

COMPARISON OF MOTOR AND SENSORY NERVE CONDUCTION IN UPPER LIMB OF DIABETICS AND NON DIABETICSAjay Kumar¹, Neelu Saluja², Ritu Purohit³, Seema Choudhary⁴**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: The physiological properties of nerve and muscle are usually modified due to patho physiological changes resulting from many diseases like diabetes. Impaired mobility and compromised dexterity leading to difficulties in daily life. Hand function in diabetes is affected mainly due to involvement of median nerve. Diabetic neuropathy the common complication of diabetes can be assessed electro physiologically by nerve conduction studies. Therefore, we analyzed both motor and sensory nerve conduction on upper limb nerves. Distal latency, Amplitude and conduction velocity were measured in both upper limbs by using RMS EMG EP II machine with surface and ring electrodes. It was found that distal latencies of both nerves were higher in diabetics than non-diabetics. The difference was statistically significant. Motor responses are more reduced below normal as compared with sensory responses in diabetics. Our study also revealed decreased amplitude and conduction velocity among cases. Our findings conclude that the nerve conduction studies are important in early detection of peripheral neuropathy so that prevention and management can be done in earliest possible way.

KEYWORDS: Type II Diabetes Mellitus, Peripheral neuropathy, Distal Latency, conduction velocity.

INTRODUCTION: Diabetes mellitus is one of the commonest metabolic syndrome in nearly all countries of the world. Diabetes in our country is increasing day by day due to changing life style which leads to reduced physical activity and obesity.¹ The associated complications of diabetes like peripheral neuropathy may be the first clinical sign of disease.^{2,3}

Diabetic peripheral neuropathy (DPN) is the most commonly reported long term complication of Type II Diabetic patients.⁴ Diabetic peripheral neuropathy affects nerves of both upper and lower limbs. Affected patient leads to functional limitations and sometimes required amputation of the limb which reduces the quality of life. However, progression of neuropathy can be reduced by early detection and intervention.⁵

Nerve conduction studies are helpful in early detection of neuropathy. These studies are most sensitive, specific, non-invasive and repeatable, hence useful in early evaluation in Diabetic peripheral neuropathy. Mostly nerve conduction studies have been accepted as an essential part of diagnosis for DPN as it has many benefits.^{6,7}

The present study was designed to study nerve conduction in apparently normal non-diabetics and diabetics patients to identify the presence of subclinical Diabetic peripheral neuropathy in upper limbs by means of electro diagnostic studies.

MATERIAL AND METHODS: The present study was carried out in the department of Physiology in Neuro physiology lab with collaboration of department of Medicine Maharaja Agrasen Medical College Agroha, Hisar. A total of 80 subjects including both males and females in the age group of 40-

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70 years were selected for study. Out of these 40 subjects marked as cases were known diabetics diagnosed with Type II Diabetes Mellitus and attending diabetic clinic in the department of Medicine while 40 were age and anthropometrically matched apparently healthy controls. Participants from both the groups having any other disorder like musculoskeletal disease, hypertension, alcoholics and smokers were excluded from the study.

Comparative data in relation to age, sex, height, weight and BMI were taken from both the groups. Detailed socio-demographic data, family history and medical history were taken from all the subjects in both the groups and their physical and clinical examination was done. The details of the study were explained to all the subjects and their informed consent was taken. Before starting the test blood sample was collected for analyzing random blood sugar followed by nerve conduction studies.

Anthropometric measurements (height & weight) were taken by using stadiometer on barefoot and electronic weighing machine. Random blood sugar levels of every subject were estimated by glucometer (glucose oxidase method). Motor and sensory nerve conduction study of median and ulnar nerves were performed on both side limbs in an environment with temperature ranging between 21-25 degree Celsius using computerized RMS EMG EP II machine with surface and ring electrodes. With the help of stimulating electrodes supramaximal stimulation was given at two different sites (distal & proximal) to obtain compound motor action potential (CMAP) in motor study while single distal stimulation of 30-35 millivolt was given to obtain sensory nerve action potential (SNAP).

For median motor study the distal stimulation (S1) was given at middle of the wrist between tendon of flexor carpi radialis and Palmaris longus whereas proximal stimulation (S2) was given at anterior cubital fossa over the brachial artery pulse. Active surface electrode (G1) placed over abductor pollicis brevis muscle and reference electrode (G2) placed over first metacarpophalangeal (MCP) joint. For median sensory study ring electrodes were used over index finger where G1 placed at MCP joint and G2 3-4 cm distal to it. The single stimulation was given at middle of the wrist.

For ulnar motor study the distal stimulation (S1) was given on medial aspect of wrist adjacent to flexor carpi ulnaris and proximal (S2) stimulation was given at elbow joint, 3-4 cm distal to medial epicondyle. The electrodes G1 placed over muscle belly of abductor digiti minimi and G2 at 5th MCP joint. During sensory study ring electrode were used over little finger where G1 placed over MCP joint and G2 3-4 cm distal to it and stimulation was given at medial aspect of wrist. Ground electrode in both the studies placed in between stimulating electrode and recording electrode. Distance between S1 and S2 was measured in mm in motor study while in sensory study distance was measured from stimulating site (S1) to recording electrode. Amplitude, conduction velocity and distal latencies were measured. Statistical analysis of data was done using t test and Microsoft Excel 2007.

RESULTS: In our present study 40 male diabetic subjects with duration of disease of 3.24 ± 1.35 years were compared with 40 age matched controls. On comparing the motor component of both upper limb nerves (Median and ulnar) in both the groups (Table 2) it was found that amplitude of CMAP and conduction velocities are reduced which was ($P < 0.0001$) statistically highly significant among diabetics. Results also show significant ($P < 0.05$) increase in motor distal latency in median and ulnar nerve of both sides in diabetics.

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On comparing the sensory component of nerves of both the groups (Table 3) it was found that distal peak latency of (right and left) median and ulnar nerves were significantly higher ($P < 0.05$) in diabetics except in right median nerve which is not quite statistically significant ($P < 0.0853$). Highly significant results ($P < 0.0001$) were seen with decreased amplitude and conduction velocities of median and ulnar nerve of both sides in diabetics.

DISCUSSION: The present study reveals alteration in electrophysiological parameters (motor and sensory) of median and ulnar nerves among diabetics. There are several mechanisms by which hyperglycemia results in nerve damage. Hyperglycemia reduces myoinositol in nerves but increases glucose influx via polyol pathway and reduces Na K ATPase activity. Increase in sodium, potassium fructose and sorbitol concentrations in the nerve absorb water through osmosis. This accumulated water causes compression of the nerve, which leads to decreased axonal transport. Pathological features of diabetic peripheral neuropathy include distal axonal loss with focal demyelination and regeneration.^{8,9} Hyperglycemia also leads to increased intracellular glucose and cellular toxicity in the endothelial cells of capillaries associated with peripheral nerves.¹⁰ Ischemia of the nerves with endothelial injury due to poor glycemic control releases inflammatory mediators which are important in long term prediction of Diabetic peripheral neuropathy.

Many previous studies have also found nerve conduction study alterations suggestive of neuropathy in diabetics. Kimura J¹¹ et al also found increased latency and decreased conduction velocity in lower limb nerves in diabetics as compared to normal subjects. W. Hoffman et al¹² found significantly slower conduction velocity in diabetics in both upper and lower limb nerves. Though not significant, tendency for reduction of ulnar motor nerve conduction velocity and median sensory velocity were found in patients of diabetes without neuropathy when compared with non-diabetic healthy controls in a study by Hussain Gauhar et al.¹³ Median and ulnar nerves in diabetics are less studied and required further evaluation.

CONCLUSION: Our findings suggest usefulness of NCS in early detection of peripheral neuropathy. Each newly diagnosed diabetic subject should be screened for neuropathy by electrophysiological evaluation of both upper and lower limb nerves. Nerve conduction studies should be included in the routine evaluation of diabetic patients which may improve the diagnostic yield. Early detection and management of diabetic peripheral neuropathy improves quality of life among patients.

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Parameters	Diabetics		Non Diabetics	
	Mean	SD	Mean	SD
Participants (n)	40		40	
Age(years)	62.74	±6.22	57.33	±5.46
Weight (kgs)	74.8	±12.84	70.5	±7.21
Height (m)	1.69	±0.08	1.67	±0.05
BMI (kg/m ²)	25.70	±3.11	23.68	±2.63
RBS (mg%)	146.42	±18.13	95.04	±12.88

Table 1: Baseline Anthropometric data of the Participants

Parameters	Subjects	Median		Ulnar	
		Left	Right	Left	Right
Amplitude (mv)	Diabetics Mean±SD	5.05±2.29	4.88±2.16	6.17±2.44	5.68±3.18
	Non Diabetics Mean±SD	8.32±2.12	8.11±3.44	8.96±2.11	8.65±2.17
	P value	0.0001	0.0001	0.0001	0.0001
CV (m/sec)	Diabetics Mean±SD	44.03±3.35	45.25±5.73	46.82±3.11	46.24±3.86
	Non Diabetics Mean±SD	50.21±3.18	49.95±3.37	51.24±3.08	51.86±2.49
	P value	0.0001	0.0001	0.0001	0.0001

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Motor Distal Latency (msec)	Diabetics Mean±SD	3.55±0.44	3.46±0.42	4.08±0.79	3.99±0.84
	Non Diabetics Mean±SD	3.14±0.66	3.19±0.68	3.34±0.51	3.36±0.57
	P value	0.0016	0.0358	0.0001	0.0002

Table 2: Parameters of motor nerve conduction in upper limbs of Diabetics and non-Diabetics

P< 0.05 statistically significant.

P< 0.0001 statistically highly significant.

Parameters	Subjects	Median		Ulnar	
		Left	Right	Left	Right
Amplitude (mv)	Diabetics Mean±SD	23.54±2.08	24.06±2.12	20.18±1.66	19.86±1.95
	Non Diabetics Mean±SD	26.11±2.16	25.89±2.11	22.07±1.44	21.78±1.45
	P value	0.0001	0.0002	0.0001	0.0001
CV (m/sec)	Diabetics Mean±SD	49.02±1.68	50.48±1.32	49.62±2.14	48.11±2.26
	Non Diabetics Mean±SD	53.61±1.13	52.88±2.01	52.16±1.85	51.78±2.19
	P value	0.0001	0.0001	0.0001	0.0001
Distal peak Latency (msec)	Diabetics Mean±SD	3.46±0.22	3.49±0.89	3.19±0.12	3.15±0.08
	Non Diabetics Mean±SD	3.24±0.15	3.21±0.49	2.91±0.04	2.96±0.09
	P value	0.0001	0.0853	0.0001	0.0001

Table 3: Parameters of sensory nerve conduction in upper limbs of Diabetics and non-Diabetics

P< 0.05 statistically significant.

P< 0.0001 statistically highly significant.

P< 0.0853 not quite statistically significant.

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