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Citation: Mulligan, J. & Amblum-Almér, R. (2014). Management of Clinical Scaphoid Injuries. Emergency Nurse, 22(3), pp. 18-23. doi: 10.7748/en.22.3.18.e1315

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Link to published version: https://doi.org/10.7748/en.22.3.18.e1315

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Initial diagnosis, management and immobilisation of a clinically fractured scaphoid in the Emergency Department.

Scaphoid fractures are the most commonly undiagnosed carpal fractures accounting for 71% of carpal bone fractures and between two and seven per cent of all orthopaedic fractures (Nishahara 2000). This type of injury also accounts for accounts for 1:10,000 attendances annually in Uk Emergency Departments (UK) (Tai, 2005). Between 5 – 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). Around 80% of scaphoid fractures occur through the middle third (waist) of the bone, while 10% involve the distal third and 10% involve the proximal third (Raby 1999). Blood supply to the scaphoid is provided by a sub
Division 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 2011). Between 2 % and 9% of patients with fractured scaphoids develop avascular necrosis (Allen 1983), which can result in reduced grip strength (Walchman, 2014)

The scaphoid plays an important part in wrist dynamics, because of its unique
Anatomy, it can articulate with all five surrounding bones. For example it articulates with the radius forming the radio carpal joint, and with the trapezium, trapezoid and capitate to aid articulation between the proximal and distal rows of the carpus (McNally et al, 2004). The scaphoid also flexes with wrist flexion and wrist radial deviation. Hence, if the scaphoids anatomy is disorganised, wrist movements can become severely compromised and the risks of cause decreased function and degenerative arthritis is increased (Gillion 2001).

The most common cause of scaphoid fracture is a fall onto an out stretched hand (McNally et al 2004), in which the bone is forced back against the dorsal lip of the radius (Purcell 2010). Because the scaphoid bridges the carpal rows, there is
also a risk of hyperextension injury (Larsen 2002). Hyperextension at the wrist causes 97% of scaphoid fractures while forced flexion causes only 3% (Richie and Munter 1999). Ossification of the scaphoid bone begins between the ages of five and six and is complete between the ages of 13-15. Before ossification is complete, the scaphoid is almost entirely cartilaginous. This explains the relative rarity of fractured scaphoids in children (Nishihara 2000). The older person who falls on the out stretched hand is likely to suffer a Colles fracture (Purcell, 2010), as 85% of older patients have been shown to have low bone mineral density and 51% have osteoporosis (Hegeman, 2004)
Hence, fractured scaphoids are more common in young adults.

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 the number of women participating in sport.

of life however they

In 1992, the British Association for Accident and Emergency Medicine (BAEM) issued guidelines for the management of scaphoid injuries, yet practice varies widely. Machin et al (2013) published guidelines in the general emergency medical network after doing a literature search found there is no one examination finding or combination of examination findings that can reliably exclude a scaphoid fracture. Hence, if the patient has sustained trauma compatible with scaphoid fracture and has anatomical snuffbox or scaphoid tubercle tenderness then they usually undergo imaging. Hence he authors searched OVID, PubMed, Cinahl and looked at related articles and guidelines from emergency departments in the UK to identify the best ways to diagnose and treat the injury. Search terms where scaphoid injuries, casts versus splints and thumb extension versus backslab. Articles with citations in past 10years were given preference though older studies were considered within context of discussion.

Management

Diagnosis Scaphoid fractures require full, accurate and competent assessments due to the bones anatomical importance and the key role it plays in function of the wrist hence, pathological abnormalities may result in serious consequences. Sjolen and Anderson (1988) stated that inadequate immobilization of a scaphoid fracture increases the chances for pseudo-arthrosis by 30% and this was reiterated by Drexler (2011). Confirming the diagnosis of a suspected scaphoid fracture can be difficult, However, pain and swelling in the anatomical snuffbox and positive axial compression test (McNalley 2004, Mc Rae 2008, Schurbert 2000). Unay et al (2009) evaluated ten manoeuvres for assessing whether patients have a scaphoid fracture and 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 experiences during any of the other manoeuvres.

The first method of detecting a 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 medico legal point of view, because an x-ray cannot detect 100% of scaphoid fractures, they should be treated as if they are confirmed until the patient returns for a follow up appointment approximately 10-14days later (Hunter, 2005)

In a prospective multi-centred study a total of 898 patients in whom a scaphoid fracture was suspected but not confirmed Monk (1995) found that only six (0.7 per cent) eventually were diagnosed with scaphoid fractures
(Monk 1995). Continued immobilisation without a definitive diagnosis
Other research has shown that the incidence of confirmed scaphoid fractures is as low as 2-12% (Leslie 1981, De Cruz 1988, Freeland 1989, Staniforth 1991). Similarly, a Dutch study of 231 patients with suspected scaphoid fractures, were assessed at between two and three weeks after their injuries (Jacobsen, 1995), found that only 1.3% of these had fractured scaphoids, 10.2% had fractures of the distal radius/radial styloid/ulna styloid/triquetral or trapezium, 88.8% of patients were diagnosed with

soft tissue injuries. Jacobsen These studies show that treating patients with a scaphoid injury with a scaphoid cast is at best questionable.

Casting

If initial x-rays reveal a fracture the scaphoids should be immobilised and the patient referred to an orthopaedic team to reduce the risk of complications. However 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 between 10 - 14 days (Steinmann 2006). Such outpatient reviews are popular because initially occult often become visible on x-ray after 2 weeks and can be diagnosed up t 8 weeks later (Machin et al, 2013).

The prevalence of true fracture amongst patients with suspected fractures is between 5-10% (Adey, 2007), and most of these are over treated resulting in lost workdays and productivity, and increased healthcare costs (Brydie 2003)

Historically, most minimally or non-displaced fractures, defined as those displaced by less than 1mm of displacement (Hughes 2012) were treated
Conservatively. With cast immobilisation. Although new forms of treatment have appeared over the last 10years, casting remains a popular option with a success rate of 90-100% if fractures are detected soon after injury (Hughes, 2012). As Wolfe (2009) notes "Hand specialists have made surgical treatment safe and reliable to a point where there has been 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. This is supported by Hughes (2012) who found conservative treatment, consisting of immobilisation in a cast resulted in a union rate of 90-100% Recommendations for cast immobilisation for an acute scaphoid fracture including whether or not to include the elbow or thumb, what materials should be sued and how long the cast should remain in place varies substantially in literature.

Almost every motion of the forearm, wrist and hand causes movement of the scaphoid bone, which puts pressure on the fracture line. To prevent such pressure Kaneshira (1999) advises application of an above elbow cast. However, Burge (2001) who compared rates between long and short arm casts with conflicting results, concludes that short arm casts can protect stable fractures during healing and long arm casts cannot dependently maintain the position of an unstable one fracture

Various researchers have examined the benefits of immobilising the wrist in different positions. Tan (2009), for example found that wrist position at immobilisation has no significant effect on union rate. However. Hambridge (2001) found that immobilisation of the wrist in an extended rather 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 controlled trials (Alho and Kankaanpoa, 1975, Clay etal 1991, Gelman et al 1989, Cohen 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 Kankaapoa 1975, Gelman et al 1989), one compared below elbow casting that

includes the thumb with elbow casting that excludes the thumb (Clay etal 1991), and one compared below elbow casting that excludes the thumb with casting of the wrist in 20 degrees flexion and extension (Cohen 2001). None of the four trials demonstrated a significant difference in non-union rates or incidences of avascular necrosis between each of the methods tested.
Doomber et al (20111) concluded that – neither above or below elbow casting, nor scaphoid type cast or Colles' cast, differed significantly', and clinicians should therefore continue to follow their preference for treatment. However, according to the Grading's of Recommendations, Assessment, and Development and Evaluation (GRADE) system (GRADE WORKING GROUP 2013). Doomberg et al (2011) meta analysis was based on low quality evidence and so recommendations made from it were considered 'weak'.

In patients with non-displaced or minimally displaced scaphoid fractures, immobilisation of the thumb is common practice. However Clay (1990) and Al-Nakhas (2011) conclude that use of a Colles cast which is a below elbow backslab that does not include the thumb, compared to immobilisation of the thumb offers no benefit. In 1960 (Russe) states that casting stable fractures, practitioners should exclude the thumb because its motions exerts compressive forces across the stable fracture site. McLaughlin (1969) also favours no immobilisation of the thumb and concludes that healing depends on the inherent stability of the fracture, rather than the length or type of cast. Maaike et al (2014) conducted a multi centred, stratified, single blind, randomised, clinical controlled trial compared trial comparing outcomes in patients given one of two forms of immobilisation. Computed tomography y ten weeks after injury revealed that, when immobilisation had excluded the thumb, 85% of scaphoids healed, but when immobilisation had included the thumb, 70% had healed. Differences in wrist motion, grip strength, or arm, shoulder or hand disability between the two groups were insignificant.

These findings are consistent with those from an earlier randomised trial Clay et al (1991) and the work of 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 the wrist in up to twenty degree extension is better than immobilising the wrist in flexion."

Continued immobilisation without a definitive diagnosis cane extends over several weeks and it should be remembered that, during these periods, the patient couldn't live and work normally. Studies by Leslie (1981), De Cruz (1988), Freeland (1989), Staniforth (1991) and Monk (1995) suggests 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

Casting
A splint is applied during the acute phase of an injury to immobilise and protect the injured extremity, encourage healing and reduce pain (Boyd 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 2006), and there is no evidence that the outcomes of splinting are inferior to those of casting. Da Cruz et al (1988) have demonstrated that, by initially resting all suspected

injuries in broad arm slings and then assessing them one week later, practitioners could reduce the number of patients who require scaphoid casts significantly. Sjolin (1988) found that when support bandages were used instead of a plaster cast is to use a the average time of treatment was lower from 15 -12 days with support bandages, and the average sick leave for manual workers, reduced from fourteen days to four days without complications.

It may be assumed that the sue of slings and supports bandages may delay definitive treatment but Langoff and Anderson (1988) have shown that delays of up to four weeks in diagnosis of scaphoid fractures make little or no difference to long – term prognoses. Hence, there is support against immobilisation in patients with a clinically suspected fracture until a definitive diagnosis can be made. There are also financial implications in the use of splints, which are cheaper and require less staff time to apply than plaster of Paris casts. However, changing established practices is difficult, particularly in healthcare services because of the complex relationship 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 improve patient outcomes in a cost effective way.

Algorithm

In light of the literature findings, the author has adopted an algorithm from the () to describe the best ay for emergency department practitioners to manage scaphoid fractures (Figure 1). The algorithm shows that after initial assessment, patients with none of the clinical features of a scaphoid fracture should be discharged with advice on soft tissue injuries. Those with suspected scaphoids fractures should have their affected wrists splinted, while those in who suspected scaphoids are ruled out should be discharged with advice on soft tissue injuries. If the fractures are still suspected but unconfirmed, the patients concerned should undergo magnetic resonance, which can detect callus formation along the fracture lines.

Summary

In recent years there ahs was a change in how scaphoid injuries are managed from conservative treatment with casts to surgical intervention (Wolfe 2009). Nevertheless, conservative treatment results in a union rate of 90 -100 %(Hughes 2012) and while most authors agree that patients with confirmed scaphoid should be treated with casts, there is debate about what type of cats to use. Although some authors advocate scaphoid casts, it is apparent from the literature that outcome after their use are no better than those after sue of a Colles cast. Most of the studies reviewed conclude that clinically fractured scaphoids are over treated, which suggest that a more restrictive policy should be implemented when no radiological fracture is present.

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