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RESEARCH ARTICLE

Severity Screening of Diabetic Neuropathy in a Tertiary Hospital, Chennai: A Cross-sectional Study

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Abstract

Diabetic peripheral neuropathy (DPN) is a common and debilitating complication of diabetes, often leading to significant morbidity if not detected early. Effective screening tools are crucial for timely diagnosis and management. The Neuropathy Disability Score (NDS) is a clinically validated, simple, and cost-effective tool used to assess the severity of diabetic peripheral neuropathy. It evaluates sensory and motor nerve function through a series of physical examinations. **Aim and Objective:** Early detection of diabetic neuropathy using the neuropathy disability score and assessment of the severity of diabetic neuropathy using the neuropathy disability score. **Methods:** This is a cross-sectional study conducted in Government Kilpauk Medical College, Chennai, during the month of March 2025. A total of 90 diabetic patients attending the Department of Physical Medicine and Rehabilitation with the inclusion criteria were enrolled. Detection of diabetic peripheral neuropathy and assessment of severity were done using the Neuropathy Disability Score (NDS). **Results:** Out of 90 patients, 26 (28.8%) patient found to have symptoms of diabetic peripheral neuropathy. 20 (22.2%) have difficulty in perceiving vibration, and 16 (17.7%) have difficulty in perceiving pressure sensation, as tested using monofilament, and 4 (4.4%) have difficulty in perceiving pain and 3 (3.3%) have abnormal deep tendon reflex. 11 (12.2%) have mild (score 3-5) and 3 (3.3%) have moderate (6-8 score) neuropathy. None of the patients had severe (score 9-10) neuropathy. **Conclusion:** DPN is one of the most common microvascular complications, largely concerned with the feet and lower limbs. Early identification and appropriate management of diabetic peripheral neuropathy using foot care and other modalities is highly advisable to prevent diabetic foot, which is the most common cause for non-traumatic amputation. NDS, which is highly sensitive to detect diabetic peripheral neuropathy even at the primary setup.

Keywords: Amputation, Diabetes Mellitus, Diabetic Peripheral Neuropathy, Footwear Modification, Monofilament, Neuropathy Disability Score, Screening, Vibration Perception

1. Introduction

DPN has been defined as "the presence of symptoms and/or signs of peripheral nerve dysfunction in people with diabetes after the exclusion of other causes"[1]. It is the most common component in the causal sequence to foot ulceration[2]. DPN of the limbs may involve large-fibre nerves (more related to touch, vibration, position perception and muscle control), small-fibre nerves (more related to thermal perception, pain and autonomic function)[3]. DPN is often asymptomatic during the early stages; however, once symptoms and overt deficits have developed, it cannot be reversed[4]. Therefore, early diagnosis and timely intervention are essential to prevent the development and progression of diabetic neuropathy.

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2. Aim and Objectives

- Early detection of diabetic neuropathy using the neuropathy disability score.
- Assessment of the severity of diabetic neuropathy using the neuropathy disability score.

3. Review of Literature

Diabetic neuropathy is one of the most prevalent chronic complications of diabetes, affecting approximately 50% of individuals with long-standing diabetes[1]. It is a major contributor to morbidity, leading to pain, numbness, risk of foot ulcers and amputations. Several studies emphasise the importance of reliable screening tools for identifying neuropathy in its early stages.

3.1 Neuropathy Disability Score (NDS)

The NDS (Table 1) is a widely used clinical scoring system for assessing diabetic neuropathy. Studies have shown that the NDS is effective in identifying patients at risk of foot complications due to its ability to detect sensory deficits[6]. However, its reliance on subjective patient responses and examiner interpretation can lead to variability in results. Despite these limitations, the NDS remains a practical and cost-effective tool, particularly in resource-limited settings[7].

3.2 Screening Tools

Shereen R. Kamel *et al.*, when studied on Clinical diagnosis of distal diabetic polyneuropathy using neurological examination scores: correlation with nerve conduction studies, concluded that taking the NCS as gold standard, NDS is 61.5% sensitivity and 100% specificity[8].

4. Materials and Methods

- Study Design - Hospital-based cross-sectional study.
- Study Population/Centre - Patients visiting the PMR Outpatient Department in GKMCH, Chennai.
- Study Duration - 1 month (March 2025).
- Study Population - 90 patients.

4.1 Inclusion Criteria

Patients diagnosed with diabetes mellitus type 2 visiting the PMR Outpatient Department in GKMCH, Chennai.

4.2 Exclusion Criteria

Not willing to participate, known case of Hypothyroidism, peripheral neuropathy, Chronic alcohol consumer.

Table 1. Neuropathy disability score

Component	Examination	Points
Vibration Sense (128 Hz tuning fork)	Hallux of the big toe	0-present 1-absent/reduced/uncertain
Pressure sensation	10g monofilament at 4/10 standard sites of the sole	0-present 1-absent/reduced/uncertain
Pain perception	Press the skin proximal part of the great toe	0-present 1-absent/reduced/uncertain
Achilles deep tendon reflex		0-present 1-present with reinforcement 2-absent
H/o foot amputation - double the score. Mild (3-5) moderate (6-8) severe (9-10)		

Above table 1 shows Age wise distribution of study participant,minimum age group were 30 years and maximum age group were 78 years. The mean age was 52.8 with standard deviation of 13.7 years.

4.3 Sample Size

According to the reference study by *et al.*,[9] the prevalence of Diabetic peripheral neuropathy is 29.4%. Sample size calculated using 95 % Confidence interval 10% precision,

$$N = \{Z(1-\alpha/2)^2pq\}\div d^2$$
$$= 1.96x1.96x29.4x70.6/10x10$$
$$= 80$$

By adding 10% non response rate, the final sample size = 90.

5. Results (Including Observations)

Age distribution of the participants shows that the minimum age is 30 years, the maximum age is 78 years, the mean age is 52.8 years, and the standard deviation is 13.7 years (Table 2). Gender distribution of the participants shows that 59 (65.5%) of the participants are female and 31(34.4)% are male (Figure 1). Body Mass Index (BMI) of the participants shows that the minimum BMI is 17.00 kg/m^2, the maximum BMI is 31.00 kg/m^2, the mean BMI is 24.6 kg/m^2, and the standard deviation is 4 kg/m (Table 3). Most of them were daily wagers, 64.4% (58), 30 (33.3%) were housewife and 2 of them were engaged in other occupations (Figure 2). 6 (6.67%) participants are illiterate, 29 (32.2%) had primary education, 46 (51.1%) studied till middle and 9 (10%) had higher education (Figure 3). Most of the participants are from urban areas (79 (87.7%) and 11 (12.2%) from rural areas (Figure 4).

The duration of diabetes mellitus was found to be 54 (60%) have <10 years and 36 (40%) have >10 years (Figure 5). Presence of comorbidities among the

Figure 1. Pie chart showing the distribution of total study participants according to gender.

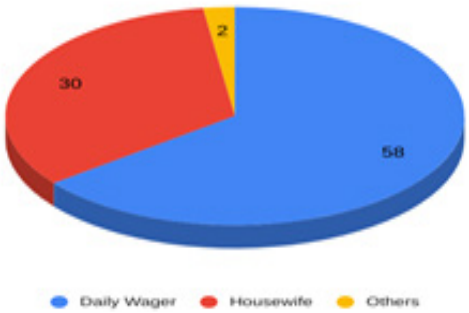

Figure 2. Occupation-wise distribution of study participants.

Table 2. Age-wise distribution of study participant

Age Distribution	Mean	Standard Deviation	Minimum	Maximum
Age (years)	52.8	13:7	30	78

Above table 2 shows Age wise distribution of study participant,minimum age group were 30 years and maximum age group were 78 years. The mean age was 52.8 with standard deviation of 13.7 years.

Table 3. BMI distribution of study participants

BMI Distribution	Mean	Standard Deviation	Minimum	Maximum
BMI (kg)	24.6	40	17	31

The above table 3 shows BMI among the study participants the range from 17-31. The mean BMI of study participants was 24.6.

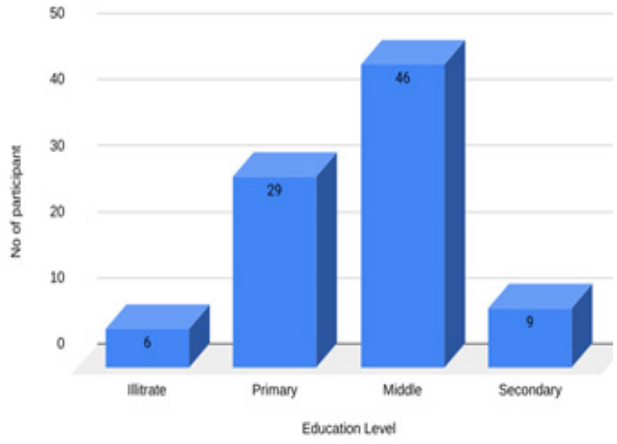

Figure 3. Education-wise distribution among study participants.

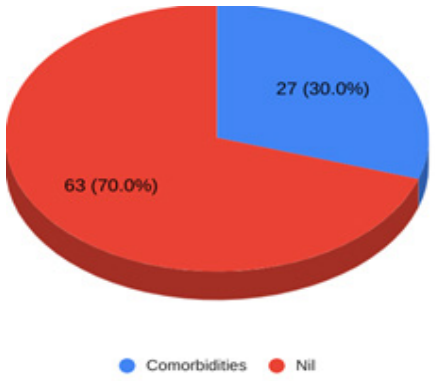

Figure 6. Comorbidities distribution among study participants.

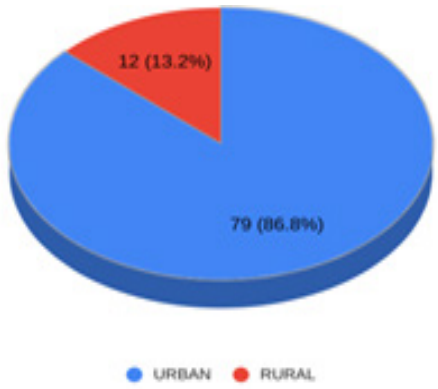

Figure 4. Locality-wise distribution among study participants.

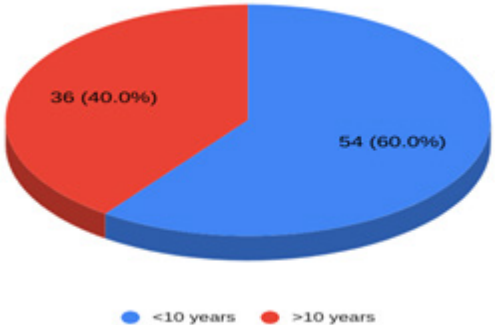

Figure 5. Duration-wise distribution among study participants.

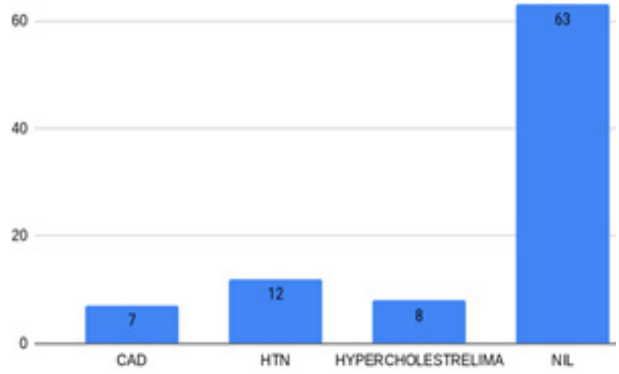

Figure 7. Comorbidities-wise distribution amongst the participants.

participants shows that 63 (70)% of the participants do not have other comorbidities, while 27 (30%) do (Figure 6). 8 (8.8%) concurrent hypercholesterolemia, 7 (7.7%) hypertension and 12 (13.3%) have hypertension along with diabetes mellitus (Figure 7). While assessing individual components of the neuropathy disability score, Pressure sensation was impaired in 16 (17.7%) participants, Vibration sense in 20 (22.2%), Pain perception in 4 (4.4%) participants and Achilles deep tendon in 3 (3.3%) participants were affected (Table 4). Diabetic peripheral neuropathy was found in 12.2% (11) on both sides, with 9 (10%) have on the right and 6 (6.6%) on the left side (Figure 8). While considering overall severity, 76 (84.4%) have no peripheral neuropathy, 11 (12.2%) have mild (score 3-5), and 3 (3.3%) have moderate (6-8 score) neuropathy. None of the patients had severe (score 9-10) neuropathy (Figure 9).

Table 4. Distribution of Neuropathy Disability Score (NDS) components among study participants

Components of NDS	Vibration Sense	Pressure Sensation	Pain Perception	Achilles Deep Tendon Reflex)
Number and Percentage of participants	20 (22.2%)	16(17.7%)	4(4.4%)	3 (3.3%)

The above table 4 shows, 20 (222%) were affected with impaired vibration perception, 16 (17.7%) were affected with impaired pressure sensation, 4 (4.4%) have difficulty in percieving pain and 3 (3.3%) were have abnormal achilles tendon reflex.

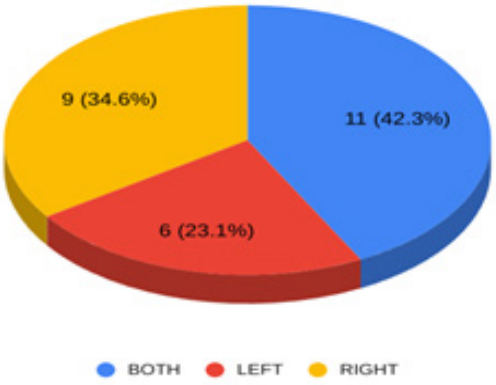

Figure 8. Side affected with DPN among study participants.

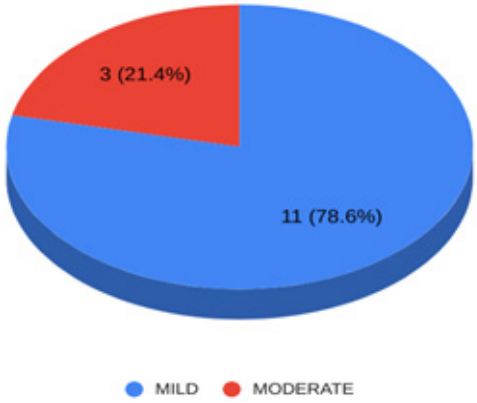

Figure 9. Severity-wise distribution of diabetic peripheral neuropathy.

The table 2 shows age-wise distribution of study participants, the minimum age group were 30 years, and the maximum age group were 78 years. The mean age was 52.8 with a standard deviation of 13.7 years.

The table 3 shows BMI among the study participants ranging from 17-31. The mean BMI of study participants was 24.6.

The table 4 shows that 20 (222%) were affected with impaired vibration perception, 16 (17.7%) were affected with impaired pressure sensation, 4 (4.4%) had difficulty in perceiving pain, and 3 (3.3%) had abnormal Achilles tendon reflex.

6. Discussion

The literature highlights the importance of early screening for diabetic neuropathy and the strengths and limitations of the NDS, as the NDS is practical and cost-effective. This study aims to bridge the gap in existing research by directly comparing the tools, providing valuable insights into their relative efficacy and applicability in clinical practice, and so early detection of diabetic peripheral neuropathy and prevention of tertiary complications of diabetic foot, and thus amputation. In our study, we found 90 participants (59 female [65.5%] and 31 male [34.4%]) whose ages ranged from 30 to 78 years, with a mean of 52.8±13.7 years. Body Mass Index (BMI) varied between 17.0 and 31.0 kg/m^2, averaging 24.6±4 kg/m^2, placing most individuals within the normal to overweight range by standard WHO criteria (and slightly elevated risk by South Asian BMI cut-offs).

Comorbidity data showed that 70% of participants had no other comorbid conditions, while 30% did. Among the comorbid subset: 8 participants (8.8%) had hypercholesterolemia, 7 (7.7%) had hypertension alone, and 12 (13.3%) had both hypertension and diabetes mellitus. The majority (87.7%) were urban residents, with only 12.2% from rural areas.

Considering education levels: 6 (6.7%) illiterate, 29(32.2%) with primary education, 46 (51.1%) up to middle school, and 9 (10%) had higher education.

Occupationally, most were daily-wage earners (64.4%; 58 people), 33.3% (30) were housewives, and just 2 engaged in other forms of work.

Regarding duration of diabetes mellitus: 54 participants (60%) had lived with diabetes for less than 10 years, while 36 (40%) had a duration exceeding 10 years. The prevalence of Diabetic neuropathy is 28.8% in our study, which correlates with a previous study done by Raveendiran *et al.,* in the Chennai population[10].

In our study, we have 12.2% had mild and 3.3 % had moderate severity of Diabetic neuropathy by using the Disability Neuropathy score.

7. Summary and Conclusion

Early identification of sensory and motor deficits in diabetic patients is essential for tertiary prevention of diabetic foot. So, timely interventions, such as patient education, glycemic control, and regular foot care is highly recommended, thereby reducing the incidence of ulcers and associated complications. Customised footwear designed to reduce pressure points and prevent foot injuries, aiming ultimately to lower the risk of ulceration and amputation.

8. References

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