(International Print/Online Journal)

SJIF IMPACT FACTOR: 5.565
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 6, Issue 2 , Page No: 620-626
March-April 2023

IJMSCR

Effect of Type 2 Diabetes on Nerve Conduction Parameters

[1]Dr. Barkha Rani, [2]Dr. Anand Kumar Singh*
[1,2]Senior Resident,
[1]Department of Physiology, [2]Department of Orthopaedics,
RIMS, Ranchi, Jharkhand, India

***Corresponding Author:**
Dr. Anand Kumar Singh
Senior Resident, Department of Orthopaedics, RIMS, Ranchi, Jharkhand, India

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

Abstract

Background- Diabetes mellitus is a major health problem in World. It is the common endocrine disorder, is characterized by metabolic abnormalities and by long-term complications like diabetic neuropathy, nephropathy, retinopathy and angiopathy. Nerve conduction velocity test is an essential reliable clinical test for the diagnosis of the diseases of peripheral nerves that include peripheral neuropathies. Nerve conduction study measures duration, latency, amplitude and conduction velocity. The present study is carried out to assess latency, amplitude and velocity of motor and sensory nerve conduction variables in median nerve.

Aims and Objectives- The aim of the study was to evaluate the latency, amplitude and velocity of median nerve in patients with type 2 DM.

Materials and methods-The study was conducted in the Department of Physiology. The study protocol was approved by the Institutional Ethical Committee. A written informed consent was obtained from each participant. The study was done in 60 (Males= 35, Females= 25) diabetic patients between the age group of 40-60 years. Anthropometric variables were recorded. Motor and sensory nerve conduction parameters of bilateral median nerves were recorded using standard technique. Values obtained were compared with normal values. Statistical Analysis- Independent t test was applied to compare the anthropometric and nerve conduction variables between male and female diabetic subjects.

Results-Anthropometric variables were comparable between diabetic male and females. Also, most of the nerve conduction variables were comparable between diabetic males and females. However, these values were less as compared to given standard values. Distal amplitude of left median motor nerve was significantly higher in males ($p=0.04$) while onset latency of left median sensory nerve is significantly prolonged as compared to females ($p=0.008$).

Conclusion-It provides evidence of association between hyperglycemia and neuropathy. Finding proposed early management of hyperglycemia in order to prevent neuropathy in type 2 diabetes.

Keywords: Nerve Conduction Velocity, Type 2 Diabetes Mellitus.

Introduction

Diabetes mellitus (DM) is one of the chronic diseases all over the world. The prevalence of diabetes is rapidly rising all over the globe at an alarming rate [(1)]. Diabetes mellitus, the most common endocrine disorder, is characterized by hyperglycaemia causing polyuria, polydipsia, polyphagia, weight loss, impairment of growth and increased susceptibility to infections[(2)].Type I insulin dependent diabetes mellitus (IDDM), is due to autoimmune mediated destruction of beta cells of the pancreas, resulting in absolute deficiency of insulin secretion, whereas type II diabetes mellitus, non-insulin dependent diabetes

mellitus (NIDDM), is characterized by resistance to insulin action and inadequate compensatory insulin secretion, resulting in hyperglycaemia. Diabetes mellitus is characterized by long -term complications like neuropathy, retinopathy, nephropathy, and vasculopathy [(3)]. Diabetic neuropathies, one of the most common complications, are heterogenous group of disorders which affect different parts of the nervous system and present with various different clinical manifestations [(4)].

Nerve conduction velocity test is an essential reliable clinical test for the diagnosis of the diseases of peripheral nerves that includes peripheral neuropathies [(5,6)]. Nerve conduction study involves a non-invasive electrical stimulation of a peripheral nerve at one site and its non-invasive measurement of the evoked response at second site over the muscle innervated by the nerve (motor nerve conduction). Nerve conduction study measures duration, latency, and amplitude and conduction velocity. Conduction velocity and latency denote the speed of nerve impulse propagation. They are altered in disease, which cause demyelination. Amplitude denotes the number of functioning fibres and it is altered in diseases causing axonal degeneration [(7)].

Methods And Materials

The study was conducted in tertiary health care centre. The study protocol was approved by the Institutional Ethical Committee. A written informed consent was obtained from each participant. The study was done in 60 (Males= 35, Females= 25) diabetic patients between the age group of 40-60 years.

Inclusion Criteria- Clinically diagnosed diabetic mellitus patients both male and female of age 40-60 yrs. Referred from Diabetic clinic.

Exclusion Criteria-

1. Patients with established diabetic neuropathy, inflammatory demyelinating neuropathies, lumbar or cervical radiculopathies or any other neurologic illness which could affect peripheral nerve conduction.
2. Chronic alcoholics, smokers, and patients with a history of occupational or environmental heavy metal exposure.
3. Patients with vitamin B12, B6 deficiency, thyroid disorders, and on medication known to cause neuropathies (Isoniazid, Anticancer, and Antiretroviral drugs).
4. Age more than 60 yrs.

Recording of Nerve Conduction Velocity: The study was done using NEURO – MEP –NET Machine equipped for EMG/NCV/EP manufactured by NEUROSOFT TM. The apparatus works on a computer with windows 98 operating system having MS Office 97 package.

Motor and sensory conduction variables of median nerve were measured. Instrument setting

a) For motor studies: Sensitivity: 2-5mv/mm, Low frequency filter: 2-5Hz, High frequency filter: 10 KHz

b) For sensory studies: Sensitivity: 10-20microv/mm, Low frequency: 5-10Hz, High frequency filter: 2-3 KHz sweep speed: 1-2 ms /mm.

Motor Median Nerve Conduction Procedure

Electrodes	Position
Recording electrode	Placed on the motor point of Abductor Pollicis Brevis i.e., midway between the distal wrist crease and the first metacarpophalangeal joint.
Reference electrode	Placed 3 cm distal to recording electrode at the first metacarpophalangeal joint.
Ground electrode	Position Placed on the dorsum of hand.
Stimulating electrode	• Distal stimulation point: placed 3 cm proximal to distal wrist crease near

Volume 6, Issue 2; March-April 2023; Page No 620-626

	the tendon of Palmaris longus. • Proximal stimulation: placed at the elbow near the volar crease of the Brachial Artery pulse.

Sensory Median Nerve Conduction Procedure

Electrodes	Position
Recording electrode	Placed 3 cm proximal to the distal wrist crease slightly radial to the tendon of Palmaris longus.
Reference electrode	Placed 3cm proximal to recording electrode
Ground electrode	Placed on thenar eminence
Stimulating electrode	• Cathode: placed at proximal interphalangeal joint of the second digit (index finger). • Anode: placed 3cm distal to the cathode

Photo 1- Median nerve stimulation at wrist

Statistical Analysis

The data were entered into MS Excel and descriptive analysing was done for anthropometric & nerve conduction variables. Unpaired t test was used to compare the anthropometric & nerve conduction variables between male and female diabetic patients. Recording data were analysed by using SPSS 17.

Results

There were no statistically significant in all anthropometric variables between male and female diabetic group. Most of the nerve conduction variables were comparable between male & female diabetic groups. Onset latencies, SNAP (sensory nerve action potential) amplitude and conduction velocity of bilateral median sensory nerves were recorded. However, the values were less as compared to given standard values [8]. However, distal amplitude of left median nerve was higher in diabetic

Volume 6, Issue 2; March-April 2023; Page No 620-626

males as compared to females. (p= 0.005) and onset latency of left median sensory nerve was significantly prolonged in males (p=0.008) as compared to females. (As shown in table 5).

Table 1: Comparison of anthropometric variables between male and female diabetic variables

Variables	Diabetic male (mean± SD)	Diabetic female (Mean ± SD)	P value
Age (in years)	52.23±11.59	50.80±13.10	0.574
Height (in cm)	162.33±7.31	160.83± 6.36	0.128
Weight(kg)	59.0±14.17	64.33±5.50	0.757

Table 2: Comparison of right median Motor nerve NCS variables between diabetic male and diabetic female

Variables	diabetic male (Mean ±SD) (Male- 35)	Diabetic female (Mean ± SD) (Female- 25)	P value
DSONALT	3.07±0.21	2.78±0.23	0.972
PRONLAT	7.05±0.21	7.35±1.41	0.107
DSAMP	2.72±1.55	2.35±3.12	0.080
PRAMP	3.82±3.20	2.72±1.97	0.412
MNCV	59.73±4.67	44.10±22.33	0.192
FWMIN	24.33±1.53	19.60±8.65	0.213

Abbreviations:

DSONLAT: Distal onset latency

PRAMP: proximal wave amplitude

PRONLAT: Proximal onset latency

MNCV: motor nerve conduction velocity

DSAMP: distal wave amplitude

FW MIN: F wave minimum latency

Table 3: Comparison of left median Motor nerve NCS variables between diabetic male and diabetic female.

Variables	diabetic male (Mean ±SD) (Male- 35)	Diabetic female (Mean ± SD) (F-25)	P value

Volume 6, Issue 2; March-April 2023; Page No 620-626

DSONALT	2.13±0.82	3.57±1.20	0.344
PRONLAT	8.5±3.04	11.47±9.38	0.253
DSAMP	3.11±1.21	2.81±1.22	0.043*
PRAMP	3±3.00	2.14±2.75	0.613
MNCV	44±6.56	45.900±24.33	0.243
FWMIN	21.67±2.89	23.20±3.42	0.746

Table 4: Comparison of right median sensory NCS variable between male and female diabetic group

Variables	Diabetic male (Mean ±SD) (Male- 35)	Diabetic female (Mean ±SD) (Female- 25)	P value
ONLAT	4.82±0.36	3.63±3.80	0.215
AMP	14.05±7.57	9.50± 5.85	0.679
SNCV	49.00±15.22	50.51±15.22	0.939

Abbreviations:

AMP: amplitude

ONLAT: onset latency

SNCV: sensory nerve conduction velocity.

Table 5: Comparison of left median sensory NCS variable between male and female diabetic group.

Variables	Diabetic male (Mean ±SD) (Male- 35)	Diabetic female (Mean ±SD) (Female- 25)	P value
ONLAT	6.07±8.25	2.08± 0.52	0.008*
AMP	16.85±4.78	16.65±7.40	0.346
SNCV	37.13±9.89	43.47±11.78	0.633

Discussion

Most of the previous literatures suggest on early involvement of median nerve in diabetic neuropathy [9,10,11,12]. Hrishikesh Bagchi et al in 2014 showed that significant reduction in both NCV and amplitude with increasing values of duration of diabetes. The commonest abnormality in diabetics is reduction of amplitude of motor or sensory nerve action potential because of axonopathy [13]. Hennessey & Others (1994) observed that women, in comparison to men have significantly larger distal amplitudes for median

Volume 6, Issue 2; March-April 2023; Page No 620-626

nerve [14]. Similar study was done by Lawrence et al in 1993[15] observed that sensory amplitude of Lt. median nerves were larger in women. Our study is contrary to this study in which male larger distal amplitudes for median nerves than female diabetic groups have. Distal amplitude of median motor nerve is higher in male than female and NCV of motor nerve in median nerve is higher in male than female which are opposed by Gakhar et al which showed that distal amplitude of median nerve in female is higher than males. Onset latency of motor of median nerves in both right and left side were comparable which is contrary to study done by Gakhar et al in 2014[16]. A study done by Zahed Ali et al in which Conduction velocities were decreased in both male and females in left median sensory which is statistically significant and our study showed that there is significant difference in onset latency of left median sensory in male and female diabetic group, which is different statistically. Our study showed that male patients had significantly longer latencies and female demonstrate faster conduction velocity. The similar result has been shown by Gakhar et al [16]. Thus, our results showed that males have larger distal amplitudes of Left Median motor nerve as compared to females. However, onset latency is prolonged of left median sensory nerve as compared to females.

Conclusions

It provides evidence of association between hyperglycemia and neuropathy. Median nerves are affected in type 2 diabetic mellitus patients.

References

1. Huizinga MM, Rothman RL. Addressing the diabetes pandemic: A comprehensive approach, Indian J Med Res 2006; 124:481- 484.
2. Dan L L,Dennisn L K, Jamson J L, Antony S F,Stephen L H,Joseph L.Diabetes mellitus:Harrison's principles of Internal Medicine. 2968-3003;18th ed. Singapore:Mc Graw Hill.2012.
3. American diabetes association. Defintion and description of diabetes mellitus: Diabetes Care 2004; 27(1). s5-s10.
4. Andrew J M B, Arthur I V, Joseph C A,Vera B,Eva LF,Roy F, Rayaz A M,Raelene E M,Jay M S, Dan Z. Diabetic neuropathies.A statement by the American Diabetes Association.
5. Fransen H, Van den Bergh PY. Nerve conduction studies in peripheral neuropathy: practical physiology and patterns of abnormality. ActaNeurol Berg 2006;106(2):73-81.
6. Kimura J. Principles and pitfalls of nerve conduction studies. Ann Neurol 1984;16(4):415-429.
7. Kong X, Lesser EA, Potts FA, et al. Utilisation of nerve conduction studiesfor the diagnosis of polyneuropathy in patients with diabetes. J Diabetes SciTechnol 2008;2(2):268-274.
8. Preston DC, Shapiro BE. BE. Basic nerve conduction studies. In:"Electromyography and Neuromuscular disorders". Boston: Bu erworth-Heinermann; 1998.p. 26-56.
9. Buschbacher RM. Median nerve F-wave latencies recorded from the abductor pollicis brevis. Am J Phys Med Rehabil.1999 NovDec:78 (6- Suppl): S32-7
10. Rota E; Quadri R; Fanti E; Isoardo G; Poglio F; Tavella A; Paolasso I; Ciaramitaro P, Bergamasco B; Cocito D.- Electrophysiological findings of peripheral neuropathy in newly diagnosed type 2 diabetes mellitus. J Peripher Nerv Syst. 10 (4): 348-353, Dec, 2005. 11.
11. El-Salem K, Ammari F, Khader Y, Dhaimat O. Elevated glycosylagted hemoglobin is associated with subclinical neuropathy asymptomatic patients: A prospective study. J Clin Neurophysiol 2009; 26 (1): 12.
12. Kimura J; Yamada T; Stevland N.P. – Distal slowing of motor nerve conduction velocity in diabetic polyneuropathy. J Neurol Sci. 42 (2): 291- 302, July 1979.
13. Bagchi H, Biswas A, Mukhopadhyay AK, A study of somatic nerve functions in Diabetic and Normal persons. Indian Medical Gazette.2014 Oct: 365-368.
14. Hennessey, W.J., Falco, F.J.E., Goldberg, G., Braddom, R.L. 1994. Gender and arm length: influence on nerve conduction parameters in the upper limb. Arch. Phys. Med. Rehabil., 75: 265–269.

Volume 6, Issue 2; March-April 2023; Page No 620-626

15. Lawrence D. G. Motor nerve conduction velocity in Diabetes. Arch Neurol 19 61; 5 (5):483- 489 November 1971. doi: 10.1001/areneur. 1901.0045017002/003.

16. Gakhar, M. Verma, S.K. and Lehri, A. A comparision of Nerve conduct velocities in Male and Female of 20 to 30 years of age group. Journal of exercise science and physiotherapy. Vol.10. No. I: 16-20.2014.

Volume 6, Issue 2; March-April 2023; Page No 620-626