Hand injuries

- Hand injuries – the commonest of all injuries – are important out of all proportion to their apparent severity, because of the need for perfect function.
- Nowhere else do painstaking evaluation, meticulous care and dedicated rehabilitation yield greater rewards.
- The outcome is often dependent upon the judgement of the doctor who first sees the patient.
- If there is skin damage the patient should be examined in a clean environment with the hand displayed on sterile drapes.
- A brief but searching history is obtained; often the mechanism of injury will suggest the type and severity of the trauma.
- The patient’s age, occupation and ‘handedness’ should be recorded.
- Superficial injuries and severe fractures are obvious, but deeper injuries are often poorly disclosed.
- It is important in the initial examination to assess the circulation, soft-tissue cover, bones, joints, nerves and tendons.
- X-rays should include at least three views (posteroanterior, lateral and oblique), and with finger injuries the individual digit must be x-rayed.

GENERAL PRINCIPLES OF TREATMENT

- Circulation If the circulation is threatened, it must be promptly restored, if necessary by direct repair or vein grafting.
- Swelling Swelling must be controlled by elevating the hand and by early and repeated active exercises.
- Splintage Incorrect splintage is a potent cause of stiffness; it must be appropriate and it must be kept to a minimum length of time. If a finger has to be splinted, it may be possible simply to tape it to its neighbour so that both move as one; if greater security is needed, only the injured finger should be splinted.
- If the entire hand needs splinting, this must always be in the ‘position of safety’ – with the metacarpo-phalangeal joints flexed at least 70 degrees and the interphalangeal joints almost straight.
- Sometimes an external splint, to be effective, would need to immobilize undamaged fingers or would need to hold the joints of the injured finger in an unfavourable position (e.g. flexion of the interphalangeal joints). If so, internal fixation may be required (K-wires, screws or plates).
- Skin cover Skin damage demands wound toilet followed by suture, skin grafting, local flaps, pedicled flaps or (occasionally) free flaps. Treatment of the skin takes precedence over treatment of the fracture.
- Nerve and tendon injury Generally, the best results will follow primary repair of tendons and nerves. Occasionally grafts are required.
METACARPAL FRACTURES

- The metacarpal bones are vulnerable to blows and falls upon the hand, or the longitudinal force of the boxer’s punch.
- Injuries are common and the bones may fracture at their base, in the shaft or through the neck.
- Angular deformity is usually not very marked, and even if it persists, it does not interfere much with function.
- Rotational deformity, however, is serious. Close your hand with the distal phalanges extended, and look: the fingers converge across the palm to a point above the thenar eminence; malrotation of the metacarpal (or proximal phalanx) will cause that finger to diverge and overlap one of its neighbours.
- Thus, with a fractured metacarpal it is important to regain normal rotational alignment.
- The fourth and fifth metacarpals are more mobile at their base than the second and third, and therefore are better able to compensate for residual angular deformity.
- Fractures of the thumb metacarpal usually occur near the base and pose special problems. They are dealt with separately below.

FRACTURES OF THE METACARPAL SHAFT

- A direct blow may fracture one or several metacarpal shafts transversely, often with associated skin damage.
- A twisting or punching force may cause a spiral fracture of one or more shafts.
- There is local pain and swelling, and sometimes a dorsal ‘hump’.

Treatment

- Oblique or transverse fractures with slight displacement require no reduction.
- Splintage also is unnecessary, but a firm crepe bandage may be comforting; this should not be allowed to discourage the patient from active movements of the fingers,
- Transverse fractures with considerable displacement are reduced by traction and pressure.
- Reduction can sometimes be held by a plaster slab extending from the forearm over the fingers (only the damaged ones)
- The slab is maintained for 3 weeks and the undamaged fingers are exercised.
- However, these fractures are usually unstable and should be fixed surgically with compression plates or percutaneous K-wires placed either across the fracture or transversely through the neighbouring undamaged metacarpals.
- Spiral fractures are liable to rotate; if so, they should be perfectly reduced and fixed with lag screws and a plate, or percutaneous wires.

FRACTURES OF THE METACARPAL NECK

- A blow may fracture the metacarpal neck, usually of the fifth finger (the ‘boxer’s fracture’) and occasionally one of the others.
- There may be local swelling, with flattening of the knuckle.
- X-rays show an impacted transverse fracture with volar angulation of the distal fragment.
Treatment

- The main function of the fifth and fourth fingers is firm flexion (‘power grip’) and, as can be readily demonstrated on a normal hand, there is ‘spare’ extension available at the metacarpo-phalangeal (MCP) joint.
- Therefore in these digits, a flexion deformity of up to 40 degrees can be accepted; as long as there is no rotational deformity, a good outcome can be expected. The hand is immobilized in a gutter splint with the MCP joint flexed and the interphalangeal (IP) joints straight until discomfort settles – a week or two – and then the hand is mobilized.

Complications

- Malunion, with volar angulation of the distal fragment, is poorly tolerated if this occurs in the second or third rays.

FRACTURES OF THE METACARPAL HEAD

- These fractures occur after a direct blow.
- They are often quite comminuted and sometimes ‘open’. Operative reduction is usually required and fixation with small headless buried screws is ideal. Occasionally the joint is so badly damaged that primary replacement is considered (Silastic, pyrocarbon or polythene– metal).

FRACTURES OF THE METACARPAL BASE

- Excepting fractures of the thumb metacarpal, these are usually stable injuries which can be treated by ensuring that rotation is correct and then splinting the digit in a volar slab extending from the forearm to the proximal finger joint. The splint is retained for 3 weeks and exercises are then encouraged.
- Displaced intra-articular fractures of the base of the fourth or fifth metacarpal may cause marked incongruity of the joint. This is a mobile joint and it may, therefore, be painful.
- The fracture should be reduced by traction on the little finger and then held with a percutaneous K-wire or compression screw.
- In the long term, if painful arthritis supervenes, treatment would be with either arthrodesis or joint excision.

FRACTURE OF THE THUMB METACARPAL

- Three types of fracture are encountered:
  - Impacted fracture of the metacarpal base;
  - Bennett’s fracture-dislocation of the carpo-metacarpal (CMC) joint;
  - Rolando’s comminuted fracture of the base.

Impacted fracture

- A boxer may, while punching, sustain a fracture of the base of the first metacarpal.
- Localized swelling and tenderness are found,
- x-ray shows a transverse fracture about 6 mm distal to the CMC joint, with outward bowing and impaction.
Treatment

- If the angulation is less than 20–30 degrees and the fragments are impacted, the thumb is rested in a plaster of Paris cast extending from the forearm to just short of the interphalangeal thumb joint with the thumb fully abducted and extended.
- The cast is removed after 2–3 weeks and the thumb is mobilized.
- If the angulation is greater than 30 degrees, so the fracture should be reduced.
- The surgeon pulls on the abducted thumb and, by levering the metacarpal outwards against his own thumb, corrects the bowing.
- A plaster cast is applied.
- If the fracture is still unstable, then a percutaneous K-wire is inserted.

Bennett’s fracture-dislocation

- This fracture, too, occurs at the base of the first metacarpal bone and is commonly due to punching;
- however the fracture is oblique, extends into the CMC joint and is unstable.
- The thumb looks short and the carpo-metacarpal region swollen.
- X-rays show that a small triangular fragment has remained in contact with the medial edge of the trapezium, while the remainder of the thumb has subluxated proximally, pulled upon by the abductor pollicis longus tendon.

Treatment

- It is widely supposed (with little evidence) that perfect reduction is essential.
- It should, however, be attempted and can usually be achieved by pulling on the thumb, abducting it and extending it.
- Reduction can then be held in one of two ways:
  - plaster or
  - internal fixation.

ROLANDO’S FRACTURE

- This is an intra-articular comminuted fracture of the base of the first metacarpal with a T or Y configuration.
- Closed reduction and K-wiring or open reduction and plate fixation can be used. With more severe comminution, external fixation is needed.

FRACTURES OF THE PHALANGES

- The fingers are usually injured by direct violence, and there may be considerable swelling or open wounds.
- Injudicious treatment may result in a stiff finger which, in some cases, can be worse than no finger.
FRACTURES OF THE PROXIMAL AND MIDDLE PHALANGEAL SHAFTS

The phalanx may fracture in various ways:
- Transverse fracture of the shaft, often with forward angulation.
- Spiral fracture of the shaft, from a twisting injury.
- Comminuted, usually due to a crush injury may with tendon damage and skin loss.
- Avulsion of a small fragment of bone.
- Metaphyseal fracture at the base of the proximal phalanx,
- Intra-articular fractures: At the distal end of the phalanx, the entire head may rotate or, more commonly, one condyle rotates through a longitudinal midline fracture into the joint. At the proximal end, displacement tends to lead to an angular deformity.

Treatment
- **UNDISPLACED FRACTURES**
  - These can be treated by ‘functional splintage’. The finger is strapped to its neighbour (‘buddy strapping’) and movements are encouraged from the outset.
  - Splintage is retained for 2–3 weeks, but during this time it is wise to check the position by x-ray in case displacement has occurred.

- **DISPLACED FRACTURES**
  - Displaced fractures must be reduced and immobilized.
  - It is essential to check for rotational correction by
    1) noting the convergent position of the finger when the MCP joint is flexed, and
    2) seeing that the fingernails are all in the same plane.

FRACTURES OF THE TERMINAL PHALANX
- The terminal phalanx, is subject to five different types of fracture:-

1) Fracture of the tuft
   - The tip of the finger may be struck by a hammer or caught in a door, and the bone shattered.
   - The fracture is disregarded and treatment is focused on controlling swelling and regaining movement.
   - The painful haematoma beneath the finger nail should be drained by piercing the nail with a hot paper clip.
   - If the nail bed is shattered and cosmesis is important, it should be meticulously repaired under magnification.

2) Mallet finger injury
   - After a sudden flexion injury (e. g. stubbing the tip of the finger) the terminal phalanx droops and cannot be straightened actively.
   - Three types of injury are recognized:
     - avulsion of the most distal part of the extensor tendon;
- avulsion of a small flake of bone from the base of the terminal phalanx; and
- avulsion of a large dorsal bone fragment, sometimes with subluxation of the terminal interphalangeal (TIP) joint.

**TREATMENT**
- The TIP joint should be immobilized in slight hyperextension, using a special mallet-finger splint which fixes the distal joint but leaves the proximal joints free.
- For tendinous avulsions (which usually occur painlessly) the splint should be kept in place constantly for 8 weeks and then only at night for another 4 weeks. Even if there has been a delay of 3 or 4 weeks after injury, this prolonged splintage is usually successful.
- Bone avulsions are also treated in a splint, but 6 weeks should suffice as bone heals quicker than tendon.
- Operative treatment is generally avoided, even for large bone fragments, unless there is subluxation.
- Surgery carries a high complication rate (wound failure, metalwork problems) without evidence that the outcome is improved. However, if there is subluxation then K-wires or small screws are used to fix the fragment in place.

**COMPLICATIONS OF MALLET FINGER**
- Non-union This is usually painless and treatment is not needed.
- Persistent droop About 85 per cent of mallet fingers recover full extension. If there is a persistent droop this can be treated by tendon repair supported by K-wire fixation of the joint, but the results are often disappointing. The alternative would be joint arthrodesis,
- Swan neck deformity Imbalance of the extensor mechanism can cause this in lax-jointed individuals. A central slip tenotomy is straightforward and can give a very good result.

3) **Fracture of the terminal shaft**
- Undisplaced fractures of the shaft need no treatment apart from analgesia.
- If angulated, they should be reduced and held with a longitudinal K-wire through the pulp for 4 weeks.
- The nail is often dislocated from its fold; if so it must be carefully tucked back in and held with a suture in each corner.

4) **Avulsion of the flexor tendon**
- This injury is caused by sudden hyperextension of the distal joint, typically when a game player catches his finger on an opponent’s shirt.
- The ring finger is most commonly affected.
- The flexor digitorum profundus tendon is avulsed, either rupturing the tendon itself or taking a fragment of bone with it.

5) **Physeal fracture**
- The basal physis can break, usually producing a Salter–Harris I fracture (Seymour fracture).
The nail may be dislocated from its fold and the germinal matrix can be trapped in the fracture.

The injury is easily overlooked if the finger is very swollen.

The nail must be cleaned and carefully replaced into its bed.

JOINT INJURIES

- Any finger joint may be injured by a direct blow (often the overlying skin is damaged), or by an angulation force, or by the straight finger being forcibly stubbed.
- The affected joint is swollen, tender and too painful to move.
- X-rays may show that a fragment of bone has been sheared off or avulsed.

CARPO-METACARPAL DISLOCATION

- The thumb is most frequently affected and clinically the injury then resembles a Bennett’s fracturedislocation; however, x-rays reveal proximal subluxation or dislocation of the first metacarpal bone without a fracture.
- The displacement is easily reduced by traction and hyperpronation, but reduction is unstable and can be held only by a K-wire driven through the metacarpal into the carpus.
- The wire is removed after 5 weeks but a protective splint should be worn for 8 weeks because of the risk of instability.
- Chronic instability

METACARPO-PHALANGEAL DISLOCATION

- Usually the thumb is affected, sometimes the fifth finger, and rarely the other fingers.
- The entire finger is suddenly forced into hyperextension and the capsule and muscle insertions in front of the joint may be torn.
- There are two types of dislocation:
  - Simple dislocation The finger is extended about 75 degrees. It is easily reduced by traction, firstly in hyperextension then pulling the finger around. The finger is strapped to its neighbour and early mobilization is encouraged.
  - Complex dislocation The avulsed palmar plate sits in the joint, blocking reduction. Furthermore, the metacarpal head can be clasped between the flexor tendon and lumbrical tendon. The finger is extended only about 30 degrees and there is usually a tell-tale dimple in the palm. Very occasionally the fracture can be reduced closed by hyperextending the MCP joint and flexing the IP joints to release the clasp. If this fails, open reduction is required. A dorsal approach is safest. After reduction the joint is stable and should be mobilized in a neighbour-splint.
- Chronic instability in the thumb MCP joint This is treated by a sesamoid arthrodesis. An alternative is formal arthrodesis. The functional result is usually very good.

INTERPHALANGEAL JOINT DISLOCATION

- Distal joint dislocation is rare; proximal joint dislocation is more common. The dislocation is easily reduced by pulling. The joint is strapped to its neighbor for a few days and movements are begun immediately.
LIGAMENT INJURIES

- PROXIMAL INTERPHALANGEAL LIGAMENTS
  - Partial or complete tears of the proximal interphalangeal ligaments are quite common. Mild sprains require no treatment but with more severe injuries the finger should be splinted in extension for 2 or 3 weeks. If the joint is frankly unstable, repair is considered. The joint is likely to remain swollen and slightly painful for at least 6–12 months. If the instability persists – reconstruction.

- METACARPO-PHALANGEAL JOINTS
  - The radial collateral ligament of the index finger is most vulnerable, although with a suitable force any ligament can be injured.

ULNAR COLLATERAL LIGAMENT OF THE THUMB METACARPO PHALANGEAL JOINT ('GAMEKEEPER'S THUMB'; 'SKIER'S THUMB'):

- In former years, gamekeepers who twisted the necks of little animals ran the risk of tearing the ulnar collateral ligament of the thumb metacarpo-phalangeal joint, either acutely or as a chronic injury.
- Nowadays this injury is seen in skiers who fall onto the extended thumb, forcing it into hyperabduction.
- A small flake of bone may be pulled off at the same time.
- The resulting loss of stability may interfere markedly with prehensile (pinching) activities.
- The ulnar collateral ligament inserts partly into the palmar plate.
- In a partial rupture, only the ligament proper is torn and the thumb is unstable in flexion but still more or less stable in full extension because the palmar plate is intact.
- In a complete rupture, both the ligament proper and the palmar plate are torn and the thumb is unstable in all positions. If the ligament ruptures completely, it will not heal unless it is repaired; this is because the proximal end gets trapped in front of the adductor pollicis aponeurosis (the Stener lesion).

Clinical assessment

- On examination there is tenderness and swelling precisely over the ulnar side of the thumb metacarpo-phalangeal joint.
- An x-ray is essential, to exclude a fracture before carrying out any stress tests.
- Laxity is often obvious but if in doubt, then the joint can be examined under local anaesthetic. If there is no undue laxity (compare with the normal side) in both extension and 30 degrees flexion, then a serious injury can be excluded. If there is more than a few degrees of laxity there is probably a complete rupture which will require operative repair.

Treatment

- Partial tears can be treated by a short period (2–4 weeks) of immobilization in a splint followed by increasing movement. Pinch should be avoided for 6–8 weeks.
- Complete tears need operative repair.