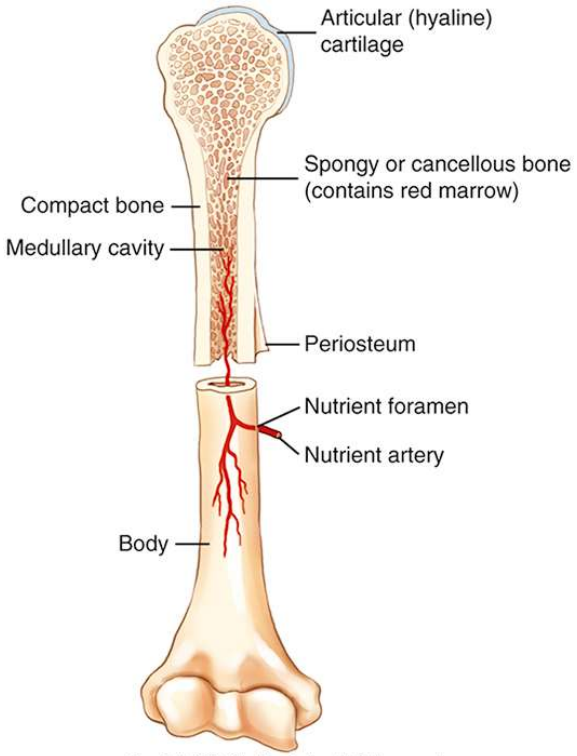
ANPH 252:

Skeletal fractures Part 1

Long bone structure:

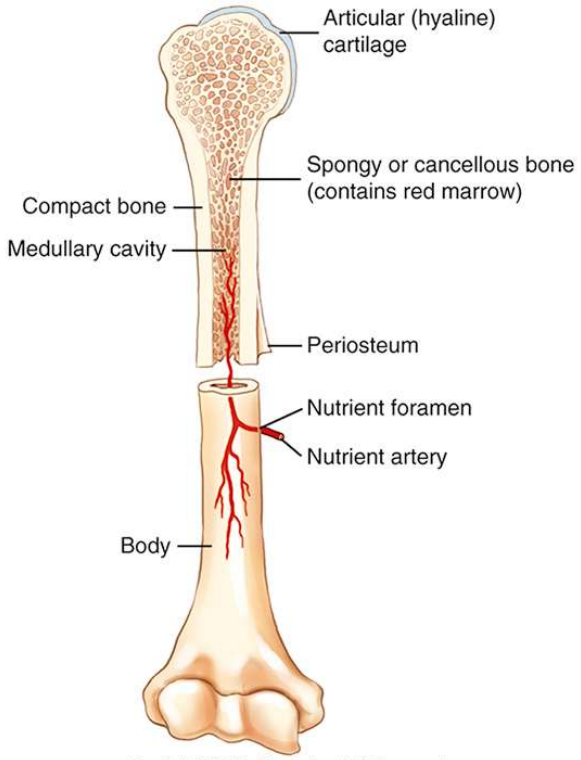
Teach yourself to recognize the location of these anatomical features on a radiograph:

1. Diaphysis
2. Medullary cavity
3. Endosteum (lines medullary cavity)
4. Metaphysis (pl. metaphyses)
5. Epiphysis (pl. epiphyses)
6. Epiphyseal line or plate
7. Compact bone
8. Cancellous (spongy) bone
9. Trabeculae
10. Periosteum
11. Articular cartilage

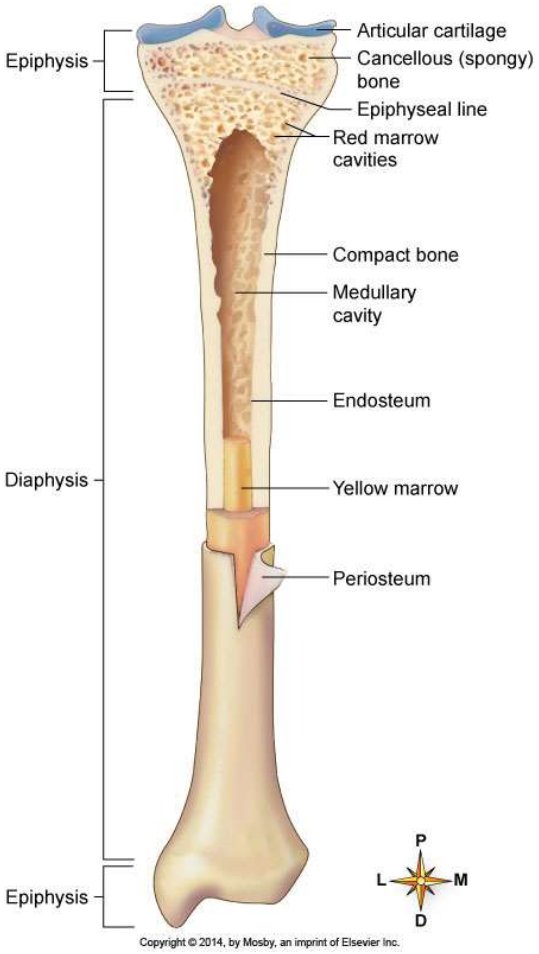


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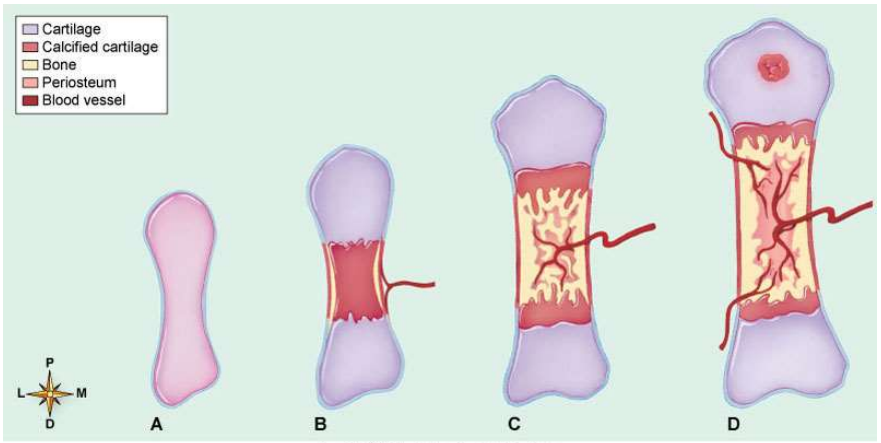
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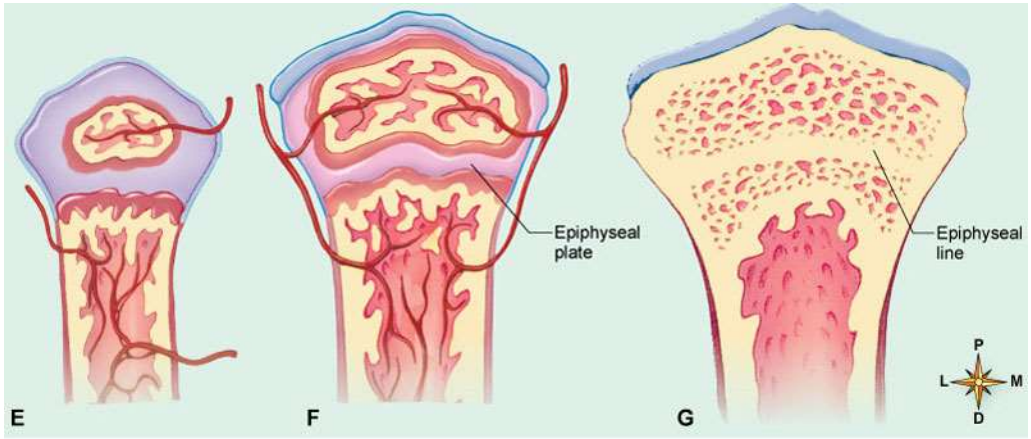
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The ossification process



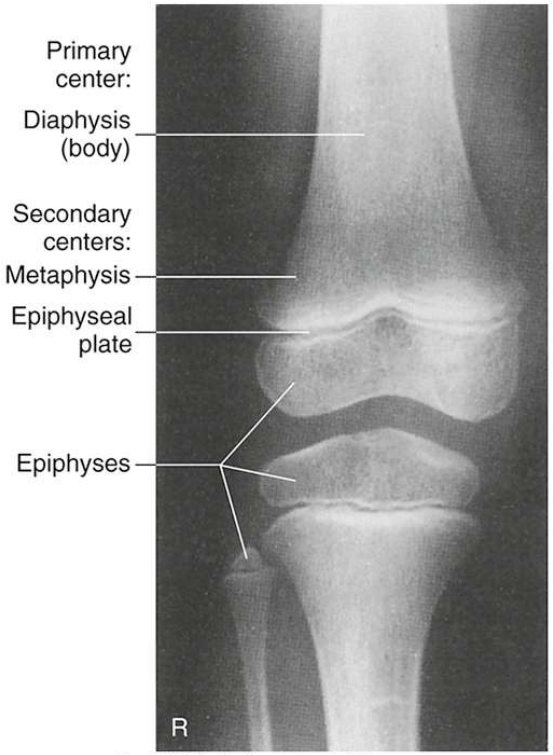
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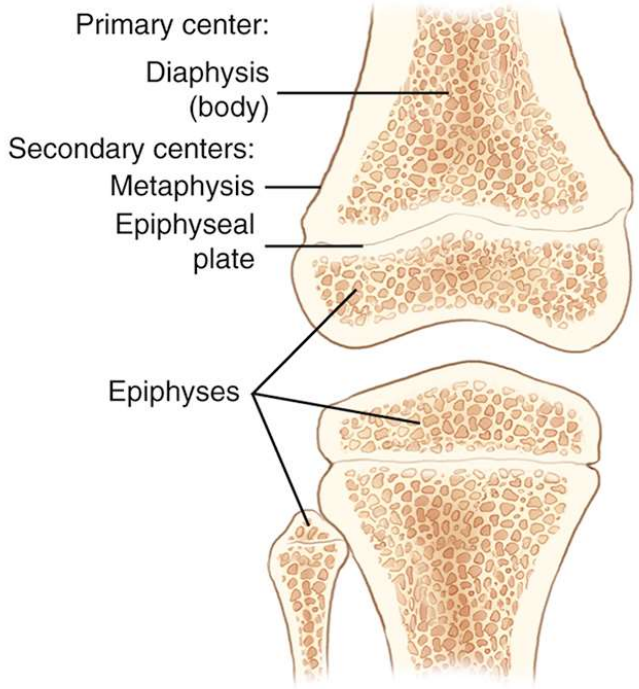
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Patton and Thibodeau fig. 8-6

An embryo's skeleton is composed of hyaline cartilage and fibrous membranes. Ossification of these tissues begins during the sixth week of development and continues until the age of 25 or so.



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Bontrager fig. 1- 21

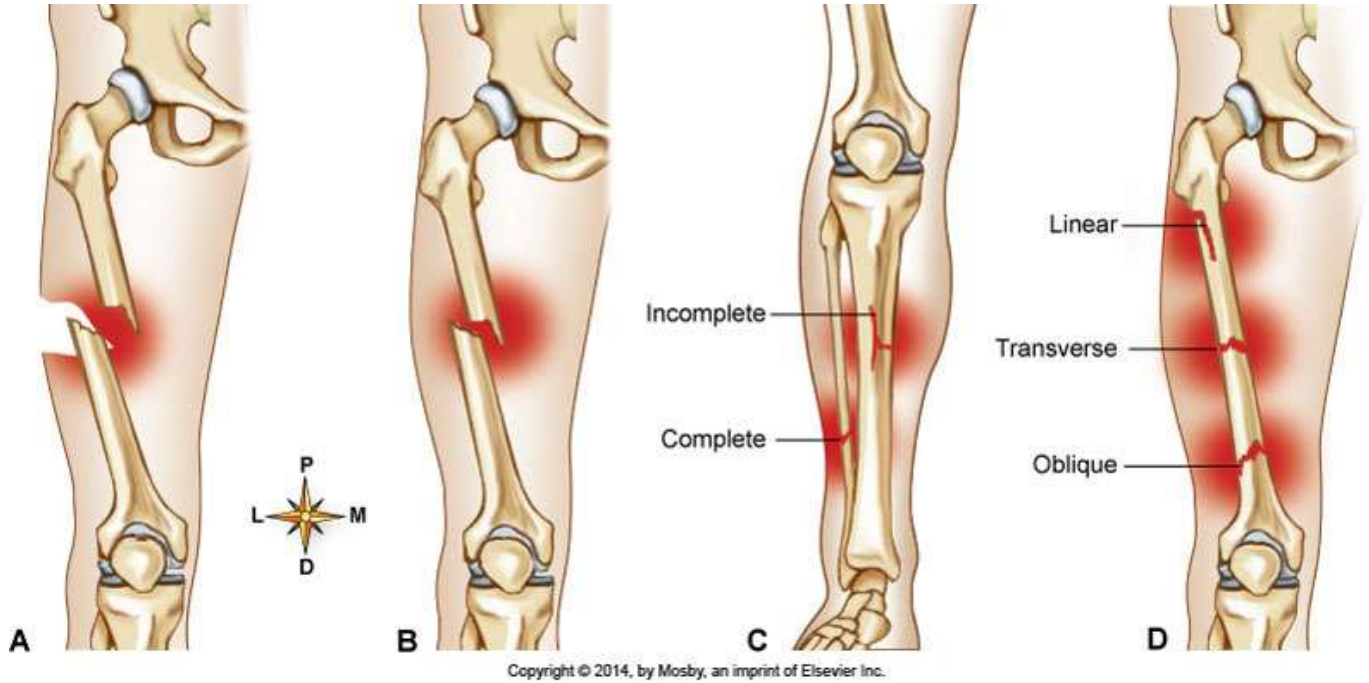
Making and remodeling bone

- Bones are made up of living connective tissue; maintenance of the bony matrix is a constant process called "remodeling", that allows bones to respond to stress and injury by changing their architecture.

- Osteoblasts constantly build bone by introducing collagen fibers and calcium salts into the bony matrix. The fibers help to withstand "twisting", and the salts crystalize to make the bone hard

- Osteoclasts release acids that dissolve the calcium crystals in the bony matrix, which releases calcium ions into the bloodstream

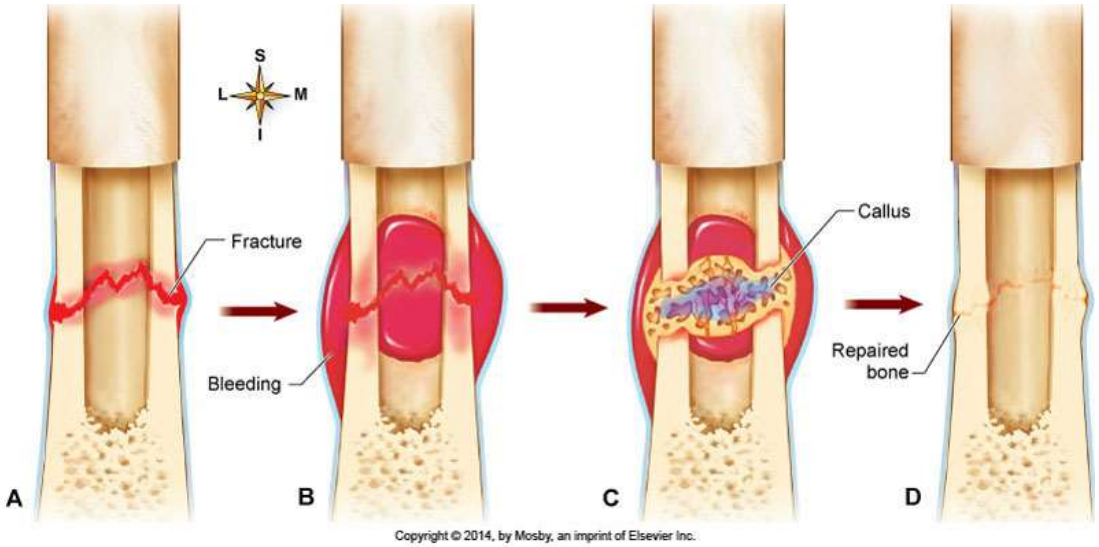
Excessive force, or metabolic bone disorders such as cancer can cause bones to fracture



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Figure 8-35 – Patton and Thibodeau

Fig. 8-36 – Patton and Thibodeau



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Fig 12 – 29 Kowalczyk

A. Fracture
B. Fracture hematoma
C. Internal callus forms within 2-3 days to 1 week. External callus within 4-6 weeks (inhibited by infection)
D. Total remodeling completed within months; fracture site may or may not be seen on radiographs.

Proper healing of a fracture depends on:

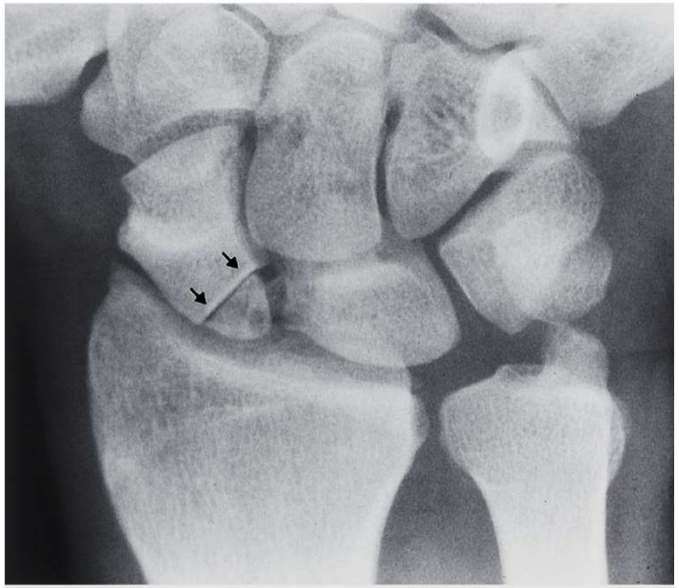
- immobilization (casting, splinting, pinning, or plating)
- proper alignment and reduction
- good vascularity and blood supply
- proper nutrition and normal hormonal levels
- appropriate exercise.
- improper healing can lead to delayed union, malunion, or nonunion.



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Eisenberg (7th ed.) fig. 4-88:callus formation
4-94: malunion due to misalignment 4-95:
Nonunion 20 years after initial injury

Fractures

- Most **common skeletal abnormality** seen in radiology

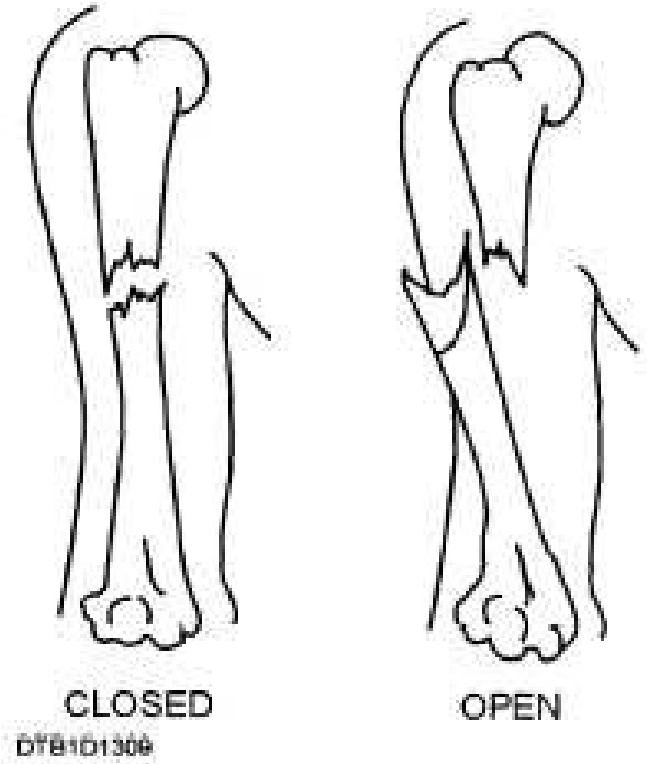
- **Fracture**: disruption of bone caused by mechanical forces applied either directly to bone or transmitted along the shaft of a bone

General Terms

- **Closed Reduction** – realignment of bone without the need of surgery
- **Open Reduction** – realign the bone fracture into its normal position through surgery
- **Internal fixation** – stabilize the bone through the use of steel, rods, screws, or plates
- **External fixation** – stabilize the bone through the use of casts, splints

Open and Closed

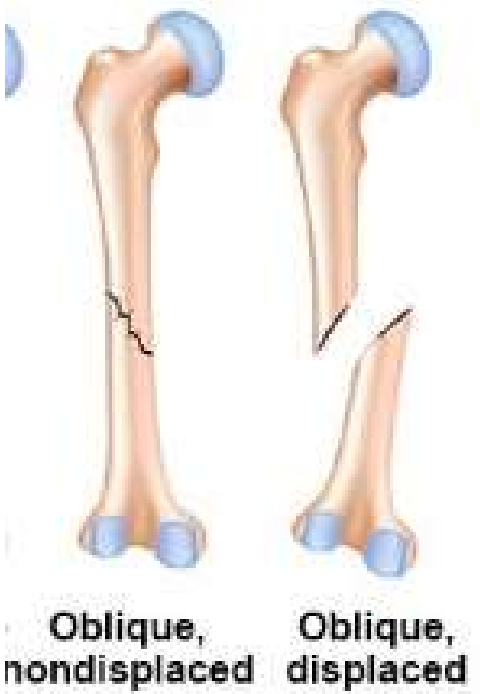
- **Open**: when bone penetrates the skin (compound)
- **Closed**: when bone does not penetrate the skin (simple)



Title	Fracture
Author	Integrated Publishing Inc
Link	http://medical.tpub.com/14274/css/Fractures-199.htm

Displaced and Non-Displaced

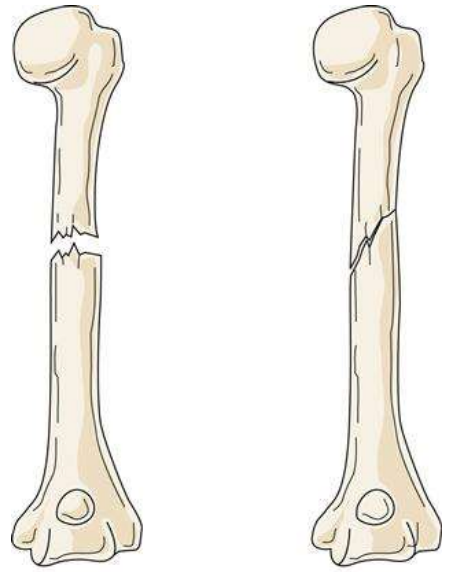
- Refers to alignment of the bone
- Displaced: two ends of the bone where the fracture occurs do not line up straight
- Non-displaced: bone breaks completely or partially but does not move and maintains its proper alignment



Title	Bone Fractures
Author	Family GP Online
Link	http://afairgo.net/fracture-of-bone/

Complete and Incomplete

- **Complete**: Fracture extends through entire cortex
- **Incomplete**: Fracture does not go all the way through the bone



Title	Alterations in Musculoskeletal Function
Author	Carol L. Danning
Link	https://basicmedicalkey.com/alterations-in-musculoskeletal-function-trauma-infection-and-disease/

Non-comminuted and Comminuted

- **Comminuted**: bone breaks into 3 or more fragments



- **Non-comminuted**: bone breaks into 2 parts

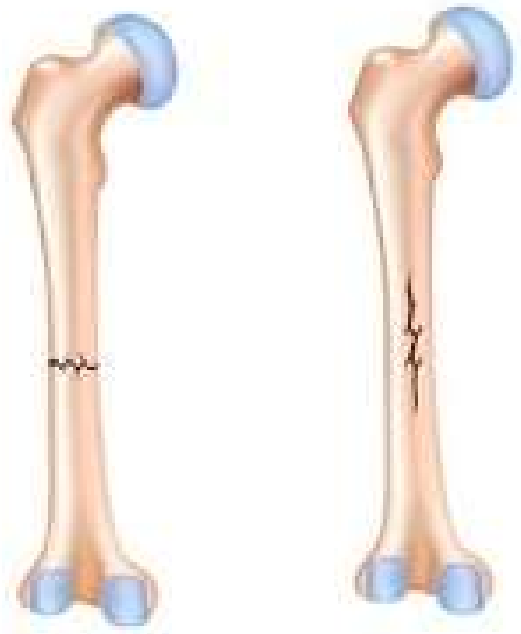


Title	Clavicle (Collar Bone) Fracture
Author	Dr. David Duckworth
Link	https://www.drdavidduckworth.com.au/patient-conditions/clavicle-fractures

Transverse and Linear

- **Transverse**: break is at right angle of the long axis of the bone

- **Linear:** break that is parallel to the long axis of the bone (also called longitudinal)



Title	Bone Fractures
Author	Family GP Online
Link	http://afairgo.net/fracture-of-bone/

Oblique and Spiral

- **Oblique**: fracture that runs obliquely through the long axis of the bone. Course of approximately 45 degrees to the long axis caused by angulation

- **Spiral**: fracture that encircles the shaft via torsional force

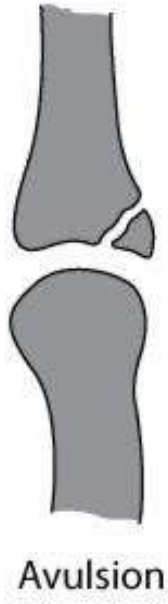


Title	Bone Fractures
Author	Family GP Online
Link	http://afairgo.net/fracture-of-bone/

Avulsion and Stress

- **Avulsion**: piece of bone is broken off due to indirect tension from a ligament or tendon

- **Stress**: tiny cracks in bone due to repetitive force due to overuse (continual jumping)





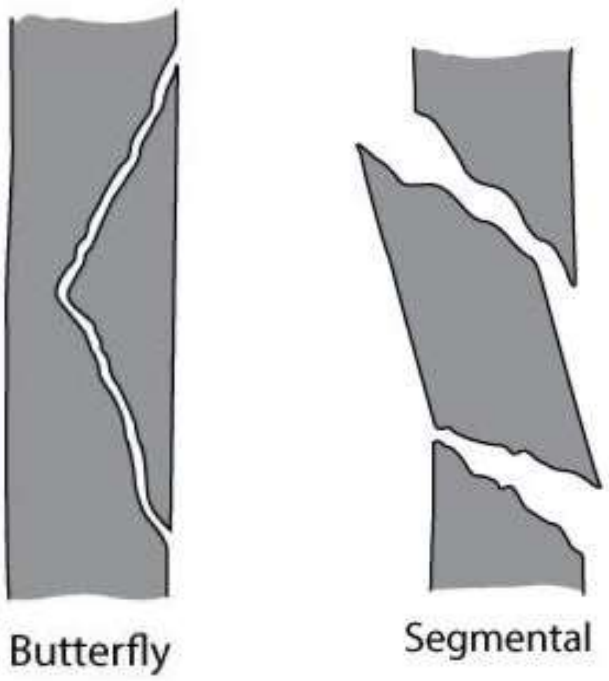
Title	Stress Fracture
Author	Pramod Kerkar, MD, FFARCSI
Link	https://www.epainassist.com/sports-injuries/foot-and-heel-injuries/stress-fracture-of-the-foot

Eisenberg Fig 4-87

Butterfly and Segmental

- **Butterfly:** elongated triangular fragment detached from two larger fragments of bone

- **Segmental**: segment of the shaft isolated by proximal and distal lines of fracture



Eisenberg Fig 4-87

Compression

- **Compression**: Bones are forced against each other and wedged



Case courtesy of Dr Sajoscha Sorrentino, Radiopaedia.org, rID: 20123

Depressed

- **Depressed**: bone which gets depressed and indents inwards to the body



Title	Depressed skull fracture
Author	Jose Caballero Alvarado, MD, Hospital Regional Docente de Trujillo
Link	http://www.trauma.org/index.php/main/image/956/C9

Greenstick fracture

- Incomplete fracture of long bones in children
- Convex side breaks and concave side bends
- Name comes from immature branch on tree that is "green"



Case courtesy of Dr Sharifah Intan, Radiopaedia.org, rID: 31084

Pathological

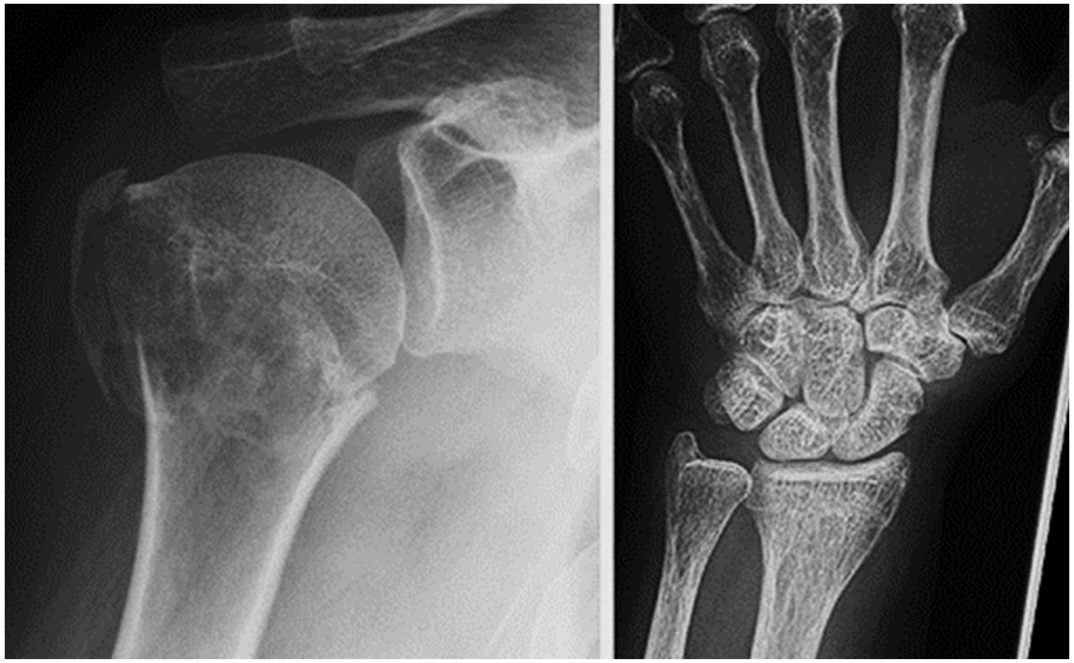
- **Pathological fracture**: occurs in bone where weakness is caused by some sort of pathology (ie. Tumor, cyst,infection, metabolic bone disease)



Eisenberg Fig 4-96

Impacted

- Impacted: bone driven into another bone



Title	Fracture General Principles
Author	Annelies van der Plas, resident radiology LUMC
Link	http://www.startradiology.com/the-basics/fracture-general-principles/

Impacted fracture

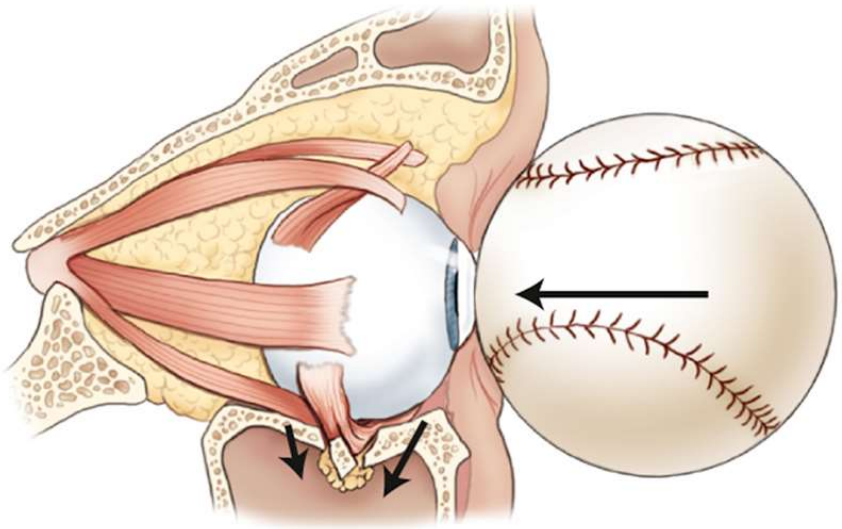
Case courtesy of Assoc Prof Frank Gaillard, Radiopaedia.org, rID: 2717



Impacted subcapital fracture of left femoral neck

Blowout fracture

- **Blowout**: Fracture of the floor of the orbits and sometimes the medial wall due to blunt object
- Traumatic blow to the face



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Bontrager 11-83

Blowout fracture

Case courtesy of Assoc Prof Frank Gaillard, Radiopaedia.org, rID: 4880



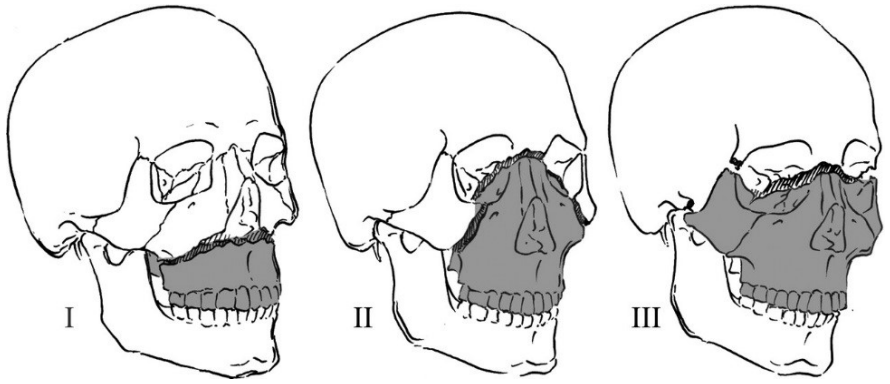
Contrecoup

- A fracture that results on the opposite side of the point of impact

Le Fort Fractures

- Le fort: fracture of the maxilla
- Involves separation of all or a portion of the midface from the skull base
- 3 types: I,II and III

Le Fort Fractures



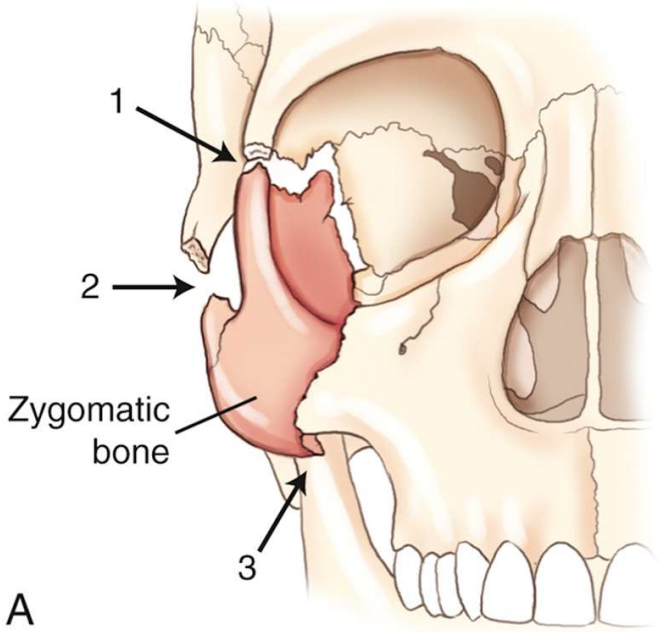
Type I is a floating palate-horizontal maxillary fracture, separates alveolar processes and teeth from the upper face

Type II is a floating maxilla-pyramidal fracture up to nasion or frontal process of maxilla

Type III is a floating face-transverse fracture, craniofacial dislocation

Tripod fracture

- **Tripod**: fracture of the zygoma in 3 places
- Caused by a blow to the cheek
- Involves orbital process, arch of zygoma, and maxillary process



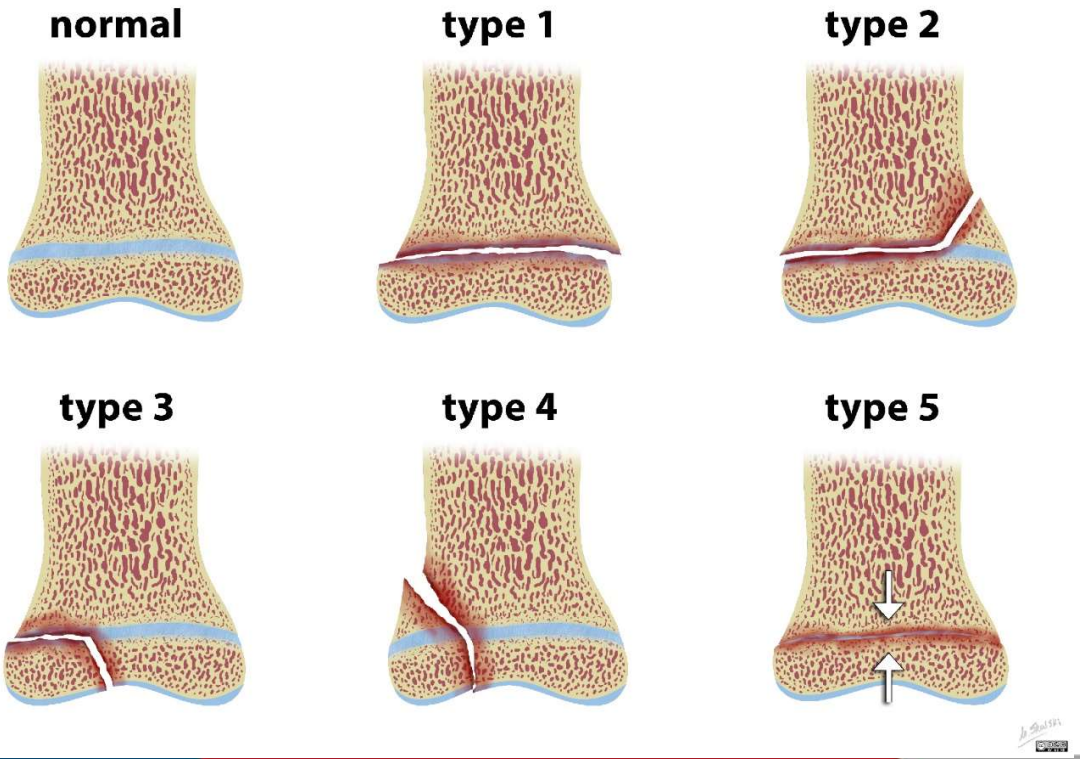
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Salter Harris

- Fracture that involves the epiphyseal (growth) plate
- Different classifications depending on how severely fractured
- Types I-V

Salter Harris Classifications

- Case courtesy of Dr Matt Skalski, Radiopaedia.org, rID: 27144



Bennett Fracture

- Fracture at the base of the first metacarpal bone
- Caused by forced abduction of the thumb

Bennett fracture

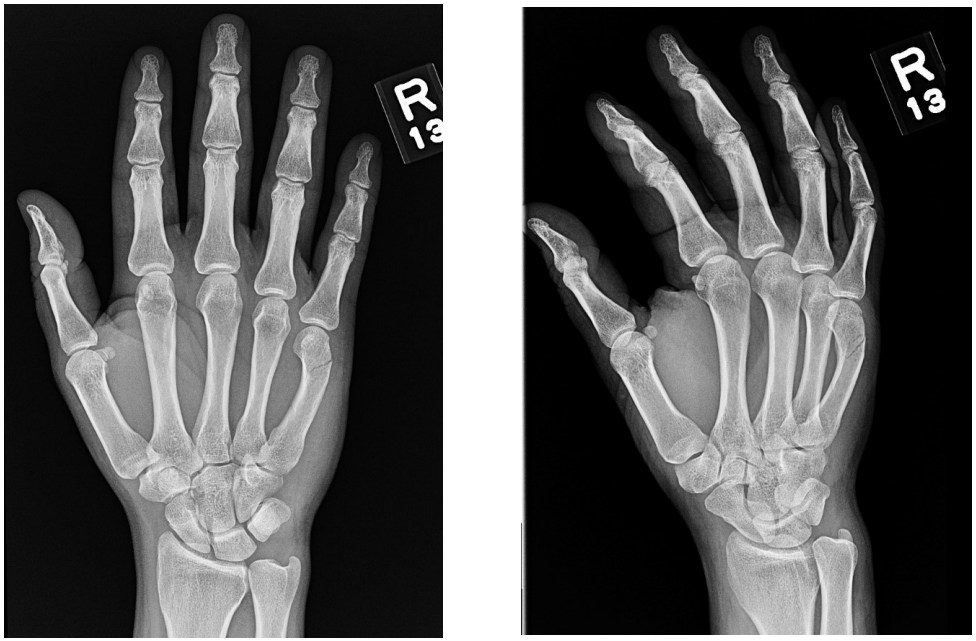


Boxer's Fracture

- Fracture of the fifth metacarpal bone
- Most common metacarpal fracture
- Derived from a clenched fist striking a solid surface
- 95% of patients are young males

Boxer's fracture

- Case courtesy of Dr Hani Salam, Radiopaedia.org, rID: 13088



Boxer's fracture

- Case courtesy of Dr Henry Knipe, Radiopaedia.org, rID: 26184



Colles Fracture

- Transverse fracture of the distal radius with posterior displacement
- Results from a fall on an outstretched hand
- FOOSH

Colles fracture

- Case courtesy of Assoc Prof Frank Gaillard, Radiopaedia.org, rID: 12382



THANKS