

RESEARCH ARTICLE

Influence of age and body mass index on nerve conduction velocity in median nerve and relation among them in the healthy population of Indore region

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ABSTRACT

Background: Nerve conduction studies (NCS) deal with the method to work on the nerve conduction velocities (NCVs) which are being capable of finding nerve lesion. NCS aids in finding nerve lesion and situations where muscles get influenced by it. There are many differences in values for NCV in different nerves in relation to geographical location and other biological factors, i.e., age, sex, and body mass index (BMI). Hence, these factors should be considered during NCS as such factors differ from place to place. **Aims and Objective:** The main purpose for doing this study was to find the influence of age and BMI on nerve conduction in the median nerve along with how they are correlated to each other. **Materials and Methods:** Around 118 normal individuals between the ages of 20 and 60 years, without any nerve lesion, were tested at index medical college, a tertiary care center, Indore. Statistical figures were described using the Statistical Package for the Social Sciences 20.0 model. **Results:** Mean NCV rises early around 20–30 years and 31–40 years, following a fall with increasing age as well as BMI. It was discovered that NCV proportionally associated with rising BMI with statistically significant ($P < 0.05$). **Conclusion:** The nerve conduction of peripheral nerves could help to evaluate peripheral nerve lesion. Age and BMI have a definitive effect on NCV. Hence, all these biological factors should be considered during interpretation of nerve conduction disorders.

KEY WORDS: Nerve Conduction Studies; Net Calorific Value; Median Nerve; Body Mass Index; Age; Sex

INTRODUCTION

Nerve conduction study (NCS) is developing as an important measuring device for confirmation of neurological disorders.^[1] Influence of age, body mass index (BMI), and temperature on NCS is well recognized.^[2] However, this influence might vary

with different geographic region. Several studies evaluated the influence of age and BMI on nerve conduction many of which are based on Caucasian subjects.^[3] NCS enables neurophysicians in comparing two different types of nerve disorder, namely demyelination and axonal degeneration.^[4,5] Presently, similar normative values were used for thin as well as obese subjects during interpretation of NCS which may not be appropriate. Hence, there is a need to evaluate the influence of these variables on NCS.

Peripheral nerve, i.e., median was chosen for nerve conduction velocity (NCV) as it is easily accessible and easy to evaluate also. Stimulation of this nerve through slow velocity electric current by putting the electrodes to the skin

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surface generates nerve impulses.^[6] The NCV has different components: (a) Motor NCS, (b) Sensory NCS, (c) H-reflex, and (d) F-wave.^[7]

Different studies done before have shown the impact of biological factors on NCV. However, we could not find any study done before in this urban region of Indore. This study was, therefore, designed to study the NCV in median nerve in normal individuals of this community and examine the affect of biological factors such as age and BMI to it along with how they are correlated to each other.

Objectives

The objectives of the study were to effect of age and BMI on NCV in the median motor nerve and to find correlation among them.

MATERIALS AND METHODS

These studies were performed in the Department of Physiology, Index Medical College, a tertiary center. This study is a cross-sectional study done after the Institutional Ethical Committee approval. This study has been done on 118 volunteers measured from Statistical Package for the Social Sciences (SPSS), model 20.

Preference Norms

Individuals between age groups (20 and 60) years, with no nerve abnormality.

Nonpreference Norms

1. Individuals with neurological or neuromuscular transmission abnormality
2. Individuals having diabetes or renal disorder
3. Individuals having any myopathy.^[8]

The participants were separated into four groups of males and females based on their ages for a comparative assessment. Category-1 consists age 20–30 years consisting of 51 volunteers; Category-2 consists 31–40 years consists 22 volunteers; Category-3 consists 41–50 years consisting of 25 volunteers, and Category-4 consists 51–60 years consisting of 20 volunteers.

Tools for Testing and Procedure

All measurements have been performed with the help of standard channel two physiograph having JAVA ALERON-202 model. NCS were done in peaceful setting with room temperature around 28–29°C. Participants were made relaxed at the laboratory setup by sitting quietly for 30 min. In median nerve, the active electrode surface was put on the motor point of abductor pollicis brevis in the upper

third of thenar eminence of the first metacarpophalangeal joint, and stimulating electrode was put near the antecubital fossa, and away from wrist and ground electrode was put at the back of the palm.

Right Median Nerve

It runs through the forearm flexors and thenar muscles, palmer surface of thumb, index, middle, and half of ring fingers.^[9]

Location

This procedure was done on lying subjects in an upright posture.

1. Active electrode: Placed halfway in between the center-point of distal wrist crease and first metacarpophalangeal joint.
2. Reference electrode: Placed closely distal to first metacarpophalangeal joint.
3. Machine setting: Sensitivity – 10 mv/division, low-frequency filter – 20 HZ, and high-frequency filter – 3 KHz, and sweep speed – 10 ms/division.^[10]

Statistical Methods

The data analysis was done using Z-test and Shapiro-Walk test with two samples mean and coefficient of correlation.

RESULTS

Age

Table 1 shows this result as on comparing the age and NCV of Category 1 versus Category 2, Category 3, and Category 4.

1. Age: The mean age for the age Category 2 (30–40), age Category 3 (40–50), and age Category 4 (50–60) was more than that of age Category 1 (20–30) with $P < 0.05$ which was found to be statistically significant.
2. NCV of rt. median nerve elbow-wrist portion: The mean NCV in age Category 1 > age Category 2, age Category 3, and age Category 4 with $P < 0.05$ which is statistically significant.

Table 2 shows the negative correlation between age and NCV with $r = 0.25$, $P = 0.01$ which is statistically significant.

BMI

Table 3 shows a fall in NCV of the elbow-wrist part with the rise in mean BMI. The mean BMI of age Category 2 >

Table 1: Different age category along with their mean age and NCV-e-w for that age category

Parameter	Cat.1	Cat.2	Cat.3	Cat.4
Age	22.057	34.739	45.88	56
NCV-e-w	72.3	56.6	55.6	54.6

NCV: Nerve conduction velocity

Table 2: Correlation of age and NCV

Parameter	No	Mean	Std. error of mean	SD
Age	118	35.64	1.18	12.89
NCV	118	64.55	1.30	14.20

$r=0.25$, $P=0.01$ negative correlation but statistically significant,
NCV: Nerve conduction velocity

Table 3: Variation in NCV with different BMI

Category	(Mean±SD)	NCV (Mean±SD)
1	21.27±4.09	29.6798.36 (72.3±21.3)
2	22.84±2.20	31.8561.25 (55.5±22.8)
3	23.06±7.32	30.9357.15 (53.5±16.5)
4	24.85±5.11	43.2977.92 (52.0±14.4)

NCV: Nerve conduction velocity, SD: Standard deviation, BMI: Body mass index

Table 4: Correlation of BMI and NCV

Parameter	No	Mean	Std. error of mean	SD
BMI	118	23.4	0.36	3.94
NCV	118	64.55	1.30	14.20

$r=0.74$ ($P=0.01$) negative correlation statistically significant,
NCV: Nerve conduction velocity, SD: Standard deviation,
BMI: Body mass index

age Category 1 with $P = 0.111$ which is non-significant while mean BMI for age Category 3 and age Category 4 > age Category 1, with $P = 0.023$ and 0.004 , respectively, is statistically significant. The mean NCV of age for category1>category2, category3 & category4 with $p<0.05$ which is statistically significant. Table 4 shows a negative correlation which is statistically significant shown by Shapiro-Wilk test between BMI and NCV.

DISCUSSION

Present work has been done to obtain the reference data for NCS in rt. median nerve in healthy subjects along with the influence of age and BMI to it in Indore district of Madhya Pradesh. Our study had been done on 118 normal humans and establishes a strong negative correlation to biological factors, i.e., age and BMI. Outcome of various studied describes the significance of relations.

Age

The outcome of 118 testing work shows that NCV falls with age. The fall in NCV may be due to less number of nerve fibers and decrease in fiber breadth. Furthermore, previous works showed that age influences NCS in extreme of age. The influence of age is seen much relevant since delivery to 1 year when myelination has not completed yet. Newly born baby, the nerve conduction is appropriately 50% of adult values. In 1 year of age, the nerve conduction reaches 75% and by

3–5 years, myelination is complete, and nerve conduction is comparable with adult reference data.^[11] However, the nerve conduction differs by <10 m/s by 60th year or even 80th year.^[12] A study has found a fall of 0.13 m/s/year.^[2]

In contrast, the result of present work in the adults between 20 and 60 years, the nerve conduction in elbow-wrist portion is less than Chouhan^[13] but more than Ginzburg *et al.*^[14] and Kimura *et al.*^[15] The NCV of adult falls with age, it begins to fall at a rate of 1.5%, faster in the upper limb than the lower limb. There is an association of slow loss of neuron with increasing age. A similar survey was discovered by Flack and Stalberg for motor NCV.^[16] While Tong *et al.*^[17] noted in their study on the effect of aging that the rate of change in NCV was greater in median nerve than ulnar nerve. In support Awang *et al.*^[18] found non-significant effect of age on NCV except for the median nerve.

BMI

Our works show the finding that the median motor nerve conduction had a significant inverse association with BMI. It might be due to fatty subcutaneous tissue in the person with increasing BMI. The adipose tissue in epineurium may be related to the amount of body fat,^[19] although its true that the amount of such fat may affect the nerve conduction. Our findings are in contrast with Baqai *et al.*^[20] who reported no effect of BMI on NCS. However, our survey is in favor of Awang *et al.*^[18] who found a fall of NCV with rising BMI in the median nerve.

In the present study, we found the influence of BMI greater in nerve conduction study which is statistically significant. In contrast Sachin *et al.*^[21] found the influence of BMI greater on sensory nerve conduction in comparison to median motor nerve study which was statistically non-significant.

Age and BMI influence the median NCV; the correlation is found to be negative but statistically significant. Hence, the given biological factors should be taken into consideration while interpreting diseased neurological situations; otherwise, normal persons may be considered as diseased and they will have unnecessary medication.

CONCLUSION

In light of the results obtained in our study, it can be considered that age with NCV and BMI with NCV are proportional to each other. So this, the phenomenon might be used for diagnosing the neurological and associated pathological conditions.

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