Capitate Stress Injuries of Both Wrists in an Adolescent Female Gymnast: A Case Report

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Abstract

Gymnastic activities expose the wrist to a wide variety of overuse and acute stresses. Injuries to the distal radius are the most commonly reported gymnastic wrist condition; however, many other structures are at risk of injury from the sport's high acute and overuse demands, including the carpal bones, most commonly the scaphoid. We describe a 17-year-old female, high-level gymnast in whom stress injuries to both capitate bones were ultimately diagnosed after initial symptoms of pain. This case demonstrated the need for prompt recognition, without which much chronic and debilitating injury would develop. For successful diagnosis, healthcare providers should carefully examine and evaluate reported wrist pain in high-level, adolescent gymnasts.

Introduction

Acute and chronic upper-extremity injuries are common in gymnasts. Typical injuries in female gymnasts involve the wrist, whereas men often report shoulder injuries.[1] In one systematic review examining wrist injuries in adolescent athletes, gymnastics was the most common sport reported.[2] During gymnastic activities, the wrist is exposed to many different types of stresses, including repetitive motion, high impact loading, axial compression, torsional forces, and distraction in varying degrees of ulnar or radial deviation and hyperextension.[1]

Radial epiphysitis is a frequent cause of wrist pain and injury in young gymnasts.[1-4] Other diagnoses include scaphoid impaction syndrome, dorsal impingement, scaphoid fractures, scaphoid stress reactions and fractures, ganglia, carpal instability, triangular fibrocartilage complex tears, ulnar impaction syndrome, and lunotriquetral impingement.[1]

Published case reports are limited on capitate stress injury.[5,6] One study[5] involved a 42-year-old male physical-education teacher who was instructing gymnastics; the other[6] described a 30-year-old male dock worker who developed a capitate stress fracture after months of using a lever to operate heavy machinery. Another study[7] radiographically reported a group of 18 children with capitate stress fractures among a larger collection of tarsal and carpal cases in a 30-year period. However, this study did not include specific demographic characteristics of patients such as gender and activities.

We describe the eventual diagnosis of stress injuries to both capitate bones of a 17-year-old, high-level gymnast, who initially presented with 2 months of pain in both wrists. The patient and her mother were informed that the data concerning the case would be submitted for publication, and they provided verbal consent.

Case Report

A 17-year-old, female gymnast presented to the sports-medicine clinic with pain in both of her wrists for 2 months. She started participating in gymnastics at age 5 years and began competing at age 12. Four months prior to initial presentation, the intensity of her practices increased when she began training with a new coach. The patient did not recall a specific single traumatic episode. Of the four gymnastic events, the balance beam bothered her the most. The patient was healthy; she had regular menstrual periods since age 13 years, did not smoke or use tobacco, and reported no previous stress fractures.

Results of physical examinations indicated no obvious wrist deformities. The patient had decreased extension and flexion on both wrists, with mildly limited supination. She had tenderness over the distal radius, ulna, and dorsal wrist but not specifically over the capitate. Findings of her

neurovascular examination and elbows test were normal. Plain radiographs of the forearm and wrist showed closed physes, but findings were otherwise unremarkable. At this point, the family agreed to obtain magnetic resonance imaging (MRI) of both wrists to investigate the source of the pain. The patient was instructed to avoid painful activity and wear braces to help limit wrist hyperextension while waiting for the MRI results.

The MRI revealed stress injuries of the capitate bones in both wrists. The patient was referred to a pediatric orthopaedist who reviewed the imaging. The surgeon noted a stress fracture of the distal third of the left capitate and stress reaction of the right distal capitate, caused by hyperextension, with a likely mechanism of metacarpal-capitate abutment (Figures 1A through 3A). The injury was less severe in the right wrist compared with the left, with limited signs of edema (Figures 1B and 2B) and no fracture line (Figures 1B and 3B). The patient continued wearing the braces to prevent hyperextension of the wrists and was asked to avoid gymnastic activity for 6 to 12 weeks.

At 6 weeks after the MRIs revealed the injury, the patient reported no pain in her wrists. Physical examination findings were normal, with a full range of motion and no dorsal tenderness of her wrist. She was directed to gradually resume activity, with progressive symptom-limited training, and return to the clinic if she felt pain. The patient did not return for any subsequent visit.

Figure 1. T2-weighted magnetic resonance imaging of the (A) left wrist and (B) right wrist, showing sagittal view of the capitate edema (white asterisk) and a fracture line (arrow) extending from volar proximal to dorsal distal in the distal third of the capitate. Notably, on the right wrist, the edema is less severe and no fracture line is seen.

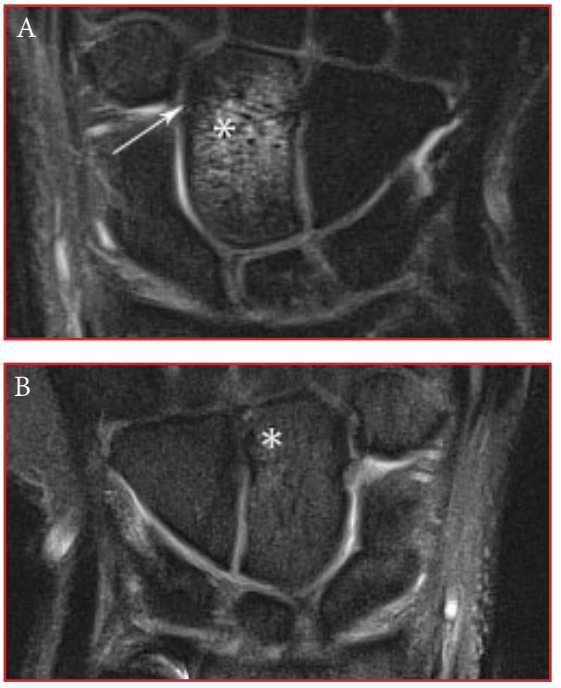

Figure 2. T2-weighted magnetic resonance imaging of the (A) left wrist and (B) right wrist, showing coronal view of capitate edema (white asterisk) and a fracture line (arrow) extending transversely in the distal third of the capitate. Notably, on the right wrist, the edema is less severe and no fracture line is seen.

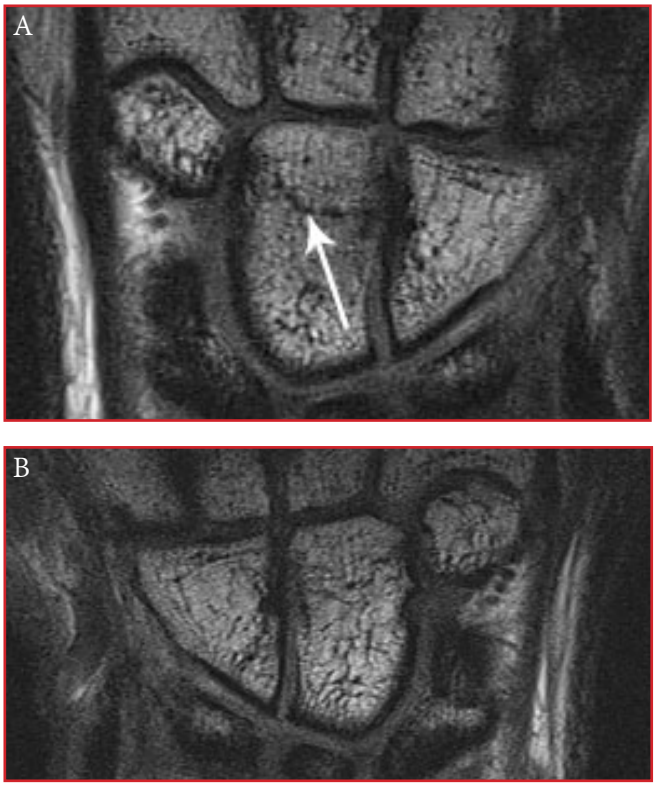

Figure 3. T1-weighted magnetic resonance imaging of the (A) left wrist and (B) right wrist, showing coronal view of the capitate fracture line (arrow) extending transversely in the distal third of the capitate. Notably, the fracture line is not visible on the right wrist, indicating a less severe injury compared with the left wrist.

Discussion

This is the first case report of a capitate stress fracture in an adolescent female athlete. The exact mechanism of injury to the capitate bone is complex; however, the axis-based position of the capitate may cause strain during ulnar and radial deviation of the wrist.[6] In the current case, the MRI revealed a less severe stress injury of the right wrist compared to the left, which could indicate that a higher level of force was applied to the left wrist during gymnastic activity. However, it could also be due to frequency of wrist bearing and strain, specific positions of the wrist, as well as many other variables. Furthermore, this patient met two out of three key risk factors detailed in a study of overuse injuries in young athletes including early onset of training (our patient started training at age 12) and sudden increase in training intensity (our patient increased training intensity with her new coach).[2] Other risk factors mentioned in a study specifically on young competitive female gymnasts included recent injury, periods of rapid bone growth, low level of bone maturation, and advanced levels of training and competition.[9]

Standard treatment for overuse injuries such as a stress fracture involves relative rest, allowing non-painful activities with appropriate bracing to limit extremes of motion.[1,3,8] Return to participation is usually over a 6- to 12-week timeframe, depending on severity of symptoms, findings of physical examination, and, though less common, findings of repeat imaging.[1,3,8] If untreated, capitate stress fractures may result in possible career-altering or ending outcomes for patients. Complications include fracture displacement, non-union in fractures involving the cortical bone, malunion of displaced fractures, avascular necrosis associated with chronic pain, loss of range of motion, and need for surgical intervention.[1-6]

Although stress injuries of the capitate in gymnasts are relatively rare,[5,6] athletes, coaches, parents, and healthcare providers should not dismiss chronic or progressive wrist pain and soreness as normal results of training. Despite normal plain radiograph findings, a high index of suspicious should be maintained when evaluating wrist pain in these athletes. Use of MRI (with situational use of nuclear medicine bone scanning and computed tomography) can be helpful to assess the presence and severity of wrist injury in high-level, adolescent gymnasts.

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Conflict of Interest

The authors report no conflicts of interest.

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