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ORIGINAL ARTICLE

Potential Role of Subclinical Hypothyroidism in Carpal Tunnel Syndrome Patients (Case Control Study)

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Abstract

Background: ***It is debatable how subclinical hypothyroidism affects peripheral nerves. The most prevalent type of nerve entrapment neuropathy, known as carpal tunnel syndrome (CTS), is brought on by compression of the median nerve at the wrist as it travels through the carpal tunnel, an osseo fibrous canal.***

Aim: ***To estimate the potential association between subclinical hypothyroidism and CTS patients without a definite risk factor.***

Patients and Methods: ***Over six months, individuals with CTS symptoms who visited the neurophysiology unit at Al-Azhar University Hospitals for an electrodiagnosis were the subjects of this case-control research. The study was carried out in two groups. Case Group: 30 CTS patients without definite risk factors; thirty healthy individuals matched for age and sex but did not exhibit any clinical indications or symptoms of CTS made up the control group.***

Results: ***Regarding subclinical hypothyroidism and euthyroidism, there was a significant difference between the control and case groups (X2= 5.45, p-value = 0.019). Thyroid-stimulating hormone (TSH) levels in the control and case groups differ statistically significantly (p=0.001). The Boston Scoring Symptoms (BSS) and TSH readings have a significant positive link (correlation coefficient: 0.588; p < 0.001). However, no relationship was discovered between the TSH levels and the Boston Scoring Functions (BSF) (p = 0.347) or the Padua's scale CTS severity grading (P = 0.284).***

Conclusion: ***Subclinical hypothyroidism CTS patients with no apparent risk factors are highly associated.***

Keywords: CTS; TSH; Padua's scale; Subclinical hypothyroidism

1. Introduction

Carpal tunnel syndrome (CTS) is a prevalent condition characterized by the compression of the median nerve at the wrist, specifically as it traverses the carpal tunnel, a bony and fibrous canal.[1]

Various risk factors contribute to the development of this condition, including age, being overweight, type 2 diabetes, rheumatoid arthritis (RA), smoking, pregnancy, congenital abnormalities, a lack of thyroid, and wrist injury. Research indicates that hypothyroidism is a notable contributing factor for carpal tunnel syndrome (CTS), with a reported frequency of 8.7% in people with hypothyroidism. Although numerous researchers have examined carpal tunnel syndrome (CTS) about hypothyroidism, there is a scarcity of studies exploring the connection between subclinical hypothyroidism and CTS.[2]

Subclinical hypothyroidism is characterized by an increased concentration of thyrotropin (thyroid-stimulating hormone or TSH) in the blood. However, free thyroxine (FT4) levels remain within the normal range.[3]

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It is debatable how subclinical hypothyroidism affects peripheral nerves. Research has indicated that neuromuscular symptoms and indications may be present in subclinical hypothyroidism. However, some investigations did not identify any involvement of the peripheral nerve.[4]

The purpose of this study is to quantify the possible correlation between carpal tunnel syndrome individuals and subclinical hypothyroidism in the absence of an apparent risk factor.

2. Patients and methods

This case-control research involved patients referred to the Neurophysiology Unit for Electrodiagnosis at Al-Azhar University Hospitals with CTS manifestations. The recruiting period lasted six months, from March 2023 until August 2023.

The ethical committee of Al-Azhar University's Faculty of Medicine approved the study. The patients who were enrolled provided written informed consent.

2.1.The patients were selected according to the following criteria:

Individuals who met the eligibility requirements and were willing to participate had a clinical history, physical examination, and electrophysiological investigation, all supporting a diagnosis of CTS. However, individuals with a history of upper limb trauma, fractures, surgeries, overt hypothyroidism, systemic diseases (such as Diabetes Mellitus) associated with CTS, pregnancy, neurological disorders that could impair hand function, and manual laborers (such as those who experience excessive vibration at work, increased hand force, and repetitive wrist posturing) were omitted.

The study was conducted in two groups: Case Group (A), which included 30 CTS patients without definite risk factors, and Control Group (B), which included thirty healthy individuals matched by age and sex and did not exhibit any clinical symptoms or indicators of CTS.

All the included patients were subjected to: After recording the demographic information for each participant, such as age, sex, height, weight, and body mass index, as well as the clinical symptoms of the patients, physical assessments (sensory and motor examinations, Tinel-Phalen tests) were conducted. The patient cohort was whole. One self-report tool used to assess the functional status and intensity of symptoms in CTS patients is the Boston Carpal Tunnel Questionnaire (BCTQ). It features two distinct scales on a five-point rating system from 1 to 5. The eleven items comprising the asymptomatic severity scale assess symptoms' kind, frequency, duration, and severity. The eight questions that make up the functional ability scale assess how CTS affects activities of daily living. The overall score is computed by dividing the total number of questions by the sum of the individual scores. More excellent scores correspond to worse functional status or symptoms.

2.2.Diagnostic protocol for CTS included:

The British Society took the clinical history for Surgery of the Hand's advice. The physical examination included the following CTS-specific examinations and a bare-hand examination: The Abductor Pollicis Brevis muscular power test, the Phalen test, the Tinel sign, and the detection of thenar muscle atrophy. Patients were electrophysiologically evaluated at the Al-Azhar University Hospital's Electro Neuro Myo Graphy (ENMG) Laboratory, and the severity of CTS was classified using the Padua scale.

2.3.Evaluation for Subclinical Hypothyroidism:

All the patients were referred to the lab of AL-Azhar University Hospitals to determine the serum thyrotropin (TSH) and free thyroxin levels in each patient. Patients with normal levels of free T4 (0.9-1.8 ng/dl) and TSH values beyond the upper limit of the normal range (0.20-4.40 mU/L) were considered to have subclinical hypothyroidism.

2.4.Statistical analysis

GraphPad Prism V8.0, Microsoft Excel 365, and IBM SPSS Statistics for Windows, Version 27, were used to analyze the data. When presenting quantitative data, the values can be expressed as Mean ± SD or as the Median (minimum-maximum and interquartile range). The Spearman correlation test was employed to investigate the relationship between TSH and the Boston score, FSS, and Padua's Scale in CTS patients. All statistical tests are deemed insignificant if the p-value exceeds 0.05. A significant p-value is less than 0.05. Highly significant is defined as a p-value < 0.001.

3. Results

Table 1. Demographic data and history details.

	CASE GROUP (N=30)	CONTROL GROUP (N=30)	STATISTICAL ANALYSIS
GENDER N (%)			
FEMALE	25 (83.3%)	25 (83.3%)	
MALE	5 (16.7%)	5 (16.7%)	
AGE (YEARS)			Mann-Whitney Test
MEAN ± SD	38.97 ± 8.1	41.23 ± 10.91	MW-U= 373.5 P-value = 0.257 ^{NS}
BMI			t-test
MEAN ± SD	24.3 ± 2.39	25.43 ± 3.62	t-value = 1.43 P-value = 0.156 ^{NS}

WORK N (%)		
HOUSEWIFE	21 (70 %)	25 (83.3 %)
STUDENT	4 (13.3 %)	1(3.3%)
TEACHER	1(3.3%)	1(3.3%)
ACCOUNTANT	1(3.3%)	1(3.3%)
ENGINEER	1(3.3%)	2 (6.7%)
MANAGER	1(3.3%)	
SELLER	1(3.3%)	

Data expressed as (mean ± SD) P-value > 0.05 is considered not significant (NS); P-value <0.05: Significant (S); P-value< 0.01 is highly significant (HS).

There wasn't no statistically significant distinction observed between the control and case groups in terms of Age (p = 0.257) and BMI (p = 0.156)

Table 2. The mean TSH and T4 in control and CTS groups.

	CASE GROUP (N=30)	CONTROL GROUP (N=30)	STATISTICAL ANALYSIS
TSH			t independent test
MEAN ± SD	3.79 ± 2.45	2.04 ± 1.1	t-value = 3.57 P-value = 0.001
FT4			Mann-Whitney Test
MEAN ± SD	1.42 ± 0.82	1.29 ± 0.21	MW-U= 346 P-value = 0.122 ^{ns}

There was a statistically significant difference between control and case groups with regards to TSH (p = 0.001), but FT4 didn't statistically deferent between both groups (P = 0.122).

Table 3. Prevalence of subclinical hypothyroid and euthyroid in control and CTS groups

	CASE GROUP (N=30)	CONTROL GROUP (N=30)
SUBCLINICAL HYPOTHYROID	(N = 9) Prevalence = 30%	(N = 2) Prevalence = 6.7%
EUTHYROID	(N = 21) Prevalence = 70%	(N = 28) Prevalence = 93.3%
CHI-SQUARE TEST	P-value = 0.019	X^2 = 5.45

There was a significant difference between control and case group with regard to Subclinical hypothyroid and Euthyroid (X2= 5.45, p-value = 0.019).

Table 4. The mean TSH, T4 levels, Boston Scoring symptoms (BSS), and Boston Scoring function (BSF) in Different Padua's Electrophysiologic Grades of CTS.

PADUA'S SCALE GRADING OF CTS	TSH	FT4	BSS	BSF
MINIMAL 4 (13.3%)	1.49 ± 0.25	1.04 ± 0.09	1.0 ± 0.0	1.5 ± 0.58
MILD 19 (63.3%)	4.44 ± 2.49	1.51 ± 0.93	2.55 ± 0.85	2.42 ± 0.51
MODERATE 6 (20%)	3.22 ± 2.48	1.14 ± 0.12	2.92 ± 0.34	3.17 ± 0.75
SEVERE 1 (.3%)	3.9 ± 0	3 ± 0	2.7 ± 0	2 ± 0
KRUSKAL-WALLIS TEST	P-value = 0.007	P-value = 0.085 n.s.	P-value = 0.005	P-value = 0.009

There were a statistically significant difference between different grads of CTS with regards to TSH (p = 0.007), BSS (p= 0.005) and BSF (P= 01.009) but FT4 didn't statistically deferent between different grads (P = 0.085).

Table 5. Spearman's rho Correlations between TSH and BSS, FSS, and pauda's scale.

		FT4	BSS	FSS	PAUDA'S SCALE
TSH	Correlation Coefficient	-0.037	.588**	0.178	0.202
	Sig. (2-tailed)	0.846	0.001	0.347	0.284
FT4	Correlation Coefficient		0.074	0.138	0.250
	Sig. (2-tailed)		0.699	0.468	0.182
BSS	Correlation Coefficient			0.627**	0.617**
	Sig. (2-tailed)			< 0.001	< 0.001
BSF	Correlation Coefficient				0.527**
	Sig. (2-tailed)				0.003

**. Correlation is significant at the 0.01 level (2-tailed).

A strong positive link (correlation coefficient = 0.575, p < 0.001) was seen between TSH readings and the score of the Boston questionnaire. However, there was no observed link between the TSH value and FSS (p = 0.347), as well as between TSH and the grading of TSH and Padua's Scale (P = 0.284).

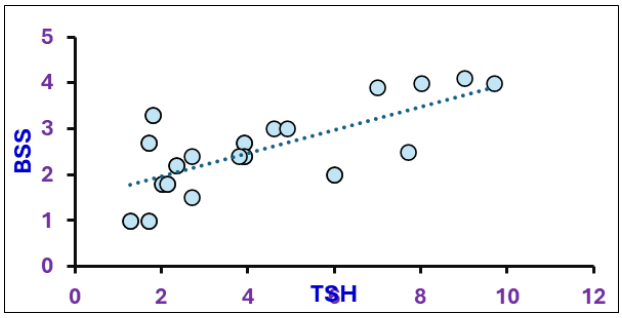

Figure 1. The Boston Symptoms score exhibits variations corresponding to the TSH levels in people with CTS

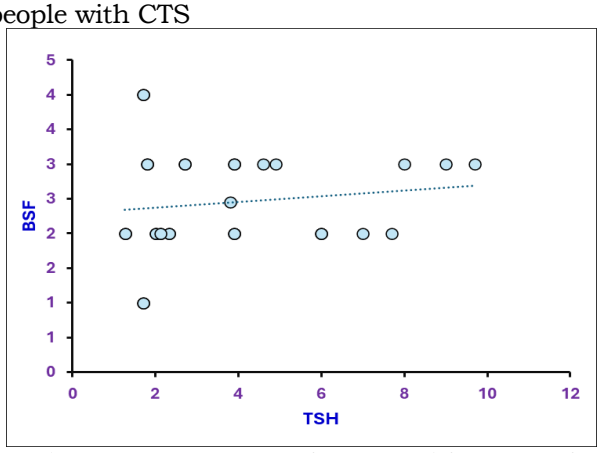

Figure 2. FSS score changes with TSH values in CTS patients.

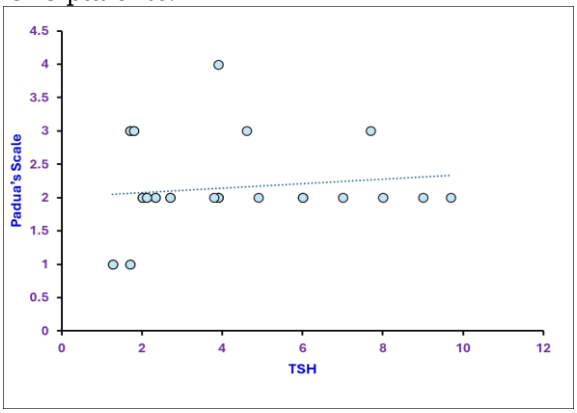

Figure 3. Padua's Scale changes with TSH values in CTS patients

4. Discussion

Hypothyroidism is a significant contributor to carpal tunnel syndrome (CTS), a condition that can be successfully managed if detected promptly. The excessive accumulation of glycosaminoglycans, hyaluronic acid, and certain mucopolysaccharides in the subcutaneous tissues causes dermal edema in myxedema. The process of deposition of the pseudo mucinous substances over the median nerve sheath within the carpal tunnel causes nerve compression, resulting in carpal tunnel syndrome (CTS).[5]

Our investigation found a potential link between subclinical hypothyroidism and carpal tunnel syndrome in persons who do not have any known risk factors.

In order to accomplish the objective of this study, all the patients included underwent a diagnostic protocol for carpal tunnel syndrome (CTS), which involved a clinical history assessment, physical examination of the hand, and the administration of CTS-specific tests. The Tinel sign, Phalen test, Abductor Pollicis Brevis muscular power test, and assessment of thenar muscle atrophy are performed. The patients underwent electrophysiological assessment at the ENMG Lab of the Al-Azhar University hospitals to evaluate Subclinical Hypothyroidism. This involved measuring blood thyrotropin (TSH) and free thyroxin levels. Patients with TSH levels exceeding the upper limit of the normal range (0.20-4.40 mU/L) and typical amounts of free T4 (0.9-1.8 ng/dl) were classified as having subclinical hypothyroidism.

The current investigation found no statistically significant distinction between the control and case groups in terms of Age (p= 0.257) and BMI (p < 0.156).

In a prior study with Takata et al., in 5 of 36 patients, thirty-one were females (86.1%), and Five were males (13.9%). The age range of the participants was between 20 and 67 years. Out of the total number of patients, 12 (33.3%) had an average Body Mass Index (BMI), 15 (41.7%) were classified as overweight, and 9 (25%) were classified as obese. The p-value for this data is 0.531.

Another study Sonoo et al.,[6], Proposed distinct underlying pathogenic mechanisms in young and elderly individuals with carpal tunnel syndrome (CTS). This study examined the distinct risk factors for carpal tunnel syndrome (CTS) in elderly and young populations. The results showed a strong correlation between increased body mass index (BMI) of over 30 and CTS.

Furthermore, Guan et al.,[7] show that individuals with a BMI of more than 29 have a risk for carpal tunnel syndrome that is 2.5 times higher than that of slender individuals with a BMI less than 20.

The current investigation found a statistically significant difference between the control and case groups in terms of subclinical hypothyroidism and euthyroidism (p-value = 0.019).

Wang et al.,[8] The high occurrence of carpal tunnel syndrome (CTS) in individuals with hypothyroidism, along with the fundamental processes that explain how hypothyroidism can lead to CTS, suggests that CTS can serve as an indicator of undetected hypothyroidism.

Brito et al.,[9] found that a strong association between hypothyroidism and surgery treatment CTS was more robust compared to the correlation between hypothyroidism and CTS. Concurrent hypothyroidism can hinder the effectiveness of conventional therapy for carpal tunnel syndrome

(CTS) and necessitate surgical intervention.

The current study found a robust positive link (correlation coefficient = 0.588, p < 0.001) between TSH readings and the grading of symptoms on the Boston questionnaire (BSS).

Bushu and Shivali,[10] found that patients with elevated TSH levels did not necessarily exhibit more severe abnormalities in EMG and NCV measures. As the TSH level increases, so does the Boston questionnaire score. While an elevated level of TSH may not directly worsen the electrodiagnostic findings in patients, it does have a negative impact on their clinical symptoms. Therefore, reducing TSH through medical intervention may improve the symptoms and functional status of patients with CTS.

Alotaibi et al.,[11] Found that there is substantial evidence supporting a connection between hypothyroidism and carpal tunnel syndrome (CTS). While two studies have indicated that one-third of hypothyroid individuals have been diagnosed with carpal tunnel syndrome (CTS) through electrophysiological methods, a 2014 meta-analysis revealed only a moderate link among hypothyroidism and CTS in investigations that accounted for possible influencing factors (odds ratio [OR] 1.44, 95% confidence interval [CI] 1.27-1.63). Additionally, there was a direct and strong correlation between the Boston questionnaire score and thyroid-stimulating hormone (TSH) levels.

The current investigation did not find any link between the TSH value and the Boston questionnaire Scoring Function (BSF) (p = 0.347), as well as between TSH and the severity grading of CTS according to Padua's scale (P = 0.284). The value of P is 0.284.

Salim,[12] found a correlation between hypothyroidism and the Pauda's scale in CTS. There is no correlation between hypothyroidism and the panda's scale in CTS patients, as indicated by the p-value (0.773), which is more than the threshold of 0.05. Among the patients, four showed a disease duration of a year or fewer or one to five years, while three patients with a period of more than five years exhibited hypothyroidism.

Singla et al.,[13] The average score on Padua's scale was 5. The right hand exhibited a more significant impact in 12 individuals, while the left was more affected in eight patients. Additionally, both hands suffered equally in five people.

Bushu and Shivali,[10] Four patients with the most elevated Pauda's scale scores, who also experienced complaints of hand clumsiness and weakness, did not observe any improvement in their symptoms. All patients reported short-lived pain at the injection sites as the primary adverse effect of the medication.

4. Conclusion

There is a strong correlation between Subclinical hypothyroidism and patients with Carpal Tunnel Syndrome (CTS) who do not have any identifiable risk factors. We propose doing screenings for subclinical hypothyroidism in these patients due to the observed strong positive connection between TSH levels and the severity of their symptoms. This test can aid in the improved management of patients with both hypothyroidism and carpal tunnel syndrome (CTS).

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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