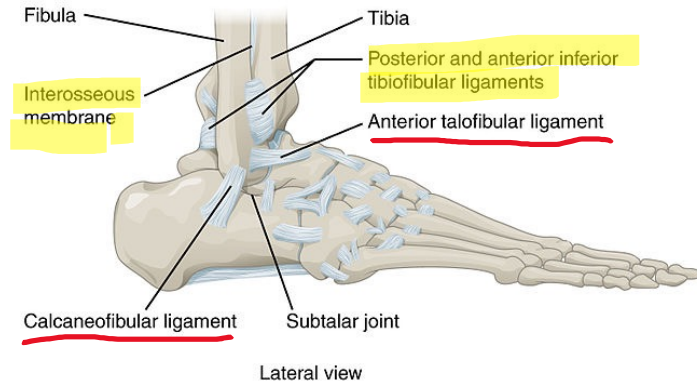
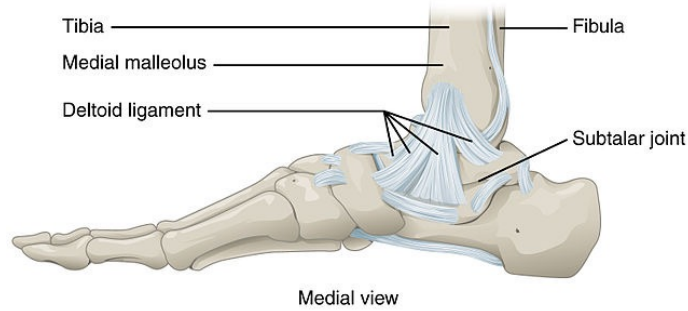
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- Any pain in midfoot zone and bone tenderness over the navicular or base of the fifth metatarsal (Obtain **Foot Series**)
- **Before viewing XR, performed bedside MSKUS of medial and lat malleoli, navicular, base of 5th MT**

Sens 100%, Spec 100%, NPV 100%, PPV 100%

Case #1

■ Differential Dx

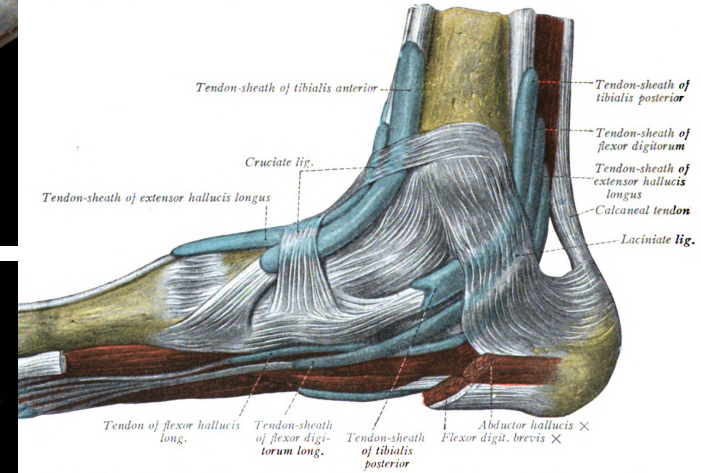
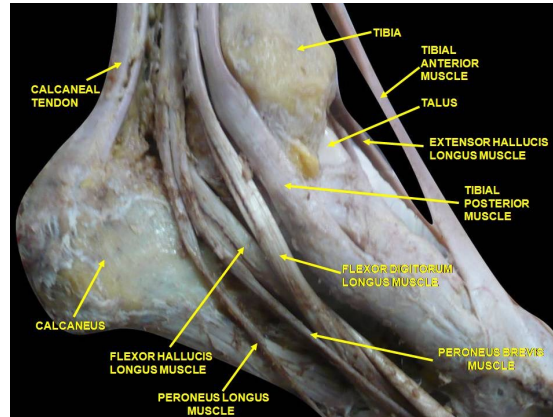
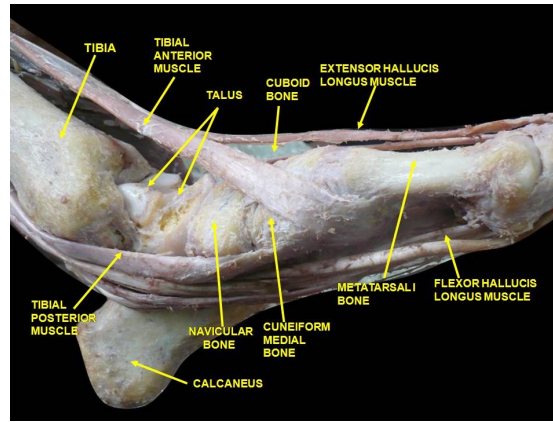
- Fracture
- Ligament sprain
- Tendon strain
- Retinaculum tear



Case #1

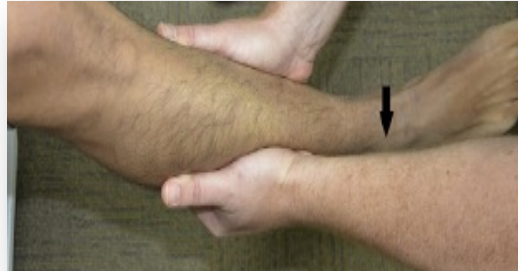
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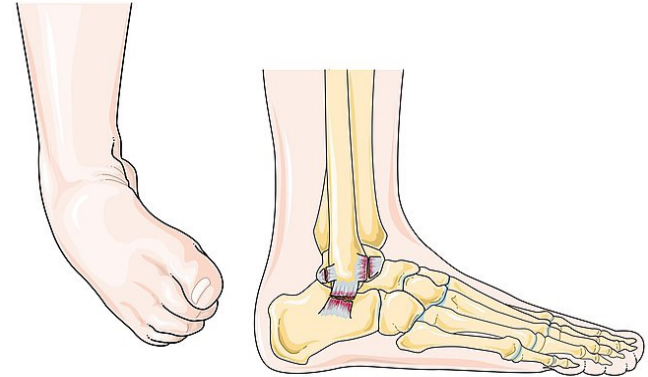
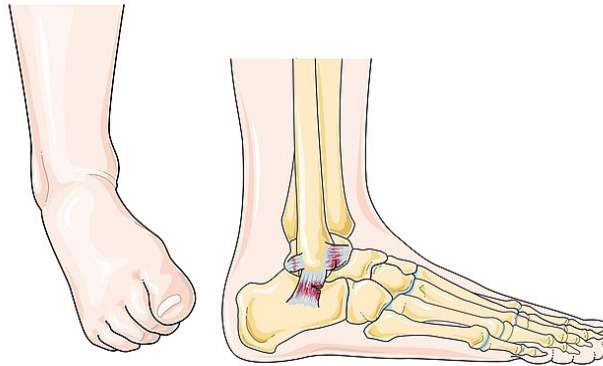
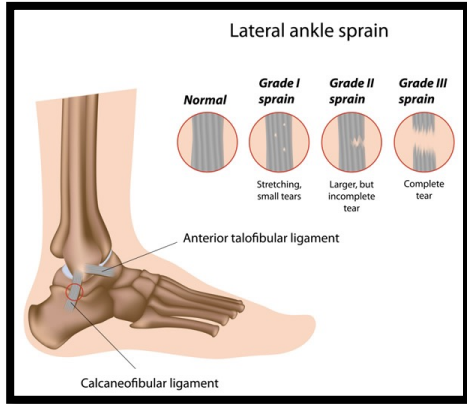
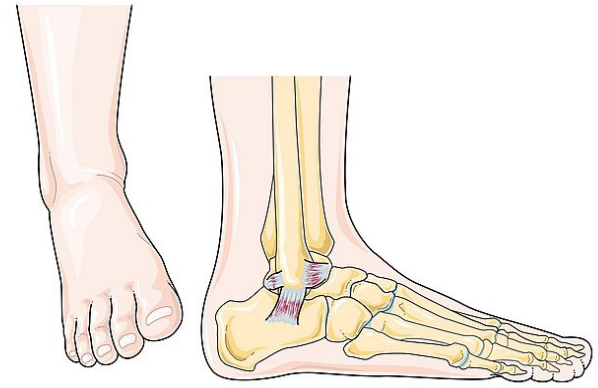
Case #1

- Moderate fusiform swelling of ankle; swelling lateral ankle
- Ecchymosis inferior to lateral malleolus
- + Squeeze test
- No pain
 - Fibular head
 - 5th MT



Case #1

- 2+ anterior drawer
- 2+ lateral talar tilt

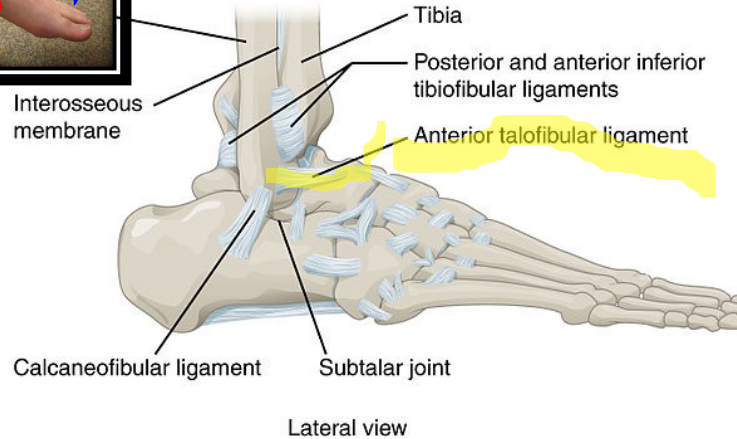
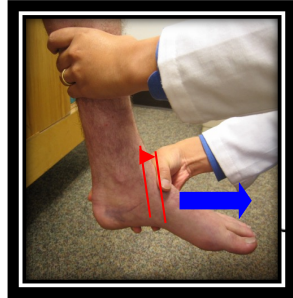


Case #1

- 2+ anterior drawer

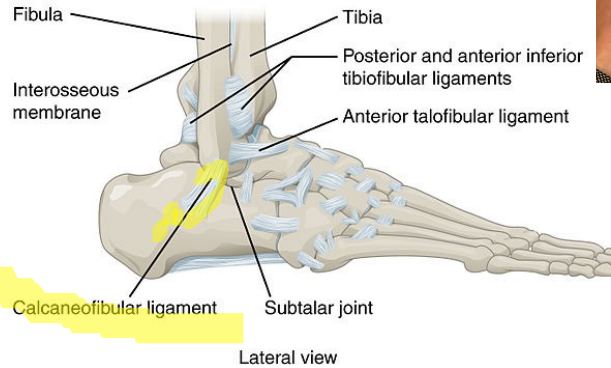
Sens = 80%
Spec = 74%

PPV = 91%
NPV = 52%



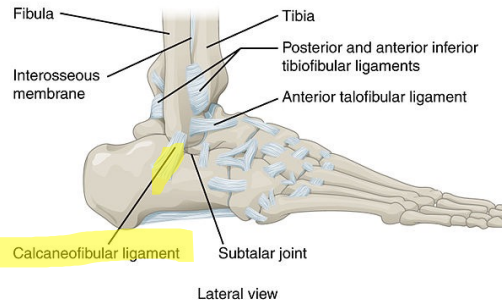
Case #1

- 2+ lateral talar tilt
- Stable medial talar tilt



Case #1

- 2+ lateral talar tilt
- Stable medial talar tilt

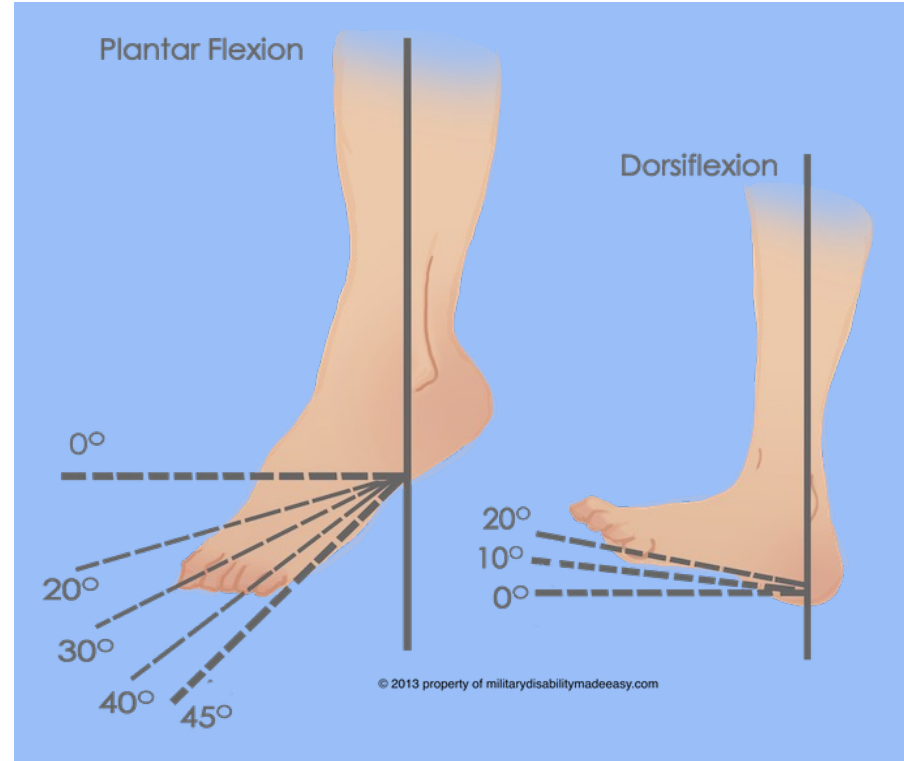


Correlating Grade of Ankle Sprains to Recovery

Grade	Drawer/Tilt Test results	Pathology	Functional Recovery in weeks
1	Drawer and tilt negative, but tender	Mild stretch with no instability	2 – 4
2	Drawer lax, tilt with good end point	ATFL torn, CFL and PTFL intact	4 – 6
3	Drawer and tilt lax	ATFL and CFL injured/torn	6 – 12

Case #1

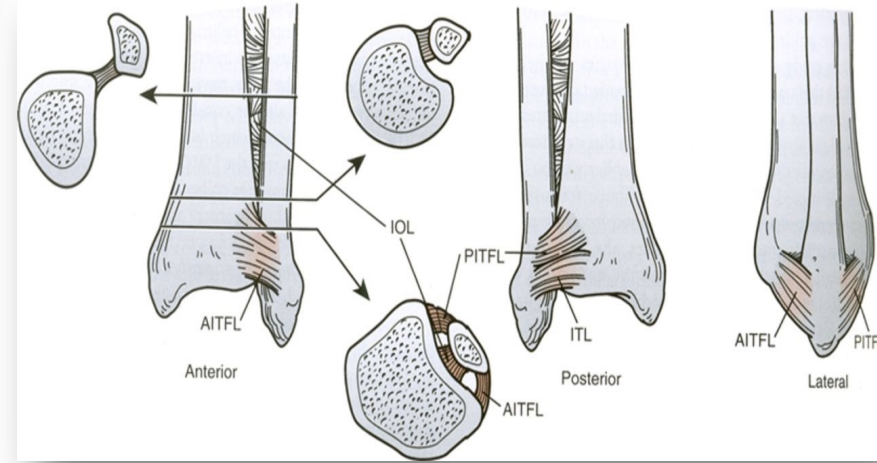
- Decreased range of motion
 - Due to swelling, pain
- Normal *overall* ROM = 65 – 75 deg
 - DF = 10 – 20 deg
 - PF = 40 – 55 deg



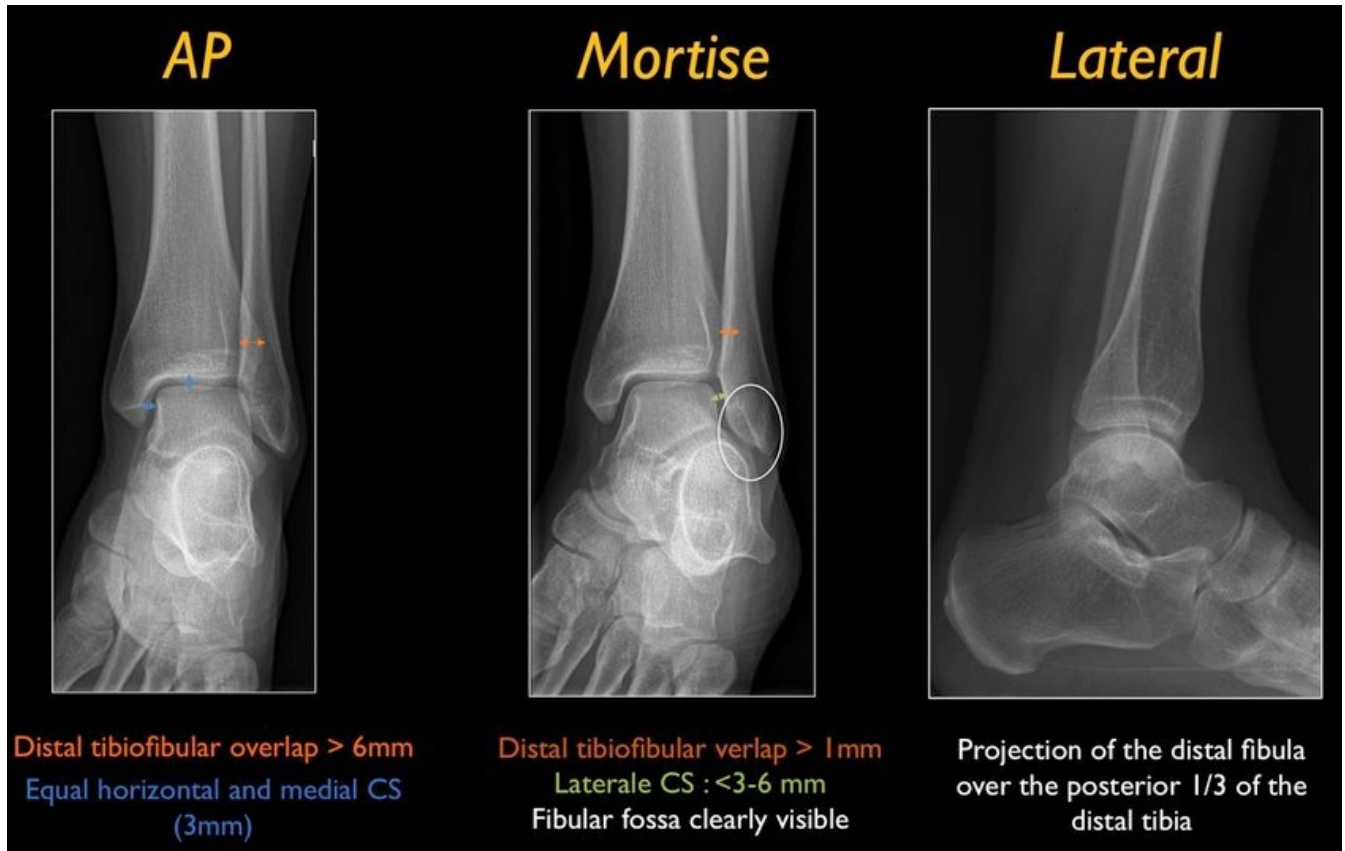
Grimston et al. Foot Ankle Int, 1993

Case #1

- Syndesmosis injury
 - “high” ankle sprain



Normal Ankle X-Ray



Case #1?



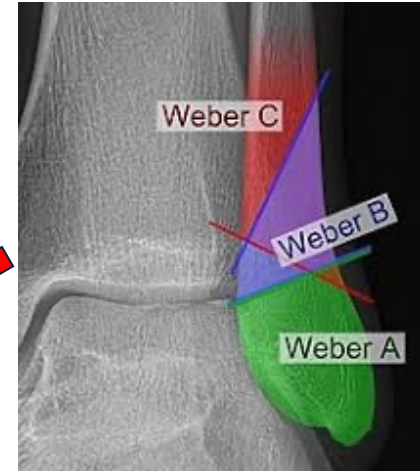
Ankle Fractures – Treatment

- If associated fracture, consider referral to subspecialist
 - Avulsion fractures
 - If small, treat like severe lateral ankle sprain
 - Healing 6 – 8 wks



Ankle Injuries – Treatment

- If associated fracture, consider referral to subspecialist if unstable
- Distal fibula fracture – determine if unstable
 - A – stable below level of syndesmosis
 - B – stable if displacement < 2 mm, MCS < 4 mm
 - C – usually ORIF



Ankle Fractures – Treatment

- Unstable fracture, referral to subspecialist
 - Maisonneuve fracture –
 - ORIF and deltoid repair
 - Consider arthroscopy for possible surg intervention of cartilage lesions



Grade 2/Grade 3/Syndesmosis Ankle Sprains – Treatment

- If fracture ruled out:
 - < 12 y/o = short leg walking cast or CAM walker ~ 3 weeks then PT
 - > 12 y/o = CAM walker ~ 3 weeks and PT starting week 1 for controlled ROM and strengthening
 - Immobilization may be shortened or lengthened based on severity of sprain and patient
 - Physical therapy is key to prevent future sprains



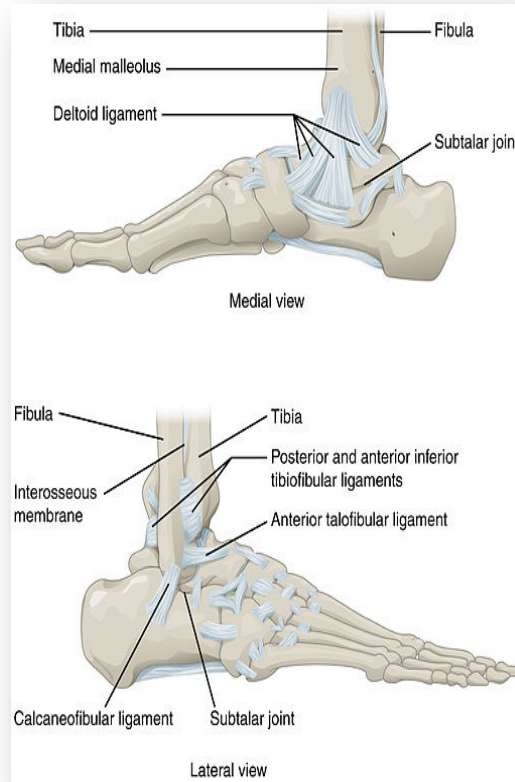
Peroneal Retinaculum Tear – Treatment

- If visualize subluxation or dislocation of peroneal tendons:
 - Refer to Subspecialist
 - Non-operative
 - Cast/immobilize x 4-6 wks but high rate (50%) of recurrence
 - Acute repair in athletes



Case #1a

- Patient is 10 yo

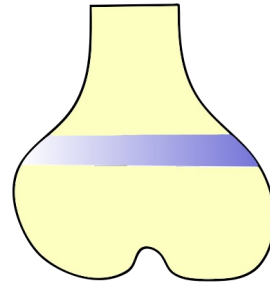


Case #1a

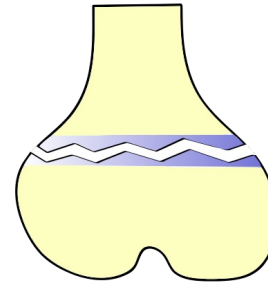
- Patient is 10 yo

- Salter-Harris Classification

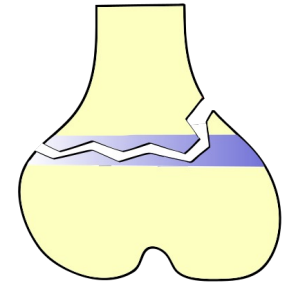
 - S-A-L-T-E-R



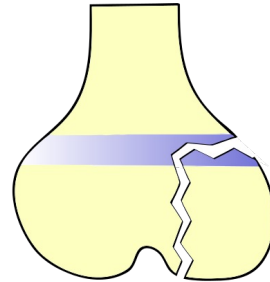
Normal



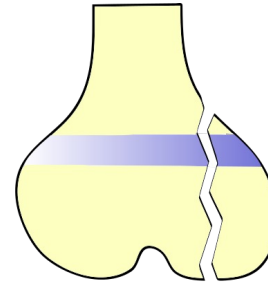
Type 1 - 5%



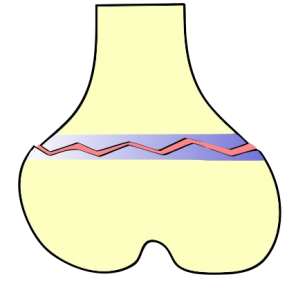
Type 2 - 75%



Type 3 - 10%



Type 4 - 10%

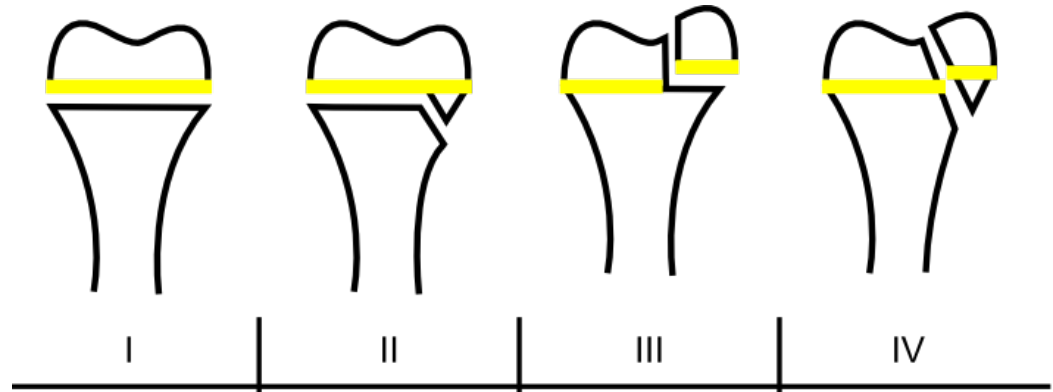
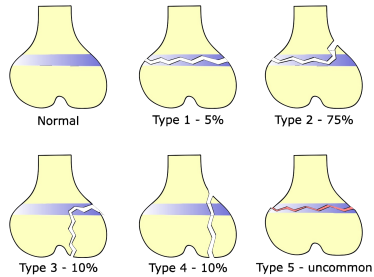


Type 5 - uncommon

F. Gaillard
2008

Case #1a

■ Patient is 10 yo



I – **S** = **S**traight across Fracture of the cartilage of the physis (growth plate)

II – **A** = **A**way from The fracture is Away from the joint (“Above” the physis)

III – **L** = **L**eading to The fracture is Leading to the joint (“beLow” the physis in the epiphysis)

IV – **TE** = **T**hrough **E**verything. The fracture is through the metaphysis, physis, and epiphysis.

V – **R** = **R**ammed (crushed). The physis has been crushed.

Salter-Harris Fractures of Ankle– Treatment

- If non-displaced:
 - SH-I: aircast, CAM walking boot, SLC for comfort; Immediate weight bearing as tolerated
 - SH-II: SLC and NWB initially to progress to WB if remains stable after XR q wk x 2
- If displaced, or SH-III or higher:
 - Refer for possible closed reduction (followed by LLC x 4-6 wk with knee flexed and NWB x 6 wk) or Refer for possible ORIF



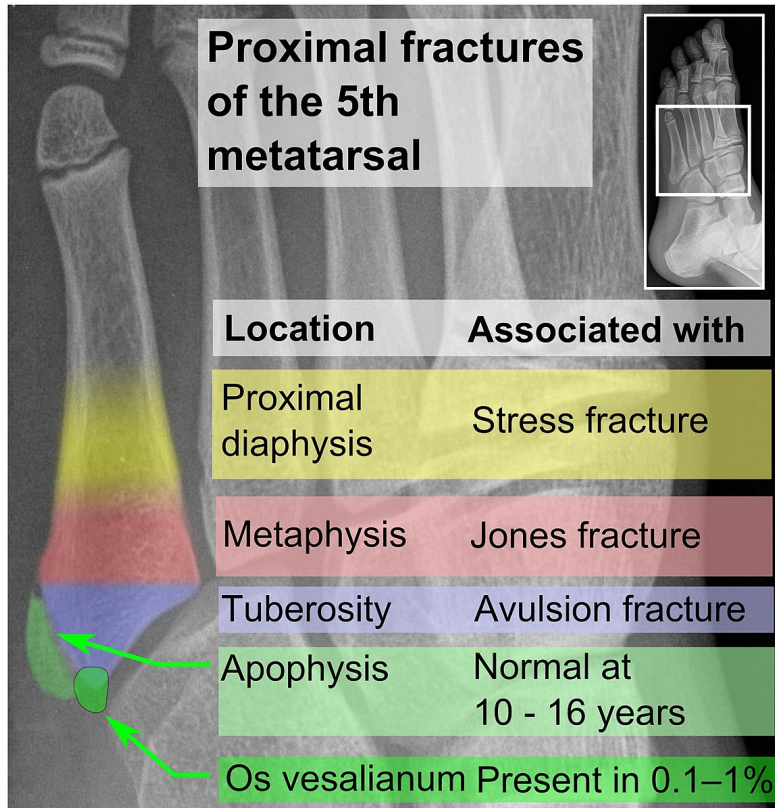
Case #1c

- Patient also has 5th MT pain
 - Order the correct XR!



Case #1c

Proximal fractures of the 5th metatarsal

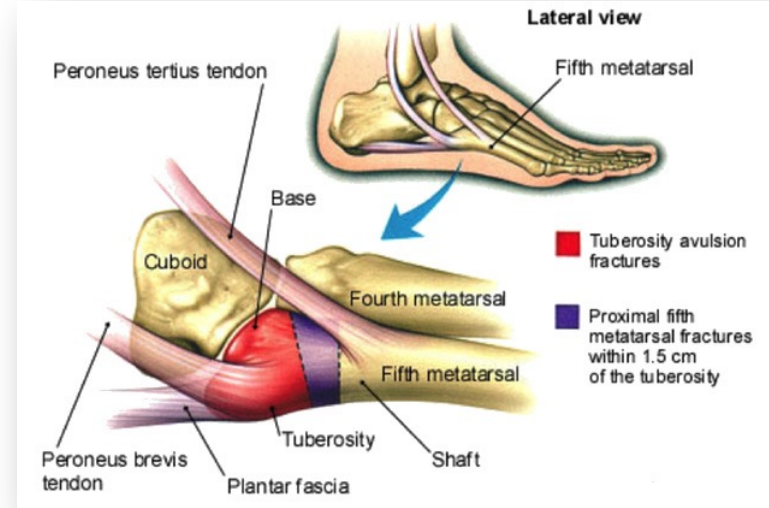


Location	Associated with
Proximal diaphysis	Stress fracture
Metaphysis	Jones fracture
Tuberosity	Avulsion fracture
Apophysis	Normal at 10 - 16 years
Os vesalianum	Present in 0.1–1%

Zone 3

Zone 2

Zone 1



Case #1c – Zone 1

Non-displaced

- Hard sole shoe, walking boot or cast
- Weight bearing as tolerated
- Sx-free in 3-6 wks; xray union in 8 wks
- Rarely may have fibrous union

Displaced/comminuted/ $>30\%$ of joint surface – Refer to ortho



Case #1c – Zone 2 (Type I)

- Type I (acute) – NWB SLC 6-8 wks
 - No intramedullary sclerosis
 - Fx line sharp, no widening
- Discuss referral for possible surgery in higher level athlete
 - Non-union up to 30%
 - Re-fracture rate up to 50%



Case #1c – Zone 2 (Type II)

- Type II, delayed - surgery
 - Fx line both cortices w/periosteal bone
 - Widened fx line w/ bone resorption



Case #1c – Zone 2 (Type III)

- Type III, non-union - surgery
 - Sclerotic bone obliterating medullary canal at fx site



Case #1c

- Patient is 10 yo; also has 5th MT pain
- Iselin's disease



The Pediatric Foot



3 yo



9 yo



15 yo

Case #1d

- Patient w/ recurrent sprains; never gotten back to 100%
 - R/O tarsal coalition, osteochondritis dissecans (OCD) of talus



Case #2

- 26 yo crashed when cycling in wine country
- R foot got caught in pedal strap as fell off bike
- Could bear weight then became painful to pedal
- R foot more swollen, went to urgent care
- Xrays normal; told to stay off feet for weekend, given crutches
- Comes to see you on Monday; still hurts to walk



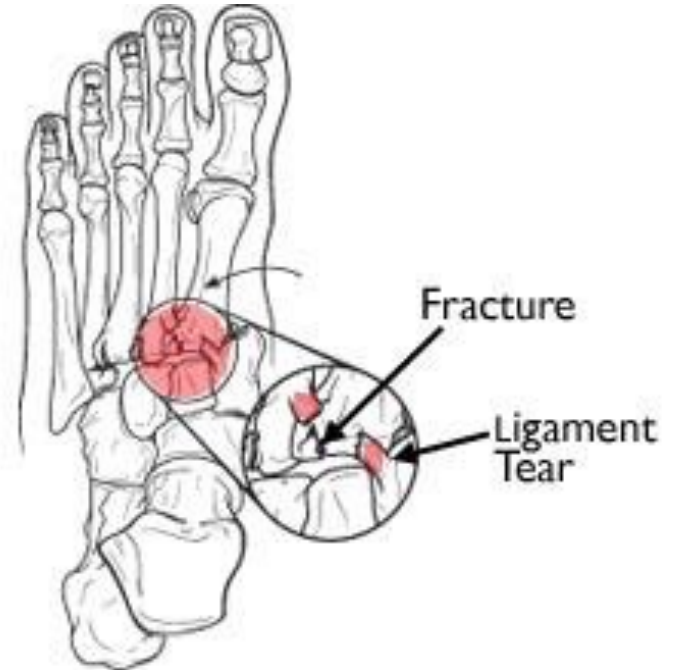
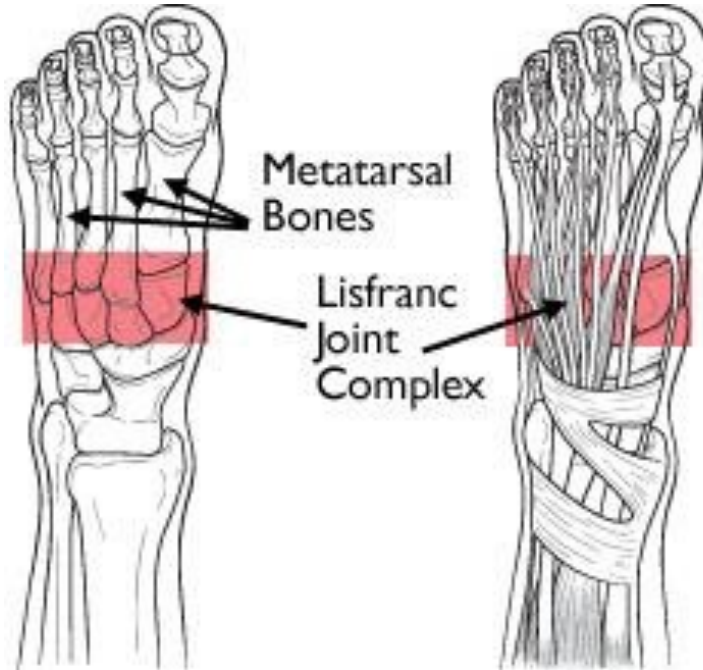
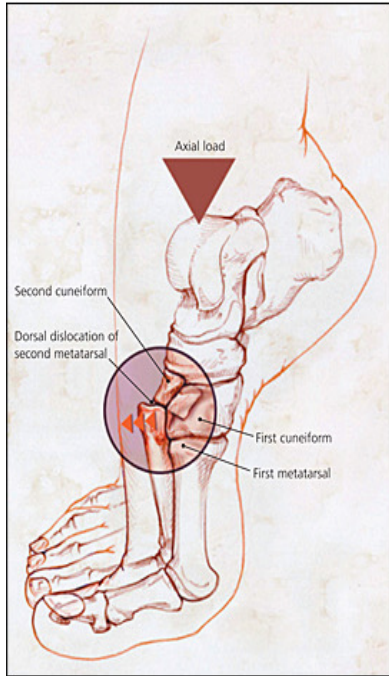
Of the following, what is the most important question to ask?

- A. How many times a day have you been icing?
- B. Were you standing or sitting for your X-rays?
- C. Have you been keeping it wrapped in a compression type of bandage?
- D. Do NSAIDs help with pain and swelling?
- E. Were you drinking more Cabernet or Chardonnay?

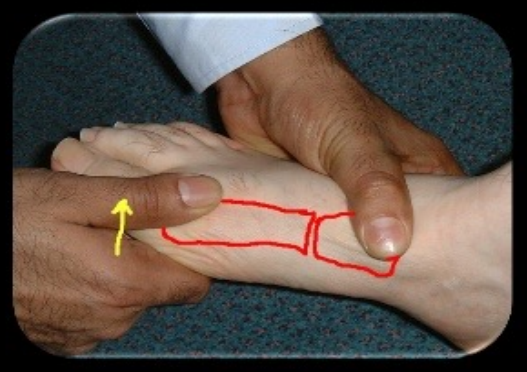
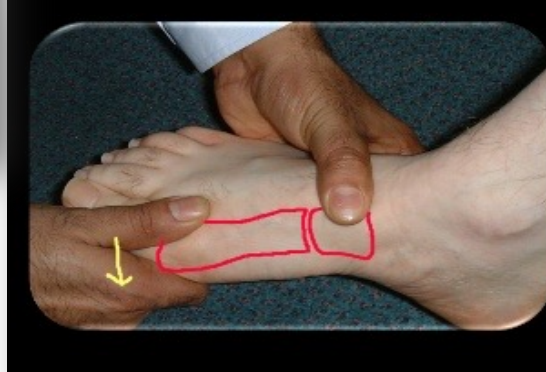
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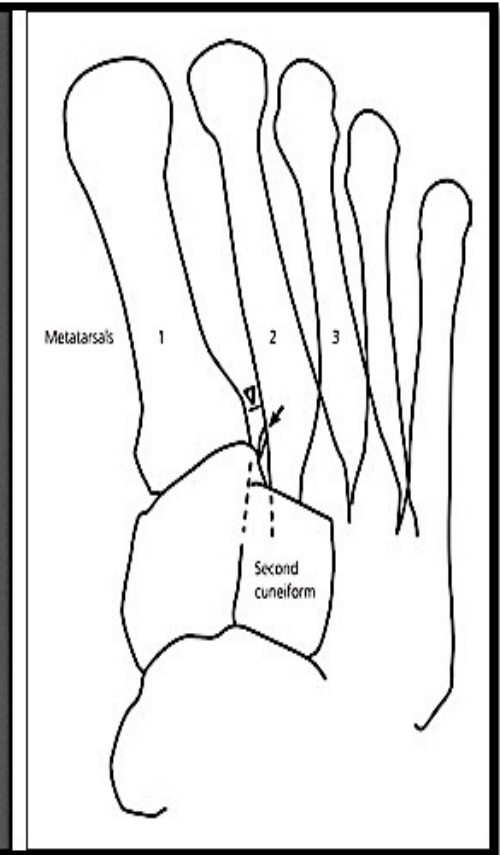
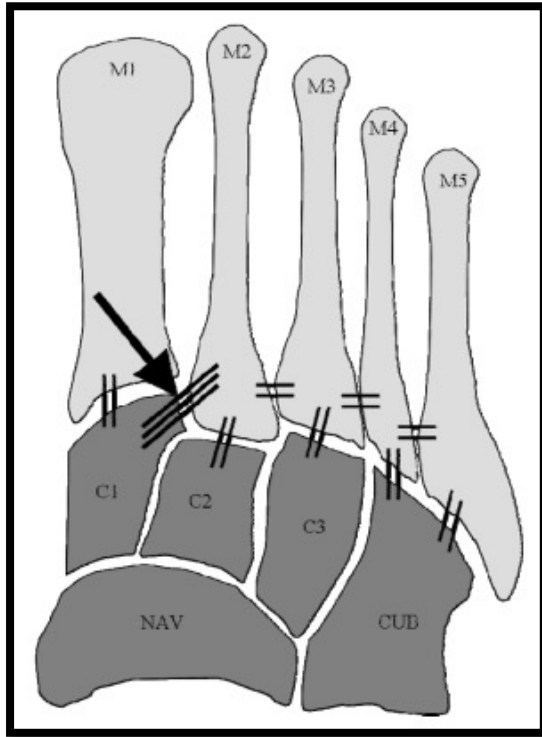
Case #2



Case #2



Case #2



Case #2



Case #2

- Stage 1: NWB/WB in SLC/CAM boot x 2-8 wks
 - Stable, <2 mm separation between the bones
 - Follow closely, consider MRI
- Stage 2 and Stage 3: refer
 - Stage 2: Separation of up to 5 mm b/w medial cuneiform and base of 2nd MT; no loss of medial arch height on WB xrays
 - Stage 3: Separation > 5 mm and loss of medial arch height

Chen J et al, Foot & Ank Specialist 2020

Case #3

- 36 yo had begun training program with a goal to compete in first half marathon
- Just moved to San Francisco from Chicago
- Begins to run usual daily 3-mile distance
- After 1 week began to have pain in medial ankle at end of run
- Now it hurts even during walking, in AM getting out of bed, and getting up after prolonged sitting

What other questions would be helpful in arriving at the diagnosis?

- A. Is there any radiation of pain?
- B. Have you injured this ankle before?
- C. What type of shoes are you wearing during your run?
- D. Where do you run in San Francisco?
- E. All of the above



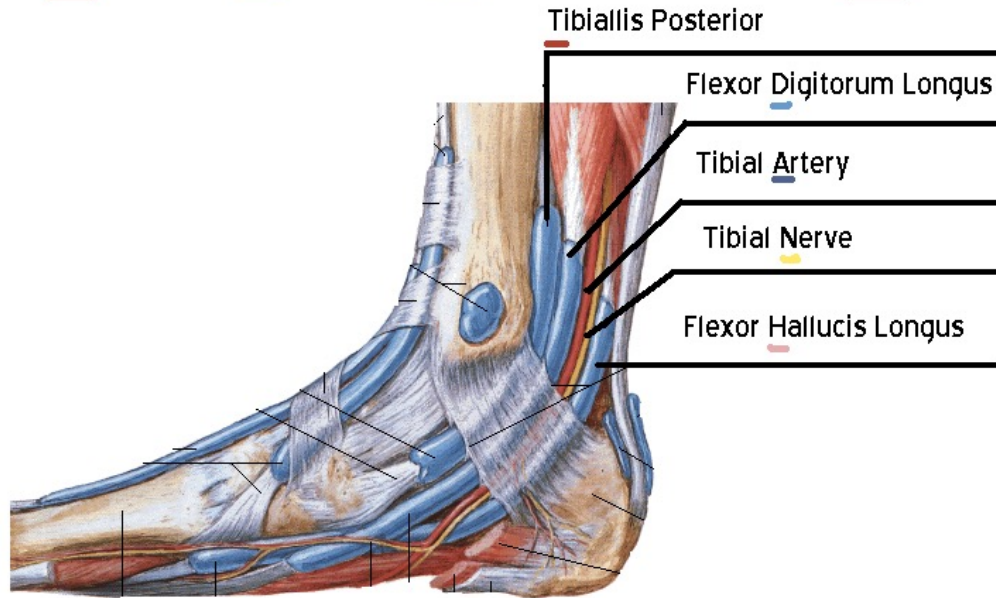
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- D. Where do you run in San Francisco?
- E. All of the above



Ankle and Foot Anatomy-Medial

Tom, Dick, And Nervous Harry



Tibialis Posterior



Case #3: Tibialis Posterior Tendinitis

■ Etiology

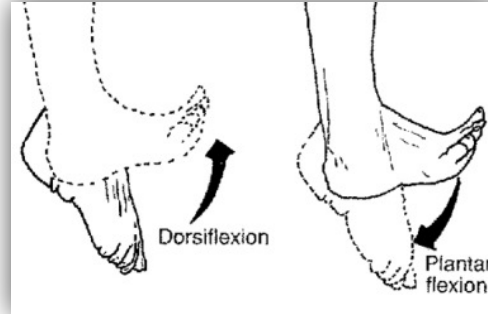
- Typically overuse/overload (too much, too soon)
- Poor footwear for pronated feet



Case #3: Tibialis Posterior Tendinitis

■ History:

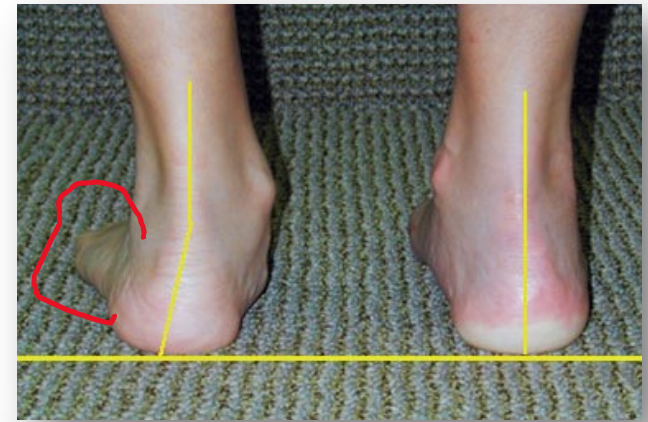
- Initially may “warm-up”
- Stiff after inactivity
- Can occur after returning back to activity too quickly after ankle injury or incomplete rehab
 - Before achieving full DF range of motion



Case #3: Tibialis Posterior Tendinitis

■ Exam:

- Pain with resisted inversion
- Tightness of posterior compartment of LE
 - May have “shin splints”
- Evaluate heel raise bilat
- “Too many toes” sign

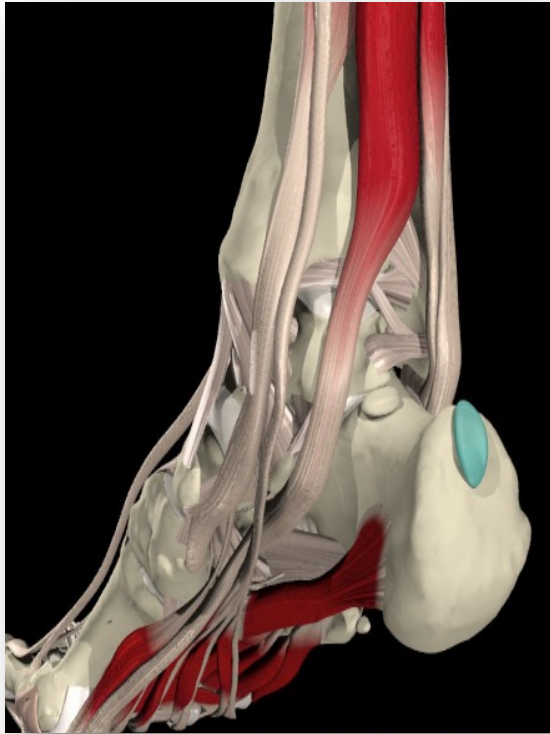


Case #4

- Now 33 yo, one year later after rehab and successful completion of 2 half marathons, has now decided to train for a full marathon.
- New ankle pain began at end of long runs, then started to hurt at beginning but would “warm-up”, only to return at end of the run.
- Hurts again in morning getting out of bed
- This time pain located back of ankle



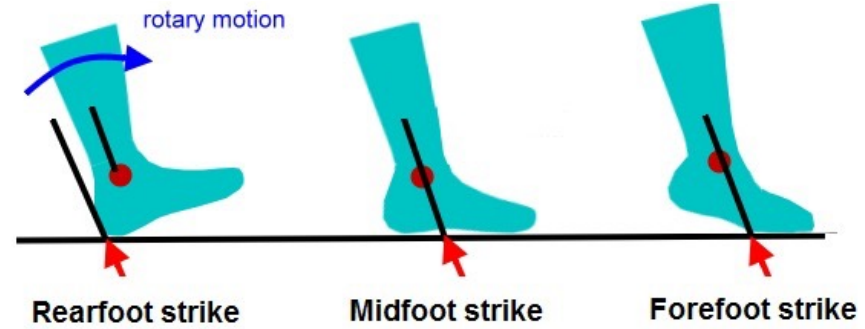
Ankle and Foot Anatomy-Posterior



Case #4: Achilles Tendon Pain

■ Etiology

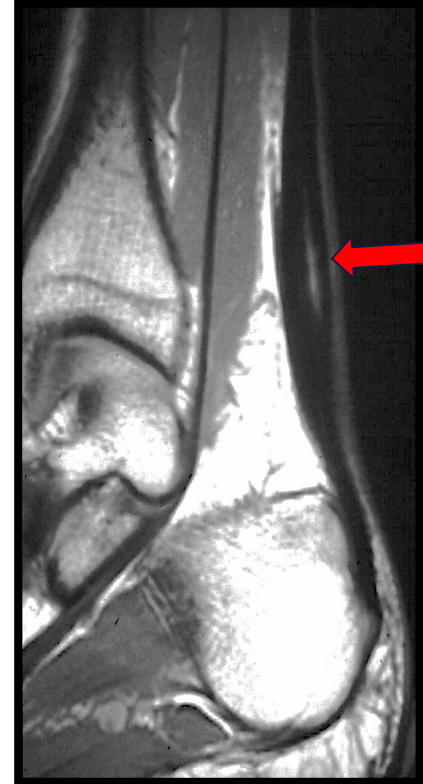
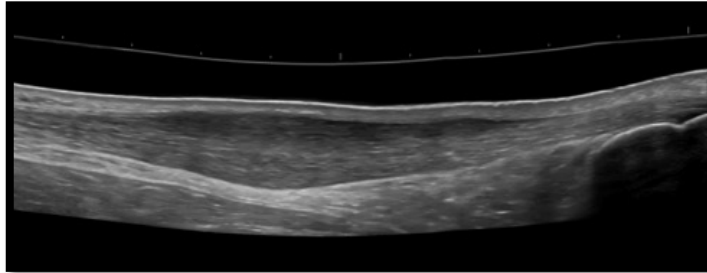
- New onset of activity or increased level of intensity or increased duration
 - Repetitive eccentric load on tendon (landing)
- Change in surface/terrain
- Change in footwear or running gait



Case #4: Achilles Tendinitis/Tendinopathy

■ Physical Exam

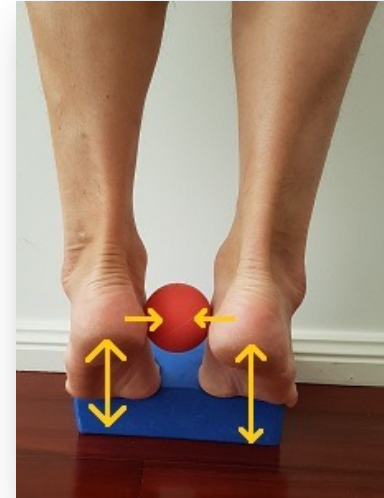
- Swelling and pain over Achilles tendon, ~ 2-5 cm proximal to insertion
- Pain with resisted PF and passive DF
- Crepitus on palpation and with ROM
- Limited DF due to pain
- Thickening of tendon



Case #4: Achilles Tendinopathy

■ Treatment

- All active treatments superior to “wait-and-see” at 3 mo
- No clinically relevant difference in effectiveness at 3 mo and 12 mo follow-up
 - Calf mm exercise therapy easiest and least expensive
 - Exercise and PRP, PRP, exercise and night splint, exercise and placebo injection, shockwave, exercise and shockwave



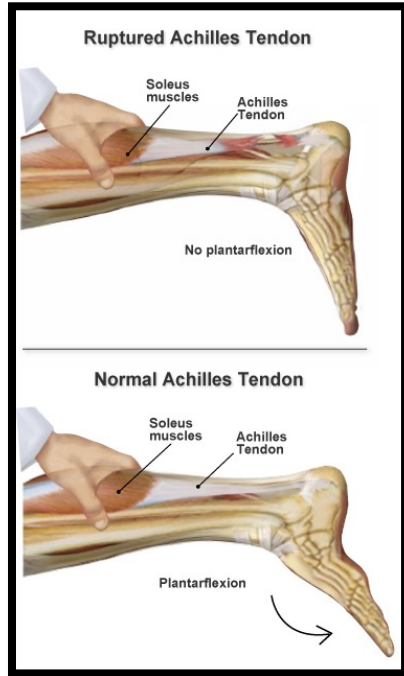
Van der Vlist et al, BJSM 2021

Case #5

- 46 yo playing for softball team in work league; while sprinting to first base felt a rock hit the back of calf and stumbled
- Needed assistance to walk off diamond
- Ice, elevation, compression wrap, NSAID
- Next day could walk into clinic wearing high top basketball shoes



Case #5 – Achilles Rupture



Case #5 – Achilles Rupture

- Simmonds' Triad
- Management
 - Meta-analyses of RCTs: operative treatment significantly reduced risk of tendon re-rupture
 - reported risk difference 5-7%
 - Operative treatment leads to significant increase in other complications
 - reported risk difference 16-21%



Amendola A, CJSM 2014

Changes You May Want to Make in Your Practice

- Apply the Ottawa Ankle and Foot Rules to your patients when deciding on radiographs
- Commit to practicing and refining your ankle and foot exam in order to narrow your differential diagnosis and improve definitive management

Any Questions?

