Isolated Scaphoid Dislocation: A Case Report and Review of the Literature

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Abstract

Background Isolated scaphoid dislocation is an exceedingly rare event with only 55 cases described. Closed reduction followed by operative intervention with Kirschner's wires (K-wire) fixation and ligamentous reconstruction are the mainstays of treatment.

Case Description We describe a patient with a solitary scaphoid dislocation treated with initial closed reduction and urgent open reduction with K-wire stabilization and ligamentous repair. The patient was immobilized for 6 weeks and on 24-month follow-up, the patient was doing well with no limitations in his daily living, no pain, and acceptable range of motion.

Literature Review A literature review was performed on the 55 cases described in the English language. The majority of the patients were males, aged between 18 and 79 years, and presented with motor vehicle accidents as the most common mechanism. Historically, isolated scaphoid dislocations were treated with closed reduction. However, K-wire fixation and, now, K-wire fixation coupled with ligamentous injury repair remain the current treatments of choice. Avascular necrosis of the scaphoid remains a rare event with only one documented case. Overall, patients do well with only minor pain and limited wrist movements. Notably, only eight cases were associated with type-II lunates. Type-II lunates appear to be protective for carpal injury.

Clinical Relevance Although isolated scaphoid dislocations remain a rare event, understanding the anatomy and the current ability to restore carpal anatomy is important. Type-II lunates appear to confer protection from carpal injuries.

Keywords

- ▶ scaphoid dislocation
- ▶ scaphoid vascularity
- ▶ lunate morphology
- ▶ perilunate dislocation
- ▶ carpus

Isolated dislocation of the scaphoid is an exceedingly infrequent entity. To date, only 55 cases have been reported in the English language with the first report in 1903.¹ Isolated scaphoid dislocations are rare due to the complex anatomy and kinematics of the carpal bones. The 20 different ligaments that interconnect the carpal bones provide significant stability and allow flexibility in multiple planes. Mechanisms mainly involve ulnar deviation in a power grip or ulnar deviation with dorsal extension.^{2,3} Motor vehicle accidents are the most

frequent cause starting with the first reported case in 1903.¹ Closed reduction has previously been the primary treatment option with a trends toward operative reduction and ligament reconstruction in the last two decades. Fortunately, avascular necrosis of the scaphoid has not proven to be a common complication; however, residual subluxation has been. We present a case of an acute isolated scaphoid dislocation treated with initial closed reduction and subsequent open reduction, internal fixation, and ligament reconstruction.

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Case Report

A 45-year-old male farmer sustained a closed twisting injury involving the rotating pulley mechanism of a corn auger. He underwent forced supination of his nondominant right wrist as he pulled his hand out of the mechanism. He did not sustain any other injuries. There was no disruption of the skin. He was initially seen at an outside institution, radiographed, splinted, and transferred immediately to our center for definitive management. Radiographs showed an isolated scaphoid dislocation proximal to the distal edge of the radius (► **Fig. 1**) in addition to a mildly displaced pisiform fracture. He had no neurovascular compromise. The patient was initially reduced in the emergency room under hematoma block by ulnar deviation, longitudinal traction, and manual pressure (► **Fig. 2**). Due to the obvious ligamentous injuries, the patient was then taken to the operating room the following morning for exploration and repair of damaged structures. Operative intervention was performed within 24 hours of the original injury.

Surgical Findings

Under general anesthesia and tourniquet compression, the wrist was exposed through a standard midline dorsal incision. The dorsal wrist capsule was reflected using a ligamentous splitting approach. The lunate was intact within the fossa. There was instability between the lunotriquetral joint with a membranous tear, though the dorsal compartment of the ligament was intact. The scaphoid was successfully reduced into its fossa. The scapholunate (SL) ligament was completely

Fig. 1 Anteroposterior radiograph showing acute radial dislocated right scaphoid.

Fig. 2 Fluoroscopic image taken after successful closed reduction.

ruptured. The articular surfaces between the scaphoid and lunate bones were denuded of cartilage down to subchondral bone as one would perform in a RASSEL procedure. Two 0.062 Kirschner's wires (K-wires) were passed transcutaneously through the radial snuff box from the scaphoid into the lunate to hold the scaphoid in a reduced position. An additional wire was placed from the scaphoid into the capitate to stabilize the midcarpal joint. An incision was made over the volar forearm to allow for exploration of the radiocarpal ligaments. The short- and long-radiolunate ligaments were intact, but a tear through the space of Poirier extended from the radio-scaphocapitate ligament around the proximal pole of the capitate extending down ulnocapitate ligament. A tear through the radio-SL (the ligament of Testut) was also noted. These volar capsular tears were repaired with sutures (► **Fig. 3**). Returning to the dorsal incision, suture anchors were placed at the dorsal tubercle of the scaphoid to reconstruct the dorsal capsule and at the tubercle of the triquetrum to allow the reinsertion of the dorsal capsular flap (► **Fig. 4**). Two 0.062 K-wires were placed between the lunate and triquetrum to stabilize this relationship (► **Fig. 5**). The dorsal LT-ligament was intact and was therefore not reconstructed; however, an imbrication of the dorsal capsule onto the triquetrum was performed during closure.

Outcome

After surgery, the patient was maintained in a Münster cast for 6 weeks with K-wire removal at 6 weeks as well. He was provided wrist therapy instruction and completed therapy at

Fig. 3 (A) Operative reduction through dorsal incision. (B) Volar tear through space of Poirier at the radioscaphocapitate ligament. Arrow points to torn radioscaphocapitate ligament (C) Volar tear repaired with sutures. Arrow points to repaired tear through the space of Poirier. R, radius; S, scaphoid; L, lunate; C, capitate.

Fig. 4 Suture anchors are placed at dorsal tubercle of the scaphoid to reconstruct the dorsal capsule and the tubercle of the triquetrum.

home. A volar wrist splint was provided for 4 additional weeks for comfort. On 6-month and 24-month follow-up, he was doing well (► **Fig. 6**). He had no pain and no limitations in his activities of daily living and has returned to farming without restrictions. His exam showed radial deviation 17 degrees (noninjured 20 degrees), ulnar deviation 30 degrees (noninjured 40 degrees), flexion 47 degrees (noninjured 70 degrees), extension 30 degrees (noninjured 60 degrees), and grip strength was 40 kg on the left and 50 kg on the right.

Discussion

Solitary scaphoid dislocations are rare, with only 55 total cases reported, yet they have been described since the early 1900s. The mechanism of injury is commonly hyperextension with axial loading of the wrist. Closed reduction can be difficult and often open reduction is required. To allow the scaphoid bone to fully rotate out of its native position and become dislocated, there must be disruption to the SL interosseous ligament (SLIL),

the radioscaphocapitate ligament, the scaphotrapezium ligament, and the dorsal radiocarpal ligament, thus allowing the scaphoid to dissociate from the radius and scaphotrapezium articulations. In partial dislocations, which are more common, the scaphoid remains attached distally to the scaphoid-trapezium-trapezoid (STT) ligaments and the scaphotrapezium articulation. Carpal bone dislocations rarely occur in isolation and are most likely seen as part of a perilunate or axial carpal dissociation pattern. The proximal carpal row is noted to be at a higher risk of dislocations due to its increased mobility compared with the distal row. Horton et al noted that dislocations of the scaphoid can be classified either as (1) isolated to the periscaphoid ligaments or (2) part of a more complex injury, and also the “luxation” can be subdivided into subluxation, proximal dislocation, or total dislocation.⁴

Leung et al described a classification system for the solitary dislocated scaphoid.⁵ The following four different parameters are considered: primary versus secondary, simple versus complex, partial versus total, and direction of dislocation.

Fig. 5 Intra-operative fluoroscopy showing Kirschner's-wire fixation.

Fig. 6 Final postoperative radiographs showing maintenance of scaphoid reduction and healed pisiform fracture.

Primary dislocations result from injury whereas secondary result from nonanatomic closed reduction of a proximal row carpal bone. Simple dislocations involve only the SL and radioscaphoid articulation. Complex dislocations also disrupt the distal carpal row, most commonly with an axial injury pattern separating the third and fourth MCP joints and the capitolunate articulation. Dislocations can be partial or total with respect to their native soft tissue attachments.

The literature on isolated scaphoid dislocation is limited to single-patient case reports or small case series. ▶**Table 1** provides a comprehensive review of all of the reported cases.¹⁻⁹ The majority of scaphoid dislocations were seen

in men (male:female = 46:3); however, the age range was noted to be between 18 to 79 years. The main mechanism was a motor vehicle accident with a forced dorsiflexion and twisting motion of the wrist. Nearly half of the cited cases had delayed diagnosis with the longest interval being 6 years.^{2,3,5,6} Approximately, half of the cases were treated with operative fixation with only one case with a total dislocation noted to have avascular necrosis.⁸ Even then the necrosis was relatively asymptomatic and limited to the proximal pole. This paucity of necrosis is surprising, especially in cases where the dislocation is total. There were even cases where the scaphoid was completely removed from the patient and replaced and none of these cases reported avascular necrosis.⁹ This lack of avascular necrosis is postulated to result from the intact intraosseous vascular channels within the scaphoid bone.⁵ All attempts should be made to preserve the radial soft tissue attachments to the distal pole and dorsal ridge to maximize blood supply if surgery is to be performed.¹⁰

If there is a partial dislocation then closed reduction with 4 to 6 weeks of immobilization has been performed. Cases of delayed diagnosis typically require operative treatment for reduction because of changes to the soft tissues. If the delay is more than a several months then secondary finger and wrist stiffness, as well as arthritic changes, within the intercarpal and radiocarpal joint can arise. Ultimately, arthrodesis or even proximal row carpectomy in these instances may be needed for pain control.⁵

Type-II lunates appear to confer some protection against carpal injury. Viegas et al has described the lunate into two types.¹¹ Type-II lunates have medial facet that articulates with the hamate while type-I lunates do not have this facet. Only eight cases were associated with a type-II lunate (▶**Table 2**). This medial facet of the lunate may confer more load to the wrist's central column making the scaphoid

Table 1 A comprehensive review of all of the reported cases

Study (year)	Age Sex Side	Dx	Dislocation	Surgical approach	Outcome
Akinci (1) ¹¹ (2012)	32 M L	5 mo	Palmar	–	Injured wrist flexion/extension: 55/55 degrees, grip strength: injured 38 kg
Akinci (2) ¹¹ (2012)	46 M R	7 mo	Radial-palmar	–	Injured wrist flexion/extension: 65/55 degrees, grip strength: injured 34 kg
Akinci (3) ¹¹ (2012)	71 M R	4 mo	Radial-palmar	–	Injured wrist flexion/extension: 40/60 degrees , grip strength: injured 25 kg
Amamilo et al ³ (1985)	63 M L	5 d	Radial	Palmar	Almost full ROM, no residual pain
Amaravati ¹² (2009)	45 M L	2.5 mo	Dorsal	Dorsal	Cooney wrist score 85 points
Antuna ¹³ (1997)	32 M L	0 d	Open palmar	Dorsal and palmar	Wrist flexion/extension: 60/30 degrees, ulnar/radial deviation: 30/10 degrees
Baek et al ⁶ (2016)	40 M R	2 mo	Palmar	Dorsal	Flexion/extension: 60/55 degrees , ulnar/radial deviation 25/15 degrees, grip strength 21 kg
Buzby ¹⁴ (1934)	47 M L	3 d	Radial	Radial	10-degree loss of wrist flexion and extension
Chloros ¹⁵ (2006)	28 M R	0 d	Radial-palmar	Palmar	Flexion/extension: 75/70 degrees, ulnar/radial deviation: 25/20 degrees
Connell ¹⁶ (1955)	36 M R	0 d	Radial	–	Full ROM, returned to heavy manual work
Ely ¹ (1903)	25 M R	1 d	Dorsal	–	Good ROM
Engkvist ¹⁷ (1986)	71 M R	0 d	Radial-palmar	Palmar	50% grip strength compared with non-injured hand, dorsovolar ROM 50 degrees injured wrist
Fishman ¹⁸ (1985)	26 M R	4 w	Palmar	–	–
Higgs ¹⁹ (1929)	41 M R	8 wk	Radial-palmar	Radial	Good ROM,
Higgs (2) ¹⁹ (1929)	48 M R	3.5 wk	Radial	–	Good grip and good
Horton et al ⁴ (2004)	33 M R	0 d	Radial	–	Wrist flexion/extension: 55/65 degrees
Inoue ²⁰ (1990)	18 M L	14 d	Dorsal	Dorsal	Flexion/extension: 50/60 degrees , ulnar/radial deviation: 30/15 degrees
Kennedy ²¹ (2006)	36 M L	0 d	Palmar	Radio-dorsal	20-degree loss of wrist extension, 10-degree loss of flexion
Kiliç ²² (2012)	25 M R	0 d	Palmar	Palmar	Wrist flexion: 50 degrees compared with 65-degree noninjured side, all other ROM equal to noninjured side

(Continued)

Table 1 (Continued)

Study (year)	Age Sex Side	Dx	Dislocation	Surgical approach	Outcome
Kolby ²³ (2007)	18 M L	14 d	Palmar	Palmar	Flexion/extension: 45/35 degrees, ulnar/radial deviation: 30/20 degrees , grip strength: 35 kg
Kuth ²⁴ (1939)	52 M L	0 d	Radial	–	20° loss of extension, 15-degree loss of flexion
Leung et al ⁵ (1998)	26 M R	21 d	Palmar-ulnar	Palmar	Wrist flexion/extension: 45/60 degrees, ulnar/radial deviation: 25/15 degrees, grip strength 35 kg
Maki ²⁵ (1982)	40 M L	0 d	Radial	–	Full ROM,
McNamara ⁹ (1992)	23 M L	0 d	Palmar	Palmar	Extension/flexion 40/65 degrees
Milankov (1) ²⁶ (1994)	43 F R	0 d	Palmar-radial	–	Full ROM, no pain
Milankov (2) ²⁶ (1994)	35 M R	0 d	Palmar	–	Full ROM, no pain
Parkes (1) ²⁷ (1973)	48 M L	1 mo	Dorsal	Dorsal	–
Parkes (2) ²⁷ (1973)	50 M R	23 d	Dorsal	Dorsal	–
Reid ⁷ (1969)	– R	–	Palmar	–	–
Ritchie ²⁸ (1988)	39 M L	0 d	Palmar-radial	Radial	Full ROM, no pain
Richards ²⁹ (1993)	49 F R	7 d	Dorsal	Dorsal	–
Russell ³⁰ (1949)	? M R	0 d	Dorsal	–	Retained 75-degree ROM
Schlossbach ³¹ (1954)	26 M R	4 d	–	–	Regained full use of wrist without pain
Szabo ⁸ (1) (1995)	38 M R	0 d	Radiopalmar	Dorsal ports	Full ROM, grip strength: 50 kg
Szabo ⁸ (2) (1995)	67 F L	0 d	Radiopalmar	Dorsal	Flexion/extension 53 /45 degrees, ulnar/radial deviation 25/35 degrees , grip strength: 21 kg
Szabo ⁸ (3) (1995)	34 M L	0 d	Radiopalmar	Dorsal	AVN proximal pole scaphoid, flexion/extension: 30/25 degrees , ulnar/radial deviation: 15/5 degrees, grip strength: 41 kg
Sides ³² (1995)	38 M R	1 d	Radiopalmar	–	Equal strength bilaterally
Sides (2) ³² (1995)	67 W L	0 d	Radial	–	–

Table 1 (Continued)

Study (year)	Age Sex Side	Dx	Dislocation	Surgical approach	Outcome
Somford ³³ (2010)	47 M L	0 d	Radio-palmar	Palmar	Flexion/extension: 50/50 degrees, radial/ulnar deviation: 20/40 degrees, grip strength: 25 kg
Stambough ³⁴ (1986)	21 M R	3 mo	Palmar	Palmar	Flexion/extension: 70/35 degrees, ulnar/radial deviation: 30/10 degrees, 85% grip strength compared with noninjured side
Takami ² (1992)	45 M R	8 mo	Palmar-ulnar	Dorsal-radial and palmar	75% normal extension, 65% normal flexion, grip strength: 30 kg
Taylor (1) (1969)	20 M L	0 d	Palmar	–	Full wrist ROM, normal strength,
Taylor (2) (1969)	48 M L	0 d	Radial	–	Full function, returned to work
Thomas ³⁵ (1977)	23 M R	0 d	Radial	–	–
Thompson (1) ³⁶ (1964)	37 M L	0 d	Dorsal	Palmar	50% loss of wrist extension, 33% loss of wrist flexion, no pain,
Thompson (2) ³⁶ (1964)	39 M R	9 mo	Dorsal	–	Persistent pain with radiocapitate arthrodesis
Thompson (3) ³⁶ (1964)	30 M L	1 mo	Dorsal	Dorsal	Good ROM
Thompson (4) ³⁶ (1964)	30 M L	1.5 mo	Dorsal	–	Returned to work
Thompson (5) ³⁶ (1964)	56 M L	9 mo	Dorsal	–	Persistent pain but refused treatment
Thompson (6) ³⁶ (1964)	79 M L	0d	Dorsal	–	–
Thompson (7) ³⁶ (1964)	60 M L	0 d	Dorsal	–	Persistent pain, taken for radiocapitate arthrodesis
Thompson (8) ³⁶ (1964)	45 M R	6 y	Dorsal	–	–
Walker ³⁷ (1943)	44 M R	9 d	Radial	Radial	5-degree loss of wrist extension, no pain
Wong ³⁸ (2015)	68 M L	0 d	Palmar	Palmar	Pain free and full function
Yasuda ³⁹	57 M L	0 d	Palmar-radial	Palmar	Full ROM and no pain

Abbreviations: AVN, avascular necrosis; F, female; K-wires, Kirschner's wires; L, left; M, male; R, right; ROM, range of motion.

less susceptible to dislocation during ulnar deviation and wrist extension.

The direction of dislocation can also provide insight into possible neurovascular injury. Median nerve compression

can result from dislocations oriented palmar and ulnarly.² Open reduction is also warranted for palmar and ulnar dislocations due to the concern for median nerve compression and thus simultaneous release of the carpal tunnel can

Table 2 Descriptions of type-I and type-II lunates

Study	Lunate type
Akinci (1)	I
Akinci (2)	I
Akinci (3)	I
Amamilo et al ³	I
Amaravati	Unable to determine
Antuna	I
Baek et al ⁶	I
Buzby	I
Chloros	I
Connell	I
Ely ¹	Unable to determine
Engkvist	I
Fishman	I
Higgs (1)	II
Higgs (2)	II
Horton et al ⁴	II
Inoue	I
Kennedy	I
Kiliç	I
Kolby	I
Kuth	I
Leung et al ⁵	I
Maki	I
McNamara ⁹	I
Milankov (1)	Unable to determine
Milankov (2)	Unable to determine
Moran	I
Parkes (1)	Unable to determine
Parkes (2)	Unable to determine
Reid ⁷	Unable to determine
Ritchie	I
Richards	I
Russell	Unable to determine
Schlossbach	I
Szabo ⁸ (1)	I
Szabo ⁸ (2)	I
Szabo ⁸ (3)	I
Sides	Unable to determine
Sides	Unable to determine
Somford	Unable to determine
Stambough	I
Takami ²	Unable to determine
Taylor (1)	II
Taylor (2)	I

Table 2 (Continued)

Study	Lunate type
Thomas	I
Thompson (1)	II
Thompson (2)	Unable to determine
Thompson (3)	Unable to determine
Thompson (4)	Unable to determine
Thompson (5)	I
Thompson (6)	II
Thompson (7)	I
Thompson (8)	Unable to determine
Walker	II
Wong	Unable to determine
Yasuda	II

be performed. Surgical approaches via palmar or dorsal incisions are typically based on the direction of dislocation.

Throughout the early-to-mid 1900s, all scaphoid dislocations that were able to be reduced treated with closed reduction and splinting definitively, though few studies note long-term follow-up.¹ In 1969, Reid et al used K-wires to assure fixation of the scaphoid.⁷ Ligamentous repair was not performed until 1985 by Amamilo et al and did not become preferred until after 2000.^{3,5,6,8} Current literature favors ligament repair with open reduction to restore normal anatomy and preserve function. Despite the method of treatment and the totality of dislocation or ligamentous injuries, most patients preserve wrist motion but suffer from mild pain and decreased wrist range of motion. It appears that primary repair with open reduction and ligament repair yields better results as almost all patients reported the ability to return to prior work (►**Video 1**; available online only).⁴ Delay to presentation and diagnosis represents the greatest risk factor for poor outcome.³ Notwithstanding, Baek et al assert that accurate anatomic reduction, ligament repair, and secure fixation have the most impact on prognosis.⁶ This case report would also support early operative intervention.

Video 1

The range of motion. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0040-1710395>.

Conclusion

Isolated scaphoid dislocations are rare. Open reduction and ligament fixation are the current treatments of choice, with

surgical approach dictated by the location of the dislocation. Despite the damage to the soft tissue attachments, the incidence of avascular necrosis with this injury pattern is low.⁵ Type-II lunates appear to be protective for this form of carpal dislocation. When identified early, isolated scaphoid dislocations has good prognosis with operative treatment.

Note

The Work was performed at the Mayo Clinic, Rochester, MN.

Conflict of Interest

None declared.

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