

Article

Prevalence of Carpal Tunnel Syndrome Among Multigravida Pregnant Women in Khyber Teaching Hospital Peshawar

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Cite this Article

Received	2025-03-17
Revised	2025-04-16
Accepted	2025-04-18
Published	2025-04-14
Authors' Contributions	Concept, design, data collection, analysis, and manuscript drafting were contributed by Z, ARK, SB, and SGSZ.
Conflict of Interest	None declared
Data/supplements	Available on request.
Funding	None
Ethical Approval	Respective Ethical Review Board
Informed Consent	Obtained from all participants
Study Registration	-
Acknowledgments	N/A
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ABSTRACT

Background: Carpal Tunnel Syndrome (CTS) is a prevalent peripheral neuropathy affecting women during pregnancy, particularly in later trimesters due to hormonal changes and fluid retention. Despite growing global awareness, limited data exist on the prevalence and functional impact of CTS in multigravida pregnant populations in low-resource settings such as Peshawar, Pakistan. **Objective:** To determine the prevalence of CTS and its association with functional impairment in activities of daily living among multigravida pregnant women using validated clinical and questionnaire-based assessment tools. **Methods:** This cross-sectional study was conducted at Khyber Teaching Hospital, Peshawar, with a sample size of $n = 218$ multigravida pregnant women aged 20–35 years, selected through convenience sampling. Women with prior wrist trauma, diabetes, thyroid dysfunction, or rheumatoid conditions were excluded. Data were collected using the Boston Carpal Tunnel Syndrome Questionnaire (BCTQ) and physical tests (Tinel's sign, Phalen's test, and carpal compression test). Functional limitation was assessed using the BCTQ functional subscale. Ethical approval was obtained, and all participants provided informed consent in accordance with the Declaration of Helsinki. Statistical analysis was conducted using SPSS v27, applying descriptive statistics, chi-square tests, and one-way ANOVA with post hoc analysis. **Results:** CTS was identified in 41.3% of participants, with mild (22.0%), moderate (17.4%), and severe (1.8%) presentations. Functional impairment was present in 39.4%, with a statistically significant association between CTS severity and ADL limitations ($F(3,214) = 17.82$, $p < 0.001$, $\eta^2 \approx 0.20$), indicating substantial clinical impact. **Conclusion:** CTS is a common and functionally significant condition among multigravida pregnant women in this population. Integrating CTS screening into routine antenatal care may enhance early diagnosis, reduce symptom burden, and improve maternal quality of life through timely physiotherapeutic interventions. **Keywords:** Carpal Tunnel Syndrome, Pregnancy Complications, Multigravida, Functional Status, Peripheral Neuropathy, Cross-Sectional Studies, BCTQ

INTRODUCTION

Carpal Tunnel Syndrome (CTS) is a common compressive neuropathy characterized by entrapment of the median nerve as it passes through the carpal tunnel, a narrow osteofibrous passage at the wrist. This condition manifests as pain, numbness, tingling, and, in advanced stages, muscle atrophy in the hand and fingers. The carpal tunnel is anatomically bordered by carpal bones and roofed by the transverse carpal ligament, enclosing the median nerve and nine flexor tendons (1). CTS is the most frequently reported entrapment neuropathy and can occur due to a variety of factors including synovial thickening, tenosynovitis, repetitive wrist activity, and hormonal or fluid balance changes—factors that are notably prominent during pregnancy (2).

During pregnancy, women experience significant physiological and hormonal changes such as fluid retention, increased body weight, and ligament laxity, which contribute to the risk of median nerve compression. The third trimester is particularly associated with fluid retention and peripheral edema, making it a high-risk period for developing CTS symptoms (3). Studies have also shown that hormonal changes, such as the presence of relaxin, may increase ligamentous laxity and predispose to compressive neuropathies (4). The prevalence of CTS in pregnant women ranges broadly, with estimates suggesting that 31% to 62% of pregnant individuals report CTS symptoms during the third trimester (5). These symptoms often resolve postpartum, but in some cases, they may

persist for months or even years, negatively affecting maternal quality of life and functional ability (6).

Although CTS is widely studied in the general pregnant population, there is a notable lack of targeted research focusing specifically on multigravida women, a subgroup that may carry unique risk profiles due to cumulative physiological strain from repeated pregnancies. Gravity—the number of times a woman has been pregnant—has been associated with various maternal health outcomes, including musculoskeletal disorders and neuropathies (7). Despite the high burden of CTS symptoms during pregnancy, especially in multigravida women, limited epidemiological data exist from low-resource settings like Khyber Pakhtunkhwa, Pakistan. Previous studies from South Asia have indicated varying CTS prevalence, influenced by factors such as age, body mass index, socioeconomic status, and healthcare access, yet few have isolated multigravida populations to assess whether repeated pregnancies exacerbate CTS incidence (8,9).

Several diagnostic tools exist for CTS, including clinical tests such as Tinel's sign, Phalen's test, and carpal compression test. However, standardized questionnaires like the Boston Carpal Tunnel Syndrome Questionnaire (BCTQ) provide a structured and validated approach to assess both symptom severity and functional impairment (10). Despite their proven utility, such tools are infrequently used in resource-limited clinical settings, resulting in underdiagnosis or misclassification of CTS severity during pregnancy. A deeper understanding of CTS prevalence and its functional impact specifically among multigravida women in this context can inform preventive strategies and early interventions tailored to high-risk groups.

Given the lack of region-specific, gravity-focused epidemiological data and the clinical importance of early CTS identification in pregnancy, this study aims to determine the prevalence of Carpal Tunnel Syndrome among multigravida pregnant women attending Khyber Teaching Hospital (KTH) in Peshawar using both clinical tests and the BCTQ. The research seeks to address the following question: What is the prevalence and functional impact of CTS among multigravida pregnant women in Peshawar as assessed through validated screening tools and physical tests?

MATERIAL AND METHODS

This observational, cross-sectional study was conducted over a period of six months at Khyber Teaching Hospital (KTH), Peshawar, to determine the prevalence of Carpal Tunnel Syndrome (CTS) and its functional impact among multigravida pregnant women. The study population included 218 pregnant women aged 20 to 35 years who had experienced two or more pregnancies. Participants were recruited through convenience sampling from the antenatal outpatient department. Inclusion criteria required participants to be multigravida, within the specified age range, and currently pregnant. Exclusion criteria included any history of wrist fracture or surgery, pre-existing thyroid disorders, diabetes mellitus (type I or gestational), rheumatoid arthritis, traumatic neuropathies, or any other known neurological conditions. Informed written consent was obtained from all participants after providing an

explanation of the study objectives, procedures, and confidentiality safeguards.

The primary outcome of interest was the prevalence of CTS, while the secondary outcome was the level of functional impairment in activities of daily living (ADLs). Data were collected using the Boston Carpal Tunnel Syndrome Questionnaire (BCTQ), a validated self-reported tool assessing symptom severity and functional status. Clinical confirmation of CTS was supported through standard physical diagnostic tests, including Tinel's sign, Phalen's test, and the carpal compression test. The BCTQ total score was used to categorize symptom severity, while the functional scale provided a quantifiable measure of ADL impact. Scores above the mean threshold were interpreted as indicative of CTS or functional limitation.

The study adhered to the ethical principles outlined in the Declaration of Helsinki. Informed consent was obtained from each participant, and all responses were anonymized to ensure confidentiality. Ethical approval was obtained from the Institutional Review Board of Khyber Teaching Hospital, Peshawar.

Data were entered and analyzed using IBM SPSS Statistics version 27. Descriptive statistics were used to summarize demographic variables, CTS prevalence, and functional scores. Continuous variables were reported as mean \pm standard deviation, while categorical variables were presented as frequencies and percentages. A chi-square (χ^2) test was applied to examine the association between age groups and CTS presence. One-way analysis of variance (ANOVA) was used to compare mean functional scores across different CTS severity levels, followed by Tukey's HSD post hoc analysis to assess pairwise differences. Effect size was calculated using eta-squared (η^2) to interpret the clinical relevance of group differences. All statistical tests were two-tailed, with a significance level set at $p < 0.05$. No imputation was required as complete responses were obtained from all participants.

RESULTS

A total of 218 multigravida pregnant women were assessed to determine the prevalence and functional impact of Carpal Tunnel Syndrome (CTS). Participants were stratified into five age groups. The largest proportion (29.8%) were aged between 32 and 35 years, while the smallest group (10.6%) was aged 20–22 years (Table 1).

The Boston Carpal Tunnel Syndrome Questionnaire (BCTQ) was used to determine both CTS symptom severity and functional limitations in activities of daily living (ADLs). The mean total symptom severity score was 18.18 ± 9.71 . Based on this cutoff, 90 participants (41.3%) were identified as having CTS, while 128 (58.7%) scored below the threshold and were classified as not having CTS. Among the CTS group, 48 (22.0%) had mild symptoms, 38 (17.4%) had moderate symptoms, and 4 (1.8%) had severe symptoms (Table 2).

Functional status, assessed using the BCTQ functional scale, had a mean score of 13.93 ± 8.10 . A total of 132 women (60.6%) reported no significant limitations in ADLs, while 86 participants (39.4%) reported varying degrees of difficulty: 35 (16.1%) were mildly affected, 43 (19.7%) had moderate limitations, and 8 (3.7%)

experienced severe functional impairment (Table 3). The association between age and CTS status was explored using the chi-square test of independence. While the highest frequency of CTS was observed in the 32–35 age group (31 out of 65), the overall

test did not yield statistical significance ($\chi^2(4) = 5.37$, $p = 0.25$), suggesting that CTS was not significantly associated with age group (Table 4).

Table 1. Age Distribution of Participants (N = 218)

Age Group (Years)	Frequency	Percentage (%)
20–22	23	10.6
23–25	47	21.6
26–28	43	19.7
29–31	40	18.3
32–35	65	29.8
Total	218	100.0

Table 2. CTS Severity Based on BCTQ Symptom Scores (Mean = 18.18 ± 9.71)

CTS Severity	Frequency	Percentage (%)
Normal	128	58.7
Mild	48	22.0
Moderate	38	17.4
Severe	4	1.8
Total	218	100.0

Table 3. Functional Status Based on BCTQ-ADL Scores (Mean = 13.93 ± 8.10)

Functional Status	Frequency	Percentage (%)
Normal	132	60.6
Mild	35	16.1
Moderate	43	19.7
Severe	8	3.7
Total	218	100.0

Table 4. Association Between Age Group and CTS Status

Age Group (Years)	CTS Positive (n)	CTS Negative (n)	Total (n)
20–22	7	15	22
23–25	20	26	46
26–28	18	25	43
29–31	14	28	42
32–35	31	34	65
Total	90	128	218
Chi-square (χ^2)	—	—	5.37
p-value	—	—	0.25

Table 5. One-Way ANOVA and Post Hoc Analysis: Functional Status by CTS Severity

CTS Severity	Mean ADL Score ± SD	n	Significant Difference from Normal (Tukey's HSD)
Normal	9.5 ± 5.3	128	—
Mild	14.5 ± 6.8	48	Not significant
Moderate	18.2 ± 7.1	38	$p < 0.001$
Severe	23.1 ± 5.9	4	$p < 0.001$
ANOVA F(3, 214)	17.82		
p-value	< 0.001		
Effect Size (η^2)	≈ 0.20		Large effect

A one-way analysis of variance (ANOVA) was conducted to assess differences in functional status scores across CTS severity categories. Results revealed a statistically significant difference in ADL scores among the four groups ($F(3, 214) = 17.82$, $p < 0.001$).

Post hoc analysis using Tukey's HSD indicated significant differences between the normal group and both the moderate ($p <$

0.001) and severe ($p < 0.001$) groups. The calculated effect size ($\eta^2 \approx 0.20$) suggested a large clinical effect of CTS severity on functional status (Table 5).

Figure 1 also showing a progressive increase in functional limitation is observed with increasing CTS severity: participants with normal findings reported a mean ADL score of 9.5 ± 5.3, while

those with mild, moderate, and severe CTS reported mean scores of 14.5 ± 6.8 , 18.2 ± 7.1 , and 23.1 ± 5.9 , respectively. This trend demonstrates a clinically relevant escalation in functional impairment corresponding to symptom severity.

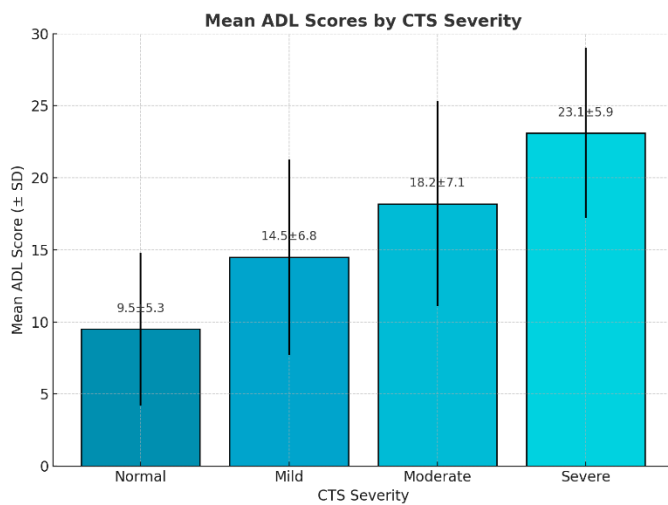


Figure 1 Mean Activities of Daily Living (ADL) scores with standard deviation across different severity levels of Carpal Tunnel Syndrome (CTS). A

DISCUSSION

The present study investigated the prevalence and functional implications of Carpal Tunnel Syndrome (CTS) among multigravida pregnant women at a tertiary care hospital in Peshawar, utilizing validated diagnostic tools including the Boston Carpal Tunnel Syndrome Questionnaire (BCTQ) and standard physical tests. The findings revealed a 41.3% prevalence of CTS in this population, with most cases falling within the mild to moderate severity range. Functional limitation in activities of daily living (ADLs) was observed in 39.4% of participants, and a strong relationship was found between symptom severity and functional impairment. These findings underscore the clinical relevance of routine CTS screening during pregnancy, especially among women with multiple gestations.

Comparative analysis with existing literature supports the observed prevalence range. A study by Oliveira *et al.* reported CTS symptoms in approximately 30–62% of pregnant women, with most symptoms emerging in the third trimester (5). Similarly, a study conducted in Malaysia by Sapuan *et al.* observed that the majority of CTS cases during pregnancy were mild and associated with daytime numbness and wrist discomfort (25). Our findings resonate with this trend, reinforcing the notion that fluid retention, hormonal changes, and ligamentous laxity in later pregnancy stages likely contribute to median nerve compression (4,6). However, our study reports a slightly higher prevalence compared to Abdelnabi *et al.*, who found an 18.5% CTS rate in a larger sample of pregnant women (28). This discrepancy may be attributed to differences in sample demographics, inclusion criteria, or geographic and lifestyle factors, such as limited access to ergonomically safe work environments and reduced awareness in our study population. The association between CTS severity and age group, although not statistically significant, showed a trend toward higher prevalence in older multigravida women. This may

be related to cumulative physiological stress from repeated pregnancies, which has been shown to alter fluid regulation and increase susceptibility to compressive neuropathies (7).

The large effect size observed in the association between CTS severity and functional limitation ($\eta^2 \approx 0.20$) highlights the clinical burden of even mild CTS symptoms during pregnancy. These findings hold particular importance for antenatal care, where early identification and conservative management—such as wrist splinting, activity modification, and ergonomic counseling—could significantly improve maternal well-being and prevent postpartum complications.

Theoretical implications of the findings suggest that repeated hormonal fluctuations and musculoskeletal adaptations in multigravida women may heighten the vulnerability of the median nerve to compression. Relaxin, a hormone known to increase ligamentous laxity during pregnancy, may further exacerbate carpal tunnel volume reduction and contribute to CTS development (4). Additionally, increased interstitial fluid volume in late pregnancy has been linked to median nerve swelling and impaired microcirculation, supporting a pathophysiological mechanism for pregnancy-related CTS (3,6).

This study offers valuable insight into an under-researched subgroup of pregnant women, yet it is not without limitations. The use of convenience sampling and restriction to a single tertiary hospital limits generalizability to other populations, particularly working women or those in different socioeconomic contexts. While validated tools such as the BCTQ were employed, the absence of electrodiagnostic confirmation (e.g., nerve conduction studies) may have influenced diagnostic accuracy. Furthermore, the cross-sectional design restricts causal inferences, and the relatively small number of severe cases limits subgroup analysis for higher severity levels.

Despite these limitations, the study's strengths include its focus on a specific and clinically relevant group—multigravida women—often overlooked in CTS research. The application of standardized clinical criteria, combined with a quantitative assessment of functional outcomes, enhances the methodological rigor and relevance for both obstetric and rehabilitative care providers.

Future research should explore longitudinal trajectories of CTS symptoms across pregnancy trimesters and into the postpartum period to better understand persistence and recovery patterns. Moreover, interventional studies assessing the effectiveness of non-pharmacological physiotherapy-based interventions could inform cost-effective treatment strategies in resource-limited settings. Expanding the sample to include diverse occupational backgrounds and performing objective diagnostic tests could also enhance the external validity and clinical applicability of future findings. CTS is a prevalent and functionally significant condition among multigravida pregnant women in this population.

The study emphasizes the need for routine screening and targeted interventions to mitigate the impact on maternal health and daily functioning. Incorporating CTS assessment into standard antenatal care protocols may offer a low-cost, high-impact strategy to improve quality of life during pregnancy.

CONCLUSION

This study determined that Carpal Tunnel Syndrome (CTS) is a prevalent condition among multigravida pregnant women in Peshawar, with 41.3% of participants exhibiting symptoms, and a significant proportion experiencing functional limitations in activities of daily living. The findings underscore the importance of early identification and management of CTS during pregnancy, particularly in women with multiple gestations who may be at higher risk due to cumulative physiological changes. Incorporating routine CTS screening using validated tools like the Boston Carpal Tunnel Syndrome Questionnaire into antenatal care can enhance maternal comfort, prevent postpartum complications, and reduce healthcare burden. Clinically, these results advocate for increased physiotherapy involvement and ergonomic education in prenatal programs. For future research, larger, multi-centered, and longitudinal studies are recommended to better understand the progression, risk factors, and optimal interventions for pregnancy-related CTS in diverse populations.

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