Clinical Profile and Management Outcomes of Patients with Carpal Tunnel Syndrome – A Hospital-Based Study

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ARTICLE INFO

Received: 8 Apr 2026
Accepted: 16 Apr 2026
Published Online: 5 May 2026

DOI: 10.5281/zenodo.20038634

Volume: 9, Number: 2, Page: 120-123

e-ISSN: 2789-5912
ISSN: 2617-0817

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ABSTRACT

Introduction: Carpal tunnel syndrome (CTS) is the most common compressive neuropathy of the upper limb, caused by median nerve entrapment at the wrist, leading to numbness, tingling, and hand weakness. It predominantly affects middle-aged adults and is more common in females. This study aimed to evaluate the clinical profile, treatment modalities, and outcomes of patients with CTS in a hospital-based setting. **Methods & materials:** This hospital-based descriptive study was conducted on 86 patients diagnosed with carpal tunnel syndrome (CTS) at Monno Medical College and Hospital, Manikganj, Bangladesh, from January 2025 to December 2025. Patients of all ages and both sexes presenting with clinical symptoms of CTS, such as numbness, tingling, nocturnal symptoms, hand pain, and weakness, were included. Data analysis was performed by SPSS version 26.0. **Result:** Most presented with numbness or paresthesia (90.7%), nocturnal symptoms (75.6%), and hand pain (69.8%), with positive Phalen's (83.7%) and Tinel's signs (79.1%). Electrophysiological assessment showed mild CTS in 37.2%, moderate in 45.3%, and severe in 17.5% of patients. Treatment was predominantly conservative (52.3%), followed by steroid injection (30.2%) and surgery (17.5%). Overall, 55.8% achieved complete symptom relief, 32.6% partial improvement, and 11.6% showed no improvement or recurrence, with the highest success observed in surgically managed patients. **Conclusion:** The majority were middle-aged females presenting with numbness, nocturnal symptoms, and moderate disease severity. Conservative management and steroid injections provided satisfactory improvement in mild to moderate cases, while surgical release achieved the highest rate of complete symptom relief, especially in severe or refractory patients.

Keywords: *Carpal Tunnel Syndrome, Nerve Conduction Studies, Neuropathy*

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INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common peripheral entrapment neuropathy, resulting from compression of the median nerve within the carpal tunnel at the wrist. It is clinically characterised by numbness, tingling, pain, and weakness in the median nerve distribution, which may progress to functional impairment and reduced hand dexterity if left untreated [1]. CTS represents a significant clinical and public health concern due to its high prevalence, chronic nature, and impact on daily activities and occupational performance. The global prevalence of CTS in the general population ranges from 3% to 6%, with a higher incidence among females and individuals aged between 30 and 60 years [2]. Several risk factors have been identified, including repetitive wrist movements, prolonged manual work, obesity, diabetes mellitus, hypothyroidism, pregnancy, and inflammatory conditions [3]. Occupational exposure to repetitive hand-intensive tasks has been particularly associated with an increased risk of developing CTS, contributing to work absenteeism and decreased productivity [4]. The socioeconomic burden of the disease, including healthcare costs and loss of workdays, further highlights the importance of early diagnosis and effective management. Diagnosis of CTS is primarily clinical, based on characteristic symptoms such as nocturnal paresthesia, hand weakness, and positive provocative tests, including Phalen's and Tinel's signs [1]. However, nerve conduction studies (NCS) remain the gold standard for confirming the diagnosis and determining the severity of median nerve compression [5]. Assessment of clinical severity, along with electrophysiological grading, plays a crucial role in guiding treatment decisions and predicting therapeutic outcomes. Management strategies for CTS depend largely on the severity and duration of symptoms. Conservative treatment is generally recommended for patients with mild to moderate disease and includes wrist splinting, activity modification, nonsteroidal anti-inflammatory drugs, physiotherapy, and local corticosteroid injections [6]. Evidence suggests that corticosteroid injections can provide short-term symptom relief, although recurrence is common, particularly in cases with prolonged symptom duration or significant nerve compression [7]. Ultrasound-guided interventions and other minimally invasive approaches have also been explored to improve treatment precision and effectiveness. Surgical decompression, most commonly through open or endoscopic carpal tunnel release, is considered the definitive treatment for patients with severe CTS or those who fail conservative therapy [8]. Surgical outcomes are generally favourable, with significant improvement in symptoms, hand function, and quality of life reported in the majority of patients. However, factors such as age, duration of symptoms, electrophysiological severity, and presence of comorbidities may influence postoperative recovery and patient satisfaction [9]. Early surgical intervention in appropriately selected patients has been associated with better functional outcomes and reduced risk of permanent nerve damage. Despite the availability of established diagnostic and treatment modalities, variations exist in clinical presentation, risk factor distribution, and treatment outcomes across different populations and healthcare settings. Hospital-based studies evaluating the clinical profile, associated risk factors,

and management outcomes are therefore essential for understanding local disease patterns and optimising patient care [10].

METHODS & MATERIALS

This hospital-based descriptive study was conducted on 86 patients diagnosed with carpal tunnel syndrome (CTS) at the Department of Orthopedics, Monno Medical College and Hospital, Manikganj, Bangladesh, from January 2025 to December 2025. Patients of all ages and both sexes presenting with clinical symptoms of CTS, such as numbness, tingling, nocturnal symptoms, hand pain, and weakness, were included. Patients with prior wrist surgery, trauma, systemic neuropathies, or other confounding conditions were excluded. A detailed clinical evaluation was performed for all patients, including assessment of presenting symptoms, hand dominance, occupational history, and comorbidities. Provocative tests, such as Phalen's test and Tinel's sign, were performed to support the clinical diagnosis. All patients underwent nerve conduction studies (NCS) to confirm the diagnosis and determine disease severity, classified as mild, moderate, or severe based on standard electrophysiological criteria. Treatment was tailored according to severity and patient preference. Conservative management included wrist splinting, activity modification, physiotherapy, and analgesics. Patients with persistent symptoms despite conservative care received local corticosteroid injections, while surgical decompression (open carpal tunnel release) was performed in severe cases or those unresponsive to non-surgical treatment. Patients were followed up at regular intervals to assess treatment outcomes, categorised as complete symptom relief, partial improvement, or no improvement/recurrence. Data on demographics, clinical features, severity, treatment modality, and outcomes were recorded. Data analysis was performed by SPSS version 26.0, using descriptive statistics. Frequencies and percentages were calculated for categorical variables, while continuous variables were expressed as mean ± standard deviation. Treatment outcomes were compared across modalities to evaluate effectiveness.

RESULTS

Out of 86 patients, 12 (14.0%) were aged ≤30 years, 18 (20.9%) were 31–40 years, 26 (30.2%) were 41–50 years, 20 (23.3%) were 51–60 years, and 10 (11.6%) were older than 60 years. The highest proportion of patients was observed in the 41–50 years age group (*Table I*).

Table I
Distribution of patients by age group (*n* = 86).

Age group (years)	Frequency (n)	Percentage (%)
≤30	12	14.0
31–40	18	20.9
41–50	26	30.2
51–60	20	23.3
>60	10	11.6

Among the study population, 31 (36.0%) were male, and 55 (64.0%) were female, showing a clear female predominance with a female-to-male ratio of approximately 1.8:1 (*Table II*).

Table II
Gender distribution of the study population (*n* = 86).

Gender	Frequency (n)	Percentage (%)
Male	31	36.0
Female	55	64.0

Numbness or paresthesia was present in 78 (90.7%) patients, nocturnal symptoms in 65 (75.6%), and hand pain in 60 (69.8%). Weakness of hand grip was observed in 34 (39.5%), while thenar muscle wasting was noted in 12 (14.0%) cases. On examination, Phalen's test was positive in 72 (83.7%) patients, and Tinel's sign was positive in 68 (79.1%) patients (*Table III*).

Table III
Clinical presentation of patients (*n* = 86).

Symptom/Sign	Frequency (n)	Percentage (%)
Numbness/paresthesia	78	90.7
Nocturnal symptoms	65	75.6
Hand pain	60	69.8
Weakness of hand grip	34	39.5
Thenar muscle wasting	12	14.0
Positive Phalen's test	72	83.7
Positive Tinel's sign	68	79.1

Based on nerve conduction study findings, 32 (37.2%) patients had mild CTS, 39 (45.3%) had moderate CTS, and 15 (17.5%) had severe CTS. Moderate CTS constituted the largest proportion of cases. Based on nerve conduction study findings, 32 (37.2%) patients had mild CTS, 39 (45.3%) had moderate CTS, and 15 (17.5%) had severe CTS. Moderate CTS constituted the largest proportion of cases (*Table IV*).

Table IV
Severity of carpal tunnel syndrome based on nerve conduction study (*n* = 86).

Severity	Frequency (n)	Percentage (%)
Mild	32	37.2
Moderate	39	45.3
Severe	15	17.5

Among the 86 patients, 45 (52.3%) were treated with conservative measures such as splinting, physiotherapy, and medications, 26 (30.2%) received local corticosteroid injection, and 15 (17.5%) underwent surgical carpal tunnel release (*Table V*).

Table V
Treatment modalities received (*n* = 86).

Treatment modality	Frequency (n)	Percentage (%)
Conservative management	45	52.3
Local steroid injection	26	30.2
Surgical release	15	17.5

Overall, 48 (55.8%) patients achieved complete symptom relief, 28 (32.6%) showed partial improvement, and 10 (11.6%) had no improvement or recurrence. In the conservative group (n=45), 20 had complete relief, 18 showed partial improvement, and 7 had no improvement. Among patients receiving steroid injection (n=26), 15 experienced complete relief, 8 showed partial improvement, and 3 had persistent or recurrent symptoms. In the surgical group (n=15), 13 patients achieved complete symptom relief and 2 had partial improvement, with no cases of treatment failure (*Table VI*)

Table VI
Treatment outcomes at follow-up (*n* = 86).

Outcome	Conservative (n=45)	Steroid injection (n=26)	Surgery (n=15)	Total (n)	Percentage (%)
Complete symptom relief	20	15	13	48	55.8
Partial improvement	18	8	2	28	32.6
No improvement/recurrence	7	3	0	10	11.6

DISCUSSION

In this hospital-based study of 86 patients with carpal tunnel syndrome (CTS), the majority of cases were observed in middle age, with 30.2% in the 41–50 years group and 23.3% in the 51–60 years group, while only 14.0% were ≤30 years and 11.6% were >60 years. This indicates that CTS predominantly affected middle-aged individuals in our cohort. Padua et al. reported a similar age pattern, noting that the peak prevalence of CTS occurs between 40 and 60 years in clinical populations [1]. Likewise, Genova et al. described that most CTS patients in their review belonged to the middle-aged group, supporting the age distribution observed in our study [2]. Gender analysis in our study showed 64.0% females and 36.0% males, reflecting a clear female predominance. Comparable findings have been reported in previous studies. Chammas et al. documented that women account for approximately 65–75% of CTS cases, with a female-to-male ratio of about 2–3:1 [3]. Similarly, Fowler et al. reported female representation of around 70% among CTS patients with associated risk factors [10]. Regarding clinical presentation, 90.7% of patients in our study reported numbness or paresthesia, 75.6% had nocturnal symptoms, and 69.8% experienced hand pain. Additionally, 83.7% had a positive Phalen's test and 79.1% had a positive Tinel's sign. In comparison, Padua et al. reported sensory symptoms such as numbness and tingling in more than 85–90% of CTS patients and nocturnal symptoms in approximately 70–80% of cases [1]. Werner and Andary also noted that positive provocative tests are seen in about 70–85% of clinically diagnosed patients [5]. The clinical findings in our study are therefore consistent with the typical presentation reported in the literature. Electrophysiological assessment in the present study revealed 37.2% mild, 45.3% moderate, and 17.5% severe CTS, with moderate cases being the most common. Similar distributions have been reported previously. Alimohammadi et al. observed that approximately 40–50% of patients had moderate CTS, while severe cases accounted for about 15–20% [9]. This similarity suggests that most patients seek medical attention during the intermediate stage of disease. In terms of management, 52.3% of patients in our study were treated conservatively, 30.2% received local steroid injection, and 17.5% underwent surgical release. This pattern aligns with recommended treatment strategies. Page et al. reported that conservative treatment, including splinting, is commonly used as first-line therapy in mild to moderate CTS and is applied in more than 50% of cases in clinical practice [6]. Additionally, Marshall et al. demonstrated that corticosteroid injections provide effective short-term symptom relief in a substantial proportion of patients and are widely used before considering surgery [7]. Outcome evaluation in our study showed complete symptom relief in 55.8%, partial improvement in 32.6%, and no improvement or recurrence in 11.6% of patients overall. Surgical management resulted in 86.7% complete relief, compared with 57.7% in the steroid group and 44.4% in the conservative group. These findings are comparable to previous reports. Sayegh and Strauch found that surgical decompression achieved symptom improvement in approximately 75–90% of patients, significantly higher than non-operative treatments [8]. Similarly, Alimohammadi et al. reported high patient satisfaction and marked clinical improvement after surgery, particularly in moderate to severe CTS cases [9]. Burton et al. conducted a randomised trial comparing local corticosteroid injection and night splinting in mild-to-moderate CTS, and found no significant difference in long-term clinical effectiveness over 24 months, though differences in surgical referral rates were seen, supporting the use of conservative and injection therapies in routine clinical practice [11].

LIMITATIONS

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

In this study of patients with carpal tunnel syndrome, the majority were middle-aged females presenting with numbness, nocturnal symptoms, and moderate disease severity. Conservative management and steroid injections provided satisfactory improvement in mild to moderate cases, while surgical release achieved the highest rate of complete symptom relief, especially in severe or refractory patients.

RECOMMENDATIONS

Based on the findings of this study, it is recommended that patients with mild to moderate carpal tunnel syndrome initially receive conservative management, including splinting, physiotherapy, and activity modification, with consideration of local steroid injections for persistent symptoms. Surgical decompression should be reserved for severe cases or those unresponsive to conservative therapy, as it provides the highest likelihood of complete symptom relief.

FUNDING
No funding sources

CONFLICT OF INTEREST
None declared

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