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Incidence of Orthostatic Hypotension during Early Postoperative Mobilization in Cardiac Surgery Patients

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ABSTRACT

This study aimed to determine the incidence of orthostatic hypotension and orthostatic intolerance during early mobilization in patients who underwent coronary artery bypass graft surgery. The study was conducted as single group pre-experimental study. Patients who underwent coronary artery bypass graft surgery (n=108) in a private hospital and a university hospital in Ankara were included in the sample. Data were collected between May 2018 and February 2019. The data were collected using a Patient Diagnostic Form and Patient Mobilization Follow-Up Form developed by the researcher. Patients were mobilized according to the mobilization program developed by the researchers. The study is reported according to Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) guidelines. The sample consisted of 108 patients (72.2% male, mean age 64.67 ± 9.40 years). Postoperative mobilization was 19.23 ± 3.08 hours. According to preoperative data, 52 participants (48.1%) had orthostatic hypotension, and 47 participants (43.5%) had orthostatic intolerance. Participants often presented signs of intolerance (26.9%) in the second mobilization phase. There was no significant difference in the incidence of orthostatic intolerance between participants with and without orthostatic hypotension (p = 0.269). The results indicate that orthostatic hypotension and orthostatic intolerance are prevalent in patients after coronary artery bypass graft surgery. Healthcare professionals should diagnose orthostatic hypotension early with accurate hemodynamic measurements and monitoring of symptoms.

Kardiyak Cerrahi Uygulanan Hastalarda Erken Mobilizasyon Sırasında Ortostatik Hipotansiyon Görülme Sıklığı

Makale Bilgisi

Makale Geçmişi

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ÖZET

Bu çalışmanın amacı, koroner arter bypass greft ameliyatı geçiren hastalarda erken mobilizasyon sırasında ortostatik hipotansiyon ve ortostatik intolerans görülme sıklığını belirlemektir. Araştırma tek gruplu deney öncesi araştırma tasarımı olarak yürütülmüştür. Çalışmanın örneklemini Ankara'da bir özel hastane ve bir üniversite hastanesinde koroner arter bypass greft ameliyatı geçiren hastalar (n=108) oluşturmaktadır. Veriler Mayıs 2018 ile Şubat 2019 tarihleri arasında toplanmıştır. Veriler araştırmacı tarafından geliştirilen Hasta Tanı Formu ve Hasta Mobilizasyon Takip Formu kullanılarak toplanmıştır. Hastalar araştırmacıların geliştirdiği mobilizasyon programına göre ameliyat sonrası mobilize edilmiştir. Çalışma Rastgele Olmayan Tasarımlarla Değerlendirmelerin Şeffaf Raporlanması kurallarına göre raporlanmıştır. Örneklem 108 hastadan (%72.2 erkek, ortalama yaş 64.67 ± 9.40 yıl) oluşmaktadır. Hastalar ameliyat sonrası 19.23 ± 3.08 saatte mobilize edilmiştir. Katılımcıların ameliyat öncesi ve mobilizasyon sırasındaki hemodinamik verileri karşılaştırıldığında 52 katılımcıda (%48.1) ortostatik hipotansiyon, 47 katılımcıda (%43.5) ortostatik intolerans saptanmıştır. Katılımcılarda sıklıkla mobilizasyonun ikinci aşamasında (%26.9) ortostatik intolerans belirtileri görülmüştür. Ortostatik hipotansiyonu olan ve olmayan katılımcılar arasında ortostatik intolerans insidansı açısından anlamlı bir fark saptanmamıştır (p = 0.269). Sonuç olarak, koroner arter bypass greft ameliyatı sonrası hastalarda ortostatik hipotansiyon ve ortostatik intolerans yaygın olarak görülmektedir. Sağlık çalışanları doğru hemodinamik ölçümler ve semptomların takibi ile ortostatik hipotansiyonu erken tanılamalıdır.

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INTRODUCTION

Early mobilization is one of the steps of the Enhanced Recovery After Surgery (ERAS), which is an evidence-based protocol developed to improve the quality of post-treatment care, to reduce morbidity and mortality, and to prevent complications (Kehlet & Wilmore, 2008; Melnyk et al., 2011). Early mobilization is highly recommended, although it has little proven benefit in terms of enhanced recovery (Castelino et al., 2016).

Studies show that most patients develop orthostatic hypotension (OH) and orthostatic intolerance (OI) after early mobilization (Bundgaard-Nielsen et al., 2009; Cassina et al., 2016; Jans et al., 2012; Jans et al., 2015; Müller et al., 2010). OH and OI, which cause delayed mobilization and increase the length of hospital stay, are two important complications seen during early mobilization (Jans et al., 2015; Ricci et al., 2015). Some studies in breast surgery, radical prostatectomy, and total hip arthroplasty address the development of postoperative OH and OI with a reported incidence of 17% to 50% and 13% to 42%, respectively (Bundgaard-Nielsen et al., 2009; Jans et al., 2012; Jans et al., 2015; Müller et al., 2010). There is not found any study on the prevalence/incidence of orthostatic hypotension during early mobilization in Türkiye.

Cassina et al. reported that 34% of patients had a decrease in mean blood pressure during early mobilization after cardiac surgery, and 17% of these patients required medical treatment. They concluded that this negatively affected the continuity of mobilization and increased the length of stay in intensive care units (ICUs) (Cassina et al., 2016). The risk of OH increases due to loss of intravascular volume, changes in fluid volume, pain due to sternotomy and analgesics (opioids) used for pain management, long-term bed rest, and antihypertensive and diuretic use after cardiac surgery (Bundgaard-Nielsen et al., 2009; Feldstein & Weder, 2012). Therefore, cardiac surgery patients should be regarded as a risk group for OH and OI.

As stated in the literature, OH and OI are common after early mobilization (Bundgaard-Nielsen et al., 2009; Müller et al., 2010; Ricci et al., 2015). Orthostatic hypotension and orthostatic intolerance threaten patient safety because they cause falls. Mobilization should be performed under strict clinical conditions and under the supervision of nurses or healthcare professionals to prevent the development of OH and OI. Increasing awareness of orthostatic hypotension and orthostatic intolerance in healthcare professionals is very critical. Thus, falls that seriously risk patient safety can be prevented. This study aimed to determine the incidence of OH and OI during early mobilization in coronary artery bypass graft surgery (CABG) patients.

Hypotheses

1- H_0: Orthostatic hypotension does not develop after early mobilization in patients who underwent coronary artery bypass graft surgery.

H_1: Orthostatic hypotension develops after early mobilization in patients undergoing coronary artery bypass graft surgery.

2- H_0: Orthostatic intolerance does not develop after early mobilization in patients who underwent coronary artery bypass graft surgery.

H_1: Orthostatic intolerance develops after early mobilization in patients undergoing coronary artery bypass graft surgery.

METHOD

Study Design

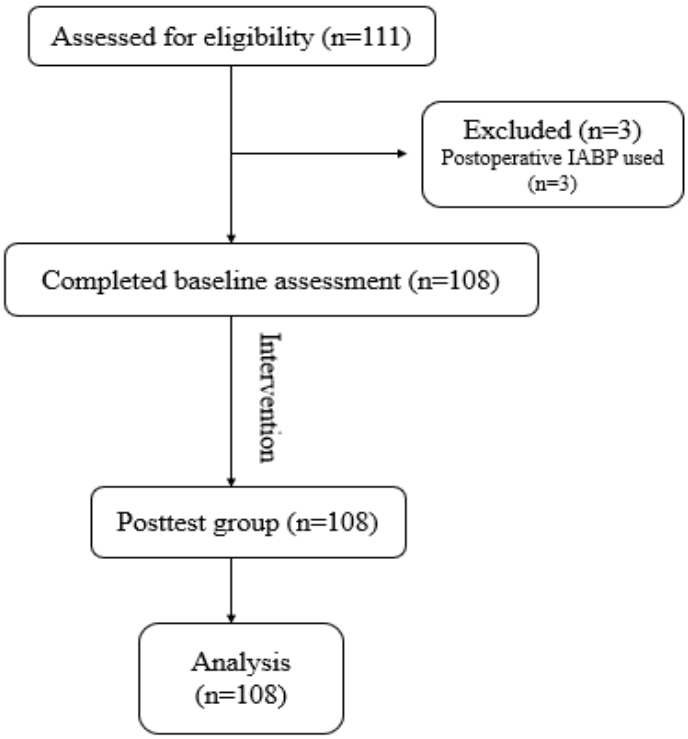
This was single group pre-experimental study. This study is presented in accordance with the Transparent Reporting of Evaluations with Non-randomized Designs (TREND) statement.

Research Sample/Study Group/Participants

The sample consisted of 108 patients who underwent CABG surgery in a private hospital and a university hospital in Ankara. Studies show that OH and OI have a wide range of incidence (Bundgaard-Nielsen et al., 2009; Cassina et al., 2016; Jans et al., 2012; Jans et al., 2015; Müller et al., 2010). A power analysis was performed using EpiInfo 7 to determine the sample size. The results showed that a sample size of 108 patients would be large enough to detect significant differences (5% probability of Type 1 error (α=0.05), 80% power, and 95% confidence interval) (Figure 1).

Figure 1

Flow diagram



The inclusion criteria:

• Hemodynamic stability (Heart rate less than 110/min at rest, mean arterial blood pressure ranging from 60 to 110 mm Hg, and oxygen-free saturation above 88%)

• Dopamine infusion equal to or less than 5 mcg/kg/min

• Lack of neurological [cerebrovascular accident (CVA), ataxia, and Multiple Sclerosis (MS)] and orthopedic (presence of fractures and sequelae preventing mobilization) contraindications

• To be volunteer

The exclusion criteria:

• Use of intra-aortic balloon pump

• Postoperative cerebrovascular accident (CVA)

• Early postoperative high-dose inotropic drug infusion (Dopamine: 10 mcg/kg/min, Noradrenaline: 0.5 mcg/kg/min)

• Dual inotropic drug infusion (Dopamine and noradrenaline infusion)

• Advanced arrhythmias preventing mobility (Sinus Tachycardia ≥ 120/min, High-Speed Atrial Fibrillation, Ventricular Tachycardia, Ventricular Fibrillation)

Research Instruments and Processes

The questionnaire consisted of two parts; a patient demographic form and a patient mobilization follow-up form (Bundgaard-Nielsen et al., 2009; Cassina et al., 2016; Jans et al., 2012; Jans et al., 2015; Müller et al., 2010).

The patient demographic form

The patient demographic data form consisted of items on sociodemographic characteristics (age, gender, education, Body Mass Index (BMI), and nutritional status), type of surgery, systolic arterial pressure (mmHg) at first hospitalization and before surgery, and diastolic arterial pressure (mmHg), mean arterial pressure (mmHg), heart rate (/min), oxygen saturation (%), pain level [Numerical Rating Scales (NRS) score], weaning time from mechanical ventilation (hour), fluid intake/urinary output (ml), drainage amount (ml), and presence of invasive catheters.

The patient mobilization follow-up form

The patient mobilization follow-up form consisted of items on mobilization time (hours), stress level before mobilization (NRS score), data [systolic arterial pressure (mmHg), diastolic arterial pressure (mmHg), mean arterial pressure (mmHg), heart rate (/min), oxygen saturation (%), pain level (NRS Score)] on OI before mobilization, and at each stage of four-stage mobilization and OI-related nausea, vomiting, dizziness, blackout, and syncope. Before postoperative mobilization stress, pain, nausea, vomiting, dizziness, blackout, and syncope were evaluated using NRS on a scale of 0 to 10.

Mobilization Program

The researcher raised the participants according to the mobilization program to ensure standardization. The mobilization program in this study was based on both a literature review (Brown et al., 2008; Bundgaard-Nielsen et al., 2009; Castelino et al., 2016; Leong et al., 2017; Perme & Chandrashekar, 2009; Shroyer et al., 2009; Stewart, 2013) and the mobilization programs of hospitals.

In related studies, patients are given three minutes for muscle pump activation and venous changes within mobilization stages. Therefore, the mobilization program was completed in four phases, and each phase was 3 minutes long.

•***Stage 1:*** The patient is placed in an upright sitting position at a 90-degree angle in bed (ICU beds have mercury degrees, which indicates the angle of sitting (3 min).

•***Stage 2:*** The patient was moved to the edge of the bed by the nurse and staff, keeping his/her sternum straight, and then he/she was seated on the edge of the bed without support, with his/her feet touching the ground (3 min).

•***Stage 3:*** In the presence of continuous hemodynamic stability, the patient was told to look ahead, and the nurse and staff supported his/her to stand upright (3 min).

•***Stage 4:*** The patient was supported to take a few steps around the bed and then was placed in an arm-supported wheelchair (3 min).

Participants were raised according to the stages above. Some participants asked for extra time between the stages to prepare themselves (resting, waiting for pain relief, etc.). Therefore, mobilization took an average of 15-20 minutes.

Pilot Study

A pilot study was conducted with 10 CABG patients to check the intelligibility and relevance of the data collection forms. None of the items were modified in the instruments. Therefore, the sample of the pilot study was included in the main study.

Data Collection

Data were collected between May 2018 and February 2019. Permission was obtained before data collection. The researcher introduced herself to the patients and informed them about the research purpose and procedure. Written consent was obtained from those who agreed to participate. The researcher explained to all participants how to fill out the data collection forms. She also briefed them on mobilization (Stages of mobilization, not performing mobilization alone, and rating as pain, dizziness, blackout, nausea, vomiting, and syncope on a scale of 0 to 10).

Sociodemographic data were collected from the files of the participants after they were hospitalized. Hemodynamic data were measured at the first hospitalization day and one hour before surgery while the patient was sitting at the bedside. Data specific to surgery and anesthesia were collected from the anesthesia form. The data one day after surgery (fluid intake/urinary output, amount of drainage, time to wean off the ventilator, and hematocrit value) and painkiller administration status were recorded from the nurse observation form.

Before the patients were mobilized, hemodynamic data, pain and anxiety levels were measured. After, the patients were mobilized according to the mobilization program, hemodynamic data was measured at each stage of mobilization. During mobilization, blood pressure was measured using a manual measuring device connected to the monitor. Heart rate and oxygen saturation were recorded from the monitor. Before mobilization and at every stage of mobilization, the patient's pain, dizziness, blackout, nausea, vomiting, and syncope status were asessed.

Data Analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS, version 23.0 for Windows, Inc. Chicago, USA) at a significance level of 0.05. For descriptive statistics, numbers and percentages were used for categorical variables. Visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov and Shapiro Wilk’s tests) were used for normality testing of continuous variables. The mean ± standard deviation was used for normally distributed data, while the median (min-max value) was used for non-normally distributed data. An independent samples t-test was used for normally distributed data between groups. The Mann-Whitney U test was used for non-normally distributed data between groups. Chi-square tests were used to compare categorical variables between independent groups.

Hemodynamic data at each stage of mobilization were compared with both before surgery and before postoperative mobilization data. Participants were grouped as “OH present” or “no OH” based on changes in blood pressure to determine the development of OH. A reduction in systolic

and diastolic pressures of 20 mmHg and/or 10 mmHg, respectively, indicated the presence of OH. The presence of one of the signs of intolerance at any stage of mobilization indicated "the development of OI during mobilization."

Informed Consent

All participants were informed that their data would be used for scientific purposes. Verbal and written consent was obtained from the participants.

Validity and reliability

Validity and reliability were checked. First, participation was based on the inclusion and exclusion criteria to reduce selection bias and to ensure the comparability of the data. Second, a pilot study was conducted with 10 participants with similar characteristics to check the reliability of the data collection forms. Third, the researchers developed a mobilization program based on a literature review. Three experts and one specialist in intensive care evaluated the mobilization program. The researchers revised the program based on expert feedback.

RESULTS

Participant characteristics

The mean age of participants was 64.67 ± 9.40 years. Of the participants, 72.2% were male, and 45.4% had primary school degrees. Participants were overweight (28.14 ± 4.70) according to BMI. The mean duration of preoperative and postoperative clinic stay was 3.18 ± 3.16 and 1.09 ± 0.39 days, respectively. Of participants, 63% underwent off-pump CABG. Six participants had postoperative arrhythmia. Participants were weaned from mechanical ventilation after 8.65 ± 2.89 hours and were mobilized after 19.23 ± 3.08 hours after surgery. They had a mean postoperative drainage amount and hematocrit of 472.22 ± 260.78 ml and 33.81 ± 4.57%, respectively (Table 1).

Table 1

Demographic Characteristics and Surgery-Related Variables of Participants (n=108)

Demographic characteristics	
Age (Year)*	64.67 ± 9.40
Male n (%)	78 (72.2)
Primary school n (%)	49 (45.4)
Body mass index (kg/m2) *	28.14 ± 4.70
Surgery-related variables	
Off-pump CABG n (%)	68 (63.0)
Length of surgery (hours)*	3.48 ± 1.44
Postoperative arrhythmia n (%)	6 (5.6)
Duration of postoperative MV (hours)*	8.65 ± 2.89
Mobilization time (hours)*	19.23 ± 3.08
Hematocrit level (%) *	33.81 ± 4.57
Postoperative drainage (ml)*	472.22 ± 260.78
Fluid intake (ml) *	3053.43 ± 478.98
Urinary output (ml) *	2625.42 ± 939.66
Length of ICU (hours)*	1.09± 0.39

*Mean±Standart Deviation

Orthostatic Hypotension

The distribution of orthostatic hypotension development during mobilization after coronary artery bypass graft surgery is shown in Table 2. Orthostatic hypotension developed in fifty-two participants (48.1%) (Table 2). Orthostatic hypotension was most common in Stage 2 (30.6%) (Table 2).

Table 2

Distribution of Orthostatic Hypotension Development During Mobilization After Coronary Artery Bypass Graft Surgery (n=108)

	Mobilization process				
	Stage 1	**Stage 2**	**Stage 3**	**Stage 4**	**Total***
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Preoperative	30 (27.8)	33 (30.6)	32 (29.6)	32 (29.6)	52 (48.1)

* Number of patients with signs of orthostatic hypotension at any stage of mobilization

Table 3 shows hemodynamic data during mobilization after coronary artery bypass graft surgery (n:52). Significant reductions were observed in systolic blood pressure, diastolic blood pressure, mean blood pressure and heart rate in Stages 1, 2, 3, and 4 of mobilization ($p<0.05$). There was significant change in oxygen saturation in Stage 3 of mobilization ($p<0.05$).

Table 3

Hemodynamic Data During Mobilization After Coronary Artery Bypass Graft Surgery (n=52)

	Preoperative	**M1**	**M2**	**M3**	**M4**	**P[1](test statistic value)**			
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**M1**	**M2**	**M3**	**M4**
Systolic Blood Pressure	129.37±15.158	115.46±15.948	111.19±14.938	111.23±18.776	114.69±17.534	**<0.001**	**<0.001**	**<0.001**	**<0.001**
Diastolic Blood Pressure	75.79±8.949	70.38±9.385	69.25±9.822	67.85±15.466	70.46±9.523	**0.001**	**<0.001**	**0.001**	**0.002**
Mean Blood Pressure	93.65±9.736	86.33±10.992	85.37±10.217	83.65±16.374	85.67±11.130	**<0.001**	**<0.001**	**<0.001**	**<0.001**
Heart rate	77.02±8.897	92.52±17.296	97.52±11.803	101.02±10.718	92.92±13.213	**<0.001**	**<0.001**	**<0.001**	**<0.001**
Oxygen Saturation	94.29±3.887	95.10±2.659	93.56±3.539	92.29±4.007	95.04±3.635	0.165	0.280	**0.009**	0.291

1-Paired Sample T test, M1: Mobilization Stage 1, M2: Mobilization Stage 2, M3: Mobilization Stage 3, M4: Mobilization Stage 4

Sex, age, nutritional status, surgery method, hematocrit level, postoperative drainage amount, blood transfusion, fluid intake/urinary output, surgery period, before mobilization stress, use of antihypertensives, use of antiarrhythmic medications, and dopamine infusion had no significant effect on OH development ($p>0.05$) (Table 4).

Table 4

Comparison of Patient Variables Between Groups with and Without Orthostatic Hypotension

	Group with orthostatic hypotension (n=52, %)	Group without orthostatic hypotension (n=56, %)	Statistical analysis
Sex			
Female	16 (53.3)	14 (46.7)	p= 0.504[1]
Male	36 (46.2)	42 (53.8)	
Nutritional status			
Mid or bad	8 (32)	17 (68.0)	p= 0.065[1]
Good	44 (53.0)	39 (47.0)	
Surgery method			
Off-pump CABG	36 (52.9)	32 (47.1)	p= 0.194[1]
On-pump CABG	16 (40.0)	24 (60.0)	
Before mobilization stress			
Yes	9 (52.9)	8 (47.1)	p= 0.667[1]
Antihypertensives medications			
Yes	6 (54.5)	5 (45.5)	p= 0.654[1]
Antiarrhythmic medications			
Yes	18 (35.3)	33 (64.7)	p= 0.110[1]
Dopamine infusion			
Yes	10 (58.8)	7 (41.2)	p= 0.337[1]
Age*	64.50 ± 9.96	64.82 ± 8.94	p= 0.861[2]
Fluid intake (ml *	2991.73 ± 515.22	3310.71 ± 439.59	p= 0.201[2]
Urinary output (ml)*	2481.73± 996.84	2758.84 ± 871.02	p= 0.128[2]
Intraoperative blood transfusion (ml)*	334.85±383.704	428.57±407.871	p=0.176[2]
Postoperative blood transfusion (ml)*	396.21±438.995	370.24±380.798	p=0.753[2]
Surgery period (hour)*	3.41±1.43	3.57±1.46	p=0.438[2]
Hematocrit level (%)**	33.82 (27-46)	33.80 (26-46)	p= 0.868[3]
Postoperative drainage (ml)**	467.31 (100-1200)	476.79 (200-1550)	p=0.846[3]

CABG: Coronary artery bypass graft, 1-Chi-square test, 2-Independent sample t-test, 3-Mann-Whitney U test, *Mean±Standart Deviation, ** Mean (Min-Max)

Orthostatic Intolerance

The symptoms of orthostatic intolerance were most and least common in Stage 2 (26.9%) and Stage 1 (9.3%), respectively. Blackout was most common in Stages 1 and 4. Dizziness was most common in Stages 2 and 3. Vomiting was observed in Stage 4 and only in one participant. No syncope was observed in participants throughout the mobilization process (Table 5).

Though not shown in tables, 48.5% of participants with OH also had OI, while 35.7% of those with no OH had OI. There was no significant difference in the incidence of OI between those with and without OH ($p>0.05$).

Table 5

Distribution of Orthostatic İntolerance Development and Symptoms of Orthostatic İntolerance During Mobilization After Coronary Artery Bypass Graft Surgery (n=108)

Mobilization	Stage 1	Stage 2	Stage 3	Stage 4	Total*
Development of OI n (%)*	10 (9.3)	29 (26.9)	24 (22.2)	12 (11.1)	47 (43.5)
Symptoms of Orthostatic Intolerance**					
Dizziness n (%)	3 (2.8)	22 (20.4)	18 (16.7)	3 (2.8)	
Blackout n (%)	7 (6.5)	16 (14.8)	14 (13.0)	5 (4.6)	
Nausea n (%)	3 (2.8)	3 (2.8)	5 (4.6)	4 (3.7)	
Vomiting n (%)	-	-	-	1 (0.9)	
Syncope n (%)	-	-	-	-	

* Number of patients with signs of orthostatic hypotension at any stage of mobilization, **Multiple responses were received.

DISCUSSION

Our results will raise healthcare professionals' awareness of hemodynamic changes (OH and OI) after early mobilization in cardiac surgery patients. Early mobilization plays an important role in accelerating postoperative recovery. Cardiac surgery patients are characterized by their risks (fluid volume depletion, drainage amount, sternum pain, etc.) for early mobilization. However, there are very few studies on early mobilization after cardiac surgery. Cassina et al. (2016) reported the incidence of OH and OI during early mobilization after cardiac surgery to be 34% and 13%, respectively (Cassina et al., 2016). Our results showed that the incidence of OH and OI during early mobilization after cardiac surgery was 48.1% and 43.5%, respectively. These results are consistent with the literature. The causes of OH after cardiac surgery are insufficient intravascular volume, autonomic nervous system dysfunction, decreased venous return, and decreased cardiac output in response to postural changes. Research also shows that low blood volume and hematocrit depending on the amount of blood loss may cause OH and OI (Lanier et al., 2015; Taito et al., 2016). Our hemodynamic data showed that OH was more prevalent before surgery than after surgery which might be due to intraoperative and postoperative blood loss and low hematocrit levels. Participants had a preoperative and postoperative hematocrit level of 41.64±5.28 and 33.81±4.57, respectively. Our results showed that the hematocrit level, the amount of drainage, and the amount of fluid intake/urinary output did not affect OH and OI ($p>0.05$). However, it should be noted that the sample size was small, which might have affected our results.

Another important reason for the development of postoperative OH is prolonged bed rest. When a healthy individual changes position from supine to standing upright after bed rest, 500-700 ml of blood is deposited in the lower extremities, splenic and pulmonary circulation, leading to a decrease in venous return, ventricular filling, and heart rate, resulting in a reduction in systolic blood pressure. The longer the rest time, the more the OH (Feldstein & Weder, 2012). Like the result of Cassina et al. (2016), our participants had long bed rest (mean 19 hours) after cardiac surgery. When patients stand up for the first time, staying in bed for a long time negatively affects this process, and OH and OI symptoms are more common in patients during this process (Feldstein & Weder, 2012). Like the result of Jans et al. (2015), OH was more common among our participants in Stages 2 (sitting at the bedside) than in Stages 1, 3, and 4, which is due to blood deposition in the lower extremities and the decrease in venous return when transitioning from rest to standing. Also, our participants asked for extra time to rest, mainly in these stages. To prevent orthostatic hypotension, shortening the in-bed rest period and providing gradual

mobilization; to increase venous return, the use of elastic bandages and in-bed exercises for muscle activity (leg crossing) are recommended (Shroyer et al., 2009).

Antihypertensives also exacerbate OH (Shroyer et al., 2009; Testa et al., 2018). Vasodilatory effects of antihypertensive drugs cause an increase in blood deposition in the lower extremities and a decrease in venous return during mobilization. The use of antihypertensives is, therefore, a greater risk factor for the development of OH. In our study, we observed no significant difference in the incidence of OH between participants who were on oral antihypertensives after surgery and those who were not ($p>0.05$). Testa et al. (2018), found ACE inhibitor, nitrates, and diuretic combinations to be associated with OH in adult patients. Healthcare professionals should consider that OH may develop during mobilization in patients on antihypertensive drugs, and therefore, should take precautions against falls during this period.

Although the causes of OI are not fully known, it is associated with low oxygen content due to reductions in cerebral blood flow in patients with OH (Jans et al., 2015). Studies on OH also focus on monitoring the symptoms of OI. The incidence of OI is reported to be 39% (Jans et al., 2015), 42% (Jans et al., 2012), 13% (Cassina et al., 2016) and 25% (Müller et al., 2010) after total hip arthroplasty, cardiac surgery, and breast surgery, respectively. In our study, during early postoperative mobilization, 43.5% of our participants had OI. Unlike previous studies, this study also evaluated the correlation between OH and OI but found no statistical relationship. Our results showed that 48.5% of participants with OH also developed OI. However, there was no significant difference in the incidence of OI between those with and without OH ($p>0.05$).

This study recruited a small group to determine the effect of an early mobilization program on OH and OI in patients undergoing cardiovascular surgery. However, our results showed that the incidence rates of OH and OI were high.

CONCLUSION AND SUGGESTIONS

Early mobilization after cardiac surgery in ICUs is a safe process, but hemodynamic changes should be considered. CABG patients were monitored during early postoperative mobilization, and the incidence of OH and OI was determined after mobilization. Healthcare professionals might overlook orthostatic hypotension because it is sometimes asymptomatic. Therefore, accurate measurement should be performed, and the patient should be observed for symptoms for the diagnosis of OH. If the values vary, then the patient's blood pressure should be measured repeatedly. Once the patient is diagnosed with OH, precautions should be taken to prevent falls. Future studies should recruit larger samples of different patient groups to investigate the factors affecting OH and OI.

LIMITATIONS

This study limitation is many factors (anesthetics, beta-blockers, cardiac output, the extent of atherosclerosis, and the amount of carotid artery occlusion) may affect the incidence of OH and OI after cardiac surgery. However, this study did not focus on those factors.

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Ethic Approval

This study was approved by the Ethics Committee of Gazi University (Document Number: 24074710-18, Decision Number: 309). Permission was obtained from the institutions involved in the study.

Conflict of Interest

No conflict of interest was declared by the authors.

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Author Contributions

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