A STUDY OF MOTOR NERVE CONDUCTION VELOCITY IN DIABETIC PATIENTS

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Abstracts: Background: Neuropathy is one of the most common complications of diabetes mellitus. Nerve conduction velocity (NCV) is an indicator of neuronal damage in the distal segment of the peripheral nerves. **Objective:** The present study aimed to investigate the nerve conduction velocity in diabetic patients and comparision with non diabetics. **Material and Methods:** Nerve conduction study for the motor part of median and ulnar nerve was performed on 25 diabetic patients (group I) and 25 non diabetics (group II). **Results:** We observed decreased motor conduction velocity in median nerve in diabetic patients as compared to non diabetics but the difference is insignificant. **Conclusion:** NCV is a simple, reliable, and sensitive tool to measure and describe nerve conduction entrapment abnormality in diabetes patients.

Key Words: Nerve conduction study, Neuropathy, Diabetics

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Introduction:

Diabetes mellitus affects over 350 million people worldwide.[1] Nerve conduction velocity (NCV) is an indicator of neuronal damage in the distal segment of the peripheral nerves. Neuropathy is one of the most common complications of diabetes mellitus. Neuropathy can cause the sensory deficit, neurological disorder, limb ulcers, osteomyelitis, and amputation.Therefore, neurological examinations, performing sensory and motor tests and determining the nerve conduction velocity are important for diagnosis and treatment.[2] This study was conducted to evaluate the presence of clinical and electrophysiological abnormalities of peripheral nerve involvement in patients with diagnosed DM.

Aim:

(1)The present study aimed to investigate the nerve conduction velocity in diabetic patients. (2) To determine the association of motor nerve conduction functions between diabetic patients and control persons. (3) To correlate the finding of the study with clinical condition of the diabetic patients. (4) To compare the NCS data of healthy subjects with standard values given by other authors.

Material and Methods:

The study was performed on 50 subjects both cases and controls of age group between 14 to 80 years in the department of Physiology after approval from Human Research Ethics committee of GMERS Medical College, Gandhinagar. After explaining procedure of the study, written and informed consent of the subjects was taken. Subjects were randomly selected on the basis of inclusion & exclusion criteria.

Inclusion criteria: Subjects of age between 14-80 years, Subjects of same race, Subjects of both the genders, from college and hospital at GMERS and Civil Hospital, Gandhinagar. Group 1: 25 diabetic patients under control without complications with duration of diabetes more than 1 year, Group 2: 25 non- diabetic patients.

Exclusion criteria: alcoholics, hypertensives, smokers, pregnant females, patient with diabetic complications, entrapment neuropathy, nutritional deficiency, endocrinal disorders, myopathy, muscle weakness, neuromuscular diseases inherited neuropathy, stroke, any pathology of upper limb, advanced liver and renal diseases. Subjects with any Congenital Anomaly, H/O trauma/fracture, Uncooperative subject, H/O psychiatric disorder.

Detailed clinical history was taken and thereafter relevant clinical examination was

performed. Neurological examination includes the examination of cranial nerves, motor system, sensory system (exteroception), including touch, temperature, pressure, vibration, proprioception, vibration sense and heat sensation, and tendon reflexes. Anthropometric measures were obtained and BMI was calculated. Vital signs were also recorded. Study participants underwent nerve conduction studies including electrophysiological measures using established methodology described by Mishra and Kalita[3].

RMS EMG EP Mark II Recorders and Medicare Systems (Chandigarh India) was used for determination of Nerve Conduction velocity.

Study included nerve conduction velocity for the motor part of median and ulnar nerves.

Result:

The study was performed in 25 cases and 25 controls (healthy subjects), of age group between 14 to 80 years in Department of physiology GMERS medical college, Gandhinagar. Subjects were randomly selected on the basis of inclusion & exclusion criteria.

A detail of the Procedure was explained to the subjects prior to recording of objectives. Relevant clinical history was taken and clinical examination was done. Age, sex, height (in cm), and weight (in kg) were recorded .BMI was calculated.[4] Right Median and Ulnar nerves were tested for motor conduction and following parameters were recorded:-

1. Latency in milli - seconds (ms)
2. Amplitude in milli - volt (mv) and micro-volt (µV).
3. Conduction velocity - meters per second (m/s).

Statistical Analysis:

Values are expressed as mean ± SD. Microsoft Office Excel 2007 and SPSS statistics 17.0 software was used for data analysis. Comparison between two groups is done by paired't' test.

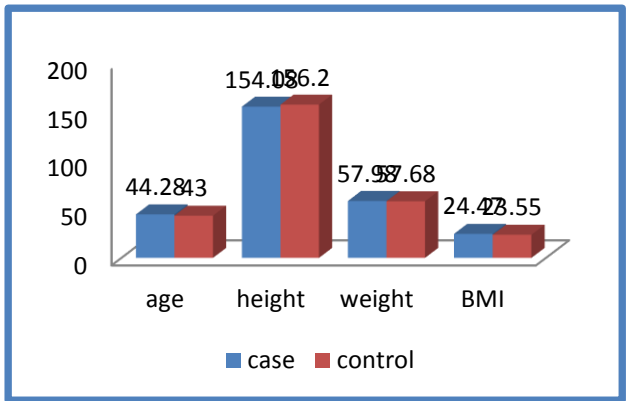
The probability level for significance was set at $P < 0.05$. $P > 0.05$ is considered as non- significant.

Table 1: Comparision of Various anthropometric measurements of cases and controls:

Parameter	Case (n = 25) MEAN±SD	Control (n = 25) MEAN±SD	P-value
Age (years)	44.28 ± 14.13	43 ± 11.9	> 0.05
Height (meters)	154.08± 7.29	156.2± 8.07	> 0.05
Weight (kg)	57.98± 10.1	57.68± 10.43	> 0.05
BMI (kg/m^2)	24.47± 4.5	23.55± 3.43	> 0.05

[BMI: body mass index; n: number of case]

GRAPH 1: **Comparision of Various anthropometric measurements of cases and controls**:



The demographic profile of subjects was comparable in two groups the cases and the controls. **Table 1** and **graph 1** shows the age, height, weight and BMI distribution of these groups. The mean age of group 1 subjects (44.28±14.13) was not significantly different from group 2 subjects (43±11.9), mean height of group 1 subjects (154.08±7.29) was not significantly different from group 2 subjects (156.2±8.07), mean weight of group 1 subjects (57.98±10.1) was not significantly different from group 2 subjects (57.68±10.43),and BMI of group 1 subjects (24.47±4.5) was also not significantly different from group 2 subjects (23.55±3.43) (p>0.05) .

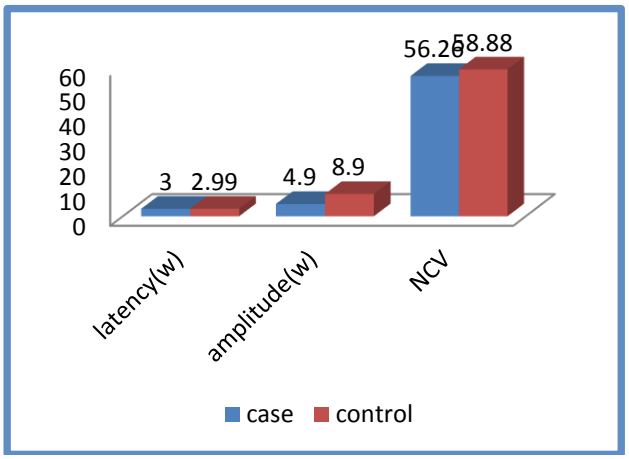
Table 2: Comparision of Right and left Median Nerve Conduction Study (motor) of Cases and Controls:

Nerve	Parameters	Case (N=25) MEAN± SD	Control (N=25) MEAN± SD	P-value
Reight median nerve (motor)	Latency (ms)*	3± 1.41	2.99± 1.18	> 0.05
	Amplitude (mv)**	4.9± 4.39	8.9± 6.76	< 0.05
	NCV (m/s)	56.26± 13.42	58.88± 4.95	> 0.05
Left median nerve (motor)	Latency (ms)*	2.82± 1.23	2.78± 1.04	> 0.05
	Amplitude (mv)**	5.44± 5.38	7.09± 4.59	> 0.05
	NCV (m/s)	55.19± 13.53	57.2± 0.23	> 0.05

*Distal motor latency measured from onset of action potential.

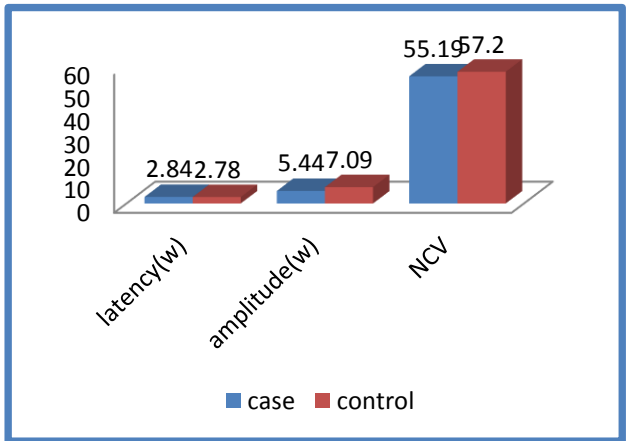
**Amplitude measured from peak to peak

Graph 2: Comparasion of Right median (Motor) nerve conduction study:



On analyzing **table – 2** and **graph - 2**, The Nerve conduction parameters of motor part of right median nerve in 25 cases and 25 controls, The conduction velocity was found to be lower in cases as compared to controls and Mean NCV in cases was 56.26(mV) and in controls was 58.88(mV) and it was not significantly lower in cases as compared to controls (p>0.05) The mean distal latency and CMAP amplitude of right median motor nerve was found lower in cases than controls. The amplitude in cases was 4.9 (mv) and in controls was 8.9 (mv) and the difference is statistically significant. (p<0.05)

Graph 3: Comparision of Left median nerve (motor) conduction study:



On analyzing **table – 2** and **graph – 3**,The Nerve conduction parameters of motor part of left median nerve in 25 cases and 25 controls, The conduction velocity was found lower in case as compared to controls but not significant. Mean NCV in cases was 55.19(mV) and in controls was 57.28(mV) (graph – 3)The mean distal latency and CMAP amplitude of left median motor nerve was found lower in cases than controls but the difference is statistically insignificant. (p>0.05)

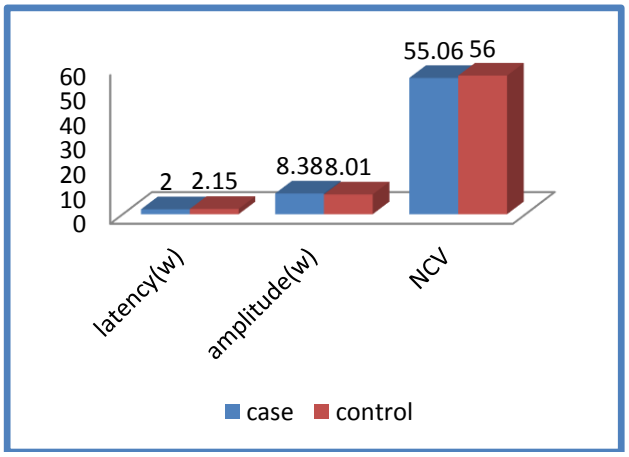
Table 3: Comparision of Right and left Ulnar Nerve (motor) Conduction Study of Cases and Controls:

Nerve	Parameters	Case (N=25) MEAN ±SD	Control (N=25) MEAN± SD	P-value
Reight ulnar nerve (motor)	Latency (ms)*	2± 0.83	2.15± 0.77	> 0.05
	Amplitude (mv)**	8.83± 6.33	8.01± 5.45	> 0.05
	NCV	55.06±	56±	>

	(m/s)	10.56	6.39	0.05
Left ulnar nerve (motor)	Latency (ms)*	1.91± 0.78	4.76± 12.6	> 0.05
	Amplitude (mv)**	7.27± 4.6	7.32± 5.5	> 0.05
	NCV (m/s)	54.02± 7.71	56.49± 8.51	> 0.05

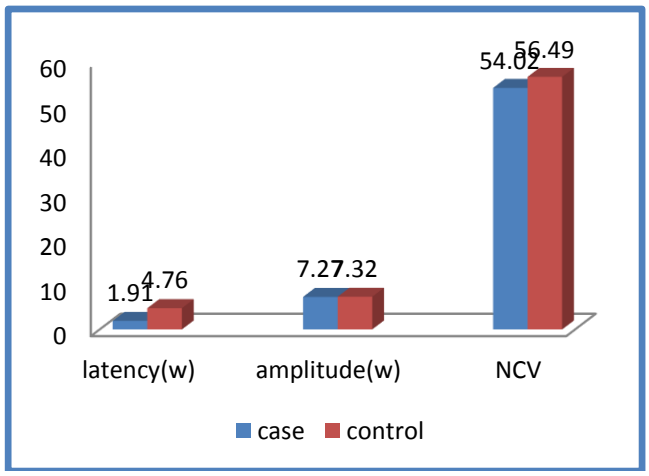
*Distal motor latency measured from onset of action potential.
**Amplitude measured from peak to peak.

Graph 4: Comparision of Right ulnar nerve (Motor) conduction study:



On analyzing **table - 3** and **graph - 4**, The nerve conduction parameters of motor part of right ulnar nerve in 25 cases and 25 controls, The nerve conduction velocity was found to be lower in cases as compared to controls. Mean NCV in cases was 55.06(mV) and in controls was 56 (mV) which shows that NCV was insignificant (P<0.05) The mean distal latency of ulnar motor nerve was found lower in cases than controls but the difference is statistically insignificant.(p>0.05) The mean amplitude of ulnar motor nerve was found higher in cases than controls but the difference is statistically insignificant(p>0.05)

Graph 5: Comparision of Left ulnar nerve (Motor) conduction study :



On analyzing **table -3** and **graph - 5**, The nerve conduction parameters of motor part of left ulnar nerve in 25 cases and 25 controls , The nerve conduction velocity was found lower in cases as compared to controls. The Mean NCV in cases was 54.02 (mV) and in controls was 56.49(mV) which is insignificant (P>0.05). The mean distal latency and CMAP amplitude of left ulnar motor nerve was found lower in cases than control but the difference is statistically insignificant. (p>0.05)

Discussion:

Neurologic complications associated with diabetes involve the peripheral nervous system. The diabetic neuropathies include several distinctive clinical symptoms and signs of peripheral nerve dysfunction in diabetics after exclusion of other causes. Nerve conduction studies are frequently used to assess the presence of severity of peripheral nerve involvement in patients with diabetes. They are sensitive, specific, reproducible, and easily standardised. In our study we correlated findings of nerve conduction studies of diabetics and non-diabetics .

Table 2 and 3 shows that conduction velocity is decreased in the median motor and ulnar motor nerves in cases as compared to controls. Paired t-test analysis showed that this difference is not significant (p value> 0.05). Aditya prakash kulkarni et al. also shows that motor conduction velocities of median nerve was significantly delayed in diabetics

compared to the controls[5]. suljic E et al shows that diabetic polyneuropathy is significantly more present in patients older than 60 years who have type 2 diabetes mellitus and values of motor conductivity at median nerve had a significant difference in all parameters (distal latency, amplitude, MCV) in the group with DM type 1[6].

Hussain G et al. also says that nerve conduction study is more powerful test and can help in diagnosing cases of neuropathy. This study showed significant electrophysiological changes with duration of disease[7]. Increase in age, increase in the duration of diabetes, and the male gender can significantly increase the risk of abnormal nerve conduction velocity[8].

Motor neuropathies (CMAP) which is not picked on routine clinical examination are observed in nerve conduction studies. The result showed that the age is inversely proportional to motor NCV in diabetic patients. Though it is known that NCV in generally decreases with increasing age but in diabetic individuals the decrease is more pronounced[9]. The commonest abnormality in diabetics is reduction of amplitude of motor or sensory nerve action potential because of axonopathy[10]. In this study both motor and sensory NCV and amplitude have been decreased in diabetic cases.Though it is stated that motor changes are not predominant in NIDDM.

In a study performed in Bangladesh also showed predominant motor involvement in both IDDM and NIDDM individuals[11]. Diabetic neuropathy in the upper limb is less severe than in the lower limb, and distal segments of nerves are affected before proximal segments [12,13] . This is generally attributed to the increased vulnerability of longer nerves [14]. For these reasons the assessment of neuropathy in this study has involved a particular emphasis on the relatively less severely involved upper limbs, which might be expected to be more responsive to treatment.

Conclusion:

Nerve conduction studies are chiefly of use in confirming the physiological extent of nerve involvement in diabetes patients. Early detection of neuropathy using NCS helps in the prevention of its long-term complications. In our study we found that nerve conduction detects neuropathy changes even before signs develop. Severity of neuropathy is also well established by nerve conduction findings. Defining the pattern of nerve involvement in diabetic neuropathy enables clinicians to set a protocol for screening of patients with subclinical diabetic neuropathy and adopt a proper protocol for early management of treatment.

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