Original Article

Gender-Based Comparison of Sensory & Motor Nerve Conduction Velocities among Healthy People of Gadap Town, Karachi

Comparison of Sensory & Motor Nerve Conduction Velocities among Healthy People

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ABSTRACT

Objective: In this study, healthy individuals' nerve conduction velocities (NCVs) in the peripheral sensory (ulnar) and motor (ulnar and personal) systems of the upper and lower limbs were examined in relation to their age and genders.

Study Design: Cross-sectional study

Place and Duration of Study: This study was conducted at the Department of Physiology at Baqai Medical University, Karachi, from January 2017 to July 2017.

Materials and Methods: 500 healthy adult males and females from the local population of Gadap town between the ages of 18 and 45 were enrolled in this study, which was done in the physiology department of the Baqai Medical University. By stimulating the ulnar nerve at the wrist and the peroneal nerve using Power Lab, the NCV of the two nerves was determined. The fundamental parametric values were then examined using the statistical tool "Statistical package for Social science" (SPSS) software version 22.0.

Results: The comparison of NCV on the basis of gender Mean values of ulnar motor and peroneal motor nerves gave statistically significant ($p<0.05$) differences for males and females and non-significant ($p>0.05$) in ulnar sensory nerve.

Conclusion: According to the study male and females had an inverse association with the ulnar sensory, ulnar motor, and peroneal motor nerves.

Key Words: Nerve conduction velocity (NCV), American Association of Neuromuscular and Electro-diagnostic Medicine (AANEM), Normative Data Task Force (NDTF).

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INTRODUCTION

A nerve conduction study (NCS) is a test that is frequently used to assess the electrical conduction capabilities of the motor and sensory nerves in the human body.[1] During the test, it is typical to assess the nerve conduction velocity (NCV), which gauges how rapidly nerves are traversed by electrical impulses.[2] It is commonly employed to identify peripheral nerve system problems. Damage and devastation to the nervous system can be identified using NCS. Other physiological parameters that affect it include age, gender, temperature, BMI, the relative use of the upper and lower extremities, the nerve diameter, myelination, and internodal distance. Consequently, a specific nerve's reference value cannot be determined globally, [1,2,3] As a result, there is no one reference value for a given nerve that takes global climate fluctuation into account. As a result, various areas and laboratories have their own standard reference values. [3,4] By observing the generated response to electrical stimulation of peripheral nerves, NCS is a crucial method for estimating peripheral nerve functioning. [5] Nerve impulses can be triggered by enough stimulation from an electrical stimulator. Electrical impulses from nerve fibers travel at a rate of 100 m/s once the action potential threshold is crossed, and the velocity is inversely related to temperature and the width of the myelin sheath around the fiber. [6,7] Conduction velocity and latency, two NCS parameters, measure the speed of nerve impulse propagation and assess how demyelinating illnesses affect the ability of motor and sensory nerves to transmit electrical signals. Amplitude, which measures the quantity of active nerve

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fibers, is diminished under conditions that lead to axonal degeneration. [8]

This technique, which records the evoked response to electrical stimulation of peripheral nerves, is regarded as the gold standard in clinical assessment of motor and sensory functions. It aids in determining the size and location of the neural lesions and measures how much nerve damage there is to differentiate between demyelination and axonal degeneration, two major peripheral nerve diseases.[9] The locations of the stimulation and recording sites as well as the distances between these locations are clearly described in normative papers. [10]

These investigations have been employed in clinical settings for many years to identify the sites of peripheral nerve illnesses inside a single nerve, along the length of nerves, as well as to distinguish between disorders of muscles and neuromuscular junctions. They also help in accurately characterizing the functioning of peripheral nerves and locating the locations of the lesions. [8,11] Late-life weakness is associated with poor physical function, mobility impairment, hospitalization, and mortality. Investigating the risk factors for strength reduction in older persons is crucial given its significant impact on late-life outcomes. [12] Maintaining or growing muscle mass does not ensure protection of strength loss with ageing, even if age-related muscle atrophy plays a significant part in diminishing strength. [12] Later in life, as adults, the nerve velocity slows down with age, more so in the lower limbs than the upper, as NCS primarily focuses on the evaluation of three different types of nerves: motor, sensory, and mixed. [12]

Power Lab will be the tool used in the investigation. It is an HTML-based software application that regulates the sampling, digitizing, and archiving of experimental data as well as their display, manipulation, and analysis. [4]

Nerve conduction studies (NCS) can be used to assess the health and function of peripheral nerves. Demyelination and axonal degeneration are the two main categories of peripheral nerve illnesses that are distinguished by NCS, which aids in defining the amount and distribution of neural lesions. [1] These techniques have been steadily improved upon, and they have been standardized, making them reliable testing in clinical settings.

MATERIALS AND METHODS

This study was conducted in the Department of Physiology at Baqai Medical University, Karachi, from January 2017 to July 2017 utilizing a comparative cross-sectional, analytical method using a dual bioamplifier from the Power lab 8/30 series by AD Instruments Australia (Model No. ML870). The Baqai Medical University Ethical Committee gave their approval for this investigation. 500 people between the ages of 18 and 45 made up the study's subjects, including 250 men and 250 women from the Gadap town's local population.

Sample Technique: An appropriate sampling method was used.

Electrophysiological Methods: Power Lab, an HTML-based software programmer, was used to conduct all of the tests. Its basic hardware unit is a multichannel recording instrument for the measurement of electrical signals and includes an isolated stimulator for electrical stimulation of nerve and muscle as well as integrated two channel Bio Amplifiers for the best recording of biological signals. [4,10,11] The orthodromic approach is more appropriate for near-nerve recording. The NDTF suggests using predetermined fixed distances and precise electrode placement rather than anatomical markers. [13]

Analysis:

1. Calculate and note the distance between the wrist and elbow markers. The separation between stimulation sites is shown here.
2. Two locations along the nerve that are at least 10 cm apart from one another will be stimulated in order to determine the conduction velocity.
3. To get the conduction velocity, divide the difference between the onsets latencies obtained at the two locations by their separation. The speed is determined in meters per second.
4. To determine the latency of a single waveform in the Lab Tutor panel, follow the same procedures as those described for wrist stimulation.
5. Enter the value of the latency in the table.

Conduction velocity = ___Distance (cm)____X 10

- Latency 2 — Latency 1 (m/sec)
- The formula-derived nerve conduction velocity will be represented in meters/second.

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

RESULTS

Table I revealed that among the 500 total samples, 50% of the male respondents and 50% of the female respondents had mean ages and standard deviations of 47.50 8.47 years and 37.01 10.2 years, respectively.

Table No.1: Demographic factors and BMI distribution in Males and females

Characteristics	Males (n=250) Mean ± SD	Female (n=250) Mean ± SD	p-Value
Age (Years)	47.50±8.47	37.01±10.2	<0.01*
Height (cms)	165.89±8.8	158±8.2	<0.01*
Weight (Kg)	65.09±9.1	58.38±10.4	<0.01*

According to Table II's comparison of the genders, there is a significant mean difference between males and females for the ulnar motor nerve and peroneal motor nerve with a p-value of less than 0.05.

Table No.2: Nerve Responses distribution on the basis of gender

Nerve(s)	Gender	Mean ± SD (m/sec)	p-value
Ulnar Sensory Nerve	Male	56.22 ± 4.36	0.34
	Female	55.88 ± 3.49	
Ulnar Motor Nerve	Male	55.17 ± 6.31	0.03*
	Female	54.03 ± 5.75	
Peroneal Motor Nerve	Male	49.23 ± 4.1	<0.01*
	Female	48.24 ± 4.31	

*P<0.05 considered significant using independent sample t-test

DISCUSSION

On peripheral nerves, nerve conduction velocities (NCVs) can be quickly determined. Nerve impulses can be triggered by enough stimulation from an electrical stimulator. A nerve fiber's electrical impulses will spread at a rate of 100 meters per second if the action potential threshold is crossed.[14] The diameter of the myelinated fibers directly affects the velocity. Therefore, the purpose of this study is to examine how age and height affect the NCVs of the ulnar sensory, ulnar motor, and peroneal motor nerves in healthy local volunteers. Peroneal NCV showed an inverse correlation with height and estimated axonal length, but no discernible correlation with median motor or sensory NCV.[23] Numerous studies have been conducted in the past to assess how anthropometric parameters like age and height affect nerve velocities. [15] However, the majority of these studies used data from people in the west. Therefore, a goal of our research is to determine how age and height affect the conduction rates of the ulnar sensory, ulnar motor and peroneal nerves.

The crucial technique of nerve conduction studies, which has received extensive validation, is employed in clinical practice. [16] Numerous research and reviews on nerve conduction studies have been released. These include the elements that have an impact on nerve speeds. These variables can be broken down into biological variables (age, height, and gender) and physical variables that have to do with the health of the nerve and muscle. [17] Our main concern was how age and height, two biological parameters, affected NCV. Most neurophysiology laboratories maintained other parameters, including temperature, at the optimal level in order to minimize variability. Age has a considerable impact on sensory nerve conduction, according to one study [18]. At birth, the conduction velocity is roughly 50% of adult values; it then gradually rises until it reaches adult values by the time a child reaches the age of three. The nerve velocity slows down as people get older, more so in the lower limbs than the upper. Another study [19] for motor nerve conduction made a similar finding. In their investigation on the impact of ageing on sensory NCV, Amato AA et al [20] found that the median nerve changed characteristics at a substantially faster rate than the ulnar nerve. Our research revealed that the peroneal motor and ulnar sensory nerves slowed down as people aged. Similar findings were made with the ulnar nerve's motor and sensory velocities. [21] We Numerous investigations have demonstrated that taller persons have considerably slower NCV, both motor and sensory. Peroneal nerve conduction velocities were found to be inversely connected with height but median nerve (both motor and sensory) NCV showed no significant association with height. It is anticipated that the velocity reduces by 2-3 m/s per 100mm in height. While comparing NCVs in the median and ulnar nerves across various height groups, we were unable to find any clear trend. [24] With increasing height, we saw that NCVs in the common peroneal nerve slowed down. The sural nerve, however, did not show any observable pattern.

CONCLUSION

In conclusion, conduction velocities can be impacted by height and age. Across various age groups and heights, we noticed a decrease in the median, ulnar (apart from sensory conduction), common peroneal, and sural nerves' velocities. To understand the discrepancy in the pattern of conduction velocities among various height groups in these participants, additional research is required. It is statistically significant that nerve conduction velocity decreases with height.

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Author's Contribution:

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Conflict of Interest: The study has no conflict of interest to declare by any author.

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