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EFFECT OF ACTIVE CYCLE BREATHING VERSUS INCENTIVE SPIROMETRY ON DYSPNEA SEVERITY AMONG PATIENTS UNDERGOING CARDIAC SURGERIES

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Abstract

Background: Cardiac surgery is considered as a life-saving intervention that can resolve many cardiac problems. One of the most common problems encountered by patients undergoing cardiac surgeries is dyspnea. In order to improve dyspnea active cycle breathing technique and incentive spirometry have been used**. Aim:** To investigate the effect of active cycle breathing versus incentive spirometry on dyspnea severity among cardiac surgery patients. **Design:** Quasi-experimental pre-posttest nonequivalent control group design **Sample:** A convenient consecutive sample of 90 adult male and female patients who undergone cardiac surgeries were enrolled in the current study. **Tools:** Two tools were utilized to collect data: (a) Personal & Medical data Form and (b) Dyspnea Index Scale. **Results:** The results showed no statistically significant difference in dyspnea severity between the three studied groups at the pre-intervention assessment. On the other hand, there was a significant improvement in dyspnea among patients in the study groups who practiced either active cycle breathing, or incentive spirometry compared to the control group at the first and second post intervention assessment. **Conclusion:** The results of the current study concluded that the practice of both active cycle breathing and incentive spirometry induced significant improvement in dyspnea severity among patients after cardiac surgeries in comparison to control group, hence, it is recommended that implementation of these breathing exercise techniques should be endorsed as an integral part by nurses who play a key role in the management of patients with cardiac surgeries.

Keywords: Cardiac Surgeries, Active Cycle Breathing, Incentive Spirometer, Dyspnea.

1. INTRODUCTION

The massive increase in the incidence of cardiac diseases is usually due to the epidemiologic transition implicating atherosclerosis, hypertension, and lifestyle risk factors. Cardiac surgery is a well-established procedure worldwide due to its safety and effectiveness in treating cardiac patients.

The coronary artery bypass grafting (CABG) and valve replacement are the two most common cardiac procedures performed worldwide. Even though cardiac surgery is performed to improve a patient's condition, there are many postoperative problems are most likely to occur. The most typical problem is dyspnea [1].

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The American Thoracic Society defines dyspnea as a subjective experience of breathing discomfort that comprises qualitatively distinct sensation that vary in intensity [2].

Postoperative dyspnea is considered as a major complaint in the early post-operative period after cardiac surgery. Cardiac surgery is associated with reduction in lung function and diminished ability by the patient to breathe deeply and cough effectively. Moreover, sternal incision, which restricts chest movement and cardiopulmonary bypass impairs gas exchange. Both the surgery and the subsequent breathing impairments increase the risk for dyspnea [2].

Active Cycle Breathing Technique (ACBT) is a chest clearing technique. It is used to remove secretions from the chest, thus improving breathing, reducing the occurrence of chest infection, and reducing overall respiratory complications. In ACBT, a cycle of breathing control and deep breathing exercises along with huffing and coughing is followed to remove secretions from the lungs [3].

Incentive spirometry (IS), on the other hand, is a method of deep breathing that provides visual feedback to encourage the patient to inhale slowly and deeply to maximize lung inflation and prevent or reduce atelectasis.

Incentive spirometry is used to expand breathing volume, improve pulmonary ventilation, raise oxygen saturation, soften respiratory discharge, prevent the accumulation of mucus and fluid in the lungs, protect against pneumonia and other dangerous lung infections and strengthens respiratory muscles [4].

Surgical nurse has a vital role in postoperative care of cardiac surgery patients. Surgical nurse is mostly responsible for breathing exercises such as chest percussion, deep breathing exercises (DBE), incentive spirometry (IS), active cycle breathing technique (ACBT), respiratory muscle training and coughing support.

Breathing exercises enhance respiratory function and improve oxygenation. Consequently, active cycle breathing technique and incentive spirometry are frequently used as beneficial strategies in improvement of dyspnea after cardiac surgeries [5].

Nurses play an important role in educating patients with cardiac surgery postoperatively to use incentive spirometer and to perform active cycle breathing which can improve patients' health condition for these types of patients. Therefore, this study aims to investigate the effect of active cycle breathing versus incentive spirometry on dyspnea severity after cardiac surgeries.

2. METHODS

2.1. Aim

The aim of this study was to examine the effect of active cycle breathing versus incentive spirometry on dyspnea severity among patients undergone cardiac surgeries.

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To fulfill such, aim the following hypotheses were postulated:

H_1: The total mean scores of dyspnea of patients who will practice active cycle breathing will be statistically different than the total mean scores of dyspnea of patients who receive routine hospital care.

H_2: The total mean scores of dyspnea of patients who will practice incentive spirometry will be statistically different than the total mean scores of dyspnea of patients who receive routine hospital care.

H_3: The total mean scores of dyspnea of patients who will practice incentive spirometry will be statistically different than the total mean scores of dyspnea of patients who will practice active cycle breathing.

2.2. Research Design

Quasi-experimental pretest - posttest nonequivalent control group design was utilized in this study, where, the researcher estimated the causal impact of active cycle breathing versus incentive spirometry (independent variable) on dyspnea severity (dependent variable) among cardiac surgeries patients.

2.3. Setting

The current study was conducted in the inpatient Cardiac Surgery Department, in one of a university hospital affiliated to Cairo University Hospitals-Egypt.

2.4. Description of the Participants

A convenient consecutive sample of 90 adult male and female patients undergone cardiac surgery. Patients were selected and divided into three equal groups (30 each). Group (1) received the routine hospital care, group (2) received active cycle breathing technique and group (3) received incentive spirometer breathing technique. Patients were selected according to the following inclusion criteria: a) Hemodynamically stable, b) Free from cognitive or neurological deficits, c) Have no acute or chronic respiratory disorders, such as chronic obstructive pulmonary disease (COPD), asthma, restrictive lung disease, d) Have no coexisting pulmonary complications such as chest infection and (e) accept to participate in this study.

2.5. Data Collection Tools. Data were collected through the following tools:

Tool 1: Personal and Medical Background Data Form (PMBDF): This form was developed by the researcher and included two parts; part (A): personal data such as patient's age, gender, level of education, marital status, occupation …etc, and part (B): medical background data, including current diagnosis, type of surgery, surgical history, history of chronic disease, smoking history, family history of cardiac diseases…etc.

Tool 2: Dyspnea Index Scale (DIS): It was used to assess the severity of dyspnea. This tool was adopted from Gartner-Schmidt et al., (2014). The tool consisted of 10 items such as (I have trouble getting air in, my breathing gets worse with stress, etc). **Scoring system,** each item has **5**- point likert scale ranged from 0-4, where (0 = never, 1 = almost

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never, 2 = sometimes, 3 = almost always, 4 = always). The total scores ranged from (0 to 40), low total scores reflected fewer dyspnea, and higher total scores reflected more severe dyspnea (worse dyspnea).

2.6. Procedure

The study was carried out through the following phases:

Preparatory phase: The researcher conducted the literature review regarding all study variables, reviewing other studies, prepare the data collection tools and seeking expert's advice in addition to obtaining the official permission to proceed with the proposed study. Then, the researcher identified patients who were undergoing cardiac surgeries and fulfilled the criteria for possible inclusion. At that time the nature and the purpose of the study as well as all other ethical considerations mentioned previously were explained to each patient individually. Eligible participants who agreed to participate in the study were asked to sign the informed consent form, then were assigned to either control group (1) who received the routine hospital care, or experimental group (2) who practiced active cycle breathing or experimental group (3) who practiced incentive spirometry. This phase took about 15-20 minutes.

Implementation phase: The researcher started collecting data from control group (1), then experimental group (2) followed by experimental group (3). This sequence was carried out to prevent contamination.

This phase included the preoperative and postoperative period

Preoperatively. For the three groups, the researcher met with the eligible participants and collected personal and medical data using tool (1).

The duration of this meeting was about 10 to 15 minutes. Then, the researcher started the pre-intervention training for both experimental groups (experimental group 2 and experimental group 3).

Regarding the experimental group (2). Who were assigned for practicing active cycle breathing (ACBT)? Firstly, the researcher explained the importance of active cycle breathing technique to each participant, this followed by demonstration and redemonstration of the technique.

For performing ACBT, the researcher started preparation for implementing the technique by instructing the patient to assume sitting position with back straight and relaxed shoulders before procedure. Then perform three to five breath control exercises, three to four chest expansion exercises, and two to three forced expiratory techniques. All components of the cycle interspersed with breathing control. The researcher asked the participants to perform the technique three times daily for five days post operatively for 15 min / session. The duration of this meeting took about 20 to 30 minutes.

***Regarding the experimental group (3*)**. Who were assigned for practicing incentive spirometry (IS)? Firstly, the researcher explained the importance of incentive spirometry

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to each participant, this followed by demonstration and redemonstration of incentive spirometry exercise.

The patient was instructed to sit up with straight back as possible, not to bend the head forward or backward, and hold the IS device in an upright position. After that, the patient was asked to put his own mouthpiece in the mouth and close the lips tightly around it. The patient was instructed not to block the mouthpiece with the tongue, and to inhale slowly and deeply through the mouthpiece to raise the balls. Finally, the patient was asked to exhale normally. The researcher asked the participants to perform this exercise three times daily for five days post operatively for 15 min / session. The patients were instructed not to use the disposable mouthpiece of another patient. The duration of this meeting took about 20 to 30 minutes.

Postoperatively. This phase was completed over five days postoperatively after being discharged from intensive care unit (ICU) in the inpatient cardiac surgery department.

Regarding **both experimental groups (2) and (3),** the researcher met with each participant (who fulfilled the criteria for possible inclusion) in the inpatient cardiac surgery department to collect the baseline data (the pre intervention assessment) related to dyspnea severity using tool (2).

The duration of each meeting lasted from 10 to 15 minutes. After that, the researcher met with each participant in experimental group 2 then experimental group 3 in the cardiac surgery department every day for five days to encourage and motivate each participant to practice active cycle breathing in accordance to experimental group 2 and incentive spirometry in accordance to experimental group 3.

The duration of each meeting took about 20 to 30 minutes. Then, follow up of both experimental groups (experimental group 2 and experimental group 3) was done by the researcher on third day postoperatively (the first post intervention assessment) and before hospital discharge (the second post intervention assessment) using tools 2

Regarding control group (1). This group received routine hospital care (routine chest physiotherapy such as early mobilization, chest percussion, deep breathing and coughing exercise). The researcher met with each participant (who fulfilled the criteria for possible inclusion) in the inpatient cardiac surgery department to collect the baseline data related to dyspnea severity using tools 2.

Then, follow up of control group was done by the researcher on third day postoperatively (the first post intervention assessment) and before hospital discharge (the second post intervention assessment) using the same tool to assess the level of dyspnea.

Evaluation Phase. The first post intervention assessment was carried out by the researcher for participants in the three groups at the third day postoperatively in the inpatient cardiac surgery department after being discharged from ICU to measure the level of dyspnea using tool 2. Then, the second post intervention assessment was conducted before hospital discharge using the same tool.

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2.7. Statistical Data Analysis

The collected data was scored, tabulated and analyzed by personal computer using SPSS program version 20 [6]. Descriptive statistics such as frequency, percentage, variable means and standard deviation were used, in addition to, inferential statistics including independent t-test, also chi square for categorical data to identify differences between the groups.

3. RESULTS

3.1 Description of Participants

Table 1: Frequency and Percentage Distribution of Personal Data among the three groups (N = 90)

Variables	Control group (n=30)		Study group I (n=30)		Study group II (n=30)		Test P-value	
	No.	%	No.	%	No.	%		
Age								
20 < 30	2	6.7	2	6.7	1	3.3		
30<40	6	20.0	4	13.3	5	16.7		
40 < 50	7	23.3	6	20.0	8	26.7	F- test	= 0.38
50 < 60	15	50.0	18	60.0	14	46.7	P-value	= 0.67
>60	0	0.0	0	0.0	2	6.7		
x̄ ± SD	49.3±13.3		50.1±11.4		47.2±14.4			
Gender								
Male	16	53.3	11	36.7	23	76.7	X^2	= 1.26
Female	14	46.7	19	63.3	7	23.3	P-value	= 0.262
Occupation								
Admistrative work	4	13.3	3	10.0	10	33.3		
Manual work	5	16.7	7	23.3	7	23.3		
Retired	5	16.7	2	6.7	2	6.7	X^2	= 15.2
Housewife	12	40.0	17	56.7	6	20.0	P-value	= 0.06
Not working	4	13.3	1	3.3	5	16.7		
Marital status								
Single	3	10.0	1	3.3	4	13.3	X^2	=1.9
Married	27	90.0	29	96.7	26	86.7	P-value	= 0.38
Education								
Can't read and write	5	16.7	8	26.7	7	23.3		
Can read and write	10	33.3	10	33.3	6	20	X^2	=7.8
Secondary	12	40.0	11	36.7	12	40.0	P-value	= 0.64
University	3	10.0	1	3.3	5	16.7		
Residence								
Urban	13	43.3	9	30.0	12	40.0	X^2	= 1.2
Rural	17	56.7	21	70.0	18	60.0	P-value	= 0.54

**Significant at p-value<0.05. Study group I: who practice active cycle breathing. group II: practice incentive spirometry.*

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Table (1) shows that there were no statistically significances difference among the three groups regarding to age (f= 0.38, p= 0.67), gender (χ^2=1.26, p=0.262), marital status (χ^2=1.9, p=0.38) and residence (χ^2=1.2, p=0.54).

Additionally, the same table shows that 53.3% of control group and 76.6 % of study group II, were males while 63.3% of study group I were females. Regarding marital status, the majority of the three groups (control, study I and study II) were married (90.0%, 96.7%, ,86.7% respectively).

Regarding place of residency, the majority of patients came from rural areas as compared to urban areas (56.7%, 70%, 60%) in the three groups respectively.

Table 2: Frequency and Percentage Distribution of Medical Background Data among the three groups(N=90).

Variables	Control group (n=30)		Study group I (n=30)		Study group II (n=30)		Test P-value	
	No.	%	No.	%	No.	%		
Smoking								
Yes	6	20	10	33.3	11	36.7	X^2	= 2.2
No	24	80	20	66.7	19	63.3	P-value	= 0.32
If yes/Number of cigarettes/days								
One pack	5	83.3	7	70.0	10	90.9	X^2	= 2.6
More than one pack	1	16.6	3	30.0	1	9.1	P-value	=0.61
Family history of cardiac disease								
Yes	5	16.7	9	30.0	3	10.0	X^2	= 3.8
No	25	83.3	21	70.0	26	86.7	P-value	= 0.14
Past medical history								
Hypertension	12	76.7	14	46.7	15	50	X^2	= 0.12
Hypertension and diabetes	7	23.3	8	26.7	7	23.3	P-value	= 0.94
None	11	36.7	8	26.7	8	26.7		
Current diagnosis								
Ischemic heart disease	15	50.0	15	50.0	15	50.0		
Valvular heart disease	12	40.0	13	43.3	14	46.7	X^2	= 1.15
Ischemic and valvular disease	3	10.0	2	6.7	1	3.3	P-value	= 0.88

**Significant at p-value<0.05. Study group I: who practice active cycle breathing. group II: practice incentive spirometry*

Table (2) clarifies that the majority of control, study groups I and II had no smoking history (80%,66.7%,63.3% respectively). The overwhelming majority of all groups didn't have family history of cardiac disease (83.3%, 70%,86,7% respectively).

As for medical history, 76.7% of control, 46.4% of study group I and 50 % of study group II had hypertension.

Meanwhile, half of each of control group, study group I and study group II complain of ischemic heart disease.

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3.2 Testing of the Research Hypotheses

Table 3: Comparison of the mean scores of dyspnea index scale among the three groups at Pre-Intervention (N=90)

Pre intervention				
Variables	**Control group (n=30)**	**Study group I (n=30)**	**Study group II (n=30)**	**F-test (P-value)**
	Mean ±SD	**Mean ±SD**	**Mean ±SD**	
1-I have trouble getting air in	2.57±0.57	2.40±0.56	2.73±0.69	2.235 **(.113)**
2-I feel tightness in my throat when I am having my breathing problem	1.30±1.09	1.97±0.93	2.30±1.02	3.555 **(.05)**
3- It takes more effort to breathe than used to	2.10±0.55	1.97±0.89	2.73±0.87	3.180 **(.05)**
4- Changes in weather affect my breathing problem	0.20±0.61	0.27±0.58	0.57±0.94	2.163 **(.121)**
5-My breathing gets worse with stress	1.73±0.83	2.00±0.69	2.03±1.03	1.088 **(.341)**
6-I make sound/noise when I breath in	1.17±1.02	0.67±0.92	1.33±1.21	3.222 **(.05)**
7-I have to strain to breathe	2.10±0.61	2.17±0.59	2.53±0.82	3.523 **(.05)**
8-My shortness of breath gets worse with exercise or physical activity	2.87±0.63	2.73±0.69	3.00±0.74	1.123 **(.330)**
9-My breathing problem makes me feel stressed	1.33±0.96	1.50±0.97	1.77±1.01	1.493 **(.230)**
10-My breathing problem causes me to restrict my personal and social life	0.33±0.66	0.40±0.77	0.63±0.96	1.140 **(.325)**
Total	15.70±3.51	16.07±4.05	19.63±5.11	3.744 **(.05)**

**Significant at p-value<0.05. Study group I: who practice active cycle. Group II: practice incentive spirometer.* Table (3) demonstrates that the pre intervention assessment mean scores for all variables of dyspnea index scale were almost comparable.

Moreover, the total mean scores of dyspnea index scale were non-significant among the three groups (F-test= 3.744, P value = .005).

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Table 4: Comparison of the mean scores of dyspnea index scale between control and study group I (ACBT) at post intervention1 and post intervention 2 (N=60)

	Post intervention 1			Post intervention 2		
Variables	**Control group (n=30)**	**Study group I (n=30)**	**t-test (p-value)**	**Control group (n=30)**	**Study group I (n=30)**	**t-test (p-value)**
	Mean ±SD	**Mean ±SD**		**Mean ±SD**	**Mean ±SD**	
1-I have trouble getting air in	2.13±0.35	1.10±0.99	5.373 **(0.000*)**	1.63±0.61	0.33±0.71	7.607 **(0.000*)**
2-I feel tightness in my throat when I am having my breathing problem	1.17±0.95	0.57±0.77	2.687 **(0.009*)**	0.80±0.96	0.13±0.43	3.489 **(0.001*)**
3- It takes more effort to breathe than used to	2.00±0.53	0.47±0.78	8.886 **(0.000*)**	1.53±0.78	0.07±0.37	9.263 **(0.000*)**
4-Changes in weather affect my breathing problem	0.07±0.37	0.00±0.00	1.036 **(0.304)**	0.00±0.00	0.00±0.00	0.000 **(1.000)**
5-My breathing gets worse with stress	1.33±0.99	0.80±0.89	2.181 **(0.033*)**	1.60±0.81	0.37±0.76	6.065 **(0.000*)**
6-I make sound/noise when I breath in	0.93±0.98	0.27±0.64	3.088 **(0.003*)**	0.53±0.86	0.00±0.00	3.375 **(0.001*)**
7-I have to strain to breathe	1.80±0.76	0.63±0.89	(5.476) **(0.000*)**	1.27±0.94	0.10±0.40	6.273 **(0.000*)**
8-My shortness of breath gets worse with exercise or physical activity	2.20±0.41	1.70±0.70	3.376 **(0.001*)**	1.83±0.65	1.37±0.89	2.286 **(0.026*)**
9-My breathing problem makes me feel stressed	1.03±1.10	0.17±0.53	3.858 **(0.000*)**	1.17±1.05	0.40±0.77	3.239 **(0.002*)**
10-My breathing problem causes me to restrict my personal and social life	0.30±0.70	0.00±0.00	2.347 **(0.022*)**	0.13±0.51	0.00±0.00	1.396 **(0.168)**
Total	12.945±3.16	5.70±1.58	11.271 **(0.000*)**	10.50±2.71	2.77±1.77	13.080 **(0.000*)**

**Significant at p-value<0.05. Study group* I*: who practice active cycle breathing.*

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Table 5: Comparison of the mean scores of dyspnea index scale between control and study group II (IS) at post intervention1 and post intervention 2 (N=60)

	Post intervention 1			Post intervention 2		
Variables	**Control group (n=30)**	**Study group II (n=30)**	**t-test (p-value)**	**Control group (n=30)**	**Study group II (n=30)**	**t-test (p-value)**
	Mean ±SD	**Mean ±SD**		**Mean ±SD**	**Mean ±SD**	
1-I have trouble getting air in	2.13±0.35	1.07±0.87	6.191 **(0.000*)**	1.63±0.61	0.37±0.56	8.334 **(0.000*)**
2-I feel tightness in my throat when I am having my breathing problem	1.17±0.95	0.57±0.68	2.813 **(0.007*)**	0.80±0.96	0.20±0.48	3.062 **(0.003*)**
3- It takes more effort to breathe than used to	2.00±0.53	0.53±0.68	9.339 **(0.000*)**	1.53±0.78	0.17±0.46	8.226 **(0.000*)**
4- Changes in weather affect my breathing problem	0.07±0.37	0.07±0.37	0.000 **(1.000)**	0.00±0.00	0.03±0.18	0.913 **(0.365)**
5- My breathing gets worse with stress	1.33±0.99	0.43±0.63	4.201 **(0.000*)**	1.60±0.81	0.37±0.56	6.841 **(0.000*)**
6-I make sound/noise when I breath in	0.93±0.98	0.00±0.00	5.198 **(0.000*)**	0.53±0.86	0.03±0.18	3.117 **(0.003*)**
7-I have to strain to breathe	1.80±0.76	0.37±0.67	7.731 **(0.000*)**	1.27±0.94	0.40±0.67	4.128 **(0.000*)**
8-My shortness of breath gets worse with exercise or physical activity	2.20±0.41	1.53±0.63	4.882 **(0.000*)**	1.83±0.65	1.17±0.70	3.784 **(0.000*)**
9-My breathing problem makes me feel stressed	1.03±1.10	0.23±0.57	3.537 **(0.001*)**	1.17±1.05	0.13±0.35	5.147 **(0.000*)**
10-My breathing problem causes me to restrict my personal and social life	0.30±0.70	0.03±0.18	2.046 **(0.045*)**	0.13±0.51	0.00±0.00	1.396 **(0.168)**
Total	12.945±3.16	4.83±1.37	12.945 **(0.000*)**	10.50±2.71	2.87±1.74	12.977 **(0.000*)**

**Significant at p-value<0.05. Study group* II*: who practice incentive spirometry.*

Tables (4and 5) testify that there was a significant difference between the control and the study group I in the total dyspnea index scores at the first post-intervention (T-test= 11.271, P value = .000) and the second post- intervention (T-test= 13.080, P value = .000). Moreover, there was a significant difference between the control and the study

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group II in the total of dyspnea index scores at the first post-intervention (T-test= 12.945, P value = .000) and the second post- intervention (T-test= 12.977, P value = .000). Therefore, the first and second hypotheses were supported.

Table 6: Comparison of the mean scores of dyspnea index scale between study group I and II (ACBT Vs.IS) at post intervention1 and post intervention 2 (N=60)

	Post intervention 1			Post intervention 2		
Variables	**Study group I (n=30)**	**Study group II (n=30)**	**t-test (p-value)**	**Study groupI (n=30)**	**Study group II (n=30)**	**t-test (p-value)**
	Mean ±SD	**Mean ±SD**		**Mean ±SD**	**Mean ±SD**	
1-I have trouble getting air in	1.10±0.99	1.07±0.87	0.125 **(0.901)**	0.33±0.71	0.37±0.56	0.242 **(0.809)**
2-I feel tightness in my throat when I am having my breathing problem	0.57±0.77	0.57±0.68	0.000 **(1.000)**	0.13±0.43	0.20±0.48	0.595 **(0.554)**
3- It takes more effort to breathe than used to	0.47±0.78	0.53±0.68	0.318 **(0.752)**	0.07±0.37	0.17±0.46	0.928 **(0.357)**
4- Changes in weather affect my breathing problem	0.00±0.00	0.07±0.37	1.036 **(0.304)**	0.00±0.00	0.03±0.18	0.913 **(0.365)**
5-My breathing gets worse with stress	0.80±0.89	0.43±0.63	1.859 **(0.068)**	0.37±0.76	0.37±0.56	0.000 **(1.000)**
6-I make sound/noise when I breath in	0.27±0.64	0.00±0.00	2.311 **(0.024*)**	0.00±0.00	0.03±0.18	0.913 **(0.365)**
7-I have to strain to breathe	0.63±0.89	0.37±0.67	1.278 **(0.206)**	0.10±0.40	0.40±0.67	2.106 **(0.040)**
8-My shortness of breath gets worse with exercise or physical activity	1.70±0.70	1.53±0.63	0.989 **(0.327)**	1.37±0.89	1.17±0.70	0.967 **(0.337)**
9-My breathing problem makes me feel stressed	0.17±0.53	0.23±0.57	0.422 **(0.674)**	0.40±0.77	0.13±0.35	1.748 **(0.086)**
10-My breathing problem causes me to restrict my personal and social life	0.00±0.00	0.03±0.18	0.913 **(0.365)**	0.00±0.00	0.00±0.00	0.000 **(1.000)**
Total	5.70±1.58	4.83±1.37	2.279 **(0.026*)**	2.77±1.77	2.87±1.74	0.221 **(0.826)**

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It is apparent from table (6) that, there is only a significant difference between study groups I and study group II in the total of dyspnea index scores at the first post-intervention (T-test= 2.279, P value = .026). However, there is no statistically significant difference between the study groups (I and II) at the second post-intervention (T-test= 0.221, P value = .826). Therefore, the third hypothesis is partially supported.

Table 7: Comparison of the total mean scores of dyspnea index scale among the three groups at the Three Times of Observation (N=90)

Groups	**Control group (n=30)**	**Study group I (n=30)**	**Study group II (n=30)**		
Study period	**Mean ±SD**	**Mean ±SD**	**Mean ±SD**	**F**	**P-value**
Pre-intervention	15.70±3.51	16.07±125.345	19.63±5.11	3.744	**.05**
Post intervention 1	12.97±3.16	5.70±130.924	4.83±1.37	125.345	**.000***
Post intervention 2	10.50±2.71	2.77±1.77	2.87±1.74	130.924	**.000***
F- test	41.2	170.7	234.77		
P- value	**0.00***	**0.00***	**0.00***		

**Significant at p-value<0.05. Study group I: who practice active cycle breathing. study group II: who practice incentive spirometry*

Table (7) highlights that there is no statistically significant difference in the total dyspnea index among the three groups at pre-intervention assessment (f= 3.744, p= 0.05), while a statistically significant difference is found among the three groups at the first post intervention assessment (f= 125.345, p= 0.000). Also, a statistically significant difference is found among three groups at the second post intervention assessment (f= 130.924, p= 0.000).

4. DISCUSSION

Regarding patients' socio-demographic characteristics and their medical data, the findings of the present study showed that there is no statistically significance difference among the three studied groups regarding to socio-demographic characteristics and their medical data, this homogeneity in terms of demographic and medical data variables enabled the investigator to consider the effect observed in the intervention groups as a consequent to the two breathing exercises performed. These results were supported by the study of Thirapatarapong & Chumwong, (2017) that investigated the effect of "pre-operative pulmonary training program in coronary artery bypass graft surgery patients at Siriraj hospital" and found that there was no significant difference between the two studied groups regarding the baseline characteristics such as age, sex and comorbidities [7]. Similarly, El-Saeed et al. (2023) study assessing the effect of comprehensive recovery program on patients' outcomes post coronary artery bypass and found that there was no significant difference between the two studied groups regarding the baseline characteristics [8]. The researcher might justify this study finding to be attributed to choosing the study and control groups according to the same inclusion criteria which makes the three groups very homogeneous and this leads to the absence of a difference among the groups pre intervention.

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Regarding to age, more than half of the total studied patients were within the age group between 50 to less than 60 years old of the study and control groups; this age of the present study may be due to this age stage of adulthood considered to be an unmodifiable risk factor for development of cardiovascular disease. The WHO reports that cardiovascular diseases risk increase as age advances [9], [10]. The finding is congruent with, Elesawy et al. (2019) study titled the '' Effect of implementing discharge plan on patient's outcomes post coronary artery bypass graft surgery. '' the researchers reported that the majority of study sample were between the age of 50 to 60 years old [11]. However, Mohamed et al. (2019) found that the mean age of study sample was 40.7±12.3 years old [12]. Also, Makalla (2014) in study titled "the role of physiotherapy in the management of patients following cardiac surgery in Tanzania" and reported that nearly half of the total studied patients were in the age group from 28-52 years [13]. This can be interpreted as; cardiovascular diseases can affect different age groups.

As regards gender, the present study clarified that more than half of study and control groups subjects were males. A possible explanation for this could be the fact that males are exposed to more cardiovascular risks (smoking; type of occupations, economical stressors) in their lifetime than females. Moreover, the low-density lipoprotein (LDL) has a greater influence in men than women, because estrogen significantly inhibits LDL (Ghaffari et al. 2018) [14]. This result is in accordance with Abdelhafez & Fouad (2023) who studied the effect of incentive spirometry on postoperative pulmonary complications and oxygenation following open heart surgery, the study findings denoted that more than half of study subjects were males [4]. Similarly, Guo, East and Arthur (2012), who investigated the effect of "a preoperative education intervention to reduce anxiety and improve recovery among Chinese cardiac patients" and reported that more than half of the patients were males [15]. However, this result is inconsistent with Ahmed et al. (2019) study titled '' Applying Cardiac Rehabilitation Exercise Protocol to Reduce Post-operative Cardio-Pulmonary Complications among Open Heart Surgery" who reported that nearly more than half of study sample were females [16]. Also, Nyawawa et al. (2010) reported that 79% of the study sample were females [17].

Pointing to marital and employment status in the current study, the majority of the studied subjects were married and more than half of them were housewives and have manual work. This is in line with the age of the research sample, where it is expected that this stage of life is characteristically for this age to be married. The findings were congruent with Elesawy et al. (2019) [11] and Atia et al. (2023) who stated that, most of the patients in their study were married and not employed [18].

Regarding the place of residence, the majority of the studied subjects predominantly came from rural areas. This finding is similar to the finding of Falcoz et al. (2013) [19] and El-Saeed et al. (2023) [20] who showed that, more than half of their study participants came from rural areas. This finding can be interpreted in light of the fact that, Cairo University Hospital is considered one of the largest hospitals and close Giza governorate rural suburbs. In addition, most of the patients find it as low-cost health care facility that suite their socio-economic status.

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According to educational level, the current study highlighted that more than half of study subjects were (can't read and write, can read and write) followed by one third of patients have secondary educational level. This finding could be explained by the nature of rural communities where most of the patients reside, so the majority of the patients coming to the hospital were low educational level. This finding is supported by Ahmed, Mohammed and Ghanem (2015) study titled "Coronary artery bypass grafting, Effect of defining and implementing nursing care standards on patient's outcomes" the study found that more than half of the patients were illiterate [21]. This finding also is consistent with a study of Ahmed, Khalil & Morsy (2017) [22] and Atia et al. (2023) [18] the researchers reported in their studies that the majority of the study sample were illiterate.

In relation to smoking. The majority of the studied subjects were non-smokers, this result may be interpreted as most of the studied patients stopped smoking as a result of physician and nursing instructions to improve their health as smoking is a modifiable risk factor of cardiac diseases. Meanwhile other risk factors might play a role in this regard. These findings are supported by a study conducted by Elesawy et al. (2019) [11] and Ahmed et al. (2019) [16] as they denoted that half of the control and study groups were non-smokers. Meanwhile, the result was incongruent with El-Saeed et al. (2023) [20] who found that, about two third of their study subjects were smokers.

Regarding the medical data among the studied subjects, the result of the present study revealed that the majority of patients had no family history of cardiac diseases. On the contrary, a study conducted by Elesawy et al. (2019) [11] denoted that majorities of their subjects had family history of coronary heart diseases.

In reference to patients' past medical history, the findings of the current study revealed that near half of the three groups have hypertension (HTN) and less than one third had diabetes with hypertension. In the same context, a study conducted by Abdelaziz and shoheib (2022) entitled "Effect of Early Ambulation Program on Selected Outcomes among Patients Undergoing Cardiac Surgery" they denoted that, the comorbidities among the studied sample were hypertension and diabetes [23]. This finding also, is compatible with Ahmed, et al. (2019) study titled " Applying Cardiac Rehabilitation Exercise Protocol to Reduce Post-operative Cardio-Pulmonary Complications among Open Heart Surgery" who reported that that nearly half of both study and control groups were suffering from hypertension and/or diabetes mellitus [16]. The factor that may be responsible for this finding is that the majority of the subjects in this study fell between fifty and sixty years of age and it is a known fact that as age advances, the incidence of chronic diseases such as hypertension and diabetes increase, consequently cardiac diseases increase.

Concerning patients' medical diagnosis, the present study showed that half of the study subjects had rheumatic heart disease, and the rest had coronary heart disease or /and rheumatic heart disease, this could be interpreted as the result of the increased incidence of rheumatic heart disease and coronary heart disease in low and middle-income countries. The findings are supported by Ahmed et al. (2019) [16]; Allam et al. (2023) [1] who found more than half of their study subjects were having rheumatic heart

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disease. However, Atia et al. (2023) stated that the majority of their subjects had coronary heart disease [18].

Concerning comparison between control and study group1(ACBT group) in relation to dyspnea severity, the findings indicated that there were no statistically significant differences in the total mean scores of dyspnea severity index scale between the control and study group I who practice active cycle breathing technique (ACBT) at pre- intervention assessment. However, there was a significant difference between both groups in the total dyspnea severity index mean scores at the first and the second post-intervention assessment.

This reflects the patients' motivation to learn and practice active cycle breathing to overcome this overwhelming distressing problem resulting from difficulty in breathing that bother them. The most appropriate explanation for the differences between the two groups may be attributed to the effect of ACBT on improving lung function by red theucing bronchospasms, enhancing collateral ventilation, re-expansion of collapsed alveoli through thoracic expansion and inspiratory holds which promote redistribution of gas between the lung segments, which result in improving dyspnea.

In a study conducted by Mahadewi, (2025) entitled " The Effect of Active Cycle of Breathing Techniques (ACBT) on Shortness of Breath and Facilitation of Airway Clearance in Obstructive Pulmonary Disease " and the researcher confirmed that patients in the exercise training group demonstrated lower levels of dyspnea than control group [24].

Similarly, Hussain et al. (2022), who conducted a study about "the effect of active cycle of breathing technique on post-operative pulmonary complications among coronary artery bypass graft surgery patients" and they concluded that ACBT is effective for improving the chest expansion and dyspnea of patients in experimental group compared to control group [3].

Concerning comparison between control and study group II (IS group) in relation to dyspnea severity, the findings indicated that there were no statistically significant differences in the total mean scores of dyspnea severity index scale between the control and study group II who practice incentive spirometry (IS) at pre- intervention assessment. However, there was a statistically significant difference between both groups in the total dyspnea severity index scores at the first and the second post-intervention assessment.

This finding may have relevance to the effect of postoperative IS training, which helped in expansion of the lung and promoted circulation of air to all pulmonary regions that resulted in increased expiratory volume, improvement in the movement of the rib cage, and increased vital capacity, consequently improved dyspnea.

This result is supported by Sweity et al. (2021) in a study entitled "preoperative IS for preventing PPCs in patients undergoing CABG surgery: a prospective randomized controlled trial" and they concluded that postoperative dyspnea improved in the study group compared to control group [25]. Additional study conducted by El-Reabai et al,

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(2023) and concluded significant reduction in the severity of dyspnea scores at first day, second day, and third day after using IS compared with before using spirometry [2].

Concerning comparison between study group I and study group II (ACBT Vs IS) in relation to dyspnea severity, the finding concluded that there was less statistically significant difference in the effect comparing active cycle breathing technique and incentive spirometry in favor of IS group. Even though both groups have shown improvements in the dyspnea severity along the assessment times. This significant difference is probably due to IS restores alveolar ventilation and enhances airflow and lung volume. It also improves breathing pattern and inspiratory volumes. This finding was inconsistent with the study conducted by Savci et al., (2006) who noted that, Both ACBT and IS methods had similar effects on the oxygenation and shortness of breath from the first day post-operatively [26]. Meanwhile, Wange, Jiandani, & Mehta (2016) reported that active cycle of breathing technique has better results than incentive spirometry in chest expansion among post abdominal surgery patients [27].

5. CONCLUSION AND RECOMMENDATION

Based on the findings of the current study, it can be concluded that almost all cardiac patients undergoing cardiac surgeries had dyspnea postoperatively. In many facets of dyspnea management, nurses play an important role, including dyspnea assessment, designing an individualized care plan, implementation of that plan, monitoring and documenting the effects of that plan, as well as providing and improving patient education. These are all important characteristics of the nursing process that promote best practices in dyspnea management. Nurses are responsible for effectively managing the dyspnea of the patients through the proper administration of medications, application of non–pharmacology-based strategies such as upright position, and breathing exercises. Postoperative IS and ACBT resulted in a significant decrease in dyspnea severity after cardiac surgery. Thus, IS and ACBT can be recognized as simple, effective, noninvasive, non-pharmacological modalities that may improve dyspnea severity. Accordingly, it may be recommended to incorporate such exercise in treatment protocols for cardiac surgery patients.

6.DECLARATIONS

6.1 Ethical Considerations

Formal approval was granted from the Ethical Committee of Scientific Research at Faculty of Nursing, Cairo- University. Also, an official permission to conduct the study was obtained from the hospital administrators. Participation in the study is voluntary and based on the participants' agreement.

6.2 Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

6.3 Competing Interests

The authors declare that they have no competing interests.

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