



## DIABETES AND HYPERTENSION CAUSE WORSE PERIPHERAL NEUROPATHY THAN DIABETES ALONE: A COMPARATIVE STUDY

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**ABSTRACT** Peripheral neuropathy is a common complication of diabetes where symptoms related to sensory and autonomic nerves damage appear earlier than those related to motor nerves damage. We conducted Nerve conduction velocity (NCV) studies of superficial peroneal nerve among 30 patients with diabetes with hypertension (diabetic hypertensive group) and 30 patients with diabetes alone (diabetic group). On comparison, it was found that the mean conduction velocity for superficial peroneal nerve was lower in cases of patients suffering with both diabetes & hypertension when compared to patients suffering from diabetes alone with statistically results for both the left nerve & the right superficial peroneal nerve.

**KEYWORDS** : diabetic neuropathy, superficial peroneal nerve, nerve conduction velocity

### INTRODUCTION

Peripheral neuropathy is a common complication of diabetes where symptoms related to sensory and autonomic nerves damage appear earlier than those related to motor nerves damage. Sensory and autonomic nerves, being thinner and longer, may be more vulnerable to metabolic alterations than motor nerves [1]. Diabetic polyneuropathy often develops as generalized asymptomatic dysfunction of peripheral nerve fibers. The first clinical symptom that usually develops in tandem with abnormal nerve conduction is decrease or loss of ankle jerks, or decrease or loss of vibratory sensation over the greater toes [2].

Diabetic sensorimotor peripheral neuropathy results in significant disability and comorbidity including severe pain, loss of ambulation, and an increased risk of non-healing ulcers and amputation [3]. We conducted a study to observe the effect of type II Diabetes Mellitus with / without hypertension on nerve conduction velocity of superficial peroneal nerve.

### MATERIALS AND METHODS

Nerve conduction velocity (NCV) studies of superficial peroneal nerve among 30 patients with diabetes with hypertension (diabetic hypertensive group) and 30 patients with diabetes alone (diabetic group) was compared using Neurosoft NEURO-MEP-MICRO 2-channel Ultraportable EMG and NCS System at Department of Physiology, Govt. Medical College, Patiala from 2015 to 2017.

Inclusion criteria were: Individuals >40 years with Diabetes Mellitus type II (Hb A1C >6.5% (48 mmol/mol) or Fasting Plasma Glucose (FPG) > 126 mg/dL (7.0 mm/L) and/or with Hypertension (defined as systolic blood pressure > 140 mm Hg / or a diastolic blood pressure >90 mm Hg not on anti-hypertensive medication) were recruited in this study after consent

Patients with alcoholic neuropathies, history of drugs or toxins exposure and secondary hypertension were excluded.

Demographic, physical variables, blood pressure measurements, random blood sugar level, renal function test using serum creatinine as marker were recorded for both groups.

The comparison of sensory nerve conduction velocity of superficial peroneal nerve was done & data was collected. Results were expressed in mean  $\pm$  standard deviation and student's t test was used for comparison with levels of significance being: Not significant:  $p > 0.05$ , Significant:  $p < 0.05$ , Highly significant:  $p < 0.01$

### RESULTS

The demographic and biochemical parameters are shown in Table 1. There were 11 males and 19 females in the diabetic group while there were 18 males and 12 females in the diabetic-hypertensive group. A significant difference in the mean age of the diabetic group as compared to the diabetic-hypertensive group ( $51.03 \pm 7.8$  vs.  $54.4 \pm 4.8$  years,  $p < 0.02$ ) was observed. There was no significance in the heights of the subjects in the diabetic and the diabetic-hypertensive group ( $162.45 \pm 7$  vs.  $162.9 \pm 6.5$  cm,  $p > 0.05$ ). There was no significance in the systolic or diastolic blood pressures of the subjects in the diabetic and the diabetic-hypertensive group (SBP:  $121.6 \pm 7.78$  vs.  $126.35 \pm 9.73$  mm Hg,  $p > 0.05$ ; DBP:  $73.6 \pm 6.15$  vs.  $76.87 \pm 5.08$  mm Hg,  $p > 0.05$ ).

Random blood sugar was comparable in both groups ( $89 \pm 10.3$  vs.  $88.74 \pm 14.3$  mg/dl,  $p > 0.05$ )

However, renal function was poorer in the diabetic group as compared to the diabetic-hypertensive group ( $0.89 \pm 0.2$  vs.  $0.81 \pm 0.16$  mmol/l,  $p < 0.05$ )

On comparing the SNCV between the diabetic-hypertensive groups vs. diabetic group, it was found that the mean conduction velocity for superficial peroneal nerve was lower in cases of patients suffering with both diabetes & hypertension when compared to patients suffering from diabetes alone with statistically results for both the left nerve & the right superficial peroneal nerve with  $p$ -value  $< 0.01$ .

### DISCUSSION

Our study compared the superficial peroneal nerve conduction velocities between 30 diabetic-hypertensives and 30 diabetics-non hypertensives and found significant decrease in the nerve conduction velocities in the diabetic-hypertensive group. This is in concurrence with Jarmuzewska et al who conducted a cross-sectional study, where it was concluded that pulse pressure (an indicator of arterial stiffness) is independently and negatively associated with nerve function i.e. as pulse pressure increases, nerve function decreases [4], and in a subsequent cross-sectional study concluded that there is a strong association between hypertension and development of SMPN (sensorimotor peripheral neuropathy) in patients with relatively short-term Type II diabetes [5]. Legrady et al recorded higher current perception threshold (CPT) values in the peroneal nerve of both diabetic and non-diabetic hypertensives compared to controls, indicating sensory loss [6]. Duration of hypertension and diabetes mellitus both correlated positively with CPTs measured on the lower extremities in the diabetic hypertensive group. This study concluded that the severity of peripheral sensory neuropathy (PSN) was similar in

non-diabetic and diabetic hypertensive patients although, in the latter, the PSN can involve more types of nerve fibers. Hypertension should thus be considered in the pathogenesis of peripheral nerve dysfunction. Gregory et al reported that superimposing diabetes on hypertension compounded disorders of nerve blood flow, conduction slowing and axonal atrophy and increased the incidence of thinly myelinated fibres in hypertensive rats [7].

Huang et al also reported a positive correlation between DPN and elevated blood pressure in non-hypertensive patients as well as hypertensive patients [8].

## CONCLUSION

Diabetic-hypertensives have worse peripheral neuropathy as compared to diabetics alone. Elevated blood pressure in diabetics can result in progression of peripheral neuropathy.

**Table 1**

Parameter	DM	DM+HTN	't' value	'p' value	Inference
Males	11	18			
Females	19	12			
Age(years)	51.03±7.8	54.4±4.8	-2.05	0.02	S
Height(cm)	162.45±7.3	162.9±6.5	-0.29	0.38	NS
Weight(kgs)	66.9±11	74.1±9.2	-2.79	0.003	HS
SBP (mm of Hg)	121.6±7.78	126.35±9.73	0.11	0.45	NS
DBP(mm of Hg)	73.6±6.15	76.87±5.08	-0.13	0.44	NS
RBS (mg/dl)	89±10.3	88.74±14.3	0.08	0.46	NS
S. Creatinine (mmol/l)	0.89±0.2	0.81±0.161	1.67	0.04	S
Nerve conduction velocity					
LEFT SPN	57.42±2.28	34.76 ±5.63	14.61	0.0000	HS
RIGHT SPN	57.35 ±2.39	34.88 ±5.588	14.77	0.0000	HS

**SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure; SPN: Superficial Peroneal Nerve**

## REFERENCES

- Kempler P. (2002). A diabeteses neuropathia klinikai képe és diagnosztikája [Clinical presentation and diagnosis of diabetic neuropathy]. *Orvosi hetilap*, 143(20), 1113–1120.
- Llewelyn J. G. (2003). The diabetic neuropathies: types, diagnosis and management. *Journal of neurology, neurosurgery, and psychiatry*, 74 Suppl 2(Suppl 2), ii15–ii19. [https://doi.org/10.1136/jnnp.74.suppl\\_2.ii15](https://doi.org/10.1136/jnnp.74.suppl_2.ii15)
- Martyn, C. N., & Hughes, R. A. (1997). Epidemiology of peripheral neuropathy. *Journal of neurology, neurosurgery, and psychiatry*, 62(4), 310–318. <https://doi.org/10.1136/jnnp.62.4.310>
- Jarmuzewska, E. A., & Mangoni, A. A. (2005). Pulse pressure is independently associated with sensorimotor peripheral neuropathy in patients with type 2 diabetes. *Journal of internal medicine*, 258(1), 38–44. <https://doi.org/10.1111/j.1365-2796.2005.01500.x>
- Jarmuzewska, E. A., Ghidoni, A., & Mangoni, A. A. (2007). Hypertension and sensorimotor peripheral neuropathy in type 2 diabetes. *European neurology*, 57(2), 91–95. <https://doi.org/10.1159/000098058>
- Legrady, P., Bajcsi, D., Lengyel, C., Varkonyi, T. T., Fejes, I., Kempler, P., & Abraham, G. (2013). Investigation of cardiac autonomic and peripheral sensory neuropathy in diabetic and nondiabetic patients with hypertension. *Clinical and experimental hypertension (New York, N.Y. : 1993)*, 35(6), 465–469. <https://doi.org/10.3109/10641963.2012.758272>
- Gregory, J. A., Jolivald, C. G., Goor, J., Mizisin, A. P., & Calcutt, N. A. (2012). Hypertension-induced peripheral neuropathy and the combined effects of hypertension and diabetes on nerve structure and function in rats. *Acta neuropathologica*, 124(4), 561–573. <https://doi.org/10.1007/s00401-012-1012-6>
- Huang, L., Zhang, Y., Wang, Y., Shen, X., & Yan, S. (2020). Diabetic Peripheral Neuropathy Is Associated With Higher Systolic Blood Pressure in Adults With Type 2 Diabetes With and Without Hypertension in the Chinese Han Population. *Canadian journal of diabetes*, 44(7), 615–623. <https://doi.org/10.1016/j.cjcd.2019.11.005>