Prevalence of Carpal Tunnel Syndrme in Obese Individuals and Electrophysiological Assessment in Symptomatic and Asymptomatic Cases

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Abstract

Objective: to find out correlation between obesity and CTS and to check whether NCV can be used as a diagnostic tool in asymptomatic cases. **Method:** A 30 subjects out of 50 were undergone for nerve conduction studies and primary outcome measure is functional status scale symptoms severity scale. **Result:** results of this study failed to reveal a significant correlation between the BMI and CTS so null hypothesis is retained. results of NCV studies found no significant difference between symptomatic and asymptomatic group, so in that null hypothesis retained.

Keywords: *carpal tunnel syndrome, nerve conduction studies, obesity.*

Introduction

Carpal tunnel syndrome is a painful, progressive condition that occurs when the median nerve in the wrist is compressed. The nerve may become compressed because it has swollen, the tendons are inflamed, or both.[1]Carpal tunnel syndrome (CTS) is the most commonly observed neuropathy in the general population [2]. In studies, an average of 30% of people complained of suffering from symptoms that indicate Carpal Tunnel Syndrome. [3].”Numbness or pain that gets worse while using hand or wrist, gripping object or flexing hand. Stiffness of fingers can be felt in morning[4]. It frequently affects women, and the female: male ratio is 3:1 [5].The known common risk factors for carpal tunnel syndrome are female gender, increased age, diabetes, and vocations involving vibration and repetitive hand movements. Obesity is being discussed as an important risk factor [6-7].There are many other factor places an individual at risk for CTS. certain medical condition are the risk for developing CTS[1] personal factor such as gender, age, BMI were reported to be important risk factor[1,8-9]The risk factors of the CTS could be the age, gender, and body mass index (BMI) .[11 12] BMI is a good indicator of body fat and it is calculated by dividing weight (kilogram) with the square of height (meter).[13]Although there are some studies showing a relationship between the BMI and CTS[12-14] .The Electro diagnostic (EDx) studies are a valid and reliable tools for confirming diagnosis of CTS[10].

Methodology: Source Of Data: different institutes of Maliba campus **Study Design:** cross sectional **Sample Size:** total 50 subjects and 30 were selected for NCV **Sampling Method:** convenient sampling.

Tools And Materials:

Electromyography machine: NeuroStim NS-4 computerized E.M.G. with N.C.V. and evoked potentials, manufacture Biotech, India.

Electrodes :button, Bar, Ring ,Disc electrode. Electrode box, Stimulator, Ground electrode.

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Conducting gel, Adhesive tape, Cotton, Inch tape, Chair, Pillow, Weighting machine, Pen ,Paper, Calculator, Informed consent form, Screening form ,Function status scale ,Symptom severity scale, Data recording sheet.

Outcome Measures: Carpal tunnel syndrome symptom severity and functional scale, Nerve conduction studies ,Motor nerve conduction velocity and motor latency of Median nerve, Sensory nerve conduction velocity and latency of Median nerve.

Procedure: After being issued clearance by The Institutional Committee of Ethics of The Shrimad Rajchandra College of Physiotherapy initiated. The subjects from Maliba campus who met the inclusion criteria, were informed about the study and a written consent was taken. First they assessed for obesity by calculating the BMI of respective individuals and for that weighing scale were used for measuring the weight and height was measured in cm by height measure on wall. After getting weight in kilo grams and height in meter their BMI was calculated by the following equation.BMI = weight (kg)/ height ^{2} (m^2).BMI more than 25 were selected. The selected individuals were given carpal tunnel syndrome symptom severity and functional scale. If, the participants were found symptomatic, and they were taken for NCS. Thus, two groups were formed: Symptomatic individuals diagnosed with CTS, Asymptomatic individuals who seemed to be at risk of developing CTS due to years of exposure to etiological risk factors. For subject classification, as CTS was defined as numbness, tingling, burning or pain in at least one of digits index finger, middle finger, or ring finger as well as confirmed electrophysiological deficiencies as described below. All participants were asked a series of questions prior to their participation to make sure they were eligible. The proposed sample size was 20 per group and was based on power calculations performed on published data. All participants were required to be between the ages of 25 and 45, as only adults were included. The upper age limit was set because sensory and motor nerve conduction changes have been found in individuals older than 50, and these could have compromised the study outcomes. Participants were excluded as per the exclusion criteria.

Protocol: After providing written informed consent and subjects were asked to fill demographic information. Then a brief physical examination was done. The tests were performed for each subject. The protocol commenced with a clinical exam, which was performed, that included Phalen's test, Tinel's sign, and a test for cervical radiculopathy. This evaluation was done first in order to reduce the potential impact of the functional tasks and nerve conduction studies on the results of the clinical tests. This helped to exclude the patients with cervical radiculopathy. After that patient was asked to fill the Boston Carpal Tunnel Questionnaire, which consists of the symptom severity scale (SSS) and the functional status scale (FSS) .

Boston Questionnaires: The questionnaires that were completed by the participants were used to gather descriptive demographic information: the Boston Carpal Tunnel Questionnaire it consists of 11 questions. Total 100 subjects who were having BMI<25, were eligible to fill the questionnaire. After that the subjects who showed score more than 1 for any of hand in questionnaire were selected as symptomatic subject for further neurophysiological assessment and same as subjects who were not having symptoms or having grade 1 in questionnaire in any of hand were selected as a asymptomatic subject for neurophysiological assessment. After the subjects completed the hand symptom questionnaire, NCS were performed on Hands of each subject. NCV study was done by using neuro perfect nerve conduction equipment. The choice of electro physiologic studies was based on the recommendations set forth by the American Association of Electro diagnostic Medicine . NCV study was carried out on the hand for which they have filled the questionnaire and the parameters used were distal motor latency and sensory conduction velocity and latency. For the sensory nerve velocity estimation, the electrodes used were the ring type finger electrodes.

Procedure For Ncs:skin Preparation: The skin area where recording, ground, and stimulating electrodes were placed was cleansed using a water swab. The subjects were positioned with the palm facing upwards and the wrist and forearm exposed. The sites for placement of the stimulating and the recording electrode were marked. Temperature was measured using a skin temperature probe. Temperature was measured at the web space of the palm between the first and second metacarpal. Nerve

conduction studies involve the stimulation of nerves with small electrical impulses over stimulation site at where nerve is more superficial and measuring the resultant responses. Surface electrodes are used to both deliver and detect the electrical impulses. The test is safe and well tolerated with only minor discomfort and no long term side effects. Patients should avoid prior application of topical creams as these may increase skin resistance to the applied current, and therefore require stronger levels of electrical stimulation. In cold environments, the limbs may need warming as cool peripheries (<32°C) slow the conduction velocity of nerves.

Placement of Electrodes:

1. **Sensory nerve conduction:** Orthodromic, midpalmar- wrist mixed nerve latencies were determined for median nerve by performing supramaximal stimulation in the palm with a handheld bipolar stimulator. An Orthodromic electrical impulse travels in the same direction as normal physiologic conduction median nerve latencies were recorded, with the electrodes that are ring electrodes placed on index fingers over with the anode angled toward the web between the index and middle finger. Ring electrode was used as it mean to measures sensory nerve conduction.The ground electrode was placed on the dorsum of the hand; one can place it nearby cathode but preferably between the stimulating and recording electrodes. Cathode placed on proximal phalanx and anode on middle phalanx. Stimulation was given on approx 10-12 cm proximal to the cathode on the center of the wrist, directly over the median nerve proximal to the distal wrist crease. Stimulation given till it reaches to its supramaximal level.

2.Motor nerve conduction: Orthodromic median motor nerve velocities measures by using disc electrodes. The active recording electrode (negative) was placed over the belly of the abductor pollicis brevis muscle and the reference electrode was placed at the base of the thumb. The bipolar stimulator was placed 8cm from the recording electrode on the median nerve at the wrist between the tendons of the flexor carpi radialis and the Palmaris longus. Other stimulation was given just below the elbow beside biceps tendon. Stimulation to wrist will give latency1 for wrist, latency 2 for wrist and velocity for wrist and stimulation to elbow will give latency 1 for elbow, latency 2 for elbow and velocity for elbow in case of motor nerve conduction. In sensory conduction only stimulation to wrist is there that gives latency1 for wrist, latency 2 for wrist and velocity for wrist.In all cases, median sensory nerve distal latencies should be measured. There are multiple techniques to accomplish this. Thus, two comparison techniques that clearly agree (either normal or abnormal) should be adequate to confirm the diagnosis. The American Association of Neuromuscular and Electro diagnostic Medicine guidelines do not recommend performing NCSs on the opposite hand. If the symptoms are bilateral, or more diffuse, then NCSs on the opposite side are useful. If initial comparisons NCSs on the symptomatic side are normal, further NCSs are rarely needed. NCSs in the asymptomatic or minimally symptomatic limb are based on clinical utility, and they need to correlate with clinical tests. There are 3 parameters used in determining whether a conduction study is normal or abnormal. These parameters are amplitude of the MUAP, latency of the response, and conduction velocity. The motor amplitude represents the summation of the individual muscle fiber action potentials within that muscle and correlates highly with the number of viable axons. The amplitude is measured in milli volt from the baseline to the negative peak of the response obtained from supramaximal nerve stimulation. Sensory amplitude (peak-to-peak) is measured in microvolt and also correlates with the number of viable axons The latency is measured in milliseconds from the onset of the stimulus to the first negative deflection from the baseline in motor conduction and to the peak of the response in sensory conduction. The conduction velocity is obtained by stimulating the nerve at two different points along the nerve at least 10 cm apart. To calculate the conduction velocity, the difference between the latencies' onset obtained at the two points is divided by the distance between the two points. It is calculated in meters per second.

Results

The obtained results were considered significant if the value of $p<0.05$.Data analysis was done using the SPSS software (version 20.0).

TABLE: 1: AGE DISTRIBUTION AND BMI IN 50 INDIVIDUALS

	MEAN	**S.D.**	**TOTAL NUMBER**
BMI	28.3	2.35	50
AGE	34.44	4.57	50

In above table mean and standard deviation of BMI and age of 50 individuals is mentioned.

TABLE:2:CARPAL TUNNEL SYNDROME AMOUNG COMPUTER WORKER

TOTAL	50
ASYMPTOMATIC	35
SYMPTOMATIC	15
PERCENTAGE	70=ASYMPTOMATIC 30=SYMPTOMATIC

TABLE: 3: MOTOR NERVE LATENCY-1 AND 2 FOR WRIST AND ELBOW

	GROUP	**N**	**MEAN OF RANK**	**SUM OF RANK**	**SIGNIFICANCE**
LATENCY 1 FOR WRIST	SYMPTOMATIC	15	3.185	265	0.184
	ASYMPTOMATIC	15	2.364	200	
	TOTAL	30			
LATENCY 1 FOR ELBOW	SYMPTOMATIC	15	3.409	278	0.061
	ASYMPTOMATIC	15	2.220	187	
LATENCY 2 FOR WRIST	SYMPTOMATIC	15	10.64		0.119
	ASYMPTOMATIC	15	12.21		
LATENCY 2 FOR ELBOW	SYMPTOMATIC	15	11.13		0.633
	ASYMPTOMATIC	15	11.45		
	TOTAL	30			

TABLE:4: MNCV FOR WRIST AND ELBOW

	GROUP	N	MEAN OF RANK	SUM OF RANK	SIGNIFICANCE
MNCV AT WRIST	SYMPTOMATIC	15	2.77	3.0	0.33
	ASYMPTOMATIC	15	11.42	7.0	
	TOTAL	30			
MNCV AT ELBOW	SYMPTOMATIC	15	2.81	3.0	0.33
	ASYMPTOMATIC	15	11.29	3.0	
	TOTAL	30			

TABLE:5:SENSORY NERVE LATENCY-1 AND LATENCY 2 FOR ELBOW AND WRIST

	GROUP	N	MEAN OF RANK	SUM OF RANK	SIGNIFICANCE
LATENCY 1 FOR WRIST	SYMPTOMATIC	15	3.11	280.0	0.050
	ASYMPTOMATIC	15	2.01	185.0	
	TOTAL	30			
LATENCY 1 FOR ELBOW	SYMPTOMATIC	15	3.26	277.5	0.063
	ASYMPTOMATIC	15	2.13	187.5	
LATENCY 2 FOR WRIST	SYPTOMATIC	15	9.93	227.0	0.835
	ASYMPTOMATIC	15	10.04	238.0	
LATENCY 2 FOR ELBOW	SYMPTOMATIC	15	10.11	240.5	0.755
	ASYMPTOMATIC	15	9.77	224.5	
	TOTAL	30			

TABLE:6: SNCV FOR WRIST AND ELBOW

	GROUP	N	MEAN OF RANK	SUM OF RANK	SIGNIFICANCE
SNCV AT WRIST	SYMPTOMATIC	15	2.56	3.0	0.33
	ASYMPTOMATIC	15	9.98	7.0	
	TOTAL	30			
SNCV AT ELBOW	SYMPTOMATIC	15	2.70	3.0	0.33
	ASYMPTOMATIC	15	9.94	7.0	
	TOTAL	30			

In above table:3 to 6 [1: Mann Whitney U test for sensory ncv and mean value for both the group is given.2:it doesn't show any difference.3:significance level is mentioned]

Discussion

For the first part of the study that is prevalence of CTS 50 people were given the questionnaire and out of 50 only 15 were having symptoms. All the 15 was both male and female. Another 35 people were asymptomatic. The reason for not finding much correlation between the obesity and CTS can be because if i can't get enough sample size. Another reason for not finding correlation is that NCV is quite sensitive to room temperature and many other factors, Readings may get deviated as some participants came in morning hours and some at afternoon hours. And another limitation of this study is that NCV room settings require electrically shielded room which was not fulfilled. The reason for not finding much correlation between obesity and CTS can be because of data selection. Also some studies shows that computer work induces very little force ,the position of fingers, wrist and foremen requires for computer work have shown that carpal tunnel pressure increases but not to the level that generally believed to be harmful. The obesity among the participant is not sever enough to exert pressure on carpal tunnel. Other reason for the same include ethnicity, male gender and younger age group. Study was done by deepanairet on effect of BMI on distal motor and sensory latency in obese individuals and concluded there is no correlation between BMI and DML and DSL. most of the studies carried out in industrial workers suggested positive association between slowing of sensory component of median nerve across the wrist with obesity. **LIMITATIONS:** A larger sample of participants would be required to have sufficient power in calculations, and decrease the probability of potential error to allow for more conclusive results on between group differences. In addition, we used only obese individuals for our study; it can be done on normal individual also. Other neuropathy condition can be taken for ncv studies. As the group was formed based on symptoms and its weakness is it is subjective and influences more on homogeneity. The results of ncv shows no difference in between groups and it can be result due to technical problems and for that one can use more reliable instrument and more precise procedure.

Conclusion

Results of this study failed to reveal a significant correlation between the BMI and CTS so null hypothesis is retained. results of NCV studies found no significant difference between symptomatic and asymptomatic

group, so in that null hypothesis retained.

Conflict of Interest – No.

Source of Funding- Self

Ethical Clearance – Obtained by The Institutional Committee of Ethics of The Shrimad Rajchandra College of Physiotherapy.

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