

# Knock Their Socks Off: Foot & Ankle Pathologies You May Be Missing

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# DISCLOSURES

I have no personal or financial interests to declare.

I receive no financial support from industry sources.

# OUTLINE

1. Morton's Neuroma
2. Lisfranc Injury
3. Achilles Rupture
4. 5<sup>th</sup> Metatarsal Fractures
  - avulsion
  - Jones
  - stress

# INTRO

Ankle special tests (we'll come back to these later)



# PRE-TEST QUESTION #1

Which of the following is a simple special test maneuver that may help confirm Morton's neuroma?

- A. Thompson test
- B. metatarsal compression test
- C. Kleiger's test
- D. anterior drawer test
- E. inversion stress test

# PRE-TEST QUESTION #2

What mechanism of injury is known to cause a Lisfranc fracture/dislocation?

- A. direct blow to the foot
- B. hyper dorsiflexion of the foot/ankle
- C. excessive external foot rotation
- D. axial load on a plantar flexed foot

# PRE-TEST QUESTION #3

Which of the following statements is true about 5<sup>th</sup> metatarsal fractures?

- A. stress fractures are most common
- B. avulsion fractures are most common
- C. Jones fractures are most common
- D. fractures of this bone are rare

# INTRODUCTION & BACKGROUND

## WHY DO WE CARE?

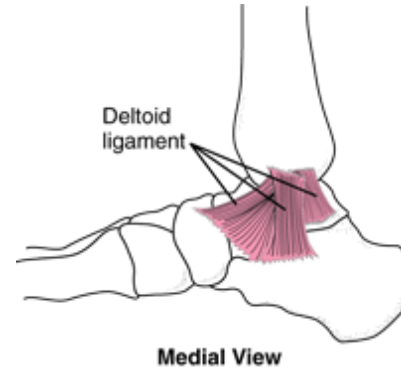
- foot and ankle susceptible to both *acute injury* and *overuse syndromes*
- foot/ankle dysfunction = disability, altered gait
- *~25% of all sports injuries* occur at the foot/ankle



# ANATOMY - LIGAMENTS

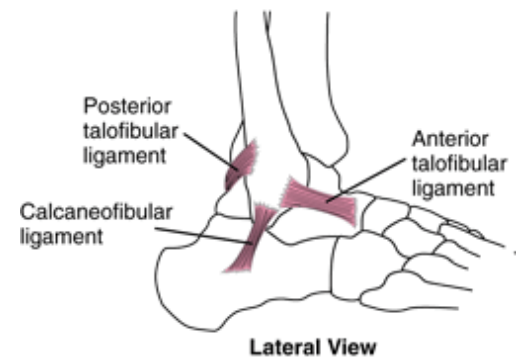
Medially (*big, thick, strong*)

- deltoid ligament



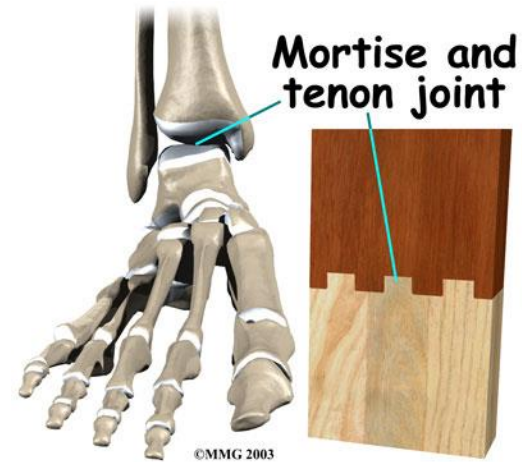
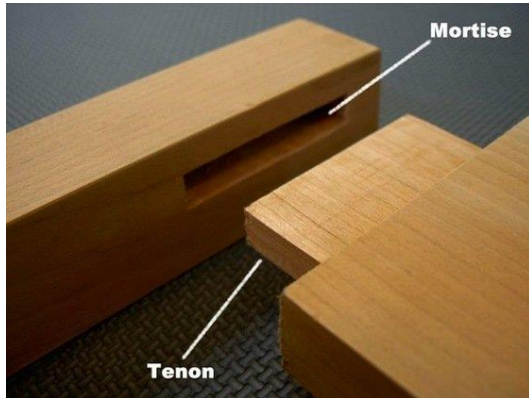
Laterally - three distinct ligaments (*puny, weak*)

- anterior talofibular ligament (ATF)
- posterior talofibular ligament (PTF)
- calcaneofibular ligament (CF)



# ANATOMY

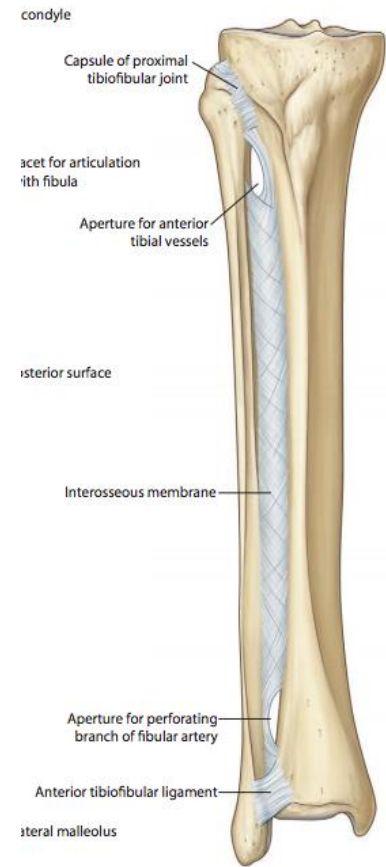
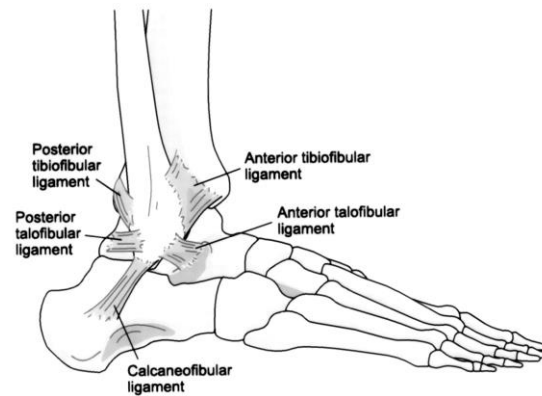
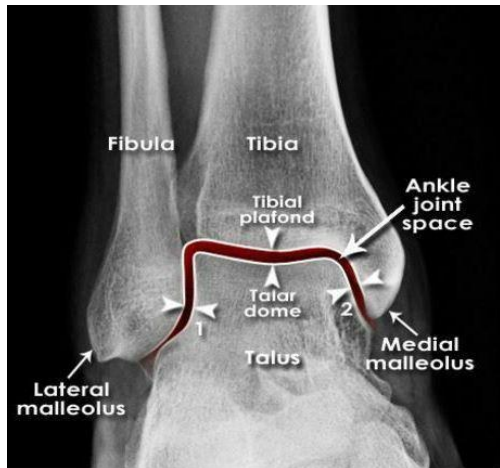
## Ankle “*mortise*” joint



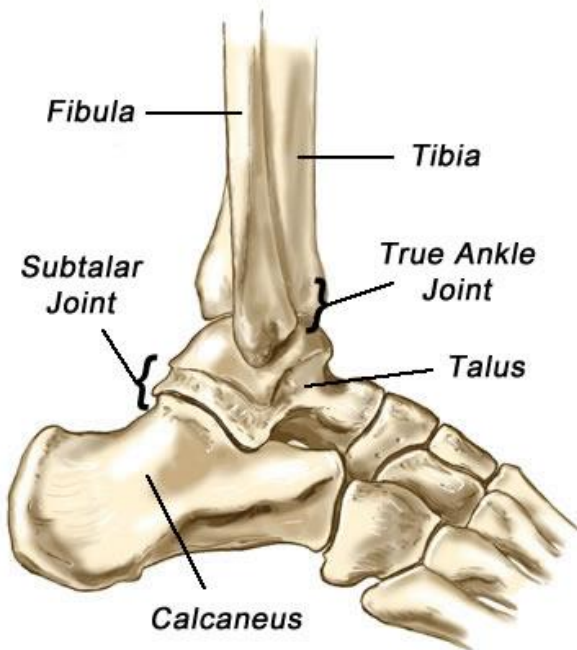
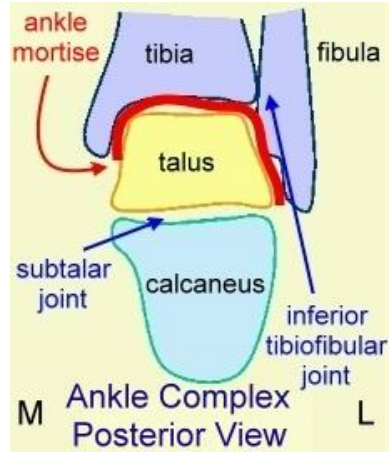
# ANATOMY

## Ankle “*mortise*” joint

- anterior tibiofibular ligament
- posterior tibiofibular ligament
- interosseous membrane



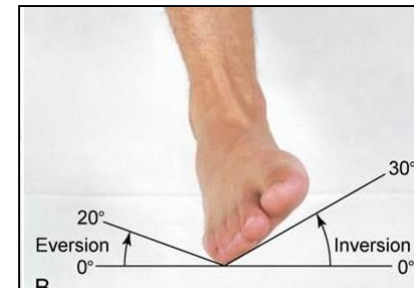
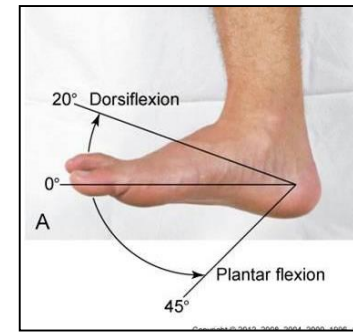
# ANATOMY: TWO "ANKLE" JOINTS



# R.O.M.

## Ankle

- dorsiflexion & plantarflexion
- inversion & eversion



## Foot

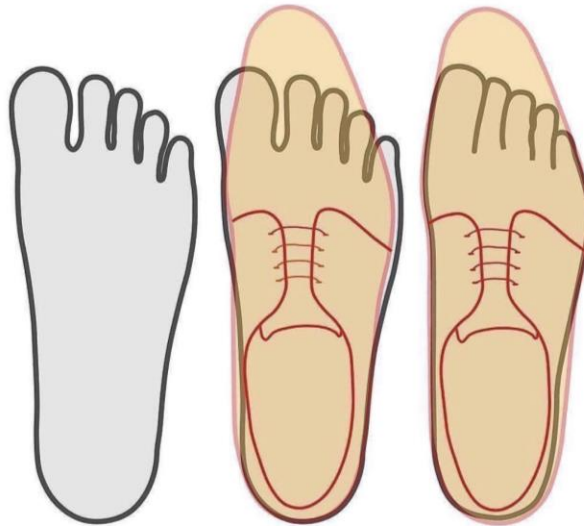
- internal (medial) rotation
- external (lateral) rotation



# MORTON'S NEUROMA

entrapment/compression of inter-digital nerve

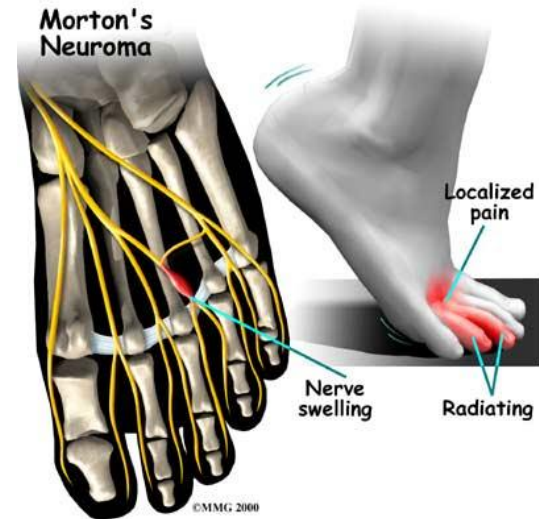
- causes: running, ballet, high heels, narrow toe box shoes
- 2<sup>nd</sup> and 3<sup>rd</sup> web spaces most common
- incidence: females > males



# MORTON'S NEUROMA

## History

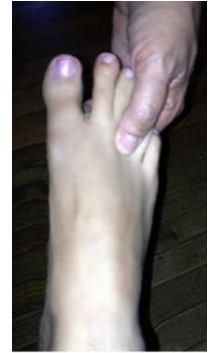
- burning, stinging pain
- worse with WB
- numbness/tingling into toes



# MORTON'S NEUROMA

## Physical Exam

- specific tenderness on area between metatarsals
- Metatarsal Compression Test



## Imaging

- X-rays not helpful
- ultrasound/MRI show most, not all



# MORTON'S NEUROMA

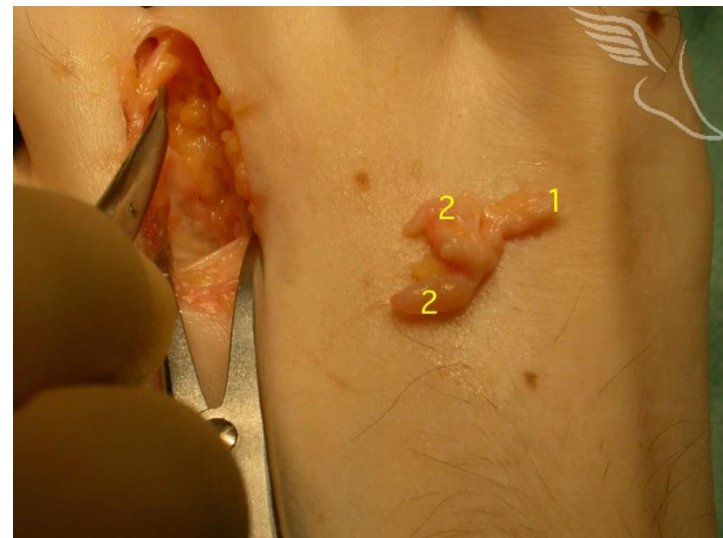
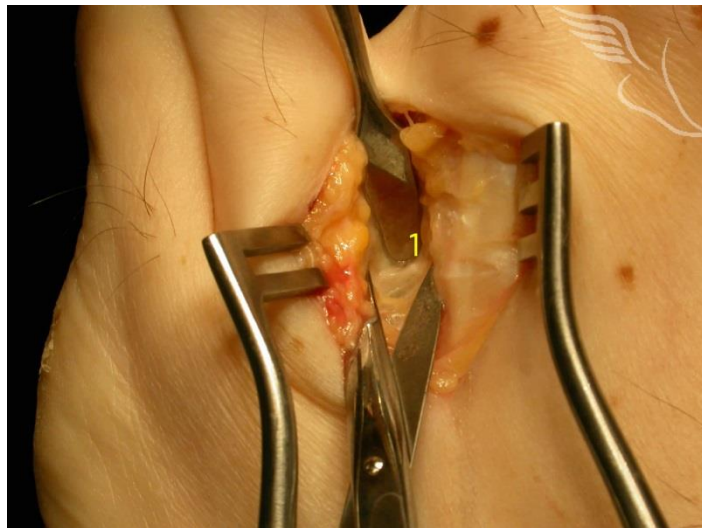
## Conservative treatment

- wide shoes, no heels
- metatarsal pads
- corticosteroid injections



## Surgical treatment

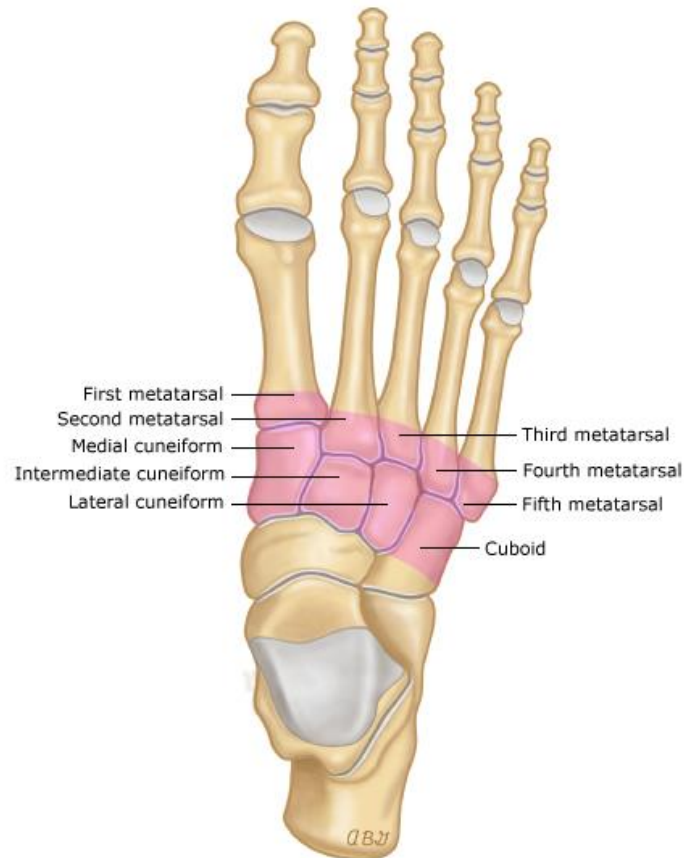
- neuroma excision



# LISFRANC INJURY

## Tarsometatarsal (Lisfranc) joint complex

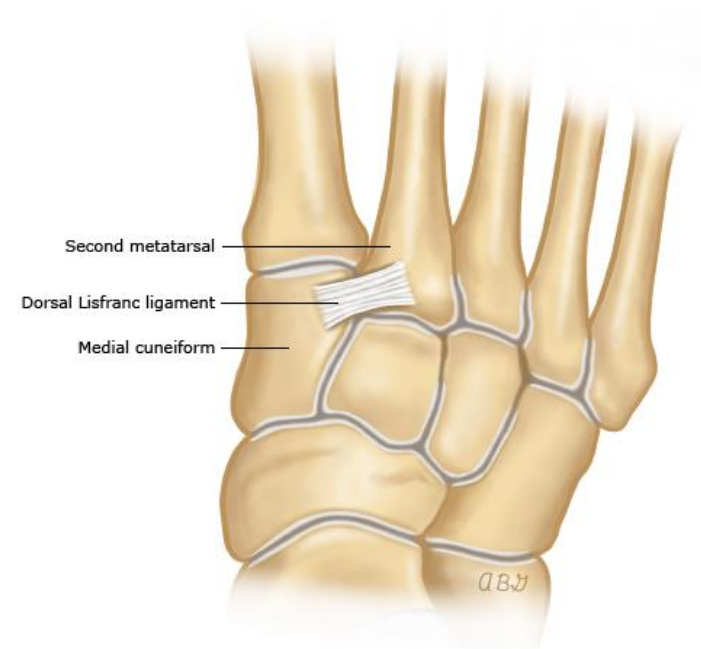
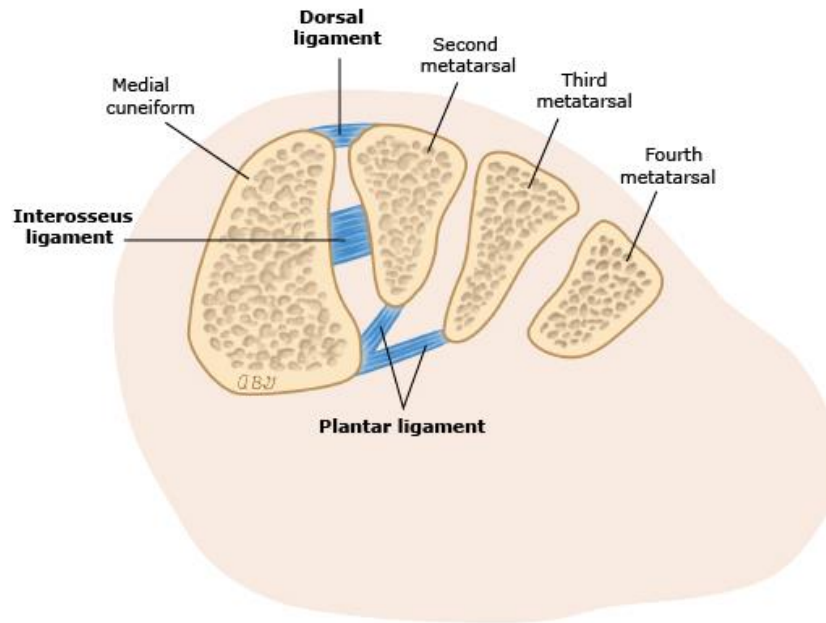
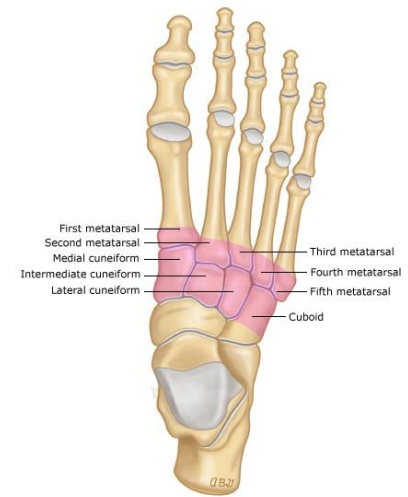
- injuries here are *not common*, but *frequently missed*
- legal *liability*



# LISFRANC INJURY

## Tarsometatarsal (Lisfranc) joint complex

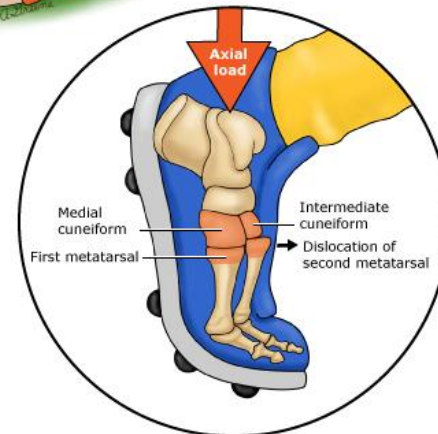
- **dorsal** ligament is most important



# LISFRANC INJURIES

## Tarsometatarsal (Lisfranc) joint complex

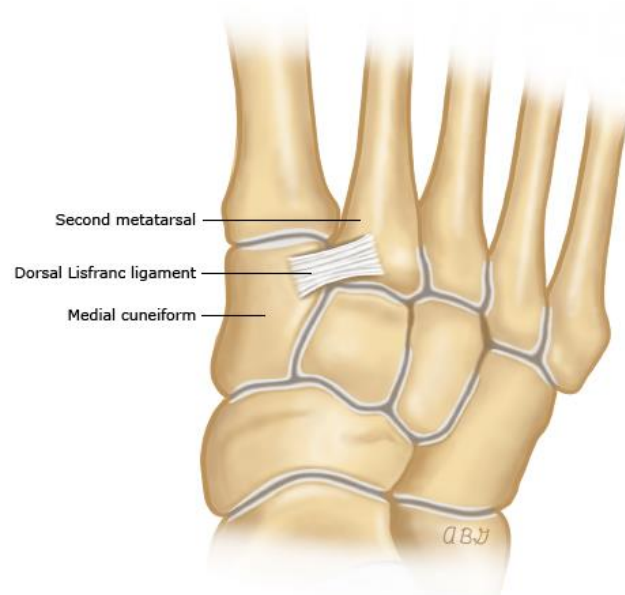
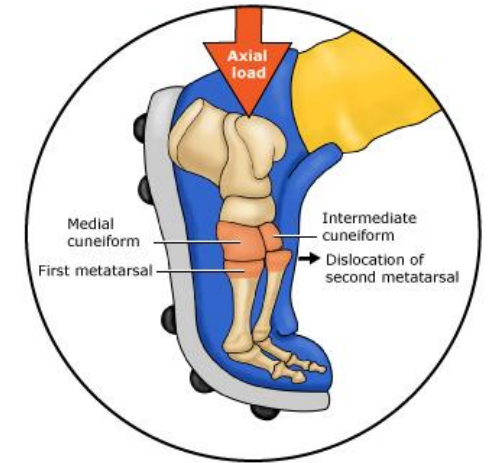
- mechanism of injury: trauma (*axial load*)
  - MVCs
  - falls
  - athletics



# LISFRANC INJURY

## Tarsometatarsal (Lisfranc) joint complex

- **terminology** can be confusing:
  - Lisfranc fracture
  - Lisfranc dislocation
  - Lisfranc “injury”



# LISFRANC INJURY

## History

- MOI (mechanism of injury)
- pain & swelling at TMT joint
- worse w/ weight bearing (often *cannot* walk)



# LISFRANC INJURY

## Physical Exam

- point tenderness at TMT joint
- swelling & *ecchymosis*
- ↓ ROM
- ↓ strength



# LISFRANC INJURY

“diastasis” = widening





# LISFRANC INJURIES



# LISFRANC INJURIES

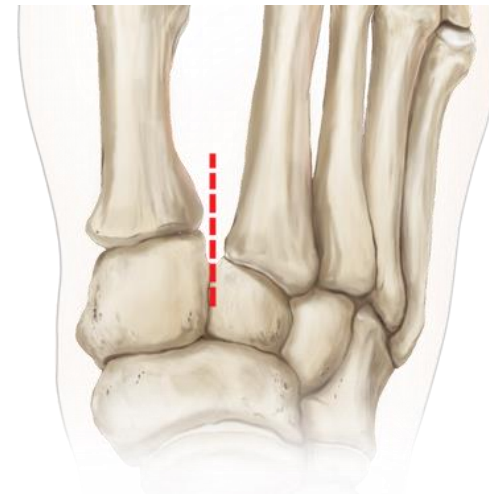


# LISFRANC INJURY

## Imaging

- X-rays: three views (AP, lateral, oblique)
  - often misread as “normal”
  - findings can be quite *subtle*

**AP View:** normally, medial borders of **2<sup>nd</sup> MT** and **middle cuneiform** should align



# LISFRANC INJURY

## Imaging

- X-rays: three views (AP, lateral, oblique)
  - often misread as “normal”
  - findings can be quite *subtle*

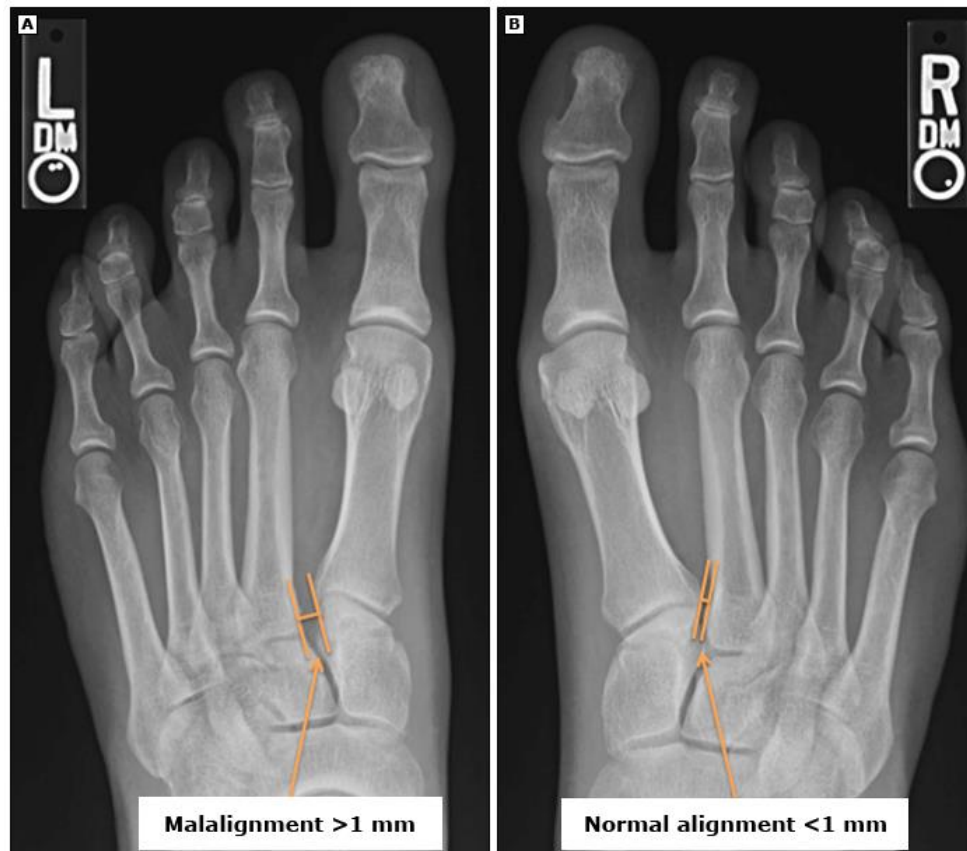
*Oblique View*: normally, medial borders of **4<sup>th</sup> MT** and **cuboid** should align



# LISFRANC INJURY

## Imaging

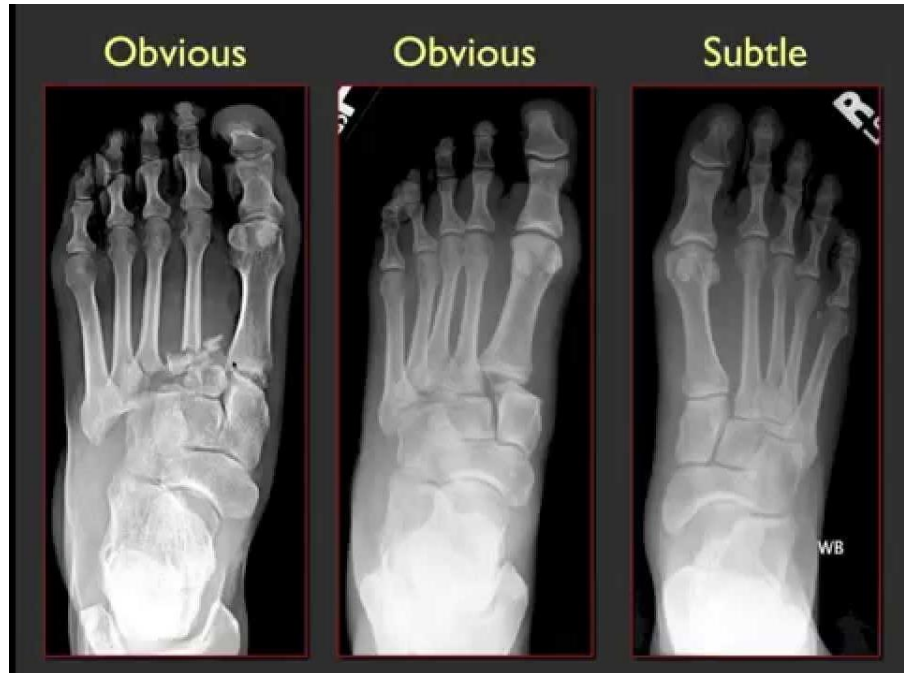
- **50%** of athletes with midfoot injuries have normal *non-weight bearing* radiographs
- Order *weight bearing X-rays on single cassette*



# LISFRANC INJURY



# LISFRANC INJURIES



# LISFRANC INJURY

## Imaging

- *But wait, there's more!!*
- Multiple studies demonstrate: even properly performed weight-bearing radiographs have *limited specificity & sensitivity* for detecting TMT injuries
- Obtain advanced imaging: *CT or MRI*

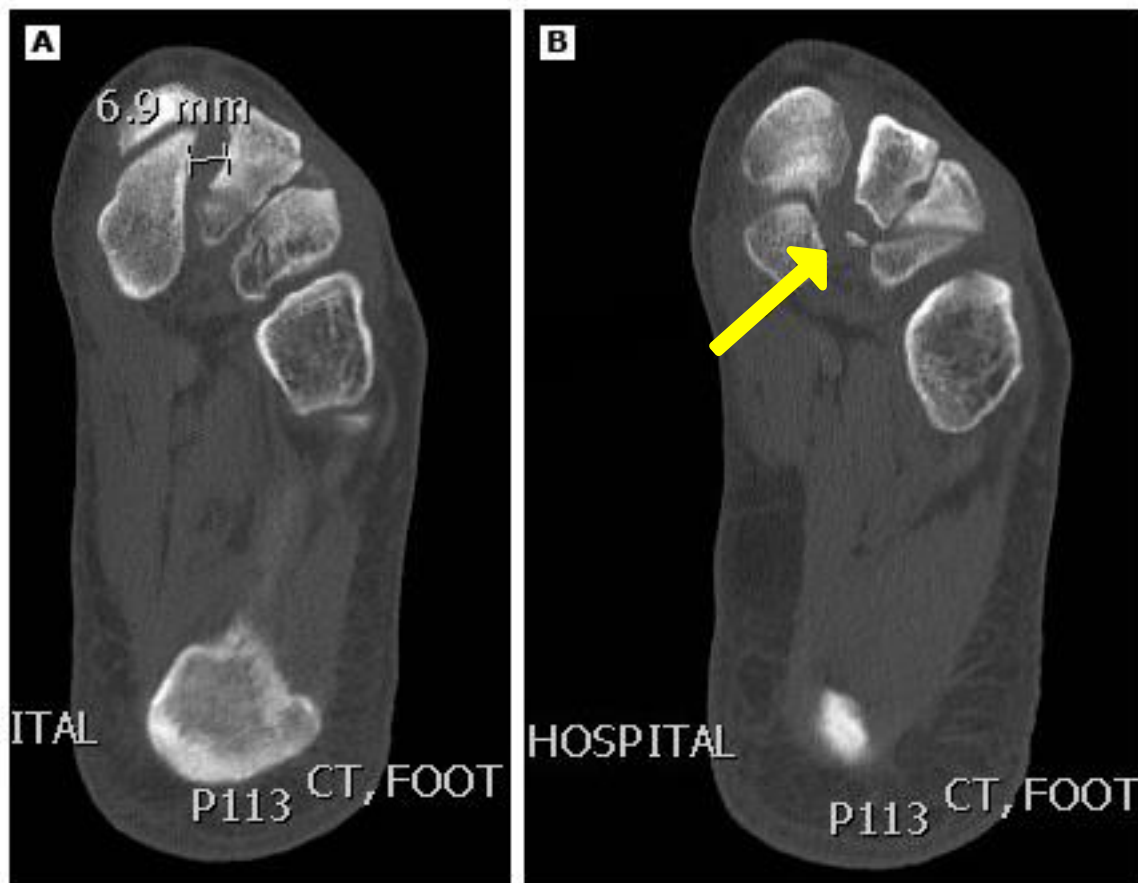




# LISFRANC INJURIES

## Imaging

- Example of a CT



# LISFRANC INJURY

Classification system?

## Acute Management

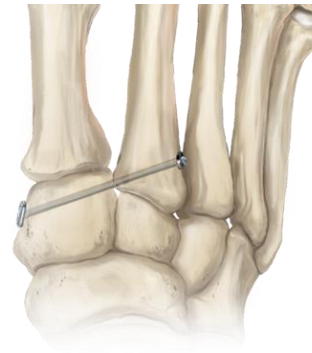
- immobilize (splint or CAM walker)
- non-weight bearing: crutches
- referral to Orthopedics



# LISFRANC INJURY

## Long-term Management

Soft Tissue Injury & Non-displaced fractures	Dislocations & Displaced Fractures
Non-operative	Operative
Immobilize 6-10 weeks, then physical therapy	Open reduction, internal fixation (ORIF)



# ACHILLES RUPTURE

- at risk with running, jumping, & *sudden acceleration/deceleration*
- at risk when current Achilles tendonitis/tendonosis

## Incidence

- General population: 0.01%  
(80% of these are during recreational sports)
- Competitive athletes: 8.3%
  - sprinters: 18%
  - decathletes & soccer: 17%
  - T&F jumpers: 12%
  - basketball: 12%



# ACHILLES RUPTURE

- ↑ recreational sport participation = ↑ rate of tendon ruptures
- peak age: 30 to 40 years (male & female)
  - this might be when *degenerative changes & high stress from sports* coincide
- rupture *4-5x* more common in men



# ACHILLES RUPTURE



## Glucocorticoids

- oral *systemic* steroids and/or *local* injections increase risk of rupture

## Fluoroquinolones

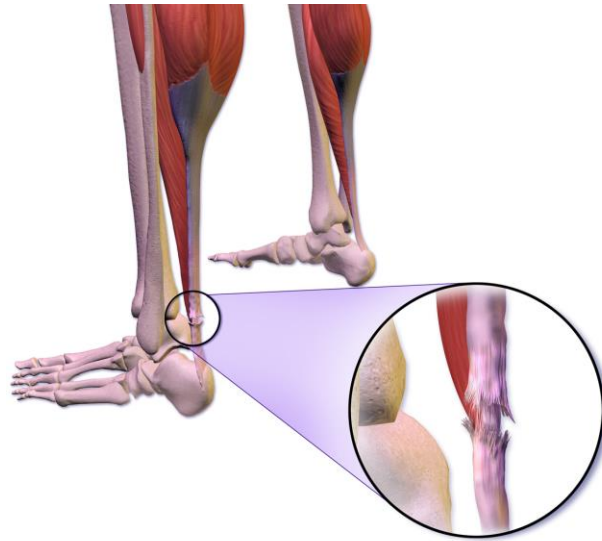
- incidence of rupture is overall rare: 12 per 100,000 (0.012%)
- but, risk is *3x higher during first 90 days* of taking for the *1<sup>st</sup> time*



# ACHILLES RUPTURE

## “water shed” area

- poor blood supply: 2 - 6 cm above the insertion point
- most ruptures occur here



# ACHILLES RUPTURE

## History

- *Sudden* pivoting or rapid acceleration/deceleration
- Struck violently in the back of ankle??
  - “got kicked from behind”
  - “someone shot me”
  - “hit by a 2x4”
- Feel & hear a *loud “pop”*
- Sharp pain, then less pain

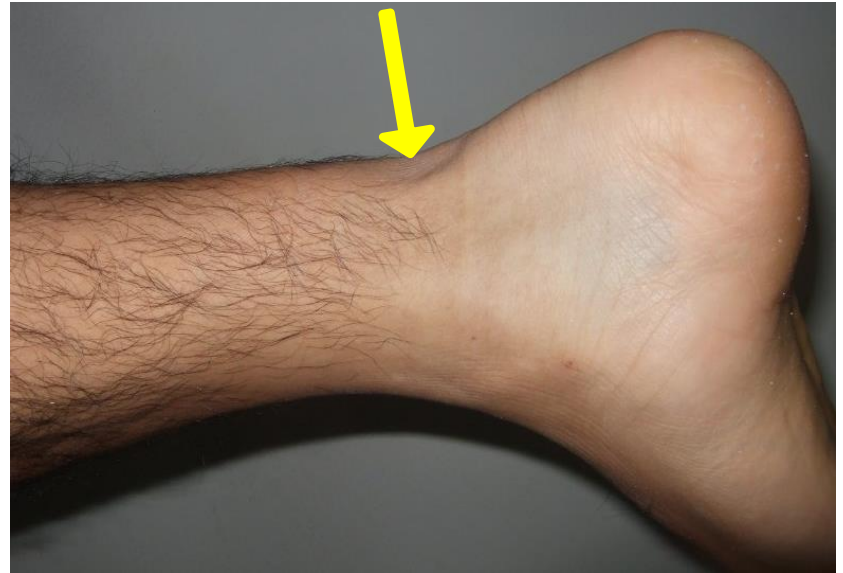




# ACHILLES RUPTURE

## Physical Exam

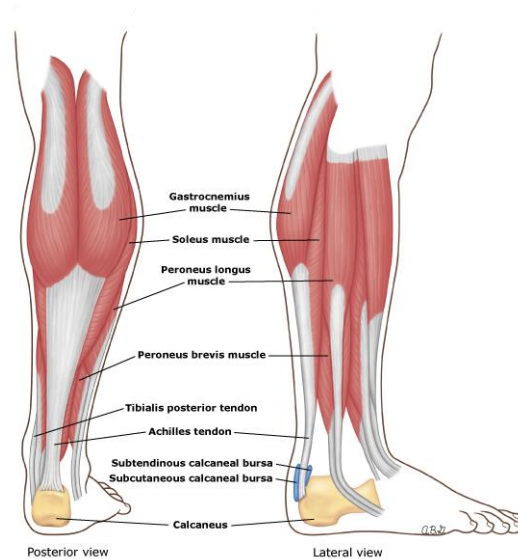
- Straightforward, but don't be fooled!
- Achilles tendon easily identified & palpated
- Palpate for *tenderness* and for *defect*



# ACHILLES RUPTURE

## Physical Exam

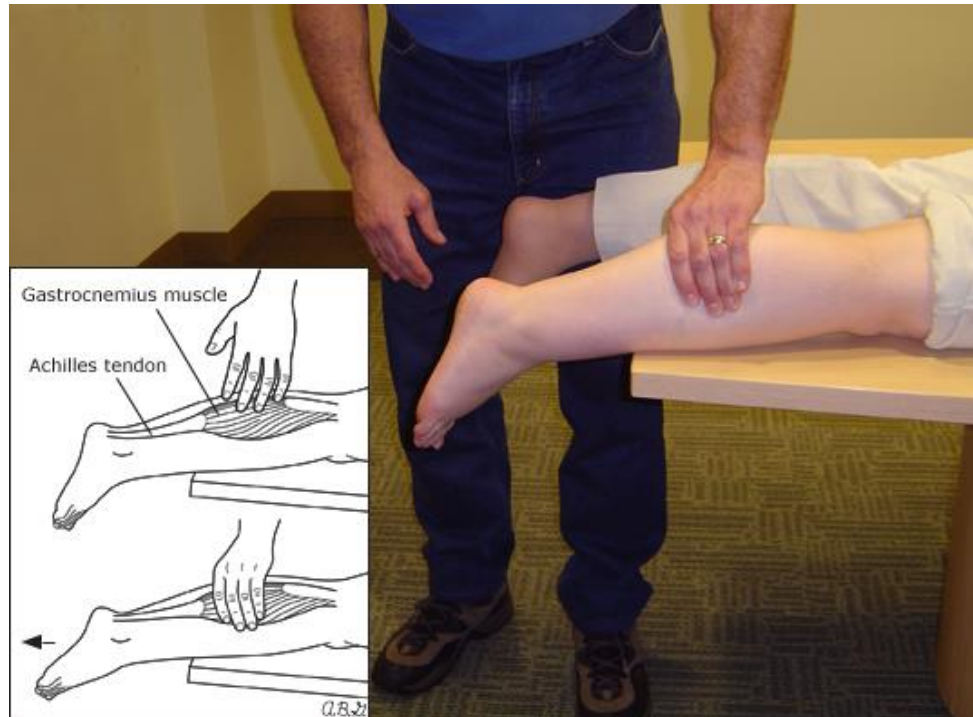
- Straightforward, but don't be fooled!
- UTD: *“sizable minority of patients with complete rupture are able to ambulate”*
  - Many are able to actively plantarflex too...how?



# ACHILLES RUPTURE

## Physical Exam

- Thompson (calf squeeze) Test
  - therefore, *more reliable* than a patient's inability to walk or plantarflex

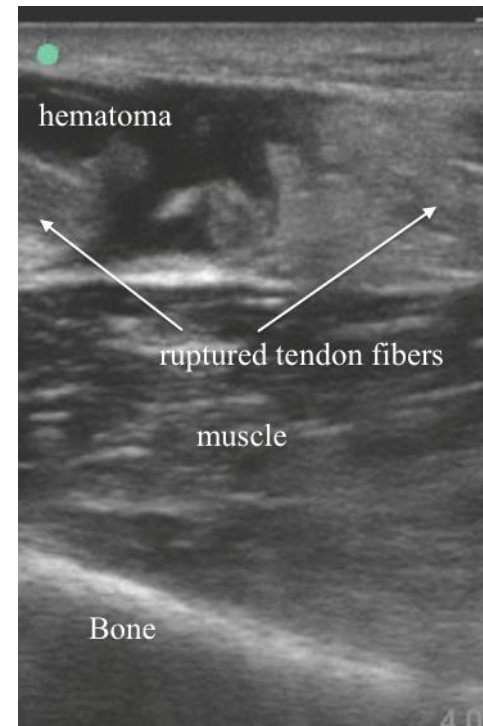
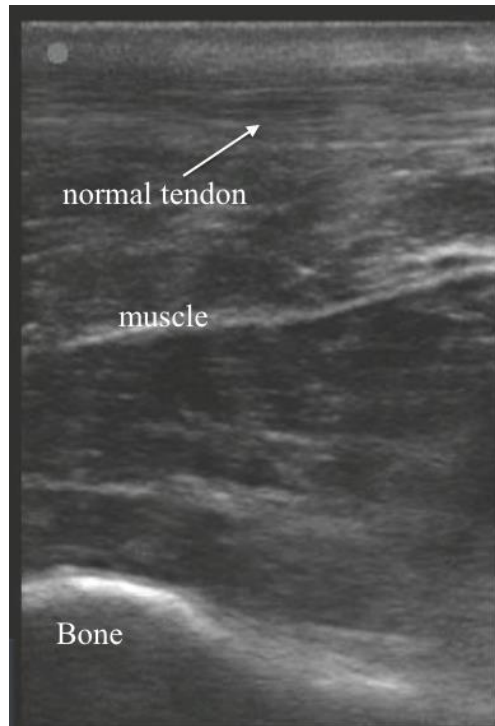


Sens	Spec
96%	93%

# ACHILLES RUPTURE

## Imaging (acutely)

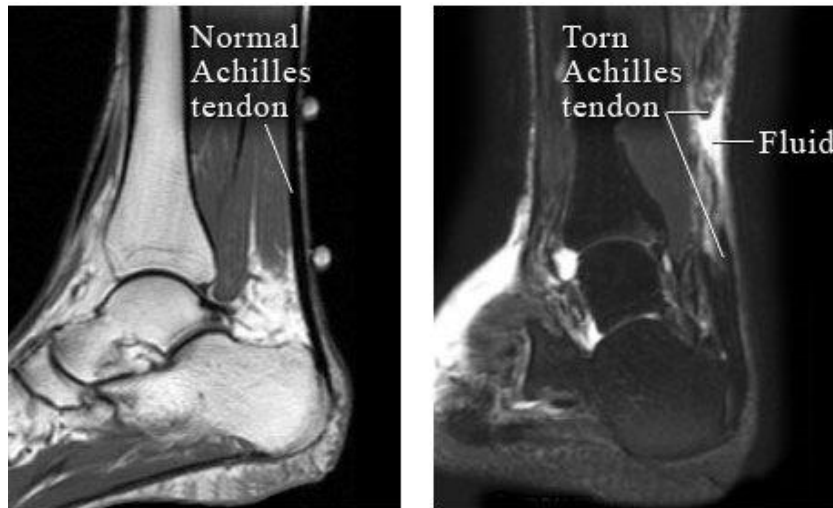
- Not necessary emergently, Achilles tendon rupture may be diagnosed *solely on clinical exam*
- Ultrasound enables rapid confirmation at bedside
  - 100% sensitivity, 83% specificity



# ACHILLES RUPTURE

## Imaging (follow-up)

- Magnetic Resonance Imaging (MRI)
- Confirmatory, surgical planning



# ACHILLES RUPTURE

## Acute Management

- immobilize (splint or CAM walker)
- *heel lift*
- non-weight bearing: crutches
- referral to Orthopedics (*1-2 days*)



# ACHILLES RUPTURE

## Long-term Management

- a) Non-operative: immobilize 6-8 weeks with heel lift
- b) Operative: repair vs. reconstruction



# 5<sup>TH</sup> METATARSAL FRACTURES

Any metatarsal can fracture...

...but the 5<sup>th</sup> metatarsal is the most common to fracture



Acute (traumatic) fracture



Stress fracture



# 5<sup>TH</sup> METATARSAL FRACTURES

Traumatic 5<sup>th</sup> metatarsal fractures are often from:

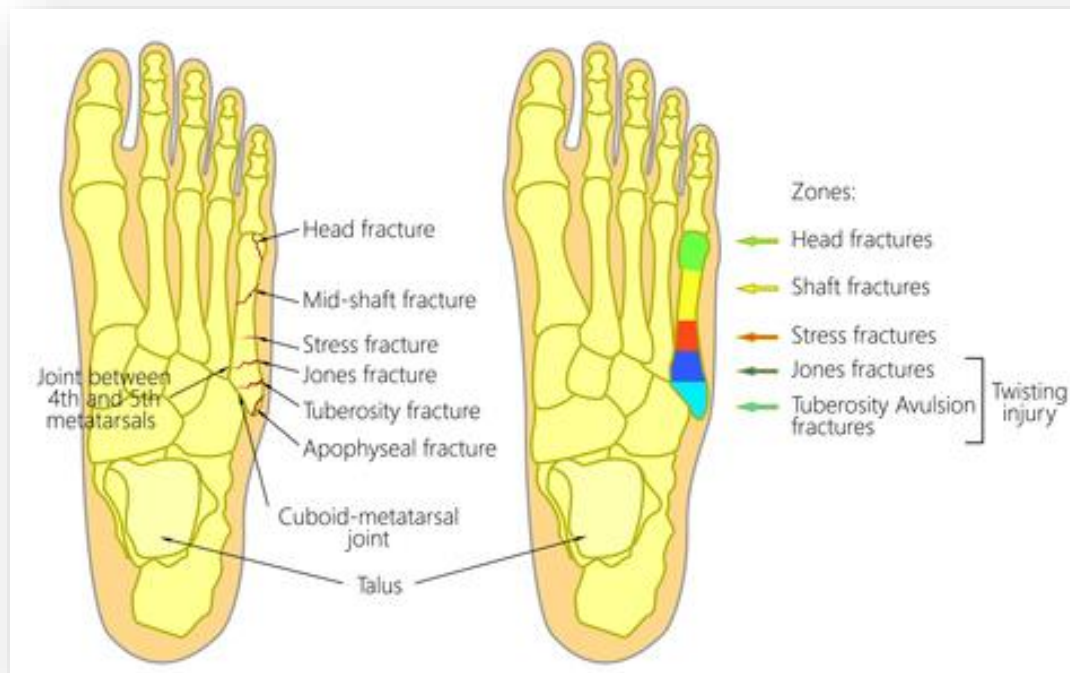
- inversion ankle injuries
- direct blow
- twisting of the foot (stepping on uneven surface)



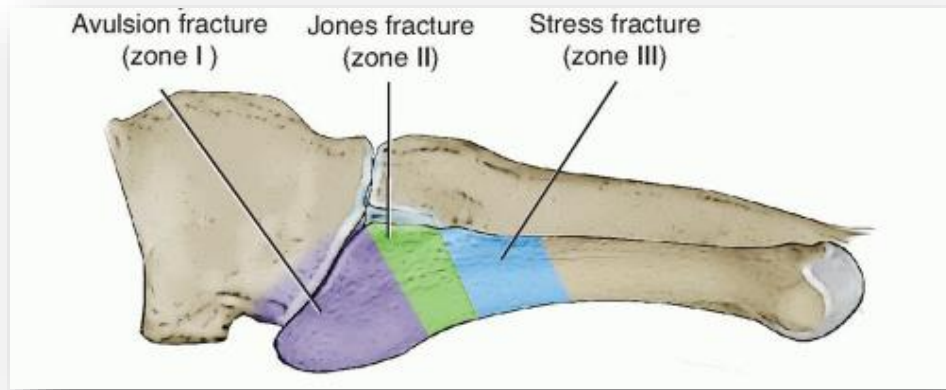
# 5<sup>TH</sup> METATARSAL FRACTURES

Can fracture anywhere, but commonly:

1. mid-diaphyseal (shaft) or head fractures (trauma)
2. proximal portion of diaphysis (stress fx)
3. junction of metaphysis & diaphysis (trauma), AKA “Jones fx”
4. tubercle (base) avulsion fractures (ankle sprain)



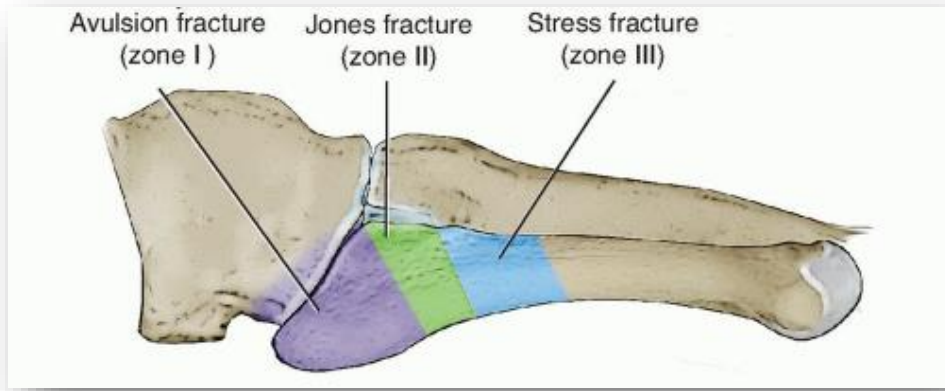
# 5<sup>TH</sup> METATARSAL FRACTURES



## Relative Frequency

- Zone 1: 93%
- Zone 2: 4%
- Zone 3: 3%

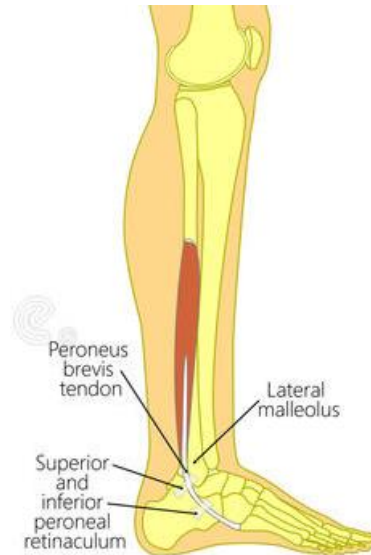
# 5<sup>TH</sup> METATARSAL FRACTURES



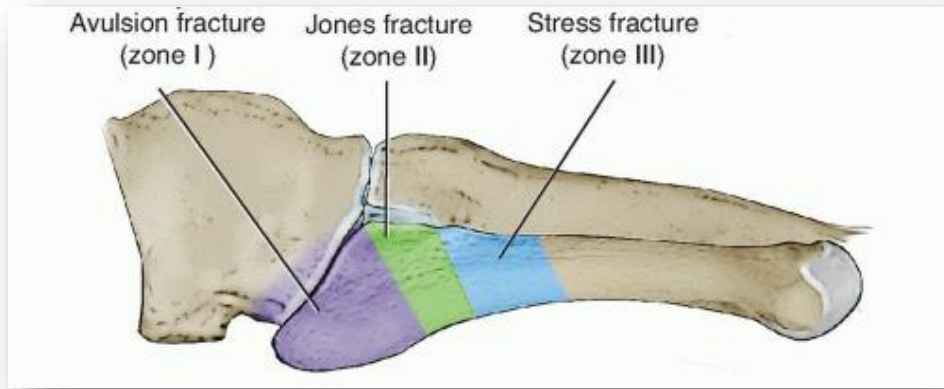
## Relative Frequency

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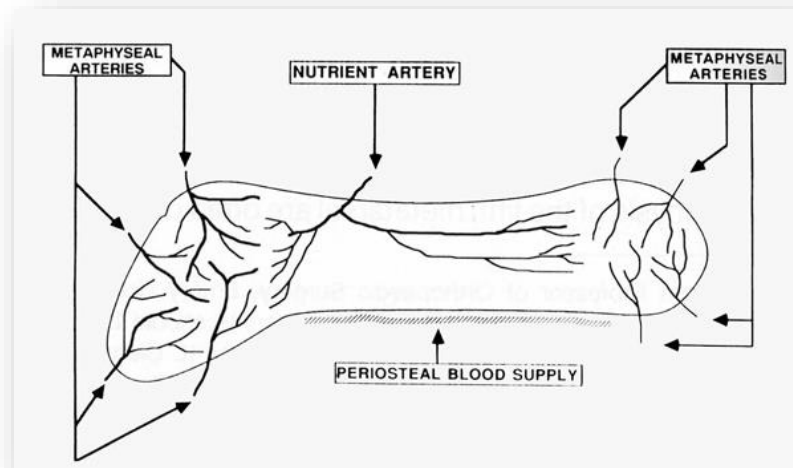
- Why are most avulsion fractures?



# 5<sup>TH</sup> METATARSAL FRACTURES



- Fractures in **Zone 2** aka “**Jones fractures**”
  - problematic due to poor blood supply (“watershed area”)



# 5<sup>TH</sup> METATARSAL FRACTURES

## Jones fractures

- increased risk of non-union (25%)
- weight bearing too early associated with increased non-union

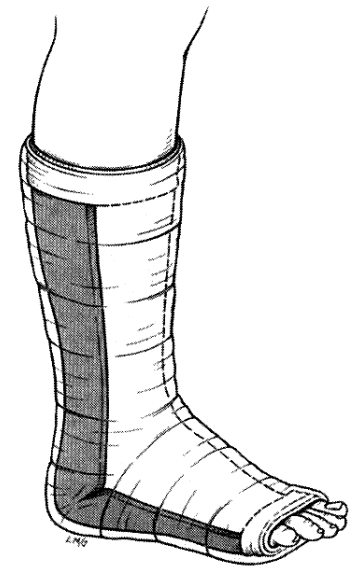


# 5<sup>TH</sup> METATARSAL FRACTURES

## *Acute* Treatment of Jones Fracture

- Non-weight bearing
- Splint: posterior short leg splint or western walker boot

1. keep ankle at 90° (very important!!)
2. begin at metatarsal heads
3. wrap around posterior heel
4. stop at level of fibular head



# 5<sup>TH</sup> METATARSAL FRACTURES

## *Definitive* Treatment of Jones Fracture

### Non-operative

- cast or western walker boot, *but avoid early weight bearing*
- bone stimulator

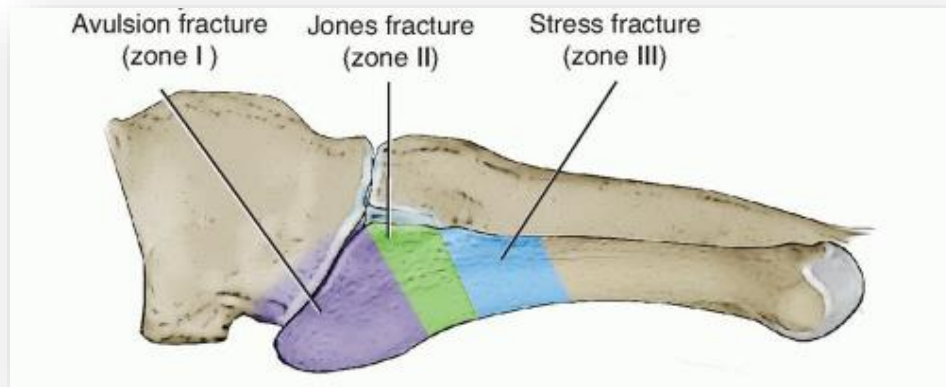
### Operative

- bone graft
- medullary screw





# 5<sup>TH</sup> METATARSAL FRACTURES



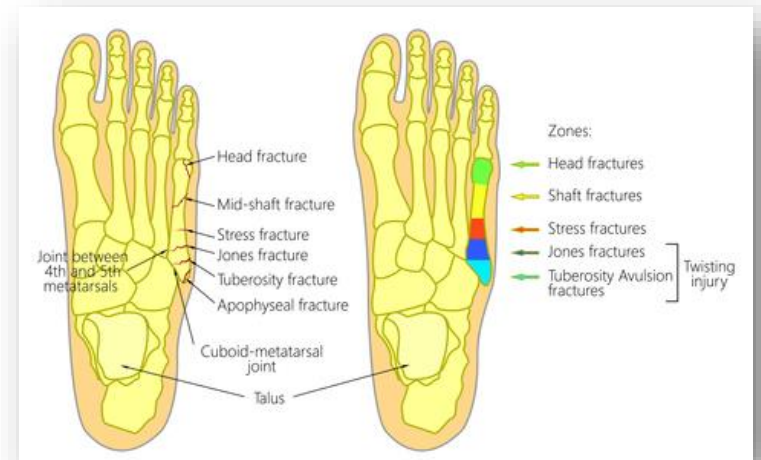
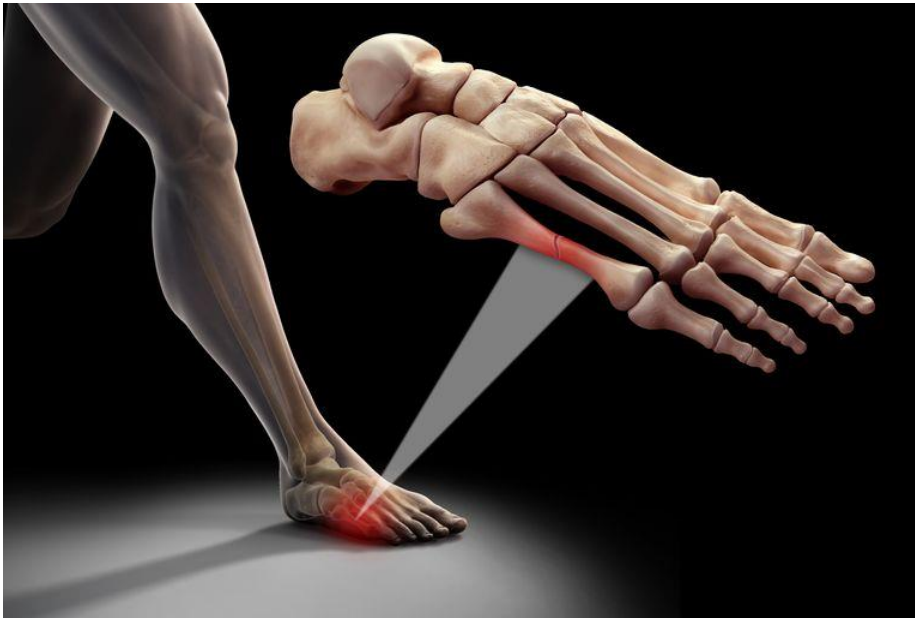
## **Zone 3:** common area for stress fractures

- common in running athletes
- treat like all other stress fractures...
  - REST: non-weight bearing with crutches, western walker boot
  - cross-training
  - bone stimulator
  - consider female athlete triad
  - may need surgery if not healing w/ conservative measures

# 5<sup>TH</sup> METATARSAL FRACTURES

Can fracture anywhere along the 5<sup>th</sup> metatarsal

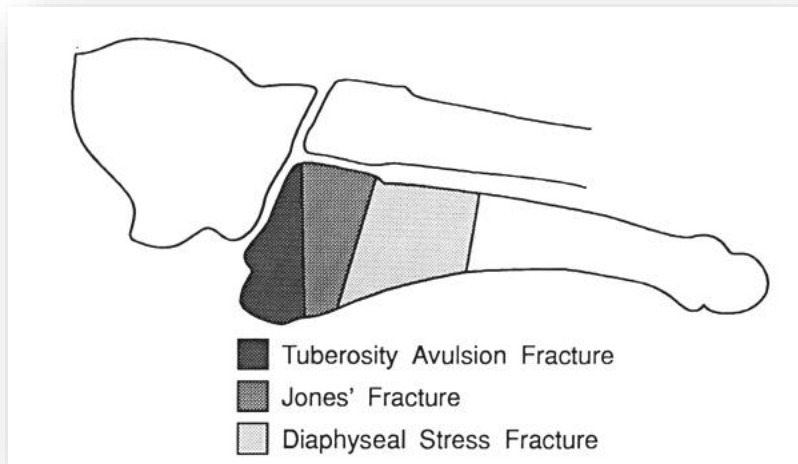
- treat any other *acute, traumatic* fracture like any other fracture...



# 5<sup>TH</sup> METATARSAL FRACTURES

## Summary

- Zone 1: non-operative, can Tx in Primary Care (treat the ankle sprain)
- Zone 2: non-operative or operative, refer to Orthopedics b/c of high incidence of non-union
- Zone 3: non-operative at first, can treat in Primary Care. If not healing, refer to Ortho for possible operative treatment



# SUMMARY: KEY POINTS

## Morton's Neuroma

- narrow toe box
- 2<sup>nd</sup> & 3<sup>rd</sup> web spaces
- metatarsal compression test

## Lisfranc Injuries

- rare, but frequently missed = legal liability
- tarsometatarsal joint complex
- often cannot weight bear
- subtle X-ray findings

## Achilles Rupture

- most occur in athletes or with recreational sports
- most common in males, ages 30 – 40
- surprise at suddenness of injury
- Thompson test
- must refer to Ortho quickly

## 5<sup>th</sup> Metatarsal Fractures

- Zone 1, Zone 2, & Zone 3
- Jones fracture – watershed area

# POST-TEST QUESTION #1

Which of the following is a simple special test maneuver that may help confirm Morton's neuroma?

- A. Thompson test
- B. metatarsal compression test
- C. Kleiger's test
- D. anterior drawer test
- E. inversion stress test

# POST-TEST QUESTION #1

Which of the following is a simple special test maneuver that may help confirm Morton's neuroma?

- A. Thompson test
- B. *metatarsal compression test***
- C. Kleiger's test
- D. anterior drawer test
- E. inversion stress test

# POST-TEST QUESTION #2

What mechanism of injury is known to cause a Lisfranc fracture/dislocation?

- A. direct blow to the foot
- B. hyper dorsiflexion of the foot/ankle
- C. excessive external foot rotation
- D. axial load on a plantar flexed foot

# POST-TEST QUESTION #2

What mechanism of injury is known to cause a Lisfranc fracture/dislocation?

- A. direct blow to the foot
- B. hyper dorsiflexion of the foot/ankle
- C. excessive external foot rotation
- D. ***axial load on a plantar flexed foot***



# POST-TEST QUESTION #3

Which of the following statements is true about 5<sup>th</sup> metatarsal fractures?

- A. fractures of this bone are rare
- B. stress fractures are most common
- C. avulsion fractures are most common
- D. Jones fractures are most common

# POST-TEST QUESTION #3

Which of the following statements is true about 5<sup>th</sup> metatarsal fractures?

- A. fractures of this bone are rare
- B. stress fractures are most common
- C. ***avulsion fractures are most common***
- D. Jones fractures are most common

# CITATIONS

1. Beutler, A. and Taylor, C. Tarsometatarsal (Lisfranc) joint complex injuries. In: UpToDate, Eiff, P. and Asplund, CA. (Ed), UpToDate, Waltham, MA, 2019
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