Scaphoid Fracture in a College Football Athlete

Sydney Lautzenheiser,

Faculty Advisor Jason C. Craddock EdD, ATL, LAT, CSCS

Florida Gulf Coast University, Department of Rehabilitation Sciences, Athletic Training Program

Abstract

Background: Athlete is an 18-year-old (175.3 cm and 77.3 kg) male JUCO football wide receiver. Athlete's prior medical history includes fractures in both wrists. No prior surgical history. Athlete reported to athletic trainer at the beginning of the season complaining of right wrist pain for approximately 1 year. Athlete denied a specific mechanism but stated that pain increased with hitting and blocking. Initial examination revealed no obvious deformities, ecchymosis, or signs of trauma. Athlete was point tender and had minor swelling on radial side of wrist, over the abductor pollicis longus and extensor pollicis brevis tendons. No snuffbox tenderness or numbness/tingling present. Athlete had full and pain free thumb ROM. Wrist extension was 50 degrees and painful if manually forced past. Athlete had full active ROM and strength with all other wrist and hand motions. Grip strength was equal bilaterally. Athlete had pain and MMT 4/5 with resisted thumb abduction. (+) Finkelstein's Test, Valgus Stress Test: (+) for pain on radial side of wrist (-) for laxity, (-) Varus Stress Test. This is a Level 4 case study. **Differential Diagnosis**: De Quervain's tenosynovitis, Scaphoid fracture, Radial styloid process fracture, RCL sprain. **Treatment**: Athlete began conservative treatment for De Quervain's tenosynovitis with athletic training staff with some relief after 2-3 weeks. Treatment involved low-level laser therapy, dry needling of extensor pollicis brevis and abductor pollicis longus tendons, rehabilitation exercises for the wrist, and wrist/thumb taping. Athlete returned to training room a few weeks later after re-injuring his wrist and was re-evaluated. Fluoroscope showed evidence of a scaphoid fracture, confirmed by X-ray and evaluation by team doctor. The athlete most likely had an old non-union fracture in the scaphoid that had never been diagnosed. This new injury fractured the bone all the way through and displaced it. After consultation with the team doctor, it was decided that the athlete would undergo surgical repair of the scaphoid. During the surgery, necrotic tissue was found, and the scaphoid bone was surgically revascularized using a graft from the radius. **Uniqueness:** Despite the high incidence of scaphoid fractures, they can be difficult to diagnose, leading to delayed treatment and complications such as non-union and avascular necrosis. Evidence has indicated that failure to recognize a scaphoid fracture may result in non-union in 5-25% of all cases and avascular necrosis in 13-50% of cases. Tenderness in the anatomical snuffbox and falling on an outstretched hand are thought to be the two cardinal signs of a scaphoid fracture, however, there are cases such as this one in which neither sign is present. This specific case is unique because the athlete presented with a non-classical mechanism of injury, none of the common signs of a scaphoid fracture, and both complications of delayed diagnosis (non-union and avascular necrosis). Scaphoid reconstruction was also completed using a vascularized bone graft from the distal radius, as compared to the typical approach of using a non-vascularized bone graft from the iliac crest. Revascularization using a distal radius graft has been shown to improve bone healing conditions and have a quicker union timeframe, shortening the return to play timeline. **Conclusion:** This case highlights the unique diagnosis and surgical treatment of an athlete suffering from a scaphoid fracture. This case further highlights the complications that can occur due to delayed diagnosis and treatment of scaphoid fractures. It also emphasizes the complexities of diagnosing athletes with scaphoid fractures and the need for early interventions.

Introduction

Scaphoid fractures are a common wrist injury, especially in football athletes given the frequency with which they experience high impact injuries to the wrist. "The scaphoid bone is the most commonly fractured carpal bone in the athletic patient and accounts for over 85% of all sport-related carpal bone fractures" (Goffin, Liao & Robertson, 2019). Scaphoid fractures can be difficult to diagnose, but if a fracture is suspected, early intervention is key. Delayed diagnosis of scaphoid fractures can lead to complications such as non-union and avascular necrosis, both of which increase the risk of obtaining arthritis. The following information will explain the mechanism of injury, clinical assessments, radiographic findings, diagnosis, treatment and return to play to provide additional information to this athlete's unique injury.

Purpose

The purpose of this case report was to introduce an 18 year-old JUCO football athlete who presented with a scaphoid fracture during the season. Due to the extent of his injury, surgery was recommended and performed. An overview of this unique injury is presented to obtain additional information and a better understanding of the importance of early diagnosis in athletes with scaphoid fractures to avoid the occurrence of complications.

Anatomy

Understanding the anatomy of the wrist is essential in understanding the injury and radiographic findings. The wrist is composed of eight carpal bones arranged into a proximal and distal row. "The scaphoid functions as a link between these two rows" (Winston & Weiland, 2017). The carpal rows are further connected by several intrinsic and extrinsic ligaments, the ability of which to stabilize the proximal carpal row depends on the integrity of the scaphoid. This is why injury to the scaphoid can result in a humpback deformity. In addition, the scaphoid bone has a limited area for vascular supply but is 80% supplied through retrograde blood flow from the dorsal carpal branch of the radial artery. The remaining 20% is supplied to the distal pole by the superficial palmar arch. "The retrograde flow to the scaphoid makes proximal pole fractures vulnerable to avascular necrosis and nonunion" (Winston & Weidland, 2017).

Case Report

Patient: This JUCO football player is a 18 year-old (77.3 kg and 175.3 cm) athlete that presented with a scaphoid fracture during the season. The following information will explain the mechanism of injury, clinical assessments, radiographic findings, diagnosis, treatments and return to play to provide additional information to this athlete's unique injury.

Mechanism of Injury: Due to the frequency with which high impact injuries to the wrist occur, scaphoid fractures are a common occurrence in football. Scaphoid fractures typically occur due to direct trauma (through hitting or blocking), or by falling onto an outstretched hand. This athlete had an unusual mechanism of injury. He reported to the athletic trainer at the beginning of the season complaining of right wrist pain for approximately 1 year. The athlete denied a specific mechanism but stated that pain increased with hitting and blocking.

Clinical Examination: Initial examination revealed no obvious deformities, ecchymosis, or signs of trauma. The athlete was point tender on the radial side of wrist, over the abductor pollicis longus and extensor pollicis brevis tendons. Minor swelling was also noted over the abductor pollicis longus and extensor pollicis brevis tendons. No anatomical snuffbox tenderness or numbness/tingling was present. The athlete had full and pain free thumb range of motion. Wrist extension was 50 degrees and painful if manually forced past. The athlete had full active range of motion and strength with all other wrist and hand motions. Grip strength was equal bilaterally. When manual muscle testing was performed, the athlete presented with pain and an MMT score of 4/5 with resisted thumb abduction.

During the clinical special testing for this injury, the athlete tested positive when performing Finkelstein's Test for De Quervain's tensosynovitis. He also tested positive for pain on the radial side of his wrist, but negative for laxity, during valgus stress testing of the wrist. Varus stress testing was negative for both pain and laxity.

Radiographic Findings: When the athlete first presented to the athletic trainer with pain, initial imaging using a fluoroscope showed no evidence of fracture and he was treated with conservative management for De Quervain's tensosynovitis. After sustaining a second injury to his wrist, the athlete returned to the training room. This time, initial imaging using the fluoroscope showed evidence of scaphoid fracture. This was confirmed through x-rays and evaluation by team physician.

Diagnosis: The athlete was initially diagnosed with De Quervain's tensosynovitis, due to the results of the clinical examination. He began conservative treatment in the athletic training room with some relief after 2-3 weeks. However, the athlete returned to the training room a few weeks later after re-injuring his wrist and was re-evaluated. Fluoroscope showed evidence of a scaphoid fracture, confirmed by X-ray and evaluation by team doctor. The athlete most likely had an old non-union fracture in the scaphoid that had never been diagnosed. This new injury fractured the bone all the way through and displaced it. After consultation with the team doctor, it was decided that the athlete would undergo surgical repair of the scaphoid. During the surgery, necrotic tissue was found, and the scaphoid bone was surgically revascularized using a graft from the radius.

Rehabilitation and Results

Fractures of the scaphoid bone can be managed conservatively and surgically, depending on severity of the injury. Extent of injury is determined based on how far the bone fragments have moved out of their normal position. Scaphoid fractures can be classified as displaced, where the bone fragments have moved out of their normal position (gaps may be present between the pieces of bone or fragments may overlap one another), or non-displaced, in which the bone fragments line up correctly. Conservative management may be recommended in cases where the fracture affects the distal pole of the scaphoid, is non-displaced, and does not show any signs of avascular necrosis. Common forms of conservative management involve cast immobilization using "short arm thumb spica cast with the wrist in a neutral position, colles cast without thumb immobilization, and below elbow plaster casts" (Goffin et al., 2019). Duration of immobilization can range from 10 weeks to 6 months, as healing time ranges from patient to patient.

Due to the location (proximal pole) and extent of this athlete's injury (nonunion and avascular necrosis), surgery was recommended and performed to repair the fractured scaphoid and revascularize the bone using a graft from the radius. Following the procedure, the athlete was immobilized in a cast for approximately 6 weeks. During this time, no rehabilitation exercise were performed, but the athlete was asked to check in with the athletic training staff daily. A bone stimulator was used to deliver low-intensity electromagnetic waves to stimulate healing. Once the cast was removed, rehabilitation exercises were initiated. In the initial phase of rehabilitation, range of motion exercises were introduced (wrist flexion, extension, supination, and pronation). In addition, blood flow restriction was introduced to regain/maintain the athlete's upper body strength. "Blood flow restriction (BFR) therapy uses low load resistance exercises, typically 20-30% of a one repetition max (1RM) during a brief and partial restriction of venous outflow from an extremity. This brief period of venous occlusion creates an anerobic environment, thereby inducing localized cellular and hormonal changes which stimulate muscle hypertrophy" (Cancio & Rhee, 2018). BFR therapy is a safe and well tolerated way to enhance recovery of upper body strength in patients following injury to the hand. Once the athlete is able to perform all ROM and wrist stretching exercises without any pain, he will be able to progress to strengthening of the wrist and fingers with a gradual increase in weight. Full return to play is expected within 6-8 months of surgery, but will be determined based on the athlete's progress during rehabilitation.

Discussion and Summary

Despite the high incidence of scaphoid fractures, they can be difficult to diagnose, leading to delayed treatment and complications such as non-union and avascular necrosis. Evidence has indicated that failure to recognize a scaphoid fracture may result in non-union in 5-25% of all cases and avascular necrosis in 13-50% of cases (Steinmann & Adams, 2006). Tenderness in the anatomical snuffbox and falling on an outstretched hand are thought to be the two cardinal signs of a scaphoid fracture, however, there are cases such as this one in which neither sign is present. This specific case is unique because the athlete presented with a non-classical mechanism of injury, none of the common signs of a scaphoid fracture, and both complications of delayed diagnosis (non-union and avascular necrosis). Scaphoid reconstruction was also completed using a vascularized bone graft from the distal radius, as compared to the typical approach of using a non-vascularized bone graft from the iliac crest. Revascularization using a distal radius graft has been shown to improve bone healing conditions and have a quicker union timeframe, shortening the return to play timeline.

This case highlights the unique diagnosis and surgical treatment of an athlete suffering from a scaphoid fracture. Further, it highlights the complications that can occur due to delayed diagnosis and treatment of scaphoid fractures. It also emphasizes the complexities of diagnosing athletes with scaphoid fractures and the need for early interventions.

References

Belsky, M. R., Leibman, M. I., & Ruchelsman, D. E. (2012). Scaphoid Fracture in the Elite Athlete. *Hand Clinics*,*28*(3), 269-278. doi:10.1016/j.hcl.2012.05.005

Cancio, J., & Rhee, P. (2018). Blood flow restriction therapy after non-operative management of distal radius fracture: A randomized controlled pilot study. *Journal of Hand Therapy*,*31*(1), 161. doi:10.1016/j.jht.2017.11.027

Goffin, J. S., Liao, Q., & Robertson, G. A. (2019). Return to sport following scaphoid fractures: A systematic review and meta-analysis. *World Journal of Orthopedics*,*10*(2), 101-114. doi:10.5312/wjo.v10.i2.101

Kawamura, K., & Chung, K. C. (2008). Treatment of Scaphoid Fractures and Nonunions. *Journal of Hand Surgery*,*33*(6), 988-997. doi:https://doi.org/10.1016/j.jhsa.2008.04.026

Steinmann, S. P., & Adams, J. E. (2006). Scaphoid fractures and nonunions: diagnosis and treatment. *Journal of orthopaedic science: Official journal of the Japanese Orthopaedic Association*, *11*(4), 424-31. doi: 10.1007/s00776-006-1025-x

Winston, M. J. (2017). Scaphoid fractures in the athlete. *Current Reviews in Musculoskeletal Medicine*,*10*(1), 38-44. doi:10.1007/s12178-017-9382-y