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RESEARCH ARTICLE

A STUDY OF CORRELATION BETWEEN BODY MASS INDEX AND MEDIAN NERVE CONDUCTION IN TYPE II DIABETES MELLITUS SUBJECTS

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ABSTRACT

There is a world-wide increase in the prevalence of Diabetes Mellitus and it is associated with an increase in obesity. As the adipose tissue in epineurium is related to some extent to amount of body fat, it is possible that the amount of such fat may affect the nerve conduction. In this study, we have analyzed effect of Body Mass Index (BMI, Group Obese) on various parameters of Median nerve conduction study in one hundred twenty three Type II diabetes mellitus subjects. All Type II diabetes mellitus subjects who recruited from OPD of the Department of Medicine, National Institute of Medical Sciences and research, Hospital, NIMS University Rajasthan Jaipur. All the subjects are on hypoglycemic medicine. BMI was determined and standardized protocol was followed while performing Nerve conduction study (NCS) in all the subjects. Medicaid System's EMG/NCV equipment with Neurostim software was used for nerve conduction velocity. Prolongation of distal latency (DL) and reduced the amplitude and conduction velocity highly significant in type II diabetes mellitus subjects sensory and motor median nerve. Higher BMI or in obese type II diabetes mellitus subjects was found to be non-significantly associated with all parameters of median nerve. The distal latency negatively correlated and amplitude and conduction velocity positively correlated with body mass index of sensory median nerve but amplitude negatively correlated and distal latency and conduction velocity positively correlated with body mass index of motor median nerve. This study demonstrated that various parameters of nerve conduction study can be affected by BMI. So, this biological factor has to be taken into consideration while interpreting nerve conduction studies.

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INTRODUCTION

Diabetes mellitus is the most prevalent metabolic disorder worldwide. The global burden of DM is enormous with an estimated 366 million people living with DM worldwide (International Diabetes Federation, 2011). India accounted for nearly one sixth of global diabetes burden in 2011 with about 62 million of people affected by diabetes which is projected to rise to 101 million by 2030 (Anjana *et al.,* 2011). Insulin resistance and abnormal insulin secretion are central to the development of type II DM. Type II DM is characterized by impaired insulin secretion, insulin resistance, excessive hepatic glucose production, and abnormal fat metabolism. Obesity, is very common in type II DM (80% or more are obese Insulin resistance, the decreased ability of insulin to act effectively on target tissues (especially muscle, liver, and fat), is a prominent feature of type II DM and results from a combination of genetic susceptibility and obesity. There is a world-wide increase in the prevalence of Diabetes Mellitus and it is associated with an increase in obesity. As the adipose tissue in epineurium is related to some extent to amount of body fat, it is possible that the amount of such fat may affect the nerve conduction. Body mass index (BMI) is an important parameter in gauging adiposity and obesity. Many studies have shown higher incidence of cardiovascular diseases especially coronary artery diseases in population with BMI greater than 25 (Romero-Corral *et al.,* 2006). Studies also reveal median and ulnar nerve compression associated with an increasing incidence of higher BMI (Landau *et al.,* 2005). In this study, we have analyzed effect of Body Mass Index (BMI, Group Obese) on various parameters of Right Median nerve conduction study in one hundred twenty three Type II diabetes mellitus subjects.

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MATERIALS AND METHODS

The study was done in the Department of Physiology in collaboration with the Department of Medicine of National Institute of Medical Sciences and research, NIMS University, Rajasthan Jaipur. After approval of the ethical committee, 123 subjects were selected for study. All subjects were diagnosed TIIDM subjects. A brief explanation of the procedure was given to the subjects and voluntary informed consent was taken. Medicaid System's EMG/NCV equipment with Neurostim software was used for nerve conduction study. Height and weight of each subject was recorded and BMI was calculated as weight (kg) divided by height (m) squared.

Inclusion criteria

- Willingness (informed consent)
- Only Diagnosed cases of male and female Type II Diabetic aged 30-50 suffering from more than 2yrs.
- The diagnosis of diabetes is made on the basis of (Revised American Diabetic Association criteria) (American Diabetes Association, 2010).
- Fasting glucose >126mg/dl and 2hr postprandial plasma glucose >200mg/dl.
- Only Right Median Nerve was taken into the consideration and test was performed.

Exclusion criteria

- No previous history of any systemic condition related to peripheral neuropathy (Hypertension, Alcoholic neuropathy, Renal failure)
- Any neuromuscular disorders such as myopathy, familial polyneuropathy or chronic polyneuropathy.
- Neuropathies associated with exogenous toxic agents, metals ordrugs.
- Skin lesions or swelling that would interfere with Nerve Conduction Study (NCS).
- Trauma in the course of nerve to be examined.

Statistical Analysis: Result was done using Statistical Package for Social Sciences version 17.0 (SPSS) software. Unpaired t–test and Pearson's Correlation coefficient was used for finding correlation between BMI and Nerve conduction velocity, latency and amplitude and applied for the obtained data and p value <0.05 is taken as significant.

OBSERVATIONS AND RESULTS

Data was statistically analyzed using appropriate tests for right median nerve study in obese TIIDM subjects. Table 1 shows the sensory right median nerve latency, amplitude and nerve conduction velocity correlated non significant (P >0.05) with obesity but obesity negatively correlated with latency but positively correlated with amplitude and NCV of right sensory median nerve in TIIDM subjects.

Table 1. Correlation between Obese and Right Sensory Median Nerve Study in TIIDM Subjects

	Variables	Obese (n – 123) TIIDM Subjects		
		Right Sensory Median Nerve		
		Mean ±SD	r-Value	p-Value
BMI(Obese) 32.69±2.77	Latency	5.46±0.51	-0.063	0.48
	Amplitude (mv)	5.12±0.54	0.041	0.65
	NCV (m/S)	48.29±2.20	0.076	0.40

Obesity negatively correlated with Latency but positively correlated with Amplitude and NCV of right motor median nerve in TIIDM subjects.

Table 2. Correlation between Obese and Right Motor Median Nerve Study in TIIDM Subjects

	Variables	Obese (n – 123) TIIDM Subjects		
		Right Motor Median Nerve		
		Mean ±SD	r-Value	p-Value
BMI(Obese) 32.69±2.77	Latency	5.72±0.58	0.23	<0.01
	Amplitude (mv)	3.81±0.40	-0.041	0.65
	NCV (m/S)	52.97±3.22	0.175	0.052

Obesity positively correlated with Latency and NCV but negatively correlated with Amplitude of right motor median nerve in TIIDM subjects.

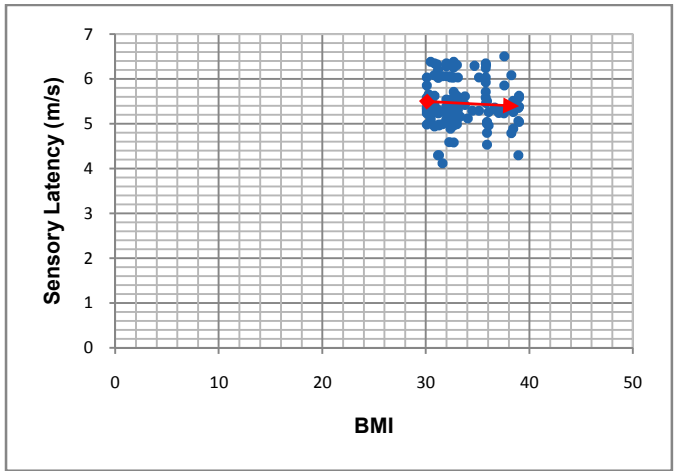

Figure 1. Correlation of Right Sensory Median Nerve Latency with BMI (Obesity)

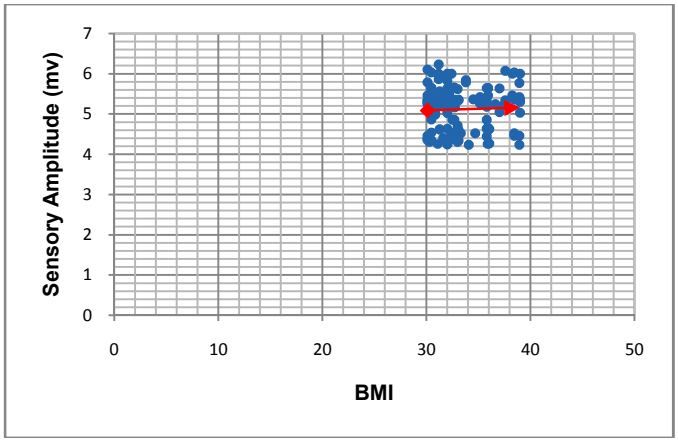

Figure 2. Correlation of Right Sensory Median Nerve Amplitude with BMI (Obesity)

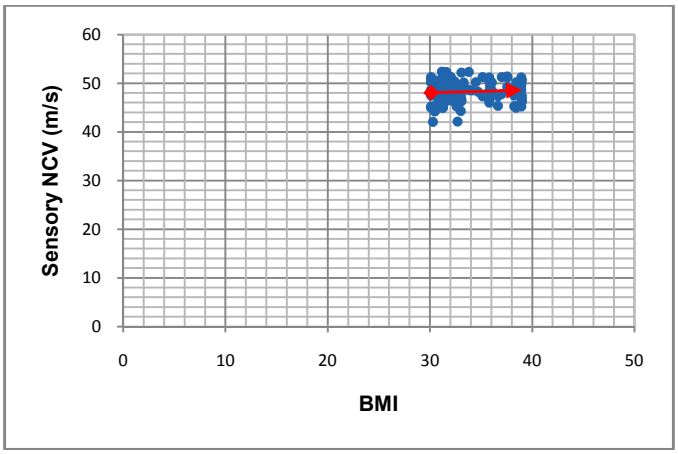

Figure 3. Correlation of Right Sensory Median Nerve NCV with BMI (Obesity)

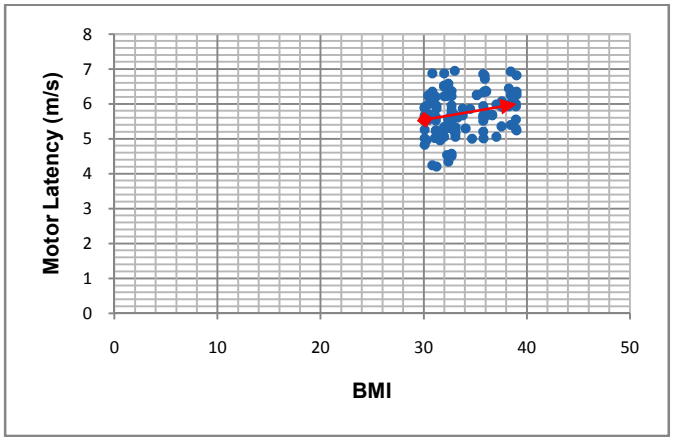

Figure: 4 Correlation of Right Motor Median Nerve Latency with BMI (Obesity)

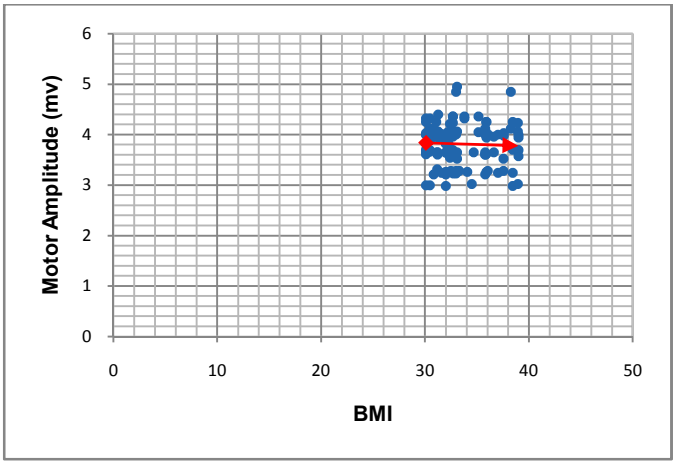

Figure 5. Correlation of Right Motor Median Nerve Amplitude with BMI (Obesity)

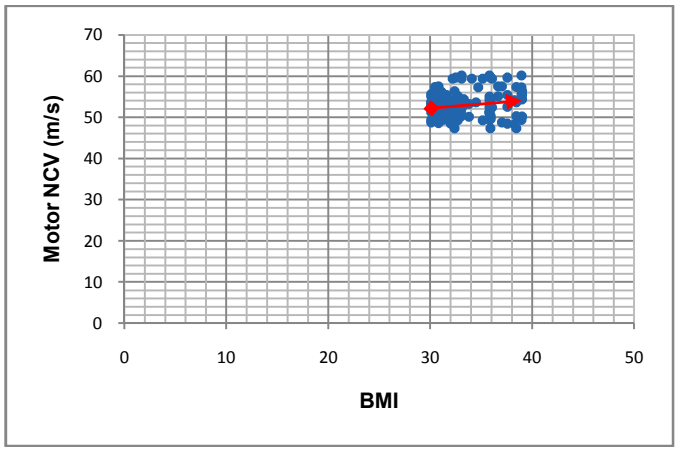

Figure 6. Correlation of Right Motor Median Nerve NCV with BMI (Obesity)

Table 2 shows the motor right median nerve latency correlated significant (P <0.05) with obesity, amplitude and nerve conduction velocity non significant (P >0.05) but obesity negatively correlated with amplitude but positively correlated with latency and NCV of right motor median nerve in TIIDM subjects.

DISCUSSION

Obesity may cause slowing of nerve conduction. If it is due to only mechanical reason, then there should be thickening of the myelin sheath which is not found in every case. There may be some type of localized metabolic problem that causes intrafascicular swelling without mechanical interference. In this study, effect of body mass index (BMI) on nerve conduction parameters for median nerve was evaluated. This study shows the sensory right median nerve latency, amplitude and nerve conduction velocity and motor right median nerve amplitude and nerve conduction velocity non significant (P >0.05) but latency correlated significant (P <0.05) with obesity. Obesity negatively correlated with latency but positively correlated with amplitude and NCV of right sensory median nerve and obesity negatively correlated with amplitude but positively correlated with latency and NCV of right motor median nerve in TIIDM subjects.

Buschbacher *et al.* (1998) who showed that sensory and mixed nerve amplitudes correlated significantly ($p < 0.01$) with BMI for all the tested nerves. This study shows correlation between sensory amplitudes but not with mixed nerve amplitudes. Mean of amplitudes in subjects with higher BMI (obese) was less than in thin subjects. They reported no correlation between BMI and nerve conduction velocity, latency or most of the other motor and sensory parameters. Aswini *et al.* (2012) found significantly positively co-relation between BMI and SNV and MNCV. In our study say that obesity negatively correlated with latency but positively correlated with amplitude and NCV of right sensory median nerve and obesity negatively correlated with amplitude but positively correlated with latency and NCV of right motor median nerve. Werner *et al.* (1994) observed that obese individuals have slowed conduction in median nerve across the wrist. They observed a strong correlation between median nerve conduction slowing and median nerve cross-sectional area at the wrist but concluded that obesity does not influence carpal canal pressure or size of median nerve at the wrist.

Yajnik *et al.* (2017) reported that BMI does not seem to affect the NCS parameters particularly. Mild positive correlation is seen between BMI and DML's. Mild positive correlation is also seen between BMI and CMAP Duration (r value =0.26) of the Left Peroneal Nerve. Similarly, negative correlation (r value = -0.23) has been observed between BMI and the Amplitude of the Left tibial Nerve. These observations were not statistically significant (p value >0.05) thereby rejecting any association between BMI and NCS variables. The findings of this study are in contrast with Awang *et al.* (2006) who showed decrease in conduction velocity in median nerve with increasing BMI. In this study only right motor median nerve latency is correlated but all parameters of right median nerve are non significant found. The findings of this study are also in contrast with Baqai *et al.* (2001) where no effect of BMI on nerve conduction parameters was reported. Werner *et al.* (2004) found that the likelihood of developing median mononeuropathy at the wrist was 2.5 times higher in obese individuals (BMI > 29) than the slender ones (BMI < 20). Thus there is a causal relationship between changed median nerve conduction parameters and increased BMI causing neuropathies which could be due to increased hydrostatic pressure or fatty tissue within the carpal tunnel in obese individuals. In conclusion this study demonstrates that most of the parameters of right median nerve conduction study are affected but not significantly associated with BMI. The correlation between obesity and right median nerve should be taken into account in clinical practice in diabetic neuropathy because more subjects are suffering diabetic neuropathy with carpal tunnel syndrome.

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