Radiology of acute injuries to the hand and fingers

Introduction

As humans, our daily activities rely on our ability to perform intricate movements with our hands and fingers, as well as being able to perform powerful gripping actions. Consequently even seemingly minor injuries to the hands can have a significant impact on activities of daily living. Minor injuries to the hands and fingers are a very common cause of attendance of the accident and emergency department.

Anatomy and terminology

Each digit contains phalanges which articulate primarily in a hinge manner with the metacarpals by way of the metacarpophalangeal joints. These then articulate with the wrist (carpus) at the carpometacarpal joints. Each of the fingers contains three phalanges (proximal, intermediate and distal), which articulate at the proximal and distal interphalangeal joints. The thumb contains only a proximal and distal phalanx, which articulate at the interphalangeal joint.

It is important to note that the digits should be referred to by name, rather than by number. This avoids any confusion that could arise, for example the index finger could be interpreted as being either the first finger or the second finger, depending on whether the thumb is counted as a finger. The digits are named: thumb, index finger, middle finger, ring finger and little finger. However, it is acceptable to number the metacarpals, from 1 to 5 (1 being the metacarpal for the thumb, 5 being the metacarpal for the little finger).

Radiological assessment

As with other parts of the skeletal system, the ABCS system can be used:
Adequacy
Alignment
Bones
Cartilage
Soft tissues.

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Adequacy

Two views should be obtained for any traumatic injury to the hand or fingers. These are usually a dorsopalmar view (*Figure 1*) and a lateral view.

Alignment

Check each digit in turn looking specifically at the alignment of the phalanges and metacarpals. This will enable detection of a dislocation. Similarly, the position of the metacarpal and carpal bones should be reviewed.

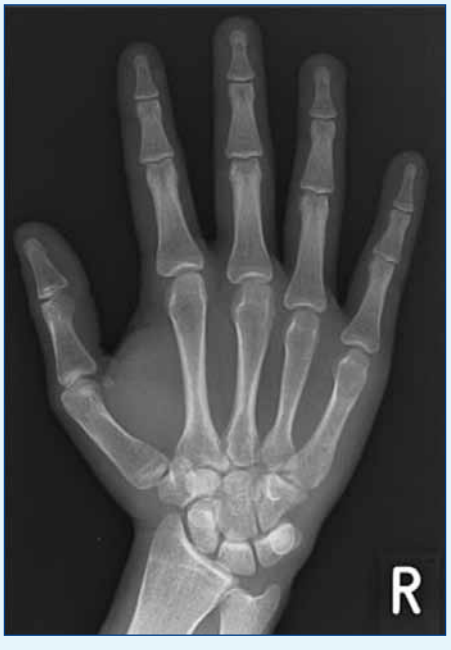
Bones

Look for any breaks in the cortex of each of the phalanges and metacarpals. Careful attention should be paid to areas which have ligamentous attachment (see below).

Cartilage

Joint spaces throughout the hands should be clearly seen and roughly equal (1–2 mm). Careful attention should be paid to any intra-articular extension of fractures.

Figure 1. Dorsopalmar radiograph showing a normal hand.



Soft tissues

Often an injury may have associated soft tissue swelling apparent on a radiograph. This may guide you to an underlying bony injury. Soft tissue injuries may also be representative of ligamentous damage.

Pitfalls

1. Sessamoids and accessory ossicles can mimic fractures but have well-corticated smooth margins
2. Dislocations and small avulsion fractures can be missed on poor quality lateral radiograph.

Commonly seen fractures

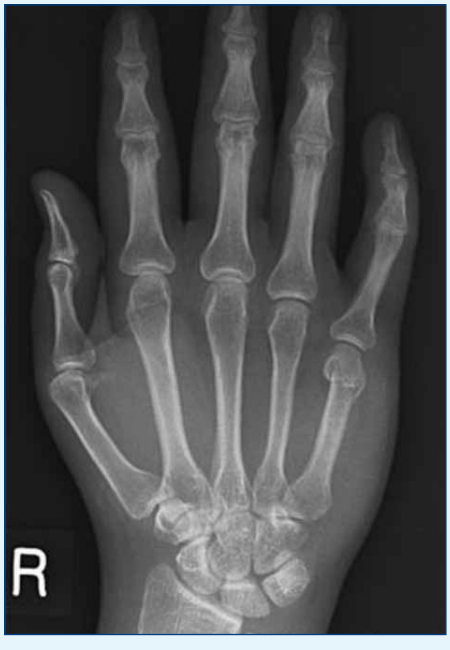
Metacarpal fractures

These occur most commonly in the fifth metacarpal, often following a punching injury (*Figure 2*). The most important features to look for in these fractures are the degree of rotation and any intra-articular involvement as these will usually need surgery (*Figure 3*) (*Table 1*).

Phalangeal fractures

Phalangeal fractures are also commonly seen. As with metacarpal fractures, the degree of displacement and rotation

Figure 2. Dorsopalmar view of hand showing a fifth metacarpal fracture (commonly referred to as a boxer's fracture owing to its association with a punch injury).



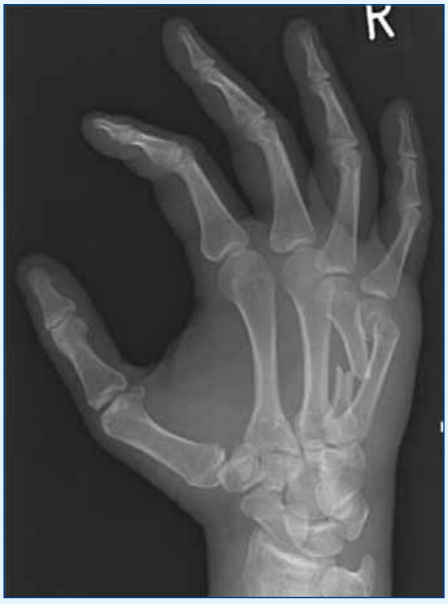


Figure 3. Oblique view of hand showing fractures of fourth and fifth metacarpals.

Table 1. Locations and effects of small avulsion fractures

Location	Structure torn
Palmar	Volar plate
Dorsal	Extensor tendon
Medial or lateral	Collateral ligament

should be assessed and care taken to identify any intra-articular extension as these fractures are more likely to require surgery (*Figures 4* and *5*).

Fractures involving attachment sites of tendons and ligaments

While these fractures may only involve small bony fragments, they are crucially important because of the attachment of tendons and ligaments and careful review of these sites should be undertaken. Usually these injuries will require surgical fixation.

Volar plate injuries

The volar plate is a thickening of the joint capsule on the palmar aspect at the bases of the phalanges, providing attachment for the flexor tendons (*Figure 6*).

Mallet injuries

These fractures involve the base of the phalanges on the dorsal aspect at the attachment of the extensor tendons. It is important to note that only 25% of mallet injuries will result in a fracture and clinical examination is therefore crucially important so as not to miss this type of injury.

Collateral ligament attachment fractures

The collateral ligaments attach on the radial and ulnar aspects of each of the phalages and metacarpals at either side of the interphalangeal and metacarpophalangeal joints. The most commonly injured of these is the so-called 'gamekeeper's thumb' (*Figure 7*). This is an abduction injury to the thumb at the metacarpophalangeal joint which results in damage to the ulnar collateral ligament.

If there is no bony injury, then radiographs taken in the neutral position may be normal. However, if valgus stress is applied then widening of the metacarpophalangeal joint may be seen on the ulnar side, indicative of ulnar collateral ligament injury. Often these injuries are seen following skiing or snow-boarding accidents (particularly on dry ski-slopes) in which the patient's thumb is bent backwards underneath him/her during a fall.

Bennett's fracture

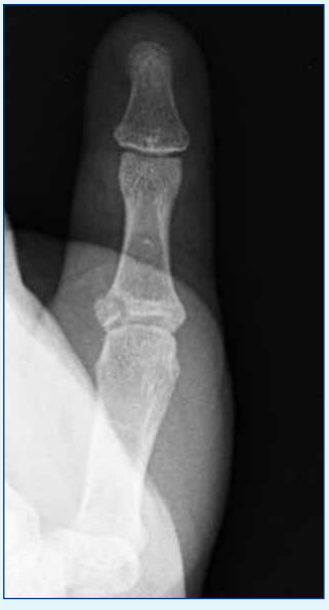
This is an intra-articular fracture of the base of the first metacarpal, which becomes dislocated at the carpometacarpal joint (*Figure 8*). Surgical fixation is often required.

Figure 4. Dorsopalmar view of ring finger showing a proximal phalanx spiral fracture.

Figure 5. Dorsopalmar view of index finger showing a 'tuft fracture' involving the distal phalanx.

Figure 6. Lateral view of a volar plate fracture involving the base of the intermediate phalanx.

Figure 7. Dorsopalmar view of the thumb showing an intra-articular avulsion fracture of the base of the of the proximal phalanx involving the attachment of the ulnar collateral ligament ('gamekeeper's thumb').



Rolando's fracture

This is similar to a Bennett's fracture but results in a comminuted intra-articular three-part fracture of the base of the first metacarpal, usually with a 'Y' or 'T' shaped fracture seen (*Figure 9*). Treatment is also usually surgical.

Dislocations

These may occur at any of the carpometacarpal, metacarpophalangeal or interphalangeal joints. Often a dislocation will be very difficult to see on the dorsopalmar view alone and will only be readily apparent on the lateral view. Before reducing any dislocation careful assessment should be made for any associated fractures, the position of which can sometimes worsen during manipulation. BJHM

Figure 8. Lateral view of the thumb showing a Bennett's fracture at the base of the first metacarpal.

Figure 9. Oblique view of the hand showing a Rolando's fracture at the base of the first metacarpal.

Conflict of interest: none.

Further reading

Raby N, Berman L, De Lacey G (2000) *Accident & Emergency Radiology: A Survival Guide.* WB Saunders Ltd, London

KEY POINTS

- Hand injuries may seem minor at first glance but can have debilitating consequences if not treated appropriately.
- Always obtain two views in assessment of any fracture.
- Careful assessment of areas of ligamentous insertion is required.
- Specialist referral will be required for some dislocations, unstable or rotated fractures, intra-articular fractures and fractures involving ligamentous attachments.