EFFECT OF TWO SELECTED POSTURAL DRAINAGE POSITIONS AND PERCUSSION ON THE BLOOD PRESSURE OF HEALTHY SUBJECTS

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ABSTRACT

This study examines the blood pressure responses of apparently healthy subjects to two postural drainage positions and percussion.

Forty-one subjects (29 males and 12 females) participated in the study and were randomly assigned into four groups, with three groups having 10 subjects (7 males and 3 females) each and the fourth group having 11 subjects (8 males and 3 females). All of the subjects were allowed to rest for five minutes before taking part in the study. Thereafter, they assumed a supine (lying) position for 10 minutes and then changed to a level or a head-down, side-lying position for another 10 minutes. Their blood pressures were then taken at the first, fifth and tenth minutes. Two of the four groups received percussion while in the selected positions.

The systolic blood pressure (SBP) and diastolic blood pressure (DBP) reduced significantly when the subjects changed from a supine (lying) position to a level or a head-down, side-lying position ($P < 0.05$). No significant difference was observed between the SBPs and DBPs of the group that received percussion and the group that did not receive percussion. We concluded that percussion did not affect the blood pressure of the subjects.

Key words: postural drainage, percussion, blood pressure

INTRODUCTION

Postural drainage is a means of mobilizing secretions from one or more lung segments to the central airway by placing the patient in various positions so that gravity can assist in the drainage process. This procedure is usually recommended where there is an increase in the daily sputum production or when the secretion becomes more difficult to clear.[1] It is used for patients with conditions such as chronic bronchitis,

bronchiectasis, cystic fibrosis, and other chest conditions. The procedure helps to reduce pulmonary infection by removing the secretion from the lungs and consequently contributes to the overall well-being of the patient. Gillart et al.[2] reported an improvement in oxygenation in patients with acute respiratory distress syndrome after using postural drainage in prone position. Postural drainage is an age-long procedure used in chest physiotherapy. Bellone et al.[3] reported that postural drainage is as effective as expiration with the glottis open in lateral position (ECTGOL) and FLUTTER device after 30 minutes of application in patients with chronic bronchitis. The FLUTTER device and ECTGOL techniques were, however, found to be more effective than postural drainage in prolonging the removal of secretions in patients with exacerbation.

In addition to the use of body positioning, deep breathing and an effective cough facilitate the clearance of secretions from the airways. A variety of manual techniques are used in conjunction with postural drainage to maximize the effectiveness of the mucociliary transport system. They include vibration, shaking, and rib springing. Physiotherapists have been involved, for a long time, in the management of various chest conditions and patients with high or low arterial blood pressure.

Foley[4] reported a decrease in systolic and diastolic blood pressures when subjects assumed a side-lying position. Barrel and Abass[5] observed a markedly reduced cardiac output in patients placed in a side-lying position and who received percussion and vibration, and undertook breathing exercises followed by coughing in a sitting position within the first 24 hours after natural valve replacement. The work of White and Mawdsley[6] revealed a decrease in the systolic and diastolic blood pressures by an average of 17.1 mmHg and 11.6mmHg respectively in response to postural drainage (i.e., level and head-down side-lying) positions though there was no response to percussion.

In a study by Green[7] in which continuous arterial blood pressure was taken, a large and immediate rise in systolic and diastolic blood pressures was reported after head-down tilting (i.e., inclined position) in the supine position from the initial head-up position, but these returned to their initial readings within seconds.

While some work has been carried out on the effect of postural drainage positions on cardiovascular responses, the effect of percussion has not been adequately investigated. Critically-ill patients verging on cardiovascular instability may require postural drainage and percussion. Therefore, the effects of this treatment on the cardiovascular system need to be studied.

The primary purpose of this study was to determine the effect of postural drainage positions (level side-lying and head-down side-lying) and percussion on cardiovascular response.

HYPOTHESES

- There would not be a significant difference in systolic and diastolic pressures between side-lying and head-down side-lying positions.
- There would not be a significant difference in systolic and diastolic pressures between the subjects with or without percussion.

METHODOLOGY

Subjects

The subjects in this study were male and female

undergraduates at Obafemi Awolowo University, Ile-Ife, Nigeria. None of the subjects was a professional athlete. All the subjects voluntarily participated in the study and signed informed consent forms. Data was collected from a total of forty-one subjects (29 males and 12 females) and analyzed. The physical characteristics of the subjects are presented in table 1. The subjects were comparable in age and anthropometric indices.

Experiment Design

Healthy volunteers were recruited and randomly assigned into four groups. Groups 1, 3 and 4 comprised 10 subjects (7 males and 3 females) each; 11 subjects (8 males and 3 females) were assigned to Group 2.

For all the groups, the blood pressure was taken at the left brachial artery. Cardiovascular responses were monitored at different times (pre-treatment and at the first, fifth and tenth minutes of treatment). Systolic and diastolic blood pressures were monitored using an automated electronic sphygmomanometer. All measurements were taken by the same person (AA) to control for inter-tester variability; the evaluator was not blinded as to group assignment.

PROCEDURE

Prior to data collection, the subjects were briefed on the procedure for the study and their ages were recorded. Their weights and heights were subsequently measured.

Each subject was allowed to sit and rest for five minutes before he or she was asked to lie supine with a pillow under his/her head. Three readings were taken at 5 minute intervals within a 10 minute period, i.e., at the first, fifth and tenth minutes, in the supine lying position.

Subjects in Groups 1 and 2 changed from supine-lying to level (i.e. horizontal) side-lying position. A pillow was placed under the head and another under the slightly flexed left upper limb to maintain the subject in horizontal plane and to ensure comfort. Subjects in Groups 3 and 4 also changed to the side-lying position; the foot of the plinth was raised by 35cm.

Subjects in Group 1 (level side-lying) and Group 3 (head-down side-lying) rested in their positions for ten minutes without percussion and their blood pressure was taken three times at the first, fifth and tenth minutes. Groups 2 and 4 received percussion on the lateral chest wall which had been draped with a soft cloth. Blood pressure readings were also taken at the first, fifth and tenth minutes.

DATA ANALYSIS

For each group, the mean blood pressure in the supine-lying position and during the treatment phase was calculated. A paired t-test was employed to compare the cardiovascular responses between the supine-lying and treatment (i.e., postural drainage) positions. Furthermore, analysis of variance was used to find out if there was a significant difference across the four groups. A P-value of less than 0.05 was considered statistically significant.

RESULTS

The physical characteristics of the subjects in each group are presented in table 1. The analysis of variance showed that the physical characteristics - weight, height and age - of the subjects in the

Table 1. Physical Characteristics of Subjects (n = 41)

Variable	Groups				
	Group 1 Level side-lying with no percussion n = 10	Group 2 Level side-lying with percussion n = 11	Group 3 Head down side-lying with no percussion n = 10	Group 4 Head down side-lying with percussion n = 10	
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	F
Age (yrs)	22.6 ± 2.6	22.7 ± 2.3	23.1 ± 2.6	23.2 ± 1.6	0.92
Height (m)	1.67 ± 6.3	1.65 ± 7.6	1.70 ± 90	1.70 ± 6.3	0.97
Weight (kg)	58.2 ± 4.4	60.9 ± 4.1	60.6 ± 6.0	58.8 ± 3.6	0.85

SD = standard deviation

four groups were comparable ($P > 0.05$) Therefore, any significant differences found in the study can be attributed to treatment effect rather than to variation in the groups' physical characteristics.

The cardiovascular responses during the different postural drainage positions are presented in table 2. Following a change in position from supine lying to the different postural drainage positions with or without percussion, a significant fall in the systolic and diastolic blood pressures was recorded ($P < 0.05$).

Table 2. Changes in Blood Pressure Following a Change in Position

Group	Variables	Supine-lying Position	Treatment Positions	t-values
			Level side-lying without percussion	
1.	Systolic	105.7 ± 6.1	85.2 ± 5.0	-9.6
	Diastolic	65.8 ± 7.8	49.5 ± 3.1	-7.1
			Level side-lying with percussion	
2.	Systolic	107.2 ± 6.2	84.4 ± 4.9	-10.7
	Diastolic	64.5 ± 7.3	49.7 ± 3.0	-7.1
			Head down side-lying without percussion	
3.	Systolic	106.0 ± 4.2	86.2 ± 3.5	-16.7
	Diastolic	63.1 ± 5.7	54.1 ± 3.1	-7.67
			Head down side-lying with percussion	
4.	Systolic	110.9 ± 6.3	94.4 ± 13.0	-5.5
	Diastolic	68.5 ± 6.0	57.2 ± 4.2	-14.5

Table 3 presents a summary of the analysis of variance for change in systolic blood pressure across the four groups in their respective selected postural drainage positions. A significant difference was noticed ($F = 3.94$, $P < 0.05$). Scheffe's post-hoc comparison test was employed to determine where the significant difference lay among the groups. There was no significant difference between side-lying position without percussion (Group 1) and side-lying position with percussion (Group 2). Similarly, no significant difference in systolic blood pressure was observed between head-down side-lying position without percussion (Group 3) and head-down side-lying with percussion (Group 4). It can therefore be concluded that percussion had no effect on systolic blood pressure.

Table 4 presents a summary of the analysis of variance for change in diastolic blood pressure for the four groups in their respective selected postural drainage positions. A significant difference ($F = 3.14$. $P < 0.05$) was observed, and Scheffe's post-hoc comparison test was performed. It showed no significant difference between side-lying position without percussion (Group 1) and side-lying position with percussion (Group 2). Likewise, head-down side-lying without percussion (Group 3) and head-down side-lying with percussion (Group 4) were not significantly different from each other. It therefore means that percussion had no effect on the diastolic blood pressure in this study.

DISCUSSION

Postural drainage as a part of chest physiotherapy is important in the rehabilitatic:

Table 3. Changes in Systolic Blood Pressure Across the Groups in Respective Postural Drainage Positions

	Group 1 n = 10		Group 2 n = 11		Group 3 n = 10		Group 4 n = 10		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F
Pre-treatment Measurement	105.7	± 6.1	107.1	± 6.2	106.0	± 4.2	110.9	± 6.2	1.69
Post treatment Measurement	88.5	± 4.9	84.3	± 4.7	86.4	± 3.4	94.4	±12.9	3.94*

*Significant at $P < 0.05$

Table 4. Changes in Diastolic Blood Pressure Across the Groups in Respective Postural Drainage Positions

	Group 1 n = 10		Group 2 n = 11		Group 3 n = 10		Group 4 n = 10		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F
Pre-treatment Measurement	66.0	± 7.8	64.5	± 7.2	63.2	± 5.9	68.5	± 6.0	1.17
Post treatment Measurement	49.5	± 3.1	49.7	± 3.1	54.2	± 3.1	57.1	± 4.2	*12.1

*Significant at $P < 0.05$

chest conditions. It was speculated that the various positions the patient assumes during the procedure coupled with percussion will affect cardiovascular response. Prior to this study, conflicting reports underlined the need for further investigation.

This study revealed that systolic and diastolic blood pressures decreased significantly when healthy subjects changed position from a supine lying position to a level or a head-down side-lying position. This observation refutes our first hypothesis, but confirms the work of Foley[4] who reported a reduction in systolic and diastolic blood pressures when subjects assumed a side-lying position. White and Mawdsley[6] also reported a significant decrease in blood pressure when healthy subjects turned to a level or head-down side-lying position from a supine-lying position.

Some studies, however, have reported conflicting results. Wikin et al.[8] noted a rise or no change in blood pressure after tilting supine subjects from horizontal to head-down position. Green[7] recorded a large and immediate rise in systolic and diastolic blood pressures after assuming head-down positions. Hasegawa and Roadboard[9] found no significant difference in systolic and diastolic blood pressures measured during standing, horizontal or head-down position.

The inconsistency in the results of the various works could be as a result of different angles of inclination used by different researchers in the selected positions.

The cause of the decrease in blood pressure observed in this study when the subjects changed from a supine position to the various side-lying positions is unknown. The decrease may reflect a local phenomenon or a generalized change in blood pressure throughout the body.[6] On the other hand, a decrease in the hydrostatic pressure in the brachial artery may be responsible for the variation in blood pressure.[10]

The application of percussion to the chest of the subjects did not significantly affect blood pressure responses and this confirmed our second hypothesis. This, however, contradicts the work of Barrel and Abass[5] who reported that pulmonary physiotherapy that included percussion and other manual techniques had an effect on the cardiovascular responses of patients, twenty-four hours after mitral valve replacement.

One important consideration in relating the work of Barrel and Abass[5] to our study is that we used healthy subjects, ruling out neurological and cardiovascular problems. Again, the stress of the unfamiliar environment of a hospital setting and apprehension, probably caused by the uncomfortable procedure, might affect cardiovascular responses markedly. Aghanwa and Erhabor[11] affirmed that improved psychiatric knowledge by physicians would result in better management of patients with chronic obstructive pulmonary disease (COPD).

One of the limitations of our present study is the small sample size of apparently healthy subjects. The results should therefore be interpreted with caution. A follow-up study should replicate this study using patients with chest problems.

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