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The Relationship between Nerve Conduction Study and Clinical Grading of Carpal Tunnel Syndrome in Bangladeshi Population

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Abstract

Introduction: The CTS is one of the clinical syndromes, it was experienced by the patients from numbness, tingling, burning and or pain associated with localized compression of the median nerve at the wrist. Median nerve with the carpel tunnel (CTS) is localized and it was compressed in median nerve, resulting in mechanical compression and local ischemia has been associated with age and sex matched control. ***Objective:*** To assess The Relationship between Nerve Conduction Study and Clinical Grading of Carpal Tunnel Syndrome in Bangladesh Population. ***Methods:*** A prospective study was conducted at Department of Neurology, Uttara Adhunik Medical College Hospital (UAMCH), Uttara, and Dhaka, Bangladesh from January to December 2021. A total 100 case were prospectively observed for the period of six months 50 patients' with symptoms consistent with CTS and 50 age and sex matched healthy control subjects were examined. Based on clinical assessment, the study patients were divided into 03 groups with mild CTS, moderate CTS and severe CTS respectively as per Mackinnsons classification. The relationship between the clinical severity grade and various nerve conduction study parameters were correlated. The study was correlated with age and gender matched control intervention and we extrapolate the any significant correlation between the clinical grades and various attributes of study traits. All the traits were carefully assessed by using logistic regression analysis and Fisher F- test statistics. ***Results*:** Out of 50 patients with symptoms consistent with CTS and 50 age and sex matched healthy control subjects were examined. The Left hand was involved in 11patients; right hand in 19 patients & 20 patients had involvement of both hands. Numbness and tingling of hand and first three fingers was the most common presenting symptom. Phalens test was positive 30 (60.0%) of our patients. 7(14.0%) pts had hypothyroidism, 10(20%) patients showed raised DM and 4(8.0%) patients showed lipid profile abnormalities. Both male and female sex ratio was 1:3. All cases were considered for the study. The distal motor latency was significantly correlated with different age group of the population and CMAP and conduction velocity not shows any significant relation with clinical severity of CTS. Since, the median sensory latency and nerve conduction velocity seen in study population and well apprehension with clinical different grading of CTS. ***Conclusion**:* Summing of the results concludes that, the sensory conduction appears to be more sensitive (95%) AUC 0.89 and significantly correlated when compared to motor conduction attributes, the correlation besides with clinical severity of CTS apart from gender and age matched cases.

Keywords: EDX-Electro diagnostic tests, CTS-Carpal tunnel syndrome, CMAP-Compound muscle Action Potentials, SNAP- Sensory nerve Action Potentials, SNCV-Sensory Nerve Conduction Velocity.

INTRODUCTION

The CTS is one of the clinical syndromes, it was experienced by the patients from numbness, tingling, burning and or pain associated with localized compression of the median nerve at the wrist. Median nerve with the carpel tunnel (CTS) is localized and it was compressed in median nerve, resulting in mechanical compression and local ischemia has been associated with age and sex matched control. Much literature cited that, the CTS is confirmed, by using EDX method, document shows many abnormalities of the median nerve fibres within the CT tunnel [1, 2]. Many studies have reported at global level, the comparisons of sensory nerve responses is significantly effective rather than uses of absolute median nerve latency by documenting the median abnormalities consistent with CTS. As per the many scientific reports suggest that, sensory fibre is a larger proportion on

myelinated fibre, which is higher energy requirements, and thus it is more susceptible to ischemic damage of cells [6, 7]. The focal compression as results of both ischemia and mechanical damages was seen in nerve fibres due to dysfunction of the myelin and disruption in the nodes of Ranvier. Many clinicians observed that, both mechanical compression and ischemia give rise to slowed conduction velocity which can allows us the electromyography, which can confirm a focal abnormality of the median nerve within the carpel tunnel point. Literature revealed that, the comparison of median sensory; latency to the ulnar or median sensory latencies by various segments outside the carpel tunnel, allows the greatest accuracy for confirming the clinical diagnosis at early stage [3]. In this regard, all clinical manifestation, the present study to know the manifestation of clinical diagnosis and the evaluation of therapeutic effects on CTS, but our objective indicators, such as electrophysiological findings are valuable supplementary tools for the clinicians and neurologists for treating the patients [4]. The present study aims to establish the relation between nerve conduction study parameters and clinical gradings. Severity assessment of CTS is a crucial step for defining prognosis and therapeutic measures. Numerous studies have been conducted on the diagnostic findings on NCS and although there have been various reports on CTS grade assessment; no specific method has been established [8-10].

MATERIAL AND METHODS

A prospective study was conducted at Department of Neurology, Uttara Adhunik Medical College Hospital (UAMCH), Uttara, and Dhaka, Bangladesh from January to December 2021. Atotal 100 case were prospectively observed for the period of six months 50 patients with symptoms consistent with CTS and 50 age and sex matched healthy control subjects were examined.Based on clinical assessment, the study patients were divided into 03 groups with mild CTS, moderate CTS and severe CTS respectively as per Mackinnsons classification. The relationship between the clinical severity grade and various nerve conduction study parameters were correlated. The study was correlated with age and gender matched control intervention simultaneously we extrapolate the any significant correlation between the clinical grades and various attributes of study traits. All the traits were carefully assessed by using logistic regression analysis and Fisher F- test statistics. All patients were evaluated the battery investigations of numbness or pain radiating to thumb, index and middle fingers often awakening the patient during night time; extension of pain from the wrist to the shoulder was examined. We assessed the tingling of fingers of both hands, examined falling of objects from the hand because of lack of sensation, sensory loss in the three digits and the radial half of the fourth digits were assessed. Atrophy of adductor policies brevis and weakness of thumb adduction was carefully examined based on the structured scale. The tinel sign atrophy; wasting of the eminence and phalens test was conducted for grading of CTS [11]. A difference between distal sensory latency of abnormal was recorded it was one 3cms proximal to the wrist crease and ulnar nerve was orthodromically simulated on the 5th digits and it was recorded in 3cms proximal to the wrist crease. The study intervention was done as per SOP procedure.

RESULTS

Out of 50 patients with symptoms consistent with CTS and 50 age and sex matched healthy control subjects were examined. Male and female ratio was 1:3 (Fig 1). The Left hand was involved in 11patients; right hand in 19 patients & 20 patients had involvement of both hands. Numbness and tingling of hand and first three fingers was the most common presenting symptom. Phalen's test was positive 30 (60.0%) of our patients. 7(14.0%) pts had hypothyroidism, 10(20%) patients showed raised DM and 4(8.0%) patients showed lipid profile abnormalities.

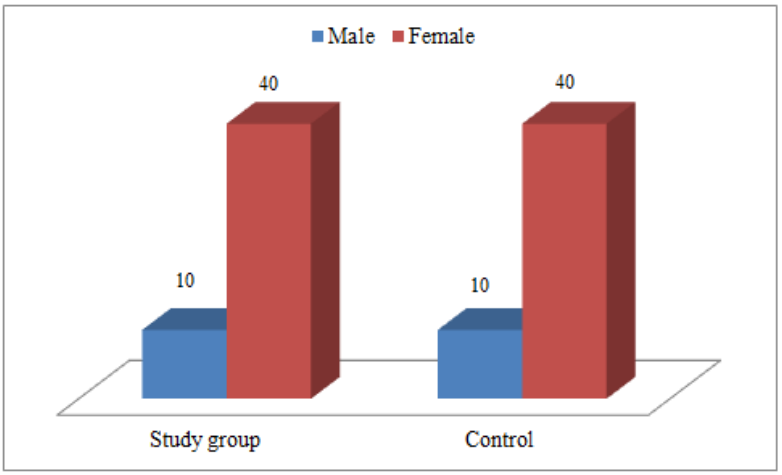

Fig-1: Gender wise distribution.

Table-1: Demographic Characteristics of Cases and Controls (N=100)

Variables	Controls	Cases	Odd ration
Mean age	48.4±1.22	49.68±1.36	2.3
Gender	M-10	M-10	1.2
	F-40	F-40	
Side of involvement		Lt-15	2.68
		Rt-20	
		B/l-15	
Severity of symptoms		Mild-14(28.0%)	1.22
		Mode-26(52.0%)	3.52
		Sev-10(20%)	0.89
Symptoms numbness		49/50(98.0%)	5.68
Tingling		46/50(92.0%)	5.33
Phalen's test positive		30/50(60.0%)	5.54
Co-morbity:			
Hypothyroidism		7/50(14.0%)	51
Dyslipidemia		4/50(8.0%)	0.68
DM		10/50(20.0%)	

Table-2: Motor Electro Diagnostic Parameters cases and Control (N=100)

	Cases Rt	Lt	Controls RLt	Lt	P Value
Distal Motor Latency >4.4milisec	35	30	0	0	Rt-<0.001
					Lt-<0.001
Distal Motor Latency >4.4milisec with clinical grading	Mild-11	Mild-12			
	Mod-17	Mod-12	0	0	
	Sev-7	Sev-6			
CMAP Amplitude(mv)(mean±SD)	5.91±5.03	5.4±3.46	9.0±1.21	8.0±1.23	Rt-<0.001
					Lt-<0.001
CMAP Amplitude(mv)with clinical grading	Mild-7.0	Mild-6.5			Rt-0.075 Lt-0.075
	Mod-6.0	Mod-5.0			
	Sev-4.0	Sev-4.0			
Latency dif b/w median & ulnar (mean±SD)	5.66±1.52	5.16±1.25	0.65±0.04	0.80±0.06	Rt-<0.001
					Lt-<0.001
Latency dif of >1.1milisecsb/w median & ulnar with clinical grading	Mild-14	Mild-19			Rt-0.777 Lt-0.371
	Mod-20	Mod-23			
	Sev-18	Sev-11			
Motor nerve conductin velocity(mean±SD)	17.33±3.05	17.66±6.11	55.92±2.09	54.28±2.11	Rt-0.001 Lt-0.086
Motor nerve conductin velocity(Mean) met/sec with clinical grading	Mild-51.3131	Mild-52.0131			Rt-0.569 Lt-0.013
	Mod-50.6836	Mod-52.5272			
	Sev-43.1633	Sev-48.3511			
F wave Latency in millisecs(mean±SD)	48.38±4.53	50.96±2.27	25.37±1.98	24.29±1.83	Rt-0.001 Lt-0.001

Distal motor latency was significantly prolonged in cases as compared to controls (P < 0.001). The distal motor latency difference between median and ulnar nerves was also significantly greater in cases as compared to controls (P < 0.001). The CMAP amplitude was significantly lower with reduced conduction velocity in cases as compared to controls (P 0.001). The MNCV is reduced in cases as compared to controls. Rt P 0.001, Left P 0.086. Distal motor latency difference between median and ulnar nerves & conduction velocity correlated with mild, moderate & severe grades.

Table-3: Sensory Conduction Parameters cases and Controls (N=100)

Variables	Case Rt	Case Lt	Control Rt	Control Lt	P value
Distal sensory latency Of Median nerve in millisecs(mean±SD)	3.6±0.09	3.8±0.05	2.75±0.04	2.91±0.08	Rt-0.001 Lt-0.001
Distal sensory latency Of Median nerve with clinical grading	Mild-3.2 Mod-3.4 Sev-3.92	Mild-2.3 Mod-3.16 Sev-4.16			Rt-0.025 Lt-0.016
Sensory latency difference between median & ulnar nerves(mean±SD)	3.50±0.37	3.20±0.93	0.190±0.05	0.18±0.02	Rt-0.001 Lt-0.001
Sensory latency b/n median & ulnar >0.2 millisecs	33	29	42	36	Rt-0.038 Lt-0.142
Sensory latency b/n median & ulnar >0.2 with clinical grading	Mild-11 Mod-19 Sev-32	Mild-13 Mod-14 Sev-2	20.0	20.0	
Sensory nerve amplitude in micro volts(mean±SD)	20.66±1059	9.66±6.65	21±1.1	22±1.4	Rt-<0.001 Lt-<0.001
Sensory nerve amplitude in micro volts with clinical grading (Mean)	Mild-06.88 Mod-9.40 Sev-0	Mild-10.16 Mod-10.44 Sev-0			Rt-0.808 Lt-0.169
Sensory NCV in mest/sec(mean±SD)	5.42±4.86	6.86±5.94	52.09±2.21	51.21±2.3	Rt-<0.001 Lt-<0.001
Sensory NCV in mets/sec with clinical grading	Mild-51.3131 Mod-53.6836 Sev-43.1633	Mild-52.0131 Mod-52.5272 Sev-48.3511			Ry-0.013 Lt-0.569

Sensory nerve action potential was absent in 11 cases on the Rt and 14 cases on the left side. Median Distal sensory Latency shows prolonged in cases as compared to controls. The latency difference between median & ulnar nerves is correlating with clinical grading. The SNAP amplitude is significantly lower in cases when compared to control group and it was not correlating with clinical grading. Median sensory nerve conduction velocity in cases is significantly less as compared to the controls and correlates well with clinical grading on the right side (P value 0.013). The Median sensory conduction velocity is less in severe cases on the left side as compared to mild and moderate cases without attaining statistical significance value 0.0569.In comparison with clinical grading there is decrease in sensory latency from mild to severe grade. Motor inching technique; In Motor inching technique maximum latency jump was 1cms below wrist crease in 24/50 (48%) cases.

DISCUSSION

The present study, we compared electrophysiological traits of CTS besides with different grading in association with age and gender wise distribution on matched control group [6, 7]. A total 50cases of symptomatic CTS shows IQR 27-84 years and in case of Control group IQR 25-81 years [1]. Predominately males were expressed the symptoms of CTS and significantly associated with grading ($p<0.01$). Our study results showed to be right side of the nerve fibre is more augmented for CTS and repetitive motion injuries. The numbness of first three fingers and tingling sensation was the commonest symptoms it was noticed during the study period ($p<0.01$). Majority of the cases or subjects shows positive Phalens test and it was found to be significant ($p<0.01$) with a cut-off value of distal latency of 4.4 millisec (68%) on left side (64%) on the right side had prolonged latencies shows significant correlation ($p<0.01$). Study noticed that there is significant difference was seen in CMAP and it was observed in the amplitude between mild and severe groups of CTS respectively. This may because of axonal loss is more in severe grades [2-3].Motor nerve latency difference between median and ulnar nerve is sensitive indicator of CTS but it does not seen significant correlation between the age group of patients. In entrapment neuropathy nerve conduction velocity is generally thought to be a sensitive (sensitivity 0.99; specificity 0.86; PPV 0.56; NPV 0.45 and AUC 0.87) indicator of the severity of demyelization and ischemia to the entrapment point of course of action [4, 5]. The sensory fibres have a larger proportion of large myelinated fibre, which have a higher energy requirement and thus are more susceptible to ischemic damage cause. Focal compression results in both ischemia and mechanical damage to the nerve fibre due to dysfunction of the myelin and disruption at the nodes of Ranvier. It is important to note that, although provocative tests and physical examination are simple and low cost methods to test for reproduction of the patient's symptoms and to determine if CTS should be suspected, provocative tests have scarce or no diagnostic value and physical examination has inadequate predictive value if the likelihood of CTS is low. There have been no trends identified between testing positive for various provocative tests and the severity of CTS and therefore proper diagnostic conclusions based on these tests cannot be made [8-10]. Severity assessment of CTS is a crucial step for defining prognosis and therapeutic measures. Although, different authors have proposed numerous classifications on CTS grade assessment and demonstrated nice correlation between the

electrophysiologic staging and the severity of clinical symptoms, no specific method has been established [12, 13]. Using the Mackinnsons clinical grading system [12], we assigned patients with clinical symptoms and signs into one of mild, moderate or severe grades, with a view of correlating the neurophysiologic differences between patients with different clinical severity grades. NCS tend to become abnormal after significant compression leads to ischemic demyelination of the median nerve. This occurs first in the fast conducting fibers which travel deep to the flexor retinaculum [1-3]. Thus, routine NCS measuring superficial sensory branch of median nerve may fail to pick up the pathology. Thus, as per the AAEM guidelines, orthodromic mixed nerve studies and comparative studies of median sensory latency to the ulnar, or median (segments outside the carpal tunnel) sensory latencies allow the greatest accuracy for confirming the clinical diagnosis [14, 15]. These techniques increase the sensitivity and specificity of diagnosing CTS. In the present study, this fact is re-emphasized with the evidence 62% patients showed prolonged SNAP latency difference between median and ulnar nerves and a graded increase in SNAP latency difference between median and ulnar nerves was noted from mild to severe clinical grade. The comparison of median sensory latency to the ulnar, or median (segments outside the carpal tunnel) sensory latencies allows the greatest accuracy for confirming the clinical diagnosis and helps to control for other confounding variables such as temperature, age, height, and other patient-specific variability. The median nerve fibers to the ring finger may be more subject to compression due to the position of ring finger fibers in the outer margin of the median nerve beneath the transverse carpal ligament [1-3, 14, 15].

CONCLUSION

The present study concludes that, the CTS shows higher distal latency, lower amplitude to reduce the conduction velocity when compared to mild cases but it was not shows significant difference. The sensory latency is significantly more in study with severe CTS as compared to mild to moderate augmentation. Study will help neurologist to take necessary decision at early stage for therapeutic option.

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