Effect of posture correction on blood pressure in persons with Forward Head Posture

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ABSTRACT

Objectives. Hypertension is also known as Elevated Blood Pressure in which SBP is equal to 120-129 mm Hg while DBP is equal or less than to 80 mm Hg or if a person taking antihypertensive drugs at any stage of higher BP according to American college of Cardiology/American Heart Association 2017 guidelines. The main objective of this study was to evaluate the efficacy of posture correction on Blood Pressure in persons with Forward Head Posture: A Randomized Control Trial.

Materials and methods. 86 patients with a mean age of 56.83±11.40 who had Forward Head Posture and raised blood pressure were randomly assigned to 2 group (N = 43 in each group). Group 1 is experimental group who performed strengthening exercise (Cervical isometrics, Rhomboids and Longus Capitis) and stretching exercises (Trapezius, Scalene, Sternocleidomastoid and Pectoralis Major and minor) 6 repetitions of each exercise, twice per week for 4 weeks). Group 2 is a control which was on antihypertensive drugs for 4 weeks. The outcome measures used was BP using Sphygmomanometer. Patients were assessed at baseline, after 4 weeks of treatment.

Outcomes. Of 86 patients, 43 patients who received stretching and strengthening exercise, received intervention twice per week for 4 weeks. There was significant within group effects (p=0.000) for Blood Pressure. The findings obtained by comparing both groups were, SBP & DBP reduced significantly after 4 weeks SBP (MD = 2.86; 95% CI 3.23 to 2.48; p=0.000) DBP (MD = 2.48; 95% CI 2.82 to 2.15; p=0.000)

Conclusions. The efficacy of posture correction in persons with Forward Head Posture is an effective treatment and could considerably decrease the Blood Pressure in Hypertensive patients.

Keywords: blood pressure, cranio vertebral angle, forward head posture, randomized control trial

INTRODUCTION

Hypertension is also known as Elevated Blood Pressure in which SBP is equal to 120-129 mm Hg while DBP is equal or less than to 80 mm Hg or if a person taking antihypertensive drugs at any stage of higher BP according to American college of Cardiology/American Heart Association 2017 guidelines [1]. In twentieth century, approximately 1 billion adults had hypertension and it will reach up to 1.56 billion by 2025. In developing countries, the prevalence of hypertension is the leading cause of death [1]. There is a positive relationship between Blood Pressure and Chronic vascular disease (CVD). As it affects both systolic BP and diastolic BP, systolic BP is most commonly affected in the case of adults [2].

Various major manifestations happened due to hypertension like Hemorrhagic Stroke, any arterial manifestation like (CAD), congestive cardiac failure, vascular disease, and kidney failure. Hypertension can have genetic background like primary hypertension (essential hypertension) due to genetic makeup and mutation [2]. Sodium is an important regulator of BP. Due to increased serum sodium concentration; there is water retention due to which blood volume and blood pressure increased. Na salt sensitivity and pressure natriuresis is mainly controlled by RAAS which leads to decreased vasoconstriction, endothelial dysfunction, and Na+ salt sensitivity (role in the pathogenesis of hypertension) [2-4]. Baroreceptors and mechanoreceptors (which sense pressure) of the circulatory system are housed.
in various locations. So hyperactivity of SNS is relevant for the maintenance of hypertension [2,4].

Globally, eight hundred seventy four million adults have increased SBP (≥140); one adult have hypertension out of four. It shows that non-optimal BP leads to the biggest risk for increased mortality. Consequences results in approximately 212 million health life lost every year and 9.4 million mortality happened [2-4].

The increased use of media devices like smart phones and computers, can lead to incorrect posture. Hyperextension and forward translation of the upper cervical vertebrae can lead to Forward head posture (FHP). Slouched-forward shoulders and rounded upper back may cause complications of Thoracic Kyphosis. Due to which there is a shortening of the muscles of the neck mainly at the posterior or side, it can lead to compression of the cervical vertebrae—which is the upper most portion of the spine [5]. The lower medulla oblongata is protected by the cervical column so close proximity between two. As known about higher mobility of the cervical column which may leads to more mechanical transition [6-9].

Past evidences from previous studies (Bakris et al & Kadu et al) shown that there is relationship between malalignment of atlas and higher BP and correction of malalignment leads to significant reduction in BP [10,11]. FHP (due to malalignment of atlas) may lead to harmful effects on BP because of close proximity between neural structures and cervical spine (as we know BP vasomotor center present in medulla oblongata). Increased BP can be due to ischemia of the brainstem [10,11].

Therefore we hypothesized for present study that misalignment at C1-C2 area is in close approximation with decreased profusion to brainstem and relatively associated with higher BP. So; present study aimed to correct the misalignment of C1-C2 area to lower the blood pressure.

**METHODS**

A Randomized Control trial ethical approval was taken from “Institutional Ethical Committee, vide letter no PTY/2021/42, Department of Physiotherapy, Guru Jambheshwar University of Science and Technology, Hisar.” Interventions of study to be performed with approval by guidelines of ethical committee. After fully describing the study to the participants, they interviewed & evaluated for eligibility and signed a written informed consent form. The inclusion criteria were age 30-70 years, the patient who is affected with Hypertension and has a CV angle less than 50° were considered to have FHP. Baseline reading of all outcomes measure was noted before the start of intervention.

Group 1 received stretching exercise (tight structures) of Trapezius, Scalenes, Sternoceiledomastoid, Pectoralis Major & Minor and strengthening exercises (weak structures) of Rhomboids, Longus Capitis and cervical isometrics; 6 repetitions for twice a week total treatment of duration is 4 weeks. Group 2 received antihypertensive medication as prescribed by their physician. Clinical assessments performed at first visit and after 4 weeks. The primary outcome was Blood Pressure assessed through Sphygmomanometer. Data were analyzed with statistical software (SPSS version 21.0). Normality of data was evaluated using the Kolmogorov-Smirnov test. An unrelated t-test was used to compare both groups.

**RESULTS**

Trial started with eighty-six hypertensive patients (43 participants with mean age 56.83±8.93 in experimental group; 43 participants with mean age 53.91±11.41 in control group) along with forward head Posture and fulfilling selection criteria were recruited for the study. Table 1 shows the descriptive statistics of participants. All patients in different group of this trial had done almost all exercise sessions.

When we compared SBP of both groups at pre assessment and post assessment level at 4 weeks; Post assessment SBP showed significant mean re-
TABLE 1. Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Experimental group</th>
<th>Control group</th>
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</thead>
<tbody>
<tr>
<td>F</td>
<td>27 (62.8%)</td>
<td>25 (58.1%)</td>
</tr>
<tr>
<td>M</td>
<td>16 (37.2%)</td>
<td>18 (41.9%)</td>
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<tr>
<td>Age</td>
<td>56.83±8.93</td>
<td>53.90±11.40</td>
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<tr>
<td>CV Angle</td>
<td>36.14±7.40</td>
<td>34.65±6.42</td>
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<tr>
<td>PRESBP</td>
<td>147.67±11.06</td>
<td>148.60±11.46</td>
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<tr>
<td>PREDBP</td>
<td>84.86±5.95</td>
<td>86.04±4.94</td>
</tr>
<tr>
<td>POSTSBP</td>
<td>140.23±8.05</td>
<td>145.76±11.58</td>
</tr>
<tr>
<td>POSTDBP</td>
<td>84.86±5.95</td>
<td>83.16±5.23</td>
</tr>
</tbody>
</table>

TABLE 2. Changes in SBP and DBP in both groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Blood Pressure</th>
<th>Pre Intervention</th>
<th>Post Intervention</th>
<th>P value</th>
</tr>
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<tbody>
<tr>
<td><strong>Experimental Group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Systolic Blood Pressure</td>
<td>147.67±11.06</td>
<td>140.23±8.05</td>
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<tr>
<td>Diastolic Blood Pressure</td>
<td>84.86±5.95</td>
<td>81.23±5.57</td>
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<tr>
<td><strong>Control Group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic Blood Pressure</td>
<td>148±11.4</td>
<td>145.77±11.5</td>
<td></td>
<td>0.001</td>
</tr>
<tr>
<td>Diastolic Blood Pressure</td>
<td>86.05±4.9</td>
<td>83.16±5.2</td>
<td></td>
<td>0.001</td>
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</table>

TABLE 3. Comparison of mean change of outcome variable between the groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Experimental Group</th>
<th>Control Group</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean improved systolic Blood Pressure</td>
<td>7.44±6.21</td>
<td>2.83±0.75</td>
<td>.001</td>
</tr>
<tr>
<td>Mean improved Diastolic Blood Pressure</td>
<td>3.62±3.73</td>
<td>2.88±0.76</td>
<td>.20</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The purpose of present trial was to examine the efficacy of posture correction on BP in persons along with Forward Head Posture. Now a days, the popularity of media devices like smart phones and computers is increasing, which leads to incorrect posture. Individuals with FHP, show slightly higher BP than individuals without FHP. The patient (male &female; 30-70 yrs) was grouped under the experimental group who received treatment for correction of forward head posture and the control group who remained only on antihypertensive medication. The intervention was given twice per week for 4 weeks (6 repetitions of each exercise). We hypothesized that correction of forward head posture helps in significantly lowering down the BP in hypertensive patients. It is found that there is a close relationship between the cervical spine and neural structures. So study findings corroborated with previous literature that any kind of malalignments on atlas vertebrae can lead to ischemia of brainstem circulation due to which BP can increase [10,11].

In FHP, there is backward rolling of occipital condyles and forward sliding occurs due to upper cervical spine extension [13,14]. These C1-C2 vertebral malalignment, compromise arterial circulation and restricts flow of cranial nerve passed along to these vertebrae that affects vital functions like BP and HR [10,11]. Previous study literature by “Jannetta et al” concluded that ischemia of arterial flow & vagal nerve flow might be a reason for elevation of blood pressure consequently leads to hyperactivation of autonomous system of the vasomotor center present in the brainstem and affects tenth cranial nerve [15].

Neurons in the C1 area are sympatho excitatory and it has been demonstrated by the findings that chemical stimulation in the rostroventral-lateral nucleus excites sympathetic preganglionic neurons resulting in elevation of arterial pressure, and accelerates the heart, and releases vasopressin and adrenal catecholamines [11].

In FHP, gravity line creates flexion moment because it crosses anterior to cervical spine. To compensate the abnormalities of excessive flexion moment and holding head in neutral, there is excessive work load of cervical neck muscle without change in length. Edwards et al conducted a study to examine neuronal pathway between cervical neck muscles and nucleus of tractus solitarius (NTS controlling BP & HR) and found a direct neuronal pathway. Therefore, any mal alignment at cervical vertebra leads to alteration in BP because of “cervico-sympathetic reflex” stimulates from muscle receptors (“muscle spindles”) in the extensor muscles at cervical region [16]. So correction of misalignment at C1-C2 area is closely related in lowering of blood pressure.

**CONCLUSION**

It is found that there is a close relationship between the cervical spine and neural structures and any kind of malalignments on atlas vertebrae can lead to ischemia of brainstem circulation due to which BP can increase. Based on findings of the study, there is significant reduction in SBP after correction of mal alignment at cervical region because of cervico-sympathetic reflex. Therefore, correction of cervical vertebral mal alignment may involve in
nonpharmacological intervention to treat forward head posture consequently result in management of hypertension in patients with Forward Head Posture.

Acknowledgement

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REFERENCES


