 DOI: 10.18231/2394-2126.2017.0014

Relation of conduction velocity of peripheral nerves to body mass index in right handed and left handed subjects

Sunil K. Rayan[1], Pandurang M. Narhare[2,*]

[1]Assistant Professor, Kamineni Institute of Medical sciences, Narketpally, Telangana, [2]Professor, Dept. of Physiology, ESIC Medical College, Sanathnagar, Hyderabad

***Corresponding Author:**
Email: drpandurang28@gmail.com

Abstract

Background and Objectives: In the past few decades, major changes have taken place in the field of peripheral nerve studies especially in the relation to its ultrastructure, histochemistry, neurophysiology and axonal transport system. Wide spread interest in disorders of peripheral nervous system, which has emerged in recent years and introduction of various new investigating techniques like nerve conduction studies. The objective of present study was to assess the relation of body mass index to median nerve conduction velocity in right and left handed subjects.

Methods: Hundred healthy individuals (50 right handed and 50 left handed) in the age group of 18-24 years were included in the study. The body weight of the subjects was measured using a pedestal type of weighing scale with a maximum capacity of 150 kg. The body weight was considered to the nearest of 0.1 kg. Height without footwear was measured using a vertical scale (Avery, India) with an accuracy 0.5 cm and was rounded to the nearest 0.01 m. Body Mass Index (BMI) was calculated from Height and weight. Median nerve conduction velocity was measured using Computerized Nerve Conduction Velocity Equipment (Neurocare^{TM}-2000 manufactured by Biotech^{TM}), Mumbai, India.

Result: The mean age of the right handed subjects was 22.28 ± 1.97 and 22.7 ± 1.66 in left handed subjects involved in the study. The mean height of right handed subjects was 160 ± 11.54 and 161.92 ± 13.03 in left handed subjects. Mean weight of right handed subjects was 57.76 ± 12.02 and 60.66 ± 15.69 in left handed subjects. Mean body mass index of right handed subjects was 23.36 ± 4.23 and 22.54 ± 4.32 in left handed subjects. A negative correlation was seen with BMI and median NCV in right handed subjects for right median nerve ($r = - 0.334$, $p<0.05$) and left median nerve ($r = -0.406$, $p<0.05$). A negative correlation was seen with BMI and median NCV in left handed subjects for right median nerve ($r = -0.314$, $p<0.05$) and left median nerve ($r = -0.406$, $p <0.05$).

Conclusion: In conclusion, BMI can affect the conduction velocities. We observed reduction in conduction velocities of the median nerve in right handed and left handed subjects with respect to body mass index.

Keywords: Anthropometry, Body Mass Index, Peripheral Nerve Conduction, Right Handedness, Left Handedness.

Introduction

In everyday life we use the hands in most of our goal directed object oriented actions.

Primary functions of the hand are to reach, grasp and manipulate objects and to perform haptic exploration. One hallmark of the human hand is its ability to effectively use objects as tools to extend the capacity of the hand; a skill that requires that the tool becomes integrated functionally in our body. Most people show hand preference in many tasks and consider themselves as right or left handed. The phenomenon of handedness has been the focus of several studies[(1-5)] Also in many bimanual situations the two hands tend to have specific roles to complete the task. The dominant hand is often considered taking a leading role and the "sub-dominant" hand a more postural and supporting role.[(6)]

In the past few decades, major changes have taken place in the field of peripheral nerve studies especially in the relation to its ultrastructure, histochemistry, neurophysiology and axonal transport system.

The conduction velocity of the nerve depends on the fibre diameter, degree of myelination and the inter-nodal distance. Other factors such as age, temperature, height, gender etc. are the physiological variables affecting nerve conduction study.[(7)]

So the objective of this study was to assess relation of nerve conduction velocity of peripheral nerves to body mass index in right and left handed subjects.

Materials & Methods

The present study was conducted in the Department of Physiology, Kamineni Institute of Medical Sciences, Narketpally, Nalgonda District, Telangana between August 2014 to August 2015.

Study Design: It is a randomized controlled trial to assess relation of nerve conduction velocity of peripheral nerves to body mass index in right and left handed subjects.

Hundred healthy individuals (50 right handed and 50 left handed) in the age group of 18-24 years were included in the study.

Materials used in the study 1. Pedestal type weighing Scale with maximum capacity of 150 kg. 2. Vertical Scale Stadiometer (Avery, India) for measurement of height 3. Computerized Nerve Conduction Velocity Equipment (Neurocare^{TM}-2000 manufactured by Biotech^{TM}, Mumbai, India.

Inclusion Criteria:

1. Age between 18 to 24 years, non-athlete,

2. Apparently healthy subjects after thorough clinical examination.

Exclusion Criteria:

1. Not ready to participate voluntarily
2. Age below 18 years and above 24 years
3. History of metabolic or cardiovascular diseases, alcoholism, smoking, neurological abnormalities like Compression neuropathy, Symptoms of abnormal sensation or numbness, Peripheral nerve injury, Radiculopathy, Cervical spondylosis and unstable body weight (change of >1% within the month before the study) etc.

Methodology: All the individuals were screened for eligibility and informed consent was taken and randomized to attend on particular dates for diagnostic evaluation. Institutional Ethics Committee approval was taken for the study.

Demographic and Anthropometric parameters were obtained before the diagnostic evaluation. Assessment was done between 10:30 AM and 1:30 PM. The subjects were instructed to have light breakfast without tea, coffee etc.

The body weight of the subjects was measured using a pedestal type of weighing scale with a maximum capacity of 150 kg. The body weight was considered to the nearest of 0.1 kg. Height without footwear was measured using a vertical scale (Avery, India) with an accuracy 0.5 cm and was rounded to the nearest 0.01 m. Body Mass Index (BMI) was calculated from Height and weight using formula-

BMI = weight (kg) / height squared (m^2)

Median nerve conduction velocity was measured in supine position in resting condition.

Median Nerve Conduction Velocity [NCV] was measured following all the precautions in right and left handed subjects using Neurocare^{TM} –2000 Computerized NCV Equipment manufactured by Biotech^{TM}, Mumbai, India.

Median Nerve Conduction Velocity [MNCV] =

$$\frac{\text{Distance between proximal and distal stimulation in mm}}{\text{Proximal latency} - \text{Distal latency}}$$

Statistical Analysis:

1. All Data are expressed as mean ± SD
2. Correlation coefficient (r) between BMI and Median Nerve Conduction Velocity in both hands of the subjects involved in the study.

Results

As depicted in Table 1, the mean age of the right handed subjects was 22.28 ± 1.97 and in left handed subjects 22.7 ± 1.66. The anthropometric parameters were slightly higher in left handed subjects than right handed subjects.

As depicted in Table 2 and Graph 1 & 2, A negative correlation was seen with BMI and median NCV in right handed subjects for right median nerve (r = - 0.334, p <0.05) and left median nerve (r = -0.406, p <0.05).

As depicted in Table 2 and Graph 3 & 4, A negative correlation was seen with BMI and median NCV in left handed subjects for right median nerve (r = - 0.314, p < 0.05) and left median nerve (r = -0.406, p < 0.05).

Table 1: Anthropometric Characteristics of the subjects involved in the study

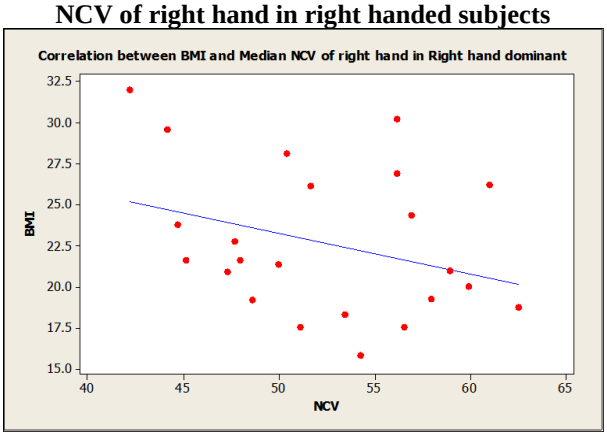
Characteristic	Left handed Subjects (n-50)	Right handed subjects (n-50)
Age (in years)	22.7 ± 1.66	22.28 ± 1.97
Sex (M / F) (n)	29 / 21	26 / 24
Height (cm)	161.92 ± 13.03	160.2 ± 11.54
Weight (Kg)	60.66 ± 15.69	57.76 ± 12.02
BMI	23.36 ± 4.23	22.54 ± 4.32

Table 2: Correlation coefficient (r) between BMI and Median NCV in both hands

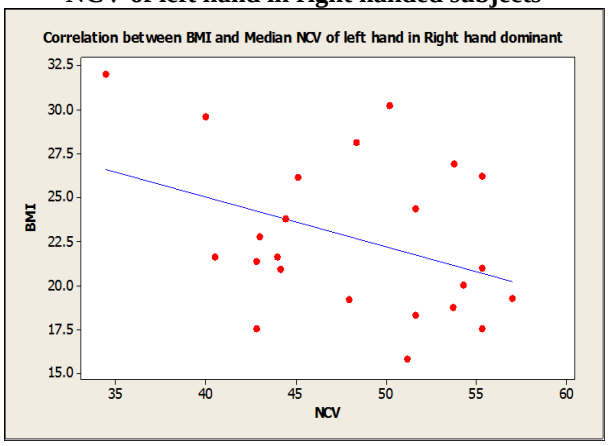
Dominant hand	Right median nerve	Left median nerve
Right handed – NCV	52.86 ± 5.79	48.77 ± 6.21
r	-0.334	-0.406
p-value	0.018	0.003
Left handed – NCV	51.82 ± 6.23	56.33 ± 5.99
r	-0.314	-0.281
p-value	0.026	0.048

p <0.05 – Significant

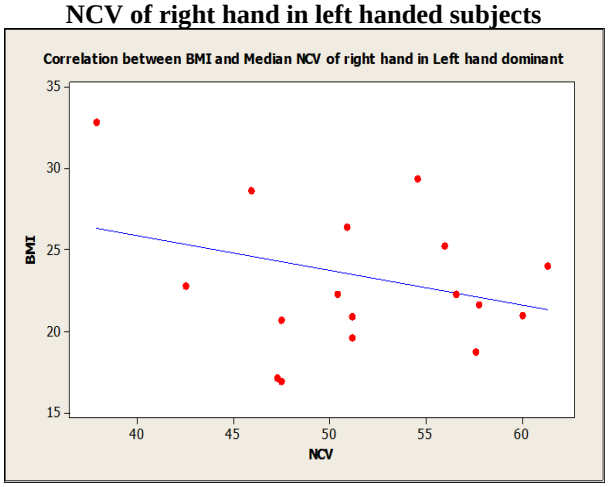
Graph 1: Correlation between BMI and Median NCV of right hand in right handed subjects



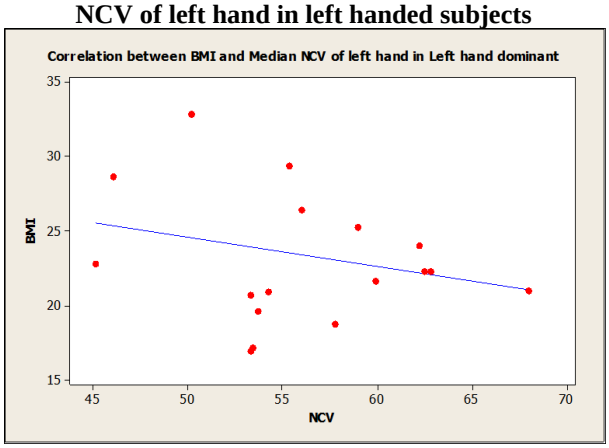
Graph 2: Correlation between BMI and Median NCV of left hand in right handed subjects



Graph 3: Correlation between BMI and Median NCV of right hand in left handed subjects



Graph 4: Correlation between BMI and Median NCV of left hand in left handed subjects



Discussion

Our study showed that strong negative correlation to BMI in both upper limbs of both right handed and left handed groups.

Sensory conduction velocity in left median nerve was significantly higher in left handed subjects. Sensory conduction velocity in right median nerve was lower in left handed subjects compared with right handed ones.

Finding of our study keeps with Navin Gupta et al[8] and Tayade M.C. et al[9] who showed Sensory conduction velocity in both right and left median nerve was significantly higher in left handers as compared with right handers.

Our study is in accordance with the study of Pardaman Singh, B. K. Maini and Inderbir Singh (1977) who found that the conduction velocity to be faster on the right side in the majority of right handed subjects and on the left side in left handed subjects.[10]

Also our study is keeping with Anuradha et al (1990) who showed a definite relationship between limb dominance and median nerve conduction although the results are not so clear in case of other nerves. The reason may be purely anatomical in that the median nerve has greater dermato-myotomal distribution than the other upper limb peripheral nerve.[11]

The findings of our study are in contrast with Buschbacher RM[12] who concluded that there was no correlation between BMI and NCV. We found slowing of NCV with respect to BMI. The median nerve sensory conduction showed reduction in the velocities with increasing BMI. This could be due to amplitude attenuation by thicker subcutaneous tissues in the persons with higher BMI.

Our observation is in agreement with Awang MS et al[13] who also observed slowing of nerve conduction velocity with increasing BMI in median nerve.

Limitations

We have not assessed role of body composition and the contribution of body fat percentage to the nerve conduction. Also studies related to motor nerve conduction should be undertaken, to properly ascertain the effect of BMI on nerve conduction velocity in peripheral nerves.

Conclusion

In conclusion weight and BMI can affect the conduction velocities. We observed reduction in conduction velocities of the median nerve in right handed and left handed subjects with respect to body mass index.

Acknowledgement

Authors are thankful to the volunteers involved in the study.

References

1. Oldfield RC. The assessment and analysis of handedness: the Edinburgh inventory. Neuropsychologia. 1971;9:97-113.
2. Corey DM, Hurley MM, Foundas AL. Right and left handedness defined: a multivariate approach using hand preference and hand performance measures. Neuropsychiatry, Neuropsychology, and Behavioral Neurology. 2001;14:144-152.

3. Franz EA, Rowse A, Ballantine B. Does handedness determine which hand leads in a bimanual task? J Motor Behavior. 2002;34:402-412.
4. Bagesteiro LB, Sainburg RL. Handedness: dominant arm advantages in control of limb dynamics. Journal of Neurophysiol. 2002;88:2408-2421.
5. Preuss UW, Meisenzahl EM, Frodl T, Zetzsche T, Holder J, Leinsinger G, Hegerl U, Hahn K, Möller HJ. Handedness and corpus callosum morphology. Psychiatry Res. 2002;116:33-42.
6. Wiesendanger M, Serrien DJ. Toward a physiological understanding of human dexterity. News in Physiol Sci2001,16:228-233.
7. Misra UK, Kalita J. Clinical Neurophysiology. Nerve Conduction Study. 2nd edn. New Delhi, Elsevier. 1999;25–28.
8. Navin Gupta, Sharmila Sanyal and Rashmi Babbar. Sensory nerve conduction velocity is greater in left handed persons. Indian J Physiol Pharmacol. 2008;52(2):189–192.
9. Tayade M.C. and Latti R.G. Effect of limb dominance on the nerve conduction studies in healthy subjects. Pravara Med Rev 2011;3(2):31-33.
10. Singh PI, Maini BK, Singh I. Bilateral asymmetry in conduction velocity in the efferent fibers of the median nerve and its relationship to handedness. Ind J Physiol Pharmacol 1977;21:364–368.
11. Sathiamoorthy A, Sathiamoorthy SS. Limb dominance and motor conduction velocity of median and ulnar nerves. Ind J Physiol Pharmacol1990;34:51–53.
12. Buschbacher RM. Body mass index effect on common nerve conduction study measurements. Muscle Nerve 1988;21(11):1398-1404.
13. Awang MS, Abdullah JM, Abdullah MR, Tharakan J, Prasad A, Husin ZA, Hussin AM, Tahir A, Razak SA. Nerve conduction study among healthy Malays. The influence of age, height, and body mass index on Median, ulnar, common peroneal and sural nerves. Malaysian Journal of Medical Sciences 2006;13(2):19–23.