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Surgical Outcomes of Carpal Tunnel Syndrome in Rheumatologic Patients

Romatolojik Hastalarda Karpal Tünel Sendromu Cerrahisi Sonuçları

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Abstract

Objectives: Carpal tunnel syndrome (CTS) is a common condition that often coexists with rheumatologic diseases, leading to significant functional impairment and reduced quality of life. This study aimed to evaluate the outcomes of open decompression surgery for CTS in individuals with rheumatologic diseases, focusing on symptom severity and functional status improvements.

Materials and Methods: A retrospective analysis was conducted on 27 patients diagnosed with CTS and concomitant rheumatologic diseases. These patients underwent open decompression surgery under local anesthesia between January 2021 and June 2023. Outcomes were assessed using the Boston symptom severity scale (BSSS) and the Boston functional status scale (BFSS) preoperatively and at follow-up appointments postoperatively.

Results: Postoperative evaluations revealed significant improvements in both BSSS and BFSS scores. Patients reported marked relief in symptom severity and improvements in their ability to perform daily activities. These improvements were consistent across the cohort, indicating the reliability of surgical intervention.

Conclusion: The findings suggest that open decompression surgery is an effective and reliable method for managing CTS symptoms in patients with rheumatologic diseases. This surgical approach not only alleviates symptom severity but also enhances functional capabilities, contributing to a better quality of life.

Keywords: Carpal tunnel syndrome, rheumatologic diseases, open decompression surgery, Boston carpal tunnel questionnaire

Öz

Amaç: Karpal tünel sendromu (KTS), sıklıkla romatolojik hastalıklarla birlikte görülen ve belirgin fonksiyonel bozukluklara ve yaşam kalitesinde düşüşe neden olan yaygın bir durumdur. Bu çalışmada, romatolojik hastalıklara sahip bireylerde KTS için açık dekompresyon cerrahisinin sonuçları, semptom şiddeti ve fonksiyonel durum iyileşmeleri açısından değerlendirildi.

Gereç ve Yöntem: Ocak 2021 ile Haziran 2023 arasında lokal anestezi altında açık dekompresyon cerrahisi uygulanan, KTS ve eşlik eden romatolojik hastalık tanısı konmuş 27 hasta retrospektif olarak analiz edildi. Sonuçlar, ameliyat öncesinde ve ameliyat sonrası kontrol muayenelerinde Boston semptom şiddet ölçeği (BSSÖ) ve Boston fonksiyonel durum ölçeği (BFDÖ) kullanılarak değerlendirildi.

Bulgular: Ameliyat sonrası değerlendirmelerde hem BSSÖ hem de BFDÖ skorlarında anlamlı iyileşmeler gözlendi. Hastalar, semptom şiddetinde belirgin azalma ve günlük aktivitelerini gerçekleştirme yeteneklerinde iyileşme bildirdi. Bu iyileşmeler tüm hasta grubunda tutarlı bir şekilde gözlemlendi ve cerrahi müdahalenin güvenilirliğini ortaya koydu.

Sonuç: Bulgular, açık dekompresyon cerrahisinin romatolojik hastalıklara sahip hastalarda KTS semptomlarının yönetiminde etkili ve güvenilir bir yöntem olduğunu göstermektedir. Bu cerrahi yaklaşım, yalnızca semptom şiddetini azaltmakla kalmayıp, fonksiyonel yetenekleri de geliştirerek daha iyi bir yaşam kalitesine katkıda bulunmaktadır.

Anahtar Kelimeler: Karpal tünel sendromu, romatolojik hastalıklar, açık dekompresyon cerrahisi, Boston karpal tünel anketi

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Introduction

Carpal tunnel syndrome (CTS) is a common peripheral nervous system disorder and the most frequently observed entrapment neuropathy. It occurs in approximately 23% of rheumatoid arthritis (RA) patients and may present as the initial symptom of the disease (1). CTS is more prevalent in women than in men and is most commonly diagnosed between the ages of 45 and 60 (2). It is characterized by pain, numbness, and motor dysfunction, particularly in the wrist and hand, resulting from compression of the median nerve within the carpal tunnel.

The prevalence of CTS increases in individuals with rheumatologic diseases due to systemic inflammation and progressive tissue damage (3). Rheumatologic diseases associated with CTS include RA, psoriatic arthritis (PsA), systemic lupus erythematosus (SLE), systemic sclerosis, and Sjögren's syndrome. The pathogenesis of these rheumatologic diseases is known to be associated with the presence of autoantibodies (4).

In RA patients, CTS symptoms may not be pronounced, as chronic pain, joint damage, and increased disability commonly observed in these individuals can mask the specific signs and symptoms of CTS (5-9). Moreover, patients often fail to clearly express CTS-specific symptoms as they may have adapted to the functional limitations imposed by their disease.

PsA, like RA, is an inflammatory erosive arthritis affecting peripheral joints. Studies have shown that the prevalence of CTS is higher in PsA patients compared to healthy controls, with electrodiagnostic examinations detecting CTS in 30.76% of PsA patients (10).

Behçet's disease is a multisystemic condition with an unknown pathogenesis (11). It is characterized by recurrent oral and genital ulcers, skin lesions, uveitis, joint, vascular, and neurological manifestations. Peripheral neuropathy, including CTS, is observed in 2.2% to 49% of Behçet's disease cases but does not show a significant correlation with disease activity based on electromyography (EMG) findings (12).

In ankylosing spondylitis, central nervous system involvement is more common than peripheral nerve involvement. However, electrophysiological studies have shown evidence of peripheral nerve involvement in 40.6% of ankylosing spondylitis patients (13,14).

Familial Mediterranean fever (FMF) is a hereditary disease characterized by systemic organ involvement due to amyloid fibril deposition. It is particularly prevalent in the Middle East and Eastern Mediterranean regions (15). Amyloid deposits, especially in the transverse carpal ligament, are a rare cause of CTS. Reports of CTS cases related to familial amyloidosis associated with FMF are limited (16). Bilateral CTS can often be an early clinical sign of amyloid deposition. Pathological examination for amyloid deposits should be considered during CTS surgeries, especially in these cases (17). In this study, CTS was observed in three FMF patients (11%), which may be attributed to the geographical prevalence of FMF. This finding emphasizes the importance of considering amyloid deposition during CTS surgery in such populations.

Given the increasing prevalence of CTS, understanding its underlying mechanisms and ensuring early diagnosis are critical for minimizing unnecessary pain and costs. Therefore, evaluating every RA patient for CTS is essential. However, there is limited information in the literature on the effectiveness and outcomes of surgical interventions in this patient group. This study aims to examine the impact of CTS surgery on symptom severity and functional status in patients with rheumatologic diseases.

Materials and Methods

This retrospective study included rheumatologic patients diagnosed with CTS who underwent open surgical treatment at the Hand Surgery Clinic of the Orthopedics and Traumatology Department in a University Hospital between January 2021 and June 2023.

Inclusion Criteria

Patients aged 18 years and older diagnosed with CTS based on clinical examination and confirmed by EMG.

Only patients with moderate and severe CTS, as determined by EMG findings, were included. Mild CTS cases were excluded due to the typically conservative management approach.

Patients with underlying rheumatologic diseases, including RA, SLE, and ankylosing spondylitis, were included to evaluate the impact of surgery on this specific population.

Exclusion Criteria

Patients with mild CTS or those without EMG confirmation of CTS.

Patients with prior carpal tunnel release surgery or other hand and wrist surgeries that could affect postoperative outcomes.

Cases with concomitant neurological disorders (e.g., cervical radiculopathy, peripheral neuropathy) that could confound symptom interpretation.

Incomplete medical records or lack of postoperative follow-up data.

Grouping and Classification

Based on EMG results, patients were categorized into moderate and severe CTS groups.

Subsequently, the patients were classified according to the Stanley classification 6 (Table 1), which considers clinical and anatomical findings to determine the severity and progression of CTS.

Ethical Considerations

Informed consent was obtained from all patients in accordance with the 1975 Declaration of Helsinki. The study protocol complied with the ethical guidelines of the institution where the study was conducted and was approved by the Ankara University Human Research Ethics Committee (approval number: i11-898-24, date: 13.01.2025).

Surgeries were performed under local anesthesia using the WALANT (wide awake local anesthesia no tourniquet) technique. A standard zigzag carpal tunnel incision was made, extending 2-3 cm proximally to the wrist crease between the palmaris longus and flexor carpi ulnaris tendons. Following skin incision, the palmar fascia, antebrachial fascia, and transverse carpal ligament were divided longitudinally. Careful median nerve neurolysis was performed, separating the nerve from the tenosynovium and flexor tendons (Figure 1). Tenosynovectomy of the flexor pollicis longus, flexor digitorum superficialis, and flexor digitorum profundus tendons was not performed. Bone protrusions from the volar surface of the carpal bones (especially the scaphoid) were not investigated for flexor tendon rupture risk. Patients were followed according to routine postoperative care protocols for idiopathic CTS surgery.

The Boston Carpal Tunnel Questionnaire (BCTQ), a patient-reported outcome measure, was utilized to evaluate symptom severity and functional status in patients with CTS. Assessments were conducted using the Boston symptom severity scale (BSSS) and the Boston functional status scale (BFSS) at multiple time points: preoperatively and postoperatively at 1, 3, and 6 months.

Rheumatology consultations were requested for all patients using antirheumatic drugs to ensure suspension of these medications preoperatively and resumption postoperatively.

In this study, statistical analyses were performed using Jamovi version 2.3.2. The normality of data distribution was evaluated using the Shapiro-Wilk test. Descriptive statistics for numerical data are reported as mean ± standard deviation and range (minimum-maximum values). Categorical data are presented as percentages. To compare more than two groups, Kruskal-Wallis was used for non-normally distributed data and one-way ANOVA test was used for normally distributed data. The Wilcoxon test and Student's t-test were used to compare repeated measures on the same subjects. Statistical significance was determined at a 95% confidence interval, with $p<0.005$ considered statistically significant.

Results

The study included 27 patients with a mean age of 58.62±8.48 years. The majority of patients were female (96.3%, n=26), and 78% were right-hand dominant. CTS affected the left side in 51.8% of cases and the right side in 48.2%. Among the patients, 14 had RA, 6 had ankylosing spondylitis, 3 had familial Mediterranean fever, 2 had Behçet's disease, and 2 had PsA.

Fourteen patients were diagnosed with moderate CTS, and thirteen with severe CTS. According to the Stanley classification, 10 patients were categorized in group A, 11 in group B, and 6 in group C. No patients were classified in groups D or E. The mean duration of symptoms was 28.51±19.91 months (Table 2).

Significant improvements were observed in both BSSS and BFSS scores following surgery. The mean BSSS score decreased from 3.23±0.61 preoperatively to 1.92±0.67 at 1 month postoperatively, 1.76±0.67 at 3 months, and 1.82±0.78 at 6 months. Similarly, the BFSS score decreased from 3.43±0.9 preoperatively to 2.56±1.04 at 1 month, 1.9±0.8 at 3 months, and 1.93±0.92 at 6 months (Table 3).

Analysis based on the Stanley classification revealed a significant difference in preoperative BSSS and BFSS scores among the groups. Post hoc analysis indicated that this difference primarily originated from group B. However, this difference was no longer observed in the 6-month postoperative evaluations (Table 4).

Table 1: Stanley classification

Types	Characteristics of the disease
A: Destructive type	Slow progression type without significant osteoarthritis
B: Reactive type	Slow progressive type with marked osteoarthritis
C: Ligamentous type	Progressive soft tissue disruption
D: Mutilans type	Progressive bony destruction
E: Juvenile type	Spontaneous intercarpal ankylosis
Stages	**Description**
I	Early erosions with reducible translation
II	Translation/subluxation with non-reducible radiocarpal osteoarthritis
III	Midcarpal joint loss
IV	Disorganized wrist with significant bone loss

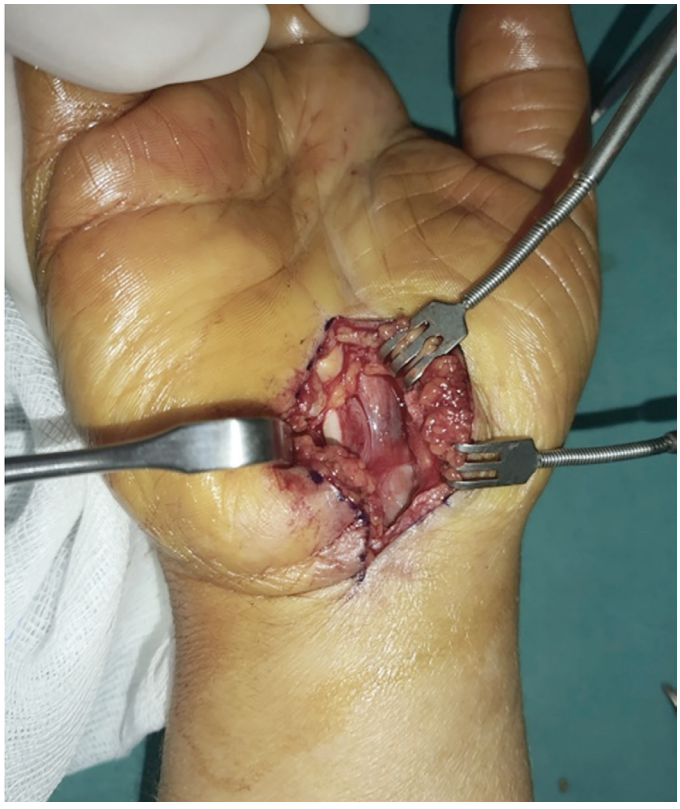

Figure 1: Extended open surgical approach in carpal tunnel syndrome surgery. Hourglass deformity and bluish discoloration of the nerve due to compression

Table 2: The demographic and clinical data	
Age (years, mean ± SD)	58.62±8.48 (44-77)
Gender (n, %) Female Male	 26 (96.3%) 1 (3.7%)
Side (n, %) Left Right	 14 (51.8%) 13 (48.2%)
Dominant hand (n, %) Left Right	 6 (22%) 21 (78%)
Disease (n, %) Rheumatoid arthritis Ankylosing spondylitis Familial mediterranean fever Behçet's disease Psoriatic arthritis	 14 (51.8%) 6 (22.2%) 3 (11.1%) 2 (7.4%) 2 (7.4%)
Carpal tunnel syndrome severity (n, %) Moderate Severe	 14 (51.8%) 13 (48.2%)
Stanley classification (n, %) A B C D E	 10 (37%) 11 (40.7%) 6 (22.2%) 0 (0%) 0 (0%)
Symptom duration (months, mean ± SD)	28.51±19.91 (6-72)
SD: Standard deviation	

Discussion

Summary of Key Findings

This study demonstrated that open CTS surgery in patients with rheumatologic diseases is effective in alleviating symptoms and improving functional outcomes. Significant improvements were observed in both symptom severity and quality of life following surgery. These findings support the use of open surgical intervention as a viable treatment option for moderate to severe CTS in this patient population.

However, the long-term impact of systemic inflammation and tissue damage associated with rheumatologic diseases on surgical outcomes remains uncertain and requires evaluation in larger patient cohorts. Despite significant functional gains, the heterogeneity of the patient group and the absence of postoperative EMG evaluations limit the generalizability of the results.

This article highlights critical points in the etiopathogenesis and diagnostic process of CTS in rheumatologic diseases. In RA, autoantibodies are responsible for persistent synovitis and widespread inflammation (7). CTS is the most common neurological finding in RA (8). Studies have reported that CTS develops more frequently in RA patients with flexor tendinopathy than in those without flexor tendinopathy (1). For diagnosis, ultrasound offers higher accuracy in CTS detection, particularly in patients with clinical symptoms and negative nerve conduction study results (9). In this study, the diagnoses of RA patients were clinically confirmed and supported by EMG findings.

Given the limitations of clinical tests, complementary EMG is recommended for suspected CTS in patients with rheumatologic diseases. In RA and PsA, EMG helps assess CTS severity and guides treatment decisions (8,18). EMG also helps identify the location and severity of nerve compression, monitor postoperative outcomes, and rule out conditions like cervical radiculopathy, brachial plexopathy, and peripheral neuropathy (19). CTS diagnosis, even in the presence of polyneuropathy, is not a contraindication for surgery (1). EMG-based classifications of CTS severity include severe CTS (Severe: Absence of sensory response and abnormal distal motor latency [DML]), moderate CTS (Moderate: Anormal finger-wrist conduction and abnormal DML), and mild CTS (Mild: Abnormal finger-wrist conduction with normal DML) (20). Regardless of CTS severity on EMG, all patients in this study showed significant postoperative functional improvement. However, the lack of postoperative EMG evaluation is a limitation.

Table 3: Boston carpal tunnel questionnaire results preoperatively and at 1, 3, and 6 months postoperative				
	Boston symptom severity scale (Mean ± SD)		Boston functional status scale (Mean ± SD)	
Preoperative	3.23±0.61		3.43±0.9	
Postoperative 1-month	1.92±0.67	p^1=0.000	2.56±1.04	p^1=0.004
Postoperative 3-month	1.76±0.67	p^2=0.066	1.90±0.80	p^2=0.011
Postoperative 6-month	1.82±0.78	p^3=0.593	1.93±0.92	p^3=0.839
p^1: Comparison between preoperative and postoperative 1 month, p^2: Comparison between postoperative 1 month and postoperative 3 months, p^3: Comparison between postoperative 3 months and postoperative 6 months SD: Standard deviation				

Table 4: Comparison of symptom duration, preoperative, and postoperative BSSS and BFSS at 6 months according to stanley staging				
	Stanley group A (Mean ± SD)	Stanley group B (Mean ± SD)	Stanley group C (Mean ± SD)	p-value
Symptom duration (months)	23.5±19.35	36.72±18.89	21.83±20.53	0.209
Preoperative BSSS	2.93±0.24	3.57±0.46	3.10±0.47	**0.044**
Preoperative BFSS	3.15±0.57	4.01±0.6	2.87±1.27	**0.014**
Postoperative 6-month BSSS	1.74±0.69	2.14±0.9	1.36±0.44	0.132
Postoperative 6-month BFSS	1.66±0.69	2.14±1.02	2±1.1	0.496
BSSS: Boston symptom severity scale, BFSS: Boston functional status scale, SD: Standard deviation				

Clinical Implications

Rheumatologic diseases involve complex autoimmune mechanisms that are not yet fully understood. Rheumatoid wrists exhibit synovial proliferation, joint erosions, and ligament laxity, leading to decreased carpal tunnel size and increased pressure. Consequently, median nerve and vascular compression result in disrupted axonal transport and ischemia. Additional potential causes of CTS in rheumatologic diseases include drug toxicity, vasculitis, and amyloidosis (21). Long-standing RA can result in synovial proliferation and tendon damage, causing histopathological changes. In RA, synovial hyperplasia and the formation of invasive synovial tissue, known as pannus, can reduce carpal tunnel space and lead to CTS compression (22). Prolonged compression results in ischemia, venous congestion, and local metabolic changes in the median nerve. Over time, inflammation in the joints leads to joint destruction, cartilage loss, and bone erosions, altering the carpal tunnel structure (23). Symptoms of CTS are reported to resolve rapidly after decompression surgery, highlighting the ischemic nature of the injury (1,3). This study aligns with previous research, showing improved postoperative BCTQ scores following standard open median nerve decompression surgery in all patients (24). Patients with joint arthrosis on Stanley classification exhibited worse BCTQ scores. However, the results demonstrated that standard open decompression of the median nerve is successful even in the presence of arthrosis in the wrist joints of rheumatologic patients.

In rheumatologic diseases, diagnosing flexor tenosynovitis can be challenging when joint stiffness restricts passive movement, making it difficult to distinguish between limited movement caused by joint stiffness and flexor tendon involvement. Flexor tenosynovitis causes swelling in the volar aspect of the distal forearm and wrist, which is typically less apparent than dorsal tenosynovitis. Flexor tendon function should be evaluated due to the risk of tendon rupture. In RA patients with minimal flexor tenosynovitis, carpal tunnel release can be performed using the same techniques as in idiopathic CTS cases (1). In this study, the degree of flexor tenosynovitis was not addressed, focusing solely on median nerve decompression.

This study's primary advantage was the absence of Stanley type D patients with progressive bone destruction. However, preoperative and intraoperative evaluation of flexor tendons is crucial in Stanley type C patients with soft tissue damage. Future studies comparing median nerve decompression with and without flexor tenosynovectomy in type C patients are needed.

Study Limitations

Several limitations of this study must be acknowledged:

Sample Size and Heterogeneity: The relatively small sample size and the heterogeneity of the patient population limit the generalizability of the findings. Future studies should include larger and more homogeneous cohorts to validate these results.

Absence of Postoperative EMG Evaluation: The lack of postoperative EMG assessments restricts the objective evaluation of surgical effectiveness. Incorporating EMG in future studies would provide a more comprehensive analysis of nerve recovery and functional outcomes.

Retrospective Design: As a retrospective study, potential biases related to data collection and patient recall could not be

completely eliminated. A prospective study design would allow for more controlled and systematic data collection.

Flexor Tenosynovitis Assessment: This study focused solely on median nerve decompression and did not evaluate the degree of flexor tenosynovitis, which could influence surgical outcomes. This should be considered in future research, especially in patients with RA.

Recommendations for Future Research

To build on the findings of this study, the following recommendations are made for future research:

Larger and Homogeneous Sample Groups: Future studies should focus on larger, more homogeneous patient populations, preferably with a single type of rheumatologic disease, to enhance the validity and generalizability of the results.

Prospective and Long-term Follow-up Studies: Long-term follow-up studies and prospective designs are recommended to better understand the durability of functional improvements and complication rates.

Incorporation of Postoperative EMG Assessments: Including EMG evaluations alongside clinical outcome measures would provide a more objective and comprehensive assessment of surgical effectiveness.

Evaluation of Flexor Tenosynovitis: Future studies should compare median nerve decompression with and without flexor tenosynovectomy, particularly in Stanley type C patients with soft tissue damage. This would provide valuable insights into the optimal surgical approach for this subgroup.

Multidisciplinary Approach and Personalized Treatment Plans: Given the systemic and complex nature of rheumatologic diseases, future research should explore personalized surgical and rehabilitation strategies involving a multidisciplinary team. This approach could optimize functional recovery and minimize postoperative complications.

Conclusion

Open CTS surgery is an effective method for alleviating symptoms and achieving functional improvement in individuals with rheumatologic diseases. These findings highlight the significance of CTS surgery within the context of rheumatologic conditions. Early surgical intervention may lead to better outcomes and improved patient quality of life.

Ethics

Ethics Committee Approval: Ethical approval was obtained from the Ankara University Human Research Ethics Committee (approval number: i11-898-24, date: 13.01.2025).

Informed Consent: Informed consent was obtained from all patients.

Footnotes

Authorship Contributions

Surgical and Medical Practices: U.B., Concept: U.B., Design: U.B., Data Collection and/or Processing: U.B., Analysis and/or Interpretation: Y.K., Literature Search: Y.K., Writing: Y.K.

Conflict of Interest: According to the authors, there are no conflicts of interest related to this study.

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