

SYMMETRY OF ELECTRO PHYSIOLOGICAL MEASURES OF SURAL NERVE IN TYPE2 DIABETES PATIENTS

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ABSTRACT

BACK GROUND AND PURPOSE: The incidence of diabetes is increasing in the present era due to altered life style and food habits. Decreased sensory perception of the foot due to neuropathy disturbs the individual in all aspects. The gold standard test to quantify this complication is nerve conduction studies (NCS). As the sensory complications occur prior to motor, sural nerve conduction velocity (NCV) can evaluate this problem early. limb dominance is one of the interesting area of research. Dominance usually place a crucial role in upper limbs. The dominant hand usually have more strength and coordination compared to non dominant hand. Based on the usage the physiological properties of the underlying structures will vary. Even the nerve properties are also influenced by dominance. Abundant literature is available on NCV symmetries in upper limbs. Studies on symmetry of lower limb sensory nerves are scarce in south Indian diabetic patients. So in this study we have measured the symmetry of sural nerve in normal and type2 diabetic individuals.**MATERIALS AND METHODS:** 20 diabetic patients were equally divided into 2 groups, B and C of each 10 persons. Age matched 10 normal individuals are included in the control group A. Sural NCS parameters are recorded bilaterally by following the standard procedures.**RESULTS:** In normal individuals there were no

*differences found between right and left side NCS values in all 3 parameters (latency, amplitude & conduction velocity). We got more p-values - for latency it is 0.673, for amplitude the value is 0.652 and for conduction velocity it is 0.604. Even in diabetics of less than 10yrs duration same findings were observed with greater p-values of 0.463, 0.653, 0.354. In more than 10yrs duration of diabetics also p-values are high 0.752, 0.598, 0.163 respectively. **CONCLUSION:** the high p-values obtained in all three parameters indicates statistical insignificance, so we can conclude that there are no symmetrical alterations of electro physiological parameters of sural nerve in normal individuals and even in diabetic patients.*

KEY WORDS: *symmetry, sural nerve NCV, type2 diabetes.*

INTRODUCTION

The world wide prevalence of diabetes according to IDF in 2017 among 18-99 yrs age is 451 million cases which will be predicted to rise up to 693 million cases by 2045¹. In Asians, particularly in Indians diabetic problem is seen at early and most productive ages. Hence people who live with diabetic complications are higher in india.² Hyderabad is having highest prevalence of diabetes as 16.6% among the southern Indian cities.³

Distal symmetrical sensorimotor polyneuropathy (DPN) is the commonest form of peripheral neuropathies that progresses from distal to proximal direction with predominant sensory involvement in glove and stocking distribution.^{4,5}

A study on 273 Karnataka coastal population have revealed the prevalence of peripheral neuropathy assessed by using Diabetic Neuropathy Symptom (DNS) questionnaire was 41.4%.⁶ DPN can affect the individuals at the diagnostic stage of type2 diabetes mellitus (DM). In detecting the neuropathy sural nerve electro physiology is the best choice as it catches the disease even in subclinical states.⁷ In lower limbs almost 60% of the diabetic patients showed sural nerve abnormalities significantly,⁸ hence this nerve is selected for the study.

Limb preference is majorly observed in upper limbs compared to lower limbs. Literature is majorly describing the symmetrical differences of motor nerve conduction velocity (MNCV) and sensory nerve conduction velocity (SNCV) in upper limbs, which is obvious.^{9,10} Navin Gupta et al., 2008, in their research on SNCV of median nerve, they concluded that more values were observed on left side.¹¹ Uner Tan in 1993, have done a study on SNCV of median and ulnar nerves and postulated that sensory nerve conduction velocities are higher on the left than the right hand and motor conduction is faster on the right hand than left in right handed normal subjects.¹²

In lower limb major studies were focused on MNCVs that to on sport specific asymmetries. Sanjivani N. et al., 2017, have recorded NCV of tibial and peroneal nerves in 100 healthy adults and concluded that no side differences were obtained.¹³ Kashif Ali et al., studied the median and

common peroneal nerves MNCV & SNCV in healthy adults and concluded that no differences exist on right and left sides.¹⁴

The studies on SNCVs on south Indian diabetic population are rare. Hence our research work is majorly focused on measuring the sural nerve NCV symmetries in normal as well as type2 diabetic patients.

MATERIALS AND METHODS

20 Diabetic patients were divided into two groups, 10 persons as Group B whoever having DM (diabetes mellitus) less than 10 yrs duration and the rest of 10 were kept as Group C with DM more than 10yrs duration. The group A is control group included 10 age matched normal individuals. Informed consent was obtained from all of the participants. Selecting criteria into study are: type2 diabetes, both genders, age 45-65yrs. Exclusion criteria are: unable to follow commands, alcoholics, smokers, other causes of neuropathy like thyroid disorders, B12 deficiency etc., skin infections, oedema or lesions in the target area.

PROCEDURE- NCS parameters were recorded bilaterally for all the 30 individuals following the standard procedures. After positioning the patient on couch the Sural nerve is stimulated antidromically. Placement of Electrodes: *Stimulating Electrode*:- along the posterior surface of the leg slightly lateral to midline 10-16 cm proximal to recording electrode. *Recording Electrode*:- postero inferior to lateral malleolus. *Reference Electrode*:- 2-3cm distal along the lateral dorsum of the foot. *Ground Electrode*:- between stimulating and recording electrodes.^{15,16} latency, amplitude and conduction velocity values were recorded.

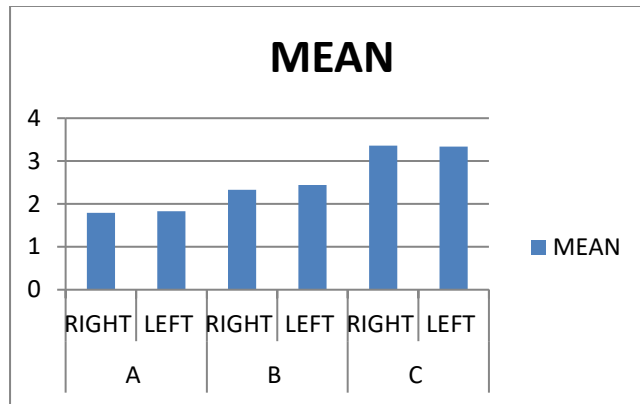
RESULTS

Results were analysed by using unpaired t test. In all of three groups we have obtained more p-values in all the three parameters.

Table: 1 Latency Values (ms) in 3 Groups

Group	N	Side	Mean	SD	P-value
A	10	Right	1.79	0.15	0.591
	10	Left	1.83	0.21	
B	10	Right	2.33	0.31	0.444
	10	Left	2.44	0.37	
C	10	Right	3.36	0.26	0.696
	10	Left	3.34	0.69	

Graph :1



The Table 1 and the Graph 1 Explains about latency values in all 3 groups. When we compare right and left sides in normals i.e, Group A the p-value is (0.591) the p-value of Group B is (0.444) and for Group C it is (0.696), the higher p-values indicate statistical insignificance, therefore no differences were observed in the latency among 2 sides in all 3 groups.

Table : 2 Amplitude Values (micro volts) in All 3 Groups

Group	N	Side	Mean	SD	P-value
A	10	Right	18.72	1.22	0.559
	10	Left	18.35	2.24	
B	10	Right	13.25	2.08	0.284
	10	Left	13.64	1.72	
C	10	Right	9.30	2.26	0.485
	10	Left	9.83	2.15	

Graph: 2

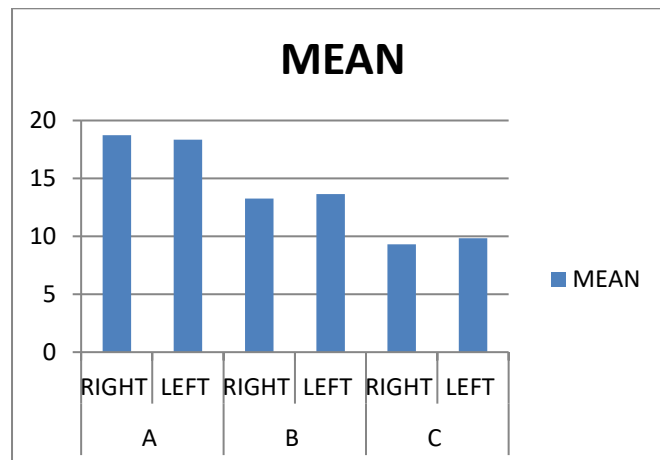
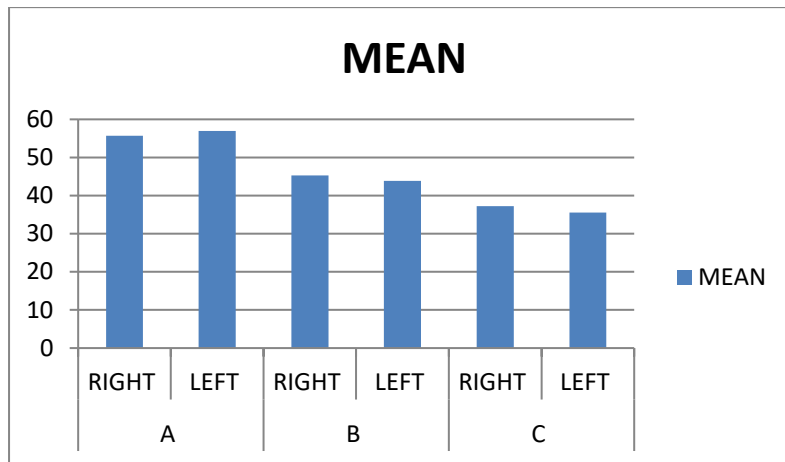


Table 2 and Graph 2 shows summarized amplitude values in all 3 groups., the p-value of Group A is 0.559, in Group B the p-value is 0.284 and for Group C the p-value is 0.485 which are high, thus statistical insignificance is observed and no difference has noticed in the amplitude between 2 sides in all three groups.

Table : 3 Conduction Velocity (m/s)Values in All 3 Groups

Group	N	Side	Mean	SD	P-value
A	10	Right	55.71	3.86	0.561
	10	Left	56.95	6.32	
B	10	Right	45.31	3.50	0.073
	10	Left	43.85	3.33	
C	10	Right	37.2	2.91	0.099
	10	Left	35.56	2.05	

Graph :3



The Table 3 and Graph 3 give details regarding the conduction velocity values in all groups. At this point the p-value of people from Group A is obtained as 0.561, the p-values of the Groups B and C are 0.073 and 0.099 respectively. The high p-values indicate that the results are not very significant. Therefore no difference has noted between the conduction velocity values on 2 sides.

DISCUSSION

The present study results from all the 3 groups gives us inference that there are no differences exist between right and left side NCS measures in normal as well as in patients of varied diabetic duration. This could be due to the change in dependence on the legs in relation to the tasks. For majority of humans the right foot is the choice for mobility tasks and left foot for stability tasks.¹⁷ Studies on adult population revealed that there is no statistical significant effect of lower limb dominance in any of the functional tests like isokinetic quadriceps and hamstring tests, hamstring:quadriceps ratios, single-leg hop for distance, single-leg vertical jump and vertical ground reaction force following a single-leg vertical jump.¹⁸ Even the power is also the same

between the lower extremities of normal people.¹⁹ Timothy M. et al., 2015, in their systemic review on the effect of limb dominance on lower limb functional performance explained that 90% of people opt the right hand to carry out any action. This is not the case with the leg as 25-45% exhibit right leg preference for activities and is majorly task specific,²⁰ thus no variation is observed in lower limbs SNCV values.

Our study results are consistently in agreement with the work done by Bruce A. Perkins et al., 2002, on Canadian population of both types of DM, where they have stated that there is no difference exist in NCS values between right and left sides of different stages of neuropathy and is symmetrical.²¹ Kashif Ali et al., done a study in normal individuals and proved that no asymmetry exists.¹² Suni Chouhan, 2012, in his study on MNCV of common peroneal nerve in young adults have found that there are no considerable differences observed among all the variables between right and left sides.²²

The alterations noted in electrophysiological measures in diabetic individuals compared to normals are due to underlying pathological process of the disease, where there is reduction in the lumen of micro vessels which compromises the blood flow and oxygenation to the nerve leads to endoneurial microangiopathy. This is illustrated by thickening of basement membrane and endothelial hyperplasia. Schwann cell demyelination also occurs. Thus reducing the conduction of the nerves.²³ As the neuropathy ascends symmetrically in both the limbs no right left dissimilarity was observed.

CONCLUSION

Since the electro physiological measures of sural nerve are symmetrical in normal as well as in diabetic patients, unilateral NCS measures can be taken into consideration in further studies.

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