RESEARCHING OF RISK FACTORS FOR SEVERE CARPAL TUNNEL SYNDROME- IS HOUSEWIFERY A RISK?

Ağır Karpal Tünel Sendromu için risk faktörlerinin incelenmesi- Ev hanımlığı bir risk mi?

Metin BALDUZ[1], Ersin NAZLICAN[2], Burak METE[2], Bahar BALDUZ[2], Muhsin AKBABA[2]

Abstract

Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy. In this study, risk factors of severe CTS were examined. This study was conducted on 227 patients diagnosed with CTS in EMG laboratuary. The criteria of American Academy of Electrodiagnostic Medicine was used as the diagnosis for CTS. All patients were examined for bilateral median and ulnar motor and sensory peak latency, amplitude and conduction velocities. The patients were classified into 4 groups electrophysiologically; Normal, Light, Medium, Severe. Electrophysiological classification was compared with the identified risk factors. The mean age of the patients was 51.04±13.37 (min=18-max=83). Severe CTS cases in both hands were higher in housewives. Housewifery increased the risk of severe CTS in the right and left hand by 2.74 and 2.23 times, respectively. In addition, obesity increased the risk of severe CTS in the right and left hand by 5.10-4.40, presence of lateral epicondylitis was 2.73-4.19 and medial epicondylitis was 4.39-4.93, respectively. Hand dominancy was increased the risk of severe CTS by 6.88 times for the left hand and 1.15 times for the right hand. Otherwise in multivariate analyse of left hand results, obesity increase the risk of severe CTS by 3.34, left hand dominancy 7.83 times, chronic disease 2.62 times, and for the right hand being a housewife increases the risk by 2.14, obesity 4.68 times and medial epicondylitis 6.40 times. This study put forth that being a housewife, obesity, dominant hand, presence of lateral or medial epicondylitis are the risk factors of severe CTS.

Keywords: Carpal tunnel syndrome, woman, risk factors.

Özet

Karpal tünel sendromu (KTS) en sık görülen tuzak nöropatidir. Bu çalışmada ağır KTS için risk faktörleri incelenmiştir. Bu çalışma EMG Laboratuvarına başvuran ve Karpal Tünel Sendromu tanısı alan 227 hasta üstünde yapılmıştır. KTS tanı kriterleri olarak American Academy of Electrodiagnostic Medicine baz alınmıştır. Bütün hastalar bilateral median ve ulnar duyusal pik latans, amplitud ve ileti hızları açısından değerlendirilmiştir. Motor ileti çalışmasında ise bilateral median ve ulnar sinir motor latans, amplitud ve ileti hızları değerlendirildi. Hastalar elektrofizyolojik olarak 4 grupta sınıflandırılmıştır; Normal, Hafif, Orta, Ağır. Elektrofizyolojik sınıflandırma belirlenen risk faktörleri ile karşılaştırılmıştır. Hastaların yaş ortalaması 51.04±13.37'dir (min=18-max=83). Her iki elde de ağır KTS vakaları ev hanımlarında yüksektir. Ev hanımlığı sağ ve sol el ağır KTS riskini sırasıyla 2.74 ve 2.23 kat artırmıştır. Ayrıca ağır KTS riski obez olanlarda 5.10- 4.40 kat, lateral epikondilit varlığında 2.73-4.19 kat, medial epikondilit varlığında 4.39-4.93 kat arttığı bulunmuştur. Dominant elde ağır KTS gelişme riskinin de sol el için 6.88, sağ el için 1.15 kat arttığı bulunmuştur. Çoklu değişkenli analizlerde ise sol el için ağır KTS riskini obez olmanın 3.34 kat, kronik hastalık varlığının 2.62 kat, sol elin dominant olmasının 7.83 kat artırdığı, sağ el için ise ev hanımı olmanın 2.14 kat, obez olmanın 4.68 kat, medial epikondilit varlığının 6.40 kat artırdığı bulunmuştur. Ev hanımlığı, obezite, dominat elde KTS, medial ve lateral epikondilit varlığı ağır KTS için risk faktörü olarak bulunmuştur. KTS tanısı alan kişilerde belirtilen risk faktörlerine sahip olmaları durumunda ağır KTS açısından koruyucu yaklaşım önerilmektedir.

Anahtar kelimeler: Karpal tünel sendromu, kadın, risk faktörü.

1- University of Health Sciences, Adana Education and Research Hospital, Neurology Department. Adana, Türkiye
2- Çukurova University, Faculty of Medicine, Department of Public Health. Adana, Türkiye

Sorumlu Yazar / Corresponding Author: Dr. Metin BALDUZ (Neurology Specialist, M.D.)
e-posta / e-mail: metdical@gmail.com
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ORCID: Metin BALDUZ : 0000-0002-1542-8005
Ersin NAZLICAN : 0000-0002-1460-1996
Burak METE : 0000-0002-0780-6176
Bahar BALDUZ : 0000-0001-5437-4321
Muhsin AKBABA : 0000-0003-3028-6698

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Introduction

Carpal tunnel syndrome is the most common entrapment neuropathy observed as a result of median nerve compression at the wrist (1). In general population CTS prevalance ranges 3.7% to 5.8% when diagnosed clinically and neuro-physiologically (2). CTS confers an economic burden on patients, employers, and healthcare institutions (3). Diabetes mellitus, obesity, fertility, contraceptives, thyroid dysfunction, and Inflammatory conditions such as rheumatoid arthritis have been associated with carpal tunnel syndrome (4). The classic symptoms of CTS are pain, numbness, and tingling in the first three fingers and half of the 4th finger, the region that median nerve distribution, especially at night. For diagnosis, a detailed history, physical examination and electrophysiological studies are needed. Phalen and tinnel tests are used physical examination. However, nerve conduction study (NCS) is a good diagnostic test with high sensitivity and specificity (5). There are some studies in literature for incidence and causes of CTS in many occupational groups. Among these studies, it was emphasized that the incidence of carpal tunnel syndrome is high in housewives. However, the effects of the factors on the severity of CTS have not evaluated yet. In this study, we aimed to research the relationship between the severity of CTS and variables such as occupation, working time, age, gender, and body mass index in patients, especially housewives, diagnosed with CTS.

Material and Method

This study was included in patients, diagnosed with CTS in EMG Laboratory in Cukurova State Hospital between November 2019 and December 2019, who had symptoms for more than 3 months. In the sample size analysis performed by taking α =0.05, power 90% and d=0.1 as reference, the number of samples to be reached was found to be 213 and 227 people were reached. The study was explained to 227 patients, and patients who gave informed consent were included. A sociodemographic form and a questionnaire prepared by the researchers were used for work and health data. The questionnaire consists of 17 questions included such as onset of the complaint, kind of pain, co-morbidities, working time (year and hours in a day), treatment, etc. The patients were divided into two main groups as housewives and other occupations outside of the house (nurse, postman, factory worker, etc.).

All patients were questioned in terms of dominant hand, symptoms of CTS (numbness, pain, weakness). diabetes mellitus, hypothyroidism, amyloidosis, polyneuropathy, inflammatory diseases of connective tissue, and acute trauma to the wrist. The most common chronic diseases in the patients included in the study were hypertension, coronary artery disease, heart failure, and anemia. Patients with these diseases or incomplete NCS were not included in the study. Patients under the age of 18 and over the age of 80 were also excluded. Patients aged 18-80 years, who did not have peripheral neuropathy or who did not have a disease that could be associated with peripheral neuropathy were included in the study and a questionnaire was applied to the patients diagnosed with CTS electrophysiologically. The height and weight of the individuals were measured and Body mass index (BMI) was calculated.

In this study, "The American Academy of Electrodiagnostic Medicine" was taken as the basis for the diagnosis of CTS (5-7). Electrodiagnostic studies were performed at normal room temperature ($24\text{-}26^0$) with surface stimulator and recording electrodes. Stimulations were given supramaximally for 0.1-0.2 ms with the bipolar superficial electrodes. Sensory conduction recordings were obtained from the 5th finger for ulnar nerve and from the 2nd finger for median nerve by ring electrodes, motor conduction

recordings were obtained from abductor pollicis Brevis muscle for median nerve with the round surface electrodes, and from adductor digiti minimi muscle for ulnar nerve. All patients were evaluated in terms of bilateral median and ulnar sensory peak latency, amplitude and conduction velocities. In the motor conduction study, bilateral median and ulnar nerve motor latency, amplitude and conduction velocities were evaluated.

In sensory nerve action potentials obtained antidromically, the filter bandwidth was 20-3000 Hz, the sweep rate was 2 ms/division, and the sensitivity was 10-20 μV/division. To determine the normal laboratory values, prospective recordings were made from 60 hands from 30 healthy people in controls, and abnormal values were calculated according to ±2 standard deviations from their mean values. According to two standard deviations, median nerve sensory latency ≥ 3.5 ms, median nerve sensory conduction velocity ≤ 40 m/s, median nerve motor distal latency ≥ 3 ms were accepted significantly for CTS. To exclude the peripheral neuropathy, unilateral posterior tibial nerve motor conduction and bilateral sural nerve sensory conduction studies were examined. No individuals with sensory conduction abnormalities, except median nerve sensory conduction abnormalities, were included in this study.

Electrophysiological data were performed according to our laboratory normals and patients were classified into 4 groups;

Normal: normal findings in all tests.
1- Mild: abnormal median sensory nerve conduction velocity and normal motor distal latency of median nerve.
2- Moderate: abnormal median sensory nerve conduction velocity and abnormal median nerve motor distal latency
3- Severe: absence of median sensory nerve response and abnormal median motor distal latency
This prospective study was approved by Cukurova University clinical ethic committee (2019/92-15).

SPSS 22 program was used in the analysis of the data. Data are given as percentage, arithmetic mean, median and percentage. Kolmogorov Smirnov test was used as the normal distribution test. Independent t test, Mann Whitney U test, Pearson chi-square test, and Binary logistic regression analysis were used in the analysis of the data. A value of $p<0.05$ was considered statistically significant.

Results

The mean age of our patients was 51.04±13.37 (min=18-max=83). Considering the relationship between occupational groups and CTS severity, it was found that both right and left severe CTS cases were statistically significantly higher in housewives compared to other occupational groups (Table 1).

Table 1: Comparing severity of CTS related to occupation.

	Occupation(right hand)			**Occupation(left hand)**		
	Others	Housewife		Others	Housewife	
CTS	n(%)	n(%)	p	n(%)	n(%)	p
Normal	13(10.9)[a]	9(8.3)[a]		33(27.7)[a]	30(27.8)[a]	
Mild	48(40.3)[a]	26(24.1)[b]	**0.002**	45(37.8)[a]	43(39.8)[a]	**0.031**
Moderate	39(32.8)[a]	36(33.3)[a]		30(25.2)[a]	15(13.9)[b]	
Severe	19(16.0)[a]	37(34.3)[b]		11(9.2)[a]	20(18.5)[b]	

a and b are the symbols pointing the statistical difference. There is a difference between column cells containing different symbols

In this study, the incidence of right CTS significantly increased in right-handed individuals, left CTS in left-handed individuals, and bilateral CTS in those who used both hands equally.

When EMG results were compared according to occupational groups, in housewives right median motor latency was statistically significantly longer, right and left median sensory velocity was slower and there was no difference in left median motor latency (Table 2).

Table 2: Comparing to EMG findings in occupational groups.

	Others		**Housewife**		**p**
Hand with CTS right/left/both n(%)	32(26.9)/16(13.4)/71(59.7)		31(28.7)/8(7.4)/69(63.9)		0.336
EMG findings	X±S.D.	Median	X±S.D.	Median	
Right motor median latancy	4.22±1.27	3.90	4.62±1.34	4.50	**0.011**
Right sensory median velocity	29.74±14.78	32.90	23.81±18.47	31.40	**0.045**
Right motor median amplitude	9.37±4.84	7.70	6.49±2.57	6.40	**<0.001**
Right median motor velocity	49.48±8.58	50.00	46.55±8.04	46.60	**0.009**
Right sensory median latancy	3.69±4.69	3.80	3.17±7.07	3.30	**0.003**
Right sensory median amplitude	11.83±11.11	10.00	6.46±5.69	6.35	**<0.001**
Right ulnar sensory velocity	57.69±6.63	56.00	60.32±6.87	58.55	**0.001**
Left motor median latancy	3.84±1.31	3.60	3.87±1.33	3.45	0.945
Left sensory median velocity	35.34±13.94	35.60	33.13±18.16	35.65	0.695
Left motor median amplitude	9.08±4.40	8.00	6.30±2.35	5.70	**<0.001**
Left motor median velocity	49.57±8.90	51.00	49.40±8.54	50.85	0.642
Left sensory median latancy	3.44±1.47	3.80	2.87±1.75	3.25	**0.003**
Left sensory median amplitude	13.58±11.48	10.60	9.17±6.31	9.10	**0.016**

X: Mean SD: Standard devialton

Univariate logistic regression analysis was performed to determine the risk factors for the presence of severe CTS in the right and left hands. Being a housewife increases the risk for right and left hand severe CTS by 2.74 and 2.23 times, obesity 5.10-4.40 times, lateral epicondylitis 2.73-4.19 times, medial epicondylitis 4.39-4.93 times, and working time 1.09-1.06 times, respectively. It was also found that right-handed dominancy increased the risk of right severe CTS by 6.88 times and left-handed dominancy was

by 1.15 times for left. Otherwise, in multivariate analyse of left-hand results, obesity increase the risk of severe CTS by 3.34, left-hand dominancy 7.83 times, chronic disease 2.62 times, and for the right-hand being a housewife increases the risk by 2.14, obesity 4.68 times and medial epicondylitis 6.40 times (Table 3).

Table 3: Univariate and mutlivariate logistic regression analysis for severe CTS.

	Left hand severe CTS					
	Univariate			Multivariate		
	B	**O.R. (%95 CI)**	**p**	**B**	**O.R. (%95 CI)**	**p**
Occupation Reference: Others Housewife	0.803	2.23 (1.014.90)	**0.046**	0.419	1.52(0.63-3.64)	0.348
Bmi Reference: Normal Obesity	1.482	4.40(1.92-10.07)	**<0.001**	1.207	3.34(1.35-8.23)	**0.009**
Chronic diseaes Reference: No Yes	1.016	2.76 (1.26-6.03)	**0.011**	0.965	2.62(1.06-6.45)	**0.036**
Lateral epicondylitis Reference: No Yes	1.433	4.19 (1.73-10.14)	**0.001**	0.618	1.85(0.32-10.72)	0.490
Medial epicondylitis Reference: No Yes	1.597	4.93 (1.93-12.60)	**0.001**	0.651	1.91(0.30-12.20)	0.491
Dominant hand Reference: Others Right or left	1.929	6.88(2.56-18.43)	**<0.001**	2.058	7.83(2.5-24.44)	**<0.001**
	Right hand severe CTS					
	B	**O.R. (%95 CI)**	**p**	**B**	**O.R. (%95 CI)**	**p**
Occupation Reference: Others Housewife	1.009	2.74 (1.45-5.15)	**0.002**	0.765	2.14(1.07-4.30)	**0.031**
Bmi Reference: Normal Obesity	1.631	5.10 (2.65-9.83)	**<0.001**	1.544	4.68(2.34-9.35)	**<0.001**
Chronic diseaes Reference: No Yes	0.520	1.68 (0.87-3.24)	0.121	0.201	1.22(0.58-2.56)	0.595
Lateral epicondylitis Reference: No Yes	1.007	2.73 (1.23-6.07)	**0.013**	-0.790	0.45 (0.08-2.52)	0.367
Medial epicondylitis Reference: No Yes	1.481	4.39 (1.84-10.50)	**0.001**	1.857	6.40(1.07-38.04)	**0.041**
Dominant hand Reference: Others Right or left	0.141	1.15 (0.62-2.13)	0.654	-0.221	0.80(0.39-1.63)	0.543

B: Beta coefficient O.R: Odds ratio CI: Confidence interval

Discussion

CTS causes working with pain and loss of work lastly, a disability that may lead to compensation claims (8). Carpal tunnel syndrom is a critical disease, especially for heavy workers and dangerous jobs. It has some great dangerous results associated with human health, occupational health and workplace. Many studies reported that the risk of CTS is the highest in slaughterhouses, poultry farms, assembly works, textile industry, supermarkets, packaging and computer workers (9). Although it is known as an occupational disease, housewives also has a high incidance of CTS (10). Biomechanical overload, which occurs with vigorous performance of certain repetitive movements, has been accepted as a major risk factor for CTS in most studies (11). In our study, CTS patients were classified and risk factors for severe CTS were examined. It has been found that being a housewife, lateral epicondylitis, medial epicondylitis, obesity, presence of chronic disease and length of the working period are important risk factors of severe CTS.

One of the findings we obtained from our study is that there is a correlation between hand dominance and the side of CTS, ipsilaterally. It was detected that the dominant hand increased the risk of severe CTS 1.15 times on the right and 6.88 times on the left. Further using long-term vibrating instruments regularly increases the risk of CTS twice, and forced wrist extension and flexion increase similarly or more (9). The dominant hand is more exposed to such traumas than the non-dominant hand. The high incidence of severe CTS with the dominant hand we demonstrated in our study confirms this thesis. In our study, female dominance was prominent (77.5%), and housewives were predominantly affected in the occupational distribution. Severe CTS findings, especially those with a high risk of developing disability, were statistically significantly higher for both hands in housewives. In many studies established that CTS is more common in women (12). Newington found that the female/male ratio was 3/1 and this ratio was observed to be consistent with our study (13). As the opposite that, In 2021, Şahin B. found that gender was not a risk factor in a series of 94 patients (14). In another a large-scale study in 2021, the rate of incidence in women was 73% in 5456 patients diagnosed with CTS (14).

The body mass index (BMI) was 29.12±4.22 kg/m². Another important result of our study is that obesity increases the risk of severe CTS by 4.40 times on the right and 5.10 times on the left hand. In previous studies, the BMI was 29-31 kg/m² (15,16). It has been reported in the literature that obesity was an independent risk factor for CTS and 70% of the cases are obese (15). According to Zhang's study showed that high body mass index, advanced age and female gender were significant risk factors for CTS (17). Although obesity has been demonstrated in previous studies as a risk factor for CTS, revealing the risk ratio of severe CTS, a cause of high disability, separates our study from the others.

In this study, it was also shown that severe CTS was significantly higher in patients with lateral or medial epicondylitis. In a case-control study, Murray found that the incidence of lateral epicondylitis in patients diagnosed with CTS was significantly higher than in control patients (18). According to Kim's research, the participants with CTS showed significantly lower hand grip strength, pinch strength, and steadiness of hand dexterity than those without CTS, fndings that are compatible with recent reports (19,20).

It has been stated in previous studies that repetitive movements for a long time were one of the main causes of epicondylitis (21). In an earlier study in the literature, it was shown that the prevalence of CTS was highest in housewives, and most of the patients were in the perimenopausal period. It has been suggested that physiological changes related to menopause may cause nerve compression (22). When comparing occupational groups and housewives, the

incidence of CTS in blue-collar female workers and housewives were almost close to each other and it was higher in housewives compared to white-collar female workers. This result showed that housewifery is a significant occupational risk group as much as blue-collar female workers (10). In the same study, it was determined that housewives have more risks than white-collar workers four times.

Cleaning activities are important for housewives especially. House cleaners has an important role in occupational groups in a study which is about patients undergoing surgical treatment for CTS (23). We think that the reasons causing CTS in house cleaners and housewives are similar.

A case-control study showed that in cooks there was a high incidence of CTS (24). The incidence of CTS in housewives who cook 3 times in a day coincides with the pathophysiological situation in cooks.

The limitations of our study are studying in a single center and in a small group.

Conclusions

In conclusion, housewifery was one of the most prominent risk factors of severe CTS. Diagnosis of epicondylitis was not only a risk factor but also a predictor for severe CTS.

We recommend that taking care of patients with CTS is very important before they become severe CTS.

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