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FREQUENCY OF DIABETES MELLITUS IN PATIENTS DIAGNOSED WITH CARPAL TUNNEL SYNDROME: A STUDY FROM A TERTIARY CARE SETTING

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ABSTRACT

Background and Objective:
Carpal tunnel syndrome is a common entrapment neuropathy caused by compression of the median nerve when it passes through the wrist. The objective of this study was to determine the frequency of diabetes mellitus in patients diagnosed with carpal tunnel syndrome.

Methods:
This descriptive cross-sectional study was conducted at the neurology unit of Lady Reading Hospital, Peshawar, from December 2019 to June 2020. A total of 140 patients aged 20–60 years with electrophysiologically confirmed carpal tunnel syndrome were included using non-probability consecutive sampling. Diabetes mellitus was established based on prior diagnosis, use of antidiabetic medications, or laboratory criteria as per American diabetes association. Data was analyzed using SPSS version 23.

Results:
Out of 140 patients, 91 (65.0%) were male and 49 (35.0%) were female. Most patients were aged 41 to 50 (42.9%). Diabetes mellitus was present in 24 patients, yielding a prevalence of 17.1% (95% CI: 10.9–23.3%). A significant association was seen between diabetes mellitus and age ($\chi^2 = 53.34$, $p < 0.001$) and gender ($\chi^2 = 15.597$, $p < 0.001$).

Conclusion:
Diabetes mellitus was found in a notable proportion of patients in our study. More studies are recommended to evaluate true prevalence in our population.

Keywords: Carpal tunnel syndrome, Diabetes mellitus, Median nerve, Nerve conduction studies, Prevalence.

INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common neuropathy of upper limb caused by compression on median nerve when it passes through the wrist. It represents one of the most frequent entrapment neuropathies which is encountered in clinical practice and patients usually present with a complaint of tingling, numbness and paresthesia in the distribution of median nerve or thenar muscles atrophy.[1,2]

The risk factors include injury due to repetitive mechanical stress, pressure on wrist, diabetes, acromegaly, thyroid dysfunction and rheumatoid arthritis.[3,4] Globally, the prevalence of CTS has been found to be 3–6%, with even higher rates reported in people with metabolic disorders, particularly diabetes mellitus (DM).[5,6] This is because individuals with diabetes are more prone to developing this condition. The mechanism is increase in endo-neural pressure, decrease in myelinated axon density, and stiffness of the transverse carpal ligament all of which facilitate nerve compression .[7]

Previous studies have reported varying frequencies of diabetes among patients with CTS; Becker et al. reported a prevalence of 4.6%, while other international studies have reported higher frequencies, highlighting regional variations and the need for local data.[8]

Recent studies have shown a strong link between diabetes and CTS. A study by Pourmemari and Shiri reported that diabetic patients have higher risk of developing CTS compared with non-diabetic individuals.[6] National and regional studies, including those from South Asia, also support this correlation. In Pakistani cohorts, the prevalence of diabetes among CTS patients has been reported in the range of 25–35% showing the increase burden of comorbid metabolic disorders in neuromuscular presentations.[8]

The electrophysiological changes in diabetics are more pronounced, initially demonstrating sensory demyelinating features in the early disease course which later on develop to sensory and motor axonopathy when the condition advances. [7, 9]

CTS is a neurological condition with a significant public health concern because of its impact on work capacity and quality of life. Evaluating the prevalence of DM in CTS is not only important for understanding disease burden but also for guiding comprehensive diagnostic and therapeutic approaches.

Diabetes is a treatable condition and knowledge of the disease among patients with CTS will help in the prevention of progression and recurrence by focusing on control of diabetes.

Despite growing evidence linking diabetes mellitus with carpal tunnel syndrome, there remains a paucity of recent local data from Khyber Pakhtunkhwa, Pakistan. Therefore, this study aimed to determine the frequency of diabetes mellitus among patients diagnosed with carpal tunnel syndrome in a tertiary care hospital.

METHODS

This descriptive cross-sectional study was carried out in the Neurology Unit of Lady Reading Hospital, Peshawar, from December 2019 to June 2020 after getting approval from the institutional ethical committee (Ref no:146/ ERB/LRH/). The study was performed in accordance with the principles of the Declaration of Helsinki and reported in line with Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

The minimum sample size was determined as 138 using WHO sample size software. The calculation was based on a 95% confidence level, an absolute precision of 3.5%, and an anticipated prevalence of diabetes of 4.6% among patients with carpal tunnel syndrome.[10] This estimate was derived from previously published literature and was used as a conservative measure due to limited local data. Participants were selected using non-probability consecutive sampling technique.

Inclusion criteria for study included both male and female genders, age range of 20-60 years, patients with confirmed carpal tunnel syndrome with or without diabetes mellitus who presented to the Neurology unit, Lady Reading Hospital, Peshawar.

Exclusion criteria included patients with other known endocrine conditions that predispose to insulin resistance/diabetes like acromegaly or Cushing syndrome, and patients taking medications that predispose to insulin resistance/diabetes (e.g. thiazide diuretics).

Patients with clinical presentation indicative of carpal tunnel syndrome, including numbness, paresthesia, hand weakness, or thenar muscle involvement in the distribution of median nerve, were evaluated using nerve conduction studies (NCS).

Carpal tunnel syndrome was diagnosed based on nerve conduction studies. A patient was considered to have CTS if sensory latency exceeded 3.5 milliseconds, motor latency exceeded 4.5 milliseconds, or if there was a discrepancy of more than 1 millisecond for motor latency or 0.5 milliseconds for sensory latency between hands.[4] Diabetes mellitus was defined as a physician diagnosis of diabetes, current use of anti-diabetic medications, or newly diagnosed based on fasting plasma glucose ≥126 mg/dL and HbA1c ≥6.5%, according to American Diabetes Association (ADA) criteria.[11]

A structured proforma was used to document the demographic details (age, sex), clinical signs and symptoms, and duration of illness. All patients went through standardized NCS to confirm CTS.

Statistical analysis was performed using IBM SPSS version 23. Frequencies and percentages were used for categorical variables, while means and standard deviations (SD) were measured for continuous variables. The prevalence of diabetes was reported with a 95% confidence interval. Post-stratification analyses were performed according to age, gender, clinical symptoms, and signs. The chi-square (χ^2) test was applied to find out associations between categorical variables, and a p-value

≤0.05 was considered statistically significant. All enrolled patients were added to the final analysis, and no missing data were observed.

RESULTS

A total of 140 patients with CTS were enrolled in the analysis. The largest proportion of patients were in the 41–50-year age group (n= 60, 42.9%). Detailed age distribution of the study population is shown in Table 1.

Table 1. Age distribution of patients with carpal tunnel syndrome (n = 140).

Age in years	Frequency (n)	Percentage
20-30	7	5.0
31-40	41	29.3
41-50	60	42.9
51-60	32	22.9
Total	140	100

Motor symptoms alone, primarily in the form of hand weakness and reduced grip strength were the most common presenting symptoms, seen in 64 patients (45.7%). On clinical examination, thenar muscle wasting which represents a late manifestation of median nerve compression was seen in 67 (47.9%) patients. Detailed distributions of symptoms and clinical signs are shown in Table 2.

Table 2: Distribution of symptoms and clinical signs in carpal tunnel syndrome (n=140).

Category	Frequency (n)	Percentage (%)
Symptoms		
Sensory only	32	22.9
Motor only*	64	45.7
Both sensory & motor	38	27.1
No classical CTS symptoms	6	4.3
Clinical Signs		
Sensory loss	12	8.6
Muscle weakness	22	15.7
Thenar muscle wasting	67	47.9
No clinical signs	39	27.9

** Motor symptoms included hand weakness and reduced grip strength.*

CTS = Carpal Tunnel Syndrome

The prevalence of diabetes mellitus among CTS patients were found to be 17.1% (n = 24; 95% CI: 10.9–23.3%).), while 82.9% (n = 116) were non-diabetic.

Table 3 shows how diabetes mellitus is distributed across different age groups among patients with carpal tunnel syndrome. The proportion of diabetic patients increased with advancing age, with the highest frequency observed in the 51–60-year age group.

Table 3: Association between diabetes mellitus and age groups among patients with carpal tunnel syndrome (n=140).

Diabetes Status	20–30 Years	31–40 Years	41–50 Years	51–60 Years	Total
Yes	1	0	4	19	24
No	6	41	56	13	116
Total	7	41	60	32	140

A statistically significant association was observed between diabetes mellitus and age groups among patients with carpal tunnel syndrome. The association was statistically significant ($\chi^2 = 53.34$, $p < 0.001$).

Significant association was noted between diabetes mellitus and gender among patients with carpal tunnel syndrome. In our study participants, diabetes was more common among male patients (19.8%) compared to female patients (12.2%). The association was statistically significant ($\chi^2 = 15.597$, $p < 0.001$).

DISCUSSION

This study showed the clinical and demographic profile of patients with carpal tunnel syndrome, with a specific focus on the prevalence of DM), which is a well-recognized risk factor for median nerve entrapment. Our results revealed a 17.1% prevalence of diabetes among CTS patients, which is moderately elevated compared to reports from some non-South Asian populations, where diabetes prevalence in CTS cohorts typically ranges from 3 - 15%, while the prevalence is lower than previously reported Pakistani studies (25–35%).[6,8,12,13] This elevated figure is the reflection of the broader national diabetes burden in Pakistan, which is among the highest globally.[14]

The most common age group of our studied population was 41–50 years, which is consistent with previous literature suggesting that CTS is most prevalent in middle-aged population.[15] In contrast to many international studies where females predominate, males constituted 65% of our cohort. This gender distribution may reflect regional occupational patterns where males are more likely to engage in repetitive manual labor, however, occupational factors were not formally analyzed in the current study and therefore this explanation should be interpreted with caution.[16,17]

The present study shows a statistically significant association between diabetes mellitus and gender. A higher proportion of male patients with carpal tunnel syndrome were diabetic as compared to females. This finding may reflect regional variations in lifestyle, occupational exposure, and healthcare seeking behavior. However, global literature generally reports a higher prevalence of carpal tunnel syndrome among females, and therefore this observation should be interpreted with caution.

In our study, a significant association was observed between diabetes mellitus and advancing age. The majority of diabetic patients were found in the 51–60-year age group. This finding aligns with

established evidence indicating that the prevalence of diabetes rises with advancing age owing to progressive insulin resistance and pancreatic β-cell dysfunction.[12] Clinically, motor symptoms alone (45.7%) were more commonly reported than sensory symptoms, which contrasts with classical descriptions where sensory disturbance is usually the earliest manifestation.[18] Furthermore, thenar muscle wasting which is a marker of advanced or prolonged median nerve compression, was present in 47.9% of patients, suggesting a significant proportion of delayed presentations in our populations. This underscores the need for earlier diagnosis and intervention, possibly through primary care awareness and screening protocols in our population.

The association between diabetes and CTS is biologically plausible, with chronic hyperglycemia leading to non-enzymatic glycation of connective tissue proteins, small vessel changes, and increased oxidative stress all of these contributing to the nerve ischemia and compression susceptibility.[12] Moreover, diabetic patients may experience more severe and bilateral CTS due to coexisting peripheral neuropathy.[12,19]

Our findings are particularly important in the context of Pakistan, because diabetes is underdiagnosed and undertreated. The prevalence seen in this study is lower than that observed in some Pakistani studies but remains significant in the context of the high national burden of diabetes. Variations may be linked to differences in study design, sample characteristics, and diagnostic criteria.

There are certain limitations of the study. It was conducted at a single tertiary care setting using non-probability consecutive sampling, which may introduce referral and selection bias. The cross-sectional design precludes causal inference, and the absence of a control group limits interpretation of the findings. Therefore, these findings may not be generalizable to the broader population. Future prospective and multicenter studies are needed to explain the strength and direction of this association, and whether better glycemic control mitigates CTS progression.

CONCLUSION

This study demonstrates that diabetes mellitus is present in a notable proportion of patients with carpal tunnel syndrome in a tertiary care hospital. While causality cannot be inferred due to the cross-sectional design, the results underscore the importance of metabolic screening in CTS patients, particularly in regions with a high burden of diabetes such as Pakistan.

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Authors' contribution:
Harwindar Kumar; Concept, design, data collection, data analysis manuscript writing
Sadiq Ali Shah; Data collection, data analysis, manuscript writing
Syed Azaz Ali Shah; Data Analysis, data interpretation, manuscript writing
Noor Ul Wahab; Data analysis, data interpretation, manuscript revision

All the authors have approved the final version to be published and agree to be accountable for all aspects of the work.

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