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Comparative study of nerve conduction velocity in normal and obese individuals.

Dr. Shubhangi Deshmane [1], Dr. S. T. Khan [2]

I. Introduction

Obesity is a state of excess adipose tissue mass.[1] The World Health Organization (WHO) labeled obesity as the most obviously visible, but most neglected public-health problem worldwide.[2, 3] Worldwide, more than 1.4 billion adults were overweight.[4] Body mass index (BMI) has been used for classification of obesity for decades. World Health organization (WHO) recommended body mass index (BMI) values as the cut off points for overweight and obesity.[5]Obesity is associated with many complications. [6] It's one of the important complication is development of carpal tunnel syndrome (CTS). Old, overweight and physically inactive people and condition that crowds or reduces the capacity of the carpal tunnel may initiate the symptoms of compression of median nerve across the wrist. Systemic conditions such as obesity, diabetes, thyroid dysfunction, amyloidosis and Reynaud's syndrome are also sometimes associated with the carpal tunnel syndrome.[7]

Estimation and assessment of Nerve conduction velocity (NCV) studies establishes diagnosis of peripheral neuropathy. Nerve conduction velocity (NCV) studies are usually carried out to (i) evaluate the integrity of, and (ii) diagnose diseases of, the peripheral nervous system. Outcome of NCV studies can diagnose and assess the degree of demyelination and axonal loss in the segment of the nerve examined. Demyelination results in prolongation of conduction time, while axonal loss generally leads to loss of nerve or muscle potential amplitude. [8]present study is an attempt to study the influence of obesity on the nerve conduction parameters of median nerve in obese and non obese individuals.

II. Aim

To assess and compare nerve conduction parameters in control and obese individuals.

III. Material and methods

The present study was conducted in Department of Physiology. The ethical committee of the institution was informed about the nature of the study. The approval of the study protocol was obtained from the Institutional Ethical Committee. The present study is a cross- sectional study.

Obese individuals in the age group of 20 to 40 years were selected as subjects. Thirty Obese individuals were included in this group. Fifteen of them were females and fifteen were males. The study subjects were selected from hospital staff, patient's relative and from general population. History of any chronic disease such as diabetes mellitus, Thyroid disease, renal failure, liver disease, leprosy and tuberculosis, smoking or any other addiction and pregnant women were excluded from study. Apparently healthy individuals in the age group of 20 to 40 years were selected as controls. Thorough general and systemic Examination was done.

1. Recording of nerve conduction parameters: [9]

Nerve conduction parameters were performed on 'RMS N ISO 9001:2000' system using "RMS.EMG.EP Mark II" software by Recorders and MedicareSystem (P) Ltd. Chandigarh, as shown in photograph 1. Motor and sensory conduction velocity of the left median nerve was measured. Instrument standardized for a) for motor studies Sensitivity: 2-5mv/mm, Low frequency filter: 2-5Hz High frequency filter: 10 KHz, sweep speed: 2ms/mm.b) For sensory studies Sensitivity: 10-20microv/mm, Low frequency: 5-10Hz, High frequency filter: 2-3 KHz, sweep speed: 1-2 ms/mm.

Nerve conduction velocities of all subjects were recorded in same time, 10 AM – 1PM. The temperature of the examination room was maintained at about 22˚C- 24˚C.The subject was taken to the room, rested for a while so as to maintain the skin temperature to the recommended level of 32˚C - 34˚C and then nerve conduction study (NCS) procedure was carried out on the subject lying comfortably in supine position on the bed.[9]

2. Recording of electrophysiological parameters:

Following electrophysiological parameters were recorded in all the subjects:

1. Latencies (ms)
2. Nerve conduction velocities(m/s)

3. Amplitude: compound muscle action potential (CMAP) in mV and sensory nerve action potential (SNAP) in µv

3.Standard Nerve Conduction Values: [10]

Nerve		Latency(ms)	Amplitude	NCV(m/s)
Median nerve(sensory)		3.06 +/- 0.41	8.91+/- 4.48(µv)	45.45+/- 9.40
Median nerve(motor)	Wrist	3.77+/-0.40	8.10+/-2.62(mV)	58.52+/-3.76
	Elbow	7.62+/-0.65	7.84+/-2.25(mV)	

In order to determine effectiveness of nerve conduction study, the data were analyzed by using unpaired't' tests. A 'p' value < 0.05 was considered to be statistically significant and 'p' value < 0.001 was considered to be statistically highly significant.

IV. Results

Table 1: showing comparison and analysis of between control and obese group for motor conduction parameters of median nerve

Parameters	Control group (n= 30) Mean ± SD	Obese group (n= 30) Mean ± SD	p value
Latency (msec)	3.49 ± 0.53	4.25 ± 0.38	< 0.0001 **HS**
CMAP Amplitude (mV)	12.40 ± 2.80	10.34 ± 2.09	0.0021 **S**
MNCV (m/sec)	56.34 ± 4.87	54.67 ± 3.60	0.1369 **NS**

L: latency, CMAP: Compound muscle action potential, MNCV: Motor nerve conduction velocity, S: significant, HS: highly significant, NS: not significant.

The Table 1 shows mean values with standard deviation of Latency, CMAP, amplitude and MNCV for median nerve in control and obese groups. From the table it was observed that

i) The mean values for motor conduction parameters of median nerve were Latency (msec) 3.49 ± 0.53, CMAP Amplitude (mV) 12.40 ± 2.80 and MNCV (m/sec) 56.34 ± 4.87 in controls. The values in obese individuals were Latency (msec) 4.25 ± 0.38, CMAP Amplitude (mV) 10.34 ± 2.09 and MNCV (m/sec) 54.67 ± 3.60. (Table 2 and bar diagram 2)

ii) The mean value of latency was prolonged in obese than that of controls.

iii) The mean value of CMAP amplitude in obese was reduced as compared to controls.

iv) Thus, both delay in latency and reduction in CMAP amplitude in obese individuals were statistically significant.

v) There was no statistically significant difference in motor conduction velocity in obese group and control group.

Table 2: showing comparison and analysis of between control and obese group for sensory conduction parameters of median nerve.

Parameters	Control group (n= 30) Mean ± SD	Obese group (n= 30) Mean ± SD	p value
Latency (msec)	2.90 ± 0.46	3.28 ± 0.56	0.0067 **S**
SNAP Amplitude (µV)	9.35 ± 1.07	8.85 ± 0.75	0.0417 **S**

SNCV (m/sec)	55.93 ± 3.91	54.39 ± 4.17	0.1730 **NS**

L: latency, SNAP: Sensory nerve action potential, SNCV: Sensory nerve conduction velocity.
The Table 2 shows mean values with standard deviation of Latency, SNAP, amplitude and SNCV for median nerve in and obese group. From the table it was observed that,

i) The mean value for sensory conduction parameters of median nerve were Latency (msec) 2.90 ± 0.46, SNAP Amplitude (μV) 9.35 ± 1.07 and SNCV (m/sec) 55.93 ± 3.91 in controls. The values in obese individuals were Latency (msec) 3.28 ± 0.56, SNAP Amplitude (μV) 8.85 ± 0.75 and SNCV (m/sec) 54.39 ± 4.17. (Table 3 and bar diagram 3)

ii) The mean value of latency was prolonged in obese than that of controls.

iii) The mean value of SNAP amplitude in obese group was reduced as compared to control group.

iv) Thus, both delay in Latency and reduction in SNAP amplitude in obese individuals were statistically significant.

v) There was no statistically significant difference in sensory conduction velocity in obese and controls.

V. Discussion

Thus in present study it was found that latency and amplitude were significantly different in obese and control group while no significant change in sensory and motor conduction velocities was observed.

Nerve conduction velocity reflects integrity of the myelin sheath and indicates transmission time in the largest myelinated nerve fibers. Amplitude reflects the size and number of nerve fibers and its measurement is important for the evaluation of neuropathy. Both latency and conduction velocity depend on an intact, myelinated nerve as myelin is essential for fast action potential propagation in normal individuals. In contrast, the amplitude of the waveform depends primarily on number of axons functioning within the nerve. Prolongation of latency usually implies demyelinating injury, while loss of amplitude usually correlates with axonal loss or dysfunction.[10, 11] Possible explanation for change in latency and amplitude in nerve conduction studies may be that, subjects with compression of median nerve have swelling of the median nerve proximal to the carpal canal and prolongation of the median nerve latency across the wrist. There was wide variation in the distribution of median nerve sensory latencies but this was an expected finding among subjects with a high BMI.[12] In nerves, amplitude was found to be varying with BMI (higher BMI associated with lower amplitude).This observation might be due to amplitude attenuation by thicker subcutaneous tissue in the person with higher BMI. Sensory amplitudes are decreased but motor amplitudes are sometimes spared with changing BMI. This is probably due to the thousand fold difference in sensory and motor amplitude.[13] Another contributory factor causing change in nerve conduction in obese people is that, individuals with increased BMI have presumably increased translocated blood volume from the legs after assumption of the recumbent position. This additional volume would swell the veins of the flexor synovial sheath and raise tissue pressure in the carpal tunnel. Such synovial engorgement can cause both the edema without inflammation as well as elevate mean tissue pressure in the carpal tunnel, which affects the median nerve conduction. [14]

In our study, we have found that nerve conduction velocity is not significantly reduced where as latency and amplitude are significantly affected. A possible explanation for nerve conduction velocity remaining within normal range is that some fibers might have degenerated and regenerated from the site of compression[15]. To study effects of obesity per se on median nerve conduction velocity in Indian population, more studies with large sample size involving more severe obese people are required.

VI. Conclusion

Thus it can be concluded that, there is increase in latency, decrease in amplitude and no change in conduction velocity of obese subject was observed. Hence, it can be concluded that, obesity in these subjects significantly affecting both amplitude and latency but could not be reason for slowing of conduction velocity.

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