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The relationship of psychological factors and sleep quality with the severity of carpal tunnel syndrome

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Abstract

Carpal tunnel syndrome (CTS), the most common entrapment neuropathy, is graded as mild, moderate and severe. We aimed to evaluate the relationship between CTS severity and depression, anxiety, sleep quality and daytime sleepiness. One hundred and forty-nine patients with a diagnosis of CTS were prospectively included in the study. There was a statistically significant difference between the painDETECT questionnaire, age, pain severity, Pittsburgh Sleep Quality Scale, Boston CTS Symptom Severity Scale and Functional Status Scale scores and the severity of CTS ($p<0.05$). There was a statistically significant difference between the Epworth sleepiness scale and the severity of CTS ($p<0.05$). There was no statistically significant difference between body mass index, Beck Anxiety, Beck Depression Score and CTS severity ($p>0.05$). We found an increase in daytime sleepiness in the severe type of CTS, which particularly affects hand functions and causes a decrease in the quality of life.

Keywords: Carpal tunnel syndrome, psychological factors, sleep quality

INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common peripheral neuropathy with an incidence of 2.7-4%. Entrapment of the median nerve in the wrist causes CTS while tingling and numbness are observed along the nerve trace in patients. In the presence of progressive nerve damage motor deficit develops and the incidence of neuropathic pain increases.[1] Electroneuromyography (ENMG) and clinical symptoms are basis for diagnosis.[2] It is thought that the wrong position of the wrist, especially during sleep, increases the pressure in the carpal canal and exacerbates the symptoms of CTS. Previous studies have shown that approximately 80% of patients with CTS wake up at night due to numbness and deterioration in sleep quality occurs.[3] However, there are not many studies evaluating daytime sleepiness.

Impairment of sleep quality may result in increased sympathetic nervous system activity and aggravate the physical and psychological stressors.[2] This can be associated with anxiety and depression as well as negative effects on activities of daily life. There are studies that suggest a relationship between anxiety and depression in patients with CTS and disease symptom severity.

We aimed to evaluate the relationship between the severity of the CTS according to the findings of ENMG and the type of pain, the presence of anxiety and depression, sleep disturbance and daytime sleepiness in patients diagnosed with CTS.

METHODS

This prospective cross-sectional study was conducted at the tertiary Physical Medicine and Rehabilitation outpatient clinic in Sivas, Turkey. The study population consisted of 149 patients who were diagnosed with CTS based on clinical symptoms and ENMG. The inclusion criteria were patients aged 18-75 years old who were able to respond to the assessment questionnaires. Patients with diabetes mellitus, thyroid diseases, amyloidosis, collagen tissue diseases, obstructive sleep apnea, history of the upper extremity trauma, pregnancy and those with signs or symptoms of cervical radiculopathy/ plexopathy were excluded from the study. The severity of CTS was evaluated by electrophysicological studies.

Electrophysiological evaluation

Electrophysiological examinations were made using the Keypoint 4-channel software 31S22 standard NCS/ENMG/EP applications (Medtronic, Skovlunde, Denmark). The American

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Association of Electrodiagnostic Medicine recommendations and criteria for diagnosis were used for electrophysiological examinations.[4] Ring electrodes were used for sensory nerve conduction study, and surface cup electrodes were used for motor nerve conduction study. Abnormal values were calculated and compared with the standard reference values of our laboratory. Accordingly, mild CTS was defined as prolonged distal latency of median nerve sensory branch, reduced median sensory nerve action potential; moderate CTS was, in addition to foregoing findings, prolonged motor distal motor latency of median nerve; and severe CTS was prolonged distal motor latency and distal sensory latency accompanied by reduced or nonexistent median compound motor action potential. The patients were categorized as mild, moderate and severe CTS according to these criteria.

Assessment scales

The age, gender, body mass index (BMI) of the patients have been recorded. The patients have been assessed by using the Numerical Rating Scale (NRS), Boston CTS Rating Scale, the Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale, the Beck Depression Inventory (BDI), the Beck Anxiety Inventory (BAI) and PainDETECT questionnaire.

Numerical Rating Scale (NRS): The NRS is a 11 point scale where the endpoints are the extremes of no pain (0) and pain as bad as it could be, or worst pain (10).

Boston CTS Rating Scale (Levine-Katz CTS Questionnaire): This scale is used to investigate complaints of pain, numbness and weakness in the hand, and to make functional and symptomatic assessments.[5] In this two-part questionnaire, there are 11 questions about symptoms and 8 questions about functional assessment. Each question has separate answer options with a score of 1 to 5. (from mild to severe). The higher the score is, the more severe the patient's functional and symptomatic complaints in CTS.[6]

Pittsburgh Sleep Quality Scale: It is used for evaluation of sleep quality quantitatively.[7] The questionnaire, which consists of 19 questions is filled by the patient, is divided into seven subcategories for assessments of sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, medication use for sleep, and daytime sleep functional disorder. Each category includes a score of 0 to 3, and 0 indicates absolutely no sleep problems and 3 indicates the worst sleep quality. An overall score > 5 shows poor quality of sleep.[8]

Epworth Sleepiness Scale: It questions the general sleepiness level of the individual.[9] It aims to evaluate the probability of falling asleep or napping in eight different daily life situations. It is a simple, easy-to-understand 8-item scale to evaluate the general sleepiness level in adults. A score of 6 and above is considered sleepy.[10]

Beck Depression Scale: This scale is used to define depression risk in adults and to measure the changes in the severity and level of depression symptoms.[11,12] Regarding the symptoms of depression, it consists of 21 items two of which are about emotional symptoms, eleven are about cognitive symptoms, two are about behavioural symptoms, five are about physical symptoms, and one is about interpersonal communication. Each item is scored between 0 and 3, and it is scored between 0 and 63 in total.[13]

Beck Anxiety Scale: It was designed to measure the severity of anxiety symptoms experienced by individuals.[14] It questions subjective anxiety and bodily symptoms. It is a self-report scale consisting of 21 items, and it is scored between 0 and 3 based on Likert scaling. The total score ranges from 0 to 63. The higher total scores indicate more severe anxiety levels experienced by the patient.[15]

PainDETECT Questionnaire: The PainDETECT neuropathic pain questionnaire was used to evaluate the presence of neuropathic pain in patients.[16] The questionnaire was first developed in order to detect the neuropathic component of pain in patients with low back pain. Patients with a total questionnaire score of 12 or less are considered to have no neuropathic pain component. If the total score is in the range of 13-18, the result is uncertain, but a neuropathic component may be present while 19 and above are considered that there is a neuropathic pain component.[17]

All used questionnaires and scales had Turkish validity and reliability.

Statistical analysis

The data has been evaluated with the SPSS (version: 22,0) IBM SPSS statistical package program. Arithmetic mean, standard deviation, min-max and median values are given for the

variables obtained by measurement and they show normal distribution. Median and IQR (Interquartile Range) are given for the variables that do not show normal distribution. The variables indicated by counting are shown as numbers and percentages. Shapiro-Wilk test has been used to fit the normal distribution. Analysis of variance has been used for those with normal distribution. Bonferroni out of post-hoc tests has been used for pairwise comparisons. The Kruskal-Wallis test has been used to compare multiple groups that did not show normal distribution. Mann Whitney U test has been used for pairwise comparisons. $P<0.05$ value has been accepted as statistically significant.

RESULTS

Of the patients, 126 were females and 23 were males with a mean age of 48.81±12.72. The mean BMI was 31.71±4.93. The severity of the CTS was graded as severe in 54 patients, moderate in 70 patients, and mild in 25 patients. In pain typing, 32.2% of the patients had nociceptive, 51% had mixed and 16.8% had neuropathic pain.

Table 1 shows the statistical data of age, painDETECT, and Epworth sleepiness scales. There was a significant difference between age and severity of CTS ($p<0.05$). Statistically significant difference was detected between mild and severe CTS, and moderate and severe CTS. There was also a significant correlation between the PainDETECT questionnaire and the severity of CTS ($p<0.05$). The correlation was seen between mild and moderate CTS, and mild and severe CTS. There was a significant difference between the Epworth sleepiness scale and the severity of CTS ($p<0.05$). The difference was detected between mild and severe CTS.

The statistical data of NRS, BMI, Pittsburgh Sleep Quality Scale, Beck Anxiety Score, Beck Depression Score, Boston Symptom Severity Scale (BSSS) and Functional Status Scale (FSS), are given in Table 2. There was a significant difference ($p<0.05$) between NRS, Pittsburgh Sleep Quality Scale, Boston SSS, FSS and the severity of CTS. There was no statistical difference found between BMI, Beck Anxiety, Beck Depression Score and the severity of CTS ($p>0.05$).

DISCUSSION

Previous studies has emphasized that depression, anxiety and deterioration in sleep quality accompany different painful syndromes. In our study, we aimed to determine the relationship between disease severity and pain type, sleep quality and psychiatric factors in CTS. There are many studies which reported that sleep quality is impaired in CTS as night time symptoms are more pronounced. In a study in which the severity of CTS was evaluated by pain and the Boston CTS scale, it was found that CTS causes a decrease in sleep quality and total sleep hours.[2] In another case-controlled study, more sleep-related problems were reported for patients with CTS than control.[18] There were other studies where sleep quality was evaluated before and after surgical treatment, with reports of an increase in sleep quality after surgery.[3,19,20] However, there were also studies that have contrary findings. Rubin *et al*., stated that there was no relationship between the severity of insomnia and the severity of CTS.[21] In another study that included 398 patients, no significant difference was found in the Insomnia Severity Index during the pre- and post-surgical follow-ups.[22] In our study, we found that sleep quality decreased in all groups, and daytime sleepiness was significantly increased in patients with severe CTS. Sleep quality affects the day time activities of the person. The increase in

Table 1: Comparison between the severity of CTS and Age, PainDETECT and Epworth Sleepiness Scales

	Mild CTS	Moderate CTS	Severe CTS	p/f
		X±SD		
Age	44.67±12.14	48.31±11.22	59.16±12.61	P:0.01 f:0.17
PainDETECT Questionnaire	12.02±4.11	14.46±4.39	16.76±4.23	P:0.01 f:11.47
Epworth Sleepiness Scale	6.89±4.03	8.61±4.20	9.60±4.40	P:0.01 F:4.41

CTS: Carpal Tunnel Syndrome, X±SD: Arithmetic Mean± Standard Deviation, p<0,05*

Table 2: The comparison between the severity of CTS and NRS, BMI, Pittsburgh Sleep Quality Scale, Beck Anxiety, Beck Depression Score, Boston SSS and FSS

	Mild CTS	Moderate CTS	Severe CTS	p
	Median (IQR)			
NRS	4.00(1.25)	6.00(2.00)	7.00(1.50)	0.01
BMI	29.90(7.40)	32.05(7.37)	32.00(4.85)	0.53
Pittsburgh Sleep Quality Scale	7.00(7.25)	10.00(8.00)	11.00(5.00)	0.01
Beck Anxiety Score	15.00(11.00)	15.00(10.00)	14.00(11.50)	0.48
Beck Depression Score	10.50(6.25)	13.00(8.50)	13.00(8.00)	0.14
Boston SSS	2.00(0.85)	2.60(0.90)	3.40(1.35)	0.01
Boston FSS	2.15(1.10)	2.70(1.00)	3.00(1.00)	0.01

CTS: Carpal Tunnel Syndrome, NRS: Numeric Rating Scale, BMI: Body Mass Index, Boston SSS: Boston Symptom Severity Scale, Boston FSS: Boston Functional Status Scale, IQR: Interquartile Range,
Mann Whitney U test, p<0,05*

daytime sleepiness in the severe CTS group may negatively affect life and cause a significant decrease in work quality. As far as we know there is no previous study evaluating daytime sleepiness in patients with CTS.

An increase in the incidence of depression has been observed in pain caused by nerve entrapment, especially in relation to the severity and duration of the neuropathic pain.[23] The prevalence of depression is increasing worldwide. Impaired sleep quality accompanying depression is also one of the prominent symptoms of depression.[24] The same symptom seen in CTS patients raises the question of the frequency of depression. However, Chan *et al*. did not find a significant relationship between symptom severity and depression in a questionnaire study with 215 CTS patients.[25] In another observational study, no correlation was found between pain severity and clinical and psychological variables.[26] At the same time, the increase in the incidence of anxiety in sleep problems should not be ignored.[27] In a study conducted in the geriatric group, a significant relationship was found between sleep disorder, daytime sleepiness and anxiety.[28] In a comparative study Yurtoğulları *et al*. reported that both depression, anxiety and deterioration in sleep quality were found to be significantly different within the CTS group.[29] We did not find a statistically significant difference between disease severity and depression and anxiety in our study.

Obesity, advanced age, and female gender are among the risk factors for CTS.[30] In female CTS patients, the peak age is reported to be between 45-54 years old.[31] In our study, we found a significant difference between age and the severity of CTS. This difference was between mild and severe and moderate and severe CTS. There are studies showing that the increase in body mass index, which is the best indicator of body fat ratio, is directly proportional to the increase in the incidence of CTS and also the severity of CTS. Increased fat ratio may cause increased hydrostatic pressure in the carpal tunnel.[32-34] In our study, although the mean BMI was found to be high at 31.71, no significant relationship was found between BMI and disease severity.

The Boston CTS scale, developed by Levin *et al*., is an easy, short and self-administered scale to evaluate the severity of symptom and functional condition in CTS.[5] It is one of the most frequently used scales in previous studies due to its high reliability and validity.[35,36] The questionnaire used in clinical follow-ups is thought to be critical before and after treatment.[37] In our study, both the increase in symptom severity and the deterioration in functional status showed statistical significance with the increase in CTS severity.

The incidence of neuropathic pain in the general population is 7-8%.[38] In CTS, the rate is 31-77%.[39] Nerve injury continues in a slow and chronic process in entrapment neuropathies. The pressure increase in the carpal tunnel causes mechanical compression and as a result of disrupting median nerve blood circulation, it result in median nerve ischemia, local demyelination and ultimately axonal loss.[40] Does the resulting nerve damage always cause neuropathic pain? In a study evaluating two groups with and without neuropathic pain with CTS, no relationship was found between disease severity and neuropathic pain.[41] It is still not clear why neuropathic pain

is prominent in some patients while nociceptive pain is prominent in other patients.[39] In our study, 16.8% of the patients had neuropathic pain. In the evaluation of neuropathic pain, a significant difference was found between the mild CTS group and the other groups.

In conclusion, we found that with the increase in the severity of the CTS, there is deterioration in sleep quality and increase in daytime sleepiness.

DISCLOSURE

Ethical considerations: This study was approved by the 'Sivas Cumhuriyet Üniversitesi Tıp Fakültesi' ethical committee (2021–01/39).

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Conflict of Interest: None

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