Comparative Study of Nerve Conduction Variables in Normotensive and Hypertensive Individuals

Dr. Barkha Rani¹ Dr. Anand Kumar Singh²
¹Assistant Professor (bonded), Govt. Medical College, Nagpur, Maharashtra, India.
²Senior Resident, Department of Orthopaedics AIIMS Raipur, Chhattisgarh-492099 India.

Abstract

Background - Hypertension is the most prevalent cardiovascular disorder that affects many organs of our body. Nerve conduction velocity test is an essential reliable clinical test for the diagnosis of the diseases of peripheral nerves that include peripheral neuropathies. Nerve conduction study measures duration, latency, amplitude and conduction velocity. The present study is carried out to assess latency, amplitude and velocity of motor and sensory nerve conduction variables in median nerve.

Objectives - The aim of the study was to evaluate the motor and sensory conduction latency, amplitude and velocity of median nerve in patients with essential hypertension.

Material and Methods - The study was conducted in the Department of Physiology. The study protocol was approved by the Institutional Ethical Committee. A written informed consent was obtained from each participant. The study was done in 50 hypertensive patients and 50 normotensive subjects between the age group of 40-60 years. Statistical Analysis - The data analysis will be done using the "MedCalc". NCV measures were expressed as mean ± SD. Student paired “t- test” and chi-square test was used for comparison of the values between hypertensive and normotensive group. p value < 0.05 was considered statistically significant.

Results - Motor components of median nerve in hypertensive show latency (7.26±0.71), amplitude (6.88±1.90) and velocity (58.46±4.57) when compared with normotensive shows latency (7.27±0.70), amplitude (7.14±2.03) and velocity (59.3±4.28). Sensory components of median nerve in hypertensive show latency (2.91±0.58), amplitude (33.13±10.51) and velocity (58.3±3.52) when compared with normotensive shows latency (2.85±0.53), amplitude (35.5±12.5) and velocity (58.1±3.15). Hence, when compared, these findings motor and sensory nerve conduction latency, amplitude and velocity in normotensives and hypertensive were not statistically significant (p> 0.05).

Conclusion - Hypertension may produce axonal degeneration, but may not be affecting the myelination thus preserving nerve conduction velocity. Thus, hypertension itself may not affect the nerve conduction variables. Extensive studies are required to study the effect of hypertension in nerve conduction taking into consideration the duration, age, BMI and severity.

Keywords - Nerve Conduction Study, Hypertension, Peripheral Neuropathy.

I. Introduction

Hypertension is a major contributor to the global disease burden. It poses an important public health challenge to both economically developing and developed countries, including India¹. Hypertension defines itself as a sustained elevation of blood pressure >140/90 mm of Hg. Diagnosis is easy and simple to treat with surplus availability of medications, but sometimes it remains undetected, untreated and sometimes the treatment is not adequately effective².

Nerve conduction velocity test is an essential reliable clinical test for the diagnosis of the diseases of peripheral nerves that includes peripheral neuropathies³,⁴. Nerve conduction study involves a measurement of the evoked response at second site over the muscle innervated by the nerve (motor nerve conduction). Nerve conduction study measures duration, latency, and amplitude and conduction velocity. Conduction velocity and latency denote the speed of nerve impulse propagation. They are altered in disease, which cause demyelination. Amplitude denotes the number of functioning fibres and it is altered in diseases causing axonal degeneration⁵.
II. Methods and Materials

The study was conducted in the Department of Physiology, Grant Govt. Medical College Mumbai, Maharashtra. The study protocol was approved by the Institutional Ethical Committee. A written informed consent was obtained from each participant. The study was done in 50 hypertensive patients and 50 normotensive subjects between the age group of 40-60 years, which included both males and females.

**Inclusion Criteria:** The criteria of considering patient hypertensive was BP >140/90 mm of Hg based on the average of 2 readings with a duration of less than 5 years on medication. The controls were healthy volunteers with BP <120/80 mm of Hg(6).

**Exclusion Criteria:** The subjects with any associated diseases like diabetes, peripheral vascular diseases, pregnancy, alcohol, tobacco, smoking, terminally ill hypertensive patients, leprosy or other conditions, which are known to cause peripheral neuropathy were excluded from the study.

**Establishment of Blood Pressure Status:** All control volunteers and hypertensive patients underwent blood pressure measurements. Standard mercury sphygmomanometer with appropriate cuff size was used to measure blood pressure. The subject was asked to sit relaxed in a chair with her/his arm supported comfortably and the pressure cuff was applied closely to the upper arm. The cuff was rapidly inflated to pressure above the level at which the radial pulse could no longer be felt. The stethoscope was placed lightly over the brachial artery and the mercury column was immediately allowed to fall at the rate of 2 mmHg per second. The first perception of the sound was taken as the systolic pressure and then the mercury was allowed to fall further till the sound ceased to be tapping in quality, became fully muffled and finally disappeared. The level where it disappeared was taken as the diastolic pressure. The cuff was then deflated to zero pressure. The measurement was repeated twice with five minute interval and the average taken for accuracy.

**Recording of Nerve Conduction Velocity:** The study was done using NEURO – MEP –NET Machine equipped for EMG/NCV/EP manufactured by NEUROSOFT TM. The apparatus works on a computer with windows 98 operating system having MS Office 97 package.

Motor and sensory conduction variables of median nerve were measured. Instrument setting-

**a) For motor studies:** Sensitivity: 2-5mv/mm, Low frequency filter: 2-5Hz, High frequency filter: 10 KHz

**b) For sensory studies:** Sensitivity: 10-20microv/mm, Low frequency: 5-10Hz, High frequency filter: 2-3 KHz

Sweep speed: 1-2 ms /mm.

Motor Median Nerve Conduction Procedure-

<table>
<thead>
<tr>
<th>Electrodes</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recording electrode</td>
<td>Placed on the motor point of Abductor Pollicis Brevis i.e. midway between the distal wrist crease and the first metacarpalphalangeal joint.</td>
</tr>
<tr>
<td>Reference electrode</td>
<td>Placed 3 cm distal to recording electrode at the first metacarpalphalangeal joint.</td>
</tr>
<tr>
<td>Ground electrode</td>
<td>Placed on the dorsum of hand.</td>
</tr>
</tbody>
</table>
| Stimulating electrode | Distal stimulation point: placed 3 cm proximal to distal wrist crease near the tendon of Palmaris longus.  
Proximal stimulation: placed at the elbow near the volar crease of the Brachial Artery pulse. |

Sensory Median Nerve conduction procedure-

<table>
<thead>
<tr>
<th>Electrodes</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recording electrode</td>
<td>Placed 3 cm proximal to the distal wrist crease slightly radial to the tendon of Palmaris longus.</td>
</tr>
<tr>
<td>Reference electrode</td>
<td>Placed 3 cm proximal to recording electrode</td>
</tr>
<tr>
<td>Ground electrode</td>
<td>Placed on thenar eminence</td>
</tr>
</tbody>
</table>
| Stimulating electrode | Cathode: placed at proximal interphalangeal joint of the second digit (index finger).  
Anode: placed 3 cm distal to the cathode |
Comparative Study of Nerve Conduction Variables in Normotensive and Hypertensive Individuals

III. Results

The results of motor nerve conduction variables were not statistically significant between normotensive and hypertensive group (P >0.05).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Hypertensive (n=50) Mean ± s.d.</th>
<th>Normotensive (n=50) Mean ± s.d.</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latency</td>
<td>7.26 ± 0.71</td>
<td>7.27 ± 0.70</td>
<td>0.9436</td>
</tr>
<tr>
<td>Amplitude</td>
<td>6.88 ± 1.90</td>
<td>7.14 ± 2.03</td>
<td>0.5100</td>
</tr>
<tr>
<td>Velocity</td>
<td>58.46 ± 4.57</td>
<td>59.3 ± 4.28</td>
<td>0.3451</td>
</tr>
</tbody>
</table>

Table 1: Motor Nerve Conduction Variables in Normotensive and Hypertensives.

The results of sensory nerve conduction variables were not statistically significant between normotensive group and hypertensive group (P >0.05).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Hypertensive (n=50) Mean ± s.d.</th>
<th>Normotensive (n=50) Mean ± s.d.</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latency</td>
<td>2.91 ± 0.58</td>
<td>2.85 ± 0.53</td>
<td>0.5904</td>
</tr>
<tr>
<td>Amplitude</td>
<td>33.13 ± 10.51</td>
<td>35.5 ± 12.5</td>
<td>0.3073</td>
</tr>
<tr>
<td>Velocity</td>
<td>58.3 ± 5.52</td>
<td>58.1 ± 3.15</td>
<td>0.7653</td>
</tr>
</tbody>
</table>

Table 2: Sensory Nerve Conduction Variables in Normotensive and Hypertensives.
Comparative Study of Nerve Conduction Variables in Normotensive and Hypertensive Individuals

Graph 2: Sensory Nerve Conduction Variables in Normotensive and Hypertensives.

IV. Discussion

This study aimed to investigate the effect of motor and sensory nerve conduction variables in patients with hypertension. No statistical significant differences were found in sensory and motor nerve conduction velocity of hypertensives as compared to normotensives.

A study was done by Dhafi r I. EI-Yassin et al(7) to assess the relationship between hypertension and peripheral neuropathy. The study assessed nerve conduction variables of sensory nerve function, motor nerve function and also Fwave measurement. They observed statistical significance of (p <0.05) for the association between hypertension patients and sensory nerve conduction that presented deterioration. However, the motor nerve conduction studies (Median, Ulnar, Tibial) did not show much changes; whereas, in their F-wave parameter assessment, the latency of the slowest Fwave was observed in the common peroneal nerve, which was prolonged. From their results, they interpret that smallest fibres were affected in hypertension.

Legrady P et al(8) presented that nondiabetic hypertensive patients also present the complications presented in diabetes. Patients who presented hypertension were undergoing antihypertensive therapy. In the study done by Viskoper et al(9), there is a reduction in nerve conduction velocity in hypertensives. This is because hypertension causes vasospasm of blood vessels supplying the nerves. Popvtzer MM et al(10) showed that motor nerve conduction velocity is reduced in hypertensives when compared with controls. The result of our study is in accordance with the study done by Shubhangi D et al(11) who failed to demonstrate the effect of hypertension on nerve conduction. Another study done by Negler et al(12) also showed similar results of our study, which showed that there is no effect of hypertension on nerve conduction. They proposed that hypertension maybe producing axonal degeneration, but not affecting myelination there by preserving nerve conduction variables. Crowley SD(13) and Yasunari K et al(14) have proved clinically that oxidative stress is an outcome of chronic inflammation in hypertensive subjects. The onset of oxidative stress in hypertensive subjects depletes the levels of nitric oxide via the formation of peroxynitrite. This mechanism has been clinically proved by Moriel P et al(15)

But, our study is in relation with the study done by Negler et al and Shubhangi D et al, which showed a negative correlation between nerve conduction and hypertension.

V. Conclusion

The following conclusion can be drawn from this study –

- Hypertension may produce axonal degeneration, but may not be affecting the myelination, thus it is preserving nerve conduction variables.
- Hypertension itself may not affect the nerve conduction variables. Associated factors such as age, BMI and other diseases may cause variations in nerve conduction defects. Extensive studies are required to study the effect of hypertension in nerve conduction taking into consideration the duration, age, BMI and severity of the disease.
- Finding of reduced nerve conduction velocity in hypertensive patients should alert the physician to the possibility of associated diseases like diabetes mellitus, alcoholism or concomitant peripheral vascular diseases.
- Extensive studies are required to study the effect of hypertension alone on nerve conduction velocity, taking into consideration the severity, duration and treatment of hypertension.
Comparative Study of Nerve Conduction Variables in Normotensive and Hypertensive Individuals

Acknowledgement

We sincerely thank Dr. Sachin H. Mukutkar Professor and Head of Department of Physiology, we also thank teachers and staff members of Department of Physiology & Department of Medicine, Grant Government Medical College, Mumbai for their support.

References


DOI: 10.9790/0853-1902151216 www.iosrjournals.org 16 | Page