IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 20, Issue 6 Ser.5 (June. 2021), PP 32-35
www.iosrjournals.org

A Comparative Median Nerve Conduction Study in Type-2 Diabetics with Symptoms of Polyneuropathy with Age and Sex Matched Normal Subjects

Dr. Bhagya.V [1], Dr. Manjushree R[2], Dr. Harsha[3]
1.Professor, Department of Physiology, JJM Medical College, Davangere
2.Post Graduate, Department of Physiology, JJM Medical College, Davangere
3.Professor Department of Medicine, JJM Medical College, Davangere.

Abstract:
Background*: Diabetes Mellitus is one among the diseases that affects peripheral nervous system and symptomatic neuropathy in uncontrolled Diabetes is one of the commonest incapacitating complications. Electro diagnostic tests can be used to detect Diabetic Neuropathy at an early stage (before development of the signs or symptoms of Neuropathy). Nerve Conduction Study (NCS) is considered to be the most sensitive, reliable, non-invasive and objective means of investigations of Diabetic Polyneuropathy. Diabetic Neuropathy is curable, and hence if detected, the proper treatment can be instituted in early stages, which again, can give rise to good outcome. As the peripheral nerve has the ability to regenerate, line of treatment can be planned.*
Aims & Objectives*: To compare and analyze the peripheral nerve conduction studies in symptomatic diabetic neuropathy cases with age and sex matched normal subjects emphasizing on use of Nerve conduction studies as a diagnostic approach to prevent Severe Neuropathy.*
Methods: *The study group consists of 30 cases diagnosed with Diabetic neuropathy referred to our neurophysiology lab and control group consists of 30 age and sex matched normal subjects who are non diabetic, healthy volunteers. Statistical analysis was done using unpaired t-test and 28 out of 30 cases considered for statistical analysis. Motor and Sensory nerve conduction studies conducted in both Median nerves using bipolar surface electrodes with RMS EMG EP MARK-II machine.*
Results: *There is a definite decrease in amplitude and nerve conduction velocities of both the sensory and motor components, axonal and demyelinating type significantly correlating with higher HBA1c levels and duration of diabetes. F minimum latencies were increased possibly more of demyelinating type of Polyneuropathy.*
Conclusion: *NCS being a simple, harmless, non-invasive and objective technique along with easy interpretation of results can be used routinely to evaluate the status of nerves in patients with Type 2 Diabetes Mellitus to prevent more disabling state at the earliest.*
Keyword*: Diabetic Polyneuropathy, Nerve Conduction Study (NCS), F-minimum latency, Median nerve*

Date of Submission: 30-05-2021 Date of Acceptance: 13-06-2021

I. Introduction

The physiological properties of nerve and muscle are usually modified due to pathophysiological changes occurring from many diseases like diabetes.[1] Diabetes is fast becoming the epidemic of the 21st century. The physiological properties of nerve and muscle are usually modified due to pathophysiological changes resulting from many diseases like diabetes.[1] The number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014 . The global prevalence of diabetes among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014. Diabetes prevalence has been rising more rapidly in middle- and low-income countries. Healthy diet, regular physical activity, maintaining a normal body weight and avoiding tobacco use are ways to prevent or delay the onset of type 2 diabetes. Diabetes can be treated and its consequences avoided or delayed with diet, physical activity, medication and regular screening and treatment for complications[2] Diabetes Mellitus is one among the diseases that affects peripheral nervous system and symptomatic Neuropathy in uncontrolled Diabetes is one of the commonest long term incapacitating complications. A widely accepted definition of diabetic peripheral neuropathy is "the presence of symptoms and/or signs of peripheral nerve dysfunction in people with diabetes after exclusion of other causes. Many previous studies have reported a wide range of prevalence of Neuropathy in Diabetics which estimates from 3% to 32%.[3] Nerve problems in diabetes mellitus can develop at any time, often occurring about 10 years after the diagnosis of diabetes. Longer the duration of diabetes and irregular being the treatment, with fluctuating blood sugar levels, higher will be the risk of developing diabetic neuropathy.[4] Sensory neuropathy (SNAP) are better

appreciated by nerve conduction studies than conventional vibration tests.[5] Nerve conduction studies (NCS) and electromyography (EMG) can document the characteristics of the neuropathy (e.g., axonal, demyelinating) and the localization (e.g. mononeuropathy versus radiculopathy or distal neuropathy) and, possibly, the severity and even prognosis for morbidity. Multiple consensus panels recommend the inclusion of electrophysiological testing in the evaluation of diabetic neuropathy. These same panels recommend the use of NCV/EMG procedures in clinical research studies. NCS/EMG establishes diagnosis quiet early than other diagnostic procedures because of its sensitivity to detect slowing of conduction of action potential in a nerve, which is an early indicator of peripheral neuropathy. Neurophysiologic studies supplemented the clinical examination by precisely localizing the lesion and characterizing the conduction abnormalities providing additional information, details and objectivity. They delineate a variety of conditions that may otherwise escape detection.[6] Mostly NCV determination is used compared to EMG for purpose of studying diabetic neuropathy since it is non-invasive, can easily be reproduced and it is sensitive which gives a clear recording with minimal disturbances. Early functional impairment of nerve in asymptomatic cases can be studied i.e. disorder affecting the nerves insufficient to produce clinical abnormality may be detected as decrease in Sensory NCV. It is useful as a tool of diagnostic, prognostic and follow up study of Neuropathy.[7]

II. Materials and Methods

Motor and sensory nerve conduction studies were conducted in both Median nerves using bipolar surface electrodes in 30 Type-2 Diabetics with symptoms of neuropathy referred to our neurophysiology lab for NCS and 30 healthy volunteers (age and sex matched) after taking informed consent. NCS was performed with RMS EMG EP MARK II machine and temperature of the lab was maintained at 21-23ºC. Latency, Amplitude, conduction velocity and F-wave studies were done by placing the active electrode over the motor point and reference electrode on the tendon with stimulation proximally and distally. Both active and reference electrodes are placed on the nerve in sensory nerve studies with Ground electrode between stimulating and recording electrode. Values taken as reference from normal values of motor and sensory nerve conduction from study by Misra and Kalita. Motor nerve conduction studies were carried out by placing active electrode over the motor point and reference electrode on the tendon by stimulating proximally and distally. Sensory nerve conduction studies were carried out with both active and reference electrode placed on the nerve. Ground electrode is placed between stimulating and recording electrode. **Motor nerve conduction studies[8]**

Median motor nerve conduction- Recording electrode is placed close to the motor point of abductor pollicis brevis and reference electrode 3 cm distal at first metacarpophalangeal joint. A supramaximal stimulation is given at wrist (3 cm proximal to the distal crease) and at elbow (near the volar crease of the brachial pulse)

III. Statistical analysis and results

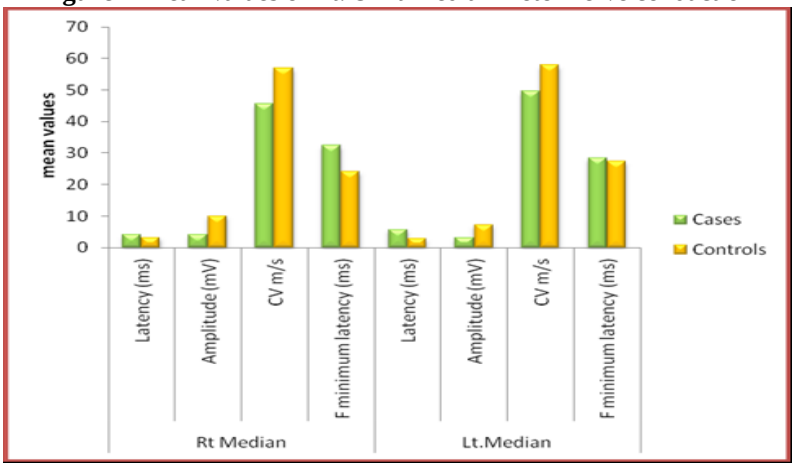
Statistical analysis was done using unpaired t-test. 28 out of 30 cases were considered for analysis as 2 cases being Severe debilitating neuropathy, no response was obtained on both motor and sensory nerve stimulation even with supramaximal strength of stimulation

Socio-demographic characteristics

Cases N=28

Sociodemographic characteristics	Cases N=28	Controls=28
Age (Mean & SD)	49.42±11.56	49.42±11.56
Sex Male	15	15
Female	13	13

Figure 1-Mean values of Rt. & Lt Median motor nerve conduction



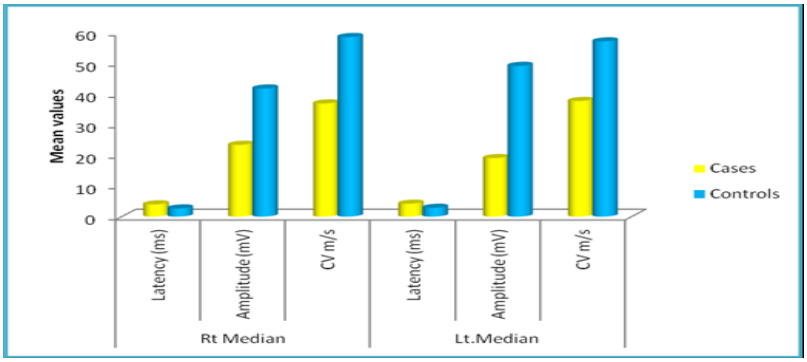


Figure-2 Comparison of sensory nerve conduction values of Rt. & Lt. Median nerves

Motor nerve conduction studies Mean of Distal motor latencies of Rt.& Lt.Median nerves in cases were increased significantly in comparison with mean latencies of the nerves in controls ($p<0.02$ and $p<0.04$ respectively). Mean of Amplitude of CMAP (compound muscle action potential) was markedly reduced in both Rt. & Lt. Median nerves. Mean Motor nerve conduction velocities also reduced significantly. F-wave response was not obtained mostly from 10 right and 9 left median nerves. F minimum latencies, were increased showing Demyelinating type of Neuropathy

Sensory nerve conduction studies – There is a significant increase in latency, decrease in amplitude and conduction velocity. No statistical significant difference in mean values of cases and controls. Therefore, the features are mixed varying in different cases, being sensory, motor, axonal & Demyelinating. 2 cases being Severe neuropathy, sensory response was not recordable.

IV. Discussion

Results of the present study indicates that there is a definite decrease in amplitude and nerve conduction velocities of both the sensory and motor components, axonal and demyelinating type significantly correlating with higher HbA1c levels and increased F minimum latencies, possibly more of demyelinating type of Polyneuropathy. Conduction abnormalities develop diffusely along the entire length of nerve but more in distal than the proximal segment. The NCV is gradually diminished by Diabetic Neuropathy, with estimate of a loss of approximately 0.5m/s/year and a simple rule is that 1% fall in HbA1c improves the conduction velocity of about 1.3m/s (Arezzo,1997). Correction of Hyperglycemia in patients results in improvement of symptoms as well as nerve conduction abnormalities (Judzewitsch et al.,1983). Elizabeth et al 1998 volume 245; number 2/Jan 1998 studied about the assessment of neuropathy in diabetic patients by study of the conduction velocity within motor and sensory fibres and came to a conclusion that longer the duration of diabetes, changes in the motor and sensory responses of the individual is certain. The studies were consistent with previous study done by Muthuselvi K et.al where in the values of the amplitude of both sensory and motor nerve conduction were found to be significantly reduced in diabetic individuals than the non-diabetic control group with significant 'p' value. It was also seen that on correlating the blood sugar values, there was an inverse relationship, with increasing blood sugar values sensory nerve conduction velocities are correspondingly decreasing and motor nerve conduction velocities too decreasing, though there are fluctuations.[5] but, in our study, correlation of cases with blood sugars was not taken into account although the cases in our study mostly presented with higher

HbA1c and blood sugar levels. These studies were also consistent with the previous study done by OLNEY;RICHARD K 1998 Also, the present study was comparable to the study done by Verma et.al who showed that in comparison to normal healthy volunteers, amplitude and conduction velocity range is significantly decreased in diabetic patients[9] and most affected nerve in upper limb being Median nerve and lower limb is sural nerve which is also comparable with study done by Zahed Ali et.al.[10] A study done by Xuan Kong et al. demonstrated that NCS using a computer based electrodiagnostic equipment was a suitable tool for the diagnosis of Diabetic Polyneuropathy.[11]

V. Conclusion

From our study, we conclude that increased distal motor latencies, reduced amplitude of CMAP and motor conduction velocities in Median, nerves indicates involvement of these nerves in the cases referred compared to the age and sex matched normal subjects. F minimum latencies increased showing a demyelinating type of Neuropathy cases with absent F-wave response in 19 median nerves in cases compared to normal subjects. There is a considerable increase in latency, decrease in amplitude of SNAP (sensory nerve action potential) and conduction velocity in the sensory nerves in cases although there was no statistical significant difference in mean values of cases and controls. The features found to be of varying –both sensory and motor involvement, axonal and demyelinating type of neuropathy. NCS being a simple, harmless, non-invasive and objective technique along with easy interpretation of results can be used routinely to evaluate the status of nerves in patients with Type 2 Diabetes Mellitus to prevent more disabling state at the earliest. Neuropathic symptoms may take years to appear, but even before, diabetic neuropathy can be diagnosed by NCS, and further damage to the nerves can be curtailed.[4]The NCS however is more powerful in detecting neuropathy which shows that NCS is helpful in detecting sub clinical neuropathies also[12]. Diabetic Neuropathy is curable, and hence if detected, the proper treatment can be instituted in early stages, which again, can give rise to good outcome. As the peripheral nerve has the ability to regenerate, line of treatment can be planned. Symptoms usually develop at any degree of neuropathic impairment or may not occur at all which indicates the need for doing nerve conduction studies. Nerve conduction studies may be effectively used to select the most beneficial therapy. Thus, it can be used as reliable tool for detection of Diabetic Polyneuropathy especially for the subclinical neuropathies and a routine NCS should be done on diabetics at least on yearly basis. The drawbacks of the nerve conduction study are that: only the status of distal nerves can be evaluated and only the status of distal nerves can be evaluated and only the velocities in the large fiber can be measured. These draw backs do not pose any serious problem, since in NIDDM, distal nerves with largest myelinated 'A' fibers are chiefly affected

Limitation of our study is small sample size due to which the features could not be delineated at large and reference standard values of nerve conduction parameters are considered from the study done by Misra and Kalita.

Correlation with HbA1c and fasting blood sugar values gives still more useful data.

References

[1]. Krarup C. Nerve conduction studies in selected peripheral nerve disorders. Curr Opin Neurol. 2002;15:579–93.
[2]. Global report on Diabetes. World Health Organization. Geneva; 2016.
[3]. Ziegler D, Gries FA, Spuler M, Lessmann F. The epidemiology of diabetic neuropathy: DiaCAN Multicenter Study Group. Diabet Med. 1993;10(suppl.2):82S – 86S.
[4]. Muthuselvi K, Shanthi M, Ethiya N. Comparison of Nerve Conduction Studies in Geriatric Normal and Diabetic Subjects. 2015;4(4):2013–5.
[5]. AL Kakrani, VS Gokhale, Karan V Vohra, Neha Chaudhary. Clinical and nerve conduction study correlation in patients of Diabetic Neuropathy. Journal of the Association of Physicians of India Jan 2014;vol 62:24-27.
[6]. J Kimura. Long and short of nerve conduction measures: reproducibility for sequential assessments. J NeurolNeurosurgPsychiatry. 2001;71:427.4 30 doi:10.1136/jnnp.71.4.427.
[7]. Wagmen & lesse. Maximum conduction velocities of motor fibers of ulnar nerve in human subjects of various ages and sizes. j neurophysiol.may 1 1952; 15(3):235–44.
[8]. U. K. Misra,J Kalita. Clinical Neurophysiology Nerve Conduction Electromyography & Evoked Potentials. 2nd ed. Elsevier India Pvt. ltd;
[9]. Verma A, Mahajan S, Khadayate P. Sensory Nerve Conduction Studies In Non-Insulin Dependent Diabetes Mellitus (NIDDM) Patients Without Symptoms Of Peripheral Neuropathy And Healthy Volunteers : A Comparative Study. 2(1):158–62.
[10]. Zahed Ali et.al. Role of Electrodiagnostic tests in Early detection of Diabetic Neuropathy. J Neurosci. 2008;23(1):36.
[11]. Kong X, Lesser EA, Potts FA, Gozani SN. Utilization of Nerve Conduction Studies for the Diagnosis of Polyneuropathy in Patients with Diabetes: A Retrospective Analysis of a Large Patient Series. 2008;2(2):268–74.
[12]. Ambreen Asad, Muhammad Amjad Hameed, Umar Ali Khan et al Comparison of nerve conduction studies with diabetic symptom score and diabetic neuropathy examination score in type-2 diabetics for detection of Sensorimotor Polyneuropathy. J Pak Med Assoc Sep 2009; Vol 59; No. 9:594-98.