Effect of Early Ambulation Program on Selected Outcomes among Patients Undergoing Cardiac Surgery

Fatma Abdelaziz Mohammed 1, Fatma Shoeib Ali 2

1-Lecturer of Critical Care and Emergency Nursing, Faculty of Nursing -Cairo University

2- Assistant Professor of Critical Care and Emergency Nursing, Faculty of Nursing -Cairo University

Abstract

Background: Early mobilization appears to be important to prevent postoperative complications, improve functional capacity, and reduce the length of hospital stay in patients after cardiac surgery. **Aim of the study:** the aim of the current study is to evaluate the effect of early ambulation program on selected outcomes among patients undergoing cardiac surgery. **Research Design:** A quasi-experimental study with one group pre-test and post-test design was utilized in this study. **Setting:** The study was carried out at the cardiothoracic intensive care unit at a private hospital, in Egypt. **Sample:** A purposive sample consisting of 30 patients who underwent cardiac surgery was included in the current study. **Tools of data collection:** Two tools were used to collect data pertinent to the current study: Tool I -Cardiac surgery patients' ambulation assessment sheet, Tool II -Borg scale (Rate of Perceived Dyspnea. **Results:** 43.3% of them were overweight, with a mean ejection fraction of 54.74± 13.37. Post- coronary artery bypass grafting (GABG) with 3 grafts, post-CABG with 4 grafts, and aortic valve replacement were the most frequent medical diagnoses among the studied sample in percentages of 30%, 30%, and 16.7% respectively, there is a significant negative correlation between the Borg scale and distance walked (r=-.483, P= 0.007) at the first assessment time, there is a significant negative correlation between the Borg scale and oxygen saturation (r=-.477, P= 0.008) at the second assessment time. However, there is no significant negative correlation between distance walked, Borg scale, and HR. There is a significant negative correlation between the Borg scale and distance walked (r=-.600, P= .000) at the third assessment time. A highly significant statistical difference between the means of Borg scale, distance walked, and oxygen saturation in the different assessment times. **Conclusion:** The early ambulation program improved functional capacity and hemodynamic parameters among patients undergoing cardiac surgery, the current study findings supported the research hypotheses. **Recommendations:** Based upon findings of the current study, the following are recommended: Used the early ambulation program with the 6-minute walk test (6-MWT) should be held periodically for such group of patients to improve their outcomes. Replication of the same study on larger probability samples at different geographical locations for data generalization.

Keywords: early ambulation -program -6-minute walk test - cardiac surgery

Introduction:

Cardiac surgery is a well-established procedure worldwide due to its safety and effectiveness in treating cardiac patients. The coronary artery bypass grafting (CABG) and valvar replacement are two heart surgery procedures to emphasize **(Smeltzer, Bare, Hinkle, et al.: Brunner and Suddarth's, 2010)**. Patients with ischemic heart disease may benefit from CABG which is regarded as an effective alternative **(Hillis. et al, 2011)**. However, because of improvements in methods and materials that have led to safer practices, it has been the most effective treatment. Despite these developments, postoperative complications are still common, a major cause of hospital stays, and a factor in the severity of functional recovery. In research including 204 heart surgery patients, 58% of the patients experienced some sort of postoperative complication, including pulmonary (31%), cardiac (15.8%), and neurological (13.9%) problems. According to Ribeiro et al., pulmonary problems are one of the main causes of the 8% global death rate.

The key to preventing it is early mobilization and respiratory physiotherapy **(Ramrez et al., 2019)**.

One of the post-operative criteria is bed rest, however muscular weakness may still appear. Because the patients' survival is their first priority, critical care nurses should encourage cardiac surgery patients' mobility through proper movement and exercise caution when assisting patients to get out of bed to avoid disconnecting lines, drains, and catheters **(Ahmed, 2019)**.

Patients undergoing heart surgery are often immobilized due to the extensive operation, which causes a number of problems. Recent advancements in the application of evidence-based early mobilization and individualized exercise have been concentrated on enhancing patients' physiological status, such as pain, hemodynamic stability, and oxygenation, as opposed to psychological outcomes, such as reducing symptoms of restlessness, anxiety, and depression **(Nachiyunde and Lam, 2018).**

Early ambulation is advised as an adjuvant therapy for cardiac surgery (CS) patients up to the third postoperative day (PO) while still in the intensive care unit to assist reduce pulmonary and circulatory complications.

Physiotherapy treatment is often prescribed to patients undergoing cardiac surgery, in order to prevent or diminish postoperative complications. The physiotherapy treatment during the hospital stay generally consists of early mobilization, range of motion exercises and breathing exercises. The value of postoperative chest physiotherapy has recently been established and accepted **(Herdy, 2008)**.

Exercises in breathing therapy have been used successfully as a treatment for heart surgery patients. These exercises are intended to decrease the risk of postoperative pulmonary problems, functional capacity impairment, and length of hospital stay due to changed pulmonary function in the early postoperative period **(Urell, Emter, Hedenstrom, 2016).**

There are systematic reviews on both preoperative techniques and breathing therapy combined with physical exercises that confirm the beneficial effect on functional capacity, decreased postoperative pulmonary complications, and length of hospital stay after cardiac surgery. Preoperative exercises have been shown to be effective in reducing postoperative complications **(Hulzebus, Smit, PHelders, et al., 2012).** Another systematic analysis found no evidence to support the idea that preoperative exercise alone is related to better cardiac surgery outcomes **(Kehler, Stamers, Tangri, et al., 2017).** However, it appears that breathing therapy using just inspiratory muscle training is effective in reducing postoperative pulmonary problems following cardiac surgery **(Karanfil, Moller, 2018).**

As a member of the medical team, critical care nurses have reportedly advanced early ambulation **(Moghadam, 2017).** In recent years, early ambulation after cardiac surgery in ICUs has become an intriguing and

appealing subject for nurses **(Hodgson, Capell, & Tipping, 2018).** It is a frequent, crucial nursing task that is frequently carried out in a critical care situation **(Anchala, 2016).** Early ambulation for cardiac surgery patients is therefore a crucial and essential role for critical care nurses **(Dafoe, Stiller, & Chapman, 2015).**

Significance of the study:

Patients undergoing cardiac surgery are often more unstable than those undergoing other types of surgery because of intraoperative and cardiac manipulation **(Tariq, et al, 2017).** Following surgery, patients are brought with a variety of tubes and lines into the cardiothoracic ICU. They usually receive bed rest as part of their routine postoperative care. Because bed rest does not considerably improve the conditions of such patients, this opinion is not backed by any facts **(Brustia,et al, 2018).**

For postoperative recovery to be centered on retaining functional capacity and to improve Quality of Life (QOL), physical and mental health are essential. Peak oxygen consumption as measured by symptom-limited cardiopulmonary exercise testing (CPET)is the gold standard for evaluating functional capacity. CPET still needs specialized equipment for gas analysis and personnel training, despite being the method of evaluating functional capacity that is most frequently accepted. Safety during testing must also be carefully examined. The 6-MWT might be a good choice because early mobilization protocols are essential nursing considerations for seriously ill patients recovering from heart surgery. According to multiple studies, early ambulation directly contributed to a shorter hospital stay and fewer postoperative issues **(Morris. et a, 2008).**

Operational definitions:

- **Selected hemodynamic parameters:** It refers to the parameters that were assessed in the current study which include heart rate, blood pressure, and oxygen saturation, these were measured by the cardiac surgery patients' ambulation assessment sheet (tool 1).
- **Functional capacity:** It refers to the dyspnea, fatigue, or exertion during exercise, this was measured by the Borg scale (Rate of Perceived Dyspnea (tool 2).
- **Types of cardiac surgery:** It refers to the different cardiac surgery which provided for cardiac patients such as coronary artery bypass grafting (GABG), mitral valve replacement (MVR).
- **Early ambulation program:** It refers to implementing of the early ambulation program utilizing the 6-minute walk test (6-MWT).

Subjects and Method:

Aim: The aim of the current study is to evaluate the effect of early ambulation program on selected outcomes among patients undergoing cardiac surgery.

Research Design: A quasi-experimental study with one group pre-test and post-test design was utilized in this study.

Research hypotheses: To achieve the aim of the current study. The following research hypotheses were formulated:

H.1. Post-cardiac surgery patients who will receive the early ambulation program will have a high total mean score functional capacity as compared to their preoperative assessment.

H.2. Post-cardiac surgery patients who will receive the early ambulation program will have stable hemodynamic parameters compared to their preoperative assessment.

Setting: The study was carried out at the cardiothoracic intensive care unit at a private hospital, in Egypt. This unit consists of three rooms, each room contains 4 beds, that received cardiac patients from different places. The researchers selected this setting because its well-equipped ICU with high tech devices, and contains large corridor that allowed to perform the early ambulation program.

Sample: A purposive sample consisting of 30 patients who underwent cardiac surgery and have met the inclusion criteria were included in the current study, within three months.

Inclusion criteria: Patients of both gender, age range from 18 - 60 years. hemodynamically stable with or without the use of positive inotropic drugs. Had no arrhythmias, and/or angina, underwent all different types of cardiac surgery, heart rate (HR) 60≤ HR ≤ 100 bpm without respiratory distress, and a respiratory rate (RR) ≤ 20 without signs of infection.

Exclusion criteria: Patients with previous pulmonary disease and acute lung disease; mechanical ventilation >24 hours: left ventricular ejection fraction (LVEF) <35% or >54: unstable angina. HR > 120 bpm at rest, and systolic blood pressure> 180 mmHg or diastolic > I00 mmHg; surgical re-intervention: and orthopedic impairments were excluded from this study.

Tools of data collection:
Two tools used to collect data pertinent to the current study:

Tool I: Cardiac surgery patients' ambulation assessment sheet: This tool was developed by the researcher. It involves two parts: Part one: Patients' demographic data such as age, gender, diagnosis, comorbidities, date of surgery, height. weight, BM, and smoking habit. Part two: Patients' baseline hemodynamic parameters, second, and third assessment variables such as heart rate, blood pressure, and SaO2%.

Tool II: Borg scale (Rate of Perceived Dyspnea): This scale was developed by **Gunnar Borg (1998).** It allows individuals to subjectively rate their level of exertion during exercise or exercise testing **(American College of Sports Medicine. 2010).** It is, a rating I category-ratio scale ranging from 0 to 10. It asks patients to rate the difficulty of breathing. It starts at number 0 where breathing is causing no difficulty at all and progresses through to number 10 where breathing difficulty is maximal.

The original Borg scale or category scale (6 to 20 scale), and the revised category–ratio (0 to 10 scale) the original scale was developed in healthy Individuals 10 correlate with exercise heart rates (e.g... RPE 15 would approximate a HR of 150 bpm), and 10 enable subjects 10 to better understand terminology **(Borg. 1982).** The

category ratio scale was later developed and has since also been modified to more specifically record symptomatic breathlessness (Modified Borg Dyspnea Scale), RPE scales are particularly valuable when HR measures of exercise intensity are inaccurate or dampened. such as in patients on beta-blocker medication. This is due to the scale's ability to capture the perceived exertion from central cardiovascular. Respiratory and central nervous system functions **(Borg, 1982).**

Tools validity and reliability:

The 6-min walking test: The 6-minute walk is a valid and reliable method of assessing functional ability in a Phase II/III cardiac rehabilitation population **(Hamilton& Haennel, 2000).** Moreover, it is a predictor of mortality and has shown high sensitivity for predicting functional capacity among post CABG surgery patients. Borg scale (Rate of Perceived Dyspnea) is a widely used and reliable indicator to monitor and guide exercise intensity **(A M Li, et al, 2005).** Cronbach alpha test for Borg scale was (0.86).

Pilot study: A pilot study was done on 6 patients (10%) of the sample to test clarity, applicability and to estimate the needed time to complete the data collection tools.

Protection of human rights:

Official agreements to carry out the present study were obtained from the head of the cardiothoracic intensive care unit, as well as agreements and written consents were obtained from patients after they are informing about the purpose and nature of the study. Each patient was informed that the participation is a volunteer and has the right to withdraw from the study at any time without any rationale. Obtained data were used only for research purposes, patients were informed that data will not be included in any further research without another new consent. confidentiality and anonymity of each subject were assured through the coding of all data.

Procedure:

The current study was carried out through two phases: preparation, and implementation.

1- **Preparation phase:**

Conduction of the current study started with an extensive literature review, selection and preparation of the data collection tools, and obtaining managerial agreements to carry out the study.

2-**Implementation phase:**

Once official permissions were granted, the actual implementation of the study was started. This phase consisted of three sessions, during the first session the researchers visited the selected ICU on daily basis to enroll patients who meet the inclusion criteria. Then, the researchers conducted the individual interviews with the patients on the day before surgery, patients who agreed to take part in the study were informed of its goals and scope, and written consent was acquired, these interviews were conducted in patient's department that takes around 1 hour, when they were able to move, at which point the patients were questioned about their capacity to move and walk, After completing the procedure checklist, which included setting up the necessary tools like an oxygen source, sphygmomanometer, pulse oximeter with a

clip to attach to the patient, countdown timer or stopwatch, a chair that is simple to move along the walking course, and a worksheet on a clipboard.

The researchers began the 6-MWT procedure. Patients were told to take all of their regular medications, dress comfortably, and utilize their regular mobility aids (canes, walkers) during the test. Then obtaining baseline hemodynamic variables were done, patients with the following conditions underwent the procedure: resting heart rate> 120 beats/min after 10 minutes rest (relative contraindication): systolic blood pressure> 180 mm Hg /- diastolic blood pressure> 100 mm Hg (relative contraindication); resting Sp02 < 85% intolerable dyspnea, unrelieved by rest; persistent Sp02 <85% (note: pending clinical presentation), abnormal gait pattern (leg cramps. staggering, ataxia).

Before moving the patients relaxed in a chair near to the starting position for at least ten minutes before the test started. The Borg dyspnea scale (RP'D) was used by the patients to rate their baseline dyspnea and overall weariness before the researchers took their pulse and blood pressure and began the paperwork. The baseline heart rate and oxygen saturation are determined and recorded using the pulse oximeter (SpO2). The patients were told that the goal of the test was to walk as far as they could for six minutes. Then they were told to go as far as they could along a level, straight hospital corridor. Patients were permitted to slow down, stop, and rest as necessary if they felt any symptoms throughout the test, such as angina, severe dyspnea, disorientation, or musculoskeletal discomfort. When they can walk again, they will, but for now they can only rest by leaning against the wall. The researchers offered supportive comments and let the patient know that he or she could lean against the wall and restart walking whenever they felt secure if the patient stopped walking throughout the test and needed to rest. The researchers stopped the walk, brought a chair over for the patient to sit in, and noted on the worksheet the time the patient stopped and the reason they were unable to continue if they did so before the six minutes were over. The entire distance walked was computed and recorded. Regarding the second session, it was conducted in the second postoperative day, and the third session was conducted before patients were discharged, theses sessions were provided during the ICU stay, the researchers repeated the previous steps of the first session, each one takes 50-60 min. The data were collected between January 2021 to March 2021.

Statistical analysis:

In order to use the data for statistical analysis, they were translated into a computer-feedable format and coded. The data were analyzed using the statistical package for social sciences (SPSS) version 26. Additionally, tables and graphs were used to show the findings. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations, T- Test was used for compares the actual difference between two means in relation to the variation in the data, Pearson correlation test, one-way ANOVA were used.

Results:

Table (1): shows that, (80%) of the studied sample were male, with a mean age of 53.66 ±10.78; however, (60%) of the studied sample were not smokers. However, 43.3% of them were overweight, with a mean ejection fraction of 54.74± 13.37.

Figure (1): clarifies that, post-CABG with 3 grafts, post-GABG with 4 grafts, aortic valve replacement were the most frequent medical diagnoses among the studied sample in percentages of 30%, 30 %, 16.7% respectively.

Figure (2): illustrates that, the comorbidities among the studied sample were diabetes, diabetes with hypertension, and hypertension with ischemic heart disease, in percentages of 26.7%, 16.7%, and 10%, respectively. However, (33.3%) of them have no comorbidities diseases.

Table (2): shows that, (40%) of the studied sample had slight dyspnea in the baseline assessment, and (43.3%) had severe dyspnea in the second assessment; however, (36.7 %) had slight dyspnea during the third assessment time.

Table (3): indicates that, (43.3%) of the studied sample had walked for 12 m distance during the third assessment (before discharge) compared to (3.3%) in the first assessment (baseline), and the mean was increased from (9.033±1.86 to 10.26± 2.391), (93.3%) had walked without assistive device. (83.3%) of the studied sample didn't receive analgesic medication before the ambulation during the third assessment time.

Table (4): reveals that, there is a significant negative correlation between the Borg scale and distance walked (r=-.483, P= 0.007) at the first assessment time.

Table (5): represents that, there is a significant negative correlation between the Borg scale and oxygen saturation (r=-.477, P= 0.008) at the second assessment time. However, there is no significant negative correlation between distance walked, Borg scale, and HR.

Table (6): reveals that, there is a significant negative correlation between the Borg scale and distance walked (r=-.600, P= .000) at the third assessment time.

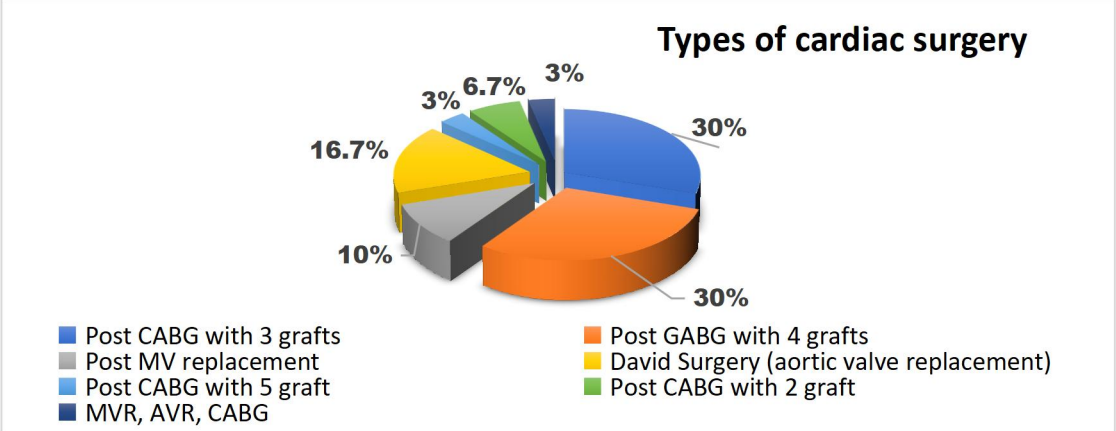
Table (7): clarifies that, a highly significant statistical difference between the means of Borg scale, distance walked, and oxygen saturation in the different assessment times.

Table (1): Frequency Distribution of The Studied Sample as Regards to Demographic and Medical Data.

Variables	N	%
Gender		
Male	24	80
Female	6	20
ICU stays		
Less than 1 week	30	100
Smoking		
Yes	12	40
No	18	60
BMI*(Kg/m2)		
18.5- 24.9 (Healthy Weight)	8	26.7
25-29.9 (Over Weight)	13	43.3
30-Above (Obesity)	9	30
Age X ± SD	53.66 ±10.78	
EF* X ± SD	54.74± 13.37	

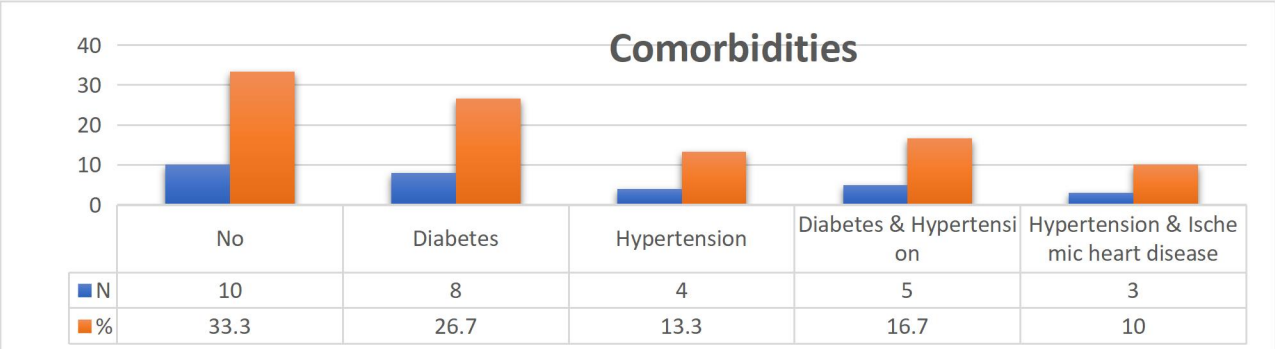
BMI*=body mass index (kilogram on meter square) EF*= Ejection fraction

Figure (1): Percentage Distribution of The Studied Sample as Regards to the Type of Cardiac Surgery.



NB – Responses are not mutually exclusive.

Figure (2): Percentage Distribution of The Studied Sample as Regards to Comorbidities.



NB – Responses are not mutually exclusive.

Table (2): Frequency Distribution of the Studied Sample as Regards to Borg Scale at Different Assessment Times.

Variables	**1st assessment Baseline (Before surgery)**		**2nd assessment (Second day of surgery)**		**3rd assessment (Before discharge)**	
	N	%	N	%	N	%
Borg scale						
Nothing at all (0)	1	3.3				
Slight (1)	12	40			11	36.7
Moderate (2)	3	10	4	13.3	10	33.3
Somewhat Sever (3)	7	23	5	16.8	5	16.7
Sever (4)	3	10	13	43.3	3	10
Very severe (5)	4	13	8	26.7	1	3.3
X ± SD	3.33 ±1.58		4.90 ±1.09		3.10±1.12	

Table (3): Frequency Distribution of the Studied Sample as Regards to the 6-min Walking Test (6MWT) at Different Assessment Times.

Variables	**1st assessment Baseline (Before surgery)**		**2nd assessment (Second day of surgery)**		**3rd assessment (Before discharge)**	
	N	%	N	%	N	%
Distance walked in meter						
4 m					1	3.3
5 m	1	3.3				
6 m	6	20	4	13.3	4	13.3
8 m	1	3.3%				
10 m	21	70%	21	70	11	36.7
12 m	1	3.3%	4	13	13	43.3
14 m			1	3.3	1	3.3
X ± SD	9.033±1.86		9.86±1.81		10.26± 2.391	
Walked with Assistive device						
Yes	2	6.7	2	6.7	3	10
No	28	93.3	28	93.3	27	90
Received medication (Medication group)						
Yes, analgesic medication			7	23.3	5	16.7
No	30	100	23	76.7	25	83.3
(Medication frequency)						
No	30	100	23	76.7	25	83.3
Once			6	20	5	16.7
PRN			1	3.3		
Received supplemental oxygen						
Yes, nasal low flow O2	3	10			2	6.7
No	27	90	30	100	28	93.3
Stopped during ambulation						
No	25	83.3	19	63.3	28	93.3
Yes (Couse of stopping)						
Cough	2	6.7	4	13.3		
Chest Pain	2	6.7	6	20	1	3.3
Dyspnea	1	3.3	1	3.3		
Fatigue					1	3.3
Symptoms at end of the exercise						
No	28	93.3	24	80	27	90
Angina	1	3.3	1	3.3		
Dizziness	1	3.3	3	1	2	6.7
Chest pain			2	6.7	1	3.3

Table (4): Correlation Between Borg Scale, Distance Walked, and Selected Hemodynamic Parameter During the First Assessment.

Variables		Borg scale	Distance walked	HR	BP
Distance walked	r	-.483			
	p	0.007**			
HR	r	.255	-.197		
	p	.174	.298		
BP	r	.361	-.170	.057	
	p	.050	.368	.765	
SaO2	r	-281	.289	-.044	.000
	p	.132	.121	.818	.999

** Correlation is significant at p≤ 0.01.

Table (5): Correlation Between Borg Scale, Distance Walked, and Selected Hemodynamic Parameter During the Second Assessment.

Variables		Borg scale	Distance walked	HR	BP
Distance walked	r	-0.283			
	P	0.130			
HR	r	.239	-0.93		
	P	.203	.624		
BP	r	.308	-.277	.176	
	P	.098	.139	.353	
SaO2	r	-.477	-.048	-.089	.069
	P	0.008**	.799	.0641	.717

** Correlation is significant at p≤ 0.01.

Table (6): Correlation Between Borg Scale, Distance Walked, and Selected Hemodynamic Parameter During the Third Assessment.

Variables		Borg scale	Distance walked	HR	BP
Distance walked	r	-.600			
	P	.000**			
HR	r	.057	-.273		
	P	.766	.145		
BP	r	-.033	0.72	.044	
	P	.861	.704	.814	
SaO2	r	-.420	.194	0.67	.248
	P	.021	.304	.723	.187

** Correlation is significant at p≤ 0.01.

Table (7): One-way ANOVA for Selected Hemodynamic Variables at Different Assessments Times.

Time of assessment / Variables	1st assessment Baseline (Before surgery)	2nd assessment (Second day of surgery)	3rd assessment (Before discharge)	*F*	*P*
Borg scale X ± SD	3.33± 1.58	4.83 ± 0.98	3.10 ±1.12	16.79	.000***
Distance walked X ± SD	9.03 ± 1.861	9.86 ±1.81	3.10 ±1.12	152.4	.000***
HR X ± SD	94.46± 8.40	94.86 ± 12.33	97.16 ±9.47	.611	.545
BP X ± SD	116.72±12.57	114.40±13.13	111.33±11.18	1.44	.241
SaO2 X ± SD	95.83±2.11	94.43±1.67	96.13±1.85	6.91	.002***

***A highly significant statistic difference at P= ≤0.005

Discussion:

Postoperatively, cardiac surgery patients (CSPs) frequently have low cardiovascular reserves **(Moreno-Lacalle,2016).** Postoperative care for CSPs is an essential and prompt component of a complete health strategy **(Anchala, 2016).** According to **Stephens & Whitman (2015),** the burden hemodynamic is the most important marker in the initial postoperative period. The primary concern to maintain hemodynamic stability and appropriate organ perfusion is CCNs' understanding of early ambulation value for CSPs' outcomes **(Anchala, 2016).**

In the last years, the 6-MWT has become one of the most popular clinical exercise tests for evaluating functional capacity. It is a practical, simple, and inexpensive test, and does not require any exercise equipment or advanced training for technicians. The test has close similarities to activities of daily living and can be performed by many elderlies, frail, and severely limited patients who could not be evaluated by standard maximal symptom-limited exercise tests, as are cardiac patients after recent major surgery. The test is widely employed in cardiac rehabilitation in various categories of patients (after cardiac surgery, after myocardial infarction, chronic heart failure), both as a functional status indicator and as an outcome measure.

The current study revealed that, the majority of the studied sample were males, with a mean age of 53.66 ±10.78, as regards the type of cardiac surgery it was shown that most of the studied sample underwent coronary artery bypass graft (CABG) and the rest underwent valve replacement, this finding is in concordance with that of

Claudia F., et al, (2007), who studied the 6-min walking test early after cardiac surgery, reference values and the effects of rehabilitation program, and found that, (70% males, mean age 64 - 10 years), cardiac surgery (67% coronary artery bypass graft (CABG), 25% valve replacement, 4% both, 4% other). This from the researcher's point of view it might be due to despite the fact that cardiovascular disease (CVD) is the leading cause of mortality globally, there are significant differences between men and women. Men are more likely than women to develop coronary heart disease (CHD) and CVD at a younger age.

Regarding measuring BMI, the current study demonstrated that 43.3% of the studied sample were overweight, this finding is in agreement with that of **Hamzah, Hassan, Aboud, (2016)** who studied six-minute walk distance after coronary artery bypass graft surgery, and found that, most of the patients overweight with the highest percentage is 13 (43.0%) in the study group and 12 (40%) in the control group. This from the researcher's point of view it might be caused by increased body weight causes high blood pressure, which is a risk factor for heart attack, and lead to impairment of the coronary artery disease. Increased body weight is also linked to high cholesterol, specifically high triglycerides and low HDL ("good" cholesterol), which plays a key role in heart disease.

Moreover, the current study illustrated that, the comorbidities among the studied sample were diabetes, diabetes with hypertension, and hypertension with ischemic heart disease, and with a mean ejection fraction of 54.74± 13.37, this finding is in concordance with that of **Claudia F., et al, (2007),** who studied the 6-min walking test early after cardiac surgery. Reference values and the effects of rehabilitation program, and found that more than 20% had comorbidities such as diabetes, and approximately half had left ventricular EF 50%.

Furthermore, the current study revealed that, more than one third of the studied sample had walked for 12 m distance during the third assessment (before discharge) compared to (3.3%) in the first assessment (baseline), and the mean was increased from (9.033±1.86 to 10.26± 2.391), this finding is in agreement with **Zanini, et al, (2019),** who studied the effects of different rehabilitation protocols in inpatient cardiac rehabilitation after coronary artery bypass graft surgery, mentioned that the 6-min walk distance on postoperative day 6 was significantly higher in groups that included exercise training, remaining higher at 30 d post-discharge ($p < .001$ between groups). Also, this finding is confirmed by **Dolecińska, Przywarska, Podgórski, Dylewicz, Lewandowski, (2020),** who studied the use of the six-minute walk test in exercise prescription in male patients after coronary artery bypass surgery and found that The 6-MWT distance increased from 420 ±80 m to 519 ±61 m ($p < 0.001$), and the energy expenditure from 4.4 ±1.4 MET to 6.3 ±1.3 MET ($p < 0.001$). This from the researcher's point of view it might be as a result of decrease the feeling of pain and discomfort at the day of discharge.

In this regard, the previous finding is contradicted by **Radi, et al (2021)** studied determinants and prediction equations of the

six-minute walk test distance immediately after cardiac surgery, and indicated that the mean 6-MWD of all patients was 321.5 ± 73.2m, which ranged from 60 to 488m. It was 57.4 ±12.8% (range: 13–91%) of the predicted reference distance of the healthy population. It could be evidently seen that post CABG subjects had lower 6-MWDs as compared to those after valve surgery (313.6 ± 75.8 vs. 327.8 ± 70.5, p = 0.001).

Moreover, the current study showed that, a highly significant statistical difference between the means of Borg scale, distance walked, and oxygen saturation in the different assessment times, this finding is in the same line with **Hamzah, Hassan, Aboud, (2016)** they studied six-minute walk distance after coronary artery bypass graft surgery, and found that, the condition of heart rate and SaO2 for 60 patient undergoing CABG surgery during six-minute walking post-operative to the mean measurement, the increase means of SaO2 for study group after six minutes walking.

The current study indicated that, there is a significant negative correlation between the Borg scale and oxygen saturation (r=-.477, P= 0.008) at the second assessment time. However, there is no significant negative correlation between distance walked, Borg scale, and HR, this finding is contradicted by **Saba, Goharpey, & Moghadam, (2021)** studied Correlation Between the 6-Min Walk Test and Exercise Tolerance Test (ETT) in Cardiac Rehabilitation After Coronary Artery Bypass Grafting: A Cross-sectional Study, indicated that, there was a moderate and significant correlation between maximum HR obtained during 6MWT and ETT (r (78) = 0.67, P\0.001). The correlation between maximum systolic BP achieved during 6MWT and ETT was moderate and significant (r (78) = 0.57, P\0.001). This from the researcher's point of view it might be caused by the summative effect of existing chronic diseases, the impacts of surgical procedure (chest and leg discomfort due to the surgical wound), and the presence of chest tubes.

The current study showed that, there is a significant negative correlation between the Borg scale and distance walked (r=-.483, P= 0.007) at the first assessment time, this finding is in agreement with that of **Dolecińska, Przywarska, Podgórski, Dylewicz, Lewandowski, (2020),** who studied the use of the six-minute walk test in exercise prescription in male patients after coronary artery bypass surgery, found that a negative correlation was found between the baseline 6-MWT distance and distance increment in the final 6-MWT (r = –0.66, p = 0.002).

Conclusion: The early ambulation program improved functional capacity and hemodynamic parameters among patients undergoing cardiac surgery, the current study findings supported the research hypotheses.

Recommendations: Based upon findings of the current study, the following are recommended:

- Used the early ambulation program with the 6-MWT should be held periodically for such group of patients to improve their outcomes.
- Replication of the same study on larger probability samples at

different geographical locations for data generalization.

Limitations of the Study: The patients enrolled in the study were from one unit in the cardiothoracic intensive care unit at a private hospital which limits the generalization of the data.

Acknowledgments: The authors would like to thank the patients for their participation in this study.

References:

A M Li. Yin J. Yu CC, Tsang T. So 11K, Wong E, ct al. (2005) :The six-minute walk test in healthy children: reliability and validity. Eur Respir J.;25(6): I 057-60.

Ahmed, H. H. (2019): The Effect of Early Ambulation on Hemodynamic and Perfusion Indices Post Cardiac Surgery. American Journal of Nursing, 7(4), 490-498.

Anchala, A. M. A , (2016) :study to assess the effect of therapeutic positions on hemodynamic parameters among critically ill patients in the intensive care unit at Sri Ramachandra Medical Centre. J Nurs Care. 5(3):2-8.

Brustia, P., Cassatella, R., Renghi, A., Gramaglia, L., Aronici, M., & Casella, F.(2018) : Fast track pathways: early ambulation after open aortic surgery in elderly patients is not only safe but recommendable. Clin Surg. 2: 1407.

Claudia F., Enrico V., Roberto L., Marcello M.,Giuseppe D., Savina N., Pompilio F., Livio D.,(2007): The 6-min walking test early after cardiac surgery.Reference values and the effects of rehabilitation programme European Journal of Cardio-thoracic Surgery 32 724—729

Dolecińska, D., Przywarska, I., Podgórski, T., Dylewicz, P., Lewandowski, J., (2020): Use of the six-minute walk test in exercise prescription in male patients after coronary artery bypass surgery (2020), Polish Journal of Cardio-thoracic Surgery, DOI: 10.5114/kitp.102340

Dafoe, S., Stiller, K., & Chapman, M. (2015): Staff perceptions of the barriers to mobilizing ICU patients. Internet Journal of Allied Health Sciences and Practice. 13(2): 1-13.

Hamilton, D., M., & Haennel, R., G., (2000): Validity and reliability of the 6-minute walk test in a cardiac rehabilitation population, Journal of Cardiopulmonary Rehabilitation: May - Volume 20 - Issue 3 - p 156-164 .

Hamzah, M., H., Hassan, H., SH., Aboud, L., S., Six Minute Walk Distance After Coronary Artery Bypass Graft Surgery: Comparative Study, 2005 IOSR Journal of Nursing and Health Science (IOSR-JNHS) e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 5, Issue 3 Ver. III (May. - Jun. 2016), PP 116-123 www.iosrjournals.org DOI: 10.9790/1959-050303116123

Herdy AH, Marcchi PL, Vila A, Tavares C, Collaco J, Niebauer J, Ribeiro JP(2008):Pre- and postoperative cardiopulmonary rehabilitation in hospitalized patients undergoing coronary artery bypass surgery: a randomizedcontrolled trial. Am J Phys Med Rehabil 2008, 87:714-719.

Hillis LD. Smith PK. Anderson JL. ct aJ. ACCF/AHA (2011): guideline for coronary artery bypass graft surgery: executive summary: a report of the American College of Cardiology foundation/Amcrican Heart Association Task Force on practice guidelines. Circulation; 124: 26 I 0-2642

Hodgson, C. L., Capell, E., & Tipping, C. J.,(2018): Early mobilization of patients in intensive care: organization, communication and safety factors that influence translation into clinical practice. Critical Care. 22(77): 1-7.

Hulzebus, Y. Smit, P. Helders, et al.Preoperative physical therapy for elective cardiac surgery patients Cochr Collabor, 11 (2012):10.1002/14651858.CD010118

Karanfil, A. Moller (2018):Preoperative inspiratory muscle training prevents pulmonary complications after cardiac surgery – a systematic review Danish Med J, 65 , pp. 1-7

Kehler, A. Stamers, N. Tangri, et al. (2017): Systematic review of preoperative physical activity and its impact on postcardiac surgical outcomes BMJ, 7 (e015712), pp. 1-12

Moreno-Lacalle, R.C.(2016): Nurturing the seeds of evidence-based practice: Early ambulation among cardiac surgery patients.International Journal of Evidence-Based Health care (S19). University of Adelaide, Joanna Briggs Institute.

Morris PE, Goad A, Thompson C, Taylor K, Harry B, Passmore L, et al. (2018): Early intensive care unit mobility therapy in treatment of acute respiratory failure. Crit Care Med. 2008;36(8):2238-43.

Moghadam, M. Y., Aminnejad, R., Azarfarin, R., Alikhani, R., Ziyaeifard, M., Beh, F. G., et al. (2017): Effects of early mobilization protocol on cognitive outcome after cardiac surgery. Ann Anesth Crit Care. 2(3):e63594.

Nachiyunde, B., and Lam, L. (2018):The efficacy of different modes of analgesia in postoperative pain management and early mobilization in postoperative cardiac surgical patients: A systematic review. Annals of cardiac anesthesia, 21(4), 363.

Radi B, Ambari AM, Dwiputra B, Intan RE, Triangto K, Santoso A and Setianto B (2021): Determinants and Prediction Equations of Six-Minute Walk Test Distance Immediately After Cardiac Surgery.Front. Cardiovasc. Med. 8:685673. doi: 10.3389/fcvm.2021.685673

Ramírez JI, Grimalt R, Espinoza C, Jalil Y, Ramírez JI, et al. (2019): Comportamiento hemodinámico y respiratorio durante la movilización temprana de pacientes sometidos a cirugía cardíaca: Experiencia en un Hospital Público. Rev Chil Cardiol 38(3): 190-197.

Saba,M., A., Goharpey, SH., Moghadam, B., A.,(2021): Correlation Between the 6-Min Walk Test and Exercise Tolerance Test in Cardiac Rehabilitation After Coronary Artery Bypass Grafting: A Cross-sectional Study, Cardiology and Therapy , DOI: 10.1007/s40119-021-00210-

Smeltzer S.,B. Bare ; Hinkle,J. et al.: Brunner and Suddarth's Textbook of Medical-Surgical Nursing (Lippincott Williams & Wilkins Medical ,2010).

Stephens, S. R., & Whitman, G. J. (2015),Postoperative critical care ofthe adult cardiac surgical patient. Part I: Routine postoperative care. Crit Care Med.43(7): 1477-1497.

Tariq, M. I., Khan, A. A., Khalid, Z., Farheen, H., Siddiqi, F. A., & Amjad, I. (2017): Effect of early 3 mets (metabolic equivalent of tasks) of physical activity on patient's outcome after cardiac surgery. Journal of the College of Physicians and Surgeons Pakistan. 27(8): 490-494.

Urell, M. Emter, H. Hedenstrom, et al. (2016): Respiratory muscle strength is not decreased in patients undergoing cardiac surgeryJ Cardiothorac Surg, 41, pp. 1-5

Zanini,M., ; Nery, R., N.,; Juliana Beust, J., Buhler, R., P.,; Silveira, A., D., Stein, R., (2019) :Effects of Different Rehabilitation Protocols in Inpatient Cardiac Rehabilitation After Coronary Artery Bypass Graft Surgery, A RANDOMIZED CLINICAL TRIAL Cardiac Rehabilitation,Wolters Kluwer Health, Inc. DOI: 10.1097/HCR.0000000000000431