IMPACT OF ANTHROPMETRIC MEASURES ON SURAL NERVE CONDUCTION IN HEALTHY SUBJECTS

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Background: Nerve conduction studies are an invaluable aid to investigate and quantify the physiological activity of peripheral nerves. These include measurement of sensory and motor conduction velocities and latencies of peripheral nerves. These nerve conduction parameters may be affected by anthropometric factors like age, sex, height, weight and BMI. In this observational study the impact of these anthropometric parameters was measured on sensory nerve conduction velocity (SNCV) and sensory latency (SNSL) of sural nerve. **Method:** Sural nerve conduction studies were conducted in EMG room of Neurology section of Medical Unit 1 at Sir Ganga Ram Hospital, Lahore on Electromyograph by Nihon Kohden MEB-5304K. **Results:** After following strict exclusion criteria by careful history and physical examination 25 normal healthy subjects recruited from local population by random sampling technique. The age range was 40-70 years with mean age 47.2±9.23 years. Gender distribution was 60% females and 40% males. The mean SNCV was found to be 53.16±5.68 meter per second (m/sec) and mean SNSL was 2.81±0.45 milliseconds (msec). **Conclusion:** It was found that the mean sural nerve conduction velocity was higher and the mean sensory latency was shorter in healthy subjects than that of the Western races. Moreover, the SNCV decreases and SNSL increases significantly with age.

Key words: Nerve conduction studies, sensory nerve conduction velocity (SNCV), sensory latency, Sural nerve.

INTRODUCTION

Nerve conduction studies (NCS) are the most sensitive and reproducible measure of peripheral nerve functions. These can define and quantitate normal nerve activity.[1] These tests examine the state of rapidly conducting myelinated fibres in a peripheral nerve.[2] Most of the nerve dysfunctions begin in the sensory nerves of the lower extremities. So measurement of sensory function in the lower limb nerves by electrical stimulation is mandatory and investigational.[3] The sensory nerve conduction velocity (SNCV) and sensory latency (SNSL) of sural nerve provides the highest diagnostic sensitivity.[4]

Nerve conduction parameters may be affected by anthropometric factors like age, sex, height, weight and BMI.[5] As it has been reported that significant slowing of conduction velocities and sensory latencies occur with increasing age and more height.[6] It was claimed further that the conduction velocity is 6 m/sec faster in females.[7] So failure to adjust normal nerve conduction values for these factors decreases the sensitivity and specificity of these electro-physiological measures and may result in misclassification of the individuals.[8]

This study was conducted to find out the mean sensory conduction velocity and sensory latency of sural nerve among the normal healthy adults from the local population and to evaluate the impact of anthropometric factors like age, sex, height, weight and BMI upon sural nerve sensory conduction and latency. So that appropriate adjustments may be considered while finding the normal values.

SUBJECTS AND METHODS

Total 25 normal adult subjects including both sexes having age range 40 -70 years were recruited by simple random sampling in this study. These subjects were selected after taking careful history and physical examination specifically neurological assessment. A strict exclusion criterion was followed.[9]

The subjects having symptoms of peripheral sensory neuropathy, autonomic neuropathy, and excessive muscle weakness were not included. Pregnant females, alcoholics and individuals having nutritional deficiency or exposure to certain toxins were excluded. Furthermore subjects with history of nerve injury, inherited, entrapment neuropathies and cerebral stroke were also not recruited. Patients with endocrinal disorders, advanced renal and liver diseases and inflammatory diseases were also not included.

First of all a written consent was obtained from each subject. Sural nerve conduction studies were conducted in EMG room of Neurology section of Medical Unit 1 at Sir Ganga Ram Hospital, Lahore on Electromyograph by Nihon Kohden MEB-5304K. The skin temperature was maintained within 36–38 °C.[10]

The sural nerve conduction velocity was measured antidromically from right leg of each subject by using surface recording electrodes.[11] The active recording electrode was placed just below the lateral malleolus. The stimulating electrode (the cathode was placed towards recording electrodes) was kept at a distance

of 14cms from the active recording electrode and this distance was kept constant in every subject.[12]

RESULTS

There were total 25 normal adults subjects having mean age 47.2±9.23 years recruited in this study. The gender distribution was 60% females and 40% males. The values of neurological parameters are as follows:

Table-1: Neurological parameters in normal subjects

Neurological parameters	No.	Mean±SD	Range
Sural nerve conduction velocity m/sec	25	53.16±5.68	43.60–68.90
Sural nerve sensory latency mSec	25	2.81±0.45	2.10–3.98

m/sec= meter per second, mSec=millisecond

Table-2: Anthropometric parameters in normal subjects

Anthropometric parameters	No.	Mean± SD	Range
Age in years	25	47.2±9.23	40–70
Height in (Cm)	25	156±10.31	135–171
BMI Kg/m²	25	22.8±3.2	21.1–24.6

Table-3: Correlation between sural SNCV and anthropometric factors

Correlation between	Correlation Coefficient (r)	*p*-value
Age and SNCV (m/sec)	-0.401	<0.05
Height and SNCV (m/sec)	-0.006	>0.5
BMI and SNCV (m/sec)	-0.149	>0.5

Correlation analysis showed a significant inverse correlation between sural SNCV and age (r= -0.401, $p<0.05$). It was found further by regression analysis (figure 1) in this study that there is 2.4 m/sec decrease in conduction velocity per ten years increase in age. SNCV had inverse insignificant correlations with height and BMI.

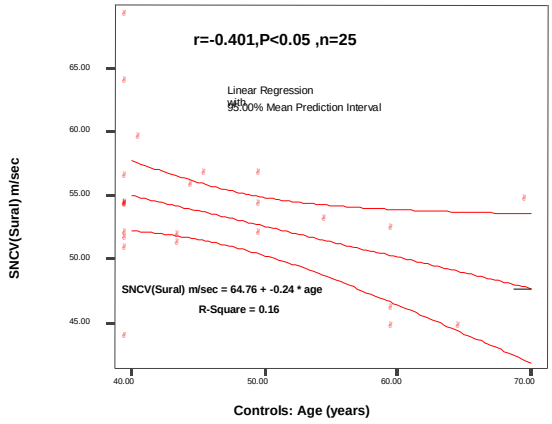

Figure-1: Regression relation between age and sensory nerve conduction velocity (m/sec) in normal subjects.

The line represents regression line, r=correlation coefficient.

DISCUSSION

Mean sural nerve conduction velocity found in this study was 53.26±5.61 m/sec with the range of 43.6–68.90 m/sec. The mean sensory latency found in this study was 2.81±0.45 mSec.

IMPACT OF DIFFERENT ANTHROPOMETRIC FACTORS:

Age: There was a significant negative correlation of sural SNCV with age (r=-0.401, $p<0.05$) in this study. It was calculated further by regression analysis that there is 2.4 m/sec fall in conduction velocity per ten years rise in age (within age range 40–70years). Some other authors describe 0.5–1.8 m/sec fall for each decade.[13] The sensory latency exhibited an insignificant direct correlation (r=0.361, $p>0.05$) with age. The decline in nerve conduction and rise in sensory latency with increasing age may be due to loss of myelinated and unmyelinated nerve fibres in peripheral nerves with aging.[14]

Height: An insignificant inverse correlation (r=-0.006, $p>0.5$) was present between sural SNCV and height. According to the regression analysis in this study there was decrease of 0.01m/sec in conduction velocity per centimetre increase in height. The sensory latency increases with increasing height (r=0.273, $p>0.05$). With each Cm rise in height the sensory latency increased by 0.02 mSec. Coefficient of variable was more with age (19.5%) than with height (6.6%). Sural SNCV and sensory latency vary more with change in age than with changing height in this study. Hence influence of height on speed of conduction reflects abrupt rather than gradual tapering of axons distally.

BMI: The sural SNCV had a non significant negative relationship with BMI. The inverse correlation of SNCV and direct relation of sensory latency with BMI indicated the sole effect of height among these relationships. So it is quite obvious that weight and obesity do not have any significant impact on nerve conduction parameters.

Gender difference: Gender difference in isolation from other highly correlated anthropometric factors such as height was not found to be significant predictor of sural nerve conduction measures in this study. So in the age range of 40–70 years there was no significant gender related difference in the conduction studies of sural nerve.

CONCLUSIONS

- Sural nerve conduction velocity had significant inverse correlation with age. It had also weak inverse relation with height. While sural sensory latency had insignificant direct relationship with age and height.
- Both neurological parameters vary more with change in age than change in height so adjustments for height and age must be considered

while developing normal standard values in this (40-70 years) age range of the subjects. Hence, more research on wider data base is required to develop norms and standards in this context.

- In the age range of 40-70 years there is no gender specific difference in the conduction measures of the sural nerve.

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REFERENCES

1. Soliman A. Diabetic neuropathy. ē Medicine Journal 2002;3(3):1–12.
2. Hendriksen PH, Oey PL, Wieneke GH, Bravenboer B, Van Huffelen AC. Subclinical diabetic polyneuropathy: early detection of involvement of different nerve fiber types. J Neurol Neurosurg and Psychiatry 1993;56:509–14.
3. Aetna Inc. Nerve conduction velocity studies. Clinical Policy Bulletin. American Medical Association 2007;No: 0502.
4. Killian J, Foreman PJ. Clinical utility of dorsal sural nerve conduction studies. Muscle Nerve 2001;24(6):817–20.
5. Stalberg E. Nerve conduction studies. Journal of Neurological Sciences 2000;17(2):1302–664.
6. Falco FJ, Hennessey WJ, Goldberg G, Braddom RL. Standardized nerve conduction studies in the lower limb of the healthy elderly. Am J Phys Med Rehabil 1994;73(3):168–74.
7. Lang AH , Puusa A, Hynninen P, Kuusela V. Evolution of nerve conduction velocity in later childhood and adolescence. Muscle Nerve 1985;8(1):38–43.
8. Stetson DS, Albers JW, Silverstein BA and Wolfe RA. Effects of age, sex and anthropometric factors on nerve conduction measures. Muscle and Nerve 1992;15(10):1095–104.
9. Willson HJ and Winer JB. Clinical evaluation and investigation of neuropathy. Journal of Neurol Neurosurg Psychiatry 2003;74(suppl II):ii3–ii8.
10. Dioszeghy P and Stalberg E. Changes in motor and sensory nerve conduction parameters with temperature in normal and diseased nerve. Electroencephlogr Clin Neurophysiol 1992;85(4):229–35.
11. Perkins BA, Greene DA and Bril V. Glycaemic control is related to the morphological severity of diabetic sensorimotor polyneuropathy. Diabetes Care 2001;24(4):748–52.
12. Sethi RK, Thompson LL. The Electromyographers' Handbook 2nd ed. Boston Little, Brown and Company Boston 1989; p.80–2.
13. Trojaborg WT, Moon A, Anderson BB, Trojaborg NS. Sural nerve conduction parameters in normal subjects related to age, gender, temperature and height: a reappraisal. Muscle and Nerve.1992;15(6):666–71.
14. Verdu E, Ceballos D ,Vilches JJ, Navarro X. Influence of aging on peripheral nerve function and regeneration. Journal of PNS 2000;5(4):191–208.

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