

COMPARISON OF SENSORY NERVE CONDUCTION IN UPPER LIMB AND LOWER LIMB IN ASYMPTOMATIC DIABETICS AND NORMAL VOLUNTEERS

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Abstract: Background & objective: Study was undertaken to evaluate the magnitude of effect of DM on nerve conduction in upper limb and lower limb in diabetic individuals and to compare the results with normal healthy volunteers. **Method:** The study was carried out at NHL medical college in 50 diabetic and 50 normal volunteers. NCV was measured by EMGNCV recording machine, Neuroperfect plus of Medicaid systems. **Result:** Amp & CV in upper limb nerve i.e. median nerve in diabetics was $30.1 \pm 8.3 \mu\text{V}$, CV 52.1 ± 3.8 m/s while in lower limb nerve i.e. sural nerve, it was $10.3 \pm 4 \mu\text{V}$ and 46.8 ± 3.5 m/s. the value for amplitude and conduction in healthy volunteers in upper limb was $36.8 \pm 5.4 \mu\text{V}$ and 58.7 ± 2.4 m/s and in lower limb the value for the same were $15.8 \pm 4.0 \mu\text{V}$ and 50.6 ± 1.9 m/s. The results were analyzed using unpaired t test and were found to be highly significant*. **Conclusion:** It was observed that in diabetes, nerves of the both the limbs are affected but the upper limb nerves are affected more.

*P value – 0.001

Key Words: Asymptomatic Diabetes mellitus nerve conduction median nerve sural nerve

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Introduction:

Nerve conduction velocity (NCV) is a test to see how fast electrical signals move through a nerve. Ultimately, conduction velocities are specific to each individual and depend largely on an axon's diameter and the degree to which that axon is myelinated, but the majority of 'normal' individuals fall within defined ranges.¹ Nerve conduction study can determine nerve damage and destruction. During the test, the nerve is stimulated, usually with surface electrode patches attached to the skin. Nerve impulses are extremely slow compared to the speed of electrical impulses which are on the order of 50%–99% of the speed of light, however, very fast compared to the speed of blood flow, with some myelinated neurons conducting at speeds up to 120 m/s (432 km/h or 275 mph).

Anthropometric and other individualized factors can cause deviation in conduction velocity. Stetson et al² and Thanakiatpinyo et al³ have described in detail the effect of individual's age, sex, local temperatures, and other anthropometric factors such as hand size and height on nerve conduction values. It is important to understand the effect of these various factors on the normal values for

nerve conduction measurements to aid in identifying abnormal nerve conduction study results. According to Stetson et al² ability to predict normal values in the context of an individual's anthropometric characteristics increases the sensitivities and specificities of electrodiagnostic procedures. Nerve Conduction Study (NCS) is a test commonly used to evaluate the function, especially the ability of electrical conduction, of the motor and sensory nerves of body.

Nerve Conduction Study is used mainly for evaluation of paraesthesia (numbness, tingling, burning) and or weakness of the arms and legs. Common disorders which can be diagnosed by nerve conduction study are⁴:

- Peripheral neuropathy
- Carpal tunnel syndrome
- Ulnar neuropathy
- Guillain Barre Syndrome
- Facioscapulohumeral muscular dystrophy
- Spinal disc herniation.

With steady improvement and standardization of method, NCS have become a reliable means of testing peripheral nerve functions. They

supplement clinical observation by precisely localizing the lesion and characterizing the conduction abnormalities⁵

In the present study nerve conduction test was selected for finding out neuropathy in diabetic for the following reasons:

1. It is easily obtainable.
2. It is painless and harmless.
3. It provides a good recording.
4. It is easily reproducible and sensitive.
5. It gives a clear recording with minimal disturbances.
6. Not much of amplification is required.
7. 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.
8. Useful as a tool of diagnostic, prognostic and follow up study of Neuropathy.^{6,7,8,9}

Stolov et al¹⁰ states that DM is one of the most commonest hereditary disorder affecting the nerve conduction adversely & according to Pranali P et al¹¹ neuropathy is most common & troublesome complication of DM. 15% of patients with NIDDM have both symptoms and signs of neuropathy but nearly 50 percent have either neuropathic symptoms or slowing of Nerve Conduction Velocity, before patient develops any sign.¹²

Since the peripheral nerve has the ability to regenerate Zahed et al¹³ proposes therapeutic intervention at earlier stages so as to have a better result in the treatment of diabetic neuropathy. So early detection of diabetic neuropathy is one of the major goals in its management. Braune HJ¹⁴ advocates Electromyography and Nerve Conduction Studies as the chief investigations for the detection of Peripheral Neuropathy.¹⁴

Aims and objectives:

The present study

- 1) exploits recent advancement of technology as a means of assessing and comparing the effect of DM status on sensory fibre of upper and the lower limb.

- 2) compares the NCV in normal healthy volunteers and asymptomatic diabetics

Material and Methods:

A prospective observational study was conducted in 50 healthy volunteers and 50 asymptomatic Diabetic cases. Individuals in the age group of 30 – 70 years were selected for the study after obtaining their detailed history. The proforma was used to note the details of cases and volunteers.

The mean age for diabetics and control was 44 years and 46 years respectively.

Out of 50 controls, 70 percent were males and 30 percents were females and in diabetics 88 percent were males and 12 percent were females.

Inclusion criteria:

Healthy Volunteers, Diabetic patients without neurological symptoms.

Age group – 30 -70 years of age

Willingness of volunteers for study.

Exclusion criteria:

Smokers, alcoholic, tobacco chewing, other neural disorder besides neuropathy, diabetic with neural symptoms, on any medication.

Subjects were examined for the sign symptoms of clinical neuropathy and those having found positive were excluded from the study.

Selected volunteers subsequently underwent sensory nerve conduction study. Nerve conduction was assessed in upper limb (median nerve) and lower limb sural nerve by using EMGNCV recording machine, Neuroperfect plus of Medicaid systems . The result was analysed using unpaired t test. Permission was taken through proper channel concerned hospital authorities. Participants were explained the aim of the study and a written consent was taken. Ethical clearance was taken.

Result & Discussion:

In present study we observed (table 2) that nerve conduction as well as amplitude of action potential is adversely affected in diabetics but the median nerve value (upper limb nerve) shows greater fall than sural nerve (lower limb nerve) values.

66% of type 1 DM and 59% of type 2 DM develop neuropathy. By far the commonest type of Diabetic neuropathy is a mixed neuropathy with small and large fiber involvement. Hrishikesh Bagchi and co-workers¹⁵ in their study found that the sensory and autonomic symptoms are more prominent than motor one.

Zahed Ali et al 2008¹³ had found the similar result. Pranali¹¹ had observed inverse relation between glycemic level and sural nerve conduction in their study in 2015.

The reason for the greater fall in nerve conduction in upper limb need to be ascertain and it requires further research.

We also observed the direct correlation between the duration of DM and nerve conduction. We observed that with increase duration of DM the incidence of neuropathy increased.

In our study Out of 50 randomly selected Diabetics, 20 cases showed attenuation of amplitude and slowing of conduction velocity. It suggests 40 percent of total cases are having Neuropathy. Thus it shows Neuropathy do not occur in all patients of NIDDM. In comparison to normal healthy volunteers, amplitude and conduction velocity range is significantly decreased in NIDDM cases in all the sensory nerves.

Stetsons and coworkers² had observed that attenuation in amplitude is more common than conduction velocity.²

Most common nerve affected in upper limb is Median Nerve while in lower limb is Superficial Peroneal Nerve.

Study by Kennedy W R¹⁶ and Trojaborg W¹⁷ showed greater reduction in nerve conduction in lower limb as compared to that in upper limbs, suggesting that long nerves are comparatively more affected.

Diabetic neuropathy affects the conduction along entire length of the nerve but distal part is affected more than the proximal part.¹⁸

A study by Turgut N et al¹⁹ in healthy and diabetic children observed a significant slowing in sural nerve conduction and latency in diabetic children compared to healthy children but there was no change in amplitude of the sural nerve nerve

Table-1: Distribution of Control and Cases According to Age

S r. N o.	Ag e (yr s.)	No. of Control						% of Total Controls	
		M		F		Total		con trol	D M ca se
		Con trol	D M	Con trol	D M	con trol	D M		
		35	4 4	15	6				
1	30 - 40	6	2	2	1	8	3	16 %	6 %
2	41 - 50	7	8	1	2	8	1 0	16 %	2 0 %
3	51 - 60	13	2 5	5	1	18	2 6	36 %	5 2 %
4	60 - 70	9	9	7	2	16	1 1	32 %	2 2 %

Table-2: Comparison of Sensory Nerve Conduction Studies: Amp (in microvolts) & CV (in m/s), in Asymptomatic Diabetics Patients and Healthy Volunteers in our Study

Sr. No.	Sensory Nerves Affected	SNCV	Controls (Mean±SD)	Cases (Mean±SD)	'p' Value
1	Median N	Amp microvolts	36.8±5.4	30.1±8.3 (6.7 microv)	0.001**
		CV m/sec	58.7±2.4	52.1±3.8 (6.6 m/s)	0.001**
2	Sural N	Amp microvolts	15.8±4.0	10.3±4.4 (5.3 microv)	0.001**
		CV m/sec	50.6±1.9	46.8±3.5 (4.8 m/s)	0.001**

** - highly significant

Conclusion:

- As compared to healthy volunteers, asymptomatic diabetic patients show significant decrease in SNCV Studies.
- There is significant reduction in amplitude and conduction velocity of all the sensory nerves in asymptomatic diabetic patients as compared to healthy volunteers but upper limb nerve shows greater fall than nerves of the lower limb.

- Distal segment of the nerve is affected more than the proximal segment but the proximal conduction delay suggests radiculopathy.
- According to Broadstone VL²⁰ sensory studies seem to be more sensitive than motor studies for detection of early polyneuropathy in adults and hence NCV being simple, harmless, non-invasive and objective technique along with easy interpretation of results can be used routinely to obtain considerable information and evaluate the status of nerves in patients with NIDDM.

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