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Effect of Preoperative Breathing Exercise on Postoperative Patients' Lung Functions

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Abstract

Pulmonary complications after surgery are a major cause of morbidity and mortality and therefore are a source area of concern in both developed and developing countries. Presently, surgical patients didn't acquire education about deep breathing activities that were adequate and many of them only received some education post operation. Aim of the study: To investigate the Effect of Preoperative Breathing Exercise on Postoperative patients' Lung Functions. A quantitative quasi-Experimental, Pre-Test and Post-Test design. A non-probability (purposive sample) of (60) patients divided into two equal groups distributed as the case and control groups (30) patients for the case group are exposed to the breathing exercise program, Pursed-lip method, and (30) patients without exposed to the breathing exercise program categories as control group. the study have been carried out in Al-Diwaniyah teaching hospital, This study conducted from 22nd of October 2018 to 25th of June 2019. There were statistically significant difference between case and control groups, patients in the case group had improvement in all parameters of lung functions than control group ($P < .05$) in the two periods of measurement post-operatively. The program show obvious difference between the lung function for both study and control groups during the post-test.

Keywords: *Preoperative, Breathing Exercise, Postoperative, patients' Lung Functions.*

Introduction

Impairment in lungs functions after surgery are one of important postoperative complications, strength of respiratory muscles could be decreased and that one reason lead to lung function change [1].

During surgery, using of general anesthetics can affect the central regulation of breathing by changing the neural drive to respiratory muscles such as the diaphragm. and because of this, the respiratory function cannot be separated from anesthesia [2].The components that can alter the pulmonary function contain unconsciousness, ventilation (whether its mechanical or spontaneous), a patient's position, anesthetics drugs, that were used during the anesthetic process on the respiratory muscles [3]. General anesthesia can alter mucociliary function, promoting retention of secretions, causing bronchoconstriction, decreased surfactant production, inhibition of alveolar macrophage activity. Moreover, anesthesia may cause atelectasis instantaneously in majority of the patients as an outcome of chest wall deformation, decreased inspiratory muscle tone, and reduced functional residual capacity (FRC) which may considerably influence gas exchange [4].

The effect of these factors on pulmonary function are appear in the early postoperative period. Lung function, measured as vital capacity (VC) and forced expiratory volume in one second (FEV1), is usually decreased by 35-60%, and a 6-13% Decreased lung function can linger for four months. In the first days following an operation, a decreased lung function can impact impaired gas exchange, and the strength of the respiratory muscle will also decrease during the first days after surgery [5]. This may be explained by insufficient diaphragmatic breathing or by the respiratory fatigue that some patients experience during the post-operative period [6]. The complications that related to anesthesia, tissue damage, immobilization, inhibition of cough, and incision of abdominal muscles which results in postoperative pain , major causes to decreased the lung volumes and limited airway clearance, which can lead to Post-operative pulmonary complications(PPC) [7-9].

Methodology

Study Design:

A quantitative quasi-Experimental, Pre-Test and Post-Test design have been carried out to study the effect of preoperative breathing exercise on postoperative patients' lung functions, in Al-Diwaniyah teaching hospital, This study conducted from 22nd of October 2018 to 25th of June 2019.

Setting of the Study:

The study is conducted in Al-Diwaniyah City, Al-Diwaniyah Health Directorate, Al-Diwaniyah teaching hospital, Surgical Wards. This hospital is a governmental, and the largest general hospital, and presents different of the medical therapeutic services in Al-Diwaniyah city.

Study Sample:

A non-probability (purposive sample) of (70) patients undergoing abdominal surgery. (10) patients of the sample for pilot study and (60) patients of the sample is divided into two equal groups distributed as the case and control groups (30) patients for the case group are exposed to the breathing exercise program, Pursed-lip method, and (30) patients without exposed to the breathing exercise program categories as control group.

Criteria for Including the Sample:

1. Adult patients age from 20 years and above .

2. Patients undergoing abdominal surgery under general anesthesia .

3. Stable condition as reported by the physician .

4. Patients with normal respiratory and cardiac functions.

Validity of the Instrument:

The face validity of the study instruments are determined by a panel of (16) experts, have experience more than ten years, from different specialties from nursing faculties.

Reliability of Instrument:

In order obtains the reliability of the study instrument five patients undergoing abdominal surgery are selected from Surgical wards for the purpose of testing the instrument their lungs capacities (FEV1, FVC, FEV%) was measured in preoperative period by used two spirometr at one time, one of them is used in the present study and the other used at Al-Diwaniyah teaching hospital. A comparison between the results of them, The result indicate, spirometr which used in present study is a reliable instrument to measure the purpose of the study.

Through developed questionnaire for Arabic version, demographic and clinical data were collected. While physiological data (Lungs volume) are collected by using the pulmonary function test machine (Portable Diagnostic Spirometer, Mir, Italy) through preoperative and postoperative assessment. During preoperative phase, the assessment was obtained (before one day of surgery for case group and, in the same day for control group), while in the post-operative phase, the assessment was done at 8th hours and 24th hours after surgery based on the previous scientific references such as [10] Regarding case group the assessment of the lungs volumes applied before and after the application of the program. For the control group, the assessment was performed only without the application of the program. The data collection process has been performed from 11th January to 14th March 2019.

The data have been collected through the use of a constructed questionnaire tool. The data analysis was done through statistical package of social science (SPSS) version (25)**.** The methods of analysis of data include**;** Descriptive Data Analysis and Inferential Data Analysis

Results

Table (1) Clinical Data of Case and Control Groups n= 60

Clinical Data	Rating And Intervals	Case group		Control group	
		Freq.	%	Freq.	%
Body mass index	Normal weight	5	16.7	8	26.7
	Over weight	13	43.3	14	46.7
	Obese	12	40	8	26.6
	Total	30	100	30	100
Smoking status	Nonsmoker	21	70	23	76.7
	Passive smoker	2	6.7	1	3.3
	Cigarette smoker	7	23.3	6	20
	Total	30	100	30	100
Duration of smoking (years)	10-19	2	28.6	4	66.7
	20-29	1	14.3	1	16.7
	30 and more	4	57.1	1	16.7
	Total	7	100	6	100
Chronic disease	Yes	12	40	10	33.3
	No	18	60	20	66.7
	Total	30	100	30	100
Type of chronic disease	Diabetic	3	25	3	30
	Hypertension	6	50	5	50
	Hypertension + diabetic	3	25	2	20
	Total	12	100	10	100
Previous surgery	Yes	15	50	13	43.3
	No	15	50	17	56.7
	Total	30	100	30	100
Type of previous surgery	Caesarian	6	20	5	16.7
	Hernia	2	6.7	2	6.7
	Hysterectomy	1	3.3	0	0
	Appendectomy	3	10	1	3.3
	Cholecystectomy	1	3.3	1	3.3
	Hemorrhoidectomy	2	6.7	1	3.3
	gastric surgery	0	0	3	10
	Total	15	100	13	100
Type of present surgery	Laparotomy	1	3.3	2	6.7
	Cholecystectomy	12	40	8	26.7
	Hernia	3	10	8	26.7
	Gastric surgery	4	16.7	3	10
	Others	10	33.3	9	30
	Total	30	100	30	100
Duration of surgery	≤1:30	20	66.7	24	80
	>1:30	10	33.3	6	20
	Total	30	100	30	100

Table (1) represent the clinical data of the case and control groups. Regarding body mass index (BMI) the table shows most of the sample in both groups are overweight (46.7%) in control group while(43.3%) in case group. In smoking status condition the table shows the majority in control group (76.7%) is nonsmoker and (70%) in the case group. Regarding type of smoking in both groups are cigarette smokers with duration of smoking (66.6%) with period of (10-19) years for control group and (57.1%) for case group who spend more than 30 years in smoking. Regarding chronic disease the study results presents that chronic disease (60%) of case group with chronic disease and (66.7%) in control group with chronic disease(50%) of both group with hypertension. Regarding previous surgery (50%) in case group have previous surgery(20%) of them with Caesarian surgery and about control group (56.7%)have previous surgery (16.7%) of them with Caesarian surgery. Regarding type of present surgery the majority of the case group (40%) have cholecystectomy surgery, and (26.7) of control group have share cholecystectomy and hernia surgery. Concerning duration of surgery (80%) in control group is more than 1:30 hours while the case group is (66.7%).

Table (2) Differences Between the Lungs Volumes for the Case and Control Group Through Pre-Operative Periods n=60

Lungs volumes	Pairs	Mean	N	Std. Deviation	T-value	d.f,	p-value
FEV1	Case	3.3173	30	0.81448	0.311	58	0.757 NS
	Control	3.2493	30	0.87842			
FVC	Case	3.9960	30	1.02234	0.149	58	0.882 NS
	Control	3.9577	30	0.97663			
FEV1%	Case	81.9163	30	4.12529	0.618	58	0.539 NS
	Control	80.9903	30	7.09822			

Table (2) shows that is non-significant difference between the levels of all the lungs' volumes between the case and control group at the pre-test in pre-operative period.

Table (3) Differences Between two Periods of Measurements of Lungs Volumes for Case and Control

Group Through Post-Operative Periods n=60

Lungs volumes	Periods of measurement	Pairs	Mean	Std. Deviation	T-value	d.f,	p-value
FEV1	Post-test 1 (after 8 hour)	Case	2.0243	0.41163	2.840	58	0.006 HS
		Control	1.6723	0.53972			
FEV1	Post-test 2 (after24 hour)	Case	2.5447	0.41462	4.795	58	0.001 HS
		Control	2.0137	0.44264			
FVC	Post-test 1 (after 8 hour)	Case	2.6630	0.47391	2.466	58	0.017 S
		Control	2.2943	0.66790			
	Post-test 2 (after24 hour)	Case	3.1487	0.49057	3.676	58	0.001 HS
		Control	2.6823	0.49205			
FEV1%	Post-test 1 (after 8 hour)	Case	76.4360	7.71847	2.076	58	0.043 S
		Control	71.6333	10.0527			
	Post-test 2 (after24 hour)	Case	80.0577	6.32315	2.039	58	0.046 S
		Control	76.113	8.50237			

Table (3) shows there are a statically differences between studied groups according level of lung volume, P-value were less than 0.006) in two period of measurement post-operatively).

Table (4) Correlation between Lungs Volume and Socio- Demographic and Clinical Data of Case Group in Post-test 2 (after24 hour) N= 30

Rating and Intervals	lungs volumes	r	p-value
Age	FEV1	- 0. 895	0.001 HS
	FVC	- 0. 619	0.002 HS
	FEV%	- 0. 416	0.003 HS
Body mass index	FEV1	- 0. 722	0.041 S
	FVC	- 0. 426	0.016 HS
	FEV%	- 0. 399	0.001 HS

Table (4) shows there are a strong negative correlation between patient's lungs volumes (FEV1, FVC,) and age (r=-0.895;0,001) (- 0.619; 0.001) respectively, FEV1 and body mass index (r = 0.722; 0.041), as well as a significant correlation among other studied parameters.

Discussion

Regarding Table (1) there was a high percentage of patients at age groups (50-59) years old, and the majority of study samples were male. This could be agreeable with [11] as their study have the same range age group, and the gender was also mainly male. The present results show

that most patients are primary school graduate, many people might live with number of social and economic barriers to stressful and conflict environment, this can prevent them for achieving higher educational levels, this result could be supported by [12] majority of their study are primary school graduate were (78.5%). It is show that there is non-significant difference between both groups in the baseline pulmonary functions parameters mentioned in the pre-operative period. This may be due to both groups were had resemble characteristic and functionally comparable to each other. The present result is similar to a study conducted by [13,14] are similar with the result of present study, and the pulmonary function test parameters did not differ between two groups before operation. After the application of the breathing exercise pursed lip methods through the present study, the results indicated that there is an improvement in the case group lungs volumes compared with those patients in the control group. The result shows that there is a significant difference between groups. Patients in the study group who demonstrate breathing exercise had a higher pulmonary function in all parameters than in control group at P- value less than 0.05 in all the post-operative periods. The applied method is an effective way to improve the post-operative patients' lung function. The results of this study agree with the observations of [15] , they concluded that the pre-operative deep breathing exercise improves the pulmonary functions, with significantly improved for lungs parameters such as FVC, FEV1 at P-value = 0.003, and P- value less than 0.001 respectively). The study shows that there is a relationship between the patient's lung volume with their age and body mass index at p-value less than 0.05 after 24 hours postoperatively, while the other results indicate there is no relationship between patients lungs volumes and other demographic and clinical data at p-value more than 0.05. Pulmonary function may decrease and affected by age. The rate of respiratory and blood circulation are increases in childhood and become in a maximum level at age group between (20–30) years, then decline again in the older age. About high body mass index there are some reasons for decline the lung function. Firstly, the diaphragm position in the thoracic cavity is elevated obviously when individual increase weight. Secondly, it appears that fat accumulation on the chest wall will impede the movement of thoracic cage by a direct resistance or the abnormal function of intercostal muscle [16,17].

Conclusion

There were no differences between lung function in both case and control groups in the pretest. There is an improvement in the postoperative patients' lungs function in study group after exposure to an educational breathing exercise program. The program show obvious difference between the lung function for both study and control groups during the post-test. Control group does not present any modification in their lung function post-operatively. In addition, there is relation between study groups and demographical data in age and body mass index only.

Conclusion

Financial Disclosure: There is no financial disclosure.

Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the University of Kufa. Faculty of Nursing, Iraq and all experiments were carried out in accordance with approved guidelines.

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