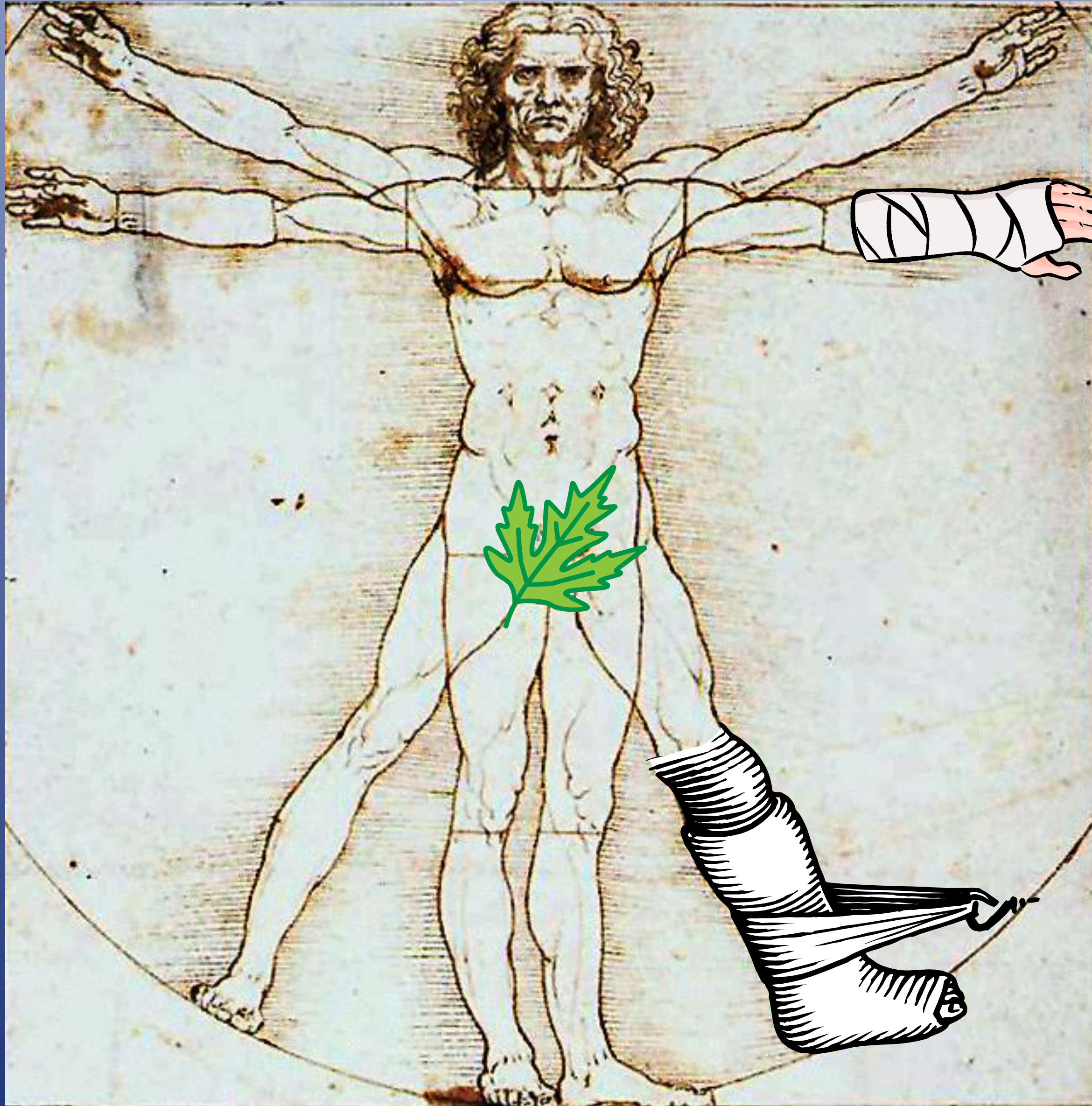
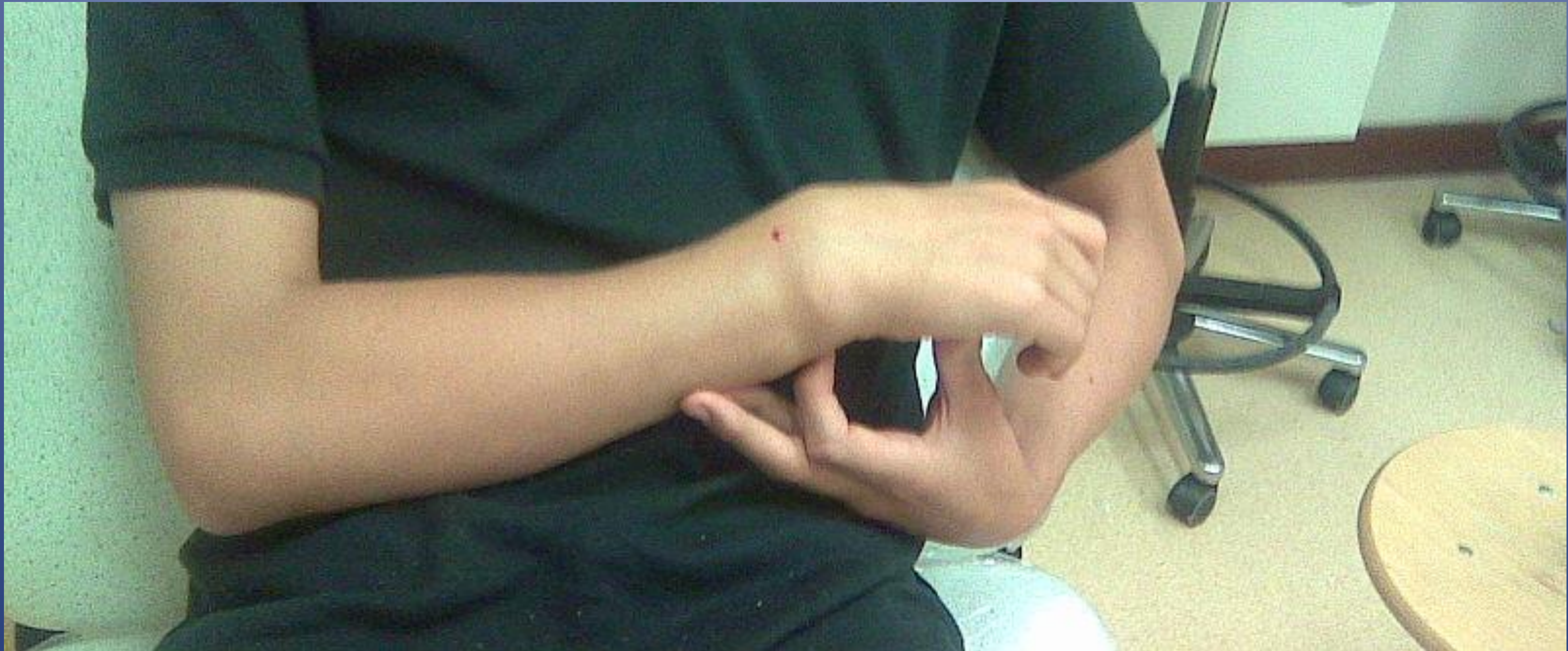
Management of Distal Extremity Injuries in College Health

John A. Vaughn, MD The Ohio State University



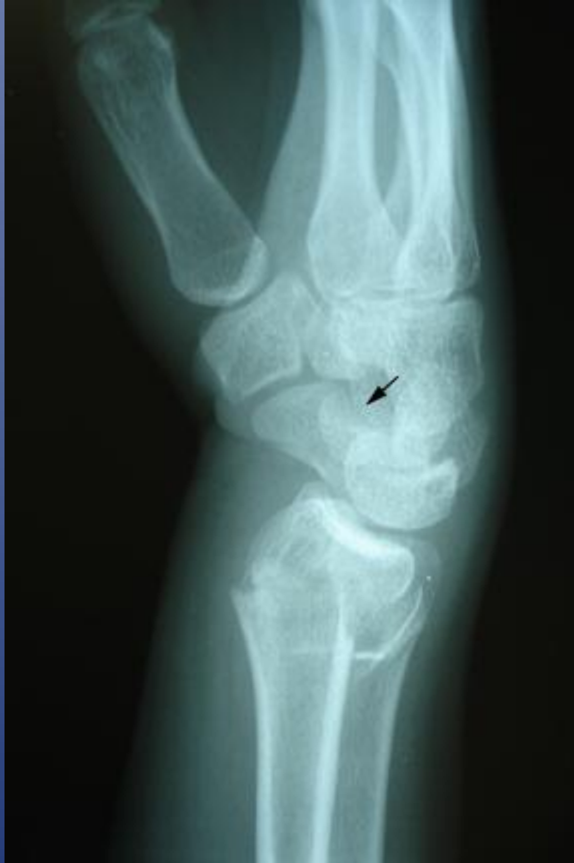
Girl trips over her flip-flops and puts her hand out to catch herself



Distal Radius (Colles') Fracture

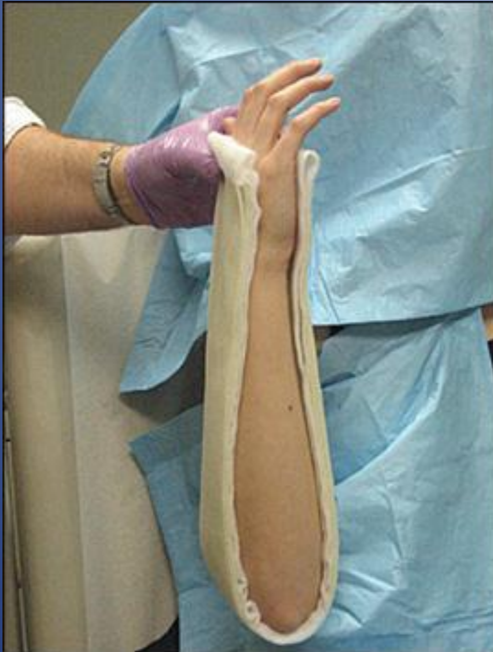
- Most common upper extremity fracture
- FOOSH!
- Extremity often looks normal
  - Swelling may not develop immediately
  - Often no deformity

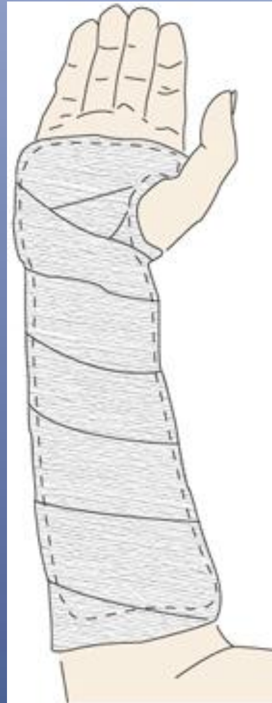
Distal Radius Fx - Evaluation



- Assess neuro-vascular status
  - Motor, sensory exam
  - Pulses, cap refill
  - Range of motion
- Obtain x-ray
  - What if you don’t have x-ray?

Distal Radius Fx – Management

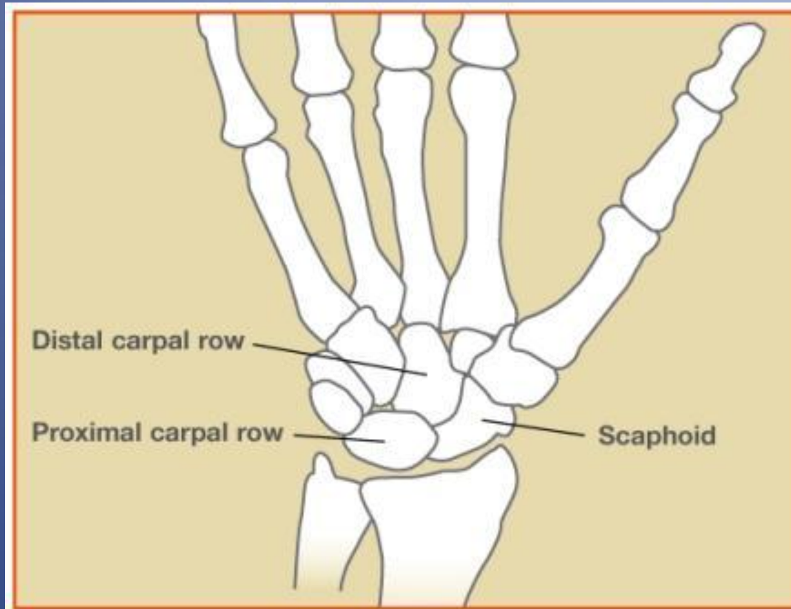


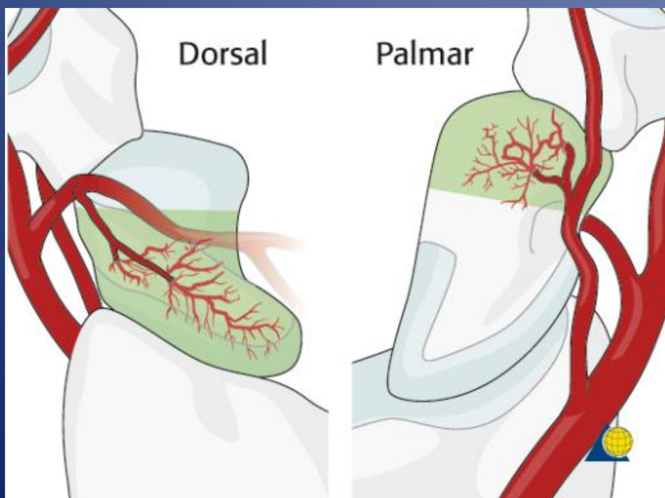


- Refer to Ortho
  - within 3-5 days
- Reverse sugar tong splint is ideal
  - 2 planes of motion
- Volar splint and a sling in a pinch

Her flip-flop fanatic friend fell the same way

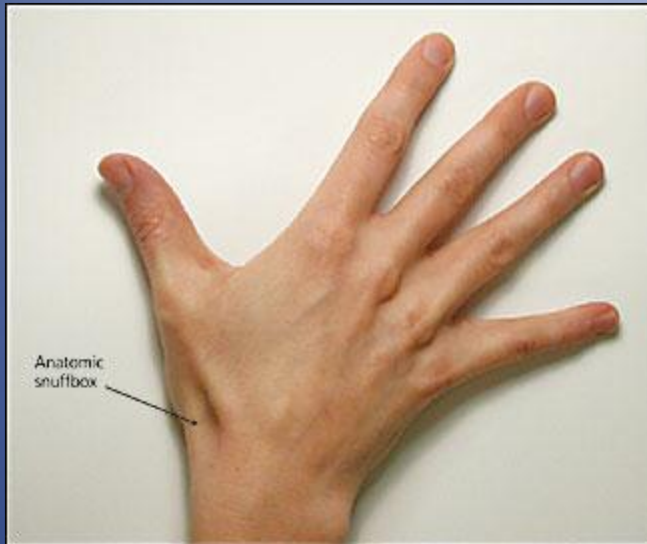
Scaphoid (Navicular) Fracture

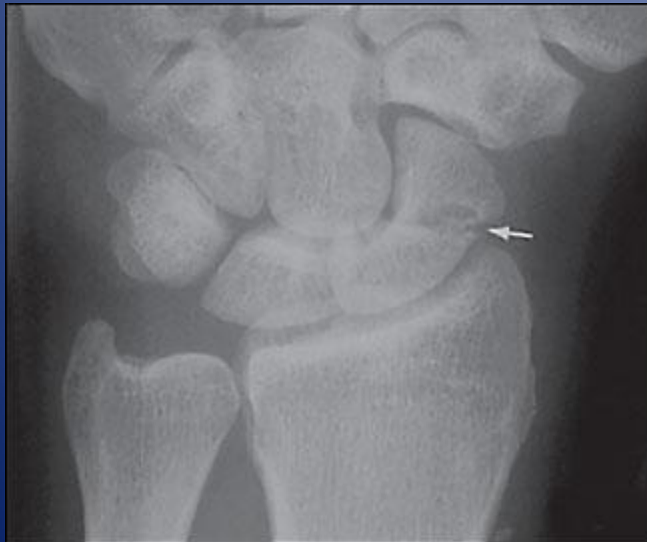




- Most common carpal fracture
- FOOSH!
- Avascular necrosis risk
  - Blood supply enters at distal pole
- Pain, worse with grip

Scaphoid Fracture - Evaluation

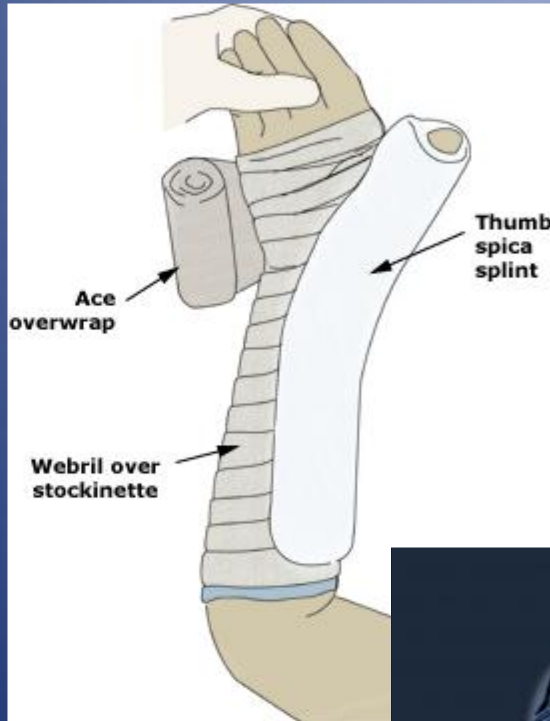




- Compare wrists
  - May look normal
- ***Snuff box tenderness***!
  - 90% sensitive for fx
  - Less specific (40%)
- Obtain x-ray…

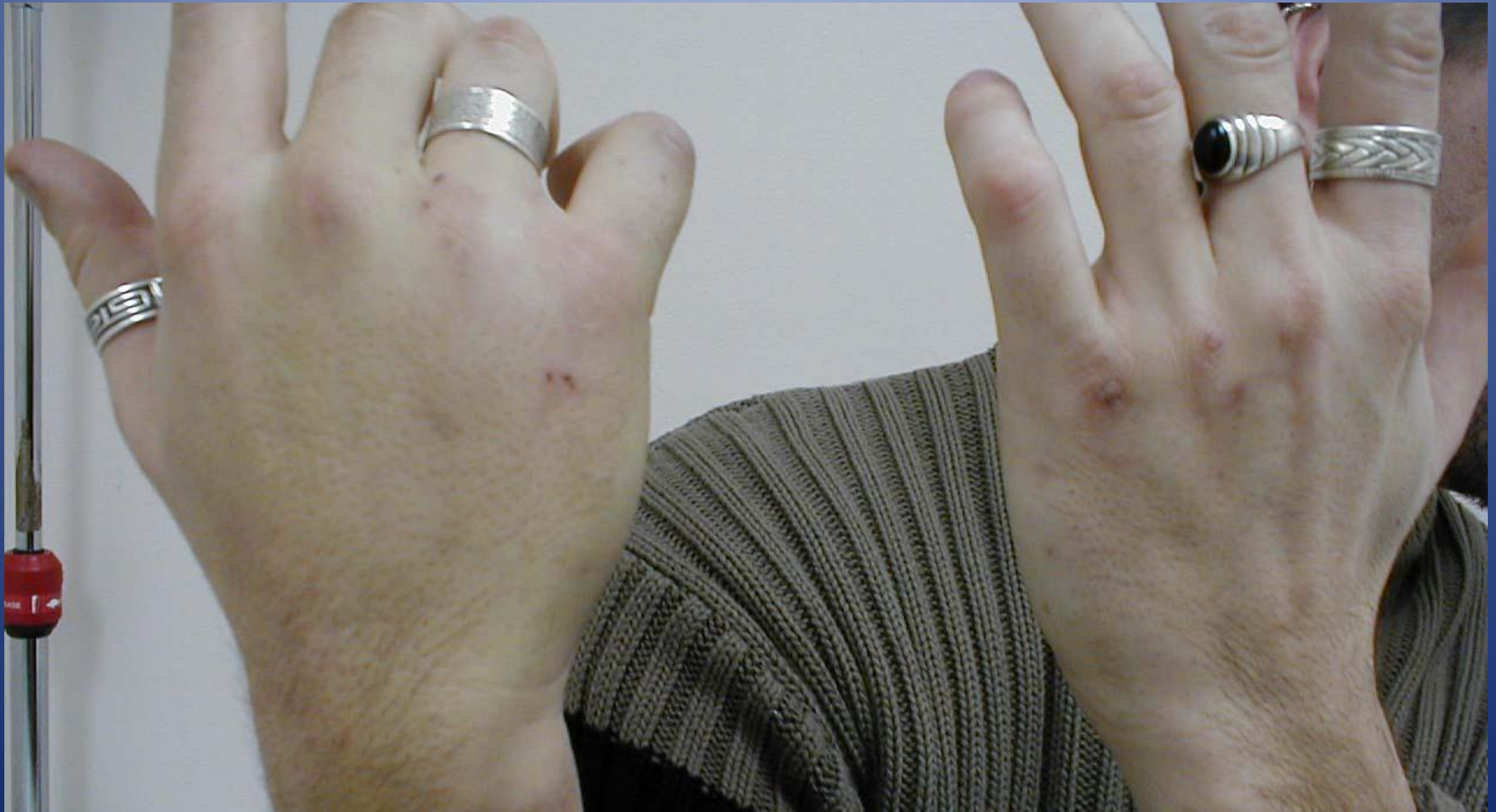
  But don't believe them!

Scaphoid Fracture - Management



- Thumb spica splint
- Reassess in 7-10 days
  - Re-check snuff box
  - Repeat x-rays
- Alternatively, MRI or CT
- Refer to Ortho if fracture is present or symptoms persist

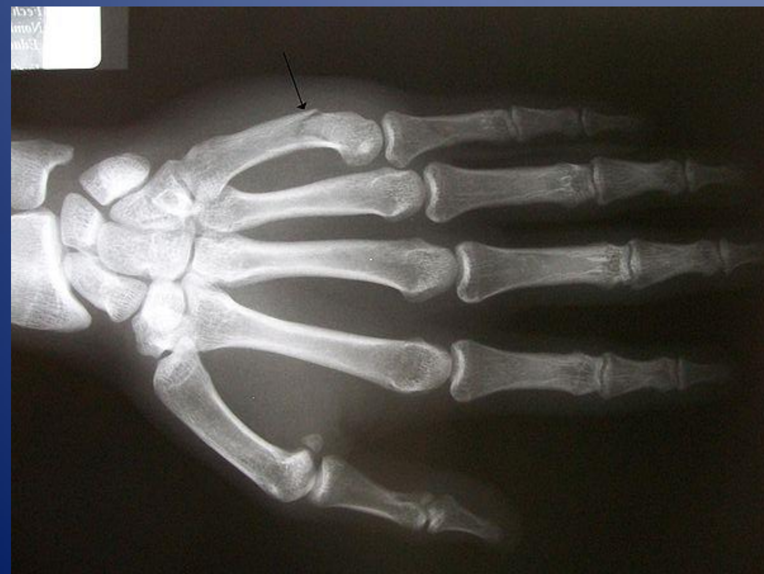
Sophomore’s girlfriend broke up with him last night and he punched a wall



Boxer's Fracture

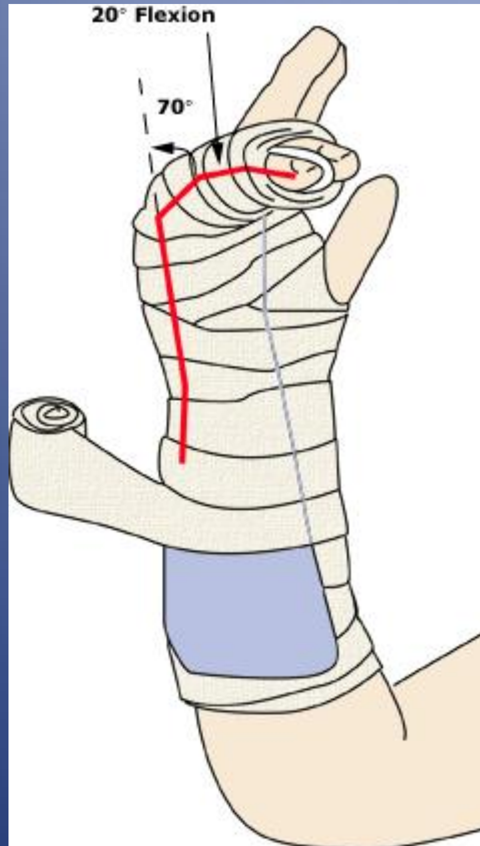
- 5th Metacarpal neck fx
- Direct trauma to a clenched fist
  - I fought the wall and the wall won.

Boxer's fracture - Evaluation



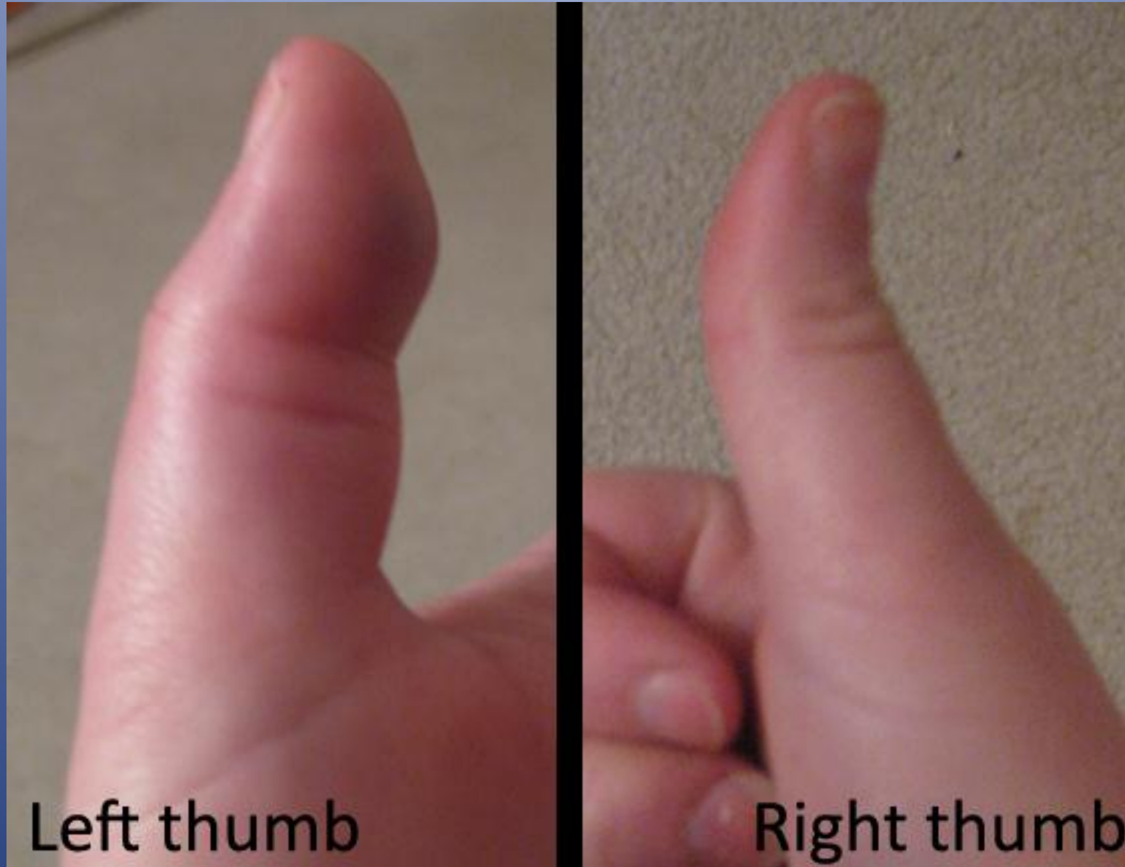
- Swelling of dorsum of hand
- Ecchymosis and Tenderness over 5th metacarpal head
- Assess rotational alignment
  - On exam
  - On x-ray

Boxer's fracture - Management

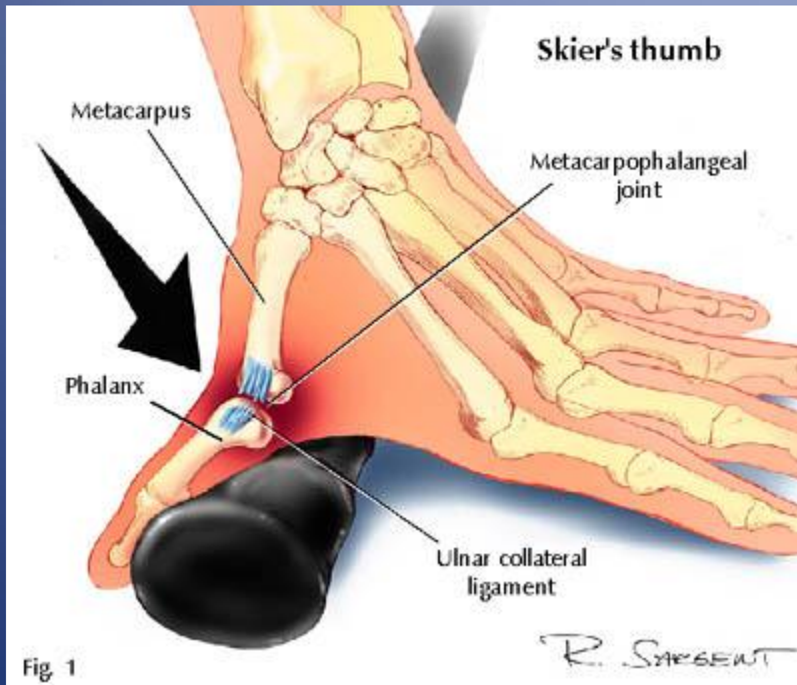


- Ulnar gutter splint
- Refer to Ortho in 1 week
- Urgent referral
  - Open fracture
  - Neurovascular compromise
  - "pseudo-clawing"
  - Significant angulation

Freshman just got back from ski club trip over break and her thumb hurts



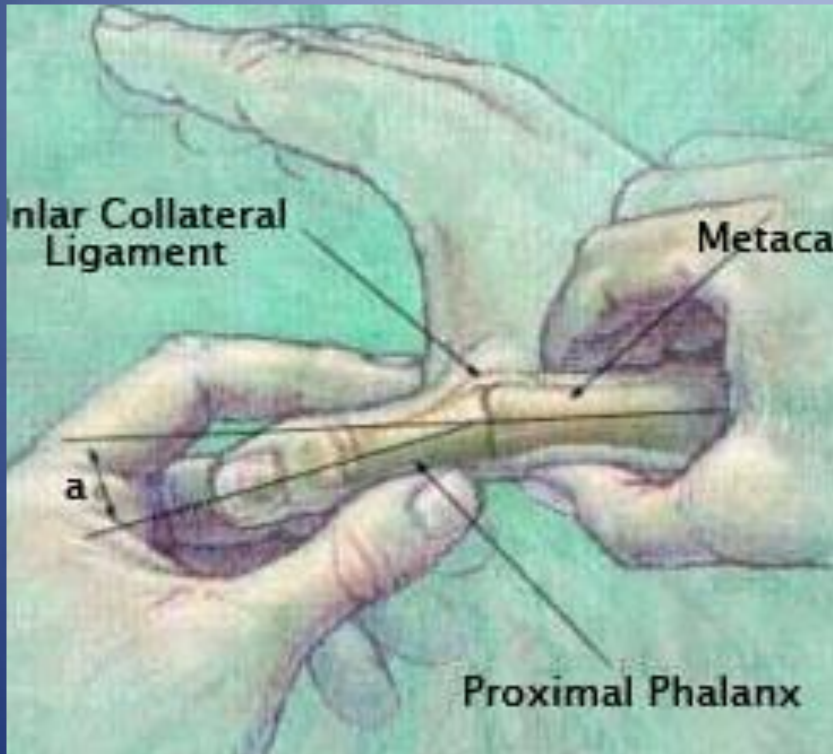
Skier's Thumb

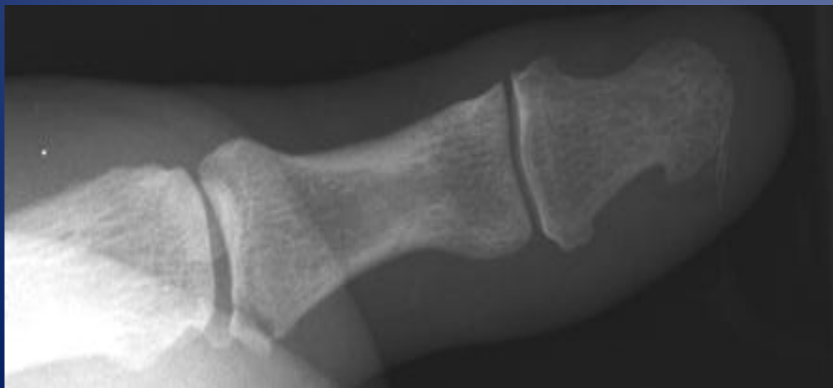


- Ulnar Collateral Ligament Tear
- Forced abduction and hyperextension of 1st MCP joint
- Ski pole injuries most common cause

Skier's Thumb - Evaluation

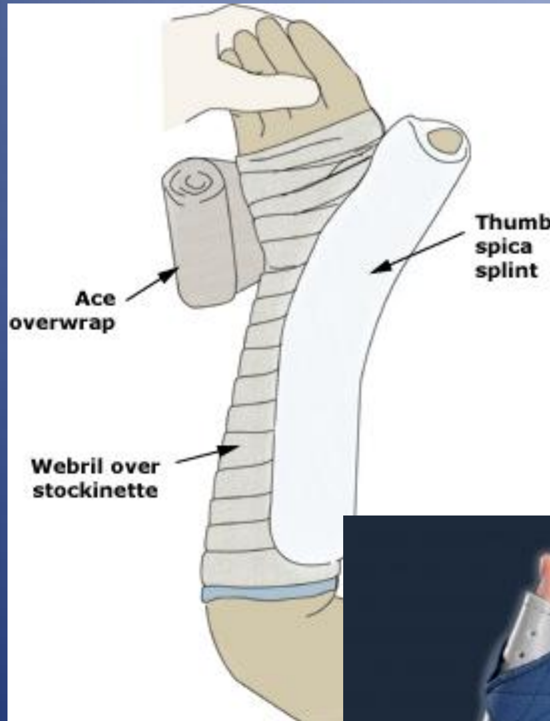
Skier's Thumb - Evaluation





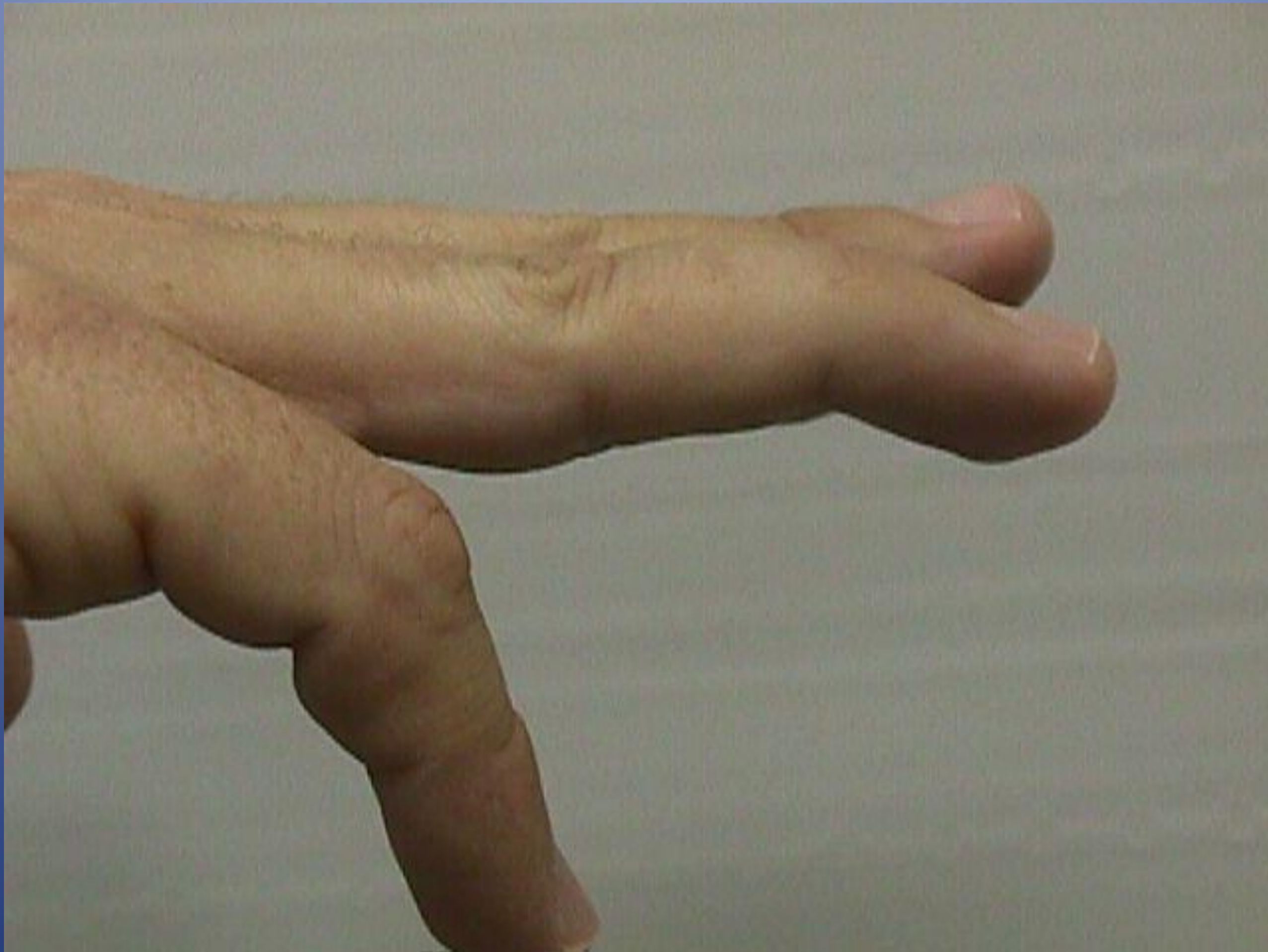
- Classic history
- Swelling of entire joint
- Tender at ulnar aspect
- Pain with extension or abduction
- Laxity of MCP joint
  - Compare to other thumb

Skier's Thumb - Management

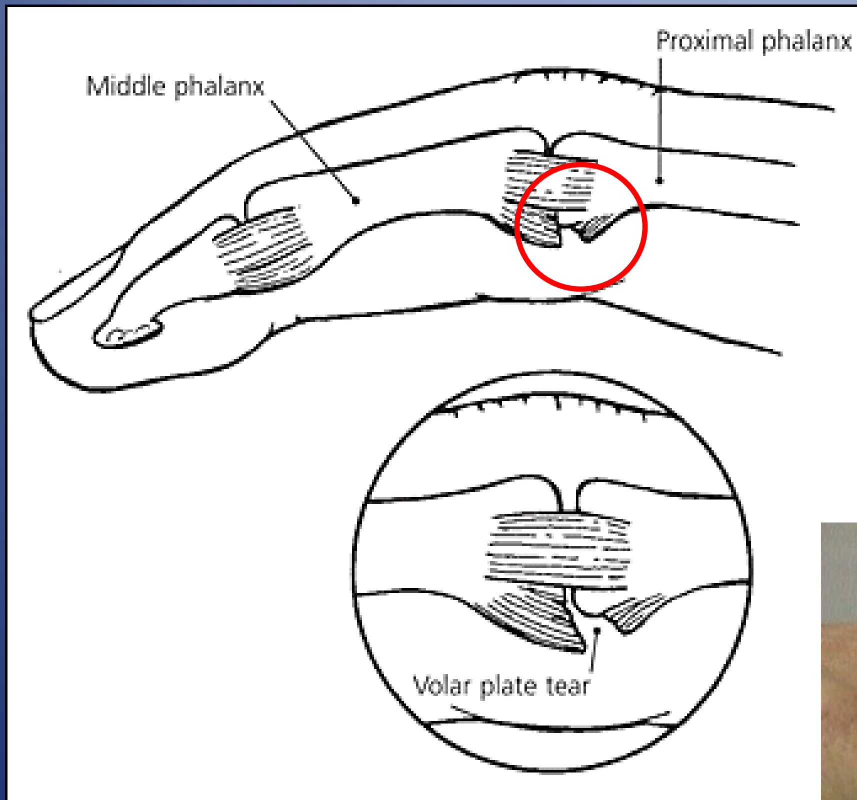


- Thumb spica splint
  - At least 6 weeks
- R.I.C.E.
- Ortho referral ASAP especially if…
  - Presence of fracture
  - Significant laxity of joint
- Early surgical repair has better outcomes

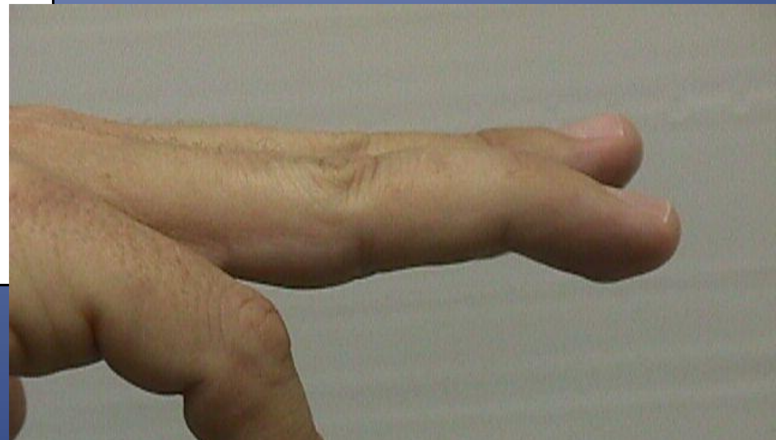
Wrestling with fraternity brother



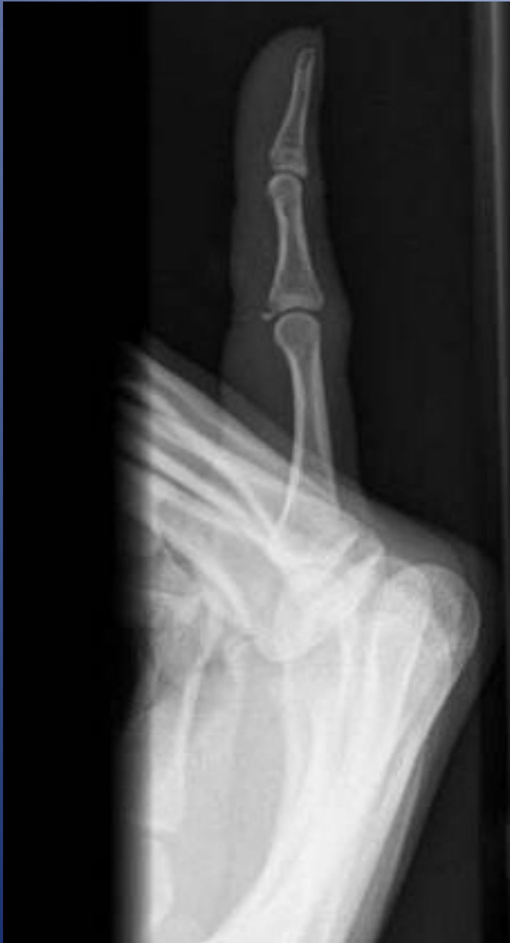
PIP Volar Plate Injuries



- Mechanism: hyper-extension of joint
- “Swan Neck” deformity
  - PIP joint hyperextended by extensor tendons

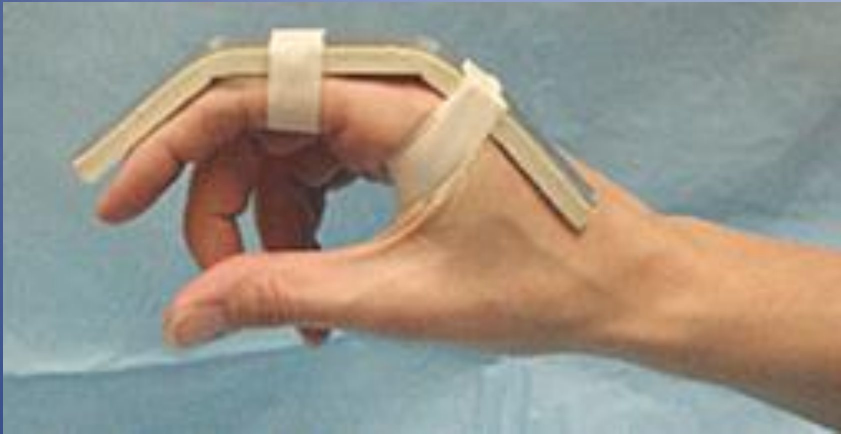


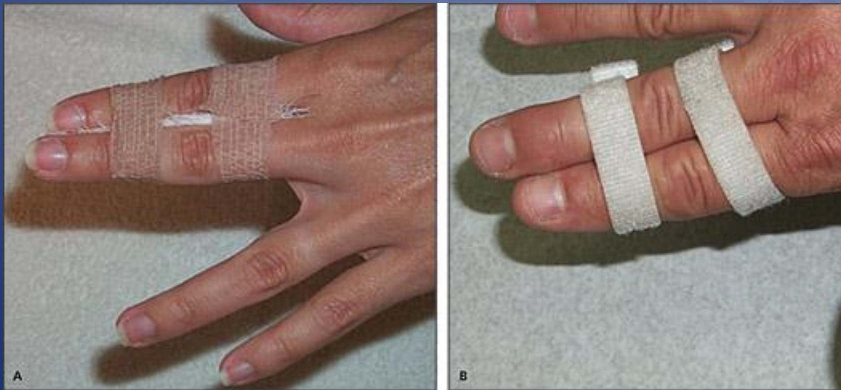
Volar Plate Injuries



- Max tenderness at ***volar*** aspect of PIP joint
- Check flexion, extension and lateral stability
- Neurovascular assessment
- X-ray to rule out avulsion fracture

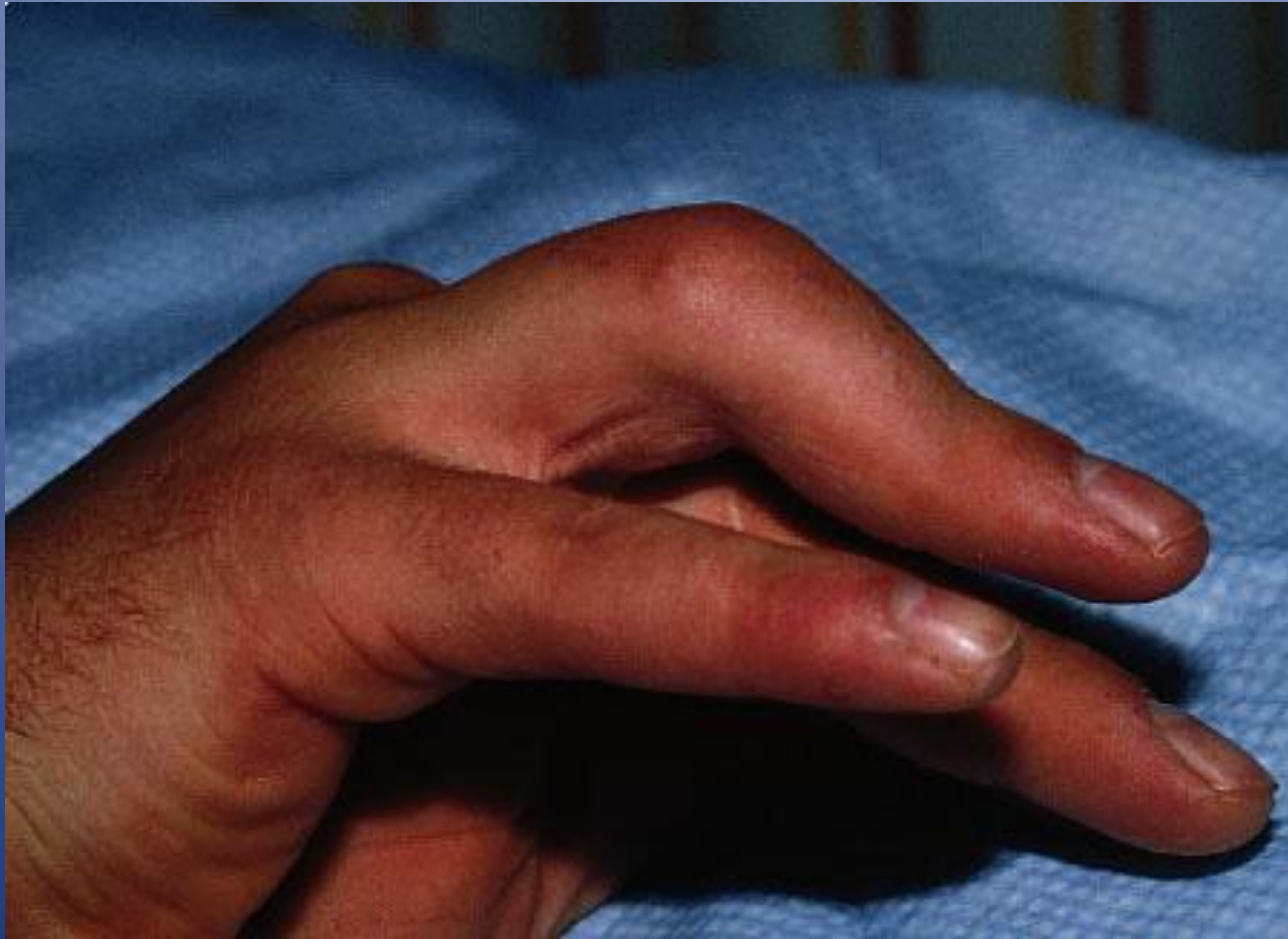
Volar Plate Injuries



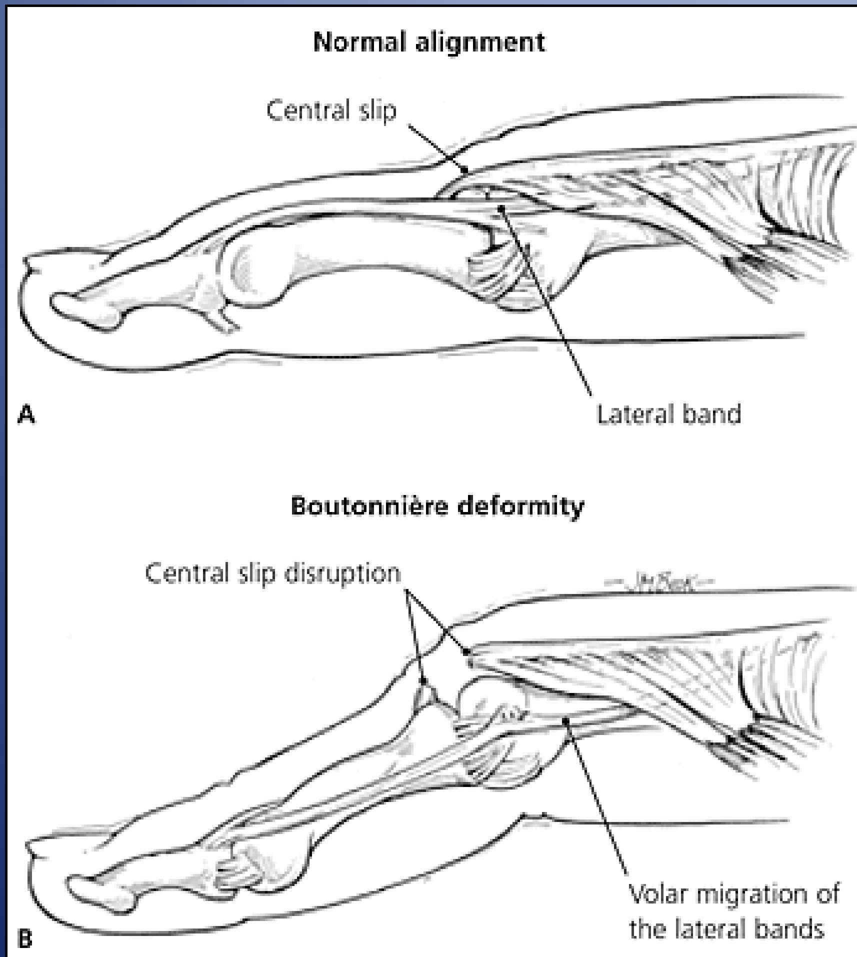


- Block Splint at 30 degrees of flexion
  - Progressively extend over 2-4 weeks
  - Buddy taping for less severe strains
- Ortho referral
  - Presence of fracture
  - Unstable joint

6 weeks later his buddy comes in

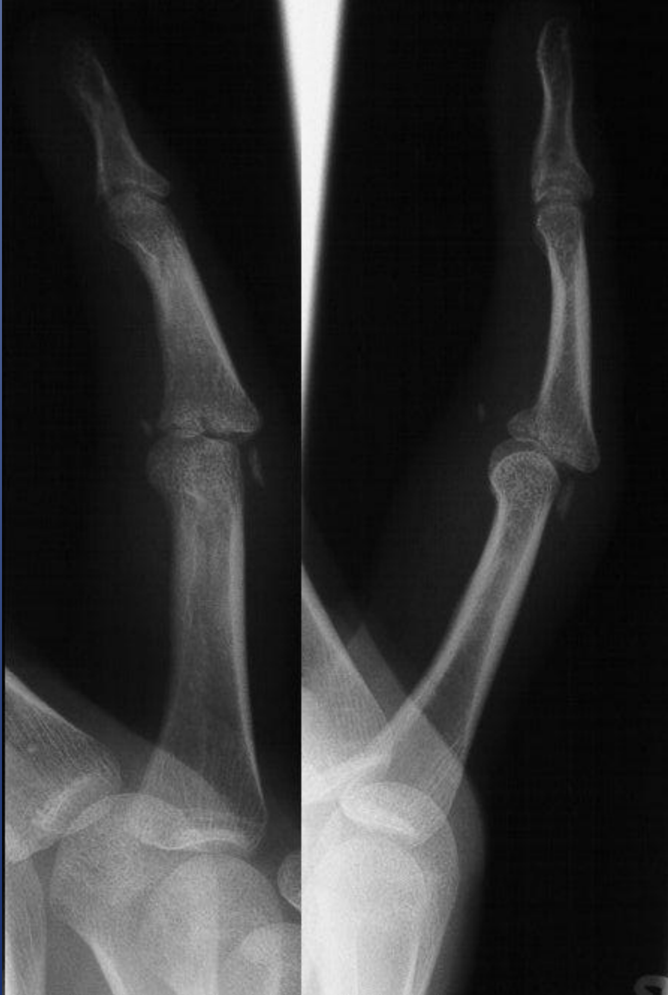


Central Slip Extensor Injury



- Boutonniere Deformity
- PIP most commonly affected
- Mechanism = forced flexion of an extended PIP joint
- *Usually don’t present for 4-6 weeks

Central Extensor Slip Injury

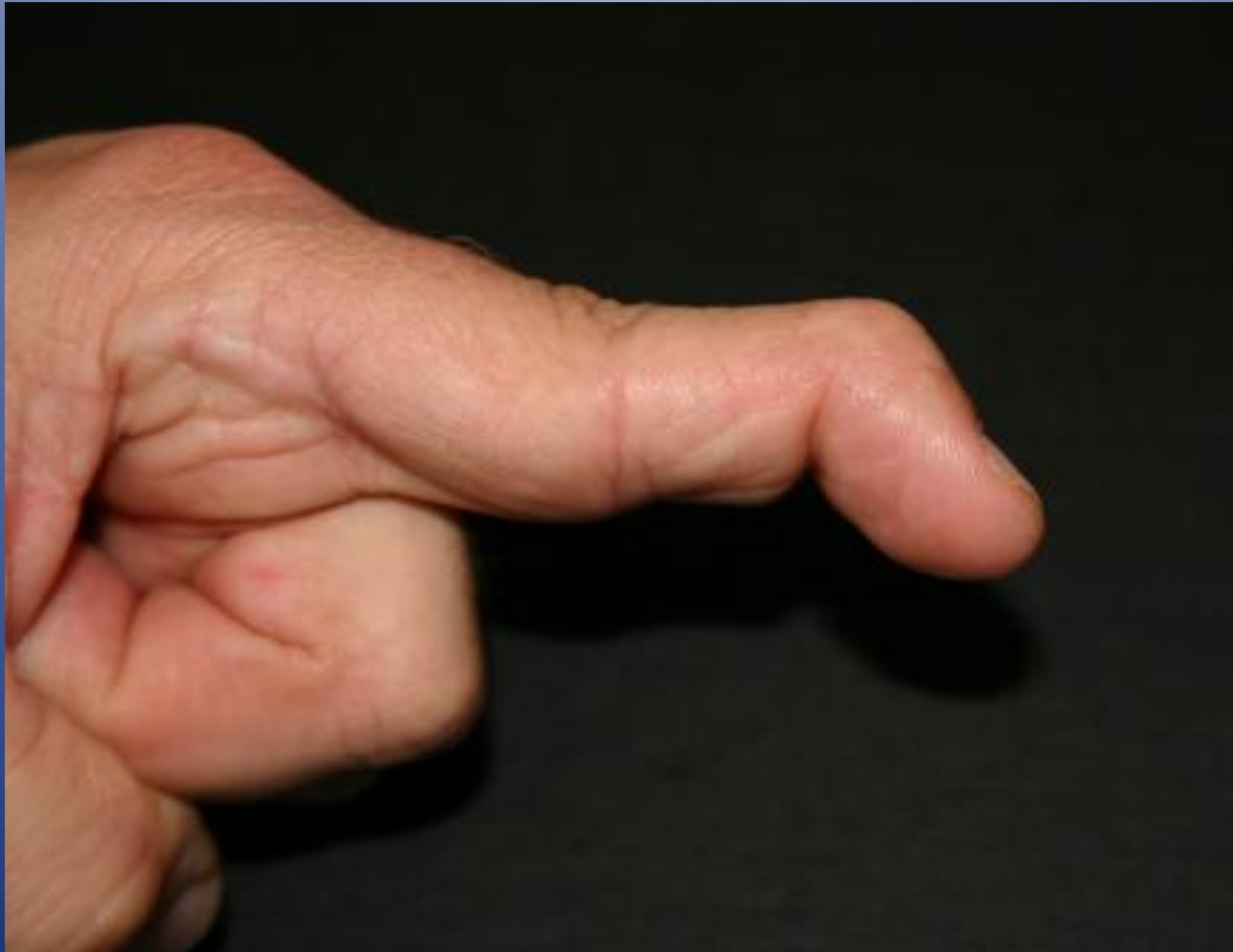


- Max tenderness at ***dorsal*** aspect of PIP joint
- Can't actively extend PIP joint
- X-ray to rule out dorsal avulsion fracture

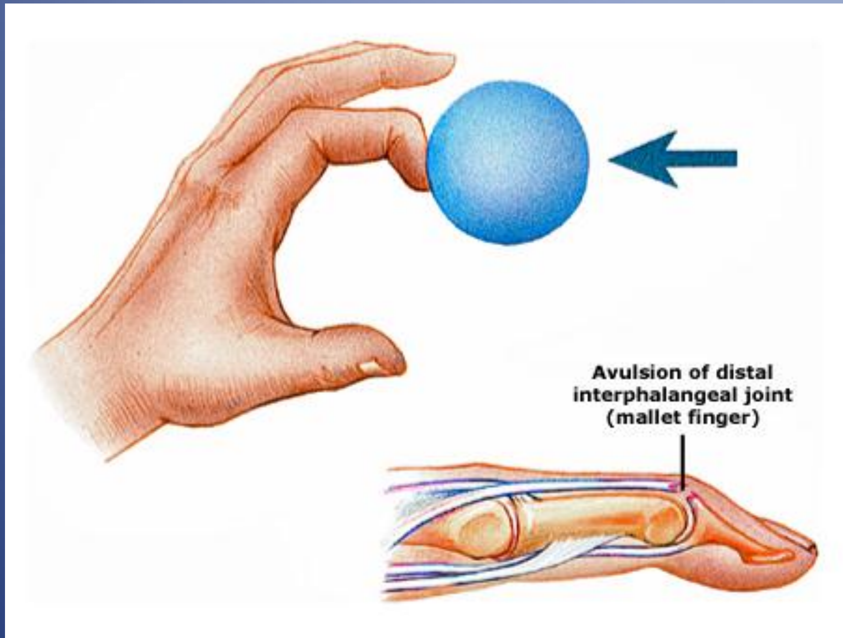
Central Extensor Slip Injury

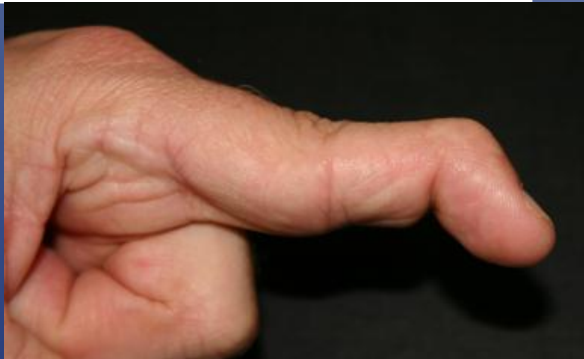
- ***Continuous*** splinting in ***full*** extension
  - 6-8 weeks
- Ortho Referral
  - Presence of fracture
  - Inability to passively extend PIP joint
  - Non-urgent
- What if you can’t tell?

Freshman tossing a baseball on the quad and “jams” his finger



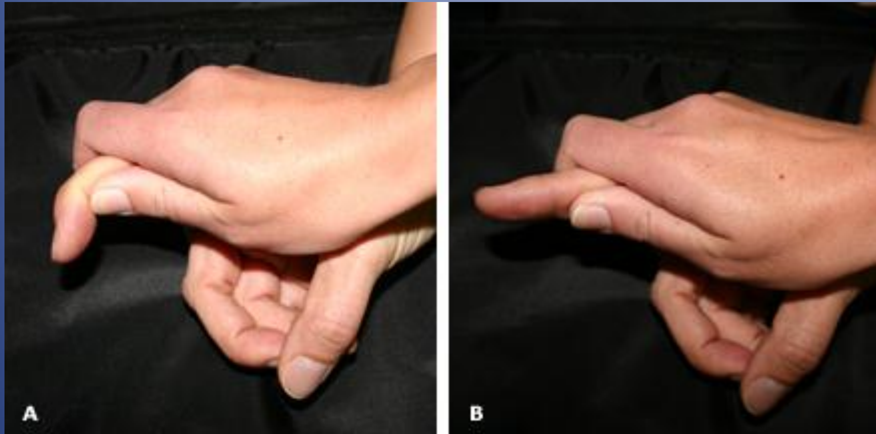
Mallet Finger

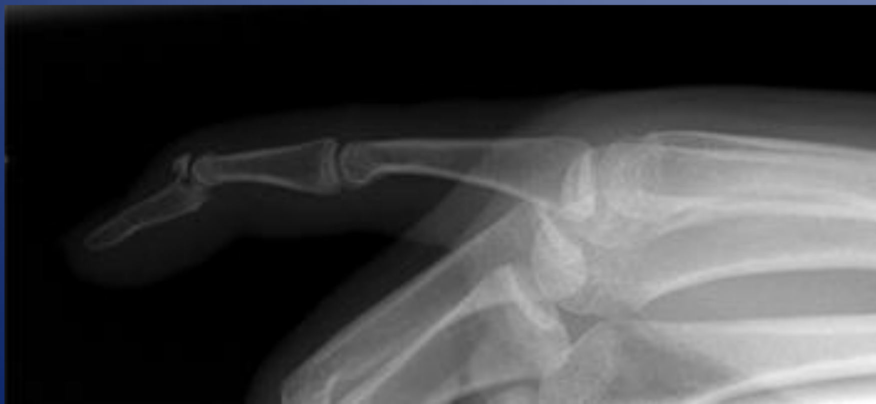




- Avulsion of DIP extensor tendon
- Most common tendon injury in finger
- Pain, swelling, bruising
- *Inability to extend DIP
  - Flexed DIP at rest

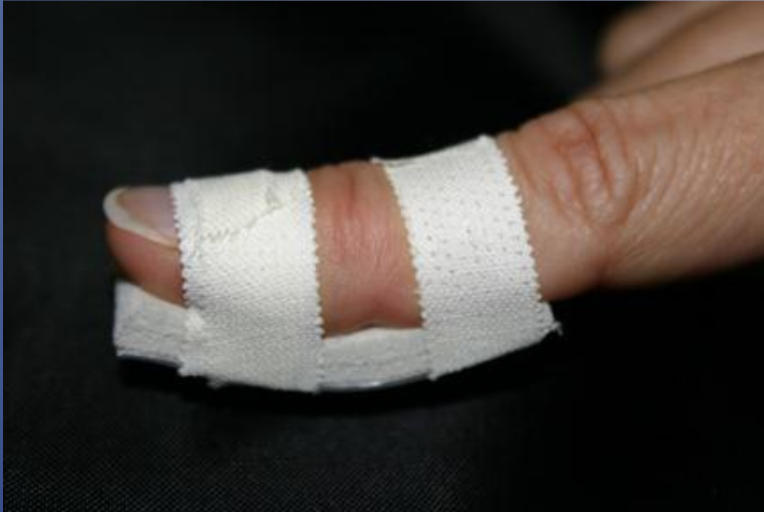
Mallet Finger - Evaluation





- Isolate extensor tendon
  - Stabilize PIP joint
- No active extension
  - Passive extension intact
- Obtain x-ray to r/o avulsion fracture

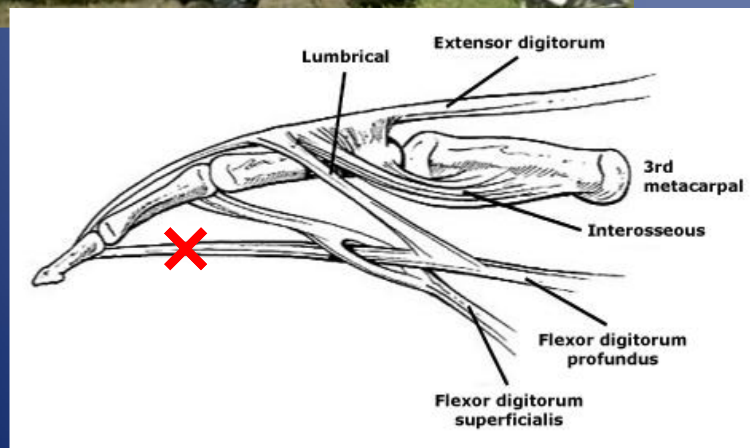
Mallet Finger - Management



- ***Continuous*** splinting in ***full extension***
  - Slight *hyper*-extension
  - 6-8 weeks
- Refer
  - Failed splinting
  - Presence of fracture
  - Distal phalanx subluxation

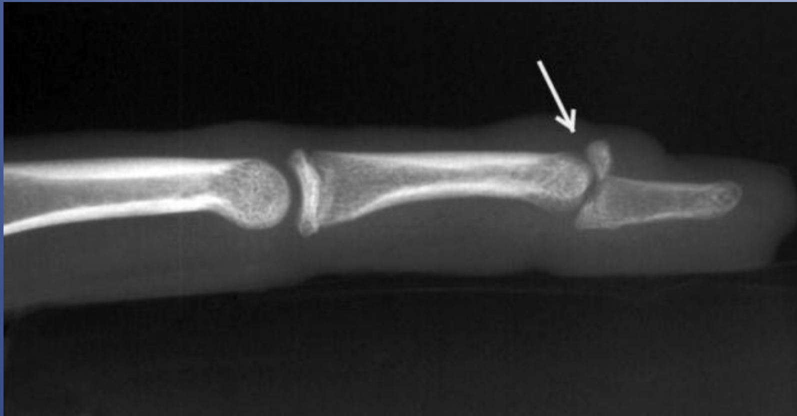
Junior playing flag football on the quad

Jersey Finger

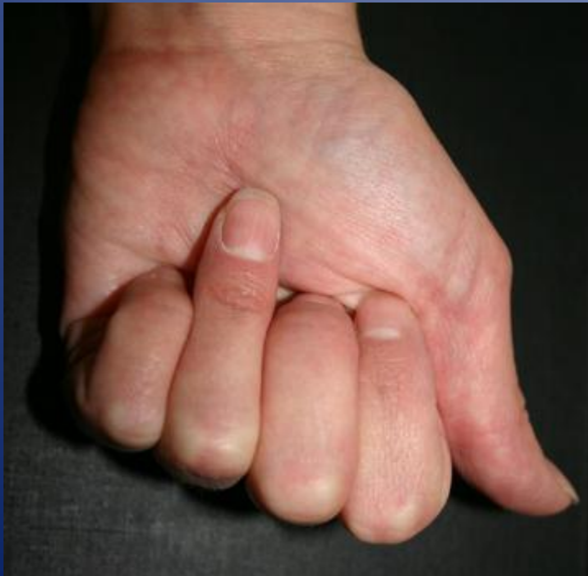


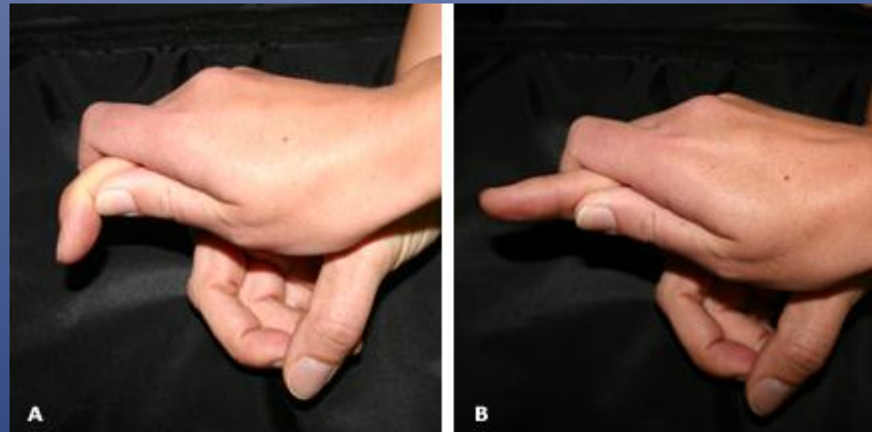
- Flexor Digitorum Profundus (FDP) Tendon rupture
- Forced hyperextension of flexed DIP joint
- Ring finger = 75% of cases

Jersey Finger - Evaluation



- *Inability to ***flex*** DIP
- Again, isolate DIP
- X-ray to rule out fractures

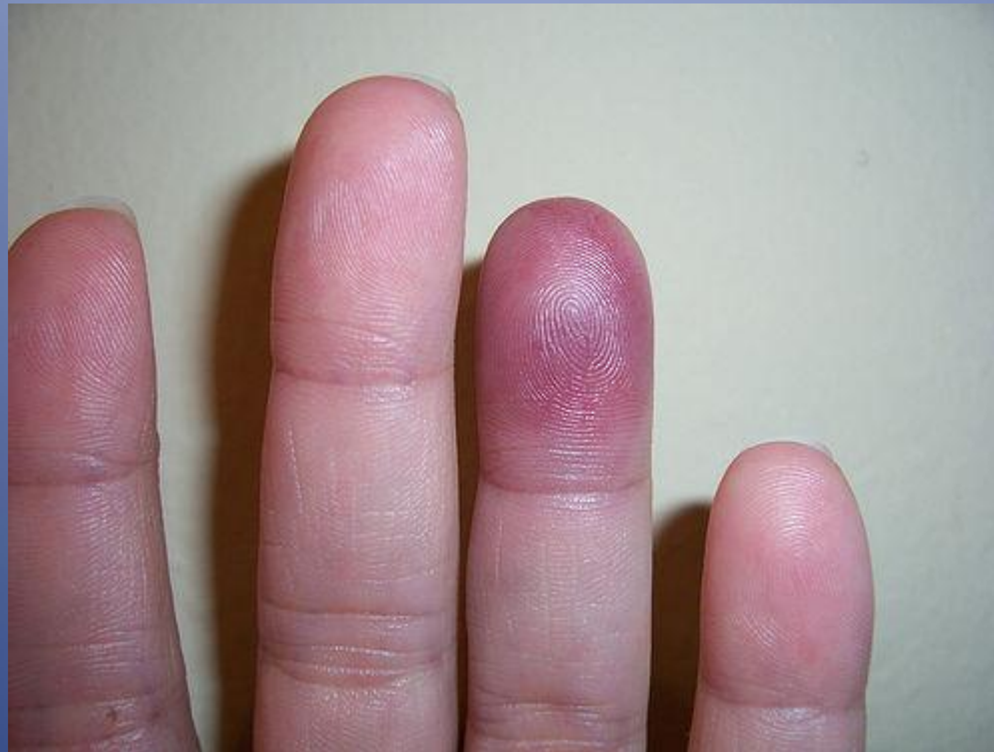




Jersey Finger - Management

- Refer ALL cases to hand surgery ASAP*
  - Call Ortho/Hand **that day**
  - Requires surgical repair
- Acute care
  - Splint with DIP and PIP joint in slight flexion.

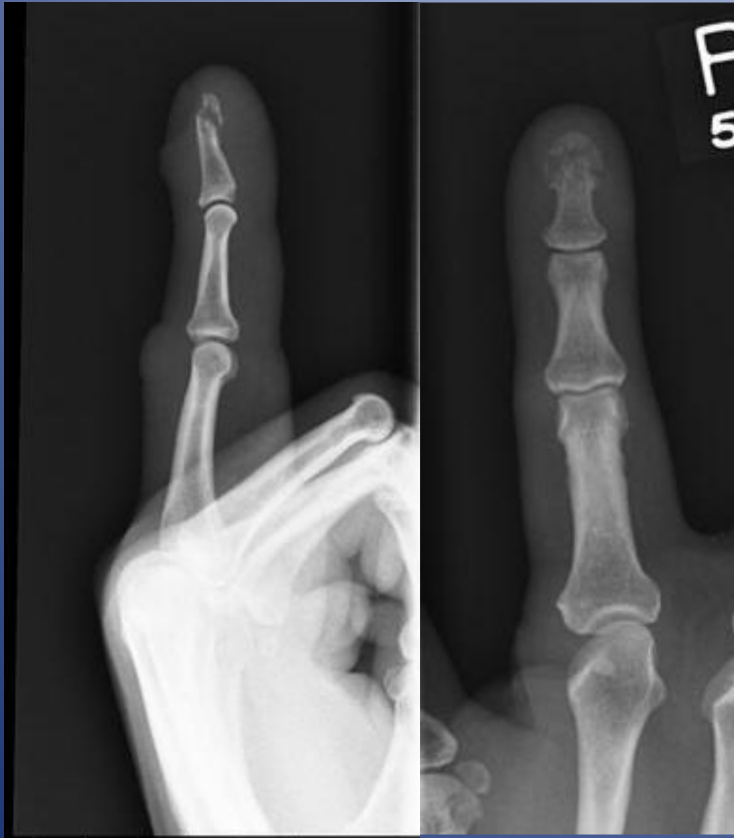
Sophomore slams the tip of her finger in her car door



Distal phalanx (tuft) fracture

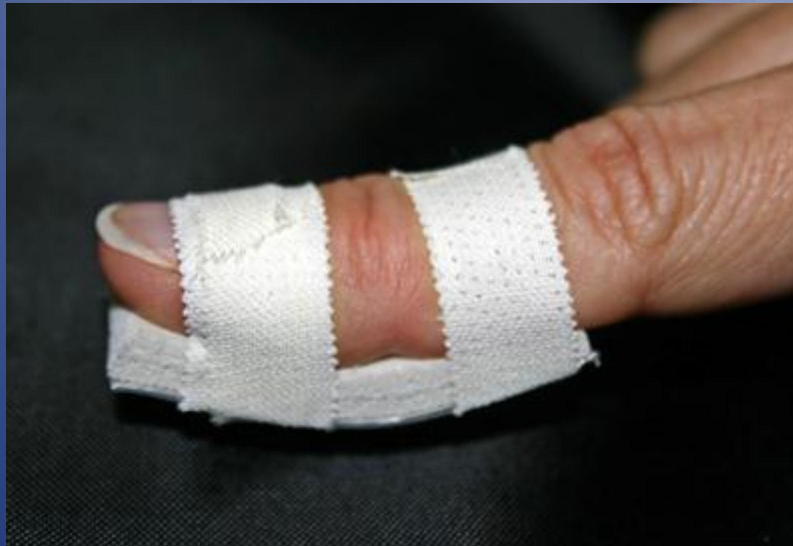
- Half of all hand fractures
- Middle finger most commonly involved
- Mechanism = direct blow

Distal Phalanx fracture - evaluation



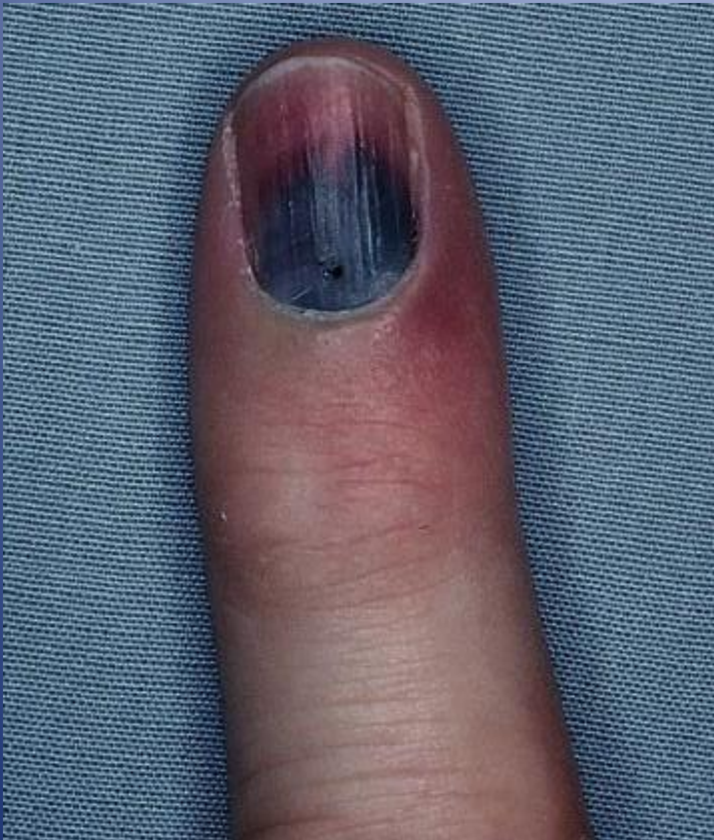
- Pain, swelling, ecchymosis
- Tuft vs. Distal Phalanx
- Neuro-vascular status
  - Capillary refill
  - 2-point discrimination
- X-ray to evaluate intra-articular fracture and displacement

Distal phalanx (tuft) fracture



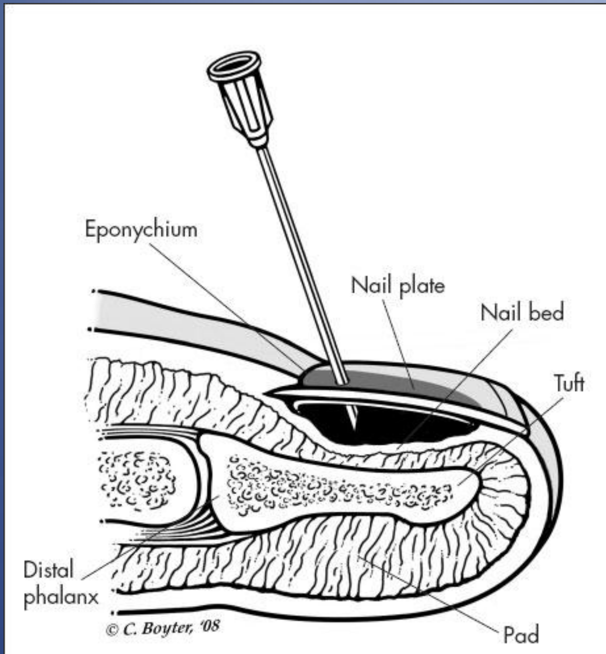
- Splint with DIP in extension for 3-4 weeks
- Referral to ortho/hand
  - Immediately
    - open fx, severe crush inury, neuro compromise
  - Within 3-4 days
    - Tendon dysfunction
    - Nerve dysfunction
    - Intraarticular (> 30%) or displaced

Nail bed Injury - Subungual Hematoma



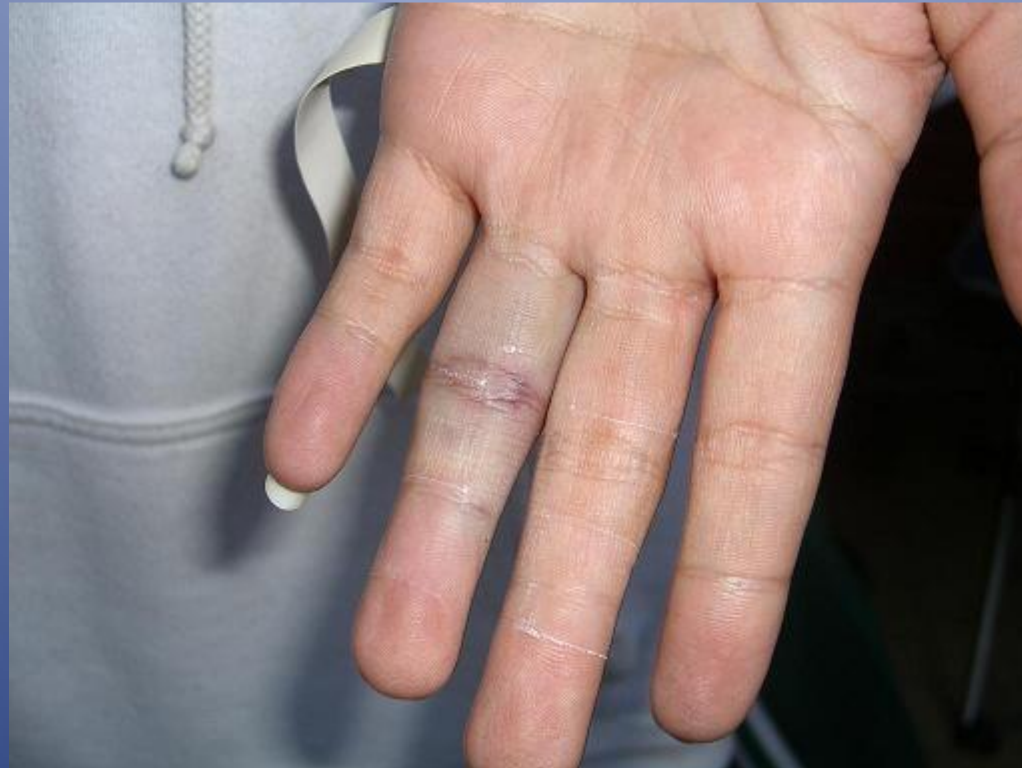
- Distal phalanx fracture more likely if hematoma involves > 50% of nail bed
- Evaluate eponychial fold for disruption or deformity

Nail bed injuries - Trephination

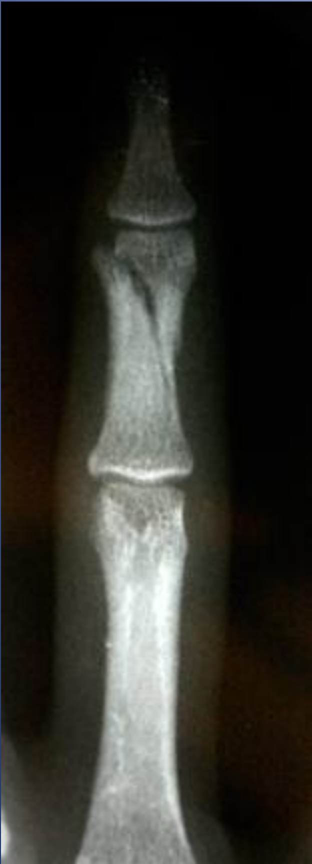


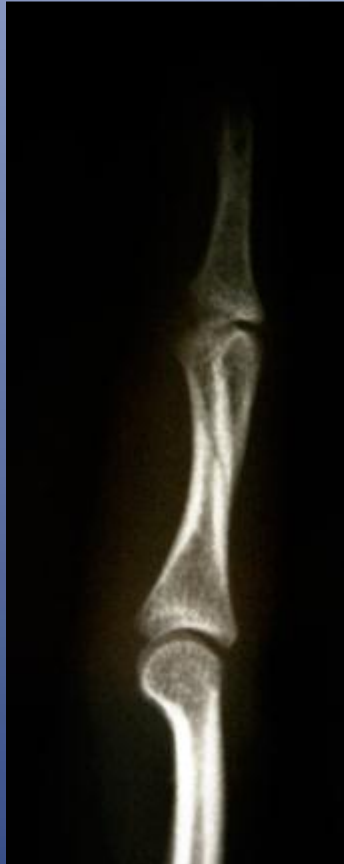
- Indications
  - Acute (< 48 hours)
  - Painful
- Electrocautery
  - 18-gauge needle
  - Heated paperclip
- No antibiotics
- Soapy soaks for 2 days

What if her finger looked like this?



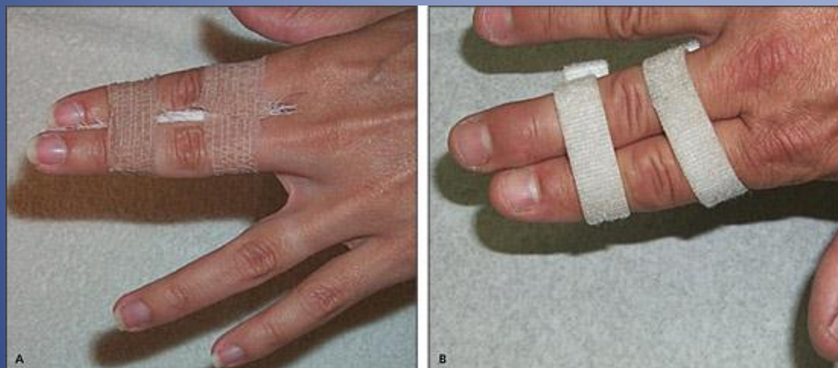
Proximal/Middle phalanx fracture





- Pain, swelling, ecchymosis
- Neuro-vascular status
  - Capillary refill
  - 2-point discrimination
- X-ray to evaluate intra-articular fracture and displacement

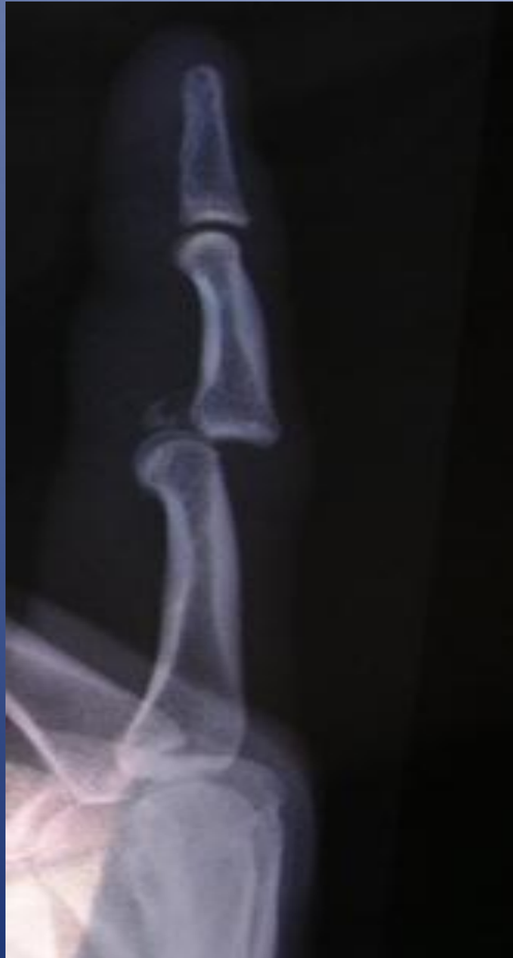
Proximal/Middle phalanx fracture - Management



- Stable, non-displaced
  - Buddy taping 4-6 weeks
  - Dorsal or volar splint for added protection and pain control
- Referral to Ortho/Hand
  - Comminuted , rotational, intraarticular, displaced, angulated or unstable

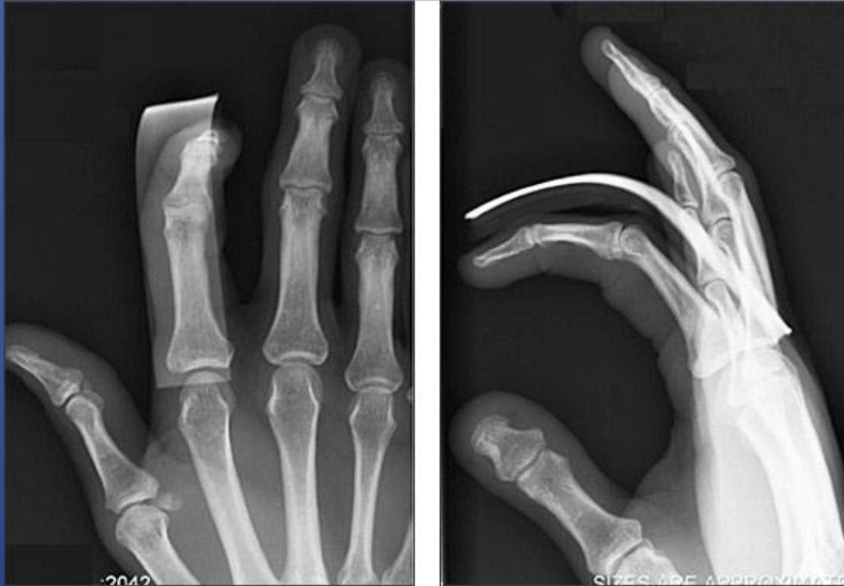
Guy walks in from soccer practice with his finger looking like this!

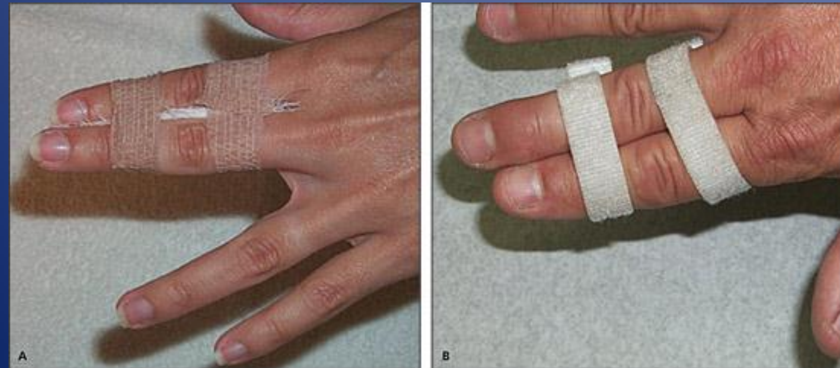
PIP dislocation - evaluation



- Most common = dorsal
  - Lateral fairly common
  - Volar rarely
- Pain, swelling, impaired range of motion and deformity
- X-ray to assess for associated fracture

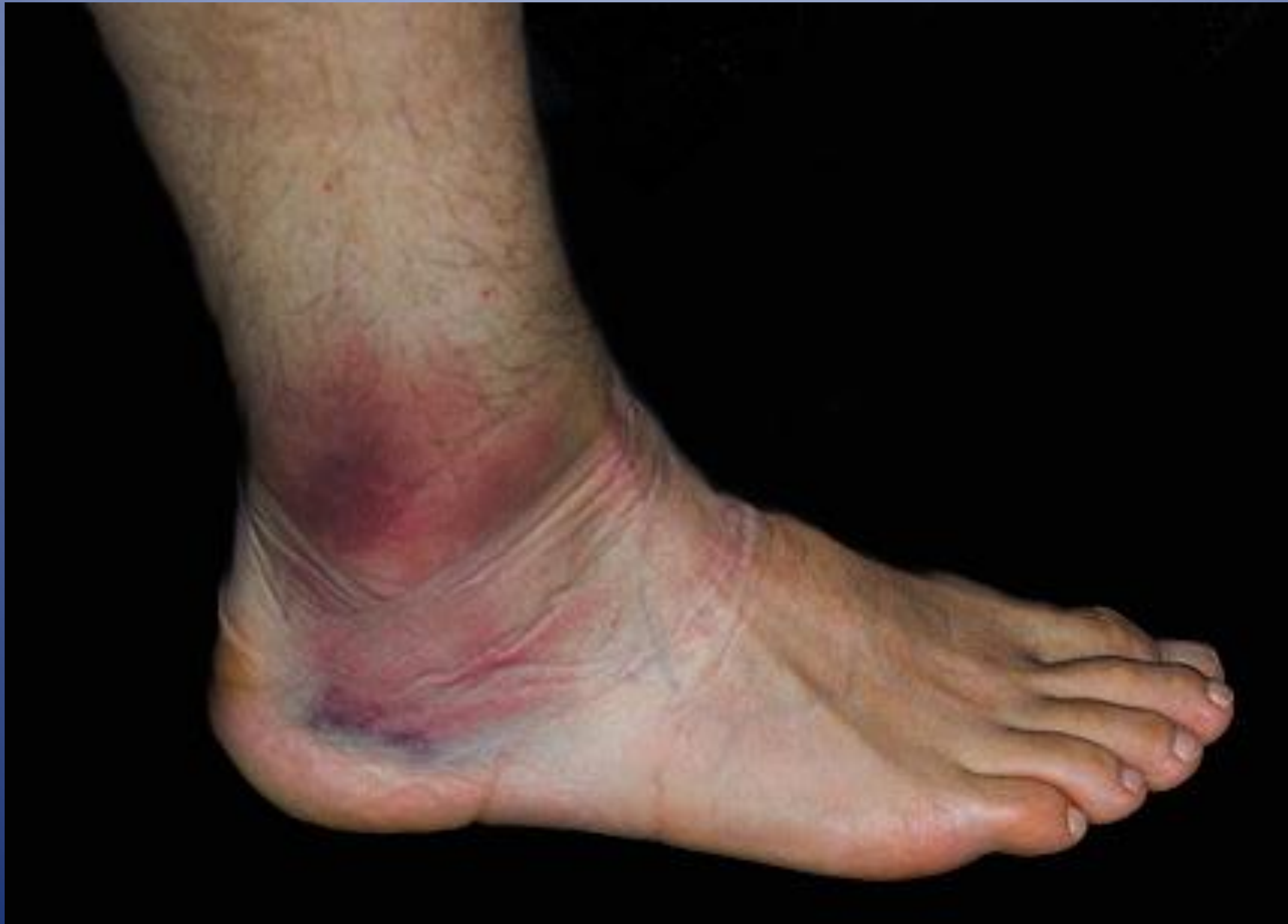
PIP dislocation - Management



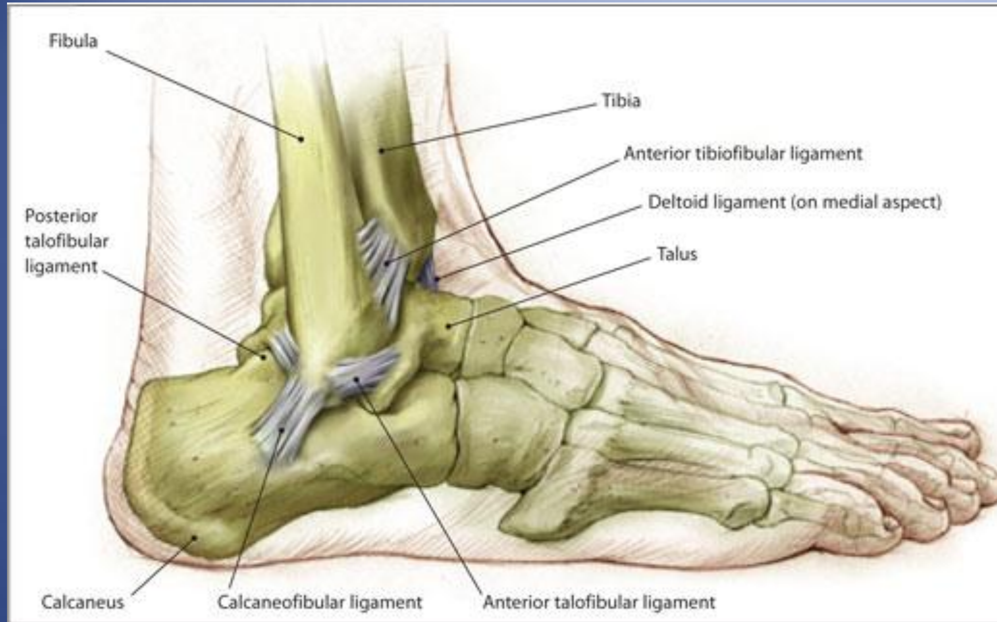


- Reduction
  - Pre/post x-rays*
  - Gentle traction, then flexion
  - Dorsal splint in flexion
    - Buddy tape after 3-5 days
- Prompt Referral
  - Irreducible
  - unstable
  - Tendon rupture
  - *Volar* dislocation

Junior playing basketball twists his ankle coming down from a rebound



Ankle Sprains



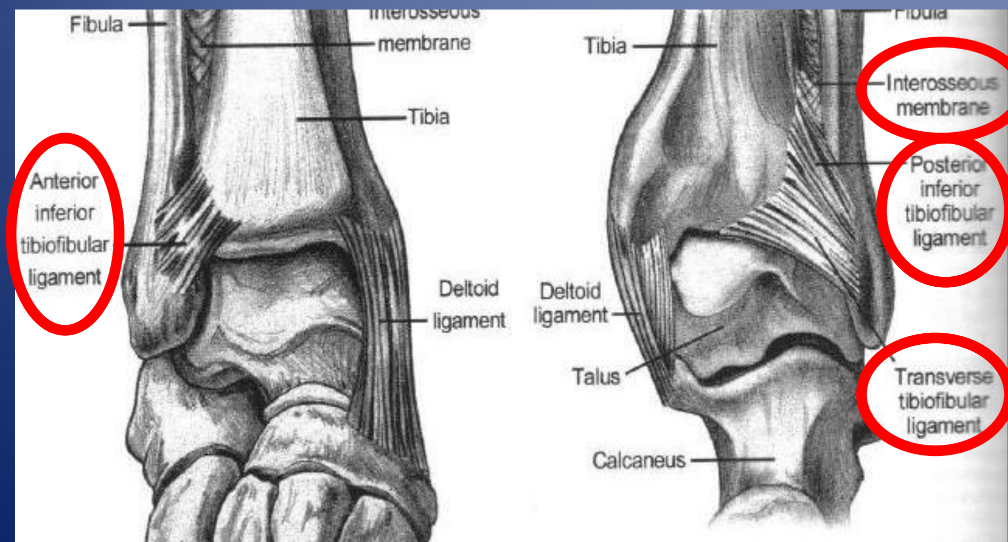
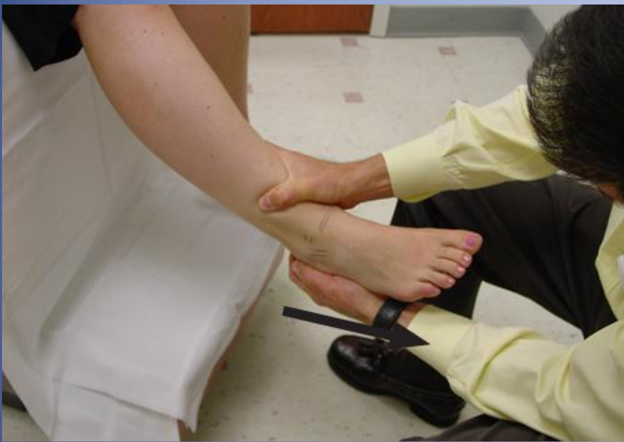


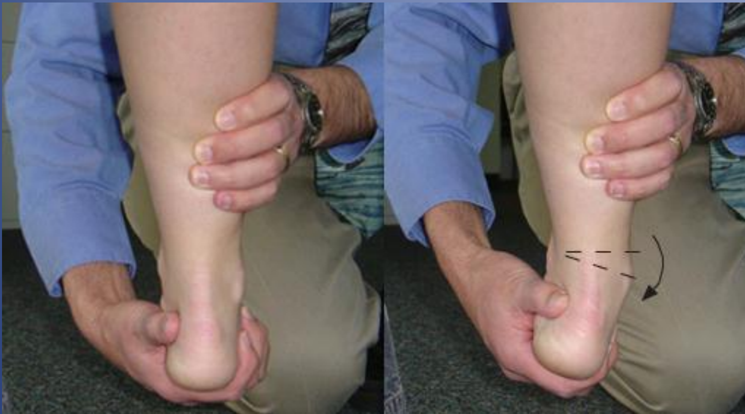
Figure 1. Anterior inferior tibiofibular syndesmosis.

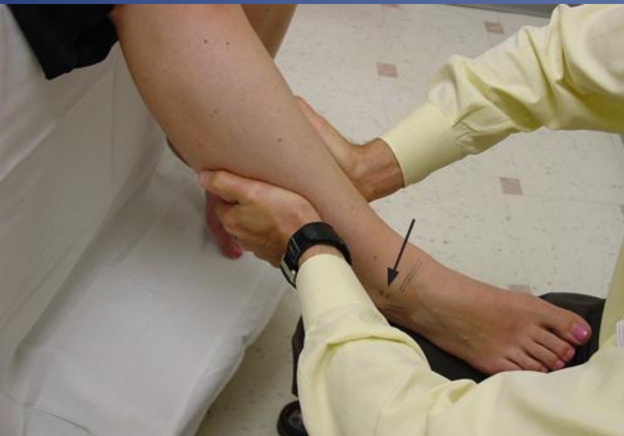
Figure 2. Posterior inferior tibiofibular syndesmosis.

- Lateral sprains most common
- Medial injuries usually result in fractures
- Syndesmotic (“high”) sprains predict poor outcomes

Ankle Sprains

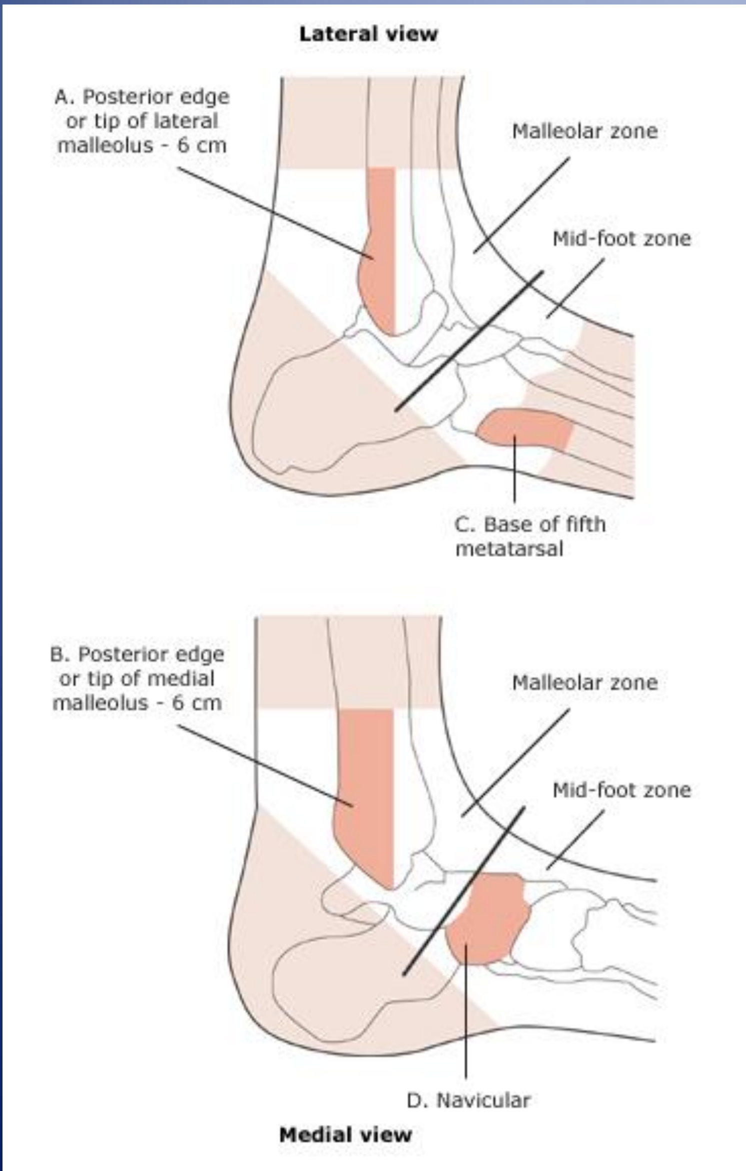






- Anterior Drawer Test
  - Assess ATF ligament
- Talar Tilt Test
  - Assess CF ligament
- Squeeze Test
  - Assess syndesmotic structures

To X-Ray or Not: Ottowa Rules



- Pain over malleolus and/or midfoot

AND

- Tenderness over malleolus and/or midfoot

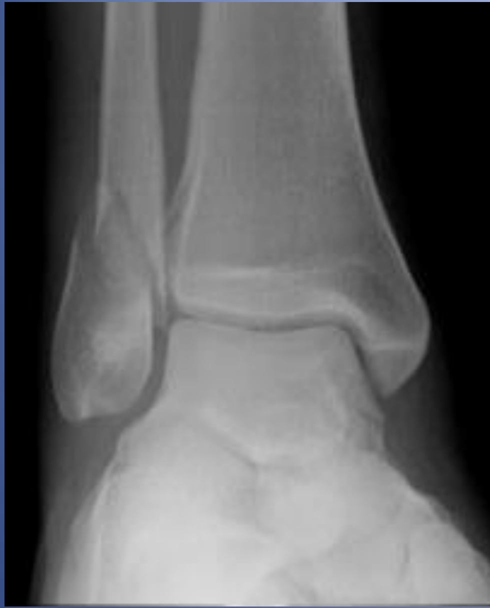
OR

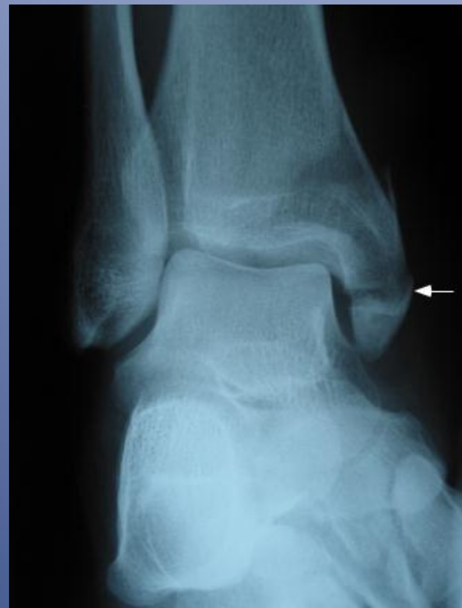
- Inability to bear weight immediately and at visit

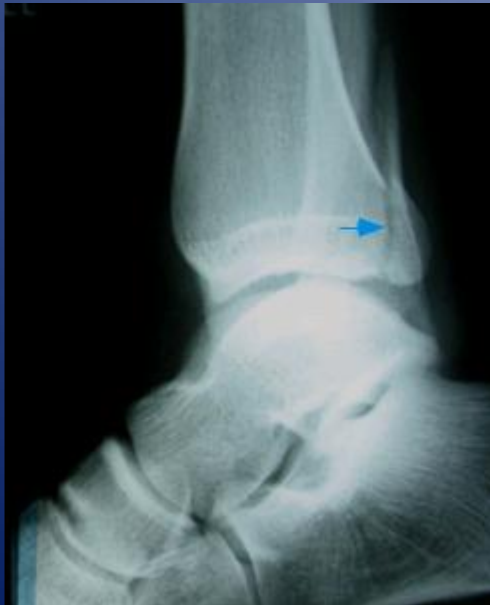
Ankle Sprain – Management

- Functional Treatment*
  I. Start PRICE protocol within 24 hours
  II. Strength and ROM exercises in 48-72 hours
  III. Endurance and balance training

Ankle fractures

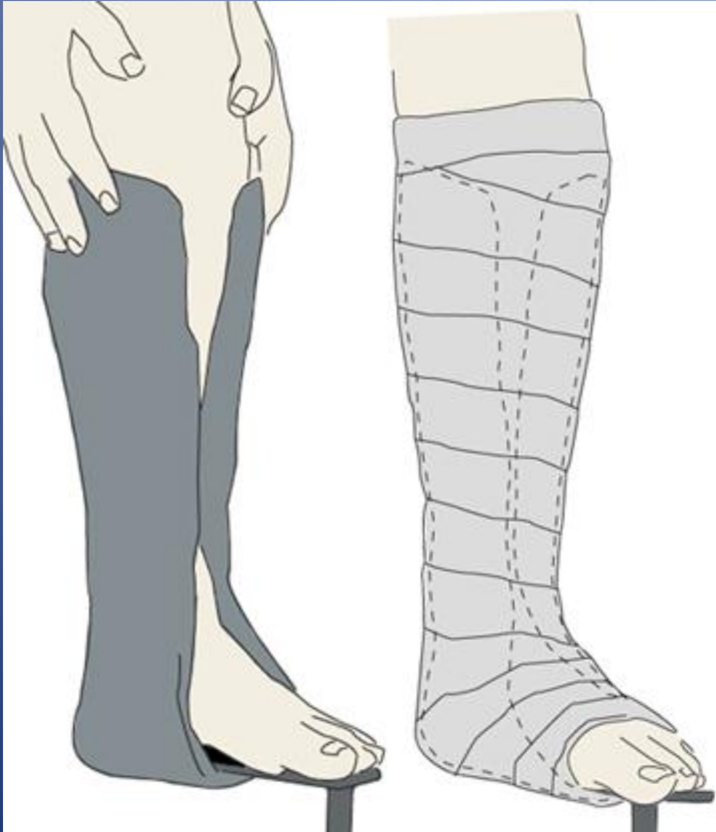






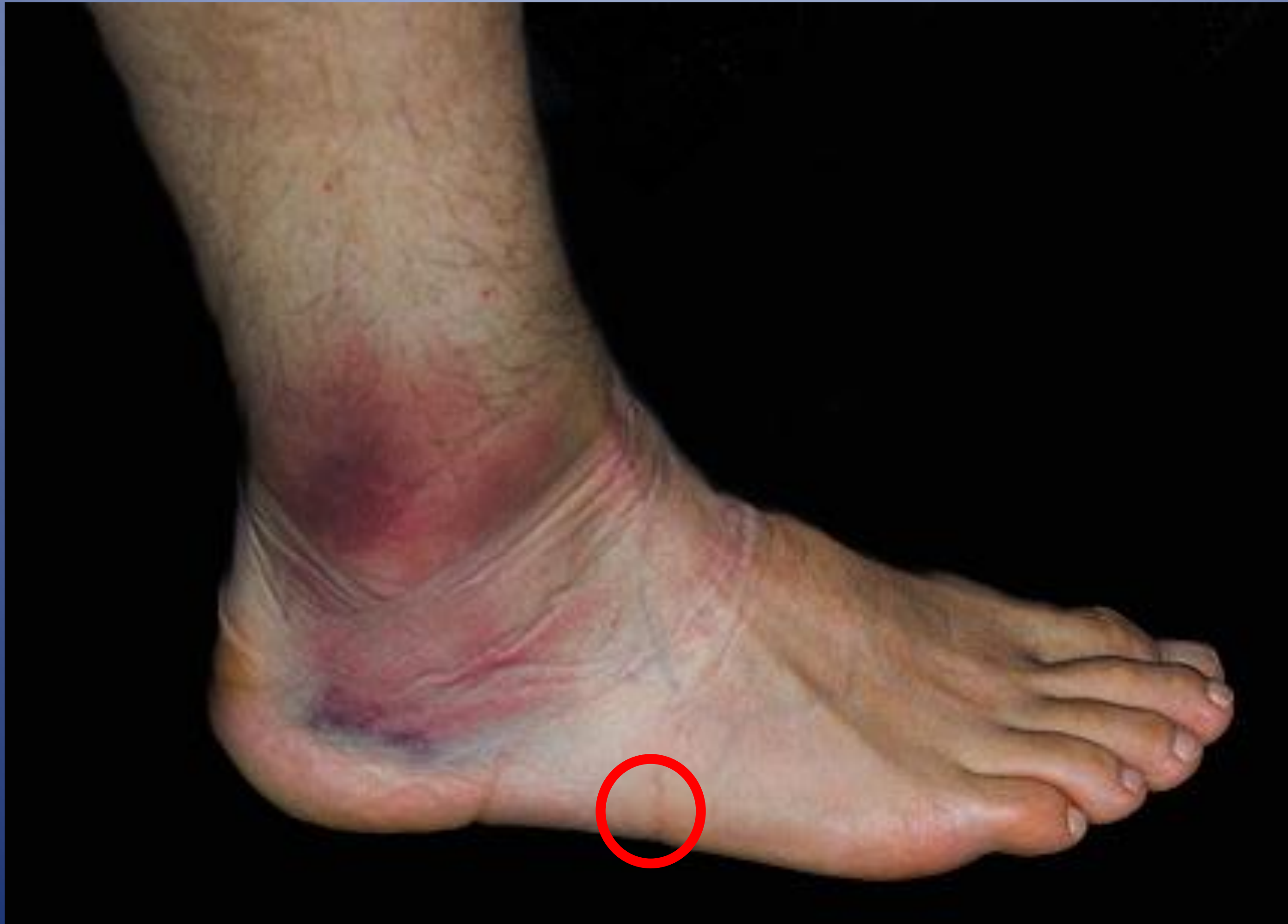
- 60-70% malleolar
  - Lateral most common and most stable
- 15-20% bi-malleolar
- 7-12% tri-malleolar
- Isolated medial malleolar fx are rare and unstable
  - Treat like bi- or tri-malleolar

Ankle fracture - Management

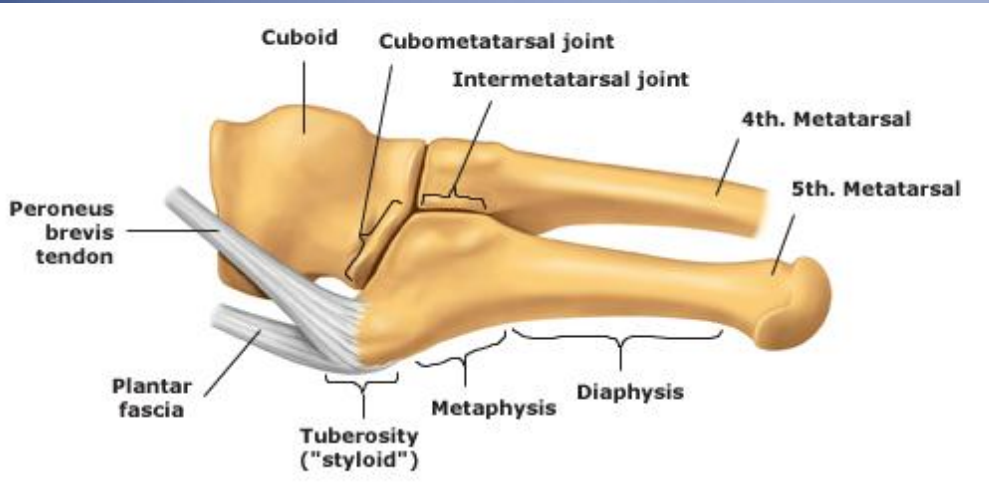


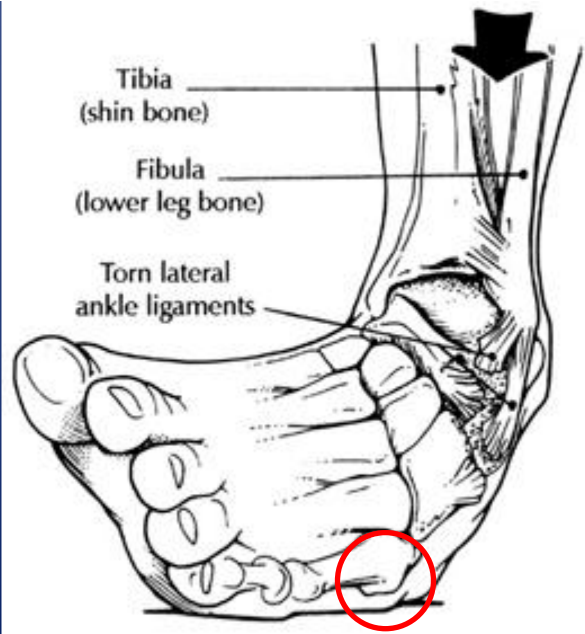
- Small, non-displaced avulsion fractures
  - Like ankle sprain
- Isolated Malleolar fx
  - Stirrup splint
    - At 90 degrees (neutral position)
    - Non weight-bearing
  - Ortho follow-up in 3-5 days

What if he has pain here?



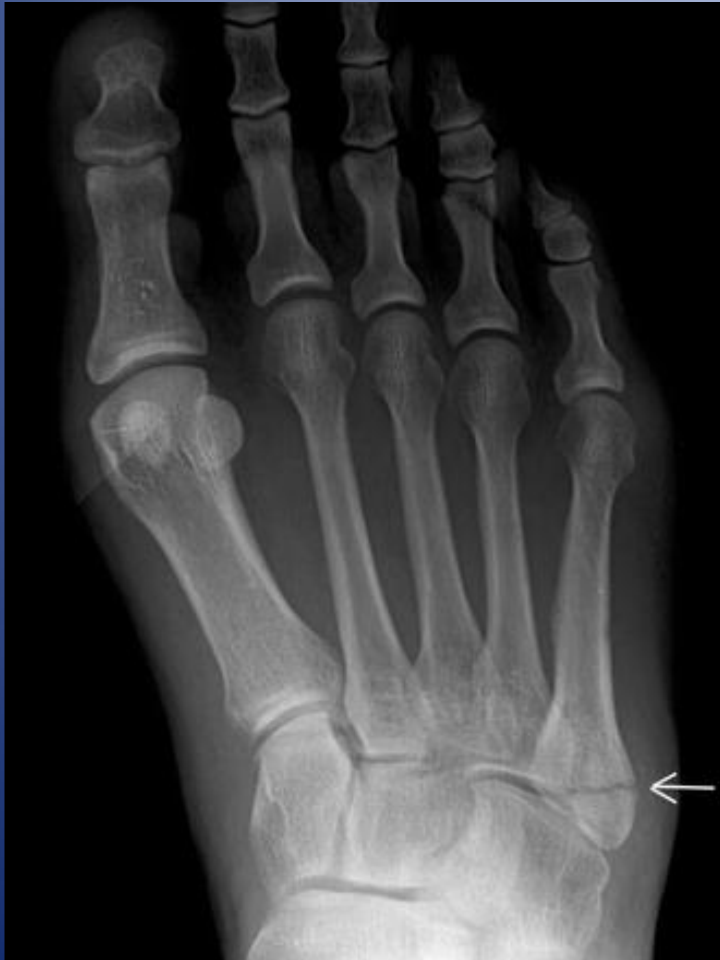
5th Metatarsal Styloid Aulsion fracture



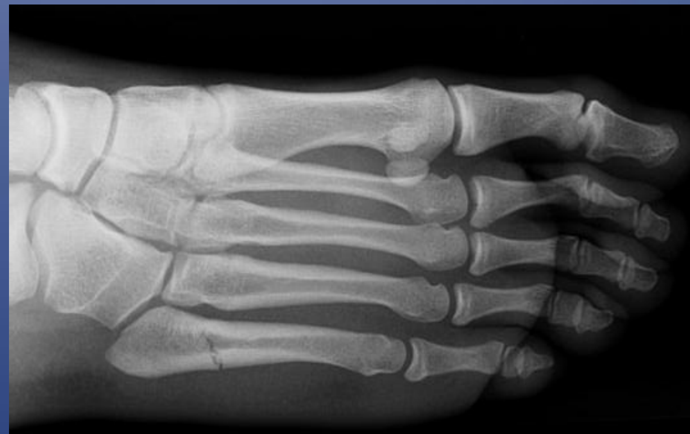


- Most common fracture of lower extremity
- Mechanism identical to lateral ankle sprain
  - Inversion while foot is plantar flexed
- Walking possible but painful

5th Metatarsal Styloid Avulsion fracture



- Swelling, ecchymosis
- Ottowa rules!
- Beware a Jones fracture
  - Same mechanism
  - Different management
  - Different prognosis

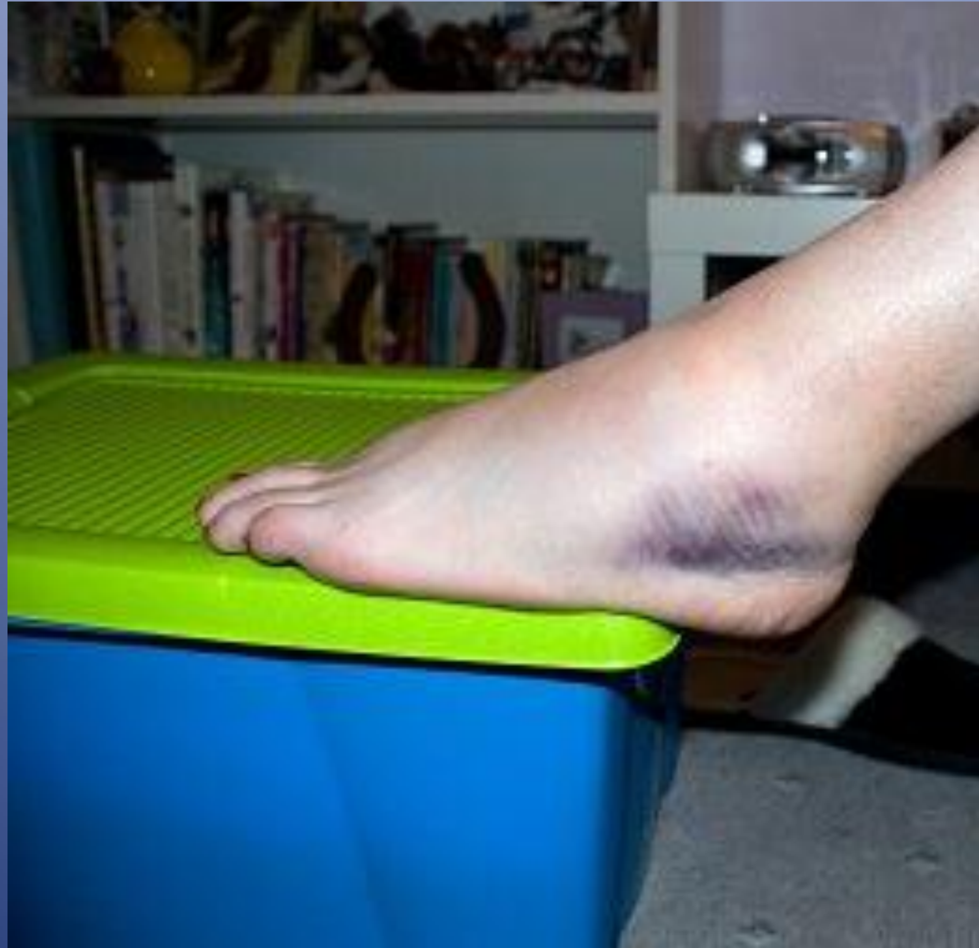


Jones fracture

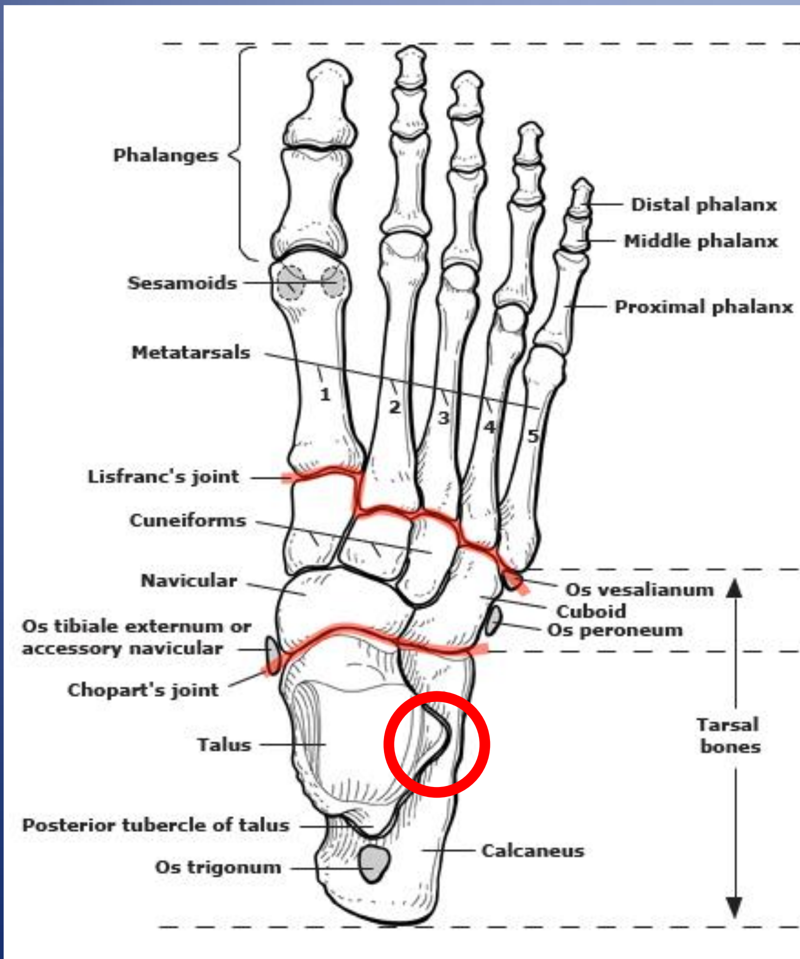
5th Metatarsal Styloid Avulsion fracture

- Conservative Management
- Weight-bearing as tolerated
- Post-op shoe +/- elastic wrap
- Usually resolves in 3-6 weeks

Junior on ski club trip who tried snowboarding this time

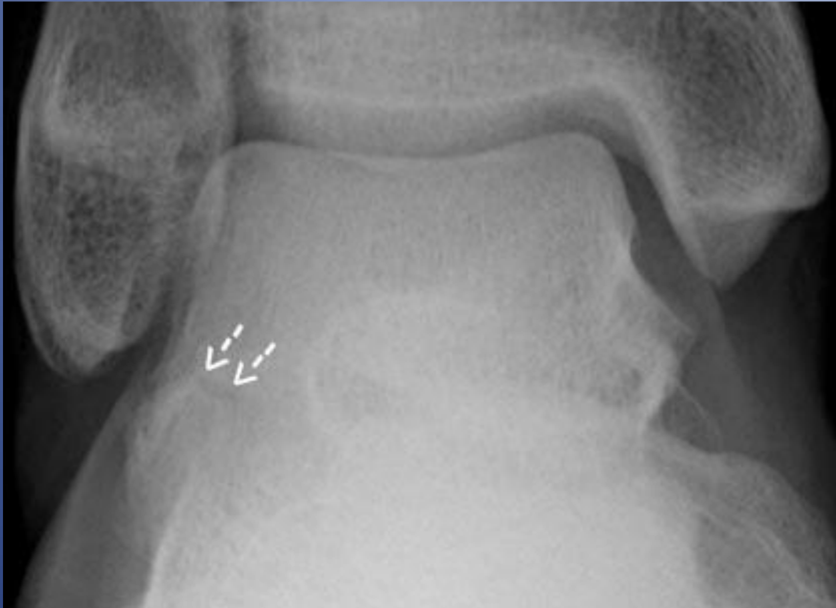


Snowboarder’s fracture



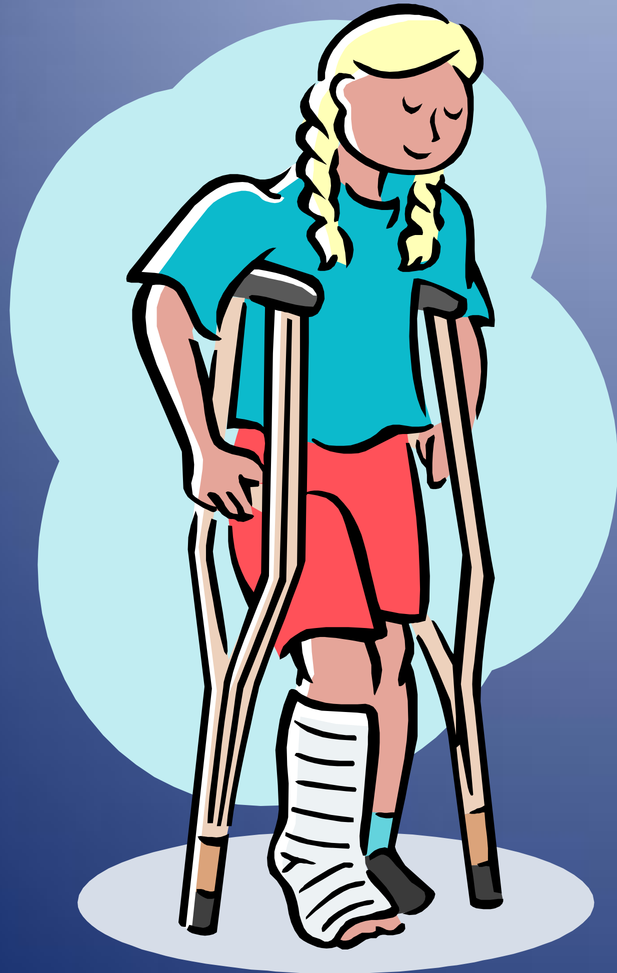
- Lateral Process of Talus
- Exact mechanism unknown
  - Axial loading + external rotation, dorsiflexion and inversion
- Soft snowboarding boots contribute

Snowboarder’s fracture



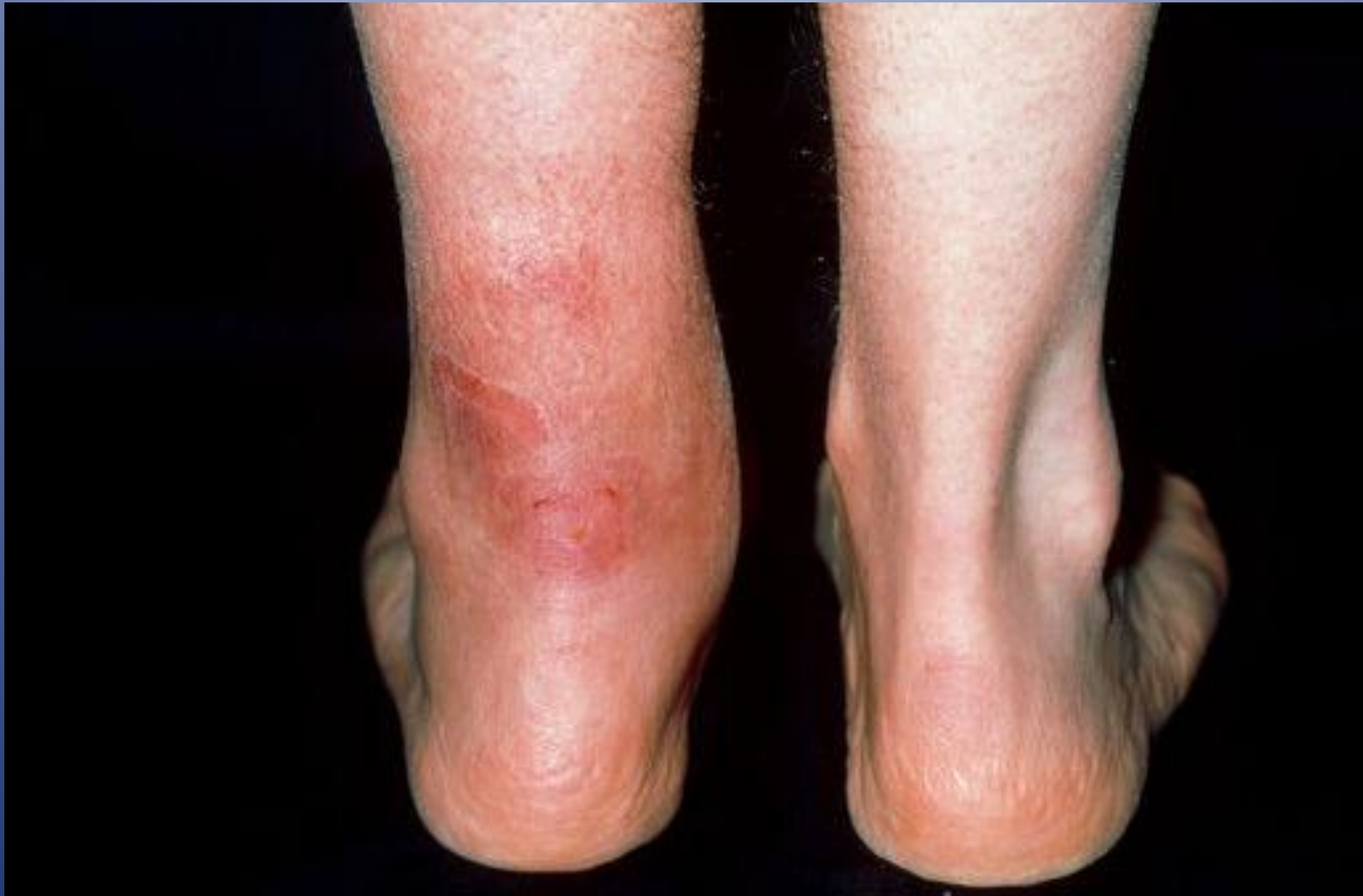
- Lateral Process of Talus fracture
- Have a high index of suspicion
- Hard to pick up on exam and on x-ray
  - looks a lot like ankle sprain

Snowboarder's fracture

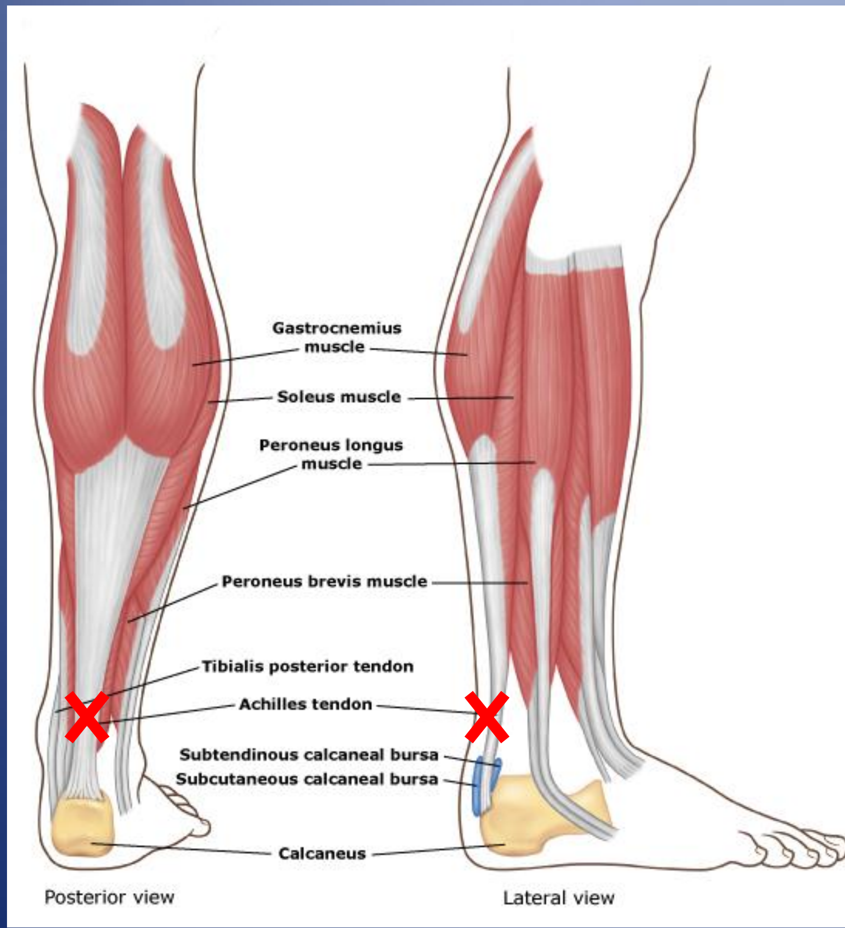


- Best treatment not really known
- Non weight-bearing
- Refer to ortho
- Err on the side of caution

A grad student playing racquetball thought he got with the ball

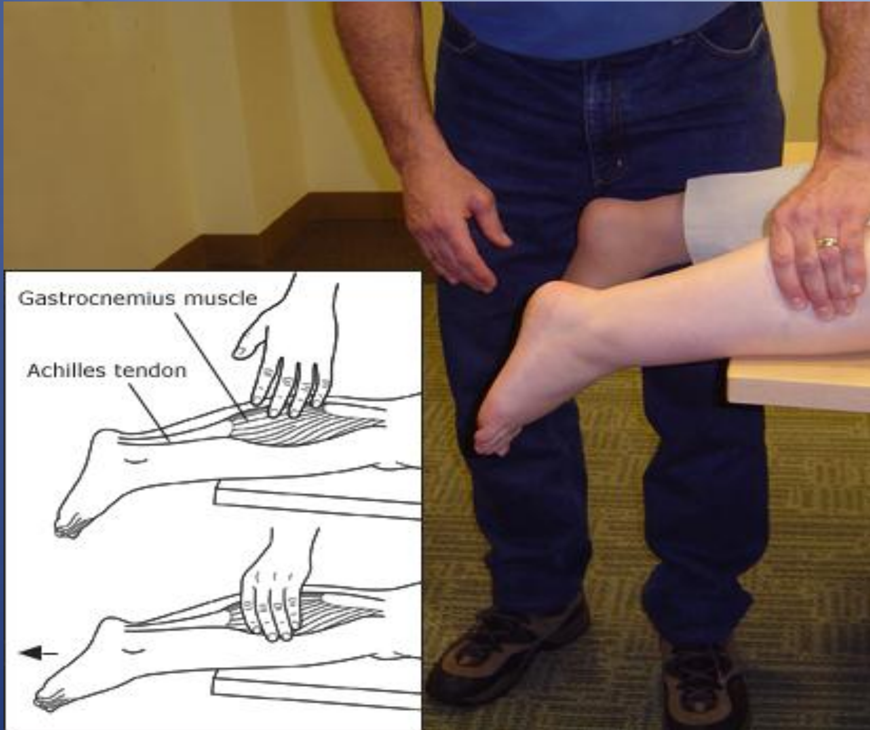


Achilles Tendon Rupture



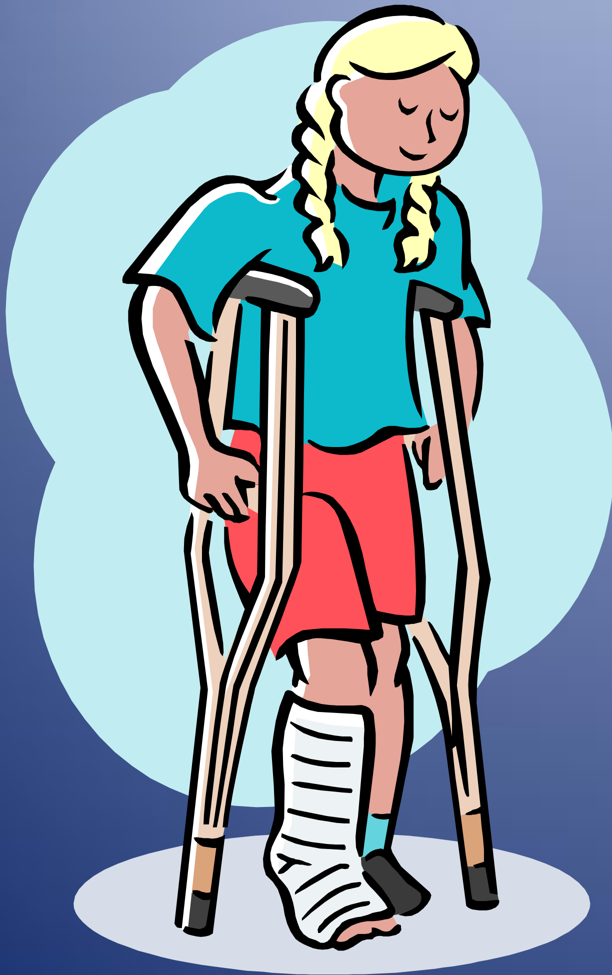
- Feels sudden “pop” or “being kicked”
- Weekend warriors in late 20’s, 30’s
- Medications
  - Fluoroquinolones
  - Steroids
- Missed 25% of time

Thompson Test



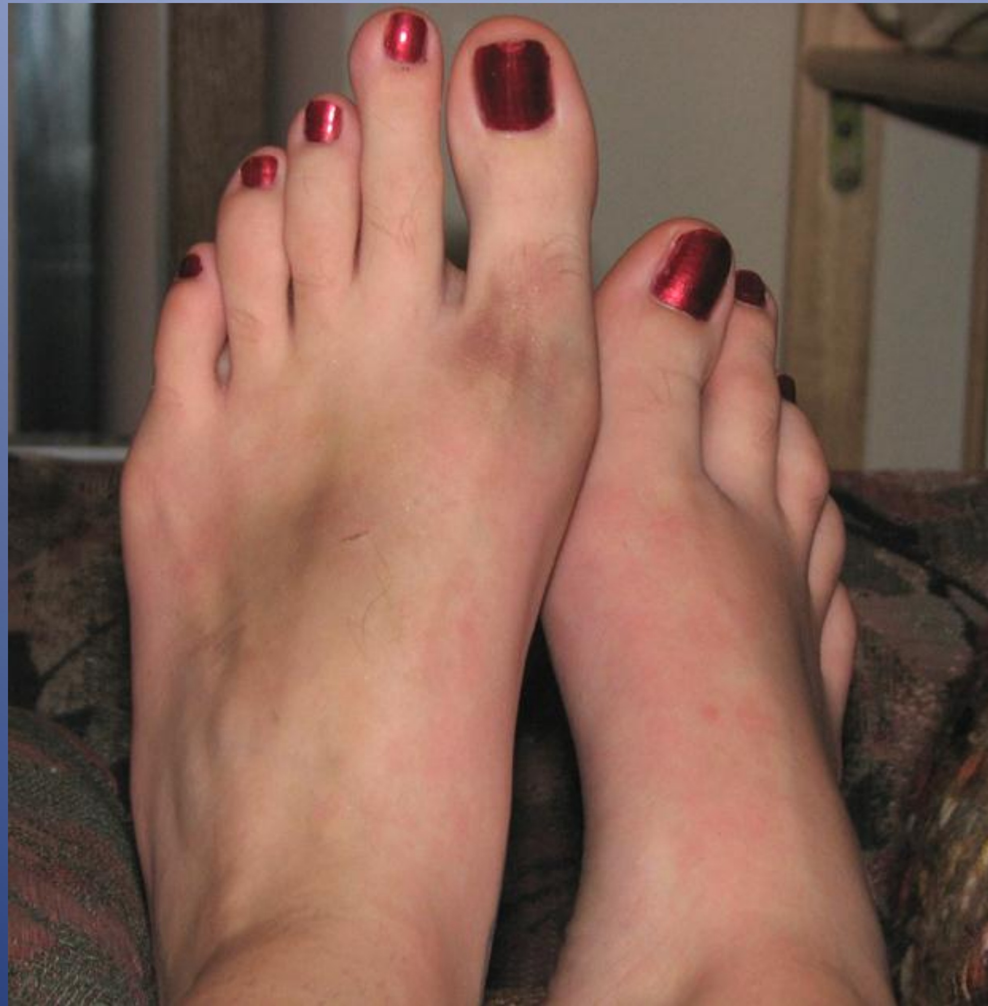
- Complete Rupture
  - ***Abnormal*** Thompson
  - Can't stand on toes
- Partial Rupture
  - ***Normal*** Thompson
  - +/- Palpable defect
  - Plantar flexion intact
  - Patient can walk
  - Tendon is not painful

Achilles Tendon Rupture

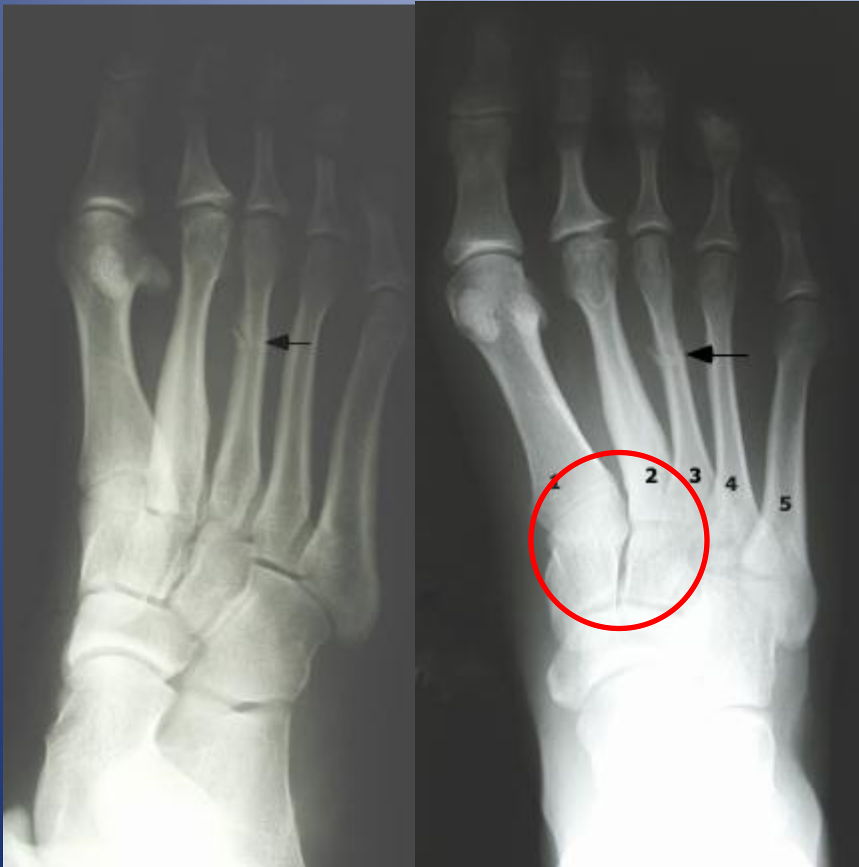


- X-rays not helpful
- Prompt ortho referral
- Non weight-bearing
- Aircast or posterior splint for comfort
  - Slight plantar flexion

Sophomore joined the bowling team and dropped a ball on her foot

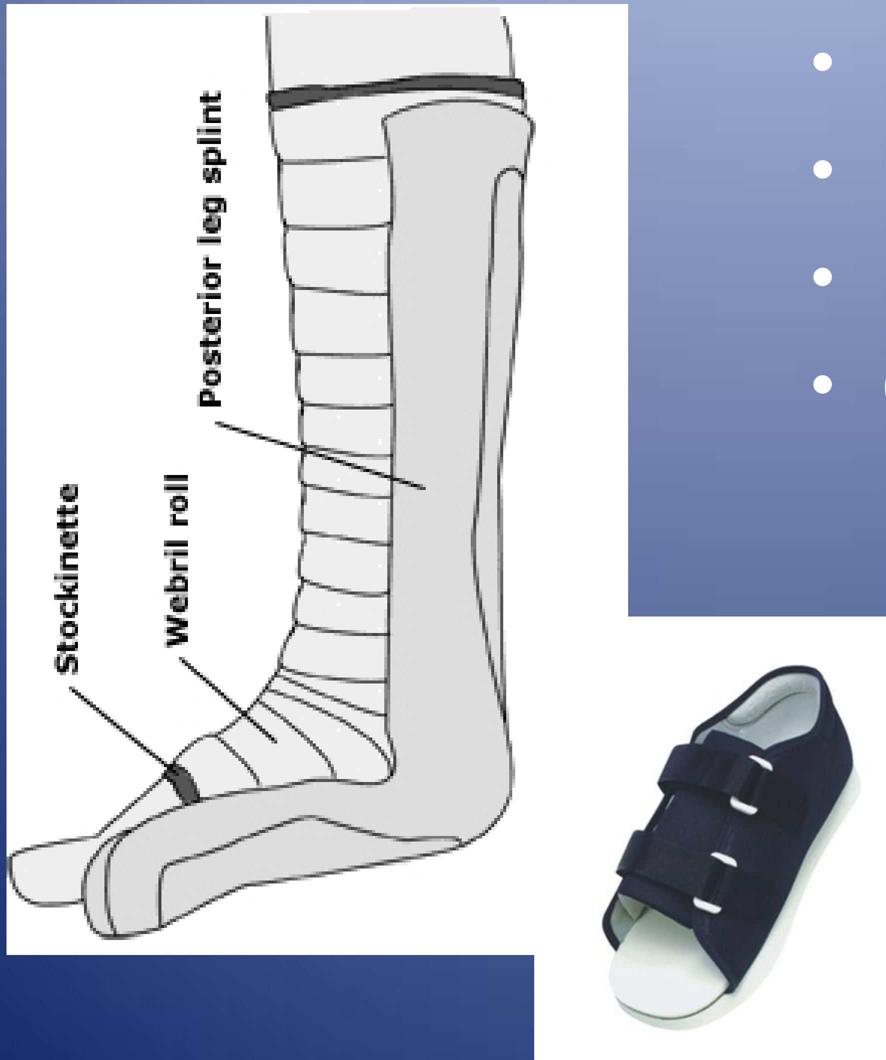


Metatarsal Fracture



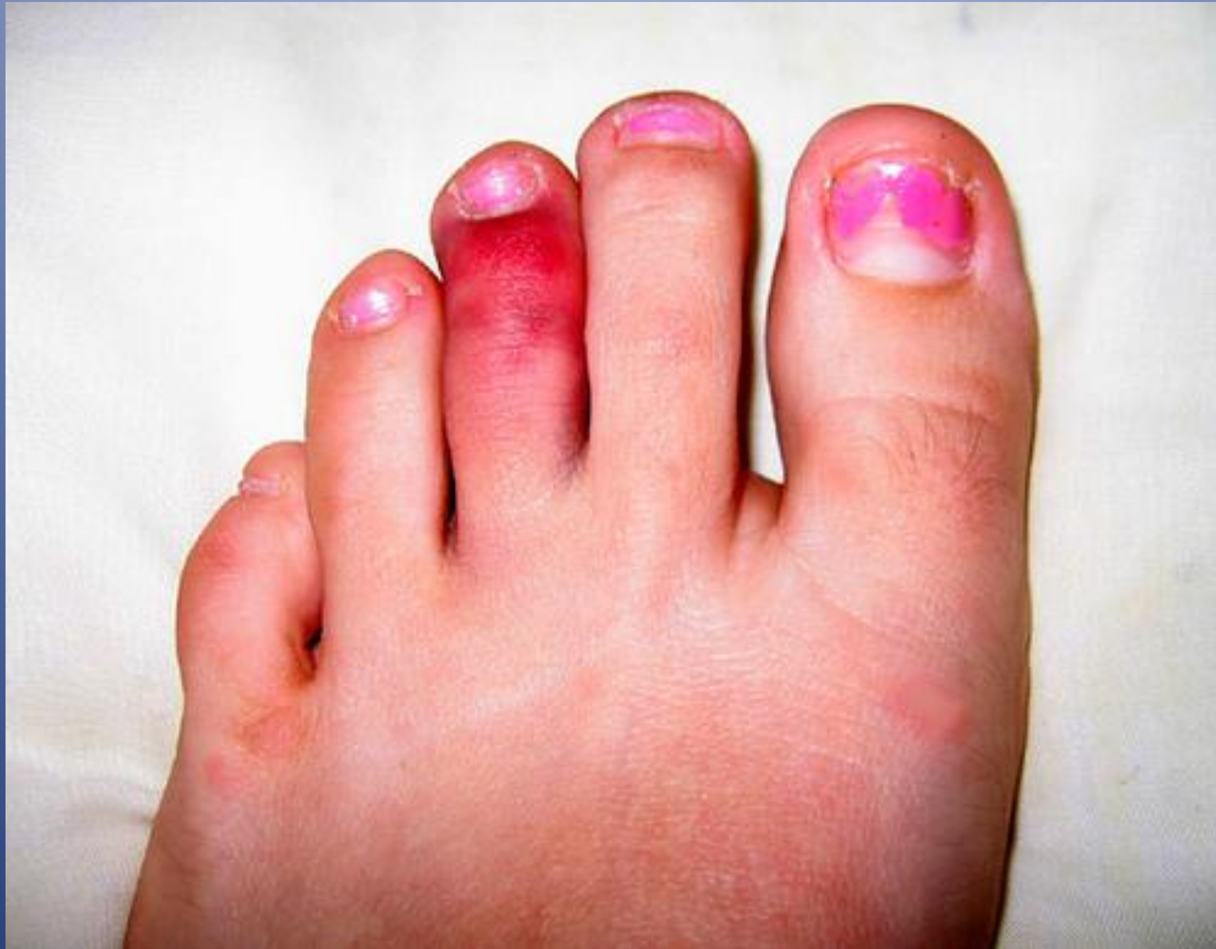
- Mechanism = direct blow or twisting
- Edema, ecchymosis, pain, point tenderness
- Neurovascular exam
  - Pain, pallor, paresthesia, pulselessness
- Lisfranc joint*

Metatarsal Fracture - Management

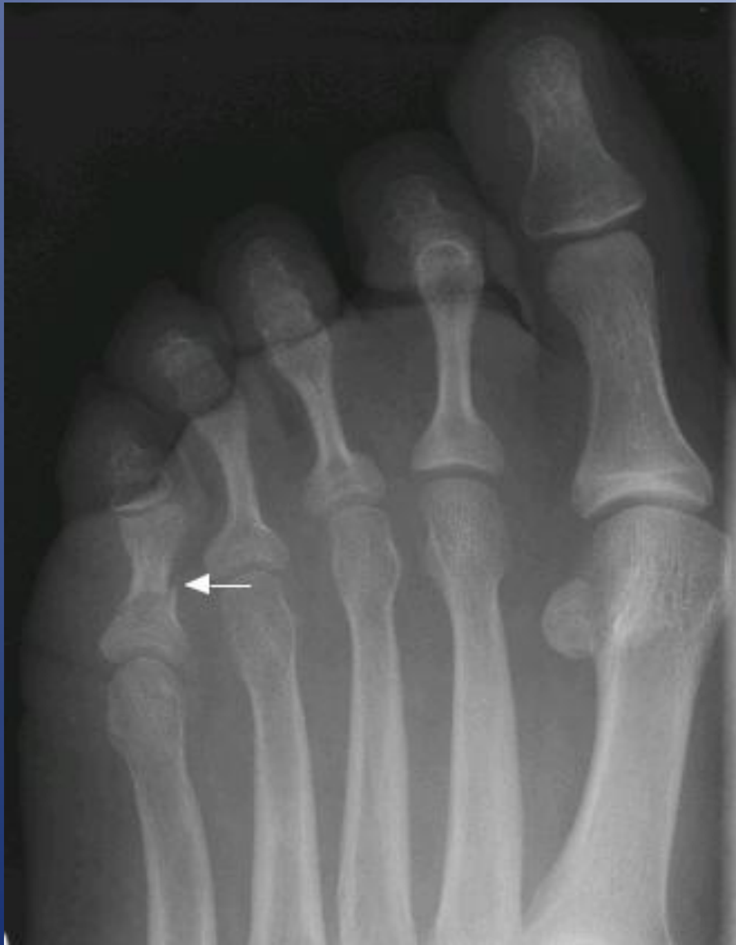


- R.I.C.E.
- Posterior splint
- Non weight-bearing
- Ortho F/U in 3-5 days
  - Immediate for open fracture and/or neuro-vascular compromise

Her friend tried to help her home and stubbed her toe… in flip-flops

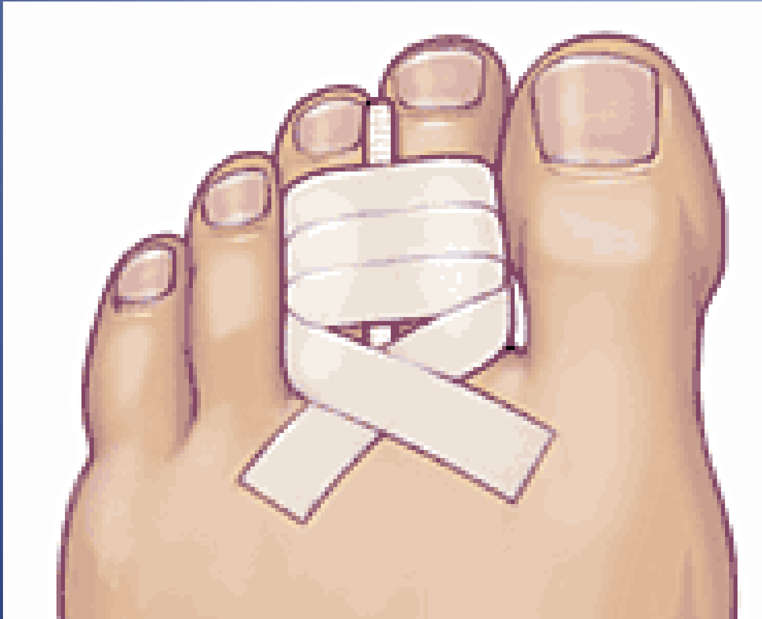


Toe Fractures



- Stubbing or direct blow
- Pain, edema, deformity, ecchymosis

Toe Fractures - Management

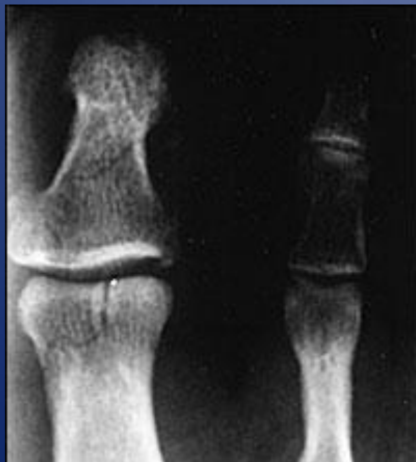


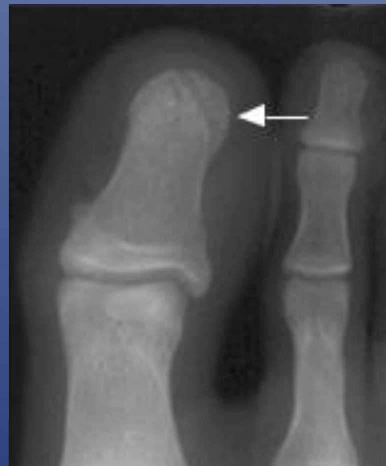
- Buddy taping
- Postop shoe prn pain
- R.I.C.E.
- Follow-up in 1-2 weeks

Toe Fracture – Referral?

1st toe fractures

- Fracture with dislocation
- Displaced intra-articular fx
- Intra-articular fx > 25% of joint space
- Unstable displaced fx





Lesser toe fractures

- Rarely
- Displaced intra-articular fx
- Irreducible fractures
- Open fractures
- Unstable displaced fractures

Basic Principles of splinting

- 1 joint above and below
- Clean, repair, and dress skin before application
- Clothing considerations
- Neurovascular status pre and post application
- R.I.C.E.
- Position of Function
- Pad between digits and bony prominences

Positions of Function for Splints

Splint	Position
Volar	Neutral forearm (thumb up), wrist slightly extended
Ulnar gutter	Neutral forearm, wrist at 20 degrees extension, MCP at 50 degrees flexion, PIP in slight flexion (10 degrees), DIP in extension
Thumb spica	Forearm neutral, wrist at 25 degrees extension, allowing thumb-index finger opposition and alignment of the thumb and forearm ("Can of Soda" position)
Finger	Finger in slight flexion
Sugar Tong	Elbow at 90 degrees flexion, neutral flexion, neutral wrist
Ankle posterior/stirrup	Ankle at 90 degrees

Upper Extremity Splints

SPLINT	INDICATION
Volar splint	Wrist fractures or sprains, fractures of 2nd to 5th metacarpals, soft tissue injuries of the hand
Reverse sugar tong splint	Wrist and distal forearm fractures
Ulnar gutter splint	5th metacarpal (Boxer's) fractures
Thumb spica splint	Scaphoid fractures, fractures of 1st (thumb) metacarpal, ulnar collateral ligament (Skier's thumb) injuries
Volar finger splint	Fractures of distal phalanges and interphalangeal joints
Buddy taping	Finger phalanx fractures, finger dislocations (post-reduction)

Lower Extremity Splints

SPLINT	INDICATION
Posterior splint	Ankle, tarsal, and metatarsal fractures, severe sprains
Stirrup splint	Ankle fractures
Buddy taping	Toe phalanx fractures
Elastic wrap/AirCast	Ankle sprains
Crutches	As needed for pain with soft tissue injuries and until ortho follow-up for fractures requiring non weight-bearing
Postoperative shoe	5th metatarsal styloid avulsion fractures, 1st toe fractures and lesser toe fx prn pain

Take Home Points

- WHEN IN DOUBT, SPLINT IT!
- ALWAYS REMEMBER THE 5 P's!
  - pallor, pain, paresthesia, pulselessness, and paralysis
- DON'T LET THE X-RAY GET IN YOUR WAY

Management of Distal Extremity Injuries in College Health

John A. Vaughn, M.D.

The Ohio State University

614-292-2787

Vaughn.7@osu.edu