Novel Treatment of a Scapholunate Ligament Injury with Proximal Pole Scaphoid Nonunion

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Abstract

Background Nonunion of scaphoid proximal pole fractures presents a challenging management dilemma to hand surgeons. This problem is further complicated in the uncommon concurrence of scapholunate (SL) ligament disruption.

Case Description A 39-year-old male patient presented with new-onset wrist pain following a remote history of a proximal pole scaphoid fracture sustained as a teenager, which was treated nonoperatively. Six months before presentation, the patient sustained a fall while snowboarding. The patient was found to have a chronic nonunion of his scaphoid proximal pole with an associated SL ligament disruption. As the proximal fragment was too small to be amenable to fixation, the patient was treated with an arthroscopic partial scaphoid excision and SL ligament reconstruction using a scapholunate intercarpal screw placed percutaneously. At 26 months, the patient exhibited no pain, near-normal strength, and wrist motion, and expressed a high-level of satisfaction from his surgery.

Keywords

- ▶ scapholunate ligament injury
- ▶ scaphoid fracture nonunion
- ▶ proximal pole
- ▶ intercarpal screw
- ▶ SLIC

Literature Review Although cases of SL ligament disruption with concomitant proximal scaphoid fractures have been reported, to our knowledge, this is the first report of SL ligament rupture occurring in the setting of a preexisting proximal pole scaphoid nonunion.

Clinical Relevance We report the use of SL ligament reconstruction augmented with intercarpal screw fixation, and excision of the proximal pole scaphoid nonunion. This minimallyinvasive approach may be a particularly useful option in young, active patients such as our own, where a motion-sacrificing salvage procedure would be less than ideal.

Introduction

Scaphoid fractures and scapholunate (SL) ligament injuries are among the most frequently encountered wrist injuries necessitating surgical repair.^{1,2} Despite their relative commonality, these injuries are often inadequately treated or missed altogether,³ which can ultimately result in the characteristic patterns of wrist degeneration termed scaphoid nonunion advanced collapse and scapholunate advanced collapse.⁴

Owing to its tenuous retrograde blood supply,⁵ the proximal pole of the scaphoid is at particularly high-risk for developing nonunion following fractures.³ Unfortunately, despite significant advances in the understanding of scaphoid biology and development of newer operative techniques and devices, nonunion of the proximal pole remains a problem for which there is no gold-standard treatment option.^{3,4,6} When the proximal fragment is unsalvageable due to its small size, degree of fragmentation or avascularity, salvage type procedures such as partial wrist fusion or proximal row carpectomy

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Table 1 Range of motion and strength values at preoperative and postoperative visits

Measure	Preoperative	4 mo follow-up	12 mo follow-up
F/E R	60/70	65/70	65/70
F/E L	60/60	50/50	60/70
R/U R	20/45	20/45	20/45
R/U L	15/40	10/35	20/40
Grip strength R	120	120	130
Grip strength L	100	68	112
Key pinch R	19	19	20
Key pinch L	11	13	19

Abbreviations: F/E, flexion/extension arc; R/U, radial/ulnar deviation.

(PRC) have been proposed.⁷ However, due to the inherent functional cost, these salvage options are not desired in younger, active patients and those who do not exhibit pancarpal arthrosis. While excision of the proximal pole of the scaphoid has been described in such instances, there is little data regarding its outcomes in the presence of SL ligament disruption.

The purpose of this report is to describe a novel method for treating a longstanding proximal pole scaphoid fracture complicated by a new-onset SL ligament injury. We present the unique case of an active, healthy male patient with a remote history of a proximal pole scaphoid nonunion, who developed new-onset wrist pain and subjective loss of grip strength due to an SL ligament disruption. He was treated successfully with an arthroscopic partial scaphoid excision

and SL ligament reconstruction utilizing a percutaneously placed intercarpal screw.

Case Report

A 39-year-old left-hand dominant male patient presented to our institution with a 6-month history of left wrist pain that began after sustaining a fall while snowboarding. Since that time, he noted that he could not hold objects due to his grip “feeling weak” and also experienced intermittent painful “clicking” with wrist motion. The patient also reported a remote history of an ipsilateral scaphoid fracture sustained over 20 years prior, which was treated with cast immobilization.

On examination, there was tenderness over the anatomic snuffbox and SL interval, with pain elicited by the scaphoid shift test. Range of motion and strength measurements are depicted in **Table 1**. Plain radiographs of the left wrist revealed an age-indeterminate nondisplaced proximal pole scaphoid fracture (**Fig. 1**). Magnetic resonance imaging (MRI) demonstrated a nonunion at the fracture site, decreased signal of the scaphoid on both T1- and T2-weighted imaging, and surrounding edema with cystic changes. There was a dorsal tilt of the lunate although no clear SL ligament tear was appreciated on MRI. A central tear in the triangular fibrocartilage (TFCC) complex was also noted.

The plan was made for a diagnostic wrist arthroscopy and TFCC debridement with the possibility of additional intervention pending the findings of the arthroscopy. Under tourniquet control, wrist arthroscopy was performed, which revealed a complete tear of the membranous and volar portions of the SL ligament (**Fig. 2**) with only a small remnant of the dorsal SL ligament still intact. The injured TFCC was also visualized, and debrided to healthy-appearing tissue. The proximal pole fragment of the scaphoid was felt to be too small for screw fixation and was excised

Fig. 1 Initial (A) posteroanterior and (B) lateral radiographs demonstrating proximal pole scaphoid fracture with scapholunate interval widening.

Fig. 2 Intraoperative arthroscopic images demonstrating (A) proximal pole scaphoid fracture and (B) scapholunate ligament disruption.

Fig. 3 Postoperative (A) posteroanterior and (B) lateral radiographs demonstrating placement of the SLIC screw at the SL interval. SLIC, scapholunateintercarpal.

arthroscopically. The remaining scaphoid was then reduced into closer apposition relative to the lunate and held provisionally with Kirschner wires. This reduction was secured by a 25-mm scapholunateintercarpal (SLIC) screw (AcuMed, LLC, Hillsboro, Oregon, United States) placed percutaneously, with satisfactory alignment confirmed under fluoroscopy. The skin and soft tissues were closed in standard fashion and patient was placed in a bulky dressing and a thumb spica splint to be worn full-time until follow-up. Postoperative radiographs are shown in ▶Fig. 3.

At follow-up, the patient's pain and strength gradually improved and by his 12 month follow-up visit, he was pain-free, with motion and strength measurements comparable to his contralateral uninjured side (▶Table 1). The patient also exhibited continued improvement in his scored outcome measures compared with preoperatively, as depicted in ▶Table 2. At that point, a planned screw removal was performed with no complications, and maintenance of the SL interval was con-

firmed with fluoroscopy (▶Fig. 4). The patient continued to do well, and at 26 months postoperative from his initial surgery, the patient reported further subjective improvement in his motion and strength, was pain-free, and expressed a high level of satisfaction with his postsurgical outcome.

Discussion

Fractures of the proximal pole of the scaphoid are especially prone to the development of nonunion, largely due to the well-documented precarious vascular supply that enters the scaphoid distally, and flows retrograde.⁵ In a large series almost 100 of scaphoid nonunions, Wong and von Schroeder reported that nearly one-fourth of all nonunions occurred at the proximal pole despite only 5% of all scaphoid fractures occurring in the same location.³ Due to this inherent risk, many authors now advocate acute operative fixation of all proximal pole fractures, regardless of the degree of

Table 2 Outcome measures over treatment course

Symptom/outcome	Maximum	Preoperative	12 mo follow-up	26 mo follow-up
QuickDASH				
Main	100	45.5	0	0
Work	100	12.5	0	0
Sports/arts	100	56.25	6.25	0
PRWE	150	59	9	4
Pain	50	23	5	3
Function	100	36	4	1

Abbreviations: QuickDASH, quick disabilities of the arm shoulder and hand outcome measure; main, 11-item QuickDASH score; work, 4-item QuickDASHwork module; sports/arts, 4-item QuickDASHsports and performing arts module; PRWE, patient rated wrist evaluation; pain, 5-item PRWE pain module; function, 10-item PRWE pain module.

displacement.⁷ Even then, the potential for nonunion remains relatively high, posing a difficult treatment dilemma for surgeons and often resulting in suboptimal outcomes.

When nonunion does occur and the proximal fragment is amenable to fixation, both vascularized and nonvascularized bone grafting methods have been described, with varying outcomes reported.^{3,4,6} However, if the proximal fragment is too small, fragmented or devoid of the vascularity to facilitate bony healing, treatment options become quite limited, and satisfactory outcomes are further impeded. In such cases, reconstructive efforts are centered around replacing the excised proximal fragment with osteochondral analogues, including scaphoid allograft and rib autograft.^{8,9} However, these procedures have their own potential pitfalls, including disease transmission, host rejection or graft integration, and donor-site morbidity or iatrogenic chest or lung injury, respectively.

While salvage techniques such as partial fusion or PRC remain as options, these are not likely to be functionally acceptable in a young active patient, such as the one presented in this case. Another treatment consideration would be the excision of the proximal scaphoid fragment, which can be done open, or arthroscopically as reported in a series of three patients by

Ruchet al.¹⁰ The authors of that series reported improvement in wrist flexion and extension, radial deviation, and grip strength for all three patients. However, it is certainly worth noting that all three patients had an intact SL ligament, as confirmed arthroscopically. In contrast, our patient presented with a new-onset SL ligament injury, for which there is little outcome data available following proximal pole excision.

With these multiple factors into consideration, the decision was made to excise the small proximal fragment arthroscopically, and reconstruct the SL ligament utilizing a relatively newer device, the SLIC screw. This particular intercarpal screw is similar in concept to previous designs, with the caveat that its differential pitch and cylinder-in-cylinder design allows for a small degree of toggle at the joint between the scaphoid and lunate. We theorized that this semirigid construct would be less likely to fail given the additional tension created between the scaphoid and lunate by the removal of the proximal fragment of the scaphoid and closing down of the SL interval, in comparison to a standard screw providing rigid fixation.

Although this particular clinical scenario is rarely described in the current literature, we feel that our results demonstrate a

Fig. 4 Intraoperative (A) posteroanterior and (B) lateral fluoroscopic images following implant removal performed at 12 months.

reasonable option in the case of an SL ligament rupture superimposed on a preexisting scaphoid proximal pole nonunion. Further study would be necessary in determining the generalizability of this treatment option for larger proximal fragments, and its potential utility in the acute fracture setting with concomitant SL ligament disruption. In addition, longerterm follow-up is necessary in the presented case to determine if our patient outcomes are maintained over time.

Conflict of Interest

None.

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