

Oh Snap!

Fracture Management for Primary Care

Presented by:

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Oh Snap!



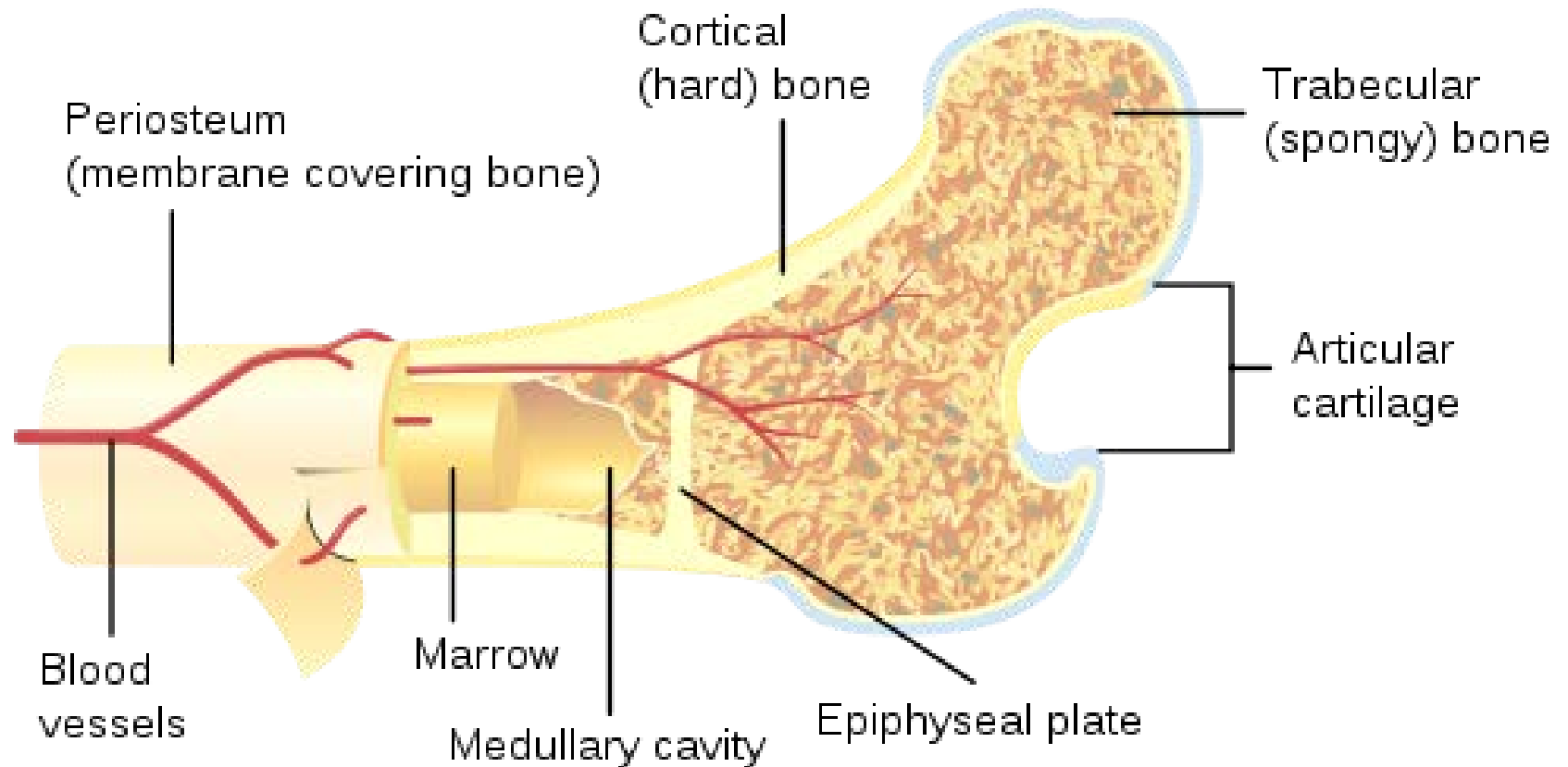
It's Going Tibia Okay.

Fracture Management for Primary Care

Bone has the remarkable and unique ability to heal by complete regeneration rather than by scar tissue formation.

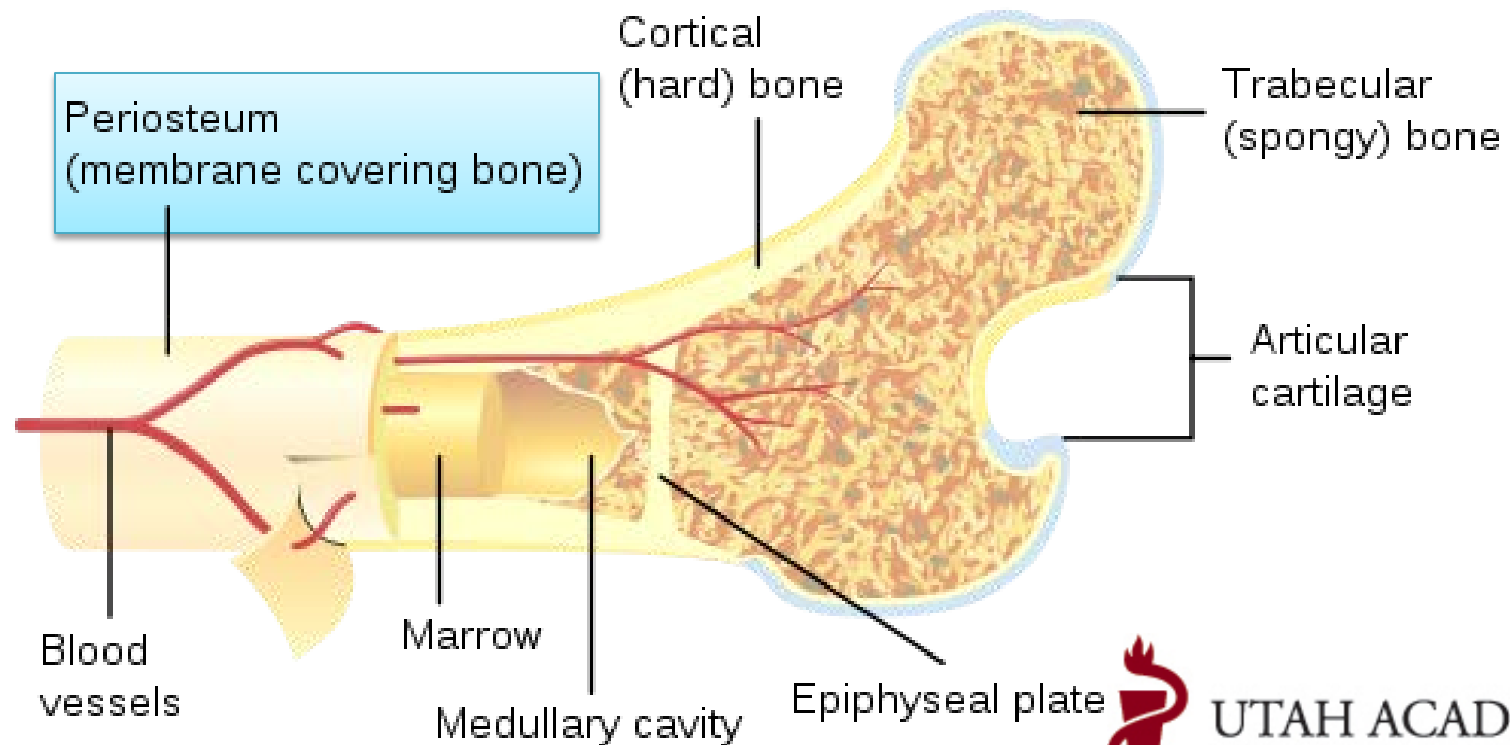


Bone Anatomy



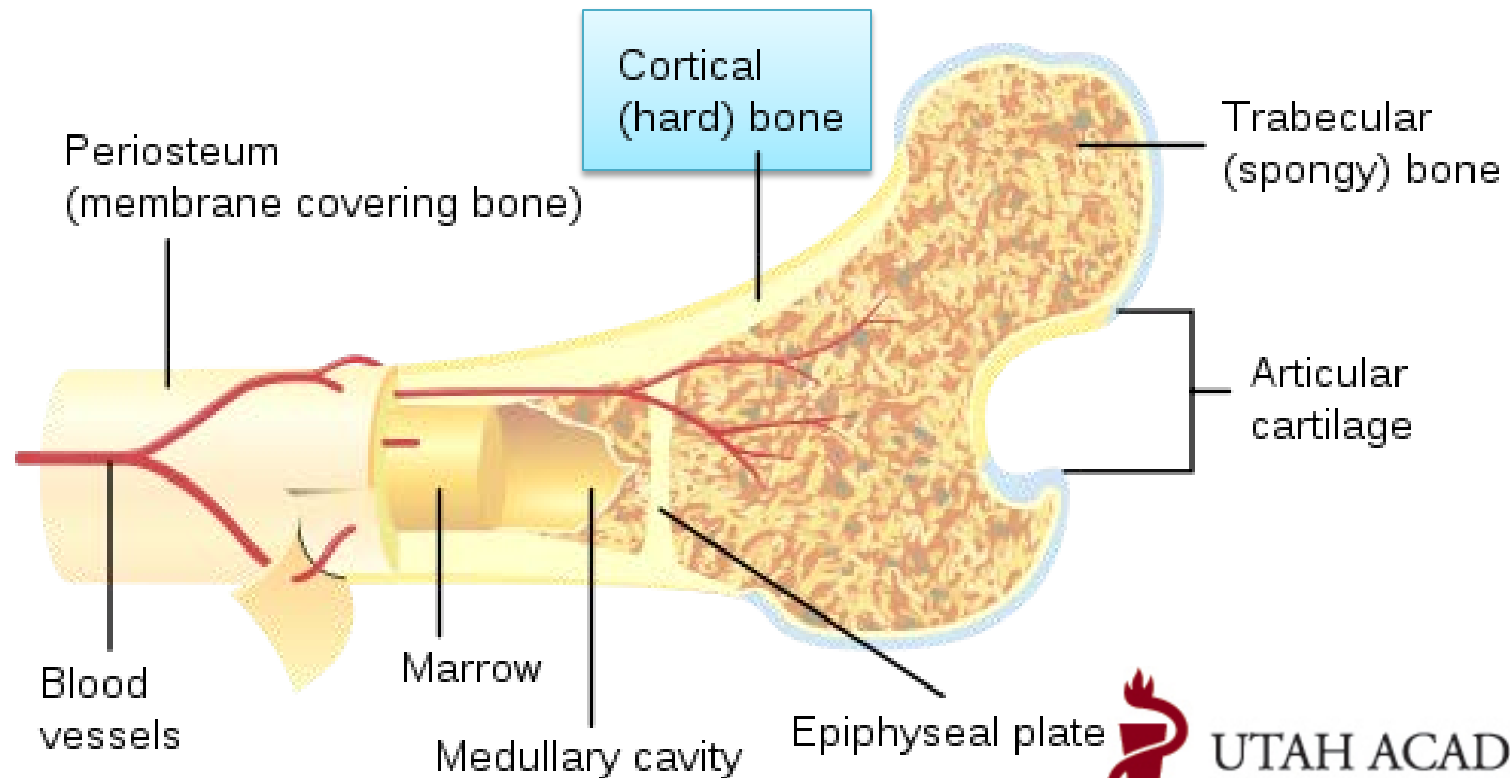
Bone Anatomy

- Periosteum
 - covers the surface of most bone



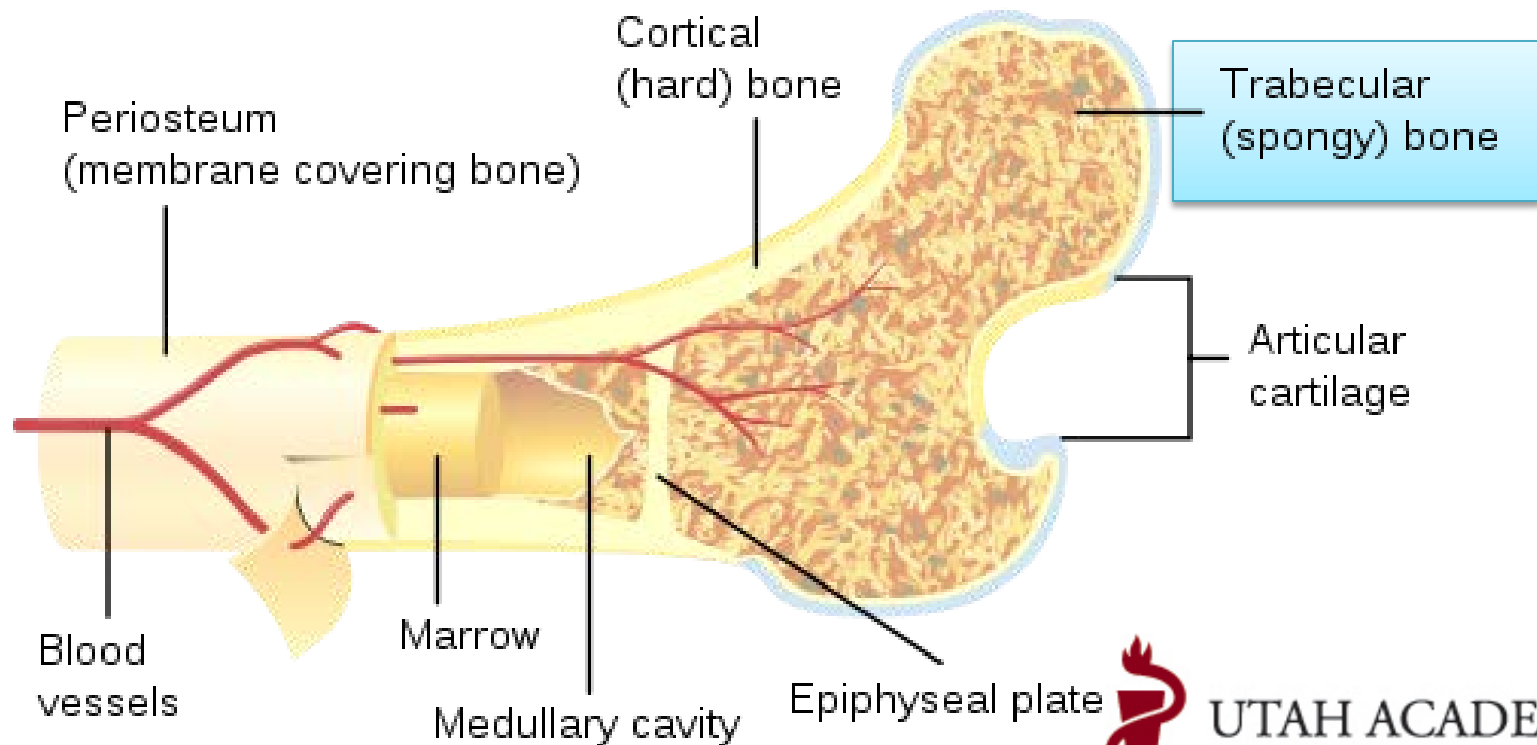
Bone Anatomy

- Cortical Bone



Bone Anatomy

- Trabecular bone (spongy/interior scaffolding)
 - heals faster than cortical bone because of its vascularization



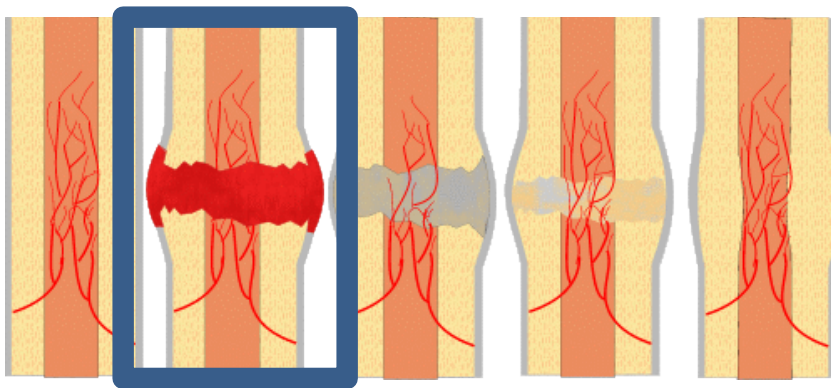
Fracture Healing

- Secondary healing is enhanced by:
 - Micromotion
 - Weight-bearing
- However, too much motion and/or load is known to result in delayed healing or even non-union



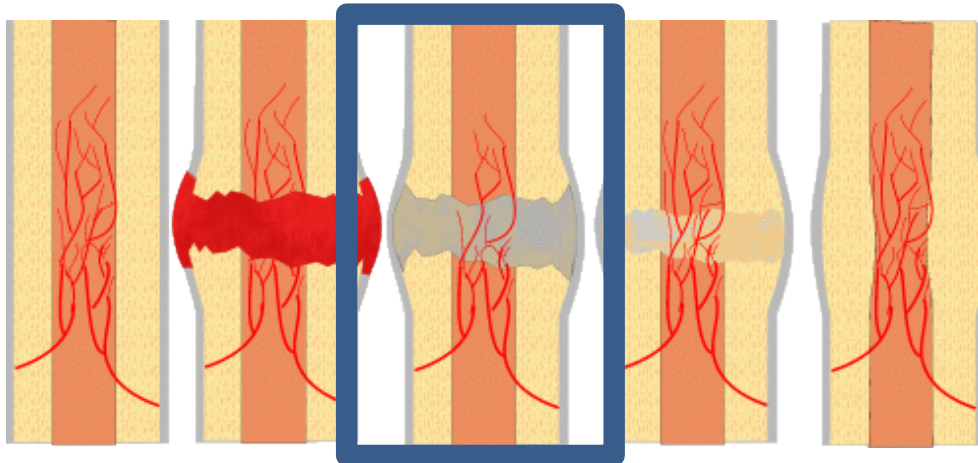
The Acute Inflammatory Response

1. A hematoma is generated
 1. Bone marrow, peripheral, & intramedullary blood
2. Acute inflammation
 1. Initiates coagulation, forming a callus template
 2. Peaks in the first 24h, is complete after 7 days



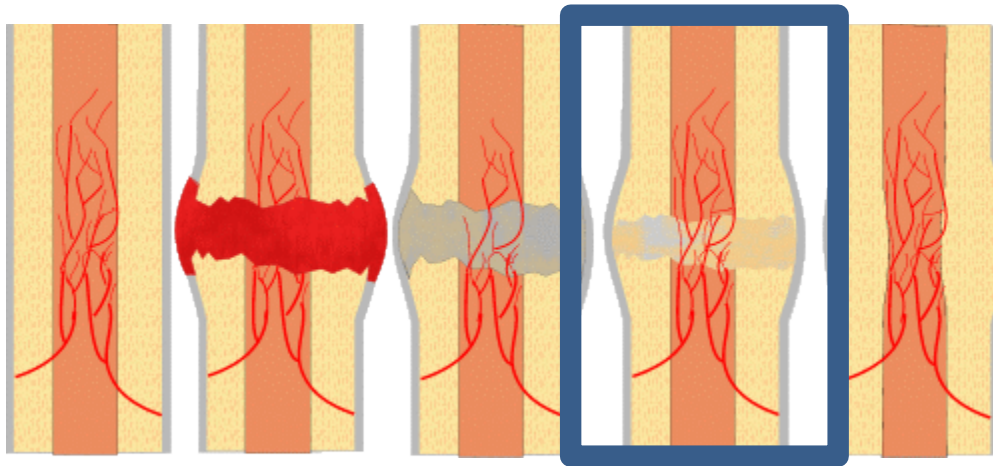
Soft Callus Formation

- 2-3 weeks post injury
 - Neovascularization
 - Decreased pain and swelling
 - Invasion of fibroblasts for collagen linkage
 - Fibrocartilage replaces hematoma



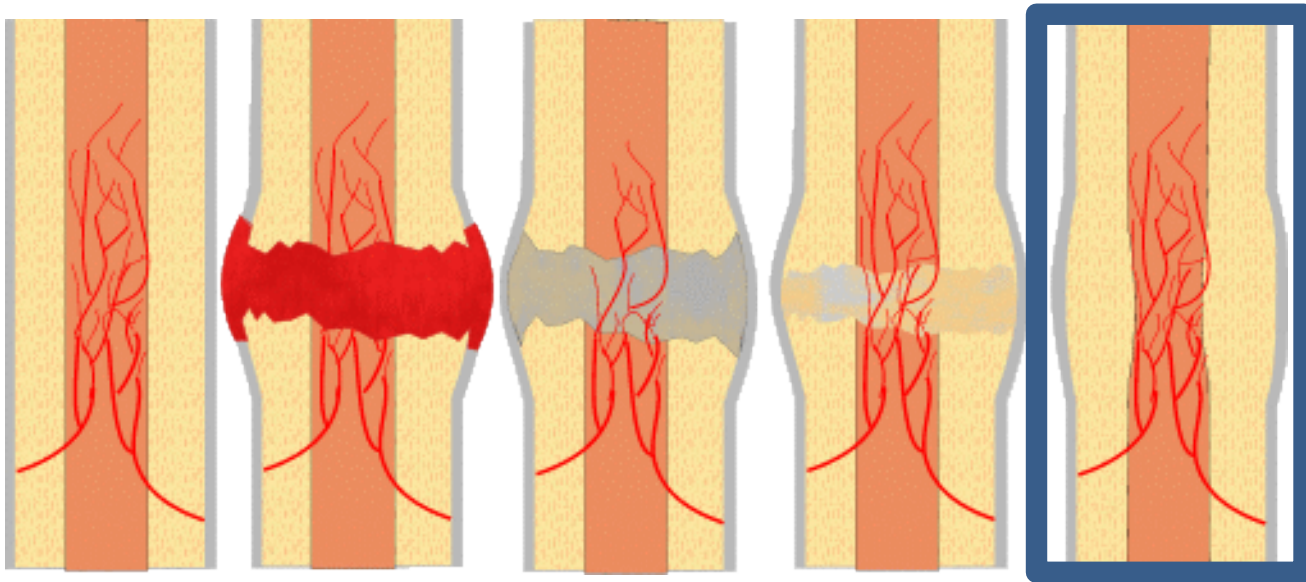
Hard Callus Formation

- 3-12 weeks post injury
 - Soft callus undergoes mineralization
 - periphery to center
 - Continues until there is not interfragmentary movement



Remodeling

- Months to years
 - Hard callus is resorbed and replaced with bone
 - External callus removed



Factors that Negatively Affect Healing

- Too much movement during the soft callus phase risks tears in the repaired tissue and compromise callus formation
- Poor vascularization of the bone fragments
- NSAIDS and steroids
- Smoking
- Older age
- Hormone imbalance
- Nutrition
- Excessive alcohol use



Do NSAIDS affect bone healing?

- Prostaglandins
 - Fracture healing relies on inflammation and formation of prostaglandins.
 - Any medication that blocks this process has the potential to impair fracture healing.
- Several animal models suggest that NSAIDs negatively impact fracture healing.
- Drawing definitive conclusions from human retrospective studies is difficult.



NSAIDS Recommendations

- Avoidance of NSAIDs in the setting of bone injury is recommended.
- Specifically completed fractures and stress fractures which are at higher risk for nonunion.
- If NSAIDs are used, the lowest effective dose for pain relief should be used for the shortest duration possible.



Ibuprofen vs Tylenol with Codeine

- Recent studies conclude:
 - Use ibuprofen instead of acetaminophen/codeine for pediatric arm fractures.
 - It controls the pain at least as well.
 - Ibuprofen is better tolerated.



Factors that Affect Healing

- Smoking
 - Smokers take significantly longer to heal than non-smokers.
 - Some studies also noted that smokers were more likely to have delayed healing.



Diabetes Affects on Fracture Healing

- Diabetes impairs both soft and hard tissue wound healing, including healing of bone



Diabetes Affects on Fracture Healing

- Changes at the tissue level
 - Reduced bone formation
 - Reduced cartilage formation
 - Accelerated loss of cartilage
 - Reduced vascularity and reduced angiogenesis
- Changes at the molecular level
 - Reduced expression of growth factors
 - Reduced expression of matrix proteins
 - Increased expression of proinflammatory genes
 - Increased expression of pro-osteoclastogenic factors
 - Increased expression of proapoptotic genes



Factors that Positively Affect Healing

- Adequate fragment apposition
- Sufficient fracture loading
- Proper fracture stabilization



Fracture Treatment Depends Upon

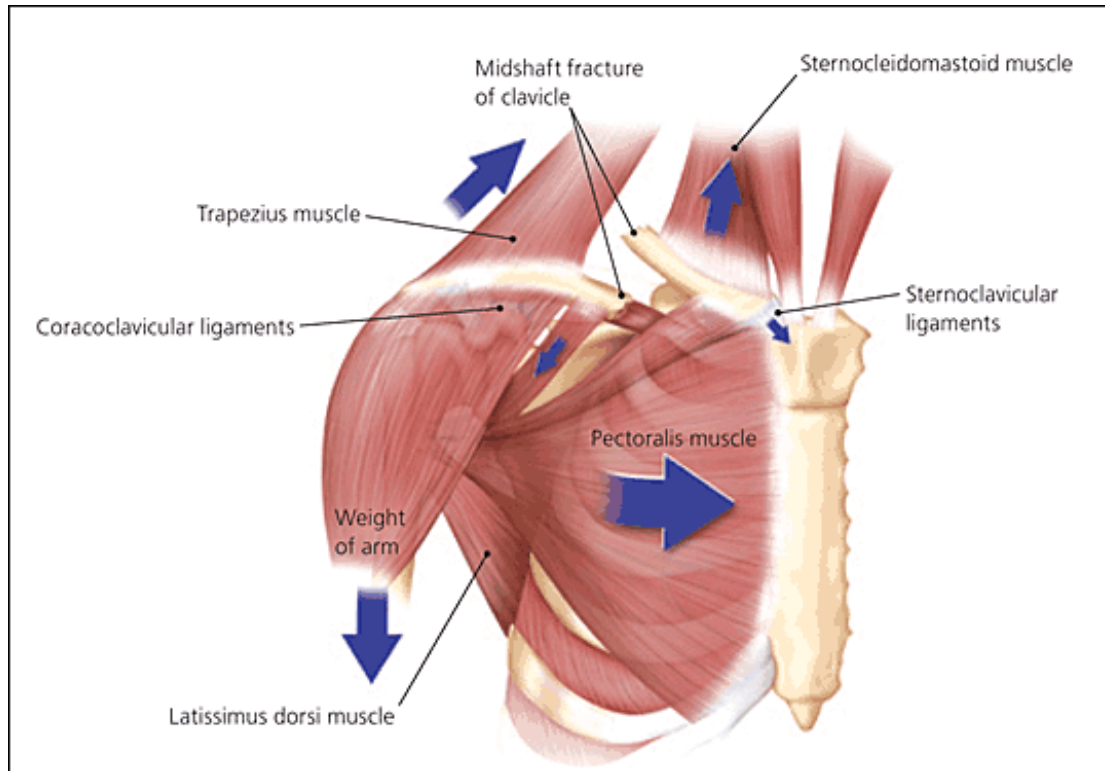
- Fracture type and characteristics
- Age of patient
- Activity level
- Quality of the bone



Clavicle



Clavicle Fracture



Clavicle Fracture

- Non-operative Treatment:
 - Most minimally displaced fractures can be treated non-operatively with some form of immobilization
 - Comfort and pain are the main goals
 - Consider sling or figure eight bandage/brace
 - Active range of motion of elbow, wrist, and hand should be performed throughout recovery
 - Monitor fracture with x-rays to ensure union
 - Patients usually can return to noncontact sports and full daily activities 6 weeks after injury.



Clavicle Fracture

- Operative Referral:
 - Open fractures
 - 100% displaced fractures and/or shortening of >1-2cm
 - May lead to shoulder dysfunction and cosmetic deformity
 - Skin tenting (may progress to open fracture)
 - Comminuted fractures
 - Neurovascular compromise



Risk Factors for Nonunion of Midshaft Clavicle Fractures

- Clavicle shortening > 15–20 mm
- Female sex
- Fracture comminution
- Fracture displacement
- Greater extent of initial trauma
- Older age



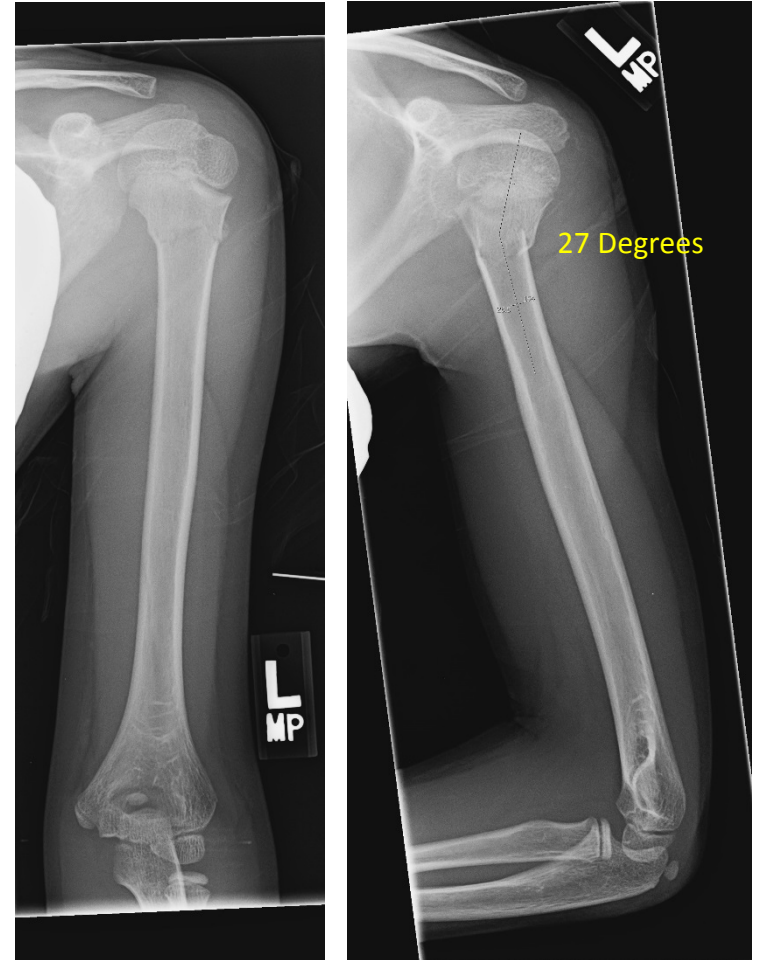
Proximal Humerus



Proximal Humerus Fracture

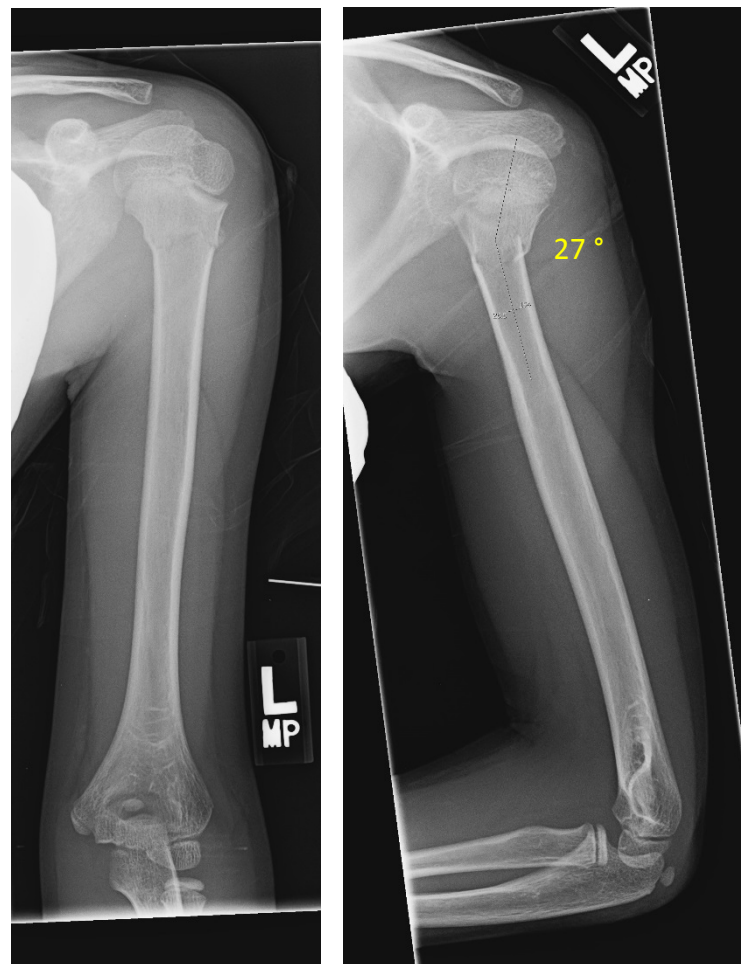
HPI:

8 yo female was racing down a hill with her bike and she crashed and landed on left elbow/shoulder.



Acceptable Deformity

- Ages 1-4 years
 - 70° without any amount of displacement
- Ages 5-12 years
 - 40-45° and displacement <51% the width of the shaft
- Ages 12 years to maturity
 - 15-20° and displacement <30% the width of the shaft



Proximal Humerus Fracture

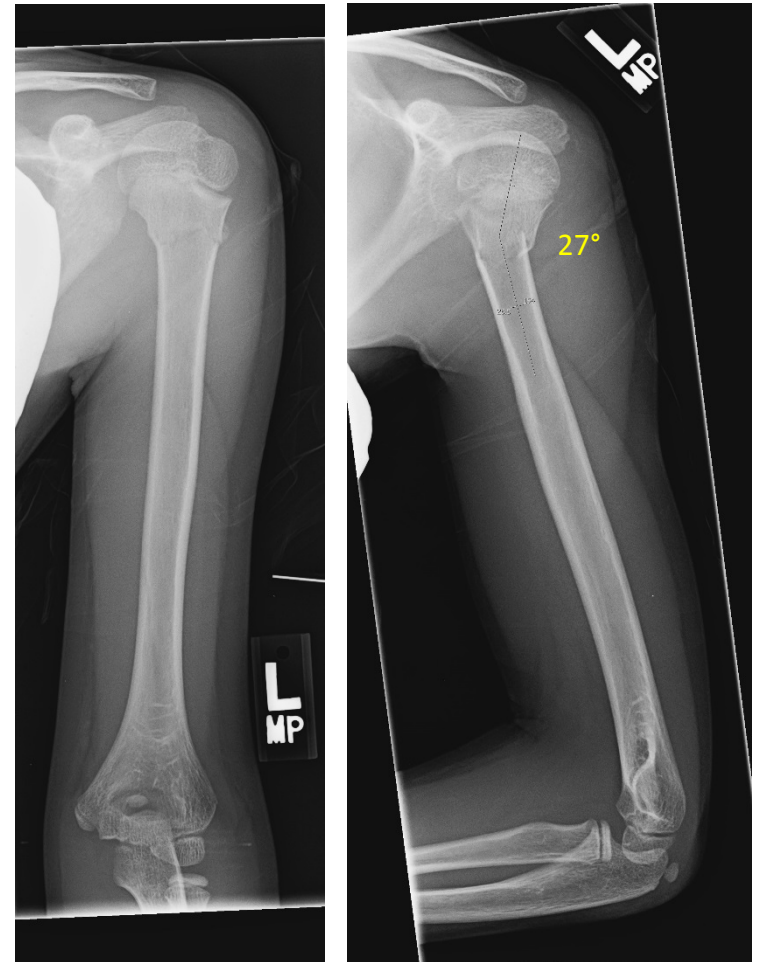
Plan:

I reviewed her x-rays and discussed that though she has a buckle-type fracture of the metaphysis of her left proximal humerus with 27° angular deformity.

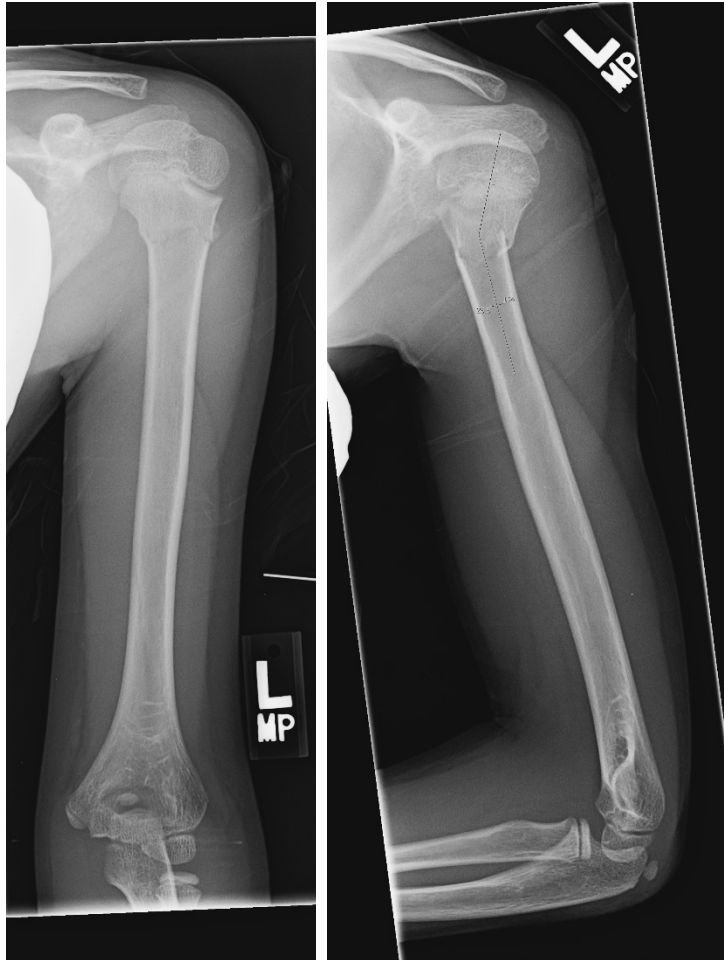
I discussed that typically acceptable deformity with conservative measures is up to 40-45°.

I did provide her with a sling and swath along with a prescription for a Sarmiento brace.

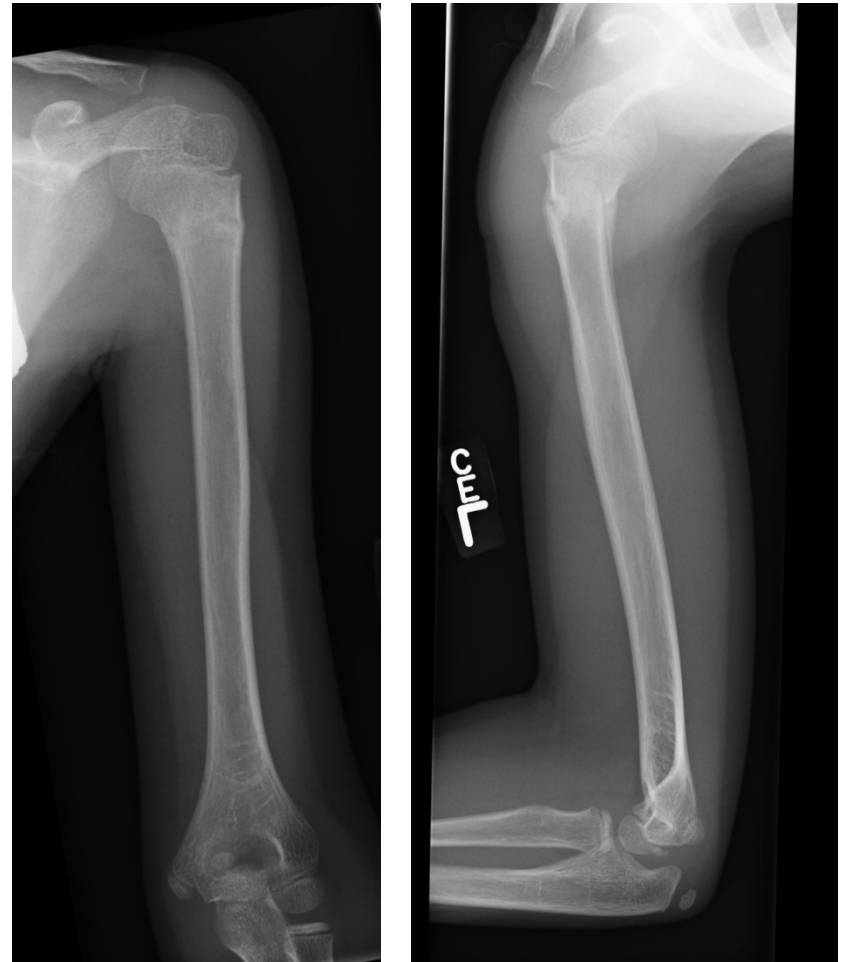
We will follow up in 2 weeks for repeat evaluation and x-rays of her humerus. If all appears to be healing well, we will continue with guarded activities.



Before



After



Distal Humerus

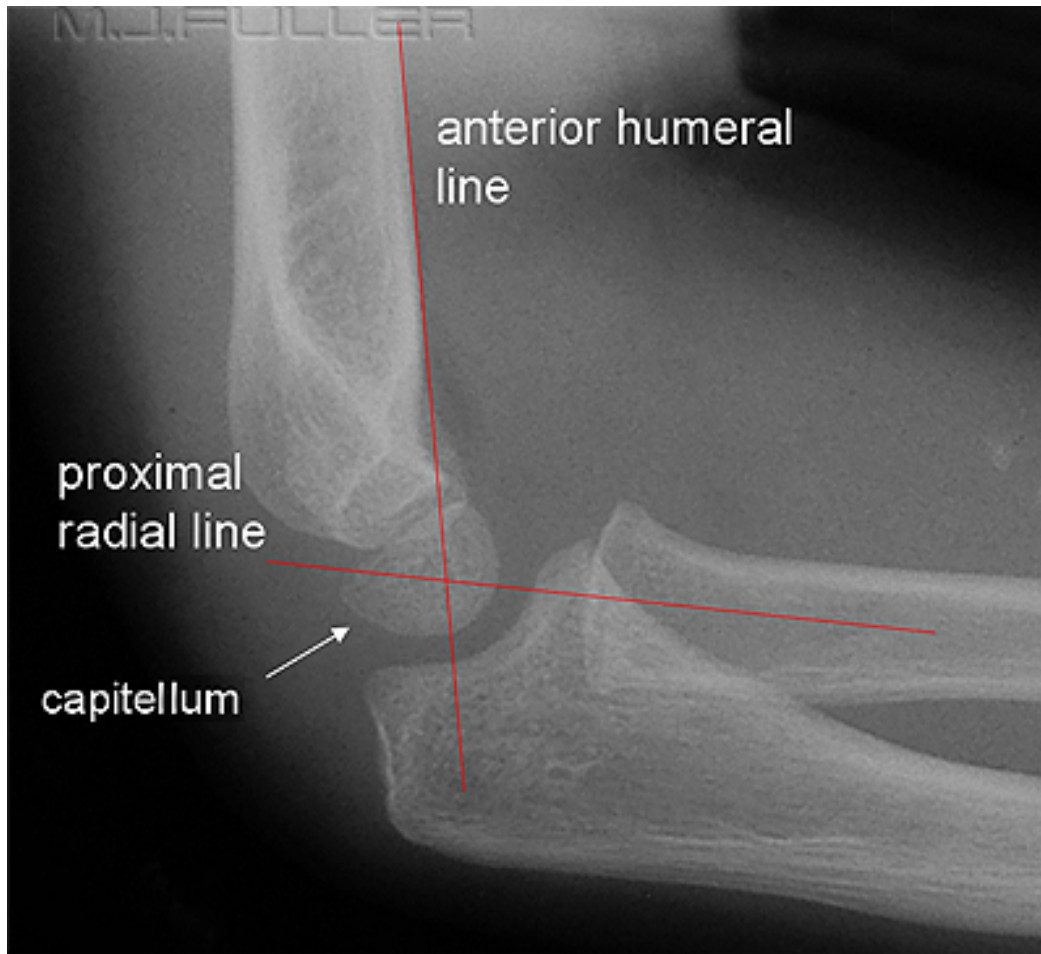


Fat Pad and Sail Sign

- A fat pad sign does not equal fracture
- A fat pad sign does indicate in increased chance of a fracture
- Posterior fat pad
 - 70% chance of fracture

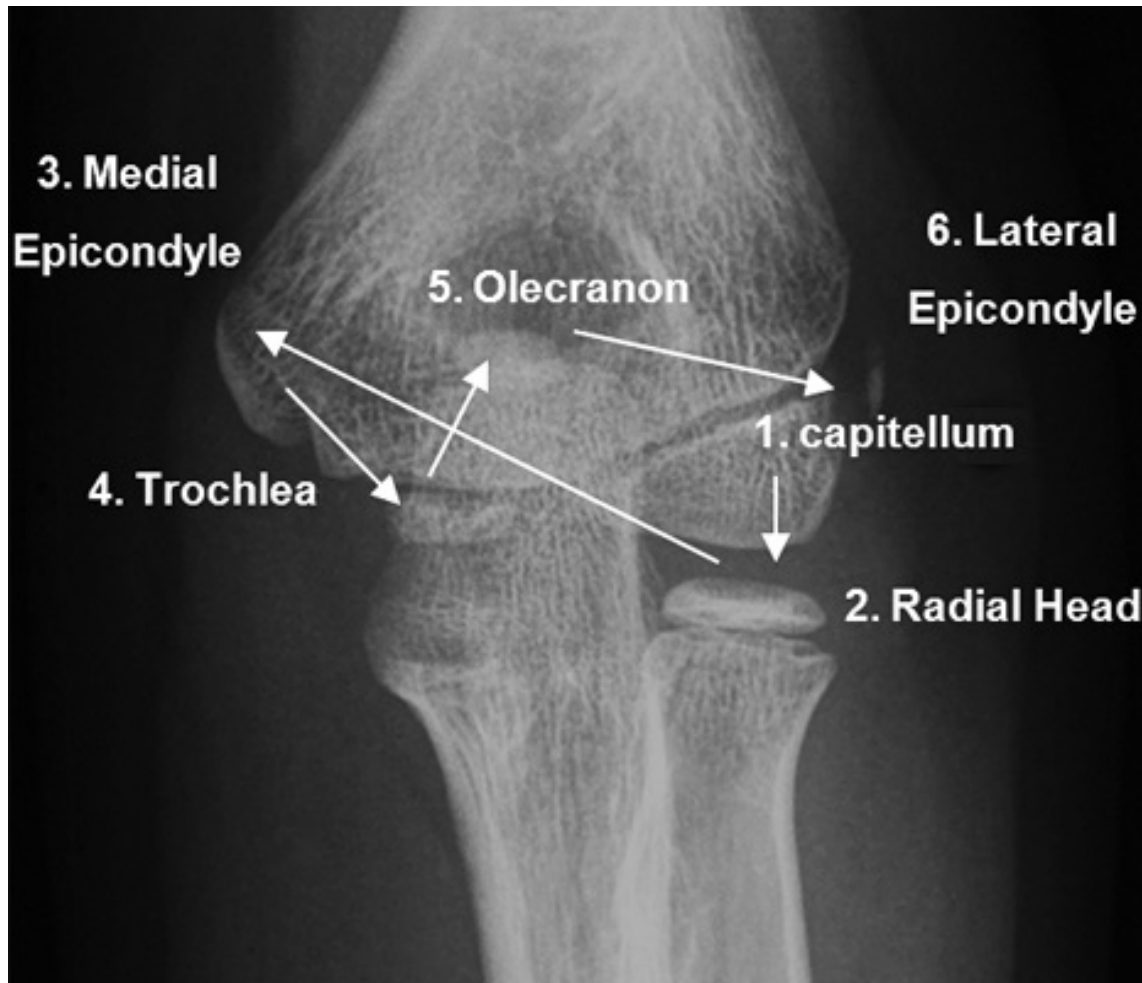


Normal Elbow Alignment



- The anterior humeral line should pass through the middle third of the capitellum

Sequence of Appearance of Elbow Ossification Centers



Sequence of Appearance of Elbow Ossification Centers

- **Capitellum** ~0.5-2 years
- **Radial Head** ~4 years
- **Internal (medial) Epicondyle** ~6-7 years
- **Trochlea** ~8 years
- **Olecranon** ~8-10 years
- **External (lateral) Epicondyle** ~12 years

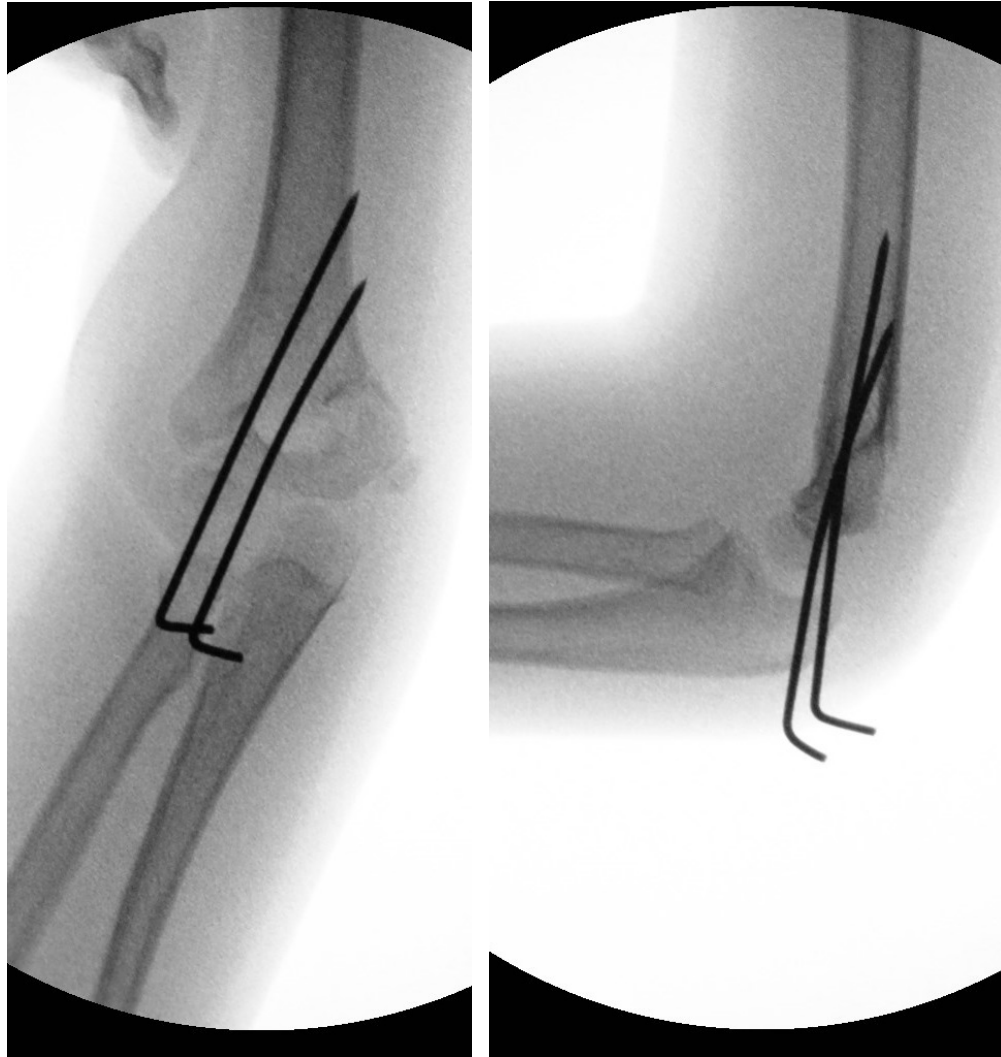


Supracondylar Fracture

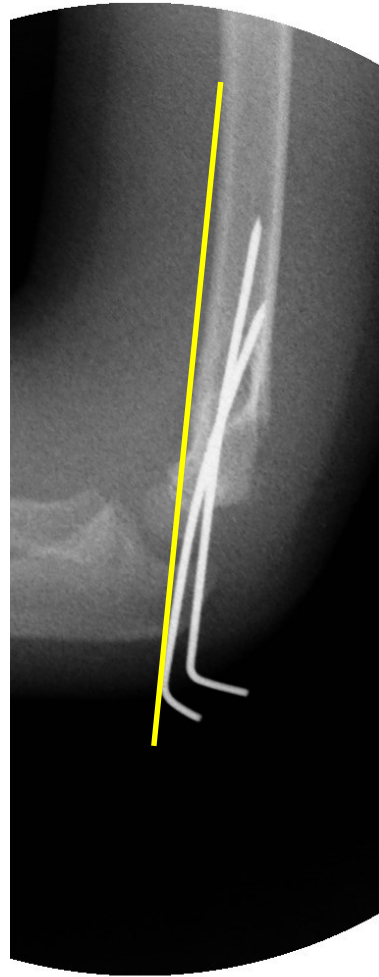
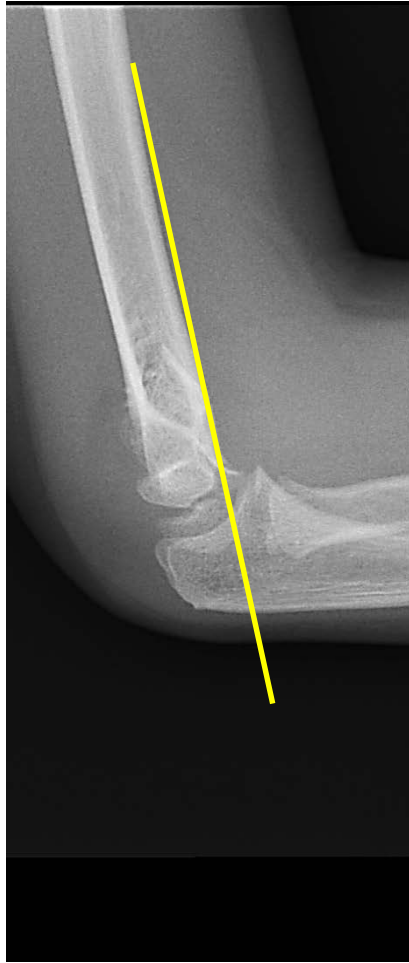
Pt is a 5Y F here today for right elbow pain. Pt reports that on 10/17/2016 she fell off of the monkey bars and reported elbow pain and arm pain. She went to InstaCare for xrays and was told she had an elbow fracture.



Referred to Pediatric Orthopedics



Pre and Post Anterior Humeral Line



Radial Head



Radial Head Fracture



When to Refer

- Articular Step-off
 - >1 mm
- Articular Incongruity/Gap
 - >2 mm displacement
- Involve more than one third of the articular surface
- Block of motion
- Severely comminuted



Treatment

- Controversial
 - Sling
 - Cast/splint for 1-2 weeks
- Guarded weightbearing until clinically healed
 - Typically 8-10 weeks



Mid-shaft Forearm Fractures



Mid-shaft Radius Fracture

HPI:

10Y M here for a left arm fx. Pt reports that he was riding his scooter yesterday afternoon and hit and bump and fell off and felt a lot of wrist pain. He was taken to InstaCare for xrays. They put him in a splint, but told him he needed to f/u soon because his fracture may need reduced.

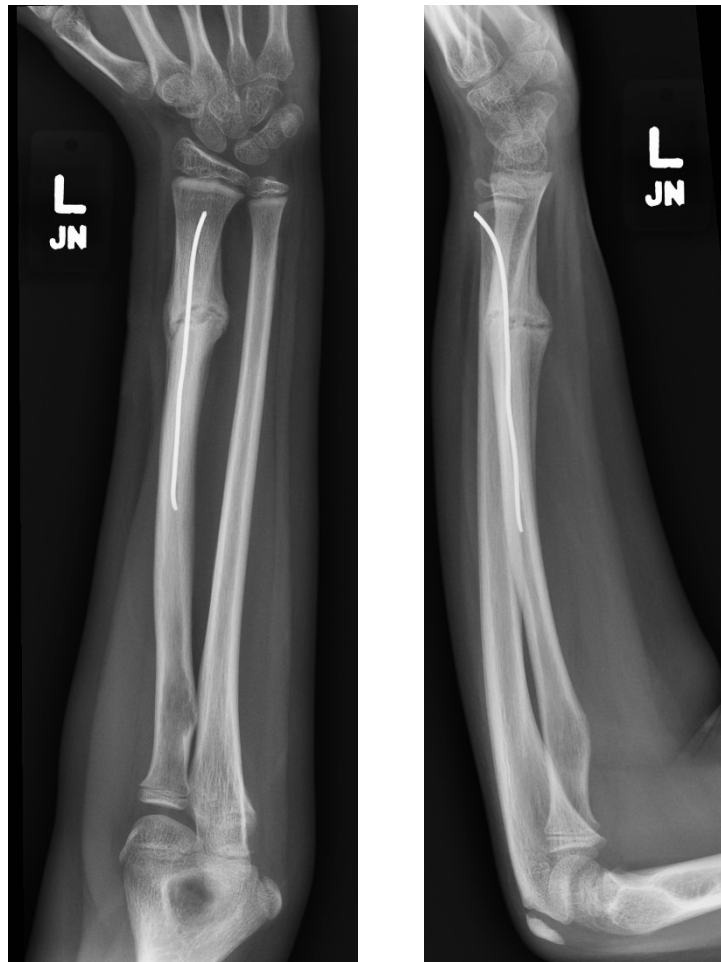


Acceptable Deformity

- Angular deformity
 - Correction of 1 degree per month, results from physical growth. Exponential correction occurs over time, increased correction occurs for greater deformities.
 - For <10 years old
 - Up to 15° of correction may occur at the wrist
- Rotational deformity
 - These do not appreciably correct
- Bayonet apposition
 - A deformity < 1cm is acceptable and will remodel if the patient is <8-10 years old
 - Patients >10 years old, no deformity should be accepted



6 Weeks Post Intramedullary Nail



Wrist Fractures



Non-operative Management of Wrist Fractures

- Non-displaced or minimally displaced fractures
- Displaced fractures with a stable fracture pattern, which can be expected to unite within acceptable radiographic parameters
- Low-demand elderly patients in whom future functional impairment is less of a priority than immediate health concerns and/or operative risks.



Intraarticular fracture



30 yo female. 4 days prior to presentation, the patient slipped and fell on some ice near her home. She tried to reach out and catch herself with her left hand, which was up stretched.

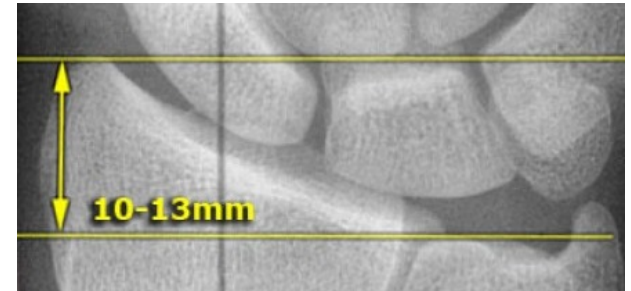


Normal Wrist X-rays

- **Radial length or height**

Radial length is measured on the PA radiograph as the distance between one line perpendicular to the long axis of the radius passing through the distal tip of the radial styloid.

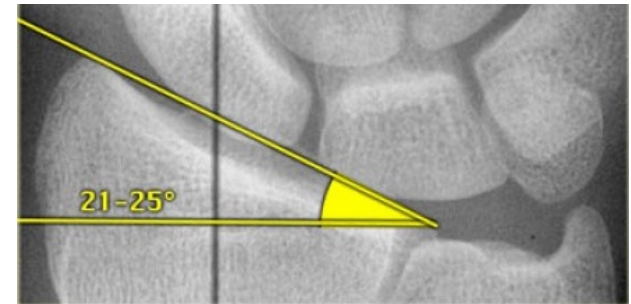
- A second line intersects distal articular surface of ulnar head.
- This measurement averages 8-18 mm.



- **Radial inclination or angle**

Radial inclination represents the angle between one line connecting the radial styloid tip and the ulnar aspect of the distal radius and a second line perpendicular to the longitudinal axis of the radius.

- The radial inclination ranges between 13 and 30 degrees .
- Loss of radial inclination will increase the load across the lunate.



- **Volar Angle**

Measured on a lateral radiograph. The radial tilt represents the angle between a line along the distal radial articular surface and the line perpendicular to the longitudinal axis of the radius at the joint margin.

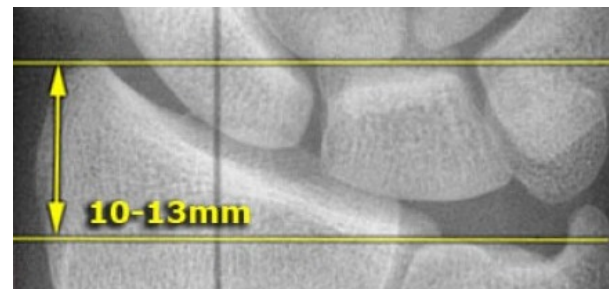
- The normal volar tilt averages 11-12 degrees and has a range of 0-28 degrees .



Acceptable Parameters for Active Healthy Patient

Radial length or height

- Within 2-3mm of contralateral side

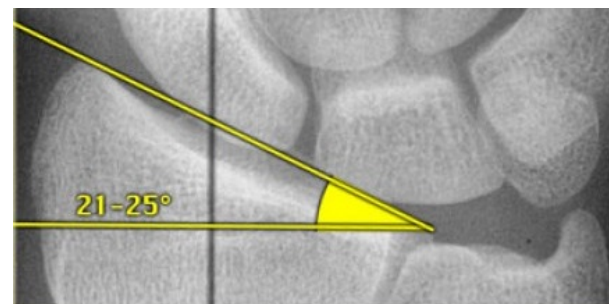


Radial inclination or angle

- $<5^\circ$ loss

Volar Angle

- 0° (neutral tilt) or greater
- $<20^\circ$



Articular Step-off

- <2 mm
- I prefer <1 mm



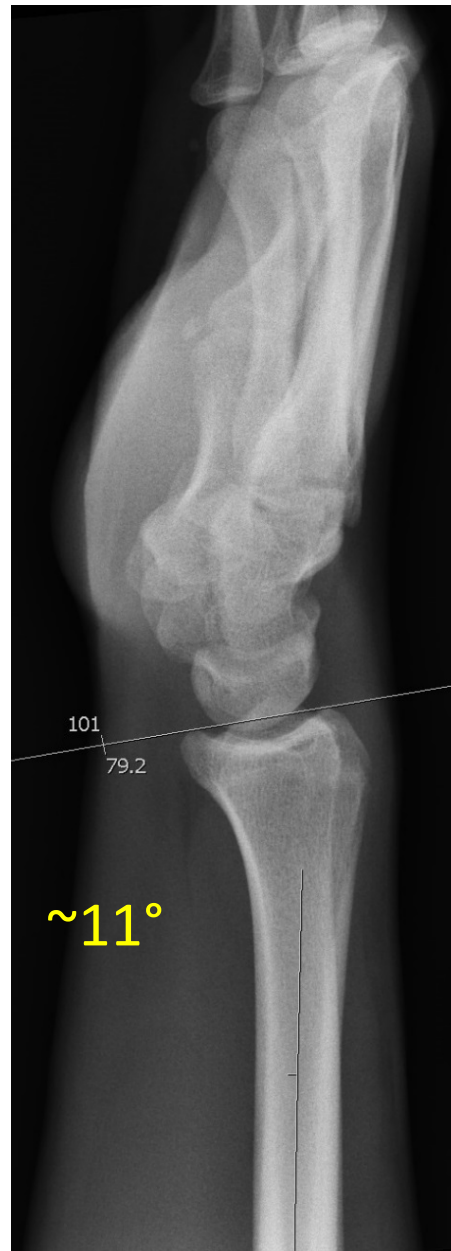
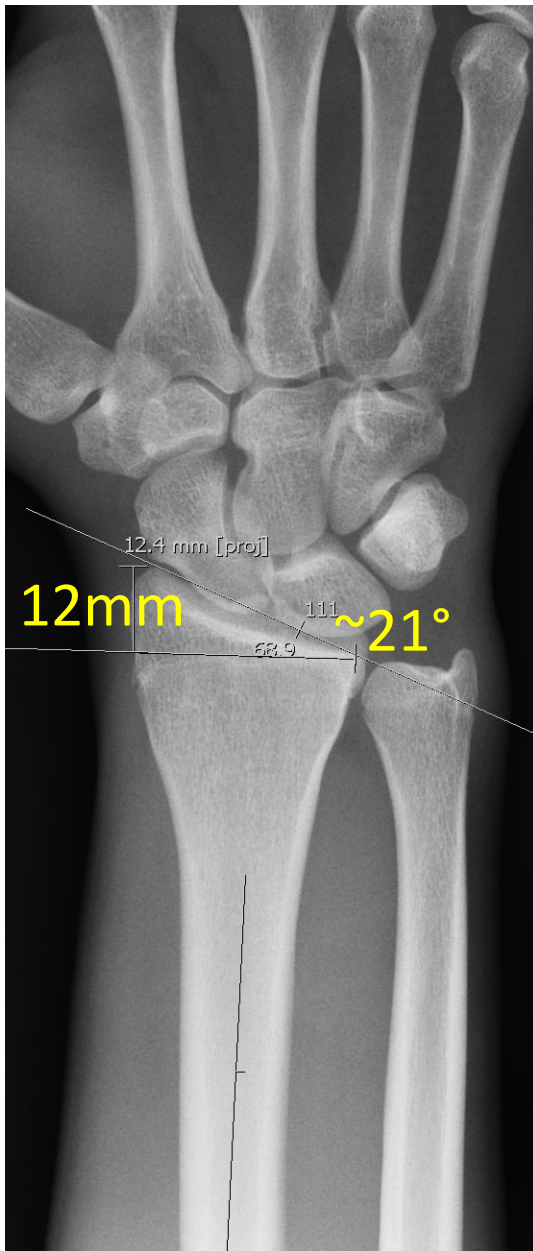
Articular Incongruity/Gap

- <2 mm



Normal Wrist X-rays





Normal Measures

- **Radial length or height**
12mm
- **Radial inclination or angle**
21°
- **Volar Angle**
11°

Indications for Reduction

- Volar Angle <0° or >20°
 - The normal volar tilt averages 11 degrees and has a range of 2-20 degrees (~110-90 degrees)
- Articular step-off >2 mm
- Radial Shortening >5 mm
- Radial inclination <15°
- Articular incongruity/gap >2 mm



Factors Associated with Redisplacement Post-reduction

- The initial displacement of the fracture
 - The greater the degree of displacement, the higher the likelihood that closed treatment will be unsuccessful
- Age
 - Elderly patients with osteopenic bones tend to displace, particularly late
- Displacement following closed reduction
 - Less likely repeat manipulation will be successful



When to Reduce Radius Fractures

- All fractures should undergo closed reduction, even if it is expected that surgical management will be needed
 - Helps limit post injury swelling
 - Provides pain relief
 - Relieves compression on the median nerve



Closed Reduction Treatment

1. A displaced fracture is typically reduced under regional or general anesthetic.
2. The deformity is then reduced.
3. A splint or cast is placed in such a way that the risk of re-displacement is minimized.
4. Post reduction and follow-up x-rays are taken to ensure that the reduction was successful and is maintained.



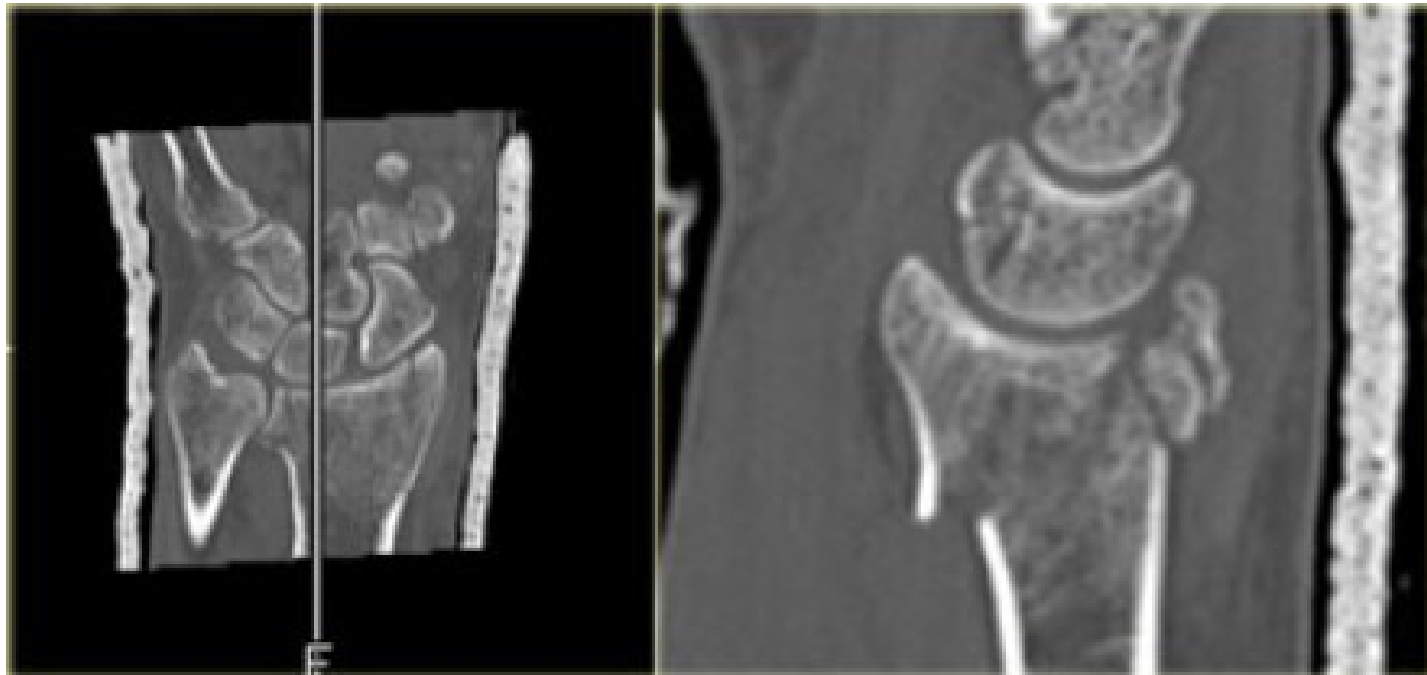
Common Forearm Fractures in Adults



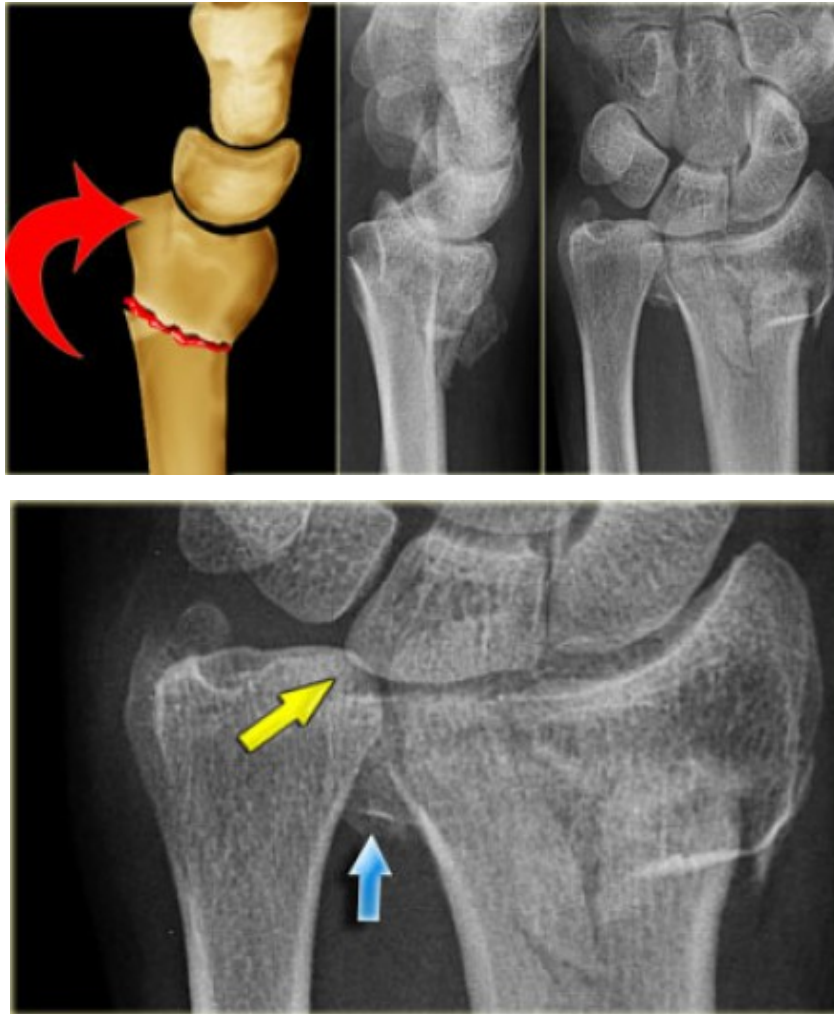
Wrist Fractures that Require Referral



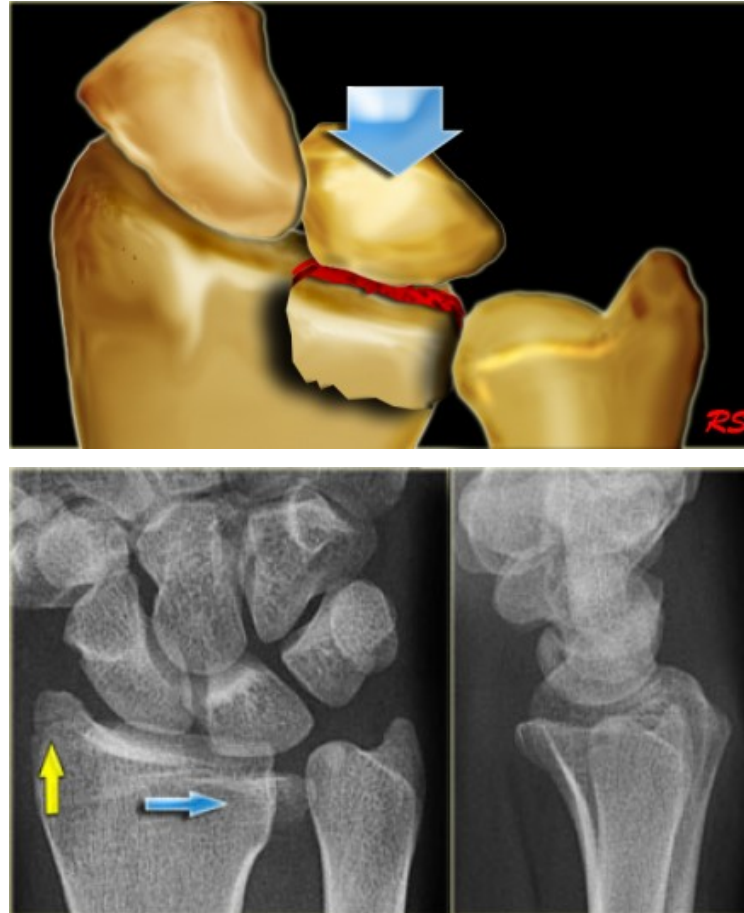
Wrist Fractures that Require Referral



Wrist Fractures that Require Referral



Wrist Fractures that Require Referral



Complication of Malunion



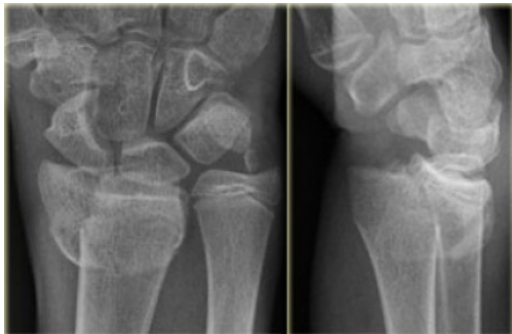
Wrist Fractures in Children



- **Torus fracture**
 - Torus/buckle fractures, are extremely common injuries in children.
 - These injuries tend to heal much more quickly than the similar greenstick fractures.



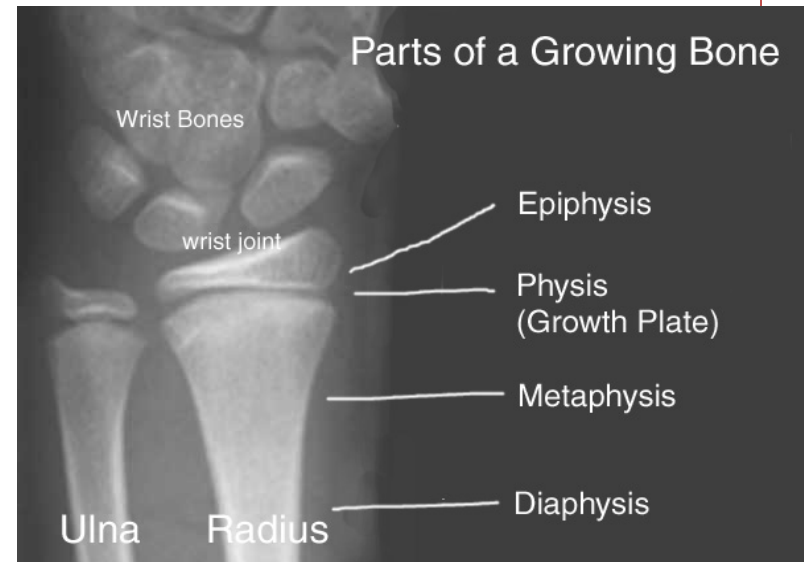
- **Green stick fracture**
 - These are partial fractures, since only one part of the bone is broken and the other side is bent.
 - Sometimes the greenstick fracture must be bent back into the proper position.



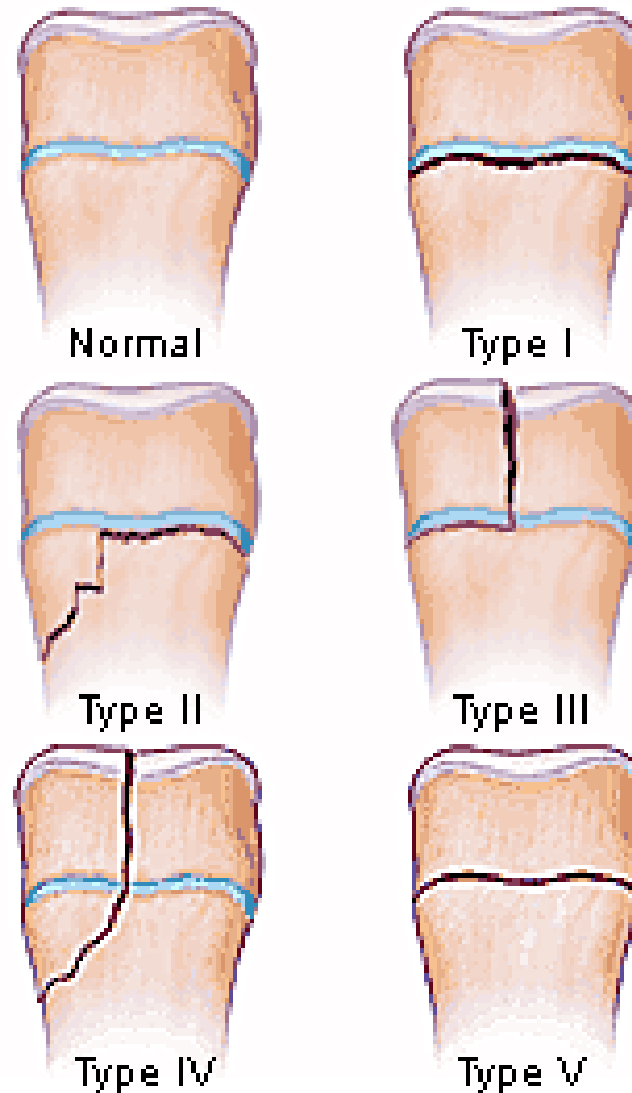
- **Salter Harris fracture**
 - These are usually Salter Harris type II fractures.
 - Reduction to the anatomical situation is necessary to prevent growth disturbances.
 - In some cases they need percutaneous pinning.

Physis Closure

- After physeal closing, injury patterns are similar to those in adults, but physis close at about:
 - 15 years in girls
 - 17 years in boys
- Pre-teens have injuries in the upper limbs
 - Contusions, strains, simple fractures
- Teenagers commonly injure lower limbs
 - Knee is most common
- Salter Harris fractures typically don't require surgery
- Open physis are about 3-5 times weaker than the surrounding capsular and ligamentous tissues, so fractures are more common than dislocations and ligamentous injuries
- Non-union is rare because immature skeleton forms callous early and heals quickly
 - More common in adults



Salter Harris Fractures



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Wrist Fractures in Children



- Unlike the adult, considerable deformity may be permitted because of the remodeling potential.
- Rotational deformity does not spontaneously correct
- Salter Harris III and IV fractures require anatomic reduction (<1-2mm displacement both vertically and horizontally)

Wrist Fractures in Children for Operative Treatment:

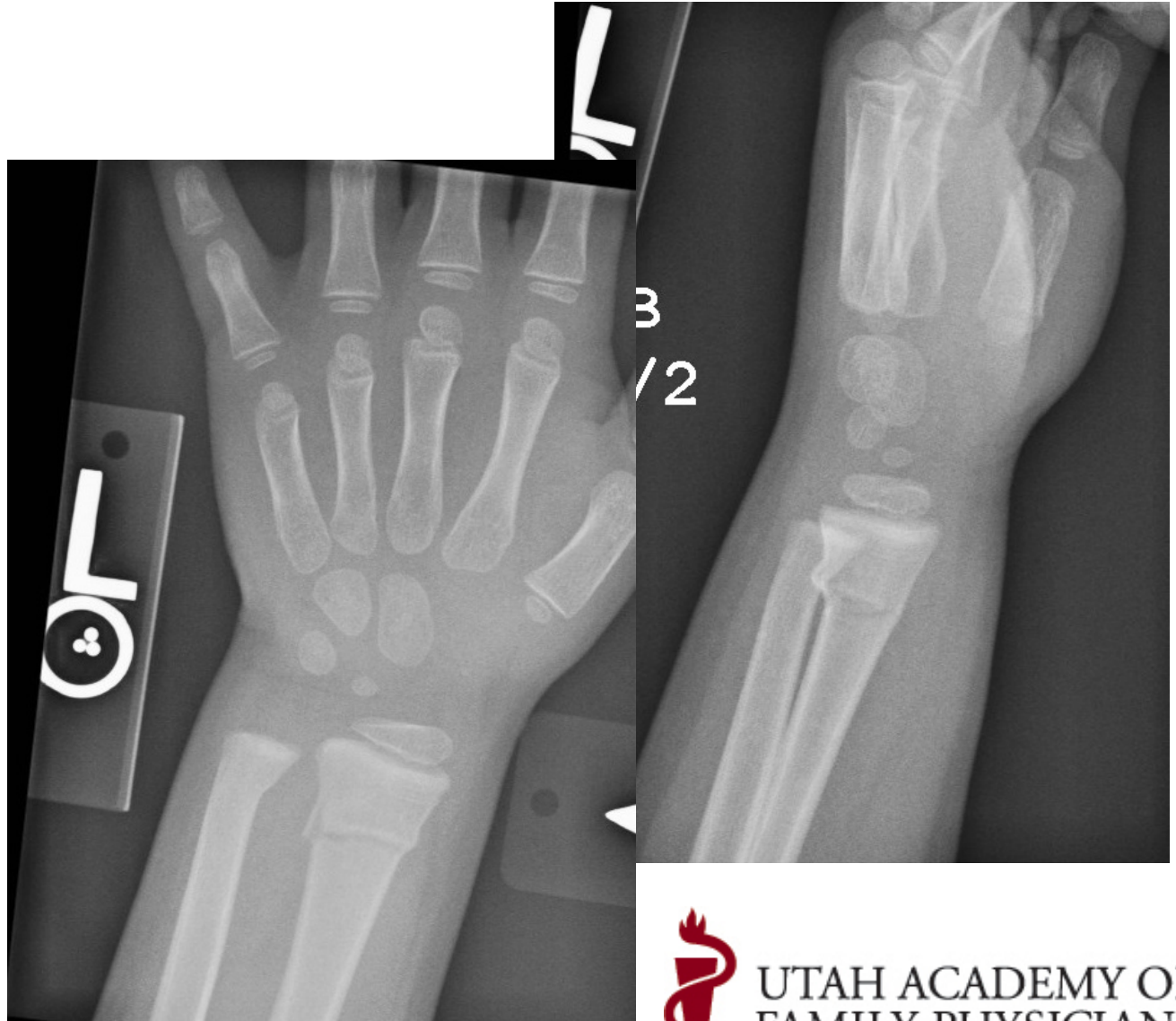
- Most open fractures
- Displaced intra-articular fractures
- Fractures with vascular injury
- Fractures with compartment syndrome
- Unstable fractures
- Rotational deformity



Distal Radius Fracture

HPI:

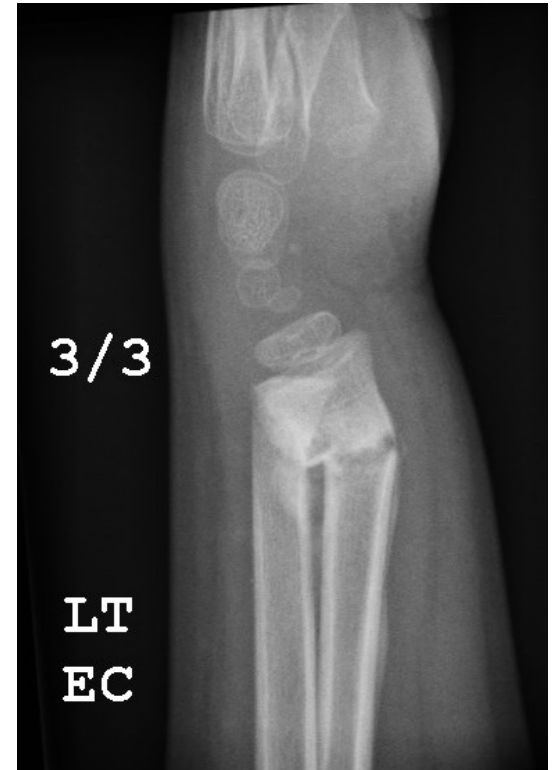
4 yo male fell off stair railing Sunday April 3rd. He was on the wrong side of a railing and jumped down 4 stairs onto a landing, onto his left arm.



3 week Follow-up



3 week Follow-up



Acceptable Deformity

- Angular deformity
 - Correction of 1 degree per month, results from physical growth. Exponential correction occurs over time, increased correction occurs for greater deformities.
 - For <10 years old
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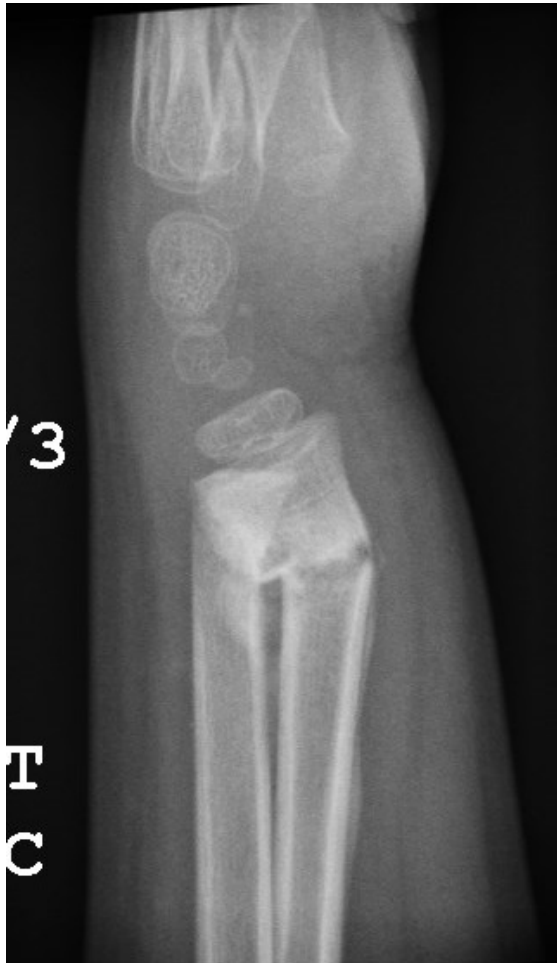
6 week Follow-up



3 month Follow-up



Progression



Scaphoid Fractures



Suspected Scaphoid Fractures

Suspected scaphoid fracture with negative x-rays:

- Apply a short arm thumb spica
- Reevaluate the patient in two weeks.
 - If a cast is not applied, the fracture can worsen over the following months.

MRI may be used initially if the patient desires an alternative approach.

At the two-week visit, the patient should be free of pain, and a follow-up radiograph should be obtained.

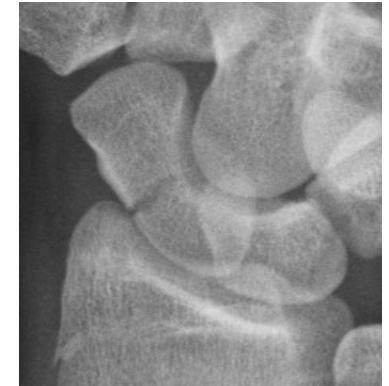
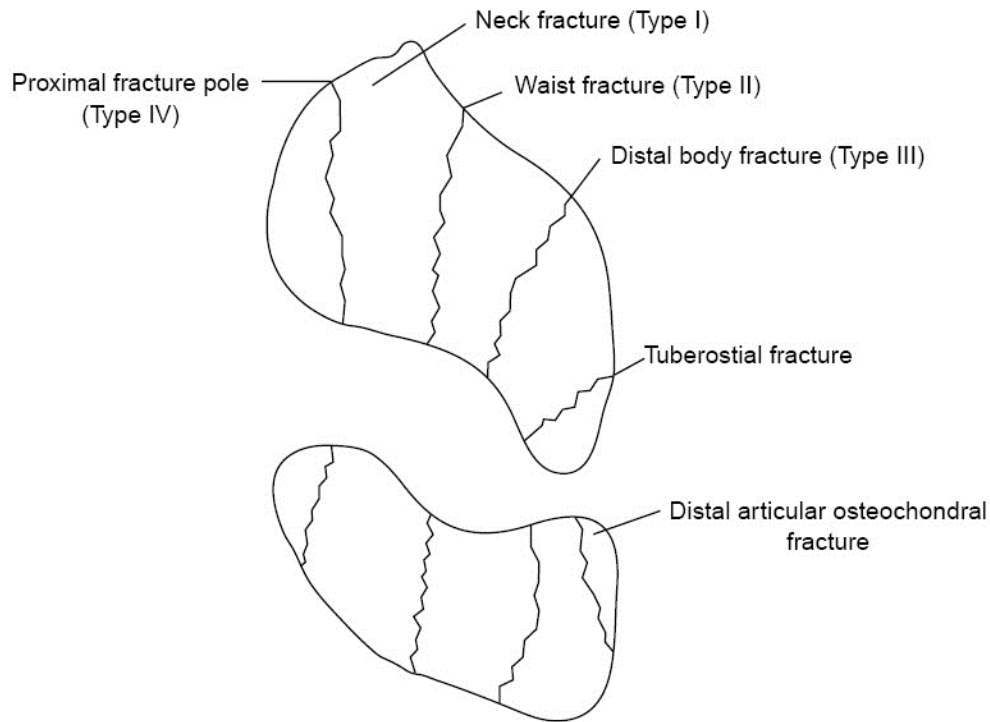


Scaphoid Fracture

Pt is a 16Y M here today for right wrist pain. Pt states that he wrecked on his bike yesterday afternoon, he was turning into the church parking lot return to sharply and fell off the bike rolling and hitting his head several times in the ground. He does not remember exactly how he landed. He reports 5/10 of pain.



Scaphoid Fracture



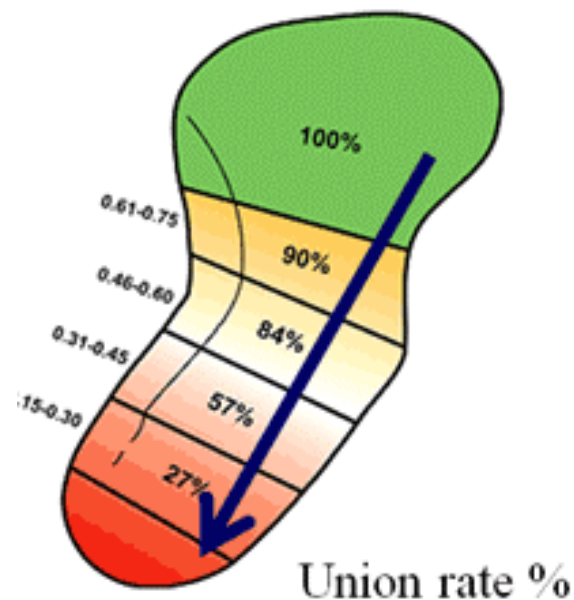
Non-Operative Treatment

- Non-displaced, acute (<4 weeks), distal third fracture
- Tuberosity fractures
- Expected time to union
 - Distal third: 6-8 weeks
 - Middle third: 8-12 weeks
 - Proximal third: 12-24 weeks



Indications for Surgery

- Proximal pole fracture
- >1mm displacement
- Fracture comminution
- Scapholunate angle >60 °
- Radiolunate angle >15 °
- Intrascaphoid angle >35 °



Nondisplaced Scaphoid Fractures

Treatment:

- Short arm thumb spica
 - Some evidence suggests that the thumb spica could be omitted from the cast
- Screw fixation may speed recovery to pre-injury activities
- As the fracture line moves proximally, there is more risk of displacement and nonunion



Scaphoid Fracture

Pt is a 16Y M here today for right wrist pain. Pt states that he wrecked on his bike yesterday afternoon. He does not remember exactly how he landed. He reports 5/10 of pain.



Date of Injury



3 months



5 months post



5 months post

CT Report:

Scaphoid waist fracture is identified. The dorsal and midportion of the fracture is well-healed with complete bony bridging.

There is a small cleft or lucent gap along the volar cortex of the fracture with about 90% of the fracture healed.



Scaphoid Fracture

Patient was doing Olympic lifts yesterday, and felt a pop in his hand, in the region of the scaphoid. Patient previously fractured the scaphoid in this hand in June of 2015, doing a very similar maneuver, but this healed with conservative treatment of casting for 6 weeks followed by bracing for an additional 4 weeks. He reports 6/10 pain at rest and with use. He is here for further evaluation.



Scaphoid Fracture 3 Months Later



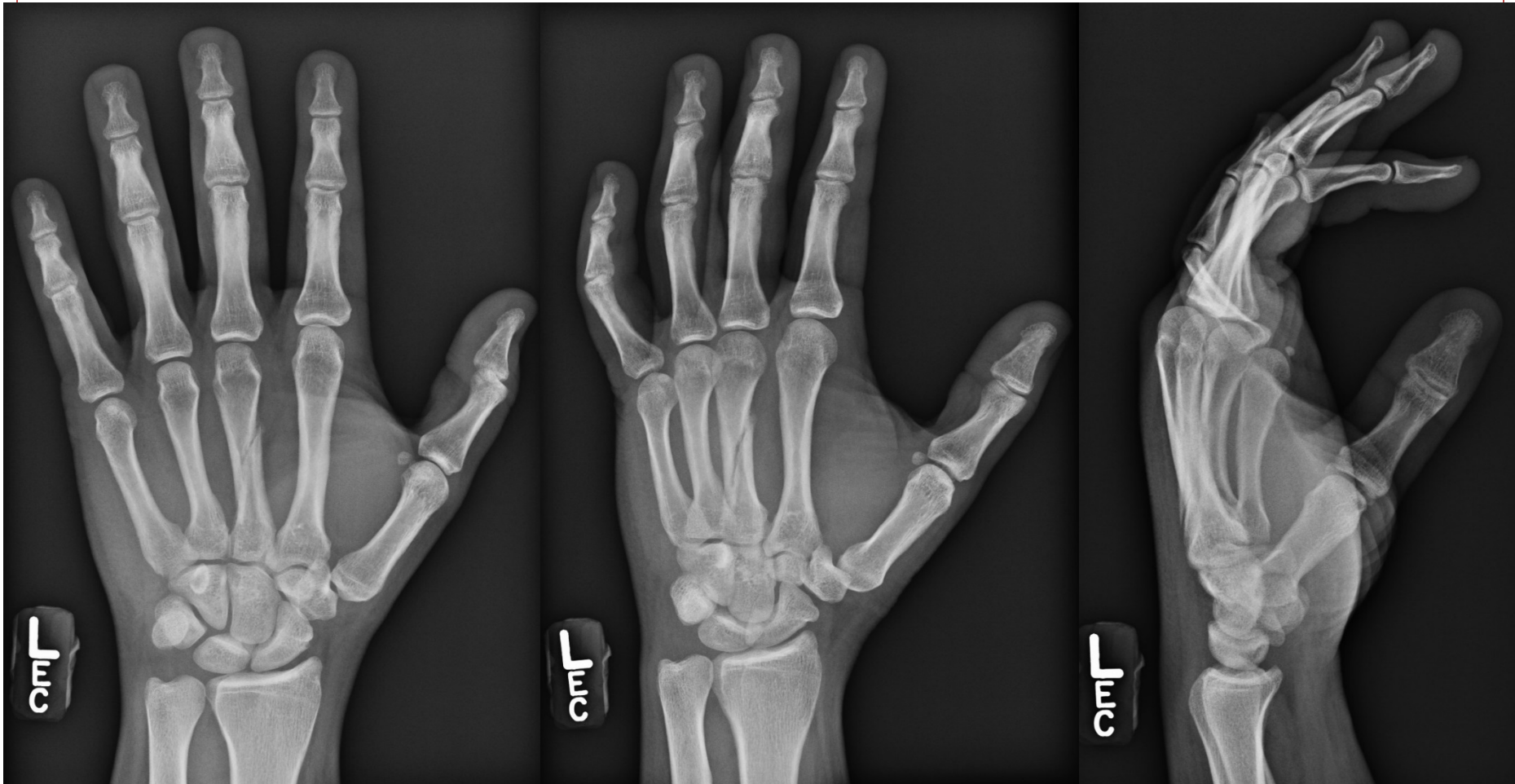
Metacarpal Fractures



Matacarpal Fracture

HPI:

Patient is a high school wrestling coach and while using his left hand for leverage while working at home, he felt a pop and pain in his hand.



Indications For Referral

- Displaced or comminuted fractures
- Dorsal angular deformity
 - 2nd metacarpal
 - any angular deformity
 - 3rd metacarpal
 - any angular deformity
 - 4th metacarpal
 - >30° deformity
 - 5th metacarpal
 - >40° deformity
- Shortening >5mm
- Malrotation

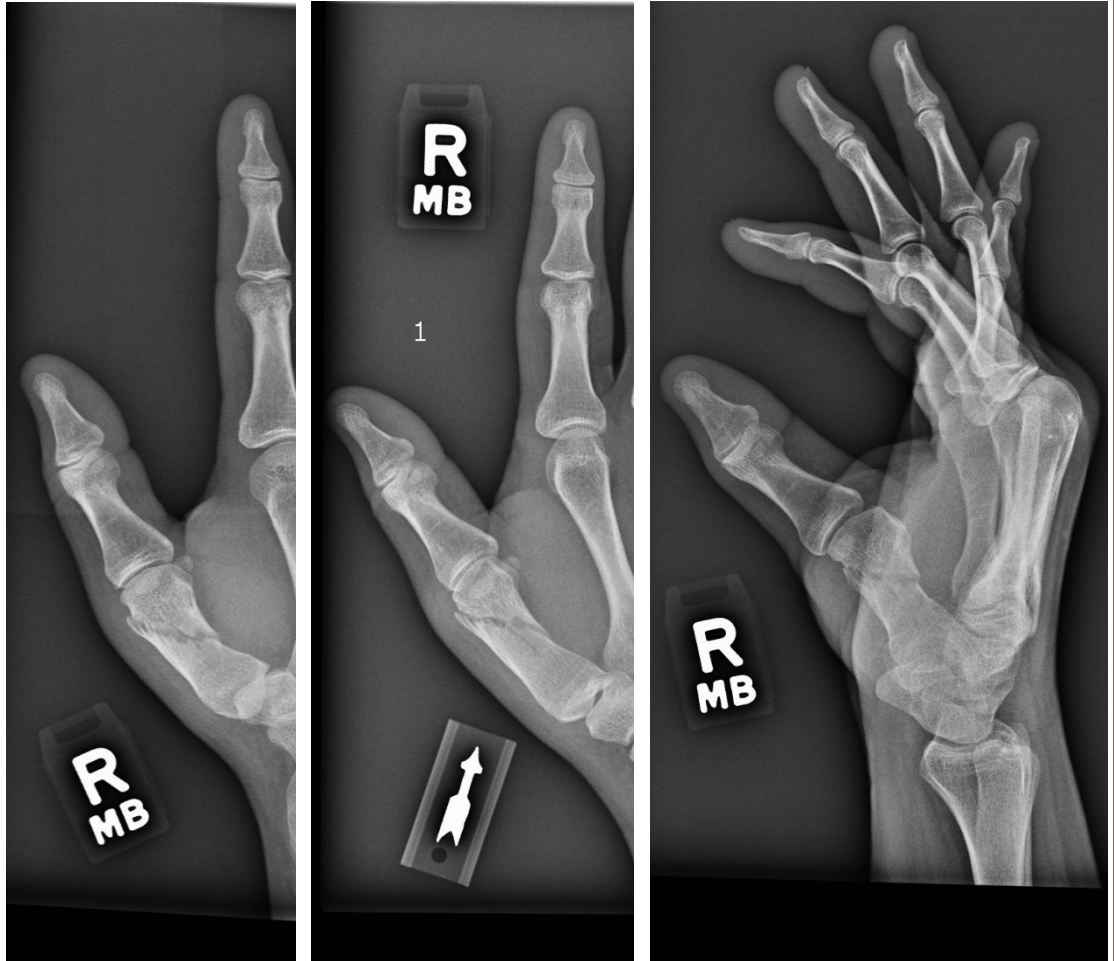




Metacarpal Fracture

HPI:

25 yo male presents with right thumb/metacarpal fracture that started 12/16/16 while being restrained at supervised living after being pushed. He fell to the ground and injured his right thumb.



2 Week Follow-up

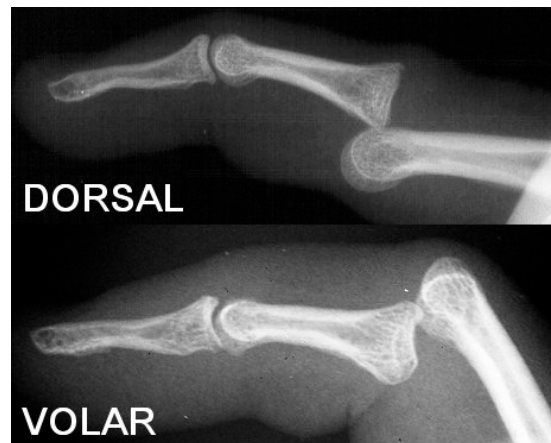


Finger Dislocation



PIP Finger Dislocation

- Posterior dislocation
 - The finger should be splinted in 20-30 degrees of flexion to allow the volar plate to heal.
- Volar dislocation
 - The finger should be splinted in extension



Mallet Finger



Bony Mallet Finger

- Treatment of minimally or non-displaced fractures:
 - Splinting the DIP joint in **neutral** position for 6-8 weeks.
 - Radiography must be performed following splint application to confirm congruity of the fracture fragment with the distal phalanx in the joint space.



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Tendinous Mallet Finger

- Treatment of a tendinous mallet includes:
 - 6 weeks of splinting the DIP joint in **hyperextension** position 24/7.
 - Followed by evening splinting for 4 more weeks
- No additional radiographs needed



Hip



Right Hip Pain in Marathon Runner

43 yo female went running this past Sunday and something felt wrong around mile 17. She could feel pain with her run along with tightness. She stopped and stretched a few times. Upon returning home, her pain increased throughout the day. She's been rolling, stretching, resting, Motrin, but has shooting pain down the front of her leg. Pain when she gets up to walk. Shoots down to her knee along with some weakness. She points to the lateral gluteus region and into her anterior thigh. 8/10 pain without Motrin.

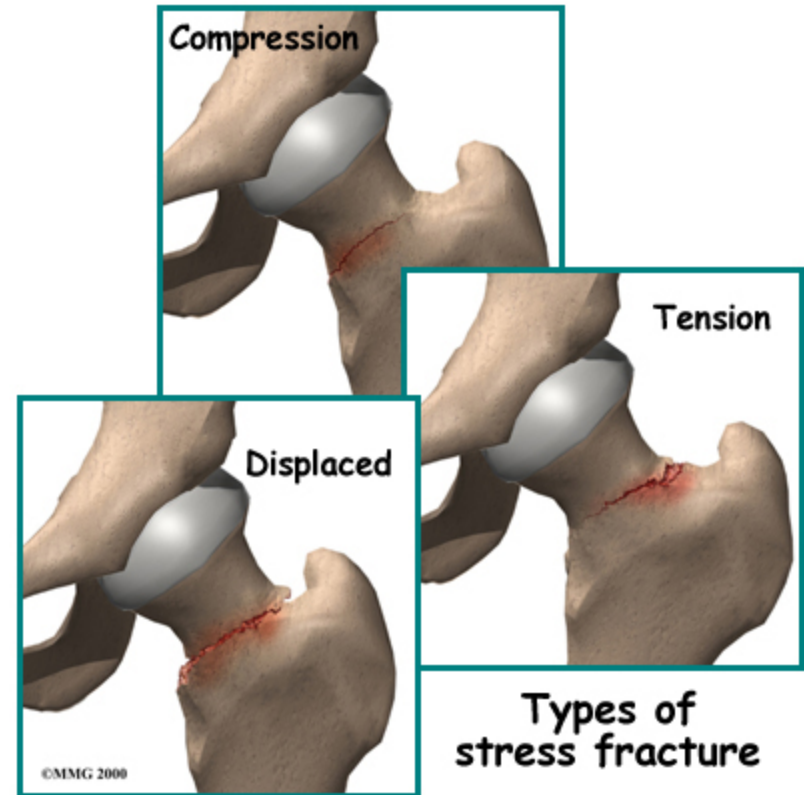


Femoral Neck Stress Fracture



Femoral Stress Fractures

- Most respond to rest, fixing biomechanical deficits, nutrition, metabolic, and hormone abnormalities.
- Surgery for:
 - Displaced Fracture
 - Tension-sided Fracture

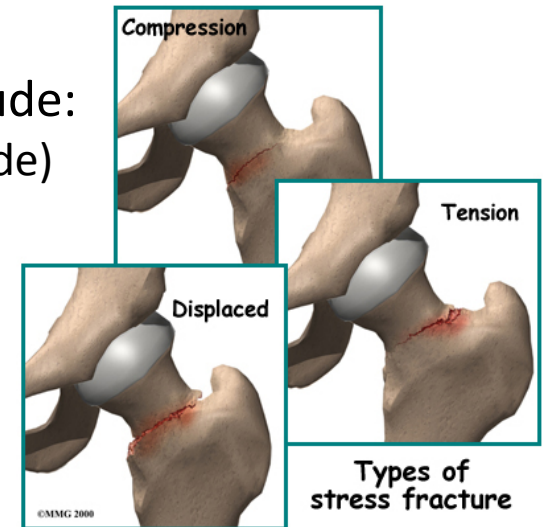


The Dreaded Black Line

(the black line of death)



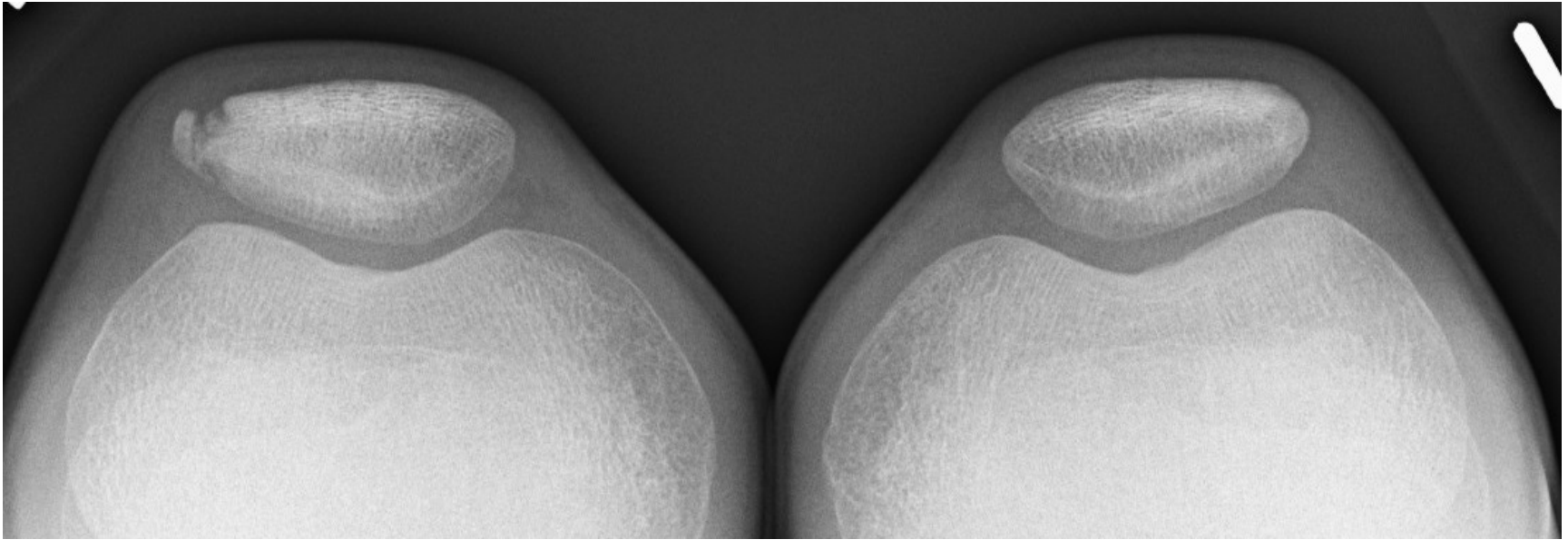
- High-risk stress fracture locations include:
 - superolateral femoral neck (tension side)
 - Patella
 - Anterior tibial cortex
 - Medial malleolus
 - Talus
 - Tarsal navicular
 - Fifth metatarsal.
- Stress fractures in these locations may lead to complications including progression to complete fractures, development of avascular necrosis or delays in healing or non-union.
- Other locations listed should heal well with relative rest from exacerbating activities and reduction of activity to the level of pain-free functioning



Lateral Patella Fracture

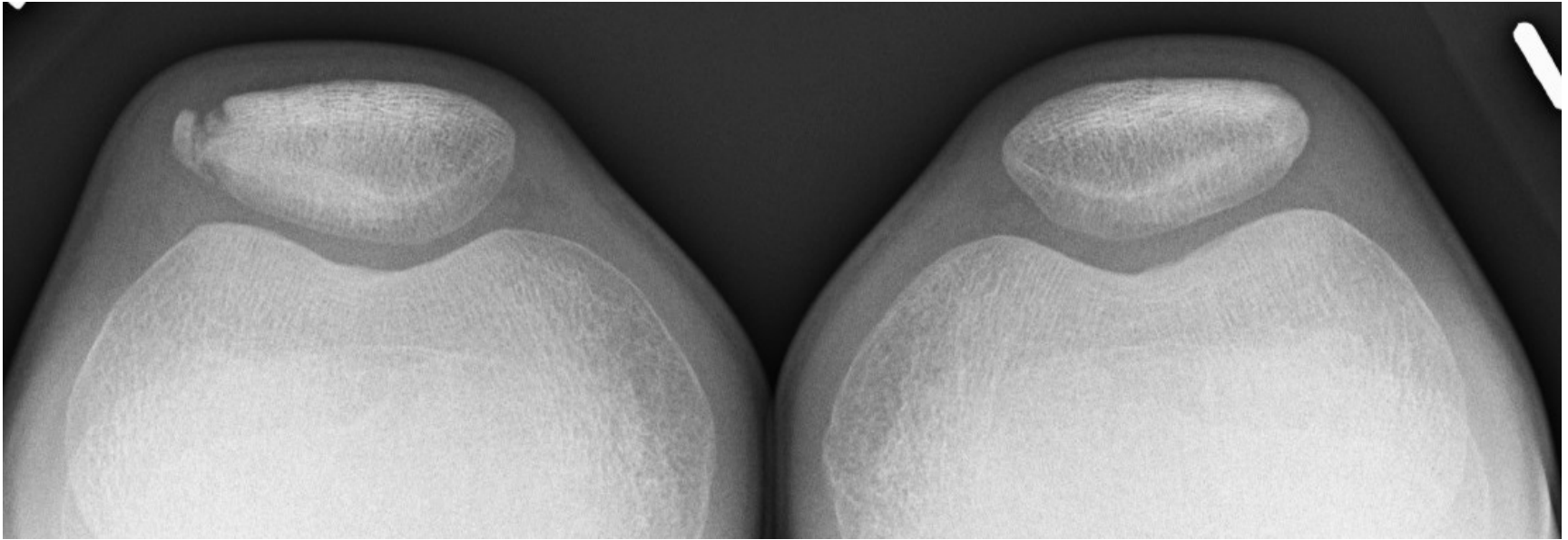


Lateral Patellar Avulsion Fracture



12 year old patient was running on playground last Friday when he noticed pain to the lateral aspect of the his right patellar. Since then he has pain with walking and full flexion. He has been trying to stay off of it which has helped the pain.

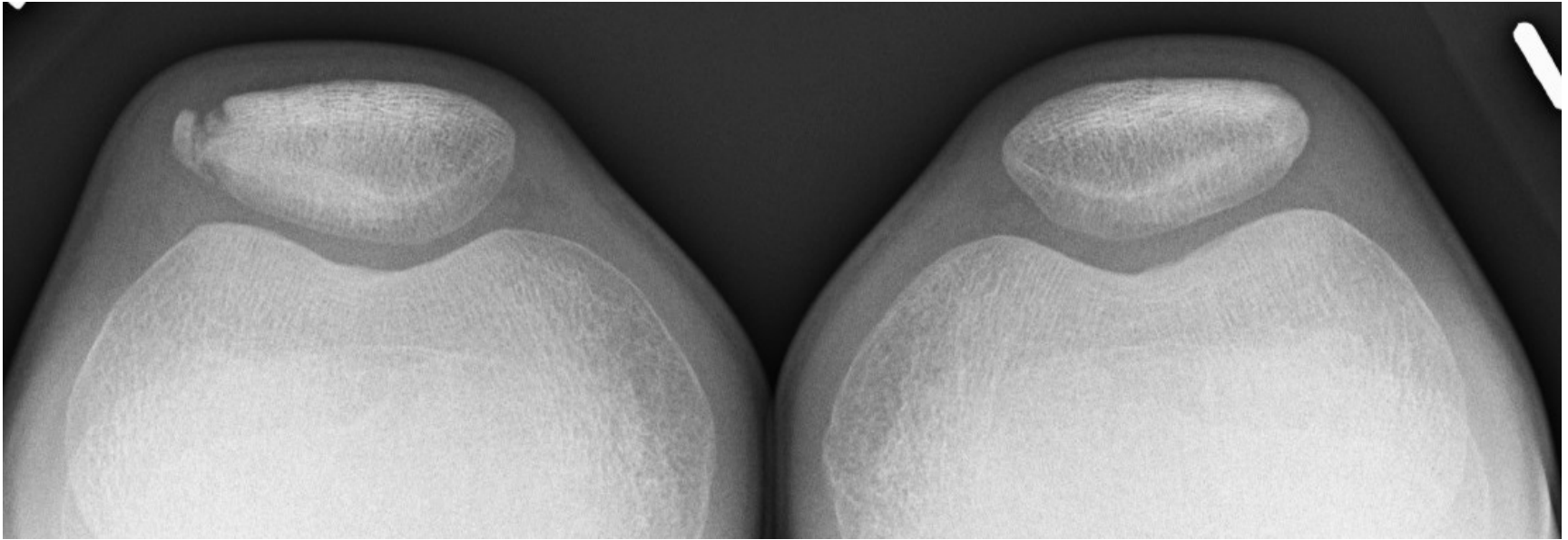
Lateral Patellar Avulsion Fracture



Initial treatment:

- Place him in a hinged knee brace with zero degrees of motion.
- Non-weight bearing with crutches.
- Tylenol for pain.
- Follow-up- 3 weeks

Lateral Patellar Avulsion Fracture

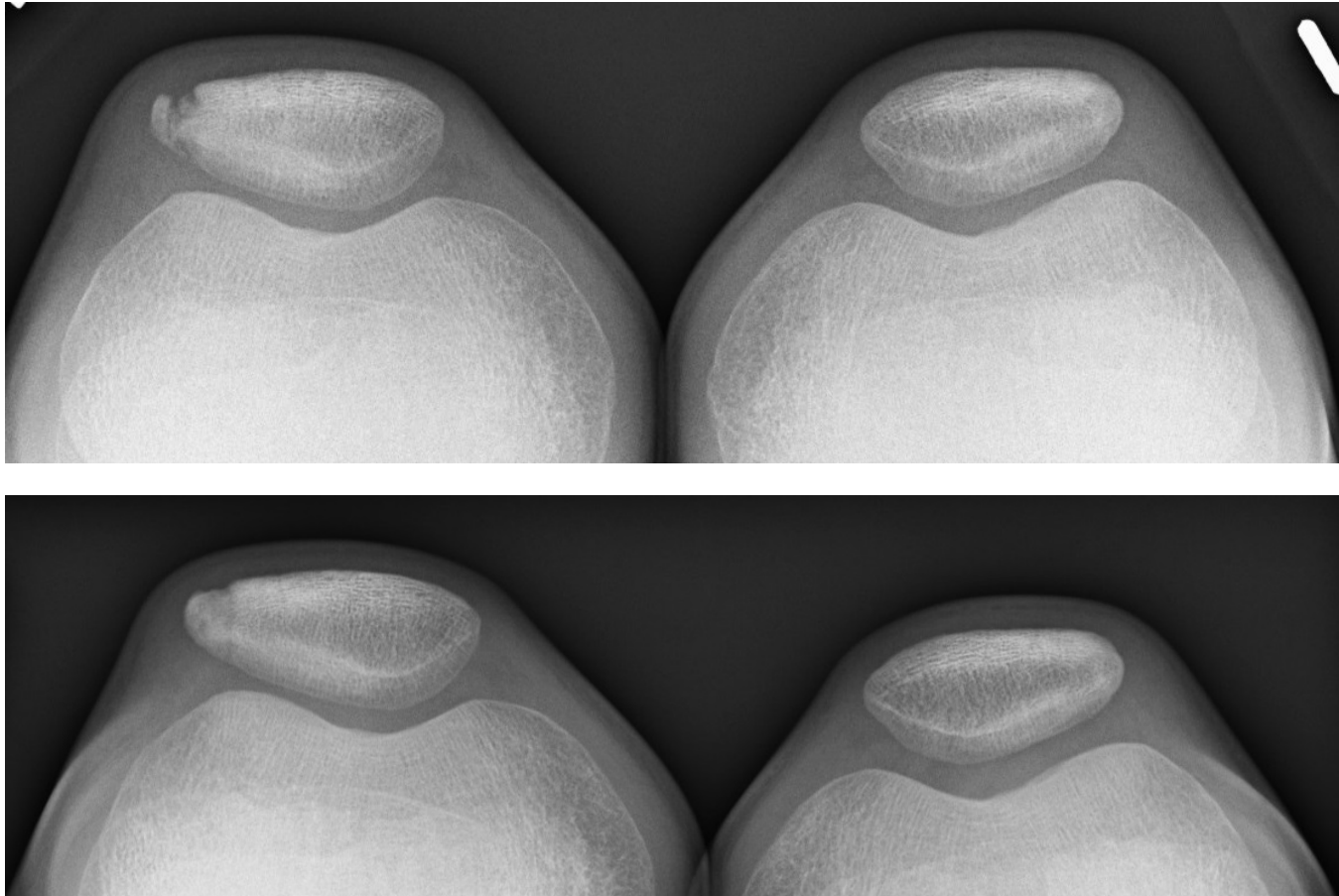


Follow-up treatment:

- 50% weight-bear with 30° flexion adjustment on his knee brace.
- In 2 weeks, may increase his knee brace to 90° and I will allow him to fully weight-bear
- I recommend against jumping and other explosive activities during the next month.



4 month post injury



Patellar Fractures

- When to refer
 - >3mm gapping of fracture
 - >2mm intra-articular step-off
 - Comminuted fractures
 - Non-union



Lateral Talus Fracture



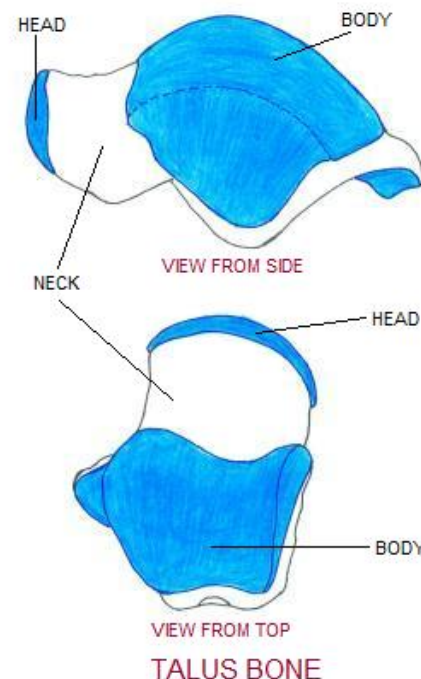
18 yo presents with ankle pain and an antalgic gait. He was sustained an eversion ankle injury while at Hang Time jumping on trampolines. Ankle radiographs reveal a lateral process fracture. A CT reveals non-displaced talus fracture. Appropriate treatment consists of which of the following?

- a) Ankle rehab and return to activity if the CT shows a Hawkin's sign
- b) Ankle splint, weight bearing as tolerated, and aggressive ankle rehab
- ☒ c) Non-weightbearing in a cast for 4-6 weeks followed by progressive weight bearing and ankle rehab
- d) Walking cast for 4-6 weeks followed by progressive weight bearing and ankle rehab
- e) Emergent orthopedic consultation because of tenuous blood supply of the talus



Lateral Talus Fractures

- A small non-displaced fracture of the lateral process may be appropriately treated with cast immobilization for 4-6 weeks.
- Lateral process
 - Support 16% of the body's weight through the leg
 - Early weight bearing risks displacement and surgical fixation
- The tenuous, retrograde blood supply of the talus is of greater concern with talar neck fractures



Syndesmosis Injury

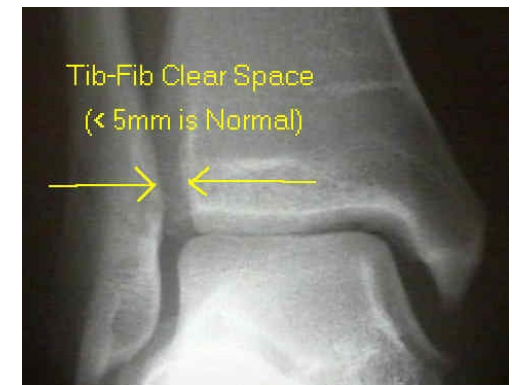
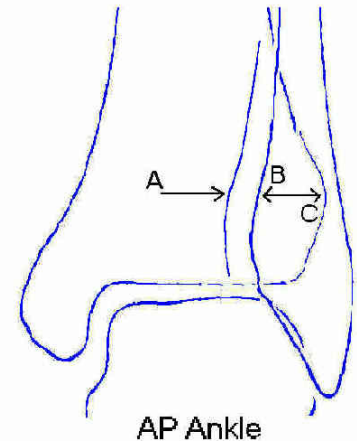


Ankle X-rays

- AP View
 - Tibiofibular overlap
 - < 10mm is abnormal and may also imply syndesmotic injury
 - Tibiofibular clear space
 - >5mm is abnormal (1 cm above the joint line) and may also imply syndesmotic injury
 - Talar tilt
 - >2mm difference in width of the medial and lateral aspects of the superior joint is abnormal and indicates medial or lateral disruption

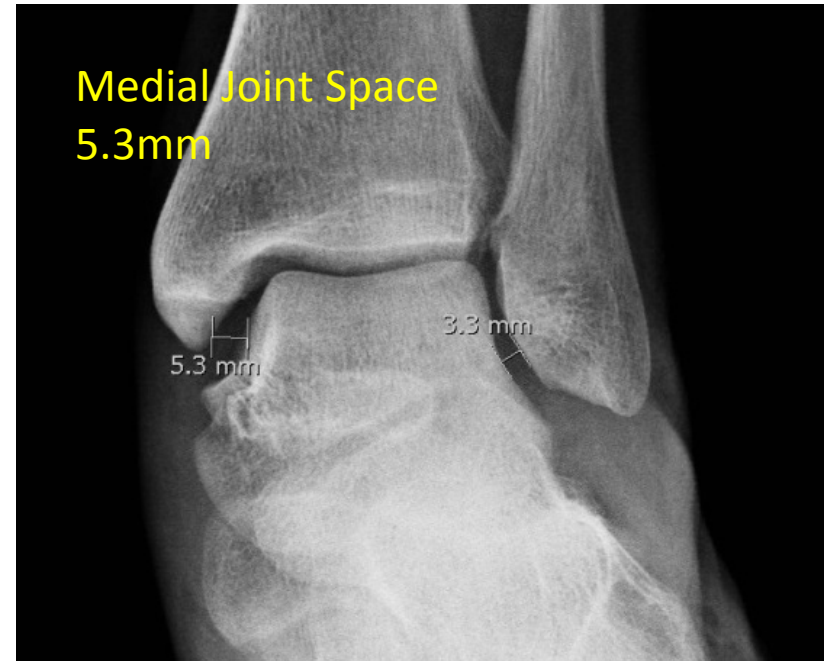
AB: Tibiofibular Clear Space: NI < 5 mm

BC: Tibio-Fibular Overlap: NI > 10 mm



Ankle X-rays

- Mortise View
 - Medial clear space
 - >4-5mm widening is abnormal and indicates lateral talar shift, which may imply a tear of the deltoid ligament and probable syndesmotic injury.
 - Consider stress view to evaluate for widening



Ankle X-rays

- Lateral View
 - The dome should be centered under the tibia
 - Evaluate for avulsion and fibula fractures



Ankle Injury Treatment

Mortise is not widened:

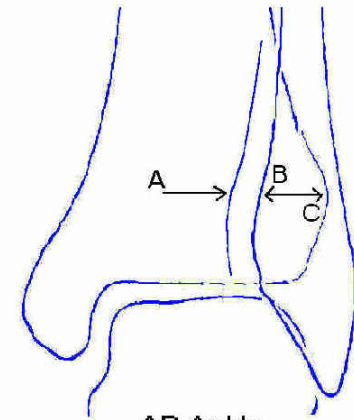
- Non-operative Treatment
 - RICE, consider short leg cast or brace for 4 weeks followed by physical therapy
 - Warn that healing can take a lot longer than an isolated lateral ankle ligament injuries

Mortise demonstrate widening:

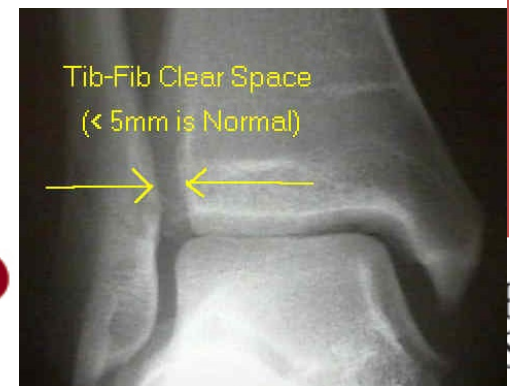
- Noted diastasis or unstable joint requires operative stabilization

AB: Tibiofibular Clear Space: NI < 5 mm

BC: Tibio-Fibular Overlap: NI > 10 mm



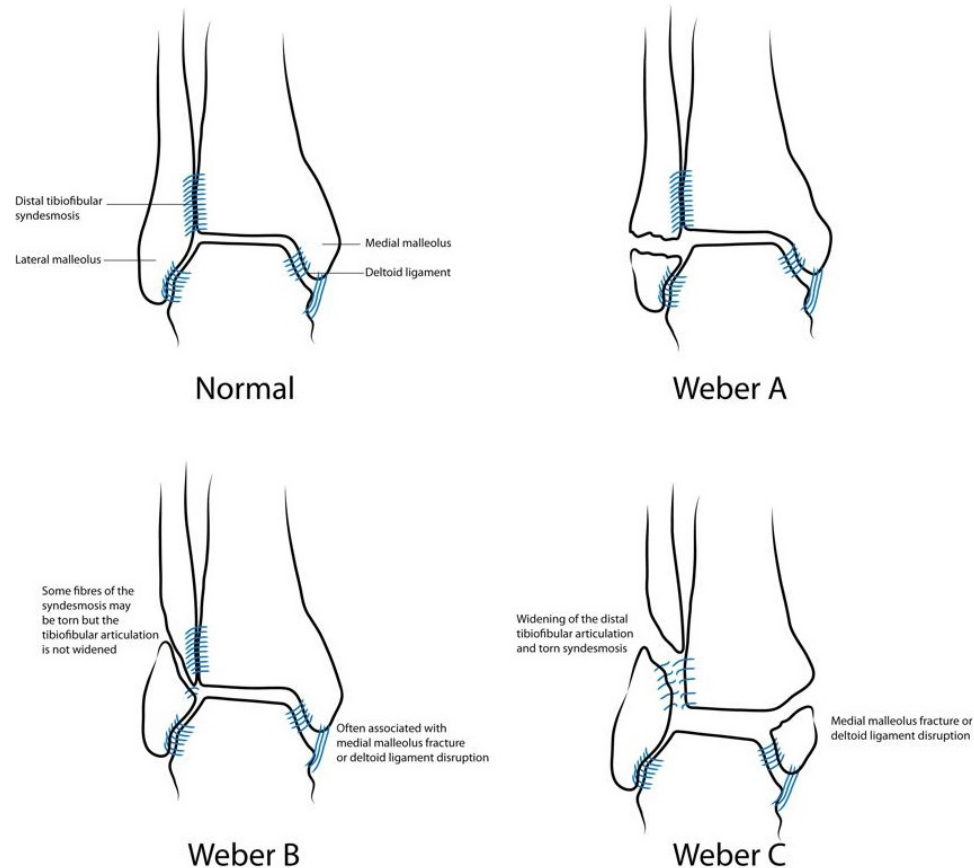
AP Ankle



Distal Fibula Fracture



Weber Classification of Ankle Fractures



Case courtesy of A.Prof Frank Gaillard, Radiopaedia.org, rID: 9642



Weber A

Pt is a 38Y F here today for left ankle pain. Patient reported she was walking on an uneven sidewalk and rolled her ankle and felt a lot of lateral ankle pain, hearing a pop.



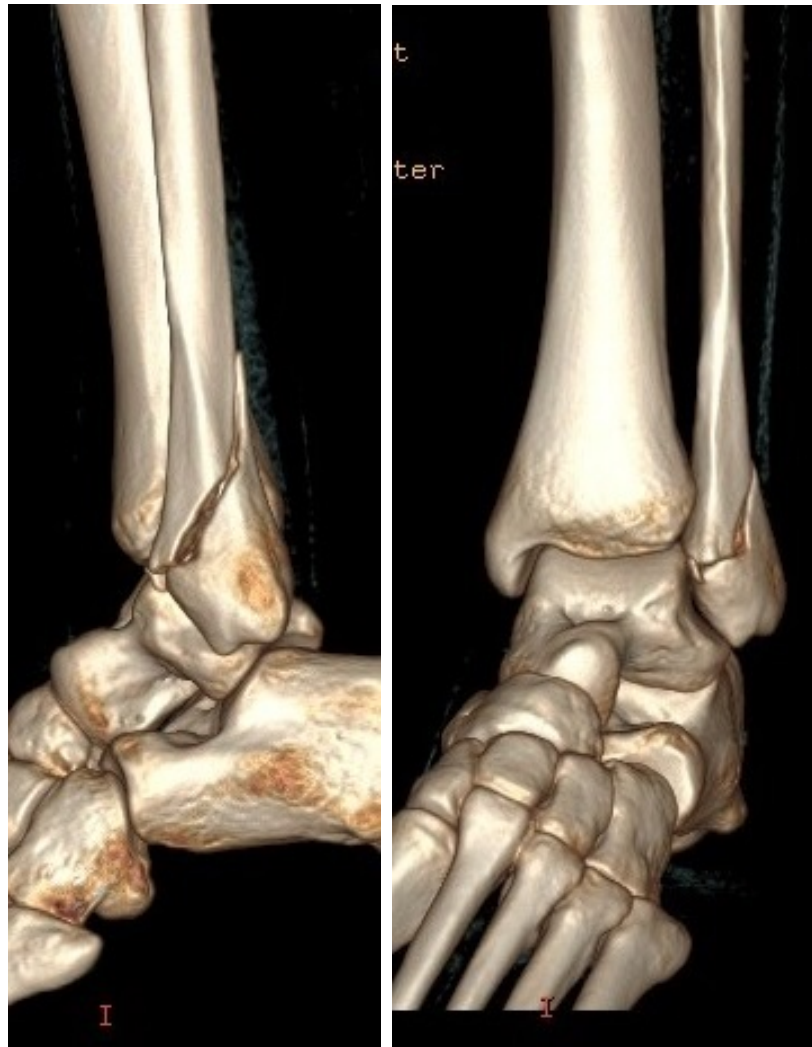
Distal Fibula Fracture

HPI:

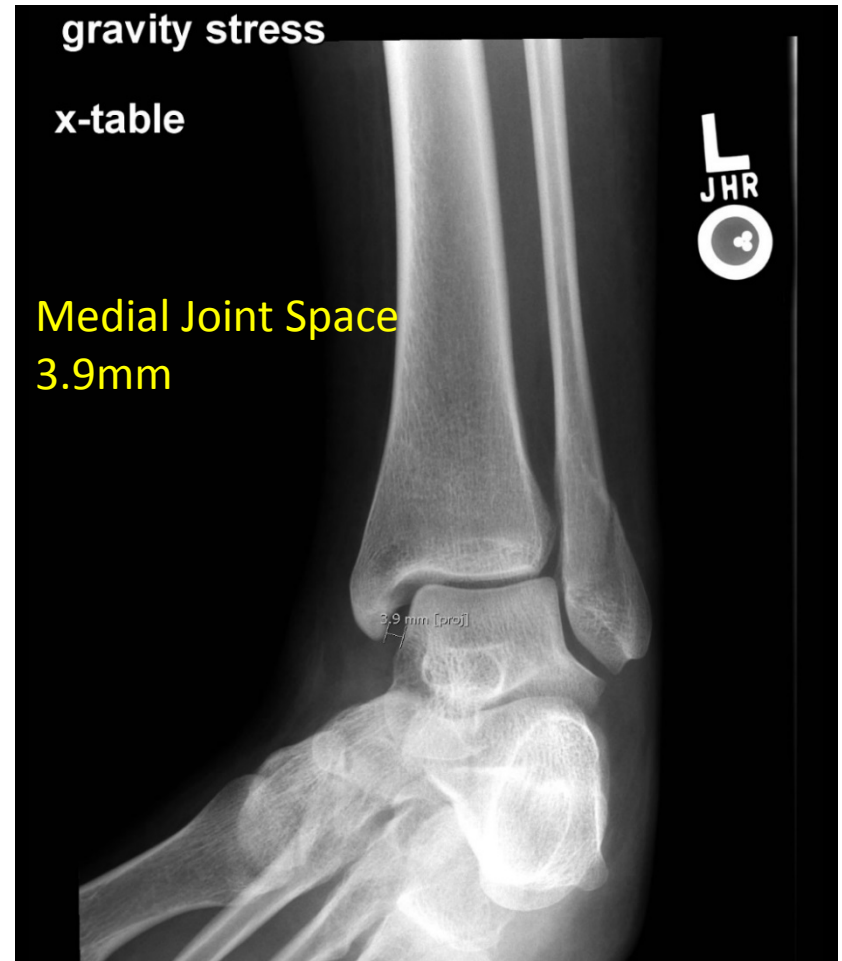
22 yo female presents with left ankle injury. She was walking on black ice and slipped and landed on her ankle and she heard a crack. She felt a lot of pain.



Weber B Fracture



Weber B Acting like a C



Referred to Foot Orthopedic Surgery



Calcaneus



Sever's Disease (Calcaneal Apophysitis)

- Thought to occur secondarily to the strong vertical shear forces along the apophysis before fusion has been completed
- Apophysis appears around 7-9 years of age, and is fused around 17.
- The mean age for presentation is 10-12 years
- Radiographs of the foot are not diagnostics of Sever's disease, but may show sclerosis and fragmentation, but these findings are also found in asymptomatic patients too. The primary utility of x-rays is to rule out other causes of heel pain
- Classic presentation includes tightness of the Achilles tendon and history of overuse found in new sporting activity or season
- Improper footwear/malalignment of the foot is also found commonly.
- Commonly athletes in track, soccer, tennis and with hard surfaces



Calcaneus Apophysis Fracture



HPI:

8 yo female. Patient's cousin, who is in a motorized wheelchair, ran over the patient's right foot when she was not looking where she was going on 12/17/16. The patient had immediate pain and had difficulty bearing weight.

Calcaneus Apophysis Fracture



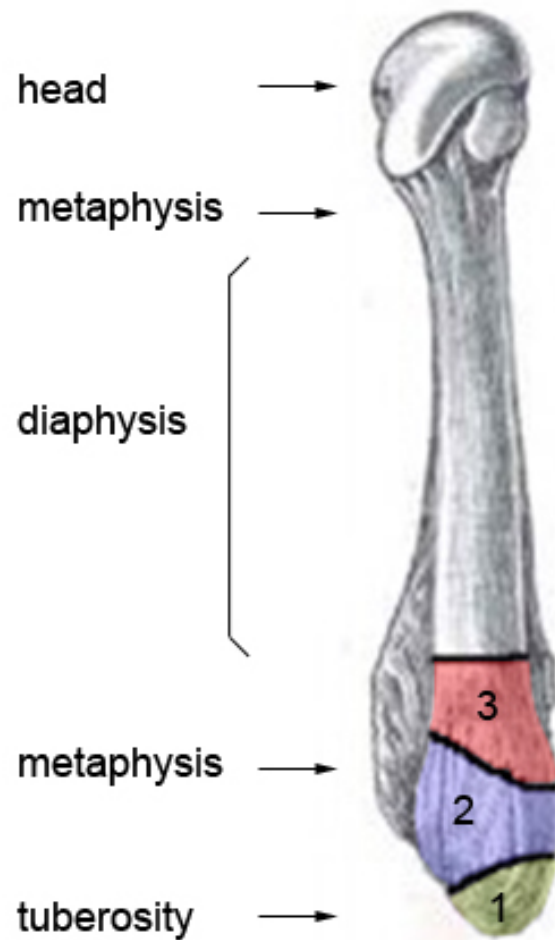
6 Weeks post injury with
initial x-ray comparison



Metatarsal



Proximal 5th Metatarsal Fractures



Zone 1 – Pseudo Jones

- Healing typically uneventful
- Rarely require surgery

Zone 2 – Jones

- Union is frequently a concern
- May require surgery

Zone 3 – Stress fracture

- Rare, but may heal with 3 months of casting
- May require surgery

3. Zone of diaphyseal stress fracture

2. Zone of Jones fracture

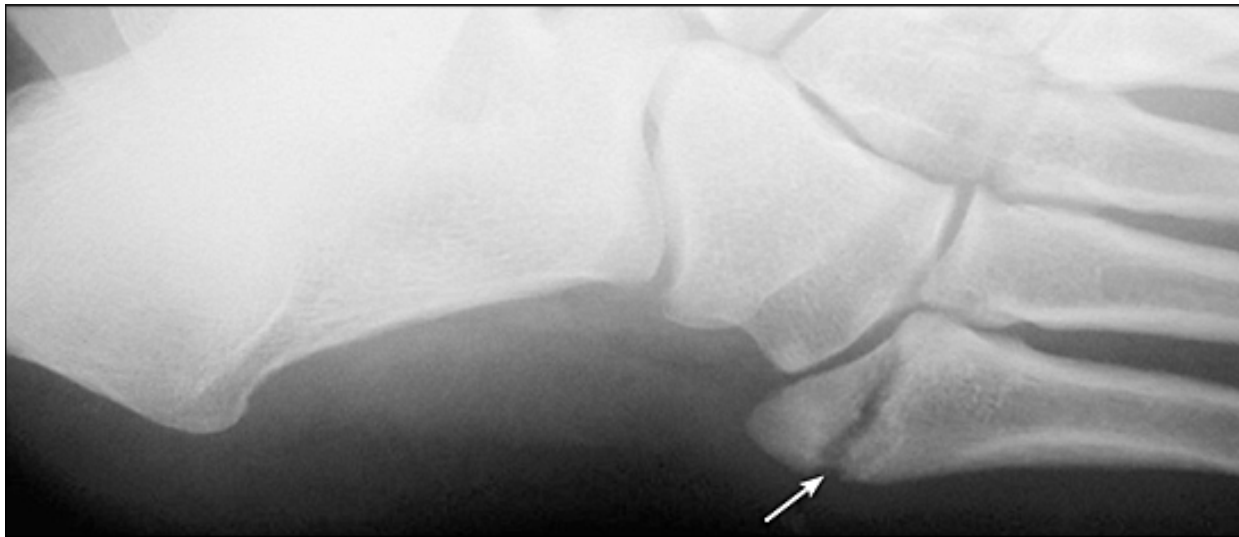
1. Zone of tuberosity fracture



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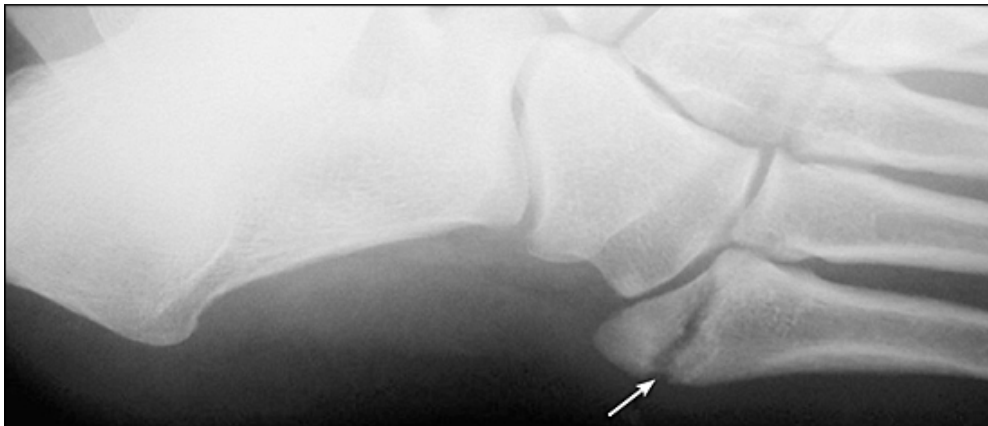
Proximal 5th Metatarsal Avulsion Fractures

- Most heal symptomatically in 3-6weeks
- Radiographic union in eight weeks.



Proximal 5th Metatarsal Avulsion Fractures

- Referral is indicated for:
 - Displaced fractures
 - Fractures with more than a 1 to 2 mm step-off on the articular surface with the cuboid
 - Nonunion



Jones Fracture



Distal Metatarsal Fractures

- Indications for surgical referral:
 - Open fractures
 - Multiple metatarsal fractures
 - Intra-articular fractures
 - Fractures of the second to fifth metatarsal shaft with:
 - at least 3 mm displacement
 - more than 10° angulation in the dorsoplantar plane



Matatarsal Fracture



HPI:

Pt is a 24Y M here today for left foot pain. Reports that he was playing soccer on 01/28/2017 and rolled his ankle and foot.

Toe



Toe Fractures



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When to Refer Toe Fractures

- Patients with first-toe fracture-dislocations
- Displaced intra-articular fractures
- Unstable displaced fractures
- Children with first-toe fractures involving the physis.
- Open fractures

Consider referring:

- Nondisplaced intra-articular fractures involving more than 25 percent of the joint surface



Splints and Casts



Splints



Thumb Spica



Ulnar Gutter



Volar Wrist



Double Sugar
Tongue



Sugar Tongue

Splints



Short Leg Splint

Splinting Tips

- Prepare before opening as humidity may start to harden the material
- Pad extremity if needed, cut fiberglass ends of to minimize abrasions
- Play extremity in neutral or functional position
- ACE wrap...but not too tight as it may cause neurovascular injury
- Discuss splint precautions for going to the ER or loosening the ACE bandage



Casts

- Radial Gutter Cast



- Thumb Spica Cast



Casts

- Short Leg Cast



- Long Arm Cast



Casting Tips

- Place stockinet, place extremity in the desired position.
 - Make sure the patient doesn't move to minimize wrinkling and ideal casting position.
- Apply sufficient padding, overlapping half length. Goal of about 2-4 layers total thickness of padding.
 - Ensure appropriate padding of the bony prominences.
- Dip and apply cast tape 2-3 layers thick with $\frac{1}{3}$ to $\frac{1}{2}$ overlap
 - Don't be tempted to finish the role if you are finished. This will decrease cast weight and bulk.
- Cut tape as needed to minimize rubbing or to wrap around thumb or other fingers
- Fold back stockinet and place the last "pretty" layer of cast tape with about $\frac{1}{4}$ overlap.
- Discuss cast precautions with patient



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Questions

