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Research Article

A study on median nerve conduction velocity in different age groups

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ABSTRACT

Background: Nerve Conduction Velocity (NCS) is a test to measure the speed and electrical activity in a nerve. Physiological factors like age, temperature, height, gender affect the nerve conduction velocity. There is paucity on the data regarding the age group at which these changes become significant. Therefore, the aim of the study was to determine the specific age group at which changes in nerve conduction velocity occurs.
Methods: 103 individuals in the age group of 15-65 years participated in the study. They were grouped into, Group I in the age group of 15-30 (n=40) years, Group II 31-45 years (n=31), Group III 46-60 years (n=32). Median motor and sensory conduction velocity were determined.
Results: There was a significant correlation between age and median motor (p=0) and sensory (p=0) conduction velocities. There was a significant decreasing trend observed in Group III.
Conclusions: Age has definite correlation with the NCS in median motor and sensory nerves. It is essential to have reference values with relation to age.

Keywords: Aging, Median nerve, Nerve conduction velocity

INTRODUCTION

Nerve Conduction Study (NCS) is a test that measures the speed and strength of electrical activity in a nerve. The test can gather information about the structure and function of both muscle and nerve. The conduction velocity of the nerve depends on the fiber diameter, degree of myelination and the inter nodal distance. Other physiological factors such as age, temperature, height and gender affect the nerve conduction study.[1]

Aging is the process that is often accompanied by changes which include slowing in muscle contractility, alteration in muscle metabolism and neuromuscular junction and reduction in nerve conduction velocity. Studies have proved that the motor and sensory conduction velocities in new born were 40% to 50% of adult values and at 3 years of age the normal values were in the adult range for all motor and sensory nerve conduction velocity.[2] Awang et al.[3] observed that conduction velocity reduction with age was not very significant. Though it is agreed that aging alters nerve conduction studies, it does not clearly define the age group at which these changes occur. Thus the purpose of this study was to study the effect of aging on nerve conduction studies of median nerves among healthy south Indian subjects and to determine the age group in which there is a significant change in the values.

METHODS

This study was done at the Institute of Physiology ad Experimental Medicine, Madras Medical College, Chennai after obtaining the institute ethical committee

clearance. Informed written consent was obtained. 103 individuals of both sexes in the age group of 15 to 65 were recruited for the study. Individuals with history of any neurological illness, diabetes mellitus, hypertension, thyroid disorders, alcoholics, smokers' obesity, leprosy were excluded from the study. They were divided into 3 groups. Group I in the age group of 15-30 (n=40) years, Group II 31-45 years (n=31), Group III 46-60 years (n=32). Dietary and personal history was ascertained. Detailed general examination and systemic examination was done. Subjects were made comfortable and the procedure properly explained. Any doubts were clarified and only those who volunteered were included in the study. The neurophysiological study consisted of motor and sensory nerve conduction study of the median nerve. They were made to sit comfortably on a wooden stool and nerve conduction study was done using RMS EMG MKII equipment. Temperature was maintained constant at 21°C-26°C. Median motor nerve conduction velocity was tested using surface electrode. The recording electrode was placed close to motor point of abductor pollicis brevis and the reference electrode 3 cm distal to first metacarpo phalangeal joint. After recording from each stimulation site, the latency was measured from the stimulus artefact to the first negative deflection from the baseline. The distance was then measured between each stimulation point, cathode stimulation point to cathode stimulating point. Dividing the distance between two stimulation points by the latency difference of the related response, conduction velocity was determined of that segment of nerve in m/sec.[1] Latency, nerve conduction velocity were measured. Ring electrodes were used to test the sensory nerve conduction velocity with the recording electrode at proximal interphalangeal joint of index finger and the reference at distal interphalangeal joint of index finger. All data were entered and analyzed using SPSS software version 17. The mean values of the three age groups were compared using one way ANOVA tests.

RESULTS

A total of 103 subjects participated in the study, of which 56 were females and 47 males. They were divided into 3 groups. Group I in the age group of 15-30 (n=40) years, Group II - 31-45 years (n=31), Group III 46-60 years (n=32). The mean age of females in the study population was 35.8±18 and males was 35.6±15.3 in the study population. The mean BMI of the subjects (females 22.63±0.6, males 22.62±0.5). There was no significant difference in the gender and BMI of the population studied. Comparison between the age groups, one-way ANOVA was performed and P value less than 0.05, was considered as significant. Table 1 shows the difference in the Median motor conduction velocity and latency difference between the age groups. The difference in the sensory nerve conduction velocity is shown in Table 2. Karl Pearson's correlation was used to assess the correlation between nerve conduction velocity and age. The correlation between age and the conduction velocity in median motor and median sensory nerve is depicted in Figure 1 and 2 respectively. There was a significant negative correlation between age and both median motor and sensory nerve with R value of -0.408 and -0.537.

Table 1: Comparison of median motor nerve conduction velocity between the three age groups.

Median nerve (motor)	Group I Mean±SD	Group II Mean±SD	Group III Mean±SD	Significance
Latency difference	3.95±5	4.21±0.6	3.95±0.6	P=0.09
Conduction velocity	59.47±3.3	56.7±1.1	52.8±4.3	P=0.000*

*P<0.05 significance

Table 2: Comparison of median sensory nerve conduction velocity between the three age groups.

Median nerve (motor)	Group I Mean±SD	Group II Mean±SD	Group III Mean±SD	Significance
Latency difference	2.27±0.4	2.5±0.2	2.7±0.6	P=0.001*
Conduction velocity	64.4±6.8	60.24±5.7	54.5±7.5	P=0.000*

*P<0.05 significance

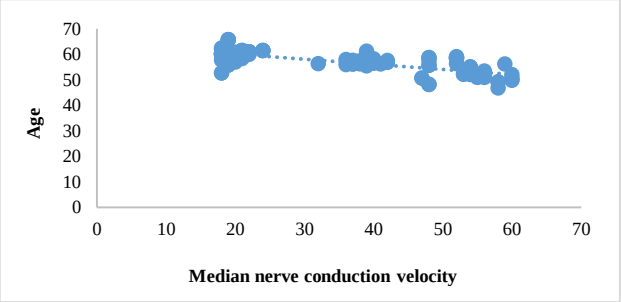

Figure 1: Correlation between age and median nerve (motor) conduction velocity.

Pearson correlation: r = -0.408; P = 0.000; (Highly significant)

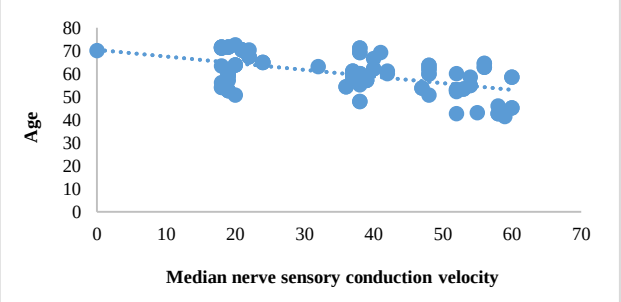

Figure 2: Correlation between age and median nerve (sensory) conduction velocity.

Pearson correlation: r = -0.537; P = 0.000; (Highly significant)

DISCUSSION

A nerve conduction study is a test commonly used to evaluate the function of the motor and sensory nerves of the human body. It measures how quickly electrical impulses move along a nerve. Aging is defined as a progressive, generalized impairment of function resulting in loss of adaptive response to stress and growing risk of age related diseases.[4]

This study aimed at finding the relation between age and the median nerve conduction velocity both sensory and motor components. We observed a significant reduction in median sensory nerve conduction velocity with aging. The results related well with the study by Tong et al.[5] who in his prospective cohort study found median sensory velocities to decrease at a rate of 0.14 m/a per year of age, and Werner et al.[6] observed a decrease in conduction velocity at a rate of 0.41 m/s per.

Awang et al.[3] revealed that there was no significant reduction in median sensory conduction speeds across different age groups and he also observed a significant reduction in median motor conduction velocity with increasing age. Our results were similar to the study of Henry et al. who observed a significant reduction in the motor median nerve conduction velocity at 50 years and above as compared to subjects of age 20-30 years.

Flaco et al.[7] have shown a 10% reduction in the conduction rate at 60 years of age. We had grouped our subjects into three groups based on age. Comparing the conduction velocities between the three age groups the decreasing trend was well observed in the age group of ≥46 years.

Hence it is evident that the values start decreasing as early as 40 years. Similar findings were reported by studies[8,9] which states that conduction velocity begins to decline after 30-40 years of age, but the values normally changes by less than 10 m/s by the sixtieth years, or even the eightieth years. The decline in nerve conduction and rise in sensory latency with increasing age may be due to loss of myelinated and unmyelinated nerve fibers in peripheral nerves with aging.[10]

Extraneous factors like malnutrition, disuse, circulatory impairment may also be the reason for the delay in nerve conduction.[11] Age has definite effects on duration of motor and sensory nerves Different nerves have different timing of aging. Without adjustment for age, the sensitivity and specificity of nerve conduction study will decrease when using the same reference data in patients with different age.[12]

Interestingly we also noted that the voltage of electrical stimulus needed to record a threshold action potential was found to increase with advancing age. In group III an electrical stimulus of 40-50 mV was needed in comparison to group I who needed 15-25 mV. The reason for the decreased excitability and conduction velocity of the nerves can be explained by the hypothesis stating that oxygen free radicals increases with aging which damages the enzyme systems in the mitochondria leading to a decrease in ATP production resulting in slowing of muscle contraction, alteration in muscle metabolism, neuromuscular junction. Thus it is essential to have reference values for the different age groups while conducting nerve conduction studies.

In conclusion, age can affect both sensory and motor conduction velocity of median nerve.

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