International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Sural Nerve Electrophysiologic Profile in Normals and Type2 Diabetics of Dissimilar Duration

Sowjanya Maruboyina[1], Sanjeev Attry[2], Kusuma Kumari. B[3], Kranthi Kumar. M[1], Eswar Reddy. K[4], Sunil Kumar[5], Ch. Sai Nikitha [6]

[1]Associate Professor, Department of Neuro Physiotherapy, Durgabai Deshmukh College Of Physiotherapy, DDMS (AMS), Hyderabad, Telangana, India.
Research Scholar in physiotherapy, NIMS University Rajasthan, Jaipur, India.
[2]Associate Professor, Department of Neuro Surgery, NIMS University Rajasthan, Jaipur, India.
[3]Professor, Department of Physiology, MRIMS, Hyderabad, Telangana, India.
[4]Professor, SIMS College of Physiotherapy, Guntur, A.P, India.
[5]Professor, Principal, NIMS College of Physiotherapy , NIMS University Rajasthan, Jaipur, India.
[6]MPT Student, Durgabai Deshmukh College Of Physiotherapy, DDMS (AMS), Hyderabad, Telangana, India.

Corresponding Author: Sowjanya Maruboyina

ABSTRACT

Background and Purpose: Diabetes is the disease of major concern of all in the present Era. The morbidity, mortality and economical burden due to this illness is escalating at a faster pace. The incidence of foot complications like ulcers and amputations are getting increased because of late diagnosis of distal symmetrical peripheral neuropathy which is the common complication of Diabetes. In this the distal sensory nerves are affected commonly due to length dependent relation. Sural nerve which carries sensory information from lateral aspect of sole is involved most frequently. The morbidity is increased due to pain, numbness, pins and needles sensations. So early detection of this sensory neuropathy by evaluating Sural NCS will help the individuals to decrease the complications and improve quality of life.
Methods: 20 participants with type2 diabetes were selected into the study, they were distributed into 2 groups, 10 individuals with less than 10yrs of diabetes duration and 10 with more than 10 yrs of diabetes duration. 10 age matched normal individuals were taken in the control group. For all the participants electro physiologic parameters of Sural Nerve were recorded bilaterally by making use of EMG OCTOPUS clarity machine.
Results: Results of latency, amplitude and conduction velocity were analysed by micro soft excel and Graph pad prism software. Statistical significance was measured with p value less than 0.05
Conclusion- All 20 Diabetic individuals have shown decrease in amplitude and conduction velocity and increase in latency when compared to normal individuals. The values were more altered in diabetics of longer duration.

Key words; Type2 Diabetes, Sensory Neuropathy, Latency, Amplitude, Sural NCV.

INTRODUCTION

Diabetes has changed its status from the problem of aged individuals to the major health concern of all the ages of the entire world. [1] The globally estimated prevalence according to IDF in 2017 for 18-99yrs age group was 451 millions and the projected hike for 2045 will be 693 millions, which is increasing at an alarming rate. [2]

India stands at vital place on the earth by contributing more number of diabetics. The mortality rate according to

WHO is 26 per 100,000 individuals. [3] In India, the South Indians are more prone to develop diabetes than North Indians. In south India, Hyderabad is at top position with prevalence of 16.6%, followed by Chennai 13.5% and Bangalore 12.4%. [4]
In total diabetics 95% are of having type2 variant. Lack of physical activity, inactive life style, imbalanced diet, obesity and strong family history favours the onset. [5]
The most worried and common complication of diabetes is neuropathy, it's prevalence in India ranges from 10.5% to 32.2% and according to western literature is up to 50%. [6] DPN is also the major cause of morbidity and mortality. [7]

Sensori motor distal symmetric poly neuropathy is the commonest and wide spread form among all neuropathies. Clinical examination of the patient usually reveals absence of pain, temperature, pressure, vibration senses and joint position sense that sequentially place the diabetic foot at ulceration, gangrene and amputation risk. [8,9]

Functional ability of any nerve is decided by the conduction velocity, which in turn lies in the hands of inter nodal distance, degree of myelination and nerve diameter. [10] In DPN the nerve undergoes atrophy and Wallerian degeneration that starts in a slowly progressive manner majorly affecting sensory fibers followed by motor fibers. [11,12] Eva L. Feldman *et al*., stated that DPN is present even at the time or after the diagnosis of type2 DM. NCS has close correlation with anatomical damage of the nerve. [13] Sural nerve is the distal nerve which is involved early and is abnormal in majority of diabetic people. [11] Electro physiologically sural nerve has the high diagnostic value in detecting DPN when compared to other tests. [14] Hence this nerve is selected for this research. NCV is the most sensitive, objective, reliable, and non invasive method to diagnose DPN. [15] NCV abnormalities occur prior to clinical diagnosis *i.e*., even in subclinical neuropathic state also. Among all parameters amplitude is the most sensitive indicator of neuropathy. [12,16,17] Major Sharmeen Sultana *et al*., in their study on Bangladesh population concluded that diabetics with shorter duration have minimal abnormality in NCS and almost similar to normals. [18] In view of above two statements this study is planned to know whether NCS abnormalities can occur in early or late stages of Diabetes?

MATERIALS AND METHODOLOGY

Individuals having type2 diabetes of age 40-70yrs, both genders, were included. The exclusion criteria were; skin lesions that will interfere with NCV procedure, neuropathy with other causes like severe liver and kidney diseases, B12 vitamin deficiency, connective tissue diseases and other metabolic or hereditary diseases, history of taking isoniazid and furaxone that may affect nerve function, chronic alcoholics, subjects having plantar ulcers and foot problems. [19]

PROCEDURE: 30 participants (20 patients and 10 age matched normals) were distributed into three groups. Group A control group consists of 10 individuals who are normals, Group-B (0-10yrs of DM), Group-C (>10yrs of DM) of 10 each, consent was obtained before starting the procedure, after proper preparation of the patient and the machine, proper explanation about the technique was given and electro physiologic parameters of Sural Nerve were recorded bilaterally by following antidromic method of stimulation.

RESULTS

The data was analysed by micro soft excel and Graph pad prism software. Data was summarized by mean ± SD for continuous data. The intergroup comparision was done by 1way ANOVA test followed by Bonferroni multiple comparision test for continuous normal data and Kruskal Wallis test and followed by Dunn's multiple comparision test for continuous non normal data.

Table 1: Sural Nerve latency values in all 3 groups

PARAMETER	SIDE	GROUP	MEAN	SD	P-value	STATISTICAL TEST
LATENCY - ms	RIGHT	A	1.79	0.15	< 0.0001	One Way ANOVA and followed by "Bonferroni's Multiple Comparison Test
		B	2.33	0.31		
		C	3.26	0.26		
	LEFT	A	1.83	0.21	< 0.0001	"Kruskal-Wallis test" and followed by "Dunn's Multiple Comparison Test"
		B	2.44	0.37		
		C	3.34	0.69		

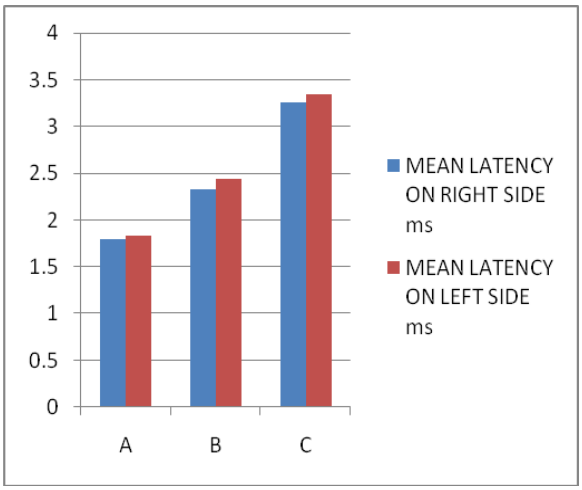


Table 1 gives inference about the bilateral Sural nerve latency values, we can notice prolonged latency in group B & Group C patients compared to Normal people (Group A). When all 3 groups are compared statistically significant difference is noticed between A&B,A&C and B&C on both sides.

Table 2: Sural Nerve Amplitude values in all 3 groups

PARAMETER	SIDE	GROUP	MEAN	SD	P-value	STATISTICAL TEST
AMPLITUDE µV	RIGHT	A	18.72	1.22	< 0.0001	One Way ANOVA and followed by "Bonferroni's Multiple Comparison Test"
		B	13.25	2.08		
		C	9.30	2.27		
	LEFT	A	18.35	2.24	< 0.0001	One Way ANOVA and followed by "Bonferroni's Multiple Comparison Test"
		B	13.64	1.72		
		C	9.83	2.15		

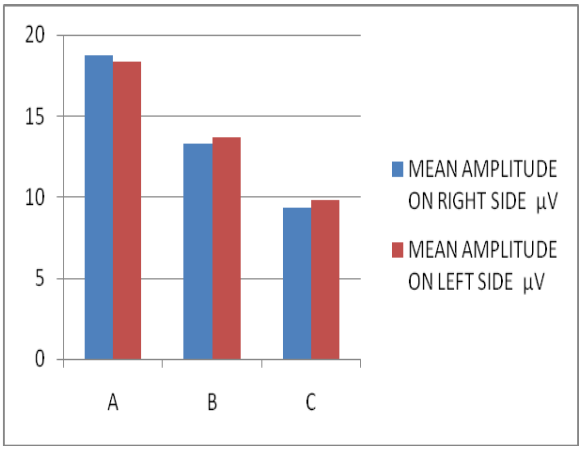


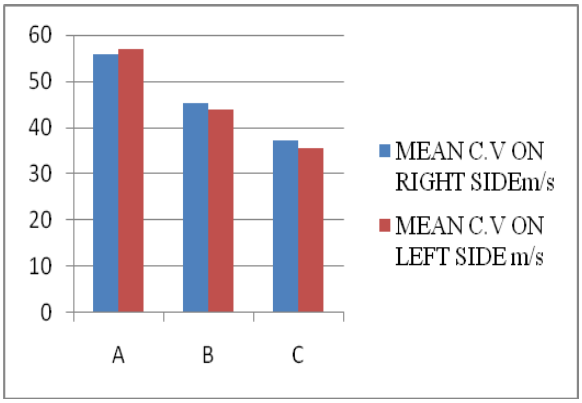
Table 2 shows the data about the bilateral Sural nerve Amplitude values, we can find decrement in group B & Group C patients compared to Normal people (Group A). When all 3 groups are compared statistically significant difference is noticed between A&B,A&C and B&C on both sides.

Table 3: Sural Nerve Conduction Velocity values in all 3 groups

PARAMETER	SIDE	GROUP	MEAN	SD	P-value	STATISTICAL TEST
COCNDUTION VELOCITY-m/s	RIGHT	A	55.71	3.86	< 0.0001	One Way ANOVA and followed by "Bonferroni's Multiple Comparison Test"
		B	45.31	3.50		
		C	37.20	2.91		
	LEFT	A	56.95	6.32	< 0.0001	"Kruskal-Wallis test" and followed by "Dunn's Multiple Comparison Test"
		B	43.85	3.33		
		C	35.56	2.05		

Table 3 illustrates the values of bilateral Sural nerve Conduction Velocity values, we can find reduction in group B & Group C patients compared to Normal people (Group A).

when all 3 groups are compared statistically significant difference is noticed between A&B,A&C and B&C on both sides.



DISCUSSION

Present study results have given us an inference that diabetes is certainly having considerable influence on electro physiologic profile of Sural Nerve based on the duration. The longer the duration the more is the latency, less is the amplitude and conduction velocity were noted in diabetics on par with the age matched normals. In our study we have not noticed statistically significant difference between normal individuals and diabetics of less duration and longer duration.

In this work a difference has been noted among the individuals of Group A, B and Group C. When Group A individuals are compared with Group B &C, statistically significant difference is noticed among all the groups. Thus we can say that as the duration of diabetes is increasing more alteration is seen in NCV parameters. This indicates a significant sensory nerve dysfunction in the peripheral diabetic neuropathy. This notation is strongly supported by the work done by Dr. Sarvesh Shirsat *et al*., in 2016; [5] Carlos Pastore, *et al*., in 1999 [14] and Yunqian Zhang et al., in 2014, [17] who have used NCV in their study and concluded that the parameters were altered more in chronic diabetics, the amplitude was altered in early diabetics. Vijay Viswanathan *et al*., 2004 [20] have suggested that conduction velocity was altered in early stages of diabetes.

Justification behind the altered NCV values is due to the pathological and structural alterations which are taking place in the neurons due to diabetes. These include deprived axoplasmic nutrition to the rear end of the axon, consequently leads to degeneration of axons. [16] Atrophy and loss of myelinated and unmyelinated axons due to Wallerian degeneration is noticed. [21] In addition to this there is also depletion of myelin basic protein between the nodes and in stretched nodes sodium channel expansion is noted along with the development of heminodes.

The myelinated axons are dense as they have quantifiable fibers in glabrous skin even in advanced neuropathic state. This may be the reason for obtaining NCV in early Diabetics (group B). [22] In chronic neuropathic states capillary walls are thickened and endothelial cells are increased. Even the Epineurial arterioles are also thickened and occluded. [23] Thus impairing the physiological properties of conduction and resulted in abnormal findings in electro physiological parameters of group C. As the peripheral nerve has the neuroplastic capacity, early detection of the abnormal findings by NCV always helps the diabetic patients to lead a good quality of life. [24] Future research can be focused on doing the study in large samples and finding the correlation between these parameters with other factors like duration of diabetes, gender influence and BMI.

CONCLUSION

Results of our study state that the electrophysiologic profile of sural nerve is altered in diabetic peripheral neuropathy individuals when compared to normals. Same study gives inference that with longer duration of Diabetes more the latency, less the amplitude and conduction velocity values were observed.

ACKNOWLEDGEMENT

We are indebted to Dr Chitturi Bhujanga Rao for his continuous support during the manuscript preparation.

REFERENCES

1. V. Mohan, S. Sandeep, R. Deepa, B. Shah, C. Varghese, "Epidemiology of type 2 diabetes: Indian scenario", *Indian J Med Res*., 2007, *125*, 217-230.
2. N. H. Choa, J. E. Shaw, S. Karuranga, Y. Huang, J. D. da Rocha Fernandes, A. W. Ohlrogge, B. Malanda, "IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045", *Diabetes Research and Clinical Practice*, 2008, *16*, doi: https://doi.org/10.1016/j.diabres.2018.02.023.
3. S. N. Akhtar, P. Dhillon, "Prevalence of diagnosed diabetes and associated risk factors: Evidence from the large-scale surveys in India", *Journal of Social Health and Diabetes*, 2017, 5 (1), 28-36.
4. S. A. Kaveeshwar, J. Cornwall, "The current state of diabetes mellitus in India", *Australasian Medical Journal*, 2014, *7*(1), 45-48.
5. S. Shirsat, M. Shende, "To Study the Sensory Nerve Conduction Velocity in Initial Stages of Diabetic Neuropathy in Type 2 Diabetes Mellitus." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)* , 2016, 15(5),40-46.
6. S. Trivedi, A. Pandit, G. Ganguly, S. K. Das, "Epidemiology of Peripheral Neuropathy: An Indian Perspective ''Annals of Indian Academy of Neurology, 2017, *20*, 173-84.
7. T. Mete, Y. Aydin, M. Saka, H. C. Yavuz, S. Bilen, Y. Yalcin, B. Arli, D. Berker, S. Guler, "Comparison of Efficiencies of Michigan Neuropathy Screening Instrument, Neurothesiometer, and Electromyography for Diagnosis of Diabetic Neuropathy", *International Journal of Endocrinology*, 2013, Article ID 821745, 7 pages.
8. J. M. A. Boulton, I. A. i. Vinik, J. C. Arezzo, V. Bril, E. L. feldman, R. Freeman, R. A. Malik, R. E. Maser, J. M. Sosenko, D. Ziegler, "Diabetic Neuropathies" *Diabetes Care*, 2005, *28*, 956-962.
9. J. G. Llewelyn, "The Diabetic Neuropathies: Types, Diagnosis And Management" *J. Neurol Neurosurg Psychiatry*, 2003,*74*, ii15–ii19.
10. M. Gakhar, S. K. Verma, A. Lehri, "A Comparison of Nerve Conduction Properties in Male and Female of 20 to 30 Years of Age Group" *Journal of Exercise Science and Physiotherapy*, 2014, 10 (1), 16-20.
11. Z. Ali, M. Hakim, M. Islam, N. B. Bhowmik, S. Nahar, A. A. Ullah, A. Haque, "Role of Electro-Diagnostic Tests In Early Detection of Diabetic Neuropathy" *Bangladesh Journal of Neuroscience*, 2008; 24 (1), 34-44.
12. J. A. Tracy, J. B. Dyck, "The Spectrum of Diabetic Neuropathies" *Phys Med Rehabil Clin N Am.* 2008 February ; 19(1): 1–v. doi:10.1016/j.pmr.2007.10.010
13. E. L. Feldman, M. J. Stevens, P. K. THOMAS, M. B. BROWN, N. CANAL, D. A. Greene, "A Practical Two-Step Quantitative Clinical and Electrophysiological Assessment for the Diagnosis and Staging of Dianetic Neuropathy" *Diabetes Care*, 1994, 17(11), 1281-1289.
14. C. Pastore, v. Izura, e. G-. Barrientos, j-. R. Dominguez, "A Comparison Of Electrophysiological Tests For The Early Diagnosis Of Diabetic Neuropathy" *Muscle Nerve*, 1999, 22, 1667–1673.
15. H. R. Fateh, S. P. Madani, R. Heshmat, B. Larijani, "Correlation of Michigan Neuropathy Screening Instrument, United Kingdom Screening Test and Electrodiagnosis for Early Detection of Diabetic Peripheral Neuropathy" *Journal of Diabetes & Metabolic Disorders*, 2016, 15(8), 2-5.
16. A. Asad, M. A. Hameed, U. A. Khan, M-.ur- R. A. Butt, N. Ahmed, A. Nadeem, "Comparison of nerve conduction studies with diabetic neuropathy symptom score and diabetic neuropathy examination score in type-2 diabetics for detection of Sensorimotor Polyneuropathy", *J. Pak. Med Assoc*, 2009, 59(9) , 594-598.
17. Y. Zhang, J. Li, T. Wang, J. Wang, "Amplitude Of Sensory Nerve Action Potential In Early Stage Diabetic Peripheral Neuropathy: An Analysis Of 500 Cases; *Neural Regeneration Research*, 2014, 9(14) 1389-1394.
18. M. S. Sultana, N. Begum, L. Ali, B. Gen, Md. M.Hossain, Nirmelendu, B. Bhowmik, S. Parveen, M. Z. Perveen,

"Electrophysiological Changes of Sensory Nerves In Patients with Type-2 Diabetes Mellitus of Different Duration", *BSMMU J*. 2010, 3(1), 9-12.

19. A. Ahmad, A. Moinuddin, A. Ahsan, A. Goel, "Study of Electrophysiological Changes in Sensory Nerves Among Diabetic Smokers", *Journal of Clinical and Diagnostic Research*. 2016, 10(1), CC09-CC11.
20. V. Viswanathan, R. Seena, M. B. Nair, C. Snehalatha, R. M. Bhoopathy, A. Ramachandran, "Nerve conduction abnormalities in different stages of glucose intolerance" *Neurology India*, 2004, 52(4), 466-469.
21. Z. ALI, M. Hakim, M. Islam, N. Bikashbhowmik, S. Nahar, A. K. M A. Ullah, A. Haque, "Role of Electro-Diagnostic Tests In Early Detection of Diabetic Neuropathy", *Bangladesh Journal of Neuroscience*,2008, 24 (1),34-44.
22. A.C. Peltier, M. I. Myers, K. J. Artibee, A. D. Hamilton, Q. Yan, J. Guo, Y. Shi, L. Wang, J. Li, "Evaluation of dermal myelinated nerve fibers in diabetes mellitus", *J Peripher Nerv Syst*., 2013, 18(2),1-11.
23. P. J. Dyck, A. Lais, J. L. Karnes, P. OBrien, R. Rizza, F. Loss, "Fiber Loss Is Primary and Multlfocal in Sural Nerves in Diabetic Polyneuropathy" *Ann Neurol*, 1986, *29*, 425-439.
24. R. Garg, A. Kumar, U. Dhar, "A Study of Median Nerve Conduction Velocity in Diabetes Mellitus Type 2 in Neurologically Asymptomatic Patients" *International Journal of Health Sciences & Research*, 2013, 3(5), 42-49.

How to cite this article: Maruboyina S, Attry S, Kumari. BK et.al. Sural nerve electrophysiologic profile in normals and type2 diabetics of dissimilar duration. Int J Health Sci Res. 2019; 9(5):196-201.

******