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A Study of the Prevalence of Carpal Tunnel Syndrome in Female Hypothyroid Patients Visiting Motahari Endocrinology and Metabolism Clinic in Shiraz in 2013

Hoda Taghavian¹, Sharareh Roshanzamir^{2*}¹ Student Research Committee, International branch, Shiraz University of medical sciences, Shiraz, Iran² Shiraz University Of Medical Sciences, Shiraz, Iran*correspondence should be addressed to ShararehRoshanzamir, Shiraz University Of Medical Sciences, Shiraz, Iran; Tell: +989177111359; Fax: +98714333275; Email: sharareh.roshanzamir@gmail.com.

ABSTRACT

hypothyroidism is mainly considered as a risk factor for Carpal Tunnel Syndrome (CTS). The aim of this study was determining the prevalence of CTS in female hypothyroid patients visiting Motahari Endocrinology and Metabolism Clinic. Method: 300 female patients with hypothyroidism were studied. Boston Carpal Tunnel Syndrome Questionnaire (symptom, functional) was filled out for the patients. In the next step, 3 signs namely Phalen's test, tinel's test and compression test were explored. Finally, electro diagnostic testing was performed on the patients and, based on the results of the electro diagnostic testing, the patients were divided into four groups: normal, patients with severe CTS, patients with moderate CTS and patients with mild CTS. Patients with a history of hand trauma or hand or foot surgery, patients with diabetes, rheumatoid arthritis, neuropathy, and/or radiculopathy were all excluded from the study. The results were analyzed using SPSS 16 software. out of the 300 patients with hypothyroidism who underwent electromyography- nerve conduction velocity (EMG-NCV) testing, 160 patients had mild CTS and 20 patients had moderate CTS. 120 patients had normal EMG-NCV test results and Phlen's, Tinel's and compression tests of a significant percentage of these patients were found to be positive. the results of the study indicated that a significant percentage of the hypotheroid patients had Carpal Tunnel Syndrome (CTS).

Key words: Hypothyroidism, Carpal Tunnel Syndrome, Thyroid dysfunction, Nerve pressure

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1. INTRODUCTION

Carpal Tunnel Syndrome (CTS) is a painful and disabling medical condition which is caused by the increase of pressure in the carpal tunnel and occurs due to the damage to the nerve that passes through the canal (median nerve). If due to any reason, including excessive use of the wrist, the pressure of the canal in the wrists area is increased, blood supply to the nerve is reduced due to blood vessel stenosis and a series of signs and symptoms are created that characterize CTS (1). The most common local neuropathy of peripheral nerves in the body is the entrapment of the median nerve in the wrist that is called CTS and the prevalence of this syndrome is reported to be up to 6.8 percent (2). There is a tunnel in the wrist called carpal tunnel. There are carpi on one side of this tunnel. Due to some reasons, sometimes the internal

space of this canal is constricted. For example, a tumor or a cyst inside the canal can constrict it. In another example, malunion of a distal radius fracture can result in the deformity of the bone and constrict the canal. However, in most cases, the cause of the constriction is the flexor tendinitis and tenosynovitis. The tendons can be inflamed due to continuous and repetitive movements of the wrist or the fingers. Sometimes, tendinitis and tenosynovitis are due to hormonal changes that appear in the patients during pregnancy or menopause (1). Also, factors such as fractures, dislocations, tumors, some diseases (for example, diabetes, thyroid disorders) and doing repetitive activities in wrist area are among things that result in the entrapment of the median never in a specific part of the wrist and result in the carpal tunnel syndrome. The manifestations of this syndrome are paresthesia, tingling and pain in the median nerve area in the hands. Sympathetic nervous

system involvement in CTS that includes increase or reduction of perspiration is commonly reported. Caccia et al (1993) reported the reduction of the wave level of sympathetic skin response (SSR) in individuals with CTS (3). But the change of their result, considering the reduction of the wave level of the healthy side simultaneously with the afflicted side, makes the interpretation of these findings difficult. Electrophysiological tests are very useful in the diagnosis of CTS in a way that the sensitivity of these tests have been reported to be between 49 to 84 percent and their specificity has been reported to be over 95 percent (4). Hypothyroidism means that the thyroid gland does not secrete enough thyroid. Women, especially those aged over 60 years old, are more at the risk of hypothyroidism. Over time, hypothyroidism can result in other diseases such as obesity, joint pain, infertility and/or heart diseases (5). Hypothyroidism is one of the common endocrine diseases that can impact both the central and peripheral nervous system. This results in peripheral mononeuropathy, polyneuropathy or compression neuropathy (6). Occurrence of CTS in hypothyroid patients in different societies has been reported extensively. The prevalence of CTS in hypothyroid patients has been reported from less than 7% to over 92% (7). According to multiples studies many patients with CTS believe that tingling, paresthesia and numbness occur due to hyperlipidemia or anemia and thus they do not consult with a doctor. As CTS is a treatable disease, early diagnosis and treatment of it is necessary. Whether it is wise for all hypothyroid patients to be referred to musculoskeletal specialist for diagnosis and treatment of CTS depends on the prevalence of this condition in hypothyroid patients in the society. Therefore, the present study is designed with the aim of determining the presence of CTS in female hypothyroid patients visiting Motahari Endocrinology and Metabolism Clinic in Shiraz.

2. MATERIALS AND METHODS

2.1. Study Procedure

300 female patients with hypothyroidism with the mean age of 38±1.8 years that had been diagnosed by endocrinologist were included in the study after being

explained about the present study and after gaining written consent from them. In this cross-sectional study all those that had hypothyroidism (regardless of the time they had hypothyroidism, the way of treatment and the level of control of the disease) were explored. The related information was registered in an information form. Boston Carpal Tunnel Syndrome Questionnaire (symptom, functional) was filled out for the patients and each patient received a symptom score and a functional score. In the next step, the patients were subjected to blind examine by a physiatrist and three signs i.e. Phalen, tincl and compression were studied. Finally, the patients were subjected to electrodiagnosis by a physical therapist that was unaware of patients' internal condition (hypothyroidism), their Boston score and examinations. Then the patients were divided into 4 groups i.e. normal, patients with mild CTS, patients with moderate CTS and patients with severe CTS, using the results of the electrodiagnosis.

2.2. Inclusion criteria

All patients with hypothyroidism visiting Motahari Endocrinology and Metabolism Clinic in Shiraz were included in this study.

2.3. Exclusion criteria

Patients that had history of hand trauma or hand surgery or the patients that had underlying diseases such as diabetes, rheumatoid arthritis, neuropathy and radiculopathy were excluded from the study.

2.4. Statistical methods

The prevalence of CTS and 95% confidence limit, frequency test were estimated for hypothyroid patients.

3. RESULTS AND DISCUSSION

3.1. Electrodiagnostic particulars

Considering Table 1, out of 300 patents with hypothyroidism, 160 individuals (53.3%) had mild CTS at least in one hand, 20 individuals had moderate CTS and 120 individuals had normal EMG-NCV test results. The highest percentage belonged to the mild group. Severe CTS was not seen in any of the studied individuals.

Table 1. The frequency of patients with CTS in at least one hand, based on the severity determined by EMG-NCV testing

CTS	Frequency	Frequency percentage	Cumulative frequency
mild	160	53.3	53.3
moderate	20	6.7	60.0
normal	120	40.0	100.0
Total	300	100.0	

3.2. Determining Boston symptoms

The group with mild CTS had the Boston symptom

questionnaire mean score of 3.5 and standard deviation of 0.9 on average for the two hands. The moderate group had the mean score of 3.5 and standard deviation of 1.1 on average for the two hands. And the group with normal

EMG-NCV test results had Boston symptom questionnaire mean score of 2 and standard deviation of 0.8 on average for the two hands. The results are given in [Figure 1](#).

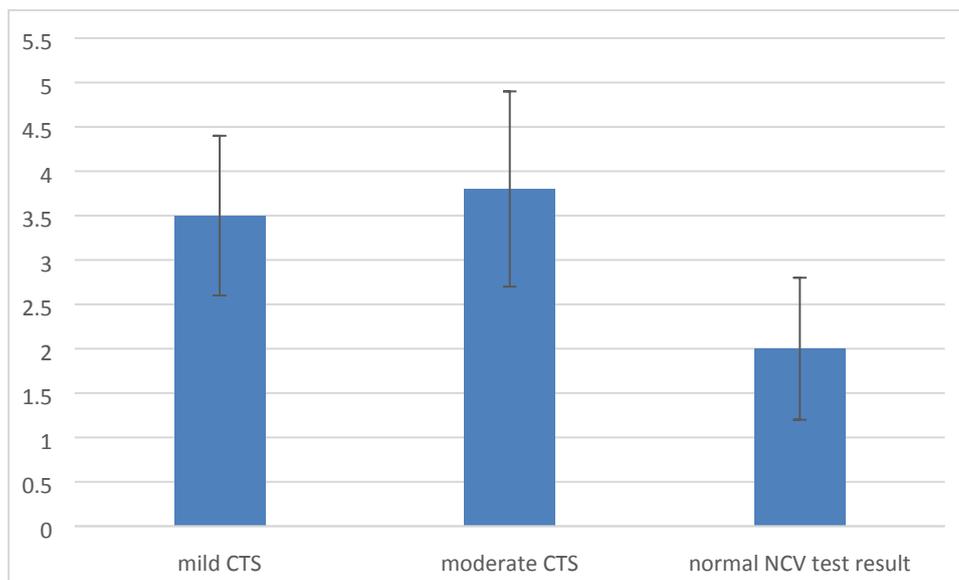


Figure 1. score chart for Boston symptoms

3.3. The score of Boston functional questionnaire

The group with mild CTS had the Boston functional questionnaire mean score of 3.7 and standard deviation of 1 on average for the two hands. The moderate group had the mean score of 3.9 and standard deviation of 1.4 on

average for the two hands. And the group with normal EMG-NCV test results had Boston functional questionnaire mean score of 1.9 and standard deviation of 0.9 on average for the two hands. The results are given in [Figure 2](#).

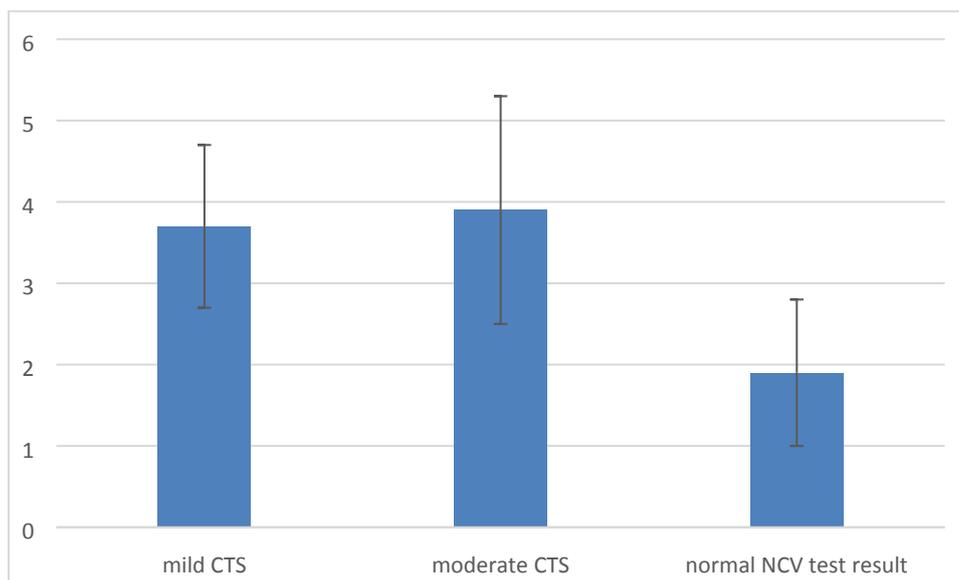


Figure 2. Score chart of Boston functional questionnaire

3.4. Tinel's test

In physical examination, 150 patients (93.75%) of the 160 patients with mild CTS visiting the clinic had positive tinel's test result in at least one hand and all of the 20 individuals with moderate CTS had positive tinel's test result in at least one hand. And 70 (58.3%) of the 120 individuals with normal EMG-NCV test results had positive tinel's test result in at least one hand.

In physical examination, 155 patients (96.87%) of the 160 patients with mild CTS visiting the clinic had positive Phalen's test result in at least one hand, based on the electrodiagnostic test. All of the 20 individuals with moderate CTS had positive Phalen's test result in at least one hand. 89 of the 120 individuals with normal EMG-NCV test results had positive Phalen's test result in at least one hand.

3.5. Phalen's test

3.6. Compression test

In physical examination, 160 patients (93.6%) of the 160

patients with mild CTS visiting the clinic had positive compression test result in at least one hand, based on the electrodiagnostic test. All of the 20 individuals (100%) with moderate CTS had compression test result in at least one hand. And 80(66.6%) of the 120 individuals with normal EMG-NCV test results had positive compression result in at least one hand.

Thyroid disease may lead to the emergence of signs and symptoms of neuromuscular disorder. Hypothyroidism may be accompanied by proximal muscle weakness, sensory-motor polyneuropathy and mononeuropathy. A study was conducted by Eslamian et al (2011) with the aim of exploring electrophysiological findings in patients with untreated hypothyroidism and with the aim of a comparison with the control group (8). In this cross-sectional case-control study, 40 patients who were diagnosed with definite clinical hypothyroidism and 40 healthy individuals were studied using electromyography and nerve conduction studies in the specialized clinic of Tabriz University of Medical Sciences for 18 month. Seven men and 33 women with the mean age of 39.5 ± 11.8 were included in the study. Clinical muscle weakness with the severity of about 4.5 was seen in 12 cases (30%). 18 cases (45%) had the lack or reduction of deep tendon reflex; 6 cases (15%) had neuropathy including 4 cases of sensory and 2 cases of sensory-motor of which 5 were mild and 1 was moderate and also 3 cases (7.5%) of myopathy and 13 cases (32.5%) of CTS were seen of which 7 patients had mild and 10 patients has moderate and severe disease in both hands. The number of the patients with neuropathy was significantly more than that of individuals without neuropathy ($P=0.001$). There was a significant relationship of age, sex, duration of the disease, TSH level and muscle weakness with emergence of neuropathy and/or myopathy. Femaleness, increase of age, duration of the disease and frequency of clinical weakness had a direct relationship with the incidence of CTS ($P<0.05$). Thus, patients with untreated primary hypothyroidism were the majority of the patients with CTS. Early treatment of hypothyroidism can prevent the progress of these disorders and minimize their occurrence (8). In the present study, overall 300 individuals with the mean age of 38 ± 1.8 were explored. All of them had hypothyroidism and were under treatment. But as the treatment duration depended on patients' memory and all of the patients remembered the treatment period approximately, exact information in this regard could not be obtained. Also, the disease control level was dependent on tests that would increase the study's cost and it was not practical. Thus, no exact information was obtained in this regard either. All the patients in the study were subjected to electrodiagnostic test and considering their EMG-NCV test results, 160 of them had mild CTS, 20 had moderate CTS and 120 of them had normal EMG-NCV test results. And of these, 70 individuals had positive tincl's test, 89 individuals had

positive Phalen's test and 80 individuals had positive compression test. The superiority of the present study with the aforementioned study was in that this study performed different tests on hypothyroid patients that had normal EMG-NCV test results and it was observed that even the patients that had normal EMG-NCV test results were at risk of CTS. The study by Eslamian had considered only EMG-NCV test as the criterion for CTS diagnosis. Diagnosis and treatment in patients with hypothyroidism that have the symptoms of CTS have remained as complicated problems. This population of the patients is less likely to clearly have the CTS symptoms. Carl et al (2000) conducted a study on 26 hypothyroid patients (45 hands) and 24 healthy individuals (47 hands) with the aim of exploring the relationship between hypothyroidism and CTS. The time of the beginning of hypothyroidism, treatment duration, thyroid hormone replacement dose and existence, characteristics and duration of the CTS symptoms were explored. Also, Phalen's, tincl's and compression tests were performed on the patients in the clinical examination. Then all of the patients and the control group were subjected to electrodiagnostic study. The results of this study indicated that 19 patients with hypothyroidism showed the symptoms of CTS and 16 of these patients had clinical examination corresponding to CTS in 6 of which CTS was verified using electrodiagnostic test. All the patients with symptoms were hypothyroid while the control group had normal electrodiagnostic test results. The results of that study are consistent with the results of the present study. It is interesting that in the present study, out of the 120 individuals that has normal electrodiagnostic test results, 70 individuals had positive tincl's test result, 89 had positive Phalen's test results and 80 individuals had positive compression test result. Of course, in the aforementioned study it is suggested that the clinical examination of individuals with CTS symptoms that had normal electrodiagnostic test results is unexpectedly in favor of the existence of CTS and, even on this basis, it has been recommended to change standard electrodiagnostic indices for diagnosis of CTS in hypothyroid patients. Karpiteskaia et al (2000) conducted a case-control study on 514 patients that had undergone surgery for CTS and 100 individuals as a control group. The aim of this study was exploring the prevalence of risk factors such as obesity, hypothyroidism, diabetes and smoking in individuals with CTS. The results of this study verified the previous studies that indicated that CTS is multifactorial and that obesity, hypothyroidism and diabetes are more prevalent in these patients. However, based on the results of this study, it did not seem that smoking was more common in individuals with CTS. This study too, confirmed the result of the present study that CTS is more prevalent in patients with hypothyroidism. The difference between that study and the present study was that the present study was cross-sectional and did not have control group. In addition, other impacting factors in CTS such as diabetes, obesity and

smoking were also explored in that study while the focus of the present study was on the electrodiagnostic particulars and physical examinations of CTS. It is suggested that many of the patients with CTS are related to thyroid disease and other metabolic diseases. In a study that was conducted by Suresh et al (2004), 206 individuals with the clinical characteristics of CTS, including individuals with a recognized underlying cause with diagnosis of CTS, were explored for thyroid dysfunction (9). The syndrome was verified in 136 of the aforementioned patients using EMG-NCV test but hypothyroidism was diagnosed only in 2 of them (1.5%) and hyperthyroidism was seen in none of them. Therefore, screening the patients with CTS for separating the thyroid dysfunction cases does not seem valuable (6). According to the results of the present study it seems that screening hypothyroid patients for CTS is useful for early diagnosis of this condition. In the study conducted by Cruz et al. (1996) some changes were reported in EMG-NCV testing. The aforementioned study was conducted with the aim of exploring the frequency of disorders in EMG-NCV test in hypothyroidism and their relationships with sensory symptoms and the levels of enzymes in muscles. And a comparison was made between the control group and the patients in terms of the delay time, range and velocity of nerve conduction in the selected nerves. Sixteen patients with primary hypothyroidism were sent for EMG-NCV test before the treatment. The disorders determined by EMG-NCV test were observed in 7.5% of the patients. There was 46.6% of myopathy and 43.7 percent of CTS and no case of polyneuropathy was observed. Clear relationship between EMG-NCV test and clinical thyroid tests in patients with myopathy and CTS was observed. In comparison with the control group, the patients significantly showed slow nerve conduction velocity. These findings are due to the recognized neuromuscular damages in hypothyroidism and these results are consistent with the results of the present study (10). In this study, 180 hypothyroid patients showed mild and moderate CTS in EMG-NCV test results. 70 to 89 patients that had normal EMG-NCV test results showed positive Phalen's test and compression test results. In fact, a positive relationship existed between hypothyroidism and CTS and hypothyroidism was one of the predisposing factors for CTS. Other factors such as age, sex, body mass index, etc. that can impact electrodiagnosis are not considered in many studies. In a study that considered these confounding factors hypothyroid was found to be a factor impacting the peripheral nerve function. Confounding factors such as diabetes, rheumatoid arthritis, neuropathy and radiculopathy that impact the NCV test were eliminated in this study and all of the patients had hypothyroidism and according to the previous studies this disease is one of the factors causing CTS. Roa et al. (1980) studied neuromuscular disorders in 20 randomly-selected patients with hypothyroidism using clinical and electrophysiological methods. 4 cases of muscle weakness,

11 cases of tingling in muscles, 3 cases of CTS, 6 cases of subclinical CST and 2 cases of neuropathy were observed in the clinical examination. Electromyogram was abnormal for 14 patients (10). Nerve conduction disorders were observed in 13 patients and they had impacted median nerve more (10 cases), compared with the peroneal nerve (1 case). In this study, 300 individuals with hypothyroidism underwent electrodiagnosis for determining the prevalence of CTS. Out of these individuals, 160 individuals had mild CTS in at least one hand and 20 had moderate CTS in at least one hand. The difference between the present study and the study by Roa et al. was in that the number of cases was higher in the present study (300 compared with 20). However, the present study only explored CTS while the Roa et al. explored other neuromuscular disorders too. Finally, 60 percent of hypothyroid patients in this study had mild or moderate CTS in at least one of their hands while in the study by Roa et al. 15% of the individuals had clinical CTS and 30% had subclinical CTS and probably this difference is due to the lower population in that study.

4. CONCLUSION

The results of the present study indicated that the prevalence of clinical and paraclinical symptoms of CTS is relatively high in hypothyroid patients. An important point in the study was that most of the hypothyroid patients with normal EMG-NCV test results had disorder based on Phalen's, tinnel's and compression tests. Therefore it can be pointed out that EMG-NCV testing is not the definite and enough tool for diagnosis of CTS. Considering the high importance of early CTS diagnosis in hypothyroid patients for preventing its reversible effects and high prevalence of CTS in this study, early screening of the hypothyroid patients for diagnosis of CTS is highly valuable. Future studies should be designed for finding better and more sensitive standards for diagnosing CTS in hypothyroid patients.

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AUTHORS CONTRIBUTION

This work was carried out in collaboration among all authors.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interests with respect to the authorship and/or publication of this article.

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