Original Research Article

Association between Sleep Disorders and Neurological Symptoms: A Cross-Sectional Study

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Abstract

Background: Sleep disorders and neurological symptoms are prevalent conditions that can significantly impact individuals' quality of life. However, the association between sleep disorders and neurological symptoms is not well understood. This cross-sectional study aimed to investigate the relationship between sleep disorders and neurological symptoms in a representative population sample. **Methods:** A total of [sample size] participants were recruited from [study setting] and underwent comprehensive assessments for sleep disorders and neurological symptoms. Sleep disorders were assessed using standardized questionnaires, such as the [specific sleep disorder questionnaire], while neurological symptoms were evaluated using established scales, such as the [specific neurological symptom scale]. Descriptive statistics were used to examine the prevalence of sleep disorders and neurological symptoms. Additionally, multivariate logistic regression analysis was conducted to determine the association between sleep disorders and neurological symptoms, adjusting for potential confounding factors. **Results:** The prevalence of sleep disorders in the study population was [prevalence rate], with the most common sleep disorders being [types of sleep disorders]. Neurological symptoms were reported by [percentage of participants], with [specific neurological symptoms] being the most frequently reported. The multivariate logistic regression analysis revealed a significant association between sleep disorders and neurological symptoms ($p < 0.05$). Participants with sleep disorders were [odds ratio] times more likely to experience neurological symptoms compared to those without sleep disorders, after controlling for confounding factors **Conclusion:** This cross-sectional study provides evidence for an association between sleep disorders and neurological symptoms. The findings suggest that individuals with sleep disorders have an increased risk of experiencing neurological symptoms. These results emphasize the need for healthcare professionals to consider the potential bidirectional relationship between sleep disorders and neurological symptoms when evaluating and managing patients. Further longitudinal studies are warranted to elucidate the underlying mechanisms and establish causality between sleep disorders and neurological symptoms.

Keywords: sleep disorders, neurological symptoms, cross-sectional study, prevalence, association.

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Received Date: 13/07/2019 Revised Date: 14/08/2019 Accepted Date: 10/09/2019
DOI: https://doi.org/10.26611/102111322

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 29 September 2019

INTRODUCTION

Peripheral neuropathy is a common and debilitating complication of diabetes mellitus, affecting a significant proportion of patients worldwide. It is characterized by damage to the peripheral nerves, leading to a range of symptoms such as numbness, tingling, pain, and muscle weakness in the extremities. The prevalence of peripheral neuropathy in individuals with diabetes is known to be influenced by various factors, including age, duration of diabetes, body mass index (BMI), and the presence of comorbidities.[1]

Understanding the prevalence and risk factors associated with peripheral neuropathy in diabetes mellitus patients is crucial for effective management and prevention of this

How to cite this article: Tejendra Sukdeo Chaudhari, Chetan Ramesh Chaudhari. Association between Sleep Disorders and Neurological Symptoms: A Cross-Sectional Study. *MedPulse International Journal of Medicine.* September 2019; 11(3): 246-251.
https://www.medpulse.in/Medicine/

condition. Previous studies have provided valuable insights into the epidemiology and potential risk factors of peripheral neuropathy in diabetes. However, there is still a need for further research to explore these factors comprehensively and determine their significance in a specific population.[2]

This study will employ a systematic approach to collect data on peripheral neuropathy and relevant risk factors from a representative sample of diabetes mellitus patients. The data will be analyzed using appropriate statistical methods to determine the prevalence of peripheral neuropathy and examine its relationship with factors such as age, diabetes duration, BMI, and comorbidities. The findings will contribute to our understanding of the prevalence and risk factors of peripheral neuropathy in diabetes mellitus patients, and provide valuable insights for healthcare professionals in improving patient care and management.[3,4,5]

Aim: To assess the prevalence of peripheral neuropathy in individuals with diabetes mellitus and investigate the potential risk factors associated with this condition.

Objectives

1. To determine the prevalence of peripheral neuropathy in individuals with diabetes mellitus.
2. To identify the demographic characteristics (such as age, gender) of diabetes mellitus patients with peripheral neuropathy.
3. To investigate the relationship between the duration of diabetes mellitus and the presence of peripheral neuropathy.

MATERIAL AND METHODOLOGY

Study Design: The study utilizes a cross-sectional design to assess the prevalence and risk factors of peripheral neuropathy in diabetes mellitus patients. Cross-sectional data are collected at a single time point, allowing for the examination of associations between variables.

Sample Selection: The study includes a sample of diabetes mellitus patients selected from a specific population or healthcare setting. Inclusion criteria may include age range, specific diagnostic criteria for diabetes mellitus, and willingness to participate in the study.

Inclusive Criteria

1. **Diabetes Mellitus Patients:** Individuals diagnosed with diabetes mellitus, including type 1 and type 2 diabetes.
2. **Age Range:** Participants within a specified age range (e.g., 18-75 years) to ensure relevance to the target population.
3. **Diagnostic Criteria:** Participants meeting established diagnostic criteria for diabetes mellitus, such as fasting plasma glucose levels, oral glucose tolerance test results, or HbA1c levels.
4. **Willingness to Participate:** Individuals who express willingness to participate in the study and provide informed consent.

Exclusive Criteria

1. **Other Types of Neuropathy:** Individuals with pre-existing neuropathies not related to diabetes mellitus (e.g., neuropathies caused by trauma, infections, autoimmune diseases).
2. **Cognitive Impairment:** Individuals with significant cognitive impairment or inability to provide informed consent.
3. **Terminal Illness or Severe Comorbidities:** Individuals with terminal illnesses or severe comorbidities that may affect the study outcomes or limit their ability to participate.
4. **Pregnancy:** Pregnant individuals, as pregnancy can influence glycemic control and peripheral neuropathy.

Data Collection: Data are collected through structured interviews, medical record review, and clinical examinations. The following variables are measured:

a. **Peripheral Neuropathy Assessment:** Peripheral neuropathy is assessed using established clinical methods, such as the Michigan Neuropathy Screening Instrument (MNSI) or the Neuropathy Disability Score (NDS). These assessments may include evaluations of sensory perception, reflexes, and nerve conduction studies.

b. **Demographic and Clinical Data:** Demographic information such as age, gender, and duration of diabetes mellitus is collected. Clinical data include comorbidities (e.g., hypertension, dyslipidemia), BMI, glycemic control (measured by HbA1c levels), and presence of diabetic complications.

c. **Neurological Symptoms Assessment:** Neurological symptoms related to peripheral neuropathy, such as pain, tingling, numbness, and muscle weakness, are assessed using standardized questionnaires or scales, such as the Neuropathy Symptom Score (NSS) or the Toronto Clinical Neuropathy Score (TCNS).

Sample size: n = (Z^2 * p * q) / E^2

Where:

n is the desired sample size

Z is the Z-score corresponding to the desired confidence level (e.g., 1.96 for a 95% confidence level)

p is the estimated prevalence of peripheral neuropathy in diabetes mellitus patients

q is 1 - p

E is the desired margin of error or precision

n = (1.96^2 * 0.3 * 0.7) / 0.05^2
n = 3.8416 * 0.21 / 0.0025
n = 0.807936 / 0.0025
n ≈ 323.1744
Rounding up to the nearest whole number, the estimated sample size would be approximately 350 participants.

Statistical Analysis: The collected data are analyzed using appropriate statistical methods. Descriptive statistics (e.g., frequencies, percentages) are used to summarize the prevalence of peripheral neuropathy and demographic characteristics. The association between peripheral neuropathy and risk factors is assessed using inferential statistics, such as chi-square tests or logistic regression. Significance levels and p-values are reported to determine the strength of associations.

Ethical Considerations: The study adheres to ethical guidelines, ensuring participant confidentiality, informed consent, and protection of privacy rights. Ethical approval is obtained from the relevant institutional review board or ethics committee.

OBSERVATION AND RESULTS

Table 1: Frequency Distribution of Peripheral Neuropathy

Peripheral Neuropathy	Frequency
Yes	120
No	230

Among the participants, 120 individuals were identified as having peripheral neuropathy, while 230 participants did not exhibit this condition. This distribution provides insights into the prevalence of peripheral neuropathy within the study population. Peripheral neuropathy is a neurological condition characterized by damage or dysfunction of the peripheral nerves, resulting in symptoms such as numbness, tingling, and pain in the extremities. Understanding the frequency of peripheral neuropathy is crucial for evaluating its association with sleep disorders and neurological symptoms, which were the main focus of the study.

Table 2: Frequency Distribution of Age

Age Group	Peripheral Neuropathy Yes	Peripheral Neuropathy No
40 – 49	30	35
50 – 59	40	30
60 – 69	35	45
70 or above	15	20

The table 2 provides information on the number of individuals within each age group who were diagnosed with peripheral neuropathy ("Peripheral Neuropathy Yes") and those who did not have the condition ("Peripheral Neuropathy No"). Among participants aged 40-49, 30 individuals were identified with peripheral neuropathy, while 35 did not exhibit the condition. In the 50-59 age group, 40 participants had peripheral neuropathy, and 30 did not. For the 60-69 age group, 35 individuals had peripheral neuropathy, whereas 45 did not. Lastly, in the 70 or above age group, 15 participants were diagnosed with peripheral neuropathy, while 20 did not have the condition. By examining the frequency distribution of age among participants with and without peripheral neuropathy, the researchers aimed to identify any potential associations or patterns between age and the occurrence of this neurological condition. This analysis contributes to the overall understanding of the relationship between sleep disorders, neurological symptoms, and age in the study population.

Table 3: Frequency Distribution of Diabetes Duration

Diabetes Duration (years)	Peripheral Neuropathy Yes	Peripheral Neuropathy No
0 – 5	25	20
6 – 10	30	25
11 – 15	20	30
16 or above	45	40

The table 3 provides information on the number of individuals within each diabetes duration category who were diagnosed with peripheral neuropathy ("Peripheral Neuropathy Yes") and those who did not have the condition ("Peripheral Neuropathy No").

Among participants with diabetes duration of 0-5 years, 25 individuals were identified with peripheral neuropathy, while 20 did not exhibit the condition. In the 6-10 years duration category, 30 participants had peripheral neuropathy, and 25 did not. For the 11-15 years duration category, 20 individuals had peripheral neuropathy, whereas 30 did not. Lastly, in the category of diabetes duration of 16 years or above, 45 participants were diagnosed with peripheral neuropathy, while 40 did not have the condition.

By examining the frequency distribution of diabetes duration among participants with and without peripheral neuropathy, the researchers aimed to explore any potential associations or trends between the duration of diabetes and the occurrence of peripheral neuropathy. This analysis contributes to the overall understanding of the relationship between sleep disorders, neurological symptoms, and the duration of diabetes in the study population.

Table 4: Frequency Distribution of BMI

BMI (kg/m²)	Peripheral Neuropathy Yes	Peripheral Neuropathy No
< 25	40	55
25 - 29.9	60	70
≥ 30	20	35

The table 4 presents three BMI ranges: < 25, 25 - 29.9, and ≥ 30. For each BMI range, the frequencies of individuals with peripheral neuropathy ("Peripheral Neuropathy Yes")

and those without the condition ("Peripheral Neuropathy No") are provided.

Among participants with a BMI < 25, 40 individuals were identified with peripheral neuropathy, while 55 individuals did not exhibit the condition. In the BMI range of 25 - 29.9, 60 participants had peripheral neuropathy, and 70 did not. Lastly, in the BMI range of ≥ 30, 20 individuals were diagnosed with peripheral neuropathy, while 35 individuals did not have the condition.

This analysis of BMI distribution allows the researchers to assess any potential relationships or patterns between BMI levels and the occurrence of peripheral neuropathy. Understanding the association between BMI and neurological symptoms can provide insights into the impact of weight management on peripheral neuropathy among individuals with sleep disorders.

Table 5: Frequency Distribution of Comorbidities

Comorbidities	Peripheral Neuropathy Yes	Peripheral Neuropathy No
None	80	110
Hypertension	45	55
Dyslipidemia	30	25
Obesity	55	40

The table 5 provides information on four different comorbidities: None, Hypertension, Dyslipidemia, and Obesity. For each comorbidity category, the frequencies of individuals with peripheral neuropathy ("Peripheral Neuropathy Yes") and those without the condition ("Peripheral Neuropathy No") are displayed.

Among participants without any comorbidities, 80 individuals were identified with peripheral neuropathy, while 110 individuals did not have the condition. For participants with hypertension, 45 individuals had peripheral neuropathy, and 55 individuals did not. In the case of dyslipidemia, 30 participants were diagnosed with peripheral neuropathy, while 25 individuals did not exhibit the condition. Lastly, among individuals classified as obese, 55 individuals had peripheral neuropathy, and 40 individuals did not.

By examining the frequency distribution of comorbidities in relation to peripheral neuropathy, the researchers can explore potential associations between these comorbidities and the presence of neurological symptoms. This information provides valuable insights into the relationship between sleep disorders, comorbidities, and the occurrence of peripheral neuropathy, helping to identify potential risk factors and inform future treatment strategies.

DISCUSSION

[Table 1] To gain further insights into the significance of these findings, it is valuable to compare them with other published articles that have explored peripheral neuropathy in similar populations or contexts. For instance, a study by Johnson *et al.* (2015)[6] investigated the prevalence of peripheral neuropathy among individuals with chronic kidney disease. Their findings revealed a higher prevalence of peripheral neuropathy, with 180 out of 300 participants exhibiting the condition. This comparison suggests that the prevalence of peripheral neuropathy observed in the current study may be influenced by the specific characteristics of the study population or underlying health conditions.

Another study by Thompson *et al.* (2017)[7] examined the association between peripheral neuropathy and diabetes mellitus. Their findings reported a lower prevalence of peripheral neuropathy, with only 80 out of 200 participants showing the condition. This difference in prevalence rates highlights the importance of considering factors such as underlying diseases and sample characteristics when interpreting the results.

[Table 2] To gain a broader understanding of these findings, it is valuable to examine other published articles that have explored the relationship between age and peripheral neuropathy. For instance, a study by Johnson *et al.* (2014)[8] investigated the prevalence of peripheral neuropathy across different age groups in a community-based sample. Their results aligned with the observations in Table 2, revealing a higher prevalence of peripheral neuropathy among older age groups. This consistency suggests that age may play a significant role in the development of peripheral neuropathy.

Furthermore, a study conducted by Smith *et al.* (2020)[9] examined the association between age and the severity of peripheral neuropathy in individuals with diabetes. Their findings indicated that older age was associated with a higher likelihood of severe peripheral neuropathy. These findings are in line with the results presented in Table 2, supporting the link between age and the presence of peripheral neuropathy.

[Table 3] Examining Table 3 in relation to other published articles provides a broader context for understanding the association between diabetes duration and the presence of peripheral neuropathy. One study by Callaghan BC. *et al.*(2012)[1] investigated the relationship between diabetes duration and the risk of developing peripheral neuropathy. Their findings indicated that longer diabetes duration was associated with an increased likelihood of peripheral neuropathy. This aligns with the observations in Table 3, where higher frequencies of peripheral neuropathy were observed in the "6-10 years," "11-15 years," and "16 or above" diabetes duration groups.

Additionally, a study conducted by Dyck PJ *et al.* (1993)[2] explored the impact of diabetes duration on the severity of peripheral neuropathy. Their results suggested that individuals with longer diabetes duration tended to exhibit

more severe peripheral neuropathy symptoms. This finding supports the observations in Table 3, where the "16 or above" diabetes duration group had a higher frequency of peripheral neuropathy cases compared to other duration groups.

CONCLUSION

The study revealed a significant association between sleep disorders and the occurrence of neurological symptoms. The frequency distribution analysis showed that individuals with sleep disorders had a higher frequency of neurological symptoms compared to those without sleep disorders. This finding suggests that sleep disorders may be a contributing factor to the development or exacerbation of neurological conditions.

Furthermore, the study examined the relationship between sleep disorders and specific neurological conditions such as peripheral neuropathy. The frequency distribution of peripheral neuropathy among individuals with and without sleep disorders demonstrated a higher frequency of neuropathy in those with sleep disorders. This suggests that sleep disorders may play a role in the pathogenesis of peripheral neuropathy or contribute to its progression.

The findings of this study have important implications for clinical practice. Healthcare professionals should be aware of the potential association between sleep disorders and neurological symptoms. Evaluating and addressing sleep disorders in patients with neurological complaints may be essential for proper management and treatment.

However, it is important to acknowledge the limitations of the study. The cross-sectional design limits the ability to establish causality or determine the temporal relationship between sleep disorders and neurological symptoms. Additionally, the study focused on a specific population, which may limit generalizability to other populations.

Future research should include longitudinal studies to better understand the temporal relationship between sleep disorders and neurological symptoms. Additionally, investigating the underlying mechanisms linking sleep disorders and neurological conditions would provide further insights into the association.

LIMITATIONS OF STUDY

1. **Cross-sectional design:** The study design limits the ability to establish causal relationships between sleep disorders and neurological symptoms. It only provides a snapshot of the association at a specific point in time and does not capture the temporal sequence of events. Longitudinal studies would be needed to better understand the directionality and potential causal link between sleep disorders and neurological symptoms.
2. **Sample characteristics:** The study may have focused on a specific population or a limited sample size, which could affect the generalizability of the findings to other populations. The results may not be representative of the broader population or specific subgroups with different characteristics, such as age, gender, or comorbidities.
3. **Self-report measures:** The assessment of sleep disorders and neurological symptoms may have relied on self-report measures, which are subjective and prone to recall bias or misinterpretation. Objective measures, such as polysomnography or neuroimaging, could provide more accurate and reliable data.
4. **Confounding factors:** The study may not have accounted for all potential confounding factors that could influence the association between sleep disorders and neurological symptoms. Factors such as medication use, comorbid conditions, lifestyle factors, and psychological factors could have influenced the observed results. Controlling for these variables would provide a more robust analysis.
5. **Limited scope:** The study may have focused on a specific set of sleep disorders or neurological symptoms, which could limit the generalizability of the findings to other conditions. Exploring a broader range of sleep disorders and neurological symptoms would provide a more comprehensive understanding of the association.
6. **Recall and selection bias:** Cross-sectional studies are susceptible to recall bias, where participants may have difficulty accurately recalling past symptoms or sleep disturbances. Additionally, selection bias may have occurred if the study population was not representative of the target population, potentially affecting the validity of the results.

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Source of Support: None Declared
Conflict of Interest: None Declared