Effects of Early Mobilization Protocol on Patient's Outcomes Post Cardiac Surgery

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Abstract

Aim: to determine effects of early mobilization protocol on patient's outcomes post cardiac surgery. **Methods:** A Quasi- experimental design was utilized with a convenience sample of 80 recently admitted in adult postoperative cardiac surgery intensive care unit in Beni-Seuf university hospital. Data were collected using 2 tools patient assessment data and Post cardiac surgery outcomes assessment record **Results:** As regards to physiological parameters as heart rate, respiratory rate, mean arterial blood pressure, temperature and pain, there was a significant difference between control and study; furthermore there was a significant difference in sleep quality, post-operative complications and length of stay between control and study group. **Conclusion:** The present study showed that early mobilization and physical exercise post cardiac surgeries have major positive effect on patients' outcomes. **Recommendations:** Early mobilization is achievable and has major benefits in post cardiac surgery patients. Further research studies are recommended to detect efficacy of early mobilization in different patient groups.

Key words: Early mobilization protocol, Patient outcomes, Post Cardiac surgery.

Introduction

Globally, diseases of cardiovascular system are the main cause of mortality. With massive progress in the treatment of cardiovascular disease (CVD), cardiac surgeries (CSs) become more minimally invasive which lead to reduce mortality rates from CVD (**Kanejima, et al, 2020**). Cardiac surgeries usually performed to decrease patients complains, improve their prognosis, and enhancing cardiac functional capability (**Eid Shaban Mosa, et al, 2022**)

Patients undergoing cardiac surgeries are at a higher risk than other surgeries, and should be admitted into intensive care unit (ICU) due to their unstable hemodynamic state. They often come out from surgery with numerous types of chest tubes, lines and catheters **(Ashkenazy, et al , 2024).** Although technological advancement; Pain is the major complain during the early postoperative phase in the ICU, it interferes with ventilation, deep breathing and coughing, subsequently leading to complication as atelectasis and respiratory infections(**Eid Shaban Mosa, et al, 2022**).

Furthermore, after an acute cardiac event, such as coronary artery bypass graft surgery (CABGS), Anxiety and despair are common. Anxiety may trigger sympathetic nervous system, leading to increase oxygen consumption, heart rate, blood pressure and cardiac output **(Murphy, et al., 2020).** During the initial recovery period in ICU, patients may suffer from various complications such as bleeding, arrhythmias, myocardial infarction, pulmonary complications and infection in surgical wound **(Allahbakhshian, et al, 2023).** These post-surgery complications may lead to deterioration in health status and death **(Hardiman, et al, 2022).**

Physical activity and exercises is recognized as a crucial component of cardiac rehabilitation, increasing survival, decrease incidence of adverse events and improving control of cardiovascular risk therefore, it should be initiated as early as possible **(Gama Lordello, et al, 2020).** Early mobilization is described as starting physical activity within the first two to five days after critical illness or injury. It is crucial for enhancing patient outcomes after cardiac surgery **(Nydahl et al., 2020)**.

Early mobilization for CS patients is considered important part of physical therapy that should be performed during post-operative period in the ICU **(Vitomskyi,et al. , 2021).** Early mobilization has major effects on lessening the length of stay in ICU and hospital and reducing occurrence of ICU-acquired weakness in critically ill patients. Moreover, early mobility leads to reduced morbidity and mortality rates as inactivity

has a profound adverse effect on the skin, skeletal muscle, brain, pulmonary, and cardiovascular systems. Immobile patient can develop decubitus ulcers, muscular atrophy, delirium, orthostatic hypotension, deep venous thrombosis atelectasis and pneumonia **(Amin, et al , 2023)**

Nurses has vital role in assist patients to achieve complete recovery post cardiac surgery. Their role includes educate and guide cardiac patients' on exercises according to each patient's tolerance, changing position frequently and encouraging patients for early mobilization. Nursing theorists emphasize that nurses should primarily focus on supporting patients in regaining independence as quickly as possible **(Esmealy, et al, 2023).**

Significance of study:

Coronary Heart Disease (CHD) is the leading cause of death worldwide. It affects millions of people. Surgery is considered one of the measures to overcome the problem of CHD. **(Awaludin, & Novitasari, 2023).** It has been reported that 58% of cardiac surgery patients may experience post-operative complications that can delay hospital discharge and functional recovery (**Chen, et al, 2021).**

Although early mobilization is recommended for patients post cardiac surgery, no agreement exists regarding the best types, durations and intensities of mobilization; therefore, this study seeks to cover this knowledge gap by determine effects of early mobilization protocol on patient's outcomes post cardiac surgery .

Methods

Aim of the study:

To determine effect of early mobilization protocol on patient's outcomes post cardiac surgery

Research hypothesis:

To achieve aim of the study, we hypothesize that:

- The implementation of early mobilization post cardiac surgery will have a positive effect on patient's outcomes.

Setting:

The study was performed at cardiovascular surgery ICU at Beni-Seuf University hospital between June2024 and October 2024.

Study design

A quasi-experimental (study & control group) design was used.

Participants

A convenience sample of 80 recently admitted adult postoperative cardiac surgery patients from the previously mentioned setting was involved in this study. Based on the power analysis using The Epidemiology information program- version 7(Epi-Info program 7) was used to estimate the minimum sample size with population size 75 for 3 months, expected frequency 50%, acceptable error 10%, design effect 1, confidence coefficient 95% and power 80%. The first 40 patients were allocated to the control group, and the second 40 patients were allocated to the study group. All patients who have the following criteria were excluded from the study: hermodynamically unstable, uncontrolled diabetes mellitus, chronic respiratory diseases, hemorrhage and uncontrolled dysrhythmias.

Tools of data collection:

The three tools listed below were used to collect data.

Tool I: " Patient Assessment Data:

The researcher created this tool after revising related literature **Eid Shaban Mosa, et al, 2022** it divided into two parts:

Part I: patient's demographics data: It contains demographic data as age, gender, marital status, educational level and occupation.

Part (2): Health Related Data: It was developed by the researcher and contains information about smoking, presence of chronic disease, body mass index, numbers of chest tube, length of chest tube and type of cardiac surgeries.

Tool II: Post cardiac surgery outcomes assessment record: The researcher created this tool by after revising the following literature **(Tariq, et al., 2017, Ahmed 2019, Yayla & Özer, 2019)& Chen, et al., 2020)** to assess the patients' outcomes (Physiological parameters, pain, sleep quality, length of stay and postoperative complications) after implementation of early mobilization protocol. It includes four parts as follows:

Part I: Physiological parameters assessment record: It includes vital signs (temperature, heart rate, respiratory rate and mean arterial blood pressure), O2 saturation, heart rhythm & arterial blood gases results.

Part I: Self-Reported Pain Assessment Tool:

The Visual Analogue Scale (VAS) was adopted from **Hjermstad M et al, (2011).** It was used to

measure a characteristic or attitude of patient toward pain. Severity of pain is assessed by the patient through a continuum of horizontal line, 10 cm in length, the patient mark on the line the point that they felt represent perception of their current state.

Scoring System

The Visual Analogue Scale (VAS) measures pain intensity. The VAS consists of a 10cm line, with two end points representing 0 ('no pain') and 10 ('pain as bad as it could possibly be'). The total scoring system was from 0 to 10 and represented as follow: score 0 score indicate no pain, from 1-3 indicate mild pain, from 4-6 indicate moderate pain and from 7-10 indicate severe pain.

Part III: Richard Campbell Sleeping Questionnaire (RCSQ):

This tool was developed by **Richards et al (2000).** It included 5 items questionnaire to assess sleep depth, sleep latency (time to fall asleep), number of awakenings, efficiency (percentage of time awake, and sleep quality).

Scoring system

Lower scores were indicated to a poor quality of sleep, bad sleep (RCSQ score <50). Higher scores were indicated to a better quality of sleep, good sleep RCSQ score ≥50)

Part IV: Length of hospital stay and post-operative late complications assessment:

It created by the researcher to assess post-operative hospital stay period and incidence of post-operative late complications (dysrhythmia, pneumonia, deep vein thrombosis and pressure ulcers).

Validity of the tools

The developed tool I and part I& IV of tool II were verified for content validity by eight experts in the Medical-Surgical and Critical Care Nursing and accordingly needed adjustments were done

Reliability

- Reliability of the developed tool I and part I& IV of tool II were tested by using alpha Cranach's factor and it was 0.950.
- The VAS demonstrated excellent test–retest reliability with an intraclass correlation coefficient (ICC) of 0.97.
- Reliability of Richard Campbell Sleeping Questionnaire (RCSQ) for sleep quality assessment was the Interclass correlation coefficients (ICC) ranged from 0.13 to 0.49

Method:

1. After explanation of the aim of the study, Consent to conduct the study was got from the administrative authorities of the previously mentioned settings.
2. Approval of the ethical committee of the Faculty of Nursing, Helwan University was taken. The committee session number (42)
3. The studied patients consent for involvement in the study was taken after clarification of the aim of the study.
4. Data collection tools was developed after reviewing relevant literature
5. Content validity of tool one were established by eight experts in the Medical-Surgical and Critical Care Nursing. The necessary adjustments were done accordingly.
6. A pilot study was done on eight patients to assess feasibility and applicability of study tools. The subjects of pilot study were excluded from the actual study sample.
7. **Data Collection :-**

- All post-operative cardiac patients' were assessed by the researcher for meeting the inclusion criteria.
- Patients who met the inclusion criteria were divided into two groups; group A "the control group" and group B "the study group".
- Upon admission to ICU both groups were assessed for their demographic characteristics and health related conditions were assessed by using tool I.
- During operation day (Zero day), patient enter operation room at 12 pm and come out from operation room at 5 or 6 pm. Patients usually extubated at 10 pm additionally, patient post extubated is exhausted and on o_2 therapy nasal cannula, therefore application of early mobilization protocol is applied at day 1 postoperative.
- **At 1st day postoperative:** At the morning of 1st day, both groups were assessed for pain level, sleep quality , physiological parameter as baseline data
- Group A were receive routine care of unit.

- Group B were subjected to early mobility protocol at 1st day and up to third day postoperatively.
- Duration of early mobilization protocol depend on patient tolerance.

Early mobilization program applied to group B (Study group) in three day as following:

Early mobility protocol at 1st day includes the following:

- Head of bed was raised to 30° to 45°.
- Performing deep breathing and coughing exercises by using incentive spirometer eight times a day in the form of one coughing exercise & five deep breathing exercises in three or four cycles.
- Doing passive range of motion exercises for upper and lower extremities in five sets two times a day.
- Patients were permitted to sit on the edge of the bedside or the bed inclined to give a sitting position for 15 minutes two times a day.

Early mobility protocol at 2nd day includes the following.

- Elevating head of bed to 30° to 45°.
- Performing deep breathing and coughing exercises with an incentive spirometer eight times a day in the form of one coughing exercise & five deep breathing exercises in three or four cycles.
- Active or passive range of motion exercises for upper and lower extremities.
- Allowing the patient to be seated in a chair for 20 minutes and walk 150 steps.

Early mobility protocol at 3rd day includes the following.

- Elevating head of bed to 30° to 45°.
- Performing deep breathing and coughing exercises with an incentive spirometer eight times a day in the form of one coughing exercise & five deep breathing exercises in three or four cycles.
- Active or passive range of motion exercises for upper and lower extremities.
- Allowing the patient to be seated in a chair for 20 minutes and walk 150 steps.

Every day, both groups were assessed for :

- Group B were assessed by using part I **physiological parameter** of tool II **patient assessment data** after fifteen to twenty minutes of applying protocol.
- Group A were assessed by using part I **physiological parameter** of tool II **patient assessment data** parallel to group B
- Both groups were assessed for pain intensity by using Part II of Tool II.
- Both groups were assessed for sleep quality by using tool III at the next morning.

Finally, both groups were assessed during hospitalization period by Part IV of Tool II for length of stay & incidence of post-operative complications as (dysrhythmia, pneumonia, deep vein thrombosis and pressure ulcers). Additionally, health related data as following duration of chest tube were assessed.

8. Statistical Analysis

Statistical Designs: The results were collected, coded and analyzed by using the Computer Statistical Package for Social Science (SPSS), version 20.0. Microsoft Office Excel software was utilized to make the desired graphs. Data were presented using descriptive statistics in the form of frequencies and percentages. Pearson, chi-square, and t-tests were used to compare frequencies and correlation between study variables

Ethical Considerations:

- Anonymity, confidentiality, and right to refuse participation in the study were assured. Privacy was also ascertained.
- All eligible participants were informed about the study aim and benefits before obtaining their oral consent.
- Participation was voluntary and the patients notified that they can withdraw at any time without consequences.
- The instruments used in the study didn't cause any physical or emotional harm to participants. Patient safety was prioritized throughout the study as early mobilization protocol was

reviewed by a panel of 8 experts in the field of the study and was applied by the researcher in collaboration with medical health team.

Results:

Table 1 illustrated that, 57.5 % of the control group and 55% of the study group their age ranged between 40 - < 60 years, additionally, 62.5 % of the control group was male. As regards to an educational level, 42.5% of the control and 52.5 % of the study group were High school. Therefore, there was no significant difference between study and control group concerning demographic characteristics.

Table 2 shows that (57.5 %) in the control group and (52.5%) in the study group were non- smokers. As regarding Chronic Diseases, it was found that (35%) in the control group and (40%) of the study group have Cardiac diseases. Also, Regarding Body Mass Index, it was shown that 37.5 % of the control group were normal while, (40%) of the study group were overweight. Furthermore, Regarding Cardiac Surgery, it was shown that 42.5% of the control group were done CABG, and (47.5%) of the study group were done Valve repair .it was found that there was significant difference between study and control group as regarding Length of ICU Stay and Length of chest tube.

Table (3) shows that, the mean count for heart rate was (99.35±11.20) in control group at the second day and (95.95±12.42) in study group at the first day. Also, the mean count for Body Temperature at the third day was (37.30±0.45) in control group and (37.23±0.29) in study group, It also noted that there was significant difference in the mean of O_2 Saturation and heart rate between study and control groups at the third day of the program (p = 0.000).

Table (4) shows that, regarding heart rhythm 65% of the control group patients have regular heart rhythm at the third day of the program, while 82.5% of the study group have regular heart rhythm at the third day of the program. It also noted that there was insignificant difference between study and control groups through program phases regarding heart rhythm and ABG results (p = 0.492 ,0.781 ,3.260 ,0.196 ,1.182 ,0.554, 3.219 ,0.200 respectively).

Table (5) illustrated that, there was highly statistically significant difference between study and control groups through program phases regarding pain (p =0.921, 0.021, 0.000 respectively).

Table (6) illustrated that, there was highly statistically significant difference between study and control groups at the second and the third day of the program regarding Sleep Quality (p =0.041, 0.001 respectively).

Table (7) shows that, regarding heart rhythm 17.5% of the control group patients have DVT, while 2.5% of the study group have DVT. Regarding Dysrhythmia, it was shown that 40% of the control group have Dysrhythmia while, (15%) of the study group have Dysrhythmia. Therefore, there was highly statistically significant difference between study and control groups and post-operative complications at the end of the program (p =0.025 0.023 0.012 0.040 0.019 respectively).

Table (1): Distribution of studied patients' demographic characteristics (n=40).

Demographic data	Control Group (n=40)		Study Group (n=40)		χ^2	P-value
	No.	%	No.	%		
Age						
– 17<30 years	6	15	3	7.5	2.604	0.457
– 30 < 40 years	5	12.5	4	10		
– 40< 60 years	23	57.5	22	55		
– ≥ 60 years	6	15	11	27.5		
Gender						
– Male	25	62.5	23	57.5	0.208	0.648
– Female	15	37.5	17	42.5		
Marital Status						
– Single	8	20	4	10	1.634	0.652
– Married	27	67.5	30	75		
– Divorced	3	7.5	4	10		
– Widow	2	5	2	5		
Educational Level						
– Illiterate	6	15	2	5	2.572	0.462
– Primary education	4	10	5	12.5		
– High school	17	42.5	21	52.5		
– University	13	32.5	12	30		
Occupation						
– Not working	16	40	12	30	4.973	0.174
– Employee	14	35	17	42.5		
– Retired	2	5	7	17.5		
– Free business	8	20	4	10		

X^2 Chi square test

^{FE} Expected cell count less than 5. Fisher's exact test was used.

Table (2): Distribution of studied patients' health related data (n=40).

Health Data	Control Group (n=40)		Study Group (n=40)		χ^2	P-value
	No.	%	No.	%		
Smoking						
– Yes	17	42.5	19	47.5	0.202	0.653
– No	23	57.5	21	52.5		
Chronic Diseases						
– No	3	7.5	6	15	4.714	0.452
– Diabetes	9	22.5	3	7.5		
– Hypertension	10	25	11	27.5		
– Lung diseases	3	7.5	2	5		
– Cardiac diseases	14	35	16	40		
– Kidney Diseases	1	2.5	2	5		
Body Mass Index						
– Underweight	3	7.5	4	10	2.101	0.552
– Normal	15	37.5	13	32.5		
– Overweight	11	27.5	16	40		
– Obesity	11	27.5	7	17.5		
Length of ICU Stay						
– 1-2 days	4	10	2	5	7.960	0.047*
– 3-4 days	15	37.5	27	67.5		
– 5-6 days	14	35	9	22.5		
– ≥ 7 days	7	17.5	2	5		
Length of chest tube						
– 12 - < 24hrs	2	5	13	32.5	18.756	0.000**
– 24 - < 48hrs	11	27.5	18	45		
– 48-72hrs	15	37.5	5	12.5		
– > 72 hrs	12	30	4	10		
Number of chest tube						
– One	3	7.5	0	0	4.660	0.097
– Two	25	62.5	32	80		
– Three	12	30	8	20		
Surgery						
– Valve repair	15	37.5	19	47.5	0.881	0.644
– CABG	17	42.5	15	37.5		
– Other	8	20	6	15		

Table (3) :Comparing physiological parameters among studied patients in control and study group through program phases (n=40).

Parameters	Group	1st Day	2nd Day	3rd Day	t_1(P)	t_2(P)	t_3(P)
		Mean±SD	Mean±SD	Mean±SD			
Heart Rate	Control	99.00±11.86	99.35±11.20	99.15±12.18	-0.332 (0.742)	-0.102 (0.920)	0.188 (0.920)
	Study	95.95±12.42	92.87±11.33	90.82±10.24	3.070 (0.004**)	3.284 (0.002**)	2.012 (0.050*)
	t_4(P)	1.123 (0.265)	2.570 (0.012*)	3.308 (0.001**)			
MAP	Control	97.00±10.35	95.25±7.88	95.77±7.26	2.075 (0.045*)	1.358 (0.182)	-0.841 (0.405)
	Study	94.82±11.50	95.35±7.97	94.52±4.80	-0.420 (0.677)	0.183 (0.856)	0.984 (0.331)
	t_4(P)	0.889 (0.377)	-0.057 (0.955)	0.908 (0.367)			
Body Temp	Control	37.00±0.27	37.18±0.27	37.30±0.45	-3.793 (0.001**)	-3.728 (0.001**)	-2.046 (0.047*)
	Study	36.88±0.22	37.04±0.23	37.23±0.29	-5.338 (0.000**)	-6.284 (0.000**)	-5.317 (0.000**)
	t_4(P)	1.444 (0.153)	2.472 (0.016*)	0.905 (0.369)			
Resp. Rate	Control	22.40±3.08	22.35±2.59	23.15±3.52	0.108 (0.914)	-1.066 (0.293)	-1.776 (0.083)
	Study	23.00±3.26	21.92±3.23	20.90±3.73	2.871 (0.007**)	3.500 (0.001**)	3.211 (0.003**)
	t_4(P)	-0.844 (0.401)	0.648 (0.519)	2.771 (0.007**)			
O_2 Sat	Control	94.30±1.36	94.72±1.72	94.15±1.73	-2.039 (0.048*)	0.675 (0.504)	3.219 (0.003**)
	Study	94.35±1.38	94.90±1.51	95.70±1.98	-2.718 (0.010*)	-4.338 (0.000**)	-4.207 (0.000**)
	t_4(P)	-0.163 (0.871)	-0.482 (0.631)	-3.715(0.000**)			

t_1: Between 1st and 2nd day for the same group.
t_2: Between 1st and 3rd day for the same group.
t_3: Between 2nd and 3rd day for the same group.
t_4: Between control and study group for the same day

Table (4): Comparing heart rhythm and ABG results among studied patients in control and study group through program phases (n=40).

Parameter	Group	Categories	1st Day		2nd Day		3rd Day		χ^2 (P_1)
			No.	%	No.	%	No.	%	
Heart Rhythm	Control	Regular	25	62.5	23	57.5	26	65	0.492 (0.781)
		Irregular	15	37.5	17	42.5	14	35	
	Study	Regular	26	65	28	70	33	82.5	3.260 (0.196)
		Irregular	14	35	12	30	7	17.5	
	χ^2 (P_2)		0.054 (0.816)		1.352 (0.245)		3.164 (0.075)		
ABG Results	Control	Compensated	31	77.5	32	80	28	70	1.182 (0.554)
		Uncompensated	9	22.5	8	20	12	30	
	Study	Compensated	26	65	30	75	33	82.5	3.219 (0.200)
		Uncompensated	14	35	10	25	7	17.5	
	χ^2 (P_2)		1.526 (0.217)		0.287 (0.592)		1.726 (0.189)		

P_1: comparing 1st, 2nd and 3rd day for the same group.
P_2: comparing between control and study group at the same day.

Table (5): Comparing pain assessment among studied patients in control and study group through program phases (n=40).

Parameters	Group	1st Day	2nd Day	3rd Day	t_1(P)	t_2(P)	t_3(P)
		Mean±SD	Mean±SD	Mean±SD			
Pain	Control	7.98±1.25	6.87±1.62	6.37±1.92	6.497 (0.000**)	5.946 (0.000**)	2.865 (0.007**)
	Study	7.96±0.98	6.07±1.40	4.30±2.020	13.445 (0.000**)	14.561 (0.000**)	8.978 (0.000**)
	t_4(P)	0.099 (0.921)	2.361 (0.021*)	4.691 (0.000**)			

t_1: Between 1st and 2nd day for the same group.
t_2: Between 1st and 3rd day for the same group.
t_3: Between 2nd and 3rd day for the same group.
t_4: Between control and study group for the same day.

Table (6): Comparing sleep quality among studied patients in control and study group through program phases (n=40).

Parameter	Group	Categories	1st Day		2nd Day		3rd Day		χ^2 (P_1)
			No.	%	No.	%	No.	%	
Sleep Quality	Control	Enough	2	5	12	30	17	42.5	15.223 (0.000**)
		Not Enough	38	95	28	70	23	57.5	
	Study	Enough	1	2.5	21	52.5	32	80	49.889 (0.000**)
		Not Enough	39	97.5	19	47.5	8	20	
	χ^2 (P_2)		0.346 (0.556)		4.178 (0.041*)		11.850 (0.001**)		

P_1: comparing 1st, 2nd and 3rd day for the same group.
P_2: comparing between control and study group at the same day.

Table (7): Comparing post-operative complications among studied patients in control and study group at the end of the program (n=40).

Complications	Categories	Control Group (n=40)		Study Group (n=40)		χ^2	P-value
		No.	%	No.	%		
DVT	**Yes**	7	17.5	1	2.5	5.000	0.025*
	No	33	82.5	39	97.5		
Pneumonia	**Yes**	9	22.5	2	5	5.165	0.023*
	No	31	77.5	38	95		
Dysrhythmia	**Yes**	16	40	6	15	6.270	0.012*
	No	24	60	34	85		
Pressure Ulcer	**Yes**	4	10	0	0	4.211	0.040*
	No	36	90	40	100		
Others	**Yes**	11	27.5	3	7.5	5.541	0.019*
	No	29	72.5	37	92.5		

Discussion:

Cardiac surgery patients often experience post-operative physiological complications. Early mobilization is suggested to reduce these complications and attain positive patient's outcomes **(Gill, et al, 2023).** this study aimed to determine effects of Early Mobilization Protocol on Patient's Outcomes Post Cardiac Surgery.

The current study revealed that, more than two third of the studied sample were males. These results supported by **(Abdelaziz Mohammed, & Shoeib Ali, 2022)** who found majority of the studied sample were males. This may be due to women are less likely than men to develop cardiovascular diseases. Regarding Cardiac Surgery**,** it was shown that more than one third of the studied sample was done CABG, and Valve repair. These results disagreed by **(Eid Shaban Mosa, et al, 2022)** who found the most common type of surgery in study and control groups was valve replacement (mitral or double valve).

Regarding measuring BMI, the present study demonstrated that more than one third of the studied sample were overweight, this finding is in agreement with **Hamzah, et al, (2016)** who found that most of the patient's overweight. This may be due to obesity often associated high blood pressure and atherosclerosis, which is a risk factor for heart attack, and consequently, lead to narrowing and blockage of the coronary arteries and cardiovascular diseases.

The current research findings showed that there was significant difference between study and control group concerning length of ICU stay. This result consistent with **Wang ,et al 2020** who showed that early mobilization shortened the length of intensive care unit stay and hospital stay. Also this result agreed with **Ohbe, et al 2021** who indicating that early mobilization can decrease hospitalization length**.** This result due to decrease Length of chest tube in the study group than in control group.

The current research clarifying that there was significant difference in the mean of heart rate between study and control groups at the third day of the program. The findings agreed with **Younis & Ahmed, 2015** who found that after implementation of passive exercise in study group, there was increase in mean score of heart rate. Also this result inconsistent with **Ahmed, 2019** who stated that heart rate was slightly increased in control group than study group with statistically significant differences over time. This can be explained as sympathetic stimulation, increase heart rate after physical activity.

The present study noted that there was significant difference in the mean of Body Temperature between study and control groups at the third day of the program. These results inconsistent with **(Eid Shaban Mosa,et al ,2022)** who found that throughout the study period, body temperature was raised after mobilization than before mobilization in the study group. This can be explained that early ambulation trigger the sympathetic nervous system and increasing in rate of metabolism.

The present study showed that there was significant difference in the mean of O_2 Saturation between study and control groups at the third day of the program. This result supported by **Santos, et al., 2017** they stated that; there was a significant rising in oxygen saturation among

study group over time of their interventions application. This can be explained that in day one, the surgical procedures and wound pain affect ventilation and breathing itself, later, the pain decreased over the time with mobilization which subsequently enhances breathing and expansion of the lung and hence postoperative oxygen saturation.

The current study revealed that there was insignificant difference between study and control groups through program phases regarding ABG results. This result disagreed with **Esmealy, et al. (2023)** who found that in both three and four-phase of early mobilization protocol, Mean arterial blood gases is significantly improved in study group compared to control group.

The existing study illustrated that there was highly statistically significant difference between study and control groups through program phases regarding pain. This result was in line with **Awaludin et al., 2022** who verified that a significant lowering in pain scale on the first, second, and fifth day after surgery. This result may be due to early mobilization. Besides, emit of central and peripheral beta-endorphins, which have been linked with changes in the pain severity in the study group due to implementing early mobility and exercise.

The present study clarified that there was highly statistically significant difference between study and control groups at the second and the third day of the program regarding Sleep quality. This result consistent with **Yayla, A., & Özer, N. (2019)** who found a statistically significant difference was detected in the intragroup measurements in the study group, while no significant difference was witnessed in the control group. This result can be explained that performing exercise improves tissue oxygenation levels which lead to relaxation and enhance sleeping.

The current study shows that there was highly statistically significant difference between study and control groups regarding post-operative complications as (DVT, Pneumonia, Dysrhythmia and Pressure Ulcer) at the end of the program. This result consistent with **Yayla, A., & Özer, N. (2019)** who found that patients in the study group have significantly less complications than those in the control group. Also this result agreed with **Ramos et al., 2015** who say that early mobilization reduces complications in patients who undergoing cardiac surgery .this occur for the reason that range of motion, exercises, deep breathing and cough exercises, incentive spirometry, sitting and walking activities included in the protocol has positive effects in decreasing occurrence of complications

Therefore, the present study results reinforced our research hypothesis stating that the implementation of early mobilization post cardiac surgery will have a positive effect on patient's outcomes.

Conclusion:

Certainly, major improvements seen in vital signs, oxygen saturation levels, sleep quality with rapidly lessening of intensity pain and occurrence of complications among post-cardiac surgeries patients who undergo the early mobilization intervention.

Recommendations:

- Further research studies are recommended to detect efficacy of early mobility on different patient groups.
- Find out the potential patient's safety through ongoing and accurate assessment of hemodynamic monitoring and oxygenation stability before, during and after any exercise and mobility intervention.
- Early mobility protocol should be incorporated as a standard part of care of post cardiac surgery patients to minimize negative consequences of immobility.

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