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Electrodiagnostic severity distribution of carpal tunnel syndrome and its clinical correlates

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ABSTRACT

Background: Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy of the upper limb. Nerve conduction studies are used to confirm the diagnosis and classify severity. Understanding the distribution of electrodiagnostic severity and its clinical correlates is important for patient management and healthcare planning.
Methods: This descriptive cross-sectional study included 100 consecutive adult patients with confirmed CTS and completed nerve conduction studies at Jordan University Hospital. Electrodiagnostic severity was classified as mild, moderate, or severe. Demographic characteristics, symptom duration, and comorbidities were analyzed using descriptive statistics. Cross-tabulation was used to examine severity in relation to selected variables.
Results: Severe CTS was the most common category, accounting for 67% of cases. Moderate CTS was observed in 21%, and mild CTS in 12%. Females represented 80% of the study population. Severe disease was proportionally more frequent among females. Patients with moderate and severe CTS were older than those with mild disease. Mean symptom duration increased slightly with greater severity. Hypertension and diabetes mellitus were common in moderate and severe groups. Other comorbidities were less frequent.
Conclusions: Severe electrodiagnostic CTS was predominant in this cohort. Female sex, older age, and certain systemic comorbidities were frequently observed in moderate and severe cases. These findings highlight the importance of early evaluation to reduce progression to advanced disease.

Keywords: CTS, NCS, Hand, Numbness

INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy of the upper limb.[1] It results from compression of the median nerve within the carpal tunnel at the wrist.[2] The condition presents with sensory symptoms such as numbness and tingling. Pain and nocturnal symptoms are also common. In advanced stages, motor weakness and thenar muscle atrophy may occur.[3]

Diagnosis of CTS is primarily clinical. History and physical examination remain essential. However, nerve conduction studies (NCS) are widely used to confirm the diagnosis and assess severity.[4] NCS provides objective measurements of median nerve function. It helps differentiate mild, moderate, and severe disease. It also supports decision-making, especially when surgical treatment is considered.[5]

Electrodiagnostic severity grading is clinically important. Patients with mild CTS may respond to conservative treatment.[6] Moderate and severe cases are more likely to require surgical intervention. Severe cases may also be associated with a longer duration of symptoms and a higher risk of permanent nerve damage.[7] Therefore, understanding the distribution of severity in a specific population is valuable for clinical planning.

Several factors may influence disease severity. Age may play a role, as nerve conduction velocity decreases with aging.[8] Systemic conditions such as diabetes mellitus may worsen nerve function.[9] Symptom duration may also correlate with severity, as prolonged compression can lead to progressive nerve damage.[10] However, the relationship between clinical presentation and electrodiagnostic grading is not always linear.[11]

Most published data on CTS severity come from Western populations. Regional differences may exist in patient characteristics, comorbidities, referral patterns, and timing of presentation. Local data are important to better understand the severity profile of patients in a specific institution. Such information may reflect access to care, awareness of symptoms, and clinical decision-making practices.

Descriptive studies focusing on electrodiagnostic grading provide practical insights. They allow clinicians to understand how frequently mild, moderate, or severe CTS presents in routine practice. They also help identify patterns in relation to demographic variables and common comorbidities.

The aim of this study was to describe the electrodiagnostic severity distribution of carpal tunnel syndrome among 100 patients with completed nerve conduction studies at Jordan University Hospital. In addition, selected demographic and clinical characteristics were examined in relation to severity using simple descriptive and comparative analysis.

METHODS

Study design and setting

This was a descriptive cross-sectional study conducted at Jordan University Hospital. The study was based on a review of patient medical records and nerve conduction study reports from January 2024 to December 2024.

Study population

The study included 100 consecutive adult patients diagnosed with carpal tunnel syndrome who had completed nerve conduction studies. Only patients with documented electrodiagnostic grading were included in the analysis.

Inclusion and exclusion criteria

Patients were eligible if they were 18 years of age or older and had a confirmed diagnosis of carpal tunnel syndrome supported by nerve conduction studies. Only cases with complete demographic, clinical, and electrodiagnostic data were included.

Patients were excluded if nerve conduction studies were not performed or if electrodiagnostic grading was missing. Patients with previous carpal tunnel release surgery were also excluded. Cases with other documented peripheral neuropathies affecting the upper limb were not included.

Data collection

Data were extracted using a structured data sheet. Demographic variables included age and sex. Clinical variables included duration of symptoms and presence of night symptoms. Comorbidities such as diabetes mellitus and hypertension were recorded when documented.

Electrodiagnostic severity was obtained from the nerve conduction study report. Severity was classified into three categories according to the documented grading system: mild, moderate, and severe.

Statistical analysis

Data were analyzed using descriptive statistical methods. Continuous variables were reported as mean and standard deviation. Categorical variables were presented as frequencies and percentages.

The distribution of electrodiagnostic severity was described. Severity categories were also compared across selected variables such as sex and diabetes status using simple cross-tabulation. No multivariate analysis was performed.

RESULTS

A total of 100 patients with completed nerve conduction studies were included in the analysis.

Regarding electrodiagnostic grading, severe carpal tunnel syndrome was the most frequent category. Sixty-seven patients (67%) were classified as severe. Moderate CTS was observed in 21 patients (21%), while 12 patients (12%) had mild CTS. The distribution of electrodiagnostic severity is presented in Table 1.

Table 1: Distribution of electrodiagnostic severity (n=100).

Severity of CTS based on NCS	N	%
Mild	12	12
Moderate	21	21
Severe	67	67
Total	100	100

When severity was examined according to sex, females represented 80% of the total sample. Female predominance was observed across all severity categories. In the mild group, 75% were female. In the moderate group, 61.9% were female. In the severe group, 86.6% were female. Severe CTS was proportionally more common among females. The distribution by sex is shown in Table 2.

Table 2: Electrodiagnostic severity by sex.

Severity of CTS based on NCS	Female, N (%)	Male, N (%)	Total
Mild	9 (75.0)	3 (25.0)	12
Moderate	13 (61.9)	8 (38.1)	21
Severe	58 (86.6)	9 (13.4)	67
Total	80 (80)	20 (20)	100

Age differed across severity categories. The mean age was 46.3 years in the mild group, 56.0 years in the moderate group, and 54.7 years in the severe group. Moderate and severe cases tended to occur in older patients. The mean duration of symptoms was 24.4 months in the mild group, 25.3 months in the moderate group, and 28.6 months in the severe group. Severe cases had slightly longer symptom duration. These findings are summarized in Table 3.

Table 3: Age and symptom duration by severity.

Severity of CTS based on NCS	Mean age (years)	Mean duration (months)
Mild	46.3	24.4
Moderate	56.0	25.3
Severe	54.7	28.6

Several comorbidities were evaluated in relation to electrodiagnostic severity. Hypertension was present in 1 mild case (8.3%), 8 moderate cases (38.1%), and 23 severe cases (34.3%). Diabetes mellitus was not observed in mild cases but was present in 33.3% of moderate cases and 29.9% of severe cases. Rheumatological diseases were more frequent in mild (33.3%) and moderate (23.8%) groups compared to severe cases (6.0%).

Ischemic heart disease or cerebrovascular disease was present in 3 moderate cases (14.3%) and 5 severe cases (7.5%), but none in the mild group. Renal disease was identified in 3 moderate cases (14.3%) and 4 severe cases (6.0%). Pulmonary disease was uncommon, occurring in 2 moderate cases (9.5%) and 2 severe cases (3.0%).

Central nervous system disorders were documented only in the severe group (6.0%). The full distribution of comorbidities by severity is presented in Table 4.

Table 4: Comorbidities by electrodiagnostic severity.

Comorbidity	Mild, N (%)	Moderate, N (%)	Severe, N (%)
Hypertension	1 (8.3)	8 (38.1)	23 (34.3)
Diabetes mellitus	0 (0)	7 (33.3)	20 (29.9)
Rheumatological disease	4 (33.3)	5 (23.8)	4 (6.0)
IHD/CVD	0 (0)	3 (14.3)	5 (7.5)
Renal disease	0 (0)	3 (14.3)	4 (6.0)
Pulmonary disease	0 (0)	2 (9.5)	2 (3.0)
CNS disorders	0 (0)	0 (0)	4 (6.0)

DISCUSSION

This study described the electrodiagnostic severity distribution of carpal tunnel syndrome among 100 patients with completed nerve conduction studies at Jordan University Hospital. Several important findings were observed.

Severe CTS was the most common category in this cohort. Two-thirds of patients were classified as severe. Mild cases represented only a small proportion of the sample. This suggests that many patients present at an advanced stage of disease. Late presentation may reflect delayed referral, limited awareness of early symptoms, or prolonged tolerance of symptoms before seeking medical care.[12]

Female predominance was evident across all severity categories. Severe CTS was particularly common among women. This finding is consistent with established literature showing that CTS is more frequent in females.[8,13] Anatomical differences, hormonal influences, and fluid retention have been proposed as contributing factors.[14] The higher proportion of severe cases among women in this cohort may reflect increased disease susceptibility or healthcare-seeking behavior.

Age also appeared to differ across severity groups. Patients with moderate and severe CTS were older than those with mild disease. This finding supports the concept that nerve conduction abnormalities may progress over time. Age-related changes in nerve function may also contribute to increased severity.[15]

Several systemic comorbidities were examined. Hypertension and diabetes mellitus were common in moderate and severe groups. Diabetes is a well-established risk factor for peripheral neuropathy and may worsen nerve conduction abnormalities.[16-18] Although most severe cases occurred in non-diabetic patients, the proportion of diabetes was higher in moderate and severe categories compared to mild cases. This suggests that metabolic factors may contribute to disease progression.[19]

Rheumatological diseases were more frequently observed in mild and moderate cases compared to severe cases. This finding may reflect earlier referral or different disease mechanisms in inflammatory conditions.[20] Cardiovascular, renal, pulmonary, and central nervous system disorders were less frequent overall. Their distribution did not show a consistent pattern across severity categories.

This study has several strengths. It focuses on objective electrodiagnostic grading. It includes a defined sample of patients from a tertiary institution. The analysis remains simple and clinically relevant. The descriptive approach provides practical insight into the severity profile of CTS in this setting.

However, some limitations should be acknowledged. The study was limited to 100 patients from a single center. The cross-sectional design does not allow assessment of causality. The sample may over-represent more severe cases due to being performed at tertiary hospital. In addition, no multivariate analysis was performed to control for confounding variables.

CONCLUSION

In this cross-sectional study of 100 patients with completed nerve conduction studies, severe carpal tunnel syndrome was the most common electrodiagnostic category. Moderate and severe cases were more frequent among females and older patients. Symptom duration showed a slight increase with greater severity. Hypertension and diabetes mellitus were commonly observed in moderate and severe groups. These findings suggest that many patients present at an advanced stage of disease in our setting. Early recognition and referral may help reduce progression to severe electrodiagnostic impairment.

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REFERENCES

1. Ibrahim I, Khan W, Goddard N, Smitham P. Carpal tunnel syndrome: a review of the recent literature. Open Orthop J. 2012;6(1):69.
2. Chammas M. Carpal tunnel syndrome. Chir Main. 2014;33(2):75-94.
3. Singjam A, Charoentanyarak K, Saengsuwan J. Prevalence and predictive factors for bilateral carpal tunnel syndrome by electrodiagnosis: a retrospective study. PLoS One. 2021;16(12):e0260578.
4. Ozdag Y, Hu Y, Hayes DS, Manzar S, Akoon A, Klena JC, et al. Sensitivity and specificity of examination maneuvers for carpal tunnel syndrome: a meta-analysis. Cureus. 2023;15(7):e42383.
5. Pourmokhtari M, Mazrooyi M, Vosoughi AR. Conservative or surgical treatment of carpal tunnel syndrome based on the severity and patient risk factors. Musculoskelet Surg. 2021;105(3):315-9.
6. Latinovic R, Gulliford MC, Hughes RAC. Incidence of common compressive neuropathies in primary care. J Neurol Neurosurg Psychiatry. 2006;77(2):263-5.
7. Thomas M, Hinton A, Heywood A, Shirley R, Chan JKK. Peripheral nerve decompression in the upper limb in spinal cord injury: experiences at the National Spinal Injuries Centre, UK. Spinal Cord Ser Cases. 2021;7(1):1-7.
8. Lam N, Thurston A. Association of obesity, gender, age and occupation with carpal tunnel syndrome. Aust N Z J Surg. 1998;68(3):190-3.
9. Karpitskaya Y, Novak CB, Mackinnon SE. Prevalence of smoking, obesity, diabetes mellitus, and thyroid disease in patients with carpal tunnel syndrome. Ann Plast Surg. 2002;48(3):269-73.
10. Burton CL, Chesterton LS, Chen Y, van der Windt DA. Clinical course and prognostic factors in conservatively managed carpal tunnel syndrome: a systematic review. Arch Phys Med Rehabil. 2016;97(5):836-52.
11. Conzen C, Conzen M, Rübsamen N, Mikolajczyk R. Predictors of the patient-centered outcomes of surgical carpal tunnel release: a prospective cohort study. BMC Musculoskelet Disord. 2016;17(1):1-9.
12. Hooper RC, Tong Y, Sanders HM, Wang L, Chung KC. An analysis of treatment choices among White and African American Medicaid patients with carpal tunnel syndrome. Plast Reconstr Surg. 2024;153(3):649-55.
13. Lakshminarayanan K, Shah R, Li ZM. Sex-related differences in carpal arch morphology. PLoS One. 2019;14(5):e0217425.
14. Al-Rousan T, Sparks JA, Pettinger M, Chlebowski R, Manson JE, Kauntiz AM, et al. Menopausal hormone therapy and the incidence of carpal tunnel syndrome in postmenopausal women: findings from the Women's Health Initiative. PLoS One. 2018;13(12):e0207509.
15. Taams NE, Drenthen J, Hanewinckel R, Ikram MA, van Doorn PA. Age-related changes in neurologic examination and sensory nerve amplitude in the general population. Neurology. 2023;101(13):1351-8.
16. Duncan SFM, Bhate O, Mustaly H. Pathophysiology of carpal tunnel syndrome. Neurosciences. 2015;20(1):4.
17. Ozkul Y, Sabuncu T, Kocabey Y, Nazligul Y. Outcomes of carpal tunnel release in diabetic and non-diabetic patients. Acta Neurol Scand. 2002;106(3):168-72.
18. Zimmerman M, Gottsäter A, Dahlin LB. Carpal tunnel syndrome and diabetes: a comprehensive review. J Clin Med. 2022;11(6):1674.
19. Sharief F, Kanmani J, Kumar S. Risk factors, symptom severity and functional status among patients with carpal tunnel syndrome. Neurol India. 2018;66(3):743-6.
20. Smerilli G, Di Matteo A, Cipolletta E, Carloni S, Incorvaia A, Di Carlo M, et al. Ultrasound assessment of carpal tunnel in rheumatoid arthritis and idiopathic carpal tunnel syndrome. Clin Rheumatol. 2021;40(3):1085-92.

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