Chapter 7

Non-operative treatment of non-displaced scaphoid fractures may be preferred

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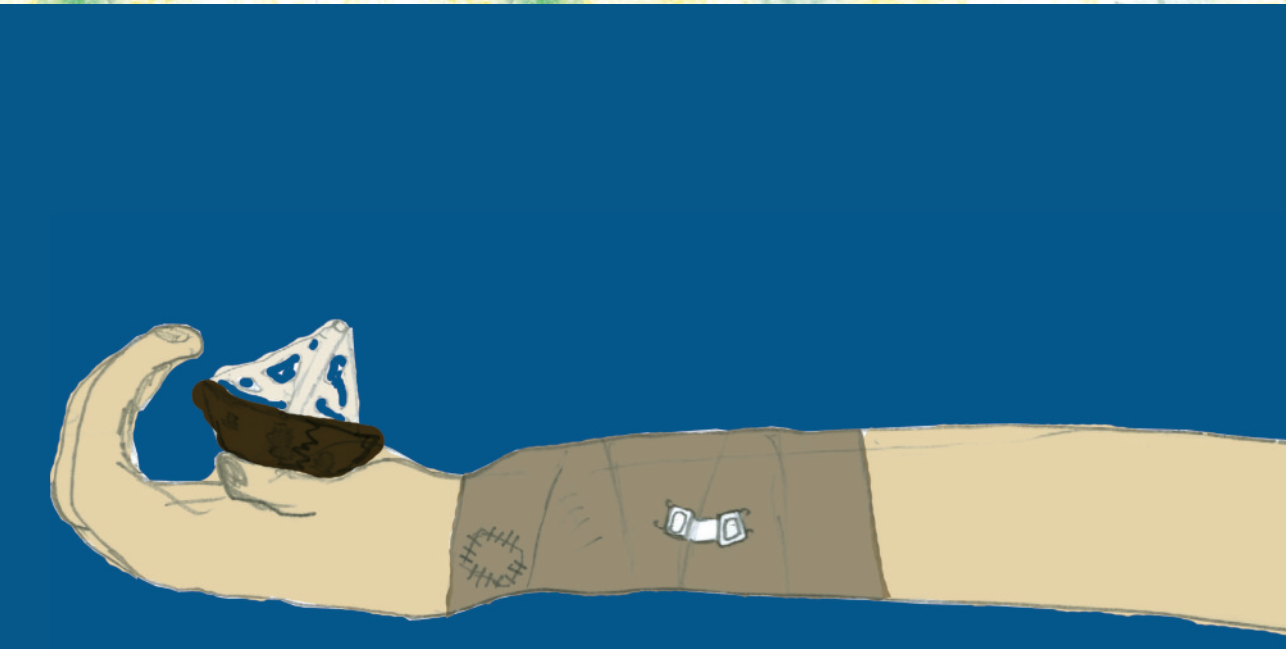


Introduction

The exact incidence of the most common carpal fracture, which involves the scaphoid bone [17], is still unknown because these injuries often remain undiagnosed. However, scaphoid fractures are estimated to account for up to 90% of carpal fractures and 2-7% of all fractures [11,18] and occur mostly among active adolescents and young adults.

Scaphoid fractures are classified into their anatomical thirds (Mayo-classification) or as stable or unstable (Herbert classification). Historically, non-displaced and minimally displaced scaphoid fractures have been treated non-operatively. Displaced comminuted or unstable scaphoid fractures have been stabilised by open reduction and internal fixation. The incidence of non-union is reported to be between 5% and 15% [7,12].

With improved, minimally invasive surgical techniques, surgical treatment of these cases has increased [5,15] and prolonged immobilisation, often lasting 8-12 weeks, can be avoided. Thus final wrist stiffness and weakness have become less frequent. Demand for surgical strategies which allow early return to work without the high costs of prolonged immobilisation has further contributed to the shift towards surgical intervention using newly developed fixation screws. Percutaneous stabilisation of scaphoid fractures also seems to reduce the non-union rate. However, cast immobilisation for non- or minimally displaced scaphoid fractures, generally advised for 8-12 weeks, can result in a union rate of more than 90%. There is at present insufficient evidence to identify which treatment of non-displaced scaphoid fracture should be preferred [3].

It is questionable whether as many as 8-12 weeks of immobilisation are necessary in the non-operative treatment of non-displaced scaphoid fractures. Reports on early scaphoid screw fixation suggest that clinical union occurs at 6 weeks and, in contrast, cohort studies of non-operative treatment propose a mean 9.7-week period for consolidation [13]. However, if only 6 weeks of immobilisation were shown to lead to a high percentage of unions, the advantages of early surgical intervention would become less apparent. At our institution we decide clinically whether consolidation has occurred after 6 weeks of immobilisation. In this study we retrospectively analysed the outcome of such treatment of non-displaced scaphoid fractures, comparing this protocol with early fracture fixation.

Materials and methods

In a retrospective study, the records of all patients treated at our institution between January 2004 and July 2007 were reviewed. Individuals with scaphoid fracture evident after plain radiography, magnetic resonance imaging (MRI), computer tomography (CT) or bone scintigraphy were included in the series. Their charts and radiographs were reviewed by staff surgeons and two radiologists with extensive experience in fracture imaging. Mechanisms of injury were divided into low- and high-energy. The results of three physical measurements were recorded: tenderness of the anatomical snuffbox, an axial compression test and a longitudinal compression test.

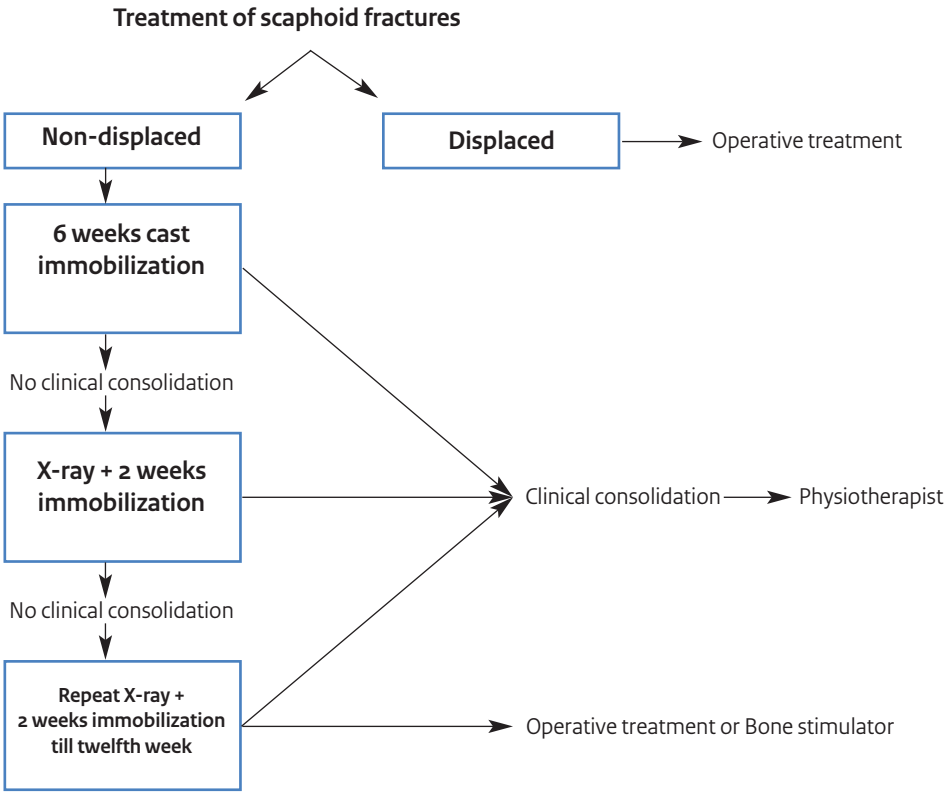
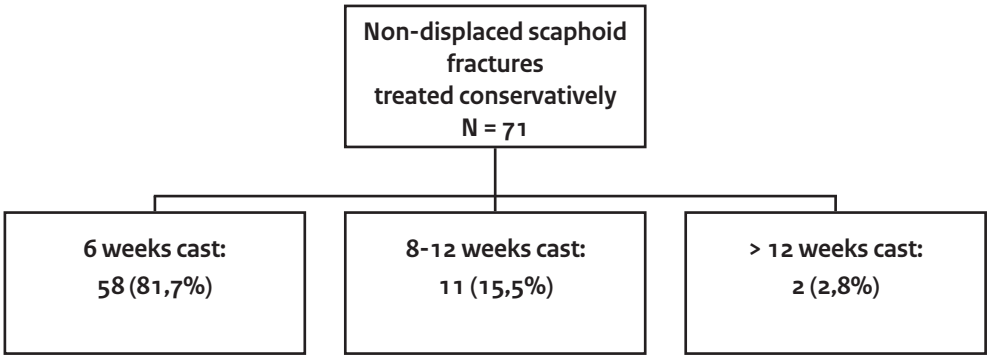


Figure 1. Flowchart of protocol for clinically suspected scaphoid fractures.

Scaphoid fracture was suspected if all three tests were positive. Standard radiographs were obtained in all cases and, if no fracture was revealed, MRI, CT or bone scintigraphy were used to confirm the diagnosis. Fractures were classified according to the Mayo and Herbert classification systems [7,9]. Initial treatment was based on the Herbert classification.
Non-displaced scaphoid fractures were treated in a below-elbow cast with thumb immobilisation for 6 weeks. Subsequently each case was clinically evaluated and, if consolidation was present at 6 weeks, exercises were started and guided as necessary by a physiotherapist. If there were signs of non-union, a new cast was applied for an additional 2 weeks. This was repeated until union was clinically confirmed in up to 12 weeks. Radiographs were obtained if there was clinical doubt. Operative treatment was preferred in cases of displaced or unstable fracture or of persistent non-union (**Figure 1**).

Clinical outcome was assessed by physical examination and scaphoid radiography. Complications such as delayed union, osteonecrosis or pseudo-arthrosis were recorded.
Cases were divided into groups (**Figure 2**) according to duration of cast immobilisation: group I, 6 weeks group II, 8-12 weeks; and group III, >12 weeks.

Figure 2. Flowchart showing duration of cast immobilisation.



Results

A total of 89 scaphoid fractures, 47 left and 42 right, were identified in the records of 88 people (61 male and 27 female); 84 injuries were caused by low-energy and 5 by high-energy mechanisms. Mean follow-up exceeded 1 year. According to the Herbert classification, 71 fractures were non- or minimally displaced and 18 were displaced. According to the Mayo-classification, there were 6 proximal, 50 waist and 15 distal non-displaced scaphoid fractures. Of the 71 non-displaced fractures, 58 (81.7%) demonstrated full clinical and/or radiographic consolidation after 6 weeks of cast immobilisation. Of the remaining 13 non-displaced fractures (1 proximal, 9 waist and 3 distal), 11 required an additional 2 weeks of immobilisation to achieve consolidation, and 2 required more than 12 weeks. In none of these cases did non-union develop during subsequent follow-up.

Of the 18 displaced fractures, 13 were treated surgically immediately and 4, comprising 2 distal pole and 2 osteoporotic fractures, were treated non-operatively with a cast for 6 weeks. (One individual left the country.) Of the 71 non-displaced fractures that were clinically consolidated after 6 weeks, 24 (33%) also showed radiological consolidation. In the remaining 47 (67%), the radiographic results were not definite. Clinical consolidation was defined if the patient had no complaints, experienced no axial or longitudinal compression pain and had regained full function of the hand.

Discussion

This study demonstrated that non-operative treatment should be considered for non-displaced scaphoid fractures. In the majority of cases the fracture was clinically consolidated after an immobilisation period of only 6 weeks. The remaining cases were followed with clinical and radiological examinations, to assess healing occurring after longer immobilisation periods. This protocol resulted in outcomes at least as good as those of protocols which dictate surgery at an early stage, to accelerate consolidation [5,6,15].

In the literature, most studies describing treated scaphoid fractures measure outcome by radiological consolidation, although the scaphoid is composed of >80% cartilage and therefore develops no callus. Radiographic consolidation is often delayed compared with clinical consolidation in all types of fracture, and non-displaced and occult scaphoid fractures frequently show no radiographic consolidation at all. In reality, asymptomatic non-union of the scaphoid does not require operative management. Consequently, clinical outcome (no tender anatomical snuffbox, no axial or longitudinal compression pain) is of more importance in daily practice than the results of repeated radiographs.

To our knowledge, there is no specific published evidence comparing durations of cast immobilisation for scaphoid fracture. Most studies describe prolonged cast treatment for up to 12 weeks. In the Netherlands, scaphoid fractures are usually immobilised for 11 weeks [22] and early surgical treatment was therefore initiated to decrease patient absence from work. Haddad and Goddard described a possible return to work within 4 weeks as an excellent result of operative management [8]; however, most physicians recommend a longer period of non-loading exercise after screw fixation. Consequently, surgical treatment is not advantageous when compared with our conservative protocol of shorter immobilisation.

The adverse effects of surgery should also be considered in the above comparison. Recent studies showed that a complication rate of up to 30% (including screw malpositioning up to 29%) can be expected, and long-term risks should be considered when recommending operative treatment [4,6,23]. A recent randomised trial reported, however, that impressive results could be obtained if technical failure was indeed avoided [15]; the mean time of surgically treated fractures to clinical consolidation was 6.4 weeks, and only 2 of 60 cases had technical problems. The contrasted group of non-operative treated fractures were immobilised for up to 12 weeks, with a difference of 5 weeks to consolidation. However, these data from a centre of excellence are not representative of common practice, where it seems that a shorter immobilisation of scaphoid fractures for 6 weeks should be offered when both surgical and non-operative treatments are possible.

The most difficult clinical decision remains, to identify which cases do require a prolonged period of immobilisation and would show benefits from early surgery. In this study, there were no confounders to identify a group among whom the need for prolonged consolidation could be predicted.

The analysis did not include differences in age, mechanism of trauma, localisation of fracture, use of medication, or associated fractures. Furthermore, because of the retrospective design of the study, the number of delayed unions or non-unions due to the peculiar blood supply in proximal pole fractures was less than might have been anticipated [21]. Other risk factors for delayed or non-union include delayed diagnosis and treatment, carpal collapse, loss of scaphoid architecture and displacement [16,19,20]. Thus it is not surprising that surgeons bypass these problems by operating on every case.

We tend to strive for a more case-specific protocol, in which a number of factors determine what treatment to follow. Accordingly, scaphoid fracture is initially treated with a below-elbow cast for

6 weeks, after which the cast is removed for clinical examination and radiography. If the fracture is healed, movement can begin. If there is any uncertainty about consolidation, 2 more weeks of immobilisation are required. This protocol is repeated to a maximum of 12 weeks, after which the case is considered for either operative treatment or bone stimulation.

In this study, only three people (2.8%) still had clinical symptoms of scaphoid fracture after 12 weeks of immobilisation, but it is very difficult to predict such cases. Of these three, one person with an occult fracture, diagnosed by bone scintigraphy and MRI, still had complaints after 1 year in spite of uneventful radiological consolidation. The other two individuals had osteoporotic fractures. This could imply that the elderly population in particular might have problems in achieving clinical and radiographic consolidation; probably arthritis and the general condition of the casualty affect healing, but surgery (primary or secondary) in this group is not an option.

In the literature, the rate of non-union among non-operatively treated scaphoid fractures is 1-18% [14]. The mean duration of immobilisation in the Netherlands is 11.1 weeks [22]. For the majority this means absence from work of more than 11 weeks, and the socio-economic costs and consequences are enormous.

The number of non-unions in larger reported series (10%) [12,24,25] may be explained by the fact that all types of fractures are included in most series, with no differentiation between non-displaced and displaced cases. For example, among the displaced fractures were 10 traumatic pseudo-arthroses which were initially missed because of delay in presentation or difficulties in diagnosis, as in the radiography of occult fractures. These casualties may not have received a below-elbow cast, and mostly visited the accident and emergency department after a new injury conferred typical signs of scaphoid fracture. Subsequent scaphoid non-union may or may not become symptomatic, so that surgery may or may not become necessary. Most such operative procedures are difficult, time consuming and expensive, and have higher complication rates than primarily operated scaphoid fractures.

Early diagnosis of a non-displaced scaphoid fracture is a challenging problem; plain radiographs are often unhelpful. Previous studies have reported that CT is less useful for acute diagnosis. Early MRI has very high specificity but lower sensitivity for scaphoid fractures than bone scintigraphy, which is a highly sensitive and reasonably specific diagnostic tool for suspected scaphoid fracture [2]. To date, despite the radiation dose, bone scintigraphy remains the method of choice for early diagnosis of suspected scaphoid fracture.

The retrospective design limits this study. In addition, there is the possibility that complications such as avascular necrosis or secondary displacement could appear after the final follow-up. Another problem is the absence of a good functional outcome score. Functional outcome is more important than the radiological outcome, because the former predicts patient satisfaction, return to work and ability to perform normal daily activities. A helpful instrument can be the Disabilities of the Arm, Shoulder and Hand (DASH) score, which has good validity and reliability but a subjective scoring system. A well-designed randomised clinical trial is therefore needed to support our hypothesis, and to determine more fully which cases will require surgery and what periods of immobilisation are most helpful. Do we have to operate on a young person who works with his

or her hands? Or is it the elderly, retired person who derives most benefit from surgical treatment? Without further detailed study we cannot answer these questions.
In conclusion, a restricted period of cast immobilisation is recommended for the initial treatment of non-displaced scaphoid fractures. In comparison, the benefits of early surgical treatment are less obvious.

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