CMX
TRAVEL & MEETINGS
SPECIALIZING IN CONTINUING MEDICAL EDUCATION

UCSF Health
Sports Medicine

NWSL
NATIONAL WOMEN'S SOCCER LEAGUE

Common Foot and Ankle Problems

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Past President, AMSSM (2011-2012)
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AMSSM
AMERICAN MEDICAL SOCIETY
FOR SPORTS MEDICINE

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Disclosures

- 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
- Section Editor, UpToDate

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?

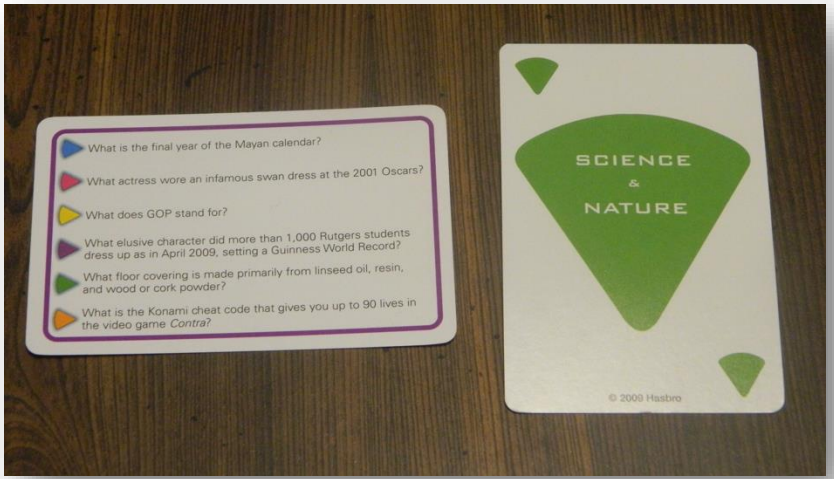
A. 22

B. 24

C. 26

D. 28

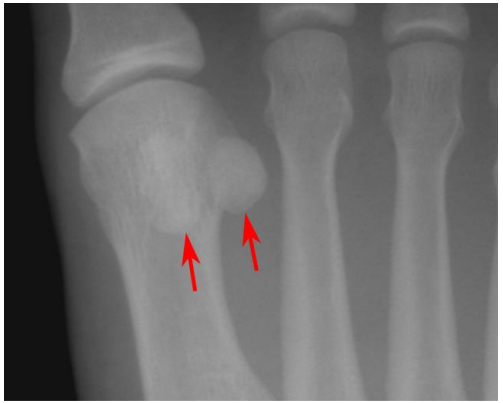
E. 30



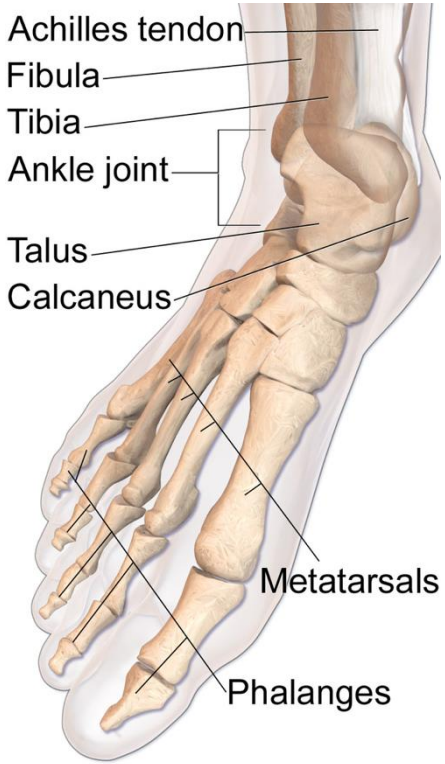
How Many Bones are in the Foot?

C. 28

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



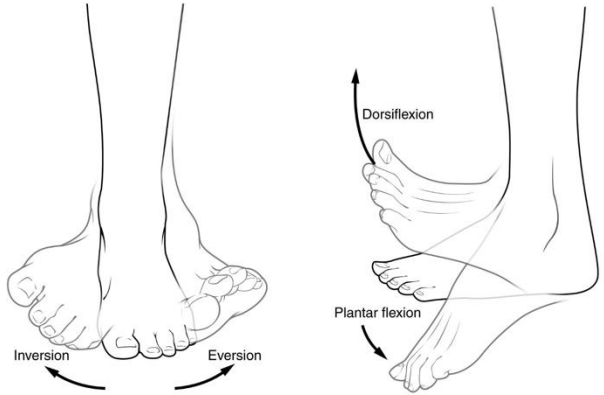
File:Sesamoidbone.png



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



https://commons.wikimedia.org/wiki/File:Eversion_and_inversion.jpg
https://commons.wikimedia.org/wiki/File:Dorsiplantar.jpg

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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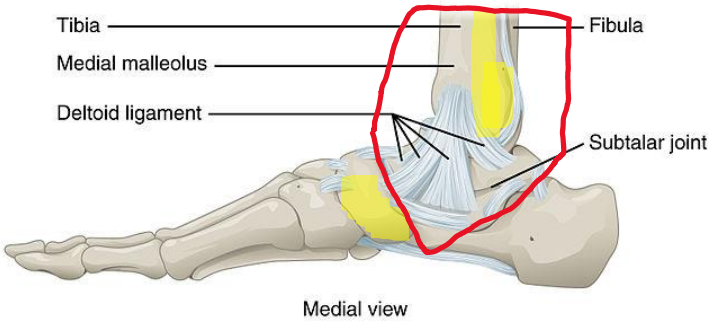
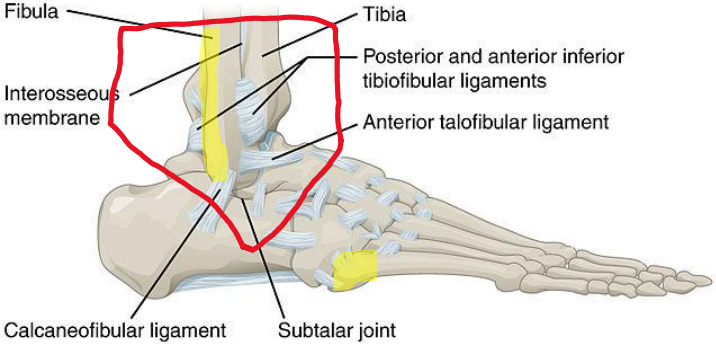
Ottawa Ankle and Foot Rules

- 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%



Medial view



Lateral view

Bachmann LM et al BMJ 2003

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

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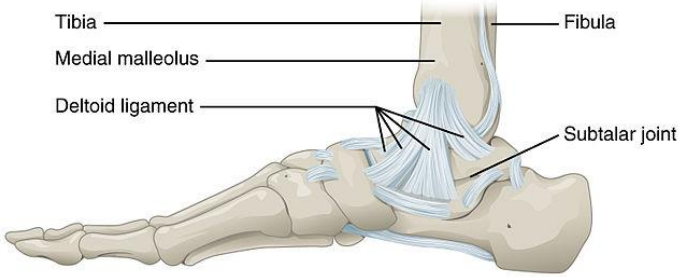
Ottawa Ankle and Foot Rules + **Bedside MSKUS**

- 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 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**

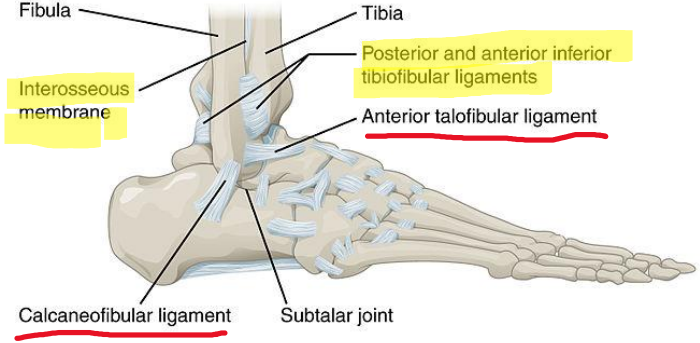
Sens 100%, Spec 100%, NPV 100%, PPV 100%

Case #1

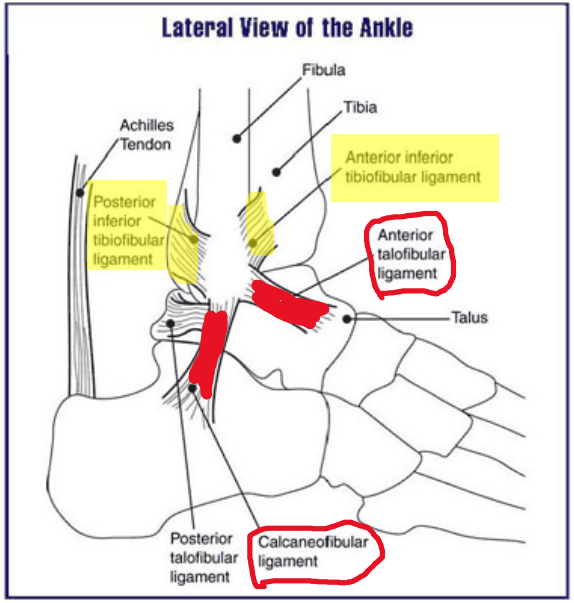
- Differential Dx
  - Fracture
  - Ligament sprain
  - Tendon strain
  - Retinaculum tear



Medial view



Lateral view



https://commons.wikimedia.org/wiki/File:Ankle.PNG

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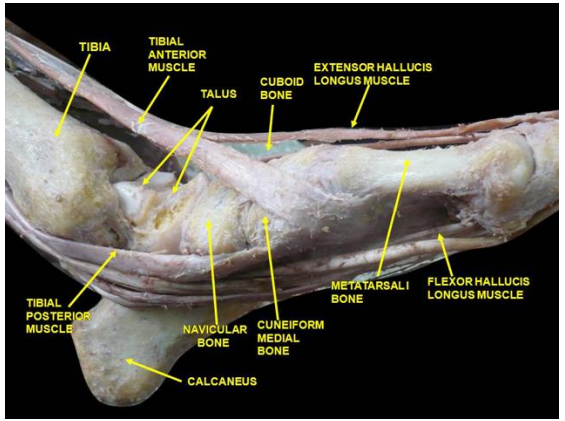

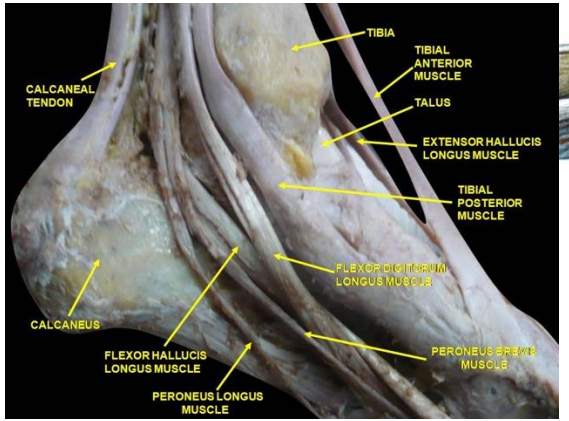

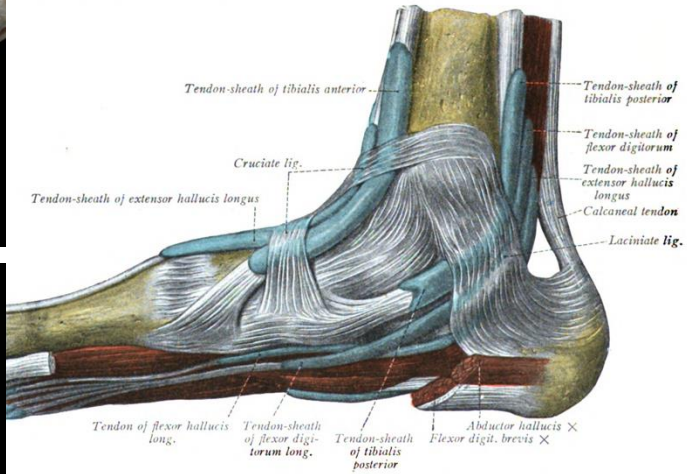

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https://commons.wikimedia.org/wiki/File:Slide2wewe.JPG
https://commons.wikimedia.org/wiki/File:Slide2cece.JPG
https://commons.wikimedia.org/wiki/File:Sobo_1909_316.png

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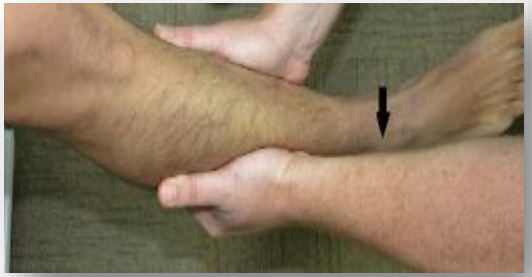
Case #1

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



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https://commons.wikimedia.org/wiki/File:Swelling_of_the_ankle_joints.jpg
https://commons.wikimedia.org/wiki/File:Schwellung_Bluterguss_Baenderirss.JPG

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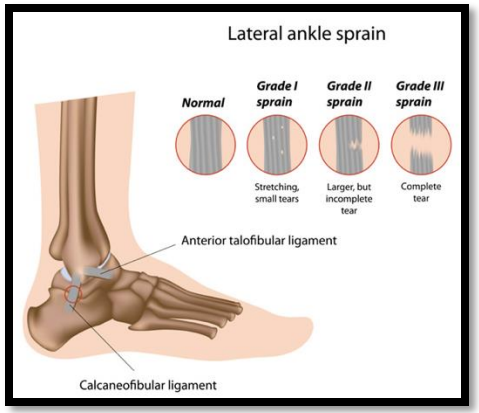
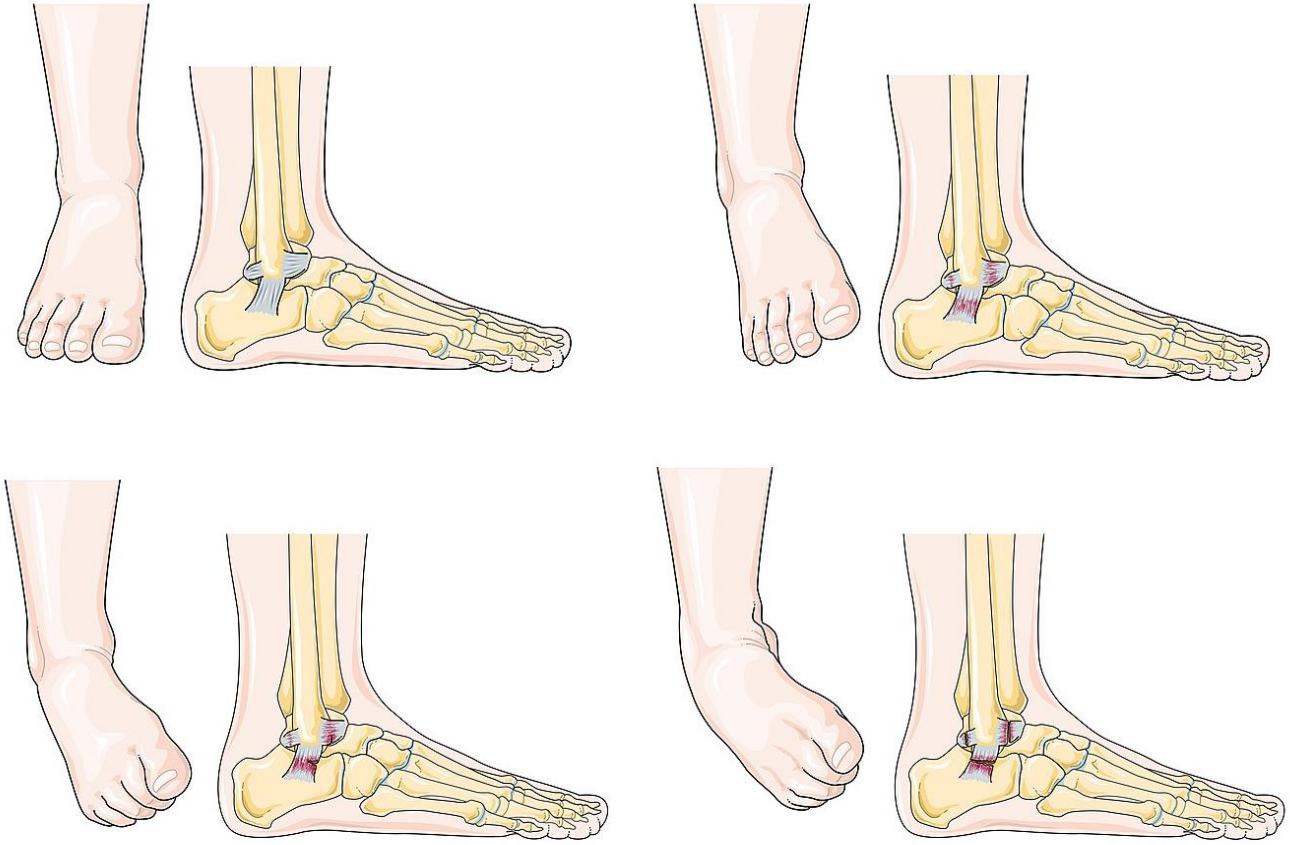
Case #1

- 2+ anterior drawer
- 2+ lateral talar tilt





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https://commons.wikimedia.org/wiki/File:Ankle_sprain_--_Smart-Servier_(cropped).jpg

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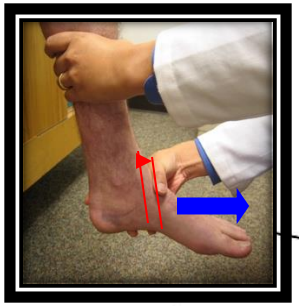
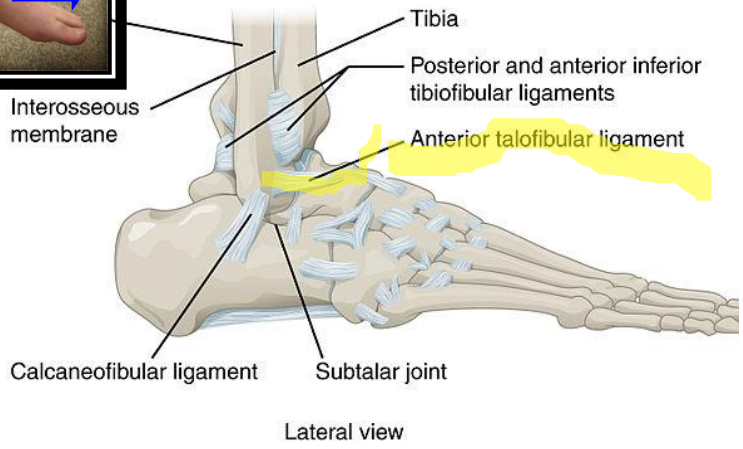
Case #1

- 2+ anterior drawer

Sens = 80%
Spec = 74%

PPV = 91%
NPV = 52%

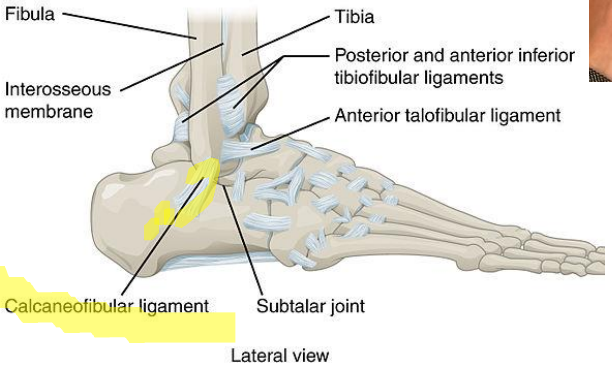




van Dijk et al. J Bone Joint Surg-Br, 1996

Case #1

- 2+ lateral talar tilt
- Stable medial talar tilt



Case #1

- 2+ lateral talar tilt
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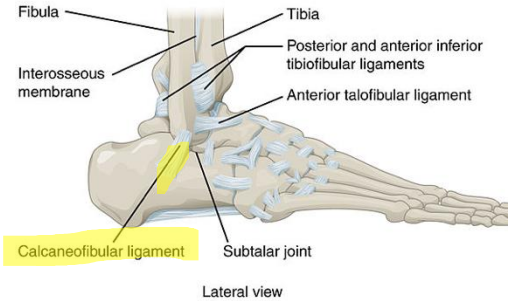
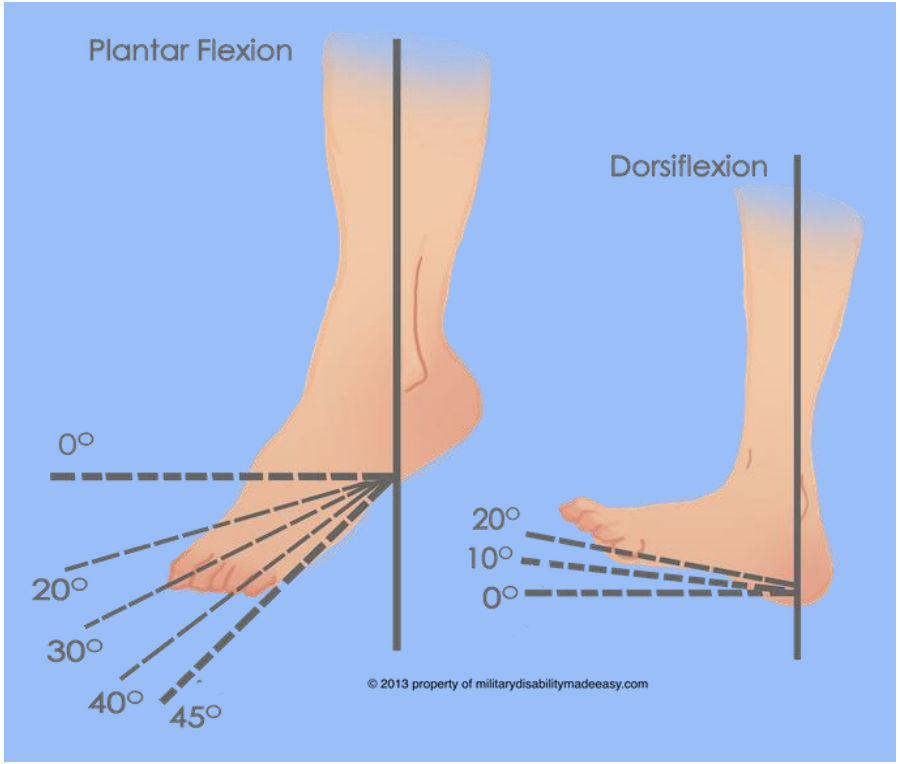


Correlating Grade of Ankle Sprains to Recovery

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

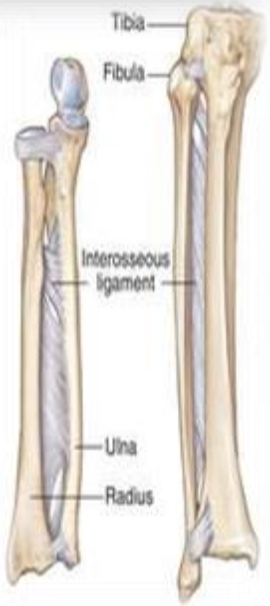
- Decreased range of motion
  - Due to swelling, pain
- Normal *overall* ROM = 65 – 75 deg
  - DF = 10 – 20 deg
  - PF = 40 – 55 deg

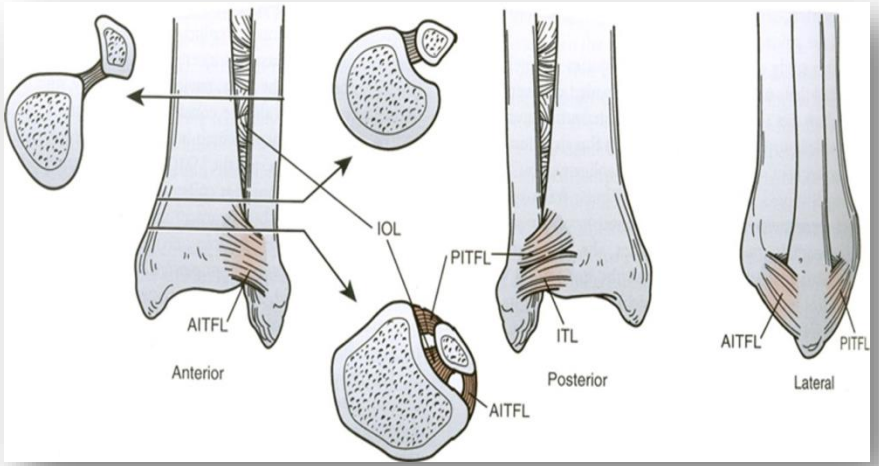


Grimston et al. Foot Ankle Int, 1993

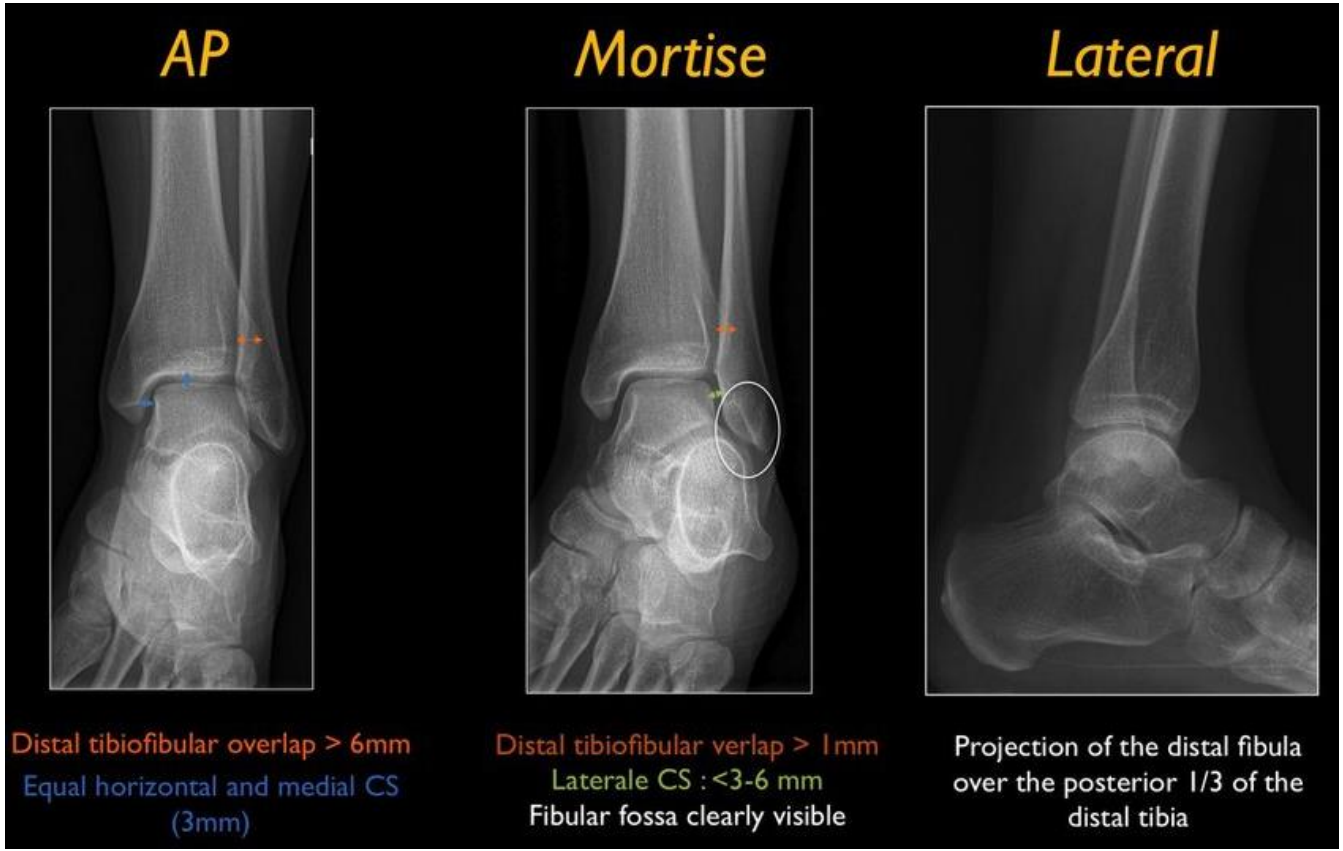
Case #1

- Syndesmosis injury
  - “high” ankle sprain





Normal Ankle X-Ray



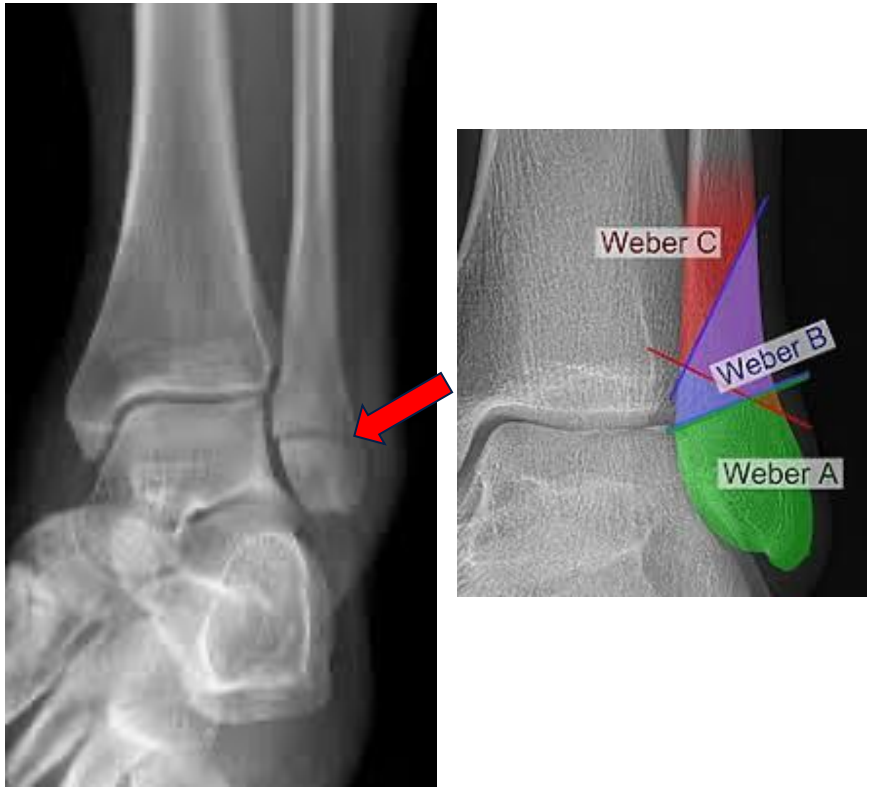
Case #1?

Ankle Injuries – 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



Canton et al. World J Orthop 2021
https://commons.wikimedia.org/wiki/File:Danis%E2%80%93Weber_classification_on_X-ray.svg

Ankle Injuries – Treatment

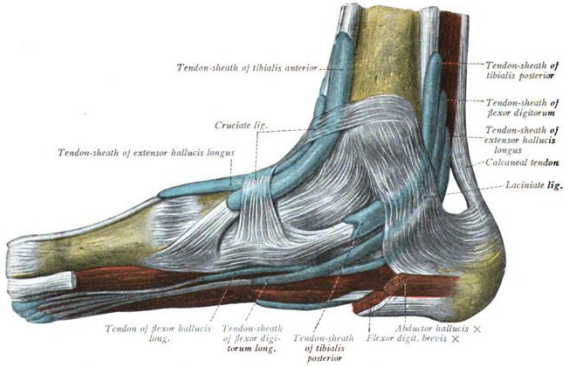
- Unstable fracture, referral to subspecialist
  - Maisonneuve fracture –
    - ORIF and deltoid repair
    - Consider arthroscopy for possible surg intervention of cartilage lesions

Fraissler et al, BMC Musculoskel Disord 2021

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

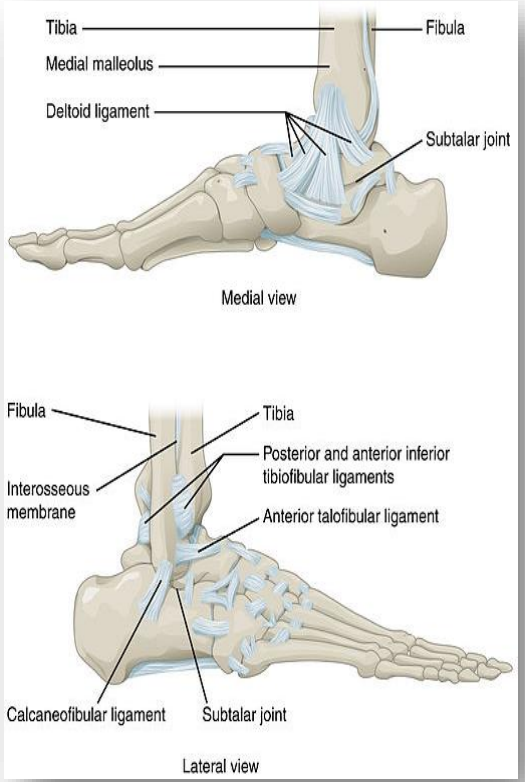


- If visualize subluxation or dislocation of peroneal tendons:
  - Refer to Subspecialist
    - Non-operative
      - Cast/immobilize x 4-6 wks but high rate (50%) of recurrence
    - Acute repair in athletes

Safran et al, MSSE 1999

Case #1a

- Patient is 10 yo

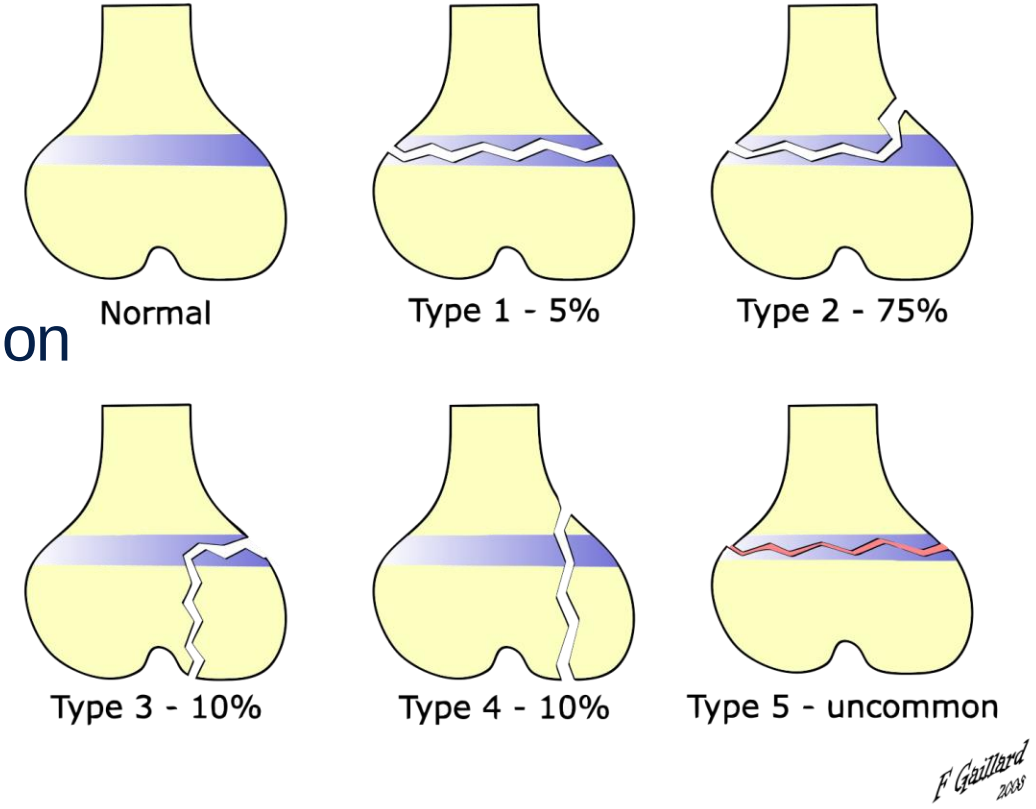


https://commons.wikimedia.org/wiki/File:Tib_fib_growth_plates.jpg

Case #1a

- Patient is 10 yo

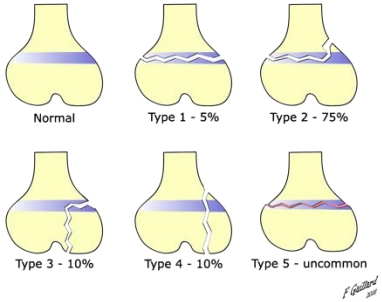
- Salter-Harris Classification
  - S-A-L-T-E-R



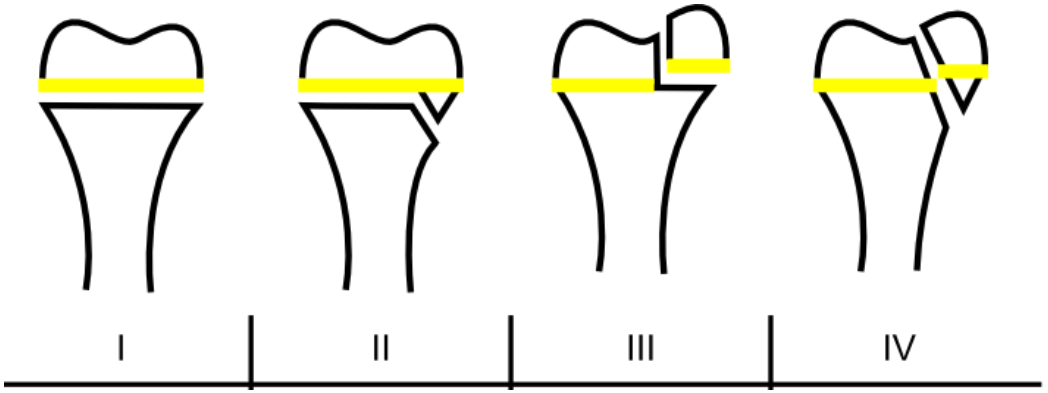
https://commons.wikimedia.org/wiki/File:SalterHarris.svg

Case #1a

- Patient is 10 yo



e.g., proximal tibia



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

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

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

IV – **TE** = **Through Everything**. The fracture is through the metaphysis, physis, and epiphysis.

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

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https://commons.wikimedia.org/wiki/File:Epiphysenfrakturen_new.png

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Salter-Harris Fractures of Ankle– Treatment

- If non-displaced:
  - SH-I and II (fibula): ankle stirrup brace/CAM walking boot and weight bearing as tolerated if no limp
  - SH-I and II (tibia): 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

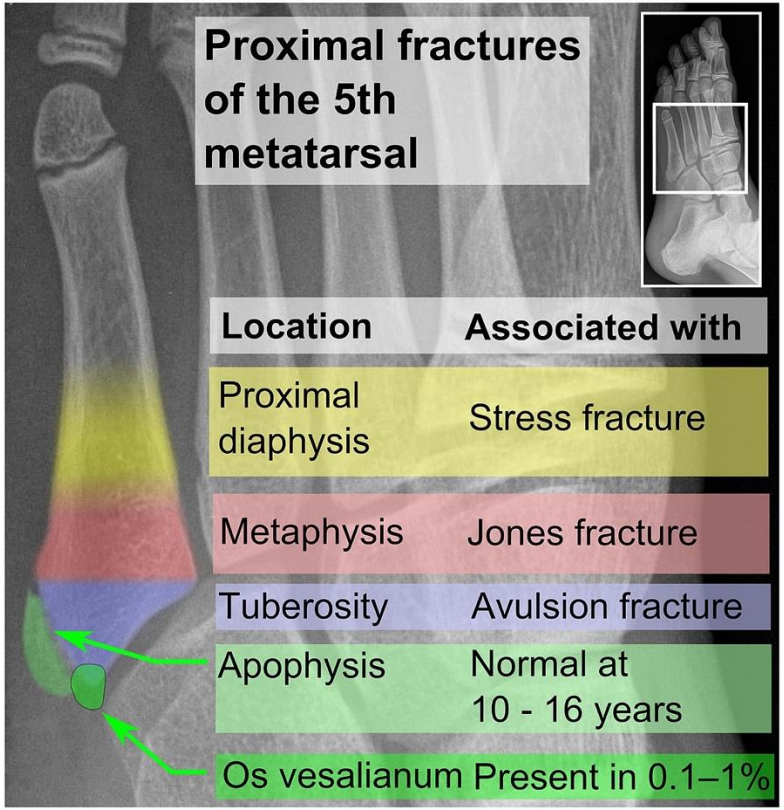
Su AW, Larson AN. Foot Ankle Clin. 2015

Case #1b

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

https://commons.wikimedia.org/wiki/File:X-ray_of_normal_right_foot_by_dorsoplantar_projection.jpg

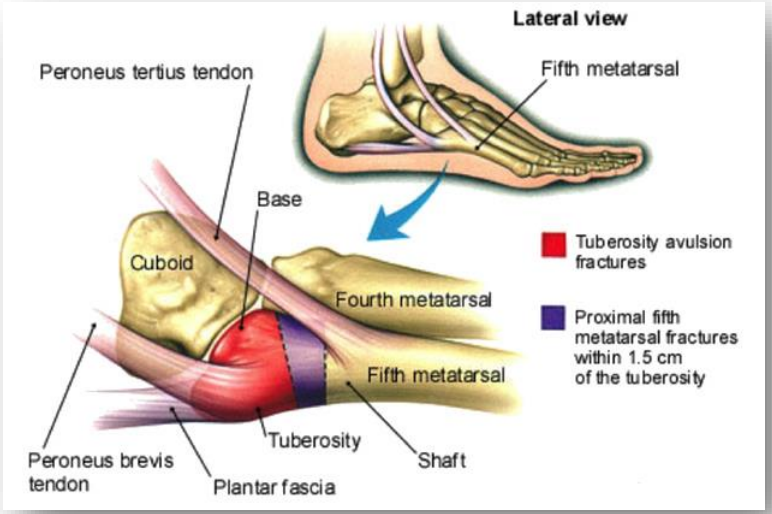
Case #1b



Zone 3

Zone 2

Zone 1



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https://commons.wikimedia.org/wiki/File:Proximal_fractures_of_5th_metatarsal.jp
Le and Anderson Curr Rev Musculoskel Med 2017

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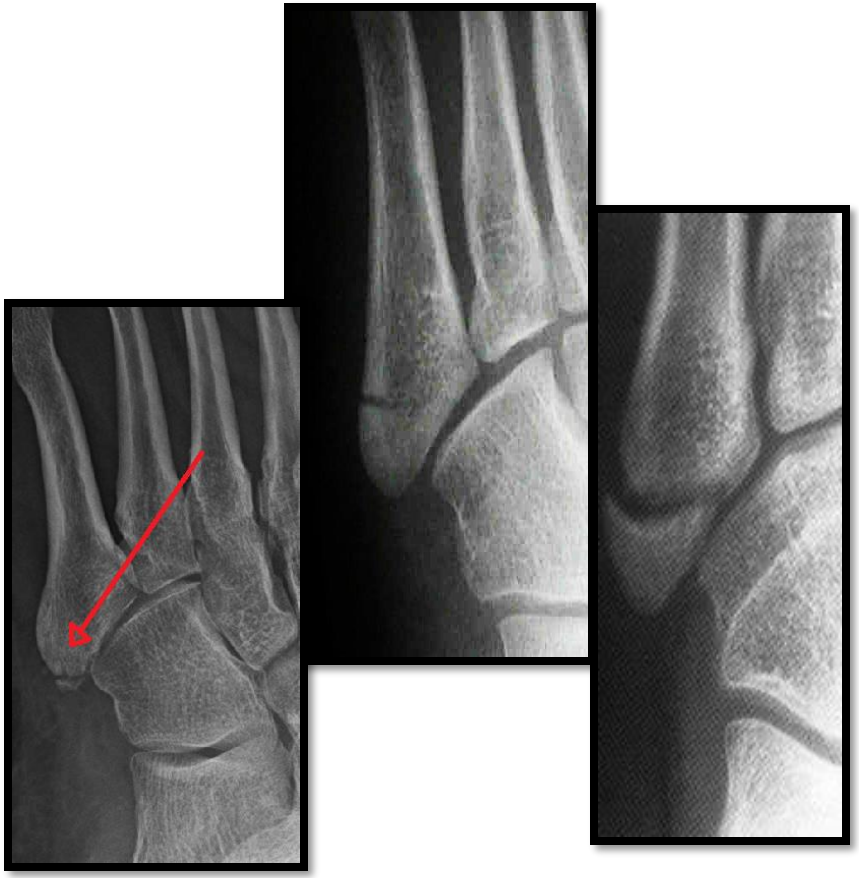
Case #1b – Zone 1

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



https://commons.wikimedia.org/wiki/File:FractureBaseof5th.png
Le and Anderson Curr Rev Musculoskel Med 2017

Case #1b – 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%

Le and Anderson Curr Rev Musculoskel Med 2017
https://commons.wikimedia.org/wiki/File:Cropped_version_of_Jonesfracture.jpg

Case #1b – Zone 2 (Type II)

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

Le and Anderson Curr Rev Musculoskel Med 2017
https://commons.wikimedia.org/wiki/File:Jones_fracture,_healing_zones_according_to_Polzer_2.jpg

Case #1b – 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

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https://commons.wikimedia.org/wiki/File:Talar_beak_in_tarsal_coalition_39jw_-_Roe_ap_-_001.jpg
https://commons.wikimedia.org/wiki/File:Kalkaneonavikulare_fibroese_oder_kartilaginaere_Koalition_-_Roe_Fuss_schraeg_mit_Vergleichen_001_-_Annotation.jpg

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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 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?

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

A. How many times a day have you been icing?

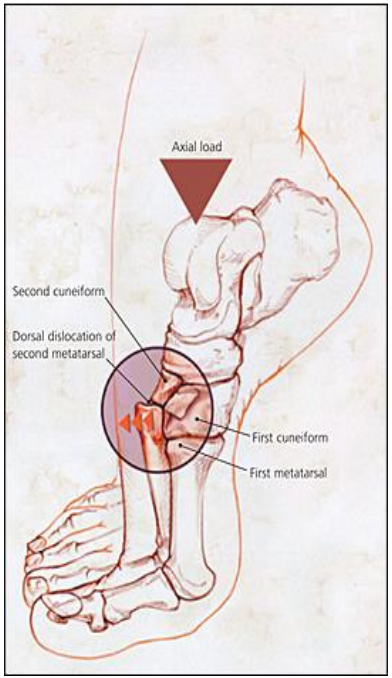
B. Were you standing or sitting for your X-rays?

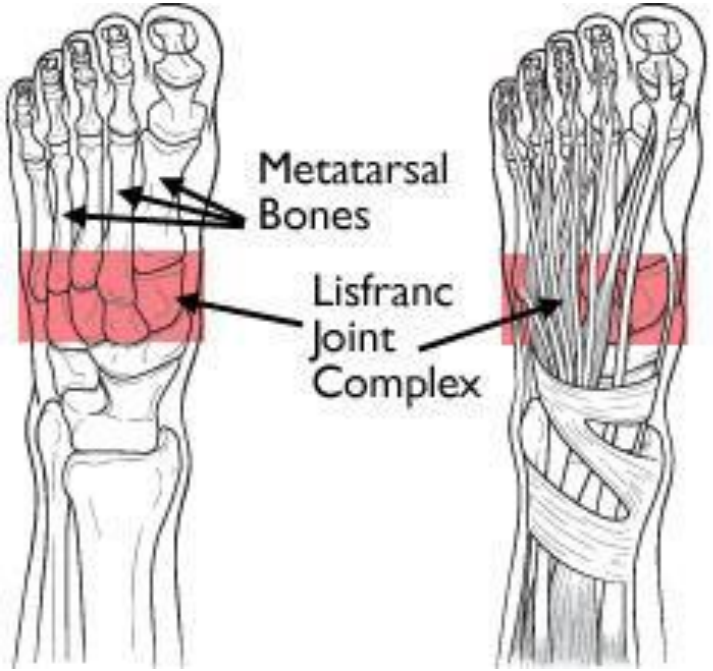
C. Have you been keeping it wrapped in a compression type of bandage?

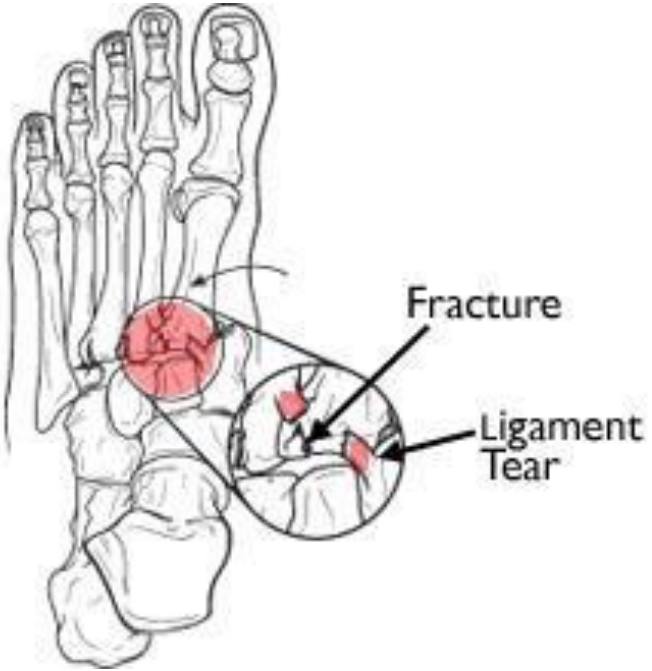
D. Do NSAIDs help with pain and swelling?

E. Were you drinking more Cabernet or Chardonnay?

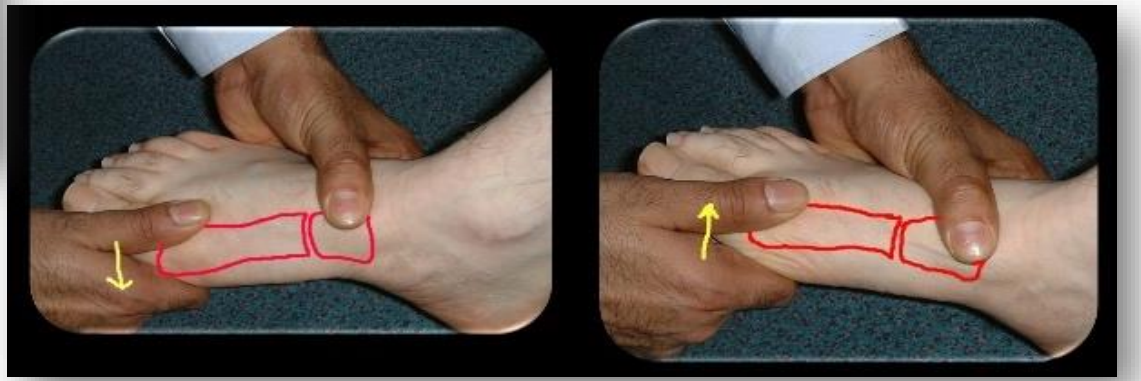
Case #2


Axial load
Second cuneiform
Dorsal dislocation of second metatarsal
First cuneiform
First metatarsal

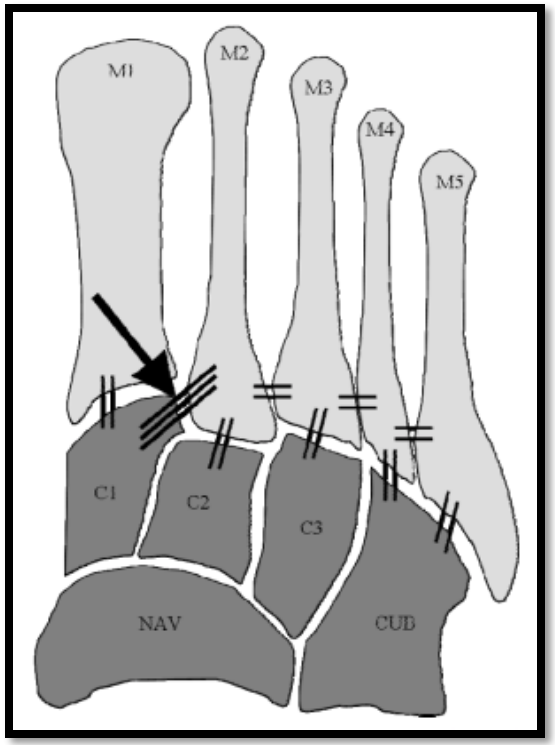

Metatarsal Bones
Lisfranc Joint Complex

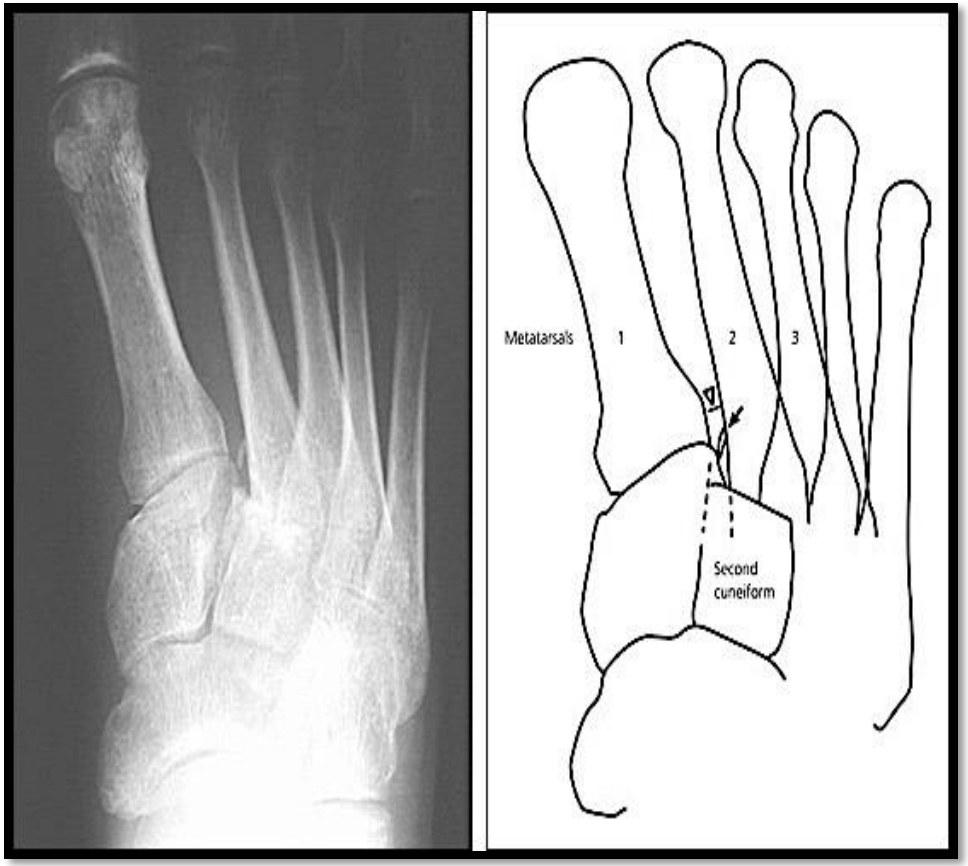

Fracture
Ligament Tear

Case #2



Case #2


M1
M2
M3
M4
M5
C1
C2
C3
NAV
CUB


Metatarsals
1
2
3
Second cuneiform

Case #2

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Case #2

- Stage/Grade? 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

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

A. Is there any radiation of pain?

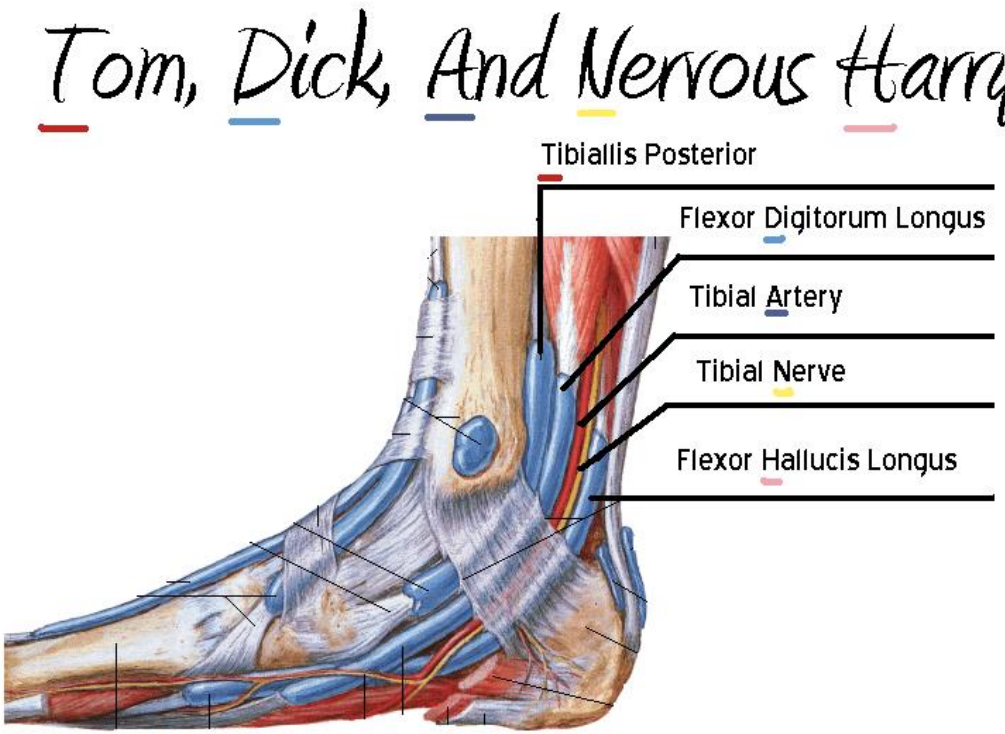
B. Have you injured this ankle before?

C. What type of shoes are you wearing during your run?

D. Where do you run in San Francisco?

E. All of the above

Ankle and Foot Anatomy-Medial

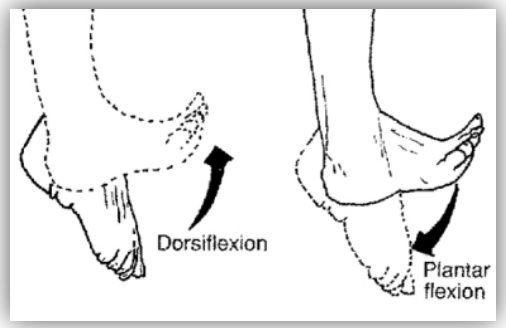


Case #3: Tibialis Posterior Tendinitis

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

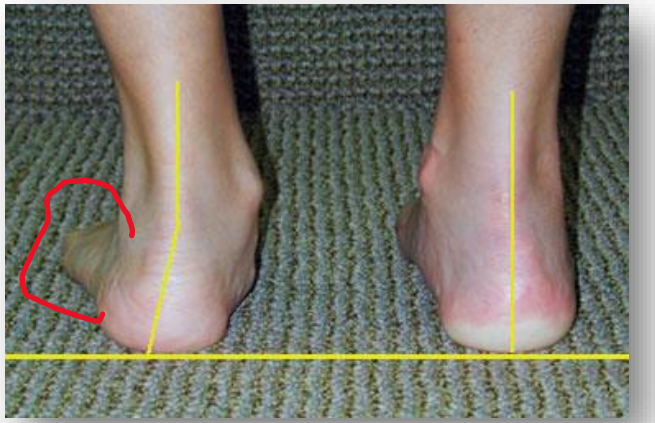
Case #3: Tibialis Posterior Tendinitis

- 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

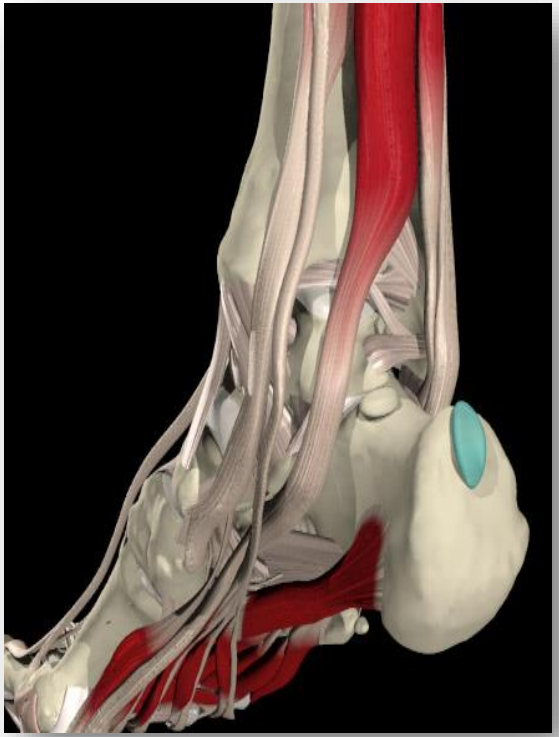
- Exam:
  - Pain with resisted inversion
  - Tightness of posterior compartment of LE
    - May have “shin splints”
  - Evaluate heel raise bilat
  - “Too many toes” sign



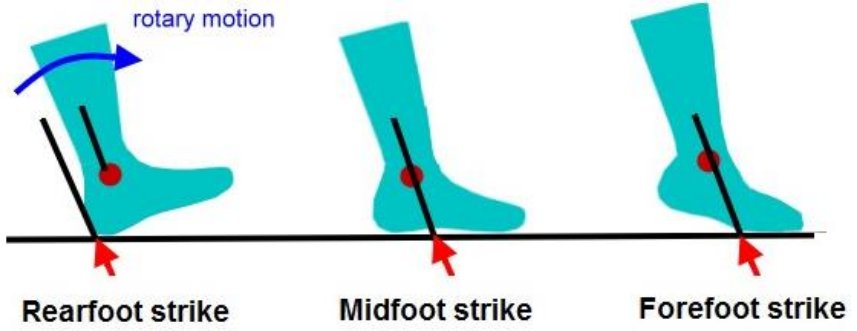
Case #4

- Now 37 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



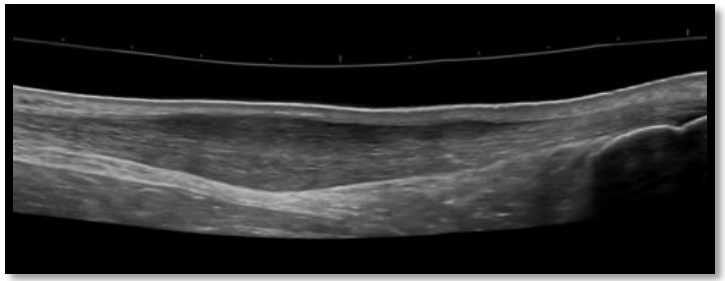
Case #4: Achilles Tendon Pain

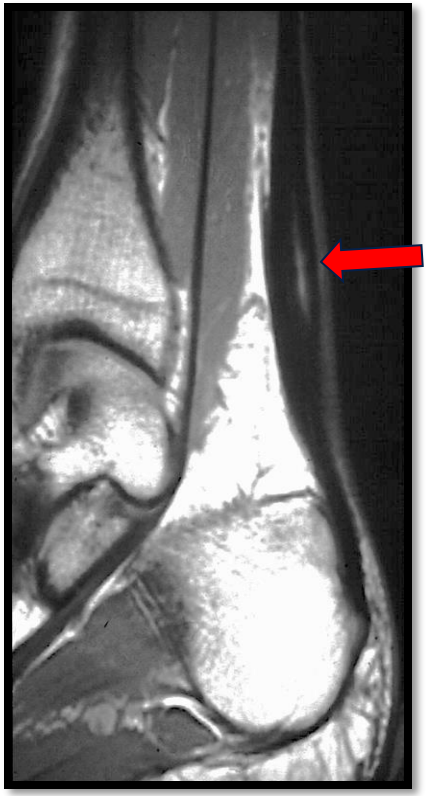


- Etiology
  - New onset of activity or increased level of intensity or increased duration
    - Repetitive eccentric load on tendon (landing)
  - Change in surface/terrain
  - Change in footwear or running gait

Case #4: Achilles Tendinitis/Tendinopathy

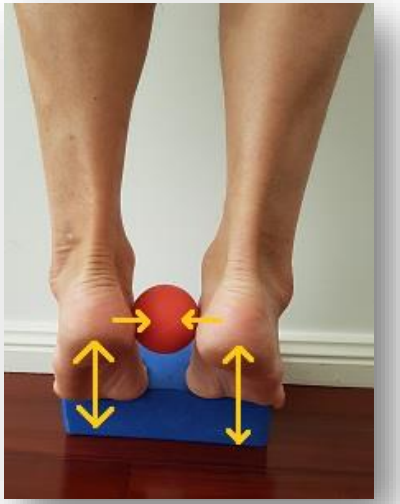
- Physical Exam
  - Swelling and pain over Achilles tendon, ~ 2-5 cm proximal to insertion
  - Pain with resisted PF and passive DF
  - Crepitus on palpation and with ROM
  - Limited DF due to pain
  - Thickening of tendon





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

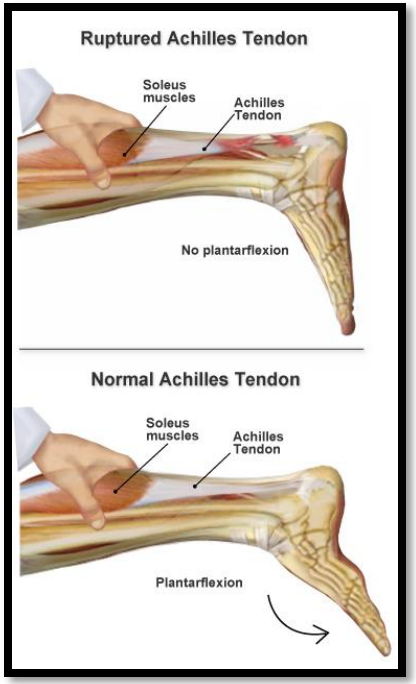


Van der Vlist et al, BJSM 2021

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 walks into clinic wearing high top basketball shoes

Case #5 – Achilles Rupture



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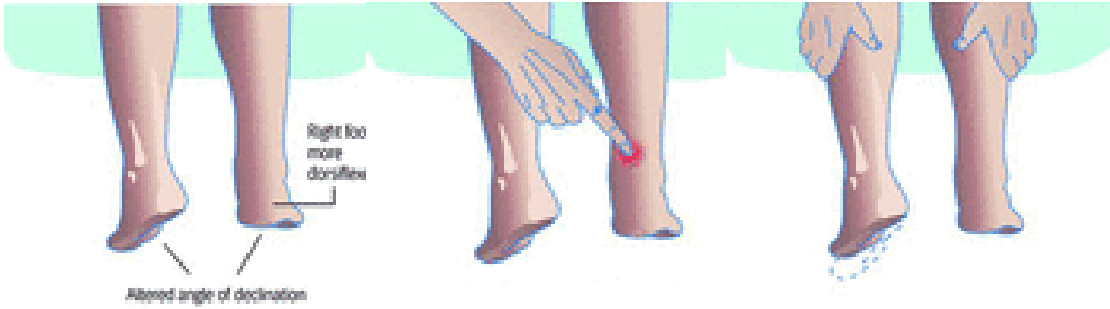
Case #5 – Achilles Rupture



- 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?