Objectives

- Learn the terminology associated with the healing of fractures.
- To know the five stages associated with fracture healing.
- To have some fun.

Result of Injury

1. Periosteum ruptures
2. Haversian system ruptures
3. Muscle tearing
4. Skin breach

STAGE OF HAEMOTOMA

- Blood seeps from the fracture site immediately.
- The ensuing haemotoma is contained by the periosteum.
- The periosteum may be stripped from the bone.
- Small capillaries may be divided stopping the blood supply.

Stage of Haemotoma

- Bleeding contained by the periosteum.
- Blood clots closing the fracture.
- Revascularized by in-growth of new vessels.
**Stage of Haemotoma**

Bleeding contained by the periosteum.
Blood clots closing the fracture.
Revascularised by in-growth of new vessels.

**STAGE OF SUBPERIOSTEAL AND ENDOSTEAL CELLULAR PROLIFERATION**

- Cell growth from the deep surface of the periosteum begins.
- Precursors to osteoblasts deposit intercellular substance.
- Collar of active tissue encircles the site.
- Bridges of tissue grow towards each other.

**STAGE OF CALLUS**

- Cell tissue grows from each fragment and matures.
- Osteoblasts develop to form bone.
- Chondroblasts form cartilage.
- Immature bone forms a callus - ‘woven bone’.
- Visible mass can be seen on radiograph.

**Callus Formation**

1. Primary callus formation active for a few weeks.
2. Less vigorous formation from the medullary canal.

**External Bridging Callus**

If the periosteum is not torn and bony apposition is intact, external bridging callus formation begins.

**STAGE OF CONSOLIDATION**

- Woven bone is transformed by osteoblasts to form mature bone.
- Large mass of woven bone becomes hardened by deposits of calcium salts.
STAGE OF REMODELLING

- Bulbous collar of hardened bone surrounds the fracture site.
- Collar is larger when periosteum has been stripped.
- Callus is usually large in children.
- Bone strengthens along lines of force and excess bone is reabsorbed.

REPAIR OF CANCELLOUS BONE

- Broad area of contact between fragments.
- Open network of trabeculae affords easier penetration by bone forming tissue.
- External callus not always present.
- Haemotoma -> Cell Proliferation -> Woven Bone.

RATE OF UNION

- Union is usually quickest in children with callus visible on X-ray within 2-3 weeks.
- Consolidation can occur within 4-6 weeks in children.
- Long bone fractures in adults may take up to 3 months to reach consolidation.

SUMMARY OF THE HEALING PROCESS

Further Reading

- [http://www.mate.tue.nl/mate/pdfs/4771.pdf](http://www.mate.tue.nl/mate/pdfs/4771.pdf)