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Nerve Conduction Study of Ulnar Nerve in Normal Subjects

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ABSTRACT
Nerve conduction study (NCS) is a test to measure the speed and electrical activity in a nerve. It has become an important non-invasive tool for diagnosis of nerve lesions. It is an important measuring device for confirmation of neurological disorders. Nerve conduction study help in differentiating two major group of peripheral nerve diseases-demyelination and axonal degeneration. There are differences in values of neve conduction study in relation to biological factors, that is age, gender and body mass index. The study regarding the change in nerve conduction study parameters with age, gender and BMI has hardly been done among the population in Kerala

Objectives

1) To estimate nerve conduction parameters of ulnar nerve in normal subjects. To compare derived values with reference values available

2) To assess variation of ulnar nerve conduction parameters with age, gender, and body mass index(BMI)

Methods: This isa cross-sectional study including 100 normal subjects. Nerve conduction study of ulnar nerve of 100 normal subjects were done in the Neurology Department of Government Medical College, Thrissur.Study participants are bystanders of patients visiting neurology department and staff of Government Medical College, Thrissur. Estimated nerve conduction study parameters of ulnar nerve of 100 normal subjects.
Analysed variation in ulnar nerve conductionstudy parameters with age, gender, and Body Mass Index

Results: There is significant difference in motor and sensory nerve conduction study parameters of ulnarnerve with age, gender, and Body Mass Index

Conclusion: As there is significant change in the values of nerve conduction study parameters of ulnar nerve with age, gender, and body mass index. These variables should be taken in consideration while interpreting nerve conduction study results

Keywords: Nerve conduction study, ulnar nerve

I. INTRODUCTION

Nerve conduction study (NCS) is a test to measure the speed and electrical activity in a nerve[1].It has become an important non-invasive tool for diagnosis of nerve lesions. It is developing as an important measuring device for confirmation of neurological disorder. Nerve conduction studies deal with the method to work on the nerve conduction velocities which are being capable of finding nerve lesions.It aids in finding nerve lesions and situations where muscles get influenced by it. There are many differences in values for nerve conduction velocities in different nerves in relation to geographical location and other biological factors, that is age, gender, body mass index.

Nerve conduction study helps in differentiating two major groups of peripheral nerve diseases-demyelination and axonal degeneration. These also help in localizing the site of the lesions. It helps to delineate the extent and distribution of neuronal lesions. Nerve conduction study has been used as a prime non-invasive investigation procedure for many neuronal and muscular diseases. Nerve Conduction Study consist primarily of the assessment of three types of nerves: motor, sensory and mixed. Motor Nerve Conduction Study include the assessment of the Compound Muscle Action Potential (CMAP), whereas sensory Nerve Conduction Study include the assessment of the Sensory Nerve Action Potentials (SNAP) of the accessible peripheral nerves in the upper and lower limbs.

The commonly measured parameters of the Compound Motor Action Potential (CMAP) include latency, amplitude, duration, conduction velocity and late responses.eg- F waves. For Sensory Nerve Action Potentials (SNAP), latency, amplitude and conduction velocity are routinely measured.

Nerve conduction velocity (NCV) is the speed at which an electrical stimulus passes through the nerves. Physiological factors like age, gender, body mass index (BMI) affect the nerve conduction studies. Peripheral nerves are used most to measure nerve conduction velocities.

This study is related with interpreting Nerve Conduction Study in normal subjects and assessing variation of nerve conduction study with age, gender, and Body Mass Index (BMI). Inworldwide, nerve conduction study among normal subjects, certain values have been assigned as reference range for latency, amplitude and conduction velocity. In India and Kerala only, few

studies have been conducted so far on this aspect. So, the present study is to evaluate whether same reference standard can be applied to the centralKerala population.

II. OBJECTIVES

1)To estimate nerve conduction parameters of ulnar nerve in normal subjects. To compare derived values with reference values available

2) To assess variation ofulnar nerve conduction parameters with age, gender, and body mass index (BMI)

III. BACKGROUND AND REVIEW OF LITERATURE

NERVE CONDUCTION STUDY

Nerve Conduction Study (NCS) involve activating nerves electrically with small safe pulses over several points on the skin of the limbs and measuring the responses obtained.It is used for diagnosis of peripheral nerve disorders[2]

Nerve conduction studies (NCSs) have played an important role in the evaluation of neuromuscular diseases. When patients present with complaints of pain, numbness, tingling, or weakness, NCS is often one of the earliest tests obtained by physicians, because it enables the quantitative assessment of peripheral nerve and muscle function and, therefore, aid the physician in identifying the physiological source of the patient's symptoms. NCSs involve the delivery of electric stimuli to peripheral nerves at accessible locations on the human body and the recording of electrophysiological responses[3] to localize the lesion site, particularly identifying whether the peripheral nerve, neuromuscular junction or anterior horn cells are involved.

Sensorynerve conduction studies are an indispensable component of the electrodiagnostic examination. They evolved from mixed NCS and were initially described by Dawson in 1950. Gilliatt and Sears first reported their clinical value in 1958. Compared to motor NCS, sensory NCS are much less standardized. The value of sensory nerve conduction study varies in various peripheral nerve fibre lesions, including plexopathies, mononeuropathies, and polyneuropathies

ULNAR NERVE

The ulnar nerve is the continuation of the medial cord of the brachial plexus and lies posteromedial to the brachial artery in the anterior compartment of the upper arm. It pierces through the medial intermuscular septum at the arcade of Struthers, which is located approximately 8 cm proximal to the medial epicondyle. Traveling behind the medial epicondyle with the superior ulnar collateral artery, the ulnar nerve enters the forearm through the cubital tunnel, which is defined as the space between the posterior and transverse bands of the medial collateral ligament (deep) and Osborne's ligament (superficial), which refers to the extension of the fascia spanning the two heads of the flexor carpi ulnaris (FCU). Compression at the level of the cubital tunnel is most frequently due to compression by Osborne's ligament.

Reference range for ulnar nerve

Reference range for ulnar nerve(motor)-conduction velocity -(51.0-70m/s), distallatency (2.3- 3.5ms), amplitude (3.9-11.5mv), reference range for ulnar nerve(sensory)-conduction velocity (41.0-58.0 m/s), distallatency (2.1-2.9ms), amplitude(10.4-106.9 μV)[4]

Various factors influence Nerve Conduction Study (NCS) which includes age, height, gender, and Body Mass Index (BMI)

EFFECT OF AGE ON NERVE CONDUCTION STUDY

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 (NCV). Studies have proved that the motor and sensory conduction velocities in newborn were 40%–50% of adult values, and at 3 years of age, the normal values were in the adult range for all motor and sensory NCV.Age can affect both conduction velocities as well as delayed responses indifferent peripheral nerves[5]

EFFECT OF GENDER ON NERVE CONDUCTION STUDY

Most gender differences in nerve conduction velocity can be largely explained by height as amplitude differences persist despite correction for height, temperature, and age[6]

Failure to adjust normal nerve conduction values for these factors decreases the diagnostic specificity and sensitivity of the described measures, and may result in misclassification of individuals[7]

EFFECT OF BODY MASS INDEX(BMI) ON NERVE CONDUCTION STUDY

Female subjects or those with lower weight had higher ulnar sensory amplitude[8].There isage- and height-related slowing of nerve

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conduction velocity (NCV) and reduction in nerve response amplitude.

Thereis longer latency association with lower body mass index in motor ulnar nerves[9].Age and BMI had impact on nerve conduction

IV. RELEVANCE OF STUDY

Nerve conduction study (NCS) is a test to measurethe speed and electrical activity in a nerve.It has become an important non-invasive tool for diagnosis of nerve lesions.

This study is therefore intended to obtain a set of data especially from central Kerala population of normal healthy subjects without any neurological problems.

V. METHODOLOGY

STUDY DESIGN: Cross sectional study
STUDY SETTING: Department of Neurology, Govt. Medical College, Thrissur

STUDY SUBJECTS

The study subjects are staff of various departments of government medicalcollege, Thrissur and bystanders of patients visiting neurology outpatient department. 100 normal subjects are included in the study of the age group 20 to 60 years, study included 50 males and 50 females

INCLUSION CRITERIA

Staff of various departments of government medical college, Thrissur and bystanders of patients visiting neurology outpatient department without any neurological problems. 100 normal subjects are included in the study of the age group 20 to 60 years. Study included 50 males and 50 females

EXCLUSION CRITERIA

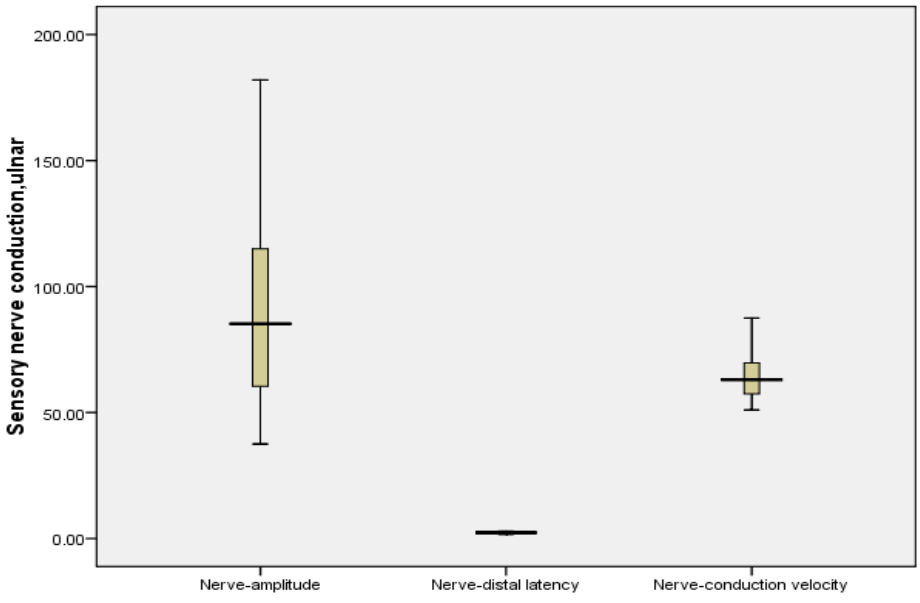
1) Any individual of neuromuscular transmission disorder.
2) Any individual suffering from diabetes,hypertension, renal disorders, and thyroid disorders which are recently detected or taking treatment.
3) Individual suffering from weakness of the upper limb and lower limb or myopathy or with history of alcohol **a**buse.

SAMPLE SIZE CALCULATION

$$n= \frac{Z\alpha^2 S^2}{d^2}$$

n=sample size
d=10% of mean
for 5% level of significance
n=62 were, s=116,mean=28.9
Final sample size is 100.so 100 subjects are taken for the study.

VI. RESULTS



BOX PLOT FOR SENSORY NERVE CONDUCTION ULNAR NERVE

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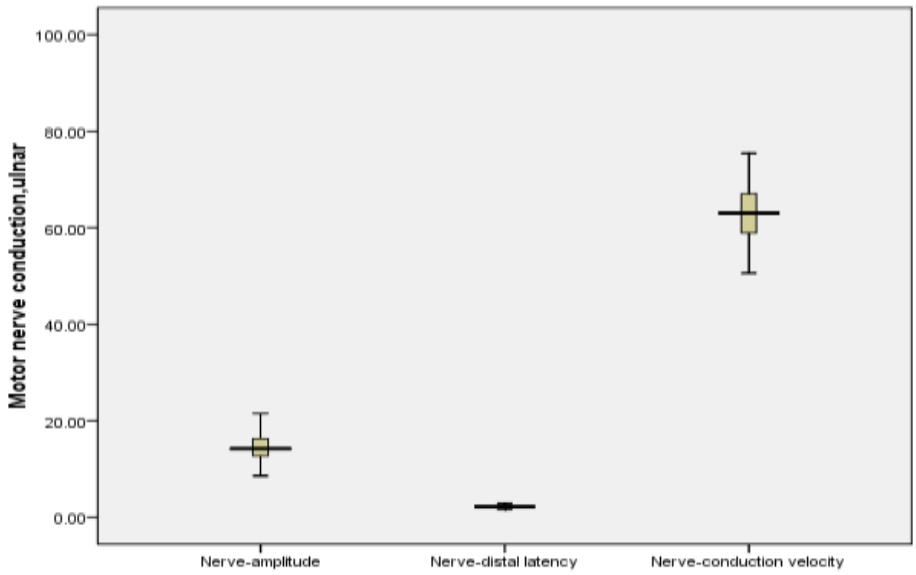

BOX PLOT FOR MOTOR NERVE CONDUCTION ULNAR NERVE

	Male	Female
Motor nerve conduction-ulnar nerve-latency	2.3	2.2
Sensory nerve conduction, ulnarnerve,latency	2.5	2.3

NERVE LATENCY WITH AGE

VII. DISCUSSION

Out of total 100 normal subjects, 50 were females and 50 were males.the subject wasbetween age group of 20 to 60 years and classified into 4 groups.

Group 1 -age between 20 to 29 years
Group2 – age between 30 to 39 years
Group3- age between 40 to 49 years
Group 4-age between 50 to 60 years

In the study,there is a decrease in motor nerve conduction- amplitude of ulnar nerve with age

Sensory nerve conduction, amplitude of ulnar nerve, vary significantly with BMI, there is a decrease in amplitude with BMI

Motor and sensory latency of ulnar nerve showed significant difference with gender Latency is less in females compared to males.

The sensory conduction velocity of ulnar nerve has significant difference with age and as age advances sensory conduction velocity decreases.

VIII. CONCLUSION

The aim of the study was to assess the variation in nerve conduction study parameters of ulnar nerve with age, gender and body mass index (BMI)

Ulnar nerve, sensory and motor- mean amplitude, latency and conduction velocity was compared with age, gender and BMI.

From the study derived data for nerve conduction study parameters of ulnar nerve in normal subjects, It is found that age has a definite effect on amplitude, conduction velocity of motor and sensory nerves. As age increases conduction velocity decreases in normal subjects.

The study also shows, gender has significant effect on various nerve conduction parameters. Males have longer, motor and sensory nerve latencies, while conduction velocity is greater in females.

Without adjustment for age, the sensitivity and specifityof nerve conduction study will decrease when using same reference data in patients with different age group. There is need to have a reference value with relation to age

The present study add evidence that adjusting nerve conduction parameters for physiological factors such as age,gender,BMI will increase diagnostic sensitivity and electrodiagnostic data should be created considering the variation of

nerve conduction study parameters with age, gender and BMI

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