

A Comparative Study Of Sural Nerve Conduction Velocity In Prediabetes And Diabetes

Dr Mayanglambam Sangeeta Devi¹, Dr Kanmi Ningshen¹, Dr Shankarappa C²

• Tutor Physiology Department Jawaharlal Nehru Institute of Medical Sciences Imphal,

• Head of Department Physiology Department Vydehi Institute of Medical Sciences and Research Centre, Bengaluru

Corresponding Author: Dr Mayanglambam Sangeeta Devi

Abstract: Diabetes is a global burden and diabetic neuropathy is a very common complication. The incidence of prediabetes is becoming higher and the risk of developing complications is more. Diabetic neuropathy is a troublesome complication of diabetes mellitus. Prediabetes is increasingly being viewed as an important contributor to neuropathy. Neuropathy can be assessed by nerve conduction studies. It can be detected by studying the nerve conduction velocity. This study aims to assess the nerve conduction velocity of sural nerve. Nerve conduction velocity of sural nerve for diabetic and prediabetic were decreased when compared with non diabetic. Nerve conduction velocity is an important parameter to diagnose neuropathy. Prediabetes may even contribute to cause early neuropathy.

Keywords: Nerve conduction study, Prediabetes, Nerve conduction velocity, Sural nerve, Diabetic neuropathy

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I. Introduction

Diabetes mellitus is one of the main causes of peripheral neuropathy. Traditionally neuropathy has been considered a chronic complications that occurs only after long term diabetes mellitus, but evidence now indicates that neuropathic complications arise atleast as early as the time of diagnosis of diabetes mellitus.¹

India accounts for 23.5 per cent of the world's disability adjusted life years (DALYs) lost due to diabetes²

Prevalence of Diabetic peripheral neuropathy in Type 2 diabetic subjects in an Indian study was shown to be 26.1%.³

Prediabetes (intermediate hyperglycemia), typically defined as blood glucose concentrations higher than normal, but lower than diabetes thresholds, is a high risk state for diabetes development. Prevalence of diabetes and prediabetes is increasing worldwide and experts have projected that more than 366 million people will have diabetes and 470 million people will have prediabetes by 2030^(4,5).

Neuropathy occurring in impaired glucose tolerance (IGT) and early diabetes are phenotypically very similar, suggesting a continuum of glucose dysregulation in which some individuals are more sensitive to early distal neuropathic injury than others⁶

Nerve conduction studies, primarily nerve conduction velocities are considered one of the most sensitive indices of the severity of neuropathy⁷.

II. Materials and methods

This is a cross sectional comparative study conducted on 40 prediabetic, 40 diabetic and 40 non diabetic men. Controls were age matched. Sural nerve conduction velocity was measured from both the sides.

Inclusion criteria

- 1) The participants were male subjects in the age group of 40 to 70 years
- 2) Prediabetes and diabetes mellitus subjects were placed according to the WHO guidelines.⁸
- 3) Age matched control subjects were recruited for the study.

Exclusion criteria

- Subjects with history of HIV, regular alcohol consumption, liver diseases, hypertension, thyroid disorders, rheumatoid arthritis and neurological disorders in consultation with the neurologist were excluded.
- Subjects with permanent pacemaker or other implanted stimulators such as deep brain stimulators or spinal cord stimulators were excluded from the study

Method of collection of data

Written informed consent was obtained from all the participants. The filled pre structured proforma and details of the clinical examination were numbered and the responses were coded and entered on a Microsoft Excel 2010

Statistical Methods: Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. The following assumptions on data is made

Assumptions: 1. Dependent variables should be normally distributed, 2. Samples drawn from the population should be random, Cases of the samples should be independent
 0+ Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients. Post-Hoc Tukey test has been done to find the pairwise significance.

III. Result

Nerve conduction velocity of sural nerve for diabetic and prediabetic were decreased compare with non diabetic. The nerve conduction velocity of sural nerve in diabetic was significantly decreased when compared to non diabetic . Moderate significant differences were observed between the prediabetes and non diabetic.

Sural	Mean ±SD			Pair wise significance		
	Group I	Group II	Group III	Group I-Group II	Group I-Group III	Group II-Group III
Velocity						
• RIGHT	47.80±6.84	44.14±6.60	40.14±7.59	0.047	<0.001	0.027
• LEFT	47.17±6.49	44.08±5.86	40.58±7.71	0.094	<0.001	0.048

Table no 1. Comparison of Sural nerve conduction velocity in three groups studied.

Graphical representation of table no. 1

IV. Discussion

Most recognized neurologic complications associated with diabetes involve the peripheral nervous system. The diabetic neuropathies include several distinctive clinical syndromes with differing clinical manifestations, anatomic distributions, clinical courses, and possibly underlying pathophysiologies. Diabetic neuropathy has been defined as presence of symptoms and/or signs of peripheral nerve, dysfunction in diabetics after exclusion of other causes, which may range from hereditary, traumatic, compressive, metabolic, toxic, nutritional, infectious, immune mediated, neoplastic, and secondary to other systemic illnesses. Since the manifestations of diabetic neuropathy closely mimic chronic inflammatory demyelinating polyneuropathy, alcoholic neuropathy, and other endocrine neuropathies, hence, before labelling diabetic neuropathy it is mandatory to exclude all other causes of peripheral nerve dysfunction. Nerve conduction studies are frequently used to assess the presence of severity of peripheral nerve involvement in patients with diabetes. They are sensitive, specific, reproducible, and easily standardized. Studies are most commonly performed on upper and lower limbs on motor and sensory nerves, My study is being performed with lower limbs on sensory nerve. Nerve conduction studies do not always correlate well with symptoms and signs. Involvement of sural nerve is more common in diabetic neuropathy suggesting that long nerves are commonly affected⁹ This is similar to our findings, Involvement of lower limb is more common due to length dependent dying back process.

The close correlation between hyperglycemia and the development of a clinically detectable neuropathy has been well documented in many studies and risk factors for the neuropathy development have been suggested such as high cholesterol levels, smoking, hypertension, male sex, older age and poor glycaemic control.^{10,11}

prediabetes neuropathy and early diabetic polyneuropathy are clinically similar, characterized by preferential injury to small nerve fibers which is usually accompanied by sensory symptoms and disabling pain^{12,13}

The nature of the relationship between prediabetes and neuropathy is not clear, although microangiopathy^{14,15,16} episodic postprandial hyperglycemia^{17,18}, and endothelial dysfunction¹⁹ may be causal factors. No large well-designed studies of the prevalence and long-term prognosis of prediabetes neuropathy have been conducted. However, several studies have demonstrated a high prevalence of prediabetes in individuals with idiopathic peripheral neuropathy (45%)²⁰, suggesting that the disease may represent the earliest stage of diabetic nerve injury.

Prolonged and poorly controlled diabetes mellitus were the most significant factors associated with Diabetic polyneuropathy and this has been reported by others^{21,22,23,24} Cheng et al²⁵ has also reported a significant relation between insulin use and Diabetic polyneuropathy.

As in my study the prediabetes subjects exhibited slower conduction velocity when compared with the Non diabetic. This is contrary to the findings of Eriksson et al,²⁶ who showed that diabetes and not prediabetes was associated with peripheral nerve dysfunction. Even though the mean sensory conduction velocity was lower in the diabetic group when compared with the prediabetes and the Non diabetic group, the prevalence of abnormal sensory conduction velocity was similar in both Non diabetic and prediabetes subjects. However, in my study we found that the sensory conduction velocity was lower in prediabetes when compared with non diabetic.

In a study by Singleton et al,²⁷ it was shown that painful sensory neuropathy was associated with prediabetes. Lehtinen et al²⁸ had reported that clinical diabetic neuropathy is not common at diagnosis of Type 2 diabetes but disturbances in peripheral and autonomic nerve function as noted by electrophysiological and cardiovascular reflex method are often present at that stage. They reported that the prevalence of abnormal nerve conduction velocity was 15.2% in newly diagnosed Type 2 diabetes.

In their study they found that the prevalence of sensory and motor neuropathy was 39% and 8% in the NDD subjects and 12% and 7% in the prediabetes subjects. Studies by Graf et al²⁹ and Tkac et al³⁰ had shown that the glycemic level was associated with abnormal conduction velocities. My study supports the idea that prediabetes is transitional state before diabetes and also the importance of nerve conduction study for early detection of neuropathy.

V. Conclusion

Nerve conduction examination primarily nerve conduction velocity can help in prompt evaluation of the diabetic neuropathy. Decreased nerve conduction velocity was observed in prediabetes when compared with non diabetic

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