

# Principle of fracture management

## Definitions

A *fracture* is a break in the continuity of bone.

A *dislocation* is a complete disruption of a joint such that there is no contact between the articular surfaces of the bones making up the joint while *subluxation* (sub=partial, luxation=dislocation) is an incomplete disruption with the bones still retaining some contact.

## Mechanism of injury

### Direct force

1. Tapping force causes transverse fractures
2. Crushing force leads usually to comminuted fractures.

### Indirect force

3. Bending force results in fractures with butterfly fragments.
4. Twisting or rotational force leads to spiral fractures.
5. Compression force leads to short oblique fractures.
6. Bending, twisting and compression force.
7. Tension leads to transverse fractures or avulsion of a small bone fragment at the point of insertion of the tendon.

## Healing

### Stages

1. Inflammation
2. Demolition (of haematoma)
3. Callus formation
4. Woven bone
5. Remodelling leading to matured bone formation.

### Duration of healing

	<i>Upper limb</i>	<i>Lower limb</i>
<i>Children</i>	3-4 weeks	6-8 weeks
<i>Adult</i>	6-8 weeks	10-12 weeks

## Clinical features

### History

- Mechanism of injury
- Duration
- Site of injury
- Past medical history
- Last meal

- Current medications

### Examinations

#### General (systemic) examination

- Evidence of shock
- Associated injury e.g. to head, chest etc.
- Systemic diseases that may lead to pathological fracture e.g. rickets, osteomalasia etc.

#### Local examination

##### Look

- Swelling
- Wounds
- Deformity

##### Feel

- Tenderness
- Distal pulses
- Test for sensation

##### Move

- Abnormal movement
- Distal & proximal joints range of movement

## Radiology

Plain X-ray is the most important diagnostic test. The following rules must be observed (*rule of 2*)

1. At least **2** views at right angle to each other.
2. The **2** adjacent joints must be included.
3.  $\pm$  **2** limbs in some cases.
4.  $\pm$  **2** times in some cases.

## Fracture description

1. **Is it open or is it close?**  
If open, is it from within or without?
2. **Site**  
Which bone?  
Which part i.e. distal, middle or upper third?
3. **Fracture line**
  - Transverse
  - Oblique
  - Spiral
  - Segmental
  - Comminuted.
4. **Displacement**
  - Angular
  - Rotational
  - Shift (displacement)
  - Impaction

- Distraction

### Causes of displacement

- Gravity
- Contraction of the muscles attached to the fragments.
- Movement of the patients.

### **Treatment**

#### General management.

- First aid
- Transport
- Shock and haemorrhage
- Pain
- Associated injuries
- Prophylaxis against tetanus when indicated.
- Antibiotics when indicated.

#### Local fracture management

Principle of fracture management

1. **Reduction:** this is the restoration of the fractured bone to its normal anatomical alignment.
2. **Immobilisation:** this holds the reduction while healing taking place.
3. **Rehabilitation:** this restores back the function of the limb to its pre-injury state.

### **Methods of reduction**

1. By **gravity** e.g. in certain humeral fractures and shoulder dislocations.
2. **Close manipulation** under anaesthesia (usually general) and preferably with good muscle relaxation. The principle behind this is to reverse the deforming force leading to the fracture.
3. **Traction** e.g. in femoral fractures and old unreduced fractures and dislocations.
4. **Open reduction** i.e. reduction by surgical means. This is indicated only when close reduction is either *impossible* or *it will be inaccurate*.

#### When is close reduction impossible?

1. When there is soft tissue interposition.
2. When fragments are too small to be manipulated by close method.
3. When fragments are trapped in the joint.

#### When is close reduction inaccurate?

1. Fractures involve joint surfaces.
2. Some radius and ulna fractures in the adult.

### **Methods of immobilisation**

1. External splints e.g. Casts and External fixation.
2. Internal splints or fixation e.g. screws, plates and intermedullary nails.
3. Continuous traction e.g. skeletal or skin tractions.

### **1. Types of external splint**

**A) Plaster of Paris (P. O. P.):** certain principles must be observed:

1. Immobilise the two adjacent joints to the fracture.
2. The limb must be adequately padded using cotton wool (Velban or Sofban).
3. An enclosing i.e. circumferential cast *must* never be applied to a freshly fractured limb.

**Advantages of POP are:**

1. It is cheap.
2. It is easily available and
3. It is safe and easily applied.

**Its disadvantages are:**

1. It is heavy
2. It is easily spoiled by water.
3. It is relatively radio-opaque.
4. Wounds are not easily assessable in casts.
5. Joint stiffness is common
6. Impaired blood flow may lead to ischaemia and Volkmann ischaemic contracture.

**Scotch cast tape** is an alternative to POP. It is light, very rigid, comes in different colours, less radio-opaque than POP and water-resistant but it is more expensive and more difficult to apply.

**Ways you can apply casts:** basically 2

1. Complete casts: a circumferential cast.
2. Slabs: apply over part of the circumference of the limb. It is held in place with bandage. Examples are back-slabs and cock-up splints. Back slabs are used for temporarily splinting fresh fractures, definitive treatment of certain fractures e.g. supracondylar fractures of the humerus; splinting inflamed limb and post operatively after tendon and nerve repairs.

**B) External Fixation:** with this method, the bone fragments are held in alignment with pins inserted percutaneously. The pins are then held in proper relation to one another by a rigid external support – usually, steel bars with interconnecting clamps. The main indication is in the treatment of severely open fractures.

### **2. Continuous tractions**

Traction is achieved by applying a pulling force on the skeleton by means of metallic pins through the skeleton or adhesive tapes attached to the skin.

### Types of tractions

- **Gravity:** this applied to upper limb injuries. A collar & cuff is applied and the weight of the arm provides continuous traction for the humerus.
- **Skin traction:** this is achieved by means of an adhesive tape applied to the leg or the forearm with a weight attached. It cannot support more than 4-5Kg weight.
- **Skeletal traction:** a pin or wire is passed through the skeleton distal to the fracture and weights are attached to this to provide traction. Skeletal traction can support much more weight than skin traction. The commonest site of insertion is the upper tibia. Others are the distal tibia, calcaneum, distal femur and the olecranium.

Skin and skeletal tractions can be applied in three ways:

1. **Fixed traction:** the pull is exerted against a fixed point as in when the traction cord is attached to the end of the Thomas' splint while the ring abuts firmly against the pelvis.
2. **Balanced or sliding traction:** the foot of the bed is raised so that the weight of the body can provide counter-traction against a weight attached to the traction cord.
3. **Combined traction:** the foot of the bed is raised, but the cord is still attached to the "W" end of the Thomas' splint.

### Complications of tractions

- Pin site infection
- Reaction to skin traction kit (Zinc oxide)
- Peroneal nerve injury especially in the elderly

## **3. Internal fixation**

### Indications

1. Difficult fractures
  - Those prone to non-union e.g. femoral neck fractures
  - Those prone to malunion e.g. ankle and wrist fractures
  - Those prone to distraction e.g. patella and olecranium fractures.

3. Pathological fractures: to facilitate patient's early mobilisation
4. Multiple fractures especially in one limb
5. Nursing difficulties e.g. quadriplegics or paraplegics or those with multiple injuries.
6. In cases where prolonged hospitalisation is undesirable e.g. elderly patients.

### Types of splints

- Plates and screws.
- Intramedullary nails e.g. Kuntscher nails.
- Wires e.g. kirchner wires.
- Screws alone.

### Complications of internal fixation

1. Infections: the most feared complication!
2. Implant failure.
3. Refracture after implant removal.
4. Implant migration.

**Open fractures:** these are fractures in which there is a communication between a wound on the surface and the fracture haematoma. It is *open from within* if the skin is pierced by the bone from inside and *open from without* if the skin is broken by the same external force that caused the fracture. The latter is more prone to contamination. The wound must first be debrided before reduction and immobilisation. Open fractures with small wounds may be immobilised with POP casts but an opening must be created in the cast to assess the wound for dressing. This opening is called a window. Open fractures with large wounds are immobilized with external fixators because they offer superior access to the wounds without compromising their rigidity.

## **Complications of Fractures**

### General complications

1. Shock and haemorrhage
2. Tetanus
3. Fat embolism
4. Pulmonary embolism

### Local complications

1. **Skin**
  - Fracture blisters
  - Plaster sores
  - Bed sores
  - Reaction to skin traction
2. **Muscles**
  - Muscle atrophy
  - Muscle weakness

- Muscle tear

### 3. Tendons

- Avulsion
- Rupture (usually late)
- Tendonitis

### 4. Nerves

- Neuropraxia
- Axonotmesis
- Neurotmesis

### 5. Vascular complications

- Direct injury to vessels
- Compression of vessels
- Vascular spasm
- Compartmental syndrome

Vascular complications if not reversed early may lead to gangrene or Volkmann's ischaemic contracture.

### 6. Bone

- Avascular necrosis
- Non-union
- Malunion
- Delayed union
- Growth disturbances in the skeletally immature.
- Osteomyelitis

### 7. Joints.

- Stiffness
- Recurrent dislocations
- Osteoarthritis
- Haemarthrosis.

### 8. Others

- Myositis ossificans
- Sudeck's atrophy