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Research Article

**RISK FACTORS AND PREVALENCE OF PERIPHERAL  
NEUROPATHY AMONG PATIENTS OF TYPE II DIABETES  
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**Abstract:**

**Aim:** A study was conducted to assess the prevalence and risk factors for diabetic neuropathy in DM2 patients, taking into account the increasing burden of type 2 (DM2) diabetes worldwide and associated microvascular and macrovascular complications.

**Place and Duration:** In the Medicine Unit II of Jinnah Hospital Lahore for six months duration from October 2019 to March 2020.

**Methods:** Patients aged 30 years and older who enrolled with DM2 were included in the study. Diabetic neuropathy symptoms (DNS) questionnaire was used to assess symptoms, and diabetic neuropathy (DNE) scores were used to assess clinical results.

**Results:** A total of 273 patients were included. The average age was  $57.8 \pm 11.5$ . The distribution of men among women was 75% (202) and 25% (71), respectively. According to the DNS tool, 41.4% of patients were positive for the presence of neuropathy, and only 24.5% had neuropathy based on the DNE result. The percentage of men affected by neuropathy was higher than women. DNS results were positive in 43.1% of men and DNE only 27.2%. The duration of the disease was positively correlated with neuropathy. Neuropathy was more common in people with high systolic and diastolic blood pressure than DNS and DNE devices.

**Conclusion:** The study showed a higher percentage of men affected by neuropathy. Therefore, a more detailed assessment should be made for older men with diabetes who have a longer duration of the disease. Lifestyle changes and careful testing should be considered as part of routine patient health education during follow-up visits.

**Key words:** diabetic neuropathy test, symptomatic of diabetic neuropathy, peripheral neuropathy, prevalence, risk factors, type 2 diabetes

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**INTRODUCTION:**

Type 2 diabetes (DM2) is one of the most common chronic diseases in the world and the number of diabetic patients is increasing. There were 366 million diabetic patients in the world in 2011 and it is expected to rise to 552 million by 2030. According to the PAKISTAN study, 6.4 million people with diabetes live in Pakistan. T2DM is a progressive disease and impairs patients' quality of life due to microvascular and macrovascular complications<sup>1</sup>. Lower limb diseases, including peripheral neuropathy, foot ulcer, peripheral arterial disease or amputation of the lower extremities, are twice as common in people with diabetes as those without diabetes and affect 30% of people with diabetes<sup>2</sup>. People with diabetes over 40 years of age. In people with diabetes, the annual population of foot ulcers in the population is between 1.0% and 4.1% and the incidence is between 4% and 10%, suggesting that lifetime incidence may be high. Like 25%<sup>3</sup>.

Screening and early identification of neuropathy gives a diabetic patient an important opportunity to actively modulate the course of suboptimal glycemic control over current targets and better foot care before significant morbidity begins<sup>4</sup>. Evidence from clinical trials regarding the effectiveness of detection strategies has shown that the incidence of amputation and ulceration is lower, and clinical practice guidelines are recommended for the detection of neuropathy<sup>5</sup>.

Most of the existing methods have been evaluated in developed countries where foot care practices are widely used<sup>6</sup>. In contrast, barefoot walking is still common in developing countries, and foot care practices are rarely used. With this in mind, this study was designed to assess the prevalence of diabetic neuropathy and risk factors among hospital participants<sup>7</sup>.

**SUBJECTS AND METHODS:**

A cross-sectional study was presented to the medical department (outpatient and hospitalized) in a Jinnah Hospital Lahore over a 6-month period from October 2019 to March 2020 among DM2 patients of both sexes. We included patients of both sexes who had been diagnosed with DM2 for at least 2 years, who wanted to attend an OPD medical ward or go to this care or seek medical care at a tertiary reference hospital. Patients with T2DM with severe comorbidities such as stroke and chronic kidney disease during recruitment, patients who came to the hospital for another disease and were referred for OPD medication for only one consultation, and pregnant women were excluded from the study.

**Sample Size**

Assuming that the incidence of diabetic neuropathy is 33%, takes into account a 5% alpha error at 20% relative sensitivity. The sample size according to 4 pq/d2 was calculated at 273.

**METHOD:**

Prior to the audit, the consent of the Corporate Ethics Committee was obtained. Written informed consent was obtained from all study participants. Information on sociodemographic characteristics, anthropometric measurements and blood pressure (BP) was collected during personal interviews using a pre-designed questionnaire. Additional details about the tests and complications were obtained from the patient's documentation. BP was measured using a standard mercury sphygmomanometer on the right shoulder in a sitting position for all study participants. If the recorded blood pressure was 40/140/90 mm Hg, the repeated BP was taken after five minutes. Peripheral neuropathy was assessed using the diabetic neuropathy symptoms questionnaire (DNS) and the diabetic neuropathy test (DNE) result.

All participants were asked about the presence of positive or negative symptoms suggesting the presence of neuropathy. DNS survey result used. Patients were asked if there was indecision, smoking, pain, tenderness, a burning sensation and numbness of the legs or feet while walking. "Yes" (positive: 1 point) or "no" (negative: no point) if the symptom has appeared more than once a week for the last 2 weeks. Maximum score: four points; there is no polyneuropathy 0 points; there are 1 to 4 polyneuropathy points.

Neurological examination was performed and neurological results were evaluated by DNE assessment. The DNE result consists of eight positions, two muscle strength tests, tendon reflex and five sensations. The maximum score is 16.> Score 3 is considered abnormal.

**Anthropometric variables**

All variables were measured according to WHO guidelines, and quality control was maintained during data collection. All measurements were made on light clothing. The weight was measured to the nearest 0.5 kg without shoes using a mechanical scale, and the scale was placed on a flat, solid surface. The height was measured with a tape measure on a flat vertical surface and recorded with an accuracy of 0.1 cm in centimeters.

**Statistical analysis used**

Data were entered and analyzed using the statistical package for social sciences version 18 (Chicago, SPSS Inc.). The results are summarized as percentages and ratios. The chi-square test was used for one-way analysis. PAGE

**RESULTS:**

A total of 273 patients were included. The initial characteristics of the study group are described in Table 1.

**Table 1: Baseline characteristics of the study population (n=273)**

Baseline characteristics	Mean± SD
Age (years)	57.8±11.5
Duration of DM (years)	8.3±6.7
Age at diagnosis (years)	49.7±11.2
BMI (kg/m <sup>2</sup> )	24.7±4.3
Diastolic BP (mm Hg)	78.3±15.3
Systolic BP (mm Hg)	128.4±12.6
Fasting blood sugar (mg/dl)	185.3±84.1
Postprandial blood sugar (mg/dl)	252.0±106.3
HbA1c (%)	9.2±2.6
Triglycerides (mg/dl)	163±113.9
Total cholesterol (mg/dl)	158.7±52.6
Low-density lipoprotein (mg/dl)	93.7±42.8
High-density lipoprotein (mg/dl)	34.6±15.4

The average age was 57.8 ± 11.5 years (30-89 years). The distribution of men among women was 75% (202) and 25% (71), respectively. The average duration of diabetes was 8.3 ± 6.7 years (2-35 years), the average age of diagnosis was 49.7 ± 11.2 years (24-80 years). About 43.1% of men are farmers, and 88.7% of women are housewives. 56% are employed, 12.8% are unemployed, 8.1% are retired and 23.1% are housewives. 9.5% of patients were illiterate, 29.4% were up to the 5th standard, 48.8% were up to the 12th standard, and 12.3% graduated. Most patients (45.4%) received oral hypoglycemic, 26% insulin, and 28.5% both insulin and oral hypoglycemic. According to the DNS tool, 41.4% of patients had positive results for the presence of neuropathy, while only 24.5% had neuropathy according to the DNE result, as described in Table 2.

**Table 2: Presence of peripheral neuropathy among diabetic patients by Diabetic Neuropathy Symptom and Diabetic Neuropathy Examination tools (n=273)**

Tools	Neuropathy present, n (%)	Neuropathy absent, n (%)
DNS Questionnaire	113 (41.4)	160 (58.6)
DNE score	67 (24.5)	206 (75.5)

A comparison of age and sex with neuropathy is shown in Peripheral Table 3. Most patients belongs to the age group 60-69 years old. Peripheral neuropathy defined by DNS was higher compared to DNE.

**Table 3: Comparison of age and gender parameters with peripheral neuropathy among diabetics (n=273)**

Variables	DNS			DNE		
	Total (n)	Neuropathy present, n (%)	Neuropathy absent, n (%)	Total (n)	Neuropathy present, n (%)	Neuropathy absent, n (%)
Age group (years)						
30-39	19	4 (21.1)	15 (78.9)	19	3 (15.8)	16 (84.2)
40-49	41	13 (31.7)	28 (68.3)	41	6 (14.6)	35 (85.4)
50-59	78	30 (38.5)	48 (61.5)	78	14 (17.9)	64 (82.1)
60-69	97	44 (45.4)	53 (54.6)	97	30 (30.9)	67 (69.1)
≥70	38	22 (57.9)	16 (42.1)	38	14 (36.8)	24 (63.2)
Gender						
Male	202	87 (43.1)	115 (56.9)	202	55 (27.2)	147 (72.8)
Female	71	26 (36.6)	45 (63.4)	71	12 (16.9)	59 (83.1)

The percentage of people affected by neuropathy increased with age as assessed by DNS or DNE, and this relationship was statistically significant using the Chi square test (P <0.05). The percentage of men affected by neuropathy was higher than women. 43.1% of men had a positive DNS result, only 27.2% were positive DNE. Parameters of the disease associated with the presence of peripheral neuropathy are listed in Table 4.

**Table 4: Comparison of disease characteristics with peripheral neuropathy (n=273)**

Disease characteristics	DNS			DNE		
	Total	Neuropathy present, n (%)	Neuropathy absent, n (%)	Total	Neuropathy present, n (%)	Neuropathy absent, n (%)
Age at diagnosis (n=273)						
<30	13	7 (53.8)	6 (46.2)	13	3 (23.1)	10 (76.9)
30-39	36	16 (44.4)	20 (55.6)	36	11 (30.6)	25 (69.4)
40-49	83	41 (49.4)	42 (50.6)	83	24 (28.9)	59 (71.1)
50-59	83	29 (34.9)	54 (65.1)	83	18 (21.7)	65 (78.3)
≥60	58	20 (34.5)	38 (65.5)	58	11 (19.0)	47 (81.0)
Duration of disease and treatment (n=273)						
≤5	124	23 (18.5)	101 (81.5)	124	13 (10.5)	111 (89.5)
6-10	74	30 (40.5)	44 (59.5)	74	13 (17.6)	61 (82.4)
11-15	40	28 (70.0)	12 (30.0)	40	21 (52.5)	19 (47.5)
16-20	25	22 (88.0)	3 (12.0)	25	14 (56.0)	11 (44.0)
>20	10	0 (0.0)	10 (100.0)	10	6 (60.0)	4 (40.0)
Current fasting blood sugar (mg/dl) (n=252)						
<125	58	28 (48.3)	30 (51.7)	58	18 (31.0)	40 (69.0)
≥126	194	78 (40.2)	116 (59.8)	194	44 (22.7)	150 (77.3)

Almost half of the patients are diagnosed with age from 40 to 49 years in people with neuropathy. Neuropathy assessed using the DNS tool was higher among people diagnosed with diabetes before 30 years of age (53.8%). The longer the duration of the disease, the greater the likelihood of neuropathy, especially when examined using the DNS tool, where the percentage of people is from 18.5 to 100%, when the duration of the disease varies from <5 years to > 5.20 years. The relationship between disease duration and the presence of neuropathy by both DNS and DNE was statistically significant ( $P < 0.05$ ). Surprisingly, the well-controlled state of fasting diabetes in the blood sugar test (FBS) had a higher percentage of people affected by neuropathy. More people in the categories of normal body mass index (BMI) and obesity category (43% each) had neuropathy versus DNS (compared to DNS and DNE tools, neuropathy was higher than systolic) and was more common in people with diastolic BP.

### DISCUSSION:

Diagnosis of diabetic neuropathy is made by a variety of methods, including neurological examination and electrophysiology, to detect and assess the disease at the earliest stage. However, the role of traditional methods and diagnostic parameters as a prognostic factor for diabetic neuropathy is controversial<sup>8</sup>. Early detection or diagnosis of neuropathy allows the doctor to take

appropriate medications to control it or at least slow its progression. It is also important to educate the patient about the care of the disease. Neuropathy is a debilitating and paralyzing problem if it is not controlled at an early stage<sup>9</sup>. The study included assessing the symptoms and signs of diagnosis of peripheral neuropathy. Because peripheral sensory neuropathy is a key element in the causative pathway of foot ulcer and amputation, it is important to choose a fast, inexpensive and accurate tool for assessing a high-risk patient. In this study, peripheral neuropathy was assessed using a DNS questionnaire and the DNE result was 41.4% and 24.5%, respectively<sup>9</sup>. Inequalities occur because Meijer *et al*. Symptom scoring is more sensitive because it has a cut-off value, as in a study by. In the study by Meijer *et al*<sup>10</sup>, the probability rates of DNS and DNE results were higher for other tests, such as nerve conduction studies. Therefore, these incorrect DNS and DNE results have been reported by Assad *et al*, Urban Rural Epidemiology study, 26% prevalence of neuropathy; 29.2% of neuropathy was detected in the outpatient treatment center of the endocrinology clinic of a public tertiary hospital in northern Pakistan; However, this study shows a large number of people with neuropathy because in a higher hospital they care about reference patients who are more symptomatic and have more complications comparable to Chandigarh results<sup>11</sup>.

The percentage of men affected by neuropathy is higher than the percentage of Bansal and colleagues who said that there were no sex differences in this study<sup>12</sup>. Neuropathy was more common in older age groups and those with longer periods of illness. The results of our study were similar to those reported in other regions of Pakistan and abroad. Studies have shown a correlation between the severity of diabetic peripheral neuropathy and exposure to total hyperglycemia. However, in this study, we used fasting plasma glucose to assess glycemic control due to a lack of Hb glycosylated value in all patients. In this study, in contrast to the studies by Dyck et al<sup>13</sup>, It was found that neuropathy is more common in people with FBS <125 mg / dl. In most symptomatic patients, BMI was normal and there was no significant relationship between BMI and the presence of diabetic peripheral neuropathy. These findings overlap with other studies in which anthropometric variables are not defined as risk factors.

In the study with BP  $\geq$ 140 / 90 mm Hg, almost half of the patients had neuropathy compared to the DNS tool. This may be due to common risk factors that cannot be changed, such as age. However, Booya et al<sup>14</sup> and Mørkrid et al<sup>15</sup>. Although there was no significant relationship between distal symmetrical sensory-motor polyneuropathy and BP levels, Imphal showed the involvement of systolic BP in diabetic neuropathy. DNS and DNE tests are quick and easy in clinical practice and are useful for early detection of neuropathy. One of the limitations of DNE is that it does not take into account the loss of temperature sensation, and therefore this technique may ignore fine fiber neuropathy. Because DNS and DNE are subjective and depend on patient collaboration and response, they should be used in conjunction with other tests, such as the vibration sensing threshold, to establish a diagnosis. The lack of data in patient files is another limitation. The duration of the disease was significantly associated with the presence of neuropathy. Therefore, basic prevention should be treated as an important element of daily practice, not only because of diabetes, but also other associated diseases such as hypertension, lifestyle changes that delay the onset of the disease.

### CONCLUSIONS:

According to the DNS tool, over 40% of diabetic patients had peripheral neuropathy. It was found that people with advanced age, male sex, younger diagnosis age, longer diabetes duration and higher current BP values had a higher neuropathy rate. Only advanced age and longer duration of the disease were significantly associated with the presence of neuropathy. The DNS result is a sensitive and confirmed result for symptoms quickly and easily in clinical practice to detect peripheral neuropathy in diabetics.

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