Acute proximal row carpectomy to treat a transscaphoid, transtriquetral perilunate fracture dislocation: case report and review of the literature

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Case Report

A 68-year-old right hand dominant female sustained a direct trauma to her right wrist during a motorcycle accident resulting in an open right index finger proximal interphalangeal (PIP) joint laceration, small finger metacarpophalangeal (MCP) joint collateral ligament injuries with a stable metacarpal shaft fracture, and a transscaphoid, transtriquetral perilunate fracture dislocation with the lunate rotated 180° on the volar aspect of the distal radius and the carpus and hand translated volarly (Fig. 1a, b).

The patient was brought to the operating room on the day of injury for irrigation and debridement and a plan for open reduction and internal fixation (ORIF) of the carpus. After extending the dorsal wrist laceration and releasing the extensor retinaculum with an ulnarly based flap, a traumatic dorsal wrist capsulotomy along the dorsal intercarpal ligament was visible with multiple extruded bony fragments from the triquetrum and scaphoid. The remainder of the capsule was divided via a ligament sparing capsulotomy. The lunate, scaphoid, and triquetrum were dislocated volarly. The lunate remained attached only by a small portion of the short radiolunate ligament with the long radiolunate ligament completely avulsed. The scaphoid was free floating with only minor attachments to the intact trapezium. The triquetrum was still attached to the hamate but was fractured dorsally and volarly with significant

comminution. The scapholunate ligament was ruptured. Attempts were made to reduce the scaphoid and lunate together, but after appreciating the gross instability from ligamentous disruption and the severity of articular injury, a decision was made to perform an acute salvage procedure. Based on the significant articular damage to the cartilage on the radiolunate side of the lunate but preservation of the articular surface of the capitate and lunate fossa of the distal radius, a proximal row carpectomy (PRC) was performed.

The scaphoid, lunate, and triquetrum were removed with minimal dissection, and the remaining small proximal carpal fragments were debrided. The capitate was then seated into the lunate fossa and given significant laxity of the radiocapitate articulation temporarily secured with two 0.045 K-wires. Instability was attributed to the loss of support of the volar extrinsic ligaments, in particular the long radiolunate ligament, which was completely avulsed from the lunate. For this reason, the radiolunate ligament was repaired directly to the capitate with suture anchors via a separate volar approach. Care was taken to preserve the remaining radioscapophcapitate ligament. Dorsally, avulsion of the hamate at the capitohamate ligament insertion was identified and repaired using a suture anchor. A sagittal split fracture of the dorsal nonarticular capitate was noted with ligamentous attachment to the trapezoid which was also reduced and secured with a suture anchor. Once the carpal injuries were addressed, the other injuries were treated, including repair of the small finger MCP ulnar and radial collateral ligaments with suture anchors and irrigation of the index finger PIP joint. Final fluoroscopic images were obtained (Fig. 2a, b).

Postoperatively, the wrist was immobilized for a total of 6 weeks after which K-wires were removed and range of motion (ROM) therapy commenced. Initial wrist ROM was 15° of flexion to 15° of extension with 10° each of radial and ulnar deviation. At a 20-month follow-up, ROM measurements of the wrist showed improved wrist flexion and extension of

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Fig. 1 PA (a) and lateral (b) injury radiographs of right wrist

25° and 30°, respectively, and radial and ulnar deviation of 10° and 15°. The patient reported no pain at rest and only minimal pain with certain activities. Radiographs at this time showed maintenance of the distal row carpal alignment without subluxation (Fig. 3a, b).

At the most recent follow-up of 46 months (3.8 years), bilateral ROM measurements demonstrated wrist flexion and extension of 35° and 45°, respectively, on the right compared to 70° and 65° on the left and radial and ulnar deviation of 5° and 30° on the affected right side compared to 20° and 45° on the left (Fig. 4a–c). Pronation and supination were 75° and 85° on the right compared to 85° and 85° on the left. The patient did continue to have limitations in motion in the injured small finger. Grip strength, apposition strength, and opposition strength on the right were 8, 6.5, and 4.5 kg compared to 18, 7, and 5.5 kg on the left. The patient reported no pain at rest and a pain of 1 to 2 on a scale of 10 with heavier activities, but she noted that her pain did not limit daily activities. Final radiographs showed maintenance carpal alignment without evidence of radiocapitate arthritis and no significant changes since prior radiographs (Fig. 5a, b).

Discussion

Perilunate fracture dislocations represent a large spectrum of injury patterns usually resulting from high-energy trauma.

Fig. 2 Intraoperative fluoroscopic PA (a) and lateral (b) images of right wrist

Fig. 3 PA (a) and lateral (b) radiographs of the wrist at 8 months of postoperative follow-up

Of these patterns, transscaphoid, transtriquetral perilunate fracture dislocations are relatively uncommon representing only 4.5 % of patients in a multicenter center study of perilunate fracture dislocations by Herzberg and colleagues [8]. Soejima and colleagues described a similar greater arc injury noting that the injuring force travels via a transosseous route through the scaphoid as opposed to the usual route through the lunotriquetral ligament [19]. There exist a number of single case reports of variations of transscaphoid, transtriquetral perilunate fracture dislocations [2,6,13,22,25].

ORIF of these injuries has been the consensus first line treatment in the literature with acceptable clinical results reported. Short- and medium-term results of ORIF have revealed maintenance of reduction with some mild to moderate limitations in ROM and strength and the development of radiographic midcarpal or radiocarpal arthritis which often does not manifest in pain and dysfunction in the short term [5,7,9,12,20,23]. Long-term series, however, reveal a notably higher rate of symptomatic degenerative joint changes. For instance, a series of 18 patients with perilunate dislocations treated with ORIF with an average of 13 years of follow-up demonstrated that 67 % of patients had radiocarpal arthritis [5]. Of a subset of seven patients with transscaphoid fracture dislocations, four of seven patients had fair or poor Mayo wrist scores, four patients had eventual

Fig. 4 Final range of motion of the wrist (a–c)

static scapholunate instability, two patients had malunion/nonunion of the scaphoid, and one patient was revised to a four-corner fusion due to persistent pain.

While the goal in treating transtriquetral, transscaphoid perilunate fracture dislocations should be anatomic reduction and fixation of carpal elements followed by ligament repair and restoration of normal carpal alignment, in wrists with significant articular damage, irreparable or avascular carpal bones, and extensive interosseous ligament injury, ORIF is not always possible. Acute primary salvage procedures such as a PRC or scaphoidectomy and four-corner fusion may be considered in these situations to avoid secondary salvage procedures after failed ORIF and ligament repair. The choice of acute salvage procedure is determined by the injury pattern and remaining uninjured carpal and ligament elements present. In the present case, primary PRC with repair of the long radiolunate ligament at the time of injury offered the advantage of a single definitive treatment which is motion-sparing while minimizing disability and rehabilitation time. As in all cases of PRC, in the acute traumatic setting, there must be preserved articular surfaces

Fig. 5 PA (a) and lateral (b) radiographs of the wrist at 3.8 years of postoperative follow-up

of the lunate fossa and proximal capitate as well as a competent radioscapophcapitate ligament. Severity of articular injury to the carpal elements, presence of an open injury, residual carpal instability, patient age, occupation, and other patient factors should be considered in the choice of treatment; in the current case of an active 68-year-old female sustaining a severe open transscaphoid, transtriquetral perilunate fracture dislocation, PRC was felt to offer the best chance for a single surgical treatment with good functional result.

PRC is commonly used to treat degenerative wrist pathology, including chronic (i.e., more than 6 weeks old) perilunate dislocations and perilunate fracture dislocations, with good long-term results reported in the literature [4,10,16–18]. Rarely, however, has PRC been reported as a primary treatment in the setting of acute trauma. In the early historical literature, we identified five instances briefly discussing acute PRC for greater arc injuries with limited recommendations [1,11,14,21,26]. In 1948, Stack reported on nine wrists in seven patients in which the scaphoid and lunate (but not the triquetrum) were excised for either transscaphoid perilunate fracture dislocations or scaphoid non-unions with degenerative changes [21]. Clinical outcome

was not detailed, and the chronicity of treated injuries was unclear, but Stack noted that “the most favorable results, from the standpoint of strength, alignment and range of motion, can be expected in those instances in which the two bones are removed as the primary treatment, as after the combined fracture and dislocation” rather than in long-standing cases with arthritic changes and limitations in motion present. In 1950, McLaughlin and Baab reported on partial or complete PRC for a variety of conditions in 31 patients, including “early” dislocations of the lunate, although the authors did not detail the conditions treated nor the time frame from injury to surgery [14]. In 1964, Campbell and colleagues reported on a series of 50 patients treated for perilunate dislocations or fracture dislocations, three of which were acute excision of some or all of the elements of the proximal carpal row performed as the initial treatment, although again the time from injury to surgery was not reported [1]. The authors reported good pain relief and acceptable ROM and strength, although they did not separately report the outcomes of those three injuries treated with acute PRC. In 1969, Jorgensen reported PRC as the treatment of a cohort of 25 patients for a variety of conditions, including a subset of nine perilunate fracture dislocations treated with PRC acutely as the primary treatment within 2 weeks of injury. Seven of these nine were pain-free and had loss of motion and strength was moderate; clinical results were graded as excellent in seven; and there were no radiographic degenerative changes observed at the final follow-up of 3 to 17 years postoperatively. Lastly, Woodward and colleagues reported in 1975 a single case of radial/volar perilunate transscaphoid fracture dislocation with an unsuccessful ORIF that was converted to a PRC acutely [26]. This patient was lost to follow-up.

In the modern literature after the year 2000, there appear another four reports of acute PRC for greater arc injuries where greater detail of the injury characteristics is provided and more rigorous assessment of outcome is described compared to the early literature [3,7,15,24]. In 2002, Herzberg and Forissier described the medium-term results of 14 transscaphoid dorsal perilunate fracture dislocations with acute surgical treatment via attempted ORIF [7]. One of the 14 cases was a widely displaced proximal pole scaphoid fracture where ORIF was attempted but abandoned for PRC through combined volar and dorsal approaches. This patient was reported to be pain-free at final follow-up. Another series reported in 2005 by van Kooten and colleagues described acute PRC in four patients with severe carpal trauma, including two isolated perilunate dislocations and two perilunate fracture dislocations [24]. Three of the four patients had a good outcome, with the patient sustaining a poor outcome being attributed to an irreparable radioscapophcapitate ligament with persistent carpal subluxation and pain necessitating a total wrist fusion. In 2009, Razafimahandry et al. reported a single case report of

a severely displaced dorsal transscaphoid perilunate dislocation in a 32-year-old male treated with an acute PRC at presentation, and at 6-year follow-up, the patient had low pain, a functional ROM, and no evidence of radiographic deterioration [15]. Lastly, an informative case-control study by Della Santa and colleagues compared clinical and radiographic outcomes of this procedure in a group of six patients undergoing elective PRC for posttraumatic wrist arthritis versus six patients undergoing emergent acute PRC for irreparable fracture dislocations of the wrist [3]. This study showed significantly better patient satisfaction and grip strength in patients with PRC after acute trauma than those who underwent elective PRC for posttraumatic degenerative disease at a mean follow-up of 36 months.

We report primary PRC in the acute setting of a severe transscaphoid, transtriquetral perilunate fracture dislocation with good pain relief, a functional ROM, and good grip strength. While this treatment in the acute setting of perilunate fracture dislocations has not generally been recommended as a first line treatment, a review of the literature including the current case supports generally good functional results and pain relief with the benefit of providing a single definitive treatment without the need for later salvage procedures. In carefully selected cases of severe carpal trauma, acute salvage procedures may be a viable alternative to ORIF and ligament repair/reconstruction.

Conflict of interest The authors have no conflicts of interest to declare.

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