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CASE REPORT

Isolated carpal scaphoid dislocation

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Isolated carpal scaphoid dislocations are rare. Because of this, treatment strategies can be conflicting and vague. The current authors present a case of isolated scaphoid dislocation that was treated initially with closed reduction and percutaneous pinning. Failure of this index treatment necessitated open reduction and internal fixation providing an adequate short-term outcome. Current treatment strategies now advocate ligament reconstruction as a first-line treatment to restore normal anatomy and preserve function.

Key-words : carpal scaphoid ; dislocation.

INTRODUCTION

Isolated closed dislocation of the carpal scaphoid is a rare injury, reported only 13 times in the literature since 1930 (*1, 3, 4, 8, 9, 12, 13, 16, 17, 19, 20, 22, 23*). Previous case-reports of isolated scaphoid dislocation suggest that hyperdorsiflexion is the primary mechanism of injury (*1, 2, 8*). Such injury provokes the disruption of the scapho-radial, scapho-lunate, and scapho-hamate articulations, allowing the scaphoid bone to be dislocated and often rotated out of its correct anatomical position while maintaining the integrity of the ligaments supporting the lunate, triquetrum, and hamate. Of the few reported cases, treatment strategies have emphasised closed reduction with percutaneous Kirschner wire fixation and more recently, open reduction with ligament reconstruction with internal fixation (*6, 8, 13, 16*). The rarity of this injury has led to the proposal of vague and sometimes conflicting treatment strategies.

Correct anatomic positioning of both the scapholunate articulation and angulation can be difficult employing conventional closed reduction methods with wire fixation. Incorrect alignment may predispose to pin failure, poor functional outcomes, and secondary dislocation. Open reduction affords a method of obtaining alignment of the scapholunate joint and scapho-lunate angulation that is superior to closed reduction and may prevent secondary dislocation (*12*). Open reduction and transarticular screw fixation does, however, prevent normal articular motion and may increase cartilage wear on adjacent joint surfaces. Because of this limitation, it should be used as a salvage procedure

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Fig. 1a. — Initial lateral radiograph demonstrating isolated complete volar dislocation of the scaphoid.

Fig. 1b. — Initial anteroposterior radiograph demonstrating a type 1 dislocation with complete dislocation of the scaphoid and normal anatomic arrangement of the distal carpal row.

and in those cases that require an early return to manual labour. Ligament reconstruction, with pre-existing ligament, autograft or allograft may provide improved results, especially for long-term outcomes. The current authors describe two methods of fixation in the same patient, exposing their inadequacies in providing anatomic restoration of this rare dislocation, and provide a literature review in discussing the potential advantages of soft tissue reconstruction.

CASE REPORT

A 36-year-old male was the driver of a car involved in a road traffic accident with another vehicle while on vacation overseas. The patient sustained an isolated volar dislocation of his left carpal scaphoid (fig 1a, 1b). The injury was treated initially at a local facility. Operative reports from an outside facility state closed reduction of the dislocated scaphoid was achieved without difficulty following longitudinal traction, dorsiflexion, and ulnar deviation of the wrist joint and direct digital pressure over the scaphoid. Percutaneous Kirschner wire fixation using three wires was used to maintain the reduction and the patient was then placed in a scaphoid type cast. Six weeks following the index procedure the patient had the plaster cast removed and two of the Kirschner wires removed. The third wire had broken during the time the patient's wrist was in the cast.

At eight weeks following surgery the patient was referred to the current authors' facility where check radiographs demonstrated a broken Kirschner wire

Fig. 2. — Lateral radiograph 6 weeks following index procedure illustrating broken Kirschner wire and scapho-lunate angulation.

Fig. 3. — Antero-posterior post-operative radiograph with Kirschner wire and screw fixation.

with scapho-lunate dissociation (fig 2). The patient admitted to no significant trauma to his wrist whilst immobilised in plaster. He was admitted for surgical exploration and reduction of the scaphoid. Ligament reconstruction and wrist fusion were both discussed with the patient who declined the former, wanting a quick return to work as a taxi cab driver. The patient also wanted to defer a wrist fusion for as long as possible. A radio-dorsal approach was undertaken to expose the scapholunate junction. Both the radio-scaphoid and the scapho-lunate ligaments were torn with minor proximal capitate migration. Repair of the interosseous ligaments was not possible eight weeks following the injury. To prevent scaphoid rotatory subluxation and in an attempt to stabilise the scapho-lunate joint preventing proximal migration of the capitate, a 22-mm Herbert screw was employed in addition to two Kirschner wires to secure fixation. The screw was placed from the proximal pole of the scaphoid across the scapholunate joint. A further two Kirschner wires were placed between the scaphoid and lunate and between the scaphoid and capitate bones (fig 3). The wrist was immobilised for a further six weeks in a scaphoid type cast. Following physical therapy the patient was back at work nine weeks subsequent to the secondary procedure.

At follow-up 2 years later, the radiographic anatomic alignment was well preserved but still demonstrated nearly 3 mm of scapho-lunate displacement (fig 4a, 4b). There was also significant

Fig. 4a. — Lateral radiograph with Herbert screw *in situ* and normal scapho-lunate alignment restored.

Fig. 4b. — Antero-posterior radiograph with restoration of normal carpal anatomy.

loss of wrist motion when compared to the other side. Motion was measured using a standard goniometer (Howmedica, Rutherford NJ). On the injured side dorsi-flexion measured 10° as compared to 30° on the uninjured side ; palmar flexion measured 50° on the affected side and 60° on the contralateral side. Pronation and supination were equal on both sides. Grip strength, measured with a dynamometer (Jamar, Jackson, MI) was similar to that of the unaffected side. Despite what the authors consider to be suboptimal radiographic results and loss of motion, the patient returned to his occupation as a taxi-driver and is satisfied with his outcome.

DISCUSSION

Scaphoid dislocations are rare (*1-4, 6-9, 12-13, 16-23*). Polveche *et al* (*18*) have divided these injuries into isolated dislocations (Type I) and scaphoid dislocations associated with axial disruption of the capito-hamate joint (Type II). This report documents an isolated scaphoid dislocation of which thirteen have been described in the literature (*1, 3, 4, 8, 9, 12, 13, 16, 17, 19, 20, 22, 23*).

The mechanism of injury in the case presented is similar to that described by Buzby (*1*) of forced hyperextension and ulnar deviation. This causes disruption of the dorsal radio-scaphoid ligament and the scapho-lunate ligaments. The scaphoid is then ejected in a radial and volar direction as demonstrated in the lateral radiograph (fig 1a). The conventional treatment for isolated acute volar dislocation has been closed reduction and percutaneous pinning. Secondary dislocation of the scaphoid following closed reduction and pinning have led to more persuasive case reports advocating for primary repair with open reduction and ligament repair (*6, 8, 13, 17*).

In this case, initial carpal alignment was obtained by closed reduction and maintained with three 1.6 mm Kirschner wires. This repair was clearly unsuccessful as demonstrated by the pin breaking and secondary dislocation of the scaphoid. It is unclear as to the degree of force required to break the percutaneous wire following the index procedure. The patient reported no single traumatic event. Although radial deviation would produce a foreshortened scaphoid and pressure across the wire, it is unlikely that such loads could have been applied through a plaster cast. Excessive mechanical forces may have been transmitted across the scapho-lunate joint secondary to a misalignment not perceived at the initial closed

procedure. Upon close examination of the postoperative radiographs the scapho-lunate diastasis was not closed down completely, and the lateral view revealed a minor misalignment of the scapholunate angulation, with dorsal angulation of the lunate, palmar flexion of the scaphoid and dorsal displacement of the capitate with respect to the lunate.

To achieve exact anatomic reduction of the scapho-lunate diastasis and angulation with closed methods alone is therefore technically demanding and may not be possible. Mayfield *et al* have described this difficulty with relation to scapholunate dissociation as the scaphoid paradox ; to close the scapho-lunate gap radial angulation is required and to obtain correct scapho-lunate angulation ulnar deviation is required (*14*). Clearly closed reduction is therefore an inexact procedure and percutaneous pinning across an inexact reduction may produce failure of the wire and the repair.

Whatever the cause of the broken wire, the resultant scapho-lunate dissociation and scaphoid rotational malalignment could only be addressed by open reduction at eight weeks following the index procedure. Direct ligament repair was not possible at the second procedure. Ligament reconstruction, capsulodesis and tenodesis procedures were all discussed with the patient ; however, these options were declined as the patient was self-employed and wanted to return to work as soon as possible with a stable wrist. Open reduction was therefore performed with conventional wire fixation of the scaphoid and capitate, and the scaphoid and lunate, augmented by a Herbert screw. The screw allowed exact positioning of the scaphoid in relation to the lunate. A scapho-lunate distance of three millimetres could be maintained in addition to correct scapho-lunate angulation of 60°. The screw also prevented further proximal migration of the capitate, as the current authors were concerned that an adequate soft tissue repair of the scapho-lunate ligament could not be achieved eight weeks following the initial injury and that the capitate was likely to further migrate. All screw surfaces were buried within subchondral bone preventing intra-articular impingement. With an open procedure the scaphoid paradox could be overcome and Herbert screw fixation preserved anatomic positioning and alignment without vascular compromise. Nonetheless, diminished function and a > 3 mm scapho-lunate disassociation at 2 years follow-up suggest this procedure does not achieve the same degree of anatomic and functional results that ligament reconstruction may confer.

As isolated scaphoid dislocations are so rare, few and only the most recent case reports advocate for open reduction with ligament reconstruction (*8, 15*). Such a shift in the literature guiding therapy is the result of clinical experience with perilunate dislocations. In a retrospective review by Inoue *et al* (*10*), ligament reconstruction with internal fixation was shown to maintain the anatomy of scapholunate reduction better than closed reduction and pinning. A case report by Horton *et al* suggests that ligament reconstruction within the context of isolated scaphoid dislocation provides excellent anatomic and functional results (*8*). Furthermore, based on the current authors' anecdotal experience with closed reduction failure and unsuccessful anatomic alignment with Herbert screw fixation, it is their belief that based on the results of ligament repair within the context of perilunate dislocation, ligament repair may offer more satisfactory anatomic and functional results.

Whilst it must be assumed that in volar dislocation the dorsal radial arterial supply was lost, there was no evidence of scaphoid osteonecrosis at two-year follow-up (*5*). In addition, there have been no reported cases of avascular necrosis complicating these injuries documented in the literature to date. In the case we present the only remaining soft tissue attachment to the scaphoid bone at surgery was the scapho-trapezial capsular ligament. It is through these attachments that the scaphoid vascularity is maintained. This has previously been substantiated by Milankov *et al* (*16*). Subsequent authors have also demonstrated that the scapholunate and radio-scaphoid ligaments heal without formal repair with just one case of late instability reported (*11, 17*). In this case, the dorsal ligaments were visualised at the time of the open procedure, eight weeks following the initial injury, however there was no evidence of ligament continuity or attempts at repair. This finding confirms that even a

tenuous scapho-trapezial pedicle is sufficient to prevent ischaemic necrosis of the scaphoid.

This report again demonstrates that conventional closed reduction and percutaneous Kirschner wire fixation of an isolated scaphoid dislocation can fail. This failure may be mediated by inexact closed reduction, secondary to competing biomechanical forces in the scaphoid paradox. Although open reduction with screw fixation as an adjunct to wire fixation facilitates anatomic articular alignment and scapho-lunate angulation without vascular compromise, the current authors believe that the patient's results suggest that this salvage procedure is inferior to ligament reconstruction. Open reduction and ligament reconstruction with internal fixation via arthrodesis or tenodesis therefore should be the gold standard of treatment in this rare injury.

REFERENCES

1. **Buzby B.** Isolated radial dislocation of carpal scaphoid. *Ann Surg* 1934 ; 100 : 553-555.
2. **Campbell Thompson T, Campbell RD, Arnold WD.** Primary and secondary dislocation of the scaphoid bone. *J Bone Joint Surg* 1964 ; 46-B : 73-82.
3. **Connell MC, Dyson R.P.** Dislocation of the carpal scaphoid. *J Bone Joint Surg* 1995 ; 37-B : 252-253.
4. **Fishman MC, Dalinka MK, Osterman L.** Case Report 309. *Skeletal Radiol* 1985 ; 13 : 245-247.
5. **Gelberman RH, Menon J.** The vascularity of the scaphoid bone. *J Hand Surg* 1980 ; 5 : 508-513.
6. **Green DP, O'Brien ET.** Classification and management of carpal dislocations. *Clin Orthop* 1980 ; 149 : 55-72.
7. **Hokan R, Bryce GM, Cobb NJ.** Dislocation of scaphoid and fractured capitate in a child. *Injury* 1993 ; 24 : 496-497.
8. **Horton T, Shin A, Cooney W.** Isolated scaphoid dislocation associated with axial carpal dissociation : an unusual injury report. *J Hand Surg* 2004 ; 29 : 1102-1108.
9. **Inoue G, Maeda N.** Isolated dorsal dislocation of the scaphoid. *J Hand Surg* 1990 ; 15–B : 368-369.
10. **Inoue G, Kuwahata Y.** Management of acute perilunate dislocations without fracture of the scaphoid. *J Hand Surg* 1997 ; 22-B : 647-652.
11. **Kuth JR.** Isolated dislocation of the carpal navicular. *J Bone Joint Surg* 1939 ; 21 : 479-483.
12. **Lueng YF, Wai YL, Kam WL, Ip PS.** Solitary dislocation of the scaphoid : from case report to literature review. *J Hand Surg* 1998 ; 23-B : 88-92.
13. **Maki MJ, Chuinard RG, D'Ambrosia R.** Isolated complete radial dislocation of the scaphoid. *J Bone Joint Surg* 1982 ; 64-A : 615-616.
14. **Mayfield JK, Johnson RP, Kilcoyne RF.** The ligaments of the human wrist and their functional significance. *Anat Rec* 1976 ; 186 : 417-428.
15. **McNamara MG, Corely FG.** Dislocation of the carpal scaphoid : an 8-year follow-up. *J Hand Surg* 1992 : 17-A : 496-498.
16. **Milankov M, Somer, T, Jovanovic A, Brankov M.** Isolated dislocation of the carpal scaphoid : two case reports. *J Trauma* 1994 ; 36 : 752-754.
17. **Murakami Y.** Dislocation of the carpal scaphoid. *Hand* 1977 ; 9 : 79-81.
18. **Polveche G, Cordonnier D, Thery D, Desrousseaux JF.** An unusual variation of luxation of the wrist : External vertical luxation. Review of the literature. *Chir Main Memb Super* 1995 ; 14 : 159-166.
19. **Richards RS, Bennett JD, Roth JH.** Scaphoid dislocation with radial-axial carpal disruption. *Am J Radiology* 1993 ; 160 : 1075-1076.
20. **Ritchie DAW, Gibson PH.** Isolated dislocation of the scaphoid. *Injury* 1988 ; 19 : 405-406.
21. **Russel TB.** Inter-carpal dislocations and fracture-dislocations. A review of fifty-nine cases. *J Bone Joint Surg* 1949 ; 31-B : 524-531.
22. **Sides D, Laorr A, Greenspan A.** Carpal scaphoid : Radiographic pattern of dislocation. *Radiology* 1995 ; 95 : 215-216.
23. **Walker GBW.** Dislocation of the carpal scaphoid reduced by open reduction. *Br J Surgery* 1943 ; 30 : 380-381.