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Efficacy of Deep Breathing Exercise on Pain Perception among Coronary Artery Bypass Grafting Patients

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Abstract: Coronary artery bypass grafting is considered a painful procedure during the first postoperative days and a high incidence of pain has been reported. Pain relief after surgery is critical to promote overall recovery, increase patient satisfaction and decrease health care costs. Educating the patients about deep breathing exercises is a simple nursing intervention and an effective approach to counteract the negative effects of pain after surgery and to change attention away from painful events. The present study aimed to evaluate the efficacy of deep breathing exercise on pain perception among coronary artery bypass grafting patients. A quasi-experimental research method of a nonequivalent control group was used. This study was carried out at the cardiothoracic intensive care unit in one of the biggest teaching hospitals in Cairo. A purposeful sample of 60 male and female adults were recruited and randomly allocated to a control and study group. Data collection tools included Structure Interview Questionnaire and pain assessment sheet. The result showed that there is a statistically significant decrease in the level of pain mean score after the study group practicing deep breathing exercises on the 1st and 2nd day (4.07±2.2 and 1.5±2.2) respectively. Additionally, there is a highly statistically significant improvement in the total mean score of pain severity (-7.6 and -10.7) at p-value (< 0.001) as compared to the control group. *Conclusion*: The coronary artery bypass grafting patients who practiced deep breathing exercises, achieved a significantly higher reduction in the total mean score of pain after implementing the approach as compared to the control group. *Recommendations*: Hence, it is recommended that implementation of the breathing exercise technique should be endorsed as an integral part by nurses who play a key role in the management of patients with coronary artery bypass grafting and care may make it more modulated in the early course of surgery so that the full benefit is received by patients.

Key words: Deep breathing exercise · Pain perception · Postoperative nursing care · Coronary Artery Bypass Grafting

INTRODUCTION

Coronary artery disease (CAD) is considered a vast public health problem and the top most leading cause of morbidity and mortality worldwide. Unfortunately, a great majority of CAD patients do not respond to medical managements. Wherefore, coronary artery bypass grafting (CABG) surgery is still the treatment of choice for many patients as it increases survival rates and quality of life, with more than one million coronary artery bypass grafts performed per year [1, 2].

CABG is a painful procedure due to median sternotomy, tissue damage and inflammation in the incision area and areas involving sternal prolonged retraction and mediastinal tube placement [3]. Pain is the most prevailing symptom identified by the patient after CABG surgery. Despite global attention to pain management, it is still one of the greatest challenges in intensive care units. The pain degree experienced is often higher than that estimated and thus, pain killers are not prescribed enough [4, 5]. Patients undergoing cardiovascular surgery are more susceptible

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to physiological and psychological responses of pain. Physiological responses to pain after surgery are associated with the sympathetic nervous system activities which increase respiratory rate, heart rate, heart irritability and blood pressure. Patients are always concerned that, after surgery, the pain will prevent them from sleeping and performing different activities [6-8].

Pain control is pivotal to maintain the patient's comfort and preventing respiratory system complications after cardiac surgery. The commonness barriers to efficient pain management are improper pain assessment by health care providers or inadequacy of pain relief proceedings. Pain could be managed using pharmacological and non-pharmacologic therapies. Diverse pharmaceutical therapies are available to reduce pain severity, fatigue and improve sleep disturbances. However, the use of these medications is associated with various side effects such as drug dependency, impaired memory and performance, increased risk of falls and respiratory arrest. Therefore, the use of non-pharmacological therapies would be more beneficial [9, 10].

Today the strong emphasis is on non-pharmacological pain relief methods including relaxation, touch therapy, music therapy, imagination, applying hot and cold therapy and yoga. Furthermore, coughing, breathing exercises, chest physiotherapy and incentive spirometry are useful practices for preventing patient's pain and maintaining comfort [11]. These methods are easy to use and may be acceptable to the patients and nurses, also are capable of implementing them independently. Deep breathing exercises is one of the appropriate non-pharmacological method and a cost-effective way which can be used for pain relief [12]. It is implemented as part of a relaxation technique to reduce surgical pain. Thus, nurses who assist patients in post-operative pain management should encourage deep breathing exercises that is performed slowly, smoothly and gently [13]. During breathing exercise education, the nurse explains and demonstrates how to inhale deeply and exhale fully, take even lengths of in-breaths and out-breaths. This exercise can be done almost anywhere and can be repeated several times during the day, whenever the patient feels stressed. This method utilizes ways to alter thoughts and focus concentration to better manage and reduce pain [14].

Breathing exercises has been used successfully as an addition to opioids for postoperative pain management in orthopedic, abdominal and sports injuries. Also, it widely used in postoperative care to prevent or reduce pulmonary complications. However, no scientific evidence for the efficacy of deep breathing exercises has been found after bypass grafting surgery to relieve pain [1, 9]. Therefore, in this study, the researcher attempts to find out the efficacy of deep breathing exercises on pain perception among coronary artery bypass grafting patients.

Significanc: Cardiovascular disease remains a public health problem worldwide which causes one third of all deaths by year 2030 [15]. More than one-third of these deaths occur in middle-aged adults. The incidence of cardiovascular diseases is increasing constantly due to the epidemiologic transition implicating atherosclerosis, hypertension and associated lifestyle risk factors as diet, smoking and physical inactivity [16]. Nearly 52% of deaths in the United States and 48% in Europe are related to these diseases. According to data in Egypt, cardiovascular diseases have been the chief cause of premature death since the 1990s. In 2017, it accounted for 46.2% of the overall mortality in Egypt [17, 18].

Coronary artery disease is the most important entity of heart disease. CAD deaths were 21.73% of all deaths, which make CAD the first killer in Egypt in 2013 [17, 19]. However, in Egypt, the National Hypertension Project found an adjusted overall prevalence of CAD 8.3% [20, 21]. A large number of patients with CAD, which do not respond to medical therapies, have to undergo cardiac surgery. The majority of cardiac surgery is performed for ischemic coronary artery disease. The prevalence of surgery is 26.79% in North America, 0.72% in Asia, 17.94% in Western Europe and 18.14% in the rest of the world [19].

Coronary artery bypass graft surgery (CABG) is an effective and widespread coronary revascularization technique to restore or optimize myocardial perfusion in CAD, nevertheless, pain is still the main manifestation reported by patients [15]. Studies show that from 47 to 75% of patients report pain in the postoperative period of cardiac surgery. Untreated acute pain may become chronic pain. The incidence of post-sternotomy chronic pain ranges from 18 to 61% in different samples. There are several long-term postoperative complications from which patients may suffer. One year after CABG surgery pulmonary function is decreased by 12 and 30% of the patients suffer from chronic thoracic pain. Living with chronic pain can be stressful; but one of the best ways can help patients to reduce stress; is by learning how to be relax through deep breathing exercises. Breathing deeply sends a message to the brain to calm down and

relax that can alleviate pain. So, one goal of pre-operative nursing care is to educate patient to improve knowledge and sense of empowerment [22]. Although deep breathing exercises have an obvious impact on preventing further postoperative pulmonary problems in cardiac surgery, few investigations have focused on the association between deep breathing exercises and pain perception, with almost no studies investigating the influence of deep breathing exercises on pain severity among patients undergoing coronary artery bypass graft during hospitalization. Several articles have been published addressing acute and chronic pain in different medical conditions [23]. However limited trials have been conducted to test the effect of breathing exercises on pain perception after CABG surgery; some of these studies have reported no effect of this type of intervention on pain perception [24]. Therefore, in this study, the researcher attempts to evaluate the efficacy of deep breathing exercises on pain perception among coronary artery bypass grafting patients.

MATERIALS AND METHODS

Aim: The present study aimed to evaluate the efficacy of deep breathing exercises on pain perception among coronary artery bypass grafting patients.

Research Hypothesis: To fulfill the aim, it was hypothesized that the coronary artery bypass grafting patients who will practice deep breathing exercises, will achieve a significantly higher reduction in the total mean score of pain severity as compared to the control group (as measured by numerical rating scales).

Design: A quasi-experimental study design was utilized to evaluate the efficacy of deep breathing exercises on pain perception among coronary artery bypass grafting patients. A nonequivalent control group design is a type of control/comparison group that is matched upon certain preexisting characteristics similar to those observed in a treatment group but to which participants are not randomly assigned to groups [25].

Setting: This study was carried out at the cardiothoracic intensive care unit at Ain Shams University hospital, Cairo - Egypt.

Sample: A purposeful sample of 60 male and female adults were enrolled and randomly selection to a control and study group. The inclusion criteria included patients of both genders between 30 and 69 years of age, able to communicate, undergoing CABG only (not associated with valve replacement or other procedures) and stabilization of hemodynamic condition after the first day from mechanical ventilator extubation (blood pressure, pulse and respiration). Patients who had a history of (a) Severe mental illness; (b) Chronic respiratory disease; (c) Previous cardiac surgery; (d) Emergency operation; (e) Renal dysfunction requiring dialysis, were excluded from the study.

Tools: Data pertinent to the study variables were collected through two main tools: (I) Structured Interview Questionnaire: it was developed by the researchers and covered two parts as (1) Demographic characteristics such as age, gender, level of education and occupation; (2) Medical background data sheet related variables such as comorbidity factors as hypertension, diabetes mellitus, pervious surgery; and smoking history. (II) Pain assessment sheet: It's administered sheet which was adapted from Erden *et al*. [26] and consists of the following items: (a) Pain location; (b) Pain severity: the scale is composed of 0 (no pain at all) to 10 (worst imaginable pain) to reflect the severity of the pain. The Numerical Pain Rating Scale (NPRS) is a subjective measure and segmented numeric version of the visual analog scale in which patients' rate the pain on an eleven-point numerical scale. The interpretation of the pain severity scores is as the following: no pain is (0); mild pain is (1-3), moderate pain is (4-6); severe pain is (7- 10) [27]. The NRS has high test-retest reliability, r = 0.96. [28]; (c) Pain quality: discomfort, pulling, aching, burning, sharp and crushing; (d) Pain pattern: constant or intermittent; (e) Pain expression: grimacing, moaning, crying, restlessness and protecting (supporting the painful area and refusing to move). It was used two times to assess pain characteristics after the first and second day from mechanical ventilation extubation, one hour before and two hours after practicing of deep breathing exercises technique for study group and at the same time for control group.

Validity and Reliability: Study tools were designed and adapted after extensive literature review and submitted to a panel of five expert staff in a medical-surgical nursing specialty, Faculty of Nursing – Ain Shams University. Each one of the experts in the panel was asked to examine the instrument for face and content validity. Modification of the tools was done according to panel judgment. The tool was translated into Arabic. The Arabic draft was

then back-translated into English by another two experts fluent in both Arabic and English to ensure uniformity of instructions to subjects.

The reliability was tested to determine the consistency of the measurement tool which an instrument measures the same way each time if used under the same condition with the same subjects. The Cronbach's alpha model, which is a model of internal consistency, was used to test tool reliability. The reliability factor of the pain assessment was 0.793. Statistical equation of Cronbach's alpha reliability coefficient normally ranges between 0 and 1; higher estimation more than 0.7 indicate acceptable reliability.

Pilot Study: Once approval was granted to carry on the proposed study, a pilot study was carried out on 10% of the sample in the same selected study setting to estimate the needed time for data collection, to judge the feasibility, objectivity, test the ability of the tool to elicit the desired information and to test appropriateness of content, wording and order. The outcomes of the pilot study approved that the study was feasible. No modification was needed; therefore, the subjects of the pilot study were included in the actual research subjects.

Procedure: Data collection was carried out in three phases to evaluate the efficacy of deep breathing exercises on pain perception among coronary artery bypass grafting patients. The study was conducted on the following phases:

The preparatory phase of the study for designing the intervention process. A comprehensive analysis of the literature on the effectiveness of deep breathing exercises among coronary artery bypass grafting patients on pain perception was performed. Experts' advice was sought to ensure content comprehensiveness, clarity, relevancy and applicability. Experts were selected based on their expertise in nursing and medical scope in general and cardiology management in particular.

Planning Phase: Through which the research design, sample size, inclusion and exclusion criteria, tools for data collection were selected and developed. Face and content validity of the study tools were tested by a panel of experts in the field of medical-surgical nursing and cardiology. Developing a preliminary draft of the study intervention was done.

Implementation Phase: Once official permission to carry out the study was granted from the head manager of the intensive care unit to proceed with the study. The aim of the study was explained to the patients who met the inclusion criteria and those who agreed to participate. After selection, the patients were randomly selected to two groups (study and control). The assessment of the demographic characteristics and medical background data sheet of the study and control group were done using the structured interview questionnaire two days before surgery. Furthermore, the study group received two training sessions over a period of two days before surgery. The training time for each session was based on each patient's capabilities, but generally, it took around 30 to 45 minutes which included a demonstration and re-demonstration of the deep breathing exercises to ensure that each patient had acquired the skill. The study groups were encouraged to carry out the deep breathing exercises three times per day before surgery. The deep breathing exercises procedure was audio-recorded and given to the study groups on their mobile phones so they could easily recall the intervention. Also, use brochure written paper in the Arabic language which describes the steps and procedure techniques to facilitate the process of education.

After surgery, the control group received only the routine hospital management. While the study group started a deep breathing exercises program approximately one hour after extubating from a mechanical ventilator and continued for the first two days. The patients were advised to perform 30 slow and deep inspiration once per hour through the mouth or nose while awake hours from morning-to-night. The exercises included three sets of 10 deep breaths with a 2-5 seconds pause between each set (7-8 minutes in total). The exercises were administered once per day by the physiotherapist in the ward and in between the patients were encouraged by the researcher to perform the breathing exercises in order to assure the process of practices.

Frequency and Duration of Breathing Exercises Techniques: Instructions concerning the frequency and duration of the exercises after cardiac surgery vary notably in clinical practice. There is no scientific evidence of how long these breathing exercises should be continued after the surgery [3]. To achieve deep inspirations each treatment session, the patients should be instructed to (a) Breath in slowly and deeply through the nose or mouth to take as much air as possible into the lungs; (b) Inhale for a count of two; (c) Then hold the breath for a count of 3 to 5; (d) Breathe the air out slowly and completely through the pursed-lip technique over a count of four; (e) Finish by holding the breath out for a count of 3 to 5 [3, 29, 30].

A lot of time should be allowed for the breath-in and breath-out and enough time should be allowed between each breath to prevent pain and exhaustion. Deep breathing exercises are preferable to perform in an upright position or standing. During the procedure, the study groups were asked to relax and to think about the feeling of relaxation while doing the breathing exercise to alleviate pain [31, 32].

Evaluation Phase: Finally, the researcher filled out a pain assessment data sheet for the study group and control group on the first and second days. One hour before and two hours after the study group had performed deep breathing exercises. In relation to control group, the researcher filled out a pain assessment data sheet at the same time for study group.

Ethical Considerations: Official permission to carry out the study was obtained from the research ethics committee in the faculty of nursing, as well as the head manager of the intensive care unit at Ain Shams university hospital. Written consent for patients' agreement was obtained after clarification of the aim of the study. Each patient was free to either participate or not in the present study and had the right to withdraw from the study at any time without any rationale and it will not affect upon process of care. Also, patients were informed that obtained data will not be included in any further researches. Confidentiality and anonymity of each subject were confirmed through the coding of all data.

Statistical Analysis: Data were collected and coded to facilitate data manipulation and double entered into Microsoft Access and data analysis was performed using Statistical Package of Social Science (SPSS) software version 18 in windows 7. Simple descriptive analysis in the form of numbers and percentages for qualitative data and arithmetic means as central tendency measurement, standard deviations as a measure of dispersion for quantitative parametric data. Quantitative data included in the study was first tested for normality by the One-Sample Kolmogorov-Smirnov test in each study group then inferential statistic tests were selected. The *P*-value of equal to or less than 0.05 was considered the cut-off value for significance.

RESULTS

Statistical findings of the current study were presented in the following order: (I) The first section is devoted to the description of the demographic characteristics and Medical background data sheet and (II) The second section presents the result that answered the research hypothesis in relation to variables of pain assessment sheet.

Section I: Demographic Characteristics and Medical Background: Regarding demographic characteristics; the mean age (44±7.2 and 42.4±8.8) was found among the study group and control group respectively. The majority of study and control groups were male (70 and 60%) respectively. In addition, almost half of the study and control subjects (46.7and 50%) were secondary level of education and half of the study group and near half of the control group were not working (50 and 43.3%). There was no statistically significant difference with p-value ≤ 0.05 between study and control groups as regards demographic characteristics (Table 1).

Concerning medical background, no statistically significant difference with p-value ≤ 0.05 was between study and control groups relating to comorbidity factors and smoking duration. Furthermore, there is a statistically significant difference between the study and control groups regarding heavy smoking with the mean of smoking duration (17.4 ± 4.6 and 16.6 ± 5.6) was found among the study and control groups (Table 1).

Section II: Pain Assessment Sheet: Concerning the severity, quality, pattern and expression of pain at first day before and after the study group practicing of deep breathing exercises are displayed in Table (2); there is no statistically significant difference between study and control groups before practice at p-value ≤ 0.05. On the other hand, there is a statistically significant difference between all of the mentioned parameters after the study group practicing deep breathing exercises as compared to the control group (29.1, 33.02, 9.9, 26.9) respectively; at p-value (< 0.001).

With regard to the severity, quality, pattern and expression of pain at second day before and after study group practicing deep breathing exercises in Table (3); show that there is no statistically significant difference between study and control groups before practice at p-value ≤ 0.05. Otherwise, there is a statistically significant difference between all of the mentioned parameters after the study group practicing deep breathing exercises as compared to the control group (45.9, 40.2, 14.3, 39.1) respectively; at p-value (< 0.001).

Figure (1) the study group reported no or mild pain (46.7 and 40%) after intervention as compared to the control group who reported moderate to severe pain (53.3 and 46.7%) respectively on the 2nd day post CABG.

Table 1: Demographic characteristics and Medical background for both study and control groups (N=60):

Variables	Study		Control		t-test / X^2	*p*-value
Age (years):						
Mean±SD	44±7.2		42.4±8.8		0.8	0.4
Gender:	No	%	No	%		
Male	21	70	18	60	0.7	0.6
Female	9	30	12	40		
Level of education:						
Can't read and write	4	13.3	3	10	8.3	0.08
Primary	1	3.3	7	23.3		
Preparatory	3	10	3	10		
Secondary	14	46.7	15	50		
University	8	26.7	2	6.7		
Occupation:						
Not working	15	50	13	43.3	1.3	0.5
Worker	9	30	13	43.3		
Employer	6	20	4	13.4		
Comorbidity factors:						
Non	3	10	3	10	0.88	0.8
Hypertension (HTN)	10	33.3	7	23.3		
Diabetes mellitus (DM)	6	20	6	20		
HTN and DM	11	36.7	14	46.7		
Smoking:						
Yes, Heavy smoker	15	50	11	36.7	6.4	0.02*
Smoking duration (years)Mean ± SD	17.4±4.6		16.6±5.6		0.4	0.7

*Statistically significant *p*-value ≤ 0.05

Table 2: Pain assessment for both groups before and after the study group practicing deep breathing exercises in the 1st day post CABG (N= 60):

	Before				After			
	Study		Control		Study		Control	
Variables	No.	%	No.	%	No.	%	No.	%
Location of pain								
Chest	30	100	30	100	30	100	30	100
Pain severity								
No pain	0	0	0	0	1	3.3	0	0
Mild	0	0	0	0	13	43.3	0	0
Moderate	9	30	11	36.7	10	33.3	4	13.3
Severe	21	70	19	63.3	6	20	26	86.7
t-test (*p*-value)	0.3 (0.8)				29.1 (<0.001) *			
Pain quality								
NO	0	0	0	0	1	3.3	0	0
Discomfort	0	0	0	0	13	43.3	0	0
Pulling	5	16.7	0	0	6	20	0	0
Aching	10	33.3	12	40	5	16.7	12	40
Burning	3	10	8	26.7	0	0	8	26.7
Sharp	12	40	10	33.3	5	16.7	9	30
Crushing	0	0	0	0	0	0	1	3.3
X^2-test (*p*-value)	7.6 (0.05) *				33.02 (<0.001) *			
Pain pattern								
No	0	0	0	0	1	3.3	0	0
Constant	18	60	13	43.3	10	33.3	22	73.3
Intermittent	12	40	17	56.7	19	63.3	8	26.7
X^2-test (*p*-value)	1.7 (0.3)				9.9 (<0.001) *			
Pain expression:								
NO	0	0	0	0	1	3.3	0	0
Grimacing	3	10	12	40	6	20	3	10
Moaning	8	26.7	8	26.7	3	10	9	30
Crying	2	6.7	3	10	3	10	8	26.7
Restlessness	13	43.3	6	20	1	3.3	9	30
Protecting	4	13.3	1	3.3	16	53.3	1	3.3
X^2-test (*p*-value)	9.9 (0.04) *				26.9 (<0.001) *			

*Statistically significant *p*-value ≤ 0.05

Table 3: Pain assessment for both groups before and after the study group practicing deep breathing exercises in the 2nd day post CABG (N= 60):

	Before				After			
	Study		Control		Study		Control	
Variables	No.	%	No.	%	No.	%	No.	%
Location of pain								
Chest	30	100	30	100	30	100	30	100
Pain severity								
No pain	0	0	0	0	14	46.7	0	0
Mild	0	0	0	0	12	40	0	0
Moderate	28	93.3	23	76.7	2	6.7	16	53.3
Severe	2	6.7	7	23.3	2	6.7	14	46.7
t-test (*p*-value)	3.3 (0.2)				45.9 (<0.001) *			
Pain quality								
NO	0	0	0	0	15	50.3	0	0
Discomfort	5	16.7	1	3.3	10	33	1	3.3
Pulling	11	36.7	6	20	2	6.7	8	26.7
Aching	12	40	15	50	2	6.7	13	43.3
Burning	1	3.3	6	20	0	0	6	20
Sharp	1	3.3	1	3.3	1	3.3	2	6.7
Crushing	0	0	0	0	0	0	0	0
Stabbing	0	0	1	3.3	0	0	0	0
X^2-test (*p*-value)	9.04(0.1)				40.2 (<0.001) *			
Pain pattern								
No	0	0	0	0	15	50	0	0
Constant	3	10	12	40	4	13.3	20	66.7
Intermittent	27	90	18	60	11	36.7	10	33.3
X^2-test (*p*-value)	4.5 (07)				14.3 (<0.001) *			
Pain expression								
NO	0	0	0	0	15	50	0	0
Grimacing	6	20	3	10	3	10	3	10
Moaning	8	26.7	15	50	1	3.3	6	20
Crying	0	0	2	6.7	1	3.3	0	0
Restlessness	9	30	8	26.7	0	0	17	56.7
Protecting	7	23.3	2	6.7	10	33.4	4	13.3
X^2-test (*p*-value)	7.9 (0.09)				39.1 (<0.001) *			

*Statistically significant p-value ≤ 0.05

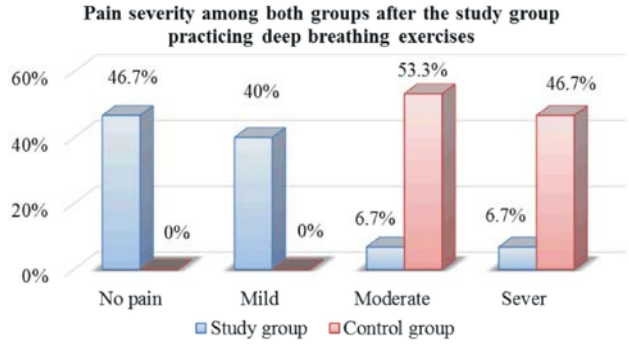

Fig. 1: Pain severity among both groups after the study group practicing deep breathing exercises on the 2nd day

Table 4: Comparison of pain severity mean score among both groups before and after the study group practicing deep breathing exercises on 1st and 2nd day post CABG (N= 60):

	Study		Control		t-test (*p*-value) Among control and study group	
Pain severity	Before	After	Before	After	Before	After
1st day	7.1±1.1	4.07±2.2	6.9±1.1	7.4±0.89	0.47 (0.6)	-7.6 (<0.001)*
t-test (*p*-value)	9.6 (<0.001) *		-3.2 (0.003) *			
2nd day	5±0.9	1.5±2.2	5.7±0.91	6.3±1	-2.8(0.006)	-10.7 (<0.001)*
t-test (*p*-value)	4.1 (<0.001) *		-3.2 (0.003) *			

*Statistically significant *p*-value ≤ 0.05

Table (4); there is a statistically significant decrease mean score of pain severity on the 1st and 2nd day after the study group practicing deep breathing exercises (4.07 ± 2.2 and 1.5 ± 2.2) respectively. On the other hand, there is a highly statistically significant improvement in pain severity among the study group on the 1st and 2nd day before and after intervention (9.6, 4.1) at a *p*-value (< 0.001). Additionally, there is a highly statistically significant improvement in pain severity between both groups on the 1st and 2nd day after the study group practicing deep breathing exercises (-7.6 and -10.7) at *p*-value (< 0.001).

DISCUSSION

Coronary artery bypass graft surgery has become a standard procedure for coronary artery disease nowadays. Patients who undergo CABG surgery, however, frequently often complain of postoperative pain and sleep disruptions. Pain is a major physical distressing complaint following surgery. Studies demonstrate that pain remain problem for the majority of adults who have suffered coronary artery bypass grafting. Non-pharmacological methods have been proposed to alleviate pain [33- 35]. Therefore, the present study aimed to evaluate the efficacy of deep breathing exercises on pain perception among coronary artery bypass grafting patients. To fulfill the aim, it was hypothesized that the coronary artery bypass grafting patients who will practice deep breathing exercises will achieve a significantly higher reduction in the total mean score of pain severity as compared to the control group. To achieve this aim, two matched groups in demographic and medical background were randomly allocated to study and control groups. Discussion of results obtained from the studied subjects was presented in two main parts as follows: (I) Demographic characteristics and medical background and (II) Pain assessment.

A purposeful sample was assigned to 60 male and female adult patients undergoing elective CABG, 30 were allocated to the study group undergoing breathing exercises and the other 30 to the control group receiving regular hospital treatment. Out of 60 participants, more than half of the samples were male and the average mean age score for the study and control groups were (44 ± 7.2 and 42.4 ± 8.8) respectively. Furthermore, almost half of the sample was in high school and not employed.

Due to men's higher absolute risk compared with women, coronary artery disease has been seen as a "male" disease, but the relative risk of female morbidity and mortality is actually higher [36]. These results were backed by several authors who found that almost half of the study patients belonged to the male predominant population age group of 65 years or less [37]. Other researchers who performed in Egypt also reported that more than half of the patients were male, illiterate and farmer. Their age ranged between 50 and 59 years with a mean age of (45.9±11.7). With respect to medical background, hypertension, diabetes and heavy smoking were present among patients in both the study and control groups. The possible explanation for that there are strong connections between heart diseases and hypertension, diabetes mellitus and smoking as potential cause. This is consistent with the findings of other researchers who found that rheumatic fever, hypertension and diabetes were present in the majority of the population with a significant difference between two groups [38, 39]. On the other hand, smoking, diabetes mellitus, hypertension, hypercholesterolemia, obesity, elevated blood viscosity, low-fiber diet and low vitamin C levels are the main cardiac risk factors [40].

The current findings revealed that there were no statistical variations in the demographic characteristics and medical background of the patients detected in the study and control groups, suggesting the only influence arising from the researcher's deep breathing exercises practice. In accordance some authors reported that, no significant differences were found between the two groups in terms of demographic or surgical data [41].

Pain following coronary artery bypass grafting surgery is known to be patient's most serious complain. Despite being generally manageable, pain in up to 75% of patients is frequently reported as moderate to extreme. Pain may also linger for extended periods after surgery, with 35% of patients experiencing recurrent thoracic pain one year after cardiac surgery. Breathing becomes shallow and irregular when a person feels pain, because of increased muscle tension in the chest wall, leading to an increase in muscle tension and subsequent heightened pain. It will lead to a relaxation response that can relieve pain by educating patients to be conscious of this cycle, along with deep breathing exercises that enable them to break it [42, 43].

Deep breathing exercises are a complementary and non-invasive therapy, in order to positively affect insomnia, depression, anxiety and pain perception. It has been shown to offset the role of the body and brain and, is thus seen as an excellent tool to promote relaxation that can relieve pain [19].

With respect to pain description in the current study (severity, quality, pattern and expression), most of the two groups complain of severe, sharp, aching and constant chest pain, especially on the first day before intervention. But after the study group performing deep breathing exercises, these parameters changed to become mild and intermittent pain for the study group compared to the control group that still complained of severe, aching and constant pain. There is no statistically significant difference between the study and control groups before intervention. On the other hand, in contrast to the control group, there is a statistically significant difference between all of the described parameters after the practice of deep breathing exercise in the study group. The key explanation for the decrease pain severity among patients in the study group was the fact that deep breathing exercises is an excellent technique to promote relaxation and it seems to be a safe method with no side effects to eliminate pain. Some research documenting the beneficial effects of post-operative breathing exercises on patients undergoing cardiac surgery have been performed to avoid loss of substantial time of sleep. Regular breathing exercises can enhance relaxation, minimize pain and improve quality sleep [13, 29].

On the second day, declining pain severity was noted among the study group. After intervention, half of the study group reported no or mild intermittent pain. In the other hand, the entire control group reported moderate or severe pain. Also, pain severity degrees show significant improvement after study group practicing deep breath exercises compared to the control group. From the point of view of the researcher, the possible explanation for that finding is that this outcome reflects the effectiveness of deep breathing exercises in decreasing the degree of pain severity degree especially when done for a couple of days. According to many researchers found that deep breathing exercise is considered a useful form of complementary and alternative treatment apparently, the presence and characteristics of pain as pre- and post-breathing exercises, highly significant differences were detected in both presence of pain, time and severity of pain [46, 47]. Also, it agrees with others who find a substantial reduction in tension, anger and depressive feelings in patients with chronic pain after breathing intervention [32]. Other authors have agreed that deep-slow and daily breathing exercises could be a significant factor in reducing pain intensity during burn dressing [14, 47]. This is accordance with several studies who have confirmed that the degree of pain after relaxation in upper abdominal surgery was substantially lower [44, 45, 48].

Overall outcome of this current study showed that after the 1st and 2nd days of practice, there was a statistically significant decrease mean pain severity score in the study group. On the other hand, there is a very statistically significant improvement in pain severity among the study group on the 1st and 2 nd day of performing deep breathing exercises as compared to the control group. Subsequently, the result of the recent study confirmed the hypothesis that the coronary artery bypass grafting patients who practiced deep breathing exercise, achieved a significantly higher decrease in the total mean score of pain severity as compared to the control group. Therefore, following the deep breathing exercises can be a promising intervention to improve health outcomes of coronary artery bypass grafting patients. Many authors concluded that the findings indicate the need for enhancement in preoperative education, especially by the nurses on non-pharmacological methods used to treat postoperative pain such as deep breathing, massaging, relaxing and music therapy [44, 45]. Finally, it is worthy affirming that nurses are the key providers of professional care in the assessment, monitoring and the multi-method approach of pain control in surgical wards postoperative care. Nursing roles are listening to complaints, assessing pain severity, planning, educating the patients about pain, facilitating the use of nonpharmacologic pain techniques and evaluating the process for achieving positive outcomes.

CONCLUSIONS

In many facets of pain management, nurses play an important role, including pain 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 pain management. Nurses are responsible for effectively managing the pain of the patients through the proper administration of medications, application of non–pharmacology-based strategies such as hot, cold, position change, simple massage and deep breathing. The deep breathing technique is a safe, economical and a non-pharmacologic nursing intervention and an efficient technique that can be recommended as pain management technique to minimize the severity of pain following coronary artery bypass grafting surgery. There is a need for nurses to consider alternative methods of pain management in addition to drug therapy.

Recommendation: Recommendations for better patient's outcome as: (a) Routine assessment of patients' pain severity before and after surgery is recommended; (b) Integrate the deep breathing technique for patients undergoing cardiothoracic operation before surgery and apply it after surgery as routine and regular care to decrease the incidence of pain associated with surgery.

Recommendations for furthers researches as: (a) Replication of the study on larger probability samples selected from different geographical areas in Egypt is recommended to obtain data of more generalizability of findings. (b) Further studies have to be carried out in order to evaluate the effectiveness of the application of deep breathing technique on severity of pain in the cardiac surgery.

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