

Nerve Conduction Abnormalities In Newly Diagnosed Type 2 Diabetes Mellitus Patients

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Abstract: Background: Diabetes Mellitus is known as the epidemic of the century. Retinopathy, Neuropathy and Nephropathy are the most common complications associated with the disease. By the time diabetes is diagnosed, Peripheral neuropathy is the common presentation due to clinically silent impaired glucose tolerance for prolonged period. Material And Methods: The present study included 40 newly diagnosed (within 3 months) diabetic patients and it was conducted at B.J. Medical College, Ahmedabad. Patients under the study were investigated for blood sugar level and nerve conduction studies of right upper and lower limbs. Result: In 40 (15 male, 25 female) type 2 Diabetes mellitus patients, Mean age was 54.6 ± 12.5 years. Out of 40 patients 12 patients had par aesthesia in the lower limbs of them 4 had sensory deficit and 3 had motor deficit clinically. 15 patients (37.5%) had abnormal sensory conduction and 10 patients (25%) had abnormal motor conduction. F wave latencies were also prolonged in both upper and lower limbs. Conclusion: Type 2 diabetic patients are at high risk of developing diabetic peripheral neuropathy. So, regular blood glucose level checking and maintaining by proper medical treatment and self examination for sensory and motor deficit of both upper and lower limbs should be advised. [Amin R Natl J Integr Res Med, 2020; 11(5):31-34]

Key Words: Type 2 Diabetes Mellitus, Nerve conduction study, Peripheral neuropathy

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Introduction: Type 2 Diabetes Mellitus is known as the epidemic of the century. Diabetes mellitus is characterized by hyperglycaemia, Polydipsia, Polyphagia and polyuria. Industrialization, Urbanization, Table work jobs, sedentary lifestyle has caused increase in incidence of Diabetes Mellitus. Second largest number of population with Diabetes mellitus lives in India¹.

Diabetes Mellitus is associated with various microvascular and macrovascular complications like retinopathy, neuropathy and nephropathy. Peripheral neuropathy remains to be a major complication in diabetic patients. There may be for a prolonged period impaired glucose tolerance before the actual disease is diagnosed.

So, hyperglycaemia related complications may be there by the time person is diagnosed with type 2 Diabetes mellitus. In peripheral neuropathy various sensory and motor deficits can occur. This study is aimed for finding nerve conduction abnormalities² in newly diagnosed type 2 Diabetes mellitus patients.

Material & Methods: A total of 40 consecutive newly diagnosed cases of Type 2 Diabetes mellitus by their clinical presentation and fasting, postprandial, random blood sugar as well as HbA_{1c} tests were studied for the abnormalities in nerve conduction studies. For assessing Diabetic neuropathy various clinical scores are also available. Diabetic neuropathy examination

score, Neuropathy symptom score, Neuropathy disability scores can be used to measure severity of diabetic neuropathy. The study was done after approval from the institutional ethics committee. An informed consent was also taken from the patients prior to inclusion in the study.

Inclusion Criteria: Newly diagnosed type 2 diabetic patients. (Diagnosis according to American Diabetes Association¹). Patients of both sexes and between 40-70 years of age were included.

Exclusion Criteria: Pre-existing heart conditions, Hypertensive patients, patients with co-morbid thyroid diseases, chronic smokers, Alcohol drinkers and morbid obesity were excluded. Patients with Chronic obstructive pulmonary disorder, severe anaemia, any other endocrinal disorder. Patients with neuropathy due to some other pre-existing disease.

Investigations included fasting blood sugar level, postprandial blood sugar level, random blood sugar level, HbA_{1c}, BMI calculation. Detailed sensory and motor examination was done. Motor nerve conduction study was done on common peroneal, ulnar and median nerves. F wave elicitation was done on common peroneal, ulnar and median nerves. Sensory nerve conduction study was done on median, ulnar, superficial peroneal and sural nerves. All the nerve conduction studies were done using RMS EMG EP Mark-II electrophysiology machine. Standard

system settings were used and the data obtained was compared with normal data². Statistical analysis was done by using Microsoft excel 2019 and was analysed using SPSS v26. Paired ‘t’ test was used for statistical analysis. P value <0.05 is considered as significant.

Results: The present study included 40 type 2 diabetic patients aged between 40 to 70 years (15 male,25 female) and was conducted at B.J. medical college, Ahmedabad. Overall, there was preponderance of female patients consisting of 62.5% of total study population. Mean age of the study population was 54.6±12.5 years. Mean BMI of the patients was 25.96±3.65 kg/m². Out of 40 patients 12 patients had paraesthesia in the lower limbs of them 4 had sensory deficit and 3 had motor deficit clinically. 15 patients(37.5%)

had abnormal sensory conductions and 10 patients(25%) had abnormal motor conductions. F wave latencies were also prolonged in both upper and lower limbs.

Nerve conduction studies were normal in 11 patients. Mean Fasting blood glucose values were mg/dl (182.69 ± 43.57mg/dl), Mean postprandial blood glucose values were (275.71 ± 83.28), and the Mean HbA1c values were (10.69 ± 2.74%).

In sensory nerve conduction studies Nerve conduction velocity was found to be reduced in 8 patients and decreased sensory nerve action potential (SNAP) amplitude in 9 patients. In Motor nerve conduction studies reduced compound muscle action potential (CMAP) amplitude was found in 6 patients.

Table: 1 Nerve Conduction Parameters Of Right Upper Limbs Of Type 2 Diabetic Patients Compared With Normal Values.

Parameters	Nerves	In patients	Normal	P value
1.Distal motor latency(ms)	Median	3.78±0.81	3.04±0.28	<0.05
	Ulnar	2.54±0.31	2.44±0.26	>0.05
2.CMAP amplitude(mV)	Median	10.52±3.61	11.10±3.47	>0.05
	Ulnar	9.54±1.89	9.46±1.79	>0.05
3.Motor conduction velocity(m/s)	Median	53.55±5.32	63.51±5.12	<0.05
	Ulnar	54.89±4.46	62.87±7.33	<0.05
4. F wave latency (ms)	Median	27.46±2.54	23.78±2.31	<0.05
	Ulnar	26.89±3.32	23.49±1.98	<0.05

(p value <0.05 is considered significant an p value >0.05 is considered as non significant.)

Table: 2 Nerve Conduction Parameters Of Right Upper Limbs Of Type 2 Diabetic Patients Compared With Normal Values.

Parameters	Nerves	In patients	Normal	P value
1.SNAP Amplitude(microvolt)	Median	13.61±7.54	15.11±6.33	>0.05
	Ulnar	10.45±4.35	12.11±4.54	>0.05
2.Sensory conduction velocity(m/s)	Median	50.52±5.13	57.06±5.09	<0.05
	Ulnar	54.65±6.41	58.41±6.47	>0.05

(p value <0.05 is considered significant an p value >0.05 is considered as non significant.)

Table: 3 Nerve Conduction Parameters Of Right Lower Limbs Of Type 2 Diabetic Patients Compared With Normal Values.

Common Peroneal Nerve	Patients	Normal	P value
1.Distal motor latency(ms)	4.34±0.89	3.54±0.68	<0.05
2.CMAP amplitude(mV)	4.41±1.98	6.77±1.88	<0.05
3.Motor conduction velocity(m/s)	43.45±6.54	51.60±5.98	<0.05
4. F wave latency (ms)	50.04±5.71	45.53±5.01	<0.05

(p value <0.05 is considered significant an p value >0.05 is considered as non significant.)

Table: 4 Nerve Conduction Parameters Of Right Lower Limbs Of Type 2 Diabetic Patients Compared With Normal Values.

Parameters	Nerves	In Patients	Normal	P Value
1. SNAP Amplitude(microvolt)	Superficial Peroneal	9.78±5.34	16.89±7.28	<0.05
	Sural	12.58±7.25	21.09±8.02	<0.05
2. Sensory conduction velocity(m/s)	Superficial Peroneal	46.33±4.33	56.01±8.65	<0.05
	Sural	50.47±6.97	56.22±8.90	<0.05

(p value <0.05 is considered significant an p value >0.05 is considered as non significant.)

Discussion: In this present study 40 consecutive newly diagnosed Type 2 Diabetic patients have been taken in the age group of 40-70 years. After confirming diagnosis of Type 2 Diabetes mellitus nerve conduction studies have been performed on these patients. In right upper limb distal motor latency of median nerve has been significantly increased while that of ulnar nerve has no significant alteration. Similar results were found in I Mori et al³ and Dutta A et al⁴ studies.

Compound muscle action potential amplitude of both median and ulnar nerves have not significantly altered. Motor conduction velocity in right upper limb in both ulnar and median nerves have been decreased. Similar results were found in E Tupkovic et al⁵ study. F wave latency of both right ulnar and median nerves have been significantly increased compared to normal. Similar results were found in Hua pan et al⁶ study.

Sensory nerve action potential amplitude in right upper limb in both the nerves have not been significantly affected. Sensory conduction velocity in right median nerve has been significantly decreased while that of ulnar nerve has not been significantly changed. Similar results were found in K Tehrani et al⁷ and Singh RB et al⁸ studies.

Distal motor latency in right common peroneal nerve has been significantly increased compared to normal values of lab. Compound muscle action potential amplitude of right common peroneal nerve has been decreased significantly compared to normal. Motor conduction velocity in common peroneal nerve has been significantly decreased compared to normal. F wave latency has been significantly increased of common peroneal nerve compared to normal. Similar results were found in X kong et al⁹ and Gill HK et al¹⁰ studies. Sensory nerve action potential amplitude of both sural and superficial peroneal nerves of right lower limb have been significantly decreased in diabetics compared to normal. Sensory conduction velocity of both sural and superficial

peroneal nerves of right lower limb have been significantly decreased in diabetics compared to normal. Similar results were found in AP Kulkarni et al¹¹ study.

Physiological Basis: In type 2 Diabetes mellitus due to genetic and environmental factors there occurs insulin resistance and impaired insulin secretion. Due to that there occurs dyslipidaemia and accumulation of reactive oxygen species in skeletal muscles. In hyperglycaemic state glucose is metabolized via various alternative pathways and end products of these pathways are responsible for various micro and macro vascular complications associated with type 2 Diabetes mellitus.

Advanced glycation end products, Polyol(sorbitol) pathway, Diacyl glycerol pathway, Hexosamine pathway causes vascular endothelial damage, reduced nerve blood flow, non enzymatic glycosylation of nerve proteins and atherosclerotic changes. All these changes are responsible for various alterations that have been found in present nerve conduction study.

Conclusion: Type 2 Diabetic patients are at a great risk of developing peripheral neuropathy. In Type 2 diabetic patients regular glucose level detection and control to prevent related neurological complications are advised. self examination for sensory and motor deficit of both upper and lower limbs should also be advised. Nerve conduction studies should also be done for early diagnosis of subclinical impairment of nerve function in newly diagnosed diabetic patients.

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