

Nerve conductive study in women with carpal tunnel syndrome in Tikrit city

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Abstract

Carpal tunnel syndrome (CTS) is one of the most common upper limb compression neuropathies. CTS account for approximately 90% of all entrapment neuropathies. An estimated one million adults from the United States (annually) have CTS requiring medical treatment. The aim of the study is to investigate to compare the normal values of median nerve of normal healthy women (distal latency, amplitude & conduction velocity) with the same values of median nerve in women with carpal tunnel syndrome. The study was conducted as a case series study for Iraqi volunteers and patients attended to rheumatology department - neurophysiology unit at Tikrit teaching hospital (TTH) at the period from the 1st of December 2010 to the 1st of August 2011. Forty healthy female subjects with a mean age of (40.315 ± 10.324 years) to compare with the CTS female patients. Thirty eight female patients with mean age group of (40.55 ± 10.230 years) with CTS affect them in right hand diagnosed by rheumatologist and neurologist then referred to nerve conductive study (NCS) and EMG unit at TTH. The NCS was done by using NIHON KOHDEN / Neuropack S1 EMG / EP Measuring System MEB-9400 MODEL 2009. There are no significance differences between control subjects & CTS patients regarding age, body mass index. Also, there are no significance difference between normal control subjects & CTS patients in regard to upper limb length, arm circumference, index finger length (IFL), index finger circumference and wrist circumference. In regard to motor activity of median nerve, there is significance increase in distal latency time of median nerve of CTS patients (5.632 ± 1.791 msec) on compare to normal control subjects (3.540 ± 0.622 msec). Also, the amplitude of action potential of motor activity of median nerve is higher in control subjects (9.217 ± 0.509 mv) in compare to CTS patients motor activity of amplitude of (6.530 ± 1.937 mv). The difference between median nerve motor amplitude is significance at ($p < 0.01$) between patients and controls. Moreover the conduction velocity in CTS patients of median motor (58.354 ± 1.789 m/sec) is significance lower ($p < 0.01$) in compare to motor conduction values of median nerve in normal control subjects (53.744 ± 4.232 m/sec). However, in regard to sensory activity of median nerve in right hand of both normal control subjects and CTS patients. The latency period in CTS patients is delayed (3.414 ± 1.606 msec) in compare to normal subjects (2.761 ± 0.344 msec). While, the amplitude of action potential of the sensory activity of median nerve is significantly lower ($p < 0.01$) in compare to normal subjects. Also, the conduction velocity of sensory activity of median nerve of CTS patients is significantly lower (38.357 ± 4.357 m/sec) on compare to conduction velocity of sensory activity of median nerve of normal subjects (48.236 ± 2.545 m/sec). The present study concludes that: The present study showed abnormal values NCS of median nerve at CTS patients as compare to normal healthy women of same age. The present study recommend that:-

Using median nerve ultrasonography as diagnostic tools to confirm or exclude CTS & minimize false positive results.

Key words: *Median nerve, women, nerve conduction, & carpal tunnel.*

Introduction

Carpal Tunnel Syndrome is a symptomatic compression neuropathy of the median nerve at the level of the wrist characterized physiologically by evidence of increased pressure within the carpal tunnel and decreased function of the nerve at that level. Carpal Tunnel Syndrome can be caused by many different diseases, conditions and events. It is characterized by numbness, tingling, hand and arm pain and muscle dysfunction. The disorder is not restricted by age, gender, ethnicity, or occupation and is associated with or caused by systemic disease and local mechanical and disease factors, (1,2,3,4). Carpal tunnel syndrome (CTS) is one of the most common upper limb compression neuropathies, (2,3). CTS account for approximately 90% of all entrapment neuropathies. An estimated one million adults from the United States (annually) have CTS requiring medical treatment, (4). In a recent surveillance study from Canterbury and Huddersfield, UK, Bland et al reported an annual incidence of 139.4 cases per 100,000 in females and 67.2 cases per 100,000 in males, with a female to male ratio of 2.07, (5). There are two distinct varieties of CTS - acute and chronic. The acute form is relatively uncommon and is due to a rapid and sustained rise of pressure in the carpal tunnel. This is most commonly associated with a fracture of the radius, burns, coagulopathy, local infection and injections, (6). The chronic form is much more common and symptoms can persist for months to years. However, in only 50% of cases is the cause identified, and can

be divided into local, regional and systemic causes, (7,8). Carpal tunnel syndrome is common in pregnant women, (7,9,10). The aim of the study is to investigate to compare the normal values of median nerve of normal healthy women (distal latency, amplitude & conduction velocity) with the same values of median nerve in women with carpal tunnel syndrome.

Patients & methods

The study was conducted as a case series study for Iraqi volunteers and patients attended to rheumatology department - neurophysiology unit at Tikrit teaching hospital (TTH) at the period from the 1st of December 2010 to the 1st of August 2011. Forty healthy female subjects with a mean age of (40.315 ± 10.324) years) to compare with the CTS female patients. Thirty eight female patients with mean age group of (40.55 ± 10.230) years) with CTS affect them in right hand diagnosed by rheumatologist and neurologist then referred to nerve conductive study (NCS) and EMG unit at Tikrit teaching hospital. The history was taken by self - administration questionnaires to elicit full information from the all subjects and patients. Full clinical examination for nervous system and locomotor system were done for all to exclude any abnormality. Subjects with diabetes mellitus, rheumatoid arthritis, thyroid dysfunction, current pregnancy, self reporting medical condition diagnosed by physician, any symptoms in neck, shoulders, wrist, hand, or fingers had lasted for more than one week in the last 12 month preceding the study, jobs characterized by highly repetitive work, were excluded from the study

from both control subjects and patients. Body weight, height were measured for normal control subjects & CTS patients. Body mass index (BMI) was calculated from body weight in Kg divided by height square in meter. The patients were examined for physiological parameters by nerve NCS as the following:

1- Motor nerve conductive study (MNCS) for median nerve for affected hand.

2- Sensory nerve conductive study (SNCS) for both median (affected nerve) and ulnar (unaffected nerve) of the same affected hand for comparison. The NCS was done by using NIHON KOHDEN / Neuropack S1 EMG / EP Measuring System MEB-9400 MODEL 2009. All data were presented as a mean and standard deviation (S.D). Unpaired T test was used to compare between means of parameters of control & CTS patients. P value less than 0.05 and 0.01 were accepted as significant value.

Results

There are no significance differences between control subjects & CTS patients regarding age, body mass index. Also there are no significance difference between normal control subjects & CTS patients in regard to upper limb length (ULL), arm circumference (AC), index finger length (IFL), index finger circumference (IFC) and wrist circumference (WC), Table (1). In regard to motor activity of median nerve, there is significance increase in distal latency time of median nerve of CTS patients (5.632 ± 1.791 msec) on compare to normal control subjects (3.540 ± 0.622 msec). Also, the amplitude of action potential of motor activity of median nerve is higher in control subjects (9.217 ± 0.509 mv) in compare to CTS patients motor activity

of amplitude of (6.530 ± 1.937 mv). The difference between median nerve motor amplitude is significance at ($p < 0.01$) between patients and controls. Moreover the conduction velocity in CTS patients of median motor (58.354 ± 1.789 m/sec) is significance lower ($p < 0.01$) in compare to motor conduction values of median nerve in normal control subjects (53.744 ± 4.232 m/sec). However, in regard to sensory activity of median nerve in right hand of both normal control subjects and CTS patients, (table 2): The latency period in CTS patients is delayed (3.414 ± 1.606 msec) in compare to normal subjects (2.761 ± 0.344 msec). While, the amplitude of action potential of the sensory activity of median nerve is significantly lower ($p < 0.01$) in compare to normal subjects. Also, the conduction velocity of sensory activity of median nerve of CTS patients is significantly lower (38.357 ± 4.357 m/sec) on compare to conduction velocity of sensory activity of median nerve of normal subjects (48.236 ± 2.545 m/sec). Table 2 & fig. 1. There is significant difference between ulnar & median nerve in regard to latency period ($p < 0.01$). The latency period is delayed in median nerve (3.414 ± 1.606 msec) of CTS patients on compare to ulnar nerve of the same hand (2.307 ± 0.236 msec), (Table 3). The amplitude of Ulnar nerve of non affected hand is higher (16.609 ± 1.355 μ v) than that of median nerve (10.06 ± 1.520 μ v). The difference is significance at ($p < 0.01$), (Table 3). Moreover, the conduction velocity in affected sensory median nerve is slower (38.357 ± 4.375 m/sec) than of sensory ulnar nerve of the same hand (48.384 ± 13.019 m/sec). The difference was significant ($p < 0.01$) between ulnar sensory and median sensory of the same hand, (Table 3).

Table (1):- shows the characteristic features of normal subjects & carpal tunnel syndrome patients, (mean & standard deviation).

	Mean ± SD Control = 40	Mean ± SD Patients = 38	P. Value
Age (years)	40.315±10.324	40.552±10.23	N S
BMI*(kg/m ²)	30.657± 4.393	33.05 ±5.156	N S
U L L*(cent)	71.842 ± 3.670	71.763 ±3.03	N S
xA C*(cent)	30.289 ± 3.401	31.631 ±3.03	N S
I F L*(cent)	9.026 ±0.617	9.144 ±0.48	N S
I F L*(cent)	6.684 ±0.49	6.855 ±0.50	N S
W C*(cent)	16.013 ±0.80	16.355 ±0.82	N S

Table (2):- show the mean and S.D of motor and sensory activities of median nerve between normal control subjects and CTS patients.

Median nerve activities	Control n= 40	Patients n= 38	P. value
Motor			
Distal latency (msec)	3.540±0.622	5.632±1.791	0.01
Amplitude (milli volt)	9.217±0.509	6.530±1.937	0.01
Conduction velocity (m / s)	58.354±1.789	53.744±4.232	0.01
Sensory			
Distal latency (msec)	2.761±0.344	3.414±1.606	0.01
Amplitude (mico volt)	13.326±1.555	10.055±1.515	0.01
Conduction velocity (m / s)	48.236±2.545	38.357±4.357	0.01

Table (3):- show the mean and S.D of the sensory activities of median and ulnar nerves in the same hand (right) of CTS female patients.

	U. S. R*	M. S. R*	P. Value
Distal latency (msec)	2.307±0.236	3.414±1.606	<0.01
Amplitude (micro volt)	16.609±1.355	10.060±1.520	<0.01
Conduction velocity (m / sec)	48.384±13.019	38.357±4.375	<0.01

U.S.R*= Ulnar sensory activities of right hand.

M.S.R*= Median sensory activities of right hand.

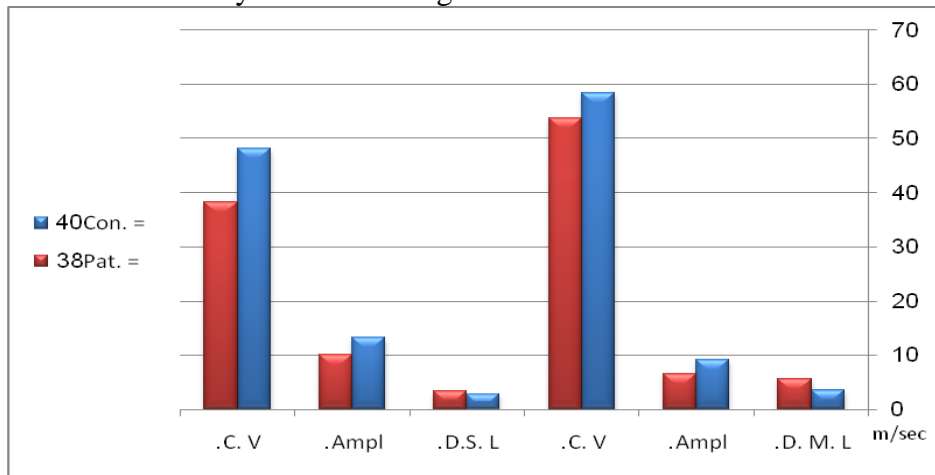


Figure (1):- show comparison median motor (right) & sensory (left) activities between normal and CTS patients.

Discussion

Thirty eight female patients with carpal tunnel syndrome were diagnosed clinically by a hand of rheumatologist and neurologist & referred for electrophysiological testing to confirm the diagnosis. NCS were performed by an electrodiagnostician with ten years experience. The present study find that the distal latency of motor median nerve of patients were (5.63 ± 1.79 msec), and it is significantly higher than that of normal subjects distal latency of motor median nerve (3.54 ± 0.62 msec) while the amplitude with CTS patients have a lower amplitude (6.5 ± 1.9 mv) as compare with normal control ($p < 0.01$). Also, the NCV of motor median nerve was significantly

lower than that of normal subjects. The same finding was true for sensory activity of median nerve. Generally, any factor which decreases the carpal tunnel capacity or increase the tunnel constituents can initiate CTS symptoms & signs, (11,12). Subsequently, carpal tunnel release is one of the most commonly performed surgical procedures, occurring between 400,000 & 500,000 times per year in the USA with estimated direct cost of 2 billion \$, (13). Carpal tunnel syndrome results from compression of the median nerve within the boundaries of carpal tunnel through an uncertain etiology & / or mechanism, (14). Peripheral neuropathy occurs mostly as sensorimotor axonopathy. The

pathogenesis of peripheral neuropathy is likely to involve several mechanisms such as compressive neuropathy, tenosynovitis & humoral mechanisms. In some original descriptions of CTS, tenosynovitis was frequently implicated as a major causative factor for CTS, (15, 16). Inflammation in the synovium of the flexor tendons can cause increase pressure in the carpal tunnel & contribute to median nerve compression, (17). Median compression is associated with decreased space in the carpal canal, which can be caused by increased edema & inflammation of tenosynovium which is seen in systemic conditions such as diabetes, arthritis, thyroid dysfunction & renal failure, (18, 19). In the present study all CTS patients were free from all above conditions. Watson et al 2002, in previous study showed that in patients with CTS, NCV was 40.5 ± 9 m/s, (20). While in the present study, NCV of median motor was 53.7 ± 4.2 m/s. The age of patients with CTS of Watson study (65 ± 9 years), while the patients in the present study were younger, (40.5 ± 10.2 years). In a previous study, there is a significant delay in conduction velocity which ranged from 9-21 m/sec in patients with CTS, (21). In the present study, NCV of sensory median nerve was 38.0 ± 4.3 m/sec in patients with CTS. These difference between present and previous study is due to the patients with CTS in the present study had a mild CTS and age differences. The symptoms of CTS include parasthesia, burning pain & numbness along the distribution of the median nerve in the hand. It is often difficult to diagnose early stage of CTS in the examination of the neuromuscular system due to similar symptoms resulting from pain in the joints and limitation of movement; however electrodiagnostic studies clearly show the existence of

subclinical neuropathy. It is gold standard due to providing objective sign of neuropathy for the differential diagnosis of CTS, (22). Electrophysiological procedures are very sensitive that they can not only confirm the clinical diagnosis in most patients but also detect an incidental finding in some symptomatic subjects, (23). The present study conclude that in the CTS, there slowing of sensory & motor conduction velocity within wrist to palm segment which is attributed to compression by the transverse carpal ligament or a disease process of the terminal segment. The decrease in the sensory conduction velocity of the median nerve suggest more severe nerve compression which reduce the amplitude of sensory nerve action potential in patients with CTS (10.05 ± 1.5 μ v) & prolongs the latency to a greater extent (3.4 ± 1.6 msec). In the present study, the result indicates that the electrophysiological investigation being a highly sensitive procedure reflects the pathology, independent of the severity of clinical involvement. The findings agree with previous studies which encourage the use of NCS in a symptomatic patients, (12, 14, 17, 23). The present study concludes that: The present study showed abnormal values NCS of median nerve at CTS patients as compare to normal healthy women of same age. The present study recommend that;- Using median nerve ultrasonography as diagnostic tools to confirm or exclude CTS & minimize false positive results.

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