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Inter-measurement correlation of Carpal Tunnel Syndrome severity assessment tools and its influencing factors

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ABSTRACT

Background and objectives. Carpal Tunnel Syndrome (CTS) is a prevalent entrapment neuropathy in which median nerve compression at the wrist causes symptoms such as tingling, pain, and muscle weakness. The severity of CTS can be assessed subjectively using the Boston Carpal Tunnel Questionnaire (BCTQ) and objectively using nerve conduction studies (NCS). This study analyzes the correlation between BCTQ scores and NCS results and examines the influence of demographic factors, pain intensity, and psychological factors on CTS severity.

Materials and methods. This analytical observational study employed a cross-sectional approach, integrating BCTQ with NCS among 40 Indonesian CTS patients. NCS severity was assessed using the Bland and Padua criteria. Additional analysis examined the influence of demographic factors, pain intensity, and psychological factors through logistic regression.

Results. Our findings revealed a weak but significant positive correlation between the BCTQ symptom severity scale (SSS) and NCS severity grade, particularly in Bland's and Padua's classifications. No significant correlations were found between the BCTQ functional status scale (FSS) and NCS severity grade. Symptom duration was a significant predictor of NCS severity grade, with durations ≥1 year increasing the risk of higher NCS severity (Bland grade 4-6) by 6.034 times (p=0.025). Anxiety increased the likelihood of severe BCTQ SSS by 9.479 times (p=0.032) and severe FSS by 10.833 times (p=0.029).

Conclusions. The study confirmed that while the BCTQ provides a useful subjective assessment of CTS severity, its correlation with objective NCS findings is limited.

Keywords: CTS, carpal tunnel syndrome, Boston Carpal Tunnel Questionnaire, nerve conduction studies, electrophysiological testing, symptom severity, anxiety

INTRODUCTION

Carpal Tunnel Syndrome (CTS) is the most prevalent entrapment neuropathy, marked by compression of the median nerve at the wrist, leading to symptoms like tingling, pain, and muscle weakness [1,2]. CTS affects primarily individuals aged 40-60, with a higher incidence in females. In the UK, prevalence rates are estimated at 88 per 100,000 for males and 193 per 100,000 for females, with about 50% of cases being bilateral, usually in the dominant hand. In Indonesia, the estimated prevalence of the condition varies from 2.7% to 5.8%. The exact prevalence in Indonesia remains unknown. A study conducted at Dr. Cipto Mangunkusumo National Central Public Hospital, Indonesia found a female-to-male ratio of 11:1, with the most common age group being 51-55 years [3–6].

Despite being the most common disorder of the hand and wrist, there is ongoing controversy regarding the standardization of management and outcome assessment. The clinical evaluation of CTS focuses on assessing neuromuscular impairments, manifesting as reduced sensitivity and grip strength.

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Management strategies vary based on the severity of symptoms assessed by a physician and range from conservative treatments like wrist splinting and non-steroidal anti-inflammatory drugs to corticosteroid injections and surgical interventions for severe cases [7].

Diagnosis of CTS is primarily based on clinical features, with electrophysiological studies serving as a confirmatory test. Patients typically report numbness, tingling, and pain along the radial side of the hand, often waking at night with numb hands. Common complaints include decreased hand strength, difficulty gripping, and frequent dropping of objects. Physical examinations may reveal hypoesthesia in the median nerve sensory distribution, positive provocative test results, and muscle weakness or atrophy in the thenar region. Physical tests such as the Phalen's test and Tinel's sign are commonly used for diagnosis [8]. Electrophysiological studies, which include Nerve Conduction Studies (NCS) and Electromyography (EMG), are crucial for determining the severity of nerve compression, and guiding management decisions [8,9].

The severity of CTS can also be assessed subjectively using the Boston Carpal Tunnel Questionnaire (BCTQ), which has been validated in Indonesia. This tool uses a Symptom Severity Scale (SSS) and a Functional Status Scale (FSS) to assign severity scores [10]. Given the limited resources in healthcare systems, diagnostics, and management are closely monitored to ensure high-quality care that is also cost-effective. Previous studies assessing the correlation between CTS severity using the BCTQ and NCS results have shown varying outcomes. Risk factors such as age, gender, symptom duration, body mass index, anxiety, depression, and pain level can influence the severity of CTS [7].

This research aims to analyze the correlation between BCTQ assessments and NCS results, considering the variability in previous studies and the infrequency of such studies in Indonesia. Furthermore, this study aims to see whether the BCTQ can be used as an alternative for determining the severity of CTS, especially in areas with limited access to NCS examination. This study also explores the relationship between demographic, psychological, and pain intensity with clinical severity using BCTQ and NCS severity based on the Bland criteria.

MATERIALS AND METHODS

This study employs an analytical observational design with a cross-sectional approach, integrating the Boston CTS Questionnaire with nerve conduction study. The study population includes adult Indonesian CTS patients at Prof. Dr. R. D. Kandou General Hospital, North Sulawesi. Sampling will use non-random consecutive sampling until the required 40 participants. Inclusion criteria are adults (age ≥18 years) diagnosed with CTS who can complete the questionnaire and consent to participate. Exclusion criteria include those who have received CTS-related surgery or injections, have wrist fractures or tumors, are pregnant or breastfeeding, or have other neuropathies/radiculopathy or systemic conditions like diabetes or rheumatoid arthritis.

The primary study variables include the severity of CTS assessed by the Bland and Padua criteria, motoric and sensory median nerve distal latencies, conduction velocities, amplitudes, and scores from the BCTQ SSS and FSS. For the comparative test to determine Bland grade 1 or Padua grade 2, we use the second lumbrical-interossei latency difference test. The BCTQ has been adapted into the Indonesian language, and its validity and reliability were tested in 2022 by Octaviana et al. [6]. It comprises two elements; an 11-item symptom severity scale and an 8-item functional status scale. Each item is graded according to the severity from 1 to 5, where 1 represents no symptom nor disability and 5 represents extreme symptoms or functional disability. The symptom severity scale and functional status scale were calculated for each patient by taking the average of all corresponding scale items. For patients with bilateral CTS, we applied BCTQ only in the most affected hand. Covariates include demographic factors (gender, age, symptom duration, body mass index (BMI)), pain intensity (assessed using a Numeric rating scale (NRS), and psychological factors such as anxiety and depression assessed using Hospital Anxiety and Depression Scale (HADS). Data collection involves demographic and clinical data recording, electrophysiological assessments, and self-administered questionnaires. Data will be processed and analyzed using SPSS 27. Numerical data will be described as means or medians, depending on distribution normality, assessed by the Shapiro-Wilk test. Correlations between BCTQ results and electrophysiological findings will be evaluated using Pearson's or Spearman's correlation coefficients. Categorical data will be analyzed using Chi-square or Fisher's Exact tests, and multivariate relationships will be examined through Binary logistic regression.

RESULTS

This research included forty individuals diagnosed with CTS. We documented demographic attributes including gender, age, symptom duration, occupation, BMI, levels of anxiety, depression, and additional comorbidities. Furthermore, we evaluated clinical features such as the type of CTS, NCS severity according to Bland and Padua criteria, severity distribution as assessed by the Boston CTS Questionnaire, outcomes from provocative tests (Phalen, Reverse

TABLE 1. Demographic and clinical characteristics

Demographic and clinical characteristics	Total (%) (N=40)
Gender	
Female	31 (77.5%)
Male	9 (22.5%)
Age (mean)	**54.60 ± 13.38**
≤ 55 years	23 (57.5%)
> 55 years	17 (42.5%)
Duration of symptoms (median)	**8 IQR 21.75-3.00**
≤ 1 year	20 (50%)
> 1 year	20 (50%)
Occupation	
Housewife	19
Healthcare worker	7
Self-employed	4
Government employee	4
Farmer	3
Teacher	2
Fisherman	1
Body Mass Index (mean)	**25.41 ± 4.08**
< 25	21 (52.5%)
≥ 25	19 (47.5%)
HADS anxiety (median)	**4.00 IQR 8.75-1.00**
Normal	25 (65%)
Mild	6 (15%)
Moderate	8 (17.5%)
Severe	1 (2.5%)
HADS depression (median)	**4.50 IQR 6.75-2.00**
Normal	31 (77.5%)
Mild	6 (15%)
Moderate	3 (7.5%)
Severe	0 (0%)
Comorbidities	
Hypertension	11 (27.5%)
Dyslipidemia	1 (2.5%)
Hyperuricemia	4 (10%)
Type of CTS	
Bilateral	29 (72.5%)
Right	8 (20%)
Left	3 (7.5%)
Bland Scale	
Very mild (1)	8 (20%)
Mild (2)	7 (17.5%)
Moderate (3)	14 (35%)
Severe (4)	3 (7.5%)
Very severe (5)	6 (15%)
Extremely severe (6)	2 (5%)
Padua Scale	
Negative STK (1)	0 (0%)
Minimal STK (2)	8 (20%)
Mild (3)	2 (5%)
Moderate (4)	20 (50%)
Severe (5)	8 (20%)
Extreme (6)	2 (5%)
BCTQ Symptom Severity Scale	
Asymptomatic	0 (0%)
Mild	13 (32.5%)
Moderate	20 (50%)
Severe	6 (15%)
Very severe	1 (2.5%)
BCTQ Functional Status Scale	
Asymptomatic	9 (22.5%)
Mild	15 (37.5%)
Moderate	9 (22.5%)
Severe	7 (17.5%)
Very severe	0 (0%)
Phalen Test	
Positive	31 (77.5%)
Negative	9 (22.5%)
Reverse Phalen Test	
Positive	21 (52.5%)
Negative	19 (47.5%)
Pain Degree (NRS) (median)	4.00 IQR 6.00-4.00
≤ 4	18 (45%)
> 4	22 (55%)
Current Therapy	
None	10 (25%)
Gabapentin	21 (52.5%)
Gabapentin + Other Analgesics	7 (17.5%)
Gabapentin + Oral Steroids	2 (5%)

Phalen, and Tinel sign), the severity of pain, and the treatments administered (Table 1).

The majority of the study participants were female (77.5%, n=31), with an average age of 54.60 ± 13.38 years. The median duration of CTS symptoms was 8 months (IQR 21.75-3), and the most common occupation was a housewife (47.5%, n=19). Nineteen subjects had a BMI ≥ 25, with an average BMI of 25.41 ± 4.08. Median anxiety scores, based on the Hospital Anxiety and Depression Scale (HADS), were 4 (IQR 8.75-1.0) with 67.5% (n=27) falling within the normal range. Median depression scores were 4.5 (IQR 6.75-2.0), with 77.5% (n=31) categorized as normal. Hypertension was the most frequent comorbidity (27.5%, n=11). Clinically, 72.5% (n=29) of patients had bilateral CTS. The most common NCS severity according to the Bland criteria was moderate (35%, n=14), and according to the Padua criteria, also moderate (50%, n=20). The median pain severity, based on the Numeric Rating Scale, was 4 (IQR 6.00-4.00). The most common therapy was Gabapentin, prescribed to 52.5% (n=21) of subjects.

The severity assessment conducted with the BCTQ revealed an average score on the symptom severity scale of 2.53 ± 0.66 and a median functional status scale of 1.63 IQR 1.7. The highest scores on the symptom severity scale were for questions about tingling sensations in the hands (Question 6), followed by levels of numbness at night (Question 8), and the numbness experienced by participants (Question 9). In terms of functional status, participants reported the most difficulty with household chores and carrying shopping bags.

Motor nerve conduction studies were performed on 38 individuals, where responses were absent in 2 patients. The findings showed a median distal motor

TABLE 2. Correlation between electrophysiological results and BCTQ

Variable	SSS		FSS		N
	r	p	r	p	
Bland	0.327	0.04*	0.109	0.503	40
Padua	0.316	0.047*	0.049	0.765	40
Distal Motor Latency	0.372	0.021*	0.106	0.527	38
Motor Amplitude	0.004□	0.981*	0.243	0.142	38
Motor NCV	-0.177	0.289	-0.044	0.794	38
Distal Sensory Latency	0.582	0.001**	0.255	0.174	30
Sensory Amplitude	-0.450□	0.013*	-0.199	0.292	30
Sensory NCV	-0.539□	0.002**	-0.281	0.132	30
Lumbrical	0.299	0.061	-0.003	0.987	40

□= Pearson correlation test; NCV = Nerve conduction velocity; SSS = Symptom severity scale; FSS = Functional status scale
***Significant correlation at p < 0.01*
**Significant correlation at p < 0.05*

latency of 4.58 ms with an IQR of 2.28. The average motor amplitude measured 7.60 ± 2.47 mV, and the median motor nerve conduction velocity stood at 51.25 m/s with an IQR of 7.15. Sensory electrophysiological tests were conducted on 10 patients who demonstrated no sensory responses. Median distal sensory latency was recorded at 4.24 ms with an IQR of 1.57. The average sensory amplitude was found to be 19.50 ± 7.89 mV, and the sensory nerve conduction velocity averaged 39.49 ± 11.39 m/s. For the second lumbrical versus ulnar interossei distal motor latency test, the median latency difference between the median and ulnar nerves was 1.37 ms with an IQR of 2.45.

Correlation of NCS with the BCTQ

Statistical correlation tests between the NCS and BCTQ showed a significant correlation between the BCTQ SSS and various NCS measures (Table 2) These include Bland's severity grade (r = 0.327, P = 0.04), Padua's severity grade (r = 0.316, p = 0.047), distal motor latency (r = 0.372, p = 0.021), distal sensory latency (r = 0.582, p = 0.001), sensory amplitude (r = -0.450, p = 0.013), and sensory nerve conduction velocity (r = -0.539, p = 0.002). However, no significant correlations were found between the BCTQ FSS and the NCS measure, including components of motor and sensory nerve conduction studies.

Spearman correlation tests conducted on each question from the BCTQ indicated that questions 6, 8, and 9 on the SSS had the most correlations (Table 3). Positive correlations were found between questions 6, 8, and 9 and both distal motor latency and distal sensory latency, while significant negative correlations were found with sensory amplitude and sensory nerve conduction velocity.

Relationship between Carpal Tunnel Syndrome severity and demographic factors, pain levels, and psychological factors

The study found a relationship between Bland's severity and symptom duration (p=0.029), whereas no relationship was found between Bland's severity and age, gender, BMI, pain levels, anxiety, or depression. (Table 4) BCTQ symptom severity scale showed a relationship with anxiety (p=0.039). There was no relationship found between the symptom severity

TABLE 3. Correlation between BCTQ components and electrophysiological outcomes

	Bland	Padua	Distal Motor Latency	Motor Amplitude	Motor NCV	Distal Sensory Latency	Sensory Amplitude	Sensory NCV	Lumbrical
S1	**0.320***	00.230	0.298	0.098	-0.132	**.447***	-0.166	**-.443***	0.184
S2	-0.002	-0.005	0.068	-0.075	-0.032	0.288	-0.195	-0.358	-0.082
S3	**0.364***	0.250	**.459***	0.043	-0.310	**.468***	-0.229	**-0.414***	0.270
S4	0.135	0.081	0.176	0.076	-0.057	0.237	-0.169	-0.135	0.077
S5	0.089	0.122	0.062	0.086	0.001	-0.007	-0.085	-0.024	0.036
S6	**0.417****	**0.445****	**0.384***	-0.099	-0.083	**0.475***	**-0.479***	**-0.494***	**0.430****
S7	0.137	0.205	0.106	0.067	-0.149	0.264	-0.209	-0.243	-0.056
S8	**0.354***	**0.335***	0.301	0.138	-0.157	**0.489****	**-0.443***	**-0.538****	0.261
S9	**0.391***	**0.368***	**0.330****	0.151	-0.113	**0.463****	-0.188	**-0.448****	0.230
S10	0.035	0.069	0.072	0.116	-0.040	**0.432****	-0.140	-0.337	0.116
S11	0.164	0.188	0.210	0.045	-0.102	**0.506****	**-0.367***	**-0.417***	0.130
F1	0.204	0.205	0.248	-0.011	-0.100	0.120	-0.079	-0.116	0.002
F2	0.135	0.023	0.169	0.125	-0.154	0.262	**-0.409***	-0.228	0.009
F3	0.051	-0.015	0.063	0.257	-0.073	0.243	-0.226	-0.250	-0.059
F4	0.005	-0.071	0.013	**0.348***	-0.015	0.220	-0.238	-0.237	-0.111
F5	-0.111	-0.074	-0.098	0.236	0.093	0.089	-0.128	-0.143	-0.156
F6	0.172	0.111	0.249	0.208	-0.103	0.396*	-0.303	**-0.465****	0.226
F7	0.070	-0.004	0.167	0.111	-0.201	0.401*	-0.282	**-0.396***	-0.013
F8	-0.016	-0.081	-0.014	0.217	-0.127	0.216	-0.099	-0.210	-0.034

***Significant correlation at p < 0.01*
**Significant correlation at p < 0.05*

TABLE 4. Correlation between electrophysiological results and BCTQ

Variable	Bland		SSS		FSS	
	1-3	4-6	Mild-moderate	Severe-Very severe	Mild-moderate	Severe-Very severe
Gender						
Male	6	3	8	1	8	1
Female	23	8	25	6	25	6
p	0.686		1.000		1.000	
Age						
≤55	18	5	20	3	19	4
>55	11	6	13	4	14	3
p	0.477		0.432		1.000	
Symptom duration						
<1 year	22	4	22	4	21	5
≥1 year	7	7	11	3	12	2
p	**0.029***		0.679		1.000	
BMI						
<25	14	7	18	3	18	3
≥25	15	4	15	4	15	4
p	0.385		0.689		0.689	
Pain level						
≤4	16	5	19	2	20	1
>4	13	6	14	5	13	6
p	0.583		0.226		**0.040***	
Anxiety						
Normal	18	8	24	2	24	2
Anxiety	11	3	9	5	9	5
p	0.715		**0.039***		**0.039***	
Depression						
Normal	22	9	26	5	25	26
Depression	7	2	7	2	8	7
p	1.000		0.645		1.000	0.645

SSS = Symptom severity scale; FSS = Functional status scale
**Significant correlation at p < 0.05*

domain of the BCTQ and gender, age, duration, BMI, or depression. The functional status scale of the BCTQ was related to pain levels (p=0.04) and anxiety (p=0.039). No relationship was found between the symptom severity domain of the BCTQ and gender, age, duration, BMI, or depression.

A multivariate analysis using binary logistic regression was conducted to identify the most influential factors affecting the severity of CTS based on Bland criteria and BCTQ (SSS and FSS). The Bland criteria were categorized into mild to moderate (Bland grades 1 to 3) and severe (Bland grades 4 to 6). Symptom severity scale were categorized into mild to moderate (total SSS score 11-33) and severe to very severe (total SSS score 34-55).). Functional status scale were categorized into mild to moderate (total FSS score 8-24) and severe to very severe (total FSS score 25-40). After incorporating variables such as age, duration, BMI, pain level, anxiety, depression, symptom severity scale, and functional status scale, several non-significant variables were eliminated from the model. The final model is presented in Table 5.

TABLE 5. Multivariate Binary Logistic Regression Analysis

Bland (Severe)	B	Sig	Exp (B)	95% CI
Female	-0.560	0.551	0.571	0.091-3.602
Duration (≥1 year)	1.797	**0.025***	**6.034**	**1.247-29.186**
Anxiety	-1.219	0.246	0.296	0.038-2.316
SSS (Severe)	1.483	0.178	4.405	0.510-38.044
SSS (Severe)	**B**	**Sig**	**Exp (B)**	**95% CI**
BMI ≥ 25	0.739	0.454	2.095	0.302-14.545
NRS >4	1.105	0.272	3.018	0.421-21.629
Anxiety	2.249	**0.032***	**9.479**	**1.215-73.966**
Bland (Severe)	1.335	0.214	3.799	0.463-31.173
FSS (Severe)	**B**	**Sig**	**Exp (B)**	**95% CI**
Duration (≥1 year)	-0.880	0.450	0.415	0.042-4.067
NRS (> 4)	2.333	0.070	10.310	0.824-129.019
Anxiety	2.383	**0.029***	**10.833**	**1.284-91.416**
Depression	-0.922	0.514	0.398	0.025-6.346

Significantly, symptom duration influenced the severity according to Bland. A duration of ≥1 year was associated with a 6.034 times higher risk of experiencing severe Bland severity (grades 4-6) (p=0.025, 95% CI: 1.247-29.186). Anxiety was identified as the most significant factor affecting the SSS. An individual with anxiety (HADS score >7) was 9.479 times more likely to experience severe SSS compared to those without anxiety (p=0.032, 95% CI: 1.215-73.966). Anxiety was also found to be the most

significant factor affecting the FSS. An individual with anxiety was 10.833 times more likely to experience severe FSS compared to those without anxiety (p=0.029, 95% CI: 1.284-91.416).

DISCUSSION

Several studies support our findings, while others do not. The study by Bozbas et al. demonstrated a positive correlation between nerve conduction severity according to Padua and the BCTQ SSS (r=0.317, p=0.003) but not with the FSS (r=0.125, p=0.425) [10]. Similarly, Dhong et al. found a relationship between electrophysiological severity by Padua and the BCTQ SSS (p=0.004), which was not seen with the FSS component (p=0.31) [11]. Corredor et al. identified a correlation between numbness and tingling questions and electrophysiological severity by Bland (p<0.001), but no correlation was found with the BCTQ FSS [12]. Our research also found a similar correlation between the Bland and Padua scales with BCTQ SSS. To the best of the authors' knowledge, there have been no studies comparing the correlation BCTQ between these two scales.

The BCTQ SSS provides a numeric measurement of symptom severity and can be used to assess CTS severity when nerve conduction studies are unavailable or delayed. Despite showing a correlation, our study and some supporting research only demonstrate a weak relationship. Fargaly and Bland discussed the reasons for this weak correlation, highlighting that subjective symptoms like tingling may arise from ectopic action potentials in affected axons, whereas pain is mainly due to dysfunction in unmyelinated small axons. Routine electrophysiological tests do not measure these action potentials and do not provide functional information on small nerve fibers [13].

The absence of correlation between the Boston functional status scale and NCS severity could be due to its evaluation of daily activities, which can be accomplished using various compensation strategies. Weakness in the APB muscle relates to neurophysiological variables such as motor amplitude, often unperceived in daily activities. Corredor et al. found a significant correlation between functional status and handgrip strength, suggesting our sampling method, which focused only on the most affected extremity, might contribute to the absence of correlation [12]. Research by Kang et al. [14] and Almigdad et al. [9] found correlations between electrophysiological severity and both Boston questionnaire scales, with variations potentially due to different research methodologies. Differences in classifying Bland grades by sensory latencies or using age-specific criteria could explain discrepancies in results across studies [15]. Studies like those by Koo et al. [16] and Zanette et al. [17] showed no correlation between electrophysiological severity and either Boston questionnaire scale, possibly due to methodological differences.

Our findings are supported by Simmons et al. [18], who observed correlations between the Boston questionnaire symptom severity scale and sensory components like amplitude and NCV, while no correlations were found with the functional status component. Our result is also consistent with several studies by Dhong et al [19] and Tryobus et al [20] The significant correlation between subjective complaints and nerve conduction measurements suggests that the BCTQ SSS reflects injuries to the median nerve accurately. Questions related to numbness, tingling, and nocturnal symptoms (questions 6, 8, and 9) were most correlated, aligning with the specific nature of nerve injury symptoms, as opposed to secondary symptoms found in soft tissue injuries [18].

Our research identified a significant relationship between nerve conduction severity and symptom duration, with increasing risks associated with longer disease duration. This aligns with findings that increased epineural edema and endoneural fluid pressure correlate with longer disease durations, leading to higher severity ratings on the Bland scale for durations exceeding one year [9, 21–22]. In contrast, no such relationship was found with the Boston questionnaire, possibly because of anxiety influencing both scales. Furthermore, our findings indicate a strong link between anxiety and both the SSS and FSS of the BCTQ. Like other physical disorders accompanied by pain and discomfort, psychological status can substantially influence physical symptoms. Chronic pain, particularly neuropathic pain exacerbated by anxiety, can cause functional reorganization in brain areas involved in pain modulation and stress regulation, such as the amygdala, hippocampus, and hypothalamus. This dysfunction, due to anxiety, may lead to decreased cortisol levels and increased glucocorticoid hypersensitivity, which intensifies neuropathic pain [23]. These observations are consistent with studies by Khan et al. [24] and Alsharif et al. [25], which found correlations between nerve conduction severity, BCTQ, and anxiety and depression as measured by the HADS questionnaire. However, our study noted correlations with anxiety but not with depression, which might be attributed to most of our patients (70%) scoring within normal ranges for depression, unlike in Alsharif's study [25] where a higher prevalence of depression was noted. Each point increase on the symptom severity scale was associated with significant increases in anxiety and depression scores, highlighting the intertwined nature of physical and psychological health in carpal tunnel syndrome.

Our study offers a comprehensive examination of CTS, comparing two frequently used NCS severity criteria and focusing on the most severely affected extremity to provide a critical assessment. However, limitations include its single-institution scope and lack of post-therapy correlation assessment, suggesting the need for broader and longitudinal studies. Future research should also evaluate patients with normal electrophysiological results and include comparisons of additional median and ulnar nerve tests to enhance understanding of CTS clinical severity. Additionally, our study does not assess whether subjects experienced anxiety before symptom onset or if the symptoms led to the development of anxiety, which is a critical factor that future research should address.

CONCLUSION

The BCTQ SSS is valuable for assessing CTS severity in scenarios where nerve conduction studies are unavailable, although it cannot substitute for these studies due to a weak correlation. It is recommended to utilize this questionnaire, especially in areas with limited access to nerve conduction examinations. Furthermore, it is essential to conduct a detailed evaluation of the intensity of numbness, tingling, and nocturnal symptoms in patients with CTS, as these are the most common and pronounced symptoms and are indicative of median nerve injury. Our research findings highlight that the duration of symptoms significantly influences the severity of nerve conduction abnormalities, as assessed by the Bland criteria. Additionally, anxiety has been identified as the most impactful factor in the severity of CTS, according to the BCTQ. Recommendations include assessing anxiety in patients with CTS and conducting further studies on patients with above-normal hospital anxiety and depression scale scores. Moreover, long-term prospective studies are needed to determine if these correlations persist post-treatment, both conservative and surgical. Lastly, there is a need to develop a more refined classification system for CTS severity that can accurately reflect both objective and subjective severity levels.

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Conceptualization, C., S.J., T.R..; methodology, C., S.J., T.R., W.W.; software, C., S.J., T.R., W.W..; validation, C., S.J., T.R., W.W, H.K., M.K.; formal analysis, C., S.J., T.R., W.W, H.K., M.K.; investigation, C., S.J., T.R., W.W, H.K., M.K.; resources, C., S.J., T.R., W.W, H.K., M.K..; data curation, C., S.J., T.R., W.W, H.K., M.K.; writing—original draft preparation, C., S.J., T.R., W.W, H.K., M.K.; writing—review and editing, C., S.J., T.R., W.W, H.K., M.K.; visualization, C., S.J., T.R., W.W, H.K., M.K.; supervision, C., S.J., T.R., W.W, H.K., M.K.; project administration, C., S.J., T.R., W.W, H.K., M.K.; funding acquisition, none. All authors have read and agreed to the published version of the manuscript."

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