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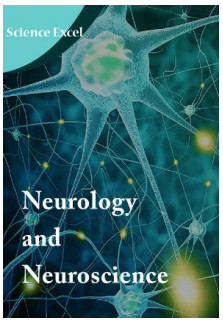

Relationship Between Compression Severity and Hand Dexterity, Sleep, Quality of Life, Neuropathic Pain, and Anxiety-Depression in Patients with Carpal and Cubital Tunnel Syndrome

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Keywords

carpal tunnel, cubital tunnel, sleep, quality of life, neuropathic pain

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Abstract

Objective: Carpal and cubital tunnel syndromes are common entrapment neuropathies [1]. Some previous studies showed that carpal tunnel syndrome and, to a lesser extent, cubital tunnel syndrome can impair sleep and quality of life [2-4]. But there are only few studies comparing these two syndromes [5]. However, no study, which evaluates hand dexterity, sleep quality, quality of life, and neuropathic pain in relation to the severity of compression determined by Electroneurography (ENMG) in both syndromes, could be found in the literature. Thus, it was aimed in the present study to investigate the relationship between hand dexterity, sleep quality, quality of life, neuropathic pain, and anxiety-depression symptoms with different levels of compression severity in patients clinically and electro-physiologically diagnosed with carpal tunnel syndrome and cubital tunnel syndrome.

Materials and methods: This study involved patients, who applied to the ENMG laboratory and were18 years or older and clinically and electro-physiologically diagnosed with carpal tunnel syndrome and cubital tunnel syndrome. The sociodemographic and clinical data of the patients who agreed to participate in the study were recorded.

Carpal tunnel syndrome was classified as mild, moderate, and severe by using the American Association of Electrodiagnostic Medicine Classification [12] based on electrophysiological data, whereas the classification of cubital tunnel syndrome was performed by using the electrodiagnostic grading system created by Zeidman and Pandey based on the American Association of Electrodiagnostic Medicine practice guidelines [13].

The Pittsburgh Sleep Quality Index [14,15] and Epworth Sleepiness Scale [16,17] were used in evaluating the sleep quality of the patients, the EuroQuol-5D Quality of Life Scale [18,19] for quality of life, the 4-item neuropathic pain scale [20,21] for neuropathic pain, the Hospital Anxiety and Depression Scale [22,23] for anxiety and depression levels, and the 9-Hole Peg Test [24] for hand dexterity. After the forms were filled in, the data of the patients having carpal tunnel syndrome and those of patients having cubital tunnel syndrome were compared statistically. Moreover, after staging them as mild, moderate, and severe, the findings of patients in both groups were compared within each group, and their relationships were investigated.

Results: Sleep disorders, neuropathic pain, depression, and anxiety disorders were observed to be much more prevalent among patients with CTS when compared to the patients with CuTS and the severity of these disorders increases together with an increase in the severity of the disease. It was also determined that CTS patients lag behind CuTS patients in fine motor skills.

Conclusion: It should be noted that all of these parameters negatively affect the quality of life of patients. Early physiotherapy and rehabilitation can be beneficial in the treatment of patients and can contribute to their quality of life.

Introduction

Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy originating from the compression of the median nerve at wrist level [1,6].Cubital tunnel syndrome (CuTS), however, is the second-most common one, which develops due to compression of the ulnar nerve at elbow level [1]. Diagnosis is made by evaluating clinical symptoms, physical examination findings, and electrodiagnostic studies. The severity of compression is as important as the diagnosis of CTS and CuTS [7]. This severity level can be determined by making use of the electrodiagnostic data [7]. Nighttime exacerbation of pain and dysesthesia are typical symptoms of these entrapment neuropathies [8,9]. The increased neuropathic pain at night and the impaired sleep quality

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in patients having CTS and CuTS can be associated with the severity of compression. Furthermore, causing functional disability, compression of the median and ulnar nerves distorts the manual dexterity, quality of life, and mental conditions of patients [10]. It can also lead to anxiety disorders and major depression [10,11]. The severity level of compression might be related with the anxiety-depression symptoms and the quality of life. Furthermore, sleep quality, quality of life, neuropathic pain, and anxiety-depression affect each other in these patients.

Materials and methods

This study enrolled patients,who applied to the ENMG laboratory of the Department of Neurology at SANKO University School of Medicineandwho were 18 years and older andclinically and electro-physiologicallydiagnosed with CTS and CuTS.

The sociodemographic and clinical data of the patients, who agreed to participate in the study, were recorded.

Carpal tunnel syndrome was classified as mild, moderate, and severe in accordance with the American Association of Electrodiagnostic Medicine classification system by making use of the electrophysiological data [12]. The electrodiagnostic grading system developed by Zeidman and Pandey in 2020, based on the American Association of Electrodiagnostic Medicine practice guidelines, was used for cubital tunnel syndrome [13].

Then, Pittsburgh Sleep Quality Index (PSQI) [14,15] and Epworth Sleepiness Scale (ESS) [16,17] were used in order to evaluate the sleep quality of the patients, whereas EuroQuol-5D Quality of Life Scale (EQ-5D) [18,19] was used in evaluating their quality of life, 4-item neuropathic pain scale [20,21] in evaluating the neuropathic pain, Hospital Anxiety and Depression Scale (HADS) [22,23] for anxiety and depression levels, and 9-Hole Peg Test [24] for hand dexterity. Data from patients with carpal tunnel syndrome and cubital tunnel syndrome were compared statistically. In addition, by staging the results as mild, moderate, or severe,the findings of patients in both groups were compared and their relationships were investigated within each group.

***Table 1**. Carpal Tunnel Syndrome Classification by the American Association of Electrodiagnostic Medicine*

Mild: Distal sensory latency prolongation and/or sensory nerve action potential (SNAP) amplitude reduction of the median nerve
Moderate: In addition to mild CTS findings, prolongation of the distal latency of the median nerve compound muscle action potential (CMAP)
Severe: In addition to prolongation of latencies in motor and sensory branches of N. medianus, absence or amplitudereduction in SNAP or absence of CMAP, frequent fibrillations observed in needle electromyography (EMG), significant reductions in full muscle contractions, and variations in motor unit potentials

***Table 2**. Zeidman and Pandey's Classification of Cubital Tunnel Syndrome*

Mild: distal latency deceleration of the ulnar CMAP across the elbow and normal ulnar SNAP
Moderate: decreased amplitude of the ulnar SNAP, prolongation of the ulnar CMAPacross the elbow
Severe: Absence of the ulnar SNAP, decreased amplitude of the ulnar CMAP/absence of the ulnar CMAP

Statistical method

The data analysis was performed using IBM SPSS V23. Shapiro-Wilk test was used in testing if the data fit the normal distribution. Mann-Whitney U test was utilized in comparingthe data that did not fit the normal distribution in paired-group comparisons. In the comparisons between three or more groups, the Kruskal-Wallis test was used for data that did not follow a normal distribution and multiple comparisons were performed using the Dunn test. Yates correction, Fisher's Exact test, and Pearson chi-square test were utilized for the comparison of categorical variables according to groupsand multiple comparisons were made using the Bonferroni correction. The analysis results areexpressedin frequency (percentage) for categorical variables and mean ± SD and median (minimum-maximum) for quantitative variables. The significance level was set at $p < 0.050$.

Results

No statistically significant difference was found between the groups regarding the distribution of gender (p=0.21). Forty-six percent of patients with CuTS were male, while 52% of participants having CTS were male. Comparing the mean ages, no significant difference could be found between the groups (p>0.50). The mean age was found to be 50 years for CuTS patients and 49 years for CTS patients. Comparing the marital statuses of participants, the marriage rate among CuTS patients (79.6%) was found to be statistically significantly higher than in CTS patients (56%) (p=0.022).Analyzing the distribution of educational level of groups, it was determined that2% of CuTS patients and 24.5% of CTS patients were elementary school graduates, whereas 2% of CuTS patients and 14.3% of CTS patients were middle school graduates(p<0.001). Moreover, 66% of CuTS patients and 38.8% of CTS patients were found to have a university degree or higher. Comparing the distribution of known comorbidities, it was found that4% of CuTS patients and 24.5% of CTS patients had hypertension, while 16.3% of CuTS patients had cardiovascular disease but no cardiovascular disease was found among (p=0.001). The tobacco and alcohol use results of the groups yielded no statistically significant difference (p>0.050). However, there was a statistically significant difference regarding the distribution of right-handed and left-handed participants (p=0.001); 80% of CuTS patients and all CTS patients were right-handed. (Table 3)

Comparing the median Epworth scores, a statistically significant difference was found between the groups (p<0.001). The median score was 6 for patients with CuTS and 12 for CTS patients. Analyzing the median Pittsburg scores of the groups, it was determined that the median Pittsburg score [7] of CuTS patients was statistically significantly lower than that of CTS patients (15) (p<0.001). Comparing the 4-item Neuropathic Pain scores of groups, there was a statistically significant difference between the median scores (p<0.001). The median score was 2 for CuTS patients and 6 for CTS patients. Statistically significant differences were found between the median scores of the groups in Eq-5D-3L (p<0.001); while the median score of CuTS patients

***Table 3**. Distribution of demographic data by groups*

	Group		Test stat.	p
	Cubital Tunnel Syndrome	**Carpal Tunnel Syndrome**		
Gender				
Men	26 (46)	23 (46)	2.349	0.534*
Women	24 (48)	26 (54)		
Marital Status				
Married	28 (56)	40 (80)	5.264	0.022*
Single	22 (44)	10 (20)		
Educational Status				
Elementary School	1 (2)a	12 (24.5)b	18.184	<0.001**
Secondary School	1 (2)a	7 (14.3)b		
High School	15 (30)a	11 (22.4)a		
University or higher	33 (66)a	19 (38.8)b		
Smoking				
Yes	24 (48)	21 (40.8)	2.154	0.341**
Never before	25 (50)	25 (51)		
Quit	1 (2)	4 (8.2)		
Alcohol Use				
Yes	13 (26)	12 (22.4)	0.032	0.859*
Never before	37 (74)	38 (77.6)		
Chronic Disease				
None	48 (96)a	29 (57.1)b	21.398	<0.001**
Hypertension	2 (4)a	12 (24.5)b		
Cardiovascular disease	0 (0)a	8 (16.3)b		
Lung disease	0 (0)a	1 (2)a		
Used Hand				
Right	40 (80)	50 (100)	---	0.001***
Left	10 (20)	0 (0)		

* Yates correction; **Pearson's Chi-Aquare; ***Fisher'sExact Test; a-b: No difference between the groups with the same letter.

***Table 4**. Comparison of test data by groups*

	Group				Test Stat.	p*
	Cubital Tunnel syndrome		**Carpal Tunnel syndrome**			
	Mean ± SD	**Median (min-max)**	**Mean ± SD**	**Median (min-max)**		
Epworth	6.86 ± 3.53	6 (1 - 16)	11.06 ± 4.89	12 (3 - 19)	627.50	<0.001
Pittsburg	7.8 ± 4.32	7 (2 - 18)	14.22 ± 5.09	15 (3 - 21)	428.00	<0.001
4 Item Neuropathic	2.54 ± 1.78	2 (1 - 7)	5.06 ± 2.47	6 (1 - 9)	506.50	<0.001
Eq-5D-3L	0.15 ± 0.15	0.08 (0.1 - 0.7)	0.35 ± 0.29	0.16 (0.1 - 0.8)	576.50	<0.001
Eq-5D-3L Vas	90.4 ± 12.77	95 (40 - 100)	72.24 ± 18.17	70 (40 - 100)	525.00	<0.001
Hospital Anxiety	6.68 ± 2.77	6 (2 - 15)	9.53 ± 3.63	9 (4 - 20)	653.00	<0.001
Hospital Depression	7.38 ± 3.98	7 (1 - 20)	10.18 ± 4.53	8 (3 - 21)	762.00	0.001
Nine Hole Peg Right	22.16 ± 6.45	20.35 (14.2 - 42.8)	32.2 ± 9.89	32.5 (16.3 - 50.2)	468.50	<0.001
Nine Hole Peg Left	20.54 ± 3.07	19.7 (15.6 - 30.2)	24.28 ± 4.96	24 (16 - 36.5)	648.00	<0.001

***Table 5**. Comparing the test data by CTS stage*

	CTS (Stage)			
	No	**Mild**	**Moderate**	**Severe**
Epworth	6.87 ± 3.48	6.33 ± 2.72	12.36 ± 1.95	16.07 ± 3.04
	6 (1 - 16)b	5.5 (3 - 12)b	12 (7 - 16)a	16 (6 - 19)a
Test stat.	48.34			
p*	<0.001			
Pittsburg	7.75 ± 4.3	9.72 ± 3.48	15.79 ± 1.53	19.2 ± 2.57
	7 (2 - 18)b	9.5 (3 - 16)b	16 (13 - 18)a	20 (12 - 21)a
Test stat.	55.416			
p*	<0.001			
4 ItemNeuropathic	2.56 ± 1.75	2.44 ± 1.04	6 ± 0.68	7.6 ± 1.35
	2 (1 - 7)b	2 (1 - 4)b	6 (5 - 7)a	8 (4 - 9)a
Test stat.	56.548			
p*	<0.001			
Eq-5D-3L	0.14 ± 0.14	0.13 ± 0.06	0.29 ± 0.22	0.73 ± 0.14
	0.08 (0.1 - 0.7)b	0.1 (0.1 - 0.3)b	0.16 (0.1 - 0.7)a	0.83 (0.3 - 0.8)a
Test stat.	51.469			
p*	<0.001			
Eq-5D-3L Vas	90.38 ± 12.52	89.44 ± 9.98	68.57 ± 10.27	52.67 ± 7.99
	90 (40 - 100)b	90 (70 - 100)b	70 (50 - 90)a	50 (40 - 70)a
Test stat.	53.81			
p*	<0.001			
Hospital Anxiety	6.62 ± 2.73	9.06 ± 3.39	10.43 ± 2.79	9.87 ± 4.45
	6 (2 - 15)b	9 (4 - 15)a	10 (6 - 15)a	8 (6 - 20)a
Test stat.	21.758			
p*	<0.001			
Hospital Depression	7.35 ± 3.91	8.39 ± 3.6	11.5 ± 4.59	11.6 ± 5
	7 (1 - 20)c	8 (3 - 16)bc	11.5 (4 - 20)ab	9 (5 - 21)a
Test stat.	17.362			
p*	0.001			

was 0.08, that of CTS patients was found to be 0.16. Another statistically significant difference was found between the median scores of the groups in Eq-5D-3L VAS (p<0.001); the median score of CuTS patients was found to be 95 and that of CTS patients was 70. There was a statistically significant difference between the median scores of the groups in the Hospital Anxiety Scale (p<0.001); the median score in CuTS group was 6 and the median score of CTS patients was 9. A statistically significant difference was observed among the median scores of the groups according to the Hospital Depression Scale (p=0.001). The median score was 7 for patients with CuTS and 8 for those with CTS. A statistically significant difference was found between the median scores of the groups in the 9-Hole Peg (Right) score (p<0.001); the median score was 20.35 for patients with CuTS and 32.5 for those having CTS. There was a statistically significant difference between the median scores of the groups in the 9-Hole Peg (Left) score (p<0.001); the median score was 19.7 for patients with CuTS and 24 for those with CTS. (Table 4)

A statistically significant difference was found between Epworth median scores of CTS patients by the severity of disease (p<0.001). The median score for non-CTS participants was 6, while it was 5.5 for those having mild CTS, 12 for those having moderate CTS, and 16 for those having severe CTS. A statistically significant difference was found between the Pittsburgh median scores by the severity of CTS patients (p<0.001). The median score for non-CTS participants was 7, while it was 9.5 for those having mild CTS, 16 for those having moderate CTS, and 20 for those having severe CTS. Furthermore, a statistically significant difference was found between the median scores of the 4-Item

***Table 6**. Comparison of quantitative data by the CuTS Stage*

	CuTS Stage			
	No	**Mild**	**Moderate**	**Severe**
Epworth	9.91 ± 4.99	5.14 ± 2.22	8.86 ± 2.19	11.83 ± 3.37
	9 (2 - 19)a	5 (1 - 10)b	8 (6 - 13)ab	10.5 (8 - 16)a
Test stat.	19.831			
p*	<0.001			
Pittsburg	4.99 ± 21	2.22 ± 16	2.19 ± 15	3.37 ± 18
	12.58 (13 - 2)b	6.29 (5 - 2)a	9.43 (9 - 7)ab	11.83 (11.5 - 5)ab
Test stat.	19.995			
p*	<0.001			
4 ItemNeuropathic	4.34 ± 2.58	1.71 ± 1.23	3.43 ± 1.51	5.5 ± 1.23
	4 (1 - 9)a	1 (1 - 5)b	3 (2 - 6)ab	5 (4 - 7)a
Test stat.	23.988			
p*	<0.001			
Eq-5D-3L	0.3 ± 0.28	0.09 ± 0.02	0.13 ± 0.02	0.41 ± 0.28
	0.16 (0.1 - 0.8)a	0.08 (0.1 - 0.2)b	0.12 (0.1 - 0.2)ab	0.41 (0.2 - 0.7)a
Test stat.	23.763			
p*	<0.001			
Eq-5D-3L Vas	77.54 ± 18.71	96.67 ± 7.3	82.86 ± 7.56	68.33 ± 16.02
	80 (40 - 100)a	100 (70 - 100)b	80 (70 - 90)ab	75 (40 - 80)a
Test stat.	24.885			
p*	<0.001			
Hospital Anxiety	8.55 ± 3.75	6.71 ± 2.53	8.29 ± 3.15	7.67 ± 3.67
	8 (2 - 20)	7 (2 - 12)	7 (6 - 15)	8 (4 - 14)
Test stat.	4.169			
p*	0.244			
Hospital Depression	9.08 ± 4.61	7 ± 2.81	10.14 ± 5.08	10 ± 6.07
	8 (1 - 21)	7 (2 - 14)	9 (5 - 18)	7 (5 - 20)
Test stat.	3.887			
p*	0.274			

Neuropathic Pain Scale by the severity of CTS patients (p<0.001). The median score for non-CTS participants was 2, while it was 2 for mild CTS, 6 for moderate CTS, and 8 for severe CTS. The median scores in the EQ-5D-3L also showed a statistically significant difference by the severity of CTS (p<0.001). The median score for non-CTS participants was 0.08, while it was 0.1 for mild CTS, 0.16 for moderate CTS, and 0.83 for severe CTS. Additionally, a statistically significant difference was found between the median scores of the EQ-5D-3L VAS by the severity of CTS (p<0.001). The median score for non-CTS participants was 90, while it was 90 for mild CTS, 70 for moderate CTS, and 50 for severe CTS. A statistically significant difference was also found between the median scores of the Hospital Anxiety Scale by the severity of CTS patients (p<0.001). The median score for non-CTS participants was 6, while it was 9 for mild CTS, 10 for moderate CTS, and 8 for severe CTS. Finally, a statistically significant difference was found between the median scores of the Hospital Depression Scale by the severity of CTS patients (p=0.001). The median score for non-CTS participants was 7, while it was 8 for mild CTS, 11.5 for moderate CTS, and 9 for severe CTS. (Table 5)

Considering the severity of CuTS, there was a statistically significant difference between the median Epworth scores (p<0.001). The median score was 9 innon-CuTS participants, while it was 5in mild CuTS patients, 8in moderate CuTS patients, and 10.5 in severe CuTS patients. A statistically significant difference was found also between the median Pittsburg scores by the severity of CuTS (p<0.001). The median score was 12.58 in non-CuTS participants, while it was 6.29 in mild CuTS patients, 9.43 in moderate CuTS patients, and 11.83

in severe CuTS patients. A statistically significant difference was found between the median scores of the 4 Item Neuropathic Pain by the severity of CuTS (p<0.001). The median score was 4in non-CuTS participants, while it was 1in mild CuTS patients, 3 in moderate CuTS patients, and 5in severe CuTS patients. A statistically significant difference was found between the median EQ-5D scores by the severity of CuTS (p<0.001). The median score was 0.16 in non-CuTS participants, while it was 0.08 in mild CuTS patients, 0.12 in moderate CuTS patients, and 0.41 in severe CuTS patients. There was a statistically significant difference also between the median EQ-5D VAS scores by the severity of CuTS (p<0.001). The median score was 80 in non-CuTS participants, while it was 100 in mild CuTS patients, 80 in moderate CuTS patients, and 75 in severe CuTS patients. (Table 6)

Discussion

There was a statistical difference between the groups in terms of marital status. The marriage rate is higher among CTS patients when compared to CuTS patients. Considering the education level, the percentage of university graduates is higher among CuTS patients than in CTS patients. The rate of comorbidities was found to be higher in CTS patients. Epworth and Pittsburgh scores of CTS patients were found to be significantly higher than CuTS patients. When compared to CuTS patients, CTS patients were determined to have poorer night-time sleep quality and higher daytime sleepiness. CTS patients frequently wake up due to pain and numbness in affected fingers and hands during the night. These patients complain more about poor sleep quality, interrupted sleep, and daytime sleepiness. Moreover, it can be seen that the neuropathic pain scores were significantly higher in CTS. Although CTS symptoms may cause insomnia at night, insomnia can make people more susceptible to a variety of nocturnal symptoms and reduce the pain thresholds due to numbness and tingling during nights of interrupted sleep. Furthermore, the scores in EQ-5D and EQ-5D VAS scales conducted to assess the quality of life were also significantly lower in CTS. The rate of anxiety and depression in CTS patients was found to be significantly higher in comparison to CuTS patients. Previous studies showed that psychiatric disorders such as anxiety and depression accompanying the CTS disrupt patients' quality of life and negatively affect their response to treatment [10,11]. It was also observed that CTS patients could perform commands significantly more slowly in the 9-hole pegboard test applied to evaluate manual dexterity.

When evaluated according to their severity, it was determined that the Epworth, Pittsburgh, 4-ItemNeuropathic Pain, Hospital Depression and Anxiety Scale scores were higher, and the quality-of-life scores were lower among moderate to severe CTS patients when compared to those having mild symptoms. Given the results of the present study, it can be seen that sleep disorders of CTS patients increased with increasing symptom severity. In some studies, it was observed that non-spontaneous sleep disruptions and short sleeping times lowered the pain threshold [8,9,11]. Given this finding, CTS patients may feel their pain more exaggeratedly as sleep disturbances increase. Consequently, with the disrupted sleep pattern, the patient falls into a vicious circle and the treatment becomes more difficult. Although there was a significant difference by the severity of the disease in CuTS patients, it was determined that the increase in severity of disease did not affect sleep, neuropathic pain, depression - anxiety, and quality-of-life parameters.

Conclusion

Sleep disorders, neuropathic pain, depression, and anxiety disorders were observed much more frequently among CTS patients in comparison to CuTS patients, and the severity of these disorders increases with the severity of the disease. Considering all these parameters, it should be noted that they have a negative impact on the quality of life of patients. CTS patients were also found to lag behind CuTS patients in terms of fine motor skills. Early physiotherapy and rehabilitation might be beneficial in the treatment of patients and contribute positively to their quality of life. Identification of these relationships can shed light on future studies by examining the results of applying multidimensional treatment parameters together.

Ethics committee approval

Ethics committee approval was obtained from the Ethics Committee of the Medical Faculty of SANKO University on 04.23.2023.

Conflict of interest

No conflict of interest.

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