Research Article

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Mid-term outcomes of proximal row carpectomy in patients with wrist arthritis: a retrospective study

El bileği artriti olan hastalarda proksimal sıra karpektomisinin orta dönem sonuçları: retrospektif bir çalışma

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Abstract

Purpose: Proximal row carpectomy (PRC) is a motion-preserving surgical option for selected patients with wrist arthritis. This retrospective study evaluated mid-term clinical and radiographic outcomes after PRC, focusing on pain relief, functional recovery and complications.

Materials and methods: This retrospective cross-sectional study included patients who underwent PRC by a single surgeon between January 2012 and January 2019. Of 75 eligible patients, 30 patients (30 wrists) who attended final clinical and radiographic re-evaluation were included. Diagnoses comprised Kienböck's disease, scapholunate advanced collapse (SLAC), scaphoid nonunion advanced collapse (SNAC), and chronic perilunate dislocation sequelae. Procedures were performed through a transverse dorsal approach, and posterior interosseous nerve resection was performed in all patients as part of partial wrist denervation. Assessed outcomes included the Mayo wrist score, flexion–extension arc, grip and pinch strength (three-trial averages compared with the contralateral side) and radiographic grading by the Culp & Jebson classification. Statistical analyses used NCSS software; $p<0.05$ indicated significance.

Results: Mean follow-up was 107.2 months (range 71-150). No revision surgery was recorded among the patients included in the final analysis. The mean Mayo wrist score was 63.7±13.7. The mean flexion–extension arc was 50.9°±20.7. Patients with Culp & Jebson stage II demonstrated higher mean flexion–extension arcs (61.9°±19.9) than stage III patients (39.4°±19.0); this difference reached statistical significance ($p=0.046$). Operated wrists showed mildly reduced grip and pinch strength compared with the contralateral side but retained functional capacity.

Conclusions: PRC provided satisfactory mid- to long-term postoperative functional status among patients who were available for final clinical and radiographic evaluation. No revision surgery was recorded in the final analysis cohort. However, the substantial attrition from the initial cohort and the absence of standardized preoperative functional data should be considered when interpreting these findings. Careful patient selection, particularly assessment of capitate and radial cartilage, remains essential.

Keywords: Proximal row carpectomy, wrist arthritis, functional outcomes, PRC, Kienböck.

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Öz

Amaç: Proksimal sıra karpektomi (PRK), el bileği artriti olan seçilmiş hastalarda hareketi koruyan cerrahi bir seçenektir. Bu retrospektif çalışmada, PRK sonrası ağrı kontrolü, fonksiyonel iyileşme ve komplikasyonlara odaklanılarak orta dönem klinik ve radyografik sonuçlar değerlendirildi.

Gereç ve yöntem: Bu retrospektif kesitsel çalışmaya, Ocak 2012 ile Ocak 2019 tarihleri arasında tek bir cerrah tarafından PRK uygulanan hastalar dahil edildi. Uygun bulunan 75 hasta arasından, son klinik ve radyografik yeniden değerlendirmeye katılan 30 hasta 30 el bileği ile çalışmaya alındı. Tanılar arasında Kienböck hastalığı, skafolunat ileri kollaps (SLAC), skafoid kaynamama ileri kollapsı (SNAC) ve kronik perilunat çıkık sekelleri yer almaktaydı. Cerrahi işlemler transvers dorsal yaklaşımla gerçekleştirildi ve tüm hastalarda parsiyel el bileği denervasyonunun bir parçası olarak posterior interosseöz sinir rezeksiyonu uygulandı. Değerlendirilen sonuç ölçütleri Mayo el bileği skoru, fleksiyon–ekstansiyon arkı, kavrama ve çimdik kuvveti - karşı tarafla karşılaştırılan üç ölçüm ortalaması - ve Culp & Jebson sınıflamasına göre radyografik evrelemeyi içeriyordu. İstatistiksel analizler NCSS yazılımı ile yapıldı; $p<0,05$ istatistiksel anlamlılık sınırı olarak kabul edildi.

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Bulgular: Ortalama takip süresi 107,2 ay idi - aralık: 71-150 ay. Son analize dahil edilen hastalar arasında revizyon cerrahisi kaydedilmedi. Ortalama Mayo el bileği skoru 63,7±13,7 idi. Ortalama fleksiyon–ekstansiyon arkı 50,9°±20,7 olarak bulundu. Culp & Jebson evre II olan hastalarda ortalama fleksiyon–ekstansiyon arkı, evre III hastalara kıyasla daha yüksekti - sırasıyla 61,9°±19,9 ve 39,4°±19,0 - ve bu fark istatistiksel olarak anlamlıydı (p=0,046). Ameliyat edilen el bileklerinde karşı tarafa kıyasla kavrama ve çimdik kuvvetlerinde hafif azalma saptanmakla birlikte fonksiyonel kapasite korunmuştu.
Sonuç: PRK, son klinik ve radyografik değerlendirmeye ulaşılabilen hastalarda orta-uzun dönem postoperatif fonksiyonel durum açısından tatmin edici sonuçlar sağlamıştır. Son analiz kohortunda revizyon cerrahisi kaydedilmemiştir. Bununla birlikte, başlangıç kohortundan önemli oranda hasta kaybı olması ve standartlaştırılmış preoperatif fonksiyonel verilerin bulunmaması, bu bulgular yorumlanırken dikkate alınmalıdır. Özellikle kapitat ve radial kıkırdağın değerlendirilmesini içeren dikkatli hasta seçimi önemini korumaktadır.

Anahtar kelimeler: proksimal sıra karpektomi; el bileği artriti; fonksiyonel sonuçlar; PRK; Kienböck

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Introduction

Wrist joint arthritis significantly impairs wrist functions, primarily manifesting as persistent pain, stiffness, and restricted movement. Its complex etiology includes multiple pathological entities, with scapholunate advanced collapse (SLAC), scaphoid nonunion advanced collapse (SNAC), Kienböck's disease, chronic perilunate dislocations, and various rheumatological conditions prominently contributing to joint deterioration [1, 2]. These conditions are characterized by the progressive degeneration of articular cartilage, structural disruption of carpal bones, ligamentous instability, and subsequent biomechanical dysfunction of the wrist joint, resulting in a decline in patient quality of life and daily functionality.

Initial management typically involves conservative approaches such as analgesics, splinting, physical therapy, activity modification, and intra-articular corticosteroid injections aimed at symptom relief and functional preservation. Despite these efforts, chronicity and progression of arthritis symptoms frequently necessitate surgical inter-vention as patients seek more definitive relief.

Among various surgical strategies, proximal row carpectomy (PRC) remains a valua-ble, motion-preserving procedure and has been widely utilized in hand surgery since its original description by Stamm in 1939 [1-3]. PRC involves excision of the scaphoid, lunate, and triquetrum bones from the proximal carpal row, creating a new articulating interface between the capitate and the radius. This radiocapitate articulation helps to alleviate pain associated with arthritic degeneration while maintaining a valuable range of wrist motion.

Although alternative surgical treatments such as partial or total wrist arthrodesis and wrist arthroplasty exist, PRC offers distinct advantages, particularly in patients with intact capitate and lunate fossa cartilage. This study aims to comprehensively evaluate the mid-term clinical and radiographic outcomes of patients who underwent PRC, assessing the effectiveness, patient satisfaction, functional outcomes, and potential complications associated with this procedure.

Materials and methods

This study was designed as a retrospective cross-sectional study. Institutional records were retrospectively reviewed to identify patients who underwent proximal row carpectomy between January 2012 and January 2019 and had at least 18 months of follow-up. Ethics approval was obtained before the initiation of the study from the Ethics Committee of Pamukkale University Hospital (ethical date: 02.10.2024 and ethical application ref: E-60116787-020-590657). Institutional records were retrospectively reviewed to identify patients who had undergone PRC with at least 18 months of follow-up. A total of 75 patients were identified and invited for final clinical and radiographic re-evaluation. Of these, 30 patients attended the final assessment and constituted the study cohort. The remaining 45 patients were not included in the final analysis because they declined participation, could not be reached, or were unable to attend the follow-

up visit. Since standardized clinical examination, functional scoring, strength measurement, and radiographic assessment could not be performed in these patients, they were excluded from the final outcome analysis. Therefore, the present results should be interpreted as representing the subgroup of patients who were available for final clinical and radiographic assessment. A flow diagram of the study is shown in Figure 1. The mean age at surgery was 41.8 years (range 21-73); 19 were male and 11 female. Diagnoses included Kienböck's disease (n=11), SLAC (n=7), SNAC (n=7) and chronic perilunate dislocation sequelae (n=5). The dominant side was involved in 63.3% of cases. Work status and patient demographics were recorded.

All surgeries were performed under general anesthesia using a transverse dorsal approach. Partial wrist denervation was performed in all patients by identifying and resecting the posterior interosseous nerve. A quadrangular capsulotomy was performed between the third and fourth extensor compartments. The proximal row bones were removed sequentially (lunate, triquetrum, scaphoid). Radial stylectomy was performed if intraoperative impingement was observed. The capsule was closed with absorbable sutures, a bulky dressing and volar splint were applied and patients were typically discharged the first postoperative day.

Pinch and grip strength of both wrists were measured using a Jamar pinch gauge and a North Coast hydraulic grip dynamometer. Three measurements were recorded and averaged for analysis. Mayo wrist scores and anteroposterior radiographs were obtained; radiographic outcomes were graded according to the Culp & Jebson classification. Measurements and clinical assessments were performed by the same examiner.

Standardized preoperative Mayo wrist scores, goniometric ROM measurements, and dynamometric grip and pinch strength values were not consistently available in the medical records. Therefore, preoperative-to-postoperative comparisons could not be performed.

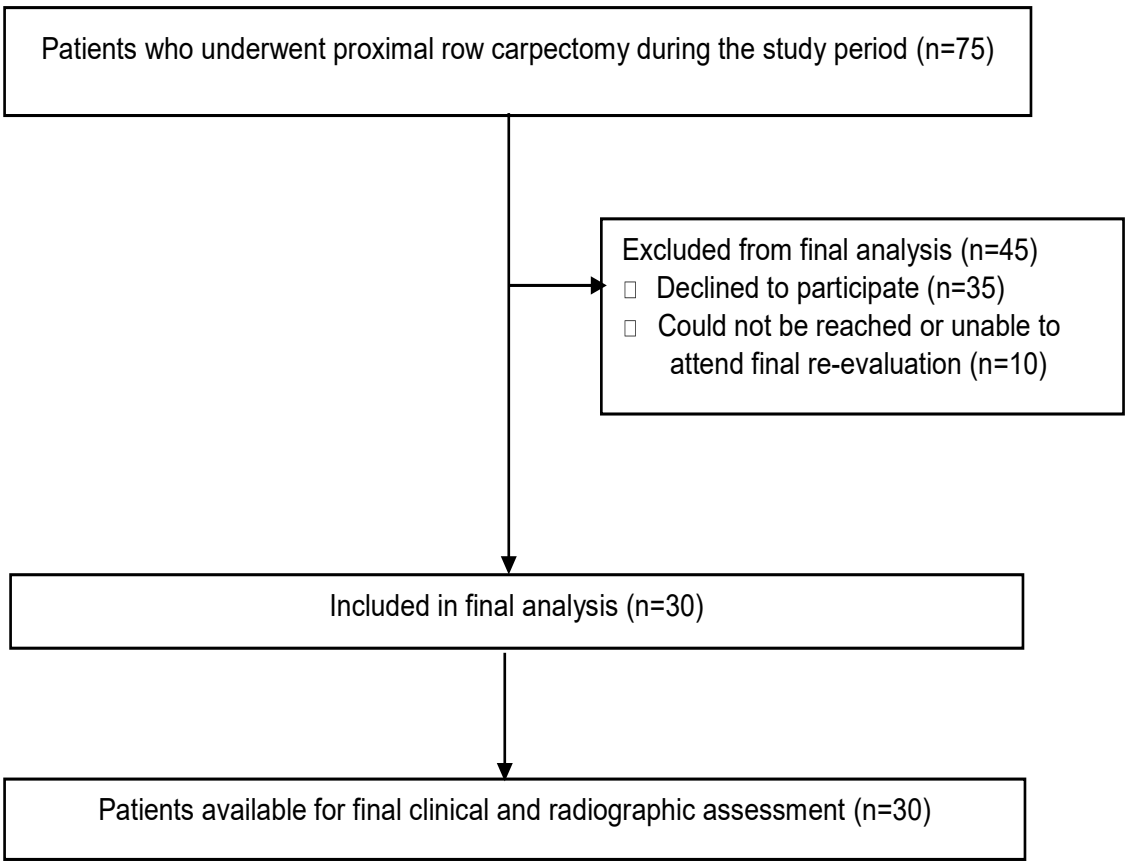

Figure 1. STROBE-based patient selection flowchart

Statistical analysis

Statistical analyses were performed using NCSS software. Descriptive statistics were used to summarize demographic, clinical, radiographic, and functional outcome variables. Continuous variables were presented as mean ± standard deviation, median, minimum, and maximum values, whereas categorical variables were presented as frequencies and percentages. The distribution of continuous variables was assessed using the Shapiro–Wilk test and box-plot inspection.

Because the main comparative analysis in the study evaluated flexion–extension percentage across Culp and Jebson radiographic stages, the Kruskal–Wallis test was used for this comparison. Post hoc pairwise comparisons were performed using the Mann–Whitney U test with Bonferroni correction. A *p*-value of <0.05 was considered statistically significant.

Results

The mean follow-up period for the patients was 107.2 months (range, 71 to 150 months). 19 (63.3%) of the patients were operated on with the dominant hand. Ten (33.3%) of the patients were manual workers, 12 (40.0%) were office workers, and the others were homemakers (26.6%). Among the 30 patients included in the final analysis, no additional or revision surgery was recorded during the follow-up period. Radiological assessment was made with the Culp and Jebson (C&J) classification according to postoperative anteroposterior radiographs, and results are shown in Table 1 [4, 5]. Pain, function, and range of motion were evaluated by the Mayo wrist score and were summarized in Table 1 [6].

Table 1. Baseline demographic characteristics and postoperative clinical outcomes

Age	Gender	Operative Hand	Dominant Hand	Profession	Diagnosis	% Pinch	% Strength	Mayo	% Fe	C&J
34	Male	Right	Right	Teacher	Kienböck	97.1	90.2	70	36.6	3
21	Female	Right	Right	Student	Kienböck	35.3	65.37	75	94.2	2
41	Female	Right	Right	Housewife	Arthrosis	93.5	97.1	75	43.7	2
58	Female	Right	Right	Housewife	Arthrosis	26	36.2	45	50	3
33	Male	Right	Right	Worker	Kienböck	31.2	32	40	9.3	3
60	Male	Right	Right	Butcher	Scaphoid Nonunion	12.9	8	40	9.3	1
31	Male	Right	Right	Self-Employment	Arthrosis	95.7	80.7	40	63.6	2
33	Male	Right	Right	Self-Employment	Kienböck	94.4	60.4	70	38.7	3
60	Female	Left	Left	Manager	Kienböck	57	50	50	42.3	2
49	Female	Right	Right	Housewife	Arthrosis	20	100	80	60.6	0
30	Male	Right	Left	Banker	Kienböck	15.1	22.2	55	54.5	1
52	Male	Left	Right	Farmer	SLAC	76.9	71.4	70	45.4	0

Table 1. Baseline demographic characteristics and postoperative clinical outcomes (contined)

Age	Gender	Operative Hand	Dominant Hand	Profession	Diagnosis	% Pinch	% Strength	Mayo	% Fe	C&J
36	Female	Right	Right	Housewife	Kienböck	52	66.6	70	45.4	1
39	Female	Right	Right	Banker	Kienböck	50	50	70	54.5	0
40	Female	Left	Right	Manager	Kienböck	20	16.6	65	54.5	2
63	Male	Left	Right	Manager	Scaphoid Nonunion	50	90.9	70	63.6	0
33	Male	Right	Right	Worker	Kienböck	66.6	93.7	80	63.6	2
46	Male	Right	Right	Worker	Arthrosis	58.3	50	40	56.2	3
36	Male	Right	Right	Worker	Kienböck	20	10	45	18.7	3
55	Male	Right	Right	Cook	Scaphoid Nonunion	75	61.5	75	34.3	2
29	Female	Left	Right	Farmer	Kienböck	40	13.3	60	25	3
57	Female	Left	Right	Housewife	Arthrosis	91.6	50	60	46.8	2
37	Male	Left	Right	Worker	Arthrosis	43.3	45.4	50	65.6	2
28	Male	Right	Right	Worker	Arthrosis	79.3	88.2	75	65.6	3
34	Female	Right	Right	Farmer	Kienböck	83.3	87.5	75	84.3	2
27	Female	Right	Left	Worker	Kienböck	69.6	45.4	70	56.2	1
47	Male	Left	Right	Worker	Perilunate Dislocation	70	66.6	65	62.5	3
73	Male	Left	Right	Dough Master	Arthrosis	44.4	50	70	31.2	3
23	Male	Right	Right	Worker	Kienböck	75.4	66.6	80	93.7	2
50	Male	Left	Right	Self-Employment	Scaphoid Nonunion	80	90	80	56.2	2

The Mayo Wrist Score measurements of the cases ranged from 40 to 80, averaging 63.67±13.7. The flexion-extension (FE) measurements of the cases ranged from 9.3° to 94.2°, with a mean of 50.87°±20.74°. While the highest mean FE percentage is seen in Stage II with 61.9°±19.93°, the lowest mean FE percentage is seen in Stage III with 39.38°±18.95° (Figure 2).). A statistically significant difference was found in flexion–extension percentage across Culp and Jebson radiographic stages (Kruskal–Wallis test, KW=6.151, *p*=0.046). Post hoc analysis using the Mann–Whitney U test with Bonferroni correction showed that this difference was significant between Stage II and Stage III.

The pinch and grip strength evaluations showed that the operated wrist's strength was slightly lower than the contralateral wrist's strength. However, these values indicated that functional hand strength was preserved postoperatively in the final assessment cohort.

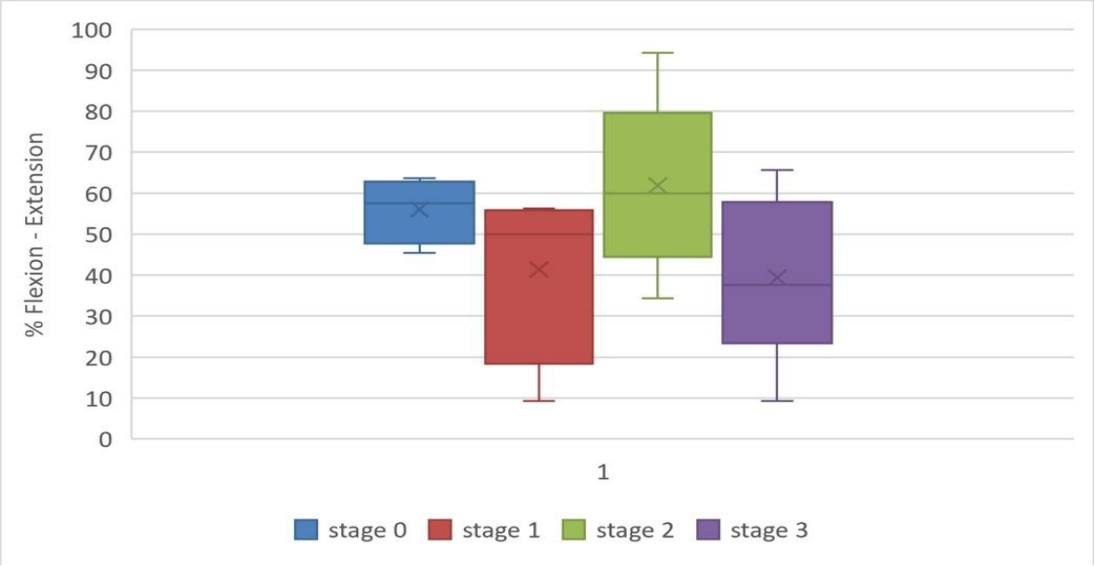

Figure 2. Flexion-extension percentage (%FE) distribution according to the Culp and Jebson (C&J) classification

Discussion

The study aimed to investigate the mid-term follow-up results of patients who underwent Proximal Row Carpectomy (PRC) surgery for wrist arthritis. The study in-cluded 30 patients who had undergone PRC with a minimum follow-up of 71 months. The results showed that the average follow-up period was 107.2 months, and no additional or revision surgery was recorded among the 30 patients included in the final analysis. The Mayo wrist score, range of motion, pinch, and grip strength were evaluated, and radiological assessments were made according to the postoperative anteroposterior radiographs.

The study results indicated that PRC is a viable surgical option for patients with wrist arthritis. PRC is a well-established surgical technique for treating wrist arthritis, used for many years. In the present study, the surgery was performed under general anesthesia with the help of a tourniquet on the hand table. The posterior interosseous nerve (PIN) was resected in all cases to achieve partial wrist denervation. Tahta and colleagues found no benefits of combining proximal row carpectomy with PIN neurectomy for wrist disorders [7]. A quadrangular capsulotomy was performed between the third and fourth extensor compartments, and the resection started from the lunate bone, followed by the triquetrum and scaphoid.

Although posterior interosseous nerve neurectomy was performed in all patients in the present series, it should be acknowledged that PIN neurectomy is not a routine component of all proximal row carpectomy procedures.

The rationale for adding PIN neurectomy was to contribute to partial wrist denervation and postoperative pain control. However, the independent effect of PIN neurectomy on clinical outcomes cannot be determined in the present study because there was no control group treated with PRC alone. Previous comparative studies have questioned whether the addition of PIN neurectomy provides a measurable clinical benefit over PRC alone. Therefore, the postoperative pain relief and functional status observed in this cohort should be interpreted as the outcomes of PRC combined with PIN neurectomy rather than PRC alone.

The Culp and Jebson classification is a method used to evaluate the results of PRC surgery. This classification is based on postoperative anteroposterior radiographs and includes three stages: I, II, and III. These stages are determined by the degree of bone collapse and the severity of the disruption in the radiocarpal joint. The Culp and Jebson classification is widely accepted among hand surgeons and allows for objective evaluation of the results of PRC surgery. In this study, radiological evaluations using this classification showed that most patients were in Stage II and demonstrated an improvement in the degree of radiocarpal joint collapse after PRC surgery.

Rettig and Raskin used temporary K-wire fixation to secure carpal alignment and prevent postoperative ulnar carpal translocation [8]. We did not use any fixation technique. All patients used a cast splint for 4 weeks. Studies in the literature describe the application of capsular interposition during proximal row carpectomy, and they found that it is an option for advanced arthritis of the wrist [9-11]. We did not need to apply this technique in our cases.

Chim and colleagues reported the results of the long-term follow-up of PRC [9]. Their study confirmed the long-term durability of PRC [12]. They had 21 failures requiring reoperation, and poorer results were associated with heavy manual labor. Among the 30 patients who were available for final clinical and radiographic evaluation, no revision surgery was recorded during the follow-up period. However, this finding should be interpreted cautiously because the clinical course and possible revision procedures of patients who were not available for final assessment could not be systematically evaluated. Although heavy manual labor has been associated with poorer outcomes after PRC in previous studies, the present cohort included a relatively limited number of heavy manual workers; therefore, no firm conclusion can be drawn regarding the effect of occupational demand on revision risk in this series. These findings suggest that PRC may be a useful motion-preserving option for selected patients with wrist arthritis. Nevertheless, because final clinical and radiographic assessment was available only for a subgroup of the initial cohort, the absence of revision surgery should be interpreted cautiously.

This study has several limitations. First, the retrospective design inherently limits the control over data completeness and may introduce information bias. Second, although 75 patients underwent Proximal Row Carpectomy during the study period, only 30 patients were available for final clinical and radiographic evaluation. This substantial attrition may have introduced selection bias, since patients who did not attend follow-up may have had different clinical outcomes, including persistent symptoms, dissatisfaction, revision surgery, or additional procedures performed elsewhere. Therefore, the absence of revision surgery should be interpreted only for the patients included in the final analysis and should not be generalized to the entire initial cohort. Third, standardized preoperative functional data, including Mayo wrist score, range of motion, and dynamometric grip and pinch strength measurements, were not consistently available in the medical records. As a result, preoperative-to-postoperative comparisons could not be performed, and the present study should be interpreted as an evaluation of mid- to long-term postoperative status rather than a definitive analysis of functional improvement. In addition, because PIN neurectomy was performed in all patients, the study design does not allow differentiation between the effects of PRC itself and the potential contribution of concomitant partial wrist denervation. Finally, the relatively small sample size and absence of a control group limit the generalizability of the findings and prevent direct comparison with alternative surgical procedures such as four-corner arthrodesis or total wrist arthrodesis.

In conclusion, proximal row carpectomy provided satisfactory mid- to long-term postoperative functional status in the patients who were available for final clinical and radiographic evaluation. No revision surgery was recorded among the 30 patients included in the final analysis. However, because of the substantial attrition from the initial cohort and the absence of standardized preoperative functional data, these findings should be interpreted cautiously. Further prospective studies with larger cohorts, standardized preoperative and postoperative assessments, and longer follow-up are needed to better define the durability and comparative effectiveness of PRC.

Ethics committee approval: This study was approved by the Pamukkale University, Non-Interventional Clinical Research Ethics Committee for the study (approved date: 02.10.2024 and approved number: E-60116787-020-590657).

Funding: No external funding was received for this study.

Institutional review board statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Pamukkale University School of Medicine (02.10.2024, No. 590657).

Informed consent statement: This retrospective study used data from patients who had provided written informed consent at hospital admission in accordance with institutional policy.

Data availability statement: All data generated or analyzed during this study are included in this manuscript. Additional anonymized data are available from the corresponding author upon reasonable request.

Authors' contributions: Conceptualization: A.N.A., A.F.D.; Methodology: A.N.A.; Software & Data curation: M.Y.,M.B.; Formal analysis: A.N.A.; Investigation: M.Y.,M.B.; Resources: M.Y.,M.B.; Writing — original draft: A.N.A.; Writing — review & editing: A.F.D.; Visualization: M.Y.,M.B.; Supervision: A.F.D. All authors have read and approved the final manuscript.

Conflicts of interest: The authors declare no conflicts of interest.

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