ijcrr
Vol 04 issue 11
Category: Research
Received on:22/04/12
Revised on:01/05/12
Accepted on:12/05/12

COMPARISON OF MEAN ARTERIAL BLOOD PRESSURE IN FOUR DIFFERENT BODY POSITIONS BETWEEN HYPERTENSIVE AND NORMOTENSIVE INDIVIDUALS

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ABSTRACT

Objectives: It is known that changes in the body positions leads to the various changes in the cardio vascular system. It is also known that many factors influence on individuals BP measurement, however BP is constantly changes from one position to another. Change in positions well known to cause change in intravascular and intra cardiac volumes and pressures, and in neurohumoral activity. Surprisingly there is little information available on the BP changes in various positions between hypertensive and normotensive individuals. Purpose of the study to compare mean arterial blood pressure response between supine, sitting, standing and supine with crossed leg positions. **Methods:** 100 volunteers,50 hypertensive and 50 normotensive, male – 49, Female – 51, age range 18 – 35 years, with mean age of normotensive individuals 22.74± 2.90 and mean age of hypertensive individuals were 27.70 ± 3.19 . Four different positions were used in this study: Sitting, Standing, Supine and supine with cross leg. Blood pressure measured by standardized mercury sphygmomanometer and MABP value was calculated as per formula. **Results:** Comparison of changes in MABP scores in different positions between hypertensive and normotensive individuals shows p – value < 0.01 which were statistically significant. **Conclusion:** The study shows that there is significant difference of positions on MABP response between hypertensive and normotensive individuals. The study concluded that in standing position MABP is lower than other positions and supine position has higher MABP values.

Keywords: Hypertensive, Normotensive, Positions, MABP (mean arterial blood pressure)

INTRODUCTION

Blood pressure is the lateral pressure exerted on the wall of the vessels by the column of blood present in it. The maximum pressure, which occurs during systole, is called systolic pressure and the minimal pressure produced during diastole is called diastolic pressure. The difference between two pressures is called pulse pressure. The average of pressure produced during a cardiac cycle is known as mean pressure. It is calculated by taking the diastolic pressure and adding one third of pulse pressure. Systolic pressure ranges from 100 to 140 mm of Hg. With the average pressure of 120 mm of Hg. In adults, diastolic pressure ranges from 70 to 90 mm of Hg and the average is 80 mm of Hg. Pulse pressure is the difference between systolic and diastolic pressures and is 40 mm of Hg. The mean arterial blood pressure is 100 mm of Hg.[1]

The concept of stages of hypertension has been applied to define levels of blood pressure. Many clinicians have continued to use more

descriptive terms such as “mild,” “moderate,” or “severe” hypertension. Therefore, to avoid confusion between physicians and patients regarding the risk associated with hypertension, it is best to describe the degree of blood pressure elevation using a staging system. When systolic and diastolic blood pressure fall into different categories, the higher stage should be used to classify the patient's blood pressure because both are independent risk factors for subsequent cardiovascular events.[2]

Hypertension is the most common disease-specific reason for which Americans visit a physician. It is currently among the leading causes of morbidity and mortality in the world and is expected to have an even greater impact on the health of the public as more of the world becomes developed.[3] In addition to the morbidity and mortality directly attributable to hypertension, high blood pressure is a powerful risk factor that in this case increases the likelihood that an individual or population will develop a wide variety of cardiovascular diseases [4,5,6,7,8] Movement from a supine or sitting position to standing causes a rapid loss of blood from the thoracic and abdominal cavities and pulling in extremities, reducing venous return and cardiac stroke volume. Under normal conditions, this stimulates baroreceptors to active the sympathetic nervous system, leading to vasoconstriction and increased heart rate to maintain a stable blood pressure as parasympathetic nerve signals to the heart are withdrawn, thus causing short term blood pressure changes, although up regulation of sympathetic activity is necessary for regulation of blood pressure, hyper reactivity is associated with harmful effects, including the development of hypertension.[9]

A change in the body position from upright to the supine increases left ventricular blood filling with simultaneous stroke volume and cardiac output increases but decreases heart rate and arterial blood pressure.[10]

Orthostatic stresses are common daily events in humans. In the upright position, a gravitational displacement of blood from the thorax to the venous vascular beds of the legs, buttock and abdomen occurs. During orthostasis, approx. 600–700 ml of blood is transferred to the regions below the diaphragm [11, 12]. Which is known as ‘venous pooling’ This results in a reduced venous return to the heart and a fall in central venous pressure with a consequent decrease in cardiac filling, stroke volume and cardiac output [13].

Gravity imposes numerous cardiovascular and neurohumoral adjustments on the human body in the standing position. Physiological adaptations mainly due to the effect of gravity occur during changes of position and can influence the symptoms of various diseases involving not only the circulatory system but also other systems (respiratory, digestive, osteoarticular etc).[14]

Posture affects blood pressure, with a general tendency for it to increase from the lying to the sitting or standing position. However, in most people posture is unlikely to lead to significant error in blood pressure measurement provided the arm is supported at heart level. None the less, it is advisable to standardize posture for individual patients and in practice blood pressure is usually measured in the sitting position. [15]

The indirect blood pressure measurement is perhaps the most frequently performed clinical procedure and important therapeutic decisions rely on its accuracy. However, its accuracy strongly depends both on the number of measurement and the circumstances during the procedure. Unfortunately, it is perhaps one of the most inaccurately performed procedures done by healthcare providers. [16]

The position of the patient during the measurement is often neglected. The reference

point for the measurement of the blood pressure is the right atrium, the so called "heart level".[17]

A change in posture is well known to cause changes in intravascular and intracardiac volumes and pressures, and in neurohumoral activity.[18, 19, 20, 21] Thus, the impact of body positioning needs to be verified as significant heamodynamic variations may lead to different interpretation of the study.[22, 23]

Some of the identified sources of error included inappropriate cuff size, wrong arm position, failure to allow a rest period before taking blood pressure, deflating the cuff too rapidly, not measuring the BP in both arms, and failure to palpate for maximal- systolic pressure before auscultation. [24]

It is known that failure to support the arm, even when the arm is in slightly flexed at the elbow and at heart level position' [25] can raise the blood pressure by as much as 10% this effect is even greater in hypertensive's and the patients taking b- blocker .[26]

By understanding how MABP varies in different body positions between the hypertensive and normotensive individual, physiotherapist can better advice on positional changes that may help in improve the stability of cardiovascular response in hypertensive patient.

Keeping in view the above this study intended to examine the comparison of Mean arterial blood pressure in four different body positions between hypertensive and normotensive individuals and to find out the changes in MABP scores in various positions between hypertensive and normotensive individuals.

METHODOLOGY

In Observational study, A total of 100 individuals, 50 hypertensive and 50 normotensive. With age of 18 to 35 years were obtained. Before they enter into the study protocol, they were explained about the procedure. A written consent form obtained from those subjects who were willing to participate in the study after screening for the inclusion and exclusion criteria. Purposive sampling technique used to collect 100 subjects of both sexes in the age group of 18 – 35 years.

Inclusion Criteria:(1) 50 hypertensives and 50 normotensive subjects in age group of 18 to 35 years (both male and female) (2) Person scoring 100 in 36 – SF questionnaire.[28] (3) Hypertensive individual with mild grade (140/90 mm of Hg). (4) BMI 18.5 – 29 kg/m^2

Exclusion Criteria: (1) Individual with any cardiovascular problems or under medication, (2) Hypertensive individual with SBP≥140 mm of hg, and DBP ≥ 90 mm of hg. 3) Acute systemic illness (4) Recent history of postural hypotension. (5)Renal hepatic disease, severe anemia, hypothyroidism and cerebro vascular accident (6) After any abdominal surgery, hernia, (7) Pregnant women, (8) Smokers.

Procedure: Subjects were instructed to wear loosen and comfortable clothing and not to eat food or do any exercise 1 hour before they start their procedure. Prior instructions about the procedure were given to each enrolled subject as explained below.

Positioning: BP was taken in each of four different postures: supine, sitting, standing and supine with crossed leg.

Sitting: Subjects sat on chair with arm and back support. The height of the seat was adjusted so that the angle of hip and knee joint was 90°

Standing: Subjects were instructed to stand free with feet slightly apart, aiming for an equal weight distribution between left and right feet.

Supine: The subjects resting comfortably on their backs in horizontal position on a couch. A pillow was placed under the head.

Supine with crossed leg: The subjects resting comfortably on their backs in horizontal position on a couch. A pillow was placed under the head. The subjects were instructed to cross the right leg in front of left leg at thigh level and relaxed.

Technique:- Patient's profile was recorded and arm circumference was measured midway between the shoulder acromian and elbow. Systolic and diastolic blood pressure were recorded by using standardize sphygmomanometer and stethoscope from brachial artery at elbow as the appearance of the korotkoff sounds (phase 1 and 5). Firstly, sitting BP was taken from the left arm, which was flexed at the elbow and supported at the heart level on the chair. After 1 minute of standing BP was measured in standing with arm supported on desk or table. After 1 minute of rest in supine BP was measured. Finally, after 1 minute BP was again taken in the supine with crossed leg position. In all the position BP was measured 3 times and mean of 3 readings taken for calculate MABP. All the measurements were recorded separately in an evaluation chart for each subject. The Mean arterial Blood Pressure was obtaining by using this formula: MABP = DBP + (1/3 SBP – DBP)

RESULTS

Among the 100 subjects, 50 hypertensive and 50 normotensive individuals and their data were taken up for statistical Analysis.

Analysis result shows that, among the normotensive individuals mean and standard deviation of MABP in sitting position is 88.14 ± 7.25, in standing position 86.00 ± 7.28, in supine position 90.76 ± 7.15, in supine with cross leg position 89.96 ± 7.12, by ANOVA and multiple comparison shows that, there is significant difference among the positions. Further value is less in standing position compare to sitting position compare to supine with cross leg position and compare to supine position. So supine position has higher value then other positions.

Result shows that, among the hypertensive individuals mean and standard deviation of MABP in sitting position is 102.32 ± 3.95, in standing position 100.60 ± 4.07, in supine position 104.74 ± 3.84, in supine with cross leg position 103.96 ± 3.71, by ANOVA and multiple comparison shows that, there is significant difference among the positions. Further value is less in standing position compare to sitting position compare to supine with cross leg position and compare to supine position. So supine position has higher value then other positions.

Result shows that, in sitting position hypertensive individual have significantly higher value with mean difference 14.48 compare to normotensive as $p < 0.01$, in standing position hypertensive individual has significantly higher value with mean difference 14.60 compare to normotensive as $p < 0.01$, in supine position hypertensive individual has significantly higher value with mean difference 13.98 compare to normotensive as $p < 0.01$, in supine with cross leg position hypertensive individual has significantly higher value with mean difference 14.00 compare to normotensive as $p < 0.01$.

DISCUSSION

Result of this study shows that in the supine position, a significantly higher MABP was observed compared to other positions in both hypertensive and normotensive individuals. Similarly lower MABP was observed in the standing position compared to other positions in hypertensive and normotensive individuals.

The position of the body is known to affect the BP readings with BP increases successively from the supine to sitting and standing and standing position. One study shows that SBP and DBP were significantly higher in the supine position than in the sitting position.[29] Results of this study supports the result of the present study. There is a theoretical basis and studies that suggest crossing leg may increase the blood pressure[30, 31]

The slowed pulse rate in the horizontal posture as compared with sitting, and quicker rate in standing as compared with sitting, squatting, depend on wholly different mechanisms and may vary independently. Variation in the cardiovascular parameter in sitting, standing and supine posture is associated with hydrostatic influence acting on the altered position of the thighs, horizontal or vertical in these postures. [32]

A significant fall in BP can be prevented by a complex regulatory system comprising a series of neurohumoral mechanisms and cardiovascular reflexes that regulate peripheral vascular resistance and capacitance, stroke volume and HR, with BP as the controlled variable. This baroreceptor reflex plays a key role in this. [33]

In present study blood pressure fluctuations more seen in the normotensive individuals then in the hypertensive individuals. Also hand placement for measuring blood pressure has major factor for error or fluctuations in various positions. As per world health organization and international society of hypertension guidelines on BP measurement recommend that BP should be measured routinely with patient's arm supported at heart level.[34] so in this study also, hand position was kept at the heart level to avoid errors.

CONCLUSION

- The study shows that there is significant effect of positions on MABP between hypertensive and normotensive individuals.
- From the results obtained it concluded that standing posture having low MABP value than other positions and also supine has higher value in both normotensive and hypertensive individuals. Also sitting is the optimal position to measure the blood pressure in clinical practice.
- Thus, the study concluded that there are higher fluctuations in blood pressure in normotensive then in the hypertensive individuals.

ACKNOWLEDGEMENT

I acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. I am also grateful to authors/ editors/ publishers of all those articles, journal and books from where the literature for this article has been reviewed and discussed.

A study in all its sense certainly can be accomplished by the guidance and assistance of many people. I take this opportunity to express my gratitude to all those who have helped me for completing this study successfully.

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