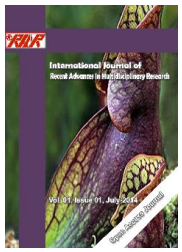

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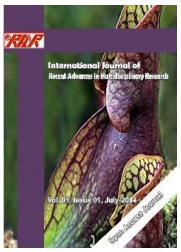

Research Article

A STUDY OF EFFECT OF TEMPERATURE ON LATENCY AND AMPLITUDE OF MEDIAN SENSORY AND MOTOR NERVE IN NORMAL SUBJECTS

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ABSTRACT

The present study was conducted in the Department of Physiology, Netaji Subhash Chandra Bose Medical College and Hospital, Jabalpur (M.P.) . Median motor and sensory nerves were examined in 60 medical students aged between 17-25 years, having no signs or symptoms of neurological impairment. Using surface and ring electrodes. Different temperature i.e. hot and cold were maintained with the help of water bath and skin temperature measured by using Digital Mercury Thermometer. The result of our study showed that as the temperature is decreased gradually from normal body temperature 37^0 C to 29^0C, latency of median motor and sensory nerve increased by 0.18 to 0.24 millisecond/^{0}C.The amplitude of median motor and sensory nerve were found increased on decreasing temperature from normal body temperature 37^0 C to 29^0C, but this increase was found statistically insignificant

INTRODUCTION

Nerve conduction study is a part of electrodiagnostic procedures that help in establishing the type and extent of the abnormality of the nerves. There are anatomical and physiological aspects to nerve conduction velocity. The conduction velocity of the nerve depends on the fiber diameter, degree of myelination and the inter-nodal distance. Other factors such as age, temperature, height, gender, and limb are the physiological variables affecting nerve conduction study. The use of conduction velocity measurement as a diagnostic procedure in neurology requires a knowledge of a range of values encountered in healthy individuals. Normal values for maximum conduction velocity in human peripheral nerve had been described way back in 1850 by Helmholtz who measured median conduction velocity of humans using crude mechanical instruments and had found the normal range to be 61.0 ± 5.1 m/s (**Mishra and Kalita, 1998**). Nerve conduction studies are being increasingly used in diagnosis and prognosis of various neurological diseases. Nerve conduction studies assess the peripheral motor and sensory functions by recording the evoked response to stimulation of peripheral nerves. They have an important role in evaluation of peripheral and entrapment neuropathies by confirming the clinical suspicion of neuropathy.

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Identifying the predominant pathophysiology such as conduction block, axonal demyelination, and temporal course of the disease i.e. Acute, subacute or chronic, the nerve conduction studies provide an objective and qualitative measure of nerve function and also help in predicting the prognosis of neuropathy. With steady improvement in recording apparatuses; nerve conduction studies have become a simple and reliable test of peripheral nerve function (**Aminoff 1999**). Temperature variation in the tissue surrounding a nerve is an important factor influencing the velocity of the nerve impulse. The distal extremities are constantly exposed to environmental temperature changes and are subjected to significant tissue temperature variation even in healthy subjects (**Halar *et al.*, 1981; Halar *et al.*, 1992; Halar *et al.*, 1983**).

MATERIALS AND METHODS

Present study was conducted in the Department of Physiology, Netaji Subhash Chandra Bose Medical College and Hospital, Jabalpur (M.P.) Sixty (60) Medical student both male and female healthy volunteers aged between 17-25 year were recruited from the First M.B.B.S batch of N.S.C.B. Medical College, Jabalpur (M.P.), having no signs or symptoms of neurological impairment. Nerve conduction study of Median nerve both motor and sensory bilaterally were performed with help of Computerized machine RMS Aleron 201 EMG and NCV, using surface and ring electrodes. Different temperature i.e. hot and cold were maintained with the help of water bath

and skin temperature measured by using Digital Mercury Thermometer.

Surface stimulation was performed as per steps following steps

S_1 –First stimulus placed at the wrist between the Palmaris Longus and Flexor Carpi Radialis tendon at the second crease. (Approximately 1cm proximal to the most distal crease.) **S_2** - Second stimulus placed at the elbow crease, medial to the Biceps tendon and Brachial artery. The criteria of selection of cases was random. The nerve were stimulated supramaximally with the wave pulses of 0.2ms duration for every recording of sensory median nerve conduction velocity and motor median nerve conduction velocity. After obtaining the first motor and sensory record at a room temperature the forearm including the elbow was cooled in a thermostated waterbath at 32^0 C for 10 minutes. The upper extremity was then lifted from the bath and dried, the electrode were reapplied over the marked points and recording was performed again. Then the arm was immersed in the water again and cooled the forearm including the elbow at 29^0 C for 10 minutes. Similarly recording was done at 39^0 C. Hence, the temperature was changed stepwise to 32^0 C, 29^0 C and 39^0 C (**Eszter Hidasi, 2008**).

RESULTS AND DISCUSSION

Table 1. Mean and standard deviation of latency and amplitude of median motor and sensory nerve recorded at various skin temperature

Temperature (^{0}C)	Motor latency(ms)	Motor Amplitude(mv)	Sensory latency(ms)	Sensory Amplitude(µv)
29	3.45 (±0.49)	12.13 (±3.53)	2.92 (±0.44)	33.81 (±13.48)
32	2.85 (±0.51)	12.03 (±3.53)	2.21 (±0.39)	34.06 (±13.14)
37	2.21 (±0.51)	11.93 (±3.52)	1.75 (±0.35)	33.95 (±13.14)
39	1.65 (±0.53)	11.84 (±3.53)	1.20 (±0.36)	33.86 (±13.13)

Mean and standard deviation of latency and amplitude of median motor and sensory nerve recorded at various skin temperature

Table 2. One way ANOVA of median motor and sensory nerve recorded at various skin temperatures

	Motor latency(ms)	Motor Amplitude(mv)	Sensory latency(ms)	Sensory Amplitude(µv)
F-value	6.847	.076	10.592	.004
Significance	.0001	.973	.0001	1.000

($p< 0.05$, statistically significant)

DISCUSSION

The result of present study showed that as the temperature is decreased gradually from normal body temperature 37^0 C to 29^0C, latency of median motor and sensory nerve increased by 0.18 to 0.24 milli second/^{0}C Table 1. On performing ANOVA these changes were found statistically significant ($p<0.05$) for median motor and sensory nerve (Table 2) in all subjects. On decreasing the temperature, rise in latency has been reported by **KTodem *et al.* 1988** (**Journal of neurology, neurosurgery and psychiatry, 1989**). The result of their study showed that distal motor latency increased non-linearly with decrease in skin temperature ($F = 5.19$, $p=0.009$). We obtained similar findings in our study. There is significant increase in latency with fall in temperature ($p< 0.05$). On decreasing the temperature gradually from normal body temperature 37^0 C to 29^0C, amplitude of median motor and sensory nerve increased Table 1.

On performing ANOVA this change was found statistically non-significant ($p>0.05$) for median motor and sensory nerve Table 2 in all subjects. On decreasing the temperature, rise in amplitude has been reported by **K Todem *et al.* 1988** (**Journal of neurology, neurosurgery and psychiatry, 1989**). The result of their study similar to our study. The findings of our study are different than that of K Todem *et al.* in linear relationship between latency, amplitude with variation in skin temperature. **Gasser and Trojaborg (1964), DeJong *et al.* (1966), Halar *et al.* (1981)** reported that there is a linear relationship between skin temperature and latency finding are similar to present study. Another similar study was performed on impact of temperature on nerve conduction study at Department of Neurology, Faculty of Medicine, Ege University, Turkey. They found distal latency extends 0.2 millisecond for the temperature decrease of each degree (**Aysin *et al.*, 2005**). Similar findings are obtained in our study. (**Buchthal and Rosenfalck, 1966; Bolton *et al.*, 1981; Lang and Puusa 1985**) found that amplitude of nerve and muscle action potentials decreases as the temperature of the nerve increases from 29 to 38°C.

Summary and Conclusion

The result of our study showed that on decreasing temperature from normal body temperature 37^0 C to 29^0C, latency of median motor and sensory nerve extends significantly from 0.18 to 0.24millisecond per degree decrease in temperature. The amplitude of median motor and sensory nerve were found increased on decreasing temperature from normal body temperature 37^0 C to 29^0C, but this increase was found statistically insignificant.

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