Orthopaedics

World of Revision

Marrow

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Instructions

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Contents

Orthopaedics

BASICS OF ORTHOPAEDICS AND TRAUMA

----- Active space -----

Anatomy of Bone

00:01:50

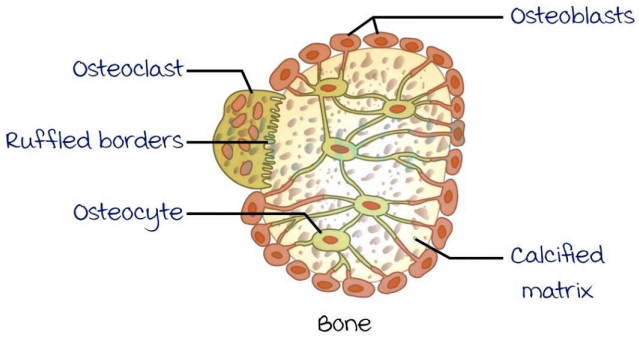
Constituents :

Bone (Osteon)

- Organic component/ Osteoid
  - Cells (5 – 10%)
    - Osteoblast :
      - Cell type : Mononuclear cells.
      - Function : Lays down osteoid matrix.
      - Rich in alkaline phosphatase.
    - Osteoclast :
      - Cell type :
        - Monocyte aggregates.
        - Multinucleated giant cells.
      - Function :
        - Phagocytic.
        - Bone resorption & remodelling.
      - Rich in TRAP & carbonic anhydrase.
      - Least in number.
    - Osteocyte :
      - Cell type : Mature/resting osteoblast.
      - Features :
        - Most abundant.
        - Longest life span.
  - Proteins (90 – 95%) :
    - Collagen : Type I. (Principal protein)
    - Osteocalcin.
    - Osteonectin.
- Water : ↑ in children
- Inorganic component : Calcium hydroxyapatite (Principal mineral)

Note :

- Menisci, ligaments & tendons : Collagen type I.
- Hyaline cartilage : Collagen type II.



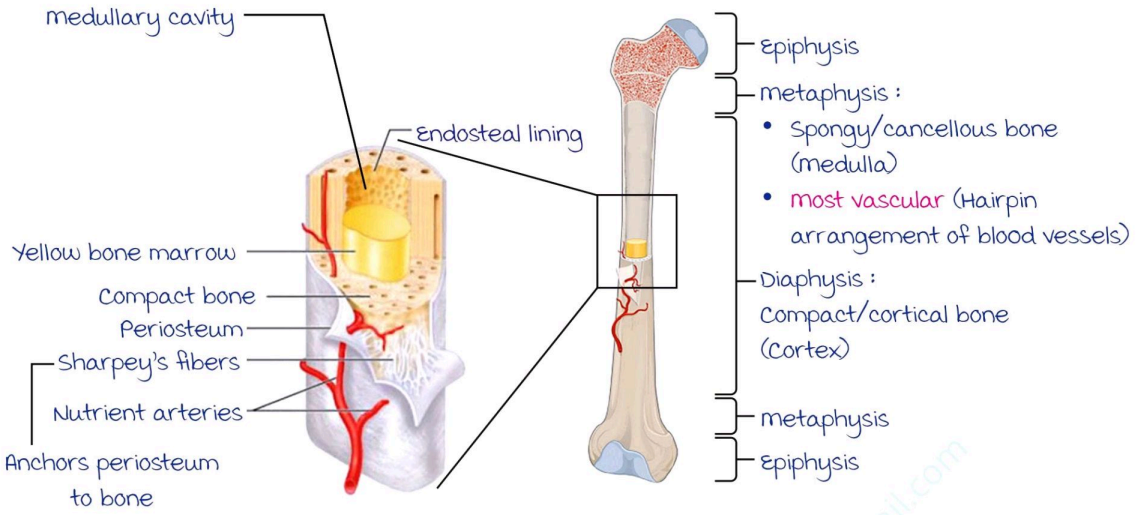
Bone markers :

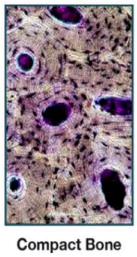
Formation markers	Breakdown markers
• Pro-collagen • Osteocalcin • Osteonectin • Alkaline phosphatase (ALP) : Bone turnover marker	• Hydroxyproline • Hydroxylysine • N & C telopeptide • Tartrate Resistant Acid Phosphatase (TRAP)

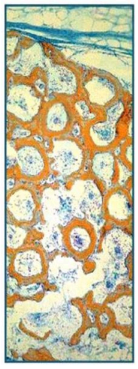
----- Active space -----

Parts of Bone :

Outer cortex & inner medulla.




Compact Bone


Cancellous Bone

Fractures

00:06:39

Diagnosis : Clinical (Pain, deformity, abnormal mobility)

↓

Radiological (X-ray).

Causes :

- Significant trauma
- Insignificant trauma → Stress # (Normal bone ; repetitive abnormal loading) : Point tenderness ⊕
- → Pathological # (Abnormal/weak bone) : Pain before fracture d/t pre-existing lesion.

Localized causes :
- Infection.
- Ischemia.
- Lesions.
- Cysts.

Generalized causes :
- Osteoporosis (m/c) : Spine > Hip > Colle's.
- Metastasis (2nd m/c) : Proximal femur & spine.
- Rickets/osteomalacia.

----- Active space -----

Pathological fractures :

Mirel's criteria for management :

- Score < 8 → Treat underlying cause.
- Score ≥ 8 → Prophylactic internal fixation + Treat underlying cause.

Pathological # : Head of humerus

Stress fractures :

- Pain after activity (Sudden ↑ in intensity/frequency).
- Lower limb bones > Upper limb bones.
- X-ray positive : 2 – 3 wks later.
- IOC : MRI (Soft tissue edema ⊕) → Detects occult fractures.
- Multiple stress # (IOC) : Bone scan.
- m/c sites :
  a. Tibia.
  b. Metatarsal : March fracture → 2nd > 3rd metatarsal ; Neck > Shaft.

March fracture

Fracture Displacement & Healing

00:13:33

Displacement :

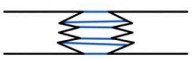
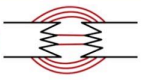
Depends on distal fragment of fracture.

Fracture Healing :

Requirements :

1. Reduction.
2. Immobilisation.

Types :

	Primary healing	Secondary healing (m/c)
Type of healing	Direct/intramembranous healing	Indirect/endochondral healing
Callus formation	Callus ⊖ 	Callus ⊕ 
Movement at # site	⊖ (Absolute stability)	Micromovements ⊕ (Relative stability)
Devices	• Compression plates • Lag screws	• Pop/braces • External fixation • Bridge plating • Intramedullary nailing

Rigid fixation (1° healing)

Callus formation (2° healing)

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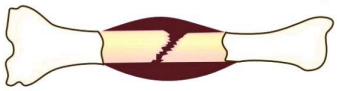
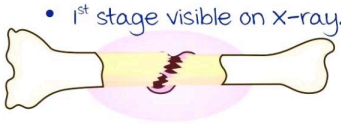
Stages of secondary healing :

1. Hematoma formation : Chemotactic factors aggregate fibroblasts



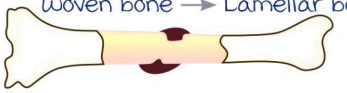
2. Granulation tissue formation : Inflammation + fibroblasts

3. Callus formation :
   - Fibroblasts → Osteoblasts.
   - 1st stage visible on X-ray.



4. Consolidation : Osteoid + calcium = rigid callus irregular collagen (woven bone)

5. Bone remodelling : Woven bone → Lamellar bone.



Malunion & Non-Union

00:20:10

Bones with ↑risk of malunion vs. non-union :

that undergo malunion rarely undergo non-union (& vice versa).

Malunion	Non-union
• Clavicle (m/c) • Supracondylar humerus • Colle's • Intertrochanteric (Extracapsular) femur	• Lower 1/3rd of tibia (m/c) • Scaphoid • Lateral condyle of humerus • Neck of femur (Intracapsular) • Neck of talus

Malunion :

- Healing in anatomically abnormal position.
- m/c cause : Improper reduction.
- TOC : Osteotomy (Cut, realign & fix bone).

Angulated malunion Osteotomy

Non-Union :

Factors affecting fracture healing :

- Patient : Age, nutrition, tobacco, alcohol.
- Improper treatment : Improper immobilization (m/c) ; inadequate reduction.
- Type of # : Open, contaminated, interposed.
- Tissue : Ischemia.

Types :

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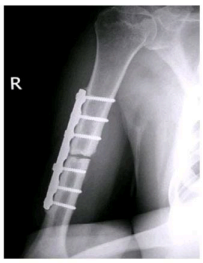
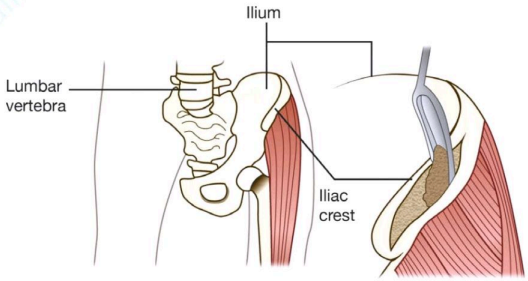
	Hypertrophic	Atrophic
Fracture	Smooth & sclerosed ends + visible fracture line	
X-ray appearance		
Callus formation	Exuberant	Absent
Bone biology	Good	Abnormal
Immobilisation	Improper	±
Treatment	Immobilization	Autologous bone grafting

Autologous bone graft :

m/c site : Iliac crest.

Characteristics	Substitutes
Osteogenesis (Form new bone)	-
Osteoconduction (Act as scaffold)	Calcium phosphate/sulphate (PmmA)
Osteoinduction (Stimulates host to form new bone)	Bone morphogenic protein



Bone graft extraction

Management of Fractures

00:24:14

X-Ray Views :

AP & lateral view : To determine displacement.

Special x-ray views :

X-ray view	Oblique view of wrist	Judet view	Merchant/skyline/ sunset/sunrise view	Mortise view
Pathology	Scaphoid #	Acetabulum #	Patella #	Ankle #

Rx :

Temporary stabilization → Definitive Rx

- Splint
- Slab
- Traction device

Conservative :

- Splint
- Slab
- Traction device
- Cast : ↑Risk of compartment syndrome in acute injury

Surgical (Best) : Internal fixation

- Upper limb : Plates & screws.
- Lower limb : Nails/rods.

----- Active space -----

Fractures of necessity : Require surgical management.

- Intra-articular # : Lateral condylar humerus #.
- Displaced patella & olecranon #. Fixed using TBW.
- Monteggia/Galeazzi #.
- Neck of femur #.

Common splints/braces :

Splints/braces	Use
• Thomas splint • Bohler Braun splint	Femur #
Dennis brown splint	CTEV
Cock up splint	Wrist drop/Radial nerve palsy
Knuckle bender splint	Claw hand/Ulnar nerve palsy
Toe raising/Foot drop splint	Foot drop/Common peroneal nerve injury
Aeroplane splint	Brachial plexus injury
• Milwaukee brace • Boston brace	Scoliosis

Traction systems :

Traction	Use
Gallow's traction	Shaft of femur # (< 2 yrs)
Dunlop's traction	Supracondylar humerus #

Common casts :

Cast/slab	Use
Hanging cast/U slab	Shaft of humerus #
Hand shaking cast	Colle's #
Glass holding cast	Scaphoid #
Cylinder/tube cast	Patella #
Patella tendon bearing (PTB) cast	Shaft of tibia #

Open Fractures

00:33:13

Fracture + break in skin and underlying soft tissue.

- m/c pathogen : Staph. aureus.
- Fracture hematoma escapes outside.

} Affects healing