Prevalence of Sensory Neuropathy in Type 2 Diabetes Mellitus and Its Correlation with Duration of Disease

Karki DB,[1] Yadava SK,[1] Pant S,[2] Thusa N,[1] Dangol E,[1] Ghimire S[1]

[1]Department of Cardiology

[2]Department of Internal Medicine

Kathmandu Medical College Teaching Hospital

Kathmandu, Nepal.

Corresponding Author

DB Karki

Department of Cardiology

Kathmandu Medical College Teaching Hospital

Kathmandu, Nepal.

E-mail: profdbkarki@gmail.com

Citation

Karki D B, Yadava SK, Pant S, Thusa N, Dangol E, Ghimire S. Prevalence of Sensory Neuropathy in Type 2 Diabetes Mellitus and Its Correlation with Duration of Disease. *Kathmandu Univ Med J* 2016;54(2):120-4.

ABSTRACT

Background

Peripheral neuropathy is one of the most common and distressing late complication of diabetes mellitus. Ignorance of the complications may develop foot ulcers and gangrene requiring amputation.

Objective

The main objective of this study is to find out the prevalence of sensory neuropathy in type 2 diabetes mellitus and to compare it with the duration of disease.

Method

Two hundred seventy one patients with type 2 diabetes mellitus of both gender age 30 years and above willing to participate were included in this study. Patients having hypothyroidism, rheumatoid arthritis, B12 deficiency, cerebrovascular disease, chronic musculoskeletal disease, Parkinson's disease, alcohol abuse, chronic renal or liver failure and cancer were excluded from the study. Touch, pin prick and vibration sensation were tested. Vibration perception threshold was recorded from six different sites of the sole of each foot using Biothesiometer.

Result

Two hundreds seventy one type 2 diabetic outpatients were studied. The mean age was 59.81±22.85 years. The overall prevalence of diabetic sensory neuropathy in the study population was 58.70%. A rising trend of diabetic sensory neuropathy with increasing age and duration of diabetes was observed. Neuropathy was found more in patients having urinary microalbuminuria. Burning and pins and needles sensation were most common symptoms.

Conclusion

The overall prevalence of diabetic sensory neuropathy in the study population was 58.70% (mean age 59.81±22.85 yrs), and its prevalence increased with duration of diabetes and increasing age. Its prevalence was found more in patients having microalbuminuria.

KEY WORDS

Biothesiometer, sensory neuropathy, type 2 diabetes mellitus

INTRODUCTION

The prevalence of diabetes for all ages worldwide has been estimated to be 2.80% and it is expected to increase to 4.40% in 2030.[1] Neuropathy is the most common complication of diabetes mellitus (DM) affecting up to 50% of patients.[2,3]

Sensory neuropathy shows a stocking-and-glove distribution in the distal extremities. Sensory symptoms may be negative or positive, diffuse or focal. Negative sensory symptoms reflect loss of sensation due to axon/neuron loss, which include feelings of numbness, loss of balance. Positive symptoms reflect abnormal excitability of the nervous system and may be described as burning, pricking pain, tingling, tightness, or hypersensitivity to touch.[4] Decrease or absent ankle reflexes occur early in the disease, while more widespread loss of reflexes and motor weakness are late findings.[4]

According to a large American study, 47% of patients with diabetes have been found to have some peripheral neuropathy.[3] The prevalence of DPN in people between the age of 18 and 90 years has been found to be 28.5% and prevalence of diabetic neuropathy in type 1 and type 2 diabetes was 22.70% and 32.10% respectively.[5]

There are different screening tests for detecting diabetic peripheral neuropathy (DPN) such as Michigan Neuropathy Screening Instrument (MNSI), United Kingdom screening test, 10g Semmes Weinstein Monofilament (SWM), vibration sensation using 128-HZ tuning fork, Biothesiomer and ankle reflex. The gold standard for diagnosis of DPN continues to be a nerve conduction study. We used Biothesiometry test to diagnose diabetic sensory peripheral neuropathy to find its prevalence in Nepalese population.

METHODS

This is a hospital-based cross sectional study carried out at Kathmandu Medical College Teaching Hospital, and Temple of Healing clinic, Nepal in which a total of 271 participants with type 2 diabetes mellitus of both gender age 30 years and above attending Kathmandu Medical college teaching hospital and Temple of Healing clinic from September 2012 to March 2013 were enrolled in the study after taking verbal consent. WHO criteria for the diagnosis of diabetes mellitus (Fasting plasma glucose ≥7.0 mmol/l (126 mg/dl) or 2–h plasma glucose after ingestion of 75 g oral glucose load ≥ 11.1 mmol/l (200 mg/dl) or HbA1c ≥6.5%) was followed. Patients having hypothyroidism, rheumatoid arthritis, B12 deficiency, cerebrovascular disease, chronic musculoskeletal disease, Parkinson's disease, alcohol abuse, chronic renal or liver failure, cancer, patients on chemotherapy and not willing to participant were excluded from the study.

Detailed history and careful clinical examination were carried out. Weight in kilogram, height in centimeter, body mass index in kg/m^2, and blood pressure in mmHg were recorded. Routine and specific investigations- Complete Blood Count (CBC), Blood urea, Serum creatinine, fasting blood sugar (FBS), post prandial blood sugar (PPBS), glycated haemoglobin (HbA1c), Total Cholesterol (TC), High Density Lipoprotein Cholesterol, (HDL-c), Low Density Lipoprotein Cholesterol (LDL-c), Triglyceride (TG), thyroid Stimulating Hormone (TSH) and Electrocardiogram (ECG) were done. Touch, pin prick and vibration sensation were tested. To test vibration sensation, 128 Hz Tuning fork was placed over great toe, medial malleolus, and patella of both legs respectively after striking the Tuning fork no hard board and asking the patient about the feeling of vibration. Vibration perception threshold volts was measured at six different sites of the sole of each foot using biothesiometer and mean value was recorded. The mean value of 15 volts and below was taken as normal and above 15 volts was taken as abnormal.[6]

SPSS version 20 was used for data entry. Variables were categorized. Descriptive statistics were used to identify diabetic peripheral neuropathy (DPN) prevalence, mean, and standard deviation. Binary logistic regression analysis was used to evaluate association between sensory peripheral neuropathy and candidate factors, calculating odd ratios (ORs) and adjusted ORs with 95% confidence interval (CI) respectively. The fit of the logistic model was assessed with the Hosmer and Lemeshow goodness-of-fit test. Statistical significance was set at $P < 0.05$.

RESULTS

Two hundreds seventy one (164 male, 107 female) type 2 diabetic outpatients were studied. The mean age was 59.81±22.85 years (male 58.96±13.25 and female 61.04±32.07). The overall prevalence of diabetic sensory neuropathy in the present study was 58.70%. The prevalence of diabetic sensory neuropathy in male and female were 57.90% and 59.80% respectively.

An increasing trend of diabetic sensory neuropathy with increasing age was observed, from 22.20% in <40 yrs to 69.60% in ≥60 yrs (OR 5.34, 95% CI 1.84 – 15.50, P=0.002). Similarly, the prevalence of diabetic sensory neuropathy increased with increasing duration of diabetes, 46.70% in <5 yrs and 70.60% in ≥5 yrs group (OR 1.80, 95% CI 1.00 - 3.20, P=0.04). Diabetic sensory neuropathy was found more in diabetes having urinary microalbuminuria (OR 1.91, 95% CI 1.04 - 3.48, P=0.036).

DISCUSSION

The prevalence of diabetic sensory peripheral neuropathy in the study population was 58.70% (mean age 59.81±22.85 yrs) which is comparable with an European study which has reported an overall DPN prevalence of 60% (mean age: 57.20 ± 10.30).[7] Morkrid K et al. have shown lower

Table 1. **Demographic data of patients.**

Variables	Abnormal test(n=/%)	Normal test(n=/%)	P-value	Odd ratio (95% CI)	P-value	Adjusted odd ratios (95% CI)
Age(years)						
<40	6(22.20)	21(77.80)	Ref.			
40-59	57(53.80)	49(46.20)	<0.005	4.14(1.54 – 11.10)	0.02	3.50(1.23 - 10.16)
≥60	96(69.60)	42(30.40)	<0.001	8.00(3.01 - 21.25)	0.002	5.34(1.84 - 15.50)
Gender						
Male	95(57.90)	69(42.10)	Ref.			
Female	64(59.80)	43(40.20)	0.758	1.08(0.66 – 1.77)	0.99	1.00(0.57-1.76
Tobacco						
Nonsmoker	145(58.20)	104(41.80)	Ref.			
Smoker	14(63.60)	8(36.40)	0.622	1.25(0.51- 3.10)	0.69	1.22(0.44 - 3.38)
BMI Kg/M²						
<25	64(53.80)	55(46.20)	Ref.			
>25	95(62.50)	57(37.50)	0.148	1.43(0.88 – 2.33)	0.25	1.38(0.80- 2.38)
Hypertension						
Absent	55(48.70)	58(51.30)	Ref.			
Present	104(65.80)	54(34.20)	0.005	2.03(1.24 – 3.33)	0.10	1.60(0.91 - 2.80)
Lipids Total cholesterol						
Normal <200 mg%	111(58.70)	78(41.30)	Ref.			
High >200 mg%	48(58.50)	34(41.50)	0.976	1.00 (0.59 – 1.68)	0.85	1.08(0.46-2.54)
Triglyceride						
Normal <150 mg%	80(63.50)	46(36.50)	Ref.			
High ≥150 mg%	79(54.50)	66(45.50)	0.133	0.69(0.42 – 1.12)	0.03	0.54(0.31 – 1.00)
LDL-C						
Normal <130 mg%	122(58.10)	88(41.90)	Ref.			
High >130 mg%	37(60.70)	24(39.30)	0.721	1.11(0.62 – 1.99)	0.81	1.11(0.44 – 2.80)
HDL-C						
Normal ≥40 mg%	86(54.10)	67(59.80)	Ref.			
Low < 40 mg%	73(45.90)	45 (40.2)	0.349	1.24(0.76 – 2.03)	0.57	1.17(0.67 – 2.02)
HbA1C						
≤7	69(51.10)	66(48.90)	Ref.			
>7	90(66.20)	46(33.80)	0.012	1.87(1.14 – 3.05)	0.08	1.62(0.94-2.78)
Duration of T2DM						
<5 Years	63(46.70)	72(53.30)	Ref.			
≥5 Years	96(70.60)	40(29.40)	<0.001	2.74(1.66 – 4.52)	0.04	1.80(1.00 -3.20)
Urinary microalbuminuria						
Absent	87(50.30)	86(49.70)	Ref.			
Present	70(72.90)	26(27.10)	<0.001	2.66(1.55 – 4.56)	0.03	1.91(1.04 - 3.48)

Ref. stands for referent

prevalence of 19.70% (mean age: 50.80±10.60 years) in Bangladesh.[8] According to Ashok S et al. DPN prevalence among type 2 DM outpatients in India is 19.10% (mean age: 62 ± 8 years).[9]

In many studies, multiple logistic regression analysis has shown age and duration of diabetes mellitus to be statistically significant risk factors for DPN.[5,7,9-11] Also in our study, increasing duration of diabetes and older age were found statistically significant risk factors for diabetic sensory neuropathy. In our study, there was no statistically significant difference in DPN between genders. This has also been confirmed by others.[9,11,12]

Maser et al. study found correlation between smoking, high HbA1c, and low HDL with higher prevalence of DPN in patients over 30 year of age.[13] Different studies have revealed hypertension, hypercholesterolemia, and microalbuminuria to be the important risk factors for development of DPN.[3,7,14,15] In our study, bivariate

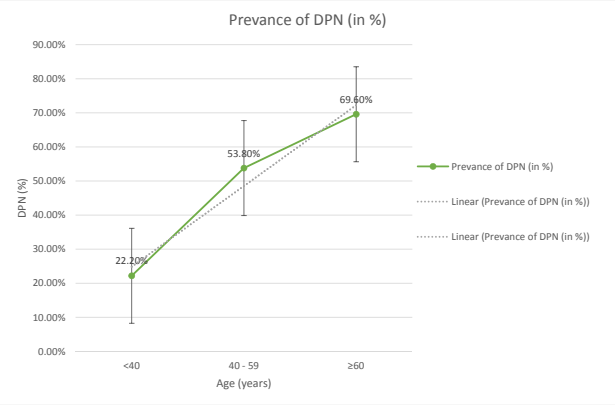

Figure 1. Age group wise trends of diabetic sensory neuropathy among study population.

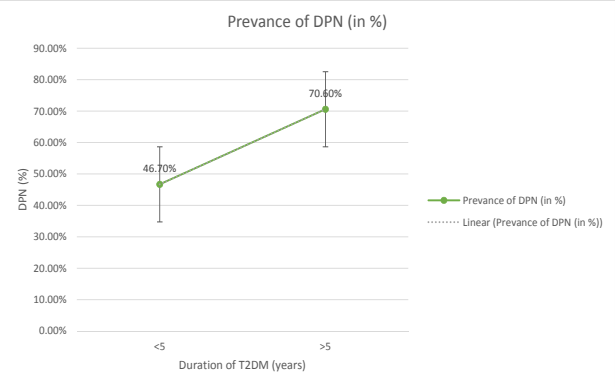

Figure 2. Relation between duration of T2DM and prevalence diabetic sensory neuropathy among study population.

analysis showed high prevalence of diabetic sensory neuropathy among patients having hypertension, smoking, dyslipidemia, microalbuminuria and BMI ≥ 25 kg/m^2. However, multivariate logistic regression analysis revealed only microalbuminuria (OR 1.91, 95% CI 1.04 - 3.48, P=0.036) to be statistically significant risk factor.

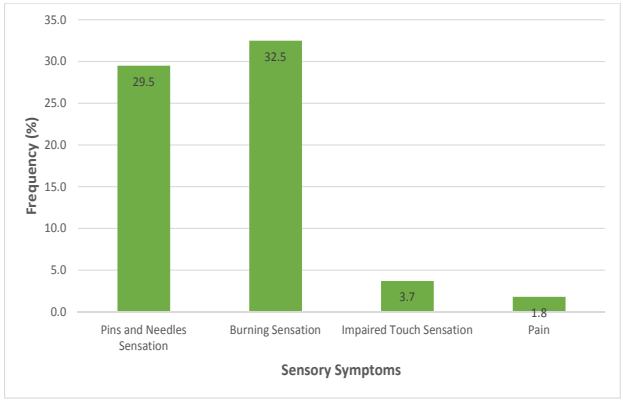

Figure 3. Prevalence of sensory symptoms of sensory neuropathy in T2DM

HbA1c is an indicator of blood glucose control and elevated HbA1c is associated with high risk of DPN.[13,16] But like others, we could not identify it as statistically significant risk factor.

Limitations

Result of biothesiometer was not compared with Nerve conduction study which is a gold standard for diagnosis of peripheral sensory neuropathy.

CONCLUSION

Vibratory perception threshold measurement by Biothesiometer is an easy, cheap and accurate method of detecting diabetic neuropathy and it is widely used in clinical practice. The overall prevalence of sensory neuropathy in diabetic patients was 58.7% (mean age 59.81±22.85yrs), and its prevalence increased with duration of diabetes and increasing age. Its prevalence was found more in patients having microalbuminuria.

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