

## Study of Nerve Conduction Conduction Tests in Diabetics



### Medical Science

**KEYWORDS :** Diabetes mellitus; nerve conduction tests; sural nerve.

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### ABSTRACT

*Diabetes mellitus has rapidly emerged as a major health problem in developed and developing countries throughout the world. Diabetes with early age onset carries higher risk for heart attacks and even higher for peripheral vascular disease and 4-5 times for stroke, 3-5 times for nephropathy. The need for early diagnosis and effective treatment is evident, and much emphasis is now being placed on identifying high risk populations and implementing strategies for prevention. There have been rapid advances in our understanding of the pathophysiology of diabetes. The present study was conducted on 50 subjects of type 2 diabetes subjects in age group 30-60 years. The subjects for control group have been selected in age group of 30-60 years seeking for various other medical problems without diabetes and having no neuropathy of any other cause. In my study sural nerve in cases group it is observed that a significant decrease in conduction velocity has occurred (1). These patients with decreased sensory nerve conduction in sural nerve are having subclinical distal sensory peripheral neuropathy.*

### Introduction:

The prevalence of diabetes is increasing rapidly in all age groups in many parts of the world for the past 30 years. Diabetes with its long term complications causes a significant economic burden for a developing country like India. Diabetes neuropathy primarily affects the peripheral nervous system<sup>(2)</sup>.

Peripheral neuropathy damages nerves in the arms and legs<sup>(3)</sup>. These are multiple factors involved in the development of diabetic neuropathy<sup>(4)</sup>.

1. Micro vascular disease
  2. Advanced glycated end products
  3. Protein kinase c
  4. Polyol pathway
  5. Free radical and oxidative stress.
- classification of diabetic neuropathy.

#### A. Diffuse

1. Distal symmetric sensori – motor polyneuropathy.
2. Autonomic neuropathy.
3. Symmetric proximal lower limb motor neuropathy

#### B. Focal

1. Cranial neuropathy.
2. Radiculopathy / plexopathy.
3. Entrapment neuropathy.
4. Asymmetric lower limb motor neuropathy.

The mean conduction velocities of all motor and sensory nerves were slower ( $P < 0.05$ ) in subjects with polyneuropathy than with out polyneuropathy. The sural SAP and peroneal MCV together serve as a good diagnostic for diabetic polyneuropathy and can be used as a simplified criterion in field studies. (Neuroepidemiology 2007).

Misawa S, KUwabara S, Kanai K, Tamura N, Nakata M, Ogwara K, Yagui K, Hattori T. Department of Neurology, chiba university school of medicine, Chiba, Japan have Investigated the effects of hyperglycemia on nodal persistent  $\text{Na}^+$  currents in human diabetic nerves, eliminating the factors of passive membrane properties on a factor. They found that hyperglycemia could suppress nodal persistent  $\text{Na}^+$  currents, because of reduced trans-axonal  $\text{Na}^+$  gradient or impaired  $\text{Na}^+$  channels, and this can be rapidly restored by glycemic control. They recognized the significance of Reduced nodal  $\text{Na}^+$  currents in partly contributing to the pathophysiology of human diabetic neuropathy. (Clin Neurophysiol 2006).

### Material and Methods:

The subjects for the cases group have been randomly selected for the study. Patients are already known type 2 Diabetic Subjects, without having neuropathy symptoms or having The present study was conducted on 50 subjects of type 2 Diabetic Subjects in age group (30-60 years) . The subjects for control group have been selected in age group of 30-60 years, seeking for various other medical problems with out diabetes and having no neuropathy of any other cause.

### Methods

#### Calculation of motor nerve conduction velocity:

Motor nerve conduction velocity is calculated by Measuring the distance is millimeter between two points of stimulation, which is divided by the latency difference in millisecond. The nerve conduction velocity is expressed as m/s.

Measurement of latency difference between the two points of stimulation eliminates the effect of residual latency.

$$\text{Conduction velocity} = D/PL-DL$$

(Where PL is the proximal latency in ms, DL is the distal latency in ms and D is the distance between proximal and distal stimulation in millimeters.)

#### calculation of sensory nerve conduction velocity

The sensory nerve conduction velocity is calculated by dividing the distance in mm between stimulating and recording sites by the latency in ms and expressed as meter per second<sup>(5)</sup>.

#### motor nerve conduction velocity tests

Median nerve stimulation is applied with the cathode 8cm proximal to where the active electrode is placed, that is between the flexor carpiradials and the and the Palmaris longus tendons. Proximal stimulation is applied in the medical aspect of the antecubital space, just lateral to the brachial artery.

Ulnar nerve stimulation is applied (a) 8cm proximal to the active recording electrode and just over the flexor carpi ulnaris tendon (b) just distal to the ulnar groove .

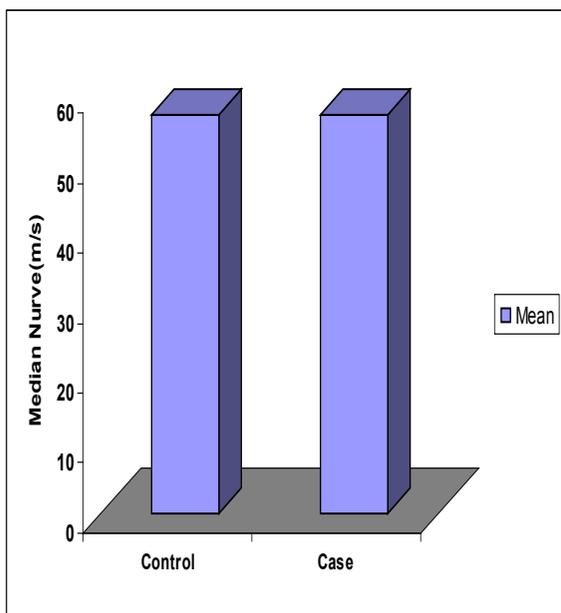
Common peroneal nerve stimulation is given at ankle 2 cm distal to the fibular neck and 5-8cm above the fibular neck. Normal range of motor conduction velocity of common peroneal nerve-42.14-50.94 m/s.

Tibial nerve is stimulated at the popliteal fossa and at the ankle lateral to the medial malleolus.

**COMPARISON OF MNCV OF MEDIAN NERVE IN CONTROL GROUP AND CASES GROUP**

**Table 1.**

MNCV	Median Nerve	
	Control	Case
Mean	57	57
S.D	3.4	3.4
t-value	0.46	
p-value	>0.05	
Result	Not Significant	



**sensory nerve conduction velocity tests**

Median nerve Stimulation is applied with ring electrodes, 4cm apart around 2<sup>nd</sup> digit with the cathode at the base of the digit.

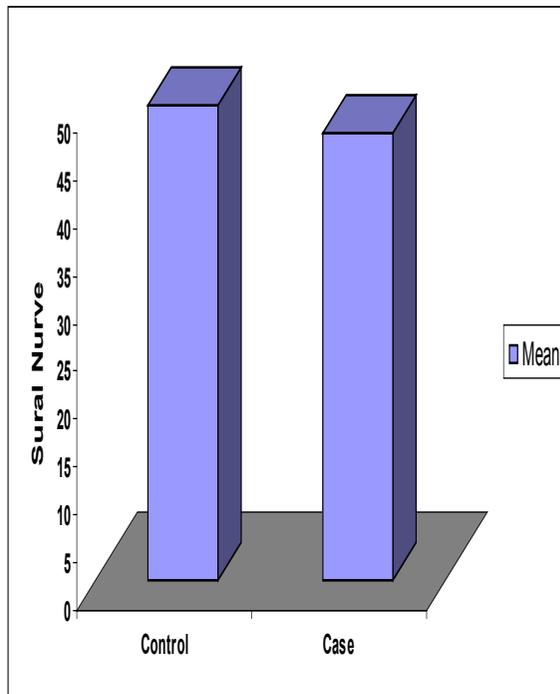
Ulnar nerve Stimulation is applied with ring electrodes around the interphalangeal joints of the fifth digit with the cathode at the base of the fifth digit.

Sural nerve Stimulation is applied slightly lateral to the mid-line in the lower third of the posterior aspect of the leg with the cathode distally.

**COMPARISON OF SNCV OF SURAL NERVE IN CONTROL AND CASES GROUP**

**Table 2**

SNCV	Sural Nerve SNCV	
	Control	Case
Mean	49.73	46.85
S.D	6.85	3.92
t-value	2.02	
p-value	<0.05	
Result	Significant	



**Graph 2**

**Discussion:**

The nerves tested for motor conduction velocities are median, ulnar, common peroneal and posterior tibial nerves.

The mean value of motor nerve conduction velocity of median nerve in control and case group is 57m/s and the estimated P value is > 0.05 which is not significant.

In comparison of motor nerve conduction velocity of ulnar nerve in control group and case group<sup>(6)</sup>.

The estimated mean is 55m/s in controls and 58m/s in case group.

The calculated P value is > 0.05 which is not significant.

Mean of common peroneal nerve in control group is 47m/s and in case group is 46m/s.

The P value is >0.05 which is not significant.

In control group the mean of posterior tibial nerve is 47m/s and in case group is 49m/s.

The estimated P value > 0.05 is not significant.

The nerves tested for sensory nerve conduction velocities are median, ulnar and sural nerves.

The mean value of sensory nerve conduction velocity of median nerve in control group is 47 m/s and in cases group it is 49 m/s, the estimated P value is > 0.05 is not considered significant.

The estimated mean value in control group for sensory nerve conduction velocity of ulnar nerve is 55 m/s and in cases group it is 58 m/s.

The calculated P value is > 0.05 which is not considered significant.

The mean value of sensory nerve conduction velocity of sural nerve in control group is 49.7 m/s and in case group is 46.85 m/s.

The estimated P value which is < 0.05 is considered significant.

In my study the motor nerve conduction velocities of median, ulnar, common peroneal nerve and posterior tibial nerves are normal in control and case group<sup>(7)</sup>.

No slowing of nerve conduction is detected in cases group. But with sural nerve in cases group it is observed that a significant decrease in conduction velocity has occurred.

The normal range of sural sensory nerve conduction velocity is 45.5-56.3 m/s. The mean conduction velocity in subjects observed with decreased sensory nerve conduction in sural nerve is 38.48 m/s<sup>(8)</sup>.

In my study we have observed 36% of cases with subclinical neuropathy in diabetes group.

This is consistent with the study done at Rochester U.S. by Richard C. Eastman in the Rochester diabetic neuropathy study and study conducted by Kocer A et al done in Turkey. It is also consistent with study done by M.C. Kayser et al Germany on sural nerve conduction.

#### Clinical significance:

Diabetes with early age onset carries higher risk for heart attacks and even higher for peripheral vascular disease and 4-5 times for stroke 3-5 times for neuropathy<sup>(9)</sup>.

The need for early diagnosis and effective treatment is evident and much emphasis is now being placed on identifying high risk populations and implementing strategies for prevention<sup>(10)</sup>.

Diabetic peripheral neuropathy is a particularly debilitating complication of diabetes and accounts for significant morbidity by predisposing the foot to ulceration and lower extremity amputation<sup>(11)</sup>.

More than 60% of non traumatic lower limb amputations are occurring among people with diabetes.

The best way to prevent neuropathy is to conduct nerve conduction velocity tests in the arms and legs<sup>(12)</sup>.

Nerve conduction studies are the most objective non invasive

measures of nerve function<sup>(13)</sup>.

They represent a valuable tool of evaluation of neuropathy in clinical studies.

A nerve conduction study is a test commonly used to evaluate the function especially the ability of electrical conduction of the motor and sensory nerves of the body.

A nerve conduction velocity test measures how quickly electrical impulses move along a nerve.

Sural nerve is a purely sensory nerve. Entrapment of sural nerve is uncommon but it is important for the assessment of generalized neuropathies.

Monitoring of sural nerve has become sensitive method for detection of subclinical and clinical neuropathies in diabetics (Act Neurol Scand 2007).

Marked slowing of nerve conduction velocity suggests demyelinating neuropathy<sup>(14)</sup>.

There is a high incidence of segmental demyelination in diabetic neuropathy and the demyelination has been suggested to be due to a schwann cell disorder, which is independent of axonal loss.

Famous diabetologist Joslin says "If you are diabetic do not lose heart, but be of good cheer".

You are one of the millions of diabetics in the world and meticulous control of your blood sugar makes you lead a normal life. If you don't control them death is not due to diabetes but only from its complications.

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