Effect of Height and BMI on Nerve Conduction Velocity

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ABSTRACT

Objective: *To know the effect of Height and BMI on median motor nerve conduction velocity.*
Background: *Nerve conduction study is part of the electro diagnostic procedures that help in establishing the type and degree of abnormalities of nerve. Nerve conduction velocity is affected by many physiological and technical factors. So we have conducted this study, to know the effect of height and BMI on median motor nerve conduction velocity.*
Materials and Methods: *A Cross – Sectional study was conducted in 50 female medical students with mean age 19 to 22 years. Nerve conduction velocity was calculated by recording evoked electromyogram (EMG) by stimulating median nerve at elbow and at wrist with the help of EMG electrodes and isolated stimulator by using Power lab 8/30 series with dual Bioamplifier. Statistical analysis was done by using Karl Pearson Correlation coefficient.*
Results: *There is moderately negative correlation with the height on motor nerve conduction velocity with "r" value -0.23487 and also slight negative correlation with BMI on conduction velocity with "r" value -0.1832.*
Conclusion: *With increasing height and BMI, nerve conduction velocity is decreased so this phenomenon should be considered for comparative studies and diagnosing pathological conditions.*

Keywords: *BMI; Height; Nerve Conduction velocity*

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Quick Response Code:	**Website:** www.innovativepublication.com
	DOI: 10.5958/2394-2126.2015.00028.6

INTRODUCTION

Electrical conduction of motor and sensory nerves of the human body is assessed by Nerve Conduction Velocity, which is a part of electro-diagnostic procedures, that help in establishing the type and nature of the nerve and commonly used to evaluate function of nerve. Nerve conduction velocity is affected by many physiological and technical variables. Physiological variables such as age, height, gender, upper limb versus lower limb, temperature affects conduction velocity. Diameter and myelination of the nerve fibers also affect nerve conduction velocity.[1]

Nerve conduction studies (NCS) are performed to diagnose the disorders of the peripheral nervous system.[2,3] These enable the clinicians to differentiate the two major groups of peripheral diseases: demyelination and axonal degeneration.[4] These also help in localizing the site of the lesions.[5,6]

Height and low body mass index (BMI) have been reported as risk factor for ulnar neuropathy at elbow and high BMI as risk factor for carpel tunnel syndrome.[7] BMI was also found to have negative correlation with sensory nerve action potential amplitude.[8] In assessment of diabetic peripheral neuropathy, BMI is very important factor to be taken into consideration.[9] Thus, influence of BMI on nerve conduction study is crucial which has to be taken into consideration while interpreting nerve conduction studies.

Peroneal and sural NCV correlated inversely with height and with estimated axonal length, whereas median motor and sensory NCV failed to show any significant relationship to height.[13] Many studies have been done previously to evaluate the influence of the anthropometric factors such as age, height and body mass index on the nerve velocities.[10,11,12] However, a majority of these studies were based on the western population. So our study includes to know the effect of height and body mass index (BMI) on median motor nerve conduction velocity.

MATERIAL AND METHODS

Cross – Sectional and Descriptive study was conducted in the Department of Physiology, Navodaya Medical College, Raichur after obtaining clearance certificate from ethical committee. The study group included 50 female medical students with age 19 to 22 years in secretory phase of menstrual phase. (to avoid the influence of hormones) Subject with present history of fever, neurological abnormalities, any limb deformities and history of systemic diseases like diabetes mellitus, hypertension, were excluded. Informed consent was taken. Height and weight measured and BMI was calculated.
BMI was calculated as per formula: Weight (Kg)/ Height (meter)^2 (Quetelet,s Index).

Instruments used for recording .Nerve conduction velocity was calculated by recording evoked electromyogram (EMG) by stimulating median nerve at elbow and at wrist with the help of EMG electrodes and isolated stimulator by using Power lab 8/30 series with dual Bioamplifier (AD Instruments Australia, Model No.ML870).

After explaining the procedure, the subject were made to lie down on the couch. They were asked to remove jewellaries. Setting with instrument was done. The EMG electrodes were placed on the abductor pollicis brevis muscle. Active electrode was placed on muscle bulk & reference electrode was placed on tendon.[1] The course of right median nerve was traced. The EMG was recorded by stimulating median nerve using isolated stimulator at wrist first and elbow at latter. The distance between two points of stimulation (one at wrist and another at elbow) was measured. The latent period was noted from recording. Difference in the latent period for two stimulation (one at wrist and another at elbow) was calculated.

Nerve conduction velocity was calculated by formula and expressed in meter/second

$$\text{Velocity} = \frac{\text{Distance between stimulation sites (mm)}}{\text{Difference between latencies (ms)}}$$

THE STATISTICAL ANALYSIS

The results were expressed in terms of Mean±SD. Statistical analysis was done by using Karl Pearson Correlation Coefficient. The data was analyzed by using SPSS 17.0 version statistical software. Microsoft Word and Excel have been used to generate graphs, tables etc.

RESULTS

Cross – Sectional and Descriptive study was undertaken in 50 female medical students with age group 19 to 22 years in secretory phase of menstrual phase. All the students belonging to the age group 19 to 22 years. The mean height of the individuals is 1.6±0.6 meter and BMI is 20.46±1.34 kg/m^2. Median Motor Nerve conduction velocity in right hand is 58.68±2.67 meter/second.

There is moderately negative correlation effect with height on motor nerve conduction velocity with "r" value -0.23487, and it is non significant. There is slight negative correlation effect of BMI on conduction velocity with "r" value -0.1832 and it non significant.

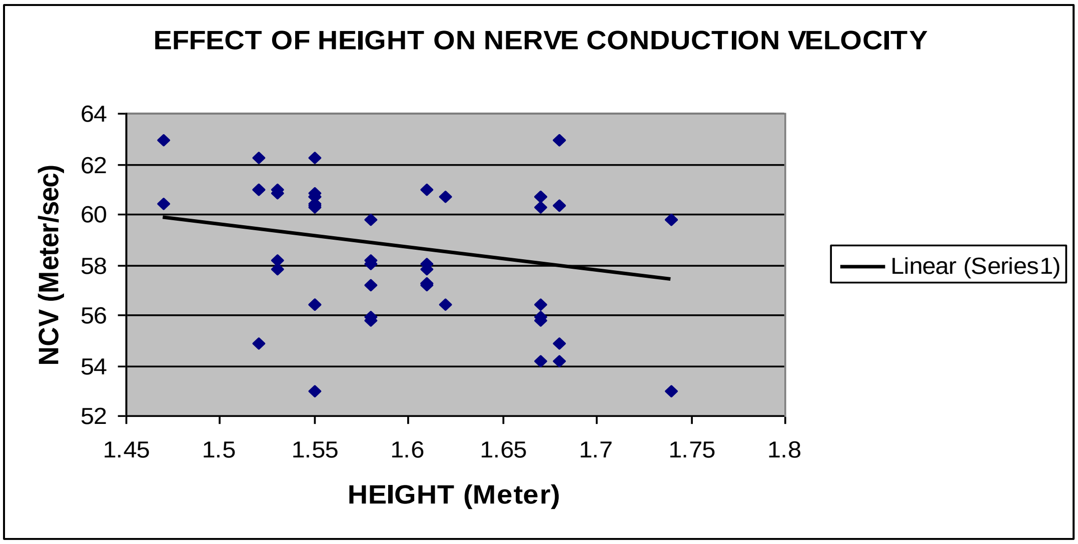
Table 1: Representing following parameters

Parameter	Mean±sd
Age (years)	19.34±0.62
Height (in meters)	1.6±0.6
BMI(kg/m$^{2)}$	20.46±1.34
Nerve conduction velocity (meter/sec)	56.58±2.67

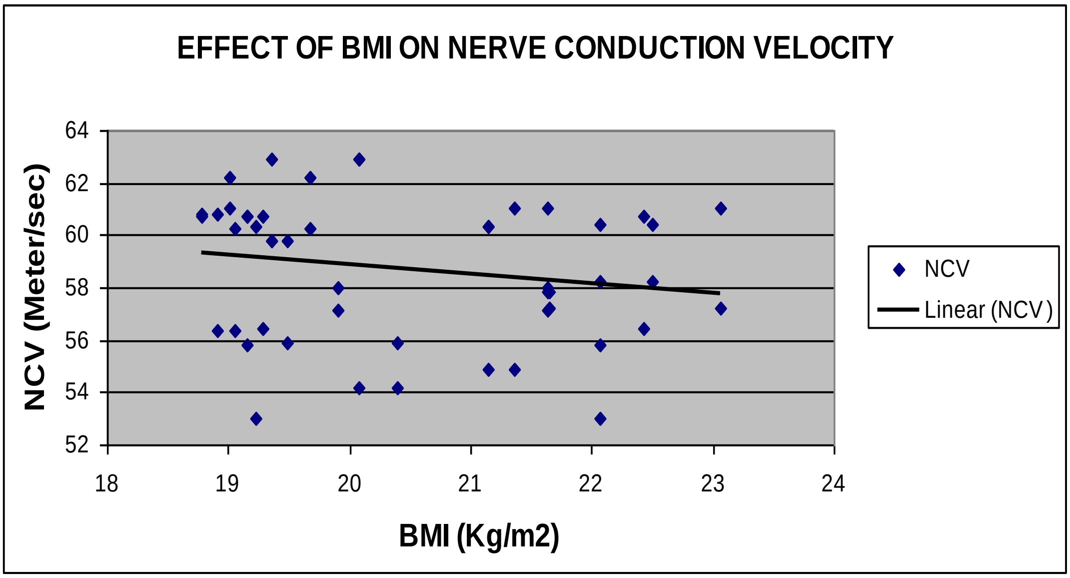
Table 2: Representing Nerve Conduction Velocity with height and BMI

Parameter	'r' value	'p' value	Significance
Height (in meters)	-0.23487	>0.05	Non significant
BMI(kg/m$^{2)}$	-0.1832	>0.05	Non significant

r—Karl Pearson correlation Co-efficient



Graph 1: Representing correlation between Nerve Conduction Velocity with height



Graph 2: Representing correlation between Nerve Conduction Velocity with BMI

DISCUSSION

The study was conducted to know the effect of height and BMI on nerve conduction velocity in right hand in 50 women during their secretory phase of menstrual cycle. Median motor nerve conduction velocity was studied. There is moderately negative correlation effect with height on motor nerve conduction velocity which is non significant. A negative correlation between distal fiber diameter and height may best explain decreased conduction velocity. Distal axonal tapering in the nerves explains the effect. Even Campbell proposed that a decrease in diameter occurs abruptly at a given distance from the cell body.[15] In mature rabbit nerves, Williams found that peripheral motor axon diameter was about half that of ventral spinal nerve root fibers and, despite an increase in myelin sheath thickness, there was an overall decrease in total fiber diameter.[16] Height-related slowing of nerve conduction velocity was observed in this study.[17] Clinical recognition of this height effect is important, otherwise an individual with mildly slowed peripheral nerve conduction velocity solely related to large stature may be labeled as abnormal.

Even with BMI, same effect has been observed. There is slight negative correlation effect of BMI on conduction velocity which is non significant which may be due to thicker subcutaneous tissue in the person with higher BMI. As the adipose tissue in epineurium may be related to some extent to amount of body Fat,[14] it is reasonable that the amount of such fat may affect the nerve conduction. Our observation are in agreement with Awang MS et al who observed slowing of conduction velocity (CV) with increasing BMI in median motor nerve.[18]

Though the height and BMI affects the median motor nerve conduction velocity, these are not statistically significant. These two factors should be considered while diagnosing pathological conditions, otherwise normal individuals may be diagnosed as abnormal and they will be on unnecessary medication.

CONCLUSION

With increasing height and BMI, nerve conduction velocity is decreased and it is statistically non significant. So this phenomenon should be considered for comparative studies and diagnosing pathological conditions. These two biological factors must be taken into consideration while interpreting nerve conduction studies.

ACKNOLEDGEMENT

Thanks to all the medical students who were voluntarily involved in study.

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