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The Clinical Neurological Manifestations of Patients Diagnosed with Carpal Tunnel Syndrome

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ABSTRACT

Background: Carpal tunnel syndrome (CTS) is a condition, in which the median nerve becomes pressed or squeezed at the wrist. This causes pain and numbness in the fingers. Therefore, a neurological study is crucial to assess the condition. **Objectives:** The objective of this study was to assess the neurological manifestations of CTS and their association with demographic and clinical features from October 2022 to March 2023. **Materials and Methods:** A quantitative study was carried out over the period of 5 months by prospectively selecting and enrolling 100 CTS patients with a confirmed diagnosis. The CTS assessment questionnaire was modified and patients consented to the study before the data collection. **Results:** Adults aged 35–44 were the dominant group and the disease was found in females 10 times more than males. The least assigned symptoms were tingling and numbness in the little finger (4%) and neck pain 22%. All the patients with CTS presented with severe levels of CTS. Statistically significant associations were found between occupations, duration of the disease, affected side, other chronic diseases, and the prevalence of the symptoms at $P \leq 0.05$. Self-management to sub-side pain and numbness had crucial impact on reducing the symptoms ($P \leq 0.05$). **Conclusion:** The prevalence of the neurological symptoms varied depending on the sociodemographic and clinical features. Self-management had a significant positive impact on reducing some of the neurological symptoms, such as pain in the wrist at night and tingling and numbness in the morning.

Index Terms: Carpus Tunnel Syndrome, Carpal Tunnel Syndrome, Neurological Symptoms

1. INTRODUCTION

A group of symptoms caused by compression of the median nerve at the carpal tunnel is known as carpal tunnel syndrome (CTS). Pain, numbness, or tingling on the anterior surface of the index, middle, or radial half of the ring finger are signs of compression of the median nerve. It is frequently linked to hand grip weakness or nighttime symptoms, including numbness and pain in the hands or arms [1].

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The pathophysiological mechanism linked to CTS is the median nerve entrapment in the wrist, which causes compression of the nerve, resulting in paresthesia, numbness, and hand muscle weakness that can be diagnosed by the nerve conduction study [2].

The disease is very common in the general population; at a point, the morbidity is rising with the advancement of modern life. Since CTS is a common illness, research on its etiology is crucial to improving the quality of life among patients. Individual characteristics such as age, sex, diabetes, hypothyroidism, obesity, tobacco, injury, and occupational factors are among the risk factors. However, the majority of the studies were conducted on western societies [3]. A multifactorial etiology has been suggested by the association between CTS and occupational i.e., repetitive and forceful work such as gripping and vibrations [4].

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The links between CTS and work-related psychological aspects at work are still unclear, despite an increasing number of studies on occupational stress [5,6]. Because of increased exposure to repetitive movements and a lack of recovery time, lean production systems and the corresponding new work organization systems are thought to intensify work pace and job demand and, as a result, increase the risk of musculoskeletal disorders. Some epidemiological studies indicate associations between a higher risk of CTS and the characteristics of the workplace [7]. Despite the available evidence of high certainty about work□related physical risk factors for CTS, there still might be a lack of awareness in clinical care for prevention [4].

The current study aims to assess the neurological manifestations of CTS and their association with demographic and clinical features.

2. MATERIALS AND METHODS

2.1. Study Design and Population

A quantitative study of cross-sectional design was carried out over the period of 5 months starting from October 2022 to March 2023. The process of the study was declared to the participants and verbal consent was taken from the patients following the ethical guarantee from the Ethical Committee for all Medical Colleges (College of Medicine, College of Dentistry, College of Pharmacy, and College of Nursing) at the University of Sulaimani.

2.2. Sampling Procedures

An accidental sampling procedure was applied to interview 100 patients with CTS who consented to the study and had the characteristics of inclusion criteria.

2.3. Inclusion and Exclusion Criteria

Patients diagnosed with CTS were included after their consent. Patients with non-confirmed diagnoses and patients who did not wish to participate were excluded.

2.4. Diagnostic Tools

The diagnostic tool: The diagnosis of this disorder has been performed by the patients' chief complaint, and provocative physical examination procedures such as Phalen's sign and Tinel's sign. Phalen's test is a series of hand motions and positions that will make the hands or fingers feel numb or tingly if a client has CTS. Tinel's sign is a tingling feeling when the clinician taps the client's skin over an affected nerve [5].

2.5. Data Collection

Data were gathered by conducting interviews with using a modified questionnaire in Sulaimani Rehabilitation and Physiotherapy Center Qanat Street.

2.6. Data Analysis

The Statistical Package for Social Science version 25.0 was used to analyze the data. Several statistical tests, including, percentages, and frequencies, are among the descriptive statistics. In the inferential statistics, Chi-square and Fisher's exact tests were used to analyze the data. The alpha level value of 0.05 was used as the cutoff for statistical significance and 0.001 for high statistical significance.

3. RESULTS

Table 1 shows the sociodemographic characteristics of the study participants, the age group between 35 and 44 years old comprises 54% of the total achieved sample. According to the findings of the present study, females were affected by CTS when compared to males (91% female and 9% male). In addition, the majority of the patients were married (69%), a quarter of the total sample was illiterate, and eight patients completed secondary school. In terms of occupation, which may have a significant impact on the prevalence of the disease, the majority of the participants were housewives, and the proportion of the patients who retired from jobs was only 1%, besides patients who were employed comprised 34% of the total sample.

Table 2 describes the clinical characteristics of the participants, the proportion of the patients who never consumed alcohol was 99%, however, 18% of them were smokers. The majority of the patients had the disease for more than 1 year, which is 71%, and the rest have it for <1 year. Regarding the side that was affected by the neurological symptoms, right arm symptoms were doubled when compared to the left side, while patients who had symptoms on both arms had. Patients who have not been diagnosed with other chronic diseases were nearly twice as many as those with other chronic diseases (65% vs. 35%, respectively). Type 2 diabetes mellitus was the most prevalent chronic disease besides CTS (11%), while only 2% of them had hypertension and gout disease. Finally, ten patients (10%) of the total sample were living with more than five comorbidities.

Table 3 shows the neurological clinical symptoms among the patients. Seventy-seven percent of the patients had pain in

TABLE 1: Sociodemographic characteristics of the study participants

Sociodemographic features	Frequency	Percent
Age groups		
35–44	52	52.0
45–54	29	29.0
55–64	12	12.0
65–74	6	6.0
75–84	1	1.0
Gender		
Male	9	9.0
Female	91	91.0
Marital Status		
Single	15	15.0
Married	69	69.0
Divorced	4	4.0
Widow or Widower	12	12.0
Level of education		
Illiterate	25	25.0
Primary school	20	20.0
Secondary school	8	8.0
Diploma	26	26.0
University and higher	21	21.0
Occupation		
Employed	34	34.0
Self-employed	5	5.0
Housewife	47	47.0
Retired	1	1.0
Jobless	13	13.0

TABLE 2: Clinical characteristics among the participants

Clinical data	n.	(%)
Alcohol consumption		
Yes	1	1.0
No	99	99.0
Total	100	100.0
Smoking status		
Smoker	18	18.0
Non-Smoker	77	77.0
Ex-Smoker	5	5.0
Duration of CTS		
<1 year	29	29.0
More than 1 year	71	71.0
Side of CTS		
Right side	55	55.0
Left Side	29	29.0
Both sides	16	16.0
Other chronic diseases		
Yes	35	35.0
No	65	65.0
Types of other chronic diseases		
Gout	2	2.0
Hypothyroid	4	4.0
DM	11	11.0
Rheumatoid arthritis	6	6.0
HTN	2	2.0
more than 5 diseases	10	10.0
Total	35	35.0
No Other diseases	65	65.0
Total	100	100.0

TABLE 3: Prevalence of neurological symptoms among the patients

Neurological symptoms	n.	(%)
Pain in wrist at night	77	77.0
Tingling and numbness at night	78	78.0
Tingling and numbness in morning	72	72.0
Tingling and numbness in little finger	4	4.0
Tingling and numbness when grasping something	54	54.0
Neck pain	22	22.0

their wrists at night, besides tingling and numbness, which accounted for 78% of the total sample. Morning symptoms also comprised 72% of the participants, particularly tingling and numbness. In addition, more than half of the patients 54% reported tingling and numbness when grasping something.

Regarding specific areas of the symptoms, only 4 percent complained of tingling and numbness in the little finger, and neck pain was presented in 22%.

In Table 4, a statistically significant relationship was found between the occurrence of tingling and numbness in the morning and the patients' occupation at $P = 0.05$. To exemplify, this symptom was reported among 100% of patients who were self-employed and more than 80% of housewife patients who work repetitively handy work at home. Moreover, all the patients who were retired from their jobs complained of the same symptoms.

Table 5 illustrates a statistically highly significant association between the clinical features of the participants and the CTS symptoms. For example, 82% of the patients who had the disease for more than 1 year presented with tingling and numbness in the morning when compared to those who had a history of <1 year which only 48% complained with this symptom at $P = 0.001$.

Tingling and numbness at night were found among those who had other chronic diseases by almost 91%. Patients with rheumatoid arthritis (RA), HTN, and comorbidity (more than five diseases) presented without tingling and numbness in the morning $P = 0.016$.

Table 6 discloses the level of CTS symptoms among the patients, by which it has being found that 100% of the study sample presented with severe levels of CTS symptoms.

4. DISCUSSION

In the current study, most of the CTS were female and they were doing housekeeping in terms of occupation. This is totally in line with the finding of a study by Hong *et al*., 2022 in China, by which female comprises the majority of the cases when compared to males (72 females and 2 males). Among the 72 females, 29 were housekeepers and 18 were farmers. In another study that aimed to explore the characteristics of CTS patients, it has being found that 63% of the cases are female and 37% – male [8].

In our study, the proportion of the right side wrist affected with CTS was 55%, the left side – 29%, and both wrists – 16%, but these results are noticed in other studies differently. For instance, Hong *et al*. found only 30% were affected with the right side, 15% – left wrist, and 55% having CTS in both wrists [8].

In the current study, a significant relationship was observed between the occupations and the occurrences of CTS. Similarly, in several studies, the role of occupations was examined among workers and concluded with the significant effects of occupation on the prevalence of CTS [9]–[11]

In this study, moreover, there is a great impact of patients' clinical data on the intensity and variation of the neurological symptoms, For example, the duration of the disease, the affected side of CTS, and the patients' other chronic diseases had a critical impact on the symptoms, patients with type 2 diabetes mellitus presented with severe neurological symptoms, especially tingling and numbness. The results of a case–control study were in line with our study presenting an association between diabetes mellitus and CTS symptoms [12]. In addition, a study of the assessment of the incidence and severity of CTS among RA patients found the same curtailment impact of RA on the incidence and symptoms of CTS [7], [12].

In our study, the level of CTS symptom intensity was analyzed by the perceived CTS questionnaire. Following the scoring, the study sample presented with severe CTS symptoms and no one was found with mild symptoms. To discuss this finding, no studies were found clearly with the same results. However, there is a substantial amount of literature highlighting the causes of the severity of CTS symptoms including, nerve injury, duration of the disease, side of the arm, occupation, and other comorbidities [13]–[16].

TABLE 4: Association between patients' occupation and the CTS symptom

Occupation	Tingling and numbness in morning		Total
	Yes	No	
	n (%)	n (%)	
Employed	21 (61.7)	13 (38.3)	34
Self-employed	5 (100)	0 (0.0)	5
Housewife	38 (80.9)	9 (19.1)	47
Retired	1 (100)	0 (0.0)	1
Jobless	7 (53.8)	6 (46.2)	13
Total	72 (72)	28 (28)	100
FET*=7.5		*P*=0.05	

TABLE 5: Association clinical features of the patients and the CTS symptom

Duration of CTS	Tingling and numbness in morning		Total
	Yes n (%)	No n (%)	
<1 year	14 (48)	15 (52)	29
More than 1 year	58 (82)	13 (12)	71
Total	72 (72)	28 (28)	100
Pearson Chi-Square=11.4		*P*=0.001	
Side of CTS	**Tingling and numbness in little finger**		**Total**
	Yes	**No**	
Right side	0 (0.0)	55 (100)	55
Left side	1 (3.5)	28 (96.5)	29
Both sides	3 (18.7)	13 (81.3)	16
Total	4 (4)	96 (96)	100
FET=11.3		*P*=0.03	
Other chronic diseases	**Tingling and numbness at night**		**Total**
	Yes	**No**	
Yes	31 (91)	3 (9)	34
No	47 (71)	19 (29)	66
Total	78 (78)	22 (22)	100
Pearson Chi-square=5.21		*P*=0.02	
Types of other Chronic Diseases	**Tingling and numbness in morning**		**Total**
	Yes	**No**	
Gout	1 (50)	1 (50)	2
Hypothyroid	3 (75)	1 (25)	4
DM	8 (73)	3 (27)	11
Rheumatoid arthritis	6 (100)	0 (0.0)	6
HTN	2 (100)	0 (0.0)	2
more than 5 diseases	10 (100)	0 (0.0)	10
Total	30 (30)	5 (5)	35
FET=6.9		*P*=0.016	

TABLE 6: The level of CTS symptoms among the study sample

Level of CTS intensity	Frequency	Percent
Mild CTS symptoms	0	0.0
Sever CTS symptoms	100	100.0

5. CONCLUSION

The study discovered that patients with CTS mainly experience neurological symptoms that interfere with their daily activities. Tingling and numbness at night were the most common symptoms among the patients. Several factors can aggregate the symptoms, including the duration of the disease and other comorbidities and their occupation.

6. ACKNOWLEDGMENT

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7. ETHICAL CONSIDERATIONS

This study was approved by the Scientific Committee of the Basic Sciences Department at College of Nursing. Then, Ethical approval was guaranteed from the Ethical Committee for the Medical Colleges at University of Sulaimani. In addition, patients were informed about the objectives of the study and their independent participation. They also provided consent to the current study.

8. CONFLICTS OF INTERESTS

The author declared that they have no conflicts of interest.

9. FUNDING

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