Nonunion Scaphoid Fracture in College Football Player

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Abstract

Background: Athlete is an 18 year-old (70 inches and 220lbs) male NCAA D1 football player. Athlete's prior medical history includes a right posterior labrum tear with arthroscopy labral repair surgery 20 months prior. Athlete reported to a physician following the completion of his football season complaining on left wrist pain that radiates to his left thumb for approximately 6 months duration. Athlete could not specify a mechanism of injury. Initial observation revealed no obvious deformities or signs of trauma. Athlete was point tender over anatomical snuff box. Full painful active range of motion, pain aggravated with movement, no pain with rest. Differential Diagnosis: Scaphoid fracture, 1st metacarpal fracture, scapholunate ligament pathology. Treatment: Athlete was referred to obtain X-rays of the left wrist and hand. X-rays revealed a proximal pole nonunion scaphoid fracture. Athlete was placed in thumb spica and referred to a surgeon for surgical consultation. Athlete underwent an open reduction and internal fixation of the left scaphoid. Following surgery, athlete was placed in thumb spica cast for 4 weeks, then placed in a healed fracture brace. After 2 months, a CT scan revealed a comminuted fracture line through the proximal pole of scaphoid and widening dorsal aspect of scapholunate interval. A bone stimulator and physical therapy was recommended. An additional 2 months later, athlete was cleared for full activity, no restrictions. Athlete still reported pain and was seen by a physician at the Air Force Hospital revealing a fracture was still present. Athlete was re-casted and given a bone stimulator. After a 6-week period, a CT scan revealed no fracture and was released to occupational therapy to restore proper range-of-motion. Uniqueness: Research has shown that scaphoid fractures are most common in males aged 15-19. It is also the most commonly fractured carpal bone with 82-89% of carpal fractures concerning scaphoid fractures. Therefore, the fact that this athlete has this injury is not unique. With this type of injury, it has been indicated that early treatment is best, however this can be a challenge because of the lack of diagnostic procedures to predict a scaphoid fracture. The challenges do not cease when the injury is diagnosed. The scaphoid has a distinctive shape with a specific blood supply that is placed in a functionally demanding location. As a result, the healing of such fractures is challenging. There is no definite "gold standard" of treatment for this injury. Research is inconclusive in whether conservative treatment or surgical intervention is superior to the other. There are studies that show conservative treatment has higher rates of nonunion. On the other hand, surgical treatment has been linked to negative long-term effects in the patient. This specific case highlights some of the treatments used successfully and not successfully leading to delayed healing. Conclusion: This case highlights this diagnosis and treatment of a proximal pole fracture of the scaphoid. It further highlights the grey area in a treatment route prescribed for the particular injury. The case further highlights the successes and failures of treatments attempted. The case review also emphasizes the complexities of treating a proximal pole displaced scaphoid fracture and the need for early interventions.

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Introduction

The scaphoid bone has been said to be one of the most important carpal bones when discussing optimal motion of the wrist joint. Injury to this structure is detrimental and requires specific and successful treatment for a positive outcome. However, a positive outcome is rarely achieved easily. An 18-year-old patient at the Air Force Academy Preparatory School presented with a scaphoid fracture and underwent a long road to recovery, losing time of his football career. This report discusses the research around the current diagnostic procedures and treatment options of a scaphoid fracture. It is then compared with the treatment endured by the specific patient previously referenced.

Classification of Fxs

There are multiple ways to classify the different types of scaphoid fractures; the first being the Herbert Classification. This type of classification is based on the stability of the fracture (Herbert 1984). Those fractures that are dislocated more than 1mm are considered "unstable".

Another classification is the MAYO classification. This divides the fractures into proximal, middle, and distal fractures. Distal fractures tend to heal quicker than proximal because they have a direct blood supply, whereas the proximal scaphoid receives its blood supply from the distal scaphoid. Therefore, the blood supply is often hindered, leading to complications in healing.

The final classification is the Russe classification which predicts the tendency of the fracture to heal based on the fracture plane orientation. According to this classification, vertical oblique fractures are the most challenging to heal. The patient of discussion was diagnosed based on the MAYO classification as having a proximal scaphoid fracture.

Mechanism of Injury and Clinical Presentation

The scaphoid is a crucial carpal bone in the wrist joint while also being the carpal bone most frequently fractured (Brauer 1997). The scaphoid bone gets its name from the Greek word, skaphos, which translates to boat. The scaphoid has a unique shape that allows it to articulate with all of the surrounding bones, the radius, capitate, lunate, trapezium, and the trapezoid. Additionally, the scaphoid is made up of mostly cartilage. Cartilage tissue does not have blood vessel or innervations within, therefore it must get its blood supply via diffusion from outside cells. Because of this, the scaphoid has a very limited blood supply. A scaphoid fracture is typically the product of FOOSH or falling on an outstretched hand, but can also result from a hyperextension mechanism. The injury can also occur following a direct blow to the scaphoid, though this is more rare.

This particular injury does not have established cardinal signs and symptoms, but there are some that are more common. The first being tenderness over the anatomical snuffbox, though this can sometimes be seen in non-injured patients because this applies pressure on the superficial branch of the radial nerve which can be uncomfortable. Inflammation is also seen over this area. Because this injury does not have a set list of key symptoms to look for in its clinical presentation, it adds to the complexity of the diagnosis of scaphoid fractures

Diagnostic Procedures

There is no gold standard of diagnosing a scaphoid fracture. It is commonly predicted based on the presence of anatomical snuffbox tenderness, swelling over the anatomical snuffbox, and 50% diminished grip strength (Grover 1996).

Imaging

Radiographs are commonly used, as they are for most fractures. Unfortunately, radiographs only detect 70% of all scaphoid fractures (Bhat 2004). It is recommended that radiographs are taken from four different views to provide the best picture of the scaphoid. However, the sensitivity for this procedure is very low. Radiographs are constantly repeated 14 days after the initial radiograph if nothing is seen at first and is still often missed.

Computed Tomography (CT) scans are often used for diagnosis of the scaphoid fractures because it allows for "adequate judgement of the cortical involvement" (Rhemrev 2011). However, the sensitivity of the CT is relatively lower compared to other methods. The main problem lies in the ability to interpret CT scans. For most, it is often difficult to diagnosis a fracture based on the distinction of the patterns of the bone.

Bone Scintigraphy, often called bone scan, has 100% sensitivity in ruling out fractures. This method is often used in comparison after radiographs. However, bone scans result in about 25% of false positives and are very expensive for the patient to obtain.

Magnetic Resonance Imaging (MRI) can also be used to aid in the diagnosis of a scaphoid fracture and is favored by multiple authors. A late MRI (19 days post injury) has shown great results. MRIs have been shown to detect trabecular fractures better, but CT scans are superior at detecting those with cortical involvement (Ali 2016). Basically, this means that CT scans are better at detecting more significant fractures that need intervention, whereas MRIs are better at detecting purely trabecular fractures and ligamentous injuries that are easier to manage conservatively. However, any amount of inflammation can easily skew the reading of an MRI.

Sonograms, commonly known as ultrasounds, are also sometimes used in the diagnosis of scaphoid injuries. High frequency ultrasound has been shown to help in the diagnosis but is solely dependent on the skill of the clinician interpreting the ultrasound. Therefore, it is not often used as a primary choice of imaging.

Treatment

There are a variety of options that can be used to treat a scaphoid fracture depending on the patient and severity of the injury. The treatments are often divided into operative treatment and non-operative treatment.

Non-operative Treatment

Fractures of the tuberosity or distal scaphoid are often treated non-operatively. Because this area of the bone has optimal blood supply, there have been many successful outcomes with cast immobilization. Evidence has shown that a successful union will occur in 90% of the fractures treated with cast immobilization. The patient is in the cast for anywhere from 4-12 weeks. Unfortunately, scaphoid fractures are very hard to immobilize because of the importance of the scaphoid carpal bone in most movements of the arm. Therefore, there are multiple castings that can be used depending on the type of fracture.

Operative Treatment

For those fractures that are in the proximal pole of the scaphoid or a displaced fracture, operative treatment is recommended. The treatment involves an open reduction and internal fixation (ORIF) with the placement of a headless compression screw to unify the displaced scaphoid. This screw is used because they "provide rigid fixation and percutaneous insertion [that] preserves the vascular blood supply, which promotes accelerated healing and early rehabilitation" (Geissler 2006). With surgical treatment, there is over a 90% union rate following a successful treatment. It is also seen that patients recover with normal range of motion and strength as long as the procedure was successful and unification occurs properly, although evidence supporting this statement is not abundant.

This review's patient had a displaced fracture of the proximal pole of the scaphoid. He underwent an open reduction and internal fixation using a headless compression screw. The patient was immobilized following surgery, only to find weeks later that the fracture was still a nonunion fracture. He then had another procedure of a revision ORIF with a radiostyloectomy where they removed the styloid process of the radius, and a AIN and PIN erectomy to eliminate the pain receptors in the area.

Discussion and Summary

While the evidence does not support one treatment over the other, there are positives and negatives to both treatments. While non-operative treatment is less invasive and painful, it only carries a 90% unification rate. On the other hand, operative treatment is shown to have some potential negative long-term effects that have not been fully investigated yet. Osteoarthritis, pseudo-arthritis, and carpal collapse have all been linked to operative treatment. However, there is a much higher unification rate and associated increased range of motion and grip strength post-operatively.

The USAFA patient, like most, underwent the indicated repair operatively, experienced complications, and turned a 6-week healing time into about 12 months. The lack of a diagnostic "gold standard" and under-researched treatment options are major factors that contribute to the complexity of this injury. Further research is needed to better the evaluation, treatment, and rehabilitation processes to ensure a better prognosis for all patients with this injury.

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