General principles of fractures treatment
- **Fracture** - loss of continuity of bone
- Hairline fracture, microscopic fracture, highly comminuted fracture
- **Dislocation** - loss of congruity between the articulation surface of joint
- **Subluxation-articulating** surface of joint are no longer congruous but still maintain contact.
Classification of fracture

- According plane of # surface

- Simple – closed
  Compound – open

- According to cause
  traumatic
  pathological
  stress or fatigue fracture

- According to number
  Single
  Multiple

- Complete #, incomplete#
Mechanism of injury

- Spiral (twisting)
- Short oblique
- Bending - Triangular ‘butterfly’ fragment
- Transverse
OPEN AND CLOSED FRACTURES
• Traumatic fracture

Direct violence:

Indirect violence: twisting, bending,

Muscular contraction.
Pathological fracture

It is one in which a bone is broken through an area weakened by pre-existing disease, & by a degree of force that would have left normal bone intact

e.g. osteoporosis, O.M., bone tumours
Stress fracture:

Bone, like other materials, reacts to repeated loading. On occasion, it becomes fatigued & a crack develops e.g military installations, ballet dancers & athletes.
How fractures happen

- A single traumatic incident
- Repetitive stress
- Abnormal weakening of the bone
Fractures healing

- Primary
- Secondary
- Haematoma
- Inflammation
- Callus
- Consolidation
- Remodelling
Fractures healing
Clinical Features of Fracture

- **History of trauma**
- **Symptoms & signs:**
  1. Pain & tenderness
  2. Swelling
  3. Deformity
  4. Crepitus
  5. Loss of function
  6. Abnormal move.
  7. N.V. injuries
Diagnosis

- Clinical picture
- Radiography
Principles of treatment

- Anatomical reduction
- Stable internal fixation
- Preservation of blood supply
- Early mobilization
Implants types

- Pin and wire fixation
- Screw fixation
- Plate and screw fixation
- Intramedullary nail fixation
- External fixation
Open fractures

- Wound debridement
- Antibiotic prophylaxis
- Stabilization of the fracture
- Early wound cover
Principles of fractures

- Fracture repair is a tissue regeneration process rather than a healing process the injured bone is replaced by bone.

- The process of repair varies according to:
  - The type of bone involved.
  - The amount of movement at the fracture.
  - The closeness of the fracture surfaces.
Principles of fractures

- Unfavorable factors
  - Impairment of blood supply
  - Infection
  - Excessive movement
  - Presence of tumor
  - Synovial fluid in intraarticular Fx.
  - Interposition of soft tissue
  - Any form of Nicotine
Definitive fracture treatment

The goal of fracture treatment is to obtain union of the fracture in the most anatomical position compatible with maximal functional return of the extremity.

- Conservative
- Operative
Principles of Treatment

- Treat the Patient, not only the fracture
- Restriction of movement
  - Prevention of displacement
  - Alleviation of pain
  - Promote soft-tissue healing
  - Try to allow free movement of the unaffected parts
- Splint the fracture, not the entire limb
Principles of Treatment

- Methods of holding reduction:
  - Sustained traction
  - Cast splintage
  - Functional bracing
  - Internal fixation
  - External fixation
Definitive Fracture Fixation Options

- **Casts and Splints**
  - Appropriate for many fractures especially hand and foot fractures

- Adults typically will get plaster splints initially transitioned to fiberglass casts as swelling decreases

- Kids typically will get fiberglass casts
CLOSED, UNDISPLACED
CLOSED, REDUCIBLE
→ CONSERVATIVE TREATMENT

2- CAST

Below Knee

Above Knee
• Complications of cast splintage
  • Liable to appear once the patient has left the hospital; added risk of delay before the problem is attended to

1. Tight cast
2. Pressure sores
3. Skin abrasion or laceration
4. Loose cast
Functional Bracing

- Prevents joint stiffness while still permitting fracture splintage and loading
- Most commonly for fractures of the femur or tibia
- Since it’s not very rigid, it is usually applied only when the fracture is beginning to unite
- Comes out well on all four of the basic requirements: “hold” “move” “speed” “safe”
Definitive Fracture Fixation Options

- Traction
  - Useful in patients who are too sick for surgery
  - Useful to maintain alignment until definitive fixation
Traction by gravity
  - Eg. Fractures of the humerus

Balanced Traction
  - Skin traction: adhesive strapping kept in place by bandages
  - Skeletal traction: stiff wire/pin inserted through the bone distal to the fracture

Femur fracture managed with skeletal traction and use of a Steinmann pin in the distal femur.
Operative

- ORIF (open reduction internal fixat.)
- External fixation
Indications of ORIF

- absolute

- relative
Indications of ORIF

- **Absolute Indications for ORIF of fractures**
  - Unable to obtain an adequate reduction
  - Displaced intra-articular fractures
  - Certain types of displaced epiphyseal fractures
  - Major avulsion fractures where there is loss of function of a joint or muscle group
  - Non-unions
  - Re-implantations of limbs or extremities
Indications of ORIF

Relative Indications for ORIF of fractures

- Delayed unions
- Multiple fractures to assist in care and general management
- Unable to maintain a reduction
- Pathological fractures
- To assist in nursing care
- To reduce morbidity due to prolonged immobilisation
- For fractures in which closed methods are known to be ineffective
Indications of ORIF

**Questionable**

- Fractures accompanying nerve of vessel injury
- Open fractures
- Cosmetic considerations
- Economic considerations
Types of Internal Fixation

- Pin & wire fixat.
- Screw fixat.
- Plate & screws fixat.
- Intra-medullary fixat.
Definitive Fracture Fixation Options

- Open Reduction and Internal fixation with Plates and screws
  - Used for many fractures especially those involving joints
4a Condylar Plate 95° (Pure Titanium/Steel)
4b Dynamic Condylar Screw DCS® (Steel)
Screw lengths 50–145 mm

4.5 mm Cortex Screw
(Pure Titanium/Steel)

6.5 mm Cancellous Bone
Screws: 16 mm/32 mm
Definitive Fracture Fixation Options

- Intramedullary Nails
  - Treatment of choice for most tibia and femur fractures
  - Used in selected humerus and forearm fractures
Internal Fixation

- “holds” securely with precise reduction
- “movements” can begin at once (no stiffness and edema)
- “speed”: patient can leave hospital as soon as wound is healed, but full weight bearing is unsafe for some time
- “safety” = biggest problem! SEPSIS!!!
  - Risk depends on: the patient, the surgeon, the facilities
Definitive Fracture Fixation Options

• Joint Replacement
  • Used in displaced femoral neck fractures in geriatric patients
  • Allows for early ambulation
  • Occasionally used in geriatric pts with comminuted shoulder or elbow fractures
Complications of internal fixation

- Most are due to poor technique, equipment, or operating conditions

- **Infection**
  - Iatrogenic infection is now the most common cause of chronic osteomyelitis

- **Non-union**
  - Excessive stripping of the soft tissues
  - Unnecessary damage to the blood supply in the course of operative fixation
  - Rigid fixation with a gap between the fragments

- **Implant failure**

- **Refracture**
Definitive Fracture Fixation Options

- **External Fixation**
  - Used primarily in the treatment of open fractures and pelvis fractures
  - Also useful as temporary stabilization prior to definitive fixation
External Fixation

- Permits adjustment of length and angulation
- Some allow reduction of the fracture in all 3 planes.
- Especially applicable to the long bones and the pelvis.

Indications:
1. Fractures of the pelvis, which often cannot be controlled quickly by any other method.
2. Fractures associated with severe soft-tissue damage where the wound can be left open for inspection, dressing, or definitive coverage.
3. Severely comminuted and unstable fractures, which can be held out to length until healing commences.

4. Fractures of the pelvis, which often cannot be controlled quickly by any other method.

5. Fractures associated with nerve or vessel damage.

6. Infected fractures, for which internal fixation might not be suitable.

7. Un-united fractures, where dead or sclerotic fragments can be excised and the remaining ends brought together in the external fixator; sometimes this is combined with elongation in the normal part of the shaft.
Complications of external fixation

- High degree of training and skill! Often used for the most difficult fractures → increased likelihood of complications
- Damage to soft-tissue structures

- Over-distraction
  - No contact between the fragments → union delayed/prevented

- Pin-track infection
OPEN FRACTURES

• Initial Management
  • At the scene of the accident
  • In the hospital
Types of Open Fractures

- The incidence of wound infection
  - correlates directly with the extent of soft-tissue damage, <2% in type 1 → >10% in type 3
  - rises with increasing delay in obtaining soft tissue coverage of the fracture.
Principles of Treatment of Open Fractures

- All open fractures assumed to be contaminated → Prevent infection!

- The essentials:
  - Prompt wound debridement
  - Antibiotic prophylaxis
  - Stabilization of the fracture
  - Early definitive wound cover
  - Repeated examination of the limb because open fractures can also be associated with compartment syndrome
### Complications of fractures

<table>
<thead>
<tr>
<th>Early</th>
<th>Late</th>
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<tbody>
<tr>
<td>- visceral injury</td>
<td>- delayed union</td>
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<tr>
<td>- vascular injury</td>
<td>- non-union</td>
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<tr>
<td>- nerve injury</td>
<td>- avascular necrosis</td>
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<tr>
<td>- compartment syndrome</td>
<td>- bed sores</td>
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<tr>
<td>- haemarthrosis</td>
<td>- myositis ossificans</td>
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<td>- infection</td>
<td>- tendon lesion</td>
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<td>- gas gangrene</td>
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<td>- fracture blisters</td>
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<td>- plaster and pressure sores</td>
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<td>- osteoarthritis</td>
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Thank you