



A COMPARATIVE STUDY ON EFFECTIVENESS OF ABDOMINAL BINDER ON BLOOD PRESSURE IN LYING TO STANDING POSITION AMONG YOUNG SELF REPORTED HEALTHY COLLEGE STUDENTS

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ABSTRACT

Aim: The Cardiovascular changes may take place during upright standing position. Several types of compression bandage are used to treat the orthostatic hypotension, mainly abdominal compression bandages are recommended for the reduction of gravity induced blood pressure drop. The aim of the study was to determine the effect of abdominal binder on blood pressure in lying and standing position among self-reported college students.

Methodology: The blood pressure was measured in both the groups from lying to standing position by the use of sphygmomanometer. Subjects in group B wear abdominal binder in lying and standing position while measuring blood pressure. The values in both the positions were recorded.

Results: The result showed there were significant changes within group analysis of systolic blood pressure in lying and standing position ($p < 0.01$) and there were significant changes in within group analysis of diastolic blood pressure without abdominal binder ($p < 0.01$) when used abdominal binder from lying to standing position ($p = 0.083$) it did not show any significant changes. The unpaired 't' test result showed insignificant changes in lying to standing in systolic blood pressure ($p = 0.892$ & 0.386) and diastolic blood pressure ($p = 0.811$ & 0.403).

Conclusion: The abdominal binder is not an effective means in maintaining blood pressure during lying to standing position. But only in diastolic blood pressure it gives significant changes in maintaining the blood pressure.

Key Words: Blood pressure, Abdominal binder, Orthostatic hypotension, Positional variation

INTRODUCTION

The autonomic nervous system plays major role in regulation of blood pressure and heart rate¹. Generally, the term blood pressure refers to arterial blood pressure. Arterial blood pressure is defined as the lateral pressure exerted by the contained column of blood on the wall of arteries. The pressure is exerted when the blood flows through the arteries².

In standing position the blood goes down from chest to the distensible venous capacitance system below the diaphragm. The abdominal contents are unsupported in anterior and inferior surface because of the gravity.

It results in drop in blood pressure, cardiac output, venous return and ventricular filling this is due to the fluid shift, approximately 500 to 1,000 ml of pooling of blood into the lower extremities is takes place within ten seconds and the total transfer occurs within 3 to 5 minutes. It will stimulate the sympathetic outflow, which results increases peripheral vascular resistance; it will limit the reduction in blood pressure³.

Any pathological variations may cause alteration in the blood pressure². Reflex mechanisms and hemodynamics prevent drop in blood pressure and bring the cardiovascular changes during upright standing position. Failure

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of one of the subsystems can lead to gravitation-induced shifts in blood volume. It results in a clinical symptoms termed orthostatic hypotension⁴. In orthostatic hypotension, this complex system does not allow the circulatory system to compensate the gravity induced drop in the blood pressure³.

Wearing an abdominal binder helps to support the abdominal contents and decreases the drop in blood pressure. The function of abdominal binder is to improve the respiratory mechanism. Several types of compression bandages are used to treat the orthostatic hypotension mainly abdominal compression bandages are recommended for the reduction of gravity induced blood pressure drop³.

The abdominal binder increases the intra-abdominal pressure. This negative pressure helps prevent redistribution of blood into the abdomen and lower extremities when in standing position⁵. The elastic abdominal binder that exerted 15 to 20 mmHg of blood pressure during standing position.

The effect of compression therapy and beneficial effect of this treatment in orthostatic hypotension is unclear. In India there are only few studies to investigate the effect of abdominal compression stocking to control the drop in blood pressure. Orthostatic hypotension commonly found in upper spinal cord injury. In India a study conducted at 2014 presented about 2716 cases of spinal cord injury patients, of that 1400 were cervical and 1316 were thoraco-lumbar, with male to female ratio of 4.2:1 and 71% in the age group of 20 to 49 years⁶.

Studies are required to examine the effectiveness of the abdominal binder in orthostatic hypotension for spinal cord injuries. Unnoticed orthostatic hypotension during the home programs may lead to immediate medical attentions. Studies in healthy subjects will provide a clear picture about the blood flow changes with binder. The present study aimed to determine the effect of abdominal binder on blood pressure in lying and standing position among young healthy self-reported college student.

MATERIAL AND METHOD

The study design was a comparative study design. After getting the approval from the institutional ethical committee, willing subjects were communicated through appropriate channels. The selection criteria includes both gender students with the age group of between 18 to 25 years within normal blood pressure (systolic blood pressure 110 to 140 and diastolic blood pressure 60 to 80) were included for screening in the present study. Subjects with the history of hypertension or hypotension, cardiovascular, respiratory, and neurological problems, underwent recent abdominal surgeries, period of menstrual cycle in females, chronic abdominal pain, obese

subjects, recent blood donors and other problems such as gastritis; spinal disc lesion, kidney stone, stomach cancer, urinary incontinence and spinal deformity were the exclusion criteria.

87 students enrolled their names to involve in the study. In which 63 students were selected based on the selection criteria. They were randomly allocated into two groups by using closed envelope method. After the commencement of the study, three students were withdrawn from the study.

Group A consisted of 30 members (control group) and Group B consisted of 30 members (experimental group). Both the groups received explanation in details about the present study. The subjects were instructed not to wear tight cloths or bands and lie down in table for blood pressure settlement and general relaxation for 5 min. Then subjects were instructed to be in supine lying position on manual tilting table and were made to wear the safety straps. The blood pressure was measured in lying position by using sphygmomanometer and stethoscope.

After the measurement the table was tilted to 90 degree to achieve upright standing position and then the blood pressure was measured in this position immediately (Figure-1). The group 'A' subject's blood pressure was measured without the abdominal binder application and the group 'B' subject's blood pressure was measured with the application of abdominal binder in both the lying and standing position. The values of blood pressure in lying and standing position were recorded.

DATA ANALYSIS AND RESULTS

The values of systolic and diastolic blood pressure with and without abdominal binder was analyzed by 't' test.

WITHIN GROUP ANALYSIS

Results of systolic blood pressure of group A & B in which p values ($p < 0.01$) showed significant difference between pre and post mean values (Table: 1 & Graph: 1). Results of diastolic blood pressure of group A in which p value ($p < 0.01$) showed significant difference between pre and post mean values (Graph: 1), but in group, B p value ($p = 0.083$) showed no significant changes in pre and post mean values (Table: 2 & Graph: 1).

BETWEEN GROUP SYSTOLIC BLOOD PRESSURE ANALYSIS

Results of post systolic blood pressure in which p value ($p = 0.386$) showed no significant difference between

with and without binder groups (Table: 3). Result of post diastolic blood pressure in which p value ($p=0.403$) showed no significant difference between with and without binder groups (Table: 4).

DISCUSSIONS

Abdominal binders are commonly advised among patients with orthostatic hypotension¹¹. The present study investigated the effect of an abdominal binder on blood pressure in lying and tilted position.

Hollister AS, et al., (1992) did the study on orthostatic hypotension, its Causes, evaluation, and management. He states that a normal hemodynamic response to changes during changing postures controlled by normal function of the cardiovascular and autonomic nervous systems. While in standing position, he found about 5 to 10 mm of Hg systolic blood pressure was decreased and the diastolic blood pressure decreased up to 5 to 10 mm of Hg and increases in pulse rate through his study³.

Tanaka H, et al., (1996) and Choe MA, et al., (1993) investigated the effect of changing position from supine to standing upright and blood pressure changes they found out the active standing result in reduction in blood pressure reduction caused by activation of cardiopulmonary baroreflex, due to a shift of blood from the splanchnic vessels⁸. These two studies states that there is fall in blood pressure level when changing posture from supine to standing position. It is due to the effect of gravity.

The present study revealed that there was a drop in blood pressure after obtaining standing position. The blood pressure drop is about 10mm of Hg in systolic blood pressure and 5 to 7mm of Hg in diastolic blood pressure.

Smit AA, et al., (2004) done his study on use of lower abdominal compression to combat orthostatic hypotension in patients with autonomic dysfunction. The study was to investigate in patients with neurogenic orthostatic hypotension the mechanism and uses of abdominal compression during standing position with 23 patients. The blood pressure with 40-60 degrees head tilted position was evaluated in three main protocols that are the effect of abdominal compression on caval vein, the level of compression and the arterial pressure response, and investigated the ability of the abdominal binder to maintain standing blood pressure. He found that the elastic abdominal binding increased standing blood pressure with 15/6 mmHg (range -3/3 to 36/14, $p < 0.05$). He concluded that the abdominal compression increases standing blood pressure to a varying degree by increasing stroke volume⁹. This conclusion was supporting this current study by increasing standing blood pressure when applying abdominal binder only on diastolic blood

pressure not in systolic blood pressure.

H.E. Smeenk, et al., (2014), did his study on Compression therapy in patients with orthostatic hypotension. He apply compression bandage in four different levels in the treatment of orthostatic hypotension: up to knee level, up to thigh level, full length and abdomen. Full length compression (lower limbs and abdomen) and compression of solely the abdomen were found to be increase in blood pressure when compared to other two level of compression. The significant reduction in systolic blood pressure was seen after postural change. This review states that compression of abdomen has greatest beneficial effect⁴ and stating that the compression of the abdomen has the greatest beneficial effect when comparing other area. Goldman et al., compared girth measurement without the abdominal binder for normal and tetraplegia subjects, and found that the girth was 6% greater from supine to sitting in the tetraplegia group above that of the normal group¹⁰. The abdomen to be compressed more easily in the supine position than in the sitting position. Inconsistent levels of compression result in lack of standardization of compression^{11, 12, 13, 14 & 15}. It may alter physiological effects of an abdominal binder. Both the studies emphasized the amount of pressure and the position of binder. However, the degree and percentage of compression of the abdominal binder was not well controlled in the present study.

The type of material used to making up the abdominal binder differed. The elastic material used in some of abdominal binders, which allow the abdomen to expand and recoil during breathing. If a rigid support is applied to the abdomen, it completely restricts the abdominal expansion during inspiration. The study by Goldman et al., evaluate the use of a standard elastic abdominal binder against a custom thermoplastic rigid abdominal binder for the same subject, and found that both abdominal binder enhanced respiratory volume outcome¹⁰. However, binding the abdomen with a rigid support may be expected to alter the pattern of breathing, and expansion of the lower ribs. Here elastic abdominal binder was used, but didn't investigate about the effect of elastic type of abdominal binder during respiration.

The adverse effect was reported when using an abdominal binder in female subjects, this was discomfort because of the abdominal binder impinging on the breast line⁵. It may limit the physiological benefit of the abdominal binder because of the noxious stimulus. The height of the abdominal binder in the present study was 30cm and discomfort was not reported.

Goldman et al¹⁰ and Boaventura et al¹¹ used 20cm, Kerk et al⁵ used 30cm, Huang et al¹⁶ used 20cm and McCool et al¹⁵ and Boaventura et al¹¹ used an abdominal binder that ranged from the pubis to the costal margin. During inspi-

ration, the diaphragm moves caudally, it presses the abdominal contents¹⁷. The abdominal binder that interferes with the rib cage. It will limit the ability of the abdominal binder to expand¹⁰.

B M Wadsworth, et al., (2009) done his study on abdominal binder used in people with spinal cord injuries: a systematic review and meta-analysis. He conducted a review on the evidence for the use of an abdominal binder on breathing and cardiovascular function in people with spinal cord injury. Comparison of studies involving elastic and non-elastic binders was performed. A mean score of 4.3 out of 8 (range: 3–6) was found. The study states that the use of abdominal binders improved vital capacity by (weighted mean difference (95% confidence interval) 0.32 (0.09, 0.55) liters, decreased functional residual capacity by 0.41 (0.14, 0.67) liters, but did not significantly influence total lung capacity¹⁸.

This current study states that the abdominal binder is not effective in maintaining the blood pressure during lying and standing position. But only in diastolic blood pressure it gives the significant difference.

CONCLUSIONS

The study showed significant changes in systolic blood pressure in within group analysis and insignificant changes in intergroup analysis. It showed binder is ineffective since there is marked difference in blood pressure changes in within group analysis and inter group analysis.

In diastolic blood pressure there were significant changes when abdominal binder was not used. But use of abdominal binder showed insignificant changes in diastolic blood pressure. It showed binder stabilize the diastolic blood pressure changing lying to standing. But there was no insignificant change in between this group.

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AUTHOR'S CONTRIBUTION

All the authors provided concept / idea / Research design. Apart from that Mr. Dhivakar Murugan provided data collection, Dr. Moushami Purkayastha provided data analysis, Dr. Raja Senthil Kandasamy provided project management, Dr. Thangavelu L Perichi Gounder provided study facilities / equipment and subjects and Dr. Sankar Sahayaraj Muthukaruppan provided writing and consultation.

ABBREVIATIONS:

SBP: Systolic Blood Pressure

DBP: Diastolic Blood Pressure

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Table 1: Within group analysis of systolic blood pressure changes in lying to standing position for both with and without abdominal binder group

Variables	Mean \pm Standard Error Mean		't' Value	'p' Value	Results
	Lying Position (Pre)	Immediately After Standing (Post)			
Without abdominal binder group	114.00 \pm 1.40	104.66 \pm 1.33	9.815	0.000	Highly significant
With abdominal binder group	116.00 \pm 1.40	109.00 \pm 1.29	7.167	0.000	Highly significant

Table 2: Within group analysis of diastolic blood pressure in lying to standing position for both with and without abdominal binder group

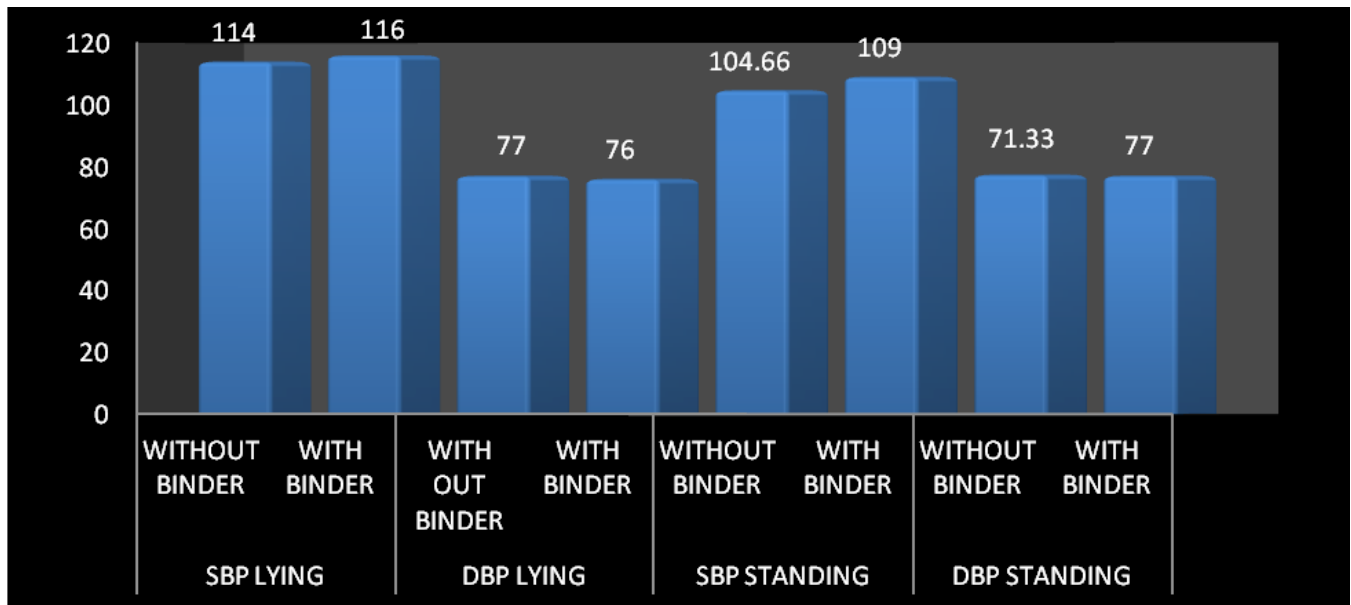
Variables	Mean \pm Standard Error Mean		't' Value	'p' Value	Results
	Lying Position (Pre)	Immediately After Standing (Post)			
Without abdominal binder group	77.00 \pm 1.28	71.33 \pm 1.28	4.572	0.000	Highly significant
With abdominal binder group	76.00 \pm 1.13	77.00 \pm 1.18	1.795	0.083	No significant

Table 3: Intra Group Analysis of Systolic blood pressures of without and with application of abdominal binder in lying to standing position.

Intra Group Analysis	Mean \pm Standard Error Mean		't' Value	'p' Value	Results
	Without Abdominal Binder	With Abdominal Binder			
Lying (Pre Values)	114.00 \pm 1.40	116.00 \pm 1.40	.019	.892	Not significant
Immediately After Standing (Post Values)	104.66 \pm 1.33	109.00 \pm 1.29	.763	.386	Not significant

Table 4: Intra Group Analysis of Diastolic blood pressures of without and with application of abdominal binder in lying and standing position.

Intra Group Analysis	Mean \pm Standard Error Mean		't' Value	'p' Value	Results
	Without Abdominal Binder	Without Abdominal Binder			
Lying (Pre Values)	77.00 \pm 1.28	76.00 \pm 1.13	.058	.811	Not significant
Immediately After Standing (Post Values)	71.33 \pm 1.28	77.00 \pm 1.18	.709	.403	Not significant



Graph 1: Comparison of mean score value of systolic and diastolic blood pressure in without and with abdominal binder in lying and standing position.



Figure 1: Measuring BP in standing position with and without the abdominal binder