ORIGINAL ARTICLE

# Clinical and Electrodiagnostic Profile of Diabetic Neuropathy in a Tertiary Hospital in Punjab, India

**Vishali Kotwal, Amit Thakur***

**Abstract**

Peripheral neuropathy is commonly seen in diabetic patients especially with uncontrolled sugar levels. Its symptoms vary according to the type of nerve fibers involved which range from pain and numbness to tingling , weakness and areflexia. This study was undertaken to study the clinical profile of peripheral neuropathy in diabetes mellitus and to correlate it with various parameters. In this study, total 50 patients were studied. The detailed clinical examination was done and various parameters were studied including nerve conduction study. The most frequent complaint in this study was tingling and numbness and the most frequent sign was loss of ankle jerk. The severity of peripheral neuropathy increased with age as well as duration of diabetes and blood sugar levels.

**Key Words**

Peripheral Neuropathy, Diabetic Neuropathy, Diabetes Mellitus

## Introduction

Diabetic neuropathy is a frequent microvascular complication of diabetes mellitus which is seen eventually in 60-70% of all people with diabetes.(1,2). Peripheral neuropathy is commonly caused in diabetics by a chronically high blood sugar which is shunted to polyol pathway and converted to sorbitol and fructose both of which lead to reduced nerve myoinosotol. Other factors in the pathogenesis of diabetic neuropathy are advanced glycation end products, oxidative stress, vascular factors, growth factors and immune mechanisms(2).It may be symptomatic or asymptomatic in some cases and the symptoms depend upon the type of nerve fibers involved i.e motor, sensory or autonomic and also on the pattern of damage which is either focal or diffuse. So, diabetic neuropathies can be classified as mononeuropathies and polyneuropathies.(2)The more common diffuse neuropathies include diabetic sensorimotor polyneuropathy and diabetic autonomic neuropathy ,which usually have a chronic and progressive course.(1,2).Diabetic sensorimotor polyneuropathy is the most common clinical subtype seen in clinical practice.(3) It is potentially the most debilitating because it is associated with pain, discomfort and disability and also many of the patients are often asymptomatic, placing them at high risk of developing foot complications.

It is seen that a combination of age at onset, duration of diabetes and HbA1C which represents chronic glycemic exposure better predicts diabetic neuropathy and other complications rather than individual components.(4).Apart from glycemic control, diabetic neuropathy is seen to be associated with other risk factors like height,(5) and potentially modifiable cardiovascular risk factors like raised triglycerides, BMI, smoking and hypertension.(6,7-13)

Chronic painful peripheral neuropathy is seen in 16% to 26% of diabetic patients (14,15) and is due to small fibre involvement(16).Though patients with painful diabetic neuropathy have more glycemic excursions than those with painless neuropathy (17) and it is related to duration of diabetes but glycemic control is not a predictor

**From the Department of Medicine & Orthopedics*, GGS Medical College and Hospital, BFUHS, Faridkot, Punjab- India**
**Correspondence to :** Dr. Vishali Kotwal, Assistant Professor, Department of Medicine, Government Medical College, Iammu, J&K- India

of painful neuropathy as opposed to insensate neuropathy. (18). Peripheral neuropathy especially painful neuropathy is also seen in patients with impaired glucose tolerance, pre-diabetes and metabolic syndrome and most of the idiopathic neuropathy is associated with impaired glucose tolerance (19,20) but neuropathy seen in impaired glucose tolerance is milder than seen in diabetes mellitus.(21) and studies have shown that a diet and exercise regime improves metabolic measures and small fibre function(19) Also, it has been seen that prevalence of neuropathy in patients with impaired glucose tolerance at 60 minutes is higher than in patients with impaired glucose tolerance at 120 minutes(22).

**Material and Method**

This study was conducted over a period of 8 months from January 2012 to August 2012 in the Post graduate Department of Medicine of Guru Govind Singh Medical College, Faridkot , Punjab. The Hospital Ethics Committee gave ethical approval for the study. A total of 50 patients of diabetes mellitus attending indoor and outdoor departments who were having diabetes of more than 6 months duration were recruited. A written consent was obtained from all the patients. The cases included patients of both sexes and different age groups ranging from 20-70 years. The patients with current foot ulcer at the time of study, past history of stroke, peripheral nerve or vascular disease, limb surgery, history of exposure to known neurotoxins e.g; alcohol intake, treatment for tuberculosis or cancer, leprosy, myelopathies or known organ failure (renal, hepatic, cardiac, respiratory) were excluded from the study. Hemoglobin estimation, TLC, differential count, Urine sugar and ketones, Kidney function tests and Liver function tests were done in all the patients. ECG was done as per needed.Peripheral neuropathy was diagnosed clinically by obtaining UKST score. The UKST score is a two-part diagnostic test comprising symptoms score (abnormal sensation, site of discomfort, time of worse symptoms, and alleviating factors) and signs or disability score (ankle reflex, pain sensation, vibration sense, and temperature perception).The symptom scores have a maximum of 9 points while the sign scores have a maximum of 10 points. Minimum acceptable criteria for diagnosis of Diabetic peripheral neuropathy are either moderate disability with or without symptoms or mild disability with moderate symptoms. The ankle reflex was examined using a flexible tendon hammer. Vibration perceptions threshold was tested by tuning fork (128Hz) on each medial malleolus. Pain sensation was tested by pinprick, touch sensation with wisp of cotton, temperature sensation by hot and cold water, position sense and deep tendon reflexes were also tested conventionally. Peripheral neuropathy was detected by nerve conduction study also and the nerves tested were Median, Peroneal and Sural. The criteria for detection and grading of peripheral neuropathy as mild, moderate and severe by nerve conduction study included Velocity (ms) between 45-49 as mild, 40-45 as moderate and < 40 as severe for Median nerve, between 40-42 as mild, 36-40 as moderate and <36 as severe for peroneal nerve . Also Amplitude was recorded and values between 2-4(mv) were graded as mild ,between 1-2 (mv) as moderate and <1mv as severe for median nerve and values between 1-2 mv was graded as mild, between 0.5-1 mv as moderate and 0.5mv as severe for peroneal nerve.

**Results**

A total of 50 cases of diabetes were studied. Majority of the cases were in the age group of 41-50 years (*Table 1*).Male to female ratio was 1.5:1.The incidence of peripheral neuropathy was 40% on clinical examination(*Table 2*) whereas it was 58% actually when nerve conduction study was done.(*Table 3*)Maximum incidence was recorded in the age group of 51-60 years (70%)(*Table 3*).Maximum incidence was noted with duration of diabetes more than 6 years(*Table 4*).Maximum incidence of peripheral neuropathy was noted in blood sugar s>300mg%(*Table 5*).Clinical symptoms of peripheral neuropathy were directly proportional to blood sugar levels. Commonest presentation of peripheral neuropathy was impaired ankle jerk seen in 36% cases followed by tingling and numbness (30%), impaired vibration (24%), impaired touch sensation (14%) and pain seen in 16% (*Table 6*).Also severity of peripheral neuropathy as assessed by UKST score or by nerve conduction study was directly proportional to the blood sugar levels (*Table 9 & 10*) as well as the duration of diabetes in both males as well as females (*Table 7& 8*).

**Discussion**

In our study, incidence of peripheral neuropathy was found to be 40% on clinical examination and 58% on nerve conduction study. Out of 50 cases, 30 were males and 20 were females. The age of the patients varied from 20-70 years; maximum patients were in the age range of 41-60 years. This is similar to study done by Kasturi *et al* (3) who found that peripheral neuropathy was more in patients over 40 years of age and with disease duration of more than 2 years. Tesfaye found a prevalence of 28% in their study (5). Young MJ *et al* (8) found an overall prevalence of 28.5% and a prevalence of 32% in

*Table 1. Age and Sex Wise Distribution of Patients*

| Age | Male | Female | Total |
|---|---|---|---|
| 21-30 | 04 | 05 | 09 |
| 31-40 | 03 | 02 | 05 |
| 41-50 | 15 | 07 | 22 |
| 51-60 | 06 | 04 | 10 |
| 61-70 | 02 | 02 | 04 |

*Table 2. Incidence of Peripheral Neuropathy in Symptomatic Patients*

| Age | Total | Male | Females | Total | %age |
|---|---|---|---|---|---|
| 21-30 | 09 | 01 | | 01 | 11.1 |
| 31-40 | 05 | 01 | 01 | 02 | 40 |
| 41-50 | 22 | 06 | 04 | 10 | 45.4 |
| 51-60 | 10 | 03 | 02 | 05 | 50 |
| 61 & above | 04 | 01 | 01 | 02 | 50 |
| Total | 50 | 12 | 08 | 20 | 40 |

*Table 3 Incidence of Peripheral Neuropathy by Nerve Conduction Study*

| Age (Yrs) | Total Cases | Total Neuropathies | Male | Female | %age |
|---|---|---|---|---|---|
| 21-30 | 09 | 02 | 01 | 01 | 22.2 |
| 31-40 | 05 | 03 | 01 | 02 | 60 |
| 41-50 | 22 | 15 | 09 | 06 | 68 |
| 51-60 | 10 | 07 | 04 | 03 | 70 |
| 61-70 | 04 | 02 | 01 | 01 | 50 |
| Total | 50 | 29 | 16 | 13 | 58 |

*Table 4. Correlation of Symptomatology of Peripheral Neuropathy with Duration of Diabetes*

| Duration of Diabetes (Yrs) | Total cases | Total cases of Neuropathy | Males with neuropathy | Females with neuropathy | %age |
|---|---|---|---|---|---|
| 1 | 05 | - | - | - | - |
| 2 | 06 | 02 | 01 | 01 | 33.3 |
| 3 | 07 | 02 | 01 | 01 | 28.5 |
| 4 | 06 | 04 | 02 | 02 | 66.6 |
| 5 | 12 | 08 | 05 | 03 | 66.6 |
| 6 | 10 | 09 | 06 | 03 | 90 |
| >6 | 04 | 04 | 03 | 01 | 100 |
| | 50 | 29 | 18 | 11 | 58 |

*Table 5. Correlation of Symptomatic Peripheral Neuropathy with Blood Sugar Levels*

| Blood sugar mg% Random | Total cases | Total cases of neuropathies | Males | Females | %age |
|---|---|---|---|---|---|
| 120-180 | 04 | - | - | - | - |
| 180-200 | 09 | 03 | 02 | 01 | 33.3 |
| 200-230 | 10 | 06 | 04 | 02 | 60 |
| 230-260 | 12 | 08 | 05 | 03 | 66.6 |
| 260-300 | 08 | 06 | 03 | 03 | 75 |
| >300 | 07 | 06 | 04 | 02 | 85.7 |
| | 50 | 29 | 18 | 11 | 58 |

T2DM and 37% in T1DM while in the age group of 70-79 years, he found a prevalence of 44%.(8).Again, J.Cabezas found an overall prevalence of 25% and a prevalence of 38% in the age group of 75-79 years and prevalence increased with age and duration of disease.(9). Karvested L *et al* found a prevalence of 25%(10). This

*Table 6. Common Clinical Features and Signs in Diabetic Patients*

| Complaints | No. of cases | %age |
|---|---|---|
| Tingling & Numbness | 15 | 30 |
| Impaired vibration | 12 | 24 |
| Impaired ankle jerk | 18 | 36 |
| Impaired touch sensation | 07 | 14 |
| Pain | 08 | 16 |

*Table 7. Correlation of Duration of Diabetes Mellitus with Severity of Peripheral Neuropathy According to Clinical Features and signs in male patients*

| Duration | Mild | Moderate | Severe | Total |
|---|---|---|---|---|
| 2 | 01 | - | - | 01 |
| 3 | - | 01 | - | 01 |
| 4 | - | 02 | - | 02 |
| 5 | - | 03 | 02 | 05 |
| 6 | - | 02 | 04 | 06 |
| >6 | - | - | 03 | 03 |

*Table 8. Correlation of Duration of Diabetes Mellitus with Severity of Peripheral Neuropathy According to Clinical Features and Signs in Female Patients*

| Years | Mild | Moderate | Severe | Total |
|---|---|---|---|---|
| 2 | 01 | - | - | 01 |
| 3 | - | 01 | - | 01 |
| 4 | - | 01 | 01 | 02 |
| 5 | - | 01 | 02 | 03 |
| 6 | - | 01 | 02 | 03 |
| >6 | - | - | 01 | 01 |

*Table 9. Correlation of Blood Sugar Levels with Severity of Peripheral Neuropathy in Male Patients*

| Blood sugar (mg %) Random | Mild | Moderate | Severe | Total |
|---|---|---|---|---|
| 180-200 | 01 | 01 | - | 02 |
| 200-230 | - | 02 | 02 | 04 |
| 230-260 | - | 03 | 02 | 05 |
| 260-300 | - | 02 | 01 | 03 |
| >300 | - | - | 04 | 04 |

*Table 10. Correlation of Blood Sugar levels with Severity of Peripheral Neuropathy in Female Patients*

| Blood sugar (mg%)(R) | Mild | Moderate | Severe | Total |
|---|---|---|---|---|
| 180-200 | 01 | - | - | 01 |
| 200-230 | - | 02 | - | 02 |
| 230-260 | - | 01 | 02 | 03 |
| 260-300 | - | 01 | 02 | 03 |
| >300 | - | - | 02 | 02 |

variability may be due to patient selection, higher age group, longer duration and severity of diabetes or better health care facilities and awareness in these countries.

Shaw *et al.* (11) found that overall prevalence in his study was 12.7% which is lowest of all studies, however risk factors were the same i.e duration of diabetes and age. The diabetic neuropathy was seen most commonly after 4th to 5th decade in our study with a prevalence of 22% in the age group of 21-30 years and 70 % in the age group of 41-70 years .In most of the patients, duration of disease was over 4 years .

Partanen *et al* (12) demonstrated rising incidence of peripheral neuropathy with increase of blood sugar levels as seen in our study. Dutta *et al* (13) found a lower incidence of peripheral neuropathy with blood sugar level in lower range. Kasturi *et al* found a positive correlation between duration of diabetes mellitus and prevalence and severity of peripheral neuropathy. Our study showed that

severity of peripheral neuropathy increased with rising blood sugar levels and increased duration of diabetes. Thus our study matched very well with the previous studies.

**Conclusion**

In our study, the prevalence of peripheral neuropathy was recorded as 40% on clinical examination whereas on nerve conduction study, it was found to be 58%.The most frequent complaint was tingling and numbness and the most frequent sign was loss of ankle jerk. Prevalence as well as severity of peripheral neuropathy increased with age as well as with rising sugar levels.

Thus it is concluded that a strict blood sugar control should be maintained in diabetics to prevent and delay the onset of peripheral neuropathy and a careful screening of diabetic patients should be done on a regular basis to detect neuropathy.

Also, nerve conduction study has an important role in detecting mild to moderate form of peripheral neuropathy in diabetic patients which is missed on only clinical examination. So nerve conduction study should be done routinely in diabetic patients who have more than 2-3 years of diabetes especially in the middle age and elderly group of people so as to pick up peripheral neuropathy at the earliest and prevent the long term complications like diabetic foot and ulcers and reduce the morbidity and mortality among these patients.

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