

# American Society of Orthopedic Professionals

## Orthopedic Lecture Series<sup>©</sup>

*Bone/ Structures, Fracture Types and Skeletal Disorders/ Specialty Casts and Appliances/Surgical Procedures, Positioning and Devices*

### **Lesson 7-8: Fractures**

# Fractures

## 1. Comminuted fracture

- ▶ One in which the bone is broken into more than 2 pieces



[http://lookfordiagnosis.com/mesh\\_info.php?term=Fractures%2C+Comminuted&lang=1](http://lookfordiagnosis.com/mesh_info.php?term=Fractures%2C+Comminuted&lang=1)

## 2. Depressed fracture

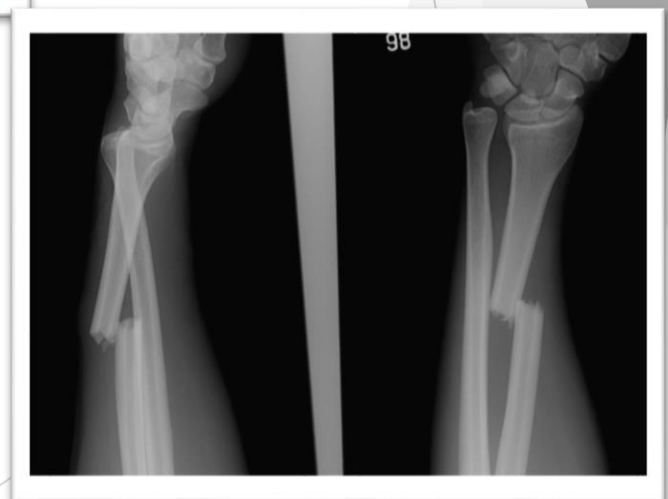
- ▶ Occurs when the bone is pushed in
- ▶ It is often seen in skull fractures



[http://en.wikipedia.org/wiki/Skull\\_fracture#/media/File:Depressed\\_skull\\_fracture.jpg](http://en.wikipedia.org/wiki/Skull_fracture#/media/File:Depressed_skull_fracture.jpg)

## 3. Displaced fracture

- ▶ A fracture in which the bones are out of alignment



[http://ortho-teaching.feinberg.northwestern.edu/cases/for\\_exam/case\\_7/cases7\\_answer.html](http://ortho-teaching.feinberg.northwestern.edu/cases/for_exam/case_7/cases7_answer.html)

# Fractures

## 3. Intra-articular fracture

- ▶ An injury in which the bones inside a joint are fracture

## 4. Simple fracture

- ▶ A situation in which the bone is in normal anatomical alignment
- ▶ Does not pierce the skin

## 5. Spontaneous fracture

- ▶ A break that occurred without trauma.
- ▶ Also called a **pathological fracture**



<http://emedicine.medscape.com/article/1240337-treatment#a1128>



<http://radiology.casereports.net/index.php/rccr/article/view/1119/359>

# Fractures

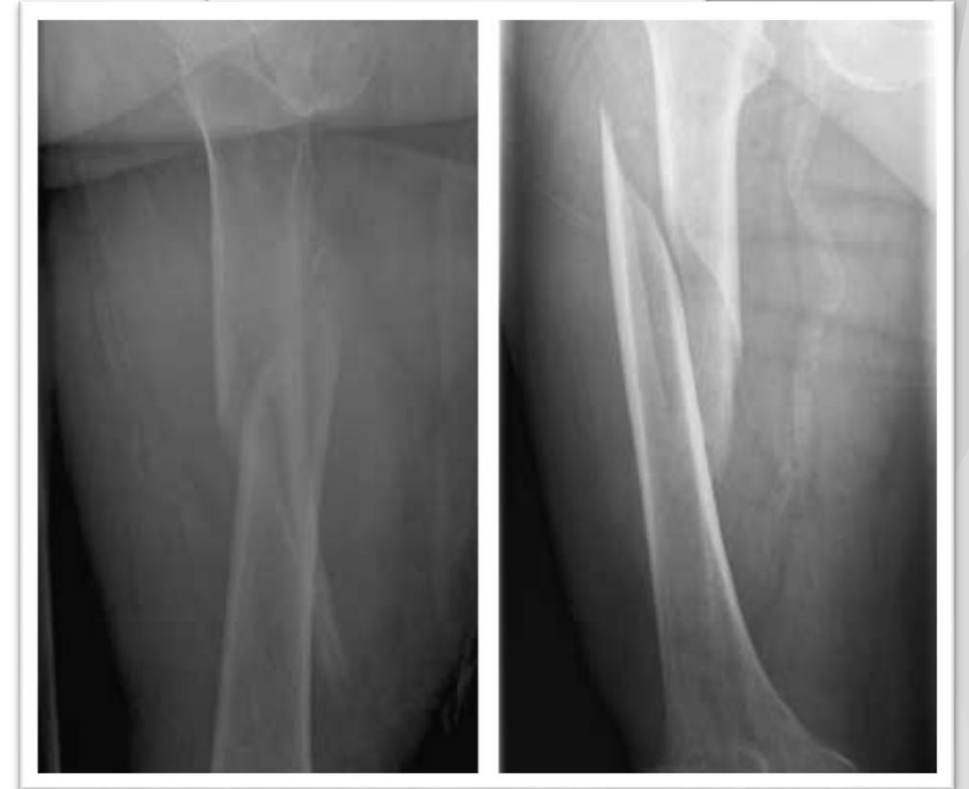
## 7. Stellate fracture

- ▶ One in which additional fractures radiate from a central fracture



## 8. Spiral fracture

- ▶ Also called a torsion fracture
- ▶ Caused by the twisting of the bone
- ▶ Is a fracture of a long bone that extends up and down the bone like corkscrew
- ▶ This type of fracture is highly unstable
- ▶ It is often misdiagnosed as an oblique fracture



# Fractures

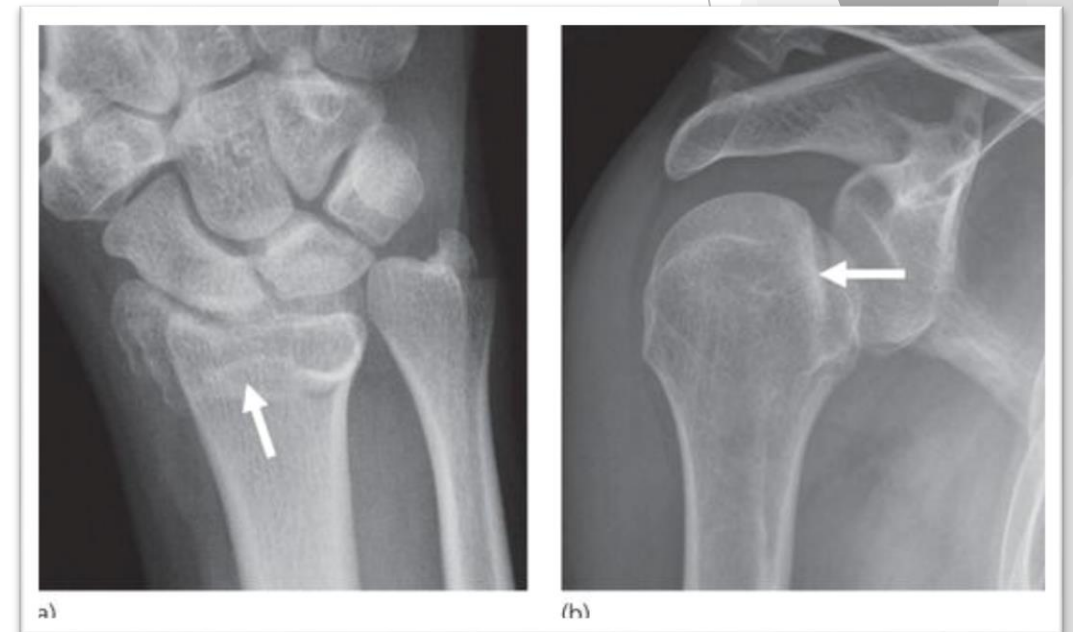
## 9. Greenstick fracture

- ▶ Involves a break on only one side of the bone cortex
- ▶ This is an incomplete fracture that is most often seen in children who have softer, more malleable bones
- ▶ Occurs from the bending of the bone
- ▶ These fractures are extremely stable, and heal well



## 10. Impacted fracture

- ▶ One in which one end of the broken bone is driven into the other broken end
- ▶ This type of fracture is difficult to see in an x-ray because the transradiant line usually seen with a fracture is missing



# Fractures

## 11. Agenetic fracture (*not pictured*)

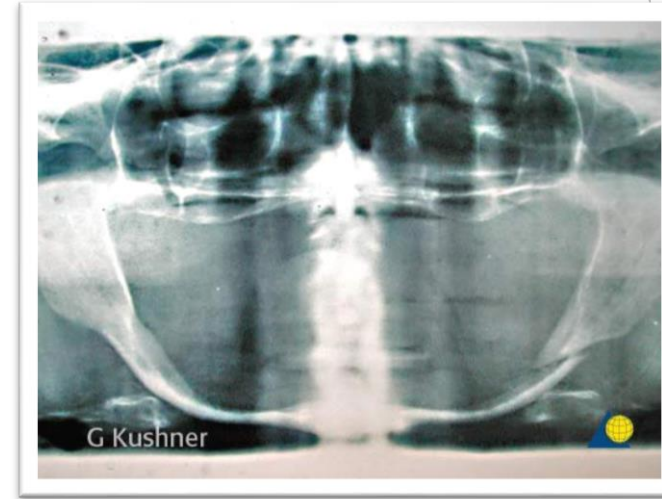
- ▶ A spontaneous fracture that results from less than ideal osteogenesis

## 12. Atrophic fracture

- ▶ A spontaneous fracture that results from bone atrophy

## 13. Buttonhole fracture

- ▶ A fracture in which the bone is penetrated by a projectile
- ▶ Causes a hole in the bone
- ▶ Also called a **perforating** fracture



<https://www2.aofoundation.org/wps/portal/surgerymobile/showPage=redfix&bone=CMF&segment=Mandible&classification=91>  
Special%20considerations&treatment=6method=Special%20considerations&implanttype=hidden&approach=6redfix\_ur=-1285234127798

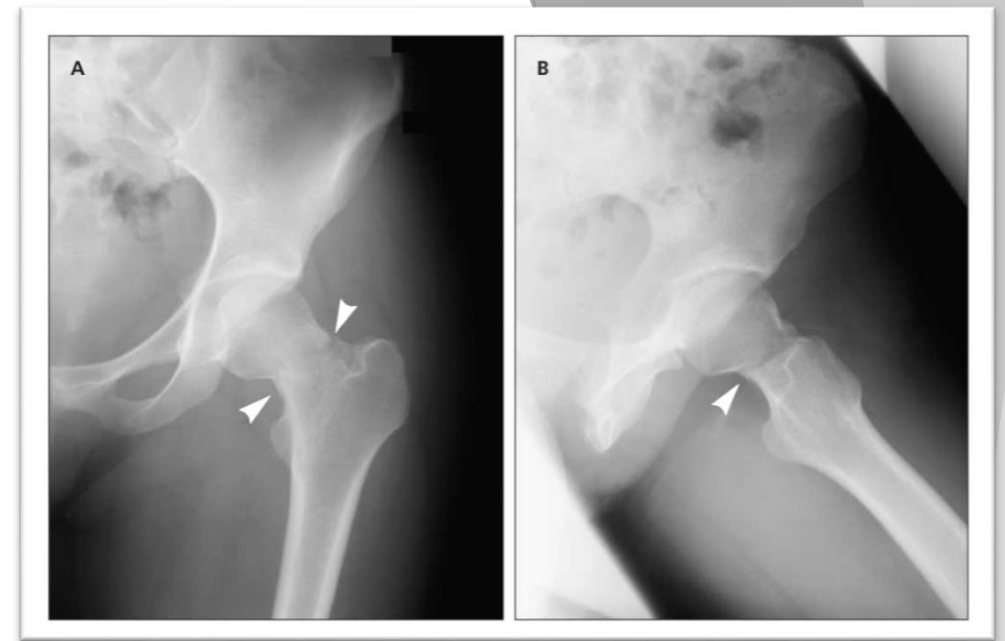


<http://www.history.com/news/perforated-skulls-from-middle-ages-found-in-spain>

# Fractures

## 14. Capillary fracture

- ▶ One that appears as a thin line in a radiograph, as the bone fragments are not separated



<https://www.tuiketzapo44.soup.io/1093>

## 15. Chisel fracture

- ▶ One where a slanted piece of bone is detached from the head of the radius



[https://www2.aofoundation.org/wps/portal/tut/p/ra/04\\_Sj9CPyKsYjYrCmIscWmRjgUrtEjEhS20203020\\_UmMDrYdXQ3dWjWwDax8jTULshvAdAsNSU!/?bone=Tibia&segment=Malleoli&soloState=lyteframe&headerTitle=44-A2&20Infrasyndesmoti&20lateral%20lesion%2C%20with%20fracture%20of%20the%20medial%20malleolus&contentUrl=srg/44/01-Diagnosis/ao\\_srg\\_diag\\_44a2.jsp](https://www2.aofoundation.org/wps/portal/tut/p/ra/04_Sj9CPyKsYjYrCmIscWmRjgUrtEjEhS20203020_UmMDrYdXQ3dWjWwDax8jTULshvAdAsNSU!/?bone=Tibia&segment=Malleoli&soloState=lyteframe&headerTitle=44-A2&20Infrasyndesmoti&20lateral%20lesion%2C%20with%20fracture%20of%20the%20medial%20malleolus&contentUrl=srg/44/01-Diagnosis/ao_srg_diag_44a2.jsp)

# Fractures

## 16. Direct fracture

- ▶ One that occurs at the site of an injury

## 17. Dyscrasic fracture (*not pictured*)

- ▶ One that occurs due to the weakening of the bone from disease

## 18. Closed fracture

- ▶ One that is not associated with an open wound

## 19. Complete fracture

- ▶ One which goes through the entire cross section of the bone



<http://www.radiologyassistant.nl/en/p420a20ca7196b/ankle-fracture-weber-and-lauge-hansen-classification.html>



<http://jortho.org/2005/2/1/e4/index.htm>



# Fractures

## 20. Compound fracture

- ▶ One in which the broken end of the bone penetrates the skin, exposing the bone



## 21. Dislocation fracture

- ▶ Occurs near a joint and involves a con-occurring dislocation of the joint



## 22. Fissure fracture

- ▶ A crack in the surface of a bone that does not extend through the bone



# Fractures

## 23. Incomplete fracture

- ▶ One that does not extend through the entire bone



<http://anatomy2hour.blogspot.com/2010/11/bone-fractures.html>

## 24. Insufficiency fracture

- ▶ A stress fracture that occurs when bone that is abnormally thin is placed under stress



<http://www.bjj.boneandjoint.org.uk/content/89-B/12/1650/F6>

## 25. Sprain fracture

- ▶ Refers to a situation in which a piece of bone is pulled away when a tendon is separated from its insertion point



<http://radiologypics.com/2013/04/06/lateral-epicondyle-avulsion-fracture/>

# Fractures

## 26. Trophic fracture *(not pictured)*

Results from nutritional deficits

## 27. Lead pipe fracture

- ▶ Involves the compression of the cortex on one side of the bone, and a crack on the opposite side of the bone

## 28. Neoplastic fracture *(not pictured)*

- ▶ One that occurs in a bone weakened by a malignancy

## 29. Neurogenic fracture *(not pictured)*

- ▶ One that occurs in a bone weakened by a neurological disorder



<http://www.eurorad.org/eurorad/case.php?id=2315>

# Fractures

## 30. Nightstick fracture

- ▶ A fracture of the shaft of the ulna
- ▶ Obtained this name because it occurs during the blocking of a downward blow of an object such a nightstick

## 31. Periarticular fracture

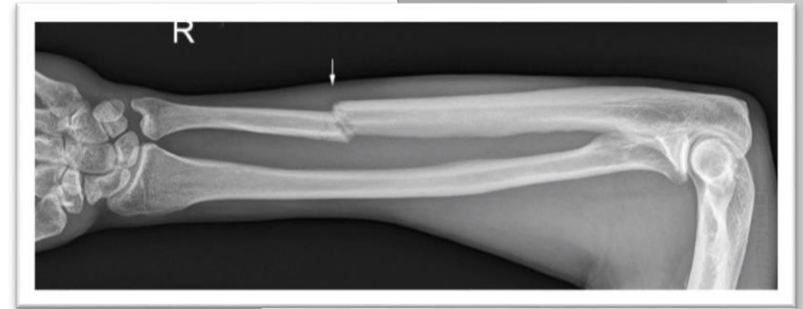
- ▶ One that occurs near a joint

## 32. Pressure fracture (*not pictured*)

- ▶ One that occurs due to pressure placed on the bone by a tumor

## 33. Resecting fracture

- ▶ One in which a fragment of bone is removed by a violent action



# Fractures

## 34. Intraosseous fracture (*not pictured*)

- ▶ Does not involve a break in the periosteum

## 35. Endocrine fracture (*not pictured*)

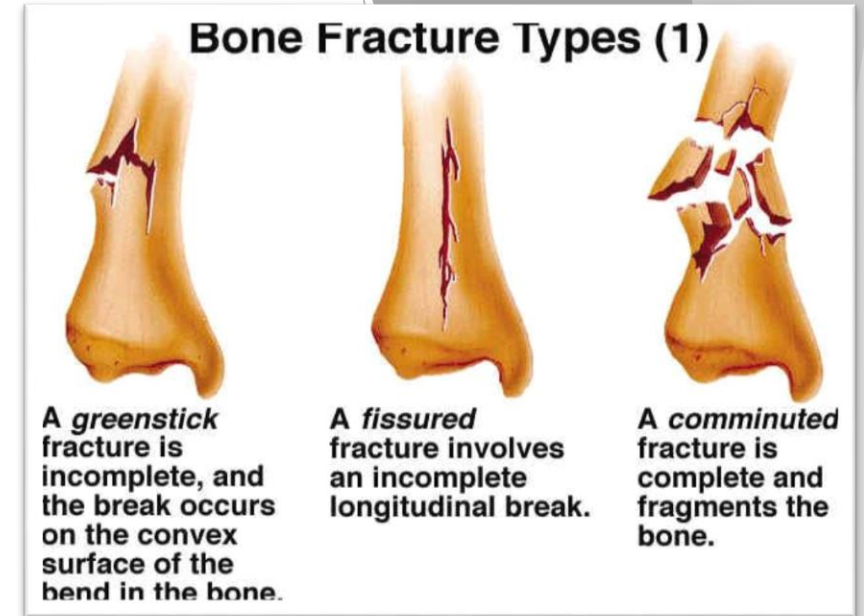
- ▶ A fracture that occurs as a result of the bone weakening from an endocrine disorder

## 36. Fissure fracture

- ▶ One that involves the surface of the bone
- ▶ Does not go all the way through it

## 37. Grenade-thrower's fracture

- ▶ A fracture of the humerus caused by the muscular actions involved in throwing a heavy object (such as a grenade)



# Fractures

## 38. Indirect fracture

- ▶ One that is at some distance from the location of an injury

## 39. Inflammatory fracture (*not pictured*)

- ▶ One that results when a bone is weakened by inflammation

## 40. Intracapsular fracture

- ▶ One that occurs within the joint capsule

## 41. Segmental fracture

- ▶ A double fracture



[http://en.wikipedia.org/wiki/Lisfranc\\_injury#/media/File:Lisfranc\\_fracture.jpg](http://en.wikipedia.org/wiki/Lisfranc_injury#/media/File:Lisfranc_fracture.jpg)



<http://orthoinfo.aaos.org/topic.cfm?topic=A00392>



<http://fracturetreatment.blogspot.com/2014/11/segmental-fracture.html>

# Fractures

## 42. Splintered fracture

- ▶ A comminuted fracture where the bones are broken into sharp thin pieces

## 43. Subcapital fracture

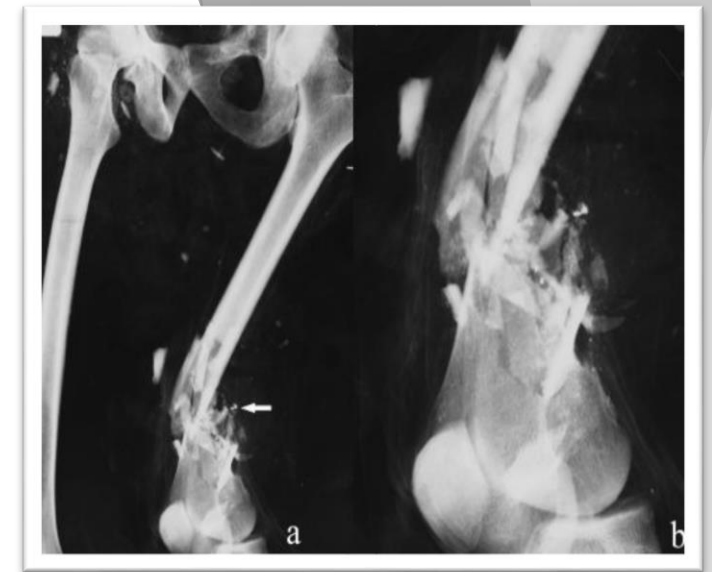
- ▶ The fracture of a bone underneath its head

## 44. Subcutaneous fracture (*not pictured*)

- ▶ One that does not penetrate the skin

## 45. Subperiosteal fracture (*not pictured*)

- ▶ One in which the break does not penetrate the periosteum
- ▶ The shape and alignment of the bone are not changed



<http://quizlet.com/16244606/x-rays-of-fractures-flash-cards/>



[http://www.utecwv.net/modules/com\\_sfservicemap/subcapital-fracture-1738.html](http://www.utecwv.net/modules/com_sfservicemap/subcapital-fracture-1738.html)

# Fractures

## 46. Supracondylar fracture

- ▶ One involving the lower end of the shaft of the humerus



[http://en.wikipedia.org/wiki/Supracondylar\\_humerus\\_fracture#/media/File:Supracondylar09.JPG](http://en.wikipedia.org/wiki/Supracondylar_humerus_fracture#/media/File:Supracondylar09.JPG)



[https://www2.aofoundation.org/wps/portal/!ut/p/a0/04/39Cpykssy0xPLMmMz0vWafGjz0KN\\_A0M3D2DDbz9\\_UMMDRyDXQ3dw9wMDAzMjfULsh0VAbWjLW0!/?bone=Humerus&classification=13-A2.3&implantstype=&method=Open%20reduction%3B%20plate%20fixation&refix\\_url=1285238778992&segment=Distal&showPage=refix&treatment=](https://www2.aofoundation.org/wps/portal/!ut/p/a0/04/39Cpykssy0xPLMmMz0vWafGjz0KN_A0M3D2DDbz9_UMMDRyDXQ3dw9wMDAzMjfULsh0VAbWjLW0!/?bone=Humerus&classification=13-A2.3&implantstype=&method=Open%20reduction%3B%20plate%20fixation&refix_url=1285238778992&segment=Distal&showPage=refix&treatment=)

## 47. Transcondylar fracture

- ▶ Fracture involving the condyles of the humerus in which the fracture line crosses the fossae
- ▶ The fracture extends into the joint capsule

## 48. Willow fracture

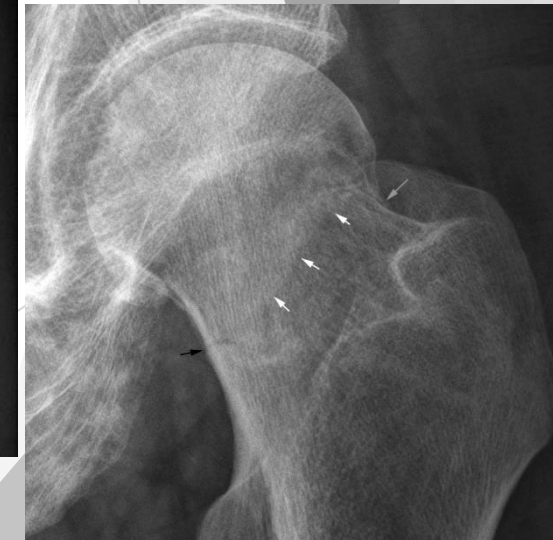
- ▶ Greenstick fracture

## 49. Basal fracture

- ▶ One involving the neck of the femur near the trochanters



<http://www.kidsfractures.com/forearm/>



<http://www.wikiradiography.net/page/Neck+of+Femur+Fractures+-+Cases>





# Fractures

## 53. Pertrochanteric fracture

- ▶ A fracture of the greater trochanter of the femur



[http://openi.nlm.nih.gov/detailedresult.php?img=3235286\\_ORI-0300-9734-082-166\\_g012&req=4](http://openi.nlm.nih.gov/detailedresult.php?img=3235286_ORI-0300-9734-082-166_g012&req=4)

## 54. Segond fracture

- ▶ On involving the iliotibial band



<http://www.seattlechildrens.org/healthcare-professionals/resources/orthopedics-case-of-the-month/acl-injuries-4-12/>

## 55. Shepherd's fracture

- ▶ A fracture of the external tubercle of the talus (astragalus)



© RACristman

<http://footrad.com/FractureTalus.html>

# Fractures

## 56. Stieda's fracture

- ▶ A fracture of the femur at the internal condyle



## 57. Sprinter's fracture

- ▶ An avulsion fracture of the anterior superior, or inferior, spine of the ilium
- ▶ In this injury, a piece of bone is pulled off by the muscular effort



<http://www.heallo.com/orthopedics/journals/ortho/2012-3-35-3/%7Bb83ff16e-a2e7-44e0-8b84-9863263851cd%7D/a-dolescent-femoroacetabular-impingement-from-malunion-of-the-anteroinferior-iliac-spine-apophysis-treated-with-arthroscopic-spinoplasty>

## 58. Wagstaffe's fracture

- ▶ A fracture with an accompanying dislocation of the medial malleolus



[https://www2.aofoundation.org/wps/porta/!ut/p/a0/04\\_Sj9CPYkssy0xPLMnMz0vMAfGjz0KN\\_A0M3D2DDbz9\\_UMMDRyDXQ3dw9wMDAx8jfULsh0VAdAsN3U1/7bone=Tibia&segment=Malleoli&soloState=lyteframe&teaserTitle=44-B2%20Transyndesmoti%20fibular%20fracture%2C%20with%20medial%20lesion&contentUrl=srg/44/01-Diagnosis/ao\\_srg\\_diag\\_44b2.jsp](https://www2.aofoundation.org/wps/porta/!ut/p/a0/04_Sj9CPYkssy0xPLMnMz0vMAfGjz0KN_A0M3D2DDbz9_UMMDRyDXQ3dw9wMDAx8jfULsh0VAdAsN3U1/7bone=Tibia&segment=Malleoli&soloState=lyteframe&teaserTitle=44-B2%20Transyndesmoti%20fibular%20fracture%2C%20with%20medial%20lesion&contentUrl=srg/44/01-Diagnosis/ao_srg_diag_44b2.jsp)

# Fractures In More Detail



<http://www.med.und.edu/radiology/BoxerFracture.html>



<http://radiopaedia.org/articles/torus-fracture-1>



<http://radiopaedia.org/articles/colles-fracture>

# Specific Upper Extremity Fractures in Detail



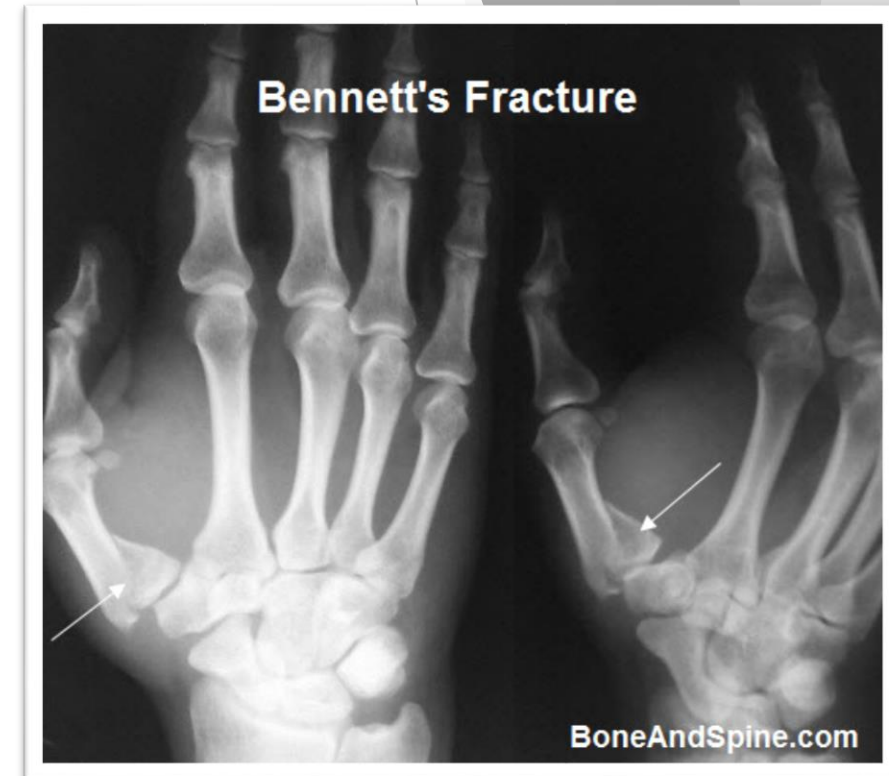
<http://www.victimsofviolence.co.uk/cica-advice-blog/>



<http://www.propublica.org/article/snooping-on-the-x-ray-tech-a-patients-dilemma>

# Bennett's Fracture

1. Is a type of intra-articular fracture which involves a dislocation
  - ▶ It is an oblique fracture of the base of metacarpal of the thumb
2. To be considered a Bennett's fracture:
  - ▶ The fracture must extend into the carpometacarpal (CMC) joint
3. Distraction of the fractured bone ends occurs during muscular action.
4. Abductor pollicis longus muscle shifts the metacarpal shaft laterally.
5. A portion of the metacarpal bone remains in articulation with the trapezium
6. Cause of Bennett's Fracture
  - ▶ Injury occurs due to a forceful abduction of the thumb
  - ▶ It is often seen in football players
  - ▶ Injury may result in arthritis
7. Treatment
  - ▶ Keeping the fragments in alignment for proper healing is a challenge
  - ▶ It may be possible to treat some of these injuries by closed reduction, and casting
  - ▶ External fixation with pins, or open reduction and internal fixation may be necessary



<http://boneandspine.com/metacarpal-fracture-xrays/>

# Barton's Fracture and Reverse Barton's Fracture

1. An intra-articular oblique fracture of the distal radius involving the radiocarpal joint.
  - ▶ It is a comminuted fracture
2. The fracture line of a Barton's fracture extends across the dorsal rim of the radius and runs into the wrist joint.
3. A fracture of the radio styloid process often accompanies a Barton's fracture.
4. This is an unstable fracture, and readily re-displaces.
5. Causes for Barton's Fracture and Reverse Barton's Fracture
  - ▶ It often occurs as the result of a fall forward onto an extended hand
6. It is the most commonly occurring fracture/ dislocation of the wrist joint.
7. Treatment
  - ▶ Non-operative treatment of this fracture often fails
8. A Barton's fracture is often confused clinically with Colles fracture.
9. A reverse Barton's fracture is much like a Barton's fracture except that the fracture lies along the volar rim of the distal radius instead of the dorsal rim.



# Rolando's Fracture

1. Like Bennett's fracture, Rolando's fracture is a fracture/ dislocation of the first metacarpal (thumb) at the base of the bone.
  - ▶ It is a comminuted, intra-articular fracture
  - ▶ Three fracture fragments are usually involved which form a T or Y pattern
2. Rolando's fracture is differentiated from Bennett's by the fact that Bennett's fracture is not comminuted
3. Cause of Rolando's Fracture
  - ▶ Like Bennett's fracture, Rolando's fracture is caused by a forceful abduction of the thumb
  - ▶ Often results in osteoarthritis
4. Treatment
  - ▶ If the bone is in many fragments, non-surgical treatment by immobilization is often advised
  - ▶ If the bone is broken into large fragment the fracture is often treated with open reduction and internal fixation
  - ▶ This type of fracture is difficult to treat
  - ▶ A relatively uncommon type of fracture



<http://radiopaedia.org/images/300>



# Buckle Fracture

1. Also referred to as a torus fracture.
  - ▶ It is a type of incomplete fracture
2. The cortex of the bone is compressed causing a buckle on the compressed side.
  - ▶ The other side of the bone is undamaged
3. 2 types of Buckle Fractures
  - ▶ Classic buckle fracture
  - ▶ Angled buckle fracture
    - These injuries are very similar
4. Classic buckle fracture
  - ▶ Involves the outward buckling of the cortex of the bone on one side
5. Angled buckle fracture
  - ▶ Involves the simple angling of the cortex
6. Cause of Buckle Fracture
  - ▶ The injury may be caused by a fall on a outstretched arm
  - ▶ It is most often seen in children because their bones are softer
7. Treatment
  - ▶ Angled buckle fracture
    - This type of fracture is stable, and heals well with casting



# Chauffeur's Fracture

1. Also called Hutchinson's fracture
  - ▶ Is an intra-articular oblique fracture of the radial styloid process
2. The fracture occurs on the articular surface of the radius, and generally extends laterally from the meeting point of the lunate and scaphoid fossae.
3. The radial styloid process may be pulled away from the radius by the ligaments.
4. A dislocation of the lunate may occur with this fracture.
5. Cause of Chauffeur's Fracture
  - ▶ The injury is called a chauffeur's fracture as it was often caused by the kickback from the starting crank of a car
  - ▶ This injury is much less common today, but still occurs during falls on the ball of the thumb
  - ▶ During forceful ulnar deviation and forceful supination of the wrist
6. Treatment
  - ▶ This fracture is treated by casting, or fixation with hardware



<http://radiopaedia.org/articles/chauffeur-fracture>

# Colles Fracture

1. This is a fracture of the distal metaphysis of the radius in which the fracture fragment is displaced dorsally (upward).
2. The articular surface of the radius may be involved.
3. The ulna styloid may also be fractured
4. Causes of Colles Fracture
  - ▶ A forced dorsiflexion of the wrist may lead to this type of fracture
  - ▶ Colles fracture results most often from a fall forward onto an extended hand
  - ▶ This type of fracture is particularly common in elderly individuals
5. Treatment
  - ▶ If there is minimal displacement, the fracture can be treated by casting
  - ▶ If the displacement is more severe, an open reduction may be necessary
6. Colles fracture may be a indicative of osteoporosis.
7. Colles fracture is associated with a higher risk of experiencing a hip fracture.



# Boxer's Fracture

1. Involves a fracture in the fifth metacarpal (little finger).
  - ▶ The fracture occurs at the distal metaphysis
2. It is called a boxer's fracture as it may result from punching an object with a closed fist.
  - ▶ The metacarpal may be fractured into fragments, or displaced
3. This type of fracture does not generally extend into the joint, so arthritis is not likely to result.
4. The loss of the knuckle of the fifth metacarpal occurs with this type of fracture.
  - ▶ In addition, the injury may lead to the mal-rotation of the fifth metacarpal
  - ▶ This is evident when a fist is made, and the fifth metacarpal overlaps the ring finger
  - ▶ This weakens the grip of the hand
5. Treatment
  - ▶ The degree of angulation of the fracture determines treatment
  - ▶ Casting with, or without external fixation may be used if the degree of angulation is small
  - ▶ These fractures often require open reduction, and internal fixation



# Mallet Fracture

1. Mallet fracture is a type of mallet finger.
  - ▶ Mallet finger is a disruption, in any of the digits, of the extensor mechanism of the distal interphalangeal joint
  - ▶ The tendon and bone are both involved in extension, and disruption of either of these can lead to mallet finger
  - ▶ If the bone is involved, it is called mallet fracture
    - The section of the bone involved is the dorsal base of the phalanx
    - This is an avulsion fracture, where a piece of bone is pulled away
    - This injury causes the finger to drop
2. Cause of Mallet Fracture
  - ▶ Often caused by a forceful hyperextension
    - This condition often leads to a stiff finger
3. Treatment
  - ▶ The condition is treated both by open and closed reduction



<http://volusiahandsurgery.com/mallet-finger-baseball-finger/>

# Smith's Fracture

1. Also referred to as a reverse Colles fracture
2. It involves a transverse fracture of the distal radius at the metaphysis.
3. This fracture involves a palmar (volar) displacement of the distal fragment of the fracture
  - ▶ Colles fracture involves a dorsal displacement
4. Cause of Smith's Fracture
  - ▶ Occurs as a result of falling forward onto flexed wrists
    - As opposed to a Colles fracture which occurs as a result of falling forward on extended wrists
5. Smith's fractures occur less frequently than Colles fractures
  - ▶ A Smith's fracture does not involve a joint
6. Treatment
  - ▶ This is an unstable fracture
  - ▶ The type of treatment depends upon the severity of the injury
  - ▶ A closed reduction may be sufficient for fractures with little angulation and displacement
  - ▶ Open reduction and internal fixation may be required to treat fractures with significant angulation



<http://abcradiology.blogspot.com/2012/11/smiths-fracture.html>

# Monteggia Fracture

1. Monteggia fracture is a fracture of the proximal ulna with an accompanying dislocation of the radial head within the elbow joint.
2. Two types of Monteggia Fractures
  - ▶ Extension
  - ▶ Flexion
3. The type depends upon the displacement of the bone fragment
4. This type of fracture is the result of force transmitted through the hand and forearm with the elbow bent.
  - ▶ The radius is pulled away from the joint by the interosseous ligament
5. Cause of Monteggia Fractures
  - ▶ Often occurs from a fall forward onto an outstretched hand while the elbow is slightly flexed
6. Treatment
  - ▶ It is necessary to repair the fracture to prevent the elbow joint from continuing to dislocate
  - ▶ Casting the fracture is not sufficient to prevent this
  - ▶ The treatment is usually open reduction and internal fixation



# Galeazzi's Fracture

1. Also called a reverse Monteggia fracture
2. It is a fracture/ dislocation
  - ▶ It involves a fracture of the shaft of the radius between the middle and distal thirds
  - ▶ A dislocation of the inferior radioulnar joint
3. The distal fragment of the radius is generally displaced toward the ulnar.
4. The dislocation is generally dorsal, but may be palmar.
5. There may be an accompanying avulsion fracture of the ulnar styloid process
6. Cause of Galeazzi's Fracture
  - ▶ This fracture is usually caused by a direct blow to the dorsal side of the wrist
  - ▶ Or by a fall forward onto an outstretched arm when the forearm is pronated
7. Treatment
  - ▶ In adults, closed reduction may fail
  - ▶ Open reduction using plates and screws is often necessary





# De Quervain's, Moore's, Skillern's, and Wilson's Fractures

## 1. De Quervain's Fracture

- ▶ Also called simply Quervain's fracture
- ▶ It is a fracture of the navicular bone in conjunction with a volar dislocation of the lunate bone

## 2. Moore's Fracture (*not pictured*)

- ▶ A fracture of the distal portion of the radius with an accompanying dislocation of the ulnar head, and entrapment of the styloid process under the annular ligaments.

## 3. Skillern's Fracture

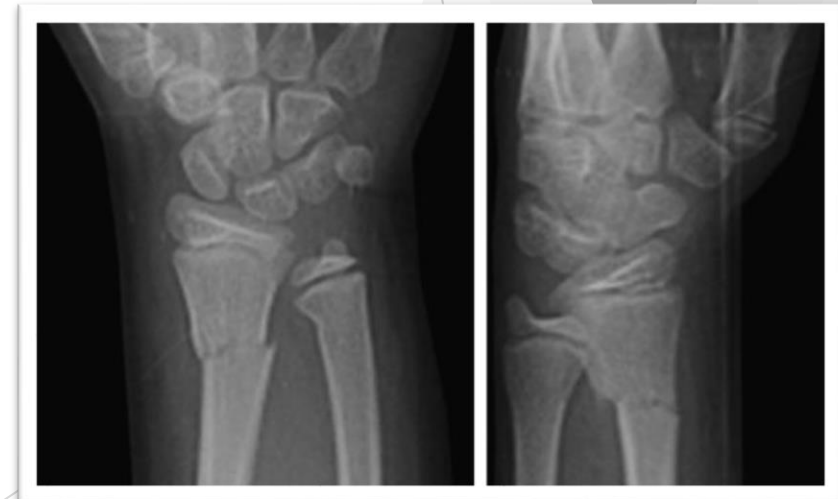
- ▶ A complete fracture through the bottom third of the radius with an accompanying greenstick fracture of the bottom third of the ulna

## 4. Wilson's Fracture (*not pictured*)

- ▶ A fracture at the site of the proximal interphalangeal joint
- ▶ A fibrous joint strip called the volar plate is found at this site
- ▶ It is part of the capsule of the joint
  - It is an avulsion at this site
- ▶ This injury is caused by hyperextension of the joint



[http://mariorad.com/lectures/mskexpert/data/html/app\\_3.html](http://mariorad.com/lectures/mskexpert/data/html/app_3.html)



[http://mariorad.com/lectures/mskexpert/data/html/app\\_3.html](http://mariorad.com/lectures/mskexpert/data/html/app_3.html)

# Tuft Fracture

1. Tuft fracture is a distal phalanx fracture
  - ▶ In other words it involves the fingertip
2. There are degrees of severity
  - ▶ Most of these are comminuted fractures with accompanying damage to the nail bed.
    - The fracture may be open, or closed
3. Cause of Tuft Fractures
  - ▶ This fracture usually results from blunt trauma to the fingertip, or a crushing injury
4. Treatment
  - ▶ The amount of damage to the nail determines the treatment
  - ▶ If the nail plate is unaffected, it is left in place, and the hematoma is drained through it
  - ▶ If the fracture is of the open variety where the nail bed is damaged or destroyed the nail is removed, and the bed repaired
  - ▶ If the finger is splinted, it is splinted in an extended position
  - ▶ Comminuted fractures and those with soft tissue damage have poorer prognosis



# Specific Lower Extremity Fractures in Detail



<http://boneandspine.com/radiographs-of-tibia-and-fibula-fracture/>



<https://ispub.com/IJRA/11/2/7850#>

# Pilon Fracture

1. A pilon fracture is a comminuted fracture of the distal end of the tibia
2. The fracture is oblique and extends medially and laterally, and to the articular surface of the tibiotalar joint.
  - ▶ The fracture may involve the metaphysis and joint
  - ▶ There may be significant soft tissue damage
3. This is an impact injury caused by axial loading.
4. Cause of Pilon Fracture
  - ▶ These fractures result when the talus is driven with force into the tibial plafond
  - ▶ In this type of fracture, the cortical bone is fragmented by the impact
  - ▶ In a high impact injury, the fibula may be involved
5. Treatment
  - ▶ This type of fracture often results in posttraumatic arthritis
  - ▶ High impact fractures tend to have a poor prognosis no matter the treatment



# Pott's, Gosselin's, & Maisonneuve Fractures

## 1. Pott's Fracture

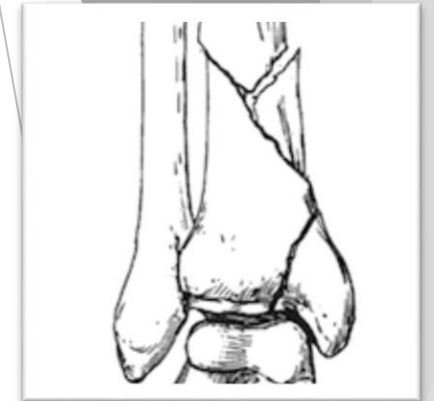
- ▶ A fracture dislocation of the ankle
- ▶ This fracture is also known as a Dupuytren fracture
- ▶ It is a fracture of the fibula above the ankle joint
- ▶ Often involves a fracture of the medial malleolus
- ▶ The internal lateral ligament is often ruptured as well
- ▶ The foot is displaced laterally



<http://teachmeanatomy.info/lower-limb/joints/the-ankle-joint/radiograph-of-a-potts-fracture-of-the-ankle/>

## 2. Gosselin's Fracture

- ▶ A v-shaped fracture of the distal tibia which extends to the ankle joint



<http://lifeinthefastlane.com/education/who-was/eponymous-fractures/>

## 3. Maisonneuve fracture

- ▶ A spiral fracture of the proximal third of the fibula
- ▶ It also includes a disruption of the distal tibiofibular syndesmosis
- ▶ A fracture of the tibia and a tear of the deltoid ligament may be associated with a Maisonneuve fracture



[http://www.wheelsonline.com/ortho/maisonneuve\\_fracture](http://www.wheelsonline.com/ortho/maisonneuve_fracture)

# Triplane Fracture

1. Also called the Marmor-Lynn fracture.
  - ▶ Involves fractures of the epiphysis, physis, and metaphysis of the distal tibia
2. The fractures are vertical, transverse, and coronal respectively
3. The growth plate of the tibia is affected
4. Cause of Triplane Fracture
  - ▶ Produced by a twisting motion
  - ▶ Injury occurs when eversion of the foot puts stress on the distal lateral growth plate of the tibia
    - A common fracture in adolescents
    - Occurs before the closing of the growth plate
5. Treatment
  - ▶ Severity of the injury is difficult to detect on radiographs
  - ▶ It is a Salter-Harris IV fracture
  - ▶ A CT scan or MRI should be performed if a triplane fracture is suspected
  - ▶ Closed reduction may be possible
  - ▶ With more severe fractures, an open reduction may be necessary



<http://eorif.com/triplane-ankle-fracture-8248>

# Tillaux Fracture

1. An avulsion fracture of the anterior lateral margin of the distal end of the tibia.
2. Cause of Tillaux Fracture
  - ▶ It is a twisting injury
  - ▶ Occurs when the anterior tibiofibular ligament pulls a part of the tibia away from the bone
  - ▶ It is caused when the foot is forcefully turned laterally, or when the leg is forcefully turned medially on a planted foot
  - ▶ This injury is common in adolescents, but is rarely seen in adults
  - ▶ In adults, the ligament involved usually breaks instead of causing an avulsion injury
  - ▶ In children and adolescents, the ligament is stronger than the growth plate
  - ▶ The ligament injury sometimes seen in adults is called Tillaux lesion
  - ▶ This injury is often caused by skateboarding accidents, and sliding in baseball
3. Treatment
  - ▶ Treatment of these fractures often involves internal fixation
  - ▶ This is a Salter-Harris II fracture



<http://eorif.com/tillaux-fracture-82380>

# Jones Fracture

1. A Jones fracture is a fracture of the base of the fifth metatarsal at the junction of the metaphysis and diaphysis.
  - ▶ The fracture generally extends into the intermetatarsal facet between the fourth and fifth metatarsals
2. The fracture produces pain in the middle and outer part of the foot, and causes difficulty walking.
3. Treatment
  - ▶ This fracture is often mistaken for a sprain
  - ▶ Diagnosis is made based on x-ray results
  - ▶ An non-displaced Jones fracture can be treated successfully with a cast, or walking boot
  - ▶ If the fracture is more severe, a screw can be used to hold the bones in place
  - ▶ This fracture may heal poorly due to the poor blood supply to the area



<http://eorif.com/AnkleFoot/JonesFx.html>



# Trimalleolar Fracture

1. Also called a Henderson fracture or a Cotton fracture
  - ▶ Involves fractures of the medial and lateral malleoli of the tibia, and the posterior process of the tibia
    - The posterior process is not actually malleolus, and therefore the name trimalleolar fracture is misleading
2. The 3 parts of the tibia mentioned all articulate with the talus bone
3. Cause of Trimalleolar Fracture
  - ▶ Caused by severe trauma
4. Treatment
  - ▶ A trimalleolar fracture is unstable, and the treatment is open reduction, and fixation
  - ▶ It is considered an orthopedic emergency
  - ▶ An ankle with a healing trimalleolar fracture is not able to bear weight even with internal fixation
  - ▶ Healing normally takes 6 weeks
  - ▶ The fracture is likely to lead to osteoarthritis



<http://radiopaedia.org/articles/trimalleolar-fracture>

# Tibial Plateau Fracture 1/2

1. Used to be called fender, or bumper, fractures as they can be caused by impact for a car
2. Cause of Tibial Plateau Fracture
  - ▶ The injury is usually caused, however, from a twisting injury, or lateral forces on the bone
3. The Schatzker classification system is used to describe 6 patterns of fracture.
  - ▶ **Type I Fracture**
    - Involve a split in the lateral tibial plateau
  - ▶ **Type II Fracture**
    - A split fracture with an accompanying depression at the lateral articular surface
  - ▶ **Type III Fracture**
    - Involve a depression of the lateral tibial plateau
  - ▶ **Type IV Fracture**
    - Found in the medial tibial plateau
    - These may be split fractures with or without an associated depression fracture
  - ▶ **Type V Fracture**
    - Involve splits through the medial plateau, and the lateral plateau
  - ▶ **Type VI Fracture**
    - The most serious, and involves a dissociation of the tibial plateau, and diaphysis



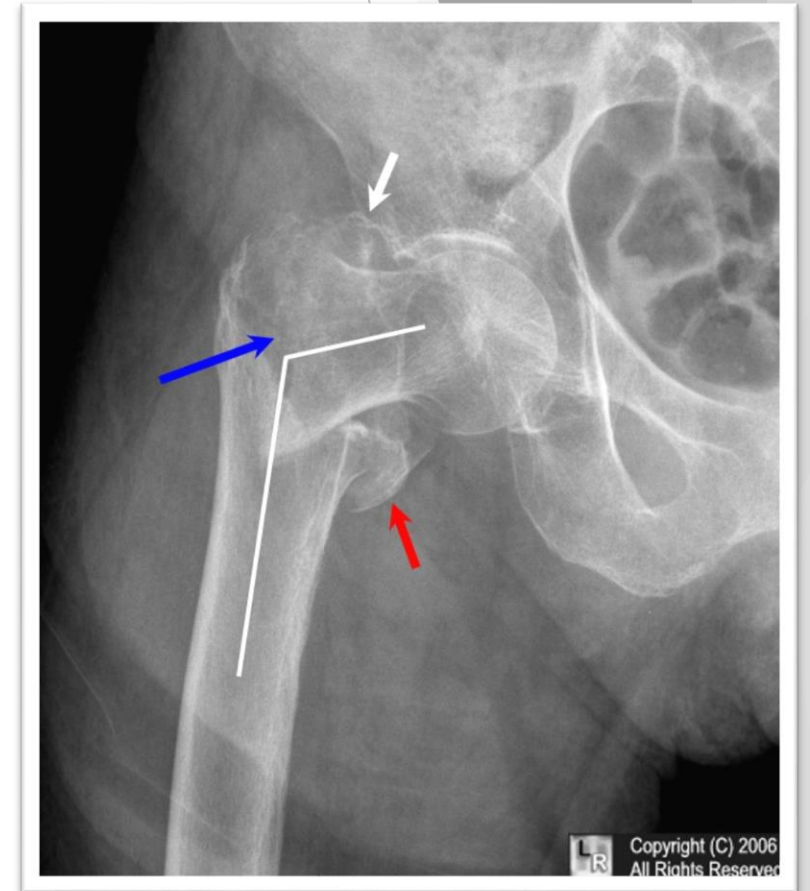
# Tibial Plateau Fracture 2/2

4. Soft tissue damage is often associated with tibial plateau fractures.
5. Cruciate ligaments, collateral ligaments, peroneal nerve injury, and popliteal artery occlusion may result from these fractures
6. Skin injuries are often associated with tibial plateau fractures, and osteomyelitis may result.
7. Symptoms
  4. Excess fluid in the knee
  5. Pain
  6. Stiffness of the joint
8. Treatment
  4. Tibial plateau fractures are easily diagnosed by x-ray
  5. Depending on the severity of the fracture reduction may be nonsurgical, or surgical
  6. Whatever the treatment, the joint may be unstable after healing due to damage to the ligaments
    4. Damage to the cartilage and articular discontinuities may also result from these fractures
  7. There is a high risk of osteoarthritis



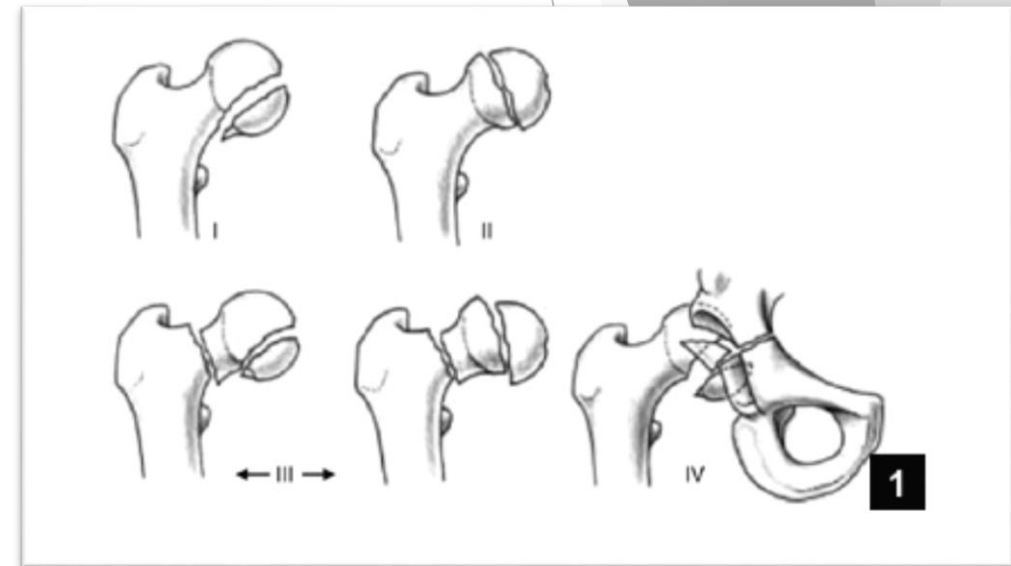
# Intertrochanteric Fracture

1. Occurs between the greater and lesser trochanters of the femur.
2. Muscular actions pull the fracture proximally resulting in external rotation and shortening of the leg.
3. This is a fracture of cancellous bone, and so the area has a good blood supply
  - The joint capsule is not generally involved
  - A fracture in this area does not usually interfere with blood supply, and can usually be repaired without requiring a hip replacement
4. Cause of Inter-trochanteric fracture
  - This fracture often occurs due to a fall
  - Prognosis is excellent
5. Treatment
  - Surgical treatment of an inter-trochanteric fracture may involve open reduction, and fixation with a metal plate and screws
  - A metal rod down the center of the bone may be used in place of a plate
  - Physical therapy begins almost immediately, and healing time is about 12 weeks



# Pipkin Fractures

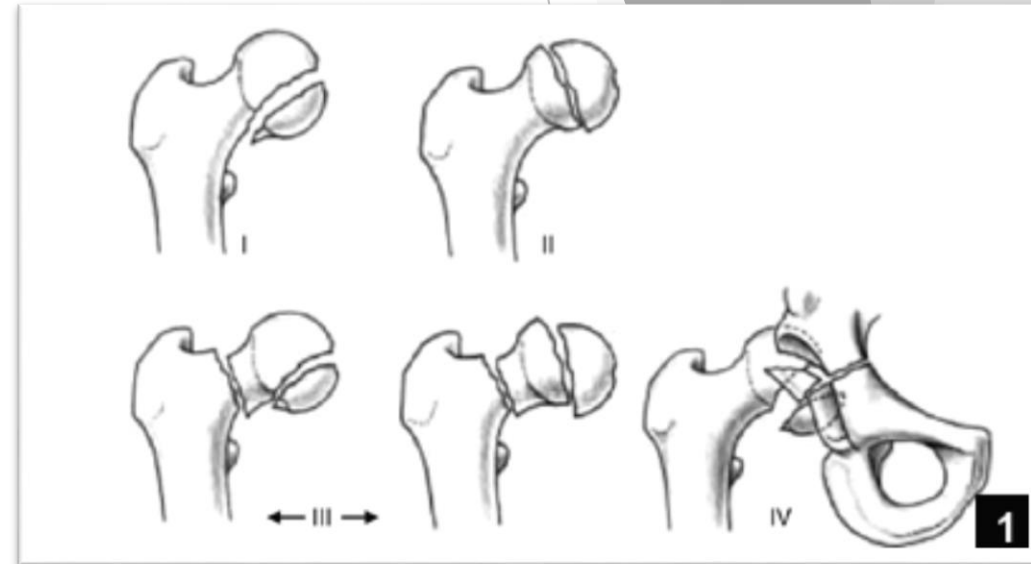
1. Pipkin classification system is used to describe fractures of the femoral head.
2. There are 4 types of Pipkin fracture
  - Type I
    - A fracture of the head of the femur inferior to the fovea centralis with an associated posterior dislocation
  - Type II
    - A fracture of the femoral head superior to the fovea centralis with an associated posterior dislocation
  - Type III
    - Is a Type I, or II Pipkin fracture with an associated fracture of the femoral neck
  - Type IV
    - Is a Type I, II, or III Pipkin fracture with an associated fracture of the acetabulum
3. Treatment
  - Treatment depends upon the types of fracture and its severity



<http://www.orthopaedicsone.com/display/Main/Femoral+head+fractures+-+Pipkin+classification>

# Femoral Head Fracture Treatment

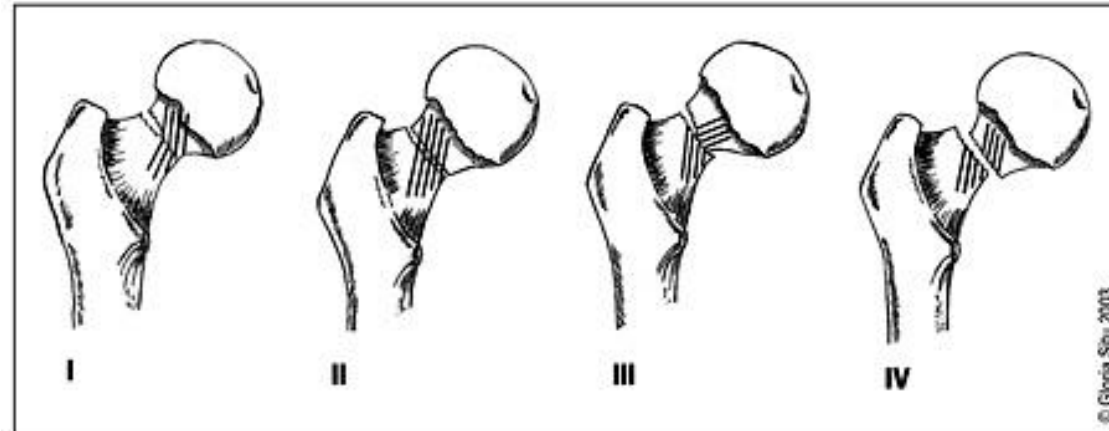
1. Femoral neck fractures disconnect the head of the femur from the shaft of the femur.
2. The blood supply is often interrupted at the time of fracture.
3. The lack of an adequate blood supply impairs the healing process.
  - This is especially true with a severe dislocation
  - For this reason, femoral fractures are often treated by a partial hip replacement
4. Treatment depends upon the severity of the dislocation, and the age of the patient.
  - Hip replacements are usually performed in older, less active patients as they wear out with activity
  - A fractured femoral head with minimal displacement may be treated by internal fixation
  - A partial hip replacement, or hip hemiarthroplasty, may be performed in which the head of the femur is replaced with a metal prosthesis
    - Prosthesis can be cemented onto the end of the bone, or press-fit
5. Rehabilitation is started right after surgery



<http://www.healio.com/orthopedics/journals/ortho/2011-5-34-5/%7Bf37f3c12-273e-452f-8575-19ff95ebe382%7D/operative-versus-nonoperative-management-of-pipkintype-ii-fractures-associated-with-posterior-hip-dislocation>

# Femoral Neck Fractures

1. The basis of the Garden classification is the displacement of the femoral head.
2. There are 4 types.
  - Garden I Fracture
    - An incomplete fracture of the femoral neck
    - It may be abducted, or impacted
    - This is a stable type of fracture
  - Garden II Fracture
    - A complete fracture of the femoral neck, but it is nondisplaced
    - This is also a stable fracture
  - Garden III Fracture
    - A complex fracture of the femoral neck with partial displacement
    - This fracture may be stable, or unstable
    - Have a high risk for the development of avascular necrosis
  - Garden IV Fracture
    - A complete fracture of the femoral neck with complete displacement
    - This type of fracture is unstable



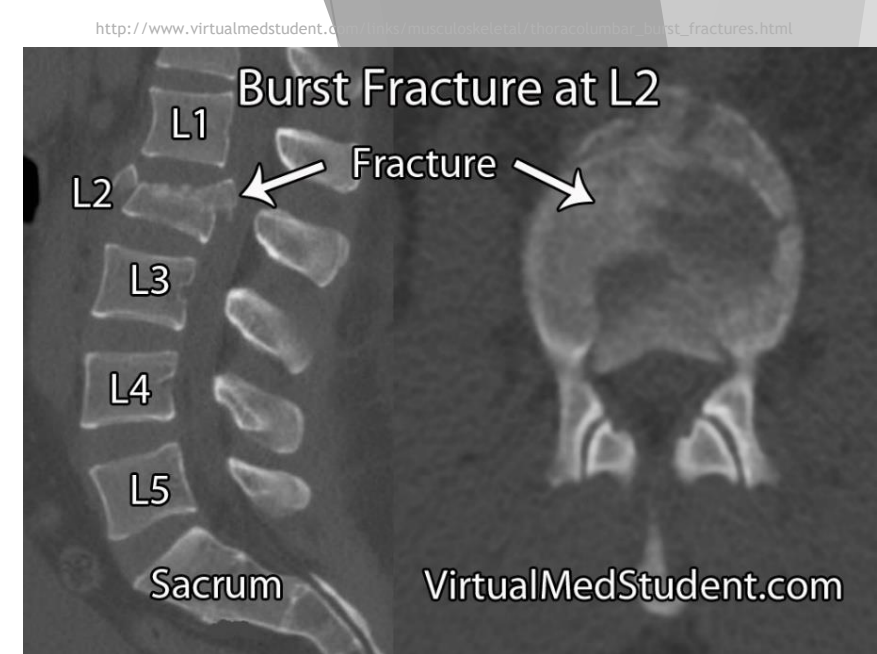
# Burst & Jefferson's Fractures

## 1. Burst Fracture

- A fracture in which the body of the vertebra is crushed all around
- The injury is severe as the bone fragments are likely to damage the spinal cord resulting in paralysis, or a lesser injury to the nerves
- This type of fracture is the result of forceful pressure on the vertebral column

## 2. Jefferson Fracture

- Involves unilateral or bilateral fractures of the first cervical vertebra at the anterior and posterior arches
- This is an axial loading (compression) injury
- It is an unstable fracture



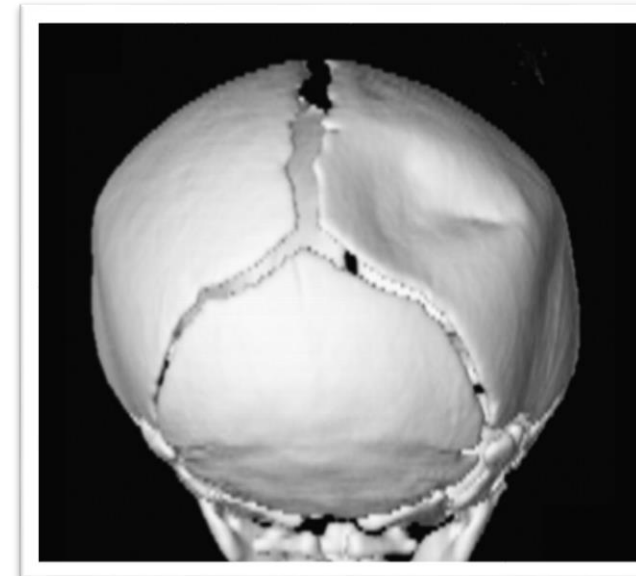
<http://cdn.lifeinthefastlane.com/wp-content/uploads/2010/04/Jefferson-Fracture-CT-XR.jpg>



# Ping-Pong Fractures

## 1. Ping-Pong Fracture

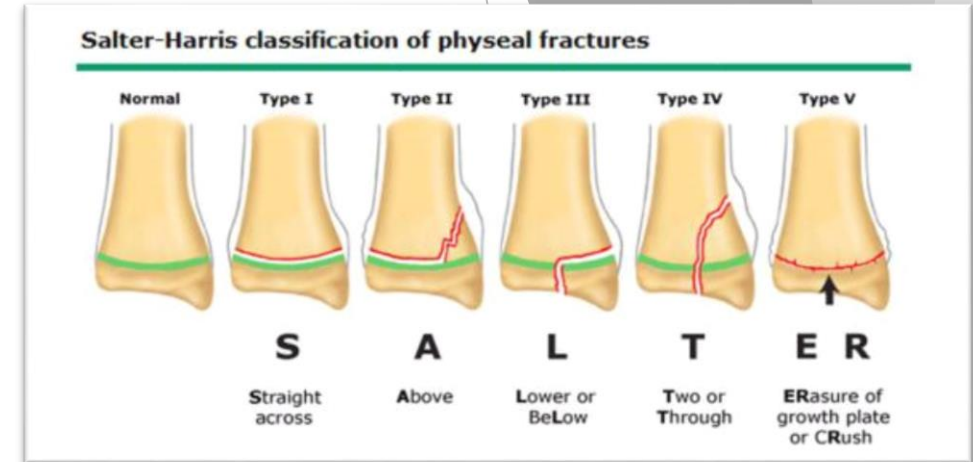
- A depression fracture of the skull
- It is called a ping-pong fracture as it resembles the depression that can be made on a ping-pong ball
- This type of fracture occurs when the bones of the skull are soft (seen in newborns and infants)
- Can occur during delivery
- May resolve spontaneously



# Salter-Harris Type I and II Fractures

1. Salter-Harris fractures are fractures of the growth plate (physis)
  - They occur before the growth plates are closed
2. There are 5 categories of Salter-Harris fractures based on the type of damage to the bony structures
  - **Type I Fracture**
    - The epiphysis of the bone is completely separated from the metaphysis
    - The physis (growth plate) remains attached to the epiphysis
    - This type of fracture requires no reduction usually, and is casted
    - The fracture usually heals normally with no disturbance to growth
  - **Type II Fracture**
    - Involves the partial separation of the epiphysis and physis from the metaphysis
    - The metaphysis is cracked
    - Usually has to be reduced, and must be immobilized
    - This is the most common type of Salter-Harris fracture, and may cause shortening of the bone

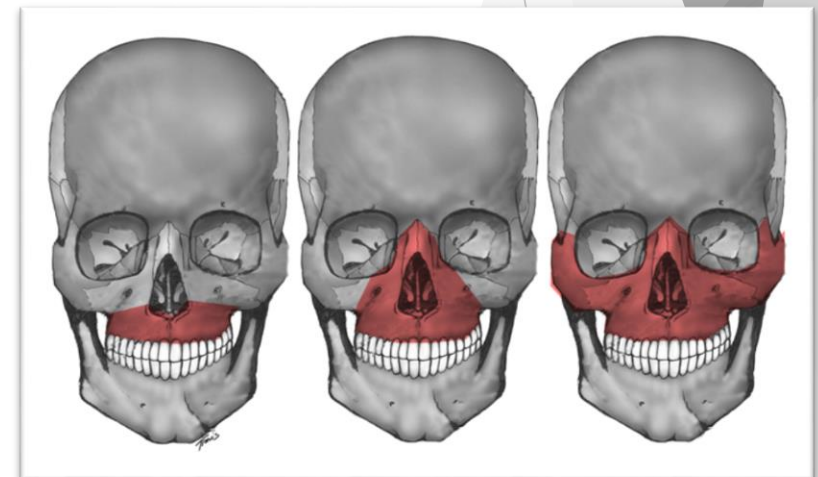
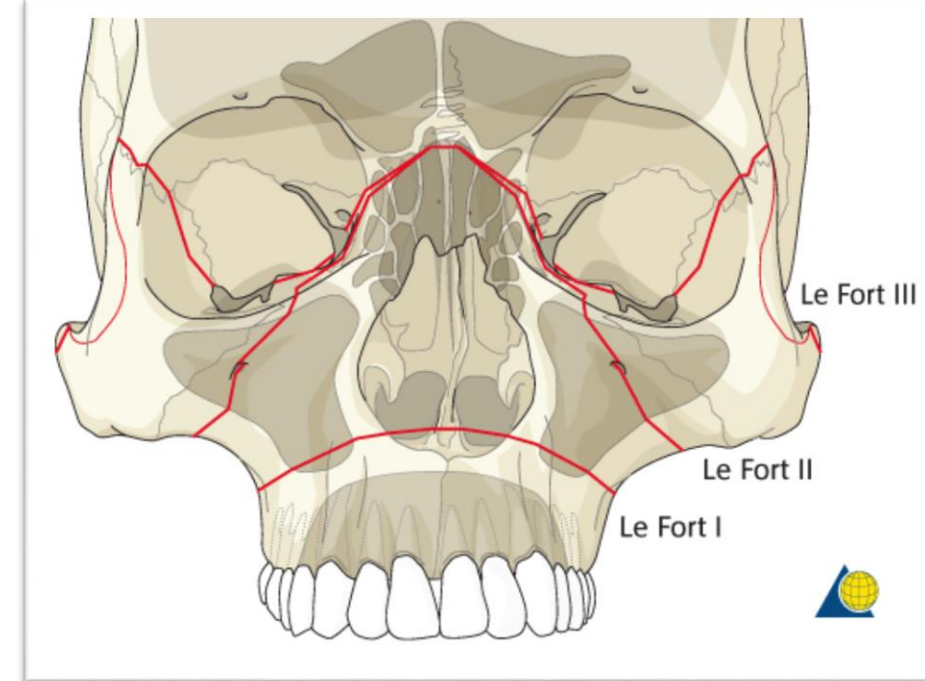
<http://ukemig-quickhit.com/2012/10/01/salter-harris-fractures/>



<http://www.radiologyassistant.nl/en/p50335f3cb7dc9/ankle-special-fracture-cases.html>

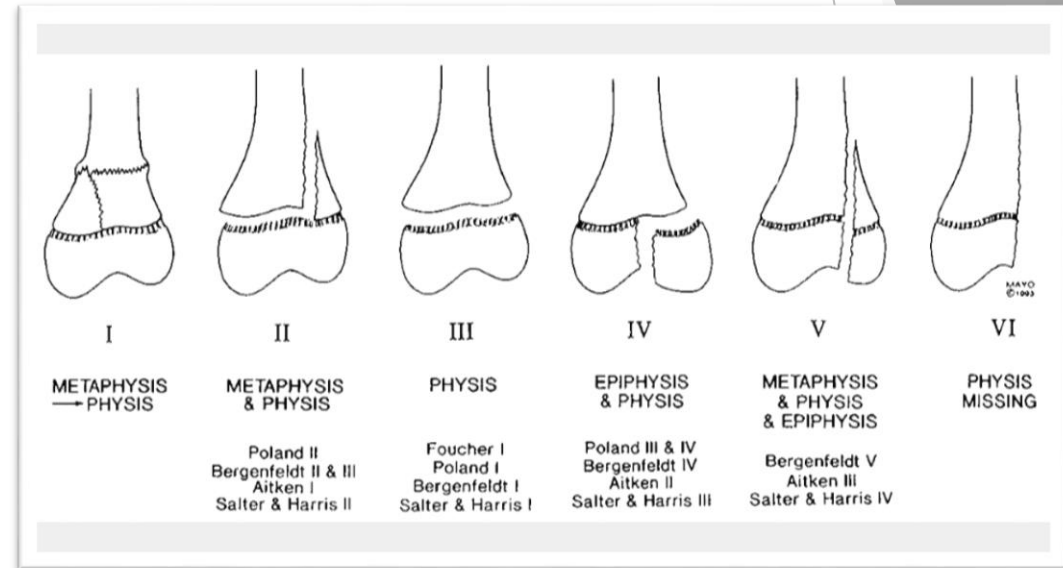
# Le Fort Fractures

1. Le Fort fracture
  - Involves the facial bones
  - It consists of a transverse fracture at the base of the upper jaw (maxillae)
2. There are 3 types of Le Fort fracture of increasing degrees of severity
  - Le Fort Fracture I
    - Involves a transverse (horizontal) segmented fracture through the alveolar process of the maxilla
    - The detached portion of bone usually holds the teeth
    - Also called Guerin's fracture
  - Le Fort Fracture II
    - Bilateral or unilateral fracture of the maxilla
    - Pyramid shaped section of the body of the maxilla is separated from the rest of the facial skeleton
    - Also called a pyramidal fracture
  - Le Fort Fracture III
    - Involves the complete separation of the maxilla, and one or more facial bones from the rest of the facial skeleton
    - Also called a craniofacial disjunction, and transverse facial fracture
3. Le Fort fractures are blunt force injuries.



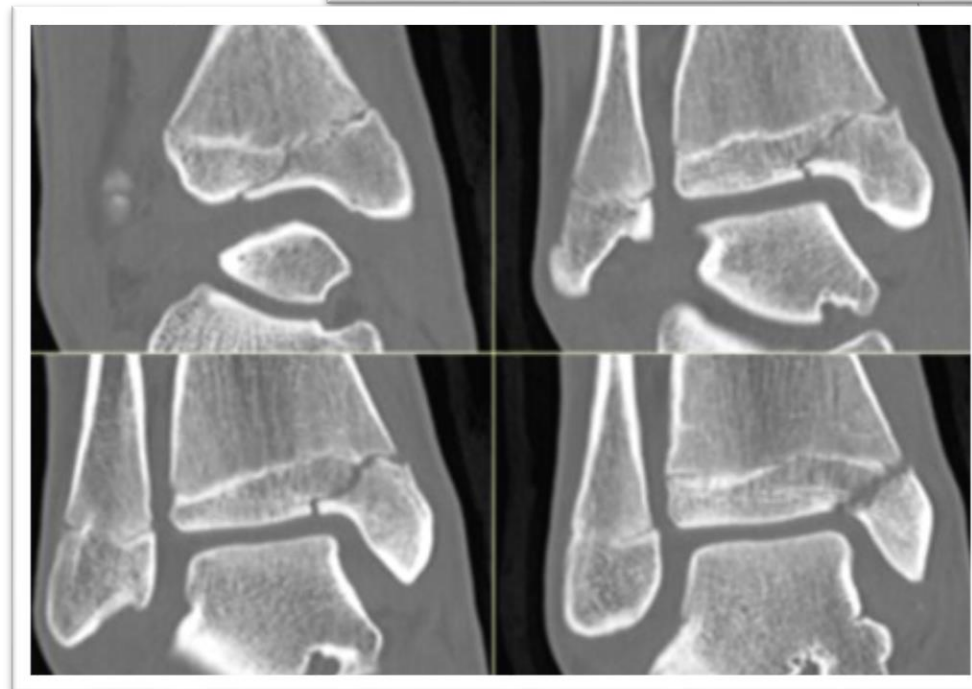
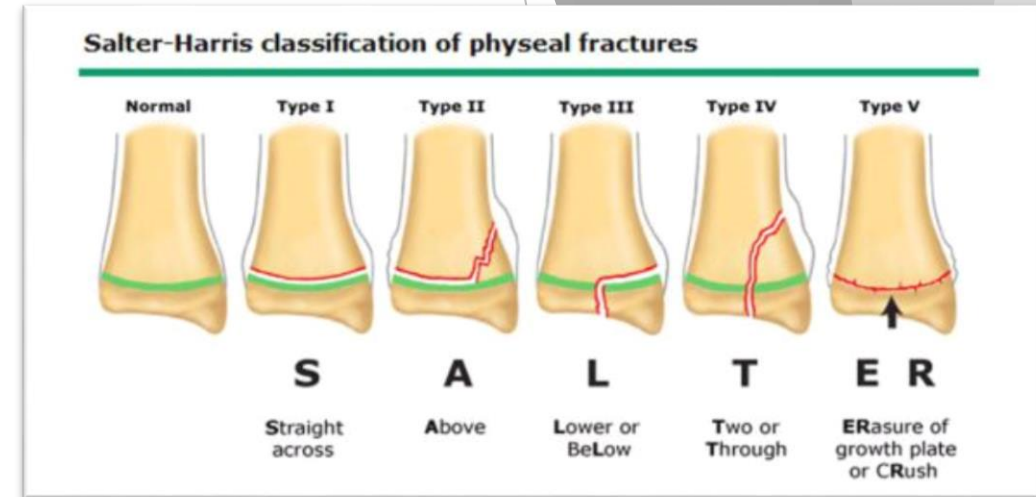
# Peterson Growth Plate Fractures

1. Is an extension of the Salter-Harris classification of growth plate fractures
2. It's a newer classification
  - Adds a type VI fracture category
3. Type VI
  - Part of the epiphysis, physis, and metaphysis is removed from the site
  - This type of fracture usually occurs with accidents involving heavy machinery, or gunshot wounds
  - An open wound, or compound fracture is usually associated with type VI fractures
  - Always necessitate surgery, and follow-up reconstructive or corrective surgery is very often required at a later date
    - As the growth plate is so damaged by the injury, bone growth is almost adversely affected.
    - Prognosis is poor



# Salter-Harris Type III Fractures

- Rare and usually occurs at the distal portion of the tibia
- The fracture extends through the epiphysis, and separates a portion of the epiphysis and physis from the metaphysis
- It affects the articular surface of the bone
- Surgery is sometimes necessary
- Prognosis is relatively good, but some disability may result



# Salter-Harris Type IV and IV Fractures

## 2. Salter Harris fracture type IV

- Extends across the physis, into the metaphysis
- Surgery is necessary to repair the surface of the joint, and to align the physis
- If perfect alignment is not attained and maintained, prognosis and poor, and growth will be affected
- Usually occurs at the distal end of the humerus

## 3. Salter-Harris fracture type V

- The result of a crushing bone and compression of the physis
- Prognosis is poor, and the growth of the bone is stunted

<http://www.radiologyassistant.nl/en/p50335f3cb7dc9/ankle-special-fracture-cases.html>



<https://www.hawaii.edu/medicine/pediatrics/pemxray/v1c18.html>