

# DIABETIC NEUROPATHY;

PREVALENCE AND RISK FACTORS FOR SEVERITY IN PATIENTS WITH TYPE 2 DIABETES MELLITUS ATTENDING DIABETIC CLINIC OF GHULAM MUHAMMAD MAHAR MEDICAL COLLEGE HOSPITAL, SUKKUR.

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**ABSTRACT.....Objective:** To estimate the prevalence of diabetic neuropathy (severity wise) and associated risk factors in patients having type 2 diabetes mellitus. **Study Design:** A cross-sectional study. **Place of Study:** Diabetes Clinic, Ghulam Mohammad Mahar Medical College Hospital, Sukkur. **Duration of Study:** From January 2009 to December 2011. **Materials and Methods:** A patients based sample of 1401 persons with diabetes (identified as per the WHO criteria) underwent comprehensive eye examination including direct & indirect Fundoscopy for diabetic retinopathy grading. Vibration perception threshold (VPT) measurements were done to assess neuropathy (cut off  $\geq 20$  V). Severity of neuropathy was graded into three groups based on VPT score as mild (20-24.99 V), moderate (25-38.99 V), and severe ( $\geq 39$  V). Univariate and multivariate analyses were done to find out the independent risk factors for severity of diabetic neuropathy. **Results:** In the overall group, the prevalence of diabetic neuropathy was 18.84% (95% CI: 16.79-20.88). The prevalence of mild diabetic neuropathy was 7.9% (95 CI: 6.50-9.33), and severe diabetic neuropathy was 5% (95% CI: 3.86-6.14). Increasing age per year ( $P < 0.0001$ ) was a statistically significant risk factor for all – mild, moderate, and severe – types of diabetic neuropathy. For severe diabetic neuropathy, other significant risk factors were duration of diabetes mellitus ( $P = 0.027$ ), macroalbuminuria ( $P = 0.001$ ), and presence of diabetic retinopathy ( $P = 0.020$ ). **Conclusions:** The results suggested that every fifth individual in a population of type 2 diabetes is likely to have diabetic neuropathy. Nearly 13% had neuropathy of moderate and severe category, making this group vulnerable for complications such as foot ulceration or lower limb amputation.

**Key words:** Prevalence, Diabetic neuropathy, Risk factors, Type 2 diabetes mellitus.

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## INTRODUCTION

Diabetic neuropathy is an important microvascular complication of diabetes mellitus. It is a major contributor to foot ulceration and lower limb amputation in persons with diabetes<sup>1</sup>. As the population of diabetes is increasing worldwide, the prevalence of diabetes-related microvascular complications is also on the rise. Duration of diabetes mellitus is an important risk factor for all diabetes-related microvascular complications such as neuropathy, retinopathy, and nephropathy. Up to 7.5% of patients with type II diabetes mellitus have clinical neuropathy at the time of diagnosis and this rate increases to 50% among patients who have had diabetes for 25 years<sup>2</sup>.

Various screening modalities for diabetic neuropathy include recording of symptoms or signs, nerve conduction studies, quantitative sensory testing, and autonomic testing. Quantitative assessment of

vibration perception threshold (VPT) is a widely applied tool in the screening for, and staging of, diabetic sensory neuropathy, particularly in epidemiological studies<sup>3</sup>. Values of VPT of more than 25 V are associated with a 6-10-fold risk of developing a foot ulcer<sup>4,5</sup>. These findings suggest the role of “severity” of diabetic neuropathy in the etiology of its complications<sup>5,6</sup>. However, there is paucity of population-based data from Pakistan regarding the prevalence based on the severity of diabetic neuropathy and the influencing risk factors. The present study was done to assess the prevalence of severity of diabetic neuropathy (mild, moderate, and severe) in patients with type 2 diabetes mellitus and report the risk factors that influence it.

## MATERIALS AND METHODS

Study subjects were recruited from the Diabetic Clinic, Ghulam Mohammad Mahar Medical College Hospital, Sukkur, from January 2009 to December 2011. The

Catchment area of above hospital is about 6 districts of Northern Sindh. A total of 1401 type II diabetic patients above the age of 40 years regardless of the duration of diabetes, underwent diabetic neuropathy assessment. The study was approved by the Institutional Review Board, and informed consent was obtained from the subjects as per the Helsinki declaration.

Procedures pertaining to the present study are described below.

### DIABETIC NEUROPATHY ASSESSMENT

Diabetic neuropathy assessment was done by measuring VPT using sensitometer. The VPT was measured by a single observer by placing biothesiometer probe perpendicular to the distal plantar surface of the great toe of both legs. The VPT was measured at a voltage level when patient felt the first vibration sensation. The mean VPT measure of three readings of both legs was considered for the analysis. Diabetic neuropathy was considered as present if the VPT value was  $>20$  V. The severity of neuropathy was graded into 3 levels: mild neuropathy (VPT score, 20-24.99 V), moderate neuropathy (VPT score, 25-38.99 V), and severe neuropathy (VPT score,  $>39$  V)<sup>7</sup>.

### DIABETIC RETINOPATHY GRADING

All patients had under gone direct fundoscopy. The suspicious cases were sent to eye opd, so that their fundi photographed by indirect fundoscopy. The diagnosis of diabetic retinopathy was based on the modified Klein classification<sup>8</sup>.

### NON- SIGHT THREATENING DIABETIC RETINOPATHY

Non-sight threatening diabetic retinopathy included cases of mild or moderate non-proliferative diabetic retinopathy<sup>9</sup>.

### SIGHT THREATENING DIABETIC RETINOPATHY

Sight-threatening diabetic retinopathy (referable

diabetic retinopathy) was defined as severe non-proliferative diabetic retinopathy, proliferative diabetic retinopathy, and clinically significant macular edema<sup>9</sup>.

### ALBUMINURIA

The patient was considered normoalbuminuric if Albumin Creatinine Ratio (ACR) was less than 30 mg/g, microalbuminuric if the ACR was between 30 and 300 mg/g, and macroalbuminuric if the ACR was above 300 mg/g<sup>10</sup>.

### STATISTICAL ANALYSIS

Statistical analyses were performed using the statistical software (SPSS for Windows, ver. 13.0 SPSS Science, Chicago, IL, USA). The results were expressed as mean + SD if the variables were continuous and as per percentage if the variables were categorical. Student's t-test for comparing continuous variables and X2 test to compare proportions amongst groups were used. Both univariate and multivariate logistic regression analyses were performed to study the effect of various risk factors using neuropathy as a dependent variable. From the univariate analysis, variables with P values  $<0.1$  were included in the multivariate logistic regression analysis to derive at the parsimonious model. P value of  $<0.05$  was considered significant.

### RESULTS

The mean age of the total study population (N=1401) was  $56.3 \pm 10$  years; 746 (53.2%) were men. Table I shows the prevalence of diabetic neuropathy (severity wise) in the study population. In the overall group, the prevalence of diabetic neuropathy was 18.84% (95% CI: 16.79-20.88); the prevalence was significantly higher in persons with known diabetes than in those with newly detected diabetes (19.77 vs. 14.40, P = 0.05). The prevalence of mild diabetic neuropathy was 5.9% (95% CI: 4.68-7.15), moderate diabetic neuropathy was 7.9% (95% CI: 6.50-9.33), and severe diabetic neuropathy was 5% (95% CI: 3.86-6.14). The prevalence of severe diabetic neuropathy was

significantly high in persons with known diabetes than in those with newly detected diabetes (5.53 vs. 2.47,  $P = 0.04$ ).

Table II summarizes the univariate analysis of risk factors influencing the severity of diabetic neuropathy. Significant risk factors common to all the three neuropathy groups were: advancing age ( $P < 0.0001$ ), longer duration of diabetes mellitus ( $P < 0.0001$ ), use of insulin ( $P = 0.006$ ), high systolic blood pressures ( $P = 0.008$ ), presence of macroalbuminuria ( $P < 0.0001$ ), and presence of diabetic retinopathy ( $P$

$< 0.0001$ ).

Table III shows the multivariate analysis of risk factors influencing the severity of diabetic neuropathy. Increasing age per year ( $P < 0.0001$ ) was statistically significant risk factor for all types of diabetic neuropathy – mild, moderate, and severe. For severe diabetic neuropathy, other significant factors were duration of diabetes mellitus ( $P = 0.027$ ), macroalbuminuria ( $P = 0.001$ ), and presence of diabetic retinopathy ( $P = 0.020$ ).

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Group (n)	Overall neuropathy % (95% CI)	Mild neuropathy % (95% CI)	Moderate neuropathy % (95% CI)	Severe neuropathy % (95% CI)
Total Study group (n=1401)	(n=264) 18.84 (16.79-20.88)	(n=83) 5.92 (4.68-7.15)	(n=111) 7.92 (6.50-9.33)	(n=70) 5.00 (3.86-6.14)
Subject with known diabetes (n=1158)	(n=229) 19.77 (17.47-22.06)	(n=70) 6.04 (4.67-7.41)	(n=95) 8.20 (6.62-9.78)	(n=64) 5.53 (4.21-6.85)
Subjects with newly detected Diabetes (n=243)	(n=35) 14.40 (9.98-18.81)	(n=13) 5.35 (2.52-8.18)	(n=16) 6.58 (3.46-9.69)	(n=6) 2.17 (0.52-4.42)

**Table-I. Prevalence of diabetic neuropathy in the study population**

\*The severity of neuropathy was graded into three levels: mild neuropathy (VPT score, 20-24.99 V), moderate neuropathy (VPT score, 25-38.99 V), and severe neuropathy (VPT score,  $\geq 39$  V). CI, Confidence interval.

Variables	Neuropathy Present				
	Absent	Mild	Moderate	Severe	
N	1137	83	111	70	
Age (years)*	54.8 $\pm$ 9.33	60.18 $\pm$ 9.94	63.61 $\pm$ 10.58	65.46 $\pm$ 9.17	<0.0001*
Men	597(52.5)	51(61.4)	61(55.0)	37(52.9)	0.453
Duration of DM (years)*	4.94 $\pm$ 5.66	6.60 $\pm$ 6.12	7.53 $\pm$ 7.95	10.13 $\pm$ 8.35	<0.0001*
Insuline Users	48(4.2)	3(3.6)	8(7.2)	9(12.9)	0.006
Body mass index (kg/m <sup>2</sup> )*	25.47 $\pm$ 4.06	25.12 $\pm$ 4.80	24.78 $\pm$ 4.16	25.21 $\pm$ 3.61	0.347
Systolic BP (mm Hg)*	138.12 $\pm$ 20.63	140.58 $\pm$ 20.69	142.50 $\pm$ 19.60	145.09 $\pm$ 21.43	0.008*
Diastolic BP (mm Hg)*	81.97 $\pm$ 11.12	82.39 $\pm$ 13.09	81.03 $\pm$ 10.75	81.60 $\pm$ 13.89	0.827
Fasting Plasma glucose (mg/dl)*	147.39 $\pm$ 59.48	155.49 $\pm$ 66.43	149.72 $\pm$ 62.02	146.16 $\pm$ 66.10	0.674
HbA <sub>1c</sub> (%)*	8.13 $\pm$ 2.16	8.43 $\pm$ 2.45	8.58 $\pm$ 2.34	8.32 $\pm$ 2.19	0.133
Microalbuminuria	164(14.4)	19(22.9)	22(19.8)	18(25.7)	<0.0001*
Macroalbuminuria	22(1.9)	2(2.4)	5(4.5)	9(12.9)	<0.0001*
Presence of DR	186(16.4)	17(20.5)	22(19.8)	27(38.6)	<0.0001*

**Table-II. Univariate analysis of risk factors for severity of diabetic neuropathy**

Data are presented as Mean  $\pm$  SD. \*Statistically significant, DM: Diabetes mellitus. BP: Blood pressure. HbA<sub>1c</sub>: Glycosylated hemoglobin, DR: Diabetic retinopathy

Variables	Mild		Moderate		Severe	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Age	1.05(1.03-1.08)	<0.0001	1.09(1.07-1.11)	<0.0001	1.11(1.08-1.14)	<0.0001*
Duration of DM(years)	1.02(0.98-1.06)	0.388	1.02(0.99-1.05)	0.273	1.04(1.00-1.08)	0.027*
Insulin users	0.65(0.19-2.25)	0.498	1.53(0.65-3.59)	0.331	2.03(0.84-4.89)	0.114
Systolic BP (mm Hg)	1.00(0.99-1.01)	0.966	1.00(0.99-1.01)	0.755	1.00(0.99-1.01)	0.648
Microalbuminuria	1.54(0.88-2.69)	0.133	1.21(0.71-2.06)	0.491	1.62(0.86-3.05)	0.133
Macroalbuminuria	1.14(0.025-5.19)	0.866	2.11(0.72-6.19)	0.174	5.13(2.01-13.05)	0.001*
Presence of DR	1.16(0.63-2.12)	0.628	1.00(0.57-1.74)	0.992	2.03(1.12-3.69)	0.020*

**Table-III. Multivariate analysis of risk factors for severity of diabetic neuropathy**  
 DM: Diabetes mellitus; BP: Blood pressure; DR: Diabetic retinopathy, \*Statistically significant, OR: Odds ratio.

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## NOTIFICATION

It is notified that article with the title of **“Mushtaq A, Ayyaz S, Khan SA. PLEURAL EFFUSION; PATTERN AT NISHTAR HOSPITAL, MULTAN Professional Med J Nov-Dec 2012; 19(6):812-815”** has been withdrawn and cancelled with decision of Editorial Board on 09<sup>th</sup> Apr, 2013. Please do not cite this article in future. It has also been removed from website.

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