ABC of emergency radiology

Hand

Otto Chan, Tudor Hughes

The hand is exposed and at risk of injury. It is therefore not surprising that hand injuries are the commonest skeletal injuries, and they account for 10-20% of attendances at accident and emergency departments. Fractures of the phalanges are more common than fractures of the metacarpals. Fractures of the distal phalanx account for half of all phalangeal fractures. Metacarpal injuries occur most commonly in the thumb and little finger.

Most injuries of the hands are easy to detect and correlate well with clinical findings. Identification of injuries is essential because early detection and appropriate management usually leads to recovery of normal function. Conversely, delay in diagnosis of what seems to be a minor abnormality can lead to a severe disability. Surgery is rarely necessary and only indicated for specific injuries. Clinical examination determines which radiographic views should be obtained.

Anatomy

Each finger consists of one metacarpal and three phalanges, and the thumb consists of one metacarpal and two phalanges. Each bone has a head, a shaft, and a base. Strong ulnar and radial collateral ligaments prevent sideways movement of the joints. The joint capsule of the interphalangeal and metacarpophalangeal joints is thickened on the palmar (volar) aspect and forms a dense fibrous structure (volar plate). This attaches to the base of the phalanx. Each finger has two flexor tendons and one extensor tendon. Sesamoid bones may be found on the palmar aspect of the hand, most commonly in the flexor tendons of the thumb at the level of the metacarpophalangeal joint.

Anteroposterior (left) and oblique (right) view of the hand

ABCs systematic approach

Assessment of radiographs should follow the ABCs system:

- Adequacy
- Alignment
- Bone
- Cartilage and joints
- Soft tissues

This article is adapted from the 2nd edition of the *ABC of Emergency Radiology*, which will be published in the autumn

Dorsal (left) and lateral (right) view of left index finger

Anteroposterior (left) and lateral (middle left) view of thumb. Anteroposterior (middle right) and lateral (right) view of finger

Anteroposterior (left) view of index finger showing soft tissue swelling over the proximal interphalangeal joint. The lateral view (right) confirms a dislocation

Adequacy

Anteroposterior and lateral views should be obtained for finger injuries, and anteroposterior and oblique views are needed for hand injuries. Special views may be necessary for specific injuries, such as thumb injuries.

Alignment

Check the alignment of each finger and thumb on two views.

Bone

Exclude a fracture by carefully following the bony contour of each digit on two views. Then check the bone density and trabecular pattern. Occasionally, a vascular groove can be confused with a fracture.

Cartilage and joints

The joint space should be uniform in width. Overlap of bone margins may indicate a dislocation, and a second view should confirm this.

Soft tissues

Always use a bright light to look for soft tissue swelling. This may be the only sign of an injury. When radiographs are taken to detect foreign bodies a metallic marker should always be placed at the site of the injury, tangential to the site of entry. Foreign bodies may be visible on one view only.

Injuries

Distal phalanges

Crush fracture

This is an extremely common injury in which the tuft is squashed and sustains a marginal chip or a comminuted fracture. Generally, a nail bed or pulp soft tissue injury is associated with a crush fracture.

Mallet finger (baseball finger)

Often caused by a direct blow to the extended digit—there is an avulsion of the extensor tendon at its insertion to the base of the distal phalanx. A less common injury is an avulsion of a small fragment of bone from the dorsal aspect of the base of the distal phalanx. The diagnosis is clinical and obvious—a flexion deformity of the distal interphalangeal joint.

Radiography is done to assess the size of the bony fragment. Most of these injuries heal with simple splinting of the joint (with a mallet splint), but complete tears of the tendon may need surgery.

Middle phalanges

Boutonnière deformity

This is a deformity of the digit with extension of the distal interphalangeal joint, flexion of the proximal interphalangeal joint, and no associated bony abnormality on the radiograph. The extensor mechanism attachment is torn, and splinting in hyperextension of the proximal interphalangeal joint is indicated to prevent a long term fixed flexion deformity.

Volar plate avulsion

This fracture is quite common. It is secondary to a hyperextension injury and sometimes associated with a dislocation of the proximal interphalangeal joint. The avulsed fragment of bone is often very small and difficult to identify. The fragment is sometimes seen only on an oblique view as a tiny flake of bone, and the clue to its presence is soft tissue swelling.

ABCs systematic approach

Adequacy and alignment

- Two views are needed to exclude dislocation of a finger
- Oblique or lateral view is needed to detect a Bennett's fracture
- Ultrasonography is needed to detect gamekeeper's thumb

Bone

The commonest sites of injury are:

- Finger tip (crush fracture)
- Base of distal phalanx (mallet finger)
- Neck (base or shaft) of fifth metacarpal (boxer's fracture)

Cartilage and joints

- Look for overlapped joint space indicating subluxed or dislocated joint—for example, Bennett's fracture

Soft tissues

- A marker of soft tissue exposure is needed to detect foreign bodies
- Radiography can localise soft tissue injury

Anteroposterior view of index finger showing crush fracture (left) and volar plate avulsion (right)

Mallet finger without (left) and with (right) fracture

Boutonnière deformity

Proximal phalanges

Spiral or transverse fracture

In this fracture the digit is often shortened and rotated; the injury is usually caused by a direct blow. The deformity is generally more obvious when patients flex their fingers. Angulation is best evaluated with a true lateral view or oblique view. The anteroposterior view usually underestimates the degree of angulation and shortening.

Metacarpal bones

Punch fracture (boxer's fracture)

This is the direct result of a punch. The neck of the metacarpal is fractured, and there is volar displacement of the head. Usually the fifth metacarpal is damaged, but injury can also occur at the head of the fourth or other metacarpals. The history and clinical findings are characteristic (although patients often deny they have been in a fight) with flattening of the knuckle. A degree of angulation is accepted as this causes negligible functional disability. The original description of a boxer's fracture was a fracture of the base of the fifth metacarpal.

Other metacarpal injuries

Oblique or even transverse fractures of the shaft or base of the metacarpals can occur in one or more metacarpals. Sometimes the fracture occurs at the base and the carpometacarpal joint, and there is the possibility of an associated dislocation or subluxation of the joint. These fractures are sometimes best treated with pin fixation.

Thumb injuries

Bennett's fracture and dislocation

This is an oblique fracture of the base of the first metacarpal and dorsal dislocation or subluxation of the first metacarpal. The fracture extends to the carpometacarpal joint and the displacement is made worse and more unstable by the abductor muscles of the first metacarpal. The management of this injury is controversial. It can be treated by closed reduction with splinting, closed and percutaneous pin fixation, or open reduction and pinning. Referral to a specialist orthopaedic surgeon is mandatory.

Gamekeeper's thumb (skier's thumb)

An abduction injury of the thumb occurs when there is outward distraction of the thumb and an avulsion of the attachment of the ulnar collateral ligament (which can be associated with a bony avulsion fracture). Stress films may show further widening of the joint space on the ulnar aspect, but these films are not recommended as they can aggravate the injury.

Ultrasonography should confirm the diagnosis. These injuries may be treated conservatively, but complete tears of the ulnar collateral ligament may require surgery.

Key points

- History is important because the mechanism of injury often provides a clue to diagnosis
- Clinical examination will give a strong clue to the diagnosis
- Early diagnosis and appropriate management is essential for full recovery
- ABCs systematic approach should be used to review radiographs

Tudor Hughes is professor of radiology, University of California San Diego Medical Centre, San Diego, USA

The *ABC of Emergency Radiology* is edited by Otto Chan, consultant radiologist, Royal London Hospital, London (zaideotto@blueyonder.co.uk)

BMJ 2005;330:1073-5

Punch fractures of fifth metacarpal—head (left) neck (middle), and base (right)

Anteroposterior view of the ring finger seems almost normal (left), but the oblique view shows an oblique fracture of base of fourth and fifth metacarpals (arrow)

Bennett's fracture and dislocation

Gamekeeper's thumb (skier's thumb). Arrow shows fracture attached to ulnar collateral ligament (note the sesamoid)