

Volar Radiocarpal Joint Fracture Subluxation Associated with Scapholunate Ligament Injury: A Case Report and Review Literatures

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The case report involves a 20-year-old man who suffered in a motorcycle accident and presented to our emergency department. The patient presented the 4th and 5th metacarpal bone fractures and volar radiocarpal subluxation with volar radiocarpal and scapholunate ligaments injuries. The patient underwent initial management involving external fixation with metacarpal bones pinning. An open reduction and internal fixation of the small marginal volar fragment with plate along with repair of the volar radiocarpal and scapholunate ligaments were then performed as definite management. The midterm outcomes were good with no complications.

Keywords: Volar radiocarpal subluxation; Scapholunate ligament injury

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Radiocarpal dislocation is a rare orthopedic injury, usually associated with high-energy trauma. According to the direction of dislocation, it is classified into two types: dorsal radiocarpal dislocation and volar radiocarpal dislocation, which is extremely rare (0.2% incidence). In most cases, it is often considered a complex injury due to its association with injury of the surrounding structures^(1,2).

The goal of management in this particular type of injury is the anatomical reduction of the radiocarpal joint as well as repairing or fixing the injuries of the surrounding structures, which are required for the best outcome. Various surgical techniques have been applied as definite management such as closed reduction with pinning, open reduction and internal fixation with wrist spanning plate, and external fixator, etc. However, these techniques have been completely satisfied because the patients later develop some complications such as joint stiffness and post traumatic osteoarthritis^(8,9).

Concerning the midterm outcome of this case, the volar radiocarpal subluxation with scapholunate ligament injury was examined. Treatment strategies have included open reduction and internal fixation with volar specific locking plate combined with volar radiocarpal and dorsal scapholunate

ligament repairs.

Informed consent was obtained by the patient. His medical history and identity blinded post-operative photographs were consented for medical publication.

Case Report

A 20-year-old left-handed dominant male involved in a motorcycle accident was referred to orthopedics department at HRH Princess Maha Chakri Sirindhorn Medical Center, four hours after an emergency visit to another hospital. Upon arrival at the previous hospital, the patient was alert and conscious, passing the primary survey of the ATLS guideline. He complained of left wrist pain with marked swelling and deformities associated with dorsal superficial skin laceration 5 centimeters over his hand. Neurovascular examination was unremarkable. The plain radiograph revealed fractures of the shaft of 4th and 5th metacarpals, fracture of anterior rim of distal end radius with volar subluxation, and ulnar translation of radiocarpal joint shown in the lateral and anteroposterior (AP) views of the wrist, respectively (Figure 1).

That night, due to the severe soft tissue injuries and nearly radiocarpal dislocation, closed reduction with multiple transverse pins of the metacarpals was performed. Furthermore, the application of bridging external fixator was accomplished to restore the alignment of dislocated joint. The post-operative x-ray showed acceptable alignment of metacarpal bones. However, on the lateral view, minor volar subluxation due to the non-anatomic alignment of small anterior fragment was still presented. Additionally, a wrist CT scan was evaluated for further assessment and evaluation of associated fracture configuration. Measurements of the anterior rim fragment of distal radius and the scapholunate distant were 9x6.2 mm and 7 mm, respectively, suggesting the presence of scapholunate ligament (Figure 2).

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Figure 1. Preoperative x-ray of left wrist. A) Anteroposterior view; B) Lateral view.

One week later, the definitive operation was performed after the soft tissue injuries subsided, which involved an open reduction with the combined approaches. From the dorsal approach, a longitudinal incision over the Lister's tubercle was made and the extensor pollicis longus (EPL) tendon was identified and protected. The joint capsule was opened in inverted-T fashion and the avulsion of scapholunate ligament from scaphoid was recognized. The gap between scaphoid and lunate and the dorsal intercalated segment instability (DISI) were corrected with joystick technique and temporary fixation with K-wire, from scaphoid to lunate and to capitate, respectively. Restoration of the scapholunate ligament to its remnant by anchor suture method was then performed. The joint capsule was closed and the EPL tendon was transposed over extensor retinaculum. From the volar approach, the operative procedure was made with modified Volar-Henry approach. The flexor carpi radialis and the radial artery were identified and preserved. The pronator quadratus was incised, and the volar rim fragment was identified, then the volar rim locking plate was effectively used to fix for distal radius fractures (Medartis®). The volar radiocarpal was repaired with anchor suture (Figure 3). The external fixator was removed and thumb spica slab was applied. The postoperative radiographs showed anatomic alignment of anterior fragment and the radiocarpal joint was reduced to anatomic position. There were no abnormal scapholunate gap and DISI deformities (Figure 4).

The suture stitches were removed at 2 week post-operation. At 6 weeks, the slab was removed then the patient was referred to physical therapy to increase range of motion of wrist and fingers. The wrist extension was from zero to 70 degree, the wrist flexion was from zero to 40 degree whereas the wrist pronation and supination were 80 degrees, and the full finger range of motion was observed at 6-month follow-up. The MAYO wrist score of 60/100, DASH score of 56, and Grip strength of left hand (29.9 kilograms) and right hand (34.4 kilograms) 29.9 were



Figure 2. Post Initial Management x-ray and CT scan of the left wrist. A) X-ray anteroposterior view; B) X-ray lateral view; C) CT-scan coronal view; D) CT-scan sagittal view.



Figure 3. Intraoperative findings. A) From dorsal approach, L) Lunate, S) Scaphoid, R) Distal radius, *) Scapholunate ligament; B) From volar approach.

evidently achieved. No complaint of pain was reported, and the patient returned to work with no complications (Figure 5).



Figure 4. Acute Postoperative x-ray. A) Anteroposterior view; B) Lateral View Six months postoperative X-ray; C) Anteroposterior view; D) Lateral View.

Discussion

Currently, there is no standard definite management for volar radiocarpal dislocation since most of the existing methods usually resulted in unacceptable clinical outcomes. Those results may be due to the low prevalence of volar radiocarpal dislocation as orthopedic injury. According to Dunn and Gui, the incidence of radiocarpal dislocation is 0.2% of all dislocations and most of them are noticeable dorsal radiocarpal dislocation. Moneim et al classified radiocarpal dislocation into two types; type 1 referred to dislocation without associated injury whereas type 2 related to dislocation with associated intercarpal ligament injury. Type II injuries are commonly due to high-energy trauma and result in worse prognosis compared to type I. Dumontier et al classified patients with radiocarpal fracture dislocation according to associated volar radiocarpal ligament injury. Type I is radiocarpal dislocation with no distal radius fracture or with only tip of radial styloid fracture, whereas type II is more commonly known to be associated with distal



Figure 5. Clinical results at six months.

radius fracture. Concerning type II, the lesion is usually large enough to involve the scaphoid fossa, though the radiocarpal ligament is still attached to the bony part. The ligament repaired is not required, therefore the better predictable result is expected compared to the first type⁽¹⁻⁴⁾.

One of the most important issues of the injury is the detection and the proper management of the volar radiocarpal ligament injury unlike the volar Barton's injury that usually requires treatment of bone. In case of deprivation of proper treatment, ulnar translation of the carpal bone will occur, which will result in serious complications such as instability and post-traumatic arthritis. According to Brandon et al series, 23% of ulnar translocation was reported and late post-traumatic radiographic arthritis up to 31% was found^(5,6).

Through multiple previous researches, the standard treatment for radiocarpal dislocation remains inconclusive. Closed reduction and pinning in cases of pure radiocarpal dislocation were suggested while open reduction with plating and pinning showed more successful cases with large radius or ulnar fracture. However, these treatment outcome studies are still not well accepted. Many cases present surgical complications such as complex region pain syndrome, joint stiffness or hardware impingement that requires implant removal^(3,4,7). In cases of ulnar translation, some clinicians suggest the open repair of volar radiocarpal ligaments, especially the radiolunate and radioscapoid ligaments, which are major ligaments for wrist joint stability. In addition,

external fixator and radiolunate pinning are recommended to counteract ulnar translation, which will prevent wrist arthrosis and poor treatment outcome. Subsequently, patients usually return with complications and require salvage operation such as total or partial wrist fusion^(6,8,11).

According to the current studies, marginal fractures of distal radius or comminute fractures are reported as 80% of cases with radiocarpal fracture dislocation. Previously, implants were not designed for fixation of fracture pieces, therefore resulting in injury of ligaments that originated or inserted to the fractured parts. These injuries were usually unrepaired or found with articular cartilage impaction. These factors beneficially contribute to the consequence of patients' treatment. David Ring et al reported satisfactory results with minimal articular impaction, using new design plate in fixation of the marginal fracture together with open repair of the injured ligament in patients who had dorsal radiocarpal fracture dislocation⁽¹⁰⁾. KC Bohm and Cowley et al reported no recurrent subluxation or dislocation after the repair of volar radiocarpal ligament with anchor suture in small case series. Moreover, they mentioned that this ligament could not be repaired by dorsal approach alone^(12,13).

This case report presents a patient who presented volar radiocarpal fracture subluxation more than 50%, with minute volar marginal fracture of the anterior rim of distal radius. Moreover, he also had associated scapholunate ligament injury. In the previous studies, this sort of patient's condition was considered as a rare injury and most patients lost the follow-up. This patient was treated by open reduction and internal fixation of the small marginal volar fragment with the new design plate, together with repairing volar radiocarpal and scapholunate ligaments. This patient was only immobilized for a short period of time and could quickly return to function with no complications such as ulnar translation and wrist instability. The midterm outcome is well accepted. However, further monitoring of wrist arthrosis is necessary as well as clinical detection of radiographic features of wrist arthritis might be required for the progression period.

What is already known in this topic?

Radiocarpal dislocation and subluxation are rare orthopedics injuries that are usually associated with high-energy trauma. The injuries are commonly associated with surrounding ligaments and bones fractures. No standard definite management is widely accepted as well as various methods resulting in unacceptable complications with associated injuries have been missed and untreated. What would the patient outcome be if all associated injuries and treatments are still unclear?

What this study adds?

Management of the patient by reduction of the

subluxated joint, repairment of the injured ligaments, and fixation of the fractured bones is shown to be a vital part that supports the patient's recovery to fulfill the function and good outcomes. Therefore, in case of volar radiocarpal dislocation and subluxation, the management of associated injuries should be managed as seriously as the reduction of the dislocated joint.

Potential conflicts of interest

The authors declare no conflict of interest.

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