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Original Research Paper

Study of correlation of demographic and anthropometric parameters with nerve conduction velocity in upper limb

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ABSTRACT:
Introduction: Nerve conduction studies (NCS) are primarily used to identify peripheral nervous system problems. Numerous anthropological and physiological factors influence nerve conduction velocity. Setting absolute criteria without accounting for these factors is said to produce false positive and false negative findings. The purpose of the current study was to evaluate how height affects nerve conduction velocity, particularly in relation to median nerve fibres in the Indian population.
Materials and Methods: In present cross-sectional prospective study 60 individuals of both sexes from all age group who voluntarily participated in study were enrolled. After obtaining demographic & anthropometric details in each participant, all were assessed for nerve conduction velocity of median motor & sensory nerve in both hands.
Observations and Results: Maximum cases i.e. 49 (81 %) amongst total participants were from age group 31 to 60 years. Males were 47 (78 %) & females were 13 (22 %). As the height increased descending trend was found in NCV values in motor fibres in both hands whereas ascending trend was observed in sensory fibres values.
Conclusion: To conclude, as baseline nerve conduction measurements are dependent on anthropometric factors, it is important to understand the effect of these various factors on the normal values for nerve conduction measurements to aid in identifying abnormal nerve conduction study results.

Keywords: NCV, Height, upper limb

INTRODUCTION:

Nerve Conduction Velocity is the study of rate of impulse conduction by motor and sensory nerve fibres of the particular nerve, which is a part of electro-diagnostic procedures helping in evaluating function of nerve. Nerve conduction studies (NCS) are primarily used to identify peripheral nervous system problems, which aid in the diagnosis of axonal degeneration and demyelination in peripheral diseases[1,2,3]. Furthermore, it aids in pinpointing the location of the lesions[4,5]. Numerous anthropological and physiological factors influence nerve conduction velocity. While anthropological factors include height, weight, and BMI, physiological factors include age, gender, temperature, and deference in the upper and lower limbs. Setting absolute criteria without accounting for height, temperature, sex, or age is said to produce false positive and false negative findings. For nerve conduction results to be interpreted correctly, temperature must be strictly controlled and anthropometric characteristics must be measured. Therefore, the important confounders, including age, sex, and anthropometric variables, should be controlled for in electrodiagnostic testing[6,7]. Prior research found that peroneal and sural NCV linked negatively with height and estimated axonal length, whereas median motor and sensory NCV did not significantly correlate with height[8]. Additionally, several earlier studies on the relationship between gender and nerve conduction velocity produced both positive and negative findings[9,10]. Numerous studies have been conducted in the past to assess how anthropometric variables, including height, age, and body mass index, affect nerve velocities[11,12,13]. Most of these research, nevertheless, focused on people in the West. The purpose of the current study was to evaluate how height

affects nerve conduction velocity, particularly in relation to median nerve fibres in the Indian population.

Aims:

To study of correlation of demographic & anthropometric parameters with nerve conduction velocity

Objectives:

A. To assess age, height, weight, BMI & gender wise distribution of study participants
B. To assess nerve conduction velocity of right & left sided motor & sensory fibers of median nerve
C. To correlate NCV findings of left & right side with gender
D. To correlate NCV findings of left & right side with height distribution

MATERIALS AND METHODS:

Present cross-sectional prospective study was conducted in the Neurophysiology lab of the Department of Physiology. 60 individuals fulfilling inclusion and exclusion criteria were enrolled an informed written consent was taken from the volunteers & Study was explained to all in their own language.

Inclusion Criteria:

60 individuals of both sexes from all age group who volunteered to participate in the study

Exclusion Criteria:

- Subject with any history of drugs/alcohol intake or medical illness which is likely to affect the nerve conduction study parameters
- Subject with present history of fever, neurological abnormalities, any limb deformities and history of systemic diseases like diabetes mellitus

Procedure:

Detailed clinical history was ascertained followed by general and systemic examination. Height and weight measured and BMI was calculated.

BMI was calculated as per formula: Weight (Kg)/ Height (meter)^2

Individuals were made comfortable and the procedure properly explained. The neurophysiological investigation included the median nerve's motor and sensory NCS. The RMS EMG MKII equipment was used to perform NCS after all subjects were asked to sit comfortably on a wooden stool. The temperature remained steady at 26 ± 20°C. The right median nerve's path was charted. The reference electrode was positioned 3 cm distal to the first meta-carpo phalangeal joint, while the recording electrode was positioned at the abductor pollicis brevis motor point. Between the stimulation locations, the nerve segment's length was measured. The length of the nerve segment was divided by the difference between the proximal and distal latency to get the conduction velocity.

NCV (m/sec) =Distance between stimulation sites (mm)/Difference between latencies (ms)

The sensory NCV was tested using ring electrodes, with the reference electrode placed at the index finger's distal interphalangeal joint and the recording electrode at the index finger's proximal interphalangeal joint. Every recording was completed, and information was gathered for analysis

Statistical analysis:

Statistical analysis was performed using SPSS software, version 20. Data were expressed as mean ± SD and frequency with percentages N (%). Unpaired t test was used to evaluate qualitative data. Statistical significance was assumed if P value less than 0.05.

OBSERVATION AND RESULT:

Table 1: Demographic parameters

Sr No	Age (Years)	Gender		Total n (%)
		Male n (%)	Female n (%)	
1	≤ 30	1 (2 %)	0 (0 %)	1 (2 %)
2	31 to 60	39 (64 %)	10 (17 %)	49 (81 %)
3	> 60	7 (12 %)	3 (5 %)	10 (17 %)
Total n (%)		47 (78 %)	13 (22 %)	60 (100 %)

Maximum cases i.e. 49 (81 %) amongst total participants were from age group 31 to 60 years. Males were 47 (78 %) & females were 13 (22 %).

Table 2: Anthropometric parameters

Sr No	Anthropometric parameters	Male Mean ± SD	Female Mean ± SD
1	**Height** (in meters)	1.66±0.03	1.61±0.03
2	**Weight** (Kg)	67.61±2.54	65.07±4.15
3	**BMI** (kg/m2)	24.4±1.01	25.3±1.23

Mean ± SD of height (meters) amongst males was 1.66±0.03 & in females were 1.61±0.03. Mean ± SD of weight (kg) amongst males was 67.61±2.54 & in females were 65.07±4.15. Mean ± SD of BMI (kg/m2) amongst males was 24.4±1.01& in females were 25.3±1.23

Table 3: nerve conduction parameters

Sr No	Nerve Tested	Nerve conduction velocity (meter/sec)		t Value	P value
		Male Mean ± SD	Female Mean ± SD		
1	**Right Median motor nerve**	57.20±1.11	57.4±1.68	**0.51**	**0.61 (NS)**
2	**Left Median motor nerve**	53.98±1.32	53.8±1.95	**-0.39**	**0.69 (NS)**
3	**Right Median sensory nerve**	58.7±0.73	58.21±1.006	**-1.96**	**0.05 (S)**
4	**Left Median sensory nerve**	54.1±0.78	53.7±0.87	**-1.59**	**0.11 (NS)**

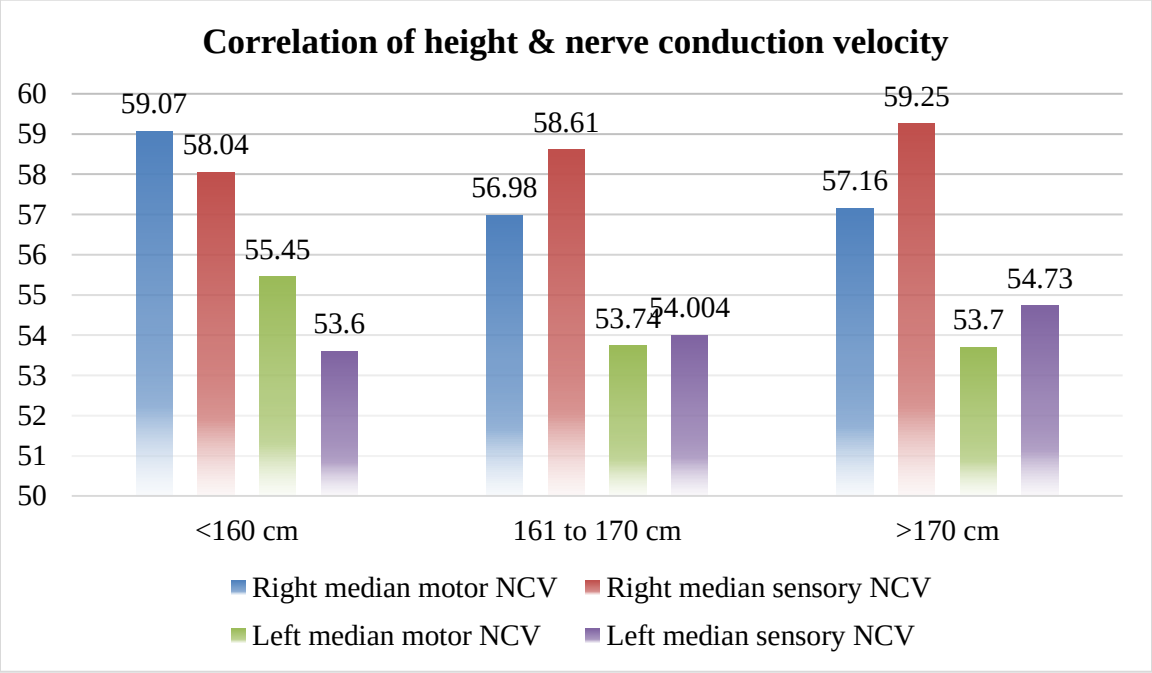
Mean ± SD of NCV of Right Median motor nerve amongst males was 57.20±1.11 & amongst females were 57.4±1.68. Result showed no statistically significant difference (P=0.61). Mean ± SD of NCV of Left Median motor nerve amongst males was 53.98±1.32 & amongst females were 53.8±1.95. Result showed no statistically significant difference (P=0.69). Mean ± SD of NCV of Right Median sensory nerve amongst males was 58.7±0.73 & amongst females were 58.21±1.006. Result showed statistically significant difference (P=0.05). Mean ± SD of NCV of Left Median sensory nerve amongst males was 54.1±0.78 & amongst females were 53.7±0.87. Result showed no statistically significant difference (P=0.11).

Table 4: Correlation of height & nerve conduction parameters

Sr No	Height (cm)	NCV of right median motor nerve Mean ± SD	NCV of right median sensory nerve Mean ± SD	NCV of left median motor nerve Mean ± SD	NCV of left median sensory nerve Mean ± SD
1	**<160**	59.07±0.77	58.04±0.79	55.45±0.99	53.6±1.16
2	**161 to 170**	56.98±1.11	58.61±0.80	53.74±1.48	54.004±0.67
3	**>170**	57.16±0.90	59.25±0.36	53.7±0.54	54.73±1.02
P value		0.00005 (S)	0.026 (S)	0.012 (S)	0.035 (S)

Mean ± SD of NCV amongst participants with height <160 cm was 59.07±0.77, 58.04±0.79, 55.45±0.99 & 53.6±1.16 for right median motor nerve, right median sensory nerve, left median motor nerve & left median sensory nerve respectively. Mean ± SD of NCV amongst participants with height 161 to 170 cm was 56.98±1.11, 58.61±0.80, 53.74±1.48 & 54.004±0.67 for right median motor nerve, right median sensory nerve, left median motor nerve & left median sensory nerve respectively. Mean ± SD of NCV amongst participants with height >170 cm was 57.16±0.90, 59.25±0.36, 53.7±0.54 & 54.73±1.02 for right median motor nerve, right median sensory nerve, left median motor nerve & left median sensory nerve respectively

Graph 1: Correlation of height & nerve conduction parameters



DISCUSSION:

Nerve conduction studies are tests that assess how well sensory and motor nerves function and how well they conduct electrical impulses. They are regarded as a crucial tool for diagnosing diseases, tracking their progression, and determining treatment-related complications. Numerous physiological variables are known to affect the nerve conduction parameters, including age, height, gender, and temperature. In present study 60 individuals of both sexes from all age group who voluntarily participated in study were enrolled. After obtaining demographic & anthropometric details in each participant, all were assessed for nerve conduction velocity of median motor & sensory nerve in both hands. Results obtained were analysed statistically. Maximum cases i.e. 49 (81 %) amongst total participants were from age group 31 to 60 years. Males were 47 (78 %) & females were 13 (22 %). Mean ± SD of height (meters) amongst males was 1.66±0.03 & in females were 1.61±0.03, weight (kg) amongst males was 67.61±2.54 & in females were 65.07±4.15, BMI (kg/m2) amongst males was 24.4±1.01& in females were 25.3±1.23. In similar study by Thakur D et al (2011)[14] average age, height and BMI were 31.24± 11.57 (years), 158.5±10.21 (cm) and 21.8± 2.11 (Kg/m2) respectively. Kumari SKR, et al (2018)[15] in their study included individuals in the age group of 15-65 years with 47 (45.3%) were females and 56 (54.7%) were males.

In present study as the height increased descending trend was found in NCV values in motor fibres in both hands whereas ascending trend was observed in sensory fibres values. In similar study by Amruta S Bennal et al (2015)[16] they found moderately negative correlation effect with height on motor nerve conduction velocity. Kumari SKR, et al (2018)[15] in their study found that the correlation of height with median nerves NCV did not show statistical significance. Nawrass Jassim1 et al (2022)[17] in their study found there was a significant negative power of height on median sensory amplitude ($r = -0.32$, $p = 0.007$). In apposite to these in study by Thakur D et al (2011)[14] they found height showed a significant positive correlation with the CMAP duration of all the motor nerves: right median ($r=0.734$, $p<0.001$), left median ($r=0.422$, $p<0.05$)

One possible explanation for the motor fibre results in relation to height is that distal conduction slows down in taller participants because of more axonal tapering and less myelination. Due to increased metabolic burden from providing the more distal axon, tall people are also more likely to lose big axons as they age[18]. The diameter of sensory fibres increases proximally after decreasing distally. As a nerve grows taller, it will taper, which means that even while the myelin sheath is growing distally, the diameter of the nerve fibre will decrease. Males' larger height and limb length, as well as differences in anatomical and physiological characteristics, can be used to explain the gender impact. Males have thicker subcutaneous tissue, which affects velocity[19].

CONCLUSION:

To conclude, as baseline nerve conduction measurements are dependent on the individual's age, sex, local temperatures, and other anthropometric factors such as hand size and height, it is important to understand the effect of these various factors on the normal values for nerve conduction measurements to aid in identifying abnormal nerve conduction study results.

If these characteristics are not taken into account when diagnosing pathological illnesses, normal people may be labelled abnormal and put on needless medication.

REFERENCES:

1. Preston DC, Shapiro BE. Basic nerve conduction studies. In "Electromyography and Neuromuscular Disorders". Butterworth-Heinemann, 1998, 778.
2. Misulis KE, Head TC. Nerve conduction study and electromyography. In "Essentials of Clinical Neurophysiology" 3rd Ed. Pioli SF (eds). Butterworth-Heinemann 2003;987.
3. Kouyoumdjian JA, zanetta DMT, Monta MPA. Evaluation of age, body mass index and wrist index as risk factors for carpal tunnel syndrome severity. Muscle Nerve; 25(1): 93
4. Evans BA and Daube JR. A comparison of three electrodiagnostic methods in diagnosing carpel tunnel syndrome. Muscle Nerve 1984; 7: 565
5. Stevens JC: AAEM minimonograph 26: the electrodiagnosis of carpal tunnel syndrome. Muscle Nerve 1997; 20: 1477-486
6. Jagga M, Lehri A, Verma SK. Effect of aging and anthropometric measurements on nerve conduction properties - A review. J Exerc Sci Physiother. 2011;7(1):1-10.
7. Salerno DF, Franzblau A, Werner RA, Bromberg MB, Armstrong TJ, Albers JW. Median and ulnar nerve conduction studies among workers: Normative values. Muscle Nerve. 1998;21(8):999-1005
8. Soudmand R, Ward LC, Swift TR. Effect of height on nerve conduction velocity. Neurology. 1982 Apr; 32(4):407-10.
9. Saeed S, Akram M. Impact of anthropometric measures on surely nerve conduction in healthy subjects. J Ayub Med Coll Abbottabad. 2008;20(4):112-4.
10. Bhorania S, Ichaporia RB. Effect of limb dominance on motor nerve conduction. Indian J Physiol Pharmacol. 2009;53(3):279-82.
11. Hennessey WJ, Falco FJ, Goldberg G, et al. Gender and arm length: influence on nerve conduction parameters in the upper limb. Arch Phys Med Rehabil 1994; 75:265-9.
12. S. Saeed, M. Akram. Impact of anthropmetric measures on sural nerve conduction in healthy subjects. J Ayub Med Coll Abbottabad 2008; 20(4).
13. Rivner MH, Swift TR, Crout BO, Rhodes KP. Toward more rational nerve conduction interpretations: the effect of height. Muscle Nerve. 1990 Mar; 13(3):232-9.
14. Thakur D, Jha S, Pandey NK, Jha CB, Bajaj BK, Paudel BH. Influence of height on the nerve conduction study parameters of the peripheral nerves. Journal of Clinical and Diagnostic Research. 2011 Apr, Vol-5(2):260-263
15. Kumari SKR, Kannan U, Patil AB. Influence of age, height, gender on median, and ulnar nerve conduction study. Natl J Physiol Pharm Pharmacol 2018;8(2):202-206
16. Amruta S Bennal, Manohar Y Pattar, R H Taklikar. Effect of Height and BMI on Nerve Conduction Velocity. Indian Journal of Clinical Anatomy and Physiology 2015;2(4):231-234
17. Nawrass Jassim, Hayder Abdulateef, Khalida I. Noel.The Significance of Height on Median and Ulnar Nerves Conduction Parameters in Male Subjects. Open Access Maced J Med Sci. 2022 Feb 02; 10(A):245-247.

18. Soudmand R, Ward LL, Swift TR. Effect of height on nerve conduction velocity. J Acta Neurol. 1982;32(2):407-10.
19. Wadoo OK, Surjit S, Agrawal BK, Monika K, Sangeeta G. Gender effect on upper limb nerve conduction study in healthy individuals of North India. J Pharm Biomed Sci. 2013;33(33):1589-93