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Coexistence of ipsilateral ulnar and median nerve entrapment

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ABSTRACT

Objective*:* Carpal tunnel syndrome (CTS) and Cubital tunnel syndrome (CuTS) are the median nerve compressions under the carpal ligament and ulnar nerve at the wrist, the most common peripheral nerve entrapment of the upper extremity. The fatty tissue due to the high body mass index (BMI) differs the severity of the entrapment symptoms. The study aims to evaluate the association between BMI and symptoms of CTS and CuTS by analyzing the patients whose entrapments are at the same extremity and onset at the same time.

Method*:* The patients were divided into two groups according to the neuropathy sit (CTS and CuTS) and four subgroups according to the BMI (Overweight, grade 1 obese, grade 2 obese, and morbidly obese). All patients were followed up with EMG and performance scale before and after surgical treatment.

Results: A total of 31 patients were included in the study. The mean BMI of the patients was 29.63 kg/m^2. The average BMI of male patients was 29.02 kg/m^2, while the average BMI of female patients was 30.3 kg/m^2.

Conclusion: In contrast to the previous hypotheses that claim the high body mass index increases the severity of CTS but reduces the formation of CuTS, our study revealed that body mass index was not related to the severity of symptoms.

Keywords
peripheral nerve,
carpal tunnel,
cubital tunnel,
entrapment,
body mass index

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INTRODUCTION

Entrapment neuropathies occur when nerves are exposed to pressure during their course in rigid anatomical structures. Carpal tunnel syndrome (CTS) occurs due to compression of the medial nerve under the flexor retinaculum ligament in the wrist, while compression of the ulnar nerve at the elbow level causes cubital tunnel syndrome (CuTS). While CTS is the most common neuropathy among entrapment neuropathies (annual incidence 424/1000000), CuTS is observed in the 2nd frequency (annual incidence 20.9 / 100000) [1,2].

In the initial phase of peripheral entrapment neuropathies, epineural blood flow is reduced due to ischemic block. As a result, the nerve slowed down the conduction velocity, and a conduction block may develop. At this stage, Wallerian degeneration has not yet begun, and the patient benefits from conservative treatment. In the late stage,

epineural edema, endoneurial edema, and segmental demyelination begin to develop. As this situation becomes chronic, Wallerian degeneration now occurs, and clinical findings such as sensory defects and muscle atrophy can be seen [3].

Patients with CTS complain of pain, numbness, and tingling in the first three fingers of the hand, while patients with CuTS have pain in the medial of the elbow and arm, numbness in the 4th and 5th fingers, and loss of strength in the intrinsic muscles of the hand. The definitive diagnosis of both syndromes is made by electromyography (EMG) and neurological examination.

Conservative treatment is given primarily to patients with mild and moderate nerve compression. In addition to anti-inflammatory drugs, splits restricting wrist movements for CTS and elbow movements are used for CuTS. Surgical intervention is required for cases resistant to conservative treatment, severe hypoesthesia, atrophy, and loss of strength. The trap channel is surgically opened, and nerve compression is decompressed.

In individuals with a high body mass index, the amount of adipose tissue around the median nerve increases, which increases the risk of entrapment neuropathy [4].

Studies have shown the coexistence of CTS and CuTS, but the frequency of median and ulnar nerve entrapment neuropathy in the same extremity and at the same time has not been reported [5,6]. In this study, it was aimed to compare the severity of entrapment neuropathies and to evaluate their demographic structure according to the body mass index of patients who were admitted to our clinic with ipsilateral CTS and CuTS complaints at the same time and who were treated with surgical intervention in the same session.

Material and methods

CTS and CuTS patients who were treated with ipsilateral surgical intervention between January 2015 and December 2019 in the Neurosurgery Department of our hospital were retrospectively analyzed. The local ethics committee approved each stage of the study, and consent was obtained from all patients.

Patients with numbness, weakness, and thenar muscle atrophy in the 1st, 2nd, and 3rd fingers due to median nerve entrapment, and patients with the same symptoms in the 4th and 5th fingers and hypothenar muscle atrophy due to ulnar nerve entrapment, and whose symptoms started on the same side and at the same time were included in the study.

Cubital tunnel and carpal tunnel syndromes were diagnosed according to the patients' neurological examination and EMG results. Numbness, tingling, and pain sensation in the palmar face of all the fingers were questioned. Tinel test was performed on the median nerve at the wrist and the ulnar nerve at the elbow, and the Phalen test was also performed on patients with suspected carpal tunnel syndrome. Patients with carpal and cubital tunnel syndrome at the same time were determined by evaluating physical examination findings and EMG results together. Cervical pathologies were excluded by performing a cervical magnetic resonance imaging. Among these patients, patients whose complaints did not recover despite using medical treatment and splint and who underwent ulnar nerve and median nerve decompression surgery under local anesthesia in the same session were evaluated.

Patients with symptoms of the CTS and CuTS occur at different times, in different extremities, patients with cervical vertebral root lesions and/or discopathy findings in cervical magnetic resonance imaging, patients with thoracic outlet syndrome and polyneuropathy, cases secondary to trauma such as fractures, nerve injury and tumor and cases with CTS and CuTS secondary to pregnancy were excluded from the study.

Parameters evaluated

Data of the patients were collected to evaluate the age, gender, which side of the surgery, presence of atrophy, smoking, diabetes, presence of thyroid disease, hypertension, educational status, occupation, and dominant hand. Preoperative EMG results of the patients were collected. Body mass index (BMI) was calculated in kg / m2 by measuring the patients' height and weight. Calculated BMIs were grouped using the World Health Organization (WHO) classification.

Statistical analysis

Spearman test was used to evaluate the correlation between BMI and severity of CTS and CuTS in statistical analysis. $P < 0.05$ was considered statistically significant.

Results

A total of 31 patients were included in the study (17 men (55%), 14 women (45%)). The average age of all patients was 51.29 ± 13.2 (Male 51.65 (min: 23-max: 70), female 50.86 (min: 14- max: 72). Nine patients were operated on from the left side, 22 from the right side, and the right/left ratio was 2.44. There was only one male patient with the left dominant hand, and the pathology of this patient was on the right side. Ipsilateral involvement of 30 right dominant patients was 22 (73.3%). Smoking was present in 17 (55%) of the patients. The number of patients with diabetes was 10 (32%). The number of patients with thyroid dysfunction was 6 (19%). The number of patients with hypertension was also 6.

The mean BMI of the patients was 29.63 kg/m2. The average BMI of male patients was 29.02 kg/m2, while the average BMI of female patients was 30.3 kg/m2. While 3 of the patients were morbidly obese, one was 2nd degree obese, and ten were first-degree obese. As a result, 45% of the patients were obese (Table 1).

Table 1. The distribution of patients according to the body mass index and gender

		Body Mass Index					Total
		Normal	Overweight	Grade 1 Obese	Grade 2 Obese	Morbid Obese	
Gender	Male	2	10	3	0	2	17
	Female	3	2	7	1	1	14
Total		5	12	10	1	3	31

The education level of the patients is that 3 of them did not go to school, 24 of them were primary school graduates, and 4 of them were secondary education graduates. 13 of the patients were housewives, 8 of them were workers, 5 of them were farmers, and the rest were in the other occupational groups (office worker, trader, students).

Physical examination of the patients revealed 17 thenar atrophy. In the EMG evaluation, 9 of the patients had mild, 14 had moderate, 8 had severe carpal tunnel syndrome, eight had mild, 15 had moderate, and 8 had severe cubital tunnel syndrome.

In carpal tunnel syndrome, the average BMI was found to be 29.86 kg/m2 in patients with mild EMG findings, 28.94 kg/m2 in moderate, and 30.59 kg/m2 in severe ones. While the mean BMI in mild cubital tunnel syndrome was 31.15 kg/m2, it was found to be 28.08 kg/m2 in moderate patients and 31.03 kg/m2 in severe ones (Table 2). According to body mass indexes and EMG findings, there was no significant correlation between carpal tunnel syndrome and cubital tunnel syndrome severity (P> 0.05).

Table 2. The severity of entrapment neuropathies in different body mass index groups

		Body Mass Index
		Mean
Cubital Tunnel Syndrome	Minor	31,15
	Moderate	28,08
	Severe	31,03
Carpal Tunnel Syndrome	Minor	29,86
	Moderate	28,94
	Severe	30,59

Discussion

Carpal tunnel syndrome and cubital tunnel syndrome are the most common entrapment neuropathies of the upper extremity. It has been reported that 93% of patients benefit from decompression surgery [7]. There are epidemiological studies in the literature separately for these two syndromes, but there are few publications regarding the operation of these two syndromes in the same session. The most known risk factors for carpal tunnel syndrome are female gender, obesity, advanced age, and repetitive hand movements [8]. Risk factors for cubital tunnel syndrome have been reported as advanced age and high BMI for men, while low BMI for women [9].

It is known that diabetes mellitus is a risk factor for both carpal tunnel syndrome and cubital tunnel syndrome. Diabetes increases the severity of entrapment neuropathy after collagen solidifying after neural ischemia due to diabetic microangiopathy and non-enzymatic collagen glycolysis [10]. Naran et al. found DM in 23% of patients with cubital tunnel syndrome [11]. It was present in 32% of our patients.

In our study, the average age of all patients was 51.2, and the number of male patients was higher than female patients, similar to the literature. Carpal tunnel syndrome is more common in females than cubital tunnel syndrome [12,13]. 13 (41.9%) of our patients were housewives, 8 (25.8%) were workers, and 5 (16.1%) were farmers. 79% of female patients with carpal tunnel syndrome were determined to be

housewives in a study [14]. Consistent with our study, it has been shown that homemakers performing activities such as cleaning and handicraft intensively and male patients work in professions with intense, repetitive hand movements increase the risk of entrapment neuropathies [13,14]. The literature has reported that entrapment neuropathies are more common in the dominant hand and arm. Wilson et al. claim that while ulnar entrapment was determined in the left side with a rate of 51.8%, entrapment was observed in 53% of the dominant arm [15]. In our study, the right side/left side ratio was found to be 2.44, and the entrapment rate on the dominant side was 73.3%.

In the literature, it has been suggested that a high body mass index increases the severity of CTS. It has been thought that supportive fat tissue around the nerve may cause stenosis in the carpal canal in people with high BMI [4,10]. Also, they showed that the fatty tissue in the carpal canal increased hydrostatic pressure [16]. The situation is the opposite in cubital tunnel syndrome. It has been thought that the increased fatty tissue at the height of the BMI creates a protective filling around the nerve against external effects [9]. In our study, no significant correlation was found between body mass index and the severity of entrapment neuropathy. While only 5 of our patients had average body weight, other patients were overweight and obese. Contrary to expectations, mild entrapment neuropathy in EMG results is observed in patients with high BMI (29.86), Severe entrapment neuropathy was observed as a result of EMG in patients with CuTS with high BMI (31.03), and it is not compatible with the hypotheses in the literature. The study results of Sahin et al. were consistent with ours, and no significant difference was found between increased BMI and the severity of carpal tunnel syndrome [17]. There are not many publications examining the association of carpal and cubital tunnel syndrome in the literature. Similar to our study, Cross et al. applied decompression procedures to patients with cubital and carpal tunnel syndrome in both pathologies in the same session [18]. Surgical intervention in two entrapment neuropathies in the same session prevents the patient from receiving anesthesia twice, decreases the duration of hospital stay, and decreases workforce loss.

Conclusions

When CTS and CuTS patients are evaluated separately in the literature, although it is hypothesized that high body mass index and thick adipose tissue increase the severity of CTS by increasing the median nerve compression, but the same adipose tissue reduces the formation of CuTS, in our study when patients with the same extremity and simultaneous onset of symptoms were evaluated, it was revealed that body mass index was not related to the severity of symptoms. Although BMI does not change the severity of neuropathy, it is an important etiological factor in entrapment formation.

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