RELATIONSHIP OF PERIPHERAL MEDIAN MOTOR NERVE CONDUCTION VELOCITY TO GRIP STRENGTH

Sumit Garg1, Ramya CS, Vinutha Shankar2, Karthiyanee Kutty2, JL Agarwal1
1. Saraswathi Institute of Medical Sciences, Hapur, UP
2. Sri Devaraj Urs Medical College, Kolar, Karnataka

ABSTRACT

Background: Hand grip dynamometry is the most accepted method for evaluating the motor integrity and grasp strength of hand. Median nerve is responsible for gross movements of the hand. Strength of hand is dependent on peripheral innervations.

Objective: To correlate the median motor nerve conduction velocity with handgrip strength.

Methods: 60 apparently healthy males between 20 – 40 years of age, not involved in heavy physical work and with no history of diabetes or peripheral neuropathy were included in the study. Informed consent was taken from all subjects. Hand grip strength of all the subjects was assessed using hand grip dynamometer. Three trials were given to the subjects and maximum strength value was accepted. Hand - Median motor nerve conduction velocity was measured with RMS-EMG MARK II machine. Data was analysed using Pearsons Correlation.

Results: There was a significant positive correlation between median motor nerve conduction velocity with handgrip strength with r = 0.502 (p<.01).

Conclusion: Hand grip strength may be a good clinical prognostic tool for determining median motor nerve integrity.

Keywords: median motor nerve conduction velocity, grip strength

INTRODUCTION

Human hand is the main structure for physically manipulating the environment, used for both gross motor skills (such as grasping a large object) and fine motor skills (such as picking up a small pebble). It is the effector organ of the upper limb; it is capable of performing countless actions owing to its function as prehension and precision. Hand is not only motor organ but also a very sensitive and accurate sensory receptor, which feeds back information essential for its own performance. Adequate muscle power is required for optimum productivity. Decreased muscle strength is a predictor of physical limitations.1 One of the many components to be considered in the examination of the hand function is hand grip strength as it provides objective and quantifiable information regarding hand function.2 Hand grip dynamometry is one of the most accepted methods for evaluating the motor integrity and grasp strength of hand. Median nerve (also called labourer’s nerve) is responsible for gross movements of the hand. Strength of hand is dependent on peripheral innervations. Nerve conduction velocity (NCV) is a non invasive procedure to ensure
neuromuscular integrity of the hand. So, the present study was proposed to investigate whether there exist any relation between hand grip strength and motor nerve conduction velocity.

OBJECTIVE:
To correlate the median motor nerve conduction velocity with hand grip strength

METHODS:
60 apparently healthy males between 20 – 40 years of age, not involved in heavy physical work and with no history of diabetes or peripheral neuropathy will be included in the study. Ethical clearance was taken from Institutional Ethical Committee. Written informed consent was taken from all subjects. Hand grip strength of all the subjects was assessed using hand grip dynamometer. Arm position for assessment of handgrip settled by The American Society of Hand Therapists was utilized. Each subject was positioned in a straight back chair without an arm rest with subject’s feet put flat on the ground. Arm position was demonstrated to all subjects. Each subject was asked to place the right hand on their right thigh and assume a position of shoulder adduction and neutral rotation, while elbow joint was in flexion for 90°, and the forearm and wrist were neutrally positioned, and the fingers flexed for the needed maximum contraction. They were instructed to breathe in through the nose and exhale through a pursed lip after a maximum grip effort was made. A demonstration of maximum handgrip strength was given to each subject before they were asked to do it themselves. Each subject was instructed to squeeze the hand - handle of the dynamometer, which was placed vertically in their hands, as hard as possible. The period of the effort did not exceed 5 seconds. A period of 30 seconds rest was given between three trials for the dominant hand to be tested and the average of the three trials was taken. Three trials were given to the subjects and maximum strength value was accepted. Median motor nerve conduction velocity was measured with RMS-EMG MARK II machine using surface electrodes for stimulation and recording. Conductive gel was used on electrodes which were secured in place with adhesive tape. Median nerve was stimulated first at wrist and then elbow separately. The equipment measures the time for the stimulating impulse to go from the site of stimulation to that of recording; i.e., the latency expressed in milliseconds (ms). Difference between the two latency periods was measured in milliseconds, which gave us time taken by impulse to travel from elbow to wrist. Distance between the wrist and elbow point of stimulation was also measured in millimeters. Motor nerve conduction velocity will be recorded as,

\[ \text{MNCV (meter/ second)} = \frac{\text{Distance between proximal & distal point of stimulation (mm)}}{\text{Proximal (PL) - Distal (DL) latency}} \]

\[ DL = \text{conduction time from more distal stimulus point to muscle} \]

\[ PL = \text{conduction time from near stimulus point to the muscle} \]

The results were analysed using Pearson’s correlation.

RESULTS:
The mean age of the subjects was 26.5 ± 7.43 years. There was a significant positive correlation between median motor nerve conduction velocity with handgrip strength with \( r = 0.502 \) (p<0.01) as shown in Figure 1.
Similarly latency was negatively correlated with grip strength ($r = -0.322, p< 0.01$).

**DISCUSSION:**
Hand grip strength is a predictor of power/strength of the hand. Reliable and valid evaluation of hand strength can provide an objective index of general upper body strength. The power grip is the result of forceful flexion of all finger joints with the maximum voluntary force that the subject is able to exert under normal biokinetic conditions. The synergistic action of flexor and extensor muscles and the interplay of muscle groups is an important factor in the strength of the resulting grip. A CMAP (compound muscle action potential) assessed by motor nerve conduction velocity, provides information regarding the muscle size as it is the summation of individual motor unit action potentials. $^8$

The present study showed that grip strength is directly proportional to the motor nerve conduction velocity and hence inversely proportional to latency. Our results are consistent with a study done by Azadeh et al which also showed positive correlation between grip strength and motor nerve conduction velocity in healthy women. $^4$ Similar results were revealed in a study done by Fattah et al which showed this correlation in diabetics. $^9$ Median NCV significantly contributed to grip strength while controlling for forearm muscle mass (forearm circumference), self-reported 24-hour caloric expenditures, and age was the result of another study done by Meter et al. $^3$ Grip strength data showed a significant decrease in total grasp at all 3 handle sizes after initial median or ulnar nerve block. The average decrease in grip strength was 38% after ulnar nerve block and 32% after median nerve block. $^{10}$ Median nerve NCV is an expensive test which involves application of electrical stimulus and needs patient cooperation as well. Hand grip strength is a simple, convenient and less time consuming process. It can be easily used to assess the efficacy of treatment in median nerve injuries such as carpal tunnel syndrome.

**CONCLUSION:**
Hand grip strength may be a good clinical prognostic tool for determining median motor nerve integrity. It can easily replace expensive motor NCV as a prognostic test to assess the effectiveness of treatment in median motor nerve disorders.

**REFERENCES:**

2. Kuzala, E.A. and Vargo, M.C. 1992. The Relationship between elbow...
position and grip strength. Am J occup Ther 46 (6), 509-512.


Conflict of Interest: None
Corresponding author:
Dr. Sumit Garg
Assistant Professor
Department of Physiology
Saraswathi Institute of Medical Sciences, Hapur, UP
Email: sumitgargdr@gmail.com