HBA1C – PREDICTOR OF EARLY PERIPHERAL NEUROPATHY IN ASYMPTOMATIC CASES OF DIABETES MELLITUS

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Abstract: Background & objectives: Electro diagnostic studies are a reproducible and noninvasive method of assessing peripheral nerve function which is deteriorated in metabolic diseases, especially Diabetes Mellitus. These studies provide a good incite in the progress of the associated dysfunctions. **Method:** 30 cases of neurologically asymptomatic Diabetes Mellitus and equal number of normal non-diabetic controls were subjected to nerve conduction study. **Results:** Mean Age of cases (45.03±9.99), Height of cases (159±7.02), MCV (P< 0.001), SCV (p<0.001) **Interpretation & conclusion:** Nerve conduction parameters were altered among the neurologically asymptomatic diabetic cases.

Key Words: Diabetes Mellitus, Nerve conduction study, Peripheral Neuropathy

Abbreviations: DM, Diabetes Mellitus; MCV, Motor nerve conduction velocity; NCS, nerve conduction study; SCV, Sensory nerve conduction velocity.

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Introduction:

A subspecialty of clinical neurophysiology include nerve conduction studies to diagnose, evaluate, and treat patients with impairments of the neurologic, neuromuscular, and/or muscular systems. It is a non invasive technique. Nerve Conduction Study is a diagnostic test of the peripheral nervous system, especially useful in evaluating diseases of the muscles, nerves, and nerve roots. It records electrical activity of the muscles and the passage of them along nerves in the limbs. The diagnosis of disease or injury is done by applying electric stimulation to various peripheral nerves both Orthodromically and Antidromically.Diabetes is the most common cause of persistent (chronic) peripheral neuropathy. The neuropathies in Diabetes Mellitus can be detected by slowing of motor and sensory functions of peripheral nerves, thus Nerve conduction study is a reliable tool for the detection of neuropathy in Diabetes Mellitus at a very early stage. Hence the present study aims to detect the nerve dysfunction at its initial stage and find an association between the nerve conduction velocity and increase in the blood sugar levels.

Materials and Method:

The present study involved neurologically asymptomatic cases of Diabetes Mellitus, it was conducted in the department of physiology, Baroda medical college and was approved by the institutional ethics committee for human research (IECHR), Baroda medical college and S.S.G. Hospital. After counseling and complete written and informed consent, 30 neurologically asymptomatic Diabetes Mellitus cases from Outpatient Department in Department of Medicine were included in the study. Then detailed history and clinical examination was done and their HbA1c was measured. The control group was pair matched with that of the case for sex match. The cases and control were then subjected to nerve conduction test for motor and sensory nerve conduction on median nerve in dominant hand.The results of the neurologically asymptomatic Diabetes Mellitus cases were then compared to the results of the controls.The levels of HbA1c were correlated with nerve conduction parameters.

Inclusion criteria:

- Neurologically asymptomatic Cases of Diabetes Mellitus
- Cases within 18 to 60 years of age
- Control group matched for age and pair matched for sex as that of the neurologically asymptomatic Diabetes Mellitus cases.

Exclusion criteria:

- Neurologically asymptomatic cases of Diabetes Mellitus with any apparent coexisting condition
- Neurologically symptomatic cases of Diabetes Mellitus
- Any uncooperative volunteer or Diabetes Mellitus case.

Result:

The mean age, height and weight of the 30 neurologically asymptomatic cases as well as equal numbers of controls was calculated.

Table:1 physical parameters of the cases as well as the controls

	Neurologically asymptomatic Diabetes cases		Controls	
	Mean±SD	Range	Mean±SD	Range
Age (years)	45.03±9.99	26 – 60	44.80±9.79	26 – 60
Height (Cm)	159±7.02	144.78 – 176.78	161.04±6.12	151 – 176.84
Weight (Kg)	59.36±12.56	36 – 83	59.30±8.60	40 - 76

Orthodromic motor and sensory nerve conduction was done on median nerve and results of both the cases and controls were compared. P value < 0.05 was taken as significant.

The mean motor nerve conduction velocity in Diabetic cases was quite low than that of the Non Diabetic controls as shown in the table: 2 this difference was highly significant ($p<0.05$).A highly significant difference was found in the latency of motor nerve conduction among the two groups, the motor nerve conduction latency being lower in the cases as compared to that of controls. Upon comparison of the Amplitude of motor nerve conduction among the two groups the motor nerve conduction amplitude was significantly low in the cases as compared to the controls.

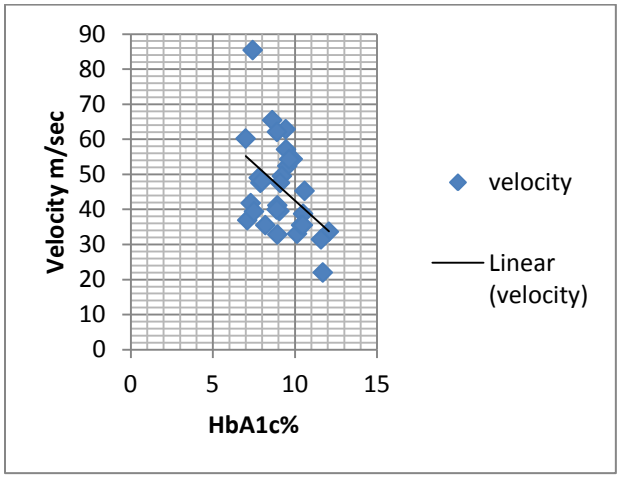
Table:2 Comparison of motor nerve conduction parameters between cases and controls

		Velocity (m/s)	Latency (ms)	Amplitude (mv)
Neurologically asymptomatic Diabetes cases	Mean±SD	8.08±2.54	2.64±2.25	45.98±13.02
Controls	Mean±SD	4.27±2.33	5.2±3.36	63.99±8.29
		t=6.38 p<0.0001	t= -5.10 p<0.0001	t= 3.53 p = 0.0008

Similarly the sensory nerve conduction velocity was significantly low amongst the cases as compared to the controls as shown in table: 3. while the sensory latency was prolonged amongst the cases as compared to the controls.

Table 3: Comparison of sensory nerve conduction parameters between cases and controls

Graph1: Correlation between HbA1c levels and motor nerve conduction velocity in Diabetic cases.



Correlating the levels of HbA1c with that of motor nerve conduction velocity in the Diabetic cases, a negative correlation was found which was statistically significant (r = -0.44). HbA1c can be used as a strong predictor for subclinical neuropathy in Diabetics as shown in figure: 1.

Discussion:

as seen in our study, a study conducted by**Anita et al**[1]showed that as compared to healthy volunteers, asymptomatic Diabetic patients show significant decrease in Sensory nerve conduction velocity. There is significant reduction in amplitude and conduction velocity of all the sensory nerves in neurologically asymptomatic diabetic patients as compared to healthy volunteers. Most commonly affected nerves are median nerve in upper limb and Superficial Peroneal in lower limb. A similar study by **Imada et al**[2] affirmed that out of total 120 cases of Diabetes in the study, median sensory nerve conduction velocities were slowed in 40% of diabetic cases.

In a study in Italy similar to present study, Electrophysiological alterations were found in 32 (82%) out of 39 DM patients, and more than half of them (62.2%) showed multiple (two to five) abnormal parameters. 42% of the patients had NCS alterations suggestive of distal median mononeuropathy, implying that metabolic factors in DM make the median nerve more susceptible to focal entrapment. Reduced sensory nerve action potential (SNAP) amplitude was observed in the median nerve in 70% of the patients.[3]**Ali et al**[4] studied that no significant variation in median motor nerve conduction velocity and amplitude of compound muscle action potential of median nerve were found among the cases and control group. But median sensory nerve action potential (SNAP) differed significantly ($p < .001$) in diabetic subjects having lower amplitudes. Median sensory nerve conduction velocity also showed significant difference among the groups ($p < 0.01$). However in present study, cases showed a significant reduction in their median motor conduction velocity and amplitude.**Huang et al**[5] observed that the deterioration in nerve conduction velocity was marked in patients with a mean HbA1c of more than 8.5%. This downward trend was also noted in nerveconduction amplitude with increase in mean HbA1c.

Conclusion:

There was a significant difference in the motor nerve conduction velocity, latency and amplitude between the cases and the controls. Similar significant difference in the sensory nerve conduction velocity, latency and amplitude was seen between both the groups.

Nerve conduction studies abnormalities commonly exist in diabetic patients in the subclinical stages of polyneuropathy, and are highly correlated to HbA1c levels.[6]

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