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Original Research Article

Burden and geographical variation of peripheral neuropathy in India: insights from a large multi-regional screening study

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ABSTRACT

Background: Peripheral neuropathy (PN) is a major cause of morbidity in India, yet it's true that community-level burden remains underreported. Understanding the distribution of neuropathy across demographic and regional subgroups is essential for targeted public health interventions. Aim and objectives to determine the prevalence and severity of PN in a large, diverse Indian population and to compare PN patterns across age, gender, diabetes status, and geographic regions.

Methods: This cross-sectional study analysed data from 153,354 adults screened across all four zones of India. The study was designed by Corona Remedies Ltd., and data were collected by them. PN was assessed using a standardized bilateral foot scoring system with a Biothesiometer, and severity was classified as normal, mild, moderate, or severe. Demographic details (age, gender, region) and diabetes status were recorded. Prevalence estimates were calculated using descriptive statistics and stratified by key subgroups.

Results: The overall prevalence of PN was 75.4%, with mild (53.9%) being the most common category, followed by moderate (16.8%) and severe (4.7%). PN prevalence was significantly higher among people with diabetes (90.1%) compared to non-diabetics (65.3%). Gender differences were minimal, with males showing slightly higher prevalence (75.8%). Wide zonal variation was observed, with PN prevalence ranging from 74.3% to 79.3%. The Eastern zone demonstrated the highest neuropathy prevalence at 79.3%, driven by a larger proportion of individuals with moderate (16.8%) and severe neuropathy (20.4%).

Conclusions: Neuropathy is highly prevalent in the Indian population, with a significantly more substantial burden among people with diabetes. These findings highlight the need for early screening and targeted interventions for diabetic individuals to prevent neuropathy-related complications.

Keywords: Peripheral neuropathy, Prevalence, Diabetes, India, Regional variability, Neuropathy screening

INTRODUCTION

Peripheral neuropathy (PN) is a damage or dysfunction of peripheral nerves, and is a major public health concern, particularly when associated with metabolic disorders such as diabetes mellitus. Among people living with diabetes, the estimated lifetime risk of developing PN is often reported to be as high as 50% or more.^{1,2} In India, the epidemiologic profile of PN is highly variable, with community and clinic-based studies indicating

prevalences that range from very low to very high, depending on demographics, diagnostic criteria, comorbidities, and region.³

A recent review of Indian data found that community-based prevalence of PN ranged from approximately 5 to 2,400 per 10,000 population in various settings, noting the influence of environmental, occupational, and socio-demographic factors on neuropathy risk.³ Among diabetic populations specifically, a rural South Indian study

reported a prevalence of 39.3% and identified age, longer diabetes duration, elevated glycosylated haemoglobin, hypertension, and body mass index as key determinants.²

Given India's large and geographically diverse diabetic population, as well as rising non-diabetic exposures such as tobacco use, hypertension, nutritional deficits, and environmental toxins, there is a compelling need to assess PN prevalence across zones, gender, age, and diabetes status. Such data will support targeted screening, prevention, and resource allocation. The present study, therefore, examined PN prevalence and severity across multiple Indian regions, stratified by gender, age group, zone, and diabetic vs non-diabetic status, to delineate the burden and distribution of PN in a large cohort.

METHODS

This study was designed as a large cross-sectional, community-based screening analysis conducted across all four zones of India. The study was designed by Corona Remedies Ltd., and data were collected by them. Data were collected through organized neuropathy screening camps and outreach activities conducted in both urban and rural locations. The geographical coverage included the northern, southern, eastern, western, and central regions of India, enabling broad demographic and regional representation.

Study population

A total of 153,354 individuals who participated in neuropathy screening programs were included in the analysis. Screening was open to adults from the general population without restriction to clinical status, occupation, or socioeconomic category. All participants who provided complete demographic details and neuropathy assessment scores were eligible for inclusion.

Inclusion criteria

Individuals aged 18 years or older, participants who underwent a complete neuropathy assessment (right foot score, left foot score, and overall score), availability of basic demographic information (age, gender, region), availability of diabetes status (self-reported or documented) were included in the study.

Exclusion criteria

Participants with incomplete neuropathy scoring data, missing demographic details (age, gender, or region) and individuals with unclear or ambiguous diabetes status documentation were excluded from the study.

Data collection tools and procedures

Neuropathy assessment was performed using a standardized scoring system applied uniformly across screening sites. Each participant underwent bilateral foot

assessment using a Biothesiometer, generating three key measures: Right foot score, left foot score and average neuropathy score.

Based on the average score, neuropathy severity was categorized into four levels: normal (<16), mild neuropathy (16-18), moderate neuropathy (19-25) and severe neuropathy (>25).

Demographic variables collected included age, gender, region, and diabetes status. Diabetes was documented based on self-report or a previously known diagnosis.

Operational definitions

Neuropathy score

Quantitative composite score assigned based on sensory and functional assessment of both feet.

Neuropathy severity

Normal: Within acceptable score range

Mild: Early sensory involvement

Moderate: Clear functional impairment

Severe: Marked loss of protective sensation

Overall neuropathy

Defined as the presence of mild, moderate, or severe neuropathy.

Outcome measures

The primary outcome of interest was the prevalence of PN (any grade) across the total population and stratified by demographic and clinical factors. Secondary outcomes included the distribution of neuropathy severity across: Gender, age groups, diabetes vs non-diabetes and geographic regions (Zones).

Data management and statistical analysis

Data cleaning, coding, and analysis were performed using Microsoft excel 2010 and IBM SPSS statistics for Windows, Version 27.0 (IBM Corp., Armonk, NY, USA) software. Continuous variables, such as age and neuropathy score, were summarized using the mean and standard deviation (SD). Categorical variables, including neuropathy severity, gender, diabetes status, and regional distribution, were presented using frequencies and percentages.

Prevalence estimates were calculated as the proportion of individuals within each neuropathy category. Stratified analyses were conducted to compare neuropathy

distribution across diabetes status and gender. Region-wise prevalence was computed as:

$$\text{Neuropathy prevalence (\%)} = \frac{\text{Mild} + \text{Moderate} + \text{Severe}}{\text{Total Participants in Region}} \times 100$$

No inferential statistical comparisons were made, as the study focused on descriptive epidemiology.

Ethical considerations

All data were anonymized before analysis. Participation in screening was voluntary, and informed verbal consent was obtained from each participant at the time of assessment. The study complied with ethical principles of the declaration of Helsinki, and no identifiable personal information was used in the analysis.

RESULTS

A total of 153,354 individuals from all four regions across India were screened. The mean age of the study population was 48.81±12.14 years (range: 18 to 100 years), with 62.9% (n=96385) males and 37.1% (n=56969) females. Overall, 39.7% (n=60806) of participants had diabetes. The mean neuropathy score was 16.07±5.10, reflecting a substantial neuropathy burden. The broad geographic coverage provided robust regional comparisons of neuropathy prevalence.

Overall prevalence of neuropathy

Among all participants, 115,637 individuals (75.4%) had neuropathy of any grade. Mild neuropathy was the most common category, affecting 82,639 individuals (53.9%), followed by Moderate neuropathy in 25,849 individuals (16.9%), and Severe neuropathy in 7,149 individuals

(4.7%). A total of 37,717 individuals (24.6%) exhibited normal findings.

Table 1: Overall distribution of neuropathy, (n=153,354).

Category	N	Percent (%)
Normal	37,717	24.6
Mild neuropathy	82,639	53.9
Moderate neuropathy	25,849	16.9
Severe neuropathy	7,149	4.7
Any neuropathy	115,637	75.4

Age-wise distribution of neuropathy

Neuropathy prevalence increased markedly with advancing age. Among individuals aged 18–50 years (n=86,012), neuropathy of any grade was observed in 65.9% of participants. In the 51-70 years age group (n=61,785), the proportion rose sharply to 87.0%. The highest burden was noted in those >70 years (n=5,557), where 92.6% exhibited neuropathy of any severity. Severe neuropathy also increased progressively across age groups, from 30.1% in 18-50 years to 58.0% in 51-70 years and 11.8% in individuals older than 70 years (Table 2).

Gender-wise neuropathy distribution

Neuropathy of any grade was present in 75.8% of males and 74.7% of females, showing a comparable distribution between the two genders. Mild and moderate neuropathy were slightly more common in males (62.9% and 64.5%, respectively), whereas females had a marginally higher proportion of severe neuropathy (38.2% vs 61.8%; numbers correspond to subgroup distributions). Overall, both genders demonstrated a high and nearly similar neuropathy prevalence (Table 2).

Table 2: Neuropathy distribution among different parameters.

Parameters	Normal	Mild	Moderate	Severe	Neuropathy of any grade	Percent neuropathy out of total (%)
Age groups (in years)	18-50 (n=86012)	29300 (77.7)	44308 (53.6)	10250 (39.7)	2154 (30.1)	56712 65.9
	51-70 (n=61785)	8006 (21.2)	35699 (43.2)	13931 (53.9)	4149 (58.0)	53779 87.0
	>70 (n=5557)	411 (1.1)	2632 (3.2)	1668 (6.5)	846 (11.8)	5146 92.6
Gender	Male (n=96385)	23329 (61.9)	51973 (62.9)	16667 (64.5)	4416 (61.8)	73056 75.8
	Female (n=56969)	14388 (38.1)	30666 (37.1)	9182 (35.5)	2733 (38.2)	42581 74.7
Diabetes	Yes (n=60806)	5607 (14.9)	34343 (41.6)	16118 (62.4)	4738 (66.3)	55199 90.1
	No (n=92548)	32110 (85.1)	48296 (58.4)	9731 (37.6)	2411 (33.7)	60438 65.3

Continued.

Parameters	Normal	Mild	Moderate	Severe	Neuropathy of any grade	Percent neuropathy out of total (%)
Zone	East (n=27323)	5654 (15.0)	15859 (19.2)	4355 (16.8)	1455 (20.4)	21669 79.3
	North (n=37244)	9568 (25.4)	20543 (24.9)	5486 (21.2)	1647 (23.0)	27676 74.3
	South (n=20130)	4949 (13.1)	10415 (12.6)	3703 (14.3)	1063 (14.9)	15181 75.4
	West (n=68657)	17546 (46.5)	35822 (43.3)	12305 (47.3)	2984 (41.7)	51111 74.4

Neuropathy in diabetic vs non-diabetic individuals

A significant disparity was observed based on diabetic status. Among individuals with diabetes (n=60,806), neuropathy of any grade was present in 90.1%, with moderate and severe neuropathy accounting for 62.4% and 66.3%, respectively. In contrast, neuropathy prevalence in non-diabetic individuals (n=92,548) was 65.3%. Diabetic participants showed substantially higher proportions across all severity categories compared to non-diabetics (Table 2).

Zone-wise neuropathy distribution

Neuropathy distribution varied across geographical zones. The East zone demonstrated the highest neuropathy prevalence, with 79.3% of participants affected, followed by the South (75.4%), West (74.4%), and North (74.3%) zones. The severity pattern also differed regionally, with the East showing the highest proportion of severe neuropathy (20.4%), while the West and North zones reported severe neuropathy in 41.7% and 23.0% of participants, respectively. Overall, all zones exhibited a consistently high neuropathy burden (Table 2).

DISCUSSION

In this large cross-sectional screening of more than 1.5 lakh individuals across all Indian zones, we identified a high burden of neuropathy: 75.4% of the screened population exhibited neuropathy at any grade. This prevalence is substantially higher than what has been reported in most clinic-based or urban diabetic cohorts from India, where neuropathy prevalence typically ranges between 19-52% depending on methodology and population characteristics.¹⁻³ The markedly elevated detection in our study may be attributed to broader community representation, inclusion of both diabetic and non-diabetic individuals, and wide geographic diversity.

As expected, PN prevalence was significantly higher among individuals with diabetes compared with non-diabetic participants, reinforcing the well-established association between chronic hyperglycaemia and peripheral nerve injury.^{1,4} This aligns with evidence showing that poor glycaemic control, longer diabetes

duration, hypertension, obesity, and dyslipidaemia are major drivers of diabetic PN in Indian populations.^{2,3,5} The observed age-related increase in neuropathy prevalence in our dataset also mirrors findings from multiple epidemiological studies, indicating that neuropathy risk rises progressively with ageing due to cumulative metabolic and microvascular damage.⁶

Gender and age differences in neuropathy distribution were relatively modest in our study, with slightly higher prevalence among males and an upward trend with increasing age. Similar findings have been reported in previous Indian studies, where males demonstrated higher neuropathy risk, potentially related to occupational exposures, tobacco/alcohol use, and delayed health-seeking behaviour.^{7,8}

The zonal variability observed in neuropathy prevalence across Indian is notable. The Eastern zone demonstrated the highest neuropathy prevalence, driven by a larger proportion of individuals with moderate and severe neuropathy. The Southern zone also showed substantial neuropathy burden, with nearly one-third of participants exhibiting moderate or severe involvement. The Western zone, which comprised the most significant proportion of the screened population, showed a neuropathy prevalence of 74.4%, with mild neuropathy forming the most common category. The Northern zone demonstrated the lowest prevalence among the four regions, though it still exhibited a high burden, with over one-fifth of participants showing moderate neuropathy. These differences may reflect heterogeneity in diabetes burden, nutritional patterns, environmental exposures, healthcare access, and awareness levels, consistent with earlier Indian reports highlighting geographic variation in neuropathy etiologies and risk profiles.^{3,9-12}

Importantly, mild neuropathy was the most common category across nearly all zones, suggesting a large pool of individuals in the early stages of nerve dysfunction. This has major public-health implications because early neuropathy is often asymptomatic yet reversible through lifestyle modifications, glycaemic optimisation, and preventive foot-care interventions.^{13,14} Detection at this stage can potentially prevent progression to moderate or severe neuropathy, which is associated with higher

morbidity, ulceration risk, and substantial economic burden.¹⁵

The presence of neuropathy in two-thirds of non-diabetic individuals in our dataset warrants further investigation. Non-diabetic neuropathy in India has been attributed to vitamin deficiencies, chronic alcohol use, infections, toxin exposures, hypothyroidism, renal disease, and idiopathic causes, with studies emphasising the diverse etiological landscape.^{3,9,16} Our findings support the need for broader neuropathy screening beyond diabetic populations.

This study has several strengths, including its very large sample size, nationwide regional representation, and uniform neuropathy scoring method. However, certain limitations exist. The cross-sectional design limits causal inference. Diabetes details (duration, HbA1c), comorbidities, and medication history were not captured, preventing deeper risk-factor modelling. Neuropathy assessment was clinical rather than electrophysiological, though validated scoring tools are widely used for large-scale screening.

CONCLUSION

This large, multi-regional analysis demonstrates an alarmingly high burden of PN in the Indian population. While neuropathy was most common among people with diabetes, a substantial proportion of non-diabetic individuals were also affected, highlighting the need for broader community-level screening beyond traditional high-risk groups. The predominance of mild neuropathy suggests a major opportunity for early detection and timely intervention to prevent progression to more severe stages. Significant regional variation underscores the importance of context-specific public-health strategies, and local awareness programs. Overall, these findings reinforce the urgent need for nationwide neuropathy surveillance, preventive methods, and early management pathways to reduce neuropathy-related morbidity in India.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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