European Journal of Clinical Pharmacy
Print ISSN: 2385-409X, **Online ISSN**: 3105-0409
Website: https://farmclin.com/

Frequency of Diabetes in Patients with Carpal Tunnel Syndrome Presenting To Neurology Unit in Tertiary Care Hospital

Article History:

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Received: 17-10-2025
Revised: 30-11-2025
Accepted: 12-12-2025
Published: 24-12-2025

Abstract: Background: Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy of the upper limb, characterized by compression of the median nerve at the wrist. Diabetes mellitus has been identified as an important metabolic risk factor contributing to the development and severity of CTS.**Objective:** To determine the frequency of diabetes mellitus in patients diagnosed with carpal tunnel syndrome presenting to the neurology unit of a tertiary care hospital.
Methods: This cross-sectional study was conducted in the Neurology Unit of Ayub Teaching Hospital Abbottabad from April 2025 to September 2025. A total of 195 patients aged 20–60 years with confirmed CTS based on nerve conduction studies were included using non-probability consecutive sampling. Blood samples were collected for HbA1c estimation, and diabetes was defined as HbA1c >6.5%. Data were analyzed using SPSS version 23. Frequencies and percentages were calculated, and post-stratification chi-square test was applied with $p \leq 0.05$ considered significant.**Results:** The mean age of participants was 42.8 ± 10.6 years, with 57.9% females. Diabetes mellitus was present in 44.1% of patients. A significant association was observed between diabetes and increasing age ($p = 0.001$), as well as urban residence ($p = 0.018$). Diabetic patients showed significantly higher frequencies of prolonged sensory latency ($p = 0.003$) and motor latency ($p = 0.005$) on nerve conduction studies.**Conclusion:** Diabetes mellitus is highly prevalent among patients with carpal tunnel syndrome and is associated with more severe electrophysiological abnormalities. Routine screening for diabetes in CTS patients is recommended for early diagnosis and better clinical management.

Keywords: Carpal tunnel syndrome, Diabetes mellitus, Nerve conduction study, Peripheral neuropathy, HbA1c

INTRODUCTION

Carpal tunnel syndrome (CTS) is the most frequent entrapment neuropathy of the upper limb and is caused by compression of the median nerve as it traverses the carpal tunnel at the wrist. It is characterized by paresthesia, pain, and weakness in the median nerve distribution, which can cause disability and severely impact daily activities. Rates of CTS differ around the world, with higher incidence in middle aged persons and women (1-3).

The underlying mechanism of CTS is elevation of pressure in the carpal tunnel, which results in ischemia, segmental demyelination and axonal degeneration of the median nerve. It has been associated with several factors, such as repetitive wrist movements, obesity, hormonal factors and systemic conditions. In particular, diabetes mellitus is an important metabolic risk factor for the incidence and severity of CTS (4-6).

Diabetes mellitus is a global epidemic and has a range of microvascular and neuropathic complications. Prolonged hyperglycemia results in metabolic changes including sorbitol accumulation, oxidative stress and microangiopathy, leading to nerve injury. This increases the vulnerability of peripheral nerves to compression and, in turn, the risk of developing entrapment neuropathies like CTS. In addition, diabetes is associated with more severe clinical and electrophysiological signs of CTS (7-9).
Earlier studies have reported variable incidence of diabetes in CTS patients, especially in hospital-based studies, where the incidence is higher. But data from our region are lacking and we need to establish the prevalence of diabetes in CTS patients in our tertiary care centres (10, 11).

Therefore, this study was conducted to determine the frequency of diabetes mellitus in patients with carpal tunnel syndrome presenting to the neurology unit of a tertiary care hospital. The findings of this study will help in understanding the magnitude of the problem and may guide clinicians toward early screening and management strategies to improve patient outcomes.

METHODOLOGY

This cross-sectional study was conducted in the Neurology Unit of Ayub Teaching Hospital Abbottabad from April 2025 to September 2025. Ethical approval was obtained from the Research Evaluation Unit, College of Physicians and Surgeons Pakistan (CPSP). Written informed consent was obtained from all participants prior to their inclusion in the study, and confidentiality of patient data was ensured throughout the research process.

The sample size of 195 patients was determined using an estimated prevalence of diabetes mellitus 45%, confidence level 95% and margin of error 7% in the OpenEpi sample size calculator. Convenience sampling was used to recruit patients from the neurology unit. Both males and females between the ages of 20 and 60 years, with a diagnosis of carpal tunnel syndrome (CTS) were recruited.

CTS was defined by nerve conduction studies (NCS) and patients were diagnosed with CTS if any two of the following criteria were met: sensory latency of more than 3.5 milliseconds, motor latency of more than 4.5 milliseconds or a difference between the two hands of more than 1 millisecond for motor latency or 0.5 milliseconds for sensory latency. Patients with known endocrine diseases that predispose to insulin resistance (such as acromegaly and Cushing syndrome) and those on drugs that cause diabetes (such as thiazide diuretics) were excluded.

After diagnosis of CTS, blood was drawn under sterile conditions with a 5 mL syringe for biochemical testing. Glycated hemoglobin (HbA1c) levels were determined and patients with HbA1c levels above 6.5% were defined as having diabetes according to the operational definition. Age, gender, place of residence, duration of symptoms, duration of diabetes, and nerve conduction parameters were documented on a preformatted proforma.

The data was entered and analysed using SPSS version 23. Continuous data (age and duration of symptoms) were reported as mean and standard deviation, and categorical data (gender, residence and diabetes) as frequency and percentage. The outcome, frequency of diabetes mellitus, was calculated. The data were stratified according to age, sex, residential area, duration of symptoms and nerve conduction study to adjust for effect modifiers. After stratification, the chi-square test was used to test the association between the variables and a p-value of ≤ 0.05 was taken as significant. Data were tabulated and graphically illustrated.

RESULTS

The study involved 195 patients with carpal tunnel syndrome (CTS). The average age of the patients was 42.8 ± 10.6 years and females were slightly more common. The prevalence of diabetes mellitus was high, suggesting a high degree of clinical co-morbidity between CTS and metabolic diseases in this cohort. The table below shows the baseline demographics of the study cohort. The majority of the patients were middle-aged, females and from urban areas.

Table 1: Demographic Characteristics of Patients (n = 195)

Variable	Category	Frequency (%)
Age (years)	20–30	38 (19.5%)
	31–40	52 (26.7%)
	41–50	61 (31.3%)
	51–60	44 (22.6%)
Gender	Male	82 (42.1%)
	Female	113 (57.9%)
Residence	Urban	121 (62.1%)
	Rural	74 (37.9%)

This table represents the main finding of the study. Many patients with CTS had diabetes mellitus according to HbA1c.

Table 2: Frequency of Diabetes Mellitus in CTS Patients (n = 195)

Variable	Category	Frequency (%)
Diabetes Mellitus	Yes	86 (44.1%)
	No	109 (55.9%)

This table shows the distribution of diabetes across different age groups. A statistically significant association was observed, with increasing frequency of diabetes in older age groups.

Table 3: Stratification of Diabetes with Age Groups

Age Group	Diabetes Yes	Diabetes No	Total	p-value
20–30	9 (23.7%)	29 (76.3%)	38	
31–40	17 (32.7%)	35 (67.3%)	52	
41–50	34 (55.7%)	27 (44.3%)	61	
51–60	26 (59.1%)	18 (40.9%)	44	**0.001***

Chi-square test applied; $p \leq 0.05$ considered significant

This table shows the association of diabetes with sex and place of residence. It was more common in women and urbanites, but the significance of this varied.

Table 4: Stratification of Diabetes with Gender and Residence

Variable	Category	Diabetes Yes	Diabetes No	p-value
Gender	Male	32 (39.0%)	50 (61.0%)	
	Female	54 (47.8%)	59 (52.2%)	**0.210**
Residence	Urban	61 (50.4%)	60 (49.6%)	
	Rural	25 (33.8%)	49 (66.2%)	**0.018***

This table evaluates the association of diabetes with electrophysiological severity markers. Diabetic patients showed higher frequencies of prolonged motor and sensory latencies.

Table 5: Association of Diabetes with Nerve Conduction Study (NCS) Findings

NCS Parameter	Category	Diabetes Yes	Diabetes No	p-value
Sensory Latency >3.5 ms	Yes	64 (74.4%)	58 (53.2%)	
	No	22 (25.6%)	51 (46.8%)	**0.003***
Motor Latency >4.5 ms	Yes	59 (68.6%)	52 (47.7%)	
	No	27 (31.4%)	57 (52.3%)	**0.005***

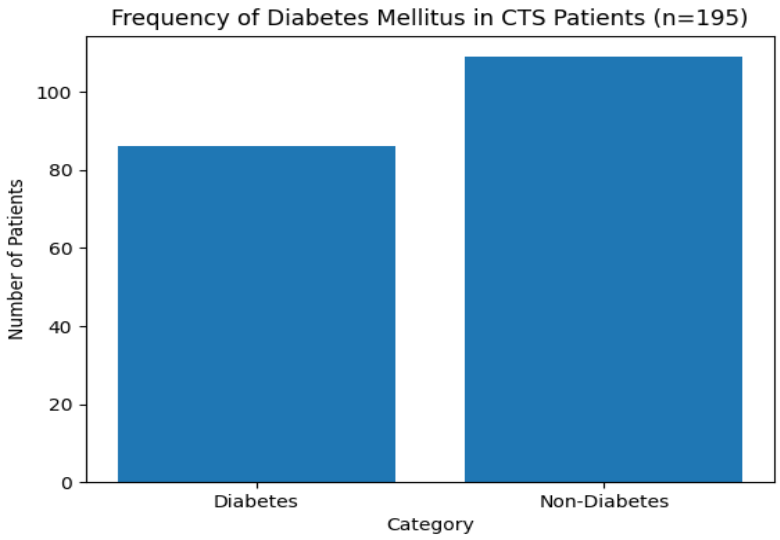

Figure 1: Frequency of diabetes mellitus among patients diagnosed with carpal tunnel syndrome (n = 195). A total of 44.1% patients were diabetic, while 55.9% were non-diabetic.

DISCUSSION

Carpal tunnel syndrome (CTS) is a frequently encountered entrapment neuropathy, and its association with metabolic disorders, particularly diabetes mellitus, has gained increasing attention. The present study demonstrated that 44.1% of patients with CTS were diabetic, highlighting a substantial overlap between these two conditions. This finding is consistent with previous regional studies, including a study from Multan reporting diabetes in approximately 45% of CTS patients, suggesting that diabetes is a significant comorbid condition in such patients (12-14).

The study subjects had a mean age of 42.8 ± 10.6 years, and most of them were aged between 41 and 50 years. This is consistent with the epidemiology of CTS, which has a higher incidence in the middle-aged population. More importantly, a statistically significant correlation between increasing age and diabetes was observed in our study ($p = 0.001$), with the greatest frequency among patients older than 40 years. This is likely attributed to the metabolic stresses and increased exposure to hyperglycemia, which cause nerve injury and increase the risk of compression neuropathies (15-17).

Our study found female predominance (57.9%) in CTS, which is consistent with the literature showing a higher rate in females, which may be influenced by hormones, carpal tunnel size, and work-related variables. Since diabetes was more common among females (47.8%) than males (39.0%), although not significant ($p = 0.210$), diabetes as a risk factor may affect both genders similarly. This suggests that although there are gender differences in the incidence of CTS, the diabetes risk factor may be similar in both genders (18).

Our study also found a significant association between residence and diabetes ($p = 0.018$), with urban patients having a higher rate of diabetes. This observation is related to urban lifestyle factors including sedentary behaviour, eating habits and the increased prevalence of metabolic syndrome, which are known to contribute to the rising prevalence of diabetes in urban areas. The clinically most relevant finding of this study was a significant association between diabetes and electrophysiological abnormalities, such as sensory ($p = 0.003$) and motor latency ($p = 0.005$) (19). These findings corroborate the idea that diabetes not only plays a role in the development of CTS, but also its severity. Hyperglycemia results in sorbitol accumulation, oxidative stress and microvessel injury, which then leads to demyelination and axonal degeneration of peripheral nerves. As a result, patients with diabetes may be more vulnerable to nerve compression and may develop more severe electrophysiological changes.

Our results are consistent with international studies, which have shown that diabetes is an independent predictor of CTS, and that CTS patients with diabetes have a poorer clinical and electrophysiological response. The prevalence of diabetes found in this study highlights the need for metabolic investigations in those presenting with CTS (20).

There are some limitations of this study. The study was conducted at a single centre and results may not be applicable to the whole population. The cross-sectional nature of the study precludes the

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determination of a causal link between diabetes and CTS. Confounding variables such as obesity, occupational risk factors and duration of diabetes were not specifically examined, and may have these associations.

CONCLUSION

Diabetes mellitus is highly prevalent among patients with carpal tunnel syndrome, affecting nearly half of the studied population. Increasing age and urban residence were significantly associated with the presence of diabetes, while diabetic patients demonstrated more severe nerve conduction abnormalities. These findings highlight the need for routine screening for diabetes in patients presenting with CTS, as early identification and management of metabolic disorders may help reduce disease severity and improve clinical outcomes. Further multicenter and longitudinal studies are recommended to explore the causal relationship and underlying mechanisms linking diabetes with carpal tunnel syndrome.

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