COMMON FRACTURES OF THE HAND AND WRIST*

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Fractures of the Distal Phalanx

Fractures of the distal phalanx are the most common fractures of the hand and are usually due to a crushing injury, particularly the fingertip being caught between two hard objects.

These distal phalanx is divided into three parts, the tuft (the distal portion adherent to the nailbed), the shaft and the articular surface (Fig. 1). Most fractures of the distal phalanx are treated conservatively.

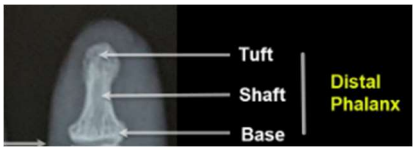

Fig. 1. Parts of the distal phalanx (boneandspine.com)

Tuft fractures, which usually present with a subungual hematoma, are often treated symptomatically with a tip protector or fold-over splint (Fig. 2) and pain management.

Fig 2. Fold-over splint (made-in-china.com)

If painful, the hematoma may be drained by nail trephination (Fig. 3). An open fracture is suspected when there is an avulsion of the nailplate. These injuries are debrided and the nailbed injury is repaired.

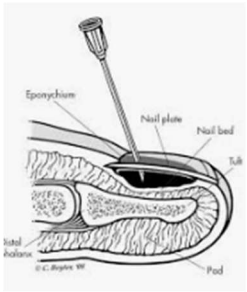

Fig. 3. Nail trephination (patientcareonline.com)

Shaft fractures, which are usually due to bending forces, may be angulated, leading to avulsion of the proximal part of the germinal matrix. These fractures will need to be debrided, reduced and fixed. The matrix needs to be repaired (Fig. 4).

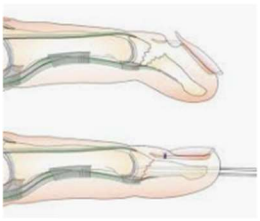

Fig. 4. Shaft fracture of the distal phalanx (somepomed.com)

Any significant displacement (>2 mm step-off) of an articular fracture of the distal phalanx is an indication for open reduction and internal fixation. Some of these displaced intra-articular fractures are due to bone fragments being avulsed off by the attached flexor, as n the Jersey finger (Fig. 5), or extensor tendon as in the Mallet finger (Fig. 6).

Fig. 5. Jersey finger (Carpenter & Rohde. Hand Clinic. 2013)

Fig. 6. Mallet finger (radiologykey.com)

Fractures of the metacarpals and phalanges

These fractures may be due to direct forces (a blow to the hand or hitting against a hard surface) or indirect forces (the finger being twisted or bent). As such, they may present in various configurations (transverse, oblique, spiral or comminuted).

Fractures involving the articular surfaces will tolerate very little displacement as this will lead to loss of motion due to a bone block or painful motion. Undisplaced or

minimally displaced fractures may be treated with immobilization usually in the safe or intrinsic-plus position (Fig. 7) until union at 3-4 weeks, then protected mobilization (in a buddy tape). Unacceptable displacement of fracture fragments or an incongruous joint is an indication for open reduction and internal fixation.

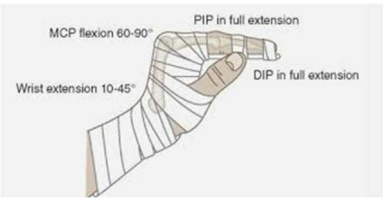

Fig. 7. Position of safe immobilization (Schneemann. Health & Medicine. 2015)


Fig.8. Intra-articular fracture of the metacarpal head (wheelessonline.com)

Undisplaced or acceptably displaced fractures of the shaft may be treated in-situ (by initial immobilization and subsequent protected motion) similar to undisplaced intra-articular fractures. This will still lead to good functional results.

No malrotation and only minimal (or even no) shortening is acceptable. Malrotation causes the fingers to scissor, and this will affect the patient's grip (Fig. 9). A shorter bone will cause relative lengthening of the tendon resulting in its weaker pull.


Fig. 9. Malrotation (orthoinfo.aaos.org)

A minimal amount of angulation may likewise be accepted. Excessive angulation in the phalanges (>10-15^0) will cause the tendons to catch against the fracture. When the 2nd or 3rd metacarpal shaft or neck is excessively angulated, the metacarpal head will be too prominent in the palm and holding on to hard objects will be painful. More angulation may be accepted at the 4th and 5th metacarpals due to more motion provided by their mobile carpometacarpal joints. In a fracture of the neck of the 5th metacarpal, the Boxer's fracture, up to 70 degrees of angulation may be accepted

(Fig. 10). Too much angulation in the thumb metacarpal (>20-30^{0}) results in limited opening of the 1st web.

Fig. 10. Boxer's fracture (Wikipedia.org)

Fractures with unacceptable displacement need to be reduced by either closed or open methods. Those fractures where closed reduction (done under adequate anesthesia) achieves an acceptable alignment may sometimes be held reduced by being immobilized until with fracture union. As most displaced fractures are unstable (they redisplace after a closed reduction), internal fixation (applied either percutaneously or by an open method) is often required.

Fractures of the distal radius

A fracture at the distal radius is the most common one in adults. These result from either low-energy (fall from standing height) or high-energy (vehicular collisions) accidents. Majority of these fractures (90%) are low-energy injuries, usually occurring in the elderly (already with osteoporotic bones) and are usually extra-articular and of a simple configuration. High-energy injuries involve younger patients and the fractures are often comminuted and intra-articular.

The classic fracture is the Colles Fracture (Fig. 11). This is an extra-articular fracture of the metaphysis of the distal radius which is volarly angulated and dorsally displaced. Other fractures may be volarly displaced (a Smith's fracture), partial articular (a Barton's involving the volar rim, and the Chauffer's involving the radial styloid, or complete articular (the joint surface broken into 2 or more fragments).

Fig. 11. Colles' fracture (Wong, et al. IJEM. 2015)

Aside from the swelling and tenderness at the wrist, some patients with a Colles fracture will present with the classic "silver-fork" deformity (Fig. 12). Patient with

the volarly-displaced Smith Fracture may present with a “golden spade” deformity (Figs. 13).

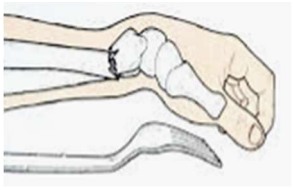

Fig. 12. Silver fork deformity (slidshare.net)

Fig. 13. Golden spade deformity (muhadharaty.com)

Intra-articular fractures with minimal step-off (≤ 2mm) and extra-articular fractures with minimal angulation (around 20 degrees from normal) and shortening (around 5mm) are acceptable. Such fractures may be treated with immobilization, usually in a short arm cast, until with fracture union (6-8 weeks).

Excessively displaced fractures are treated by closed or open reduction. Fractures in which closed reduction is successful and are determined to be stable may then be immobilized in a cast or splint. Those which are reduced but unstable (reduction won’t be maintained in the cast) undergo percutaneous fixation. Fractures in which closed reduction is not successful (reduction is not achieved) or is not attempted anymore (due to treatment delay or the need for more rigid fixation allowing earlier motion) are treated with open reduction and internal fixation (Fig. 14).

Fig. 14. Distal radius fracture fixation (Stuby, et al. plos.org. 2015)

While the extremity is in a cast, it’s important that the patient do various range of motion exercises for the fingers (such as the “six-pack” exercises) to prevent stiffness as this will delay the patient’s return to previous function (Fig. 15).

Fig. 15. 6-pack exercises

Open Fractures

An open fracture is a break in the bone combined with a soft tissue injury which allows for communication between the fracture and the external environment, increasing the chance of a subsequent infection.

Approximately 5% of hand fractures are open. They usually occur in young males and often from work-related accidents. They are mostly associated with high energy injuries, such as falls from a heights and motor vehicular accidents) but can also occur in low energy impact as well, with the skin break caused by piercing of the sharp fragments of the fractured bones when they are displaced.

The simplest way to classify open fractures is that of Swanson (1991). He divided the open fractures into two classes, types 1 (clean) and type 2 (contaminated, those whose treatment has been delayed for more than 24 hours and those in patients with significant systemic illnesses). Although both types of injuries, during the first surgical procedure, will need wound debridement and irrigation, as well as fracture stabilization, the type 1 injuries may be closed immediately, while the type 2 will need delayed wound closure/coverage (Fig. 16).


Fig. 16. A type 2 or contaminated open fracture (eorif.com)

After 48-72 hours form the first surgery, the wounds in type 2 injuries may be closed, and the other injuries repaired or reconstructed, during the "second-look" procedure if there is no infection.

Especially in high-energy injuries or those caused by sharp or penetrating objects, these open fractures are frequently associated with injuries to the adjacent tendons, blood vessels and nerves. Planning for the treatment must include the repair or reconstruction of these structures, and the Hand Rehabilitation program neded once the hand is made whole. The skeletal framework need to be stabilized however before any other repair can be done.

Prophylactic intravenous antibiotics are started as soon as patients with open fractures of the hand are seen at the emergency room. These are usually broad-spectrum which can cover for the normal skin flora (usually a 1st or 2nd generation Cephalosporin). Contaminated wounds will need additional antibiotics. These prophylactic antibiotics are given until wound closure or when shifted to a culture-guided option in case of an actual infection.

Open fractures of the hand have generally poorer results due to stiffness and the resultant loss of hand function.