Original Article

Vital Signs, Pain and Difficulty of Patients During Mobilization after Open-Heart Surgery

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The study was conducted in the cardiovascular surgery service of the Dokuz Eylul University Hospital in Izmir, Turkey.

Abstract

Background: Early mobilization of the patient is recommended to accelerate the recovery process after cardiac surgery.
Objective: This study conducted to determine vital signs, levels of pain and difficulty of patients during mobilization after open-heart surgery and the factors affecting mobilization.
Methodology: The study was descriptive and cross-sectional. The study comprised patients who had undergone open-heart surgery at a university hospital in Turkey. Eighty-five patients were mobilized. Vital signs of the patients recorded before, during and after mobilization. The patient mobility, and the observer mobility scales were used.
Results: There was difference between heart rate before, during and after mobilization in patients. Patients especially found experienced more pain and difficulty during walking in the patient room. Patients aged 66 years and older experienced had more pain and difficulty standing up the edge of the bed. Patients with a hemoglobin value of 9.4 and below experienced more pain and difficulty in walking in the patient room. Patients with an Ejection Fraction value below 49% had more pain and difficulty in sitting on the edge of the bed, standing, and walking in the patient's room. Patients with a hemoglobin value below 9.4 and an Ejection Fraction value below 49% could not walk in the room despite physical support.
Conclusions: Patients with hemoglobin value below 9.4 and ejection fraction value below 49% had a difficulty in mobilization. We recommended evaluating the effectiveness of the early mobilization program for patients who have open-heart surgery had factors affecting mobilization.

Keywords: Cardiac Surgery, Early Mobilization, Pain, Postoperative Care, Vital Sign

Introduction

Cardiovascular diseases are common in developing countries. There are various medical and surgical treatment options for treating cardiovascular disease. Open heart surgery is frequently used in the surgical treatment of heart diseases (Vervoort et al., 2020; Williams, 2021). The postoperative period is the most critical period for patients undergoing open-heart surgery. Patients with open heart surgery encounter cardiovascular, pulmonary and many complications in the postoperative period(Mali and Haghaninejad, 2019; Matos et al.,2020; Pahwa et al., 2021; Udzik et al., 2020; Seese et al., 2020).It was emphasized that long-term bed rest causes postoperative complications. Studies have reported that many complications can be prevented by mobilization in the early postoperative period (Cassinaet al. 2016;

Moradian et al. 2017; Yayla & Ozer, 2019). Additionally, it has been reported that early mobilization provides a holistic psychosocial and social benefit as well as improving physical functions (Mosa et al.,2022). In a systematic review of the effects of early mobilization after open heart surgery by Santos et al., it was found that early mobilization prevented postoperative complications, increased functional capacity, and reduced the length of hospital stay after cardiac surgery (Santos et al., 2017). Moreover, in a meta-analysis, it was reported that early mobilization improved physical function in patients after cardiac surgery, mobilization had a positive effect on recovery, and no side effects occurred during early mobilization after cardiac surgery (Kanejima et al., 2020).Early mobilization of the patients have recommended in evidence-based accelerated surgical care protocols to accelerate the recovery process after cardiac surgery, reduce hospital stay and cost (Engelman et al., 2019).Although early mobilization recommended, A systematic review and meta-analysis were determined that patients are mostly inactive and in-bed during hospitalization and, time spent in lying or sitting positions was 89% for inpatients in surgical units (Fazio et al., 2020).

Mobilization of patients is a basic interventions. The haelth professionals have role in helping patients to get up and moving after surgery. Knowing the factors affecting the postoperative mobilization of patients will help health professionals to plan interventions for these factors. We could not find a study evaluating the factors affecting the mobilization of patients after open-heart surgery. It is important to determine the vital signs, level of pain and difficulty of patients mobilized after open-heart surgery and the factors affecting mobilization. This study conducted to determine the levels of pain and difficulty experienced by patients during mobilization after open-heart surgery and the factors affecting mobilization.

Research Questions

Are there a difference between pre- and post-mobilization vital signs of patients after open heart surgery?

What are the level of pain and difficulty experienced by patients after open heart surgery during mobilization?

What are the factors affecting the mobilization level of patients after open heart surgery?

Methodology

The type of Research: The research was descriptive and cross-sectional.

Participants and Setting: The study was conducted in the cardiovascular surgery service of a university hospital in Izmir, Turkey. During the data collection process, 278 patients had open heart surgery. The study was conducted with 85 patients who voluntarily agreed to participate in the study and whose written consent was obtained, were older than 18 years old, had no cognitive problems in self-expression, had no hearing and vision problems, and had no physical limitations. One hundred ninety-three patients were excluded from the study. Those were the patients who stayed in the intensive care unit for more than 48 hours after surgery, took positive inotropic drugs (dopamine, dobutamine, etc.), and had poor clinical general conditions (with unstable vital signs), no orientation, surgery-related complications (arterial fibrillation, bleeding, opening in the sternum, etc.) and oxygen saturation below 94%.

Instruments: The data of the study, the patient socio-demographic and clinical characteristics form, the Patient Mobility Scale and the Observer Mobility Scale were used. The patient socio-demographic and clinical characteristics form was used to determine the socio-demographic and clinical characteristics of the patients. There were 10 questions including socio-demographic characteristics of the patients, chronic disease, type of surgery, length of stay in the intensive care unit, presence and number of chest tubes, postoperative hemoglobin level, and ejection fraction values.

***The Patient Mobility Scale*:** It was developed to determine the level of pain and difficulty experienced during postoperative mobility (Heye et al., 2002). This scale assesses the level of pain and difficulty experienced during four post-operative activities (turning from

side to side in bed, sitting on the edge of the bed, standing, and walking in the patient's room). The lowest and highest possible score for each item is between 0 and 15, and the total scale score is between 0 and 120. An increase in the scale score indicates an increase in pain and difficulty related to the activity. The decrease in the score indicates that the pain decreased and the mobility difficulties decreased in the patients while performing the four movements (Heye et al., 2002).

***The Observer Mobility Scale*:** It was used to evaluate mobility during the post-operative four activities. The degree of dependency/independence status is evaluated from '1 to '5.' A score of 'one' means that he/she can perform the relevant activity independently without a verbal stimulation or physical assistance; A score of '5' indicates that the patient is unable to perform the relevant activity despite verbal warning or physical assistance. Turning, sitting, standing and walking scores are summed and the mean score value is calculated. In the calculation of the scale score; the observer mobility score is obtained by summing the scores of the four activities in the scale. The lowest and highest score that can be obtained from the scale is between 4 and 20. An increase in the scale score indicates that the movement skills of the patients are insufficient, and a decrease in the scores indicates that their ability to move after surgery is good/sufficient (Heye et al., 2002). In our study, the surgeons did not allow the activity of 'turning from one side to the other in the bed to preserve the median thoracotomy incision in the patients. For this reason, three activities were scored and the scale total score was not given.

Data Collection: Postoperatively, the patient's socio-demographic and clinical characteristics form was filled in by the researcher in the form of questions and answers by interviewing the patient face to face. The patients were interviewed 48 h after the surgery and after coming from the intensive care unit. The hemoglobin value (Hb) and ejection fraction (EF) value is the postoperative values. Pain before mobilization was evaluated with the Visual Analog Scale. The patients stated that they did not have pain that would prevent mobilization. The patients were mobilized by the researcher. Heart rate, respiratory rate and blood pressure were measured by the researcher while the patients were lying in bed before being moved. Blood pressure, heart rate and respiratory rate were measured again two minutes after the patients who were suitable for mobilization took a sitting position in bed before standing up. After the patients were mobilized, blood pressure, heart rate and respiratory rate were measured again two minutes after they took a sitting position in bed. The blood pressure of the patients was measured using a digital sphygmomanometer. Heart rate and rhythm were obtained from the patient monitor. During the mobilization of the patients, the items of the patient mobility scale were asked the patient. After the patients were mobilized, the observer mobility scale was filled in by the researcher (Figure 1).

Statistical Analyses: The data obtained in the study were evaluated in the SPSS (version 20, IBM). Number, percentage, mean and standard deviation were used to evaluate the data of the study. Significance test of the difference between two means in Independent Groups between gender, age, hemoglobin value variables and patient mobility scale score; Mann–Whitney test was used between two-category variables such as non-normally distributed ejection fraction and patient mobility scale scores, and Kruskal-Wallis Analysis of Variance was performed for variables with more than two categories, such as body mass index. One-Way Analysis of Variance in Repeated Measurements was used to compare vital signs in the pre-mobilization, sitting position and post-mobilization period. A value of 0.05 was set as the level of significance in the study.

Ethical Considerations: The research conformed to the principles in the Declaration of Helsinki. We obtained permission from the institutional review ethics board of the study hospital (no: 2016/25-04).The researcher explained the study purpose and process and invited these eligible patients in this study. All patients who agreed to participate in this study provided signed informed consent.

Results

Patients' Characteristics

The mean age of patients who had open heart surgery was 61.68 ±9.94 (min=36 – max=83). 62.4% (n=53) of the patients were male, and the mean body mass index was

26.18 ±2.88 (min=20.20 – max=35), and they were considered 'overweight'. The length stay of patients in the intensive care unit is 37.83 ±11.92. The mean postoperative hemoglobin level of the patients is 9.73 ±1.20. The mean Ejection Fraction values of the patients were 52.76 and ±9.37. Coronary artery bypass graft surgery was performed in 70.6% (n=60) of the patients. 35.3% of the patients had hypertension and 29.4% had diabetes and hypertension (Table 1)

The Vital Signs, Pain and Difficulty of Patients during Mobilization

There was no significant difference between systolic blood pressure, diastolic blood pressure and respiratory rate before mobilization, in sitting position and after mobilization in patients with open heart surgery (p= .428, p= .560, p= .348; p>.05). A significant difference was found between the heart rate of the patients (p= .000; p<.05). Heart rate was high after mobilization (Table 2). Mean scores of pain experienced by the patients during the sitting on the edge of the bed, standing and walking in the patient's room were 9.63 ±1.47, 9.50 ±2.18, and 10.10 ±2.95, respectively. The difficulty levels of the patients in sitting on the edge of the bed, standing and walking in the patient's room were 10.40 ±1.72, 10.10 ±2.37 and 10.47 ±2.96, respectively (Table 3). While 37.6% (n=32) of the patients who had open heart surgery were sitting on the edge of the bed with verbal stimulation and physical assistance, 62.4% (n=53) depended on the nurse to sit on the edge of the bed. While 14.1% (n=12) of the patients could stand up with verbal stimulation and physical assistance, 85.9% (n=73) of the patients depended on the nurse to stand up. 12.9% (n=11) of the patients walked in the patient's room with verbal warning and physical assistance, 65.9% (n=56) of the patients depended on the nurse to walk in the room, 21.2% (n=18) could not walk in the room despite the help.

The Factors Affecting Mobilization

There was no difference in the pain and difficulty levels of sitting on the edge of the bed according to gender. (p=.053, p=.066; p>.05). According to gender, there is a difference in the pain and difficulty levels of standing up and walking in the patient's room. It was determined that women experienced more pain and had difficulty. (p= .027, p= .037, p= .01, p= .01; p<.05)**.** There was no difference in the pain and difficulty levels of sitting on the edge of the bed and walking in the patient's room according to the age of the patients. (p= .86, p= .23, p=.094, p= .073; p>.05). It was found that patients aged 66 years and older experienced more pain and difficulty in standing up (p=.022, p=.024; p<.05). According to the body mass index of the patients, there was no difference between the pain and difficulty levels of sitting, standing up and walking in the patient's room. (p=.190, p=.646, p=.825, p=.841, p=.331, p=.244; p>.05)**.** According to the hemoglobin levels of the patients, it was found that the pain levels in sitting on the edge of the bed were similar (p=.055; p>0.05), while the patients with an Hb value of 9.4 and below had more difficulty sitting on the edge of the bed (p=.018; p<.05). It was determined that patients with Hb level of 9.4 and below experienced more pain when standing up (p=.023; p<.05). It was determined that patients with Hb value of 9.4 and below experienced more pain and difficulty in walking in the patient's room (p= .001, p=.000; p<.05). It was determined that patients with EF value ≤ 49% had more pain and difficulty in sitting on the edge of the bed, standing, and walking in the patient's room (p=.001, p=.000, p=.000, p=.000, p=.000, p=.000; P<.05) (Table 4). According to the observer mobility scale; There was a difference in the walking in the patient's room according to the hemoglobin level (p=.041; p<.05) and EF values (p=.000; p<.05) of the patients. It was found that patients with Hb level ≤ 9.4 and EF value 49% and below could not walk in the room despite physical support.

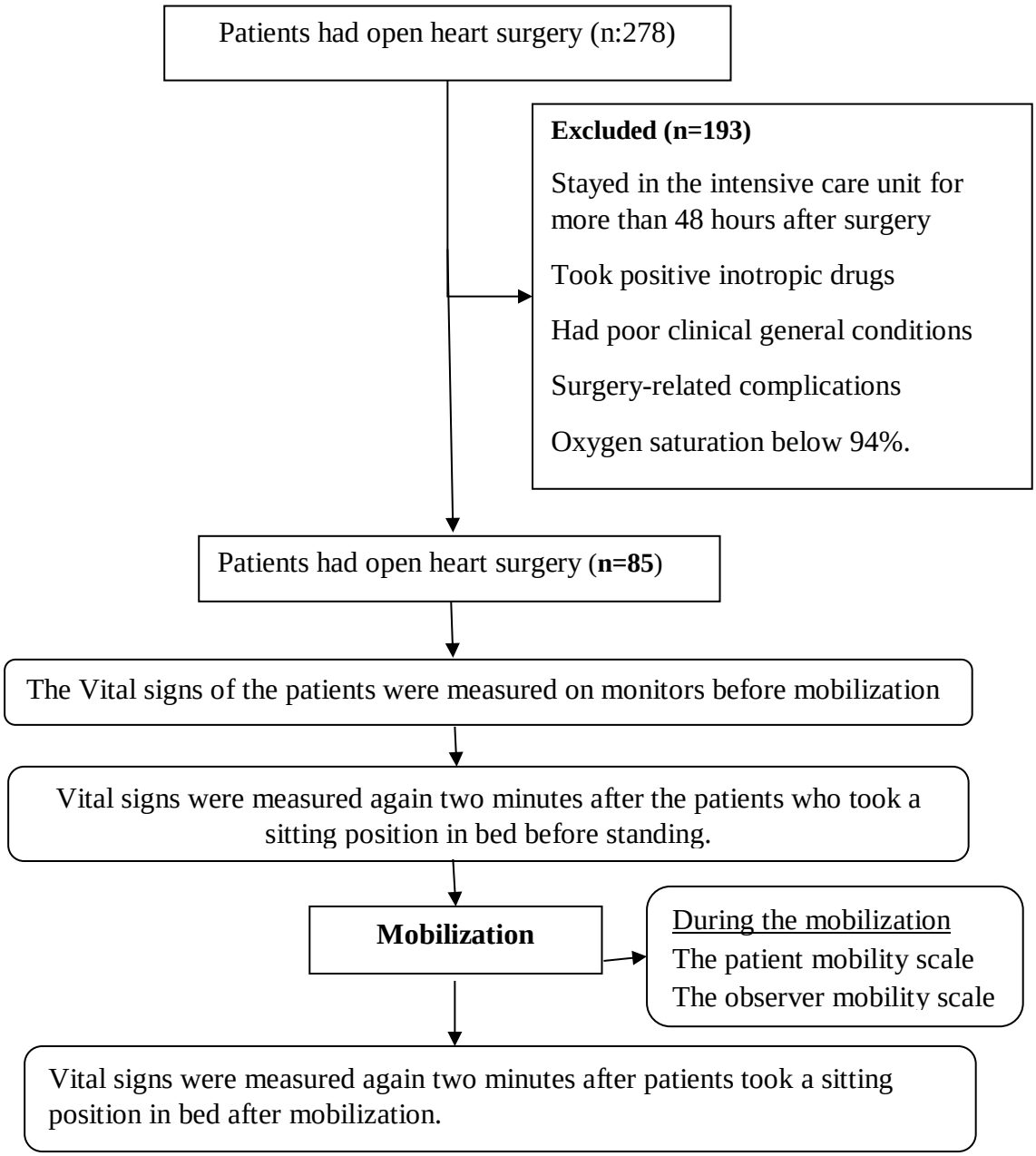

Figure 1: Study Plan

Table 1: Clinical characteristics of patients with open heart surgery (n:85)

Clinical Features	$\bar{x} \pm SS$ (min – max)	
Length of ICU stay (h)	37.83 ±11.92 (24–48)	
Hemoglobin Value (g/dl)	9.73 ±1.20 (7.70–14)	
Ejection Fraction (%)	52.76 ±9.37 (20–65)	
	(n)	**(%)**
Surgery		
Coronary Artery Bypass Graft	60	70.6
Heart Valve Surgery	24	28.2
Coronary Artery Bypass Graft + Heart Valve Surgery	1	1.2
ChronicDisease		
Hypertension	30	35.3
Diabetes mellitus +Hypertension	25	29.4
Diabetes mellitus	8	9.4
Diabetes mellitus +Hypertension+COPD	3	3.5
Hypertension+COPD	2	2.4
COPD	1	1.2

COPD: Chronic Obstructive Pulmonary Disease; ICU: Intensive CareUnit

Table 2. Vital signs of patients before and after mobilization (n:85)

Vital Signs	**mobilization pre-** $\bar{x} \pm SD$	**in sitting position** $\bar{x} \pm SD$	**mobilization post-** $\bar{x} \pm SD$	**F**	**p**
Heart rate/min	92.95 ± 8.11	94.28 ±8.48	95.20 ± 7.82	9.525	***.000**
Systolic Blood Pressure (mm/Hg)	129.51 ±12.68	127.75 ± 12.67	127.75 ±17.64	0.853	.428
Diastolic Blood Pressure (mm/Hg)	71.21 ±9.10	70.37 ± 7.93	70.95 ±8.42	0.581	.560
Breaths/min	23.23±1.63	23.08±1.94	22.88±1.75	1.063	.348

F: One-Way Analysis of Variance in Repeated Measurements

Table 3. Mean pain and difficulty scores of patient mobility scale items in patients with open heart surgery (n:85)

Patient Mobility Scale Items	$\bar{x} \pm SD$ (min – max)
Sitting	
Pain	9.63 ±1.47 (6–12)
Difficulty	10.40 ±1.72(7–15)
Standing	
Pain	9.50 ±2.18 (6–15)
Difficulty	10.10±2.37 (4–15)
Walking	
Pain	10.10 ±2.95 (6–15)
Difficulty	10.47 ±2.96 (6–15)

Table 4. Pain and difficulty levels in sitting, standing and walking by the patients according to the factors affecting mobilization

Features	Sitting		Standing		Walking	
	Pain $\bar{x} \pm SD$	Difficulty $\bar{x} \pm D$	Pain $\bar{x} \pm SD$	Difficulty $\bar{x} \pm SD$	Pain $\bar{x} \pm SD$	Difficulty $\bar{x} \pm SD$
Gender						
Woman (n:32)	10.03± 1.57	10.87 ± 1.97	10.18±2.36	10.68±2.60	11.46±2.69	11.78±2.76
Male (n:53)	9.39 ± 1.36	10.11 ± 1.50	9.11± 1.98	9.58±2.13	9.28±2.81	9.67±2.82
	t=1.96 p=.053	t=1.87 p=.066	t=2.24 ***p= .027**	t=2.12 *** p= .037**	t=3.52 *** p= .001**	t=3.35 *** p= .001**
Age						
≤65 (n:51)	9.41±1.35	10.21±1.61	9.07±2.01	9.52±2.26	9.66±2.91	10.00±2.86
≥66 (n:34)	9.97±1.58	10.67±1.87	10.17±2.28	10.70±2.38	10.76±2.93	11.17±3.01
	t=1.73 p= .086	t=1.20 p= .23	t=2.32 *** p= .022**	t=2.29 *** p= .024**	t=1.69 p= .094	t=1.81 p= .073
BMI						
Normal (n:26)	10.00±1.35	10.65 ± 1.67	9.73 ± 2.21	10.23 ± 2.26	10.07 ± 2.88	10.30 ± 2.83
Overweight (n:51)	9.54±1.56	10.33 ± 1.78	9.41 ± 2.28	9.98 ± 2.43	9.88 ± 2.96	10.27 ± 2.95
Obese (n:8)	9.00 ± 0.92	10.00 ± 1.60	9.50 ± 1.51	9.37 ± 2.44	11.62 ± 3.06	12.25 ± 3.24
	KW: 3.31	KW: 0.874	KW: 0.386	KW: 0.346	KW: 2,211	KW: 2,819

		p= .190	p= .646	p= .825	p= .841	p= .331	p= .244
Hb							
≥ (n:44)	**9.5**	9.34±1.47	9.97±1.64	9.00±2.02	9.54±2.21	9.11±2.66	9.36±2.57
		9.95±1.41	10.85±1.71	10.07±2.24	10.48±2.46	11.17±2.91	11.65±2.92
≤ (n:41)	**9.4**	t=1.943 p= .055	t=2.404 *** p= .018**	t=2.320 *** p= .023**	t=1.858 p= .067	t=3.402 *** p= .001**	t=3.845 *** p= .000**
EF							
≤49% (n:15)		10.86±1.24	11.93±1.38	11.80±2.48	12.33±2.49	12.66±2.79	13.06±2.63
≥50% (n:70)		9.37±1.38	10.07±1.61	9.02±1.78	9.50±2.03	9.55±2.70	9.91±2.74
		U= -3.447 ***p= .00**	U=-3.768 *** p= .000**	U=-3.887 *** p=.000**	U=-3.761 *** p=.000**	U=-3.487 *** p=.000**	U=-3.589 *** p=.000**

BMI: Body Mass Index; Hb: hemoglobin (g/dl); EF: Ejection Fraction (%) U: Mann–Whitney test, KW:Kruskal-Wallis Analysis

Discussion

We determined vital signs, pain levels and difficulty in patients who underwent open heart surgery in mobilization. In our study, there was no significant difference in among of the systolic and diastolic blood pressure and respiratory rates of the patients before mobilization, the sitting position and after the mobilization, but a significant difference was found in the heart rates. In another study, no change was found in the heart rate of patients who underwent initial mobilization after cardiac surgery (Cassina, et al., 2016). In another study, a difference was found between heart rate and systolic blood pressure values before and after the first mobilization of patients who had open heart surgery (Ahmed, 2019; KOse&Avşar, 2021). In studies conducted with patients other than cardiac surgery; while there was no difference between blood pressure and oxygen saturation values before and after early mobilization in intensive care patients, a significant difference was found in respiratory rate and heart rate (Mosa et al., 2022; Ozçelik, et al., 2017). It was found that blood pressure, pulse and respiratory rate values of other operated patients increased significantly when they stood up after surgery (Mahmudova & DOnmez, 2019; Yolcu et al., 2016). It is thought that the heart rate increases with the increase in the workday of the heart due to the effort made after the mobilization.

While mobilizing the patients who had open heart surgery in the postoperative period, it was found that they experienced more pain and had more difficulty during the walk in the patient's room compared to the other activities. In another study, it was found that patients who had surgery experienced the most pain while sitting on the edge of the bed (Yolcu et al., 2016). In another study, it was found that patients had difficulty standing up after surgery (Mahmudova & Donmez, 2019).Our research findings were similar to previous studies. It was observed that patients who had open heart surgery had difficulties during mobilization and needed support. Patients may have been forced during mobilization due to the presence of the incision, discomfort from the chest tube, pain.

It was found that female patients experienced more pain and difficulty in standing and walking in the patient's room than male patients. In a study examining the postoperative mobilization levels of patients who had undergone surgery, it was found that female patients experienced more pain and had more difficulty than male patients (Yolcu et al., 2016). It is thought that female patients need more support during mobilization.

It was determined that patients over 65 years of age who had open heart surgery experienced more pain and difficulty during the standing. It was found that patients who had surgery had difficulties during

mobilization in the postoperative period, and patients between the ages of 60 and 69 were more dependent during mobilization (Yolcu et al., 2016). It was found that elderly patients who underwent cardiac surgery had a decrease in walking speed after surgery. Advanced age was found to be a risk factor for decreased physical functionality after cardiac surgery (Itagaki et al., 2019). Changes in the musculoskeletal system with aging may decrease functional independence or loss of function (Bucher & Johnson, 2014). Therefore, elderly patients with open heart surgery may have difficulty in mobilization.

It was found that patients with open heart surgery with a hemoglobin level of 9.4 and below experienced more difficulty in sitting on the edge of the bed, more pain in standing, and more both pain and difficulty during the walking in the patient's room. We could not find a study examining the relationship between hemoglobin value and mobility levels in the literature. Hemoglobin is the substance found in the structure of erythrocytes and provides oxygen transport throughout the body. When the hemoglobin level is low, the oxygen carrying capacity of the blood decreases and tissue hypoxia occurs. In people with low hemoglobin, symptoms such as decreased cell oxygenation, breathing more frequently during activity, muscle fatigue, weakness, decreased participation in the movement, and pain with movement can be seen (Rote & McCance,2010). Patients with hemoglobin levels ≤ 9.4 and below may have experienced pain and difficulty during mobilization due to the decrease in their oxygen carrying capacity.

It was determined that patients with open heart surgery and ejection fraction value ≤ 49% had high levels of pain and difficulty in activities such as sitting on the edge of the bed, standing, and walking in the patient's room. A study reported that the EF values of the patients did not affect mobilization, but researchers exclude patients with low EF in the same study (Cassina et al., 2016). The ejection fraction value shows the pump function of the left ventricle and how well the heart is working. The decrease blood flow to the muscles due to the decrease in EF value, symptoms such as weakness and fatigue may occur with the deterioration of tissue perfusion (Komamura, 2013).Patients with low EF values may have experienced pain and difficulty during mobilization due to their inability to tolerate activities due to impaired tissue perfusion and could not be mobilized despite assistance.

Limitations: A limitation is the lack of information regarding the mobilization of patients who stay in the intensive care unit for more than 48 h after open heart surgery, whose peripheral oxygen saturation is below 94%, and who receive positive inotropic support.

Conclusion: Patients undergoing open heart surgery experienced more pain and difficulty in the walking in the patient's room. Patients who women, 66 years of age and older, Hb level of 9.4 and below, and EF values of 49% and below had felt more pain and difficulty in the standing and the walking in the patient's room. We found that patient with Hb level of 9.4 and below and an EF value of 49% and below could not walk in the patient's room despite physical support. Patients should be informed and encouraged about early mobilization to support the postoperative recovery process with open heart surgery. It is recommended to evaluate the effectiveness of the preoperative physical activity program to be created for patients with factors affecting mobilization.

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