Post-traumatic Scapholunate Advanced Collapse of the Wrist: A Case Report

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ABSTRACT

Objective: The purpose of this report is to describe a patient with scapholunate advanced collapse (SLAC) of the wrist.

Clinical Features: A 38-year-old man presented to a chiropractic teaching clinic with right wrist pain after falling off of the tailgate of a truck 7 years prior. The mechanism of injury was a fall on an outstretched hand. Ultrasonography and radiography were performed, which demonstrated abnormal lunate kinematics and scapholunate interval diastasis associated with a clenched-fist maneuver. These findings were consistent with SLAC.

Intervention and Outcome: Following the diagnosis of SLAC, the wrist was splinted. Conservative care consisting of physical therapy included paraffin dips, therapeutic ultrasound, and stretching. The patient received only minimal alleviation of pain, and a surgical consultation was obtained. The patient elected surgical intervention, utilizing the proximal row carpectomy procedure.

Conclusion: This case demonstrates a patient with chronic wrist pain, with progression to carpal instability, which ultimately manifested as SLAC. We demonstrate, utilizing multiple imaging modalities, both preoperative and postoperative findings. To our knowledge, this is the first case to describe the use of diagnostic ultrasonography in the evaluation of the proximal row carpectomy procedure. (J Chiropr Med 2018;17:128-134)

Key Indexing Terms: *Wrist; Trauma; Ultrasonography*

INTRODUCTION

Scapholunate advanced collapse (SLAC) pattern of wrist arthritis was described in 1984, when Watson and Ballet reviewed 4,000 wrist radiographs and found degenerative arthritis in 210 cases and, of these, 57% were arthritis between the scaphoid, lunate, and radius.¹⁻⁴ Scapholunate ligament (SL) tears are the most common wrist ligament injury caused by rupture of the intrinsic ligament connecting the scaphoid to the lunate.^{5,6} Therefore, attenuation of the SL, whether traumatic or atraumatic in etiology, predisposes the wrist to eventual development of SLAC.⁷ Scapholunate ligament injury is the leading cause of SLAC of the wrist.^{8,9} If SLAC is a result of trauma, the mechanism

is most typically axial overload or hyperextension with supination or ulnar deviation.^{5,8,9}

Optimal treatment of symptomatic SLAC wrist should initially involve nonsurgical options.^{7,9,10} Symptomatic treatment (ie, splints, modalities, and injection) may be used.^{3,9,10} Surgical options are warranted though, whenever there is persistence of pain following treatment attempts utilizing conservative measures.⁹ Surgical treatment is planned on the basis of symptoms, physical examination findings, radiographic findings, stage of arthrosis, and the surgeon's preference.^{7,9,11} Scapholunate advanced collapse of the wrist is a pattern of degenerative wrist arthritis that was traditionally treated with total wrist arthrodesis.¹² Over the years, additional alternative surgical procedures have been introduced, which allow for better maintenance of the original wrist anatomic morphology and improved postsurgical range of motion (ROM).¹ Proximal row carpectomy (PRC) involves removal of the scaphoid, lunate, and triquetrum with creation of a new articulation between the capitate and the radius.^{10,12}

This report describes a 38-year-old man (co-author D.J.M.) with chronic right wrist pain who was diagnosed with SLAC initially through diagnostic ultrasonography (US). Multiple imaging modalities of both SLAC and PRC are presented. To our knowledge, there are no reported cases of US imaging in the postsurgical PRC.

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Case Report

A 38-year-old white man presented to a chiropractic teaching clinic with pain in his right wrist, focused at the lateral aspect of the scaphoid and paresthesia in digits 1 to 4, distally. The original mode of injury occurred 7 years earlier, when the patient was thrown from the tailgate of a vehicle moving approximately 20 mph, sustaining a fall on an outstretched hand, with injury to his right wrist. The greatest extent of pain was located along the dorsal aspect of the right wrist, described as a deep, throbbing pain. He presented to the emergency department, where a standard 4-view wrist series and an additional specialized scaphoid projection was performed. Radiographic evaluation of the right wrist revealed no signs of carpal fracture or joint instability. No further imaging was performed. The wrist was splinted and the patient was told to “give it time to heal.”

The patient then underwent physical therapy for the treatment of traumatic tendinopathy of the extensor compartment 3 times per week, for the first 2 months, which included paraffin dips, therapeutic ultrasound, passive and active ROM, and stretching. Frequency of treatment was gradually reduced as swelling decreased, and ROM improved. There was never full resolution of the symptoms, and there was persistent loss of ROM, with pain. He experienced pain in the wrist consistently over the next 7 years. The patient rated the pain from a 1 out of 10 to a 3 to 4 out of 10 on a numeric pain scale. The pain had been chronic, but recently flared up by the patient’s recent participation in the construction of a fence. This job required the use of a power drill, hand-held 2-man power auger, and lifting 80-lb fencing. The pain was consistent, dull, and achy. The paresthesia of his right hand was constant. The patient, at the time, was attending chiropractic college and experienced exacerbation of pain while performing adjusting maneuvers. He utilized active care with icing when needed, myofascial treatment, and kinesio taping of the forearm. He also received a chiropractic trial of care for 3 weeks, including carpal mobilization, but it provided limited relief. The right wrist pain was minimal in comparison to the asymptomatic left wrist.

The elevated levels of pain localized in the region of the radioscapoid joint, along the dorsal aspect of the right wrist. This acute escalation of pain prompted a US examination of the right wrist. It demonstrated scapholunate diastasis, and concurrent proximal migration of the capitate, upon performing a clenched-fist maneuver (Fig 1, Supplementary Video 1). Subsequent radiography of the right wrist was performed 2 days later, which again demonstrated diastasis of the scapholunate joint of 4.0 mm, associated with a clenched-fist maneuver (Fig 2). Both the US and radiographic findings were consistent with SLAC. Due to the complexity of internal derangement in the right wrist, magnetic resonance imaging (MRI) was ordered. A 2-compartment contrast MRI of the right wrist confirmed the diagnosis of SLAC. The MRI demonstrated

abnormal enhancement within the scapholunate joint, reinforcing the diagnosis of SL tear (Fig 3). This diagnosis prompted a consult with an orthopedic surgeon. Proximal row carpectomy was offered as a surgical intervention. The objectives of PRC were reduction of chronic pain, increased functional movement, increased ROM, and halting progressive arthritis of the radioulnar joint and carpal joints. The surgical approach included the removal of the scaphoid, lunate, and triquetrum bones of the right wrist.

Subsequent postoperative radiography and US imaging demonstrated migration of the distal row bones to the resected proximal row, creating a new articulation of the capitate and lunate fossa within the radioulnar joint (Figs 4 and 5). During the first 2 postoperative weeks, the right hand and forearm were in a ventral half cast with gauze, and an ace bandage was applied dorsally to allow for healing of the incision. The patient was instructed to move his fingers as much as possible during this time and ice the wrist and hand to tolerance. At that time, the pain was constant, the swelling was extreme, and the patient experienced paresthesia throughout the hand. Over the following 4 weeks, the wrist was splinted with a custom brace. Instructions were given for moving the fingers, clenching the fist, and ice to tolerance. In the following month, a custom brace was provided, and physical therapy consisting of Class IV laser treatments for the right wrist, instrument assisted muscle work, active and passive stretching, and squeezing a therapeutic stress ball were employed. Paresthesia was present in the right median nerve distribution. Sixty days following surgery, a right volar short arm resistive orthotic brace was prescribed to be worn for 8 hours each day in the extension position and 1 hour each day in the flexion position, for a duration of 2 months. At the last follow-up, the patient experienced minimal pain, with full resolution of his paresthesia, and no functional limitations in his activities of daily living. Patient consent to utilize radiological imaging or other clinical information relating to the case was obtained prior to publication of this case report.

DISCUSSION

Scapholunate advanced collapse is the most common type of degenerative arthritis in the wrist.^{2,4,8,9,13} The cause of SLAC is usually thought to be traumatic injury to the SL; however, the differential diagnosis of SLAC includes idiopathic osteonecrosis (Kienböck’s disease and Preiser’s disease), infection, scaphotrapeziotrapezoid arthritis, inflammatory arthritis, scaphoid nonunion advanced collapse, calcium pyrophosphate deposition disease, and pseudogout have been reported in association with SLAC.^{3,7-9,14,15}

Symptomatology ranges from debilitating wrist pain with reduction in grip strength and ROM to asymptomatic patients, where the finding is merely incidental.⁷ Asymptomatic SLAC wrist generally does not require treatment; however, there are no studies on the long-term success of

Fig 1. Transverse ultrasonography of the dorsal right wrist with neutral (A) and clenched fist (B) demonstrates instability with scapholunate interval diastasis, evidenced by abnormal displacement of the lunate with concurrent proximal and anteroposterior migration of the capitate. Notice the cortex of the capitate displacing the lunate, which has now entered the field of view.

Fig 2. Posteroanterior radiography of the right wrist with neutral (A) and clenched fist (B) projections demonstrates instability with diastasis at the scapholunate interval. Mensuration of the interval on the neutral projection (A) was 2.5 mm in width, which increased on the clenched fist projection (B) to 4.2 mm.

Fig 3. Coronal T1-weighted fat saturated contrast magnetic resonance imaging demonstrates abnormal enhancement within the scapholunate interval (arrowheads), consistent with complete dissociation of the scapholunate ligament.

nonsurgical treatment for SLAC wrist, nor are there any long-term natural history studies.^{3,8,9,11} In addition to the poor understanding of its natural history, the extent of scapholunate injuries, which manifest into SLAC wrist and ultimately arthritis, is not clearly understood.¹ The classic presenting symptoms of SLAC include wrist pain with activity, loss of motion, swelling, and periscaphoid tenderness.¹⁴ Physical examination will often reveal a wrist joint effusion, dorsal radial wrist swelling, and tenderness in the radioscaphoid joint.^{3,10} Along with clinical investigation, radiological studies play a vital role in the diagnosis of SLAC wrist.^{9,16} Diastasis of the scaphoid and the lunate is an imaging finding on the wrist posteroanterior view that can be present following SL dissociation. Diastasis is demonstrated radiographically if there is widening to a dimension > 4.0 mm at the midpoint of the scapholunate joint.⁹ Ultrasonography evaluation of the dorsal scapholunate joint space is also reliable, with a normative value of 2.0 mm and a standard deviation range of ± 0.6 mm; although, there is some discrepancy regarding the normal dimension of the scapholunate joint.⁶ Tanaka et al reported a normative value of 1.8 mm measured with MRI.¹⁷ However, the difference in normal dimensional value between US and MRI is likely because of the increased spatial resolution in the near field obtained with US.^{18,19}

Diagnosis or treatment of SL injuries rarely occurs during the acute phase, when it would still be possible to do

Fig 4. Posteroanterior radiography of the right wrist following proximal row carpectomy demonstrates complete removal of the scaphoid, lunate, and triquetrum, with creation of a new articulation between the capitate and the radius.

a direct repair on the ligament.¹ The delay in diagnosis often necessitates surgical intervention, with multiple reconstructive techniques for surgeons to choose from for the best maintenance of normal carpal kinematics, while also providing optimal grip strength and ROM.¹ Scapholunate advanced collapse is a pattern of degenerative wrist arthritis that was traditionally treated with total wrist arthrodesis.¹² Historically, limited wrist arthrodesis involved joints, such as scaphotrapeziotrapezoid, lunotriquetral, or scapholunate.²⁰ Today, however, arthrodesis treatment options for SLAC wrist include 4-corner, capitulunate, and complete wrist arthrodesis. Options other than arthrodesis include PRC, denervation, and radial styloidectomy.^{3,7,15} Among the motion-preserving procedures, 2 of the most commonly performed are PRC and capitate-lunate-hamate-triquetrum arthrodesis (4-corner arthrodesis).²

The PRC procedure was originally introduced by T. T. Stamm and has since become a well-established option for surgical treatment of radiocarpal arthrosis.^{7,10,21} The primary indications for a PRC are SLAC, scaphoid nonunion advanced collapse, Kienbock's disease, failure lunate or scaphoid implants, or chronic perilunate dislocation.^{2,10,15,22} Advantages of PRC are obvious: technical simplicity, short rehabilitation, immediate functionality of the wrist, and few complications.^{2,3,10,15} In addition, there is little risk of infection, no pseudarthrosis, or implant-related complications compared to partial arthrodesis.¹⁵ There has been continued evidence of satisfactory results with PRC over the years,

Fig 5. Extended field of view ultrasonography of the right wrist with normal alignment (A) of the radius, lunate, capitate, and third metacarpal articulations. Following proximal row carpectomy surgical intervention (B), notice the resection of the proximal row with associated proximal migration of the capitate and the new long-axis articulation of the radius, capitate, and third metacarpal.

specifically satisfactory clinical function and postoperative pain relief.^{10,15,21} Wall et al¹⁰ and Stern²² have all reported an average grip strength that was 87% of the contralateral side. Wyrick et al⁴ reported an average grip strength preservation as high as 94%, following PRC intervention.^{2,10-12,23} For postoperative average ROM, Wall et al¹⁰ and Stern²² reported a minimum of 71% of the contralateral normal wrist, with preservation as high as 80%, according to Rettig and Raskin.^{10,15,24}

Excellent results have been reported with PRC for SLAC wrist, with the purported advantages being earlier motion, no hardware, and no need for arthrodesis to occur.^{3,10} However, if a wrist is devoid of certain surgical prerequisites, it may necessitate that alternative operative procedures be performed. Contraindications for PRC include loss of cartilage either on the head of the capitate or in the lunate fossa of the distal radius.^{3,4,7,10,15,22} Surgical options known as salvage procedures are the only choices left for the surgeon once there is cartilage loss, tailored according to the extent of osteoarthritis.^{1,10} Also, patient age and occupation are a factor that can influence choice of procedure.¹⁰ It should be taken into consideration that poorer results of PRC have been reported in young patients, especially those under the age of 35 and those with high-demand, manual labor occupations.^{7,10,25,26}

Motion preserving procedures are a good surgical option in patients who have localized degenerative or arthritic changes of the carpus.²⁰ However, although optimal treatment for these injuries continues to evolve, controversy exists regarding whether PRC or 4-corner arthrodesis results in the most satisfactory clinical outcome for the arthritic, painful wrist.^{10,13} Even though there is a plethora

of information in the literature regarding partial wrist arthrodesis, a universal consensus has yet to be agreed upon.^{7,15} Careful consideration of variables, such as age, etiology, chief complaint, extent of arthrosis, as well as expectations for recovery following surgery, can help the clinician advise an optimal surgical option, which maximizes both clinical outcomes and patient satisfaction.⁷ The major remaining unknown factor is which motion preserving wrist treatment provides the best long-term outcomes.¹⁵ Additional studies in the future will be necessary for better understanding regarding the long-term natural history, which will enhance clinical decision-making.¹

Limitations

As this report is a single case, parameters regarding diagnosis or treatment outcomes may not necessarily be applicable in other patients or the general public.

CONCLUSION

The utility of this case report is the presentation and description of SLAC in the wrist and the progression of the disease ultimately leading to surgical intervention involving a PRC. Both preoperative and postoperative radiological imaging is presented to provide comprehensive imaging characterization on multiple imaging modalities. In addition, a comprehensive overview of surgical options for treatment of SLAC is also discussed. To our knowledge, this is the first case demonstrating a postsurgical wrist following a PRC procedure on diagnostic US.

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No funding sources or conflicts of interest were reported for this study.

CONTRIBUTORSHIP INFORMATION

Concept development (provided idea for the research): D.L.A.

Design (planned the methods to generate the results): D.L.A.
Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): N.W.K.

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APPENDIX A. SUPPLEMENTARY DATA

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jcm.2018.02.001>.

Practical Applications

- The case report provides clinical information regarding surgical choices for the treatment of scapholunate advanced collapse in the wrist.
- The case report provides explanation on how to radiologically diagnose scapholunate advanced collapse.
- The case report provides a description, as well as the clinical indications and benefits, of the proximal row carpectomy surgical procedure.

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