Pisotriquetral Pain Treated with Bilateral Pisiform Excision in a Collegiate Diver

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Abstract

Background Pisiform excision and pisotriquetral arthrodesis are two surgical options for the treatment of pisotriquetral joint pain when conservative methods fail. However, it is unclear which option is best for patients who experience substantial, repetitive loading on their wrists and wish to preserve wrist flexibility and function.

Case Description We present a case of bilateral ulnar-sided wrist pain related to the pisotriquetral joint in a 19-year-old collegiate diver. The pain was exacerbated by activities specific to this sport that requires wrist hyperextension, namely full weight-bearing on the hands (handstands), and has an impact on the hands and wrists upon water entry during dives due to direct palmar pressure. There were no radiographic signs of arthritis; however, there were bone marrow changes on magnetic resonance imaging (MRI). Management with rest, splinting, and corticosteroid injection failed to relieve the pain and precluded his ability to return to full-time diving. Treatment consisted of bilateral pisiform excision. Postoperatively, the patient returned to full-time competitive diving with resolution of his painful symptoms.

Literature Review Pisiform excision has been shown to have successful outcomes in terms of return to play for lower impact athletes (such as badminton) but has not been reported in athletes who experience a high degree of force repetitively (such as gymnasts or divers). There is one report of pisotriquetral arthrodesis in a young gymnast with suboptimal results.

Clinical Relevance This case report demonstrates that pisiform excision is a successful treatment for elite athletes who experience repetitive, palmar force on hyperextended wrists and subsequently develop ulnar-sided wrist pain.

Keywords

- pisiform excision
- pisotriquetral joint
- athlete
- ulnar wrist pain

The pisotriquetral joint is a common site of ulnar-sided wrist pain and tenderness.¹ Pisotriquetral pain unresponsive to conservative management is treated with arthrodesis or pisiform excision.^{2–5} There is little information on the effects of pisiform excision in younger patients, especially for athletes, such as divers, who experience high impact on the pisotriquetral joint. The sport of diving involves repetitive axial compression, with the hands hyperextended particu-

larly during water entries and handstands. When diving from a 10-m platform, a diver reaches speeds of approximately 15 to 16.4 m/s, which leads to significant force directly on the palm estimated at 2 to 2.4 G (1 G = 9.8 m/s²) due to the use of the flat-hand grip during head-first entries (► **Fig. 1**).^{6,7} There is a theoretical risk that removing the pisiform may place the ulnar nerve and artery at a risk of traumatic injury or repetitive compression. Alternatively, the effects of

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Fig. 1 The flat-hand grip used during water entry in competitive diving involves wrist hyperextension and pronation.

pisotriquetral fusion may alter the mechanics of the carpus and lead to other sources of pain. This report highlights the presentation and decision-making process in a young athlete.

Case Report

A 19-year-old male collegiate diver presented with insidious onset of bilateral ulnar-sided wrist pain that had gradually worsened over a period of 9 months. The pain was located on the volar side of the wrist over the proximal portion of the hypothenar eminence and pisiform bone. He reported severe pain during wrist extension such as when entering the water head-first with a flat-hand grip.

Physical examination of the hands and wrists showed normal alignment of the fingers and wrists without swelling or deformity. Pain was elicited with wrist extension and

loading of the pisiform onto the triquetrum. No tenderness was noted proximally over the flexor carpi ulnaris (FCU) tendon. There were no signs of ulnar neuropathy.

Bilateral X-rays were unremarkable, including posteroanterior and anteroposterior oblique views and carpal tunnel views. Magnetic resonance imaging (MRI) demonstrated non-specific bone marrow edema involving the triquetrum (►**Fig. 2**) suggestive of repetitive trauma, which was more pronounced in the right hand than in the left hand. A nuclear bone scan showed focal hyperperfusion and hyperemia and delayed uptake in the bilateral triquetrum/pisiform complexes, which was also suggestive of repetitive low-grade impaction.

Initial treatments consisted of wrist taping, nonsteroidal anti-inflammatory medication, nighttime splinting, and avoidance of diving for several weeks, but the pain did not resolve. Corticosteroid injections to the bilateral pisotriquetral joints were given as the final means of conservative treatment. He was splinted fulltime for 3 weeks postinjection with some improvement; however, he still reported pain while performing daily activities and was unable to return to diving.

Due to the failure of conservative treatment, operative intervention was deemed necessary—both pisiform excision and pisotriquetral arthrodesis were considered. A collective decision was made to proceed with pisiform excision due to the desire to maintain wrist mobility. The more symptomatic right wrist was operated on first. Examination of the articular surface of the pisiform revealed a small cartilaginous surface measuring less than 1 cm². The corresponding surface of the triquetrum was almost twice as large, and at the distal edge of the triquetrum was a region of articular surface with abnormal wear. The wrist was immobilized postoperatively for 2 weeks. A removable orthosis was used for an additional 5 weeks while a program of active range of motion exercises was initiated. Therapy was advanced to passive stretching and progressive strengthening as tolerated. The patient was asked to refrain from weight-bearing and diving

Fig. 2 Coronal views of the preoperative magnetic resonance imaging of the right wrist (T1-weighted image on left, T2-weighted image on right) demonstrate bone marrow edema within the triquetrum (arrows).

activities until he could perform full range of motion painlessly. At 2.5 months after surgery, he had full range of motion and returned to diving. He did not have any recurrence of his right-sided wrist pain.

The left wrist remained symptomatic, and left pisiform excision was performed 6 months after the contralateral surgery. In comparison to the prior excision, there were no visible erosions in the cartilage of the pisiform or triquetrum; however, there was some thickened synovium. The same postoperative protocol was followed with similar results. At 6 months follow-up, he returned to full diving activities with normal range of motion and continued to dive throughout his last 2 years of college.

Discussion

Diving is a sport with a tremendous amount of repetitive palmar impact on hyperextended wrists; however, the wrists are also flexed during certain diving maneuvers and therefore maintaining wrist mobility is a priority. We weighed the risk of increased exposure of the ulnar neurovascular bundle against concerns regarding the stability of a pisotriquetral arthrodesis, which could alter the kinematics of the wrist. In the end, excision appeared to be the simplest, least invasive way to treat the patient's symptoms and allow him to return to diving. Postoperatively, our patient never developed any symptoms of ulnar nerve compression when resuming his training and competition. He has remained symptom-free for 4 years.

The pisiform bone acts as a fulcrum, translating forces from the forearm muscles across the wrist. In flexion, the FCU pulls the pisiform proximally and palmarly, widening the pisotriquetral joint space. In extension, the pisiform is displaced distally, causing narrowing of the joint space.⁸ Pain in the area of the pisiform can be because of a wide variety of pathologies including tendinitis at the insertion FCU, arthritis of the pisotriquetral joint, subluxation of the pisiform with associated synovitis, fracture of the triquetrum or pisiform, rheumatism, or osteonecrosis.⁴ In cadaveric studies (69% male, 31% female [average age: 72.5 years]), erosive arthritic changes were present in more than 80% of pisotriquetral joints; however, the symptomatic presentation is less commonly reported.^{9,10} Primary osteoarthritis appears in patients older than 50 years with no history of trauma.^{3,10,11} In younger patients, secondary osteoarthritis has been reported in both racquetball players and gymnasts, with the symptoms attributed to repetitive trauma.^{12,13} Our patient did not have gross articular wear, but synovitis and changes at the edges of the articular surfaces were noted during surgery. This implies that some abnormal contact or pisotriquetral abutment was occurring during activities.

We suspect that the articular contact between the pisiform and triquetrum became clinically symptomatic during repetitive axial loading and wrist hyperextension during diving activities. In a case series of pisotriquetral pain in racquetball and tennis players, Helal postulated that their pain was because of a torsional stress upon the capsule of the pisotriquetral joint by repeated sharp pronation and supination movements when

wielding a racquet.¹³ The flat-hand grip used by divers also requires pronation of the forearms in addition to wrist extension, which may have caused further pisotriquetral abutment. In our patient, the bone marrow edema within the triquetrum seen on MRI further validates some increased contact forces between the pisiform and triquetrum.

Pain related to the pisiform that does not resolve with conservative treatment has been treated with pisiform excision or pisotriquetral arthrodesis.²⁻⁵ The potential advantages and disadvantages of these two options are still debated. O'Keefe et al conducted a biomechanical study comparing excision with arthrodesis and found that after pisiform excision, greater FCU forces were required to move the wrist because the moment arm function had been removed.¹⁴ Less dynamic changes were noted with the arthrodesis, but the authors advised that the long-term impact of arthrodesis on midcarpal kinematics is still unknown. Beckers and Koebke stated that the pisiform contributes to the stability of the ulnar column of the wrist by holding the triquetrum in the correct position, thus preventing its subluxation in extreme extension. The pisiform is also thought to create space for the ulnar neurovascular bundle to pass through Guyon's canal, thus offering some protective function to these structures.¹ Studies on the effects of pisiform excision report that the vast majority of patients have relief of pain and no long-term adverse effects on wrist range of motion and strength.^{2,3,5}

The case presented here is unique because the pisiform excisions were performed in a young athlete who repetitively experienced tremendous impact on the pisotriquetral joint. Helal reported four cases of pisiform excision in racquetball and squash players, with all patients returning to play with no reported adverse outcomes.¹³ Abrams and Tontz reported a case of pisotriquetral instability in a 14-year-old female gymnast treated with pisotriquetral arthrodesis.¹² At 1 year postsurgery, the patient had returned to full gymnastics activity. However, at the 2-year follow-up, she had developed mechanical abutment of the fused pisiform and distal ulna upon extreme wrist flexion and forearm rotation, which led to her discontinuation of gymnastics.

In summary, pisotriquetral impaction should be considered in athletes with ulnar-sided wrist pain. In this patient, pisiform excision was a successful mode of treatment without any appreciable long-term sequelae for a competitive diver.

Conflict of Interest

None.

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