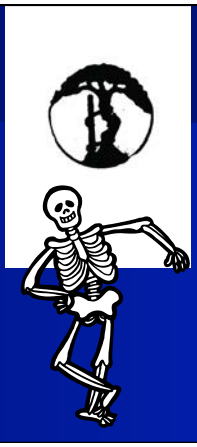
Fractures
Classifications, Healing

Orthopaedics:

Ortho – straight

Paedics – children

Musculoskeletal systems
Bones, joints, muscles, tendons, ligaments, peripheral nerves, blood vessels.
special tissue:– meniscus, bursae, cartilage etc.



Divisions of Orthopaedics

Trauma Surgery
Spine Surgery
Arthroscopy & Sports Medicine
Hand Surgery
Paediatric Orthopaedics
Joint Replacement (Arthroplasty)
Oncology

Trauma - 80 % (worldwide)

Our setup > 95%

Trauma:

Neglected Disease
Leading cause of death of young people(<40)

- 300 BC management of fracture at Naga-ed-Der,
- Hippocrates & Celsus described wooden splintage
- El Zahrawi used **POP derivatives** on #
- Antonius Mathijsen used POP bandage & derivatives
- Thomas invented traction, Gooch applied functional bracing
- A. Pare managed compound #
- 1875 Joseph Lister used first wire fixations

Fracture

Break in the continuity of bone: cortex

Most of time, break: complete, displaced

Causes of fracture:

considerable strength to resist stress

a)Traumatic incidence
b) Repetitive stress
c) Abnormal weakening – pathological fracture

Why classify fractures?

- As a Treatment Guide
- To Assist with Prognosis
- To assist in Documentations
- To Speak A Common Language

Types of Classifications

- On the Basis of Aetiology
- Based on the Displacement
- Based on the Morphology
- Relationship with external environment
- Anatomic description
- Salter-Harris classification
- AO classification

On the Basis of Aetiology

Traumatic Fracture

Sustained due to trauma
Normal bone generally get fractured
Fractures from fall, RTA, fight etc.

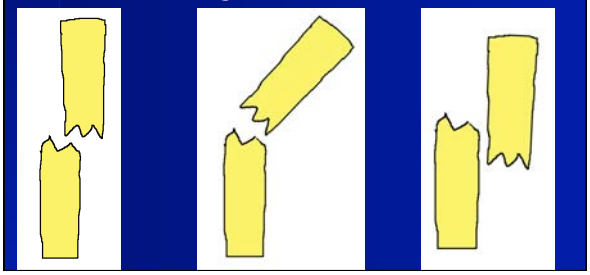
Pathological Fracture

Based on the Displacement

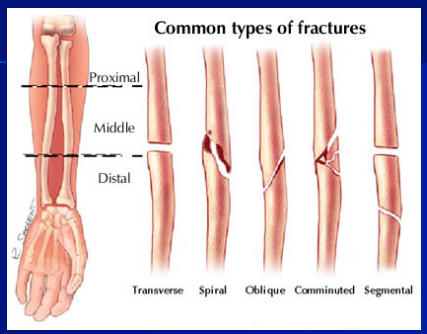
- Un-displaced
- Displaced

- Displacement: the amount the pieces of a fracture have moved from their normal location
- Distal fragment in respect to the proximal one
- Subdivided into 3 sub-categories: translation, angulations, and shortening

- Translation : is sideways motion of the fracture
- Angulation: amount of bend at a fracture described in degrees.
- Shortening: amount a fracture is collapsed expressed in centimeters.



Based on the Morphology



Relationship with external environment

Closed Fracture
Open (Compound) fracture

- **Inside Out**
- **Outside In**
- **Classification** (Gustilo & Anderson , 1976)
  - **Grade 1 clean wound less than 1 cm.**
  - **Grade 2 wound is more than 1cm. long and minimal soft tissue damaged**
  - **Grade 3 extensive soft tissue injury or high energy trauma**

Open fracture

- Grade 3 A adequate soft tissue coverage
- Grade 3 B inadequate soft tissue coverage
- Grade 3 C associated vascular injury that required repaired regardless of size of wound

Anatomic description - Location

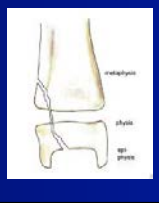
- anatomic location of the fracture by giving the bone involved & location on the bone
- Examples are: distal radial shaft, proximal 1/3 humeral shaft, intra-articular distal tibial

Salter-Harris classification

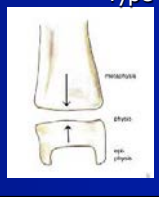
Type I

Type II

Type III



Type IV

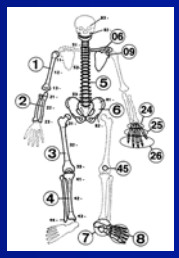


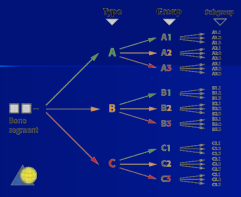
Type V

AO classification

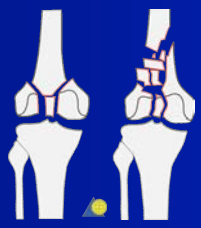
Alpha-numerical system of classification
Number; 1, 2, 3
Alphabet; A, B, C

- Which bone?
- Where in the bone is the fracture?
- Which type?
- Which group?
- Which subgroup?





33 – C3.3

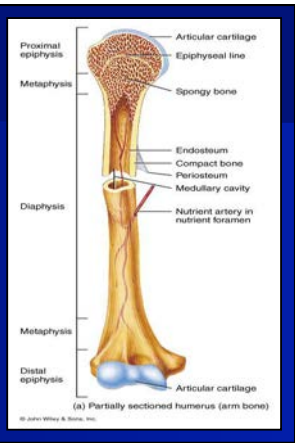


Fracture Healing

- No different from soft tissue healing
- End result is mineralized mesanchymal tissue
- Occurs through continuous series of stages which starts immediately after a bone fractures
- Healing occurs in most fractures whether they are splinted or not

Bone Anatomy

- Diaphysis
- Metaphysis
- Epiphysis – Prox/ Dist
- Epiphyseal line
- Periosteum
- Cortical bone
- Cancelleous bone
- Articular Cartilage
- Medullary cavity
- Marrow
- Nutrient artery



- Composition of Bone: bone cell & extra cellular matrix
  Matrix – organic, inorganic
  inorganic matrix – calcium, phosphorous
- Bone cells:
  Osteoblasts, osteocytes, osteoclasts
- Remodelling of bone:
  Bone has ability to alter its size, shape and structure in response to stress.
  Happens through out life

- Blood Supply of Bone

Nutrient artery: enters from middle, divides into two ends, each again divided

Metaphyseal vessels: many small vessels derived from anastomosis around the joint, pierce metaphysis

Epiphyseal vessels: these vessels enter directly into epiphysis

Periosteal vessels: has rich blood supply, many small vessels enter the bone

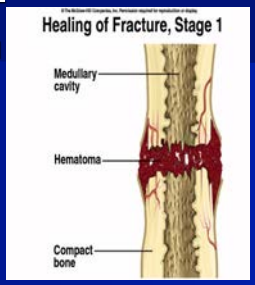
Stages of Cortical Bone Healing

Begins to heal after #,

- Stage of Haematoma
- Stage of Granulation Tissue
- Stage of callus
- Stage of Remodelling
- Stage of Modelling

- Stage of Haematoma

Up to 7 days, blood from Bone, the periosteum & local Soft tissue stripped from #, Some osteocytes die, others Sensitized to respond by Differentiating into daughter Cells, this cell contribute healing



- Stage of Granulation Tissue

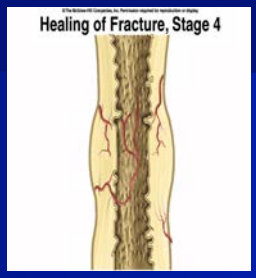
for 2-3 weeks, the sensitized daughter cells produce cells, which differentiate, organize to provide blood vessels, fibroblasts, osteoblasts.
These cells form soft granulation Tissue between fracture Fragments, cellular tissue gives soft tissue,

Stage of callus

4-12 weeks, granulation tissue differentiates further, creates osteoblasts, theses cells lay down an intercellular matrix, impingement with calcium Salts – formation of callus (woven Cells)
Callus- first sign of union
Seen on X-ray, after 3 weeks of #, Slower in adults than children, Slower in cortical bone than cancelleous

Stage of Remodelling

Slow process, 1-4 years
The callus (woven cell) replaced by mature bone
Pocket of callus is replaced By pocket of lamellar bone



Stage of Modelling

Bone is gradually strengthened
Shaping occurs at endosteal, periosteal surface
Major stumulus comes from wt. bearing, muscle strength

Healing of Cancelleous Bone

Follow different pattern, bone uniform spongy Tissue, no medullary cavity, large area of contact Between the trabeculae
Direct union: Haematoma, granulation formation – Mature osteoblasts day down woven bone (callus) In intercellular matrix, two fragments unite

Factors Affecting Bone Healing

Age of the patient
Type of bone
Pattern of fracture
Disturbed patho-anatomy
Type of Reduction
Immobilization
Compounding
Compression at fracture site
Electrical stimulation

Thank You !