J. Appl. Environ. Biol. Sci., 2(10)556-559, 2012

ISSN 2090-4274
Journal of Applied Environmental and Biological Sciences
www.textroad.com

The Effect of Application of the Physiologic Cough Assist on Pulmonary Volumes in Patients Undergoing Thoracic Surgery

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ABSTRACT

Background: Patients undergoing surgery, especially thoracic surgery are at the risk of atelectasis which affects patients' pulmonary volumes. Many methods have so far been proposed to improve pulmonary volumes. Considering that the physiologic cough assist device has had a significant effect on reducing respiratory complications, its effect on pulmonary volumes has been examined in this study.
Materials and Methods: This study is an empirical study. 60 patients, candidates for thoracic surgery, consecutively entered into the study. Data collection was done through questionnaires. The pulmonary volumes were measured in both pre- and postoperative stages (after using cough assist). Data was analyzed by the means of descriptive and inferential statistics.
Results: Most of the subjects in the intervention group were female (53%) and in the control group the majority were male (53%). The majority of subjects were age group of 50-54 years old. The findings showed that there is a significant difference ($p = 0.05$) between the intervention and control groups after using cough assist in terms of the volume current (vc), forced vital capacity (fvc) and forced expiratory volume (FEV1). The results indicated that reducing pulmonary volumes in the intervention group, the patients who regularly used cough assist was less than that in the control group and it caused a decrease in respiratory disorders.
Conclusion: The results of this issue revealed that cough assist is effective in improving pulmonary volumes.
KEYWORDS: cough assist, pulmonary volumes, thoracic surgery

INTRODUCTION

For various reasons including the use of sedatives or pain in surgical incision, the possibility of deep breathing after surgery becomes less for patients undergoing thoracic and abdomen surgery (1). After surgery, the patient's inability in coughing and deep breathing, immobility and lack of effective secretion exclusion from lung causes accumulation of secretions, obstruction of airway and atelectasis (1). Controlling the amount of current volume and forced vital capacity determine the degree of injury and disorder (2). To improve pulmonary volumes, various methods such as pulmonary physiotherapy, breathing with intermittent positive pressure and cough assist have been suggested for these patients (2). These complications lead to delay in the flow of patients' recovery; therefore, one of the major objectives of preoperative nursing cares is to show how the condition of ventilation and oxygen to blood can be improved after surgery (3). In the plan for nursing care after thoracic surgery, the priority care is focused on the improvement of ventilation and re-dilatation of pulmonary with maintaining and clearing the airway. Physiologic assist for cough reflex is a technique to avoid postoperative respiratory complications especially the thoracic surgery (4). Using it causes to dilate the collapsed tubular and helps to exclude secretions, the purpose of this method is to encourage the patient to breathe deeply, the maximum dilation of the bronchus, increasing pulmonary volumes to improve oxygenation and suitable ventilation, improving pulmonary volumes and prevention of atelectasis specifically in patients undergoing surgery (5).

In the study conducted by Marchant et al (2002) on the effect of postoperative physiologic assist for cough reflex, expiratory volume was (0.92) and vital capacity (0.97) liter per minute when using physiologic assist of cough before and after surgery, expiratory volume was reached 1.18 liter per minute and vital capacity 1.26 liter at per minute in these patients that was the indicator of an improvement in pulmonary volumes after the use of physiologic assist for cough reflex. The results of this study have showed the successful effect of applying physiologic cough assist on improving pulmonary volumes (3).

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MATERIALS AND METHODS

This study is an empirical study. 60 patients consecutively interred into the study as candidates for thoracic surgery. Data collection was conducted through questionnaires. In this study, eligible patients were randomly included in two groups of intervention and control if they consented to participate in the study. The study population included all patients undergoing pulmonary surgery admitted in the surgical ward. The samples were included 22 males and 38 females in the age range of 15-65 years old among 60 patients in both groups. The tool for data collection was the checklist and physiologic information form. The checklist consisted of three parts: personal profile, information on health condition, paraclinical information such as radiology reports and the answer of pre- and postoperative examinations. Items recorded in the physiologic information form include: temperature and pulse, respiratory rate, breathing depth and pulmonary volumes. Content validity was used to determine the scientific validity of the checklists and simultaneous observation was used to determine the reliability of physiologic information form.

Instruments used in this study include: oral thermometer, stethoscope, and pulse oximetry that all of them were standard instruments and the symptoms of all patients were controlled by the researcher. Descriptive and analytical software and appropriate tests such as chi-square were used to analyze the data. In this study, the effect of cough assist on pulmonary volumes has been investigated in patients after thoracic surgery, in the way that the researcher has randomly placed the patients in two groups of intervention and control according to the subjects' profile such as lack of the history of previous surgeries after referring to the mentioned ward and selecting the desired patients. The necessary training has been orally, face to face and individually given to patients in the intervention group. At the beginning, the method of applying cough assist has been explained to patients for assessing the pulmonary volumes. Measuring pulmonary volumes was conducted through spirometry in two stages by an experienced nurse. The pulmonary volumes including (FEV1, FVC, vc) were measured before surgery in the first stage and five days after applying cough assist as the second stage.

RESULTS

Subjects were homogenized in both groups regarding variables such as type of disease, type of surgery, education level, length of stay, sex, acute respiratory infections, history of chronic pulmonary infections, history of smoking, bronchodilators consumption and the value of oxygen consumption. Findings indicate that the rate of arterial oxygen saturation was normal in both groups of intervention and control in 100 % cases.

Table 1: Absolute and relative frequency distribution of current volume in the control group %

operation day	First time (a day before surgery)		Second time (5 days after surgery)	
VC per liter	number	Percent	number	Percent
2-9.2	-	-	16	54
3-9.3	-	-	10	33
4-9.4	28	93	4	13
5-9.5	2	7	-	-
Total	30	100	30	100
Mean	72.4		06.3	
SD	150.0		542.0	

The results indicate that for the majority of samples (93%) in the control group the current volumes are about 4- 4.9 liters for the first time, and for the 54% majority of samples in the second time (fifth day after surgery) their current volumes were about 2-3 liters which it indicates a significant difference between the first and second time in the control group.

Table 2: Absolute and relative frequency distribution of vital capacity in the control group

operation day	First time (a day before surgery)		Second time (5 days after surgery)	
VC per liter	number	Percent	number	Percent
2-9.2	0	0	18	60
3-9.3	0	0	12	40
4-9.4	30	100	0	0
Total	30	100	30	100
Mean	66.4		86.2	
SD	129.0		505.0	

It shows that the whole %100 of samples in the control group had a vital capacity equal to 4-4.9 liters in the first time. The majority of samples (60%) in the control group had a vital capacity equal to 2-2.9 liters in the second time that showed that there is a significant difference between the first and second time.

Table 3: Absolute and relative frequency distribution of the current volume in the intervention group

operation day	a day before surgery (First time)		5 days after surgery (Second time)	
VC per liter	number	Percent	number	Percent
2-9.2			2	7
3-9.3			4	13
4-9.4	30	100	24	80
Total	30	100	30	100
Mean	77.4		57.3	
SD	107.0		402.0	

The results showed that all samples in the intervention group had a current volume equal to 4-4.9 liters in the first time and the majority of samples (80%) had a current volume between 4-4.9 liters in the second time. Results showed that there is a significant difference between intervention group in the first and second time ($p<0.05$).

Table 4: Absolute and relative frequency distribution of vital capacity in the intervention group

operation day	a day before surgery (First time)		The third after surgery (Second time)	
VC per liter	number	Percent	number	Percent
2-9.2			0	0
3-9.3			6	020.0
4-9.4	30	100	24	80
Total	30	100	30	100
Mean	70.4		36.3	
SD	104.0		356.0	

It indicates that the subjects in the intervention group had% 100 vital capacity about 4-4.9 liter for all patients in the first time, however, the majority had 80% vital capacity about 4-4.9 liter in the second time.

The results showed that there is a significant difference between experimental group in the first and second time ($p<0.05$).

The results obtained from the study of pulmonary volumes in the patients show that the majority of the patients had % 80 current volumes and forced expiratory volumes about 4-4.9 liter in the intervention group. The majority of 53% of current volume, 60% of vital capacity and 100 % of forced expiratory volume had less than 2.99 liters in the control group.

DISCUSSION AND CONCLUSION

Surgery as a treatment method is associated with difficulties and complications that in addition to increase the cost and length of stay, it puts the patients' lives at risk too(6). Among them, respiratory complications are the most common and dangerous issues that the patients and surgical team deal with after surgery (7). Statistical results show that there is a significant difference between intervention and control groups in terms of current volume, forced vital capacity and forced expiratory volume after surgery ($p<0.05$). These results show that the reduction of pulmonary volumes is less than the control group in studying samples regularly done cough assist (intervention group) and this method had led to decrease in respiratory disorders.

On this issue, Schwartz (1994) writes: Total capacity of the lung and its various parts will be reduced to a considerable extent after thoracic surgery in the way that the forced vital capacity decreases more than 20-25% (8). In patients undergoing thoracic and upper abdomen surgeries, their pulmonary volumes such as forced vital capacity will be decreased less than those that training the above exercises had not been given to them if they don't train coughing and deep breathing after surgery (9).

Also, surgeons put major importance on the speed of flow and expiratory volume to study the function of lung in the standard tests and consider it as an important index to evaluate patients for surgery (10).

For confirming these findings we can point to the study by Lyndmn and Yrnam (1971) in which they showed that using cough assist in the intervention group led that this group of patients undergoing thoracic showed the vital capacity of 6.538 % and forced expiratory volume 8% better than those in the control group which means this method led that the intervention group experienced postoperative changes in vital

capacity and expiratory volume in the control group (11). Chatvin et al (2002) studied the effect of physiologic cough reflex assist on pulmonary volumes in patients prone to acute respiratory infections in an experimental study. In this study, persuasive spirometry was conducted in the control group and physiologic cough reflex assist was used in the intervention group. The results of the study showed that physiologic cough assist has reduced the risk of respiratory complications such as accumulation of mucus, atelectasis, pneumonia and respiratory infections and causes to improve the pulmonary volumes (12). Brown et al (2001) conducted a study with the aim of studying the effect of physiologic cough reflex assist on the pulmonary volumes in patients suffering from chronic obstructive pulmonary that the results showed that using cough assist had increased the expiratory flow from135 liters per minute to 144 liters per minute in patients suffering from chronic obstructive pulmonary diseases. The results of the study indicated that physiologic cough reflex assist must be used to help improve pulmonary volumes in these patients (13). Results obtained from the use of postoperative cough assist showed that there exist a significant difference in both groups of intervention and control in terms of current volume, vital capacity and forced expiratory volume $P<0.05$. Preoperative FEV1 was between 3-3.9 liters for %100 of the subjects in the control group that compared to after surgery, 60% of the patients had FEV1 between 2-2.9. The results show a significant difference between per- and postoperative intervention groups. Results showed that in the intervention group, 93% of the patients had preoperative expiratory volume equal to 3-3.9 liters and in the same group; 83% had postoperative forced expiratory volume equal to 3-3.9 liters. Results showed that there is a significant difference between the first and second time. Final conclusion resulting from the findings of this study determines that the postoperative pulmonary volumes had differences in both groups of intervention and control. The obtained results in connection with the objectives of this study indicate that using cough assist has been effective in improving pulmonary volumes in the intervention group with level of confidence 95 to 99.8% and $P<0.05$ and the research hypothesis that is to improve postoperative pulmonary volumes using physiological cough assist is accepted.

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