Review

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Perioperative management of distal radius fractures

Jiang An Lim[1,2], Bryan LC Loh[1,2], George Sylvestor[1] and Wasim Khan[1]

Abstract

Fractures of the distal radius are the most common upper limb fracture and account for over a sixth of all fractures seen in emergency departments. Although most of these fractures are managed non-operatively, a significant number of complex injuries undergo operative management. This educational review of up to date guidelines discusses the perioperative management of distal radius fractures and provides readers with continuing professional development activities.

Keywords

Distal radius fractures / Wrist fractures / Colles' fractures / Smith's fractures / Perioperative management / Continuing Professional Development activities

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Introduction

Fractures of the distal radius are wrist fractures that involve of the metaphysis of the distal radius. Distal radius fractures are the most common upper extremity fracture and account for over a sixth of all fractures seen in emergency departments (Mauck & Swigler 2018, Park & Goldie 2012). They are one of the most common injuries encountered in orthopaedic practice (British Orthopaedic Association Standards for Trauma and Orthopaedics (BOAST) 2017). The incidence of these fractures in older patients correlates with osteopenia, and older patients with previous distal radius fractures are more likely to sustain an osteoporotic fracture at other sites (Schousboe et al 2005). Common risk factors in older people for a distal radius fracture are detailed in Table 1.

Low energy injuries or falls are more often seen in older patients and usually result in mildly displaced extra-articular fractures (Figure 1), whereas high energy injuries are more common in younger patients and usually lead to comminuted and displaced intra-articular fractures (Figure 2) (Martinez-Mendez et al 2018).

Distal radius fractures can, in addition to the distal radius, involve the radiocarpal joint, distal radioulnar joint (DRUJ) and the distal ulna (Mauck & Swigler 2018). The subtypes of distal radius fracture can present differently, with different mechanisms of injury and different forms of management (Malik et al 2010). Although few fractures follow the classical descriptions below, the described features allow fractures to be grouped and management stratified.

Colles' fracture

This is a metaphyseal fracture of the distal radius that typically occurs 2.5cm proximal to the carpal articulation which presents with dorsal displacement and angulation as well as radial shortening of the distal radial fragment (Panthi et al 2017). This fracture pattern is classically described on lateral plain film X-rays of the wrist as a 'Dinner Fork' deformity and is associated with an ulnar styloid fracture. Typically, Colles' fractures are low energy, intra-articular and extra-articular distal radius fractures which occur due to a fall on the extended wrist. Colles' fracture and similar variations are the most common fracture of the distal radius in adults (Panthi et al 2017).

[1]Department of Trauma and Orthopaedics, Addenbrookes Major Trauma Unit, Cambridge University Hospitals, Cambridge, UK
[2]School of Clinical Medicine, University of Cambridge, Cambridge, UK

Corresponding author:
Jiang An Lim, School of Clinical Medicine, University of Cambridge, Cambridge CB2 0SP, UK.
Email: jal219@cam.ac.uk

Table 1 Risk factors

Decreased bone mineral density
White ethnicity
Family history
Prolonged steroid use
Female gender
Early menopause

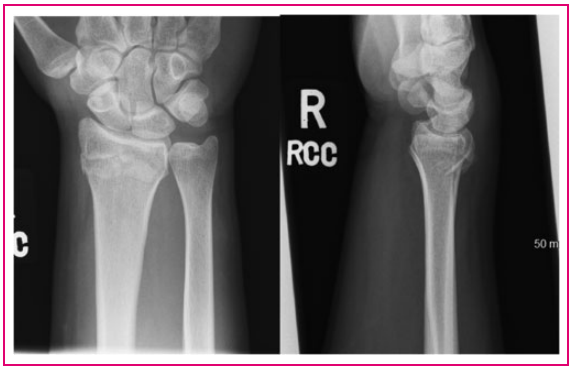

Figure 1 Posteroanterior and lateral view radiographs of a low energy mildly displaced distal radius fracture

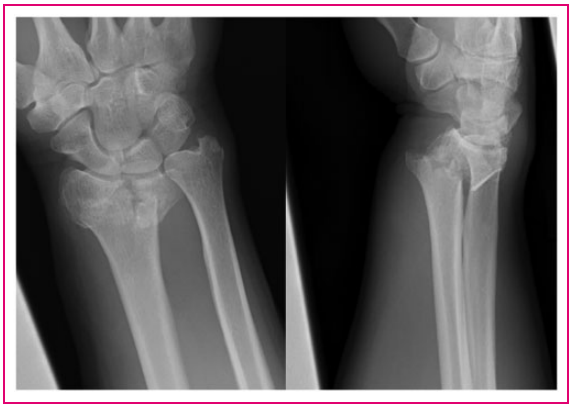

Figure 2 Posteroanterior and lateral view radiographs of a high energy comminuted intra-articular displaced distal radius fracture

Smith's fracture

The features of a Smith's fracture often lead it to be thought of as a 'Reverse Colles' on the basis of its presentation and mechanism of injury (Matsuura et al 2017). It usually occurs due to a fall on a flexed wrist, which presents with volar angulation of the distal fragment. Radiographically, the fracture is characterised by a 'Garden Spade' deformity on lateral plain film X-ray of the wrist (Matsuura et al 2017). These fractures tend to be more unstable.

Barton's fracture

Barton's fractures are intra-articular rim fractures of the distal radius, which can be either dorsal or volar (Walenkamp et al 2015). Dorsal rim fractures are more common and usually result from forced dorsiflexion and pronation, whilst volar rim fractures usually occur from a fall onto a supinated hand. Barton's fractures are usually unstable and can present with subluxation or dislocation of the carpal bones (Walenkamp et al 2015).

Table 2 Checklist of assessments where open fracture is suspected

Condition of the surrounding skin and soft tissue
Quality of vascular perfusion via capillary refill time and radial pulses
Integrity of nerve function via sensory two-point discrimination
Motor function of the muscles of the hand

Other less common subtypes of distal radius fractures include Chauffeur's fracture, Die-Punch fracture and Galeazzi fracture dislocation (Caldwell et al 2019). Chauffeur's fractures are oblique avulsion fractures of the radial styloid, whilst Die-Punch fractures are intra-articular fractures involving depression of the lunate facet of the radius. Both fracture patterns result from hyperextension of the wrist. Finally, Galeazzi fracture dislocation is a fracture of the distal third of the radius with an associated DRUJ dislocation (Caldwell et al 2019). A Galeazzi fracture is typically due to a fall onto an outstretched hand (FOOSH) with the forearm in pronation (Yohe et al 2019).

History and physical examination

Fractures of the distal radius usually occur due to a FOOSH, with the wrist in dorsiflexion. Patients with distal radius fractures typically present to the emergency department with pain, swelling and deformity with an associated restriction in the range of motion. According to the BOAST guidelines, it is important to investigate the mechanism of injury, duration and quality of symptoms when taking a detailed history from the patient (BOAST 2017). It is also essential to document these findings alongside co-existing medical conditions that may affect fracture healing such as smoking and osteoporosis. Furthermore, establishing the patient's functional status before the injury, hand dominance, as well as occupational demands and hobbies is useful as this can guide the treatment direction and inform assessment of recovery during follow-up (The British Society for Surgery of the Hand (BSSH) 2018).

A careful physical examination should be performed, inspecting the general appearance of the wrist and assessing for any gross deformities. The presence of any lacerations which suggests an open fracture would require surgical debridement and stabilisation (BOAST 2017). Table 2 provides a checklist of assessments to carry out for patients in whom open fracture is suspected. Once again, it is important to document these findings as they will be used as a baseline for re-examination. Following an examination of the wrist, a

thorough examination of the joints proximal and distal to the wrist should be conducted as associated injuries of the elbow, carpal bones and hand are easily missed (Walenkamp et al 2015).

The physical examination should also focus on ruling out complications that result from distal radius fracture. Such complications include carpal tunnel syndrome, Extensor Pollicus Longus tendon rupture and compartment syndrome (Sato et al 2018). Careful attention should be paid to the function of the median nerve as carpal tunnel syndrome is the most frequent neurologic complication associated with distal radius fractures and may require treatment with acute carpal tunnel release (Al-Amin et al 2018) (see Appendix 1, Task 1).

Imaging

Radiographic imaging is important for the assessment of distal radius fracture severity and stability, as well as for guiding treatment. Plain film X-ray is the standard imaging modality and should include both posteroanterior (PA) and lateral views of the wrist as shown in Figures 1 and 2. Radiographic evaluation should consider the radial height, inclination and shift as well as ulnar variance, dorsal tilt and intra-articular step (BOAST 2017).

Additional imaging with computerised tomography (CT) of the wrist may be indicated for the confirmation of occult fractures, which are suspected on the basis of the history and physical examination but are not demonstrated on plain film X-rays (BSSH 2018). CT imaging can be useful in operative planning (Figure 3) but should only be performed once the initial management steps have been made. Magnetic resonance imaging scan is performed to identify and better delineate soft tissue injuries where indicated (NICE 2016) (see Appendix 1, Task 2).

Treatment

The basic principles of treatment are to achieve adequate fracture reduction and to use a method of immobilisation that will maintain reduction to facilitate healing (NICE 2016). In addition, pain management that is tailored to the patient's requirements should be provided. If manipulation of the fracture is indicated in the emergency department, intravenous regional anaesthesia (IVRA) – 'Bier's block' – should be administered by healthcare professionals trained in the technique (BSSH 2018). If IVRA cannot be administered, then haematoma block is a safe and viable alternative for initial painless manipulation (Tseng et al 2018).

Figure 3 CT 3D reconstructions of a distal radius fracture to better demonstrate fracture configuration and plan surgery

Treatment of distal radius fractures can involve both non-operative and operative management, the choice of which depends on multiple factors (Calbiyik 2018). Factors such as activity level, fracture characteristics and medical comorbidities need to be considered and discussed with the patient to decide upon the most appropriate treatment option. In patients older than 65 years, dorsally displaced fractures can generally be primarily managed non-operatively unless there is significant deformity or neurological compromise (BOAST 2017).

Immobilisation can be achieved by the use of either a full plaster of Paris (POP) cast or a plaster back slab. Although a full POP will provide more stability, it will not accommodate any soft tissue swelling as a back slab would (Corsino et al 2020). The choice of immobilisation technique also takes into account the expertise of the personnel carrying out the application of the splint as well as the preference of the patient (BSSH 2018). When undertaking immobilisation with either of these methods, it is imperative that a cast with three-point moulding is used. As well as adequate analgesia and fracture stabilisation, patients with distal radius fractures should be referred to a fracture clinic to be assessed within 72 hours (BOAST 2017).

Indications for surgery

In some patients with distal radius fractures, operative management is necessary. Indications generally include significant displacement, instability, open fractures and neurovascular deficit. Simple fractures are generally managed with Kapandji wires (K-wires) as shown in Figure 4 (Malik et al 2010). More displaced and unstable fractures should be considered for open reduction and internal fixation (Figure 5). In younger patients, it is also important to consider ulnar variance, intra-articular step and dorsal tilt when assessing whether the patient may benefit from surgical reconstruction (BOAST 2017). Surgery should be performed within 72 hours of injury in cases of intra-articular fracture and within one week for extra-articular fractures (NICE 2016). Occasionally, an external fixator may be used for comminuted intra-articular fractures with significant soft tissue injury; the fixator can either be replaced with other forms of fixation when the soft

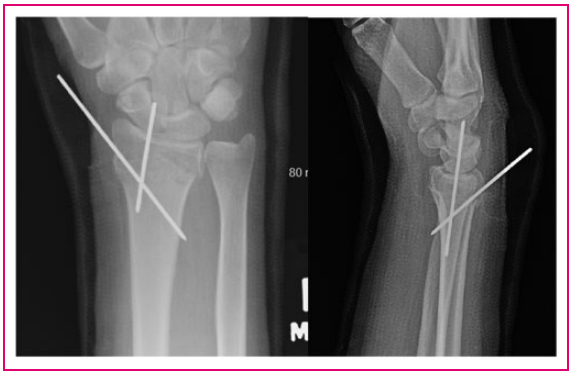

Figure 4 Distal radius fracture stabilised with two K-wires and a plaster

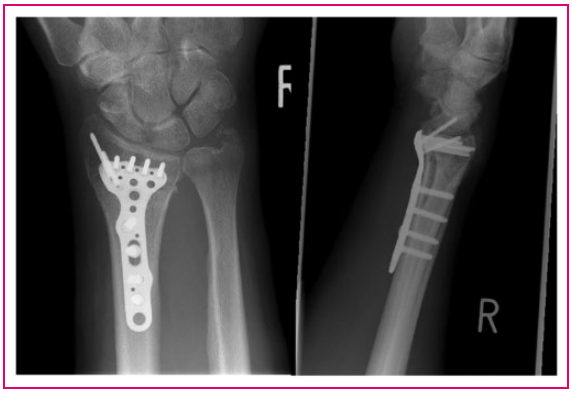

Figure 5 A distal radius fracture stabilised with a locking plate

tissues permit or used definitively till fracture union is achieved (Malik et al 2010).

Ultimately, the aim of all forms of management is to both optimise functional recovery and promote early mobilisation to reduce the risk of stiffness. If not managed properly, these fractures may cause severe functional deficit and can result in significant morbidity, often leading to limited usage of the affected hand (Corsino et al 2020).

Postoperative management

After initial management, patients should be followed up in the fracture clinic where they should receive information regarding expected functional recovery, rehabilitation and advice about returning to normal activities (Nasser et al 2018). Older patients should additionally be assessed for falls risk as well as bone health and be referred to a fracture liaison service or falls service if appropriate (BOAST 2017).

Interprofessional coordination is necessary to achieve optimal outcomes. In the context of postoperative fracture management, the fracture liaison service demonstrates this principle. The fracture liaison service involves a dedicated co-ordinator who liaises between the orthopaedic team, patient and other specialties to arrange for bone mineral density testing, treatment recommendation and follow-up (Bonanni et al 2017). This service can be particularly useful for older adults who suffered a distal radius fracture, as these fractures may be an indicator of increased risk for osteoporosis, pathologic fractures and overall increased morbidity and mortality (Padegimas & Osei 2013).

Not all distal radius fractures require follow-up imaging. As per BOAST guidelines, a repeat X-ray of the wrist one to two weeks after injury or manipulation is only necessary if the fracture pattern was unstable and subsequent displacement would require surgical intervention (BOAST 2017). For patients with stable fractures, removal of the cast four weeks after the injury should be considered to allow for early mobilisation. As outlined by BSSH, an X-ray at the time of removing the plaster cast is not required unless there is clinical concern (BSSH 2018).

Complications

Simple distal radial fractures usually heal well and have no long-term complications. However, complex fractures have a higher rate of neuropathic pain, complex regional pain syndrome and post-traumatic arthritis (Pope & Tang 2018). The most frequent complication of distal radius fracture is malunion with an intra-articular or extra-articular deformity (Corsino et al 2020). This occurs when there is poor realignment of fracture fragments, which leads to a shortened radius relative to the ulna. Malunion can cause reduced wrist motion, wrist pain as well as reduced forearm rotation. Other complications include carpal tunnel syndrome, tendinitis, non-union, hardware complications and tendon attrition (Corsino et al 2020) (see Appendix 1, Task 3).

Conclusion

Distal radius fractures can be challenging to manage due to the complex anatomy of the structures surrounding the wrist. Early recognition and prompt treatment are key to providing the best outcome for patients and reducing long-term sequelae. Although this review is not a comprehensive review of distal radius fractures which is a vast topic in itself, it has been written to give a general overview for perioperative practitioners to enable them to be aware of the principles of managing these patients.

Key phrases

- Fractures of the distal radius are the most common upper extremity fracture and a common presentation in the emergency department.
- Plain film X-ray is the standard imaging modality for distal radius fractures and should include both PA and lateral views of the wrist.

- Patients with distal radius fractures should be referred to the fracture clinic for assessment within 72 hours of initial presentation.
- The optimal management of distal radius fractures is decided after a thorough history, examination and radiological assessment.

No competing interests declared

ORCID iDs

Jiang An Lim https://orcid.org/0000-0003-1610-7956
Bryan LC Loh https://orcid.org/0000-0002-8140-3965

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Appendix 1: Continuing Professional Development activities

Task 1. Review and reflect: review the BOAST guidance – the management of distal radial fractures (BOAST 2017; www.boa.ac.uk/resources/boast-16-pdf.html). Reflect on your role in facilitating the appropriate management of patients with these fractures. Notional learning hours: one hour. Knowledge and skills dimension: core, C2 personal and people development, C5 quality.

Task 2. Review and discussion: spend some time with an emergency care practitioner reviewing the radiographs of a distal radius fracture. Discuss how the radiological factors affect the decision on management. Notional learning hours: one hour. Knowledge and skills dimension: core, C2 personal and people development.

Task 3. Review and discussion: spend some time with an orthopaedic surgeon reviewing the potential complications of a distal radius fracture. Discuss how the complications present and how they are managed. Notional learning hours: one hour. Knowledge and skills dimension: core, C2 personal and people development.