



# The Relationship Between Thyroid Dysfunctions and Symptom Severity and Functionality in Patients with Carpal Tunnel Syndrome

## Karpal Tünel Sendromu Olan Hastalarda Tiroit Fonksiyon Bozukluklarının Semptom Şiddeti ve İşlevsellik ile İlişkisi

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### Abstract

**Objective:** Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy caused by compression of the median nerve in the wrist. This study aimed to examine the relationship between thyroid dysfunctions and symptom severity and functional status in patients with CTS.

**Method:** Forty-four consecutive patients who were clinically and electrophysiologically diagnosed with CTS and met the inclusion criteria were included in the study. Demographic characteristics, thyroid hormone levels and electroneuromyography results of the patients were recorded. Boston questionnaire-symptom severity scale (BQ-SSS) and Boston questionnaire-functional status scale (BQ-FSS) were used to evaluate symptom severity and functionality, respectively. The patients were divided into two groups: Group 1 (n=25) included CTS patients with normal thyroid function and group 2 (n=19) included CTS patients with thyroid dysfunction.

**Results:** There was no significant difference between the two groups in terms of age, gender, body mass index, symptomatic side, electrophysiologically determined CTS severity, and BQ-FSS (all p>0.05). The mean symptom duration was  $10.64 \pm 3.08$  months in group 1 and  $24.63 \pm 14.06$  months in group 2 ( $p<0.001$ ). The mean BQ-SSS score was  $36.48 \pm 5.85$  in group 1 and  $42.00 \pm 8.10$  in group 2 ( $p=0.013$ ).

**Conclusion:** It was observed that CTS symptoms were more severe and symptom duration was longer in CTS patients with thyroid dysfunction. Therefore, detection and treatment of thyroid dysfunctions in patients with CTS may be beneficial in improving symptoms.

**Keywords:** Functional status, karpal tunnel syndrome, thyroid hormones



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**Cite this article as:** Korkmaz N, Korkmaz İ. The Relationship Between Thyroid Dysfunctions and Symptom Severity and Functionality in Patients with Carpal Tunnel Syndrome. Bagcilar Med Bull 2022;7(3):212-216

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Bagcilar Medical Bulletin published by Galenos Publishing House.

### Öz

**Amaç:** Karpal tünel sendromu (KTS) el bileğinde medyan sinirinin sıkışması ile ortaya çıkan en sık rastlanan tuzak nöropatidir. Bu çalışma, KTS'li hastalarda tiroit fonksiyon bozuklukları ile semptom şiddeti ve fonksiyonel durum arasındaki ilişkiye incelemeyi amaçladı.

**Yöntem:** Çalışmaya klinik ve elektrofizyolojik olarak KTS tanısı konan ve dahil edilme kriterlerini karşılayan 44 ardışık hasta alındı. Hastaların demografik özellikleri, tiroit hormon düzeyleri ve elektronöromiyografi sonuçları kaydedildi. Semptom şiddeti ve işlevselligi değerlendirmek için sırasıyla Boston anketi-semptom şiddet ölçeği (BQ-SSS) ve Boston anketi-fonksiyonel durum ölçeği (BQ-FSS) kullanıldı. Hastalar iki gruba ayrıldı: Grup 1 (n=25) normal tiroit fonksiyonu olan KTS hastalarını ve grup 2 (n=19) tiroit fonksiyon bozukluğu olan KTS hastalarını içerdi.

**Bulgular:** İki grup arasında yaş, cinsiyet, vücut kitle indeksi, semptomatik taraf, elektrofizyolojik olarak belirlenen KTS şiddeti ve BQ-FSS açısından fark yoktu ( $\text{tümü } p>0,05$ ). Ortalama semptom süresi grup 1'de  $10,64 \pm 3,08$  ay ve grup 2'de  $24,63 \pm 14,06$  aydı ( $p<0,001$ ). Ortalama BQ-SSS skoru grup 1'de  $36,48 \pm 5,85$  ve grup 2'de  $42,00 \pm 8,10$  idi ( $p=0,013$ ).

**Sonuç:** Tiroit fonksiyon bozukluğu olan KTS'li hastalarda, KTS semptomlarının daha şiddetli ve semptom süresinin daha uzun olduğu görüldü. Bu nedenle KTS'li hastalarda tiroit fonksiyon bozukluklarının saptanması ve tedavisi semptomların iyileştirilmesinde faydalı olabilir.

**Anahtar kelimeler:** Fonksiyonel durum, karpal tünel sendromu, tiroit hormonları

## Introduction

Carpal tunnel syndrome (CTS), known as neuropathy due to entrapment of the median nerve at the wrist level, is one of the most common peripheral entrapment neuropathies. Its prevalence in the general community varies between 3.7% and 5.8% (1).

CTS presents with pain, numbness and tingling localized in the first three fingers and the lateral side of the fourth finger, and symptoms that can progress to loss of strength in some patients (2). Therefore, it affects daily activities and quality of life in many patients and may cause loss of workforce (3). CTS is generally idiopathic (4). However, conditions such as obesity, osteoarthritis, Colles' fractures, amyloidosis, acromegaly and rheumatoid arthritis may facilitate the development of CTS by disrupting the structure of the joint or metabolic diseases such as diabetes mellitus causing deterioration in the structure of the nerve (5). In addition, it has been reported that thyroid dysfunctions are effective in the development of CTS (6). Nerve conduction studies found that 29% of hypothyroid patients were accompanied by CTS. It has been suggested that myxedema and accumulation of pseudo-mucinous material play a role in median nerve compression in hypothyroidism (7). Moreover, Roquer and Cano (8) have defined CTS associated with hyperthyroidism. However, the relationship of thyroid dysfunction with symptom severity and functional status in patients with CTS is not clear.

Few studies have examined the effect of thyroid dysfunction on CTS operation outcomes, but different results have been revealed (9,10). In this study, it was aimed to examine the relationship between thyroid dysfunctions and symptom severity and functional status in patients with CTS.

## Materials and Methods

This study was approved by Ankara City Hospital the Local Ethics Committee of the Medical Center (E1-22-2412). Informed consent was obtained from all participants included in the study. The study was conducted in accordance with the Declaration of Helsinki. In this study, patients who applied to Orthopedics and Traumatology outpatient clinic of a tertiary hospital between January 2021 and December 2021 and were diagnosed with CTS were reviewed retrospectively.

The study was conducted with 44 patients who met the inclusion criteria. Patients who were diagnosed with CTS by anamnesis, physical and electrophysiological examination, aged between 18 and 65 years, whose thyroid

hormone levels were evaluated and who had the necessary data for the study were included. Patients who received any treatment for CTS in the last three months, had a known chronic disease history (diabetes mellitus, Colles' fracture, amyloidosis, acromegaly, rheumatoid arthritis, etc.), were pregnancy, and had missing demographic and clinical data were excluded. Patients' age, gender, body mass index (BMI), symptomatic side, symptom duration, thyroid hormone levels [thyroid stimulating hormone (TSH), free triiodothyronine (fT3), and free thyroxine (fT4)], electroneuromyography (ENMG) results, and symptom severity and functional status evaluated with the Boston questionnaire were recorded in the patient follow-up form created by the authors.

The thyroid hormone levels of the patients at the time of admission were recorded. Patients were divided into two groups according to their TSH, fT3 and fT4 values as euthyroid group (group 1) and thyroid dysfunction group (hypothyroid or hyperthyroid, group 2). Decreased fT3 and/or fT4 hormone levels with increased TSH levels were defined as hypothyroidism; increased fT3 and/or fT4 hormone levels with decreased TSH level were defined as hyperthyroidism. Normal thyroid hormone levels were defined as euthyroidism. Subclinical hypothyroidism and subclinical hyperthyroidism were included in the group with thyroid dysfunction. Increased TSH and normal fT3 and fT4 hormone levels were defined as subclinical hypothyroidism; decreased TSH and normal fT3 and fT4 hormone levels were defined as subclinical hyperthyroidism (11). The reference range of thyroid hormones was as follows: 0.55-4.78 mU/L for TSH, 2.3-4.2 ng/L for fT3, and 0.89-1.76 ng/dL for fT4.

Electrophysiological evaluation was performed using Nihon Kohden 4-channel (China) ENMG device according to American Association of Neuromuscular and Electrodiagnostic medicine diagnostic criteria. CTS was classified as mild, moderate and severe according to the severity of compression of the median nerve in the electrophysiological evaluation (12). The Boston questionnaire assesses symptom severity and functional status in patients with CTS and consists of two parts: Symptom severity scale (BQ-SSS) and functional status scale (BQ-FSS) (13). This questionnaire was developed by Levine et al. (13), and its Turkish validity and reliability was demonstrated by Sezgin et al. (14). BQ-SSS is evaluated with 11 questions and BQ-FSS with 8 questions. Each question is

scored between 1 and 5. The mean score is calculated by dividing the total score by the number of questions. The mean score is determined separately for symptom severity and functional status. High scores correlate with symptom severity and impaired functionality (13).

The estimation of sample size was made using the G Power software (3.1.9.4). It was assigned that based on the study of Roshanzamir et al. (9), the minimum number of patients for each group was 17, with 95% power and 5% type I error probability.

### Statistical Analysis

The research data were uploaded to the computer and analyzed via "SPSS (Statistical Package for Social Sciences) for Windows 22.0 (SPSS Inc, Chicago, IL)". The Kolmogorov-Smirnov test was performed to obtain whether the variables were normally distributed. Mean  $\pm$  standard deviation or median and minimum-maximum values were used for continuous data for normally or abnormally data, respectively. Frequency (percent) was used for categorical data. The chi-square test was performed to compare categorical variables. The Student's t-test or Mann-Whitney U test was used to compare continuous variables for normally or abnormally distributed data, respectively. A p-value  $<0.05$  was considered statistically significant.

### Results

The mean age of 44 patients included in the study was  $55.47 \pm 10.85$  years, 31 (70.5%) were female and 13 (29.5%) were male. The symptomatic side was right in 24 patients (54.5%), left in 19 patients (43.2%) and bilateral in 1 patient (2.3%). The mean symptom duration was  $16.68 \pm 11.71$  months and BMI was  $32.42 \pm 5.20$  kg/m<sup>2</sup>. In ENMG examination, mild CTS was found in 3 (6.8%), moderate in 12 (27.3%), and severe in 29 (65.9%) patients. The mean BQ-SSS score of the patients was  $38.79 \pm 7.33$  and the mean BQ-FSS score was  $26.39 \pm 5.29$ . Twenty-five (56.8%) patients were euthyroid (group 1, n=25) and 19 (43.1%) patients had thyroid dysfunction (group 2, n=19).

There was no significant difference between the two groups in terms of age, gender, BMI, symptomatic side, severity of CTS, and BQ-FSS (all p>0.05). The mean symptom duration was  $10.64 \pm 3.08$  months in group 1 and  $24.63 \pm 14.06$  months in group 2 (p<0.001). The mean BQ-SSS score was  $36.48 \pm 5.85$  in group 1 and  $42.00 \pm 8.10$  in group 2 (p=0.013). Table 1 shows the demographic and clinical parameters of the two groups.

### Discussion

This study compared the functional status and symptom severity of CTS patients with and without thyroid dysfunction. It was observed that CTS symptoms were more severe and symptom duration was longer in patients with thyroid dysfunction. However, there was no difference between the two groups in terms of functional status and electrophysiologically determined nerve compression severity.

CTS is associated with various diseases and occupational risk factors (15,16). A number of studies have reported that thyroid dysfunctions increase the risk of peripheral neuropathy (8,17,18). In a study, 43% of patients with thyroid dysfunction had mononeuropathy and polyneuropathy, and 30% had entrapment neuropathy (19). It has been stated that the most common neuropathy associated with hypothyroidism is CTS (17,20). In addition, in a study investigating the etiological factors of CTS, it was shown that 23.7% of patients with CTS had thyroid dysfunction (21). In this study, thyroid dysfunctions were found in 43.1% of the patients. We think that this high rate is due to the fact that only the patients whose thyroid function tests were examined were included in the study.

Previous studies have proposed various hypotheses regarding peripheral nerve compression in thyroid dysfunctions. It has been suggested that pseudomucinous substances accumulating in the median nerve sheath cause compression of the nerve in hypothyroidism (22). In addition, it has been reported that in hyperthyroidism, the nerve may be more open to compression and the carpal ligaments may be compressed more due to stiffness, and as a result, axonal function may be impaired (8). In fact, although it is known that thyroid dysfunctions are a risk factor for CTS, the relationship between thyroid dysfunctions and symptom severity and functional status in these patients is not clear because, in the literature, the data on this subject are limited and have revealed contradictory results (9,10). In a study examining the factors affecting symptom severity and functional status in patients with CTS, no effect of hypothyroidism on symptoms was found (10). In another study conducted in patients with CTS who were operated on, it was found that euthyroid patients had more improvement in their symptoms compared to hypothyroid patients (9). Our study determined that the symptoms of patients with thyroid dysfunction were more severe than those of euthyroid patients.

**Table 1. Comparison of the demographic and clinical characteristics of the groups**

	<b>Group 1 (n=25)</b>	<b>Group 2 (n=19)</b>	<b>p</b>
<b>Age (years), mean ± SD</b>	55.24±12.68	55.78±8.18	0.870
<b>BMI (kg/m<sup>2</sup>), mean ± SD</b>	32.31±5.33	32.58±5.17	0.875
Gender, n (%)			0.682
Male	8 (32)	5 (26)	
Female	17 (68)	14 (74)	
<b>Symptom duration (months), mean ± SD</b>	10.64±3.08	24.63±14.06	<0.001*
<b>Symptom side, n (%)</b>			0.228
Right	16 (64)	8 (42)	
Left	9 (36)	10 (53)	
Bilateral	0 (0)	1 (5)	
<b>ENMG, n (%)</b>			0.117
Mild	0 (0)	3 (16)	
Moderate	7 (28)	5 (26)	
Severe	18 (72)	11 (58)	
<b>BQ-SSS, mean ± SD</b>	36.48±5.85	42.00±8.10	0.013*
<b>BQ-FSS , mean ± SD</b>	26.32±3.37	26.50±7.29	0.914

SD: Standard deviation, BMI: Body mass index, ENMG: Electroneuromyography, BQ-BSSS: Boston questionnaire-symptom severity scale, BQ-FSS: Boston questionnaire-functional status scale, \* Statistically significant, p-value <0.05

In this study, although symptom severity of patients with thyroid dysfunction increased significantly compared to those with euthyroidism, functionality did not differ between the two groups. However, Sharief et al. (19) showed a significant relationship between symptom severity and functionality in patients with CTS, and functionality decreased as symptom severity increased. The difference for the lack of functional status between the groups in this study may be due to the fact that the sensory conduction of the median nerve is mostly affected in patients with hyperthyroidism and hypothyroidism, as reported in the study of Somay et al. (23). In addition, although this is not significant, it may be due to the higher number of patients with moderate and severe CTS in the euthyroid group.

Studies have reported that the incidence of CTS increases with age (24,25). It has been mentioned that female gender is an independent risk factor for CTS (24). Moreover, it has been shown that BMI and obesity are strongly associated with CTS, and a one-unit increase in BMI increases the risk of CTS by 8% (26). In our study, there was no difference between the two groups in terms of age, gender and BMI values. Therefore, we think that the effect of these parameters on symptom severity is minimized and the relationship between thyroid functions and symptom severity is better reflected.

Suresh and Morris (27) stated that routine screening for thyroid dysfunction in patients with CTS was not necessary. In our study, although the mean age was similar in both groups, symptom duration was significantly longer in

those with thyroid dysfunction. This result suggests that CTS presents with symptoms at an earlier age in patients with thyroid dysfunction, or that thyroid dysfunction may exist in those whose CTS symptoms occur at an early age. Therefore, we think that it may be useful to evaluate the thyroid functions of patients with CTS symptoms at an early age. However, prospective controlled studies are needed on this subject.

The current study showed that thyroid dysfunctions are associated with duration and severity of CTS symptoms. Therefore, this study may be beneficial for future research assessing whether symptoms regress after thyroid dysfunction treatment, whether surgery is still required in patients with thyroid dysfunction, or whether the post-surgical recovery of the patients with and without thyroid dysfunction is different.

### Study Limitations

The main limitation of this study is its retrospective design and another limitation is the small number of patients included in the study.

### Conclusion

In conclusion, the symptoms of CTS patients with thyroid dysfunction may be more severe than those with CTS alone. In addition, the symptoms of these patients may begin at an earlier age. Therefore, diagnosis and treatment of thyroid dysfunctions in patients with CTS may be beneficial in improving symptoms.

## Ethics

**Ethics Committee Approval:** This study was approved by University of Health Sciences Turkey, Ankara City Hospital the Local Ethics Committee of the Medical Center (E1-22-2412).

**Informed Consent:** Informed consent was obtained.

**Peer-review:** Internally and externally peer-reviewed.

## Authorship Contributions

Concept: N.K., Design: N.K., Data Collection or Processing: N.K., I.K., Critical Revision of Manuscript: N.K., I.K., Writing: N.K., I.K.

**Conflict of Interest:** No conflict of interest was declared by the authors.

**Financial Disclosure:** The authors declared that this study received no financial support.

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