ORIGINAL ARTICLE

Distribution of Clinical Symptoms in Carpal Tunnel Syndrome

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Abstract

Objective: To determine the distribution of clinical symptoms based on the gender and age of patients with Carpel Tunnel Syndrome (CTS).

Study Design: A cross-sectional observational study.

Place and Duration of Study: Department of Physiology, College of Medicine, King Saud University, Riyadh, Saudi Arabia, from April 2009 to June 2011.

Methodology: Two hundred and twenty seven subjects with carpal tunnel syndrome symptom were recruited. CTS was diagnosed based on the clinical history and examination. For further confirmation of CTS symptoms, nerve conduction studies (NCS) were conducted.

Results: There were 67 (29.5%) males and 160 (70.5%) females with mean age of 47.79 ± 5.53 years. Distributions of symptoms were 34.3% at the level of whole three lateral fingers, 14.9% were at the level of hand and forearm, was common in males compared to females. However, 48.8% symptoms at the level of whole hand, and 11.3% at the tips of the three lateral fingers were common in females compared to males. Distribution of symptoms in the whole three lateral fingers (41.6%) were significantly higher (p = 0.0001) in patients who were more than 50 years of age and symptoms at the level of wrist region (12.7%) were significantly higher (p = 0.001) in patients with age group less than 50 years.

Conclusion: The distribution of CTS symptoms at the level of whole of three lateral fingers, hand and forearm were higher in males compared to females, and symptoms at the lateral three tips of the fingers and whole hand were common in females compared to males. Furthermore, the symptoms in whole three lateral fingers were higher in patients with more than 50 years of age and at the level of wrist region were higher in patients with age less than 50 years.

Key Words: *Clinical symptoms. Carpal tunnel syndrome. Nerve conduction studies.*

INTRODUCTION

The Carpal Tunnel Syndrome (CTS) is the most common upper limb neuropathy caused by an entrapment of the median nerve at the level of the carpal tunnel.[1] The condition decreases the tunnel's size or swells the structures contained within it compresses the median nerve, such circumstances can happen congenitally, traumatically or due to systemic or inflammatory effects. The well established causes of CTS include diabetes mellitus, rheumatoid arthritis, acromegaly, hypothyroidism, pregnancy and tenosynovitis.[2,3] Moreover, CTS is also common in working-aged people caused by physical occupational activities such as repeated and forceful movements of the hand and wrist or use of hand-held powered vibratory tools.[4-6] The clinical symptoms reported are gradual onset of numbness, tingling in the median nerve distribution of the hand.[4] Pain may disturb the night sleep and patients often hang the affected hand over the side of the bed to gain relief. Moreover, patients also complain of progressive weakness and clumsiness in their affected hand. In CTS, the compression of the nerve results in damage to the myelin sheath and manifests as delayed latencies and slowed conduction velocities.

In different countries, the health care institutions differ from each other in terms of their practice and protocols. Hence, in different health care sectors, the diagnosis of CTS is based on different methods including patient's history, findings of a physical examination and electro-diagnostic testing.[7] However, in CTS, the severity of sign and symptoms and methods of diagnosis does not often correlate well with the extent of nerve damage and distribution of clinical symptoms.

Therefore, the present study was conducted to determine the distribution of clinical symptoms in Saudi patients with CTS and the symptoms were further confirmed and correlated with NCS studies.

METHODOLOGY

This descriptive cross sectional study was conducted in the Department of Physiology (Clinical Physiology Unit), College of Medicine, King Saud University, Riyadh, Kingdom of Saudi Arabia during the period April, 2009 - June 2011.

Non-diabetic adult Saudi patients, with clinical suspicion of having CTS were selected from the primary care department, King Abdul Aziz University Hospital, King Saud University, Riyadh, Saudi Arabia. After obtaining a written consent, apart from the clinical notes received

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Received: June 28, 2012; Accepted: September 28, 2013.

from the primary care department, again detailed clinical history and clinical examination was conducted. The carpal tunnel syndrome was diagnosed based on the clinical history. For the confirmation of carpal tunnel syndrome findings, these patients were referred to the Clinical Physiology Unit for Nerve Conduction Studies (NCS).

Patients who suffered from diabetes mellitus, renal disease, liver disease and patients on anti-tuberculosis medications were excluded from the study. Moreover, the subjects with normal median nerve NCS study were also excluded from the study.

For median nerve study, silver surface electrodes were used, the recording electrodes were placed over the belly of abductor pollicis brevis muscle and the reference electrodes were placed over the first metacarpo-phalangeal joint. The stimulation site for wrist was middle of the wrist between the tendons of flexor carpi radialis and palmaris longus muscles and for antecubital fossa medial to the Biceps brachii muscle tendon with distal distance of 8 cm and the ground electrodes were placed on the back of the hand. For median sensory study, the recording electrodes were placed over the metacarpal-phalangeal joint of the index finger and the reference electrodes were placed 3 – 4 cm distally. The stimulation site for wrist was middle of the wrist between the tendons of flexor carpi radialis and palmaris longus muscles with distal distance of 14 cm. The ground electrodes were placed on the back of the hand. However, for ulnar motor study, the recording electrodes were placed over the abductor digiti minimi muscle and the reference electrodes were over the fifth metacarpal-phalangeal joint. The stimulation site for wrist was medial wrist adjacent to the flexor carpi ulnaris tendon and below the elbow 3 – 4 cm distal to the medial epicondyle with distal distance of 8 cm and ground electrode was placed on the back of the hand. For ulnar sensory study, the recording electrodes were placed over the metacarpo-phalangeal joint of the little finger, the reference electrodes were placed 3 – 4 cm distally and the stimulation site was medial wrist with distal distance of 14 cm. The ground electrodes were placed on the back of the hand.[8] The whole procedure was conducted on EMG Machine.[8]

The data was gathered and analysis was performed by using SPSS version 17.0. Frequencies and percentages were calculated for qualitative variables, mean ± SD were calculated for quantitative variables. Statistical analysis was conducted using chi-square test and Fisher's exact test to measure the association between clinical symptoms, age and gender. A level of statistical significance was established at a value of $p < 0.05$.

RESULTS

There were 160 females and 67 males with mean age of 47.79 ± 5.53 years. Table I shows the distribution of carpal tunnel syndrome symptoms according to gender of the patients. The distribution of symptoms was such that 23 (34.3%) males and 41 (25.6%) females had whole of three lateral fingers involved. Lateral three tips of the finger were involved in 4 (6.0%) males and 18 (11.3%) females. Whole hand was involved in 25 (37.3%) males and 78 (48.8%) females; Wrist region in 5 (7.5%) males and 12 (7.5%) females and the hand and forearm was involved in 10 (14.9%) males and 11 (6.9%) females. The distribution of carpal tunnel syndrome symptoms shows insignificant association with gender of the patients.

Table I: Distribution of carpal tunnel syndrome symptoms according to gender of the patients.

Distribution of symptoms according to gender	Male (n = 67)	Female (n = 160)	p-value
Whole of three lateral fingers	23 (34.3%)	41 (25.6%)	0.18
Tips of fingers (lateral three)	4 (6.0%)	18 (11.3%)	0.32
Whole hand	25 (37.3%)	78 (48.8%)	0.11
Wrist region	5 (7.5%)	12 (7.5%)	0.99
Hand and forearm	10 (14.9%)	11 (6.9%)	0.06

$p < 0.05$ considered significant.

Table II: Distribution of carpal tunnel syndrome symptoms according to age of the patients.

Distribution of symptoms according to age of patient	Age of the patients		patients and percentage (Total 227)	p-value
	Less than 50 years (n = 126)	More than 50 years (n = 101)		
Whole of three lateral fingers	22 (17.5%)	42 (41.6%)	64 (28.2%)	0.0001
Tips of fingers (lateral three)	13 (10.3%)	9 (8.9%)	22 (9.7%)	0.72
Whole hand	61 (48.4%)	42 (41.6%)	103 (45.4%)	0.30
Wrist region	16 (12.7%)	1 (1.0%)	17 (7.5%)	0.001
Hand and forearm	14 (11.1%)	7 (6.9%)	21 (9.3%)	0.28
Total	126 (100%)	101 (100%)	227 (100%)	–

Table II demonstrates the distribution of carpal tunnel syndrome symptoms according to age of the patients. The mean age of the patients was 47.79 ± 5.53 years. The patients were divided into two groups of less than 50 and more than 50 years of age. The distribution of CTS symptoms in the whole of the three lateral fingers was significantly higher ($p = 0.0001$) in patients who were more than 50 years of age compared to the patients who were less than 50 years of age. However, the distribution of CTS symptoms at the levels of wrist region were significantly higher ($p = 0.001$) in patients with age group less than 50 years of age as compared to the patients who were more than 50 years of age. There was no significant difference in the distribution of CTS symptoms at the levels of tip of the fingers, whole hand and hand and forearm regions among the patients.

DISCUSSION

In spite of marvellous advancement in medical sciences, there is no gold standard or clear-cut consensus in the diagnosis of carpal tunnel syndrome. Clinical diagnosis of CTS depends on the knowledge and skills of the

individual physician.[9] Moreover, in CTS, the severity of sign and symptoms and methods of diagnosis does not often correlate well with the extent of nerve damage and protocols of the diagnosis, hence, the physicians are not properly diagnosing the disease but facing the elements of difficulty and controversy as well.[4] Most of the physicians believe that the distribution of clinical symptoms involving the lateral one third of the hand is due to the CTS, but it must be kept in mind that the anatomy of the hand and clinical features does not always reflect the real disturbances and not every pain in hand mediated to the lateral three fingers is due to the CTS. Therefore, in the present study, the distribution of clinical symptoms in patients with CTS was determined along with nerve conduction studies (NCS).

In the present study, the distribution of symptoms was 34.3% at the level of whole of the three lateral fingers and 14.9% were at the level of hand and forearm, it was common in males as compared to females. However, these symptoms at the level of whole hand were 48.8%, and tips of the three lateral fingers were 11.3% common in females as compared to males. Considering the age, the distribution of symptoms in the whole of the three lateral fingers 41.6% were significantly higher in patients who were more than 50 years of age and the symptoms at the level of wrist region 12.7% were significantly higher in patients with age group less than 50 years.

De Krom *et al*. conducted a study in The Netherlands and found that the prevalence of carpal tunnel syndrome symptoms were more among adult women than adult men.[10] Similarly, Saeed and Irshad conducted a study in Pakistan and reported that the presentation of CTS was more common in female gender and dominant hand was affected more frequently.[11] Similar results for whole hand were observed in this study.

There is a wide-ranging harmony about what clinical features are indicative of carpal tunnel syndrome (CTS), there is no internationally agreed upon definition. Although it is easy to recognize a typical case clinically, there are many patients with atypical symptoms. It is, thus, important that CTS should be identified as accurately as possible. Several attempts have been made to formalize diagnostic criteria for CTS. Some are simply the opinion of an expert in the field. Clinically, definite CTS diagnosis based on recurring night-time or activity-related numbness or tingling involving the palmar aspects of at least two radial fingers.[12] A criteria-pain or paresthesia or sensory loss in the median nerve distribution shows Tinel's test positive, Phalen's test positive, nocturnal exacerbation of symptoms, motor loss with wasting of abductor pollicis brevis, and abnormal conduction time.[13,14] This makes it explicit that CTS is a condition that results from a particular pathologic process at a specified site, and it allows the inclusion of a laboratory measurement (nerve conduction studies) as a supportive additional diagnostic criterion. No single clinical feature is sufficient to make the diagnosis, and the syndrome cannot be defined solely by a laboratory measurement such as NCS.[15]

There are points of similarity and dissimilarity between the methods, as would be expected from distinct approaches to the diagnostic problem. The patients who misclassified as normal but had abnormal nerve conduction studies suggestive of CTS were much more heterogeneous. Some of these patients clearly had dual pathology and the second condition dominated the clinical picture. In those subjects with only neuro-physiological evidence of CTS, clinical history was often obviously atypical. A clinician's opinion is often held up as the definitive arbiter of whether a patient has CTS or not. However, clinical diagnosis not 100% accurate and there is no reason to believe that it is reliable for CTS.

Katz *et al*. assessed the value of a history and physical examination findings in diagnosing the carpal tunnel syndrome, and determined whether patients were at high or low risk for the carpal tunnel syndrome.[16] Similarly in the present study, the diagnosis of CTS was based on the clinical symptoms and NCS.

Several techniques has been developed for the diagnosis of carpal tunnel syndrome,[17,18] based on the patient's history, findings of a physical examination, and often electro-diagnostic testing. Distribution of clinical symptoms and diagnostic confirmation is a clinical challenge. It is well recognized that physical examination maneuvers have limitations in sensitivity and specificity. Nerve conduction studies (NCSs) are often thought to provide desirable objective evidence of median mono-neuropathy in the diagnosis of CTS. However, their utility as a diagnostic criterion standard has been called into question by several investigators. The different diagnostic tools were adopted in the diagnosis of CTS, however, the main concern regarding distribution of clinical symptoms is still vague.

In the present study, we diagnosed the CTS on the basis of the clinical history and the distribution of CTS symptoms, and further confirmed on the NCS findings. Moghtaderi *et al*. reported that ultrasound is a good diagnostic modality for patients categorized as moderate CTS.[19] Watson demonstrated that an evidence-based electro-diagnostic approach efficiently confirms the diagnosis to identify neurogenic mimickers or super-imposed processes that may influence the response to treatment and helps the clinician in management decisions in conjunction with the severity of the clinical symptoms.[20]

Miwa reported that CTS severity increases with age and ultrasonographic measurement of the median nerve cross-sectional area (CSA) is an additional or complementary method for CTS diagnosis and median nerve CSA is a useful diagnostic measurement for CTS.[21] One cannot deny from the significance of various

tools adopted to diagnose the CTS, but distribution of symptoms in CTS patients is more important to minimize the chances of misdiagnosis as well to facilitate the physicians to manage the CTS. It is suggested that combined approach of clinical history, examination and NCS diagnostic method can be used as an screening tool for CTS diagnosis.

CONCLUSION

The distribution of CTS symptoms at the level of whole of the three lateral fingers and hand and forearm were higher in males compared to females and these symptoms were common at lateral three tips of the fingers and whole hand in females compared to males. The distribution of symptoms at the level of whole of the three lateral fingers were significantly higher in patients who were more than 50 years of age and the symptoms at the level of wrist region were significantly higher in patients with age group less than 50 years.

Acknowledgement: The authors are thankful to the Deanship of Scientific Research, King Saud University, Riyadh, Saudi Arabia for supporting the work through the research group project number RGP-VPP 181.

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