2

The hand and wrist

The 'hand' lies distal to the carpometacarpal (CMC) joints and provides fine control, with movement relying on a relatively simple arrangement of bones, tendons and ligaments. By contrast, the 'wrist', acting as a link between the hand and the forearm, is much more anatomically, functionally and radiographically complex.

Biomechanically, the wrist transfers forces from either the forearm to the hand (as in throwing) or the hand to the forearm (as occurs in swimming). To achieve efficient transfer of force, the wrist must be able to remain stable while under load during movement or in a fixed position.

The hand and wrist are particularly susceptible to injury due to their exposed position and their key role in many activities. Up to 9% of all sports injuries involve the hand and wrist (Lee and Montgomery 2002). Sports involving ball handling, gymnastics and fighting are the leading causes of injury. Sport is the most common cause of phalangeal fractures in 10- to 39-year-olds and produces 43% of all injuries in 10- to 19-year-olds (Snead and Rettig 2001).

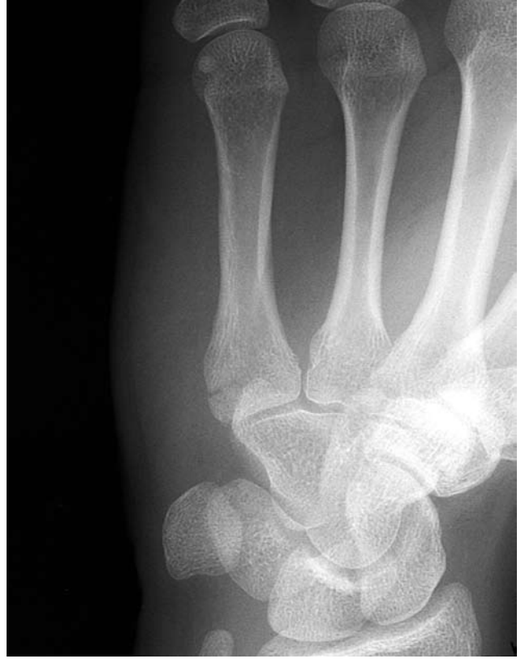
In the past, sporting injuries of the hand and wrist were often casually and sometimes poorly managed. Injured fingers were frequently strapped to the neighbouring finger and painful wrists were supported with strapping to enable the athlete to continue playing or competing. It was not uncommon for strapping to be reapplied for months, with little attention paid to the nature of the underlying injury. An immediate or early return to sport was the clear priority.

However, experience has taught us that this relaxed approach to hand and wrist injuries can result in significant deformities and disabilities, many of which can be avoided with appropriate management at the time of the injury. The prompt restoration of stability and function is now recognised as essential to achieving an optimal treatment outcome. Imaging plays an important role in this process, contributing to a fast and accurate diagnosis.

A basic set of conventional radiographs is often all that is required to assess the hand. However, the wrist frequently needs further work up, with either special views or the use of additional imaging methods. Ultrasound has become an extremely valuable diagnostic tool used to assess foreign bodies (see Fig. 2.1), abnormalities of tendons and ligaments, soft-tissue masses such as ganglia, some vascular injuries, and synovitic processes affecting small joints (Read et al. 1996). Targeted high-resolution CT examination can further characterise bone lesions, including subtle or radiographically occult fractures and dislocations. MRI has an important role in the diagnosis of bone marrow changes, the triangular fibrocartilage complex

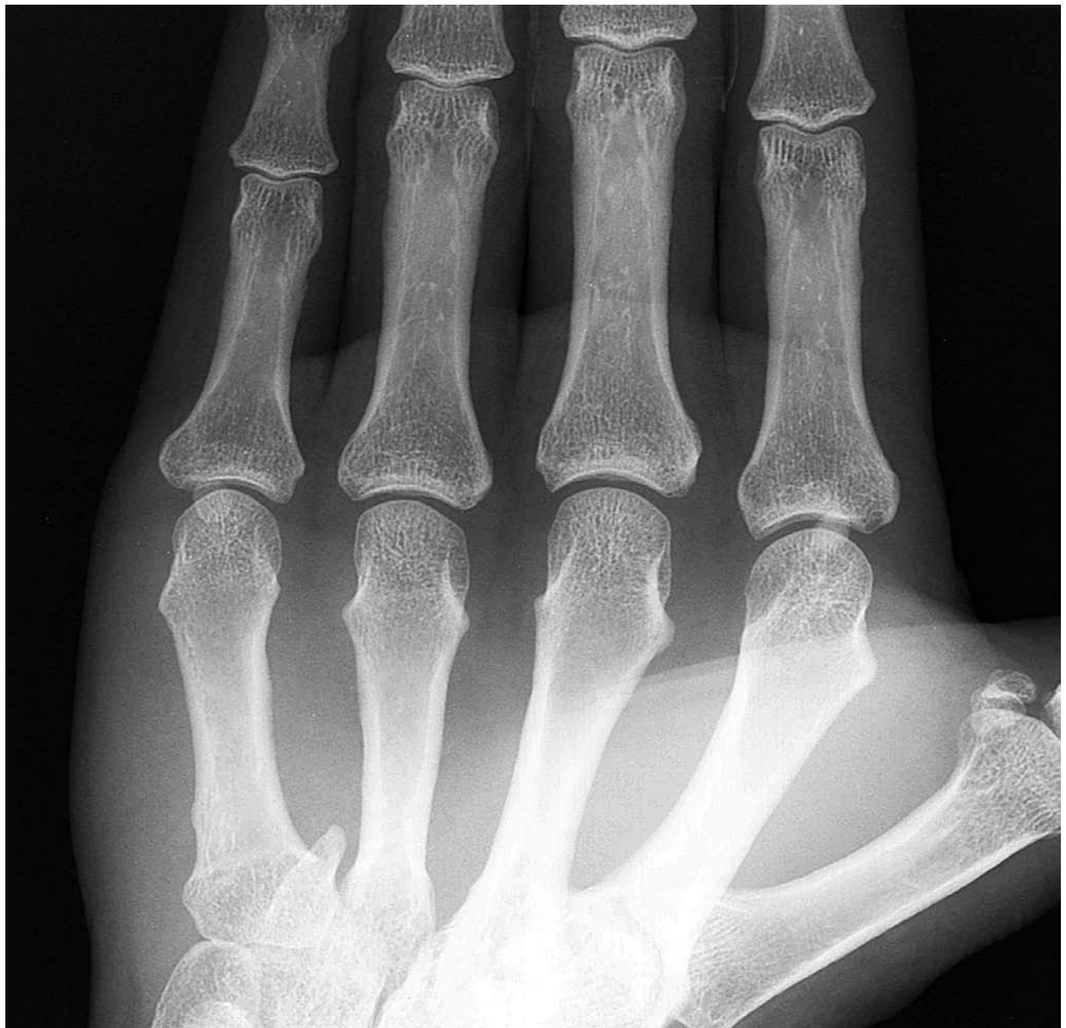
A reversed oblique view (see Fig. 2.7) is a useful additional view to demonstrate injury at the base of the fourth and fifth metacarpals and the adjacent carpals and medial CMC joints. The technique is discussed on page 000.

If an intra-articular fracture of a metacarpal head is suspected, Brewerton's view (Anderson 2000) is a valuable additional view (see Fig. 2.8). This view brings the majority of the articular surfaces of the MCP joints into profile and enables identification of small articular fractures. The radiographic technique to acquire this view is discussed on page 000.



▶ **Fig. 2.7** This reversed oblique view shows an incomplete undisplaced fracture at the base of the fifth metacarpal and enables examination of the hamate as well as the fourth and fifth CMC joints.

▼ **Fig. 2.8** Brewerton's view shows a large proportion of the articular surfaces of the MCP joints and is particularly valuable when an intra-articular fracture is suspected. This examination is normal.



Hand injuries

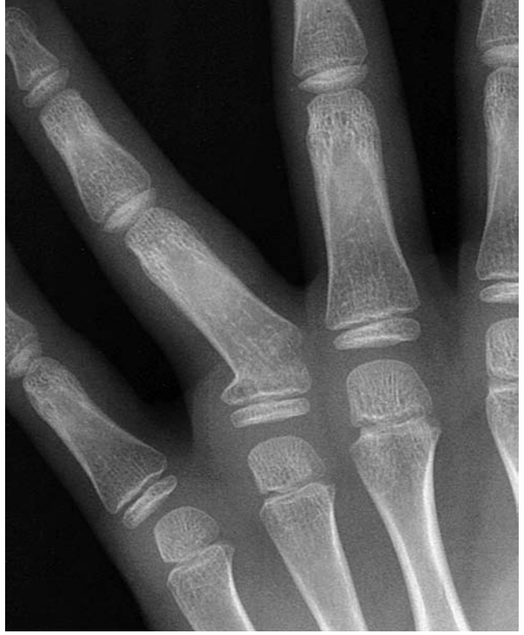
Hand injuries may involve bone, joints, tendons, ligaments and other soft tissues.

Bone and joint injuries

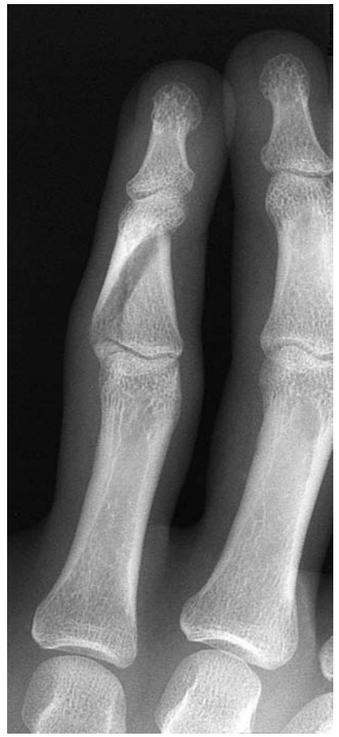
Finger injuries

Phalangeal fractures

Residual deformities following a phalangeal fracture may interfere with normal function. Consequently, all suspected phalangeal fractures require imaging, since particular fractures need orthopaedic assessment. If deviation (see Fig. 2.9) or rotation (see Fig. 2.10) of the distal fracture fragment has occurred and is left unreduced, the fingers may cross when a fist is made. This would interfere with normal hand function. Other fractures, such as condylar fractures, are intrinsically unstable and usually require fixation (see Fig. 2.11).

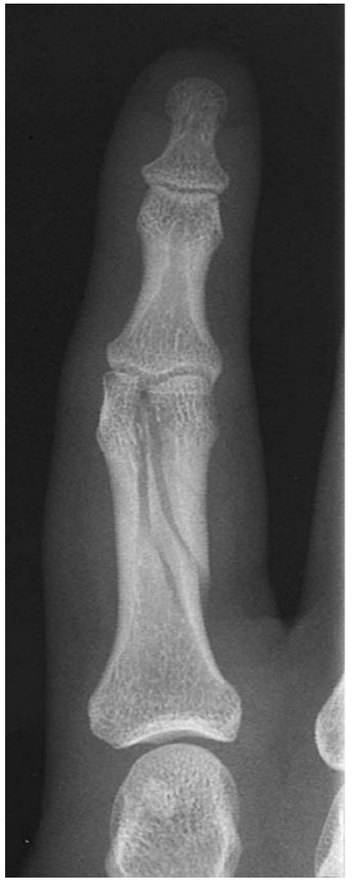


▲ **Fig. 2.9** If deviation such as this is uncorrected, overlapping of the fingers will result when the fingers are flexed.



▲ **Fig. 2.10** A fracture of the middle phalanx with considerable rotation of the distal fragment. If this rotation is uncorrected, the fingers may overlap when a fist is formed.

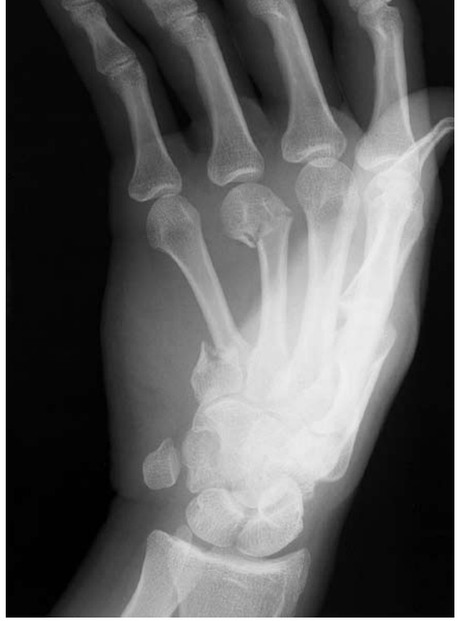
▶ **Fig. 2.11** Uni- or bicondylar fractures (a) are usually unstable and require fixation (b). Note that the distal screw has broken at surgery and the head of the screw has been removed.



Metacarpal fractures

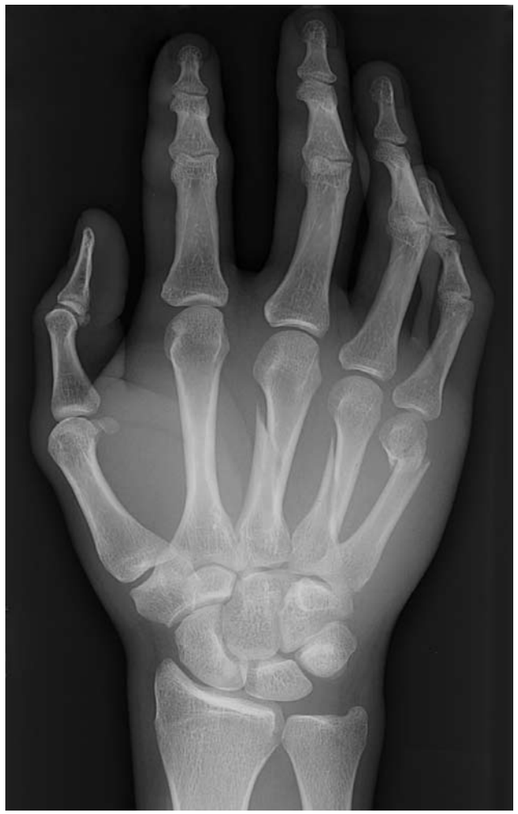
Metacarpal fractures are a common hand injury, usually resulting from punching (see Fig. 2.35) and direct trauma (see Fig. 2.36). A large percentage of metacarpal fractures result from fighting and football. The most common type is a fracture of the fifth metacarpal neck (see Fig. 2.37): metacarpal fractures represent a third of all hand fractures, and fractures of the fifth metacarpal account for half of these (Lee and Jupiter 2000). Characteristically, palmar angulation of the metacarpal head occurs and this deformity is often accepted. However, it must be remembered that in some sports, such as cricket, golf and tennis where a comfortable bat, club or racquet grip is essential, reduction of the angulation may be necessary to avoid a bony lump in the palm of the hand. Rotational deformities are also functionally significant and it is important to appreciate this deformity on radiographs. For each 1° of malrotation at the metacarpal fracture site, there may be as much as a 5° malrotation at the fingertip (Opgrande and Westphal 1983). The acceptability of malrotation will vary with the manual activity required by the individual. There is a strong ligament that passes between metacarpal heads two to five. These ligaments prevent separation of the metacarpals and add stability to metacarpal shaft fractures. Fractures of the second and fifth metacarpals are subsequently less supported as they have the ligament only on one side.

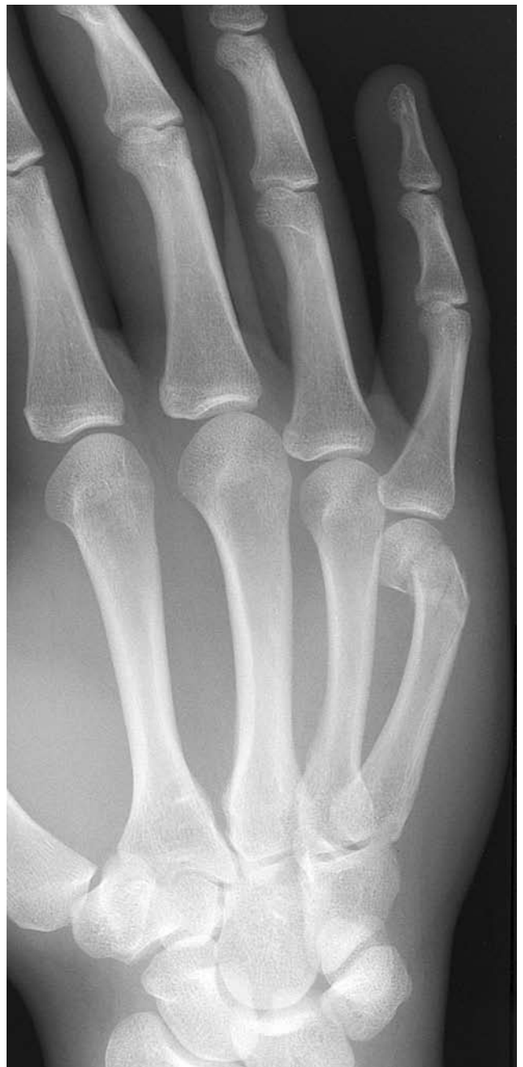
Metacarpal heads have a large articular surface extending onto the palmar aspect of the neck, allowing increased metacarpophalangeal flexion. The size of the articular surface will increase the chance of an intra-articular fracture. A Brewerton's view is a valuable extra view that helps to examine a large percentage of the articular surfaces when an intra-articular fracture is suspected (see Fig. 2.38(a)). The view is obtained with the hand AP and the dorsal surfaces of the fingers lying on the cassette. The MCP joints are flexed to 45º and the beam is centred on the third MCP joint using a straight tube (see Fig. 2.38(b)). If large enough, intra-articular fractures can often be identified by careful inspection of the routine plain film series (see Fig. 2.39).



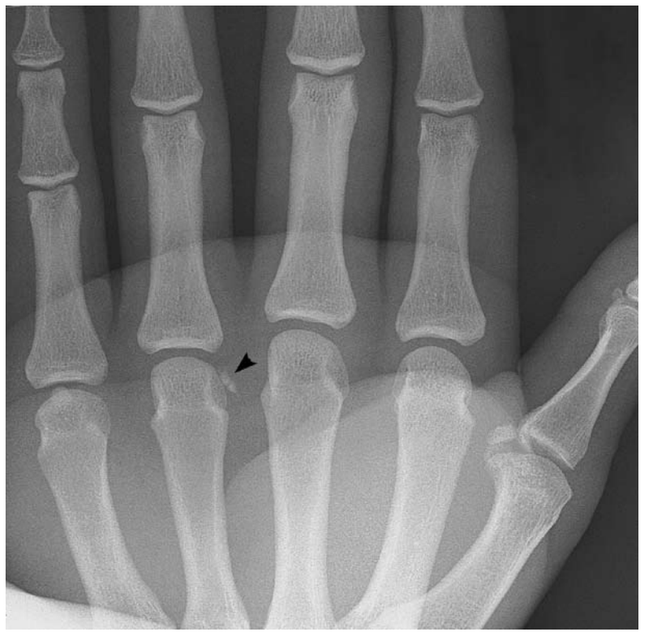
▶ **Fig. 2.35** Fractures of the fourth and fifth metacarpals have resulted from punching. The medial CMC joints and the hamate may also be injured as a result of this mechanism.

▼ **Fig. 2.36** Metacarpal fractures are also commonly caused by direct trauma. Fractures of the third, fourth and fifth metacarpals have resulted from a stomping injury suffered during a game of rugby.





▶ **Fig. 2.37** By far the most common metacarpal fracture is a fracture of the neck or distal shaft of the fifth metacarpal. Palmar angulation of the metacarpal heads will invariably occur. This is usually a punching injury, and on weekends casualty films always contain examples of this injury.



▲ **Fig. 2.38(a)** A gymnast at the Sydney 2000 Olympics hit his hand on the vaulting apparatus during a performance. An initial PA view shows possible bony density projected over the lateral margin of the head of the fourth metacarpal (arrow).
◀ **(b)** A Brewerton's view was obtained on the same athlete as in (a) and this view clearly shows an intra-articular fracture with displacement of the fragment.

▼ **Fig. 2.39** An intra-articular fracture of the head of the second metatarsal resulting from direct trauma is easily seen on routine hand views.