Comparison of Nerve Conduction Studies in Geriatric Normal and Diabetic Subjects

Muthuselvi K.[1*], Shanthi M.[2], Ethiya N.[3]

[*1]Associate Professor, Dept. of Physiology, Govt. Theni Medical College, Theni
[2]Associate Professor, Institute of Physiology, Madurai Medical College, Madurai
[3]Associate Professor, Institute of Physiology, Madurai Medical College, Madurai

Abstract: ***Background and objective: Diabetes mellitus is one among the disease that affects the peripheral nervous system worsely and ageing too has its impact over the peripheral nerve functions. Nerve conduction study is used as the best tool to diagnose peripheral neuropathy. This study aims at the comparison of nerve conduction studies in aged diabetic individuals and their normal counterparts. Method: The study group consists of 30 diabetic male subjects in the age group of 60-80 years in whom other neurological disorders were ruled out and the control group consists of 30 non-diabetic male subjects in the same age group without any neurological disorders. Blood sugar values were estimated by fully automatic analyzer method. Nerve conduction studies were done by Jaeger-Toennies-Neuroscreen plus. The amplitude and the nerve conduction velocity of the tibial nerve for the motor component and sural nerve for sensory component were studied and compared. Blood sugar values were correlated with sensory and motor NCVs. Result: The amplitude and the NCV of sensory nerve conduction were markedly reduced in diabetic subjects with extremely significant 'p' value when compared with non-diabetic controls. The amplitude and NCV of the motor nerve conduction were also reduced in diabetic subjects. With increasing blood sugar values there was a progressive decrease in both sensory and motor nerve conduction velocities. Conclusion: From the present study it is concluded that there is a significant decrease in the nerve conduction study parameters, both sensory and motor system in diabetic subjects.***

Keywords: NCS, Diabetics, Peripheral Neuropathy

1. Introduction

NCS is one among the neurophysiological method by which the electrical properties of the motor and sensory nerves can be evaluated. In the past two decades, major advances have taken place in the field of peripheral nerves; especially in relation to its structure, histochemistry, neurophysiology and axonal transport systems. These advances have not only contributed to a better understanding of normal peripheral structure and function but also in relation to various diseases. Diabetes mellitus which affects about 16 million people (Younger.DS Brinfin199)has many complications and diabetic neuropathy in one among them. 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. Although there are different types of diabetic neuropathy, sensorimotor neuropathy is more common and nerve conduction study remains the mainstay to assess the nerve function in diabetes. 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. Therefore the present study involves the motor and sensory nerve conduction studies in the diabetic subjects of 60-80 years and a comparison is made with the normal individuals in the same age group.

2. Methods and Materials

The study group consists of 30 male subjects suffering from diabetes mellitus of varying duration in the age group of 60-80 years, who were not having any other neurological disorders. The random blood sugar was estimated by fully automatic analyzer method. Nerve conduction studies were done by using Jaeger-Toennies-NeuroscreenPlus, a subsidiary of Viasys health care. With reference to the neurographic programs motor and sensory NCV and amplitude cursors are automatically set by the program. In addition to the temperature, the delta distance can be directly entered during the NCV examinations. If the initials [S] for stimulation site, [R]for recording site are entered during the recording, the corresponding entries will appear. The measurement can stopped by pressing [Esc].The signals recorded are saved by executing the command[F3].With [F4] a report preview is displayed on the screen. Sensory antidromic: Sural nerve in both lower limbs was chosen for sensory antidromic study; since it is purely sensory. Nerve conduction of sural nerve is recorded by the surface electrode between the lateral malleolus and tendoachilles. The nerve is stimulated antidromically 10-15 cms proximal to the recording electrode, distal to lower border of gastrocnemius at the junction of middle and lower third of the leg. During the recording, the leg should be relaxed and lateral position is convenient. The normal sural nerve conduction velocity is >40m/s. The amplitude of the sensory nerve action potential is 6 micro volts. By pressing the start key the observation mode is activated which will be indicated by a yellow light on the screen. This mode is used to determine the patient's stimulation threshold, whereas the actual measurement is performed in the average mode. The stimulus can be triggered by activating the foot key or directly at the stimulator. While the stimulus is triggered by pressing the foot key, the stimulation current is gradually increased until the response potentials looks as desired. If the foot key is pressed more than 0.6 seconds a brief beep tone can be heard and by cyclical stimulation the current intensity may be increased to define the stimulation threshold. If the start key is pressed now, the measurement will be automatically activated, the signal lamp down on right will become green, and stimulation will be continued until a number of 10 sweeps has been recorded. The signal is averaged in the recording mode so that another averaging step is triggered as soon as the foot key is pressed. Stimulate until the desired potential form is achieved. The measurement is stopped by pressing the [esc]key. The trace is saved automatically. Press the tab key in order to activate the next sequence. After the recording has been completed, the distance between the stimulation and recording site has to be entered for the sequence measured. Thus the nerve conduction velocity will be automatically calculated.Motor-Orthodromic: Tibial nerve was chosen for the motor component. Tibial nerve conduction is studied by placing the surface recording electrode on the abductor hallucis slightly below and anterior to the navicular tuberosity. Surface stimulation is used behind and proximal to the medial malleolus and in the midline (MA and LIVESON1983).The normal conduction velocity of the tibial nerve is.40m/sec. The amplitude of the compound muscle action potential is 8 micro volts. The program of nerve conduction study-motor will automatically be started by pressing the foot or start key. There are four sequences preset. In the first sequence the [ri.motor distal] measurement is performed to define the latency, whereas the NCV is determined by means of the [ri.motor proximal] measurement performed in the second sequence. If the foot key in the recording mode is pressed to trigger the stimulus, the screen signal will be overwritten by the new value measured. As soon as the current intensity is increased and the maximum muscle potential has been reached, the supramaximal muscle response is obtained. Press the tab key in order to activate proximal stimulation. The signal recorded in the previous sequence by means of distal measurement will now be kept in memory. As soon as the stimulation is continued by pressing the foot key, the measurement programmed is also immediately active in the second sequence. The stimulus intensity used for distal measurement will be kept unchanged so that there is no need to start with 0 ma, but can go on approaching the supramaximal stimulus intensity for proximal stimulation, taking the value previously adjusted as a basis.

3. Results

Table 1: Comparison of sensory amplitude on right and left lower limb of the control and diabetics

Contents		Control		Diabetics	
		X	s	x	S
Sensory amplitude	Right	8.5	3.52	3.5	4.4
	Left	8.3	3.61	3	3.95

$P<0.05$

Table 2: Comparison of sensory nerve conduction velocity on right and left lower limb of the control and diabetics

Contents		Control		Diabetics	
		X	s	x	S
Sensory NCV	Right	42.8	3.91	20.2	9.31
	Left	43.3	3.75	19.1	9.51

$P<0.05$

Table 3: Comparison of motor amplitude of the distal and proximal segments of the tibial nerve in the control and diabetics

Contents		Control		Diabetics	
		X	s	x	S
Motor amplitude	Proximal	9	3.36	4.1	3.5
	Distal	8.1	2.96	3.6	3.14

$P<0.05$

Table 4: Correlation between blood sugar values and sensory nerve conduction velocities in diabetic individuals

Contents		Control		Diabetics	
		x	s	x	S
Blood sugar		94.87	10	267.7	85.13
Sensory NCV	Right	42.8	3.91	20.2	9.31
	Left	43.3	3.75	19.1	9.51

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. 'p' value is also significant. The sensory nerve conduction velocities were markedly reduced in diabetic subjects and the 'p' value is extremely significant, which implies that diabetes mellitus has strong negative influence over the sensory nerve conduction. The motor nerve conduction velocities were also reduced in diabetic subjects and 'p' value is significant. It is also seen that on correlating the blood sugar values, there is 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.

4. Discussion

Results of the present study indicate that there is a definite decrease in amplitude and nerve conduction velocities of both the sensory and motor components. There is also a significant correlation between the increasing blood sugar values and decreasing NCVs. 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. According to the present study also, the mean values of both the motor and sensory nerve conduction velocities in the diabetic subjects were significantly reduced, sensory more than the motor. The present study also reveals the association of increasing blood sugar values having its implications over the sensory and motor nerve conduction velocities. With increasing and uncontrolled blood sugar levels there was a steep fall in the sensory NCV and a linear decrease in the motor NCV too. These studies were consistent with the previous study done by OLNEY;RICHARD K 15 920:129-137 March 1998.As per the journal of Neurobiology of ageing in Inchianti study by Angelo Di Lorioa et al vol.27 issue 9; 1280-1288 (Sep2002) average conduction velocities in the peripheral nerve decreases linearly with age. But according to our present study, ageing doesn't have any influence over the motor and sensory nerve conduction velocities when averaged, though the nerve conduction velocities in motor and sensory nerves were reduced in some individuals of the study.

5. Conclusion

From the present study, the results suggested that there is a definite decrease in the nerve conduction study parameters, both sensory and motor in the diabetic subjects. Sensory nerve conduction velocity is the most affected parameter in the diabetic subjects. There is also a significant decrease in the motor nerve conduction velocities. The amplitude of both the sensory and motor conductions is equally affected. The added information apart from comparing the NCS is that there is a strong correlation between the blood sugar values and the nerve conduction velocities, both sensory and motor. This implies that strict control of blood sugar levels, with early detection of diabetic neuropathy, and proper treatment will prevent further damage to the peripheral nerves, which otherwise will be worsening as the disease progresses. Therefore NCS is the best option to prevent nerve damage in diabetes, if detected early.

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