FRACUTURES OF THE RADIUS AND ULNA

Mechanism of injury and pathology
- Fractures of the shafts of both forearm bones occur quite commonly.
- A twisting force (usually a fall on the hand) produces a spiral fracture with the bones broken at different levels.
- An angulating force causes a transverse fracture of both bones at the same level.
- A direct blow causes a transverse fracture of just one bone, usually the ulna.
- Additional rotation deformity may be produced by the pull of muscles attached to the radius: they are the biceps and supinator muscles to the upper third, the pronator teres to the middle third, and the pronator quadratus to the lower third.
- Bleeding and swelling of the muscle compartments of the forearm may cause circulatory impairment.

Clinical features
- The fracture is usually quite obvious, but the pulse must be felt and the hand examined for circulatory or neural deficit.
- Repeated examination is necessary in order to detect an impending compartment syndrome.

X-RAY
- Both bones are broken, either transversely and at the same level or obliquely with the radial fracture usually at a higher level.
- In children, the fracture is often incomplete (greenstick) and only angulated.
- In adults, displacement may occur in any direction – shift, overlap, tilt or twist.
- In low-energy injuries, the fracture tends to be transverse or oblique; in high-energy injuries it is comminuted or segmental.

Treatment
- **CHILDREN**
  - In children, closed treatment is usually successful because the tough periosteum tends to guide and then control the reduction.
  - The fragments are held in a well-moulded full-length cast, from axilla to metacarpal shafts (to control rotation).
  - The cast is applied with the elbow at 90 degrees.
  - If the fracture is proximal to pronator teres, the forearm is supinated; if it is distal to pronator teres, then the forearm is held in neutral.
  - The position is checked by x-ray after a week and, if it is satisfactory, splintage is retained until both fractures are united (usually 6–8 weeks).
  - Throughout this period hand and shoulder exercises are encouraged.
  - The child should avoid contact sports for a few weeks to prevent re-fracture.
Occasionally an operation is required, either if the fracture cannot be reduced or if the fragments are unstable. Fixation with intramedullary rods is preferred. Alternatively, a plate or K-wire fixation can be used. Childhood fractures usually remodel well, but not if there is any rotational deformity or an angular deformity of more than 15 degrees in children under 6 years or 10 degrees in children between 6 and 12. In those over 12 years old even slight angular deformities are unlikely to remodel satisfactorily.

**ADULTS**
- Unless the fragments are in close apposition, reduction is difficult and re-displacement in the cast almost invariable.
- So predictable is this outcome that most surgeons opt for open reduction and internal fixation from the outset.
- The fragments are held by interfragmentery compression with plates and screws.
- Bone grafting is advisable if there is comminution.
- The deep fascia is left open to prevent a build-up of pressure in the muscle compartments, and only the skin is sutured.
- After the operation the arm is kept elevated until the swelling subsides, and during this period active exercises of the hand are encouraged.
- If the fracture is not comminuted and the patient is reliable, early range of movement exercises are commenced but lifting and sports are avoided.
- It takes 8–12 weeks for the bones to unite.
- With comminuted fractures or unreliable patients, immobilization in plaster is safer.

**OPEN FRACTURES**
- Open fractures of the forearm must be managed meticulously.
- Antibiotics and tetanus prophylaxis are given as soon as possible; the wounds are copiously washed and nerve function and circulation are checked.
- At operation the wounds are excised and extended and the bone ends are exposed and thoroughly cleaned.
- The fractures are primarily fixed with compression screws and plates; if the wounds are absolutely clean, the soft tissues can be closed.
- If bone grafting is necessary, this is best deferred until the wounds are healed.
- If there is major soft-tissue loss, the bones are better stabilized by external fixation.
- The aim is to obtain skin cover as soon as possible; if plastic surgery services are available, these should be enlisted from the outset.
- If there is any question of a compartment syndrome, the wounds should be left open and closed 24–48 hours later, with a skin graft if needed.
Complications

❖ EARLY
  o Nerve injury Nerve injuries are rarely caused by the fracture, but they may be caused by the surgeon! Exposure of the radius in its proximal third risks damage to the posterior interosseous nerve where it is covered by the superficial part of the supinator muscle. Surgical technique is particularly important here; the anterior Henry approach is safest.
  o Vascular injury Injury to the radial or ulnar artery seldom presents any problem, as the collateral circulation is excellent.
  o Compartment syndrome Fractures (and operations) of the forearm bones are always associated with swelling of the soft tissues, with the attendant risk of a compartment syndrome. The threat is even greater, and the diagnosis more difficult, if the forearm is wrapped up in plaster. A distal pulse does not exclude compartment syndrome!
  o The byword is ‘watchfulness’; if there are any signs of circulatory embarrassment, treatment must be prompt and uncompromising.

❖ LATE
  o Delayed union and non-union: Most fractures of the radius and ulna heal within 8–12 weeks; high energy fractures and open fractures are less likely to unite. Delayed union of one or other bone (usually the ulna) is not uncommon; immobilization may have to be continued beyond the usual time. Non-union will require bone grafting and internal fixation.
  o Malunion With closed reduction there is always a risk of malunion, resulting in angulation or rotational deformity of the forearm.
  o Cross-union of the fragments, or shortening of one of the bones and disruption of the distal radio-ulnar joint.
  o Complications of plate removal Removal of plates and screws is often regarded as a fairly innocuous procedure. Beware! Complications are common and they include damage to vessels and nerves, infection and fracture through a screw-hole.