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A study to compare the five different body positions on peak expiratory flow rate and respiratory rate in patients with chronic obstructive pulmonary disease (COPD) at National Heart Institute, New Delhi, India

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Original Article

A study to compare the five different body positions on peak expiratory flow rate and respiratory rate in patients with chronic obstructive pulmonary disease (COPD) at National Heart Institute, New Delhi, India

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Abstract

Introduction: Chronic obstructive pulmonary disease (COPD) is a non-transferable lung illness that continuously causes toiled breathing, weakness and inconvenience. If this situation continues, the patient may exhibit proof of respiratory disappointment with adjusted mental status and a noteworthy change in the values of arterial blood gas from normal values. **Objective:** The objective of the study was to find the effect and compare five different body positions (sitting with back support, supine, sitting without back support, semi-fowler and standing) on peak expiratory flow rate (PEFR) and respiratory rate (RR) in COPD patients. **Method:** One group repeated measures design was chosen for the inpatient department (IPD) patients with COPD at National Heart Institute in New Delhi. Purposive sampling technique was used to obtain the sample.The interview schedule, bio-physiological measurement and observation methods were used to measure the study variable. **Result:** The findings revealed that PEFR achieved by patients with COPD were significantly affected by body positions. Standing (294.88±66.6) prompted results which were essentially higher than every single other position pursued by sitting without back support (273.76±68.4), sitting with back support (269.52±64.4), semi-fowler (264.54±61.9) and lowest mean percentage in the supine position (229.76±71.9) in PEFR. In respiratory rate, the highest mean percentage was found in standing position (32.89±5.9) followed by sitting without back support (32.04±5.71), semi-fowler (31.69±5.9), supine (33.98±6.8) and lowest mean percentage (32.3±5.7) in sitting with back support on RR in patients with COPD. **Conclusion:** It was concluded that standing position was highly effective to increase PEFR and sitting with back support to decrease RR in COPD patients.

Key words: Body positions, chronic obstructive pulmonary disease, peak expiratory flow rate, respiratory rate, evaluative approach

Introduction

The Global initiative for chronic obstructive lung disease (GOLD) has defined COPD as a typical, preventable and treatable infection that is portrayed by tireless respiratory side effects and restriction of movement of air which is because of the airway and alveolar irregularities more often caused by poisonous particles or gases (Global Initiative for Chronic Obstructive, 2018). The impediment of chronic airways is normally found in COPD is caused by a blend of little airways ailments and parenchyma devastation which is different from individual to individual. In many patients, COPD is related to noteworthy accompanying perpetual sicknesses, which increment morbidity and mortality (World Health Organization, 2017). COPD is the fourth-driving reason for death around the world, causing in excess of three million passings consistently, and in excess of 66% of individuals with the ailment which they are unaware of (Melam et al., 2014). According to WHO, 65 million individuals had moderate to serious

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COPD worldwide. In 2005, greater than 3.17 million individuals perished of COPD, which relates to 5% of all passing's all around.

According to WHO, the prevalence of COPD in 2016 was 251 million cases globally (Global Initiative for Chronic Obstructive, 2018). In this manner, the emphasis was given on proper conclusion of the illness and bringing issues to light in the public eye with respect to expanding pervasiveness and worldwide monetary weight in diagnosing and overseeing COPD. Numerous researchers had detailed critical changes in pulmonary function with positioning. Reduction of forced vital capacity by 12% and forced expiratory volume by 15% in one second was observed in the people with non-COPD between the diverse body positions of sitting and drooped half lying. Positions influence respiratory muscle movement by changing the length of the respiratory muscles amid rest and instigating changes in ventilation and perfusion, specifically, the most extreme air trade that happens relies upon gravity. Mean expiratory pressure and peak expiratory flow rate (PEFR) is impacted by lung volume and muscle length-pressure relationships, which are thus affected by body positions (World Health Organization, 2017).

In COPD, there is a chronic airflow limitation which is generally dynamic and is related to a strange provocative reaction of the lung to toxic particles or gases which prompt narrowing of little airways pursued by the loss of elastic force. This results in dynamic airflow confinement, air catching and dynamic shortness of breath on the effort. The Mini-Wright peak flow meter is small, easy to carry and reliable instrument which measures the maximum flow rate generated during forceful expiration. It is convenient to test and it measures the ease with which lung ventilation occurs. The results were analyzed to see whether there were any effect of different body positions on PEFR and RR in 75 (Inpatient department) patients with COPD in terms of maximizing the strength of the respiratory muscles and efficiency of cuffing and huffing techniques to enhance the expectoration of sputum out of lungs. Thereforethis study was an attempt to use simple, cost-effective intervention i.e. measuring PEFR and RR in different body positions to find out most suitable body position which could ease the symptoms like breathlessness among COPD patients.

Objectives

1. To find the effectiveness of five different body positions (sitting with back support, supine, sitting without back support, semi-fowler and standing) on PEFR and RR in patients with COPD.

2. To compare five different body positions (sitting with back support, supine, sitting without back support, semi-fowler and standing) on PEFR and RR in patients with COPD.

3. To find the association between five different body positions (sitting with back support, supine, sitting without back support, semi-fowler and standing) on PEFR and RR with selected variables.

Materials and methods

An evaluative comparative approach and one group repeated measure design were utilized in this investigation. Repeated measure design usually signifies a study in which data are collected three or more times. It involves the exposure of the same subject to more than one experimental treatment. Purposive sampling technique was utilized to get the samples. The sample consisted of 75 patients (In-patient department) with COPD at National Heart Institute in New Delhi. The inclusion criteria included patients (In-patient department) who were diagnosed with COPD, hemodynamically stable and had been on medical treatment for more than one year. Patients with acute exacerbation or any respiratory diseases like cystic fibrosis, interstitial lung diseases and hypercapnia, unstable cardiovascular status, recent (within two months) abdominal/chest surgery, mental retardation, rib fracture, pregnant women and cancer patients were excluded. All patients participated in the study were informed with the proper details about the peak flow meter and the procedure. Informed consent was taken prior to the procedure. Proper history was taken along with a detailed clinical examination.

The patient was briefed about the procedure and consent was taken to take photos of her while performing different body positions with peak flow meter.

Five different body positions were used in this study:

1. Sitting with back support - The patient assumes a comfortable position while upper body part of the patient resting on the head of the bed with extra pillows behind the back that makes 90 degrees with the foot of the bed.	
2. Supine - The patient assumes a flat position on the bed by making 180 degrees with the bed by providing pillows below the head.	
3. Sitting without back support - The patient assumes a comfortable position on the bed with an upper-body part of the patient making 90 degrees with the foot of the bed without any support of extra pillows.	
4. Semi-fowler - The patient assumes a comfortable position on the bed with upper body part resting on the head of the bed, makes a 45-degree angle with a foot of the bed while lower limbs resting parallel to the bed.	
5. Standing - The patient assumes his/her body in upright posture making a 90-degree angle with the ground by keeping a few distances between feet.	

Tools for data collection

Tool I- Demographic proforma

A structured interview schedule was prepared to collect the sample characteristics. The characteristics included patient's age, gender, educational status, employment status and geographical location.

Tool II- Physical parameters form

A structured interview schedule was prepared to get information regarding health status and to what extent he/she was affected by COPD. Information regarding registration number, height, weight, BMI and co-morbidities were obtained from the patient. It contained six questions regarding medical history, surgical history, smoking history, breathing exercises and number of years affected with COPD. In vivo biophysiological method was used to measure basic vital parameters like pulse, blood pressure, oxygen saturation and RR along with specific systemic examinations namely heart sounds, murmurs, signs of respiratory distress, breathing pattern, symmetry of breathing, pleural rub, pleural fluid, collapse, consolidation, air entry, rhonchi and crepitations were measured. Scoring was given to this section.

Tool III- Proforma worksheet

It dealt with five different body positions (sitting with back support, supine, sitting without back support, semi-fowler and standing) and their relationship with PEFR and RR.

Reliability of the tool

The tool was administered to 10 COPD patients to establish reliability. Inter-rater reliability was used in this study. R= Number of agreements/Number of agreements + Number of disagreements

Reliability was found to be 0.8. Thus the tool was found to be reliable.

Data collection

Five different body positions such as sitting with back support, supine, sitting without back support, semi-fowler and standing position were provided to all selected patients (In-patient department) with COPD. Each position was maintained for three minutes to check the RR and PEFR followed by baseline position i.e. sitting with back support for two minutes at rest. The patient was provided with each position for three minutes then the investigator checked RR (using her seconds watch) for one minute followed by PEFR for another one minute in the same position and recorded in proforma worksheet. The patient was provided baseline position (rest for two min) before switching to next body position to avoid biases. The patient was instructed to blow out air as fast as he/she could in peak expiratory flow meter by three times and highest PEFR value among three reading was recorded in proforma worksheet. Then switched to next position which was supine position and the whole procedure was repeated.

Result

Objective 1: To find the effectiveness of five different body positions on PEFR and RR in patients with COPD.

Table 1:

Five different body positions on PEFR in the patient with COPD

N=75

Body positions	PEFR			
	Mean	SD	**Mean %**	**Rank**
Sitting with back support	269.52	64.4	58%	II
Supine	229.76	71.9	46.9%	V
Semi-fowler	264.54	61.9	55.1%	IV
Sitting without back support	273.76	68.4	57%	III
Standing	294.88	66.6	61.4%	I

Table 1 clearly showed that PEFR accomplished by patients with COPD was fundamentally influenced by body positions. The highest mean score obtained (294.88±66.6) was found in standing position and lowest mean score (229.76±71.9) in the supine position on PEFR in patients with COPD (Table 1).

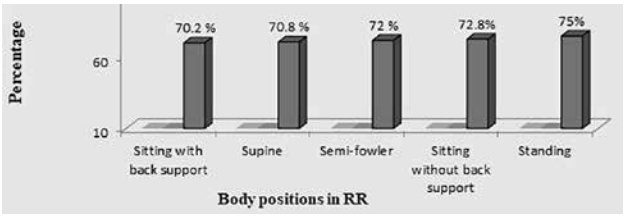

Figure 1: A bar diagram showed the mean percentage of RR in five different body positions in patients with COPD

Figure 1 clearly showed that the highest mean percentage was found in the standing position (75%) and the lowest mean percentage in sitting with back support (70.2%) on RR in patients with COPD.

Objective 2: To compare five different body positions with PEFR and RR in patients with COPD.

Table 2:

Sum of squares, mean square and F ratio of the PEFR in COPD patients

N=75

PEFR	Sum of square	Mean square	df	F	P
Between group	4892188.86	1223047.215	4	148.04	0.05
Within group	3056683.12	8261.3057	370		0.05

The data presented in Table 2 indicate that there was a significant difference between five different body positions with peak expiratory flow rate. One way analysis of variance was used and F ratio (148.04) was greater than tabulated F value (5.63) at 0.05 level of significance. Therefore null hypothesis was rejected and inferred that there was statistical significant difference between five different body position and peak expiratory flow rate. Further to evaluate the difference between body positions, post hoc test in the form of protected t-test was applied using two-tailed t table at 0.05 level of significance.

Table 3:

Comparison of five different body positions on PEFR in patients with COPD

Body positions	Difference of sample means
Sitting with back support and supine	39.76**
Sitting with back support and semi-fowler	4.98
Sitting with back support and sitting without back support	4.24

Body positions	Difference of sample means
Sitting with back support and standing	25.36
Supine and semi-fowler	34.78*
Supine and sitting without back support	44**
Supine and standing	65.12**
Semi fowler and sitting without back support	9.22
Semi-fowler and standing	30.34*
Standing and sitting without back support	21.12

Df = 70, Critical difference=29.52 Table value = 1.990 (P>0.05)
**= Highly significant, *= Significant

The highest mean difference was found in supine-standing (65.12) and the lowest mean difference in sitting with back support-sitting without back support.

Table 4:
Sum of squares, mean square and F ratio of the RR of the COPD patients

RR	Sum of square	Mean square	df	F	P
Between group	4892188.86	60.684	4	1.658	0.05
Within group	3056683.12	36.60	370		0.05

The data presented in Table 4 indicated that there was a significant difference of five different body positions with respiratory rate. One way analysis of variance was used and F-ratio was 1.658 is less than tabulated F-value (5.63) at 0.05 level of significance. Therefore the null hypothesis was accepted. As there was no statistically significant difference found between five different body positions and respiratory rate, therefore further analysis was not performed.

Objective 3: To find the association between five different body positions on PEFR and RR with a selected variable in patients with COPD.

Table 5:
Association between five different body positions on PEFR with selected variables in patients with COPD

Variables	$\chi 2$
Age	26.2**
Gender	8
Smoking	13*
BMI	16*

(df = 4) Table value = 9.49 (P>0.05)
**= Highly significant, *= Significant

Table 5 clearly shows that Chi-square values were computed to find out the association between five different body positions on PEFR with selected variables in patients with COPD revealed that there was a significant association between mean score when compared to age, smoking and BMI whereas there was no significant association between mean score when compared to gender. Hence it was concluded that differences in mean score values related to age, smoking and BMI except gender were actual differences and not only by chance in PEFR ($p<0.05$).

Table 6:
Association between five different body positions on RR with selected variables in patients with COPD

Variables	$\chi 2$
Age	30.35**
Gender	7.3
Smoking	10.75*
BMI	11.75*

(df = 4) Table value = 9.49 (P>0.05)
**= Highly significant, *= Significant

Table 6 clearly shows that Chi-square values were calculated to find out the association between five different body positions on RR with selected variables in patients with COPD which revealed that there was a significant association between mean score when compared to age, smoking and BMI whereas there was no significant association between mean score when compared to gender. Hence it was concluded that differences in mean score values related to age, smoking and BMI except gender were actual differences and not only by chance in RR ($p<0.05$).

Nursing implications

Nursing practice

This study has revealed that proper body posture among COPD patients can promote the integrity of the human system and enhances quality of life as well. When the COPD patient feels shortness of breath then appropriate support like oxygenation, comfortable body position and reducing vigorous exercises should be provided by the nurse to reduce the exacerbation and improve ventilation. These practices can act as preventive measures for the patient to alleviate the suffering, so that comfortable life can be headed.

Nursing education

Student nurses should also participate voluntarily in the awareness program which helps them further to develop as a lifelong learner who can easily adapt to changes and can simultaneously bring changes in the community by imparting knowledge to neglected section of the community. Most patients with COPD do know about the medical management for the disease except adjunctive measures like simple body postures to reduce symptoms such as shortness of breath, fatigue and anxiety.

Nursing administration

Nurse leaders should encourage the staff nurses and student nurses to apply analytical and problem solving skills on daily basis problems encountered with patients having COPD. Direct guidance and mentorship should be effectively provided to the student nurses, so that effective measures can be implemented for the COPD patients.

Nursing research

This study can contribute in terms of the beneficial effect of different body positions for the COPD patients to alleviate the symptoms like shortness of breath, anxiety, fatigue and promote quality of care in terms of reducing discomfort.

Discussion

This study revealed that PEFR was highest in the standing position. The findings of the study were consistent with the previous study and it showed similar results on seven diverse body positions (standing, seat sitting, sitting in bed with backrest vertical, sitting in bed with backrest at 45 degrees, recumbent, side-lying, and side-lying with head-down tilt 20 degrees) on 25 individuals with non-COPD and 11 individuals with restrictions in airways to measure PEFR (Badr, Elkins, & Ellis, 2002).

This study revealed that RR was lowest in sitting with a back support position. The findings were consistent with another study conducted on 26 patients with spinal cord injury to assess the effect of different sitting postures namely normal sitting posture and without back support sitting posture on forced vital capacity, forced expiratory volume in one second, PEFR and forced expiratory flow in wheelchair (Namrata & Anjali, 2012).

There was a significant association between five different body positions on PEFR with selected variables such as age, smoking and BMI except for gender. There was a significant association between five different body positions on the RR with selected variables such as age, smoking and BMI. No significant supporting studies had been found.

Conclusion

Body positions had a great impact on PEFR and RR in COPD patients. Standing body position produced highest PEFR in COPD patients followed by semi-fowler, sitting with back support, sitting without back support and supine positions. Sitting with back support position produced lowest RR followed by supine, semi-fowler, sitting without back support and standing position among COPD patients. Upright position enhanced PEFR due to proper expansion and greater elastic recoil of lungs while on the other hand sitting with back support position reduced the increased RR in COPD patients by supporting lung muscles, so that the exchange of gases was effectively done.

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