STUDY OF NERVE CONDUCTION VELOCITY IN NON DIABETIC AND TYPE II DIABETIC INDIVIDUALS

MUNAWAR F., HAQ F.U., ISHAQ N. AND BHATTI T.J.
Department of Physiology, Shalamar Medical and Dental College, Lahore – Pakistan

ABSTRACT

Background and Objectives: Nerve conduction velocity (NCV) test measures the speed of conduction of an electrical impulse through a nerve. The NCV test can establish nerve damage and devastation. Nerve conduction studies (NCS) are not regularly conducted to identify the neuropathy. This study will help to observe the difference in nerve conduction velocity between non diabetic and type II diabetic individuals using power lab.

Methods: The study comprised of total of 30 subjects 15 nondiabetic subjects and 15 known type II diabetes mellitus patients belonging to the both sexes and aged between 20 to 60 years Psychiatric or traumatic illness or those with a language barrier were excluded. Those who refused to participate were also excluded.

Results: The result showed that nerve conduction velocity gradually decreased from the controls (63.68 ± 17.47) as compared to the individuals with a raised sugar level (42. 89 ± 11.79).

Conclusion: The study proved neuronal involvement in the diabetese mellitus which is accelerated by poor glycaemic control. Therefore nerve conduction studies should be carried out for the early detection and management of neuropathy in the diabetic patients.

Keywords: Nerve Conduction Velocity, Diabetes Mellitus.

INTRODUCTION

A nerve conduction study (NCS) is a test commonly used to assess the function, particularly the capacity of electrical conduction of motor and sensory impulses in nerves in human being. Nerve conduction velocity (NCV) is a general measurement made during this test. A nerve conduction velocity test measures how speedily electrical impulses move about along a nerve. It is often done at the same time as an EMG, in order to rule out or identify muscle disorders.[1]

Diabetes mellitus (DM) is a mounting public health problem upsetting people worldwide both in developing and developed countries.[1]

World Health Organization rates diabetic peripheral neuropathy to be wide spread neuropathy globally. Approximately 45 to 60% of patients with DM will develop manifestation of peripheral neuropathy.[2]

Diabetic peripheral neuropathy (DPN) begins in the distal extremities and then travels proximally. The longest axons exhibit symptoms first, with pain being evident to begin within feet, then distal lower extremities, and ultimately the hands.[3]

In the presence of moderate to severe disease, conventional nerve conduction studies (NCS) are generally reliable diagnostic methods for diabetic polyneuropathy.[4]

Diabetes mellitus, the frequent endocrine turmoil, is characterised by metabolic abnormality and by long-standing complications like diabetic retinopathy, nephropathy, angiopathy and neuropathy. Diabetic peripheral neuropathy is the existence of symptoms and signs of peripheral nerve dysfunction in people with diabetes after ruling out other causes and often builds up as generalized asymptomatic dysfunction of peripheral nerve fibres.[6]

Study Design and Subjects

A cross sectional study was done on patients with known DM Type 2 and normoglycaemic individuals. The study was conducted in the Department of Physiology, Shalamar Medical and Dental College, Lahore Pakistan from September to November 2012 after taking the approval of research and ethical review committee. The patients selected were clinically diagnosed Type 2 diabetics attending the outpatient department of the Shalamar Medical Teaching Hospital, who gave their consent for the study.

Data Collection

Verbal consent was asked for and if the patient agreed

Corresponding Author: Prof. Dr. Farida Munawar
Head, Department of physiology, Shalamar Medical and Dental College, Lahore
E-mails: faridamunawar2004@yahoo.com faridamunawar2016@hotmail.com

to participate a written questionnaire was administerred. This questionnaire included demographic details like age, sex, knowledge about onset of DM, medications and treatment course.

Subjects

The study subjects comprised of total 30 males and females aged 20 – 55 years and above who are known cases of DM type II on oral hypoglycaemic drugs and non diabetic individuals, taking both the groups in equal numbers. Psychiatric or traumatic illness or those with a language barrier were excluded.

METHODOLOGY

Random blood sugar was determined in normal subjects and diabetic patients using glucometer (ACCU-CHEK).

Nerve conduction velocity was assessed using AD instrument – power lab/30 series at Department of Physiology Shalamar Medical College, Lahore – Pakistan.

The neurophysiological measurements were carried out in a warm room with the participants in a sitting position and with their forearms partly flexed.

The recording electrode and grounding electrode was placed on the skin overlying the muscle supplied by the nerve. The stimulating electrode with a strap was placed along the course of the nerve. These electrodes were connected through bio amp cable to Bio amp console in power lab.

With the help of stimulating electrode the nerve was first stimulated at the distal end and action potential was observed. The latent period was measured. The nerve was stimulated at proximal end and the action potential was recorded and latent period was noted. The difference between the two latent period gives the time taken by the impulse to travel from proximal to distal point. The distance between the points of stimulation was measured. The conduction velocity was calculated in m/s by the formula:

Distance between stimulation sites / difference in latent periods.

RESULTS

For statistical analysis SPSS version 17 was used.

In table 1 and 2 descriptives of non diabetics and diabetics are given. In non diabetics the mean age is 31.91 ± 11.049 and in diabetics mean age is 49.08 ± 8.751 year. Duration of diabetes in diabetics is 12.20 ± 5.808. Blood sugar random in non diabetics is 108.69 ± 28.877 whereas in diabetics is 315.53 ± 84.82 mg/dl. Figure 2 shows graph of conduction velocity in a non-diabetic subject showing a conduction velocity of 65.7 meters/second. In figure 3 graph of conduction velocity for a diabetic patient is shown where as wrist latency is .0028 seconds and elbow latency at.01 second with a conduction velocity of 36.1 meters/ second.

Fig. 1: *Nerve conduction velocity being performed on power lab.*

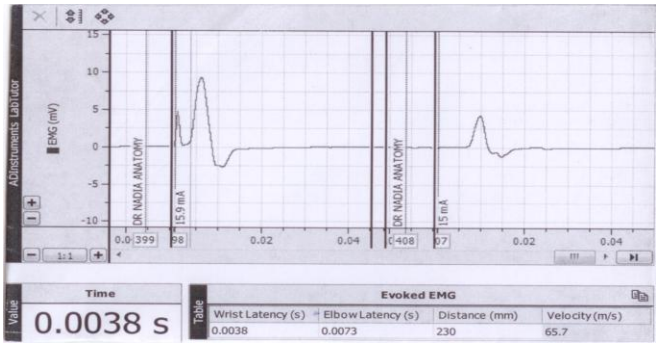

Fig. 2: *Nerve conduction velocity graph in a non-diabetic subject.*

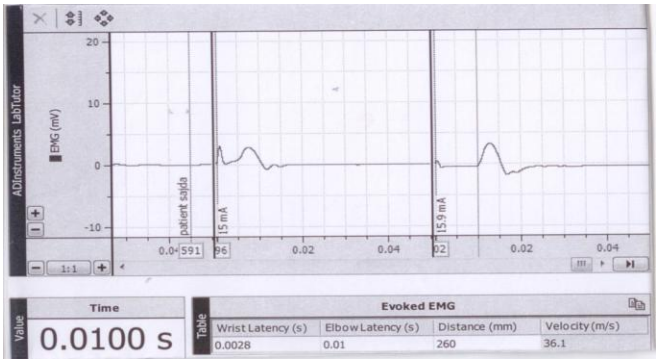

Fig. 3: *Nerve conduction velocity graph in a diabetic patient.*

In table 3 comparisons of nerve conduction velocities between non diabetic and diabetic individuals is given with statistically significant difference in P < .001.

Table 4 shows a statistically significant difference (P < .01) between random blood sugar in non diabetics and type II diabetics.

DISCUSSION

Diabetes is a major health problem in developing cou-

Table 1: *Descriptives of non-diabetics.*

	Range	*Minimum*	*Maximum*	*Mean*	*Std. Deviation*
Age of respondents	33	20	53	31.91	11.049
Weight (Kg)	27	53	80	67.75	9.488
Height in inches	12	60	72	65.08	3.175
Blood sugar random (mg/dl)	80	78	158	108.69	28.877
Duration of diabetes in years	0				

Table 2: *Descriptives of diabetics.*

	Range	*Minimum*	*Maximum*	*Mean*	*Std. Deviation*
Age of respondents	27	33	60	49.08	8.751
Weight (kg)	55	45	100	74.00	15.578
Height in inches	8	56	64	60.64	2.541
Blood sugar random (mg/dl)	315	145	460	315.53	84.82
Duration of diabetes in years	17	5	22	12.20	5.808

Table 3: *Comparison of median nerve conduction velocities between non-diabetics and Type II diabetics.*

	N	*Mean*	*Std. Deviation*	*Std. Error Mean*	*P-value*
Non-diabetics	15	63.68	17.47	4.84	P < .001
Type II diabetics	15	42.89	11.79	3.27	

P < .001 Highly significant

Table 4: *Comparison of random blood sugar between non-diabetics and type II diabetics.*

	N	*Mean*	*Std. Deviation*	*Std. Error Mean*	*P-value*
Non-diabetics	15	108.69	28.87	8.003	P <0.01
Type II diabetics	15	315.53	84.82	23.54	

P <0.01=significant

ntries like Pakistan. This study will help determine the change in nerve conduction velocity, which indicates microvascular damage in patients with DM type 2.

Value of life is compromised due to a common complication of diabetes mellitus which being diabetic neuropathy with high morbidity. A challenging treatment of neuropathy at the sub clinical level lessens the hazard of neuropathy. For this reason; there is a requirement of a process to make out the at-risk diabetic patients for neuropathy.[6]

Researchers observed that the nerve conduction velocity progressively decreased from non-diabetics (63.68 ± 17.47) to the diabetics with poor glycaemic control (42.89 ± 11.79). The patients with history of diabetes for more than 10 years who were on insulin and followed the regime regularly with good glycaemic control showed a mild reduction in conduction velocity than non diabetics. The findings are in agreement with those of earlier investigators.[7]

A female patient 52 year of age with history of diabetes type II for one and a half year only and not taking oral hypoglycemic regularly because of poverty and dependency on children said she cannot knead the flour properly for cooking chapatti as she feels tingling sensation and pain in fingers of her hands. Her conduction velocity was 20.1 meters/second. Therefore, scrutinising of diabetic patients with NCV studies may aid in forecasting the commencement of diabetic neuropathy. Follow-up studies and interventional studies are imperative to highlight the significance of the NCV

estimation as our study was only cross sectional.

The underlying pathophysiology of diabetic peripheral neuropathy is not clearly understood possibly a long standing hyperglycaemia gradually leads to neurovascular damage and ultimately neuropathy.[8]

In ***conclusion*** although this study was conducted on a relatively small group of patients, it provides an evidence of association between hyperglycaemia and neuropathy. Our findings propose early management of hyperglycaemia in order to prevent neuropathy in type 2 diabetes.

Author's Contribution

FM: Concept, power lab operation, Data analysis and interpretation. FUH: Data Collection and power lab operation. NI: Data collection and approach to female patients. TJB: Data organization and review of paper.

ACKNOWLEDGEMENTS

The authors are obliged to laboratory staff of physiology department for their co-operation.

REFERENCES

1. Garg R, Kumar A, Dhar U. A Study of Median Nerve Conduction Velocity in Diabetes Mellitus Type 2 in Neurologically Asymptomatic Patients. Int J Health Sci and Res. 2013; 3 (5): 42-9.
2. Dahiru TA, Jibo AA, Mande AT, Hassan. Diabetes Mellitus in Developing Countries and Case Series Nig J Med. 2008: 17-19.
3. Vavra MW, Rubin DI. The peripheral neuropathy evaluation in an office-based neurology setting. In Seminars in neurology, 2011 Feb (Vol. 31, No. 01, pp. 102-114). © Thieme Medical Publishers.
4. Galer BS, Gianas A, Jensen MP. Painful diabetic polyneuropathy: epidemiology, pain description, and quality of life. Diabetes Res Clin Pract. 2000 Feb. 29; 47 (2): 123-8.
5. Rutkove SB, Kothari MJ, Raynor EM, Levy ML, Fadic R, Nardin RA. Sural/radial amplitude ratio in the diagnosis of mild axonal polyneuropathy. Muscle and Nerve, 1997 Oct. 1; 20 (10): 1236-41.
6. Lawrence DG, Locke S. Motor nerve conduction velocity in diabetes. Arch Neurol. 19615: 483–489.
7. Llewelyn JG, Tomlinson DR, Thomas PK. Diabetic Neuropathies In: Dyck PJ, Thomas PK, editors. Peripheral Neuropath. Fourth Edition. Phila: Elsevier; 2005: 1951-1952.
8. Turgut N, Karasalihoglu S, Kücükugurluoglu Y, Balci K, Ekuklu G, Tütüncüler F. Clinical utility of dorsal sural nerve conduction studies in healthy and diabetic children. Clini Neurophys. 2004 Jun. 30; 115 (6): 1452-6.
9. Ziegler D, Rathmann W, Dickhaus T, Meisinger C, Mielck A. Prevalence of Polyneuropathy in Pre-Diabetes and Diabetes Is Associated With Abdominal Obesity and Macroangiopathy The MONICA/KORA Augsburg Surveys S2 and S3. Diabetes care, 2008 Mar. 1; 31 (3): 464-9.