

Study Of Relation Between Motor Nerve Conduction Velocity And Height In Healthy Individuals

Anup Patel^{*}, Saurin Sanghavi^{**}, Rachit Joshi^{***}, Brijesh Patel^{****}, Jignesh Harkhani^{*}, Sadhna Joshi^{*****}

^{*}Tutor, ^{**}Assistant Professor, ^{****} Professor, Department Of Physiology, GMERS Medical College, Gandhinagar, ^{***}Associate Professor, Department Of Physiology, GMERS Medical College, Patan, ^{****} Tutor, Department Of community medicine, GMERS Medical College, Ahmedabad, Gujarat

Abstract: Background: Nerve conduction velocity is being used as a widespread measure of diagnosis of nerve function abnormalities. Dependence of nerve conduction parameters on intrinsic factors like age and sex, as well as extrinsic factors like temperature is well known. Lateralization of various cerebral functions like speech, language, visuospatial relations, analysis of face, recognition of musical themes and use of hand for fine motor movements have also been studied. The aim of this study is to compare the nerve conduction velocity of different subjects with different height using median nerve and find out whether there is any difference in relation between motor nerve conduction velocity and height. Method: The study was carried out in students of B J Medical College by the use of standard 2 channel physiograph. Comparison of motor nerve conduction velocity between subjects of different height was done under equation of Pearson correlation. Result: There are several factors which affect nerve conduction velocity. Some skills like music, sports activities are also due to hemispheric difference. Age and sex affect nerve conduction velocity. Here we compare the relation between height and motor nerve conduction velocity. On comparison of motor nerve conduction velocity of median nerve with different height of the subjects the study shows that there is significant decrement in nerve conduction velocity with increase in height of subjects. Conclusion: From the results we can conclude that there is inverse correlation between height and nerve conduction velocity of subjects.

Key Words: Height, Nerve conduction velocity, Median nerve

Author for correspondence: Dr Anup Patel, 46, Ratnamani tenaments, Opp. Gyanda girls' school, Ghatlodia, Ahmedabad, Gujarat, India, 380061, Email:-anup2185@gmail.com

Introduction: Nerve conduction study has emerged as a major tool for diagnosis as well as prognosis of nerve function disorders¹. Intrinsic factors like age and sex, as well as extrinsic factors like temperature on nerve conduction are well known². Various cerebral functions like speech, language, visuospatial relations, analysis of face, and recognition of musical themes and use of hand for fine motor movements have also been studied with lateralization. Handedness and nerve conduction have also been studied well³. There are some evidences available for comparison of height and nerve conduction velocity. Further studies are required to establish correlation between height and nerve conduction velocity. Here this comparison is done in total of 50 subjects.

Materials and Method: Selection of subjects was done from 50 male healthy, medical students with. 25 students are left handed and remaining 25 are right handed. The study was

done under ethical standard of institution with permission of ethical committee.

Criteria for selection of subjects:

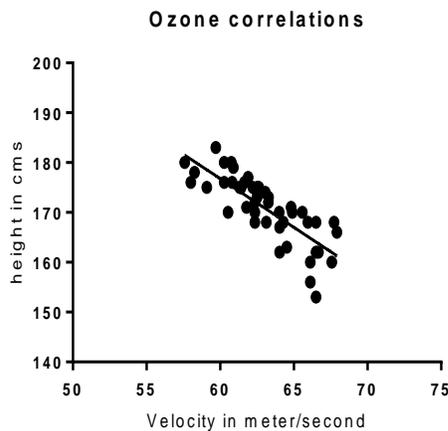
- 1) Age group:- 16 to 30 years
- 2) BMI:- 20 to 25⁴(normal)
- 3) No history of injury to upper limbs, spinal cord, brain.
- 4) Absence of abnormal signs over limbs (tingling, numbness, pain in limbs, tremor, ataxia, muscle weakness, wasting of muscles).
- 5) No known history of neuropathy, neuromuscular disorders, muscle disorders.
- 6) No history of familial neural, muscular or neuromuscular disorders.
- 7) No history of Leprosy, Arthritis.

If the answer of each question is yes than subject can be included in the study⁵.

Tools for testing and procedure: A standard 2 channel physiograph having RMS EMG EPMK II one of latest software in the study of nerve conduction was used for measurement. Subjects were acclimatized to standard room temperature (26⁰C +/-2⁰C) for 10 minutes⁶.

After that the procedure was performed under following settings, For motor nerve conduction sensitivity: 2-5mV/mm, Sweep speed: 2-5ms/mm, Filter: 2-5 Hz (low frequency), 10 KHz (High frequency)⁷. Supra maximal stimulation is used for motor nerve conduction studies. Median Nerve of both the sides is first stimulated at distal point (wrist) then at proximal point (elbow). The action potential is recorded and difference between distal and proximal latencies is obtained. Distances were measured by a standard measure tap. Motor NCV is calculated in meter/second by the formula Distance between two stimulated point divided by difference in latent periods. Motor nerve conduction velocity of both sides were obtained nearly equal. Average of both sides for Motor NCV is considered and further calculation was done.

Result: In comparison of motor nerve conduction velocity and height in 50 normal individuals it is seen that there is inverse relationship between these two parameters by the equation of correlation⁸.



No. Of subjects	Average Height	Average motor NCV	Correlation R	Result
Right Hand	171.1 +/- 18	62.91 +/- 6	-.8036	Inverse correlation
Left Hand	171.1 +/-18	62.06 +/-6	-.7813	Inverse correlation

P value < 0.001

The graph clearly suggests that, as the height of individual increases the velocity of motor nerve conduction decreases showing the inverse relationship between these two parameters.

Results were presented by the equation of Pearson correlation sequence. P value less than 0.05 was considered as significant.

Discussion: We are very aware about the involvement of nerves in various metabolic diseases like Diabetes as well as other neuropathies. But before that we should know normal physiological factors affecting the nerve and its conduction. As we know nerve conduction velocity is affected by many known factors such as Age, sex, handedness etc. Also degree of Myelination, fibre diameter and internodal distance has important role in affecting the nerve conduction velocity⁹. Genetic factors as well as some peripheral factors (biological¹⁰ and environmental¹¹) may be involved. Similar results were found in a study conducted by Reinisch JM et al where he found diethylstilbestrol does affect the nerve conduction velocity in males. Coren shown in his book advances in psychology that certain environmental and biological factors affect the conduction velocity in healthy individuals. In one study at Dept of Physiology, B. P. Koirala Institute of Health Sciences Ghopa Camp, Dharan , they found that the height showed significant correlation with nerve conduction study parameters for the motor nerves and few sensory nerves¹².

They say diagnostic Conclusion which were made from the data without making correlation with the height may be invalid for patients who are taller or shorter than average individuals. In the study they also correlated distal latencies and amplitude of CMAP, found positive relationship with height. It should be considered while developing standard/reference normative data for different nerves. In another study done by Takano K, Kirchner F negative correlation between height and maximum nerve conduction is seen in both sexes¹³.They tested ulnar nerve of both the sides in more than 650 medical students and

found statistically significant higher nerve conduction velocity in shorter individuals than taller ones. They also got slightly higher conduction velocity in females than males. However with regards to its relation to height males have higher nerve conduction velocity than females. In a study done by Bodofsky E, Tomaiolo A, Campellone J they established negative correlation between nerve conduction and height (axon length)¹⁴. According to them Ulnar Motor Nerve Motor Conduction Velocity appears to be inversely proportional to the square root of height, which further supports our study that motor nerve conduction velocity is affected by height of individual. Maria T. Gadia, MD, Norihiko Natori MD, Laura B. Ramos MD have examined associations between height, quantitative sensory, motor nerve conduction and clinical indices of diabetic peripheral neuropathy in 100 adult diabetic patients (25 to 70 years). The peroneal and posterior tibial motor nerve conduction velocity were inversely related to height¹⁵. Here we are trying to establish relationship between the height and nerve conduction velocity.

Textbook of practical physiology by pal GK suggested similar results. The reason behind comparison is that there may be longer tapering of nerve in the distal part of the nerve in taller individuals¹⁶. This tapering may reduce the thickness of the nerve as we go distally. Also there may be chance of thinner myelination as we move distally in the nerve. On comparison of distal latencies with height it is seen that as the height increases distal latency also gets longer ($r=0.8543$, $Pvalue<0.01$). It shows impulse conduction takes longer time to travel through the distal part of the nerve which also supports to our result and the reason may be due to tapering and poor myelination at distal end. We know clearly that two most important factors affecting the nerve conduction velocity are myelination and thickness of nerve. Myelination causes to the impulse to be conducted faster. Lesser the myelination lesser will be velocity of nerve conduction. Also, as the thickness of the nerve increases conduction of impulse from the nerve gets faster. The

relationship should be established with further studies.

Conclusion: As per the results obtained in our study and in the light of the above discussion it can be concluded that there is inverse correlation between height and nerve conduction velocity of subjects.

Acknowledgement: We pay our sincere thanks to Department of Physiology, B J Medical College, Ahmedabad for their help at each and every step during the study. We are also thankful to Govt. Physiotherapy College where we have conducted this study for their support. We are also grateful to our subjects who in spite of their precious time gave consent and active participation in this study.

References:

1. http://en.wikipedia.org/wiki/Nerve_conduction_study
2. Dr Diana S, Dr James W, Dr Barbara A et al. Effects of age, sex, and anthropometric factors on nerve conduction measures. *MUSCLE & NERVE* October 1992;15: 1095-1104.
3. William Ganong. Learning and memory, Language and speech In: Ganong's review of Medical Physiology. 24rd edition. London: Mc Graw Hill. 2013 : 367-382.
4. Bruce R and David F In:Harrison's principle of internal medicine.18th edition. USA:Mc Graw Hill.2012;1: 612-622.
5. Michael J and Arthur K. Numbness, Tingling and Sensoryloss In: Harrison's principle of internal medicine 16th edition. USA: Mc Graw Hill.2012; 1:186-191.
6. THAKUR D, JHA S, PANDEY NK, et al. Influence of height on the nerve conduction study parameters of the peripheral nerves. *Journal of Clinical and Diagnostic Research* Apr 2011;5: 260-263.
7. Misra UK, Kalita J. Introduction to electrodiagnostic signals and their measurements In: Clinical Neurophysiology. 2nd edition. New Delhi: Elsevier.2008: 11-20.
8. Park K. Health Information and BioStatistics In: Park's Text book of Preventive and

- social medicine. 21st Edition. Jabalpur:Banarasi Das Bhanot. 2011: 778-792
9. Pal G K and Pravati Pal. Nerve conduction Study In: Text book of Practical Physiology.2nd edition. Chennai:Orient Longman.2007: 227-234
 10. Reinisch JM, Sanders SA. Effects of prenatal exposure to diethylstilbestrol (DES) on hemispheric laterality and spatial ability in human males. Hormonal Behaviour March 1992; 26: 62–75.
 11. Coren S . Left-handedness and the rare Trait marker model In:Left Handedness Behavioural implications and anomalies.1st Edition. Nether Holland: Elsevier.1990: 3-33.
 12. THAKUR D, JHA S, PANDEY NK, et al. Influence of height on the nerve conduction study parameters of the peripheral nerves. Journal of Clinical and Diagnostic Research Apr 2011; 5: 260-263.
 13. Takano K and Kirchner et al. Relation between height &the maximum conduction velocity of ulnar motor nerve in human subjects. Japanese Journal of Physiology 1991;41(3):385-396.
 14. Bodofsky E, Tomaio A and Campellone J. The mathematical relationship between height and nerve conduction velocity. Electromyogrphy and Clinical Neurophysiology May-Jun 2009;49(4):155-160.
 15. Maria T. Gadia, MD, Norihiko Natori et al. Influence of height on quantitative sensory ,nerve conduction and clinical indices of diabetic peripheral neuropathy. DIABETES CARE. SEPTEMBER-OCTOBER 1987; 10: 613-616.
 16. Pal G K and Pravati Pal. Nerve conduction Study In: Text book of Practical Physiology.2nd edition. Chennai:Orient Longman.2007: 227-234

Source Of Financial Support-Nil

Conflict Of Interest-None
