EFFECT OF DESIGNATED NURSING INTERVENTION ON SEVERITY OF PAIN AND ANXIETY DURING CHEST TUBE REMOVAL AMONG CARDIAC SURGERIES PATIENTS

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Abstract

Background: Cardiac surgery which includes coronary artery bypass grafting and heart valve surgery represents the most common classes of surgical procedures performed globally. Chest tube removal has been defined as a painful and frightening procedure for Intensive Care Units patients.
Aim of the study: To evaluate the effect of designated nursing intervention on severity of pain and anxiety during chest tube removal among cardiac surgeries patients.
Design: A quasi-experimental design is utilized.
Sample: A purposive sampling of 60 adult patients from both genders who were randomly allocated and alternatively divided into two equal groups, study and control.
Setting: The study was conducted in the cardio-thoracic Intensive Care Unit at Fayoum University Hospitals.
Tools: Four tools were used for data collection, (I) a Structured Interviewing Questionnaire, (II) a Numerical Pain Rating Scale, (III) an Adapted McHill Questionnaire, and (IV) Hamilton Anxiety Scale. Results: This study showed that there was a highly statistical significant decrease of severity of pain and anxiety during chest tube removal after implementing the designated nursing intervention.
Conclusion: It can be concluded that implementation of designated nursing intervention has a statistical significant effect on the severity of pain and anxiety during chest tube removal.
Recommendations: the study recommends applying the designated nursing intervention to cardiac surgery patients during chest tube removal.

Keywords: Cardiac surgery, Chest tube removal, Pain, Anxiety

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1. INTRODUCTION

Open heart surgery plays an important role in the management of wide range of cardiovascular diseases and encompasses the care of a patient with greater acuity and complexity. Cardiac surgery, including coronary artery bypass grafting and heart valve surgery represent the most common classes of surgical procedure performed globally (Elsaed, et al. , 2020).Following surgical procedures of the chest, tube thoracotomy is the gold standard for evacuation of accumulated postoperative fluid and air. Large bore chest tubes are commonly used to drain both the pericardial and pleural spaces following open heart surgery and are nearly always placed following esophageal and lung surgery. Following pulmonary resections, the conditions in the pleural space change. Postoperative blood, pleural fluid, and air accumulate in the pleural space of the body's natural position and gravity (Wilson, et al., 2019).

Chest tube removal has been defined as a painful and frightening procedure for patients in intensive care units. Beyond the association between cardiorespiratory pain and anxiety, pain can cause feelings of anxiety that in turn can increase the sensitivity of the patient to the pain. So, it seems that by controlling pain, anxiety can also be controlled. Although the American Society for Pain Management Nursing indicates that optimum pain management before, during, and after every procedure is everyone's right, the pain of chest tube removal is poorly and inefficiently managed (Sajedi-Monfared, et al., 2021).

Nurses are responsible for patients' rest and pain. To control pain and anxiety, non-pharmacological methods having no side effects confer higher priority

than pharmacological method because they can be used independently by nurses and are easily accepted by patients. Non pharmacological interventions such as distraction techniques, guided imagery, music, cold therapy, relaxation techniques and art have been found to be inexpensive complements to pharmacologic treatments, effectively reducing both anxiety and acute pain (Brescia, etal., 2021).

Significance of Study

According to El-Sadek, et al. (2022) stated that, after cardiac surgery 86% of patient's experienced acute severe pain and 33% - 75% of the patients suffer from moderate to severe acute postoperative pain. Unrelieved postoperative pain can hinder patients' ability to cough and mobilize effectively, which leads to postoperative complications. The prevalence of anxiety after open heart surgery in patients has been reported to be 24.7 - 66 %. Patients after cardiac procedures can experience high levels of fear and anxiety, as the surgeries are often complicated, risky and include the possibility of serious complications (Akhlaghi, et al., 2021).

Based on Kakar, et al. (2021) demonstrated that, anxiety and discomfort are unpleasant feelings which can results from the pain associated with chest tube removal. Whilst inadequate postoperative pain management has been reported to slow postoperative recovery, increase the length of stay in hospital and lead to increase in postoperative complications, dissatisfaction with care and opioid consumption. Moreover, pathological anxiety manifests as an excessive worrying thoughts of being disabled, persistent palpitations, headache, and sleep disturbance, butterflies in stomach and generalized muscular tension. Also anxiety affects patients' efforts at reducing risk factors, different facets of quality of life, therapeutic compliance, exercise programs (Tola, et al ., 2021).

Aim of the Study

The aim of this study is to evaluate the effect of designated nursing intervention on severity of pain and anxiety during chest tube removal among cardiac surgeries patients through the following objectives:

1. Assess severity of pain and anxiety before intervention.
2. Design nursing intervention before chest tube removal based on literature review.
3. Implement designated nursing intervention.
4. Evaluate the effect of designated nursing intervention on the severity of pain and anxiety after chest tube removal.

2. THEORETICAL FRAMEWORK

The present study aims to evaluate the effect of designated nursing intervention on severity of pain and anxiety during chest tube removal among cardiac surgeries patients. This study utilizes the KOLCABA'S Comfort Theory (CT) by Katharine Kolcaba's. Smith (2020) reported that the comfort theory was developed in the 1991. The CT, a middle-range nursing theory, assists nurses in focusing on the phenomenon of patient comfort. Kolcaba's hypothesizes that there is a relationship between patients' needs, nursing interventions, comfort, and outcomes.

Conceptual framework of comfort theory:

Health care needs

Conceptually: Health care needs are defined as needs for comfort arising from stressful health care situations that cannot be met by recipients' traditional support systems. They include physical, psychospiritual, sociocultural, and environmental needs made apparent through monitoring and verbal or nonverbal reports, needs related to pathophysiological parameters, needs for education and support, and needs for financial counseling and intervention (Puchi et al., 2018).

Operationally: In the current study, healthcare needs for comfort is defined as a lack of comfort in two contexts; physical (pain) and psychospiritual (anxiety).The researcher assesses the physical and psychspiritual needs of patients (severity of pain and anxiety associated chest tube removal), identifies singes and symptoms of pain and anxiety and identifies their negative effect on patients.

Comfort interventions

Conceptually: Comfort interventions are defined as intentional actions designed to address specific comfort needs of recipients, including physiological, social, cultural, financial, psychological, spiritual, environmental and physical interventions. Within these contexts of experience, there are three types of comfort interventions described later: technical, coaching and comfort food for the soul (Auyezkhankyzy et al., 2022).

Operationally: In this study, the researcher anticipates plan interventions and coordinates their activities to fulfill the unmet comfort (designated nursing intervention) specific for pain and anxiety associated with chest tube removal. Technical interventions are specified by the researcher or by nursing protocols. They include applying cold therapy before removal for study group. Coaching consists of supportive nursing actions as active listening for patients and help patients to express their feelings regarding intervention and so forth. Comfort food for the soul is those extra special, holistic, and more time-consuming nursing interventions such as hand massage and breathing technique.

Intervening variables

Conceptually: Intervening variables are defined as interacting forces that influence recipients' perceptions of total comfort. They consist of variables such as past experiences; age, attitude, emotional state, support system, prognosis, finances, education, cultural background, and the total

elements of recipients' experience (Puchi et al ., 2018).

Operationally: In this study, the researcher took into consideration the variables that might affect the implementation of the interventions such as age, gender, educational level, occupation and marital status. The researcher observes the patient's awareness and response to nursing intervention. The researcher also knows how to deal with the impact of variables on the application, in addition to knowing the correct tools and ways to use them.

Enhanced Comfort

Conceptually: Comfort is defined as the state being experienced immediately by recipients of comfort interventions. It entails the holistic experience of being strengthened through having comfort needs addressed (Boudiab & Kolcaba, 2015).

Operationally: In this study, the researcher carries out for patients that appropriate interventions regarding pain and anxiety associated with chest tube removal include cold application, breathing technique and hand massage. After that, the researcher evaluates the effect of designated nursing intervention on severity of pain and anxiety as measured by tool (II & IV).

Health-seeking behaviors (HSBs)

Conceptually: Health-seeking behaviors represent the broad category of subsequent outcomes related to the pursuit of health. They are defined by recipient(s) in consultation with the nurse Health-Seeking Behaviors. HSBs could be internal or external. Realistic HSBs are determined by recipients of care in collaboration with their health care team (Awal, 2017).

Operationally: In this study, the researcher evaluates the outcome of the intervention through the patients' expression that the severity of pain and anxiety has decreased as measured by tool (II & IV).

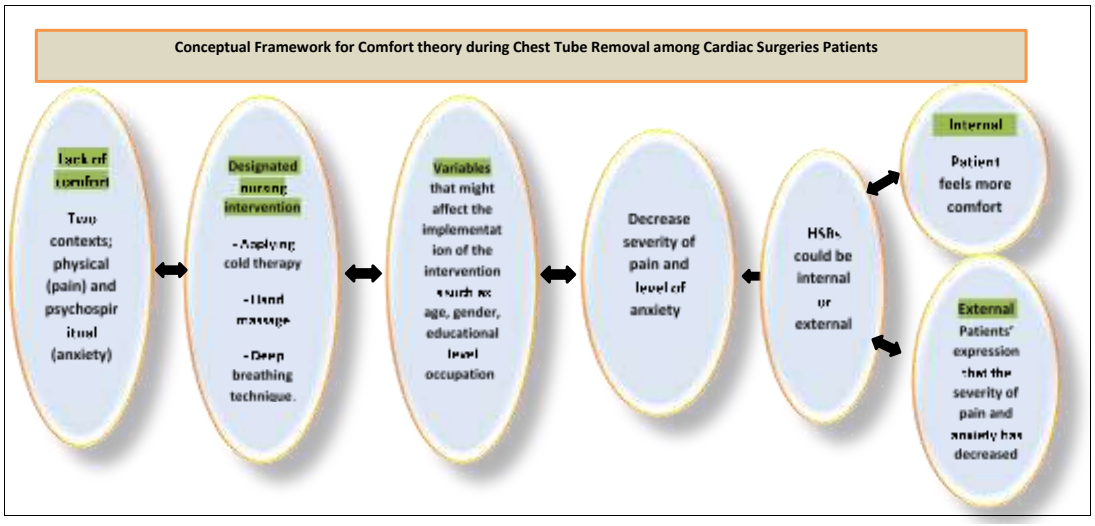

Figure (1): Conceptual framework of comfort theory during Chest Tube Removal among Cardiac Surgeries Patients designated by the researcher based on literature review

Research Hypothesis:

At the end of the study Patients who will receive designated nursing intervention are more likely to experience less pain and anxiety during chest tube removal than patients who will receive routine hospital care as measured by tool (II & IV).

Research Design:

A quasi-experimental research design was utilized in this study.

Setting:

This study was carried out at the cardio-thoracic intensive care unit at Fayoum University Hospitals.

Subjects:

A purposive sample of 60 adult patients from both genders undergoing chest tube removal after cardiac surgeries.

Inclusion criteria

- Age from 18 to 60 years old.
- Hemodynamically stable patients without any cardiac medication.
- Patients who have one or two mediastina or pleural chest tubes.
- Chest tube removal for the first time.

Exclusion criteria

- Patients with Mechanical ventilation support.
- Unconscious or cognitively impaired patients.
- Infected chest tube site.
- Patients undergoing Redo or re-open heart surgery
- Hand amputation, diseases (arthritis), inflammations.
- Edema, burn wound, lesion or fractures in hands.
- Patients with Communication problems.
- Patients with drug abuse or alcohol addiction.
- Patients with history of chronic pain.

Tools of data collection:

Tools of data collection were used to achieve the purpose of the current study. The collection of data was achieved by the following tools:

Tool I: Structured Interviewing Questionnaire

This tool adapted form (Sumithra, 2017) and modified by researcher by changing the arrangement and editing some of words. It is consists of the following two parts:

Part 1: Demographic data to cover the personal data and the characteristics of the studied patients as (age, gender, education level, occupation, marital status, smoking and body mass index).

Part 2: Health related information which includes type of surgical procedure, type of chest tube, duration of chest tube insertion, and physiological parameter (hemodynamic) before and after intervention.

Tool II: The Numerical Pain Rating Scale

It is adopted from (McCaffery & Beebe, 1989). It used to measure the severity of pain before, immediately, 5, 10, 15 and 30 minutes after chest tube removal. This is scale that ranged from (0 -10). In this tool, a score of zero indicates no pain, 1- 3 indicates mild pain, 4 - 6 indicates moderate pain, 7 - 9 indicates sever pain, while a score of 10 presents the worst pain imaginable.

Tool III: Adapted McHill Questionnaire

It is adopted from (Melzack, 1975) and calculates the overall quantification of pain after removal. It provides the sensory, affective and pain intensity score after chest tube removal.

Tool IV: Hamilton Anxiety Scale

It is adopted from (Hamilton, 1988). It used to measure the severity of anxiety before and after intervention. The scale consists of 14 items; each item was scored on a scale of 0 (not present) to 4 (severe).

Field work includes three phases based on comfort theory:

I-First phase (Health care needs)

During this phase; the researcher visited the selected setting regularly, three days¬ per week. And selected patient regarding inclusion exclusion criteria and after that assign them to either a study group or a control group randomly. Concerning health care needs, each patient was assessed individually and data collection was filled by the researcher in the morning or afternoon shifts after surgery by using Tool (I) Structured Interviewing Questionnaire was filled for the study and control group by the researcher. Also severity of pain and anxiety was assessed by using Tool (II) The Numerical Pain Rating Scale and Tool (IV) Hamilton Anxiety Scale. It took around five to ten minutes for each patient.

II-Second phase (Comfort interventions)

The researcher anticipates plan interventions and coordinates their activities to fulfill the unmet comfort (designated nursing intervention) that are specific for pain and anxiety associated chest tube removal. Based on the basic assessment, the procedures for each group are as follows: in the control group, no intervention was done for the patients and the chest tubes were removed according to the policies. Chest tubes were removed without any interventions and received routine care according to the ward policies.

In the study group, 30 minute before removal; after providing privacy and a quiet environment, putting patients in a semi‑ fowler position with a pillow under their head to achieve more comfort during the intervention; their rough cloths were also removed, measuring hemodynamic parameters and explaining the procedure:

Deep breathing technique

The patients were instructed on how to perform the deep breathing by the researchers. Deep breathing were inhaling slowly from the nose and exhaling through semi closed lips two times slower than inhalation with closed eyes until feeling relaxed.

Cold application

Before the intervention, the participants were given some information about cold application and how to make it.

These steps were followed to apply the ice bag:

- Ice cubes were put in ice bag which was wrapped in dressing gauze.
- Because one ice bag was not long enough to cover around the chest tubes completely, two curved ice bags which were attached to each other were applied around chest tubes
- A layer of sterile gauze was then placed over the chest tube and skin to prevent direct contact with the ice bag.
- Apply ice bag around chest tube and covering a five square inch area around the tubes.
- It remained in contact with the patient's skin for 20 minutes.
- The chest tube was removed maximally two minutes after lifting the ice bag.

Hand massage

After performing hand hygiene, the researchers hold each hand for 5-10 seconds and apply 5-10 mL of unscented hypoallergenic cream to hand and wrist, patients received 20 minutes of hand massage.

These steps were followed to apply the massage technique

- Effleurage was used to spread the hypoallergenic cream over the participant's hands by massaging from the base of the fingers to the wrist.
- Petrissage as a short, gentle and rapid movement was used to squeeze, roll or knead the hands fingers.
- Tapotement (i.e. beating or percussion) was used as short taps done with the fingers.
- Friction was used to rub the layers of tissues against each other in order to increase blood flow.

III-Third phase (Enhanced Comfort):
Objectively; the researcher evaluates the effect of designated nursing intervention on severity of pain and anxiety as measured by tool (II & IV). subjectively; the patients verbalize that the severity of pain and anxiety has decreased. For pain evaluating; The Numerical Pain Rating Scale, it was filled six times before, immediately, 5, 10, 15 and 30 minutes after chest tube removal. Adapted McHill Questionnaire It was filled only one time after chest tube removal. For anxiety evaluating; Hamilton Anxiety Scale It was filled two times before and after intervention.

3. RESULTS

Table (1): Frequency and percentage distribution of demographic characteristic for study and control group (N: 60):

Variables	**Study Group** (N=30)		**Control Group** (N=30)		**X^2- test**	**p-value**
	No.	**%**	**No.**	**%**		
Age (years)						
18 30 years	1	3.3%	3	10%	6.5	0.09
31-40 years	8	26.7%	11	36.7%		
41-50 years	5	16.7%	0	0%		
51-60 years	16	53.3%	16	53.3%		
Mean ±SD	**51.4± 4.5**		**49.4±5.3**			
Gender						
Male	20	66.7%	21	70%	0.08	0.9
Female	10	33.3%	9	30%		
Level of education						
Illiterate	4	13.3%	1	3.3%	4.6	0.1
Secondary	7	23.3%	14	46.7%		
University	19	63.4%	15	50%		
Occupation						
Unemployed	11	36.7%	13	43.3%	1.18	0.6
Non professional	6	20%	8	26.7%		
Professional	13	43.3%	9	30%		
Marital status						
Single	2	6.7%	6	20%	6	0.11
Married	24	80%	24	80%		
Divorced	3	10%	0	0%		
Widow	1	3.3%	0	0%		

*statistical significant p-value ≤0.05

Table (1) explains that there was no statistical significant difference with p-value >0.05 between study group and control as regards different demographic characters which indicated proper matching between two groups in these variables.

Table (2): Health related information for study and control group (N: 60):

Variables	**Study Group** (N=30)		**Control Group** (N=30)		**X^2- test**	**p-value**
	No.	**%**	**No.**	**%**		
Type of surgery						
Valve	18	60%	15	50%	0.61	0.6
CABG	12	40%	15	50%		
Type of chest tube						
Pleural	4	13.3%	3	10%	2.4	0. 3
Mediastinal	14	46.7%	14	46.7%		
Both	12	40%	13	43.3%		
Duration of insertion						
1-2 days	14	46.7%	18	60%	2.3	0.3

2-3 days	12	40%	11	36.7%		
More than 3 days	4	13.3%	1	3.3%		

*statistical significant p-value ≤0.05

Table (2) illustrated that there was no statistical significant difference with p-value >0.05 between study group and controls as regards health related information. The majority of the studied patients had undergone valve surgery in study and control groups were 60%, 50%. Also illustrates that 46.7% in the study and control patients had mediastinal chest tube. As regards duration of insertion the majority of them between1-2 days 46.7%, 60% respectively.

Table (3): Physiological parameters before and after chest tube removal for study and control group N: 60:

Variables	**Study Group** (N=30)		**T- test**	**p-value**	**Control Group** (N=30)		**T- test**	**p-value**
	Before	**after**			**Before**	**after**		
Vital signs								
Temp	37.01±0.19	37.06±0.15	-2.1	**0.04***	37.04±0.15	37.2±0.15	-5.3	**<0.001***
Pulse	90±4	84±6	9.3	**<0.001***	90±3	94±2	-9.7	**<0.001***
RR	16±1	13±2	7.8	**<0.001***	14±2	16±1	-4.9	**<0.001***
Blood pressure								
Systolic	130.7±5.8	117±9.5	7.5	**<0.001***	133.7±4.9	136.3±5.6	-2.5	**0.01***
Diastolic	86.7±4.8	77±6.5	5.9	**<0.001***	88.7±5.1	90±0	-1.4	0.2

*statistical significant p-value ≤0.05

Table (3) illustrated that there was a statistical significant decrease in mean of all vital signs (body temperature, pulse, RR systolic and diastolic blood pressure) after chest tube removal with p-value <0.05 among study group but there was a statistical significant increase in all vital signs among control group after chest tube removal.

Table (4): Assessment of pain severity before and after intervention during chest tube removal for study and control group (N: 60):

Variables	**Study Group** (N=30)		**Control Group** (N=30)		**X^2 Test**	**p-value**
	No	**%**	**No**	**%**		
Before						
Mild	0	0%	0	0%	4.04	0.1
Moderate	6	20%	1	3.3%		
Sever	24	80%	29	96.7%		
After						
Mild	26	86.7%	0	0%	46	**<0.001***
Moderate	1	3.3%	3	10%		
Sever	3	10%	27	90%		

*statistical significant p-value ≤0.05

Table (4) above illustrates that; there is no statistically significant difference with p-value >0.05 between study and control groups as regards degree of pain severity before chest tube removal with high percentage of severe pain for study and control groups 80%, 96.7% respectively.

On the other hand, there is statistically significant difference between study and control groups as regards degree of pain severity after chest tube removal with increase in percentage of patients with mild pain 86.7% with p-value <0.001. However, there was no change in pain score among control group after tube removal.

Table (5): McHill Pain score after chest tube removal following intervention for both study and control group (N: 60):

Variables	**Study Group** (N=30)		**Control Group** (N=30)		**T- Test**	**p-value [a]**
	Mean	**SD**	**Mean**	**SD**		
Total McHill score after removal	4.2±2.9		13.5±1.1		-163	**<0.001***
Grades of McHill score					**X^2 Test**	
Mild	26	86.7%	0	0%	49.1	**<0.001**
Moderate	1	3.3%	3	10%		
Sever	3	10%	27	90%		

*statistical significant p-value ≤0.05

Table (5) illustrated that regards McHill score there was a statistical significant lower mean among study group 4.2 versus 13.5 among control group with p-value <0.001 with high percentage of mild degree of pain among study group 86.7%)verses control group with high percentage of sever degree of pain 90%.

Table (6): Assessment of anxiety level before and after intervention during chest tube removal for study and control group (N: 60):

Variables	**Study Group** (N=30)		**Control Group** (N=30)		X^2 **Test**	**p-value**
	No	**%**	**No**	**%**		
Before						
Mild	0	0%	0	0%	1.01	**0.9**
Moderate	1	3.3%	0	0%		
Sever	29	96.7%	30	100%		
After						
Mild	26	86.7%	0	0%	49.1	**<0.001***
Moderate	1	3.3%	0	0%		
Sever	3	10%	30	100%		

*statistical significant p-value ≤0.05

Table (6) above illustrates that; there is no statistically significant difference with p-value >0.05 between study and control groups as regards degree of severity of anxiety before chest tube removal with high percentage of severe anxiety for study and control groups 96.7%,100% respectively. On the other hand, there is statistically significant difference between study and control groups as regards degree of severity of anxiety after chest tube removal with increase in percentage of patients with mild anxiety 86.7% for study group with p-value <0.001. However, there was no change in anxiety score among control group after tube removal.

4. DISCUSSION

Regarding the demographic characteristics of the study and control groups, there were 60 patients in this study. They were divided into two equal groups, one for the study and one for the control. Regarding demographic characteristics of the studied patients of both study and control groups, the present study findings revealed that the mean age of the studied patients in both study and control groups was (51.4± 4.5, 49.4±5.3) respectively. Concerning gender, two third of the studied patients were males in both groups. In regard to educational level for patients in both study and control groups, the majority of them completed university education. Concerning occupation, majority of the studied patients in the study group were professionals; while they were unemployed in the control group. Furthermore, majority of the patients in both groups were married.

Results of the study indicated that there were no significant differences between study and control group regarding socio demographic characteristic .This indicated proper matching and using randomization to prevent biases and made the results fair between the two groups regarding those variables. This finding was supported by Jarrah et al. (2022) who reported, in the study about "The effect of slow deep breathing relaxation exercise on pain levels during and post chest tube removal after coronary artery bypass graft surgery" in Jordan, that there were no significant differences between the two groups in baseline measures(demographic characteristics) as a result of proper matching and using randomization. Similarly, Çevik et al. (2020), who conducted "Effect of Applying Cold Gel Pack to the Sternum Region on the Postoperative Pain after Open-Heart Surgery" in Turkey, reported that there were no statistical significant differences in the demographic characteristics of the patients as a result of proper randomization between groups.

Regarding body mass index, it was noticed that more than half of the studied sample were with high percentage of overweight grade among study group versus higher percentage of overweight among control group. It is associated with an increased cardiovascular risk, on the one hand, of obesity itself and of associated medical conditions as hypertension, diabetes and insulin resistance, on the other hand. Obesity has an important role in atherosclerosis and coronary artery disease. Obesity leads to structural and functional changes of the cardiovascular system which causes heart failure and increases the risk of atrial fibrillation and sudden cardiac death.

Likewise, Dwivedi et al. (2020) who conducted "Association between obesity and cardiovascular outcomes: updated evidence from meta-analysis studies " in Texas, reported that obesity measured by using BMI and was strongly associated with an increased risk of cardiovascular disease. Obesity

increases the risk of a number of diseases and is often comorbid with other cardiovascular risk factors such as diabetes, hypertension, elevated plasma lipids, left ventricular hypotrophy, subclinical atherosclerosis, and obstructive sleep apnea.

Concerning smoking, the current results found high percentage of heavy smokers among study and control groups with high mean smoking index found among study group versus among control group. Smoking harms nearly every organ in all body system. Smoking is a major risk factor for cardiovascular disease, respiratory disease, cancer and other illnesses. Negative effects of tobacco smoke on the circulatory system include raised blood pressure and heart rate, less oxygen carried by the blood during exercise, increased risk of stroke and heart attack due to blockages of the blood supply, and damage to the lining of the arteries which is thought to be a contributing factor to atherosclerosis (the build-up of fatty deposits on the artery walls).

This result was consistent with Gallucci et al. (2020) who reported in the study entitled "Cardiovascular risk of smoking and benefits of smoking cessation " in Italy, that smoking increases mortality from all causes and has a crucial role in atherosclerotic cardiovascular disease. Active smoking and secondhand smoke exposure determine more than 30% of coronary heart disease mortality. On the same scope Levin et al. (2021) reported, in the study about "Genetics of smoking and risk of atherosclerotic cardiovascular diseases: a Mendelian randomization study" in United Kingdom, that smoking is a risk factor for cardiovascular disease and it is associated with atherosclerotic cardiovascular disease.

Regarding information related to health, more than half of the study group was valve surgeries, but half of the control group was CABG surgery and the other half was valve surgeries. Cardiac surgery, including coronary artery bypass grafting and heart valve surgery, represents the most common classes of surgical procedure performed globally. It is often used to treat complications of ischemic heart disease (for example, with coronary artery bypass grafting), correct congenital heart disease, or to treat valvular heart disease from various causes, including endocarditis, rheumatic heart disease, and atherosclerosis.

This explanation agrees with Mohammadi et al. (2018) who reported, in the study entitled "Effects of cold application on chest tube removal pain in heart surgery patients" in Iran, that the cardiac surgery is the most frequent therapeutic intervention for ischemic and cardiac valve diseases. Thousands of patients undergo cardiac and vascular surgeries as coronary artery bypass grafting and heart valve surgery in the United States every day.

The current result illustrates that near half of the study and control patients had a mediastinal chest tube and approximately less than half of the study patients had both plural and mediastinal tubes. At the end of a cardiac procedure, one or more chest tubes were placed in the mediastinal space to continuously monitor postoperative blood loss and to prevent undesirable blood collection, especially in the pericardial space. Pleural tubes are sometimes used when the pleural space is entered, and when left or right internal mammary arteries are used as a graft. In this case, a left pleural chest tube will also be placed before closing the chest in order to drain blood, pleural fluid, or evacuate air introduced during surgery.

In accordance with the present study, Ntinopoulos, et al. (2020) who conducted " Active clearance of chest tubes after cardiac surgery: a propensity score matched analysis" in Switzerland, reported that chest tubes are inserted in the pericardial and pleural cavities postoperatively in almost all patients after cardiac surgery to facilitate the evacuation of shed blood. Also chest tubes are required for all cardiac surgery patients to evacuate shed mediastinal blood in the early hours after surgery. On the same line Obafemi et al. (2022) who conducted "An automated line-clearing chest tube system after cardiac surgery" in California, confirmed that chest tube drainage is an essential component of postoperative management in cardiac surgery. Adequate drainage from the mediastinum can prevent cardiac tamponade whereas drainage from the pleural space improves respiratory status and decreases the work of breathing.

Based on the duration of the chest tube insertion, most of those who participated in the study removed in a period ranging from one to two days. This result of the decrease amount of drainage from chest tube and breath sounds has been normal for 24 hours, stability of patients' condition and decision of a physician regarding patients. In this respect Mazloum's (2018) "The impact of using ice on quality of pain associated with chest drain removal in post cardiac surgery patients: An evidence-based care" in Iran, reported that chest drain is usually removed 1-2 days after surgery if the fluid volume is < 100-150 cc and breath sounds are normal for 24 hours.

In addition, Sasa (2019) who conducted "Evidence-based update on chest tube management" explained that chest tube removal may be discontinued when evidence of lung re-expansion is observed, such as improved X-rays, symmetric chest expansion, absence of tidaling, and improved overall respiratory function. However, the primary consideration for chest tube removal is the amount of drainage and/or air leak. Traditionally, the chest tube is removed when drainage is less than 100 mL/day. Current literature is more aggressive, citing that CTTs can be removed safely when output is less than 400 mL/day, in the absence of air leaks.

Regarding assessment of physiological parameters before chest tube removal, the present study revealed

that there is slight elevation of blood pressure, pulse, and respiration; but normal range for temperature with no statistically significant difference between study and control groups. This could be a result of the negative effect of pain and anxiety on physiological parameters. Both pain and anxiety activate the sympathetic nervous system. Catecholamine levels increase, which may place a significant burden on the cardiovascular system, especially in a critically ill patient. Activation of the sympathetic nerves system results in tachycardia and hypertension, which leads to increased myocardial oxygen demand.

On the same scope, Sole et al. (2020) reported that the physiological response to stress interferes with the healing process and impairs perfusion and oxygen delivery to tissue. Hemodynamic instability, immunosuppression, and tissue catabolism may also occur. Hyperventilation (tachypnea), secondary to pain and anxiety, can be stressful to the patient because rapid breathing requires significant effort with the use of accessory muscles. They also reported physiological responses to pain and anxiety including tachycardia, tachypnea, hypertension, increased cardiac output, pallor and/or flushing, cool extremities and other symptoms.

This finding is supported by Erzincanli and Kasar's (2021) study entitled "Effect of Hand Massage on Pain, Anxiety, and Vital Signs in Patients before Venipuncture Procedure: A Randomized Controlled Trial" in Turkey, which reported that the effect of pain and anxiety is an unpleasant feeling that can lead to abnormal heart rate, blood pressure, and serious complications among patients. It can exacerbate symptoms and increase negative psychological and physiologic effects including heart rhythm.

Regarding assessment of pain severity before chest tube removal, the current study indicated high percentage of severe pain for study and control groups. This pain resulted from presence of chest tube movement that causes pain. Presence of pain reduces movement, deep breathing, and coughing and participation in activity related to hospitalization. This finding is in accordance with Kıy et al. (2022) who conducted " The effect of cold application on pain in patients with chest tubes before deep breathing and coughing exercises: A randomized controlled study" in Turkey, reporting that, chest tube insertion is a painful procedure. The chest tube movement causes pain while breathing, coughing or other procedures that interfere with and delays patient recovery.

Similarly, Wei et al.(2022) who conducted "Randomized controlled trial of an alternative drainage strategy vs. routine chest tube insertion for postoperative pain after thoracoscopic wedge resection" in China, reported that indwelling drainage tubes from chest cavity is one of the leading causes of postoperative pain after thoracic surgery. In addition, Huang et al. (2021) who conducted " Efficacy and safety of omitting chest drains after video-assisted thoracoscopic surgery: a systematic review and meta-analysis" in Denmark, reported that chest drains are associated with severe pain and may affect pulmonary function that leads to infectious complications and prolonged length of stay.

Regarding anxiety, results of the present study showed that the anxiety score in the study and control groups was severe before chest tube removal. This could be a result of severity of pain associated with open heart surgery which is considered one of the most invasive and stressful procedures and related connection as chest tube, fear of unrelieved pain, hospitalization, fear from complication and fear from death. In addition, feeling of pain increases the level of anxiety.

On the same scope, Sajedi-Monfared et al. (2021) who conducted " Cold therapy and respiratory relaxation exercise on pain and anxiety related to chest tube removal: A clinical trial" in Iran, confirmed that the association between cardiorespiratory pain and anxiety can cause feelings of anxiety that, in turn, can increase the sensitivity of the patient to the pain. So, it seems that by controlling pain, anxiety can also be controlled. Also Tareq et al. (2020), who conducted "Effects of Cold Presentation on Pain & Anxiety during Chest Tube Removal among Post-Operative Cardiac Surgery Adult Patients" in Bangladesh, reported that anxiety and discomfort are unpleasant feelings which can result from the pain associated with chest tube.

Concerning physiological parameters after intervention, all vital signs were statistically decreased but within normal rage among study group verses control group. These results illustrated the positive effect of designated nursing intervention on physiological parameters through making patients feel relaxed rather than anxious which decreased the sympathetic effect of pain and anxiety on vital signs. In this respect, Özcan and Karagözoğlu (2020), who conducted "Effects of progressive muscle relaxation exercise, cold application and local anesthesia performed before chest tube removal on pain and comfort levels and vital sings of the patient" in Turkey, emphasized that significant differences were detected between groups in the comparison of respiration, pulse, systolic and diastolic blood pressure values rustling decrease pain and anxiety level after intervention.

Results of Seweid et al. (2021), who conducted "Effect of cold application on incisional pain associated with incentive spirometer after coronary artery bypass graft surgery" in Egypt, demonstrated that all studied patients have normal physiological parameters after cold application. Besides, Kunter and Gezer (2019), who conducted " The effect of cold application before breathing exercises on sternotomy pain: a quasi-experimental study " in

Turkey, confirmed that there were statistical significant differences regarding blood pressure, heart rate and respiration after cold gel packs to reducing pain.

With respect to the severity of the pain after the chest tube was removed, the severity of the pain decreased to mild pain in the study group compared to the control group. However, there was no change in pain score among control group after tube removal. Pain after chest tube removal often caused by pulling of the endothelial tissue adhered to the chest tube can cause pain. Results of this study confirmed the positive effect of the designed nursing care which included cold application, deep breathing technique and hand massage on pain alleviation and improving pain severity.

Nonpharmacological interventions for pain related to chest tube removal include music therapy, aromatherapy, cold application, and other techniques. Cold therapy has a significant short-term analgesic effect for many disorders causing pain as a primary symptom. Results of Chen et al. (2022) - who conducted " Cold application for pain and anxiety reduction following chest tube removal: A systematic review and meta- analysis" in Taiwan- confirmed that the act of removing the chest tube often causes pulling of the endothelial tissue adhered to the chest tube and stimulates intercostal nerves and inflamed pleura, all of which can cause pain. Also cold application is a common Nonpharmacological intervention used to relieve the pain caused by CTR.

Furthermore, Sandhya and Jebarose (2020) - who conducted "Effectiveness of Ice Compress Application upon the Level of Pain among Patients with Chest Drainage" in China - confirmed that the insertion of chest tube causes pain due to damaged intercostal nerves at the incision site and irritation of pleura during catheter placement and removal, so using ice therapy numbs the sensory pain nerve terminals and decreases the conduction of pain. Peripheral application of ice results in vasoconstriction, decreases the blood flow to that particular region, minimizes the production of histamine, serotonin, and bradykinin, and diminishes the severity of inflammation, pain and edema.

Concerning the anxiety scores in the study and the control groups following chest tube removal, it was noted that severity of anxiety is decreased to mild in the study group which received the intervention versus the control group. Therefore, it is recognized that designated nursing care results in a considerable decrease in patients' anxiety associated with removal. Furthermore, as the level of pain decreases, the level of anxiety decreases. In line with the results of the study Nasirnejad et al. (2020) - who conducted " Effect of Rhythmic breathing on the Severity of Pain and Anxiety in Patients after Coronary Artery Bypass Graft: a clinical trial study" in Iran - confirmed that rhythmic breathing, as a distraction method, is used together with other pharmacological and non-pharmacological methods of pain and anxiety management.

5. CONCLUSION

This study demonstrates that cold application, breathing exercise and hand massage are effective techniques to reduce the severity of pain and anxiety during chest tube removal.

6. RECOMMENDATIONS

Applying the cold application combined with breathing exercise and hand massage as a care protocol before CTR for patients of post cardiothoracic surgery, and applying it after surgery as routine and regular care to decrease the severity of pain and anxiety associated with chest tube removal.

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