

Student Corner

Prevalence, Clinical Spectrum and Electro-diagnostic Features of Carpal Tunnel Syndrome in Patients Presented to a Territory Care Hospital

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Abstract

Objective: To determine frequency, etiologies, clinical and electrodiagnostic features of the Carpal tunnel syndrome (CTS)

Methods: A descriptive cross-sectional study was performed in neurology department Mayo Hospital Lahore. After taking the approval from ethical committee of King Edward Medical University Lahore, 94 patients were included study from July 2022 to December 2022. Patients diagnosed as CTS on the basis of history, clinical examination of age 18-70 years were selected. Patients with history suggestive of polyneuropathy and radiculopathy were excluded from the study. Information was collected on the pre-designed performa along with other demographic variables.

Results: Out of 861 patients of neuropathies due to various disorders, 94 patients were having CTS with over all prevalence was 10%. A total of 94 patients were evaluated with a mean age of 40.4 ± 11.1 . Among them, 79.8% were females and 20.02% were males. In electrodiagnostic settings 57.4% patients had unilateral and 42.6% had bilateral carpal tunnel syndrome (CTS). Idiopathic Carpal tunnel syndrome, and obesity were the main etiologies with prevalence of 53.1% and 26.8% respectively and 6.3% diabetic patients had isolated carpal tunnel syndrome. According to electrophysiological criteria of carpal tunnel syndrome, 21.5% cases were mild, 54.2% were moderate, and 23.4% were severe.

Conclusion: Carpal tunnel syndrome is more prevalent in females than in males. Idiopathic carpal tunnel syndrome (CTS) is most frequently encountered in electrodiagnostic laboratory. It is recommended to evaluate contralateral asymptomatic side in the clinically diagnosed patients because symptomatic carpal tunnel syndrome in one hand usually comes with the asymptomatic carpal tunnel syndrome (CTS) in the contralateral hand.

Key words: Carpal tunnel syndrome (CTS), median entrapment neuropathy (MEN), electrodiagnostic (EDX study),

How to cite this:

Iqbal K, Bano S, Numan A. Prevalence, Clinical Spectrum and Electro-diagnostic Features of Carpal Tunnel Syndrome in Patients Presented to a Territory Care Hospital. J Pak Soc Intern Med. 2023;4(2): 155-159

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Introduction

Carpal tunnel syndrome (CTS) is the most common median entrapment neuropathy (MEN) in the upper limb. Tingling, numbness, frequent awakening at night, episodic hand paresthesia, and weak thumb flexion are the characteristic symptoms of the CTS. Etiology is usually idiopathic but various risk factors like obesity, Diabetes mellitus, manual work, hypothyroidism, pregnancy can contribute to development of CTS.¹

The median nerve arises by the combination of the lateral cords (C6-C7) and median cord (C8-T1) fibers.² It enters the wrist along with the tendons of nine finger flexors. The carpal bones made the floor of the tunnel

making a narrow pathway for median nerve. This narrow pathway is known as carpal tunnel. The long term flexion movements of the hand are thought to be the prominent cause of the CTS.

There are no gold standard diagnostic criteria for the carpal tunnel syndrome. Therefore, the diagnosis is made practically with clinical signs and symptoms, provocative tests (Tinel's and Phalen's test), electrophysiological testing,³ and neuromuscular ultrasound. The best electrophysiological classification of median entrapment at wrist is given by American Association of Neuromuscular and Electrodiagnostic Medicine (AANEM).⁴ This classification differentiates between mild and moderate

cases of CTS. The AANEM criterion is very helpful to exclude other disorders as radiculopathy and polyneuropathy from CTS.^{4,5}

Electrophysiological studies play a vital role for the diagnosis of median nerve entrapment (MEN). It helps to predict the risk of CTS symptoms in asymptomatic patients. Prolongation of DML is the basic feature in EDX testing of CTS6 that was first described by Simpson in 1956.⁷ The obesity was the prominent cause of CTS but recent studies has revealed that prolong work with dominant hand is the major cause of carpal tunnel syndrome.^{6,8} In this study, we aimed to check the prevalence along with clinical and electro-diagnostic features of carpal tunnel syndrome, and to check the association of clinical and electrophysiological severity of CTS.

Methods

This cross sectional study was performed after taking approval from ethical committee of King Edward Medical University, Mayo Hospital, and Lahore. After the approval of synopsis, the data of clinically diagnosed carpal tunnel syndrome (CTS) patients was collected from July 2022 to December 2022. The patients with signs and symptoms of cervical radiculopathy, polyneuropathy, and plexopathy were excluded from the study. The patients with contraindicated conditions for the electrodiagnostic procedure such as Edema and pacemaker were also excluded from the study.

Conventional methods of nerve conduction studies and electromyography were used to confirm the diagnosis. Provocative maneuvers such as Tinel's test and Phalen's maneuver were used to support the diagnosis.⁹ All the demographic variables, clinical signs and symptoms, along with electrodiagnostic findings were noted on the manual Performa by Neuro Electrophysiologist. The data was analyzed on the SPSS version 25. The mean and standard deviation were calculated for the quantitative variables. e.g. Age and frequency/ percentage were calculated for qualitative variables e.g. gender, Tinel and Phalan test, disease severity, risk factors etc.

The electro diagnostic procedure was done according to the protocol of CTS as given by the Preston.⁹ For motor conduction study (MCS), routine median, ulnar, and radial study was performed. Recording was taken from Abductor pollicis brevis (APB), abductor digiti minimi (ADM), and extensor indicis proprius (EIP) respectively. The temperature was maintained to minimize the error of demyelination during procedure. The CMAP, and latencies of all the nerves were recorded from their respective muscles. Distance was taken from proximal to distal stimulation carefully. The sensory conduction study (SCS) was done antidromically with carefully recording the SNAP and sensory latency. The

conduction velocities (CV) were calculated manually for all the nerves. The F responses were calculated for all the nerves. Any drop in the latency by >25% of the reference value was considered abnormal along with slow conduction velocity by >70-80%.¹⁰ the contralateral hand was tested for the reference values (if not involved clinically or electrophysiologically).

During needle electromyography (EMG), following muscles were sampled skillfully, Abductor pollicis brevis (APB), first dorsal interosseous (FDI), flexor carpi radialis (FCR) or Pronator Teres (PT) either unilaterally or bilaterally. Spontaneous activity, recruitment, MUAP (Motor Unit Action Potential) morphology and interference pattern were analyzed. Presence of spontaneous activity is labelled as denervation and presence of polyphasic, long duration >15mV MUAPs with amplitude <3mV was labelled as re-innervation. The reduction in the interference pattern was labelled as mild, moderate, or severe depending upon the recruitment pattern.

Results

A total of 861 patients were presented to the electromyography laboratory during study period. Out of these 861 patients, 94 patients were clinically and electrophysiologically diagnosed with isolated median nerve entrapment (CTS), making its prevalence 10%.

Male to female ratio was approximately 1:4, 20.2% male, and 78.9% female respectively with mean age of 40.4±11 as shown in demographic section of table 1.

The patients have complaint of tingling, numbness, pain during work, and motor weakness with percentages 96.8%, 97.9%, 97.9% and 85.1% respectively. (As shown in the Clinical features section of table 1.). In the EDX settings, 57.4% patients had unilateral and 42.6% patients had bilateral clinical symptoms and signs. During the procedure for the unilateral complaints in 61 patients, 42 patients were tested positive for bilateral median nerve compression at wrist. The yield of asymptomatic mild CTS was found in 68.8% patients.

Idiopathic Carpal tunnel syndrome and obesity were the main etiologies with prevalence of 53.1% and 26.8% respectively. (As shown in the table 2.) The demyelinating nerve injury was seen in 80.9% of the patients, making it most likely a demyelinating neuropathy. The EDX study revealed 21.1% mild, 54.2% moderate, and 23.4% severe cases. Detail is shown in Table 3.

Provocative tests played a vital role in the diagnosis of carpal tunnel syndrome. Tinel's test was positive in 91.5% and Phalen's test was positive in 91.7% patients. Weak thumb flexion and opposition were also the hall mark with reduced recruitment in 79.8% of the patients proportional to the motor weakness.

Table 1: Clinical and demographic features of 94 patients with CTS

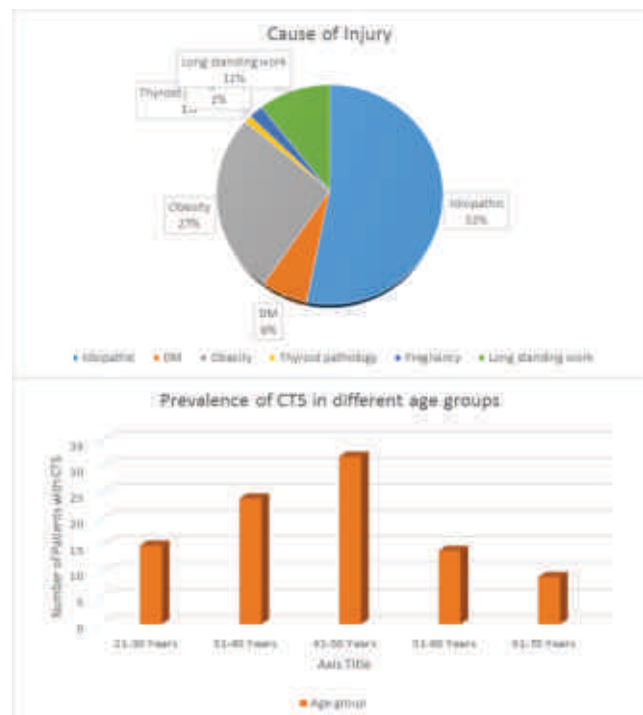
Demographics				
Sr.	Variable	Characteristic	Frequency	Percentage
1.	Age	20-40	49	52.1%
		41-60	45	47.8%
		61-70	10	10.6%
2.	Gender	Male	19	20.2%
		Female	75	79.8%
Clinical Features				
3.	Tingling	Yes	91	96.8%
		No	03	3.19%
4.	Numbness	Yes	92	97.9%
		No	02	2.12%
5.	Pain at rest	Yes	80	85.1%
		No	14	14.8%
6.	Pain during work	Yes	92	97.9%
		No	02	2.12%
7.	Atrophy	Yes	26	16.6%
		No	68	72.3%
8.	Motor Weakness	Yes	80	85.1%
		No	14	14.8%
Provocative Tests				
9.	Tinel's test	Positive cases	86	91.5%
10.	Phalen's maneuver	Positive cases	87	92.6%
Electro diagnostic Features				
11.	Pathophysiology	Axonal	18	19.1%
		Demyelinating	76	80.9%
12.	Re-innervation	Yes	6	6.6%
		No	88	93.6%
13.	Recruitment	Reduced	75	79.8%
		Normal	19	20.2%

Table 2: Etiologies of Carpal Tunnel Syndrome (CTS)

Sr No	Etiology	Frequency	Percentage
1.	Idiopathic	50	53.1%
2.	Diabetes Mellitus (DM)	6	6.3%
3.	Obesity	25	26.5%
4.	Pregnancy	2	2.1%
5.	Long standing work	10	10.6%
6.	Thyroid Pathology	1	1.1%

Table 3: Correlation between EDX and clinical severity of the 94 CTS patients

Clinical Severity	EDX Severity				Pearson correlation coefficient
	Mild	Moderate	Severe	Total	
Mild	12	4	0	16	-----
Moderate	6	36	6	48	-----
Severe	2	11	16	29	-----
Total	20	51	22	94	P= 0.02 Positive



Discussion

Median entrapment neuropathy (MEN) is one of the routinely encountered issue in clinical setup. We observed different causes that can affect median nerve in the distal forearm. Just as many past studies suggested, 79.8% females were affected with CTS.¹¹ in a survey by Atroshi et al. 64% females were affected. According to many theories, sex hormones play a role in incidence of CTS among females. The hormonal imbalance during pregnancy and at menopause might be the reason of high prevalence of CTS in females.¹² in another study by Paranthakan, 56% of the females and 44% of the male population was electro physiologically proven to have CTS.¹³

Among patients with proven CTS, idiopathic CTS was 53% of the total etiologies whereas an European study by Kurt et al. mentions that obesity is the leading cause of the CTS.¹⁵ The high prevalence of ICTS might be due

to un-noticed flexion and extension movements of the hands. The long term flexion of wrist can affect the median nerve easily as explained by Mohamed Aboul in an Egyptian case control study.¹⁴ The long dominant hand work is a major risk factor for developing CTS according to a cross sectional study by Aslam K.⁸ It accounts the third major etiology in our setup. The most prominent people seen to have work related CTS are those who do more than 4 hours computer work on daily basis. The repeated twisting and bending of hand with wrong wrist posture might be the risk for developing CTS.

According to the study conducted by Daniel B. Nora et al., the most common clinical features of CTS were finger paresthesia (92.7%) and severe pain in the thenar territory (78.9%) during work¹⁶, and our results were consistent with the study as paresthesia and pain were seen in 97.9% and 97.2% patients respectively. The provocative tests e.g. Tinel's Test and Phalen's Maneuver were 85% and 92% sensitive in the diagnosis of CTS according to the study by Bruske J et al.⁸ Our results were closed to this study where 91% and 92% patients were Tinel's and Phalen's test positive.

Most of the studies suggest that carpal tunnel syndrome is the most common demyelinating neuropathy 1 3 5 6, our study supports the hypothesis because electromyography was normal in most of the mild or mild-moderate cases of MEN making it a pure demyelinating neuropathy (80.9%). Only a few cases (19.1%) of severe CTS with muscles wasting were seen to have axonal pathophysiology.

The study was performed in the Mayo Hospital, Lahore only, that's why the results of this study cannot be generalized. There was no follow up NCS/EMG test, so there is no results regarding prognosis

Conclusion

Carpal tunnel syndrome (CTS) is more prevalent in females than in males. It is effecting nearly every fifth person in the general population. Unilateral symptomatic CTS usually come with the asymptomatic CTS on the contralateral side, that's why contralateral limb study is necessary. Although idiopathic CTS is the most commonly encountered cause, but obesity and long-standing work with the dominant hand is the prominent cause of CTS in the patients. A thorough case history, clinical as well as electrophysiological examination are recommended for disease diagnosis and assessing its severity. It will help the referring clinician to utilize

EDx report appropriately. Thus manage patients early to prevent complications.

Conflict of Interest: *None*

Funding Source: *None*

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