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DIAGNOSIS AND TREATMENT OF SCAPHOID FRACTURE

Julie Mulligan and Jeshni Amblum discuss findings from a literature review of the best ways to manage a common injury of the wrist.

Abstract

Many patients with scaphoid fractures present at emergency departments but how they are managed can vary widely. This article reviews the literature on management of scaphoid injuries, discusses different types of immobilisation and determines best practice.

Keywords

Scaphoid fracture, casting, thumb extension

SCAPHOID FRACTURES account for 71% of carpal bone fractures, and between 2% and 7% of all orthopaedic fractures (Nishihara 2000). This type of injury also accounts for one in every 10,000 attendances annually in UK emergency departments (EDs) (Tai and Ramachandran 2005). Between 5% and 12% of scaphoid fractures are related to other fractures (Malik et al 2010).

The scaphoid is one of the eight carpal bones that make up the wrist. It is the largest carpal bone in the proximal row, and crosses between this and the distal row (Purcell 2010). About 80% of scaphoid fractures occur through the middle third, or waist, of the bone, while 10% involve the distal third and 10% the proximal third (Raby et al 1999).

Blood supply to the scaphoid is provided by a subdivision of the radial artery from the distal end of the scaphoid. Because blood flows in a distal-to-proximal direction, the proximal portion of the scaphoid is vulnerable to inadequate blood supply when fractures occur, which in turn makes it susceptible to avascular necrosis (Ramponi 2012). Between 2% and 9% of patients with fractured scaphoid develop avascular necrosis (Allen 1983), which can result in reduced grip strength (Waldman 2014).

The scaphoid plays an important part in wrist dynamics and, due to its unique anatomy, it can articulate with all five surrounding bones. For example, it articulates with the radius forming the radiocarpal joint, and with the trapezium and the trapezoid and capitate bones to aid articulation between the proximal and distal rows of the carpus (McNally and Gillespie 2004).

The scaphoid also flexes with wrist flexion and wrist radial deviation. This means that, if the scaphoid’s anatomy is disorganised, wrist movements can become severely compromised, and the risks of decreased function and degenerative arthritis are raised (Gillion 2001).

The most common cause of scaphoid fracture is a fall onto an outstretched hand (McNally and Gillespie 2004), which can force the bone back against the dorsal lip of the radius (Purcell 2010). Because the scaphoid bridges the carpal rows, there is also a risk of fracture in a hyperextension injury (Larsen 2002). Hyperextension at the wrist is the cause of 97% of scaphoid fractures while forced flexion causes 3% (Ritchie and Munter 1999).

Ossification of the scaphoid bone begins in people aged between five and six years, and is complete by the age of between 13 and 15. Before ossification is complete, the scaphoid is almost entirely cartilaginous, which explains the rarity of fracture in children (Nishihara 2000). According to Hegeman et al (2004), 85% of older patients have low bone mineral density and 51%...
have osteoporosis. Consequently, older people who fall onto their outstretched hands are likely to sustain Colles’ fractures while fractured scaphoids are more often seen in young adults (Purcell 2010).

Hughes and Braebender (2012) found that, although scaphoid fractures occur most frequently in men in their second or third decade, the proportion of such injuries sustained by women may be increasing, perhaps due to a rise in the number of women participating in sport.

After conducting a literature search, Machin et al (2013) found there is no single examination finding or combination of findings that can reliably exclude scaphoid fracture. They suggest that, if a patient has sustained trauma compatible with scaphoid fracture, and has anatomical snuffbox or scaphoid tubercle tenderness, they should undergo imaging.

A coloured X-ray of a hand with a fractured scaphoid bone that has not healed is shown in Figure 1.

To identify the best ways to diagnose and treat scaphoid fracture, the authors conducted a literature review. They used the search terms ‘scaphoid injuries’, ‘casts versus splints’ and ‘thumb extension versus backslab’ to search the CINAHL, Medline and Ovid databases, and relevant articles and guidelines from EDs in the UK. Articles published during the past ten years were given preference but some older studies were considered. Results of the review are discussed below.

Management

Scaphoid fractures require full, accurate and competent assessments due to the bone’s anatomical importance and the role it plays in wrist function. Pathological abnormalities can have serious consequences and inadequate immobilisation of a scaphoid fracture increases the risk of pseudoarthrosis by 30% (Sjølen and Anderson 1988, Drexler et al 2011). Although confirmation of diagnosis can be difficult, the injury is indicated by pain and swelling in the anatomical snuffbox, and a positive result to an axial compression test (Schubert 2000, McNally and Gillespie 2004, McRae 2006).

In an evaluation of ten manoeuvres for assessing whether patients have scaphoid fracture, Unay et al (2009) found that pain experienced during pronation or when the thumb and index finger is being pinched is more likely to indicate scaphoid fracture than pain experienced during any of the other manoeuvres.

The first method of detecting scaphoid fracture is plain radiography with four scaphoid views, with which up to 70% of all scaphoid fractures can be detected (Rhemrev et al 2011). From a medicolegal point of view, because X-rays cannot detect 100% of scaphoid fractures, the injuries should be treated as if they are confirmed until the patients concerned return for follow-up appointments between ten and 14 days later (Hunter 2005).

In a prospective, multicentred study of 898 patients in whom scaphoid fracture was suspected but not confirmed after initial radiological examination, Munk et al (1995) found that only six (1%) patients were eventually diagnosed with scaphoid fracture.

Other research has shown the incidence of confirmed scaphoid fracture after initial radiological examination is as low as between 2% and 12% (Leslie and Dickson 1981, DaCruz et al 1988, Freeland 1989, Staniforth 1991).

Similarly, in a Danish study of 231 patients whose suspected scaphoid fractures were assessed at between two and three weeks after their injuries, Jacobsen et al (1995) found that only three (1%) of the patients had fractured scaphoids; 23 (10%) patients had fractures of the distal radius, the radial styloid or ulnar styloid bones, the triquetral bone, or the trapezium bone; and 205 (89%) had soft tissue injuries. These studies show that treating patients with scaphoid fracture with scaphoid casts is, at best, questionable.

If initial X-rays of injuries reveal a fracture, the scaphoid should be immobilised and the patient referred to an orthopaedic team to reduce the risk of complications. If a fracture is clinically indicated but not obvious on X-ray, the patient should be treated with cast immobilisation and given a follow-up clinical examination with X-rays after between ten and 14 days (Steinmann and Adams 2006). Such outpatient reviews are popular because initially occult fractures are often visible on plain X-ray two weeks after injury and sometimes visible eight weeks after injury (Machin et al 2013).

The prevalence of true fracture among patients with suspected fracture is between 5% and 10% (Adey et al 2007). Most of these injuries are overtreated resulting in lost work days and productivity, and increased healthcare costs (Brydie and Raby 2003).

Historically, most minimally or non-displaced fractures, defined as those displaced by less than 1mm (Hughes and Braebender 2012), were treated conservatively with cast immobilisation. Although new forms of treatment have appeared over the past ten years, casting remains a popular option with a success rate of between 90% and 100% if fractures are detected soon after injury (Hughes and Braebender 2012).
As Wolfe (2009) notes: ‘Hand specialists have made surgical treatment safe and reliable to a point where there has been a notable paradigm shift from treating scaphoid fractures in a cast to treating them operatively. Casting however remains a safe and effective option for healing in many cases.’

Recommendations for cast immobilisation for acute scaphoid fracture, including whether or not to include the elbow or thumb, what materials should be used and how long a cast should remain in place, vary substantially in the literature.

Almost every motion of the forearm, wrist and hand causes movement of the scaphoid bone, which in turn puts pressure on the fracture line. To prevent such motion, Kaneshiro et al (1999) advise application of an above-elbow cast. However, from a comparison of union rates between long- and short-arm casts that produced conflicting results, Burge (2001) concludes that short-arm casts can protect stable fractures during healing and that long-arm casts do not always maintain the positions of unstable fractures.

Various researchers have examined the benefits of immobilising the wrist in different positions. Tan and Muffulli (2009), for example, found that wrist position at immobilisation has no significant effect on union rate, although Hambidge et al (1999) found that immobilisation of the wrist in an extended, rather than flexed, position can ensure more wrist movement at six-month follow up.

Doornberg et al (2011) carried out a systematic review and meta-analysis of four randomised control trials (Alho and Kankaanpää 1975, Clay et al 1991, Gellman et al 1989, Cohen and Shaw 2001) that involved a total of 523 patients. Two of these trials compared outcomes of above- and below-elbow casting that includes the thumb (Alho and Kankaanpää 1975, Gellman et al 1989), one compared below-elbow casting that includes the thumb with below-elbow casting that excludes the thumb (Clay et al 1991), and one compared below-elbow casting that excludes the thumb with casting of the wrist in 20° flexion and extension (Cohen and Shaw 2001). None of the four trials demonstrated a significant difference in non-union rates or incidence of avascular necrosis between each of the methods tested.

Doornberg et al (2011) conclude that there was no difference between above- or below-elbow casting, scaphoid-type cast or Colles’ casts, so clinicians should continue to follow their preference for treatment. However, according to the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system (GRADE Working Group 2013), Doornberg et al’s (2011) meta-analysis was based on low quality evidence and so recommendations made from it should be considered ‘weak’.

In patients with non- or minimally displaced scaphoid fractures, immobilisation of the thumb is common practice, and Clay et al (1991) and Al-Nahhas (2011) conclude that a below-elbow backslab that excludes the thumb, or a Colles’ cast, offers no benefit over a cast that includes the thumb. However, Russe (1960) states that, in casting stable fractures, practitioners should exclude the patient’s thumb because its motion exerts useful compressive forces across the stable fracture site. McLaughlin (1969) also disfavours immobilisation of the thumb and concludes that healing depends on the inherent stability of the fracture, rather than the length or type of cast.

Mallee et al (2014) conducted a multicentred, stratified, single-blind, randomised, clinical controlled trial comparing outcomes in patients given one of two forms of immobilisation. Computed tomography ten weeks after injury revealed that, when immobilisation had excluded the thumb, 85% of scaphoid fractures had healed, but when immobilisation had included the thumb, 70% of such fractures had healed. Differences in wrist motion, grip strength, or arm, shoulder or hand disability between the two patient groups were insignificant.
These findings are consistent with those of an earlier randomised trial (Clay et al 1991) and of work by Modi et al (2009), all of whom conclude that immobilisation of the thumb offers no advantage. Machin et al (2013) state that there is no benefit in using a scaphoid cast instead of a Colles’ cast and that immobilising a wrist in up to 20° extension is better than immobilising the wrist in flexion.

Continued immobilisation without a definitive diagnosis can extend over several weeks and it should be remembered that, during these periods, the patients concerned cannot live and work normally. Studies by Leslie and Dickson (1981), DaCruz et al (1988), Freeland (1989), Staniforth (1991), Jacobsen et al (1995) and Munk et al (1995) suggest that patients with non-displaced fractured scaphoid do not benefit from immobilisation of the elbow and thumb, and that less cumbersome approaches to immobilisation are safe and strong.

Splints are applied during the acute phases of injuries to immobilise and protect the injured extremities, encourage healing and reduce pain (Boyd et al 2009). As non-circumferential immobilisers, splints allow for swelling in the acute phase of injury and more flexibility of the wrist. Patients tend to prefer splints to casts (Karantana et al 2006) and there is no evidence that the outcomes of splinting are inferior to those of casting. DaCruz et al (1988) have demonstrated that, by initially resting all suspected injuries in broad arm slings and then assessing them one week later, practitioners can reduce the number of patients who require scaphoid casts.

It may be assumed that the use of slings delays definitive treatment, but Langhoff and Anderson (1988) have shown that delays of up to four weeks in diagnosis of scaphoid fracture make little or no difference to long-term prognoses. There is therefore an argument against immobilisation in patients with clinically suspected fractures until definitive diagnoses are made.

In addition, splints are cheaper and require less staff time to apply than plaster of Paris casts. However, changing established practices can be difficult, particularly in healthcare services because of the complex relationships between organisations, professionals and patients. Nevertheless, changing practice from application of casts to splints in patients with no obvious scaphoid fractures would benefit staff by freeing up their time, and could improve patient outcomes in a cost-effective way.

The College of Emergency Medicine (2013) has issued an algorithm describing the management of suspected scaphoid fractures. This has been adapted for Figure 2.

![Algorithm for managing patients with suspected scaphoid fracture](image-url)
Summary
In recent years there has been a tendency to manage scaphoid fractures with surgical intervention (Wolfe 2009). Yet conservative treatment with casts results in union rates of between 90% and 100% (Hughes and Braebender 2012) and, while most authors agree that patients with confirmed fractured scaphoids should be treated with casts, there is debate about what type of cast to use.

Although some authors advocate the use of scaphoid casts, it is apparent from the literature that outcomes after their use are no better than those after the use of Colles’ casts.

Most of the studies reviewed by the authors conclude that clinically fractured scaphoids are overtreated, which suggests that a more restrictive policy should be implemented when no radiological fracture is present.

References


Conflict of interest

None declared

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