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ORIGINAL RESEARCH

Effect of Preoperative Breathing Exercises Combination on Postoperative Respiratory Status and Pulmonary Complications for Patients with Cardiac Surgery

Rajwan Talib Abdullah [1], Rajha A. Hamza Al-Kassar [2], Wadhah A. Mahbuba [3].

[1] *Department of Adult Nursing, College of Nursing, University of Kufa, AL-Najaf, Iraq.*
[2] *Department of Adult Nursing, College of Nursing, University of Kufa, AL-Najaf, Iraq.*
[3] *Department of Surgery, College of Medicine, University of Kufa, AL-Najaf, Iraq.*

CORRESPONDING AUTHOR: Rajwan Talib Abdullah, Department of Adult Nursing, College of Nursing, University of Kufa, AL-Najaf, Iraq.
Email: ragiwant.alibrahimy@uokufa.edu.iq

ABSTRACT

Background: Cardiac surgeries have negative impact on patients' respiratory function and contribute to develop of postoperative pulmonary complications (PPCs). Different breathing exercises such incentive spirometer and diaphragmatic breathing are recently used to reduce postoperative pulmonary complications.

Objectives: This study aims to evaluate the effect of preoperative breathing exercises combination on respiratory status and pulmonary complications postoperatively in patients with cardiac surgery.

Methodology: Quasi-experimental design study conducted in 75 patients planned to undergo cardiac surgery divided into two groups; interventional with 38 participants and control with 37 participants. The interventional group received preoperative breathing exercises combination and control group received postoperative routine exercises only. All patients with on pump; coronary artery bypass grafting (CABG), valve, or CABG with valve surgeries.

Results: The study results indicated that patients in the interventional group who practiced preoperative breathing exercises had a lower postoperative pulmonary complication rate especially atelectasis with a statistically high significance difference (p-value ≤ 0.005).

Conclusion: This study concluded that added preoperative breathing exercises with conventional postoperative therapy is an effective method for reduce occurrence of postoperative pulmonary complications especially atelectasis in interventional group compared with control group.

Recommendations: Further studies with a larger sample size, multicentric approach, and with same or different breathing strategy should be conducted to allow the generalization of findings and determine the effectiveness of non-therapeutic intervention on PPCs especially atelectasis for patients with cardiac surgery.

Keywords: Cardiac surgery, Postoperative pulmonary complication, Respiratory status, Breathing exercises, Incentive spirometer, effect.

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INTRODUCTION

Cardiac surgeries ranking among most frequent and complex surgeries which become an important treatment for coronary and structural heart disease (Wang et al., 2023; Atabey & Şahinalp, 2023). However, cardiac surgical procedure uses advance techniques and materials to allow safe procedure, there are still associated risks (Rodrigues et al., 2021).

Accordingly, Cardiac surgery had a negative impact related to pulmonary function (Majumdar et al., 2019; Abdulrdha & Tawfiq, 2015). Severe diaphragmatic dysfunction leading to prolonged mechanical ventilation and related pulmonary complications, may occur in 6% of patients (Tralhão et al., 2020).

Many studies emphasized that respiratory muscles inhibition that contribute to pulmonary complications are caused by the incisional pain, and from anesthetic procedure itself which have many effect such as altered mucociliary function that may promoted airway secretion retention, and from anesthetic drug which may release the circulating mediators leading to bronchoconstriction and prolonged functional residual capacity reduction, equal to 20% due to decrease respiratory muscles tone which is almost always associated with atelectasis (Handayanto et al., 2020; Sullivan et al., 2021; Jage & Thakur, 2022; Al-Reda & Hamza, 2020).

Postoperative pulmonary complications (PPCs), including atelectasis, pleural effusion, diaphragm paralysis, pneumonia, bronchoconstriction, hypoxemia, weakened respiratory muscles, prolonged use of mechanical ventilation, pulmonary edema, and respiratory failure, may occur after CABG surgery (Liu et al., 2020). PPCs are causes of the poor postoperative outcome leading to increase morbidity and mortality, length of stay in hospital (HLOS) and costs of hospital care (Fischer et al., 2021).

Recently, the exercise- based intervention have implemented in pre-surgical care called pre-habilitation with the goal to prepare patients for surgery by improving physical, metabolic, and psychosocial reserves. Pre-habilitation may play an important role in cardiovascular surgery (Drudi et al., 2019).

However, postoperative physiotherapy importance is well-documented, little is established on the value of the preoperative intervention which may delivered to decreased PPCs in patients planned to cardiac surgery. These may involve inspiratory muscle training (IMT), breathing exercises, and exercise training (Shahood et al., 2022).

Respiratory muscle exercises are provided for patients before and after cardiac surgery for improve their respiratory muscles strength, prevent complications, and reduce hospitalization (Naseer et al., 2019). The use of incentive spirometer (IS) and the deep breathing exercises (DBEs) can be used easily and without complications by patients and are also low-cost methods (Zerang et al., 2022).

Nursing personnel are responsible for monitoring, instructing, and educating. Pre-operative education usually directed by specialist nurses and includes a review of patient's case, detailed history and the clinical examination, and additional tests and investigations (Kreem & Hamza, 2019). Critical care nurse's involvement is crucial in helping the patient recover from open heart surgery, promoting healing, and avoiding complications (Abdelhafez & Fouad, 2023).

However, several studies in different countries documented the effects of preoperative breathing exercises for patients with cardiac surgeries but in Iraq there is only one study framed the same issue which is motivation for new evidence highlight the effectiveness of theses breathing exercises combination on those patients and in turn enhanced the health care services provided.

AIMS OF THE STUDY

This study aims to evaluate the effect of the preoperative breathing exercises combination on respiratory status and pulmonary complications postoperatively in patients with cardiac surgery.

METHODOLOGY

Design of the study:

The quasi-experimental design (Nonequivalent Control Group Design) has been used to determine the effectiveness of breathing exercises preoperatively on improving lung function outcomes for patients with cardiac surgery.

Sample and sampling of the Study:

The researcher selects 75 subjects who planned to undergo elective cardiac surgery and meet the eligible criteria to be included in this study by using homogenous purposive sampling technique which is type of non-probability sampling methods.

Study setting:

This study conducted in the surgical department of Al-Najaf Center for Cardiac Surgery and Trans-Catheter Therapy, Najaf, Iraq during period from 14th November 2023 to 11th March 2024. The study approved by the Medical Ethics Committee (MEC)/ College of Medicine / University of Kufa.

Eligible criteria:

Adults patients who schedule for elective cardiac surgery, speak Arabic, cooperate to participate in the study and without neurological or cognitive deficits were included in the study. Patients with MI or shock during previous 2 months and uncontrolled hypertensive disease were excluded.

Determination of sample size:

The researcher used G-power software to calculate appropriate sample size based on statistical power, significance level, and effect size. Therefore, a sample of (75) participants was determined for this study.

The Study groups:

The study sample of 75 participants who met the inclusion and the exclusion criteria and purposefully allocated into two groups. The interventional group included (38) participants who practicing preoperative breathing exercises combination added to postoperative conventional therapy while the control group with (37) participants underwent usual postoperative exercises only. Patients in the interventional group individually received a training session for 30 minutes and a written instructional pamphlet in Arabic language with supportive pictures. The breathing exercises was as follow: patients take 10 slow deep breaths by incentive spirometer and hold it for 3 to5 seconds then remove mouthpiece, exhale through mouth, and cough during exhaling. The patients take 0.5 to 1 minute rest thereafter practicing diaphragmatic breathing for 10 minutes while lying in bed or semi-sitting position and relaxing shoulders then take deep breath by nose and feel the diaphragm movement, hold breath 2 to 3 seconds and exhaling through pursed lips. This cycle repeated every 2 hours during awaking hours one day before surgery. In addition, the researcher emphasized the infection control measures.

Regarding evaluation of the effect of breathing exercises, serial evaluation was done postoperatively in ICU to note any respiratory changes or PPCs occurrence; after surgical procedure (day0) and for three consecutive days (day1, day2, and day3) each after 24 hours diagnosed by physician who was blinded to the sample assignment and documented by the researcher.

Study instrument:

Based on literature review and supervision of the field experts, the study instrument has developed. The instrument consists of eight parts are:

Part I: Socio-Demographic Data:

This part involved (5) demographics characteristics obtained from participants through interview before the procedure. The five variables that comprise the socio-demographic information are: age, sex, education level, employment status, and residence.

Part II: Clinical Characteristics:

These characteristics collected from patients' medical records and interview. This part included the following (3) sections: **Present History** (surgery approach and type), **Past Medical History** (chronic disease; Diabetes Mellitus; Coronary Artery Disease; Heart Failure; Hypertension; Kidney Diseases; Inflammatory Diseases; Anemia; and respiratory diseases, and previous surgical history including cardiac- relating surgery), and **Clinical Aspects and Smoking Status** (body mass index parameters; Height in cm and weight in Kg, patient' smoking status; Active- Smoker; Passive- Smoker; and Non-Smoker, patient' education about breathing exercises or chest-physiotherapy, and its sources including physician, nurse, books, Peers, Internet\ TV, or Others).

Part III: Respiratory Status and Complications:

This part consists of two special checklists were developed based on relevant previous study by Sweity et al., (2021) to assess respiratory status (dyspnea, cough, wheezing, sweating, use of accessory muscles, diminished air entry, and abdominothoracic breathing) and PPCs (atelectasis, pneumonia, respiratory insufficiency, pleural effusion, pneumothorax, and bronchospasm). The incidence of PPCs and any change from normal respiratory status was assessed by the physician who was blinded to patient's group assignment.

Rating and Scoring:

The Respiratory status and complications were scored at (0), a mark has given for each normal (absent) findings and at (1), a mark has given for each altered (present) findings. The Body mass index (BMI) was classified in according to World health organization (WHO) guidelines into four classes: underweight (<18.5 Kg/m2), normal weight (18.5 to 24.9 Kg/ m2), overweight (25.0 to 29.9 Kg/ m2), and obesity (30 and more Kg/ m2).

Validity of the Study Instruments:

The face validity of the instrument determined by (12) medical surgical nursing and (1) Consultant cardiothoracic and vascular surgeon experts, who have (14) to (37) experience years. All the experts were examining the instrument content and gave their valuable suggestions, and taken into accounts by the researcher.

Ethical consideration:

Before data collection, the researcher interviewed each participant and explained the purpose of the study, benefits, and potential risks then personal agreement obtained from the participant and signing on informed consent. The researcher explained to the participants that they have right to engage in the study voluntary, reject the participation in the study at any time before and during the study, any concerns about privacy and confidentiality of the personal information were clarify in precision.

Methods of data collection:

The researcher employed face to face interviews with each patient; and patient' medical record to gather their socio-demographic and clinical characteristics data. Regarding evaluation of respiratory status and the PPCs incidence, the researcher uses same special checklists for all study and control group.

Statistical Analysis:

The data of this study were analyzed with Statistical Package of Social Sciences (SPSS) version 20. The data were normally distributed and parametric statistical tests were used. A p-value ≤ of 0.05 was considered to indicate a statistically significant difference.

- Descriptive data analysis: presented as tables, figures, frequencies, percentage.
- Inferential data analysis: Fisher exact chi-square test, independent t test, and ANOVA.

RESULTS

Table (1) shows that the majority of the intervention and control groups participants were (36.84% and 32.43%) in the age groups (51–60) and (61-70) years old, respectively; were males (60.53%

and 70.27%), respectively. Also, (26.32%) in intervention group graduated from primary school and (16.22%) able to read and write with the same percent graduated from secondary school and college or postgraduate school in control group. Moreover, (63.16%) of intervention group were unemployed occupants of urban area. Finally, (59.46%) and (81.08%) in control group were unemployed and residence in urban, respectively.

Table (2) shows that most of patients in the intervention group (78.95%) and control group (67.57%) underwent open median-sternotomy surgery; mostly valve surgery (63.16%) and (67.57%), respectively. For the past clinical history, (52.63%) in the intervention group and (32.43%) in the control group were hypertensive. The highest percentage (78.95% of intervention group and 59.46% of control group) had PCI. In addition, more than half of patients in the intervention group (52.63%) were obese, while more than half of patients in the control group (51.35%) were overweight. Moreover, most of the participants in the intervention and control groups (92.11% and 81.08%) respectively, were non-smokers.

Finally, most of patients (97.37%) in intervention group and (94.59%) in control group were not received education before surgery while the remain (2.63%) of intervention group and (2.70%) of control group sourced their knowledge from the Internet\ TV and (2.70%) of the control group from reading a book.

Table (3) shows the respiratory status of both intervention and the control groups. There was a statistically significant differences in the occurrence of respiratory symptoms including dyspnea on days 0 and 1; wheezing on days 1; sweating on days 1 and 2; and diminished air entry on day0, 1, 2, and 3 (all P-values <0.05), while all other respiratory symptoms were statistically non-significant (all P values >0.05) using the exact Fisher chi-square test.

Table (4) shows a statistically significant differences in occurrence of postoperative respiratory complications between the intervention and the control groups; atelectasis on days 0, 1, 2, and 3; pleural effusion on day 1; and bronchospasm on day 0 (all p-values <0.05), while all other postoperative respiratory complications were statistically non-significant (all P values >0.05) using the exact Fisher chi-square test.

Figure (1) shows graphical comparison using bar chart to demonstrates percentage rate of atelectasis incidence among intervention and control groups.

DISCUSSION:

Postoperative pulmonary complications (PPCs) remain the leading cause of morbidity and mortality after cardiac surgery despite the advancement in the surgical techniques and perioperative care. The current study was conducted with the aim of evaluating the effect of preoperative breathing exercises combination on respiratory status and pulmonary complication postoperatively for patients undergoing elective cardiac surgeries.

The study results indicate that breathing exercises (using of incentive spirometer (IS) in combination with diaphragmatic breathing) preoperatively was an effective method in reduce atelectasis and enhance respiratory state postoperatively for patients with cardiac surgery.

The effect of preoperative breathing exercises combination on PPCs

According to study conducted in Iraq-Sulaymaniyah, revealed that the most common postoperative complications among 246 patients performing CABG surgery was PPCs with (14.2%) which include atelectasis and chest infections (Mohammed & Nadr, 2021).

In the present study (Table 3, Figure 1), there was a highly significant decrease in the incidence of atelectasis in the intervention group throughout the postoperative study period (p-value = ≤0.005). This result is consistent with a randomized prospective study in Pakistan with 170 patients undergoing

CABG, the study found a significant difference in postoperative atelectasis in patients in the interventional group for 5 days preoperatively compared to patients in the control group (p-value = 0.04) (Gilani et al., 2016).

These results were confirmed by another RCT conducted in Iraq, Baghdad, with 64 patients who were scheduled for variety cardiac surgery, which shows patients in the intervention group (preoperative IS used two days before surgery) had a lower incidence of PPCs compared to the control group (without preoperative IS use) (Faleh & AL-Fayyadh, 2022).

Moreover, Faleh & AL-Fayyadh, (2022), conducted a narrative review of 14 studies involving 3908 participants who undergoing Coronary Artery Bypass Grafts and/or valvular surgery. This review concluded that preoperative pulmonary rehabilitation lead to reduction in occurrence of PPCs and has positive effect on HLOS and improving pulmonary function.

In contrast, Manapunsopee et al., (2020), conduct a randomized clinical trial for 90 patients scheduled to undergo CABG in Thailand. The study group received IS and DBE, and the control group received DBE only. There was no significant difference between groups regarding PPCs.

Also, another single blinded randomized clinical trial of 100 patients who were undergoing CABG were randomly allocated into interventional group who were enrolled in a preoperative protocol of deep breathing, cough and incentive spirometer and control group with conventional routine. This study concluded there is no significant difference between groups in terms of atelectasis and hypoxemia (p Value>0.05) (Moradian et al., 2019).

The possible explanation of difference with the present study result may be non-compliance of patients with designed exercises in intervention group, timing of therapy use, and period of practicing in relation to the surgery (pre or post). Combination of breathing exercise using diaphragmatic breathing and IS can strengthen inspiratory muscles, improve lung capacity and compliance, thus prevent postoperative pulmonary complications.

In addition, bronchospasm represents the clinical manifestation of bronchial muscles contraction resulting in reduced alveolar air flow (Gautam & Shakya, 2019). Bronchospasm during weaning from CPB may be due to an allergic drug reaction (eg, protamine) or transfusion reaction (e.g., blood products, plasma expanders), inadequate anesthesia, or pre-existing asthma or chronic obstructive pulmonary disease (Roberts et al., 2023). In the present study, the combination of breathing exercises was an effective method in reduction the bronchospasm occurrence with high statistical differences between both groups (p-value= 0.001). The highest incidence of bronchospasm was in day0 (immediately after surgery) with 12 of 37 (32.43%) patients in the control group.

Regarding to pleural effusion, it occurs frequently in patients recovering from cardiac surgery. In patients undergoing CABG or heart valve surgery, between 41% and 89% develop pleural effusions in the first 7 days after surgery and 10% develop a pleural effusion occupying more than 25% of the hemithorax in the subsequent month (Schiefenhövel et al., 2022). The present study shows a significant reduce in pleural effusions during immediate postoperative period (day1) of intervention group compared to those in control group.

These results are closely consistent with a prospective quasi-experimental study conducted in Egypt with 150 patients undergoing cardiac surgeries and equally divided into 3 group practicing different respiratory modalities in the two days preceding surgery and the 2nd and 3rd postoperative days. Showed that the third group which practices all respiratory modalities (Deep breathing exercises + IS use) had 2% postoperative bronchospasm (1 of 50 patients) and 6% pleural effusion (3 of 50) which close to our study result with 2.63% (1 of 37 patients) and 5.26% (2 0f 38) respectively (Askar et al., 2020).

On the other hand, there were no statistically significant differences between the groups in other respiratory complications.

The effect of preoperative breathing exercises combination on respiratory status:

The present study also found that patients within the intervention group had a fewer number of incidences regarding dyspnea, sweating, wheezing, and decrease air entry than those in control group (Table 4). There is a statistically significant reduction in day0 and day1 for dyspnea; day1 and day 2 for sweating; day1 for wheezing. Moreover, this study shows a high statistical significance related to occurrence of decreased air entry between both groups during study period in reflection to reduce incidence of atelectasis, pleural effusion, pneumothorax, and bronchospasm as showed in table (3).

The results are in line to a monocenter retrospective study conducted in India with 321 patients with cardiac surgery. The study found patients who received pre and postoperative nurse-guided incentive spirometry had fewer numbers of incidences of postoperative dyspnea and sweating than those patients who received postoperative physiotherapist-guided breathing exercises only or pre and postoperative physiotherapist-guided breathing exercises (Su et al., 2022)

Dyspnea and pulmonary edema are also responsible for sweating. Pre and postoperative use of IS and diaphragmatic breathing decrease the shrinking of the lungs thus decreased stress on the lungs for proper breathing. Therefore, pre and postoperative nurse-guided incentive spirometry had fewer numbers of incidences of postoperative dyspnea and sweating.

CONCLUSIONS:

The current study concluded that added preoperative breathing exercises with conventional postoperative therapy is an effective method for reduce occurrence of postoperative pulmonary complications (PPCs) especially atelectasis in an interventional group compared with a control group.

RECOMMENDATIONS:

Further studies with large sample size, multicentric approach, and with same or different breathing strategies should be conducted to allow the generalization of results and determine the effectiveness of non-therapeutic intervention on PPCs especially atelectasis for patients with cardiac surgery.

Limitations: The main study limitations were its single-center nature and the small size of the analyzed sample.

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Conflicts of interest: The authors declare no conflicts of interest.

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TABLES & FIGURES:

Table (1): Socio-demographic data of interventional and control groups

Socio-Demographic Data	Rating and Intervals	Intervention *(n=38)*		Control *(n=37)*	
		F.	%	F.	%
Age groups (Years)	<= 30	6	15.79	4	10.81
	31 - 40	3	7.89	2	5.41
	41 - 50	3	7.89	8	21.62
	51 - 60	14	36.84	11	29.73
	61 -70	12	31.58	12	32.43
Gender	Males	23	60.53	26	70.27
	Females	15	39.47	11	29.73
Level of Education	Doesn't Read or Write	9	23.68	5	13.51
	Able to Read and Write	8	21.05	6	16.22
	Primary School Graduate	10	26.32	5	13.51
	Intermediate School Graduate	2	5.26	4	10.81
	Secondary School Graduate	2	5.26	6	16.22
	Institutes Graduate	4	10.53	5	13.51
	College or Postgraduate	3	7.89	6	16.22
Working Status	Retired	3	7.89	6	16.22
	Governmental Employee	8	21.05	3	8.11
	Private Worker or Self-Employed	0	0	4	10.81
	Jobless	24	63.16	22	59.46
	Student	3	7.89	2	5.41
Residence	Rural	14	36.84	7	18.92
	Urban	24	63.16	30	81.08
Total		**38**	**100%**	**37**	**100%**

%= percentage, F. = frequency.

Table (2): Frequency distribution of Clinical data for Intervention and Control groups

Clinical History	Rating and Intervals	Intervention*(n=38)*		Control *(n=37)*	
		F.	%	F.	%
Approach	Open Median-sternotomy	30	78.95	25	67.57
	Mics	8	21.05	12	32.43
Type of Surgery	CABG	12	31.58	11	29.73
	Valve Surgery	24	63.16	25	67.57
	CABG &Valve Surgery	2	5.26	1	2.70
Chronic diseases	DM	11	28.95	11	29.73
	CAD	11	28.95	8	21.62
	HF	1	2.63	2	5.41
	HTN	20	52.63	12	32.43
	KD	9	23.68	5	13.51
	Inflammatory Diseases	11	28.95	5	13.51

	Anemia	7	18.42	5	13.51
	RD	1	2.63	3	8.11
Previous Surgery	No	7	18.42	15	40.54
	PCI	30	78.95	22	59.46
	ASD closure surgery	1	2.63	0	.00
BMI Categories	Underweight (< 18.5)	2	5.26	0	.00
	Normal (18.5 - 24.9)	4	10.53	8	21.62
	Overweight (25 - 29.9)	12	31.58	19	51.35
	Obese (30 and more)	20	52.63	10	27.03
Smoking Status	Active- Smoker	3	7.89	6	16.22
	Passive- Smoker	0	0.00	1	2.70
	Non- Smoker	35	92.11	30	81.08
Receive Breathing Exercise or Chest-Physiotherapy Education	No	37	97.37	35	94.59
	Yes	1	2.63	2	5.41
Source of Breathing Exercise	None	37	97.37	35	94.59
	Books	0	.00	1	2.70
	Internet\ TV	1	2.63	1	2.70
Total		**38**	**100%**	**37**	**100%**

%= percentage, F. = frequency.

Table (3): Percentage rate of Postoperative Respiratory Complication between Intervention and Control groups.

Postoperative Respiratory Complication			**Intervention *(n=38)***		**Control *(n=37)***		***Chi*-test *(df=1)***	***P* value**	**(Sig.)**
			F.	**%**	**F.**	**%**			
Atelectasis	Day 0	No	30	78.95	11	29.73	18.324	<0.001	(HS)
		Yes	8	21.05	26	70.27			
	Day 1	No	31	81.58	11	29.73	20.454	<0.001	(HS)
		Yes	7	18.42	26	70.27			
	Day 2	No	35	92.11	19	51.35	15.444	<0.001	(HS)
		Yes	3	7.89	18	48.65			
	Day 3	No	38	100.00	30	81.08	7.929	0.005	(HS)
		Yes	0	0.00	7	18.92			
R. Insufficiency	Day 0	No	38	100.00	36	97.30	1.041	0.493	(NS)
		Yes	0	0.00	1	2.70			
	Day 1	No	38	100.00	35	94.59	2.110	0.240	(NS)
		Yes	0	0.00	2	5.41			
	Day 2	No	38	100.00	34	91.89	3.209	0.115	(NS)
		Yes	0	0.00	3	8.11			
	Day 3	No	38	100.00	34	91.89	3.209	0.115	(NS)
		Yes	0	0.00	3	8.11			
Pleural Effusion	Day 0	No	35	92.11	29	78.38	2.822	0.113	(NS)
		Yes	3	7.89	8	21.62			
	Day 1	No	36	94.74	28	75.68	5.442	0.025	(S)
		Yes	2	5.26	9	24.32			

	Day 2	No	34	89.47	31	83.78	.525	0.516	(NS)
		Yes	4	10.53	6	16.22			
	Day 3	No	35	92.11	35	94.59	0.187	0.666	(NS)
		Yes	3	7.89	2	5.41			
Pneumothorax	Day 0	No	38	100.00	34	91.89	3.209	0.115	(NS)
		Yes	0	0.00	3	8.11			
	Day 1	No	37	97.37	33	89.19	2.016	0.200	(NS)
		Yes	1	2.63	4	10.81			
	Day 2	No	37	97.37	33	89.19	2.016	0.200	(NS)
		Yes	1	2.63	4	10.81			
	Day 3	No	37	97.37	32	86.49	3.016	0.108	(NS)
		Yes	1	2.63	5	13.51			
Bronchospasm	Day 0	No	37	97.37	25	67.57	11.619	0.001	(HS)
		Yes	1	2.63	12	32.43			
	Day 1	No	37	97.37	34	91.89	1.114	0.358	(NS)
		Yes	1	2.63	3	8.11			
	Day 2	No	37	97.37	35	94.59	0.376	0.615	(NS)
		Yes	1	2.63	2	5.41			
	Day 3	No	38	100.00	37	100.00		N/A	
		Yes	0	0.00	0	0.00			

%= percentage, F. = frequency, d.f = degree of freedom, P = probability value. NS= non-significant.

Table (4): Percentage rate of Respiratory Status between Intervention (n=38) and Control groups (n=37)

Respiratory Status			**Intervention *(n=38)***		**Control *(n=37)***		***Chi*-test *(df=1)***	***P* value**	**(Sig.)**
			F.	**%**	**F.**	**%**			
Dyspnea	Before surgery	No	35	92.11	34	91.89	.001	.973	(NS)
		Yes	3	7.89	3	8.11			
	Day0	No	32	84.21	13	35.14	18.812	<0.001	(HS)
		Yes	6	15.79	24	64.86			
	Day1	No	36	94.74	21	56.76	14.826	<0.001	(HS)
		Yes	2	5.26	16	43.24			
	Day2	No	33	86.84	26	70.27	3.068	.097	(NS)
		Yes	5	13.16	11	29.73			
	Day3	No	36	94.74	33	89.19	.784	.430	(NS)
		Yes	2	5.26	4	10.81			
Cough	Before surgery	No	32	84.21	36	97.30	3.794	.108	(NS)
		Yes	6	15.79	1	2.70			
	Day0	No	34	89.47	34	91.89	.130	.719	(NS)
		Yes	4	10.53	3	8.11			
	Day1	No	33	86.84	34	91.89	.502	.711	(NS)
		Yes	5	13.16	3	8.11			
	Day2	No	33	86.84	36	97.30	2.784	.200	(NS)
		Yes	5	13.16	1	2.70			
	Day3	No	37	97.37	37	100	.987	.321	(NS)

		Yes	1	2.63	0	.00			
Wheezing	Before surgery	No	38	100	37	100		N/A	
		Yes	0	.00	0	.00			
	Day0	No	37	97.37	32	86.49	3.016	.108	(NS)
		Yes	1	2.63	5	13.51			
	Day1	No	38	100	31	83.78	6.698	.012	(S)
		Yes	0	.00	6	16.22			
	Day2	No	36	94.74	34	91.89	.244	.674	(NS)
		Yes	2	5.26	3	8.11			
	Day3	No	36	94.74	35	94.59	.001	.978	(NS)
		Yes	2	5.26	2	5.41			
Sweating	Before surgery	No	35	92.11	37	100	3.043	.240	(NS)
		Yes	3	7.89	0	.00			
	Day0	No	35	92.11	28	75.68	3.765	.065	(NS)
		Yes	3	7.89	9	24.32			
	Day1	No	33	86.84	22	59.46	7.188	.007	(HS)
		Yes	5	13.16	15	40.54			
	Day2	No	36	94.74	26	70.27	7.832	.006	(HS)
		Yes	2	5.26	11	29.73			
	Day3	No	34	89.47	30	81.08	1.055	.346	(NS)
		Yes	4	10.53	7	18.92			
Use of Accessory Muscles	Before surgery	No	38	100	37	100		N/A	
		Yes	0	.00	0	.00			
	Day0	No	37	97.37	35	94.59	.376	.615	(NS)
		Yes	1	2.63	2	5.41			
	Day1	No	38	100	36	97.30	1.041	.493	(NS)
		Yes	0	.00	1	2.70			
	Day2	No	37	97.37	37	100	.987	.321	(NS)
		Yes	1	2.63	0	.00			
	Day3	No	38	100	37	100		N/A	
		Yes	0	.00	0	.00			
Diminished Air Entry	Before surgery	No	38	100	36	97.30	1.041	.493	(NS)
		Yes	0	.00	1	2.70			
	Day0	No	33	86.84	14	37.84	19.242	<0.001	(HS)
		Yes	5	13.16	23	62.16			
	Day1	No	35	92.11	11	29.73	30.755	<0.001	(HS)
		Yes	3	7.89	26	70.27			
	Day2	No	35	92.11	16	43.24	20.569	<0.001	(HS)
		Yes	3	7.89	21	56.76			
	Day3	No	36	94.74	24	64.86	10.455	.001	(HS)
		Yes	2	5.26	13	35.14			
Abdomino-thoracic Breathing	Before surgery	No	38	100	37	100		N/A	
		Yes	0	.00	0	.00			
	Day0	No	38	100	36	97.30	1.041	.493	(NS)

	Yes	0	.00	1	2.70			
Day1	No	38	100	36	97.30	1.041	.493	(NS)
	Yes	0	.00	1	2.70			
Day2	No	37	97.37	35	94.59	.376	.615	(NS)
	Yes	1	2.63	2	5.41			
Day3	No	37	97.37	37	100	.987	.321	(NS)

%= percentage, F. = frequency, d.f = degree of freedom, P = probability value. NS= Non-Significant at (P > 0.05).

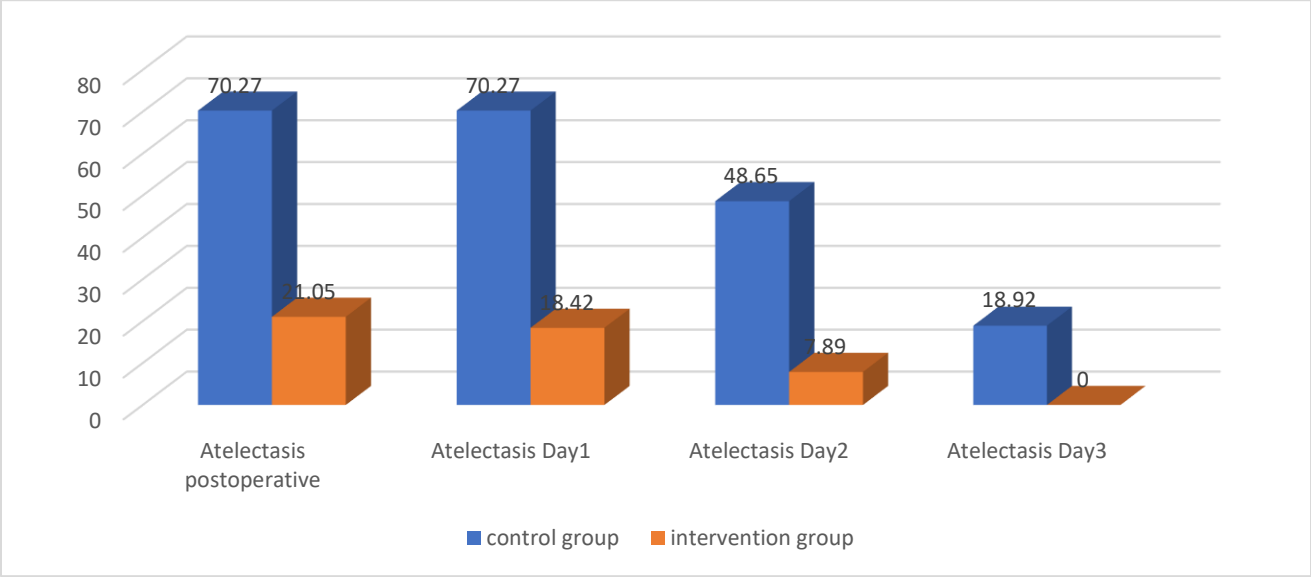

Figure (1): Bar chart of percentage rate of atelectasis incidence among intervention (n=38) and control group (n=37)