



## Estimation of Prevalence of Polyneuropathy in Type 2 Diabetes Mellitus by Nerve Conduction Study

### KEYWORDS

Diabetes Mellitus, Polyneuropathy, Electrophysiology, NCS

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### ABSTRACT

India faces a grave health care burden due to high prevalence of type 2 diabetes and Indians are susceptible to the major diabetic complications. This is a comparative study between Diabetic and Non Diabetic patients for establishing prevalence of polyneuropathy through Nerve Electrophysiological study. This study aims to observe clinical and electrophysiological patterns of polyneuropathy in patients with type 2 diabetes and determine existence of an association between various patient parameters and neuropathy. This study revealed that 50% of diabetic patients have symptomatic neuropathy. Numbness (100%) is the commonest symptoms observed, while impaired vibration sense (17.5%) is the commonest sign. Electrophysiologically, Distal Symmetrical Sensory neuropathy is the most common pattern (85 %), with Axonal sensory neuropathy (60%) being the commonest type. Abnormal NCS patterns are more commonly associated with poorer glycaemic control (3.33% in RBS < 200 mg / dl vs 46.66% in RBS 251-300 mg /dl).

### INTRODUCTION:

Diabetes mellitus has reached epidemic proportions worldwide. It is strongly related to lifestyle and economic change. Diabetes mellitus is often not recorded as cause of death. It leads to complications, which subsequently become the cause of death. Diabetes Mellitus is the Eighth most common cause overall mortality<sup>1</sup>. According to International Diabetes Federation, 2015 estimates, presently India has 69.18 million diabetic subjects<sup>2</sup>, and this is projected to increase to 123.5 million by the year 2040.<sup>2</sup>

Vascular complications, both micro and macro vascular, predominate the features of Indian diabetics. Many complications are present at the time of diagnosis. It is the complications of the foot that cause great functional impairment. Diabetic neuropathy (DN) is the most cause of polyneuropathy in general practice<sup>3,4</sup>.

### METHODS AND MATERIALS:

This is a cross sectional, observational study of 40 cases of Type 2 diabetes mellitus and 20 Non diabetic controls. Study was conducted over a period of 1 year (2014-2015).

### Inclusion Criteria:

All patients of Type 2 diabetes mellitus with or without symptoms of diabetic sensorimotor neuropathy.

### Exclusion Criteria:

1. Type 1 diabetes mellitus.
2. Patients below 15 years or above 70 years of age.
3. Already established complications of neuropathy like diabetic foot etc.
4. Sensorimotor neuropathy of other causes

### Methodology:

Patients were diagnosed according to American Diabetes Association criteria, 2015<sup>5</sup>. A detailed history taking and a thorough clinical examination, especially neurological examination was done. Whenever needed, Spine involve-

ment was excluded by the X – rays. Suggestive findings of other diseases were looked for and such cases were excluded. A basic investigatory workup was done and cases with evidence of malnutrition were excluded. Parameters like RA factors, ANA, VDRL, HIV by ELISA, chest X ray etc. were done when necessary.

### Electrophysiology:

A complete Nerve conduction study (NCS) was done for these patients. Motor conduction studies were done on median, ulnar, common peroneal and posterior tibial nerves with respect to latency, amplitude, velocity and F waves. Sensory conduction studies were done on median, ulnar, superficial peroneal and sural nerves with respect to latency, amplitude and velocity. These results were also compared with the standard reference values. Deviation of > 2 was considered abnormal. Observers variability was reduced to almost nil, as the study was conducted by the same staff and same reporting specialist for all the patients.

### Statistical method:

Chi square test is the statistical method used in our study.

### OBSERVATIONS –

#### Following parameters were observed:

1. **Gender:** Out of the 40 Cases, 29 were male (72.5%) and 11 were females (27.5%) with the ratio of M:F ~ 3:1. Out of 20 controls 12 were males and 8 females with a ratio 1.5 : 1.
2. **Age:** Minimum age was 34 years and the maximum age was 68 years, with mean 51.9± 10 years. Maximum number of cases (37.5 %) observed were from the age group 51 – 60 years.
3. **Treatment:-** this study, most patients were on OHA's alone 23 (57.5%), 13 (32.5%) were both on insulin and OHA and 3 (7.5 %) were first time detected diabetics. Only 1(2.5%) was on insulin therapy alone. Majority of the symptomatic (70.0%) were found to be in the

OHA group. However, 2 (10.0%) of the symptomatic were found to be first time detected diabetics who were not on any treatment.

4. **Duration of Diabetes:** More number of patients were seen in the duration of 3-6 years. The minimum duration of diabetes observed was 10 days and the maximum was observed to be of 6 years with a mean  $3.57 \pm 1.66$  months.
5. **Symptomatology:** Out of the 40 patients studied, 20 (50%) cases presented with the symptoms of diabetes only; 13 cases presented with the symptoms of both diabetes and neuropathy (32.5%) and 7 cases presented with the symptoms of neuropathy only (17.5%). Control group was asymptomatic. The commonest symptoms of diabetes noticed was polyuria (54.54%). The symptoms of neuropathy noticed were tingling and numbness (100%), burning sensation (25%), weakness in any limbs (15%), cramps in calves/foot and pain in any limbs (20% each) and allodynia (5%). In this study loss of vibration sense was commonest abnormality detected (17.5 %). The sensory symptoms were present mainly in the lower limbs and distally, except in three patients who also had upper limb involvement, out of which 2 were symptomatic
6. **Blood Glucose Levels:** The majority of symptomatic were in the range of 251-300 mg/dl (n=10, 50%). The minimum value of blood sugar observed was 200 mg/dl and the maximum value was 400mg/dl with a mean  $267 \pm 56.77$  mg/dl.
7. **HbA1c:** Majority of the patients in the study had an HbA1c levels between the intervals of 7-9 %. The minimum value observed was 6.5% and the maximum value was 10% with a mean  $8.27 \pm 0.86$ %.
8. **NCS Pattern:** Out of 40 Case studied, 30 had abnormal NCS (75.0%), While 10 (25.0%) showed normal study. Out of 20 controls, 2 showed abnormal NCS findings. Both were from the age group more than 50 years. Of the 40 cases studied, the most common type of nerve damage was axonal degeneration (60%), while demyelinating type of damage was seen in 40% patients. The most common type of neuropathy observed was Symmetrical axonal sensory type (40%). 2 symptomatic patients were found to have a normal NCS report. Two patients who belonged to asymptomatic control group showed abnormal NCS of Axonal Degeneration type, Sensory motor neuropathy.
9. **Motor Abnormality on NCS:** More CAMP Amplitude abnormality was noted in Common peroneal nerve (57.5%) as compared to Posterior tibial nerve (52.5%). More F wave latency was noted in Common peroneal nerve (33.33 %) as compared to Posterior tibial nerve (25%). Two Normal Control patients showed abnormal values for CAMP and F wave latency of Common peroneal nerve.
10. **Sensory Abnormality on NCS:** Most SNAP nerve abnormalities were note in Sural Nerve (55%) as compared to superficial Peroneal nerve (50%).

#### DISCUSSION :

Results show that significant numbers of diabetic patients (75%) have features of neuropathy on electrophysiological studies and 50% of diabetic patients had symptomatic neuropathy. Furthermore, there is a significant association between the abnormal NCS and the blood sugar levels ( $p=0.0003$ ). In this study a strong association is found between the abnormal NCS and the duration of diabetes ( $p=0.0062$ ). Study shows increase in abnormal NCS as duration of Diabetes increases. It was also found that there is a strong association between the HbA1C levels and

the NCS reports. ( $p=0.001$ ). HbA1C levels of < 7 had 0%, 7-8% had 30%, 8-9% had 53.33% and > 9% had 16.66% of patients with abnormal NCS reports.

#### CONCLUSIONS :

1. 40 subjects of diabetes were studied with an objective of assessing neuropathy in them.
2. Prevalence of symptomatic diabetic neuropathy is high.
3. Neuropathic symptoms can be the presenting features at the time of diagnosis of diabetes.
4. Most common clinical presentation of diabetic neuropathy is distal symmetrical sensory neuropathy affecting mainly the lower limbs.
5. Electrophysiological methods are more sensitive tools to detect the presence of neuropathy in diabetics especially in the asymptomatic patients.
6. Electrophysiologically, the most common type of neuropathy detected in new diagnosed diabetes is axonal sensory type which can be present even at the time of diagnosis of diabetes.
7. The earliest change seen in the nerve fibres determined electrophysiologically is the reduction in the amplitude of the action potential, indicating axonal degeneration as the main pathology in diabetic neuropathy.
8. Although both motor and sensory abnormalities are detected at diagnose, the degree of sensory involvement is relatively higher.
9. Duration of diabetes is significantly associated with both the clinical presentation of neuropathy and electrophysiological abnormalities detected. As the duration of diabetes increases the prevalence of DPN also increases.
10. Glycaemic status has significant association with both the clinical presentation of neuropathy and electrophysiological abnormalities detected. As the sugar level increases the prevalence of neuropathy also increases.
11. Long term glycaemic control is significantly associated with the electrophysiological abnormalities detected.
12. Patients treated with OHA are found to have more clinical symptoms of neuropathy and highly abnormal electrophysiological studies whereas patients on insulin are found to be asymptomatic and have more normal electrophysiological studies.
13. In two healthy controls with abnormal NCS, investigations like serum TSH, B12 levels, CBC with PS and X ray spine were done. More investigations could not be performed due to limitations of the clinical setup and financial cost. However, both of these patients were of age of > 50 years and totally asymptomatic.

#### REFERENCES :

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