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THE SIGNIFICANCE OF NERVE CONDUCTION STUDY IN DIABETIC SENSORIMOTOR POLYNEUROPATHY

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Abstract

Background: Diabetic sensorimotor polyneuropathy (DSPN) is one of the most common and disabling complications of diabetes mellitus. The early diagnosis is crucial to avoid progression of the disease and decrease the morbidity. Peripheral nerve function is objectively assessed by nerve conduction studies (NCS), and neuropathic changes can be detected. Objective: To define the role of neurological testing in the diagnosis of diabetic sensorimotor polyneuropathy, localization of the nerve damage, distinguishing DSPN from other peripheral nerve lesions, and early diagnosis. Methods: A cross-sectional descriptive study was conducted in tertiary care hospitals of Peshawar, Khyber Pakhtunkhwa, Pakistan, from June 2023 to December 2023. Patients were recruited using convenience sampling to yield 250 diabetic patients with peripheral polyneuropathy. A structured questionnaire was used for collecting data and nerve conduction studies were used to assess peripheral nerve involvement. Data has been analyzed in SPSS version 22. Results: The mean age of participants was 50.24 years and 61.6% of the participants were males. 67.6% of the patients had type 2 diabetes mellitus and 57.6% of them had their diabetes for over 2 years. In many cases, there were also neuropathic symptoms, including numbness, tingling, or burning sensations (78.4%), loss of sensation in the feet (79.6%) and weakness in the lower limbs (72.0%). 53.9% of the participants had foot ulcers. Additionally, 78.0% had had an NCS before. The research showed that there was a very high prevalence of both sensory and motor symptoms of diabetic sensorimotor polyneuropathy. Conclusion: DSPN, characterized by sensorimotor polyneuropathy is common among diabetic patients and is associated with substantial sensory and motor loss. Nerve conduction studies are an important tool in early detection, localization and evaluation of peripheral nerve involvement. Their use can aid in the early diagnosis, better clinical management, and possibly lower the risk of diabetic neuropathy complications occurring during the long-term.

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Introduction

Diabetes mellitus (DM) is a chronic metabolic disease defined by abnormally high blood glucose levels due to either decreased insulin secretion or insulin action, or both (1). This disease has become a major health burden globally and prevalence has rapidly risen worldwide, especially in low and middle income countries. Several microvascular and macrovascular complications are linked to longterm hyperglycemia such as retinopathy, nephropathy, neuropathy, cardiovascular disease and peripheral vascular disease, that are responsible for a number of morbidity and mortality (2). One of the most prevalent and incapacitating complications of diabetes mellitus is diabetic neuropathy. It is caused by a long-term imbalance in metabolism and is accompanied by a progressive injury to peripheral nerves. Diabetic sensorimotor polyneuropathy (DSPN) is one of the many forms of diabetic neuropathy, and is the most common, affecting around one-third of diabetes patients (3). The clinical signs are numbness, paresthesias, burning sensations, neuropathic pain, muscle weakness, and absent protective sensation, mainly in the lower body (4). Hyperglycemia-induced oxidative stress, mitochondrial dysfunction, inflammation, dyslipidemia and impaired insulin signaling all play a role in the development of DSPN (5). Poor glycemic control, duration of diabetes, hypertension, obesity, dyslipidemia and cardiovascular disease have been linked to the onset and progression of neuropathy (6).

DSPN, if undiagnosed and untreated, can cause foot ulceration and infection that eventually can result in lower-limb amputation, which can be a significant impact on quality of life (7).

Peripheral nerve function testing using nerve conduction studies (NCS) is regarded as objective and reliable to detect peripheral nerve neuropathy. They help identify subclinical neuropathy, help to localize neuropathy, help to grade neuropathy and help to differentiate diabetic neuropathy from other peripheral nerve disorders (8). Prompt diagnosis by NCS can enable early intervention and prevent the disease and its complications.

The present study aims to assess the importance of nerve conduction studies in DSPN, to localize the nerve damage, to distinguish it from other peripheral nerve lesions, and to enable early diagnosis for better treatment results.

Materials and Methods

A descriptive cross sectional study was performed on the significance of nerve conduction studies (NCS) in diabetic sensorimotor polyneuropathy (DSPN) in the tertiary care hospitals of Peshawar, Khyber Pakhtunkhwa, Pakistan during the period of June 2023 to December 2023. The study was conducted with 250 patients who were diagnosed with peripheral polyneuropathy secondary to diabetes mellitus by a non-probability convenient sampling technique. All male and female patients were eligible to participate and patients with peripheral polyneuropathy unrelated to diabetes mellitus were excluded. Ethical clearance was taken from the institutional research committee and permission from the administration of the hospitals and data was collected by a structured close-ended questionnaire.

All participants provided written informed consent before they were enrolled. Peripheral nerve involvement, localization of peripheral nerve injury and electrophysiologic characteristics of diabetic sensorimotor polyneuropathy were evaluated with nerve conduction studies. Data collected was entered and analyzed with Statistical Package for the Social Sciences (SPSS) version 22. The data analysis was conducted using descriptive statistics and the results were tabulated, graphically displayed and summarized in figures.

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Results

250 patients with diabetic sensorimotor polyneuropathy were included in the study. The ages of the participants ranged from 23 to 94 years old (mean age = 50.24 years). Sixty-one percent (n=154) of the study population consisted of males and 38.4% (n=96) females.

As for the duration of diabetes, 57.6% (n=144) of the participants had diabetes for more than two years, 22.8% (n=57) for more than one year, 13.6% (n=34) for one year, and 6.0% (n=15) for six months. The prevalence of Type 2 diabetes mellitus was higher as 67.6% (n=169) of the participants had Type 2 diabetes mellitus, while 32.4% (n=81) had Type 1 diabetes mellitus.

	Frequency	Percent
6 months	15	6.0
1 year	34	13.6
More than 1 year	57	22.8
More than 2 year	144	57.6
Total	250	100.0

Table 1: ***History of Diabetes***

Fewer than half of the participants (82.4%, n=206) used lifestyle changes for the diabetes and 62.4% (n=156) used insulin. Clinical manifestations suggestive of diabetic sensorimotor polyneuropathy were common. Numbness, tingling or burning (78.4%, n=196) and loss of sensation in the feet (79.6%, n=199) were reported by participants. Three-quarters of patients (n=180) had weakness in the lower limbs and 53.9% (n=134) had foot ulcers.

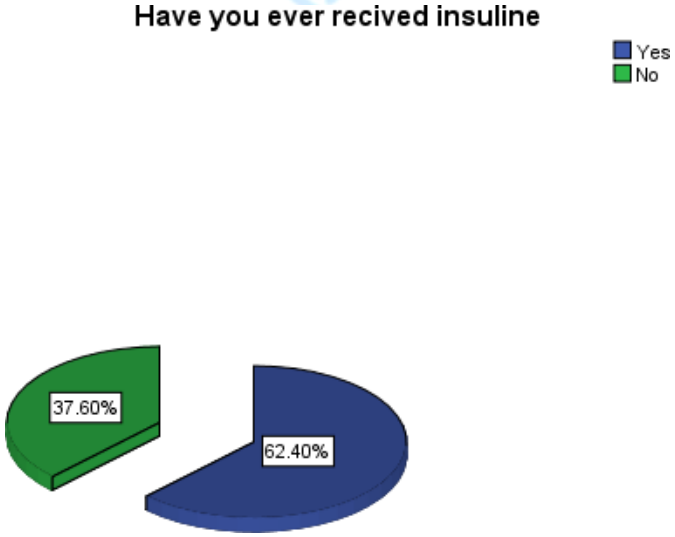

Figure 1: Insuline usage

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The most common symptoms reported were: muscle weakness (34.8%, n=87); difficulty moving limbs (33.6%, n=84); pain and numbness in hands and feet (18.8%, n=47); and frozen shoulder (12.8%, n=32). In addition, the 195 participants had previously had a nerve conduction study (NCS).

	Frequency	Percent
Pain and numbness in hands and Feet	47	18.8
Difficulty in moving limbs	84	33.6
Muscles weakness	87	34.8
Frozen shoulder	32	12.8
Total	250	100.0

Table 2: ***Common symptoms***

Evaluation of functional status indicated that 168 patients (67.2%) were able to continue with their normal work activities and 82 (32.8%) found their work performance to be impaired. Also, 79.2% (n=198) reported factors that made their symptoms worse. The overall results showed a high prevalence of sensory and motor manifestations among the patients with diabetes, thus pointing out the clinical significance of nerve conduction studies in the identification and evaluation of diabetic sensorimotor polyneuropathy.

Discussion

Diabetic sensorimotor polyneuropathy (DSPN) is one of the more prevalent chronic microvascular complications of diabetes mellitus, and has been linked to high morbidity and decreased quality of life. The mean age range of the participants in the present study was 50.24 years, with most people being male. The majority of the participants had a long duration of diabetes, with a mean duration of 12.2 years, suggesting a link between diabetes duration and neuropathic complications. In the study population, Type 2 diabetes mellitus (T2DM) prevalence was higher than Type 1 diabetes mellitus (T1DM). Participants were affected by symptoms suggestive of peripheral neuropathy, such as weakness in the lower limbs, numbness, tingling or burning sensation and loss of sensation in the feet, with a high proportion affected by these symptoms. The results are in line with the previous studies that identified DSPN as a distal symmetrical neuropathy with sensory and motor abnormalities in the lower limbs (9). A majority of the participants indicated they had foot ulcers, highlighting the clinical burden of diabetic neuropathy and its relationship with poor sensation and a higher risk of foot complications. This is consistent with other published reports that associate DSPN with foot ulceration, infection and ultimately amputation, and as such have accounted for significant health care costs and impact on quality of life (10). Most of the subjects had previously had a nerve conduction study which illustrates the increasing importance of electrophysiological assessment in diabetic neuropathy. Nerve conduction studies are objective tests that give information about nerve function and are the benchmark to confirm the presence of peripheral neuropathy, determine the severity, localise nerve involvement, and differentiate diabetic neuropathy from other peripheral nerve disorders (11, 12, 13). The results of this study corroborate past research indicating that NCS is a useful tool for early detection and evaluation of DSPN (14). In conclusion, the study emphasizes the high prevalence of neuropathic symptoms in diabetic patients and stressers the role of nerve conduction studies in the diagnosis and management of diabetic sensorimotor polyneuropathy.

Conclusion

Diabetic sensorimotor polyneuropathy is a frequent complication of diabetes mellitus and often presents with sensory, motor and/or foot symptoms. This study revealed a significant high prevalence of the neuropathic symptoms among

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diabetic patients especially the longer they had been diagnosed with the disease. Nerve conduction studies can be used to detect peripheral nerve involvement, determine the location of nerve damage and to distinguish diabetic neuropathy from other neuropathies objectively and reliably. Using NCS for early identification of neuropathic changes can help with timely intervention, minimising complications and enhancing patient outcomes.

Limitations

There were several limitations of this study. First, the findings of the study may be limited in their generalizability because a non-probability sampling technique (Convenience Sampling) was used. Secondly, the study was carried out in selected tertiary hospitals of Peshawar, and may not be representative of the total population of diabetes in the city. Thirdly, the cross-sectional study design prevented causal inferences or the evaluation of changes in neuropathy over the course of the study. Lastly, detailed electrophysiological parameters of nerve conduction studies were not analyzed to assess nerve involvement and the severity.

Recommendations

i. Routine nerve conduction studies should be considered for diabetic patients, particularly those with long-standing diabetes or neuropathic symptoms.
ii. Early screening programs should be implemented to facilitate timely diagnosis and management of diabetic sensorimotor polyneuropathy.
iii. Healthcare professionals should educate diabetic patients regarding glycemic control, foot care, and lifestyle modifications to reduce neuropathic complications.
iv. Future studies should include detailed NCS parameters and longitudinal follow-up to evaluate disease progression and treatment outcomes.
v. Multicenter studies with larger and more representative samples are recommended to improve the generalizability of findings.

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