General Principles of Fractures

By: Ahmad Al-Masri
BAU
Bones tissue

(a) Epiphysis
- Spongy bone (spaces contain red bone marrow)
- Compact bone
- Yellow bone marrow
- Blood vessel
- Periosteum
- Central cavity (contains yellow bone marrow)

(b) Diaphysis
- Compact bone
- Spongy bone
- Osteon
- Blood vessels and nerve in central canal
- Osteoblasts
- Lacuna
- Osteocyte
- Canalicula
• Types of Bone:
  1) Long bones
  2) Short bones (bones of the wrist and ankle)
  3) Flat bone (sternum, and most skull bones)
  4) Irregular bones (vertebrae and hip bones)
  5) Sesamoid bones (patella)
Histology of bone tissue

• 4 cell types make up osseous tissue

1) Osteoprogenitor (which develop into Osteoblasts)

2) Osteoblasts (bone forming cells) → synthesis & mineralization of bone during initial bone formation & later bone remodeling.

3) Osteocytes → mature bone cells which derived from osteoblasts, it exchange nutrients & waste with blood.

4) Osteoclasts → bone resorbing cells that’s responsible of growth, maintenance and bone repair.
Zones of Growth in Epiphyseal Plate (growth plate)

- **Zone of resting cartilage:**
  - anchors growth plate to bone
- **Zone of proliferating cartilage:**
  - rapid cell division (stacked coins)
- **Zone of hypertrophic cartilage:**
  - cells enlarged & remain in columns
- **Zone of calcified cartilage:**
  - thin zone, cells mostly dead since matrix calcified
  - osteoclasts removing matrix
  - osteoblasts & capillaries move in to create bone over calcified cartilage
Fracture

- A fracture is a break in the structural continuity of bone. It may be a crack, a crumpling or a splintering of the cortex.
- The resulting bone fragments may be displaced or undisplaced.
- If the overlying skin remains intact, it is a closed fracture.
- If the skin or a body cavity is breached, it is an open/compound fracture.
- Fractures are caused by:
  1) Injury m.c
  2) Repetitive stress
  3) Abnormal weakening of the bone.
Fracture due to INJURY

Direct force

- Bone breaks at the point of impact, soft tissues are also damaged.
- A direct blow usually splits the bone transversely or ‘butterfly’ fragment.
- Damage to the overlying skin is common

Indirect force

- Bone breaks at a distance from where the force is applied; soft-tissue damage at the fracture site is not common.
- Most fractures are due to a combination of forces
  • Twisting → spiral fracture.
  • Compression → short oblique fracture.
  • Bending → triangular ‘butterfly’ fragment.
  • Tension → transversely.
FATIGUE or STRESS fractures

occur in normal bone which is subjected to repeated heavy loading.

\[ \downarrow \]

creates minute deformations that initiate the normal process of remodeling

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combination of bone resorption & bone formation

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repeated and prolonged exposure to stress and deformation

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bone resorption occurs faster than replacement

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leaves the area liable to fracture.

Typically in:
- Athletes
- Dancers
- Military personnel
Cont.

• A similar problem exists in people who are on medication that alters the normal balance of bone resorption and replacement; stress fractures are increasingly seen in patients with chronic inflammatory diseases who are on treatment with steroids or methotrexate.
PATHOLOGICAL fractures

• Fractures may occur even with normal stresses if the bone has been weakened by:
  1) change in its structure (e.g. in patients with osteoporosis, osteogenesis imperfecta or Paget’s disease, bisphosphonate therapy)
  2) lytic lesion (e.g. a bone cyst or a metastasis).
Examples:-

- Comminuted fracture.
- Open fracture.  Abs?
- Stress fracture.  M.c. place?  X-ray!!  CT/MRI?
- Compression fracture.  M.c. place?
- Pathological fracture.
TYPES OF FRACTURE

• Fractures are divided into a few well-defined groups:

• COMPLETE FRACTURES:
The bone is split into two or more fragments.

• INCOMPLETE FRACTURES:
The bone is incompletely divided and the periosteum remains in continuity.

eg:- greenstick fracture where the bone is buckled or bent, seen in children more than adults.