SCIENTIFIC ARTICLE

# Arthroscopic Proximal Row Carpectomy

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**Purpose** Proximal row carpectomy is an effective procedure for treating a variety of wrist pathologies. To date, all outcome studies have reported on the results of an open procedure, with a dorsal capsulotomy. We present our technique and early results of arthroscopic proximal row carpectomy.

**Methods** A total of 17 consecutive patients (10 men and 7 women) underwent arthroscopic proximal row carpectomy. After routine arthroscopy, the proximal carpal row was removed with an arthroscopic bur, with care being taken to protect the articular cartilage of the head of the capitate and the lunate fossa. The average time of the procedure was 70 minutes (range, 34–110 min). Range of motion exercise was initiated 2 days postoperatively. We assessed clinical follow-up objectively by evaluating range of motion and grip strength. We assessed subjective outcomes with the Disabilities of the Arm, Shoulder, and Hand questionnaire and with a patient-centered questionnaire assessing satisfaction, return to prior employment, and pain.

**Results** A total of 16 patients were available, with an average follow-up of 24 months (range, 12–48 mo). There were no complications, no revisions were required, and no arthroscopic procedure was converted to open technique. At final follow-up, the average wrist flexion-extension arc was 80% of the contralateral side, and grip strength averaged 81% of the contralateral side. The mean Disabilities of the Arm, Shoulder, and Hand score was 21. All 16 patients rated themselves as satisfied or very satisfied with the procedure. Eleven patients had no work restrictions and 13 were able to return to previous employment. Ten patients rated themselves as having mild or no pain.

**Conclusions** Arthroscopic proximal row carpectomy appears to be a safe, effective, and reliable procedure for a variety of wrist conditions, and it allows for rapid mobilization of the wrist compared with the open procedure. Range of motion and grip strength compare favorably with existing values in the literature for the open technique. *(J Hand Surg 2011; 36A:577–582. Copyright © 2011 by the American Society for Surgery of the Hand. All rights reserved.)*

**Type of study/level of evidence** Therapeutic IV.

**Key words** Arthroscopy, case series, proximal row carpectomy, scapholunate advanced collapse wrist, wrist arthritis.

Proximal row carpectomy (PRC) is a common motion-preserving procedure for the treatment of a variety of degenerative and traumatic conditions of the wrist, including carpal instability, carpal dissociation, scaphoid nonunion, Kienböck's disease, and scapholunate advanced collapse wrists.[1] Along with 4-corner arthrodesis, PRC is often considered salvage surgery because of concern for loss of range of motion, decrease in grip strength, possible progression of arthritis, and unreliable outcomes. However, recent

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studies have shown reliable longevity[2,3] and satisfactory pain relief and function, with decreased complication rates compared with 4-corner arthrodesis.[4–7] In addition, the advantages of PRC versus midcarpal arthrodesis include less postoperative immobilization, no opportunity for nonunion, and no need for subsequent hardware removal.

First described by Stamm in 1944,[8] PRC relies on a radiocapitate articulation as the link between the lunate fossa of the distal radius and the remaining carpus. This turns a complex link system into a simple sloppy hinge joint. Proximal row carpectomy permits some degree of radial-ulnar deviation; in addition, it permits the dissipation of torsional loading across the new joint between the capitate and lunate fossa. It is hypothesized that the newly formed radiocapitate joint works through both rotation and translation, decreasing the expected amount of wear of this joint and improving the durability of this procedure.[9,10]

There are several potential advantages of an all arthroscopic PRC (APRC). In the open procedure, the wrist is typically immobilized for at least several weeks postoperatively, to allow for healing of the capsule and dorsal ligaments. An arthroscopic procedure avoids an open capsulotomy, thus allowing for early postoperative mobilization of the wrist. With less soft tissue disruption, there may be a faster recovery compared with the open procedure, with reduced postoperative pain and scarring. In addition, with the relative sparing of the capsular ligaments with an arthroscopic procedure, there may be enhanced postoperative stability of the reconstructed wrist.

Until now, the term PRC has generally described an open procedure, through a dorsal wrist approach.[11] We are aware of only 2 articles describing APRC,[12,13] and those deal only with the technical aspects of this procedure. There are only limited examples in the literature of arthroscopic excision of other carpals. Complete and partial arthroscopic trapeziectomy have been described in the treatment of thumb carpometacarpal arthritis with good success.[14] In addition, arthrosis of the proximal hamate has been described with partial arthroscopic resection.[15,16]

The purposes of this study were to present our surgical technique, assess outcomes, and describe our early experience with all-arthroscopic proximal row carpectomy.

## MATERIALS AND METHODS

### Patient demographics

From January 2006 to March 2009, 17 patients (10 men and 7 women) underwent APRC. We observed patients for a minimum of 12 months' follow-up (mean, 24 mo; range, 12–48 mo). The average age at time of surgery was 56 years (range, 43–69 y). The dominant wrist was involved in 8 patients, including 1 ambidextrous patient. The primary pathology included scapholunate advanced collapse (10 wrists), combined static scapholunate and lunotriquetral instability (4 wrists), Kienböck's disease (1 wrist) scaphoid nonunion with advance collapse (1 wrist), and Kienböck's disease with scapholunate advanced collapse (1 wrist).

We obtained data on range of motion and grip strength preoperatively and for all follow-up visits. Radiographs of the wrist were also taken during preoperative evaluation to assess the pattern of arthritic disease with attention to the capitolunate and radiolunate articulations. If the capitolunate joint was involved, PRC was not performed. If notable arthrosis of either the head of the capitate or the lunate fossa of the radius was found at the time of the procedure, the APRC was not performed. We performed final follow-up radiographs on all patients.

Preoperatively, all patients reported reduced wrist function with pain and weakness. Every patient had persistent activity-related pain despite nonsurgical treatment consisting of activity modification, bracing, nonsteroidal anti-inflammatory drugs, and steroid injections.

Patients were asked to complete the Disabilities of the Arm, Shoulder and Hand (DASH) Questionnaire,[17] a validated questionnaire that evaluates symptoms and functions. This 30-item form is scored from 0 to 100 points; higher scores demonstrate increasing disability. We also used a second questionnaire based on a form employed by DiDonna et al[2] to assess satisfaction, wrist pain, pain medication use and return to previous employment.

### Surgical technique

The patient is placed supine with the wrist secured in a wrist arthroscopy tower that applies 5-kg traction throughout the operation. Good access to the dorsum of the wrist is essential and adequate visualization with the fluoroscopy arm in the horizontal position should be confirmed before draping. A tourniquet is used infrequently, although one is always applied preoperatively as a precaution.

Routine radiocarpal and midcarpal arthroscopy is carried out using the 3/4, 4/5, 6R, 6U, midcarpal radial (MCR), and midcarpal ulnar (MCU) portals as necessary. Then ARPC is performed through the midcarpal portals. After diagnostic and operative arthroscopy, the small joint arthroscopic bur or shaver is introduced into the midcarpal joint through the MCR portal, with the MCU portal used for viewing with the arthroscope.

**FIGURE 1:** Initial removal of distal ulnar pole of scaphoid. Arthroscope is in MCU portal; bur is in MCU portal.

**FIGURE 2:** Entire proximal carpal row has been excised; carpus continues to be distracted with 5-kg traction.

The bur is used to decorticate the medial corner of the scaphoid at the midcarpal scapholunate joint, with care being taken not to injure the articular cartilage of the head of the capitate. A small shaver can often be used to perform the initial resection as well. Once an adequate portion of the corner of the scaphoid is removed, the MCR portal is slightly enlarged with careful dissection and the 4.0-mm hooded bur is introduced into the midcarpal joint. Great care should be taken to avoid injuring the articular cartilage of the head of the capitate. The use of the larger bur facilitates more rapid removal of bone.

The scaphoid is then removed from ulnar to radial and distal to proximal (Fig. 1). The STT portal is used to facilitate removal of the distal pole of the scaphoid while viewing in the MCR portal.

After scaphoid excision, the arthroscope is placed in the STT or MCR portal. The bur is placed in an enlarged MCR or MCU portal, and then the lunate (distal to proximal) and triquetrum (distal to proximal) are sequentially removed (Fig. 2). Under arthroscopic visualization, a fine synovial rongeur is useful to remove tiny fragments of bone or cartilage that remain adherent to the capsule. Confirmation of a complete APRC is made with fluoroscopy.

Traction is then released, and arthroscopy and fluoroscopy are used to confirm seating of the head of the capitate in the lunate fossa (Fig. 3). If there is sufficient radiocarpal impaction with radial deviation of the wrist, an arthroscopic radial styloidectomy is then performed, with the bur in the 1/2 portal and the arthroscope in the 3/4 portal.[18]

**FIGURE 3:** After release of traction.

Postoperatively, a bulky dressing and volar splint are applied, allowing immediate finger range of motion. The patient is seen in the office 2 days postoperatively, when the bandage is removed and a removable volar splint is applied for comfort. Early active and passive range of motion of the

wrist and digits is encouraged, and return to activity is within the limits of comfort. Formal hand therapy is prescribed on an individual basis as needed.

## RESULTS

During the study period, 17 wrists in 17 patients were treated by APRC. One patient was lost to follow-up a month after surgery.

Several patients had additional procedures performed at the time of APRC. Ten patients had evidence of radiocarpal impingement and underwent radial styloidectomy. Five patients also underwent triangulofibrocartilage debridement, and 2 patients underwent arthroscopic removal of hardware from prior surgery. One patient underwent simultaneous extensor indicis proprius transfer for an unrelated chronic extensor pollicis longus rupture, and 1 patient had a carpal tunnel release.

The mean procedure time was 70 minutes (range, 34–110 min). There were no complications. None of the arthroscopic procedures were converted to open surgeries. No patient required revision surgery. There were no instances of radiocarpal subluxation despite early mobilization.

Average time of follow-up was 24 months (range, 12–48 mo). On final follow-up examination, the mean flexion-extension arc was 94° (range, 50° to 130°), or 80% of the contralateral side. The average radial-ulnar deviation arc was 40° (range, 20° to 55°), or 78% of the contralateral side. Average maximum grip strength was 81% of the contralateral side.

There was subjective improvement in all patients. Postoperative DASH scores and satisfaction questionnaires were available for all 16 patients. The average DASH score was 21 points (range, 0–61 points), with a lower number representing decreased disability. Of 16 patients, 8 subjectively rated themselves as very satisfied with the results of the procedure and the remaining 8 patients reported being satisfied. Of 16 patients, 13 returned to their previous employment, including 5 who returned to work with lifting restrictions. Only 3 of 16 patients were unable to return to previous employment. Five patients reported no pain, 5 had mild pain, and 6 had moderate pain. A total of 11 patients did not require narcotic pain medication, 3 did so occasionally, and 2 did so daily.

## DISCUSSION

Arthroscopic PRC can be accomplished in a reasonable surgical time, has potential advantages over the standard open PRC, and provides results that are similar to the open PRC at 1-year follow-up.

Most proven arthroscopic techniques for larger joints were developed after a long history of successful open treatment. The potential advantages of an arthroscopic procedure over an open arthrotomy have typically been decreased pain, less scarring, better appearance, less soft tissue damage, and earlier range of motion leading to a faster recovery.[18–20] In addition, joint surfaces are typically best evaluated arthroscopically, and associated intra-articular pathology can be diagnosed. Wrist arthroscopy has become, for many, the treatment of choice for a variety of conditions, including TFCC tears, intercarpal ligament injuries, fractures, ganglia, synovitis, and distal radioulnar arthrosis.[16,17] A proximal row carpectomy is a successful open procedure that lends itself to the development of an all-arthroscopic technique.

Long-term studies[2,6,7,21–26] have shown the reliability of an open PRC for a variety of intra-articular pathologies, with preservation of approximately 75% of contralateral grip strength and range of motion (Table 1). The present study extends this conclusion to the technique of APRC, as our results compare favorably with studies in the literature describing the open procedure. Both the arthroscopic and open procedure appear to provide similar results in terms of pain relief, loss of grip strength, and range of motion. This is most likely due to the fact that significant biomechanical limitations remain; there is incongruity in the radius of curvatures between the head of the capitate and the lunate fossa, and the overall height of the wrist is shortened.

Major limitations of this study are that it is retrospective and lacks a control group. In addition, our study investigated results at an average of 2 years after surgery. However, we have seen no failures, or cases of progressive radiocarpal arthritis, with patients even at 4-year follow-up. In addition, it would have been helpful to obtain DASH and pain scores at different time points for each patient, to more adequately assess improvement.

An arthroscopic technique also offers the advantage of assessing the articular surfaces of the midcarpal and radiocarpal joints, which may be underappreciated by imaging studies. Considerable intra-articular degeneration may lead to a decision to perform arthrodesis, although no planned APRC in this series was aborted owing to findings at arthroscopy.

Most authors report immobilization of the wrist for 2 to 6 weeks after an open PRC.[1–4,22,24–26] An arthroscopic PRC reduces surgical trauma to the dorsal capsular ligaments. This allows for an early

**TABLE 1. Comparison of Long-Term Studies of Open PRC and APRC**

| Author | Patients (n) | Average Age | Average Follow-Up (mo) | Average Flexion/ Extension Arc | Grip Strength (% of Contralateral) | Failures |
|---|---|---|---|---|---|---|
| Tomaino et al[23] | 24 | 42 | 72 | 77 | 77 | 1 |
| Jebson et al[22] | 18 | 43 | 157 | 77 | 83 | 2 |
| DiDonna et al[2] | 15 | 38 | 120 | 72 | 91 | 4 |
| Vanhove et al[4] | 15 | 45 | 38 | 79 | 77 | 0 |
| Croog and Stern[21] | 18 | 38 | 120 | 105 | 87 | 3 |
| Dacho et al[25] | 30 | 40 | 27 | 75 | 50 | 1 |
| Richou et al[24] | 21 | 36 | 116 | 76 | 78 | 3 |
| El-Mowafi et al[26] | 12 | 30 | 24 | 70 | NA | 1 |
| Weiss et al (current study) | 17 | 56 | 24 | 94 | 81 | 0 |

NA, not available.

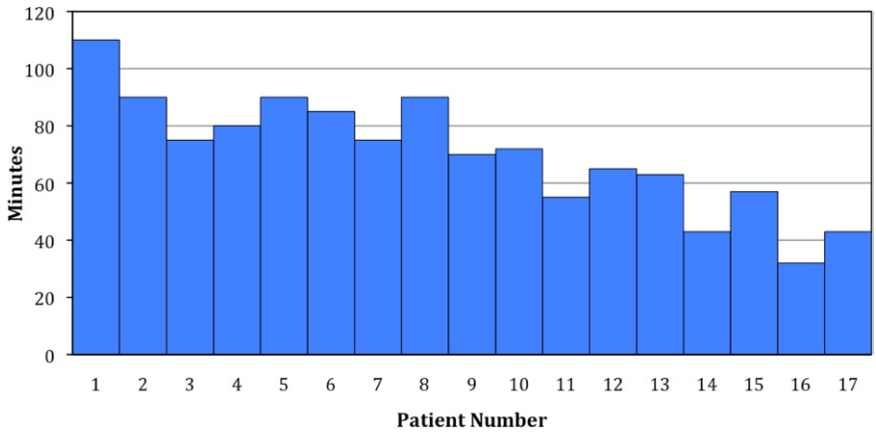


**FIGURE 4:** Length of procedure per patient.

and rapid recovery of motion compared with the open procedure. Most of our patients continued to improve in motion and function for 9 to 12 months, although some patients achieved their maximum benefit by 4 months. However, whereas range of motion and strength may recover faster in an APRC, the long-term results appear comparable to the open procedure, and there may not be a long-term clinical benefit to the arthroscopic procedure over an open PRC.

This is a technically challenging procedure and should be undertaken only by the experienced wrist arthroscopist, because inadvertent injury to articular cartilage surfaces can easily occur. In addition, there is a considerable learning curve; our first procedure took almost 2 hours, whereas we can now consistently perform the procedure in less than 1 hour (Fig. 4). The same indications apply as for the open procedure, in that it should be reserved for patients without significant arthrosis of the proximal capitate or lunate fossa. Based on our early experience, an all-arthroscopic proximal row carpectomy appears to be a viable, safe, and effective alternative to open PRC in the treatment of many wrist disorders.

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