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Original Research Article

Study of Nerve Conduction Velocity in Type-2 Diabetic Patients with Neuropathy in Tamil Nadu Population

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Conflict of interest: Nil

Abstract:

Background: Neuropathy in Type -2 diabetic patients mainly causes sensory symptoms and signs of nerve dysfunction which are more subjective. Hence, a neuro-physiological study has to be done to study the pathophysiology, severity and prognosis of neuropathy in these patients.

Method: 95 patients diagnosed with Type-2 DM of duration more than 1 year to more than five years were studied. Electro-physiological tests were done for measuring NCV and SNAP of median, peroneal and sural nerves. These tests were carried out using the EMG/NCV/EP ALERON 202 channel machine.

Results: In each nerve, NCV and SNAP values were higher in newly diagnosed patients and diabetic patients of 1 year duration and quite less in those diagnosed with more than 5 years duration.

Conclusion: The present parameters of NCV and SNAP will help the physician, endocrinologist, and neurophysician predict the prognosis of nerve dysfunction in Type -2 Diabetes patients and treat them efficiently to avoid mortality and morbidity among those patients.

Keywords: NCV, SNAP, Diabetic Neuropathy, HbA1c, Electro-physiological tests, Tamil Nadu.

Introduction

As a systemic disorder, diabetes affects both the central and peripheral nervous systems. Virtually every aspect of the nervous system and its supporting structures, from the cerebral convex to the effector organs may be involved in the complications of diabetes. These involvements are caused by the direct effect of hyperglycemia or hypoglycemia. Hyperglycemia induces metabolic derangements, neurochemical alterations, serum lipid changes, and vascular, coagulation, and thrombotic abnormalities. The most common symptoms present in patients with diabetic neuropathy are sensory pain and paresthesias and most common sign is loss of vibration sense. Distal symmetrical sensorymotor polyneuropathy is the most common type of diabetic neuropathy. Hence, an attempt is made to evaluate the nerve conduction velocity and sensory nerve action potential in the nerves of the upper and lower extremities to measure the level of disturbance in their velocity and amplitude of the action potential.

Material and Method

95 diabetic patients aged between 30-65 years who regularly visited Dhanalakshmi Srinivasan Medical College and Hospital Perambalur, Tamil Nadu – 621212 were studied.

Inclusive Criteria: Confirmed patients with Type-2 diabetes more than 1 year duration were selected for the study.

Exclusion Criteria: Juvenile diabetic DM patients on anti-depressants and thyroid medications were excluded from the study.

Method: Every patient's diagnosis was confirmed by fasting, post-prandial Randomand HbA1c tests. Electrophysiological tests for NCV and SNAP were done using an EMG/NCV/EP Electron 20.2 channel machine manufactured by RMS using the standard protocol, and findings were noted.

The duration of the study was from October 2021 to October 2022.

Statistical analysis: Duration of diabetes and clinical manifestations were classified by

percentage. NCV and SNAP were studied with their mean value (±SD). The statistical analysis was carried out using SPSS software. The ratio of males and females is 1:1.

Observation and Results

Table- 1: Study of duration of diabetic patients 12 (12.6%) were since one year, 20 (21%) were since three years, 40 (42.1%) were more than five year.

Table- 2: Clinical manifestation of type-II DM patients 13 (13.6%) Tachycardia, 10 (10.5%) had MI, 6 (6.31%) had orthostatic hypotension, 7 (7.36%) had gastroparesis, 8 (8.42%) had diarrhea, 12 (12.62%) incontinence of stool, 6 (6.31%) erectile dysfunction, 13 (13.6%) neurogenic bladder, 6 (6.3%) had heat intolerance, 9 (9.47%) had hypoglycemia, 5 (5.26%)had sweating disturbance.

Table- 3: Study of electro diagnostic findings.

In median nerve in since 1 year DM patients48.5 (±1.2) NCV, 36.6 (±1.8) SNAP In Sural nerve 48.10 (±0.7) NCV, 27.8 (±1.80), SNAP peroneal Nerve, 46.84 (±2.2) NCV, 2.90 SNAP

3rd year – In Median Nerve 47.3 (±1.1) NCV, 35.5 (±1.3) SNAP, In Sural nerve 47.28 (±1.4) NCV, 26.6 (±1.7) SNAP, In peroneal Nerve 46.84 (±2.2) NCV, 2.90 (±0.2) SNAP

5th year MD patients – median nerve 37.3 (±2.2) NCV, 29.32 (±1.2) SNAP, Sural nerve – 39.18 (±1.4) NCV, 16.72 (±2.2) SNAP. More than 5year median nerve – 12.20 (±2.3) NCV, 7.22 (±2.2) SNAP, Sural nerve 4.19 (±2.82) NCV, 0.96 (±3.2) SNAP. In personal nerve 14.6 (±2.3) NCV, 1.20 (±1.3) SNAP.

Table 1: Study of duration of diabetic patients (Total No of Patients: 95)

Sl No	Duration of diabetic diagnosed	No of Patients	Percentage
1	Since 1 year	12	12.6
2	Since three years	20	21
3	Since five years	23	24.2
4	More than five years	40	42.1

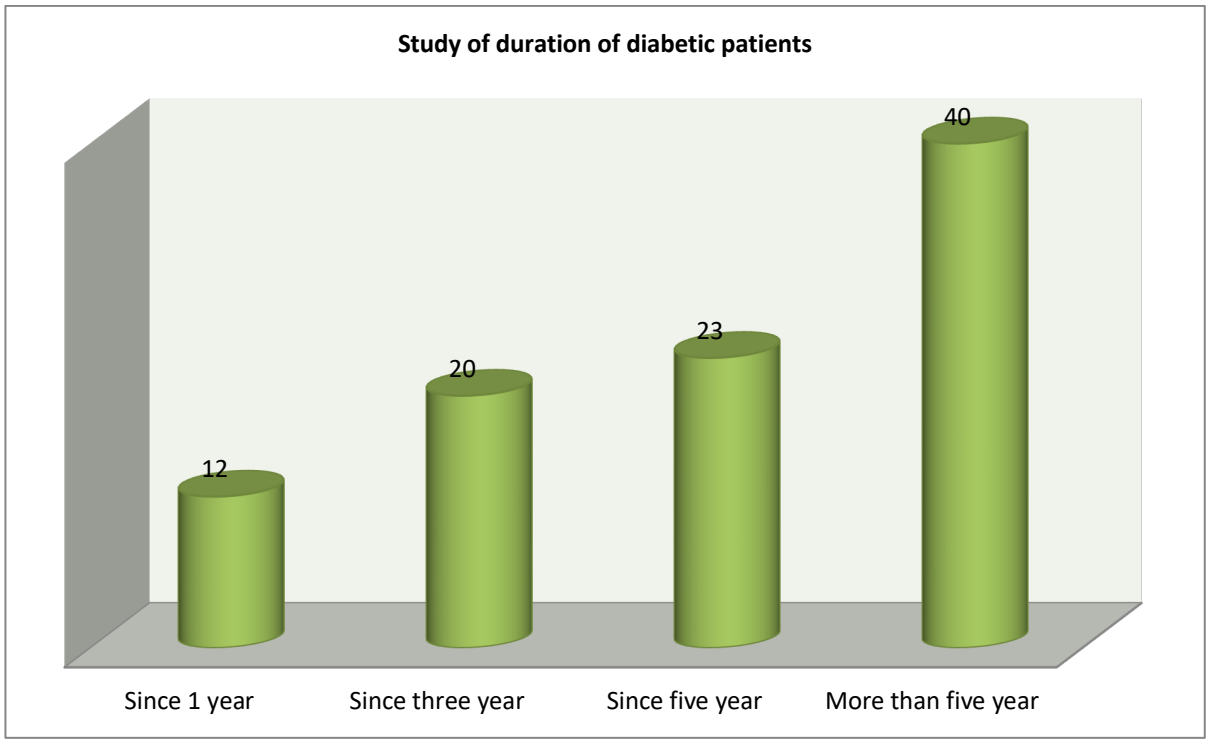

Figure 1: Study of duration of diabetic patients

Table 2: Clinical manifestations of diabetic neuropathic patients (Total No of Patients: 95)

Sl no	Particulars	No of Patients	Percentage
A	Cardiac		
	Tachycardia	13	13.6
	Myocardial Infarction	10	10.5
	Orthostatic hypotension	6	6.31
B	GIT		
	1) Gastro paresis	7	7.36

	2) Diarrhea	8	8.42
	3) Incontinence of stool	12	12.6
C	Genito-Urinary 1) Erectile dysfunction	6	6.31
	2) Neurogenic bladder	13	13.6
D	Miscellaneous 1) Heat intolerance	6	6.31
	2) Hypoglycemia	9	9.47
	3) `Sweating disturbance	5	5.26

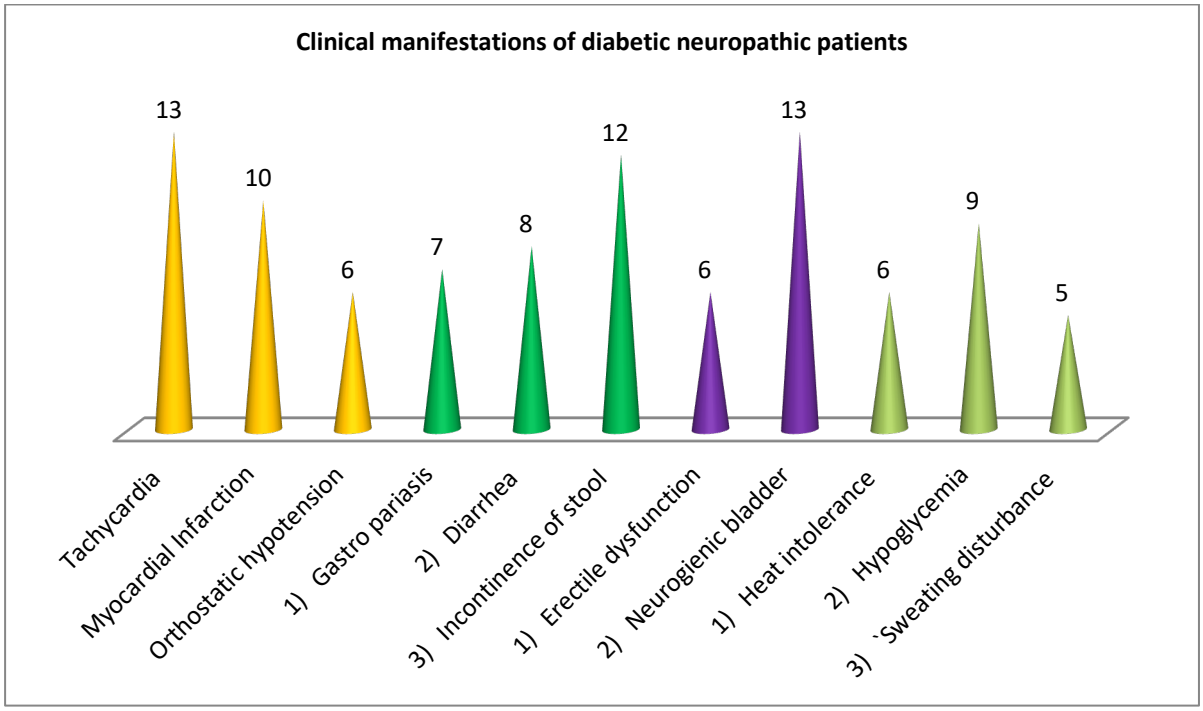

Figure 2: Clinical manifestation of diabetic neuropathic patients

Table 3: Study of electro-diagnostic findings of nerve conduction velocity and sensory action potential of sensory nerve (Total No of Patients: 95)

Sl no	Group of DM	Median nerve		Sural Nerve		Peroneal nerve	
		NCV in m/sec mean (±SD)	SNAP in µV mean (±SD)	NCV in m/sec mean (±SD)	SNAP in µV mean (±SD)	NCV in m/sec mean (±SD)	SNAP in µV
1	One year	48.50±1.2	36.6±1.8	48.10±0.7	27.82±1.80	46.84±2.2	2.90±0.2
2	Three year	47.30±1.1	35.5±1.3	47.28±1.4	26.6±1.70	45.78±2.4	2.60±0.3
3	Five year	37.30±2.2	29.32±1.2	39.18±1.4	1.18±3.3	16.22±2.2	1.90±0.2
4	More than 5year	12.20±2.3	7.22±2.2	4.19±2.82	0.96±3.2	14.6±2.3	1.20±1.3

NCV = Nerve conduction velocity, SNAP= Sensory nerve Action potential.

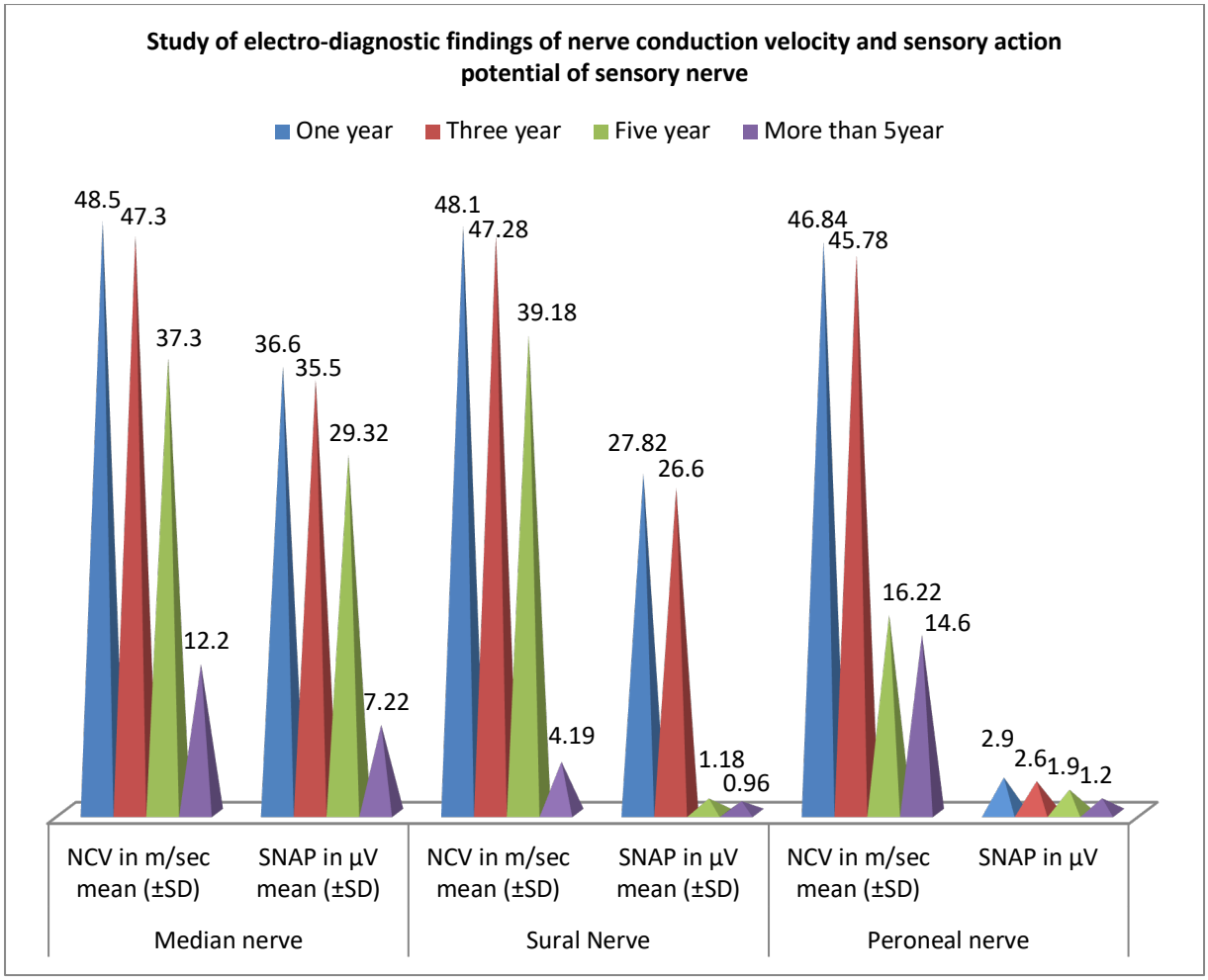

Figure 3: Study of electro-diagnostic findings of nerve conduction velocity and sensory action potential of sensory nerve

Discussion

The present study of nerve conduction velocity (NCV) in type–II DM in Tamil Nadu Population - 12 (12.6%) since One year of diagnosis as DM, 20 (21%) were since three years, 23 (24.2%) were since five years, and 40 (42%) were more than five years (Table 1). The clinical manifestations were that 13 (13.6%) had tachycardia, 10 (10.5%) had MI, 6 (6.31%) had orthostatic hypotension, 7 (7.36%) had gastroparesis, 8 (8.42%) had diarrhoea, and 12 (12.61%) had incontinence of stool, 6 (6.3%) had erectile dysfunction 13 (13.6%) had neurogenic bladders. 6 (6.3%) had heat intolerance, 9 (9.47%) had hypoglycemia, and 5 (5.20%) had sweating disturbances (Table 2). In patients with more than 1 year and less than 3 years (a) Median Nerve: 48.50 (± 1.2) NCV, 36.6 (± 1.8) SNAP. In more than 5 years, 12.20 (± 2.3) NCV, 7.22 (± 2.0) SNAP(b) Sural nerve – 48.10 (± 0.07) had NCV, 27.82 (±1.80) SNAP, and in more than five years, 39.18 (± 1.4) had NCV, 1.18 (± 3.2) SNAP. In peroneal nerve – first year 46.84 (± 2.2) NCV, 2.90 (± 0.2) SNAP. In more than five years: 14.6 (± 2.3) NCV, 1.20 (± 1.3) SNAP (Table 3). These findings are more or less in agreement with the previous [5,6,7] studies. It was quite significant to observe that NCV and SNAP values were quite decreased in chronic patients with DM with diabetic neuropathy, which is an alarming sign of sensory neuropathy leading to disability [8,9]. Patients with a decreased value of NCV and SNAP should be hospitalised and treated more meticulously. The distal symmetrical polyneuropathy may involve sensory or motor involvement, but motor signs are not prominent. The sensory symptoms reach up to knee level before the motor signs in fingers start, because of the length-dependent dying back process. Fibre-dependent axonopathy results in increased predisposition in taller people [10].

The distal symmetrical polyneuropathy is further classified into large-fibre and small-fibre neuropathy. Large fibre neuropathy is characterised by painless paresthesias, with impairment of vibration, joint position, touch and pressure sensation, and loss of ankle reflex. In the advanced stage, ataxia may occur. Large fibre neuropathy results in a slowing of nerve fibre conduction; hence, in the present study, a significant decrease in NCV and SNAP values was observed (Table 3).

The slowing of nerve fibre conduction results in impairment of quality of life, and activities of daily living. Small-fibre neuropathy, on the other hand, is associated with pain, burning, and impairment of pain and temperature sensations, which are often associated with autonomic neuropathy and result in morbidity and mortality.

Glucose is the obligate fuel for brain. More than 90% of the energy needed for brain function is derived from the oxidation of glucose, requiring constant glucose supply from liver. A glucose transport protein spanning the cell membranes twelve times, facilitate the transfer of glucose across the blood-brain barrier in a non-rate limiting manner. In hyperglycemia, nerve conduction and nerve potentiality will be impaired, it leads to diabetic neuropathy.

In the severe neuropathic conditions, NCV and SNAP may be insensitive; hence, correlative investigations of blood, EEG and MRI are necessary to diagnose the severity of involvement in other areas of nervous system. Most of the diabetic neuropathies doesn't show positive symptoms in severe stages and hence lead to bad prognosis and thorough evaluation is needed.

Summary and Conclusion

The present study of NCV in diabetic neuropathy patients of the Tamil Nadu population is quite helpful to physicians and endocrinologists to treat diabetic neuropathic patients because it helps to understand the level of damage in the absence of overt clinical symptoms. Hyperglycemia also causes depletion of nerve myoinositol through a competitive uptake mechanism, which leading to severe morbidity and mortality in patients, but this study demands further, genetic, nutritional, histopathological, and biomolecular studies because the exact cause and mechanism of diabetic neuropathy still remains obscure.

Limitation of study: The smaller sample size, and the lack of futher latest technologies are the limitations of the study.

This research work has been approved by the ethical committee of Dhanalakshmi Srinivasan Medical College and Hospital Perambalur, Tamil Nadu – 621212.

References

1. Harati et al. – Diabetes and the Nervous System Endocr. Cline of North America, 1996; 332–347.
2. Prasad N – comparative analysis of electrophysiological parameters of the median nerve in normal and diabetic subjects, Ind. Med Gazette, July 2013; 261-64.
3. Auer RN, Weiloch T, Olsson Y – The distribution of hypoglycemic brain damage, Acta Neuropathol. (Berlin). 1984; 64; 177–191.
4. Browning R G, Olson DW – 50% Dextrose: antidote or toxin? Ann. Emerge. Med. 1990; 19; 683-687.
5. Levit NS, Stanberry KB – Natural progression of autonomic neuropathy and autonomic function tests in a cohort of IDDM Diabetes Care. 1996; 19: 751-4.
6. W, Zeigler D – mortality in diabetic patients with cardiovascular autonomic neuropathy. Diabetes med. 1993; 10: 820-4.
7. Bajaj M, Banerji MA, - Type-2 diabetes in South Asians: A Pathophysiological Focus on the Asian Indian Epidemic, Curr Diab Rep. 2004; 4: 213–18.
8. Gauhar H et al. – Nerve conduction velocity as a predictor of diabetic peripheral neuropathy in type 2 diabetic mellitus patients. IJCMPR. 2013; 3(5): 42–49.
9. Cosson E, Brigadier AF, Paries J fas/fas ligand pathway is impaired in patients with type-2 diabetes. The influence of hypertension and insulin resistance in diabetes metab. 2005; 31: 47–54.
10. Celikeretal – Early detection of neurological involvement in DM electromyography Clin. Neurophysiology. 1996; 36: 11: 29–33.
11. Avjitmondal, Sangitasen, Debarati Chanda: Evaluation of diabetic polyneuropathy in type 2 diabetes mellitus by nerve conduction study and association of serenity of neuropathy with serum SFASL level.