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Prevalence of Neuropathy at Initial Diagnosis of Type-2 Diabetes Mellitus

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ABSTRACT

Background: This study was conducted to determine prevalence of neuropathy in first time detected asymptomatic type 2 diabetes mellitus (DM).
Method: A cross sectional descriptive study involving 300 patients was carried out over a period of 3 years at our Institute. All the recruited 300 patients underwent blood investigations for detecting and confirming diabetes mellitus. Neurological examination was carried out to find out evidence of neuropathy. Further evaluation was carried out to find out associated confounding conditions like hypertension, smoking and obesity.
Results: Out of 300 subjects recruited 165 were male and 135 were female. The mean age was 49.15 years and standard deviation was +/- 12.574. At initial presentation of newly detected diabetic patients prevalence of neuropathy was found to be 28%. HbA1c was found to have significant association with prevalence of diabetic neuropathy at the time of diagnosis of type 2 diabetes mellitus (p value .001). There was no significant association between diabetic neuropathy and other confounding factors like hypertension (p-value: 0.159), smoking (p value-0.712) and body mass index (p value: 0.858). There was no association between gender and prevalence of diabetic neuropathy.
Conclusion: There is high prevalence of diabetic neuropathy in newly diagnosed patients with type 2 diabetes mellitus. There is need for frequent health check-up including laboratory evaluation to detect diabetes mellitus in early stage so that diabetes mellitus can be detected and treated during presymptomatic stage and its complication are either prevented or treated early.

Keywords: Neuropathy, Diabetes Mellitus, Undiagnosed, Presymptomatic, Microvascular Complications

INTRODUCTION

Diabetes Mellitus is a serious, major and yet manageable disease. It is among the leading causes of morbidity and mortality all over the world and is reaching epidemic proportion.[1] Type 2 diabetes mellitus accounts for more than 90% cases of diabetes mellitus. Currently about 425 million people have diabetes mellitus and by 2045 this figure is likely to increase by 48%.[2] Diabetes Mellitus leads to various microvascular and macrovascular complications over a period of time. With increasing duration of the disease, there is an increase in the prevalence of various complications due to DM. This problem is further aggravated by the fact that significant number of patients remains asymptomatic for several years before they

develop symptoms or diabetes related complications or are incidentally diagnosed when they are evaluated for some unrelated medical conditions.

Diabetes mellitus affects nervous system in multiple ways with differences in distribution, type and clinical courses of diabetic neuropathy.[3] Diabetes neuropathies are among the most common long-term complications of diabetes and are a significant cause of morbidity and mortality.

Various studies have shown highly variable rate of prevalence of neuropathy at the time of diagnosis of diabetes mellitus in otherwise asymptomatic patients. Variations in the reported prevalence of diabetic neuropathy are wide. These astounding results are mostly due to adoption of different criteria for diagnosis and partly due to difference in age and duration of diabetes in the population examined. Tripathy RR et al found that high proportion of patients at first diagnosis complained of cutaneous paraesthesia as well as muscle pain and cramps.[4] Even in the West careful questioning may elicit features of neuropathy in around 30% of the patients with newly diagnosed diabetes.[4] In 1980, Radtzmann KP et al found peripheral neuropathy in 6.3% and autonomic neuropathy in 7.3% of the patients.[5] In 1993-94, Nambuya AP et al found neuropathy in 46.4% of the patients.[6] In 2005, Dutta A et al found evidence of peripheral neuropathy in 29 % of the patients.[7]

This study was conducted to determine the prevalence of neuropathy in patients who were never diagnosed with DM previously.

METHODOLOGY

An informed consent was obtained from all the subjects included in the study. Three hundred adult subjects with first time diagnosed type 2 diabetes mellitus who attended OPD of general medicine or were admitted in the ward at our medical college hospital were included in the study. It was a cross-sectional descriptive study conducted over a period of three years from January 2021 to December 2023 at our Medical Institute.

Inclusion Criteria: Newly detected type 2 diabetes mellitus and age above 18 years.

Exclusion Criteria: Patients with type 1 DM, past history of DM or co-morbid conditions likely to affect nervous system were excluded from the study.

Demographic information and clinical evaluation were carried out to determine age, gender and body mass index (BMI). Fasting and postprandial venous samples were collected for estimation of blood sugar by glucose oxidase method. Levels of glycated hemoglobin (HbA1c) were measured by high pressure liquid chromatography. Diabetes mellitus was diagnosed as per the guidelines set by American Diabetes Association in 2012.Diabetes was defined as fasting blood sugar ≥ 126 mg/dl, 2 hour post prandial blood sugar ≥ 200 mg/dl and HbA1C ≥ 6.5%.

Detailed neurological examination was carried out to find out evidence of sensory, motor or autonomic neuropathy.

Data was compiled and analysed for statistical calculation including mean, standard deviation. Statistical tests Student's t test and chi square test were employed. SPSS software was used for statistical analysis. Relationship between HbA1c, hypertension and diabetic neuropathy was analysed.

RESULTS

There was a total of 300 subjects in our study. The age of the subjects varied from 25 years to 81 years. The mean age was 49.15 and standard deviation was 12.574. Majority of our patients were in the age group between 34-58 years. One hundred sixty five (55%) out of total study population of 300 were male and 135 (45%) patients were female. None of the female patients had history of smoking; 125 out 165 male patients had history of smoking. Out of 300 patients 84 patients (28%) were

found to have diabetic neuropathy. There was no statistically significant association between history of smoking and prevalence of diabetic neuropathy (p value-0.712).

Relationship between Hypertension and Diabetic Neuropathy

On analysis of blood pressure record, 29% of our diabetic patients were found to have hypertension. Twenty four percent had stage-1 hypertension, 5% had stage-2 hypertension while 43% had prehypertension. Twenty eight percent patients had normal blood pressure. Analysis was carried out to find out association between hypertension and diabetic neuropathy (Table No. I).

Table No. I: Relationship of smoking and hypertension with diabetic neuropathy

Variable		Total	Neuropathy Absent	Neuropathy Present
Smoking	NO	175	141	36
	YES	125	94	29
HTN	NO	213	169	35
	YES	87	71	25

Relationship between Body Mass Index and Diabetic Neuropathy

In our study 152 (50.6%) patients were overweight, 26 (8.6%) were obese, 2 (0.6%) were underweight and 120 (40%) had body weight within normal BMI. There was no statistically significant association (p value: 0.858) between BMI and prevalence of diabetic neuropathy in our study (Table No. II).

Table No. II: BMI and its association with Neuropathy

BMI groups	No.	Mean	S. D.	Neuropathy Absent	Neuropathy Present
<18	2	17.4	0	1	1
19-25	120	22.91	1.693	94	29
26-30	152	26.12	1.098	116	43
>30	26	33.01	0.491	18	11
Total	300	25.98	3.190	229	84
Chi-Square Value				0.762	
p-value				0.861	

Relationship between Gender and Diabetic Neuropathy

Further analysis carried out to find out association between gender and prevalence of diabetic neuropathy. In our study 28% patients had diabetic neuropathy. Out of 165 male patients 47 (28.4% males) had neuropathy; among the female patients, out of 135 patients 37 (27.4% females) had diabetic neuropathy. There was no significant difference in the prevalence of diabetic neuropathy in either gender (Table No. III).

Table No. III: Relationship between gender and neuropathy

Gender	Total	Neuropathy Absent	Neuropathy Present
Female	135	110	37
Male	165	130	47

Relationship between HbA1c and Diabetic Neuropathy

Majority of our patients had elevated HbA1c level. More than 90% had HbA1c level above 6.5%. HbA1c was above 9.5% in 18.3% patients, 15.6% patients had HbA1c between 8.5 and 9.4%, 28.6% patients had HbA1c between 7.5 and 8.4%, thirty two percent patients had HbA1c between 6.5 and 7.4% and 5.3% patients had HbA1c less than 6.5%. In our study percentage of neuropathy was higher in patients with higher level of HbA1c level (Table No. IV).

Table No. IV: Relationship between HbA1c and diabetic neuropathy

HbA1c groups	Total	Neuropathy Absent	Neuropathy Present
<6.5	16	16	0
6.5- 7.4	96	87	9
7.5- 8.4	86	69	17
8.5- 9.4	47	26	21
>9.5	55	18	37
Total	100	216	84

DISCUSSION

Diabetes mellitus is a major health problem all over the world esp. in countries in the Asia-Pacific region. Changes in life style related to poor physical exercise and unhealthy food habits have resulted in significant increase in incidence and prevalence of diabetes mellitus worldwide.[8] There is usually a delay in the making the diagnosis of DM. Previous reports found that there is usually a delay of 4-7 years before a clinical diagnosis of diabetes mellitus is made.[9] This delay is sometime because of lack of adequate screening program to detect DM in early stage. But sometime diagnosis of diabetes mellitus is delayed because of inadequate follow up of patients who were initially found to have hyperglycemia and were not followed up due to clinical inertia.[10] This delay in the detecting DM and preventing diabetic complications leads to high prevalence of various microvascular complications in the presymptomatic stage of DM. Rate of prevalence of microvascular complications due to diabetes varies widely from study to study which reflect variation related to precision of diagnostic method and frequency of screening programs in various studies. During this asymptomatic phase of hyperglycemia many patients without their awareness develop various diabetes related microvascular complications like neuropathy, nephropathy or retinopathy. Neuropathy is a common complication seen in diabetes mellitus. It accounts for more often hospitalization as compared to other diabetic complications and is the commonest cause of non-traumatic amputation.

Our study was carried out over a period of 3 years including 300 newly detected type 2 diabetes patients (165 male and 135 female) to find out the prevalence of diabetic neuropathy at the time of diagnosis of type 2 diabetes. The mean age of the diabetics in our study was 49.15 ±13.47 years. The maximum incidence of diabetes was seen in patients who were between 34-58 years of age. Fifty five percent patients in our study were males while 45% were females. In our study 45% of patients were overweight and 9% were obese. In study by Nambuya AP et al 53.5% (33.8% females and 19.7% males) were overweight and 11.3% (8.5% men and 2.78% women) were underweight.[6] The mean fasting blood glucose in our study was 186.15 mg/ dl with a standard deviation of 56.21 and the average PPBS was 271.9 mg/ dl with a standard deviation of 73.9. In the study by Dutta A et al the mean FBS and PPBS were 220.9 mg/ dl and 333.3 mg/ dl respectively in patients with diabetic neuropathy at initial diagnosis of DM.[7] Cathlineau et al in their study found FBS and PPBS to be 182 and 209 mg/ dl respectively.[11] Twenty nine percent of our patients had hypertension.

Approximately one half of people with diabetes have some form of diabetic peripheral neuropathy (DPN) and this prevalence of diabetic neuropathy further increases with the duration of the DM. Significant number of patients remain asymptomatic after onset of DM and diabetic neuropathy. According to an estimates clinical or subclinical diabetic neuropathy is seen in two third of diabetic patients.[12] Significant proportion of patients is found to have diabetic neuropathy at the time initial diagnosis of diabetes mellitus. The estimates of DPN prevalence vary widely from 9.6 to 78% in different study populations.[13] Radtzmann KP et al found peripheral neuropathy in 6.3% and autonomic neuropathy in 7.3% of

the patients.[5] Nambuya AP et al found neuropathy in 46.4% of the patients.[6] Dutta A et al found evidence of peripheral neuropathy in 29 % of the patients.[7] The incidence of neuropathy in the present study was 28%. Our study found no significant difference in prevalence of neuropathy in either gender.

Twenty nine percent of our patients had hypertension. Association between diabetic neuropathy and hypertension was studied by M F Jannot and found a positive correlation between the two.[14] There was no significant difference (p-value: 0.159) in the incidence of neuropathy between the diabetic patients who had a history of hypertension and those who did not have hypertension.

Studies regarding link between obesity and diabetic neuropathy have shown that increasing body weight is associated with higher prevalence of diabetic neuropathy. Brian C. Callaghan et al showed that diabetes and weight were significantly associated with peripheral neuropathy.[15] In our study there was no significant relation between BMI and diabetic neuropathy.

As diabetic complications are linked to the duration and severity of hyperglycemia, HbA1c which reflects long term glycemic variability can be indicator for diabetic neuropathy. Jian-bin Su et al in their study found that there was close association between HbA1c and prevalence of diabetic neuropathy.[16] Peterson M et al reported that increase in HbA1c level led to more severe neuropathy as evidenced by diminished nerve amplitude.[17] In our study also there was a direct association between level of HbA1c and prevalence of diabetic neuropathy. There was statistically significant association (p value <0.001) between level of HbA1c and prevalence of diabetic neuropathy.

CONCLUSION

This study shows high prevalence of neuropathy at the time of diagnosis of type 2 diabetes mellitus. There is need for regular health check-up and laboratory assessment to detect diabetes in early stage and prevent or treat diabetes related complications. It is likely to decrease the burden of diabetes related morbidity and mortality.

Declaration by Authors

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Conflict of Interest: Nil

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