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The Relation of Comorbidities with Outcomes of Carpal Tunnel Release Surgery

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Keywords

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Abstract

Objective: Systemic diseases negatively affect carpal tunnel syndrome (CTS). Therefore, it is logical to hypothesize that systemic diseases may also be related to poor post-operative outcomes. Herein, the authors aimed to address the relationship between systemic diseases and carpal tunnel release outcomes.

Methods: Cases with carpal tunnel release were grouped and compared regarding to presence or absence of systemic diseases such as rheumatoid arthritis, diabetes mellitus, hypothyroidism, obesity, and hypertension. In this study, 48 cases were included (24 with and 24 without systemic diseases). The Boston Carpal Tunnel Questionnaire was used to evaluate the symptoms and functions in cases. Its higher scores indicate more negative symptoms and functional capacity.

Results: The groups with and without systemic diseases exhibited similarity in age and gender scores. Given symptoms and functions, cases with systemic diseases had significantly higher pre- and post-operative scores than cases without systemic diseases. In both groups, the scores from post-operative period were significantly lower than those in the pre-operative period ($p < 0.001$). However, the groups exhibited similarity in mean difference in symptom and function scores between pre- and post-operative periods. Also, there were significant positive correlations between pre- and post-treatment scores.

Conclusion: This study demonstrated that systemic diseases are negatively associated with poor pre- and post-operative outcomes in CTS. These findings may contribute to more realistic post-operative expectations.

Introduction

Carpal tunnel syndrome (CTS) is the most common encountered compressive neuropathy and is characterized by compression symptoms of the median nerve at the wrist. Clinically, CTS commonly leads to nocturnal pain, numbness, and paresthesia in the first three fingers and the radial half of the fourth finger of the affected hand¹. Risk factors associated with CTS are wrist trauma, repetitive wrist working, lesion or inflammation in carpal tunnel, alcohol consumption, smoking, female gender, white race, aging, menopause, hypermobility, pregnancy, hormonal therapy, and contraceptive drugs²⁻⁵. In addition, many systemic diseases, such as rheumatoid arthritis, diabetes mellitus, hypothyroidism, obesity, acromegaly and hypertension, can be actively involved in CTS²⁻⁵.

The diagnosis of CTS is based on the clinical signs and complaints, but electromyograms and ultrasounds can be used to confirm clinical diagnosis⁶. Therapeutic approaches for CTS are conservative

procedures (e.g., splinting, cortisone injection, and physical therapy) and surgical interventions, including endoscopic and open carpal tunnel release⁷⁻⁹. Currently, the superiority of surgical and conservative treatment options over each other has not been clearly established¹⁰. However, surgical intervention has been demonstrated to be an effective option for severe CTS⁹. Therefore, surgery may be an appropriate option for patients with severe complaints, a low adherence to conservative options, and a high partiality for recovery, while patients with mild complaints who have not tested conservative options and are hesitant about surgery may opt for non-surgical options¹⁰.

The satisfaction related to carpal tunnel release surgery may be low in many patients. For these patients, a new evaluation considering differential diagnoses is recommended¹¹. On the other hand, the identification of possible factors associated with complaints of CTS after surgery is crucial for optimized pre-operative management and better post-operative outcomes¹¹. However, there is limited literature on the systemic factors influencing CTS complaints after surgery. Previous studies have mostly focused on local causes related to the wrist and carpal tunnel, and iatrogenic injury, inadequate decompression, concomitant cubital tunnel surgery, pre-operative severe symptoms and low grip strength, scar or synovitis have been reported as risk factors for poor post-operative outcomes¹¹⁻¹⁶. On the other hand, although many systemic diseases have been shown to be actively involved in CTS²⁻⁵, their roles in the complaints after surgery have not been evaluated adequately. Given the negative effects of many systemic diseases on CTS, it is sensible to hypothesize that these systemic diseases may be related to poor post-operative outcomes. Thus, the authors aimed to evaluate the relationship between systemic diseases and carpal tunnel release outcomes.

Materials and Methods

This comparative study was conducted at the Van Yuzuncu Yil University Hospital, Department of Plastic and Reconstructive Surgery, considering the Declaration of Helsinki perspective. Ethics committee approval was obtained retrospectively (dated 10/05/2024 and number 2024/05-21).

Cases who had undergone carpal tunnel release were invited by telephone to participate in this study. Those who accepted the invitation and gave written consent were included in this study. Cases evaluated for this study were grouped and compared regarding to presence or absence of systemic diseases. To eliminate the effects of age and gender, which are associated with CTS²⁻⁵, the groups were matched in terms of these parameters. Accordingly, 48 cases who underwent carpal tunnel release were included in this study (24 cases with and 24 cases without systemic diseases).

Considering that rheumatoid arthritis, diabetes mellitus, hypothyroidism, obesity, and hypertension are common systemic diseases associated with increased CTS risk²⁻⁵, the study focused on the presence or absence of these conditions, specifically noted for each case. Thus, only five systemic conditions were included in this study. Additionally, these were the most common systemic diseases and the sample size for the rarer conditions was too small. In addition, demographic characteristics and clinical features, such as age, gender, weight, height, BMI, postoperative duration, and working status, were recorded.

The Boston Carpal Tunnel Questionnaire (BCTQ) was used to evaluate the symptoms and functions in cases with carpal tunnel release surgery. It has been demonstrated that the BCTQ is reliable and functional in Turkish cases with CTS¹⁷. Also, the BCTQ has reliability and validity for evaluating the symptomatology and functionality in cases with carpal tunnel release surgery¹⁸. The BCTQ contains 19 items, 11 assessing symptoms and eight assessing functions^{17,18}. Each item has five separate answers corresponding to scores between 1 and 5. The average score is obtained by separately dividing the scores of symptoms and functions by the number of questions, varying from 1 to 5. Thus, the mean score is calculated separately for symptoms and functions, where higher scores indicate more negative symptoms and functional capacity^{17,18}.

Inclusion and Exclusion Criteria

Cases with carpal tunnel release surgery, adults aged 18 to 64 years, and cases who obtained written informed consent for the present study were included in this study. On the other hand, geriatric cases (aged >64 years), problems affecting wrist structure, pregnancy, and psychological disorders were excluded from this study.

Statistical Analysis

The variables were statistically analyzed using IBM SPSS Statistics version 27.0. The Shapiro-Wilk test was applied to data for the normality assumption of continuous variables. Some variables (postoperative duration and postoperative function) in both groups and some variables (age, BMI, and postoperative symptom) in the group including systemic diseases exhibited skewed distribution. According to the normality test results, the parametric (Independent t and Paired t) and non-parametric tests (Mann-Whitney U and Wilcoxon) were applied. The tests applied to variables are given below the tables. The continuous variables were given as mean±SD (min.-max.). A p<0.05 was accepted as statistically significant level.

Results

The groups were found to be similar in terms of

demographics and clinical features, including age (p=0.079), gender (p=1.0), weight (p=0.173), height (p=0.246), post-operative duration (p=0.211), and working status (p=1.0). However, the group including systemic diseases had higher scores of BMI than the group without systemic diseases [28.99±2.17 (25.00-32.05) versus 26.39±2.21 (21.63-29.97)] (p<0.001) (Table 1).

Given the comparative statistics for symptoms, the group with systemic diseases had significantly higher pre-operative [3.19±0.73 (1.73-4.55) vs 2.68±0.29 (2.09-3.09), p=0.003] and post-operative [1.63±0.58 (1.0-4.0) vs 1.34±0.19 (1.0-1.82), p=0.019] scores than the group without systemic diseases. In the both groups, the scores from post-operative period were significantly lower than those in the pre-operative period (p<0.001). However, the groups exhibited similarity in mean difference in symptom scores between pre- and post-operative periods [1.56±0.59 (0.09-2.55) vs 1.34±0.23 (0.82-1.73)] (p=0.094) (Table 2).

Considering the comparative statistics regarding functions, the group with systemic diseases had significantly higher pre-operative [3.34±0.72 (1.88-4.50) vs 2.84±0.37 (2.13-3.38), p=0.005] and post-operative [1.75±0.55 (1.0-3.63) vs 1.41±0.20 (0.13-1.88), p=0.003] scores than the

group without systemic diseases. In both groups, the scores from post-operative period were significantly lower than those in the pre-operative period (p<0.001). However, the groups exhibited similarity in mean difference in function scores between pre- and post-operative [1.59±0.43 (0.88-2.50) vs 1.43±0.32 (0.88-1.88)] (p=0.150) (Table 3).

In addition, the Spearman correlation analyses demonstrated that there were significant positive correlations between pre- and post-operative scores in terms of both symptom (n=48, r=0.814, and p<0.001) and function (n=48, r=0.774, and p<0.001).

Discussion

In this comparative study, cases who underwent carpal tunnel release were grouped regarding to presence or absence of systemic diseases and compared in terms of CTS complaints. The background of this study was based on the hypothesis that systemic diseases may be related to poor post-operative outcomes, considering their negative effects on CTS²⁻⁵. Accordingly, the authors evaluated the relationship between systemic diseases and carpal tunnel release outcomes. As a result, operated CTS cases with systemic diseases had worse both pre- and post-operative outcomes compared to those without systemic diseases.

Table 1: Demographic characteristics and clinical features of the groups

	Patients with systemic diseases (n=24)	Patients without systemic diseases (n=24)	P
Age, years	56.13±8.38 (35-64)	52.79±7.19 (40-64)	0.079*
Gender, F/M	19/5	19/5	1.0**
Weight, kg	78.17±10.86 (63-104)	73.92±10.42 (59-98)	0.173***
Height, m	1.64±0.1 (1.48-1.83)	1.67±0.08 (1.53-1.86)	0.246***
BMI, kg/m ²	28.99±2.17 (25.00-32.05)	26.39±2.21 (21.63-29.97)	<0.001***
Postoperative duration, month	34.88±31.40 (4.0-111.0)	23.92±21.84 (2.0-104.0)	0.211*
Working status, Housewife/Others	17/7	17/7	1.0**

Postoperative duration in both groups, and age and BMI in the group including systemic diseases exhibited skewed distribution.

*The Mann-Whitney U test; **The Fisher's Exact test; ***The Independent samples t-test

Table 2: The symptom scores of the two groups

BCTQ score	Patients with systemic diseases (n=24)	Patients without systemic diseases (n=24)	p
Symptom (pre-op.)	3.19±0.73 (1.73-4.55)	2.68±0.29 (2.09-3.09)	0.003*
Symptom (post-op.)	1.63±0.58 (1.0-4.0)	1.34±0.19 (1.0-1.82)	0.019**
p	<0.001***	<0.001****	
Difference	1.56±0.59 (0.09-2.55)	1.34±0.23 (0.82-1.73)	0.094*

Postoperative symptom in the group including systemic diseases exhibited skewed distribution.

*The Independent-Samples T test; **The Mann-Whitney U test; ***The Wilcoxon test; ****The Paired t test

Table 3: The function scores of the two groups

BCTQ score	Patients with systemic diseases (n=24)	Patients without systemic diseases (n=24)	p
Function (pre-op.)	3.34±0.72 (1.88-4.50)	2.84±0.37 (2.13-3.38)	0.005*
Function (post-op.)	1.75±0.55 (1.0-3.63)	1.41±0.20 (0.13-1.88)	0.003**
p	<0.001***	<0.001***	
Difference	1.59±0.43 (0.88-2.50)	1.43±0.32 (0.88-1.88)	0.150*

Postoperative function in both groups exhibited skewed distribution.

*The Independent-Samples T test; **The Mann-Whitney U test; ***The Wilcoxon test

The findings of this study may be used to predict outcomes after surgery and contribute to more realistic post-operative expectations.

To date, some systemic factors affecting CTS in non-operated patients have been documented²⁻⁵. Namely, the relationship between systemic diseases and CTS has been demonstrated in non-operated cases²⁻⁵. However, when considering operated cases, previous studies have mostly focused on local risk factors for poor post-operative outcomes¹¹⁻¹⁶. Therefore, this study has an original aspect because it addresses the relationship between systemic diseases and post-operative CTS complaints.

Although some pre-operative factors have been addressed to predict post-operative outcomes¹⁹⁻²¹, have the role of systemic diseases is not clear in cases with surgery. The present study revealed that the investigated systemic diseases are negatively associated with CTS at both pre- and post-operative periods, and there were significant positive correlations between pre- and post-treatment scores in terms of both symptom and function. These findings suggest that systemic diseases continue to be risk factors for poor outcomes after surgery as they were before surgery. Also, these findings seem consistent with the results of Jansen et al.²², who showed that the pre-operative clinical severity of CTS was the most important factor in predicting improvement after surgery. Similarly, Yetiş et al.²³ have reported that high pain and symptom severity and low hand grip strength are important factors for functional status in operated CTS cases. In addition, Fernandes et al. have recommended re-evaluation in case of failed surgery for CTS and drew attention to local factors such as scar, fibrosis, and adhesions¹¹.

In addition, this study revealed that carpal tunnel release surgery is effective in both cases with and without systemic diseases when considering pre- and post-operative comparisons. Considering the degree of effect (difference between pre- and post-operative periods), carpal tunnel release surgery exhibited similar therapeutic efficacy in cases with and without systemic diseases. However, since cases with systemic diseases had more severe pre-and post-operative CTS than without systemic diseases²⁻⁵, this difference between the groups seems to have continued despite the mentioned improvement. Moreover, our results revealed significant positive correlations between pre- and post-operative scores in both symptom and function. Consistent with our findings, Chow et al.¹³ have found significant recovery after carpal tunnel release, and they reported that this recovery was associated with a more severe BCTQ scores.

Although the specific effects of the above-mentioned systemic diseases on CTS have not been fully elucidated, some mechanisms underlying this relationship have

been proposed. For example, myxedematous infiltration, swelling and thickening of fascia and synovial membranes resulting in median nerve ischemia and compression can be seen in hypothyroidism²⁴. Rheumatoid arthritis induces joint damage and deformation caused by destructive inflammation, mechanical compression and ischemic damage caused by increased carpal tunnel internal pressure with synovial growth and ligament laxity²⁵. Diabetes is a well-known disorder associated with neuropathies, and hereditary factors and double-crushing mechanisms may play an important role in nerve compression in diabetic cases²⁶.

The limitations of the present study may be considered as follows. This study included data from single-center with relatively small sample size. Thus, its findings may not be generalizable strongly. Patients were recruited by telephone and on a voluntary basis; this may cause selection bias. Only five systemic conditions were included in this study because they were common and associated with CTS²⁻⁵ and the sample size for the rarer conditions was too small, but other systemic conditions may also influence the results. In addition, BMI is a confounding factor, as it was higher in the group with systemic diseases and BMI itself is a risk factor for CTS⁵, which may affect the outcomes. Since the literature directly related to the subject is limited, the discussion depth may be limited. Future directions of the research topic should be larger, more detailed and multicenter studies.

In conclusion, this study focused on the association of systemic diseases with carpal tunnel release surgery outcomes, and demonstrated that the investigated systemic diseases are negatively associated with CTS at both pre- and post-operative periods in terms of both symptom and function. These findings may be used to predict outcomes after surgery and contribute to more realistic post-operative expectations.

Conflict of Interest

The authors declare that there is no conflict of interest.

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Authors Contribution

Demir CY; conception, data collection, data interpretation, drafting of the manuscript, final approval. Soyalp C; data collection, data interpretation, final approval. Radman BMA; data collection, data interpretation, final approval. Isik BN; data collection, data interpretation, final approval.

Data Availability

All data available upon formal request to the corresponding author.

Ethics Statement

The ethical approval was received retrospectively from Van Yuzuncu Yil University Institutional Review Board (Date: 10/05/2024, IRB Approval No. 2024/05-21)

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