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EFFECT OF POSTURAL DRAINAGE POSITIONS ON VITAL PARAMETERS IN ASYMPTOMATIC HEALTHY INDIVIDUALS

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ABSTRACT

Background: Postural drainage is used exclusively or in combination with other airway clearance techniques in the management of chronic pulmonary diseases. Postural drainage therapy helps to prevent accumulation of secretions in patients who are at high risk for pulmonary complications. It also helps to remove accumulated secretions from the lungs. The role of body positioning on lung function and the clinical implications of postural drainage has been identified in a variety of settings including intensive care units. There is dearth in literature on effects on postural drainage on vital parameters. Thus the objective of the study was to measure the vital parameters at different postural drainage positions in healthy asymptomatic adults.

Methods: Twenty healthy subjects participated in the study. The instruments used in the current study included a Pulse oximeter, Sphygmomanometer, Stethoscope, Postural drainage table. The outcome measures of interest were heart rate, respiratory rate, oxygen saturation, blood pressure and Borg's scale of rate of perceived exertion. The changes in the vital signs were recorded at different head down tilting position of 0°, 15° & 30° in both supine and prone lying positions

Results: Statistical significant difference was found for Systolic Blood Pressure in prone lying at different degrees of tilt ($p=0.001$) and Diastolic Blood Pressure in prone lying ($p=0.000$).

Conclusion: Postural drainage positioning should be given with caution and under proper monitoring as there is a risk of change in the blood pressure even in asymptomatic elderly population. The monitoring of vital signs should be done during the therapy to decrease the risk of complications.

Keywords: Postural Drainage Technique, Tilt Table, Vital Parameters, Healthy, Asymptomatic, Body positioning.

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INTRODUCTION

Postural drainage (bronchial drainage) is a means of mobilizing secretions in one or more lung segments to the central airways by placing the patient in various positions so that gravity assists in the drainage process [1]. In order to improve the pulmonary functions, postural drainage may be used exclusively or in combination with other airway clearance techniques [2]. The postural drainage therapy helps to prevent accumulation of secretions in patients who are at high risk for pulmonary complications and also helps to remove accumulated secretions from the lungs [3]. The postural drainage positions are based on the anatomy of the lungs and the tracheobronchial tree [4]. The different lobes of each lung and segment can be drained using the different positioning of the patient. A detailed procedure of application of postural drainage therapy along with indications, contraindications and hazards of postural drainage therapy has been given by American Association for Respirator Care (AARC). The role of body positioning on lung function and the clinical implications of postural drainage has been identified in a variety of settings including intensive care units [5]. Postural Drainage techniques may have significant changes in vital signs as observed in a cross-sectional study [6]. A survey study done by Bhat et al; 2016 has indicated that vitals should be monitored during the therapy [7]. Therefore postural drainage has attained its clinical significance as a vital treatment therapy for improving lungs physiology.

Full text articles in English language were reviewed using various search engines like Scopus, Medline, Cinhal, Springer link and Science direct. It was found that the physiological effects of postural drainage techniques have been well studied and documented in previous studies. For instance a study was done by (Ross et al. 1992) to assess the effect of postural drainage on ventilator homogeneity. The findings from the study concluded that postural drainage positioning influences ventilation homogeneity [8]. Similarly Eserlsmet and his colleagues in 2007 reported the effects of different positioning on vital parameters like blood pressure. This study concluded that the blood pressure tends to drop in the standing position compared with the sitting, supine and supine with crossed legs [9]. Systolic and diastolic blood pressure was highest in supine position when compared the other positions. The differences in systolic blood pressures at these positions was statistically significant ($P < 0.001$) but the difference between diastolic blood pressures was not statistically significant ($P > 0.05$). From the detailed literature search, the role of postural drainage in treating lungs conditions has been extensive study and it can be used as an adjunct modality for mucus mobilization and airway clearance [22]. However, a dearth of literature was found on other in vital parameters like heart rate, blood pressure, oxygen saturation and rate of perceived exertion indifferent postural drainage positions which often involved head-down tilt in adults. These parameters hold great clinical significance and implications and thus care should be taken to interpret the changes

while positions the patients. Thus a research question was formulated with the null hypothesis that there was no statistical significant difference on vital parameters with different tilting position of postural drainage technique. The aim of the study was to detect the changes in vital parameters at different degrees of postural drainage titling techniques in normal healthy asymptomatic individuals. The Objective of the study was as follows:

1. To measure heart rate, blood pressure (systolic and diastolic), respiratory rate, rate of perceived exertion and oxygen saturation with tilt position at 0° , 15° and 30° in supine lying (head tilt down).
2. To measure heart rate, blood pressure (systolic and diastolic), respiratory rate, rate of perceived exertion and oxygen saturation with tilt position at 0° , 15° and 30° in prone lying (head tilt down)

METHODOLOGY

Twenty healthy subjects participated in a cross sectional study conducted at the physiotherapy department, Kasturba Hospital, Manipal University, Manipal, Karnataka. The participants were recruited based on the following inclusion and exclusion criteria.

Inclusion Criteria: Healthy adults above 40 years of age

Exclusion Criteria: subjects with known hypertension; known diabetes mellitus, cardiac disorders like Arrhythmias, Heart blocks, Recent Myocardial Infarction, Valvular diseases and respiratory disorders like COPD, Bronchial asthma, Bronchiectasis, Cystic fibrosis, Pneumothorax etc.

Table 1: Participants Demographics

AGE GROUPS	MEN	WOMEN
40-44yrs	5	0
45-49yrs	4	5
50 & >50yrs	6	0
Total	15	5

The instruments used in the current study included Pulse oxymeter, Sphygmomanometer, Stethoscope, Postural drainage table (Fig.1, 2 and 3). The dependent outcome measures of interest were heart rate, respiratory rate, oxygen saturation, blood pressure, Borg scale of perceived exertion. The postural drainage technique at different head down titling position of 0° , 15° & 30° in supine and prone lying was used as the independent variable.

PROCEDURE

Participants, who volunteered into the study, were explained and instructed about the correct procedure following which an informed consent was taken. Initially postural hypotension was ruled out by recording blood pressure in sitting and immediately in supine lying. The participants were then made to lie on the postural drainage table and a bar near the head-end of the postural drainage table was placed for gripping and support in case for fear of falling during the tilting of the table. For safety, straps were also used to prevent falls during tilting. Blood pressure was measured for brachial artery using mercury sphygmomanome-

ter and stethoscope with the cuff tied around the lower part of the upper arm [10]. Respiratory rate was recorded by observing the thorax movement in females and movement of abdomen in male participants [11]. All participants were given the Borg's Scale of perceived exertion (rating of 10) and were asked to grade their rate of perceived exertion at each position. For determining the oxygen saturation level, the probe of the pulse oxymeter was placed on the index finger of the participants as a standard technique [12]. All the dependent variables like blood pressure, heart rate, respiratory rate, oxygen saturation level and rate of perceived exertion were initially recorded in supine position at 0° (Fig.1). Following this, these dependent variables were also measured at 15° (Fig.2) and 30° (Fig.3) head down tilt position on postural drainage table in supine as shown in Fig 1. The participants were then brought to neutral at 0° positions and made to lie prone on the table after a gap of 10 minutes to nullify the changes in vitals if any however the actual time for rest period was not found in the literature. The same procedure of recording the dependent variables was repeated in prone lying at 0°, 15°, & 30° with the head end tilted down.



Figure 1 (a): Postural drainage on tilt table at 0° supine.



Figure 1 (b): Postural drainage on tilt table at 15° supine.



Figure 1 (c): Postural drainage on tilt table at 30° supine.

Statistical Analysis: Descriptive analysis was performed for the outcome variables of interest to test the normality of the data; following which repeated measures of analysis of variance (ANOVA) was used to test the statistical significant difference. In all cases the level of significance was

set as $p \leq 0.05$. The data analysis was done using the SPSS package version 16.

RESULTS

The results for various outcome measures at different positions of postural drainage obtained have been presented in tables below.

Table 2: Comparison of means for vital parameters at different positions of postural drainage (n=20)

Outcome variable	Testing positions	MEAN ± S.D	Sig. (p value)
Systolic Blood Pressure: Supine (mm/Hg)	INCLINATION		0.236
	0 degree	125.5 ± 11.3	
	15 degree	125.0 ± 12.3	
	30 degree	128.6 ± 15.8	
Systolic Blood Pressure: Prone (mm/Hg)	0 degree	123.7 ± 11.8	0.001
	15 degree	128.5 ± 12.7	
	30 degree	133.0 ± 14.1	
Diastolic Blood Pressure: Supine (mm/Hg)	0 degree	84.6 ± 11.5	0.049
	15 degree	85.5 ± 13.9	
	30 degree	89.0 ± 14.9	
Diastolic Blood Pressure: Prone (mm/Hg)	0 degree	84.0 ± 10.0	0.000
	15 degree	93.1 ± 12.0	
	30 degree	98.3 ± 14.4	
Heart Rate: Supine (beats/min)	0 degree	77.6 ± 12.9	0.813
	15 degree	76.2 ± 13.7	
	30 degree	77.1 ± 14.5	
Heart Rate: Prone (beats/min)	0 degree	78.6 ± 14.1	0.786
	15 degree	77.1 ± 15.9	
	30 degree	78.2 ± 15.5	
Respiratory Rate: Supine (Counts/min)	0 degree	21.2 ± 3.07	0.237
	15 degree	21.6 ± 4.44	
	30 degree	22.0 ± 4.05	
Respiratory Rate: Prone (Counts/min)	0 degree	21.5 ± 3.1	1.000
	15 degree	21.4 ± 3.1	
	30 degree	21.5 ± 3.4	
Oxygen Saturation: Supine (%)	0 degree	98.7 ± 1.0	0.545
	15 degree	98.2 ± 0.9	
	30 degree	98.5 ± 1.3	
Oxygen Saturation: Prone (%)	0 degree	94.2 ± 20.5	0.420
	15 degree	98.2 ± 1.1	
	30 degree	97.9 ± 1.3	
Rate of Perceived Exertion: Supine (Borg's Scale 10)	0 degree	5.0 ± 0	0.542
	15 degree	8.0 ± 0	
	30 degree	8.0 ± 0	
Rate of Perceived Exertion: Prone (Borg's Scale 10)	0 degree	6.0 ± 0	0.587
	15 degree	7.0 ± 0	
	30 degree	7.0 ± 0	

DISCUSSION

It is evident from table 2 in the results section that there was a statistically significant difference for systolic blood pressure at different degrees of tilting in prone position with a p value of 0.001. It can also be observed that the mean systolic pressure increased with increase in the degree of head tilt down from 0° to 30°. The possible reason for the increase in systolic pressure with increasing degrees

of head tilting could be attributed to assistance of gravity to peripheral blood flow. These findings were supported by a previous study done by Martin et al. 2004 [13]. On the contrary, there was no significant change in systolic blood pressure in supine position with tilting and the mechanism for no change is not well documented or understood. We assume that the changes in systolic blood pressure could have been similar with supine lying and prone lying. The possible reason for increase in systolic blood pressure only in prone lying could be due to compression of the abdominal and heart structures. The data on changes in systolic blood pressure with head tilt is scarce in healthy asymptomatic adults; however studies done by James et al; 1999 on elderly population have reported correlation of baroreflex sensitivity with orthostatic systolic blood pressure changes [14]. From the results of the present study it can be suggested that the systolic blood pressure does not change significantly with supine head titling in healthy individuals. We also found that systolic blood pressure in prone position; the mean value of systolic blood pressure at 30° head tilt down in supine was higher compared to 0° and 15° position. This supports our hypothesis that similar trend of increase in systolic blood pressure was seen in supine but less as compared to prone lying due to which significant results could not be obtained. The reason for the increase in systolic blood pressure in supine lying can be supported by the findings of the study conducted by Zaidi et al. 2000 [15]. The study reported that there was a progressive increase in Systolic Blood Pressure (12-21%) with increasing head tilt angle and the changes were more till 45° from supine. The possible reason for these findings could be attributed to decrease in cardiac output and stroke volume with initial head tilt compensated by increase in heart rate and vasoconstriction at later stage. Nevertheless, a study conducted by Naschitz et al; 2007 reported that systolic blood pressure decreases from supine to standing due to orthostatic hypotension [16]. The studies conducted by Wilkins et al. 1950 and Hasegawa et al; 1979 observed rise or no change while changing position from supine to head down [17,18]. The immediate rise in systolic and diastolic blood pressures after attaining head down positions are the observed physiological changes as reported by Brook 2013 [19]. The reduction in systolic and diastolic pressure with head down tilting was also supported by the previous study done by Arigbabowo & Adedoyin 2009 [1]. Since the present study found a significant increase in systolic blood pressure with head tilt down, care should be taken while mobilizing the patients in tilt table and future studies should be done to support this result. The other major findings from the study suggests that there was a significant change in diastolic blood pressure with different degrees of titling in both supine and prone positions ($p=0.049$ and 0.000 respectively). It can be seen that the diastolic pressure increases slightly with increase in head tilt suggestive of similar findings from the previous study like Zaidi et al. 2000 & Coonan et al; 1983 [15], [23]. It was reported that increase in Diastolic Blood Pressure with head tilt was 20-33%. Rufa et al; 2013 observed decrement in diastolic

pressure with head down position in crooked kneeling [20] which was just the opposite from the findings of the current study. The possible reason for this cannot be explained on the basis on available data and future studies should be done. Rapsomaniki et al; 2014 reported that people with increased systolic pressure tend to have increased risk of bleeding strokes and stable angina while those with higher diastolic pressure may have an abdominal aortic aneurysm [21]. Since it is a weak section of main artery and can burst causing excessive bleeding and become vital. In such instance care should be taken during positioning while performing postural drainage as an underlying pathology could prove to be fatal. In the present study, twenty healthy adults without any previous history of cardiac, respiratory diseases, hypertension and diabetes mellitus were included. Therefore the result presented is an idea of baseline changes in vital parameters that can be expected in a normal healthy individual. This can help to predict the changes with head tilts in venerable group of patients with other pathology. None of the subjects in the present study showed any change in heart rate at different inclinations though a progressive increase in heart rate has been reported by previous study done by Zaidi et al; 2000 [15]. The findings from the present study suggest that blood pressure is an important vital parameter that gets altered with changes in different body positioning during postural drainage technique. Since postural drainage is a widely used technique care should be taken to rule out the possible consequent changes in vital parameters [24]. In the present study it can be inferred that there are significant changes seen in systolic blood pressure ($P < 0.05$) and diastolic blood pressure ($P < 0.05$), therefore more caution should be taken while giving postural drainage with head down tilt in adults suffering from cardiovascular conditions, admitted to intensive care units [25]. The results from the study also highlights that other vital parameters like heart rate, respiratory rate, oxygen saturation do not get altered to a large extent to show significant changes while change in position at tilt table however future studies should be done to support this hypothesis.

CONCLUSION

The blood pressure changes are seen in postural drainage positions in adult healthy individuals. But there are no significant changes in other parameters during and after the therapy. However a study with larger sample size should be done to rule out this hypothesis as there is limited data available on the given area. Therefore in future, further more studies need to be done. The present study conclude that postural drainage positioning should be given with caution and under proper monitoring as many patients can become symptomatic.

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