

# Proximal Row Carpectomy and 4-Corner Arthrodesis in Patients Younger Than Age 45 Years

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**Purpose** To examine the long-term outcome of patients aged less than 45 years who underwent either proximal row carpectomy (PRC) or 4-corner arthrodesis (4CA) for wrist arthritis.

**Methods** We reviewed a retrospective cohort of 89 patients aged less than 45 years who underwent either 4CA (n = 51) or PRC (n = 38) for wrist arthritis. Mean follow-up was 11 years in the 4CA group and 18 years in the PRC group.

**Results** Overall, there were no differences between groups in the need for revision surgery. Complications included 6 nonunions in the 4CA group (12%), 1 infection in each group, and 11 patients who experienced radiocarpal impingement (8 4CA and 3 PRC). There was no difference in the number of patients reporting moderate or severe pain between the PRC and 4CA groups. Mean flexion-extension arc was 54° after 4CA, compared with 73° after PRC. Patients who underwent 4CA had slightly improved grip strength (65% of the opposite side) compared with those who had PRC (54%). Mean postoperative Disabilities of the Arm, Shoulder, and Hand questionnaire scores were 32 versus 19 (PRC vs 4CA) and patient-rated wrist evaluation scores were 27 versus 28 (PRC vs 4CA). Comparing radiographic arthritis, the 10-year outcome, free of moderate/severe arthritis for the PRC and 4CA groups, was 70% and 71%, respectively.

**Conclusions** Both PRC and 4CA represent a good surgical option for young patients with wrist arthritis, with similar complication rates, postoperative pain levels, wrist function, and long-term outcomes free of arthrodesis. Proximal row carpectomy has improved motion and fewer complications. (*J Hand Surg Am.* 2017; ■(■): ■–■. Copyright © 2017 by the American Society for Surgery of the Hand. All rights reserved.)

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

**Key words** Carpectomy, corner, arthrodesis, row, proximal, young.

**D**ESPITE MANY INNOVATIONS IN surgical techniques over the past half-century, treatment of wrist arthritis continues to be challenging with controversy surrounding treatment and technique.

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When degenerative changes spare one or more critical articulations in the wrist, such as the lunate facet, motion-sparing procedures are preferred over total wrist arthrodesis. Although motion-preserving procedures such as proximal row carpectomy (PRC) or 4-corner arthrodesis (4CA) have been used successfully in older, low-demand patients,<sup>1–15</sup> there is controversy about the best option for the younger, high-demand patient.<sup>2,5,10,13,14,16–19</sup>

Since its description by Stamm,<sup>20</sup> excision of the proximal carpal row has proven to relieve pain and preserve motion predictably as a treatment for radioscaphoid arthritis in cases of grade 2 scapholunate advanced collapse (SLAC), scaphoid nonunion

advanced collapse arthritis, and Kienböck disease.<sup>1–15,18</sup> Historically this procedure is reserved for early SLAC arthritis in which there is still preservation of capitate and lunate fossa cartilage. Advantages of PRC include the procedure's simplicity and relatively rapid recovery, whereas its disadvantages relate to the potential for development of radiocapitate (RC) arthritis. Although RC arthritis may be related to excessive loads on the capitate head during wrist motion because of a mismatch in its radius of curvature and that of the lunate fossa,<sup>2,5,12–15,17–19,21–25</sup> there has not been a definitive link between RC arthritis and patients' pain and wrist motion.<sup>2,5,10,13–18,25,26</sup>

Since the first report by Watson and Ryu,<sup>26</sup> scaphoid excision with capitate–lunate–hamate–triquetral arthrodesis (4CA) has been demonstrated to relieve pain predictably while preserving carpal height and motion through the native radiolunate (RL) articulation.<sup>2,10,13,14,16–18,27,28</sup> Disadvantages of 4CA include a risk of nonunion, potentially prolonged wrist postoperative immobilization, technical complexity, and increasing rates of RL arthritis on recent longer-term studies.<sup>2,10,13,14,16–18</sup> Like PRC, the development of radiographic findings of RL arthritis has not been correlated with poor clinical outcomes in these studies.

Although PRC does not have indications identical to 4CA, there are many situations in which the surgeon may decide between these motion-preserving procedures to provide patients with pain relief, such as in cases of stage 2 SLAC or scaphoid nonunion advanced collapse arthritis<sup>2</sup>; unfortunately for situations in which both PRC and 4CA may be offered, the best procedure for a young active patient remains unclear.<sup>5,19,27,28</sup> The purpose of this study was to examine long-term results, complications, and wrist function in patients who were aged less than 45 years when they underwent either PRC or 4CA for wrist arthritis.

## MATERIALS AND METHODS

After we obtained institutional review board approval, we performed a review of all patients aged less than 45 years who underwent PRC or 4CA at a single institution over a 36-year period, by 12 different surgeons. Exclusion criteria included an underlying diagnosis of spasticity or arthrogryposis, Kienböck disease, Volkmann ischemic contractures, juvenile arthritis, or inadequate follow-up, defined as less than 2 years of clinical follow-up.

**TABLE 1. Demographics and Surgical Considerations (n = 103)**

Demographics	4CA	PRC
Patients	51	38
Follow-up, y (mean [range])	11.3 (2–23)	17.9 (2–41)
Age, y (mean [range])	34 (14–44.9)	34 (15–44.9)
Gender (male:female)	46:5	28:12
Involved dominant hand (n [%])	19 (37)	25 (49)
Laborers	24 (47)	29 (57)
Smokers	10 (20)	12 (24)
Etiologies		
Posttraumatic	45	30
Preiser disease	0	2
Other arthritis	6	6
Preoperative		
Total arc of wrist motion	72	72
Grip strength	60	50
Concomitant surgical procedures (n [%])		
Selective neurectomy	18 (35)	10 (20)
Duration of immobilization, wk (mean [range])	6.6 (4–12)	5.1 (4–8)

### Demographics and surgical considerations

Overall, 89 patients aged less than 45 years underwent either PRC (n = 38) or 4CA (n = 51) between 1976 and 2009. **Table 1** lists the demographic, preoperative characteristics and surgical considerations. The PRC group had longer follow-up, more females ( $P < .05$ ) and laborers ( $P < .05$ ), and fewer post-traumatic etiologies ( $P < .05$ ), whereas the groups were similar in age, numbers of individuals who smoked, preoperative arc of motion, and number of selective neurectomies (posterior interosseous ± anterior interosseous nerves) performed.

### Clinical evaluation

Medical records were reviewed for demographic information, surgical indications and techniques, operative and postoperative interventions, and clinical outcomes. Range of motion was measured using a goniometer in the clinic, whereas grip strength was averaged over 3 consecutive measurements using a dynamometer (Jamar, Cambridge, MA) as a percentage of the opposite side. Subjective patient outcome measures were obtained through a

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