

Hand Function among Patients with Carpal Tunnel Syndrome

Israa Anwar^{1*}, Afshan Ameer², Shehryar Azam³, Mehwish Khalid¹, Hafiz Muhammad Asim¹

¹Lahore College of Physical Therapy, Lahore Medical & Dental College, Lahore, Pakistan

²Nishtar Medical University Hospital, Multan, Pakistan

³Bakhtawar Amin Medical and Dental College, Multan, Pakistan

Email: *israanwar4@gmail.com, mehwish.khalid@lmdc.edu.pk, dean.lcp@lmdc.edu.pk

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Abstract

Background: Carpal Tunnel Syndrome (CTS) is the compression of the median nerve in carpal tunnel of wrist which leads to the typical symptoms of numbness, paresthesia and sometimes pain in the patient's hand. The symptoms are usually sensed in the first three radial fingers and the lateral side of the ring finger because these areas are innervated by the median nerve. **Objective:** To assess hand function among patient with Carpal Tunnel Syndrome (CTS). **Methods:** This was a descriptive study in which 41 subjects (27 females and 14 males) were included from Ghurki trust teaching hospital, Lahore and Shalamar hospital, Lahore (from August 2018 to October 2018) according to inclusion criteria. Samples were collected according to WHO (World Health Organization) calculator. Hand function was measured with Boston Carpal Tunnel Questionnaire (BCTQ). **Results:** Majority of the patients with CTS fell into mild functional severity and mild symptom severity. The mean score for functional severity was 2.34 and for symptom severity it was 2.97. **Conclusion:** Activities of daily living such as grasping, writing, gripping and carrying objects were affected by the symptoms of pain, numbness, tingling and weakness in the patients suffering from CTS.

Keywords

Carpal Tunnel Syndrome, Boston Carpal Tunnel Questionnaire, Hand Function

1. Introduction

The term "Carpal Tunnel Syndrome" (CTS) was first used in 1939, although CTS was first noted in medical literature as earlier as the start of 20th century

[1]. CTS is a condition in which entrapment of median nerve occurs in carpal tunnel of the wrist. Median nerve passes from carpal tunnel of wrist which is located between the flexor retinaculum and carpal bone. The median nerve can move up to 9.6 mm to allow the flexion of the wrist joint and move to a lesser extent during extension [2].

The compression of the median nerve within this tunnel leads to the typical symptoms of numbness, paresthesia and sometimes pain in the patient's hand. The symptoms are usually sensed in the first three radial fingers and the lateral side of the ring finger, because these areas are innervated by the median nerve which is a branch of the brachial plexus. As the condition progresses, the symptoms persist during the day and may be aggravated by heavy activities involving the hand or wrist. When the nerve is compressed for a longer period, nerve degeneration and thenar atrophy may occur [3].

Prevalence of CTS in general population is 3% to 6% [4]. In general, it is more prevalent in women compared to men, and although CTS can occur at any age, it most commonly occurs between 40 and 60 years [5]. In most cases, CTS is idiopathic [6], but major risk factors include obesity, especially in younger patients [7]. Specific diseases that affect the synovium such as diabetes mellitus, rheumatoid arthritis, tenosynovitis can cause also secondary CTS [8]. There is a tentative evidence that hypothyroidism may also increase the risk [9]. CTS has a higher prevalence in the population where there is a repetitive movement of hand related to their occupational requirement [10].

There is a high incidence of CTS in cold weathers and low incidence in summer [11]. Clinical symptoms, nerve conduction studies (NCS) and Phalen's test is performed to diagnose CTS. Phalen's test has 42% - 85% sensitivity and 54% - 98% specificity [12]. Treatment options for CTS include conservative and surgical treatments. Conservative treatment includes rest, splinting and use of corticosteroids. Both splinting and steroid injections are effective short-term, but there is little evidence for their long-term effectiveness [6]. Surgical release of the carpal tunnel is known to be effective and is typically used for patients who fail to achieve adequate relief with conservative managements and for those with moderate to severe symptoms [13].

Hand Function is the ability of the hand and wrist joint to work properly in all directions without any limitation. Normal hand function is a major part of daily livings. The hand is a fascinating biological motor system. Hand is used to perform activity of daily livings like gross motor activities such as grasping and picking and fine motor activities as well like writing, painting and playing musical instruments with the help of linked action of other digits [14].

Hand function impairments in patients with CTS are common. First symptom to appear is weakness of muscles of hand and with passage of time if untreated, disease causes atrophy of the muscles hence resulting in decline of the normal hand functions. A study suggested that patients with mild to moderate CTS are more likely to report mild symptoms and functional limitations whereas patients

with more severe disease may report less severe symptoms but have more severe functional limitations of the hand [12]. Impaired hand functions affect most of the activity of daily livings. Hand function of the patients with CTS can be assessed by using the disease-specific BCTQ (Boston Carpal Tunnel Questionnaire). The scale measures the severity of symptoms and functional status in patients with CTS.

The objective of the study was to evaluate the hand function among the patient with CTS No such study has been conducted in Pakistan to evaluate the hand functions of the patients suffering from CTS. This study was conducted to determine the difficulties in performing activities of daily livings such as writing, gripping, carrying grasping in these patients so a proper treatment can be provided to improve their ability to perform routine daily activities according to their severity level.

2. Materials and Methods

A descriptive study was conducted from August 2018 to January 2019. The ethical approval was granted by the Institutional Review Board of Lahore Medical and Dental College, Lahore. Sample was calculated by WHO Sample size calculator keeping $\mu = 0.96$, margin of error as 2% and confidence interval as 95%. The study settings were Ghurki Trust Teaching Hospital, Shalamar Hospital Lahore. 30 patients were recruited from Ghurki Trust Teaching Hospital, 11 from Shalamar Hospital Lahore. The sampling strategy utilized was non probability convenience sampling.

The inclusion criteria of this study included patient age ranging from 20 to 65 years of age. Patient should have the symptoms of CTS for at least 6 months. Patients with liver diseases, cognitive impairments, rheumatic arthritis and prior hand or wrist surgery were excluded from the study. Hand function was measured through functional severity scale of BCTQ, by measuring the activity of daily livings like gripping, carrying and second part of BCTQ consisted of symptom severity scale which measured pain, numbness, tingling, and weakness.

In BCTQ for functional severity scale, total score range was from 11 to 55 with 11 (asymptomatic), 12 - 22 (mild), 23 - 33 (moderate), 34 - 44 (severe), 45 - 55 (very severe) and for symptom severity total score was 8 to 40 with 8 (asymptomatic), 9 - 16 (mild), 17 - 24 (moderate), 25 - 32 (severe) and 33 - 40 (very severe).

Statistical Analysis

Data was collected through BCTQ questionnaire. The data was analyzed statistically by SPSS version 23. The frequency distribution and correlation were applied to check out the results of our study. In this data analysis, we conducted the result by checking symptoms severity that comprise of pain at night, pain at day time, numbness, weakness and tingling with functional severity that comprise of activity if daily livings, of the patients with CTS.

3. Results

Out of total 41 patients, 65.85% (n = 27) was between (21 - 35) age group, 0% (n = 0) is between (36 - 50) age group and 34.14% (n = 14) is between (51 - 65) age group. Majority of the patients were included from the (21 - 35) age group (**Table 1**). Majority of the patients found in our study were female with 65.9% (n = 27) (**Table 2**).

Majority of the patients included in this study were post pregnant women with the percentage of 65.9% (n = 27) and other 34.1% (n = 14) were diabetic patients (**Table 3**).

When symptoms severity was assessed, no one was in asymptomatic category whereas majority of the patients were in moderate category with 46.3% (n = 19). Other categories with percentages are given below (**Table 4**). Majority of the

Table 1. Classification representing age.

Age (years)	Frequency (n)	Percentage (%)
21 - 35	27	65.85
36 - 50	0	0.0
51 - 65	14	34.14
Total	41	100

Table 2. Gender distribution.

Gender	Frequency (n)	Percentage (%)
Male	7	17.1
Female	34	82.9
Total	41	100.0

Table 3. Distribution according to conditions.

Condition	Frequency (n)	Percentage (%)
Diabetic	14	34.1
Post Pregnant	27	65.9
Total	41	100.0

Table 4. Symptom severity distribution.

Symptom Severity	Frequency (n)	Percentage (%)	BCTQ Score
Asymptomatic	0	0.0	11
Mild	12	29.3	12 - 22
Moderate	19	46.3	23 - 33
Severe	9	22.0	34 - 44
Very Severe	1	2.4	45 - 55
Total	41	100	11 - 55

patients were in moderate functional severity category with 51.2% (n = 21) and 0% (n = 0) were in very severe functional severity category. The list is given below (Table 5 & Table 6) (Figure 1).

Table 5. Functional severity distribution.

Functional Severity	Frequency (n)	Percentage (%)	BCTQ Score
Asymptomatic	04	9.8	8
Mild	21	51.2	9 - 16
Moderate	14	34.1	17 - 24
Severe	02	4.9	25 - 32
Very Severe	00	0.0	33 - 40
Total	41	100	8 - 40

Table 6. Correlation between symptom severity category and function severity.

	Writing	buttoning	Holding objects	Gripping	Opening Jar	Household chores	Carrying Objects	Bathing or Dressing
Pain at Night	0.052	0.001	0.043	0.02	0.06	0.057	0.09	0.12
Waking up due to pain	0.300	0.529	0.145	0.021	0.007	0.288	0.088	0.003
Pain times per day	0.145	0.330	0.051	0.040	0.001	0.145	0.055	0.001
Pain at Daytime	0.066	0.067	0.119	0.053	0.038	0.075	0.141	0.024
Pain Duration at Daytime	0.135	0.854	0.021	0.213	0.051	0.271	0.540	0.012
Numbness	0.101	0.003	0.203	0.071	0.000	0.077	0.016	0.029
Weakness	0.008	0.006	0.057	0.004	0.007	0.010	0.000	0.034
Tingling	0.016	0.027	0.007	0.087	0.001	0.040	0.003	0.001
Numbness/Tingling at Night	0.017	0.018	0.064	0.094	0.000	0.079	0.006	0.013
Numbness/Tingling waking up at night	0.195	0.057	0.001	0.010	0.028	0.065	0.001	0.051
Difficulty Grasping	0.013	0.044	0.008	0.009	0.000	0.000	0.008	0.190

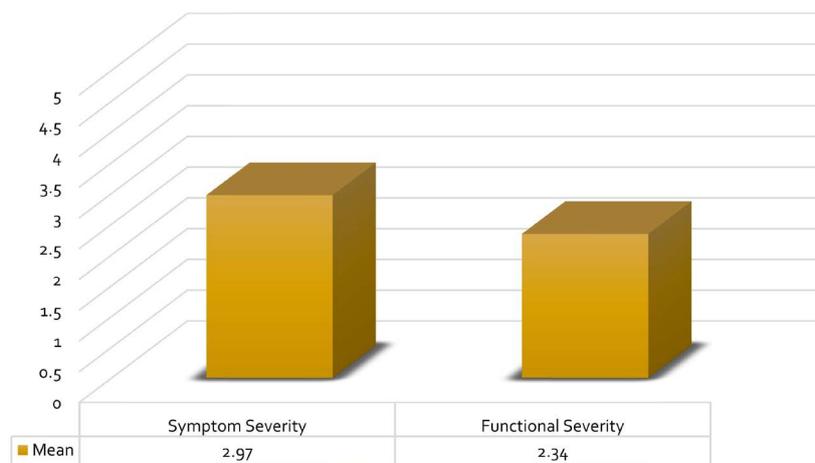


Figure 1. Mean score of symptom severity and Functional severity in n = 41.

4. Discussion

In carpal tunnel syndrome, hand impairments are common and symptoms range from pain to tingling, numbness and weakness that affect the activity of the daily living of the patients like gripping, holding and carrying [15]. In this study we evaluated the hand function among the patients with CTS by using BCQT and determined the Symptoms Severity and Functional Severity of all the patients.

CTS is the entrapment of median nerve in carpal tunnel of wrist with the symptoms of pain, tingling and numbness and weakness in lateral aspect of hand, more precisely in lateral 3 and half fingers and hand [15]. Boston carpal tunnel questionnaire is used to measure symptoms related to CTS. It measures symptom severity (symptom severity scale SSC) including 11 questions and functional severity (functional severity scale FSC) including 8 questions [16].

Pain, numbness, tingling and weakness were the major symptoms patients presented with. These symptoms were affecting the daily life of the patients by effecting the activities of daily living including gross motor activities, like grasping, carrying holding, and fine motor activities as well like writing, griping and buttoning the shirts [15].

In the current study we found that majority of the patients (46.3%, n = 19) were suffering from moderate symptom severity and no patients in asymptomatic category. While in functional severity symptoms are concerned, majority of the patients were in mild function severity with 51.2% (n = 21) and no patients reported very severe functional severity. A research conducted in 2009 by Anderson *et al.* in India, used BCTQ and results showed that the majority of the patients were in mild symptom severity category and the functional severity category [15].

Mean values for symptom severity in this study was 2.97 which falls in mild symptoms category. As far as functional severity was concerned the mean was 2.34 which too fell in the mild functional severity. According to a research conducted by Tang, Lai *et al.* in 2017. The mean score for the symptom severity was 1.1 and for functional severity the score was 1.15 [16].

The reason for a higher mean values for symptom severity and functional severity in my study could be due to the post pregnant patients [17] and diabetic patients [18].

CTS is one of the most common musculoskeletal system disorders. It is characterized by the compression of a nerve originating from the back of the elbow and anterior aspect of the wrist to the hand under a ligament at the wrist level [19]. It usually causes numbness and tingling radiating to fingers. Numbness and tingling are accompanied by pain and loss of strength in time [20]. Symptoms and findings of the patient are important for diagnosis of CTS. These findings should be confirmed by electrophysiological studies. Nerve conduction study is the most precise diagnostic test for CTS; however, nerve conduction studies were reported to be normal in 22% of the patients who were definitely diagnosed with CTS in the clinic setting [21].

Therefore, we may suggest that Prompt recognition, timely management, and avoidance of risk factors responsible for the manifestations of carpal tunnel syndrome have practical implications in the treatment of carpal tunnel syndrome.

5. Conclusion

Activities of daily living such as grasping, writing, gripping and carrying were affected by the symptoms of CTS such as pain, numbness, tingling and weakness in the patients suffering from CTS.

Recommendation and Limitation

Sample size was relatively short due to limited time and resources as study was conducted only in city of Pakistan. A larger study with general population should be planned. A comparative study between physiotherapy treatment and surgical treatment should be conducted to see the results of physiotherapy on CTS.

Conflicts of Interest

This article is retrieved from thesis held in 2019 at Lahore College of Physical therapy, LM&DC.

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