Findings that shed new light on the possible pathogenesis of a disease or an adverse effect

Carpal contusions in an elite platform diver

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Summary

Wrist and hand injuries are common in elite divers, as all correctly performed dives end with a head first entry into the water with the hands extended above the head. This case presentation was an Olympic level diver with 3 months of persistent dorsal wrist pain. MRI findings showed contiguous contusions to the lunate, capitate, hamate and distal radius and also a peripheral tear of the ulnar attachment of the triangular fibrocartilage complex (TFCC). The repeated dorsiflexion stress of entry into the water likely caused these injuries. Although the authors had suspected a TFCC injury and did find an isolated ulnar-sided peripheral tear, the complicating carpal contusions led us to choose a conservative treatment plan, which was the only intervention the patient ultimately required.

BACKGROUND

All successful dives at the elite level end with the divers entering the water hands first. This can lead to a variety of wrist and hand injuries. Due to the repetitive nature of these injuries, wrist and hand problems frequently go untreated or undertreated and are not commonly reported in the literature. There are two methods that have been described for effective entry into the water for the purpose of creating a water hole to minimise splashing. The first is with both hands clenched into fists, with one thumb wrapped in the other fist. The second involves entry with both hands open and flat, both wrists extended and radially deviated and with both forearms slightly pronated.¹

There exist few published articles concerning repeated impact injuries to the wrist in competitive divers. In this case, our evaluation diagnosed the patient with bony contusions in the lunate, capitate, hamate and distal radius. The repeated dorsiflexion stress of entry into the water was the cause of these injuries. Although the authors had suspected a triangular fibrocartilage complex (TFCC) injury and did find an isolated ulnar-sided peripheral tear, the complicating carpal contusions led us to choose a conservative treatment plan, which was the only intervention the patient ultimately required. Possible further treatment might have included arthroscopic repair of his TFCC injury, if his symptoms were to persist or worsen despite resolution of his bony contusions.

CASE PRESENTATION

A 15-year-old male, 10 m platform and 3 m springboard diver, presented with discomfort in his right wrist that had persisted for 2–3 months. The patient is right hand dominant, thus his right hand leads upon entry into the water. He presented to the clinic with pain during wrist extension

when entering the water and pushing himself out of the pool. He also reported pain with turning door knobs and twisting the tops off of jars. Initial treatment included a taping technique that his athletic trainer was familiar with which worked temporarily, but once he was in the water the taping quickly became ineffective. He denied swelling, numbness, tingling, weakness or a specific traumatic event preceding this injury. The patient has no significant medical history or prior surgeries. He is a high school student who dives at the Olympic level.

Physical examination of the wrist revealed tenderness to palpation over the ulnar aspect of the wrist dorsally including over the TFCC and radio-ulnar joint. There was no oedema, erythema or ecchymosis. The pain was worse with ulnar deviation and extension of the wrist. The patient had normal range of motion to flexion, extension, radial and ulnar deviation with normal motor strength and an intact neurovascular examination of the entire upper extremity. The patient had pain with passive ulnar deviation of the wrist. There was no snuff box tenderness, no pain with axial loading of the thumb, no tenderness at the scaphoid tubercle and no pain with radial deviation of the wrist. He had no scapho-lunate ligament tenderness and a negative Watson's test. The patient did have evidence of generalised ligament laxity.

INVESTIGATIONS

Plain radiographs of the right wrist (figure 1) revealed no evidence of fracture, dislocation or soft tissue swelling. The patient had negative ulnar variance.

Findings on MRI showed contiguous contusions to the lunate, capitate, hamate and distal radius and also a peripheral tear of the ulnar attachment of the TFCC (figures 2–4).

Figure 1 Radiographs showing negative ulnar variance.

DIFFERENTIAL DIAGNOSIS

- ▶ TFCC tear
- ▶ Scapho-lunate ligament tear
- ▶ Carpal stress fracture
- ▶ Carpal instability
- ▶ Ganglion cyst
- ▶ Distal radioulnar joint instability (DRUJ) instability
- ▶ Extensor tendonitis.

TREATMENT

At follow-up evaluation, the patient's pain had improved after diving with a custom-moulded rigid extension brace. The patient was allowed to return to diving activities as tolerated. He was advised to continue using the brace while diving and to take non-steroidal anti-inflammatory drugs (NSAIDs) as needed.

Figure 2 MR arthrogram; triangular fibrocartilage complex tear.

OUTCOME AND FOLLOW-UP

The patient found the rigid brace to be limiting and again resumed taping the wrist for support after 2 weeks of diving in the brace. Over the ensuing 2–3 weeks, the symptoms improved and he was able to continue diving competitively without difficulty.

DISCUSSION

The contusions found in the distal radius, lunate, capitate and hamate are indicative of impact stress to the carpal bones of the wrist. There is only one case of reported carpal stress fracture in a competitive diver, which was a scaphoid fracture resulting in open reduction and internal fixation.¹ Common injuries reported with repetitive stress to the wrist include subtle carpal instability, dorsal impaction syndrome, sprains, dorsal ganglion cysts, flexor carpi ulnaris tendonitis and TFCC injuries.² Less common injuries include scaphoid stress fractures, radial styloid fractures or metacarpal fractures.^{1–3} Scaphoid impaction syndrome occurs as a result of repetitive hyperextension stress such as in gymnastics and weight lifting. These patients typically present with pain and weakness, dorsal wrist pain with extension and tenderness to palpation over the dorsal aspect of the scaphoid. In chronic cases, athletes can develop a hypertrophic ridge on the dorsal rim of the scaphoid sufficient to impair extension. Similar

to scaphoid impaction syndrome, athletes can suffer from radial styloid impingement syndrome. This is similar to the scaphoid impingement syndrome except the pain is worse with radial deviation. The TFCC includes the articular disc, dorsal radio-ulnar ligament, volar radio-ulnar ligament, ulno-lunate ligament, ulno-triquetral ligament, meniscus homologue, ulnar collateral ligament and the extensor carpi ulnaris.⁴ It has attachments on the radius, ulna, lunate and triquetrum and functions primarily to stabilise the DRUJ.⁴ The TFCC also cushions the carpals on the ulna, assists with axial loading of the wrist, provides a larger surface for the radius to glide and provides some stability during pronation and supination of the wrist.⁴

Conservative treatment of these injuries includes rest, NSAIDs, taping, splinting or bracing. The primary goal of conservative management is to prevent or lessen dorsiflexion stress. Surgical intervention may be necessary for the treatment of those patients not responding to conservative management, and for some TFCC tears and scaphoid, styloid or metacarpal fractures. Scaphoid impaction cases that have developed a large ridge on the dorsum of the scaphoid may require cheilectomy to remove the bony extension block. TFCC injuries may also require surgical intervention. Depending on the size and location of the tear, treatment can vary greatly.⁵ The exact surgical procedure performed can vary based on the degree of ulnar

Figure 3 MR arthrogram; sagittal T2 weighted image showing contusions to distal radius, lunate and capitate.

variance present. A tear with negative ulnar variance may indicate debridement of the TFCC only, whereas a tear with positive ulnar variance could indicate debridement of the TFCC and an ulnar shortening procedure.⁵ These can be repaired via both open and arthroscopic techniques. Indications for TFCC surgical repair include traumatic ulnar-sided peripheral tears, with the best surgical candidates being those with an isolated acute traumatic event.⁶

Plain radiographs are useful in the initial evaluation of wrist and hand injuries, and may identify bony abnormalities causing pain. Typical views should include a dorso-palmar and a lateral view. Some carpal abnormalities will not be seen on these projections and additional specialised views can be obtained. Those patients who do not improve with rest and conservative treatment or suspected to have ligamentous or tendinous injuries should have further imaging. Axial CT is another modality frequently used to detect pathology in wrist injuries and may help diagnose occult fractures not identified on plain radiographs. CT should be performed using contiguous 2 mm slices with the axis of orientation determined by which bone is thought to be injured. Ultrasound (US) is an additional diagnostic tool that can be used to assist in the evaluation of the soft tissue structures surrounding the wrist. Joint effusions, ganglia, tendon and ligament injuries can all be visualised using US. Care must be taken to image the suspected area in both

the longitudinal and transverse planes to avoid incorrect interpretation of the US findings.⁷ MR imaging remains the most comprehensive diagnostic tool to address both bone and soft tissue pathology.⁷ MR can be used to diagnose problems in the TFCC, hyaline cartilage, DRUJ, ganglion, ligament tears (scapho-lunate better than luno-triquetral) and changes relating to the carpal bones.⁸

Learning points

- Being thorough and ordering proper imaging is vital to proper diagnosis, treatment and prevention of carpal wrist injuries.
- Most hand and wrist complaints in individuals suffering from repetitive extension injuries can be treated conservatively.
- Worsening symptoms, loss of normal motion or lack of improvement after adequate non-surgical intervention could indicate the necessity for further intervention.
- Proper rest and bracing is often adequate for complete recovery.

Competing interests None.

Patient consent Obtained.

Figure 4 MR arthrogram; coronal T2 weighted image showing contusions to distal radius, lunate and capitate.

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