

Chapter 2

Nonoperative Management of Non-displaced Acute Scaphoid Fracture

Megan Tomaino and Thomas B. Hughes

Case Presentation

The patient is a 15-year-old male with a history of left wrist pain following a football-related injury. He described the initial injury as hyperextension of his left wrist during football practice. He was seen at an urgent care center and initially diagnosed with a left wrist sprain. At that time, he was given a cock-up wrist splint. The patient continued to play football and “re-aggravated” his wrist 1 month later. He presented to a primary care sports medicine physician with left wrist pain. He reported that the pain had never resolved from a month earlier. New X-rays were obtained at that visit, an MRI was ordered, and the patient was removed from sports. The MRI was obtained about 1 week later and the patient was placed in a long arm cast and was referred to a hand surgeon for definitive care. He had no prior medical or surgical history, and he had no previous history of trauma to the left wrist. He denied tobacco use.

T. B. Hughes (✉) · M. Tomaino
Department of Orthopaedic Surgery, University of Pittsburgh
School of Medicine, Pittsburgh, PA, USA
e-mail: thughes424@aol.com

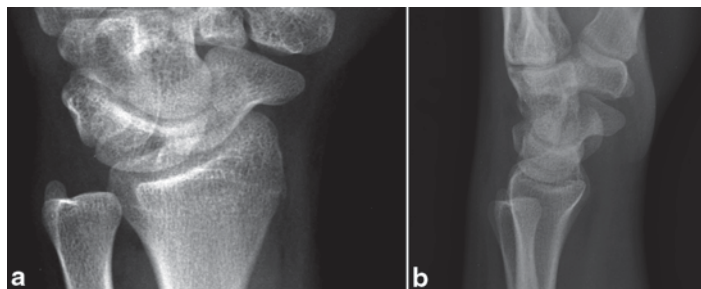


Fig. 2.1 An oblique radiograph **a** and lateral radiograph **b** obtained a day after the patient's injury. No true *AP* view was obtained. It is difficult to definitively identify a fracture line on these radiographs. (Published with kind permission of ©Megan Tomaino and Thomas B. Hughes, 2015. All rights reserved)

Physical Assessment

In the urgent care center on the day of the injury, the patient had point tenderness to the lateral side of the thumb, decreased grip strength, and mild wrist swelling at the radiocarpal joint. One month after the injury, the left wrist was mildly edematous with decreased wrist extension, focal tenderness in the anatomical snuff-box, and diminished grip strength of the left hand.

Diagnostic Studies

Radiographs of the left wrist on the day after the injury were interpreted as normal. These radiographs were subsequently reviewed by the upper extremity specialist and the scaphoid fracture could not be appreciated (Fig. 2.1). Repeat radiographs were obtained a month after the initial injury which are shown in Fig. 2.2. These demonstrated a minimally displaced scaphoid fracture. An MRI of the left wrist obtained 1 week later (5 weeks after the initial injury) revealed a non-displaced scaphoid waist fracture and intense



Fig. 2.2 An AP radiograph obtained 1 month after the injury clearly demonstrates an abnormality at the waist of the scaphoid (*arrow*). This, combined with persistent radial wrist pain, is enough to make the diagnosis. (Published with kind permission of ©Megan Tomaino and Thomas B. Hughes, 2015. All rights reserved)



Fig. 2.3 Select coronal MRI demonstrating the fracture of the waist of the scaphoid. (Published with kind permission of ©Megan Tomaino and Thomas B. Hughes, 2015. All rights reserved)

edema of both the scaphoid and lunate. No fracture was identified in the lunate (Fig. 2.3).

Management Chosen

The patient was initially diagnosed with a left wrist strain and treated with a splint for 4 weeks. Initial recommendations for splinting and activities for the patient were nonspecific. It is clear

that either the patient was noncompliant or the urgent care clinic was not explicit enough in their recommendations that the patient be immobilized, avoid wrist activities, and seek follow-up care.

When the non-displaced scaphoid fracture was suspected at 4 weeks, the patient was removed from sports, placed in a splint, and sent for an MRI. It was appropriate for the patient to be immobilized at this point (although some may recommend inclusion of the thumb in the splint, which was not done) and removed from football. It is unclear what specific advantage the MRI provided in diagnosis, treatment, or stratification of risks for this patient. After the non-displaced scaphoid waist fracture was discovered on MRI, he was immobilized in a cast for 7 weeks.

Clinical Course and Outcome

The cast was removed when there was radiographic evidence of scaphoid healing (11 weeks post-injury), and the patient had some wrist stiffness but no snuffbox tenderness. He was given a removable thumb spica splint and range of motion exercises for the wrist, but no formal physical therapy and he was not allowed to return to sport. The patient was encouraged to increase his activity as tolerated, but he continued to be restricted from participating in heavy lifting, football, or any sports. Fifteen weeks after the injury, X-rays demonstrated good healing of the fracture and the splint was recommended for comfort only. He was released to return to activities as tolerated, including football. At 15 weeks post-injury, X-rays revealed progressive healing of the mid-body fracture with good consolidation (Fig. 2.4). He had full range of motion of the left wrist, no pain, and he was able to return to normal activities.

Clinical Pearls/Pitfalls

- The key to identifying scaphoid fractures is to suspect them. The practitioner must be “aggressive” in the diagnosis of scaphoid fractures.

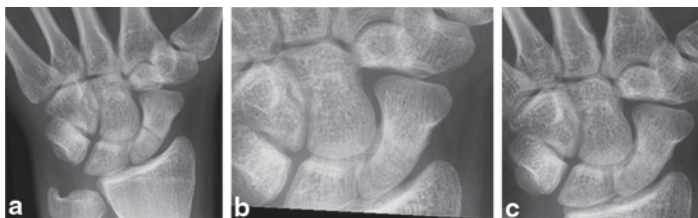


Fig. 2.4 AP radiographs obtained at 7 **a**, 11 **b**, and 15 **c** weeks after the injury demonstrate progressive healing of the fracture. (Published with kind permission of ©Megan Tomaino and Thomas B. Hughes, 2015. All rights reserved)

- Education of nonspecialists must continue as there is still a significant percentage of missed occult scaphoid fractures that have been seen by a practitioner that do not receive appropriate treatment or counseling. As more practice extenders are utilized in our health delivery system, this issue will continue to be significant.
- Patients with radial wrist pain need to be given specific instructions and limitations, including immobilization, in order to prevent scaphoid nonunions.
- Repeat imaging and close follow-up are critical for the successful treatment of the occult scaphoid fracture.
- When noncompliance is anticipated, advanced imaging may help establishing a diagnosis and lead to appropriate treatment.
- Complete bony union for scaphoid fractures takes several months. Even with occult fractures not visible on initial radiographs, healing can take three months or more.
- The results of nonoperative treatment are excellent with very few risks of complications. This approach to treatment should be considered for all non-displaced fractures and the risks of surgical intervention carefully weighed.

Literature Review and Discussion

The 15-year-old patient with a football injury in this case study represents a classic presentation of a scaphoid fracture. These fractures are most commonly seen in young adult males (age 15–40 years) after sports-related injuries or a fall on an outstretched hand. In recent decades, an increasing percentage of scaphoid fractures are occurring in young women, possibly because of increased participation in athletics [1, 2]. A typical description of the injury is a traumatic hyperextension of the wrist with radial deviation, such as described by the current patient during football practice. Patients often complain of generalized wrist or thumb pain and may not have pain over the scaphoid. Common physical exam findings include point tenderness over the anatomic snuffbox or thumb, decreased wrist range of motion, and weakened grip [1]. The current patient suffered from severe point tenderness over the thumb and weak grip of the left hand though radiographs interpreted as normal. The sensitivity of radiographs for scaphoid fractures can be as low as 70% and highly subject to the experience of the reader, resulting in easily missed fractures on initial testing [3]. Missed or untreated scaphoid fractures are at increased risk of nonunion, carpal collapse, and degenerative arthritis. Therefore, physicians should have a high degree of clinical suspicion for these injuries. In patients with vague symptoms about the radial wrist and thumb, the diagnosis must be excluded definitively prior to discharging the patient. Patients who are at risk for a scaphoid fracture should be placed in full-time immobilization, including the thumb, until the diagnosis is confirmed or eliminated.

Further testing with serial radiographs, a computed tomography (CT) or magnetic resonance imaging (MRI) scan is recommended. Serial radiographs may be effective. However, since several weeks of immobilization and activity modification are required between X-rays, there is a significant opportunity cost to this method of treatment. In order to return patients to sport and work faster, early advanced imaging can be helpful.

While CT scans are faster, widely available, and expensive, they are less reliable for identifying non-displaced scaphoid fractures.

CT scans do provide a better resolution of the anatomy of the fracture, in particular if the fracture is displaced and requires reduction. While some studies have shown CT scans to have poor sensitivity to displacement, it remains the best test available to assess displacement. In cases where initial radiographs are normal, it is very unlikely that displacement has occurred, and CT scans are probably unnecessary. However, in cases where there is an obvious fracture at initial presentation, CT scanning should be considered to assess displacement.

MRI is the most sensitive test to identify non-displaced fractures, and could have been helpful in this case had it been ordered after his initial evaluation at the urgent care clinic [1]. As it was not ordered until after the fracture was identified on the plain films, it did not aid in the diagnosis in this case. MRI can be useful to identify avascular necrosis, although this waist fracture was at limited risk for this problem [4].

Once the diagnosis of an acute non-displaced scaphoid fracture is confirmed, there are two main approaches to treatment: (1) non-surgical immobilization and (2) surgical fixation. Both types of management ultimately aim to heal the fracture and avoid delayed union, nonunion, and avascular necrosis. Scaphoid fractures are at higher risk for these issues due to easily disrupted blood supply to the proximal pole. Branches from the radial artery supply the waist and distal tubercle; however, the proximal pole of the scaphoid relies exclusively on intraosseous blood flow, which can become disrupted with a fracture [1].

General considerations when evaluating the role of surgical and nonsurgical management include time to union, risk of nonunion, time to return to work or activities, functionality of the wrist, complications, overall cost, and patient satisfaction. Some studies have shown faster time to union, return to work, and return of range of motion with surgical fixation over casting, but others have found no evidence to support faster fracture union with surgical fixation [5–8]. In one randomized study, no statistically significant difference in time to union or rate of union was found in 53 patients with acute, non-displaced scaphoid waist fractures treated with either percutaneous screw fixation or immobilization for 10 weeks [8]. While patients managed nonoperatively cannot mobilize the wrist

as quickly as surgical patients, the benefits of earlier mobilization after surgery may be transient. Follow-up from 12 months to 10 years after fracture has shown no statistically significant difference in fracture union, ROM, or patient satisfaction [7, 9–11].

Surgical treatment may be considered over immobilization in cases where the patient needs to return to work without a cast sooner. While it may seem that laborers are likely to gain the most from operative treatment, it may be those that do lighter tasks that can actually return to work sooner. Occupation is a significant factor in the consideration of surgery versus conservative treatment as self-employed and patients in nonmanual labor positions generally return to work faster than those in manual jobs, regardless of treatment [7, 12]. Surgical fixation may be favored when the patient is employed in a job that is precluded by cast treatment because they are able to return to work sooner without a cast [8, 11, 13]. It should be noted that attitudes of the patient, employer, insurance company, and socioeconomic status of the patient are also significant factors in time to return to work [9, 12].

An additional consideration in developing treatment plans are complications. The literature has demonstrated a higher rate of complication with surgical treatment over conservative treatment [9, 14]. Short-term complications of surgery include prominent hardware, technical difficulties, infection, complex regional pain syndrome, and scar-related problems, whereas long-term complications include scaphotrapezial and scaphotrapezotrapezoid joint osteoarthritis. The higher rate of arthritis with surgical treatment is thought to be from disruption of the scaphoid cartilage with screw fixation, although scaphotrapezial osteoarthritis is found in a small percentage of patients managed nonoperatively as well [10, 13, 15]. Additional complications noted in a small population of non-surgical patients included intercalated segment instability discovered at 7-year follow-up. It has been suggested the instability in these cases may also be associated with a ligamentous injury at the time of fracture [11].

While there has been recent literature to support operative treatment of non-displaced fractures, there are certainly significant risks to surgical treatment that cannot be ignored. Based on these risks, some authors, such as Dias et al., developed an “aggressive

conservative treatment” approach [9, 11]. Other authors have adopted a variation of this treatment approach which generally includes “aggressive” early diagnosis of the fracture and immobilizing all patients unless they have immediate cause for surgical fixation [15–17]. Early diagnosis and immobilization is important in preventing nonunion, and therefore, any patient suspected of having a scaphoid injury should be evaluated carefully with radiographs and possibly a CT or MRI.

The optimal cast for immobilizing an established scaphoid fracture has been studied; however, no significant differences in union rate have been noted with long arm, short arm, or thumb spica casts [17, 18]. A short arm thumb spica cast is generally accepted [14]; however, some institutions use a short arm cast with 20° wrist dorsiflexion and leaving the thumb free for scaphoid fractures [9, 11, 19]. A recent study has even demonstrated that in patients where the thumb is not included, there is a greater extent of healing compared to those in whom the thumb is immobilized [18]. The following algorithm compromises between both practices. If the scaphoid fracture is diagnosed via radiographs, and is non-displaced, a thumb spica cast should be applied initially. These fractures are less stable than more subtle injuries and fear of further displacement is warranted. At 6 weeks, if there is no displacement, or early signs of healing, it can be converted to a short arm cast without the inclusion of the thumb. If the initial radiographs are normal, and the diagnosis is made through serial radiographs or advanced imaging, this fracture is inherently stable and a short arm cast leaving the thumb free for 6–8 weeks can be applied. Regardless of the cast type, all patients should be re-evaluated with radiographs after 6–8 weeks. If radiographs show significant healing, a cast does not need to be reapplied. If radiographs do not clearly demonstrate healing at 6–8 weeks, a CT scan may be needed to assess healing at that point. Once 50% of the fracture has bridging bone, the patient can be given a removable splint for comfort and return to activities of daily living as tolerated. All patients should be re-evaluated with radiographs again to ensure fracture healing between 12 and 16 weeks postfracture. Patients with clear signs of nonunion, such as fracture motion and vacuolization, are recommended for surgical fixation.

In deciding to manage an acute non-displaced scaphoid fracture with an “aggressive conservative” treatment plan or surgical fixation, having a discussion with the patient regarding the potential risks and benefits of both surgical and nonsurgical treatment is essential. Besides the potential complications of surgery or immobilization, a significant concern for the patient is return to work and activity. These needs for return to activity must be carefully weighed against the higher risk of surgical complications seen with operative management. Both surgical and conservative treatment plans show no significant difference in union, rate of nonunion, or range of motion, and the conservative approach avoids the increased risk of complication associated with surgical fixation.

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