

Volar Dislocation of the Triquetrum - Case Report and Review of Literature

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Abstract In contrast to triquetral fractures, dislocations of the triquetrum are very uncommon because of the very strong ligamentous support. They occasionally occur in association with complex wrist injuries, isolated dislocations however are extremely rare. We report a case of a male athlete who sustained an isolated volar dislocation of the triquetrum. The injury was treated by open reduction, fixation with Kirschner-wires and direct repair of torn ligaments. Kirschner-wires were removed after 6 weeks and physiotherapy was started. At 3 years follow-up he reported to be free of pain and showed only slightly restricted grip strength and range of motion when compared to his uninjured hand. A review of the literature indicates that final outcomes are usually satisfactory if prompt diagnosis and treatment occurs. However persistent pain and impaired hand function may result because of delayed diagnosis or insufficient repair of associated ligament injuries.

Keywords Triquetrum · Dislocation · Ligament injury · Wrist injury · Carpal bones

Introduction

Fractures of the carpal bones are by far more prevalent than dislocations. Triquetral fractures are, following scaphoid fractures, the second most frequently listed injuries of the carpus and account for about 20–30 % of all carpal fractures [1]. Dislocations of the triquetrum are extremely rare because of

the very strong ligamentous support between its surfaces and the surrounding carpal bones. In our literature review we have only identified 11 such case reports (Table 1). Attached to its dorsal surface are the dorsal radiocarpal ligament (DRCL) and dorsal intercarpal ligament (DICL). The two ligaments form a V-shaped dorsal radiosaphoid ligament that has the ability to vary its length by changing the angle between the two arms of the V. The triquetrum is stabilized on its palmar surface by the ulnotriquetral, triquetrocipitate and triquetrohamate ligaments. It is additionally bound to the lunate by the lunotriquetral (LT) interosseous ligament. The LT ligament covers the palmar, proximal and dorsal part of the lunotriquetral joint, leaving the distal part of the joint open to communicate with the midcarpal joint [2].

Triquetral dislocations that have been reported in literature ($n = 11$) mostly occurred in a combined setting with additional carpal injuries. Isolated volar dislocations are extremely rare and only four cases have been recorded [3–6].

The following case reports an isolated volar dislocation of the triquetrum and highlights currently available diagnostic and treatment options of this condition. We additionally provide a review of the limited literature and discuss possible complications that may impair final outcome.

Case Report

A 36-year-old, right-handed male athlete sustained an injury to his left wrist during a judo competition. His combatant forced his hand into flexion, ulnar deviation and supination while pulling him to the ground. On immediate presentation in our department, his wrist was tender and fixed in slight flexion. Extension of the little finger was impaired and the tenderest spot was located directly over the pisiform bone. There was no evidence of ulnar or median nerve damage and capillary refill was uneventful.

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Table 1 Review of literature

	Dislocation	Treatment	Outcome (follow up)	Patient details
Kellam and McGoey, 1945 [1]	NS	NS	NS	
Motta, 1953 [6]	Volar	CR, splint	free of pain, range of motion slightly impaired (1 year)	27-year-old male
Frykman, 1980 [4]	Volar	Excision of triquetrum	painfree, movements unimpaired, power of grip slightly impaired (19 months)	41-year-old male
Soucacos and Hartofilakidis-Garofalidis, 1981 [3]	Volar	Excision of triquetrum	painfree, range of motion normal (34 months)	38-year-old male
Bieber and Weiland, 1984 [11]	Dorsal	OR, K-wires	no pain, full range of motion, grip strength normal (8 months)	58-year-old male
Goldberg and Heller, 1987 [16]	Dorsal	CR, splint	discomfort over ulnar aspect of wrist with heavy lifting, range of motion slightly restricted (31 months)	32-year-old male
Fowler, 1988 [10]	Volar	OR, splint	range of motion slightly impaired, grip fair, little sensational impairment (3 months)	61-year-old male
Lundkvist et al. 1991 [9]	Volar	1. CR, splint. redislocation 2. CR, K-wires	wrist motion slightly restricted, grip strength half of uninjured hand, no pain (3 years)	58-year-old male
Inoue, 1992 [17]	Dorsal	OR, K-wires	VISI, half loss of range of motion and grip strength (18 months)	31-year-old male
Ikpeme and Hankey, 1995 [8]	Dorsal	OR, K-wires (delayed)	no pain, range of motion slightly restricted (1 year)	19-year-old male
Müller et al. 1995 [5]	Volar	OR, K-wires	SL dissociation, pain during forceful movements (2,5 months)	44-year-old male
Own case	Volar	OR, K-wires	free of pain, grip strength and range of motion slightly impaired (3 years)	36-year-old male

NS not specified, VISI volar intercalated segment instability, K-wires Kirschner-wires, SL scapho-lunate, OR open reduction, CR closed reduction

Radiographs of the left hand and wrist showed palmar dislocation of the triquetrum with ulnarward displacement of the pisiform and a fracture of the ulnar styloid process (Fig. 1). A subsequent CT scan confirmed the diagnosis and excluded additional injuries. It also further elucidated the entrapment of the pisiform bone under the dorsoulnar margin of the triquetrum (Fig. 2). After an unsuccessful



Fig. 1 Plain radiographs of left wrist taken at day of injury. Dorsopalmar and lateral views show rotation and dislocation of the triquetrum and a fracture of the ulnar styloid process. Note the concurrent dislocation of the pisiform bone

effort of closed reduction under general anaesthesia, open reduction was carried out from a dorsoulnar approach. After reducing the pisiform, the triquetrum was reduced easily into its correct anatomical position. There were no signs of cartilage injury or avulsion fractures of the affected carpal bones. Intraoperative the wrist showed an unimpaired range of movement without a tendency of triquetral redislocation, and wrist kinematics was unremarkable for SL ligament incompetence. The LT membrane, the triquetro-hamate-capitate ligament and the dorsal radiocarpal ligament were completely torn. Subsequently the triquetrum was stabilized by two 1.2 mm Kirschner-wires to the lunate and hamate (Fig. 3) and the LT ligament and DRCL were directly repaired with 4–0 Monocryl. Postoperative the wrist was immobilized in a splint, placing the wrist in 20° of extension. Fingers were left free to move.

After 6 weeks the splint and Kirschner-wires were removed. Radiographs showed a normal carpal alignment without signs of SL or LT ligament incompetence (Fig. 4). After K-wire removal physiotherapy was carried out three times a week for 2 months with active and passive range of motion exercises and wrist traction. Three years after the injury he reported to be free of pain but experienced a mild loss of grip strength. Wrist motion was comparable to his uninjured hand except for a flexion loss of 20°. He was successfully able to resume work and his sporting activities.

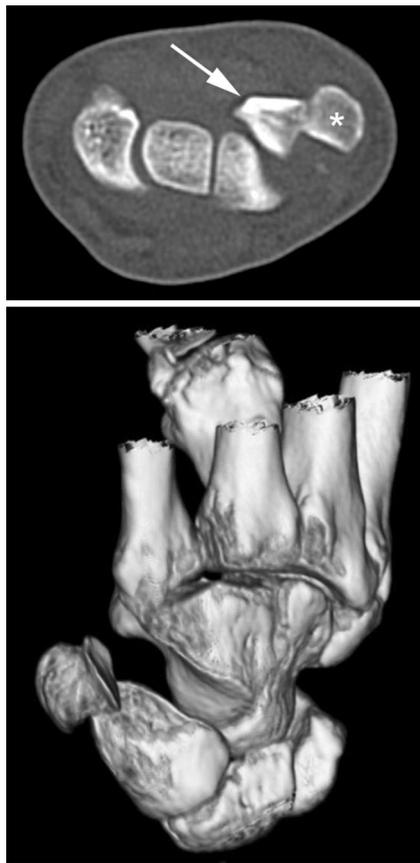


Fig. 2 CT scan taken at day of injury. The axial plane shows volar dislocation of the triquetrum (*white arrow*) with entrapment of the pisiform bone (*asterisk*) behind its dorsoulnar margin. The saddle shaped geometry of the triquetro-hamate joint, which provides the mechanism of this injury, can be observed in the 3D reconstruction of the CT scan

Discussion

Dislocations of the triquetrum are rarely encountered because of extensive ligamentous attachments to its surfaces. Still, volar as well as dorsal dislocations have been described in



Fig. 3 Plain radiographs taken 2 days after surgery: Dorsopalmar and lateral views show transfixation of triquetrum to hamate and lunate



Fig. 4 Plain radiographs in ulnar and radial abduction taken after Kirschner-wire removal. No signs of carpal instability can be observed. Note the bony union of the ulnar styloid process and the ulna

literature and Table 1 provides a complete summary. All recorded dislocations occurred in adult men, most frequently in the setting of a high-energy trauma. Dorsal triquetral dislocations were commonly associated with additional hand injuries, whereas volar displacements were more likely to occur in an isolated fashion. An explanation may be the intrinsic tendency for palmar movements of the triquetrum due to the saddle shaped articulation between the hamate and the triquetrum, which forces it in a palmar direction during ulnar deviation and flexion [7]. This anatomic prerequisite correlates with the trauma mechanism of the presented case, where forced ulnar deviation and supination of the flexed wrist led to volar displacement of the triquetrum.

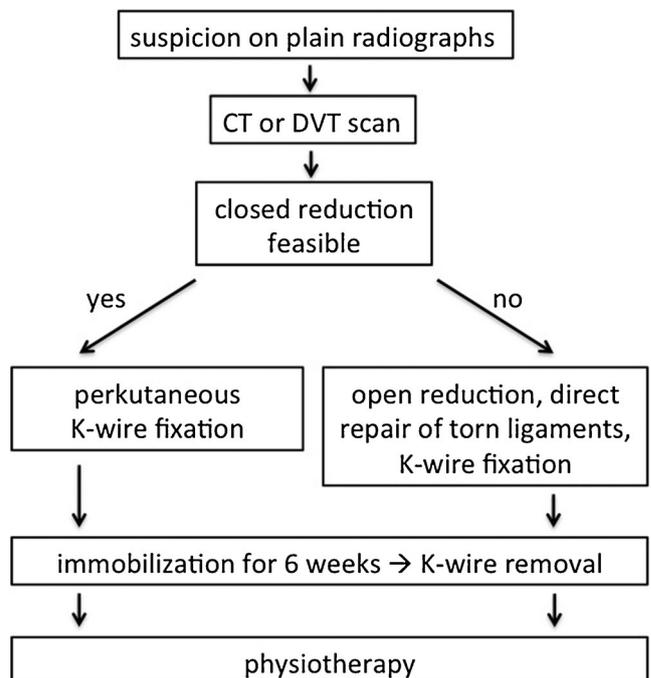


Fig. 5 Treatment algorithm for triquetral dislocations. Further information on treatment details is displayed in the sections “*case report*” and “*discussion*”

hamate, luno-triquetral and ulno-triquetral ligaments suggests a peritriquetral plain of injury as described by Ikpeme and Hankey which differs from the plain of injury in transscaphoid perilunate dislocations [8].

Although triquetral dislocations can be seen on plain radiographs, they easily may initially be missed for correct diagnosis [3, 4, 8–11]. Still, dislocation of the pisiform secondary to triquetral dislocation is a common feature of this injury and evident on dorsopalmar as well as lateral radiographs (Fig. 1) [3, 5, 6, 10]. The resultant delay in treatment may lead to irreversible damage to bone and cartilage, so that excision of the triquetrum or repetitive surgery becomes necessary [3, 4, 8]. We therefore recommend a Digital Volume Tomography (DVT) or CT scan, if there is any sign of carpal misalignment on plain radiographs. As DVT scans are associated with a reduced exposition of radiation, we are increasingly using them in our department instead of CT scans in diagnostics of complex hand injuries.

Treatment for acute cases most often consisted of open reduction and fixation with Kirschner-wires, as closed reduction is commonly not feasible (Table 1). If closed anatomical reposition is achieved, pinning with K-wires is recommended to facilitate LT-ligament cicatrization and to prevent redislocation of the triquetrum [9]. In cases where open reduction is necessary, we additionally suggest direct repair of torn ligaments to K-wire pinning. So far, access to palmarly dislocated triquetral bones was through a volar approach [3, 4, 10]. We chose a dorsoulnar approach avoiding the ulnar artery and nerve. In review of published case reports and current concepts in the treatment of ligamentous wrist injuries we propose a treatment algorithm for triquetral dislocations, which is summarized in Fig. 5.

Dislocation of the triquetrum can lead to a variety of intrinsic and extrinsic carpal ligament injuries. In our case the LT ligament, the triquetro-hamate-capitate ligament and DRCL were torn. These ligament tears may lead to dissociative carpal instability (CID), non-dissociative carpal instability (CIND) or, if occurring in combination, to complex carpal instability (CIC).

CID results from disruption of intrinsic ligaments, e.g. the LT ligament. Common complaints of LT ligament disruption are point tenderness at the ulnar aspect of the wrist, laxity and often a “giving-way” phenomenon. Carpal instability and volar intercalated segment instability (VISI) might be visible on radiographs [12].

In this case, the torn LT ligament was directly repaired with absorbable sutures. However, if closed reduction of the triquetrum is possible, acute LT tears may also be treated by transient fixation with K-wires only [13].

CIND results from extrinsic carpal ligament injuries. Tears of the triquetro-hamate-capitate and DRCL, as occurred in our case, can lead to palmar midcarpal instability [14]. To prevent this complication, immobilization of the triquetro-hamate

joint was accomplished by fixing the triquetrum to the hamate with Kirschner-wires. In addition we directly repaired the DRCL, which was easily feasible through the dorso-ulnar approach.

We also observed an avulsion fracture of the ulnar styloid process in our patient. Attached to it is the triangular fibrocartilage complex (TFCC). The ulnotriquetral ligament originates from the ulnar aspect of the TFCC. Thus, avulsion fractures of the ulnar styloid process resemble a class IB TFCC injury according to Palmer [15]. In our case fixation of the triquetrum with K-wires was sufficient as the ulnar styloid process was not dislocated.

According to the literature, the overall outcome after triquetral dislocations was good (Table 1). Most patients had no or little pain at the time of follow up and only slightly restricted wrist motion and grip strength. However, a few had on-going pain, distinctive restrictions in their wrist motion and a significant loss of grip strength. These observations are in line with our case, where only minor limitations in grip strength and range of motion were present 3 years after the accident.

Thus, good functional outcomes with preservation of the triquetrum are usually feasible if prompt diagnosis and treatment of triquetral dislocations are accomplished. As a delay in diagnosis can lead to necrosis of the triquetrum, we recommend CT-scans or DVT scans of the carpus, if there is any suspicion of carpal misalignment on plain radiographs.

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