Original Article

HEIGHT, WEIGHT, BMI, FBS, PPBS, CORRELATED WITH NERVE CONDUCTION VELOCITY IN TYPE II DIABETES MELLITUS PATIENTS

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ABSTRACT

Aims: To look for changes in nerve conduction velocity (NCV) in newly diagnosed type II diabetic subjects. To compare the nerve conduction velocity studies of both sensory and motor nerves in upper and lower limb are correlated with height, weight, BMI, fasting and PPBS.

Materials and Methods: The study comprises of 40 subjects, 25 subjects were male and 15 subjects were female aged between 38-62 years. All the patents are on oral hypoglycaemic agents. Random sampling techniques were applied for the criteria of sample selection.

Results: The mean MCV was significantly lower in type II diabetics common peroneal nerve (38.37±9.43) m/s and posterior tibial nerve (9.78±9.39) m/s. The mean SNC in the type II diabetes median nerve 43.25±11.64, ulnar nerve 43.62±15.77 m/sec sural nerve 38.27±14.32 m/sec and posterior tibial nerve 33.51±20.39. The height mean 163.53±7.23 cm, weight mean 66.98±8.70 kg, BMI 25.10±3.29, FBS mean 158.70±56.58 mg/dl and PPBS mean 223.68±67.95 mg/dl. Abnormal MCV, SCV was found to be associated with FBS and PPBS.

Conclusion: Hyperglycaemia is a well established risk factor in type 2 diabetic subjects. Other parameters correlated with Height, Weight, BMI, FBS, PPBS increases most recognized neurological complications. Predominately sensorimotor distal polyneuropathy is the most common of the diabetic neuropathy. Distal sensorimotor polyneuropathy. In our study conducted the changes of diabetic neuropathy affected sensorimotor nerves in both limbs. Nerve conduction studies not only used to diagnose the DM but also monitor the effects of treatment of DM by regular NCS good glycemic control, symptoms of diabetic neuropathy can be reversed and further complication like foot ulceration.

KEYWORDS: Correlation of height; Weight; BMI; Fasting; Posts prandial blood sugar with nerve conduction velocity.

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Access this Article online

Quick Response code

International Journal of Physiotherapy and Research

ISSN 2321- 1822

www.ijmhr.org/ijpr.html

Received: 10-01-2014 Accepted: 25-01-2014

Peer Review: 10-01-2014 Published: 11-02-2014

INTRODUCTION

Diabetic neuropathy is the most common and troublesome complication of diabetes mellitus leading greater morbidity. Patients have a 12 times higher risk of amputations when correlated with FBS, PPBS, height, weight, BMI due to diabetic neuropathy. The presence of other vascular complication such as peripheral vascular diseases in diabetes increases the risk of diabetic foot complications. However the progression of neuropathy can be reduced by early detection and intervention.

Nerve conduction studies, primary nerve conduction velocities are consider one of the most sensitive indices of the severity of neuropathy. Nerve conduction tests are used to localize lesions and to describe type and severity of the pathophysiologic process. In type II diabetic patients decreased nerve conduction velocity (NCV) is probably one of the earliest neuropathic abnormalities and is often preserved even at diagnosis. Thereafter, showing of NCV generally progresses at a steady rate of approximately 1m/s/year and it shows a correlation with the dura-

tion of diabetes. It is well known that neuropathy has metabolic component in its pathophysiology. Hence early metabolic aberrations as seen in FBS, PPBS may also have to change in the nerve conduction. Studies in Caucasian population have shown that FBS, PPBS is associated with dysfunction in peripheral nerves. There are also studies showing a higher prevalence of undiagnosed abnormal glucose metabolism in patients with peripheral neuropathy. This study was done to look for changes in nerve conduction in the early hyperglycaemic phase i.e., FBS and PPBS.

OBJECTIVES

1. To study the nerve conduction in diabetic patients [type II] with peripheral neuropathy and to evaluate the relationship between the duration of peripheral neuropathy and diabetes mellitus.

2. To assess the nerve conduction studies for using it as screening test in field study of diabetes mellitus for early detection of neuropathic complications of diabetes.

3. To compare the conduction velocity of sensory and motor nerves in upper and lower limb of type II diabetics with peripheral neuropathy is correlated with type II diabetes.

MATERIALS AND METHODS

The study comprises of 40 subjects associated with peripheral neuropathy symptoms. Among the 40 subjects 25 subjects were male and the other 15 were female aged between 38- 62 years. All the patients are on oral hypoglycaemic agents. None were using insulin. Random sampling techniques were applied for the criteria of sample selection.

Inclusive criteria: Having diabetes mellitus type II, duration of diabetes (2-6 years), on using oral hypoglycaemic agents they are having peripheral neuropathic symptoms.

The nerve conduction studies were carried out on neuro perfect EMG- 200. EMG/NCV/EP system [Medicaid systems, Chandigarh] for all the 40 subjects. After taking the consent of the subjects detailed clinical examination was done to all subjects. The median, ulnar, common peroneal, posterior tibial nerves were taken into consideration and tests were performed.

Exclusive criteria: Neurological disorder persons, smokers, chronic alcoholism, renal failure, type I diabetic patients are excluded.

RESULTS AND TABLES

The mean MCV was significantly lower in the type II diabetes. Common peronial nerve 38.37±9.39 m/sec. The mean SNC in the type II diabetes median nerve 43.25±15.77 m/sec, ulnar nerve 43.62±15.77 m/sec, sural nerve 38.27±14.32 m/sec and posterior tibial nerve 33.51±20.39 m/sec.

The BMI 25.10±3.29, FBS mean 158.70±56.58 mg/dl and PPBS mean 223±3.29 mg/dl. Abnormal MCV,SCV was found to be associated with FBS and PPBS.

Table 1: Correlation between fasting blood glucose levels and motor nerve conduction.

			Latency (ms)			Amplitude (mv)			NCV (m/s)		
			MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE
FASTING BLOOD GLUCOSE 158.70 ± 56.58	COMMON PERONEAL NERVE	RIGHT	4.87±1.02	-0.17	0.2946	3.39±1.98	0.272	0.0895	38.37±9.43	0.092	0.571
		LEFT	4.57±1.39	0.007	0.9647	3.31±1.97	0.834	0.0146	38.77±7.62	0.176	0.2766
	POSTERIOR TIBIAL NERVE	RIGHT	5.34±2.77	-0.042	0.796	4.87±3.37	0.326	0.0402	39.72±8.96	0.128	0.4306
		LEFT	5.00±2.49	-0.079	0.6293	4.38±2.81	0.237	0.1417	39.78±9.39	0.166	0.3045

Fasting blood glucose levels are positively correlated with amplitude and NCV of CPN right side. Only latency of CPN was negatively correlated with fasting blood glucose levels.

Table 2: Correlation between post prandial blood glucose levels and motor nerve conduction.

			Latency (ms)			Amplitude (mv)			NCV (m/s)		
			MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE
POST PRANDIAL BLOOD GLUCOSE 223.68±67.95	COMMON PERONEAL NERVE	RIGHT	4.87±1.02	-0.174	0.2822	3.39±1.98	0.334	0.0345	38.37±9.43	0.237	0.1401
		LEFT	4.57±1.39	0.054	0.7412	3.31±1.97	0.352	0.0259	38.77±7.62	0.258	0.1083
	POSTERIOR TIBIAL NERVE	RIGHT	5.34±2.77	-0.016	0.9196	4.87±3.37	0.311	0.0509	39.72±8.96	0.078	0.6314
		LEFT	5.00±2.49	-0.104	0.522	4.38±2.81	0.268	0.0737	39.78±9.39	0.168	0.2986

Postprandial blood glucose levels were positively correlated with Amp, Ncv of CPN. Other than this Latency of PTN and CPN are negatively correlated with postprandial blood glucose levels.

Table 3: Correlation between BMI and motor nerve conduction studies.

			Latency (ms)			Amplitude (mv)			NCV (m/s)		
			MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE
BMI 25.10±3.29	COMMON PERONEAL NERVE	RIGHT	4.87±1.02	0.268	0.074	3.39±1.98	0.075	0.6174	38.37±9.43	0.233	0.1485
		LEFT	4.57±1.39	-0.387	0.0136	3.31±1.97	-0.034	0.8348	38.77±7.62	0.105	0.5208
	POSTERIOR TIBIAL NERVE	RIGHT	5.34±2.77	-0.01	0.9934	4.87±3.37	-0.039	0.8089	39.72±8.96	-0.139	0.3938
		LEFT	5.00±2.49	0.025	0.8777	4.38±2.81	-0.1	0.5402	39.78±9.39	-0.178	0.2719

BMI positively correlated with Lat, Amp, Ncv of CPN right side and it is negatively correlated with amp, latency and NCV of CPN left side.BMI negatively correlated with amp, latency and NCV of PTN right side and it is negatively correlated with amp and NCV and latency is positively correlated with latency.

Table 4: Correlation between Height and Motor nerve conduction.

			Latency (ms)			Amplitude (mv)			NCV (m/s)		
			MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE
HEIGHT 163.53±7.23	COMMON PERONEAL NERVE	RIGHT	4.87±1.02	0.201	0.2134	3.39±1.98	-0.306	0.0548	38.37±9.43	-0.114	0.4833
		LEFT	4.57±1.39	0.209	0.1946	3.31±1.97	0.143	0.3773	38.77±7.62	-0.115	0.4815
	POSTERIOR TIBIAL NERVE	RIGHT	5.34±2.77	0.108	0.5053	4.87±3.37	0.227	0.1582	39.72±8.96	-0.007	0.9679
		LEFT	5.00±2.49	0.11	0.5009	4.38±2.81	0.211	0.1905	39.78±9.39	-0.227	0.1591

The height was positively correlated with latency and amp of CPN [right and left side] and negatively correlated with NCV of CPN. The height was positively correlated with amp and latency of PTN [right and left side] and negatively correlated with NCV of PTN right and left side.

Table 5: Correlation of weight and motor nerve conduction.

			Latency (ms)			Amplitude (mv)			NCV (m/s)		
			MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE
WEIGHT 666.98±8.70	COMMON PERONEAL NERVE	RIGHT	4.87±1.02	-0.112	0.4926	3.39±1.98	-0.139	0.391	38.37±9.43	0.211	0.1916
		LEFT	4.57±1.39	0.251	0.1183	3.31±1.97	0.132	0.4162	38.77±7.62	-0.134	0.4087
	POSTERIOR TIBIAL NERVE	RIGHT	5.34±2.77	0.048	0.7701	4.87±3.37	-0.172	0.2896	39.72±8.96	0.131	0.4213
		LEFT	5.00±2.49	0.085	0.604	4.38±2.81	-0.175	0.28	39.78±9.39	-0.273	0.0878

The weight is negatively correlated with Latency, amplitude of CPN[right side] and positively correlated with latency, amplitude of CPN[left side].The weight is positively correlated NCV of CPN[right side] and negatively correlated with NCV of CPN[left side].

The weight is positively correlated with latency, amp of PTN [right and left side] and it is positively correlated with NCV of PTN [right side] and negative in left side of PTN.

Table 6: Correlation Between fasting blood glucose levels and Sensory nerve conduction.

		Latency (ms)			Amplitude (mv)			NCV (m/s)		
		MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE
FASTING BLOOD GLUCOSE 158.70±56.58	ULNAR Nerve	2.81±0.68	-0.11	0.4984	11.74±6.26	-0.073	0.6548	43.62±15.77	-0.219	0.1737
	MEDIAN nerve	2.75±0.85	-0.434	0.0052	12.08±6.31	-0.264	0.0998	43.25±11.64	-0.385	0.014
	SURAL nerve	2.87±1.14	-0.356	0.0244	7.36±6.39	-0.063	0.6993	38.27±14.32	-0.272	0.0898
	POST ERIOR TIBIAL nerve	3.31±3.99	-0.051	0.7526	5.41±4.86	-0.093	0.5675	33.51±20.39	-0.093	0.569

Postprandial blood glucose levels were positively correlated with Amp, Ncv of CPN. Other than this Latency of PTN and CPN are negatively correlated with postprandial blood glucose levels.

Table 7: Correlation between post prandial blood glucose levels and sensory nerve conduction.

		Latency (ms)			Amplitude (mv)			NCV (m/s)		
		MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE
POST PRANDIAL BLOOD GLUCOSE 223.68±67.95	ULNAR nerve	2.81±0.68	-0.143	0.3788	11.74±6.26	0.065	0.6909	43.62±15.77	-0.003	0.9874
	MEDIAN nerve	2.75±0.85	-0.198	0.2207	12.08±6.31	-0.196	0.2249	43.25±11.64	-0.126	0.4384
	SURAL Nerve	2.87±1.14	-0.155	0.3396	7.36±6.39	0.079	0.6295	38.27±14.32	-0.07	0.669
	POSTERIOR TIBIAL nerve	3.31±3.99	-0.046	0.7762	5.41±4.86	-0.023	0.89	33.51±20.39	0.153	0.3475

Postprandial blood glucose levels are negatively correlated with ulnar, median, sural and posterior tibial nerve Lat, Amp, posterior tibial nerve conduction was positively correlated with post prandial blood glucose.

Table 8: Correlation of BMI levels and sensory nerve conduction.

		Lat (ms)			Amp (mv)			NCV (m/s)		
		MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE
BMI 25.10±3.29	ULNAR nerve	2.81±0.68	-0.163	0.3143	11.74±6.26	-0.073	0.6539	43.62±15.77	0.171	0.292
	MEDIAN nerve	2.75±0.85	-0.158	0.3308	12.08±6.31	-0.198	0.221	43.25±11.64	0.132	0.4156
	SURAL nerve	2.87±1.14	-0.054	0.743	7.36±6.39	-0.091	0.5769	38.27±14.32	0.152	0.3504
	POSTERIOR TIBIAL nerve	3.31±3.99	-0.426	0.0061	5.41±4.86	-0.455	0.0032	33.51±20.39	-0.163	0.3144

BMI levels are negatively correlated with Lat, Amp of ulnar, sural, median and posterior tibial nerve. Positively correlated with Ncv of ulnar, median and sural nerves.

Table 9: Correlation between height levels and sensory nerve conduction.

		Latency (ms)			Amplitude (mv)			NCV (m/s)		
		MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE
HIGHT LEVELS 163.53±7.23	ULNAR nerve	2.81±0.68	-0.032	0.8429	11.74±6.26	-0.235	0.144	43.62±15.77	-0.173	0.285
	MEDIAN nerve	2.75±0.85	0.18	0.2652	12.08±6.31	0.122	0.4546	43.25±11.64	-0.107	0.5115
	SURAL nerve	2.87±1.14	0.012	0.9432	7.36±6.39	-0.382	0.0151	38.27±14.32	-0.261	0.1042
	POSTERIOR TIBIAL nerve	3.31±3.99	0.195	0.2276	5.41±4.86	0.151	0.3532	33.51±20.39	-0.119	0.4639

Height is negatively correlated with latency of ulnar nerve and positively correlated with latency of median, sural and posterior tibial nerve.

Height is negatively correlated with amplitude of ulnar and sural nerves and positively correlated with median and posterior tibial nerve.

Table 10: Correlation between weight levels and sensory nerve conduction.

		Latency (ms)			Amplitude (mv)			NCV (m/s)		
		MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE	MEAN±SD	r-VALUE	P-VALUE
WEIGHT 66.98±8.70	ULNAR nerve	2.81±0.68	-0.193	0.2338	11.74±6.26	-0.193	0.2338	43.62±15.77	0.09	0.5811
	MEDIAN nerve	2.75±0.85	-0.075	0.6477	12.08±6.31	-0.15	0.3542	43.25±11.64	0.115	0.4812
	SURAL nerve	2.87±1.14	-0.107	0.5811	7.36±6.39	-0.149	0.3588	38.27±14.32	-0.001	0.9942
	POSTERIOR TIBIAL nerve	3.31±3.99	-0.287	0.0727	5.41±4.86	-0.268	0.095	33.51±20.39	-0.072	-0.113

Weight is negatively correlated with latency of ulnar , median ,sural and posterior tibial nerve. Weight is negatively correlated with amplitude of ulnar, median, sural and posterior tibial nerve. Weight is positively correlated with NCV of ulnar ,median nerve and negatively correlated with sural, posterior tibial nerve.

DISCUSSION

This study showed that a relatively higher fasting blood glucose, post prandial blood glucose levels, height, weight and BMI with co-related NCV in type-2 diabetes.

This study shows that factors of weight, height and BMI influence results of late responses and NCV. The subjects with heavy weight have lower SNCV and motor nerve conduction velocity amplitudes than those with smaller weights. These changes are statistically found in the SNCV of median, ulnar, with SNCV of sural and posterior tibial nerve negatively co-related to latency, amplitude of ulnar and sural nerves. Positively co-related to latency of median, sural posterior tibial nerve. These findings are similar to chi-RenHung etal[2].

The weight is negatively correlated with Latency ,amplitude of CPN[right side] and positively correlated with latency ,amplitude of CPN[left side].The weight is positively correlated with NCV of CPN[right side] and negatively correlated with NCV of CPN[left side].The weight is positively correlated with latency, amp of PTN[right and left side]and it is positively correlated with NCV of PTN[right side] and negatively in left side of PTN. These results are related to Chin RC etal.[3].

Height is the most important factor in nerve conduction studies height is negatively co-related with NCV of ulnar, sural, median and posterior tibial nerve. Positively co-related to latency of median, sural and posterior tibial nerve. This findings are related to Soudmand R et al[4].

In our study the body mass index values of 20 persons on the study group were above 25%. This indicates over weight according WHO. The mean values of BMI in study group were 2.10±3.29 which is statistically significant. This findings were similar to Bshse.f, Buchthal RM, Aswini dutt R etal[5-6]. They found significantly positively co-relation between BMI and SNV and MNCV. In our study say that BMI. Levels are negatively co-related with latency, amplitude of ulnar, median and posterior tibial nerve. Positively co-related with NCV of ulnar, median and sural nerve.

BMI positively co-related with common peroneal nerve and posterior tibial nerve latency, negatively co-related with common peroneal nerve of left side amplitude and posterior tibial nerve latency, amplitude, NCV.

Fasting blood glucose levels are negatively correlated with latency; amplitude and NCV OF ulnar, medial, sural and posterior tibial nerve7.These change are similar to Arindam Dutta etal. Postprandial blood glucose levels were positively correlated with Amp, Ncv of CPN. Other than this Latency of PTN and CPN are negatively correlated with postprandial blood glucose levels. Postprandial blood glucose levels were positively correlated with Amp, Ncv of CPN. Other than this Latency of PTN and CPN are negatively correlated with postprandial blood glucose levels. These results are similar to Lehtinen JM et al [8]. Had reported that clinical diabetic neuropathy is not common at diagnosis of type-2 diabetes but peripheral nerve dis-function recorded by electro physiologically.

Viswanathan et al. [9] had reported that prevelence of sensory and motor nerve pathway. These two studies are similar to our study; Grat et al; had shown that the glycemic level was associated with abnormal NCV[10]. Verasuriya et al; had observed an inverse co-relation between NCV and FBS in Srilanka type-2 diabetic subjects[11]. In our study an inverse co-relation of SNCV and MNCV parameters in FBS, PPBS, BMI, Height, Weight in multiple linear regression analysis. This indicates a possible direct effect between hyperglycaemia and abnormal SNCV and MNCV.

CONCLUSION

Hyperglycaemia is a well established risk factor in type 2 diabetic subjects. Other parameters correlated with Height, Weight, BMI, FBS, PPBS increases most recognized neurological complications. Predominately sensorimotor distal polyneuropathy is the most common of the diabetic neuropathy. Distal sensorimotor polyneuropathy, the most common complication of DM may cause severe morbidity. In our study conducted the changes of diabetic neuropathy affected sensorimotor nerves in both limbs. Nerve conduction studies not only used to diagnose the DM but also monitor the effects of treatment of DM by regular NCS good glycemic control, symptoms of diabetic neuropathy can be reversed and further complication like foot ulceration.

Conflicts of interest: None

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How to cite this article:
A C Sekhar, M V M, K M Sekhar. HEIGHT, WEIGHT, BMI, FBS, PPBS, CORRELATED WITH NERVE CONDUCTION VELOCITY IN TYPE II DIABETES MELLITUS PATIENTS. Int J Physiother Res 2014;2(1):388-393.