

Comparison of Vibratory Quantitative Sensory Testing and Nerve Conduction Studies in Diabetic Peripheral Neuropathic Patients

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Abstract:

Objective: Peripheral neuropathy due to diabetes is a serious problem. The key to control this problem is its early and definite diagnosis and treatment. After clinical examination, Nerve conduction studies (NCS) and Vibratory Quantitative Sensory Testing (QST) are commonly testing methods for early evaluation of diabetic peripheral neuropathy.

Research Design and Methods: In our study we tried to establish the sensitivity, specificity and comparison between Nerve conduction studies (NCS) and Vibratory Quantitative Sensory testing in population in Kolkata, India by single visit cross sectional study in 35 subjects of 30- 60 years age group.

Results: Vibratory QST shows 73% sensitivity and low specificity, NCV shows 100 % specificity and low sensitivity. Chi square test value is 0.024 ($p > 0.05$).

Conclusion: we can conclude that these tests cannot replace each other but complementary to each other for early and definitive diagnosis of diabetic neuropathy.

Key words: DPN, diabetic peripheral neuropathy, QST, quantitative sensory testing, NCV.

I. Introduction

Peripheral neuropathy is a chronic and devastating complication of diabetes that affects motor, sensory and autonomic nerve fibers and may cause disability. Previous studies reported that 28-54% of patients with diabetes have Diabetic Peripheral Neuropathy.^{1 2 3} Early detection of peripheral neuropathy due to diabetes and monitoring of its progression remains a challenge. Two commonly used methods for evaluation of nerve functions are NCV and vibratory QST, in clinical practice there is potential role of both these methods for diagnosis of DPN

Both NCS & vibratory QST are used to assess the function of large myelinated nerve fibres whereas vibratory QST also assess small myelinated nerve fibres. NCS is an objective electrophysiological test that is considered gold standard for evaluation of peripheral nerve as compare to Vibratory QST which is mainly a subjective test.

In our study we have compared NCS & vibratory QST to determine their reliability in screening for DPN. Several studies had been done in these parameters in different countries but very few studies have been published in our country till date.^{4 5 6 7 8} Determining the correlation between the two testing modalities can help us for early accurately diagnosing DPN.

II. Materials And Methods

The primary end point of the study is to assess the sensitivity of two tests and establish a correlation between them.

Single visit cross sectional study is conducted in 35 patients of whom 30 had signs & symptoms of diabetes & 5 without signs and symptoms of diabetes. Patients selected are between 30-60 years, with variable duration of disease.

Studies of nerve conduction are carried out by instrument in the Department of Neurology, Calcutta National Medical College, Kolkata, with the help of Nicolet Spirit Model – EMG, NCS, and Evoked Potential instrument.

Distance between the 2 points of stimulation (mm)

NCV = -----

Difference between proximal and distal latency (m.s)

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It is determined in easily accessible selected nerves like Median and Ulnar nerve in upper limbs and Common Peroneal and Sural nerve in lower limbs. For our study purpose for better comparison we have considered the lower limbs nerves only.

The sites of stimulation of different nerves and the sites of recording		
Nerve	Site of Stimulation	Site of recording
Common Peroneal	Proximal – neck of fibula Distal – Ankle	Extensor digitorum brevis.
Tibial Nerve	Proximal – Tibial tuberosity Distal – Midway between medial and lateral malleoli	Adductor Hallucis

Sensory Nerve Conduction Velocity Study –

SNCV study is done similarly like motor nerve conduction velocity study.

The sites of stimulation of different nerves and the sites of recording		
Nerve	Site of Stimulus	Site of recording
Sural	Mid Calf (Right & Left)	Ankle

Normative value has been obtained from age sex matched 30 control population by using the instrument in Neurology department Calcutta National Medical College, Kolkata. The normative data has been attached below and further comparison with cases has been done with these normative data.

Standard Normal Values Of Motor Nerve Conduction:

Nerve	Site	Latency (ms) Mean +/- SD	Amplitude (mV) Mean +/- SD	NCV m/s Mean +/- SD
Median	Wrist	3.57 – 0.45	8.1 – 2.75	58.52 – 3.81
	Elbow	7.57 – 0.70	7.81 – 2.35	61.75 – 8.37
Ulnar	Wrist	2.58 – 0.36	8.51 – 2.01	61.45 – 5.73
	Elbow	8.67 – 1.05	8.07 – 2.01	59.34 – 5.52
Radial	Forearm	3.01 – 0.45	10.0 – 2.1	61.2 – 2.5
Peroneal	Ankle	4.55 – 0.59	3.59 – 1.69	46.54 – 4.44
	Knee	10.08 – 1.03	3.61 – 1.71	49.67 – 8.77
SENSORY VALUES				
Median	Wrist	3.06 – 0.41	8.91 – 4.48	45.45 – 9.40
Ulnar	Wrist	2.83 – 0.40	6.5 – 1.5 (uV)	51.2 – 7.9
Radial		3.45 – 0.57	11.7- 6.5	
Sural		3.01 – 1.21	9.71 – 5.57	50.9 – 5.54

Vibratory QST conducted in department of neurology, Calcutta National Medical College, Kolkata with help of instrument Neuopathy Analyser-Vibrotherm Dx(vibration and thermal perception threshold detector). In our study we have taken the average of both legs as we find not so much difference of values.

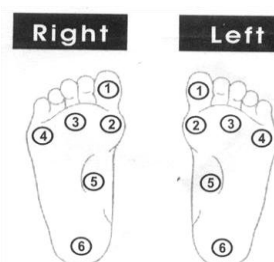
Vibration Sensation Testing:

On the instrument digital display on the front panel indicates the vibration amplitude in volts. The voltage can be increased from 0 to 50 volts, which controls the amplitude of vibration at which the vibrator button vibrate.

Procedure:

Probe is applied to patients hand and explained the feel of vibration clearly. Now the patient was asked to concentrate on feet and tell as soon as he starts feeling the vibration. The value is noted.

Vibration Sensation Test	
Site	In Volts
1. Great toe	
2. First metatarsal head	
3. Third metatarsal head	
4. Fifth metatarsal head	
5. Instep	
6. Heel	
Total	
Average	



The normative data is as follows and cases have been compared with this normative data mentioned below.

Normal – 15 Volts.

Grade I - 16 – 25 Volts.

Grade II - > 25 Volts.

III. Results

Table 1. Showing relation between Nerve Conduction Study (NCS) abnormalities between symptomatic and asymptomatic patients of diabetic neuropathy.

NCS	With symptom of DM	Without symptom of DM	Total
ABNORMAL	20	0	20
NORMAL	10	05	15
TOTAL	30	05	35

Table I shows that 66% of symptomatic patients had abnormal NCS and none of asymptomatic cases have abnormal NCS. Sensitivity and specificity test have been performed and it showed – sensitivity for NCS is 66% and specificity is 100%.

Table 2. Showing relation between Vibratory QST abnormalities between symptomatic and asymptomatic patients of diabetic neuropathy.

Vibratory QST	Symptom of DM	No symptom of DM	Total
ABNORMAL	22	3	25
NORMAL	8	2	10
TOTAL	30	5	35

Sensitivity and specificity test has been performed, sensitivity for vibratory QST is 73.3% and specificity for QST is 40%.

Table 3. Correlation between NCS and vibratory QST

	Normal VPT	Abnormal VPT	Total
Normal NCS	6	9	15
Abnormal NCS	4	16	20
Total	10	25	35

Chi square test is performed between NCS and vibratory QST.

Chi square = 0.024 (p value \geq 0.05)

Considering the two test it appears that there is no significant difference between two tests in respect to diagnostic capacity.

IV. Discussion

Very few clinical trials have compared vibratory QST to NCS in different corners of world. They reported to have mild to moderate correlation.^{4,5,8}

In our study we tried to establish comparison between QST and NCV in our city Kolkata in patients with or without diabetic peripheral neuropathy. We have included 30 patients with signs and symptoms of neuropathy. We found that sensitivity of vibratory QST is 73.3% and specificity is 40%, whereas sensitivity of NCV is 66.7% and specificity 100%.

Comparison between the two tests was done. Chi square test value was 0.024 (P > 0.05). We did not find any significant correlation among Indian diabetic patients with or without clinical signs of neuropathy, so it can be concluded that, these test cannot replace each other, rather complementary to each other to evaluate peripheral neuropathy in diabetes mellitus. So all diabetic patients should undergo vibratory QST, if they are abnormal should be confirmed by NCV.

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