Effect of Different Mechanical Compressive Forces on MNCV of Median Nerve in Normal Females

Narkeesh Arumugam[1], A. and Kaur[2], J. & Multani[3], N.K.
[1]Reader, Depatment of Physiotherapy & Sports Science, Punjabi University, Patiala-147002, Punjab
(email: narkeesh@yahoo.com)
[2]Lecturer in Physiotherapy, Sardar Bhagwan Singh Post Graduate Institute of Bio Medical Sciences & Research, Balawala, Dehradun (UA)
[3]Prof. & Head, Depatment of Physiotherapy & Sports Science, Punjabi University, Patiala-147002, Punjab

Abstract

The study was conducted on 30 normal females ranging in age from 19-20 years to evaluate the effect of different mechanical compressive forces (50 mm Hg & 100 mm Hg) on motor nerve conduction velocity (MNCV). Conduction Velocity of left Median Nerve was measured at normal body temp. MNCV was measured three times in each subject. First testing of MNCV was done without applying any proximal compression force while second and third MNCV measurements were taken by applying proximal compressive forces above the elbow level equal to 50 mm Hg & 100 mm Hg respectively. The results indicate significant decline in the MNCV after applying compression to the nerve. The decline was related to the magnitude of compression.

KEYWORDS: Motor nerve conduction velocity, Mechanical compression, Median nerve

Introduction

The nerve conduction studies have an important role in the evaluation of peripheral and entrapment neuropathies by confirming the clinical suspicion of neuropathy. Identifying the predominant pathophysiology such as conductive block, axonal degeneration or demyelinating; sensory or motor; and temporal course of disease i.e. acute, sub acute or chronic, and the Nerve Conduction studies provide an objective and qualitative measure of nerve function and help in predicting the prognosis of neuropathy *(Michael, 1999).*

Rydevik et al (1981) and Lung Borg et al (1982) illustrated that direct nerve compression at 30 mm Hg for 2-4 hours produces reversible changes, whereas prolonged compression above this time period at the same pressure level may cause irreversible damage to the nerve. *Parry et al (1981)* reported that during transient paralysis experimentally induced in humans by an inflated cuff around the arm, the conduction velocity falls by as much as 30 percent. A complete conduction block occurs after 25-30 minutes of compression.

The main objective of the present study was to find the changeability in the nerve conduction velocity before and after the compression of the peripheral nerve.

Materials & Methods

Two hundred girl students studying in the Department of Physiotherapy, Sardar Bhagwan Singh Post Graduate Institute of Biomedical Sciences and Research (SBSPGIBSR), Balawala, Dehradun were chosen as the study for population. Thirty subjects were selected from the department of physiotherapy based on the inclusion and exclusion criteria. Normal (medically fit) girl students between 19-20 years of age,

having 5.3-5.5 feet height and weighing between 40-45 kg were chosen as the subjects. Subjects who were using medicine or irradiation or having history of any neurological, muscular, metabolic and systemic disorders, or having history of any injury during past 6 months or subjects unwilling to continue were excluded from this study. The study was performed in the air conditioned laboratory of Department of Physiotherapy at SBSPGIBSR, Balawala, Dehradun. Room temperature was maintained between 21-23^{o}C for creating ideal testing conditions. The body /skin temperature of the subjects' was keept 36^{o}C-37^{o}C by an infrared lamp and by warm water Immersion during MNCV measurement.

For the measurement of MNCV, the recording electrode was placed close to the motor point of abductor pollicis brevis and reference electrode three centimeters distal to first metacarpophalangeal joint. Supramaximal stimulation was given at wrist 3 cm proximal to distal wrist crease and at elbow near the volar crease of brachial pulse *(Mishra & Kalita, 2004).*

For evaluation of the proximal segment of median nerve, the stimulation was also given at axilla and Erb's point. The distal latency, nerve conduction velocity of different segments and compound muscle action potential amplitudes were measured following stimulation at different levels. Conduction velocity in meters/sec was calculated as per the following formula.

$$\textbf{Conduction Velocity} = \frac{\text{Conduction distance (cm)}}{\text{Proximal latency - Distal latency (msec)}}$$

Sphygmomanometer was used to produce mechanical compression. The pressure used in the procedure is 50mm of Hg and 100mm Hg. MNCV was measured as per the procedure described above.

Results and Discussion

Table 1 enlists the mean values of motor nerve conduction velocity of median nerve before and after the application of compression force of 50 & 100 mm Hg. Initially without compression, the mean MNCV value was observed to be 56.19 m/sec. Application of mechanical compression to the tune of 50 mm Hg caused the MNCV to decline to an average value of 53.42 m/sec. This decrease calculates to 2.77 m/sec, which is significant at 5% level (table 2). Further increase in compressive force above the elbow level to 100 mm Hg resulted in further decrease in motor nerve conduction velocity of the median nerve. The slowing of conduction velocity is statistically significant.

Table 1: Mean values of MNCV of Median Nerve before and after the application of compression forces

	N	MNCV (m/sec) Mean ± SD
Before Mechanical Compression (BMC)	30	56.19 ± 4.03
At Compression force of 50 mm Hg (CF 50)	30	53.42 ± 4.74
At Compression force of 100 mm Hg (CF 100)	30	51.60 ± 4.91

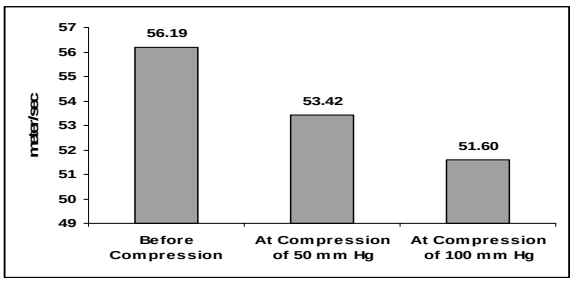

Figure 1: Comparison of the effect of application of compression of left median nerve on motor nerve conduction velocity

Table 2: Statistical evaluation of the Mean difference of MNCV of Median Nerve before and after the application of compression forces

Test Pair	Paired Differences			t
	Mean	SD	SEM	
MNCV BMC – MNCV CF 50	2.77	3.40	0.62	4.47*
MNCV BMC – MNCV CF 100	4.58	3.48	0.64	7.22*
MNCV CF 50 - MNCV CF 100	1.82	1.12	0.20	8.87*

* t values significant at 5% level

The study reveals that there was decrease in the nerve conduction velocity with compression of peripheral nerve. Increase in the compression force on the median nerve further decreased the values of nerve conduction velocity. In terms of percentage, 5% slowing was observed at compression of 50 mm Hg which increased to more than 8% on further increase of compression to 100 mm Hg. The results of the study are in agreement to *Parry et al (1981)* who reported that during transient paralysis experimentally induced in humans by an inflated cuff around the arm, the conduction velocity falls by as much as 30 percent.

Conclusion

The subjects were found to have significant changes in MNVC of the median nerve on compression. The significant differences could be attributed to diagnosis of early entrapment, conduction block or other neuropathies. The MNCV showed changes according to the degree of compression. The study proved beneficial for diagnostic purpose, to give a baseline for the changes in MNCV according to the compression force applied. The study has implications in finding out whether the compression force is stagnant or progressive.

References

Lung, B.G., Gelberman, R.H., Minteer-Convery, M., Lee, Y.F. and Hargens, A.R. 1982. Median nerve compression in the carpal tunnel function response to experimentally induced controlled pressure. *J. Hand Surg.,* **7(3):** 252-259.

Michael, J.A. 1999. *Electrodiagonosis of clinical neurology.* 4th Edition. Churchil Livingstone, New York, 253-289.

Mishra, U.K. and Kalita, J. 2004. *Clinical neurophysiology. nerve conduction, electromyography & evoked potentials.* Elsvier, New Delhi. 30-35.

Parry, G.J., Cornblath, D.R. and Brown, M.J. 1981. Transient conduction block in acute peripheral nerve ischaemia. *Muscle Nerve,* **4:** 441.

Rydevik, B., Lundborg, G. and Bagge U. 1981. Effects of graded compression on intraneural blood flow: An in vivo study on rabbit tibial nerve. *J. Hand Surg.,* **6(1):** 3-12.