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Effectiveness of Prehabilitation on Improving Emotional and Clinical Recovery of Patientsundergoning Open Heart Surgeries

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I. Introduction

Cardiovascular diseases (CVDs) are the number one cause of death globally. Many people die each year from CVDs. An estimated 17.9 million people died from CVDs in 2016, representing 31% of all global deaths. More than 75% of deaths occur in low and middle income countries (WHO, 2017). World Health Organization stated that by 2020 cardiac disease will be the number one cause of death worldwide and estimates that 25 million people per year will suffer from heart disease. Cardiac surgery is considered an effective treatment for severe forms of cardiovascular diseases that cannot be treated by medical treatment or cardiac interventions (Tung, 2012).

Although the benefits of cardiac surgery, it is considered a major stressful experience for patient who are candidate for surgery. If patients are not well prepared for this experience, they may develop a range of adverse consequences that can significantly affect their lives (Rief Winfried, 2017). When the individual exposed to stress, the body act to restore the state of stability and maintain human functions, however, if the defense system is low, stressors will break the individual's stability and disturb human body equilibrium (Neuman, 2011).

There are some factors that that have been identified and can contribute to development of poor outcome after cardiac surgery. Physical comorbidities such as hypertension, diabetes, lung diseases, anemia and nutrition in addition to the concurrent cardiac disease contribute to development of deconditioning. (Chakravarthy, 2017). In addition, preoperative stress induces anxiety and depression caused by uncertainty of surgical outcome, pain, fatigue, ICU experience, unfamiliar environment, job loss and financial burdens due to prolonged hospitalization and recovery (Alshvang, 2018; Rief W., 2017).

Prehabilitation can decrease incidence of postoperative complications as it prepares patients for surgical stress through enhancing their defenses to meet the demands of surgery. When patients anticipate the postoperative sequence of events, they will prepare themselves to act certain behaviors, identify their roles and actively participate in their own recovery, therefore, anxiety levels are decreased and functional capacity is enhanced (Alshvang, 2018).

Prehabilitation programs can comprise interventions that include physical exercise, psychological prehabilitation, nutritional optimization and risk factor modification. Physical exercise are associated with improvements in the functioning of the various physiological systems, reflected in increased functional capacity, improved cardiac and respiratory functions and make patients fit for surgical intervention (Banugo P, 2017; Michael McCann 2019).

Prehabilitation programs should also prepare patients psychologically in order to cope with stress, anxiety and depression associated with postoperative pain, fatigue, limited ability to perform the usual activities of daily living through acting in a healthy manner. Although the benefits of psychological preparations, there are limited studies which investigated the effect psychological prehabilitation to confirm its effect on psychological, quality of life and physiological outcomes of patients who had undergone cardiac surgery (Levett, & Grimmett, 2019).

Psychological interventions include providing patients with information about what is expected during perioperative period, correcting misconceptions about cardiac surgery, preoperative preparation, ICU environment, attached equipment and devices and purpose of using them, chest tubes, postoperative pain, pain medications, wound splint, importance of arm and leg exercise, early ambulation, proper nutrition during

recovery period, the expected recovery period, time of return to work and life style modification. These interventions aim to reduce patient's anxiety and increasing the patients' engagement in postoperative rehabilitation (Guo, 2012).

Surgical intensive care nurses can support their patients by conducting preoperative visits, providing continuous and repeated explanations to patients and their families concerning the postoperative sequence of events, orient them to ICU environment, routines and rules and their roles after ICU discharge in order to prevent readmission (Alshavang 2018, Kalogianni 2015)

In this regard, there is a gap in studies investigated the effect of prehabilitation interventions (Sawatzky J, 2014). They focused mainly on improving patients' physical and pulmonary functions; however, there are no standardized protocols for physical prehabilitation for cardiac surgical patients recommended by studies. A systematic review of the effect of prehabilitation on cardiac surgical patients' outcomes conducted by Marmelo, Rocha and Goncalves 2018 revealed the effectiveness of these interventions on improving patients' outcomes. However, there is a diversity in timing, duration, frequency and type of interventions implemented (Marmelo F, 2018).

In addition, there are limited studies on psychological morbidity and prehabilitation, nutritional intervention and risk factor modification in studies of prehabilitation(Alshvang, 2018; Engelman et al., 2019; Furze G, 2009; Levett & Grimmett, 2019). Limited studies produce insufficient evidences confirming the effectiveness of psychological prehabilitation and which interventions are most effective for cardiac surgical patients. Therefore, no standardized interventions available for nurses to prepare patients psychologically for this stressful experience. They are inconsistent in providing information to their patients to support them psychologically. This leads to lack of information provision..

Standardized prehabilitation program is therefore needed. This program that incorporate standardized interventions to optimize patients' mental and functional capacity to be implemented during preoperative period while patients are waiting cardiac surgery is necessary. Given the lack of standardized, multimodal hospital based prehabilitation program to be used by surgical intensive care nurses to prepare their patients while they are waiting for surgery, this study is conducted to investigate the effectiveness prehabilitation interventions both physical and psychological on the physiological and psychological outcomes of patients undergoing cardiac surgery.

The aim of the study

The study aims to determine the effect of prehabilitation interventions on outcomes of patients undergoing cardiac surgeries

Research hypotheses

- Patients undergoing cardiac surgery subjected to the prehabilitation intervention exhibit less anxiety, stress and depressive manifestations than those who are not subjected.
- Patients undergoing cardiac surgery subjected to the prehabilitation intervention exhibit less postoperative complications than those who are not subjected.

Operational definitions:

- **Physical prehabilitation includes** breathing exercise, use of incentive spirometer, coughing, leg exercise and early mobilization.
- **Psychological prehabilitation** includes information about cardiac surgery and perioperative process such as ICU stay and recovery, benefits of mobilization, pain management, post discharge activities and follow up.
- **Psychological outcomes:** these outcomes include level of stress, anxiety and depression using depression, anxiety and stress.
- **Clinical outcomes:** these outcomes include duration of tracheal intubation and mechanical ventilation, complications such as atelectasis, respiratory tract infection, arrhythmia, postoperative pain intensity and the length of ICU and hospital stay.

II. Materials And Method

Materials

Research design:

A quasi experimental research design was used to conduct this study.

Settings:

This study was conducted at the department of cardiothoracic surgery of Alexandria Main University Hospital, and the open heart intensive care unit of the New University Hospital of Alexandria.

Subjects:

A convenience sample of 60 adult patients who were admitted to the cardiothoracic department to undergo elective open heart surgery for valve replacement, coronary artery bypass graft or both constituted the subjects for this study. Patients who were illiterate, hemodynamically unstable and taking anxiolytics were excluded from the study. The sample was equally assigned to two equal groups: group I, the control group (30 patients) and group II, the study group (30 patients). The study sample size was calculated by power analysis using (Epi-Info program), expected frequency=50%, acceptable error=10%, design effect=1, confidence coefficient=95% and power=80%.

Tool

One tool namely emotional, physiological, clinical, cognitive and functional capacity outcomes of prehabilitation intervention assessment tool was utilized to collect the data of this study. This tool was used to assess the patients' responses to prehabilitation intervention. It is consists of one adopted scale, the Arabic version of Depression, anxiety and stress scale (DASS) which was adopted from (Moussa, 2016) to assess the emotional state of patients undergoing elective open heart surgery, in addition to clinical related outcomes which was developed by the researcher after reviewing the related literature to assess the physical and clinical status of patients who had undergone open heart surgery. It includes severity of pain using numerical rating scale, duration of tracheal intubation and mechanical ventilation and incidence of complications such as respiratory tract infection, atelectasis, ARDS, dysrhythmias and myocardial infarction

Method

- An official letter from the Faculty of Nursing was sent to the appropriate authorities.
- An informed consent was obtained from patients. It included the aim of the study, potential benefits, risks and discomforts from participation in this study.
- The anonymity, confidentiality and privacy of responses, voluntary participation and right to withdraw from the study were emphasized before inclusion in the study sample.
- The study tool was developed by the researcher and consists of three parts. Part one of the tool named depression, anxiety and stress scale was adopted from (Moussa, 2016). While part two was developed by the researcher after reviewing the related literature (Jo-Ann V Sawatzky, 2014 ; Minnella, 2017).
- A variance sheet was developed by the researcher after reviewing the related literature in order to identify variances in implementation prehabilitation interventions.
- A booklet titled with دليل الممارسات التأهيلية للمرضى الخاضعين لعمليات القلب المفتوح was developed by the researcher to guide the prehabilitation interventions implemented by the researcher and act as a reference of information for patients subjected to prehabilitation intervention.
- An agreement on the content validity of the booklet was also obtained from the same experts in the field of critical care and emergency nursing, cardiothoracic surgery and nursing education.
- A pilot study was carried out on 6 patients who are scheduled for open heart surgery to test clarity and applicability of the study tool.
- Reliability of the tool was done using Cronbach's alpha test and result was 0.812. This value indicates that the data collection tool is reliable.

Data collection:

- Data were collected by the researcher over a period of 7 consecutive months (from April 2019 to October 2019)
- The list of patients scheduled for surgery within one week was checked to recruit the subjects.
- Data were collected first from the control group and after its completion, it was collected from the study group to prevent the contamination between the control and study group that might affect the study results.

For both groups:

- The bio-demographic data such as age, sex, level of education, occupation, marital status, diagnosis, type of surgery and comorbidities the was obtained and recorded.
- The patients' level of stress, anxiety and depression was assessed for each patient individually and recorded using part II of the tool "Depression, Anxiety and Stress scale (DASS)" three times:
- DASS 1: on admission (baseline).
- DASS 2: on the day before surgery.
- DASS 3: on the second day postoperative.

For the control group

- Patients were left to receive the routine hospital care which includes preoperative information about surgical procedure provided by resident physicians and surgeons.

For the study group

- Patients were subjected to prehabilitaton intervention one week before the elective cardiac surgery. The first session of prehabilitation was implemented on the admission day after assessing patients' level of depression, anxiety and stress. This session taken approximately one hour and included providing verbal explanations guided by the use of written instructions in addition to demonstration of the necessary skills included in the prehabilittion interventions.
- The verbal information provided to patients includes significance of surgery, patients' role in their own recovery, ICU stay, equipment and attached devices and movement in bed and out of bed postoperatively.
- The subsequent sessions of prehabilitation were implemented daily until the day of surgery and included redemonstration and follow up.
- Patients were also informed with the importance of physical prehabilitation. They were trained to perform arm, shoulder and circulation exercises which include e.g exercises, knee exercises and ankle exercises performed three times/day, each time comprises 10 movements.
- Patients received instructions about respiratory muscle training through demonstrating how to practice breathing and coughing exercise and how to use incentive spirometer.
- Patients were provided education about importance of appropriate nutrition in the preoperative period particularly protein and carbohydrate intake and salt restriction in diet and they will resume oral intake postoperatively after extubation in the following order, oral fluids, soft diet and ordinary diet for cardiac patients.
- Patients were instructed to perform exercises daily and compliance to performance is important for effectiveness of interventions.
- The subsequent sessions of prehabilitation included daily interview with patients to assess their performance of exercise, verbalization of new concerns and clarification and correction of any misconceptions regarding open heart surgery.

Outcomes assessment

- The patients' level of depression, anxiety and stress were assessed for both groups in the day before surgery and after 48 hours postoperatively.
- Clinical related outcomes were measured within 48 hrs.postoperatively. It include the highest pain intensity experienced by the patient during the day using numerical rating scale, mean arterial pressure, mean pulse rate, duration of mechanical ventilation and tracheal intubation.
- Functional capacity indicators were assessed which includes timing of mobilization out of bed, timing of first ambulation, frequency and duration of ambulation, ability to perform activities of daily living in term of eating, walking and toileting.

Limitation of the study:

- The small sample size and the data that were collected from only one cardiac unit.
- This study conducted over a period of one week preoperative that limit the identification of the effectiveness of prehabilitation over a period of several weeks before elective cardiac surgery.

III. Results

Table I represents the distribution of the studied groups according to demographic data. Concerning patients' age, this table shows that 56.7% of the study group of patients aged 50+ years while 63.3 % of the control group of patients aged 50+ years. The mean age was 49.10±13.06 and 49.17±12.78 for the study and control group respectively. In relation to sex, this table shows that 63.3% of the study group was males compared to 53.3 % of the control group of patients.

In relation to marital status, this table shows that 86.7% of patients in the study group were married compared to 83.3% of patients in the control group. Regarding presence of children, this table shows that 83.3% have children compared to 93.3% of patients in the control group. Regarding level of education, this table shows that 46.7% of patients in the study group have secondary education. Concerning working condition, this table reveals that 30% of patients in the study group were not working compared to 36.7% of patients in the control group.

Table (I): Frequency distribution of the studied groups according to demographic data

Demographic data		Groups				Test of Significance
		Study (n=30)		Control (n=30)		
		No.	%	No.	%	
Age (years)	20-	2	6.7	3	10.0	X^2= 0.902 P= 0.825
	30-	6	20.0	5	16.7	
	40-	5	16.7	3	10.0	
	50+	17	56.7	19	63.3	
	(M±SD)	49.10±13.06		49.17±12.78		t= 0.021 P= 0.983
Sex	Male	19	63.3	16	53.3	X^2= 0.617 P= 0.432
	Female	11	36.7	11	46.7	
Marital status	Single	4	13.3	2	6.7	X^2= 3.686 P= 0.297
	Married	26	86.7	25	83.3	
	Divorced	0	0.0	2	6.7	
	Widowed	0	0.0	1	3.3	
Presence of children	Yes	25	83.3	28	93.3	X^2= 1.456 P= 0.228
	No	5	16.7	2	6.7	
Level of education	Primary	10	33.3	16	53.3	X^2= 3.795 P= 0.150
	Secondary	14	46.7	7	23.3	
	BSC	6	20.0	7	23.3	
Working condition	Not working	9	30.0	11	36.7	X^2= 0.902 P= 0.924
	Governmental work	4	13.3	4	13.3	
	Private business	4	13.3	3	10.0	
	Day work	8	26.7	9	30.0	
	Retired	5	16.7	3	10.0	

BSC: Bachelor of Science $\mathbf{X^2}$: Chi square test **t**= student t test * Significant p at ≤0.05

Table II represents the **distribution of the studied groups according to clinical data.** Regardingpatients' **diagnosis** and **type of surgery** required, it can be noted from this table that 43.3% of patients in the study group diagnosed with valvular disorder and required valve replacement and 40 % diagnosed with coronary artery disease and required coronary artery bypass graft compared to 46.7% of patients in the control group diagnosed with valvular disorders and required valve replacement and 46.7% diagnosed with coronary artery disease and required coronary artery bypass graft. Concerning previous **surgical history**, this table shows that 73.3% of patients in the study group did not undergo any surgical procedure before compared to 53.3% of patients in the control group.

Table (II): frequency distribution of the studied groups according to clinical data

Clinical data		Groups				Test of Significance
		Study (n=30)		Control (n=30)		
		No.	%	No.	%	
Diagnosis	Coronary artery disease	12	40.0	14	46.7	X^2= 3.858 P= 0.277
	Valve disorders	13	43.3	14	46.7	
	Coronary artery disease & valve disorder	5	16.7	1	3.3	
	Aneurysm & coronary artery disease	0	0.0	1	3.3	
Type of surgery required	CABG	12	40.0	14	46.7	X^2= 3.858 P= 0.277
	Valve replacement	13	43.3	14	46.7	
	CABG & valve replacement	5	16.7	1	3.3	
	Aneurysm repair	0	0.0	1	3.3	
Previous surgical history	Yes	8	26.7	14	46.7	X^2= 2.584 P= 0.108
	No	22	73.3	16	53.3	

$\mathbf{X^{2:}}$Chi square test * Significant p at ≤0.05

Table III represents the **frequency distribution of the mean scores of depression of the studied groups along the study times.** It can be noted from this table that the mean score of depression was10.70 ±3.905 for patients in the study group compared to 10.63 ±4.238 for patients in the control group on patients' admission to cardiothoracic department with no significant difference between the two groups (P= 0.947). in the day before surgery, the mean score of depression decreased to 9.53 ±3.674 among patients in the study group after implementation of prehabilitation interventions and increased to 12.50 ±3.954 among patients in the control group with statistically significant difference between the two groups (P=0.004). A 48 hours after open

heart surgery, the mean score of depression further decreased to 5.87 ±3.748 for patients in the study group compared to 11.67 ±4.381 for patients in the control group with statistically significant difference between the two groups (P=0.000)

Regarding anxiety, this table also representsthe **frequency distribution of the mean scores of anxiety of the studied groups along the study times.** It can be noted from this table that the mean score of depression was 8.67 ±2.733 for patients in the study group compared to 8.10 ±2.310 for patients in the control group on patients' admission to cardiothoracic department with no significant difference between the two groups (P= 0.872). In the day before surgery, the mean score of depression decreased to 7.73 ±2.318 among patients in the study group after implementation of prehabilitation interventions and increased to 10.50 ±2.474 among patients in the control group with statistically significant difference between the two groups (P=0.000). A 48 hours after open heart surgery, the mean score of depression further decreased to 5.10 ±2.264 for patients in the study group compared to 9.27 ±3.342 for patients in the control group with statistically significant difference between the two groups (P=0.000)

In relation to stress, this table illustrates the **frequency distribution of the mean scores of stress of the studied groups along the study times.** It can be noted from this table that the mean score of depression was 13.20 ±2.709 for patients in the study group compared to 12.47 ±3.579 for patients in the control group on patients' admission to cardiothoracic department with no significant difference between the two groups (P= 0.377). In the day before surgery, the mean score of depression decreased to 11.07 ±2.638 among patients in the study group after implementation of prehabilitation interventions and increased to 14.43 ±2.775 among patients in the control group with statistically significant difference between the two groups (P=0.000). A 48 hours after open heart surgery, the mean score of depression further decreased to 7.53 ±2.675 for patients in the study group compared to 12.03 ±4.115 for patients in the control group with statistically significant difference between the two groups (P=0.000).

Table (III) Frequency distribution of the mean scores of depression, anxiety and stress of the studied groups along the study times

Emotional outcomes			**Mean ±SD**		**Test of significance**
			Study (n=30)	**Control (n=30)**	
Depression	**Time of assessment**	**On admission**	10.70 ±3.905	10.63 ±4.238	t= 0.066 P= 0.947
		The day before surgery	9.53 ±3.674	12.50 ±3.954	t= 3.014 P= 0.004*
		48 hours after surgery	5.87 ±3.748	11.67 ±4.381	t= 5.51 P= 0.000*
Anxiety	**Time of assessment**	**On admission**	8.67 ±2.733	8.10 ±2.310	t= 0.872 P= 0.387
		The day before surgery	7.73 ±2.318	10.50 ±2.474	t= 4.475 P= 0.000*
		48 hours after surgery	5.10 ±2.264	9.27 ±3.342	t= 5.658 P= 0.000*
Stress	**Time of assessment**	**On admission**	13.20 ±2.709	12.47 ±3.579	t= 0.891 P= 0.377
		The day before surgery	11.07 ±2.638	14.43 ±2.775	t= 4.807 P= 0.000*
		48 hours after surgery	7.53 ±2.675	12.03 ±4.115	t= 5.022 P= 0.000*

X^2Chi square test **t**= student t test * Significant p at ≤0.05

Table (IV) represents **the frequency distribution of the studied groups according to the highest of postoperative pain intensity. This table shows that** in day one postoperative**,** 50% of patients in the study group described the worst pain experienced as moderate compared to 60% of patients in the control group who reported that the worst pain experienced as severe with significant difference between the two groups (P= 0.001*).

As regard the highest of postoperative pain intensity in day two postoperative, this table depicts that 56.7% of patients in the study group described the worst pain experienced as moderate compared to 60% of patients in the control group who reported that the worst pain experienced as severe with significant difference between the two groups (P= 0.044*).

Table (IV): Frequency distribution of the studied groups according to the highest pain intensity experienced over two consecutive days post cardiac surgery.

Time of assessment	The highest pain intensity	Groups				Test of significance
		Study (n=30)		Control (n=30)		
		No.	%	No.	%	
Day one postoperative	Mild	1	3.3	1	3.3	X^2= 19.561 P= 0.001*
	Moderate	15	50.0	11	36.7	
	Sever	14	46.7	18	60.0	
Day two postoperative	Mild	4	13.3	4	13.3	X^2= 6.240 P= 0.044*
	Moderate	17	56.7	8	26.7	
	Sever	9	30.0	18	60.0	

X^2Chi square test* Significant p at ≤0.05

Table (V) represents the **frequency distribution of the studied groups according to ventilation and oxygenation parameters assessed over two consecutive days post cardiac surgery.**

Concerning **duration of mechanical ventilation**, this table illustrates that the mean duration of mechanical ventilation was 4.70 ±2.914 hours for patients in the study group compared to 6.23 ±4.057 hours for patients in the control group with no significant difference between the two groups (P= 0.098). In relation to postoperative complications, this table illustrates that 100% of patients in the study group did not developed atelectasis compared to 93.3% of patients in the control group, 96.66 of patients in the study and control group did not developed respiratory tract infection, and 86.7% of patients in the study and control group did not developed cardiac dysrhythmias.

Table (V): Frequency distribution of the studied groups according to clinical outcomes

Clinical outcomes			Mean ±SD				Test of significance
			Study (n=30)		Control (n=30)		
Length of ICU stay			2.80 ±0.610		3.47 ±1.456		t= 5.351 P= 0.024*
Length hospital of stay			3.80 ±0.997		5.47 ±1.306		t= 4.940 P= 0.030*
Post-operative complications	Atelectasis	Yes	0	0.0	2	6.66	X^2= 0.341 P= 0.502
		No	30.0	100.0	28	93.33	
	Respiratory tract infection	Yes	1	3.33	1	3.33	X2= ------ P= -------
		No	29	96.66	29	96.66	
	ARDS	Yes	0	0.0	0	0.0	X2= ---- P= -----
		No	30.0	100.0	30.0	100.0	
	Dysrhythmias	Yes – Atrial fibrillation	2	6.7%	3	10.0%	X2= 1.200 P= 0.753
		Yes – Bradycardia	2	6.7%	1	3.3%	
		No	26	86.7%	26	86.7%	
	MI	Yes	0	0.0	0	0.0	X2= ------ P= -------
		No	30.0	100.0	30.0	100.0	

IV. Discussion

Cardiac surgery is a complex intervention that induces higher level of stress that affects patients both physiologically and psychologically, alters the human systems' equilibrium, impairs patients' defenses and ability to tolerate the surgical stress. This in turn can prolong patients' recovery after surgery with development of postoperative complications Marmelo et al (2018). Cardiac prehabilitation includes a range of preventative interventions that can be delivered by nurses to patients undergoing cardiac surgery.

Effect of prehabilitation interventions on psychological status of patients

Psychological factors have an impact on both short and long term physiological and psychological surgical outcomes. Cardiac surgery is a stressful intervention associated with anxiety and depression. Psychological prehabilitation, physical exercise and nutritional education can enhancing patients' defenses and coping skills, reducing stress, anxiety and depression associated with cardiac surgery (L. Levett, & Grimmett, C., 2019; Milliken D).

In relation to **stress**, the present study results revealed that the mean score of stress decreased in the day before surgery from the baseline score on admission in the study group after implementation of prehabilitation interventions and increased in the control group. A 48 hours postoperatively, the mean score of stress significantly decreased in the study group. However, in the control group, the mean score of stress remained close to baseline stress score.

As regard to **anxiety**, the present study results revealed that the mean score of anxiety also decreased in the day before surgery from the baseline score on admission in the study group after implementation of prehabilitation interventions and increased in the control group. A 48 hours postoperatively, the mean score of anxiety significantly decreased in the study group. In the control group, the mean score of anxiety decreased from the day before surgery but remained higher than the baseline score.

Regarding **depression**, the present study results showed that the mean score of depression decreased in the day before surgery from the baseline score on admission in the study group after implementation of prehabilitation interventions and increased in the control group. A 48 hours postoperatively, the mean score of depression further decreased significantly in the study group. However, in the control group, the mean score of depression also decreased from the day before surgery but it was higher than the baseline score indicating that patients in the control group were depressed postoperatively than preoperatively.

Stressors identified from patients questions include concerns related to the **surgical procedure** such as the scene of the operating theater, sternotomy, how the sternal wound heal again inside the sutured skin, being sedated for long time postoperatively, concerns related to **ICU environment** such as who are going to assist them in absence of family members. Their ability to practice certain behaviors postoperatively such as moving out of bed, fear of severe pain, practicing breathing exercise and using incentive spirometer in the presence of sternal wound, ability to perform daily living activities post discharge such as walking, going outdoors, caring for child and when they will return to work. Lastly, concerns about the outcomes of surgery such as fear of death, prolonged recovery that affects their ability to return to work and financial issues.

The finding of this study regarding reduction of depression, anxiety and stress scores in the study group may be attributed to the effect of psychological interventions started by first identifying major sources of patients' stress, provokes of anxiety and depressionby the researchers in addition to assessing patients' needs assessment is essential before starting any educational program. The researcher actively listened to patients' main concerns, fears regarding their surgeries and frequently asked questions by patients and provided information and explanations based on the individual patient's needs and answers to questions.

The current study findings are similar to the findings of McHugh et al (2001), Ali et al. (2019), Gou et al. (2012), and Kalogianni et al. (2015) who reported decrease in depression and anxiety by the effect of educational intervention in patients undergoing cardiac surgery. As well Furze et al. (2009) reported significant reduction of depression and cardiac misconceptions in patients undergoing bypass surgery provided a patient's booklet covering cardiac myths and misconceptions, reducing risk factors, and what to expect during the hospital stay and subsequent recovery period.

Contrary to the current findings, Goodman et al.(2008) and Arthur et al. (2000) reported that preoperative preparations and the nurse-led interventions including lifestyle counseling and preparation for surgery did not reduce anxiety prior to elective coronary artery bypass surgery.

The effect of prehabilitation interventions on physiological and clinical outcomes

Emotional state of patients who are waiting cardiac surgery can negatively affects physiological parameters; increase blood pressure, pulse rate and respiratory rate (Bahrami, 2013), increase pain perception, prolong duration of mechanical ventilation and contribute to development of postoperative complications. Prehabilitation interventions have been associated with improved physiological functions, stabilization of vital signs, and decreased duration of mechanical ventilation.

In relation to **mechanical ventilation**, the result of this study revealed that although there was no significant difference, the duration of mechanical ventilation decreased among patients in the study group.

The results of this study is similar to Sobrinho et al (2014) et al and the systemic review of Marmelo et al (2018) who documented decrease in mechanical ventilation time but without significance between the study and control groups of patients undergoing myocardial revascularization subjected to preoperative respiratory therapy. In addition, Tung et al (2012) documented those patients in the study group subjected to preoperative individualized exercise before cardiac surgery used a non-invasive ventilator less frequently than those in the control group.

Contrary to the result of this study, Kalogianni et al (2015) reported that preoperative education of patients undergoing cardiac surgery did not reduce the duration of intubation in the ICU.

The result of this study revealed that the mean severity of **postoperative pain** was significantly lower in the study than the control group. In addition, most of patients in the study group reported experience of moderate pain in comparison to patients in the control group who reported experience of severe pain both in the

first and second day postoperative. This can be related to control of psychological factors that can affect pain experience such as anxiety and depression through enhancing patients' self-efficacy, encouraging optimism and practicing adaptive behaviors before and after surgery.

The result of this study is similar to the finding reported by the Nielsen et al. (2010) and Topp et al. (2009) who reported improved postoperative pain in groups subjected to prehabilitation but in patients who undergone spinal surgery and total knee arthroplasty.

Contradictory to the result of this study, Shuldham et al (2002) and Watt-Watson et al. (2004) reported absence of significant difference between the study and control group of patients subjected to pre-operative education before coronary artery bypass graft surgery

In relation to **length of ICU and hospital stay**, the present study revealed that length of stay the study group decreased significantly in the study group when compared to the control group. This may be related to rapid stabilization of patients' condition and improved outcomes in the study in comparison to the control group which reflected improved patients psychological status which contributed to stabilization of patients' clinical condition and rapid restoration of functional capacity evidenced by early mobilization, increased frequency of ambulation and independency. Compliance to health behaviors may be another cause of improved patients outcomes and early discharge.

Results of the current study are supported by Arthur et al. (2000) and Marmelo et al (2018) who reported that prehabilitation reduced in the length of ICU and hospital stay and improved of functional capacities in patients undergoing non-urgent cardiovascular surgical intervention. Similar findings reported Nardi et al (2019) increased SaO_2 values and reduced postoperative length of in-hospital stay in patients undergoing elective cardiac surgery and subjected to preoperative respiratory physiotherapy and motor exercise.

The result of this study is in contradiction withSawatzky et al (2014) . They reported that there was no difference in the length of hospital stay between the control group and prehabilitation group of patients undergoing elective coronary bypass graft. Sørlie et al. (2007) and Sobrinho et al. (2014) also reported no significant difference in in length of ICU stay among patients undergoing myocardial revascularization subjected to preoperative respiratory therapy.

Effect of prehabilitation on occurrence of postoperative complications

The result of this study revealed that there was no significant difference between the study and the control group in relation to postoperative complications.

The result of this study is in contradiction with Valkenet et al. (2017) and Marmelo et al. (2018) who reported decreased postoperative complications in patients subjected to pre-operative home-based inspiratory muscle training program.

Cardiac prehabilitation is a multimodal strategy that can effectively enhance cardiac patients' defenses to deal with physical and psychological stress of surgical intervention. Nurses have vital role in multidisciplinary tem caring for patients scheduled for elective cardiac surgery through providing care based on individual patient's needs and concerns.

Providing psychological support through informing patients what is expected before and after surgery, providing adequate answers to patients' questions can effectively reduce patients stress and therefore, alleviate anxiety and depression associated with the surgical experience. Promoting physical fitness through demonstrating exercise, respiratory muscle training reduce incidence of complications and support patients' prognosis. Nutritional education and counseling can also support patients' positive outcomes. Therefore, this study was conducted to determine the effect of prehabilitation interventions on outcomes of patients undergoing cardiac surgery.

V. Conclusion And Recommendations

Cardiac prehabilitation in the form of providing information about surgery, circulation exercise, deep breathing exercise, incentive spirometer training and nutritional education implemented daily by patients scheduled for elective open heart surgery one week before surgery have been shown to improve patients' emotional state, physiological and clinical outcomes.

VI. Recommendations

Based on the result of this study, it can be recommended that surgical intensive care nurses should conduct a baseline psychological assessment for patients who are scheduled for elective open heart surgery. They are also required to provide specialized patients' multimodal prehabilitation interventions that are tailored to the patients' needs and abilities.Additionly, establishing an effective nurse patient interaction is an important prerequisite for the acceptance and compliance of patients waiting cardiac surgery with the prehabilitation interventions provided by nurses. Regarding future research, replication of this study on a larger sample is needed to allow generalization of the finding, evaluation of the effect of prehabilitation interventions

implemented before hospital admission. Investigation of the effect of using other measures to relief anxiety; reduce stress and depression such as massage, guided imagery and distraction is also recommended.

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