

# Fractures of the upper extremity

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The aim of this paper is to outline the diagnosis and management of fractures of the upper extremity in adults. The paper seeks to elucidate the pitfalls in management that may lead to unexpected and poor outcomes.

## Clavicle

Fractures of the clavicle are common, and they are rarely complicated. As a rule, treatment is symptomatic providing the patient with pain relief, and a sling or collar and cuff to minimise motion at the fracture site during the early part of the healing process. Generally patients should wear a collar and cuff or similar device for two to three weeks, following which they can undertake light activities with their arms at waist level, but it is often six to eight weeks before they are able to participate in activities at shoulder level or above. A radiographic assessment of these fractures often causes concern because of the degree of comminution, or the orientation of the comminuted fragments, but the clavicle and the surrounding structures are surprisingly forgiving, and long-term disability relating to displaced fragments is rare. Furthermore, the cosmetic appearance of the healed fracture rarely, if ever, relates to the initial x-ray appearance. There are two clavicle fractures that cause concern, the first is an oblique fracture of the distal one third of the clavicle (Figure 1). These fractures may cause an unsightly cosmetic deformity as the injury is essentially a variant of an acromio-clavicular dislocation, in that the entire shoulder girdle subluxes inferiorly leaving a sharp end of the medial fragment protruding under the skin. If a major cosmetic deformity is present at the time of pres-

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entation, or if skin compromise is evident from the medial fragment, these fractures should be referred for orthopaedic opinion.

The second type of clavicle fracture that is of concern is the fracture sustained in a high-energy injury, such as mountain bike or motorcycle accidents (Figure 2). These fractures tend to be very slow to heal and indeed may go to non-union, probably because of the degree of soft tissue stripping which renders the fracture site relatively avascular. As a rule of thumb, if there is not good clinical evidence of healing in six to eight weeks, referral to an orthopaedic surgeon is recommended.

## Acromio-clavicular dislocation

There are three grades of acromioclavicular dislocation commonly encountered. Grade 1 is a 'sprain' of the acromioclavicular ligaments, the patients have pain on palpation over the acromioclavicular joint, but radiographs are normal. In Grade 2 injuries the capsule of the acromioclavicular joint is disrupted but the coracoclavicular ligaments are intact, radiographs show a subluxation of acromioclavicular joint. Grade 3 injuries imply that the acromio and coracoclavicular ligaments are disrupted such that the radiographs demonstrate a complete dislocation of the

joint. The initial management of all these injuries is analgesia and appropriate support of the arm. The vast majority of these injuries heal without long-term sequelae; an occasional patient will have on-going pain around the outer end of the clavicle necessitating orthopaedic referral. Grade 3 injuries are a particular problem in females, because of the unsightly cosmetic appearance, which is less obvious in males because of the contour of trapezius. If this injury is encountered in a female, the cosmetic deformities should be pointed out to the patient, and if it is not acceptable then referral is essential.

## The proximal humerus

Fractures of the proximal humerus are said by some orthopaedic surgeons to be unsolved fractures because of the difficulty of identifying the fracture pattern accurately, and choosing the fracture management that will give the best possible outcome. Assessment of these fractures begins by obtaining appropriate radiographs. The good anterior posterior view and a trans scapular lateral are essential for assessing these fractures (Figures 3 and 4). I like to think of the head of the humerus as being an ice cream on top of an ice cream cone. The AP radio-

graphs may show that the head of the humerus is rolled off the humeral shaft either medially or laterally, and on the trans scapular lateral the head is inevitably rolled backwards. Care should be taken to identify the number of fracture fragments. If the greater and lesser tuberosities are fractured, and there is a surgical neck fracture, these fractures are best referred. Any displaced fractures, displacement being defined as greater than 45° angulation or separation of the fragments by more than 1cm, should be referred for orthopaedic review, except in the very elderly in whom treatment is symptomatic. It is important to remember that fractures of the proximal humerus are unforgiving and, if you have any concerns about the fracture pattern, discussion with an orthopaedic surgeon is advised. In young adults, fractures of the proximal humerus occur in association with high velocity injuries, and are best treated by an orthopaedic surgeon unless there is minimal displacement. If the fractures are undisplaced, immobilisation in a sling or collar and cuff for two weeks, then gentle mobilisation with or without the assistance of a physiotherapist is recommended. It is important to warn older patients about the bruising that develops following these fractures. This can be quite distressing for the patient as the bruising often extends into the forearm and, occasionally, into the hand, causing discolouration of the entire arm. Fractures of the proximal humerus treated this way mean that the patient can often use the arm by their side at about the four to six week interval, but more active use of the shoulder should not be anticipated before at least eight to twelve weeks.

### Fractures of the humeral shaft

Generally speaking, fractures of the humeral shaft should be referred for orthopaedic opinion, but as a rule, they are forgiving fractures and if you are well equipped to institute and monitor treatment then they can be managed outside a hospital setting. Minor degrees of angulation, five to 10° of varus or valgus and five to 10° of flexion

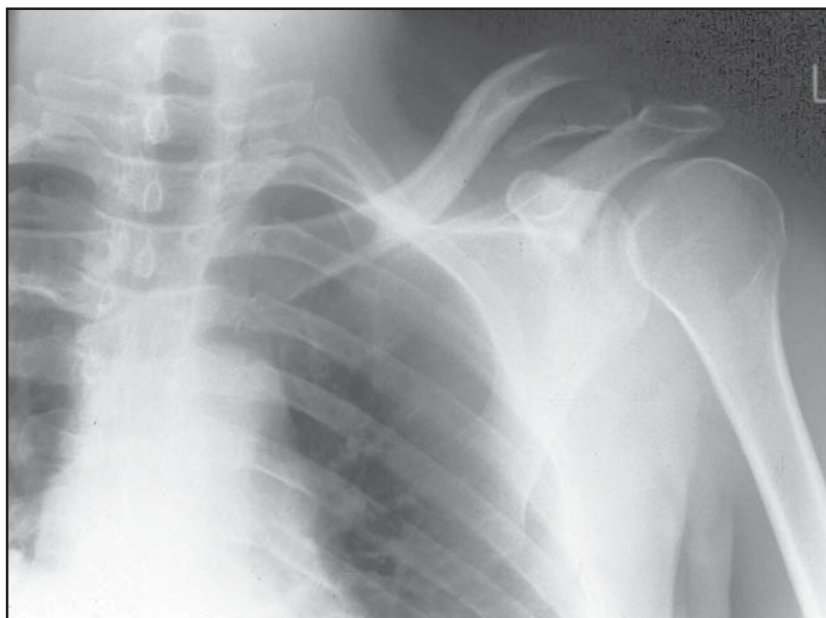


Figure 1. Oblique fracture of distal third



Figure 2. High-energy injury of clavicle

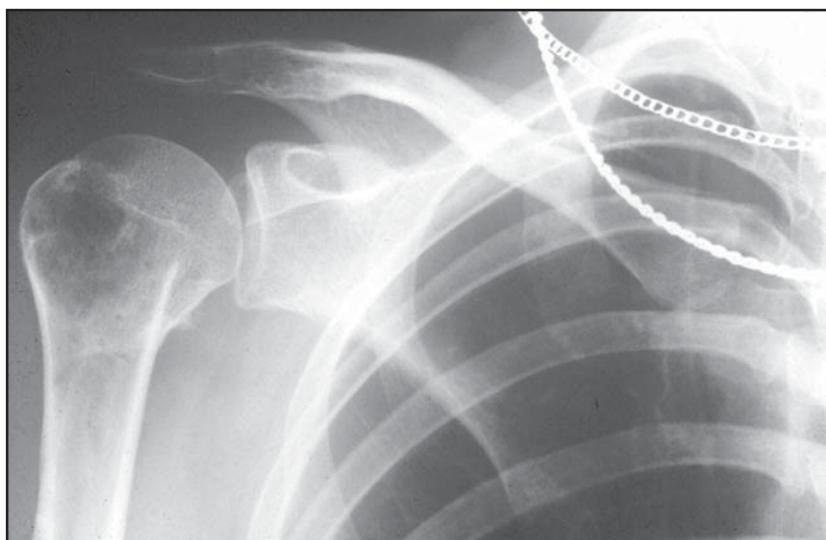


Figure 3. Shoulder AP view



Figure 4. Shoulder trans-scapular view

and extension are well tolerated (Figure 5). Distraction at the fracture site is, however, poorly tolerated and non-union will often ensue if it is allowed to remain unchecked. Treatment in a modified U slab plaster extending up over the shoulder prevents distraction from the fracture site and generally allows uneventful healing. Fractures treated in this manner can be expected to show callus formation in three to four weeks, at which time a fracture brace can be applied to allow mobilisation of the shoulder and elbow during the remainder of the fracture healing process. A flexion deformity at the elbow can be anticipated at the cessation of treatment due to adherence of the brachialis and biceps over the fracture site, but this usually resolves within a period of a month or two. It is important to avoid shoulder stiffness and early aggressive physiotherapy is imperative if the patient shows signs of developing this. Fractures of the distal third of the humerus, particularly those involved in the elbow joint, must be referred for treatment.

### The elbow

Supracondylar fractures and distal humeral fractures involving articular surface should be referred for orthopaedic review. Fractures of the ole-

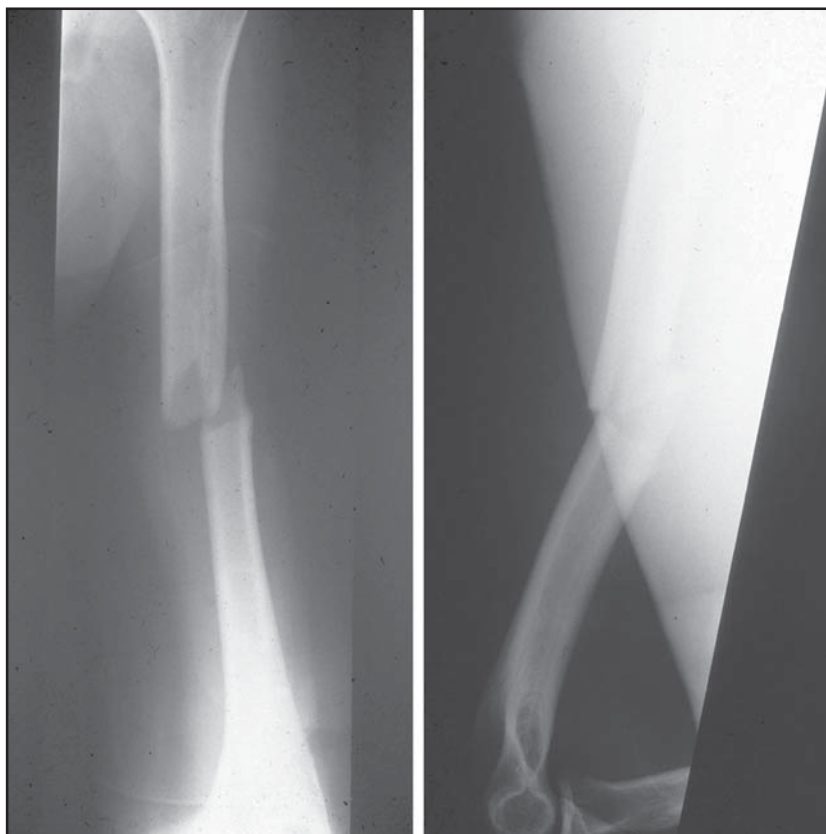


Figure 5. Fracture of humeral shaft

cranon that are undisplaced can be treated symptomatically with a short period of immobilisation followed by a gentle mobilisation, allowing approximately six weeks for fracture healing to occur. Any fracture with greater than 2mm displacement should be referred for orthopaedic review. Fractures of the radial head are very common, and the vast majority of these are easily managed. Initial assessment

focuses on the medial side of the elbow where, if there is significant tenderness below the medial epicondyle of the humerus, there may have been a dislocation in association with the radial head fracture, and an orthopaedic opinion should be sought. If there is no medial tenderness, it is important to assess the type of radial head fracture. The vast majority of these fractures are Type 1, 3 and 5 as illustrated

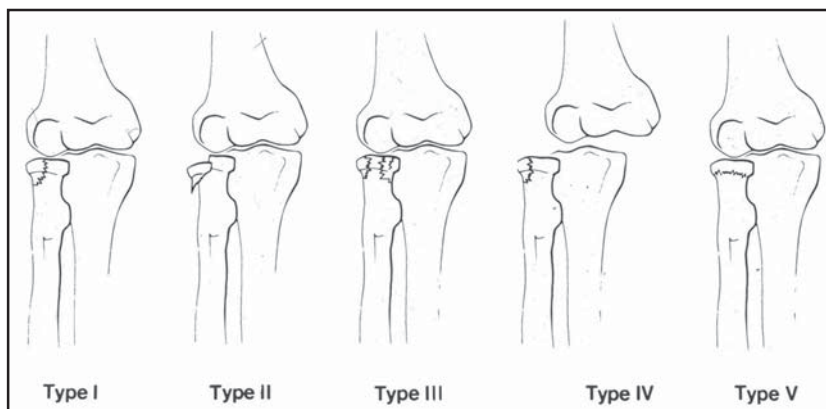


Figure 6. Fractures of the radial head





Figure 7. Fracture of radial shaft

(Figure 6). Displaced fractures (Type 2) are relatively uncommon, but if there is significant displacement (greater than 2mm) orthopaedic opinion should be sought. Type 4 fractures are associated with a dislocation of the elbow, and referral is important. Following the diagnosis, the early symptomatic treatment consists of resting the elbow, usually in a plaster back slab, for a period of five to seven days followed by gentle mobilisation within the limits of pain. If a practitioner is confident of joint aspiration, aspiration of the haemarthrosis often provides significant pain relief. If the initial assessment reveals that the patient cannot pronate or supinate the forearm, suggesting a mechanical block to this motion, then referral is important. Patients with radial head fractures can generally return to light activities in two weeks, and to more strenuous activities in four to six weeks. Patients should be warned to expect a loss of 15–20° of extension; this extension loss will persist for several months.



Figure 8. Intra-articular fracture distal radius

### The forearm

The majority of forearm fractures should be referred for orthopaedic opinion. However isolated fractures of the ulna shaft can be treated by an above elbow cast for four to six weeks. However, these fractures carry a significant risk of non-union, and if after four to six weeks immobilisation there is no callus formation they should be referred. Isolated fractures of the radius (Figure 7) particularly in the distal third of the radius should all be referred for orthopaedic assessment, because these are very often associated with injuries to the radio-ulna joint, and these fractures demand internal fixation.

### The wrist

Fractures of the wrist are common, particularly in the elderly. In thinking about these fractures, consider:

- i) the age of the patient
- ii) the type of fracture
- iii) the mechanism of injury.

In general, older patients have fractures that are more forgiving, and patients over the age of 65–70 have fractures that behave differently from those in younger patients. In thinking about the type of fracture, they may be metaphyseal, intra-articular, or may involve the volar or dorsal margins of the radius. These radial fractures often co-exist with fractures of the distal ulna, usually the ulna styloid, or an injury to the distal radio-ulna joint (Figure 8). The mechanism of the injury is important because these fractures, when they occur in young patients, do so because of a high energy injury and they may be associated with injury of other carpal bones. These types of fracture can cause major problems in the long term. Looking at the radiographs of distal-radial fractures it is important to identify the degree of dorsal angulation, the amount of shortening of the radius, measured by assessing the level of the articular surface of the radius compared with the articular surface of the ulna at the distal radio-ulna joint, and if the fracture is intra-articular, if there is any intra-articular displacement. If there is appreciable shortening, if there is dorsal angulation over 30°, or if there is intra-articular displacement of greater than 2mm, reduction is essential. When reviewing the radiographs, pay particular attention to the presence of an ulna styloid fracture, as this can be the site of later pain following wrist fractures. Scaphoid fractures in association with distal radius fractures are

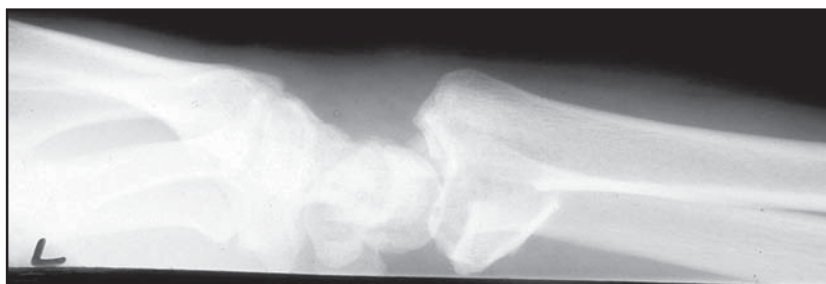


Figure 9. Fracture volar lip distal radius

uncommon but indicate a severe injury, and referral is recommended. Clearly fractures of the distal radius range from the relatively simple injuries to very complex injuries. Fractures that can be safely treated include fractures of the radial metaphysis, but accurate reduction is important. The techniques of reduction are beyond the scope of this paper, and readers are referred to standard orthopaedic texts for this information and should seek practical experience in an orthopaedic department. Fractures involving the dorsal or volar lip of the distal radius (Figure 9), intra-articular fractures and comminuted fractures in young people should be referred for treatment as their outcome is often prejudiced by anything other than perfect reduction, and this can usually only be obtained by surgical means.



Figure 10. Scaphoid fracture



Figure 11. Malrotation following phalangeal fracture

### The scaphoid

Fractures of the scaphoid have an unpleasant reputation because of non-union and, to a lesser extent, avascular necrosis. In assessing radiographs of scaphoid fractures it is important to look for any evidence of displacement, for if this is recognised referral is essential. Displacement of scaphoid fractures implies that there has been an injury to the adjacent intercarpal ligaments and these fractures need to be treated by reduction and internal fixation. Radiographs of displaced fractures will show either distraction at the fracture site, translation of the fracture fragments, or angulation which is usually best seen on the lateral radiograph (Figure 10). As a rule of thumb, fractures in the distal third of the scaphoid have a good prognosis, and as one moves proximally the prognosis for union becomes more uncertain. Transverse undisplaced fractures of the scaphoid will usually heal in six to eight weeks, but if they are in the proximal third, the healing time can be significantly longer. If the fractures are oblique, the healing may also be delayed. If there is no evidence of the union following six to eight weeks of immobilisation in a scaphoid cast the patient should be referred.

### The metacarpals

Fractures of the metacarpals, particularly 5th metacarpal, are common. Displacement of the fractures is uncommon except for the 5th metacarpal. Clinical assessment focuses on shortening and angulation of the fracture site and an assessment of rotation of the fingers. Fractures of the 5th metacarpal head are the most common metacarpal fracture, and must be reduced if there is more than 30° of angulation on a true lateral radiograph. Angulation cannot be assessed on an oblique radiograph. Reduction of these fractures can be difficult because they are usually impacted, and if they cannot be reduced referral is essential. Isolated fractures of the metacarpal shafts are generally well tolerated and they result in a few millimetres of shortening of the metacarpal, and can usually

be treated symptomatically. If there are two adjacent metacarpals fractured then these often require internal fixation to regain metacarpal length.

Fractures of the 1st metacarpal base are common; they may be transverse metaphyseal fractures or intra-articular fractures with subluxation of the metacarpal base from the trapezium. Both these fractures require accurate reduction, which is usually easy to obtain but difficult to maintain, and referral to an orthopaedic service is recommended.

### Phalangeal fractures

Phalangeal fractures are common particularly in the younger, sporting population. They cause considerable disability if inappropriately managed. Residual deformity, particularly malrotation is poorly tolerated (Figure 11). The pattern of phalangeal fractures is very varied and beyond the scope of this paper. As a rule, intra-articular fractures need accurate reduction and this often requires open reduction. Displaced fractures of the proximal phalanx require reduction and maintenance of length and prevention of mal-rotation, this can be achieved by the application of a static traction system, which requires careful attention to detail. Avulsion fractures of the volar surface of the base of the middle phalanx or the head of the proximal phalanx, result from a hyperextension injury to the joint and avulsion of the volar plate. These are painful injuries that are best treated with 'buddy' strapping to prevent re-injury during the healing of the soft tissue envelope. Mallet finger fractures are common and if the avulsed fragment involves more than 30% of the joint surface some form of internal fixation is required.

Fractures of the hand cause a good deal of morbidity if inappropriately treated. Even when well treated, stiffness in the hand is a major disability and should be avoided. Early physiotherapy is essential to minimise the morbidity. In general the fractures heal very fast, and only short periods of immobilisation are necessary.