

The Effect of Family-Centered Care on the Duration of Weaning From Mechanical Ventilation in Coronary Artery Bypass Surgery Patients: A Clinical Trial Study

Leila Safaeepour,¹ Jamileh Mokhtari Nouri,^{2,*} Seyed Tayeb Moradian,³ and Seyed Mohammad Saied

Ghiasi⁴

¹Critical Care Nursing MSc Student, Faculty of Nursing, Baqiyatallah University of Medical Sciences, Tehran, IR Iran

²Nursing PhD, Department of Management, Associate Professor, Faculty of Nursing, Baqiyatallah University of Medical Sciences, Tehran, IR Iran

³Nursing PhD, Assistant Professor, Faculty of Nursing, Baqiyatallah University of Medical Sciences, Tehran, IR Iran

⁴Anesthetist, Assistant Professor, Faculty of Medical, Baqiyatallah University of Medical Sciences, Tehran, IR Iran

*Corresponding author: Jamileh Mokhtari Nouri, Nursing PhD, Department of Management, Associate Professor, Faculty of Nursing, Baqiyatallah University of Medical Sciences, 6th Floor, Nursing Faculty, P. O. Box: 14115-111, Tehran, IR Iran. Tel: +98-9122488525, Fax: +98-2188600047, E-mail: mokhtari@bmsu.ac.ir

Received 2017 January 23; Accepted 2017 February 01.

Abstract

Background: The use of nonpharmacological methods has been emphasized in the recent years. These methods are used to decrease the duration of weaning from mechanical ventilation after coronary artery bypass graft (CABG) surgery.

Objectives: The present study aimed at determining the effect of family-centered care on the duration of weaning from mechanical ventilation in patients undergoing CABG.

Methods: This clinical trial study was conducted in Jamaran Heart Subspecialty hospital in Tehran in 2016. Initially, convenient sampling method and random allocation were used by quaternary blocks to allocate patients into 2 groups of experimental and control, with 35 participants in each group. In the intervention group, the patients' family member chosen by the patient was entered into the ward during the weaning process. Patient's entrance time to the ward to extubation time was considered as the duration of weaning from mechanical ventilation in the 2 groups.

Results: Duration of weaning in the experimental group was 97 minutes less than the control group; in other words, the weaning duration of those in the control group was 1.4 times greater than those in the experimental group. This difference was statistically significant between the 2 groups ($P = 0.05$).

Conclusions: Family-centered care reduced the duration of weaning from mechanical ventilator in patients undergoing coronary artery surgery, which can remarkably decrease complications due to ventilation with positive pressure in these patients.

Keywords: Family-Centered Care, Mechanical Ventilator, Coronary Artery Bypass Graft (CABG), Weaning, Clinical Trial

1. Background

Cardiovascular diseases are the most common serious, chronic, and life-threatening diseases in the world (1). It has been estimated that the largest cause of worldwide death until 2020 would be coronary artery disease (2). American heart association (AHA) states that in the case of removing cardiovascular diseases, life expectancy would increase to 7 years in the United States. In England, cardiovascular diseases with 16 000 deaths per year is considered as the first cause of death. The growing trend of suffering from cardiovascular diseases is not specified to Western countries. In the study of Kita, it has been found that this group of diseases is increasingly growing in Japan as well (3). In a study in Finland, it was found that 9.1% of males and 4.9% of females were suffering from angina pectoris (4). Cardiovascular diseases in Iran, like many other countries, are the leading causes of death and the lost years

of life (5). In addition, among the cardiovascular diseases, coronary artery diseases are introduced as the first and the most common cause of death (6).

No action like cardiac surgery could influence the quality of life of patients suffering from cardiovascular diseases. Cardiac surgery is the most common therapeutic intervention for ischemic disease and valve problems. It has almost been about 35 years since CABG is being performed in the medical centers of the world (1). The prevalence of this surgery in North America, Asia, West Europe, and other areas is 26.79%, 0.72%, 17, 94%, and 18.14%, respectively. Of the open heart surgeries, 60% are specified to CABG in Iran (7). Following CABG, patients are directly transferred to ICU and are being observed by an experienced nurse who has specific and enough skills and knowledge in caring for such patients until they come out of anesthesia, and reach adequate oxygenation and hemodynamic stability.

After heart surgery, patients need meticulous monitoring in ICUs. Mechanical ventilation is one of the most common and most popular treatments in the period after surgery for all these patients (8). Patients undergoing mechanical ventilation experience many psychological and physiological negative complications (9, 10).

The process of weaning patients from mechanical ventilator in CABG patients, due to maintaining hemodynamic stability, is specifically important because inappropriate extubation could cause unpleasant complications (11).

Weaning from mechanical ventilator is one of the important processes of treatment in ICU because the process of weaning from mechanical ventilation allocates 40% of the whole duration of mechanical ventilation. Therefore, on time weaning from mechanical ventilation and extubation is clinically important (12).

In the recent years, nonpharmacological methods have been emphasized to decrease the duration of weaning from mechanical ventilator because one of the most important roles of nursing is early identification of physiological and psychological stresses (13). The presence of one member of the family as another nonpharmacological approach can control and decrease the physiological and psychological stress of the patients and their families (14). Family-centered care is not a new topic, but it is a growing philosophy and movement in a therapeutic care, resulting in improving quality of care and decreasing costs (15, 16). Family-centered care is has been indicated as one of the main implications of nursing in the 21st century, and its aim is to maintain the integrity of the patients' family and provide unique care for every patient (17, 18). In the family-centered education model, the active presence of the family is essential in assessing and diagnosing requirements and trainings because it is believed that illness of a family member results in the involvement of all the members of the family in the course of the disease cycle (19, 20).

2. Objectives

The importance of this issue, insufficiency, and deficiencies of the family-centered nonpharmacological studies at the time of weaning from mechanical ventilator in ICU, encouraged the researchers to assess the effect of family-centered care on the duration of weaning from mechanical ventilator in CABG patients in ICU as a type of nonpharmacological intervention in these patients.

3. Methods

This was a clinical trial study documented in Iran clinical trials recording center with IRCT201609014299N4 code.

The study population included all the patients' candidates for open heart surgery who were hospitalized in Jamaran hospital in Tehran from May 2015 to October 2016; they were transferred to ICU after undergoing open heart surgery by mechanical ventilator. Inclusion criteria were as follow: patient's willingness to participate in the study; age 18 to 75 years; performing heart surgery for the first time; nonemergency heart surgery; cardiac ejection fraction greater than 30% ($EF > 30\%$); and lack of psychological problems. Exclusion criteria were as follow: bleeding more than 300 mL per hour; a need for surgical intervention; any type of neurological disorder after surgery; unusual events during surgery (such as pumping time more than 2 hours and severe bleeding during surgery); lack of hemodynamic stability during weaning; and compromising patient's health and the need for health team intervention; delay in weaning process based on the physician order; returning to the operating room; requiring tranquilizers and painkillers more than the current treatment protocols; having IABP (Intra-Aortic Balloon Pump) after surgery; rhythm dependence to pacemaker; coagulation problems; and receiving more than one type of inotrope, or receiving inotrope with an unusual dose after surgery. Number of the samples was calculated to be 64 by considering Alpha equals (5%), Beta (10%) and power (80%) using Altman's Nomogram and according to standard difference (21). Considering 10% sample loss, 70 individuals (35 in each group) were studied. Convenient sampling method was used initially based on the inclusion criteria, and then random allocation with foursome blocks was done for the 2 groups.

Data collection tools included a researcher-made sheet for collecting demographic features, 3 underlying diseases, underlying risk factors, and underlying factors related to heart surgery, and recording the sheet of weaning duration from mechanical ventilator, in which the duration of the patient's entrance to ICU to the time of extubation was recorded. The validity of the collection sheet was examined by 10 experienced instructors. For sampling, samples who met the inclusion criteria were selected and provided written informed consent a day before surgery. Then, one member of the family, who was preferred by the patient, was familiarized with the ward environment by the researcher and received some explanations about the patient's conditions (tracheal tube, mechanical ventilator, chest tube, and other cards). Moreover, entering time and ways of providing care to the patient in the ICU after the surgery were explained to the patient's entourage. Furthermore, the necessary training was provided by the researcher considering the following points: patient's entourage should stay somewhere that does not disturb the medical team or other patients, and only he/she has to pay attention to the patient; he/she has to talk to the patient

and reassure the patient that the surgery has been performed successfully; he/she has to pay enough attention to the medical team recommendations; he/she should not intervene in the therapeutic routine actions; he/she has to go out of the ward if the medical team orders so; she/he may need to go out of the ward in the case of other patients' critical conditions; and physically, the patient should be in a corner of the ward where the entourage is in a relaxed condition to observe only his/her patient. One patient of the experimental group was being observed in every shift. The day after the surgery when the patients were transferred to ICU OH, the research process continued after the demographic information was filled out. Patient's entry time to ICU until his/her extubation was measured by a chronometer and documented. In the experimental group, after the patient's first inspiratory effort and if the patient's entourage had the inclusion criteria, the intervention would have been done, and the vital signs documented, and the patient's entourage would have entered to the ICU. In addition, in the control group, after the patient's entry to the ICU OH and in the case of meeting the inclusion criteria, the patient's vital signs were documented and only the usual cares were provided for the patient.

Measurement outcome in this study included the time of weaning from mechanical ventilator by chronometer (from the time of entering to the ward to the full extubation) based on minute. To avoid bias, patients and the staff, who were responsible for providing care and treating patients in ICU, did not know anything about the results of the actions and how the patients were categorized in the groups. Meanwhile, a nurse injected any type of painkillers or tranquilizers. In addition to documenting the drug dosage, the researcher documented the vital signs measurements at the already set times. In the case of any special condition for the patient, which has been explained in the exclusion criteria, the patient was excluded from the study, and special therapeutic actions were done according to the physicians and nurses' opinion of the related ward. Data were entered into SPSS Version 21 software. Independent t test was used for quantitative demographic information and chi-square test for qualitative demographic information. Kolmogorov-Smirnov one-sample test was used to verify data normality. Considering data normality, independent t test was used. Statistical significance was set at $P \leq 0.05$.

4. Results

Table 1 demonstrates the quantitative demographic features of the patients hospitalized in cardiac ICU in the 2 experimental and control groups. No significant differences were observed between the 2 groups in quantitative

demographic features based on the results of the independent t test ($P > 0.05$).

Table 2 demonstrates the qualitative demographic characteristics of the hospitalized patients in cardiac intensive care unit in the 2 groups. The results of the Chi-square statistical test revealed no statistical differences between the 2 groups with respect to qualitative demographic characteristics ($P > 0.05$).

Table 3 displays the underlying diseases of the hospitalized patients in cardiac intensive care unit in the 2 groups. Chi-square statistical test results showed no statistical differences between the 2 groups in underlying diseases ($P > 0.05$).

Table 4 demonstrates the underlying risk factors of hospitalized patients in cardiac intensive care unit in the 2 groups. Chi-square statistical test results revealed no statistical differences between the 2 groups in underlying risk factors ($P > 0.05$).

Table 5 presents the underlying factors related to the cardiac surgery of the hospitalized patients in cardiac intensive care unit in the 2 groups. Independent sample t test results showed no statistical differences between the 2 groups in underlying factors ($P > 0.05$).

Table 6 exhibits the weaning time between the 2 groups. The mean and standard deviation of weaning time in the intervention group was less than that of the control group; in other words, the mean of weaning time in the control group was 1.4 times higher than that of the intervention group. Independent sample t test results showed statistical differences between the 2 groups in weaning time ($P < 0.05$).

5. Discussion

The results of the present study revealed that family-centered care was useful in decreasing the duration of weaning patients from mechanical ventilation. Tables 1 and 5 present qualitative and quantitative demographic features, underlying diseases, and underlying risk factors related to heart disease of the patients participating in the study, which were homogeneous and were not significantly different from one another prior to the study.

Early weaning from mechanical ventilator is important in all the cardiac surgery units in the world because of some benefits such as faster recovery, faster discharge from ICUs, and preventing several complications of mechanical ventilation (12, 22). The results of the present study revealed that the presence of a member of the family could make a significant difference in decreasing the duration of patient's weaning from mechanical ventilator so the time in experimental group had decreased 97 minutes compared with the control group.

Table 1. The Quantitative Demographic Characteristics of the Hospitalized Patients^a

Variable	Groups		Statistical Test (Independent Sample t Test)		
	Intervention	Control	t	P Value	df
Age	62.17 ± 9.72	62.0 ± 9.17	0.76	0.94	69
BMI	28.16 ± 4.57	27.88 ± 3.75	0.28	0.78	69

^aValues are expressed as mean ± SD.

Table 2. The Qualitative Demographic Characteristics of the Hospitalized Patients^a

Variable	Groups		Statistical Test (Chi Square Test)		
	Intervention	Control	χ ²	P Value	df
Sex (Male)	25 (71.4)	27 (75)	0.11	0.73	1
Marital (Married)	35 (100)	36 (100)	-	-	-
Job (Retired)	18 (51.4)	18 (50)	0.94	0.81	3
Education (Diploma)	6 (17.1)	17 (47.2)	11.14	0.38	4

^aValues are expressed as No. (%).

Table 3. Underlying Diseases of the Hospitalized Patients^a

Variable	Groups		Statistical Test (Chi square Test)		
	Intervention	Control	χ ²	P Value	df
Hypertension (No)	22 (62.9)	19 (52.8)	0.74	0.39	1
Diabetic Mellitus (No)	22 (62.9)	23 (63.9)	0.01	0.92	1
Hyperlipidemia (Retired)	25 (71.4)	23 (63.9)	0.46	0.49	3
Pulmonary disorders (No)	33 (94.3)	36 (100)	2.12	0.14	1
Neurological disorders (No)	34 (97.1)	35 (97.2)	0.00	0.98	1

^aValues are expressed as No. (%).

Table 4. The Underlying Risk Factors of the Hospitalized Patients^a

Variable	Groups		Statistical Test (Chi Square Test)		
	Intervention	Control	χ ²	P Value	df
History of surgery	26 (74.3)	25 (69.4)	1.46	0.69	3
Sedative consumption (No)	24 (68.6)	21 (58.3)	0.80	0.37	1
Inotrope drug use (No)	32 (91.4)	33 (91.7)	0.00	0.97	1
Smoking (No)	28 (80)	28 (77.8)	0.53	0.81	1
Opium consumption (No)	27 (77.1)	32 (88.9)	1.74	0.18	1
Cardiac medications use (No)	32 (91.4)	29 (80.6)	1.74	0.19	1

^aValues are expressed as No. (%).

The results of this study were significant during weaning from mechanical ventilator, which could be due to the introducing and explaining the surgery process from

the beginning of the study until ICU postdischarge because the patient's entourage, due to his/her friendly and emotional relationship with the patient, introduced the

Table 5. The Underlying Factors Related to the Cardiac Surgery of the Hospitalized Patients^a

Variable	Groups		Statistical Test (Independent Sample t Test)		
	Intervention	Control	t	P Value	df
Number of graft	3.29 ± 1.05	3.44 ± 1.09	-0.55	0.69	69
Number of drain	2.23 ± 0.49	2.08 ± 0.37	1.41	0.16	69
Ejection fraction	49.00 ± 7.84	46.53 ± 7.82	1.33	0.19	69
Operating room time (minute)	243.28 ± 41.11	237.78 ± 46.00	0.53	0.60	69
Cross-clamp time (Minute)	42.21 ± 19.14	38.42 ± 16.44	0.86	0.39	64
Time pump (Minute)	65.42 ± 26.50	61.00 ± 24.92	0.70	0.49	64

^aValues are expressed as mean ± SD.

Table 6. Comparing the Weaning Time Between the 2 Groups^a

Variable	Groups		Statistical Test (independent Sample t Test)		
	Intervention	Control	t	P Value	df
Weaning time	259.43 ± 131.14	356.11 ± 256.16	-1.99	0.05	69

^aValues are expressed as mean ± SD.

surgery process to the patient at home with the patient's comfort and tranquility in mind when the patient has not yet experienced pain or restlessness and has not learned the confounding factors. Safavi et al. by quoting from Hosseiny, stated that introduction process has a significant positive effect on patients before the surgery, which is inconsistent with the results of the present study (23). The same results were achieved in the study of Mary Beth Happ et al. In their study, with the aim of family presence and observation during weaning from mechanical ventilator, they found that family presence influenced the duration of weaning from mechanical ventilator (24).

In addition to the sessions of introducing the unit and process of the surgery, which could play an important role in the duration of weaning from the mechanical ventilator in the 2 groups, the same quantitative and qualitative demographic information, underlying diseases, underlying risk factors, and underlying risk factors related to heart disease of the patients prior to the study between the 2 groups could be another factor in confirming the effect of family member presence because the studies have shown that these factors can significantly influence the success rate of weaning from mechanical ventilator. Jalalian et al. had stated that they had 63% success rate in their study, and one of the causes of such high statistic was the similarity between demographic information and underlying factors and disease (25). In addition, in other studies, the success rate in weaning from mechanical ventilator was 38% to 70%; the authors believed that one of the causes of this

success was the similarity between demographic information and lack of remarkable risk factors prior to the intervention (26).

The underlying diseases of the patients who underwent cardiac surgery and were hospitalized in the ICU are presented in Table 3. One of the causes of the high success in weaning from mechanical ventilator in the 2 groups is that these diseases were not significant in these 2 groups although the duration of weaning from mechanical ventilator in the experimental group was 1.4 time less than the control group. Studies have indicated that preoperative, transoperative, and postoperative variables are related to the prolonged mechanical ventilation time (27). Some studies have found that some demographic factors such as age (28), heart surgery, and underlying factors such as the number of heart surgery, and the amount of ejection fraction (29), and underlying diseases such as the history of mental disease, diabetes mellitus, and hyperlipidemia (30) can independently predict complications after heart surgery such as the longtime of weaning from mechanical ventilator.

Performing family-centered care had 97-minute effect on the duration of weaning from mechanical ventilator in the experimental group compared with the control group. In other words, patients in the experimental group were separated from mechanical ventilator 97 minutes earlier than patients of the control group. The weaning patients of the control group from the mechanical ventilator was totally 1.4 times of those in the experimental group. More-

over, the process of family-centered care is a process has to be started before the patient and his/her family's entry to the heart surgery process and should be continued after this process. Selecting a member of a family who has a more emotional and friendly relationship with the patient is helpful in conveying the necessary information to the patient because a member of the patient's family can convey the information with words more familiar to the patient and answer his/her questions. Similarity of qualitative and quantitative information, disease underlying factors, and heart surgery prior to the educational information can decrease complications caused by long time weaning from mechanical ventilator.

Acknowledgments

This article is the result of a MSc thesis of Baqiyatallah Medical Sciences University with the registration code of clinical trial center IRCT 201609014299N4. Also, we would like to extend our thanks to Jamaran Heart hospital staff for their assistance in this project.

Footnotes

Authors' Contribution: Leila Safaeepour: searching, data gathering, and writing the manuscript; Seyed Tayeb Moradian: data analysis. Jamileh Mokhtari Nouri, Seyyed Mohammad Saied Ghiasi: study design, data gathering, and writing the manuscript.

Funding/Support: All the research financial and material support was supported by Baqiyatallah University of Medical Sciences.

References

- Hoyert DL, Xu J. Deaths: preliminary data for 2011. *Natl Vital Stat Rep*. 2012;**61**(6):1-51. [PubMed: 24984457].
- Lloyd-Jones DM, Hong Y, Labarthe D, Mozaffarian D, Appel LJ, Van Horn L, et al. Defining and setting national goals for cardiovascular health promotion and disease reduction: the American Heart Association's strategic Impact Goal through 2020 and beyond. *Circulation*. 2010;**121**(4):586-613. doi: 10.1161/CIRCULATIONAHA.109.192703. [PubMed: 20089546].
- Kita T. Coronary heart disease risk in Japan ? an East/West divide?. *Eur Heart J Suppl*. 2004;**6**:A8-A11. doi: 10.1016/j.ehjsup.2004.01.003.
- Ahto M, Isoaho R, Puolijoki H, Laippala P, Romo M, Kivela SL. Prevalence of coronary heart disease, associated manifestations and electrocardiographic findings in elderly Finns. *Age Ageing*. 1998;**27**(6):729-37. [PubMed: 10408668].
- Hatmi ZN, Tahvildari S, Gafarzadeh Motlag A, Sabouri Kashani A. Prevalence of coronary artery disease risk factors in Iran: a population based survey. *BMC Cardiovasc Disord*. 2007;**7**:32. doi: 10.1186/1471-2261-7-32. [PubMed: 17971195].
- Sara JD, Eleid MF, Gulati R, Holmes DJ. Sudden cardiac death from the perspective of coronary artery disease. *Mayo Clin Proc*. 2014;**89**(12):1685-98. doi: 10.1016/j.mayocp.2014.08.022. [PubMed: 25440727].
- Babae S, Shafiei Z, Sadeghi MM, Nik AY, Valiani M. Effectiveness of massage therapy on the mood of patients after open-heart surgery. *Iran J Nurs Midwifery Res*. 2012;**17**(2 Suppl 1):S120-4. [PubMed: 23833593].
- Aghaie B, Rejeh N, Heravi-Karimooi M, Ebadi A, Moradian ST, Vaismoradi M, et al. Effect of nature-based sound therapy on agitation and anxiety in coronary artery bypass graft patients during the weaning of mechanical ventilation: A randomised clinical trial. *Int J Nurs Stud*. 2014;**51**(4):526-38. doi: 10.1016/j.ijnurstu.2013.08.003. [PubMed: 24035670].
- Wojnicki-Johansson G. Communication between nurse and patient during ventilator treatment: patient reports and RN evaluations. *Intensive Crit Care Nurs*. 2001;**17**(1):29-39. doi: 10.1054/jiccn.2000.1547. [PubMed: 11176006].
- Chlan L. Integrating nonpharmacological, adjunctive interventions into critical care practice: a means to humanize care?. *Am J Crit Care*. 2002;**11**(1):14-6. [PubMed: 11785552].
- Wood G, MacLeod B, Moffatt S. Weaning from mechanical ventilation: physician-directed vs a respiratory-therapist-directed protocol. *Respir Care*. 1995;**40**(3):219-24. [PubMed: 10141679].
- Akhtar MI, Hamid M. Success and failure of fast track extubation in cardiac surgery patients of tertiary care hospital: one year audit. *J Pak Med Assoc*. 2009;**59**(3):154-6. [PubMed: 19288941].
- Karnatovskaia LV, Johnson MM, Dockter TJ, Gajic O. Perspectives of physicians and nurses on identifying and treating psychological distress of the critically ill. *J Crit Care*. 2017;**37**:106-11. doi: 10.1016/j.jcrrc.2016.09.008. [PubMed: 27676170].
- Shapira M, Tamir A. Presence of family member during upper endoscopy. What do patients and escorts think?. *J Clin Gastroenterol*. 1996;**22**(4):272-4. [PubMed: 8771421].
- Wolff JL, Boyd CM. A Look at Person- and Family-Centered Care Among Older Adults: Results from a National Survey [corrected]. *J Gen Intern Med*. 2015;**30**(10):1497-504. doi: 10.1007/s11606-015-3359-6. [PubMed: 25933625].
- Heru AM. Family-centered Care in the Outpatient General Psychiatry Clinic. *J Psychiatr Pract*. 2015;**21**(5):381-8. doi: 10.1097/PRA.000000000000097. [PubMed: 26352224].
- Gallo KP, Hill LC, Hoagwood KE, Olin SC. A Narrative Synthesis of the Components of and Evidence for Patient- and Family-Centered Care. *Clin Pediatr (Phila)*. 2016;**55**(4):333-46. doi: 10.1177/0009922815591883. [PubMed: 26116351].
- Kenner C, Press J, Ryan D. Recommendations for palliative and bereavement care in the NICU: a family-centered integrative approach. *J Perinatol*. 2015;**35** Suppl 1:S19-23. doi: 10.1038/jp.2015.145. [PubMed: 26597801].
- Creasy KR, Lutz BJ, Young ME, Stacciarini JM. Clinical Implications of Family-Centered Care in Stroke Rehabilitation. *Rehabil Nurs*. 2015;**40**(6):349-59. doi: 10.1002/rnj.188. [PubMed: 25648522].
- Uhl T, Fisher K, Docherty SL, Brandon DH. Insights into patient and family-centered care through the hospital experiences of parents. *J Obstet Gynecol Neonatal Nurs*. 2013;**42**(1):121-31. doi: 10.1111/1552-6909.12001. [PubMed: 23316896].
- Rahmani R, Motahedian Tabrizi E, Rahimi A. To assess the effect of planned meeting on the physiologic indicators of the patients who suffer from Acute Coronary Syndrome. *J Crit Care Nurs*. 2013;**6**(1):57-64.
- Cheng DC, Karski J, Peniston C, Raveendran G, Asokumar B, Carroll J, et al. Early tracheal extubation after coronary artery bypass graft surgery reduces costs and improves resource use. A prospective, randomized, controlled trial. *Anesthesiology*. 1996;**85**(6):1300-10. [PubMed: 8968177].
- Safari M, Mahmoodi M. Effect of preoperative education and information on stress and weaning from mechanical ventilation in patients undergoing coronary artery bypass graft surgery selected hospitals in Tabriz. *Journal martyr Beheshti University of Medical Sciences. Pa-joohandeh*. 2005;**10**(5):9-15.

24. Happ MB, Swigart VA, Tate JA, Arnold RM, Sereika SM, Hoffman LA. Family presence and surveillance during weaning from prolonged mechanical ventilation. *Heart Lung*. 2007;**36**(1):47-57. doi: [10.1016/j.hrtlng.2006.07.002](https://doi.org/10.1016/j.hrtlng.2006.07.002). [PubMed: [17234477](https://pubmed.ncbi.nlm.nih.gov/17234477/)].
25. Jalalian HR, Aslani J, Panahi Z. Factors affecting the duration of mechanical ventilation device isolation of patients in intensive care units. *Trauma Mon*. 2009;**2009**(03, Autumn):163-8.
26. Arroliga A, Frutos-Vivar F, Hall J, Esteban A, Apezteguia C, Soto L, et al. Use of sedatives and neuromuscular blockers in a cohort of patients receiving mechanical ventilation. *Chest*. 2005;**128**(2):496-506. doi: [10.1378/chest.128.2.496](https://doi.org/10.1378/chest.128.2.496). [PubMed: [16100131](https://pubmed.ncbi.nlm.nih.gov/16100131/)].
27. Fonseca L, Vieira FN, Azzolin Kde O. [Factors associated to the length of time on mechanical ventilation in the postoperative period of cardiac surgery]. *Rev Gaucha Enferm*. 2014;**35**(2):67-72. [PubMed: [25158463](https://pubmed.ncbi.nlm.nih.gov/25158463/)].
28. Pannell LM, Reyes EM, Underwood SR. Cardiac risk assessment before non-cardiac surgery. *Eur Heart J Cardiovasc Imaging*. 2013;**14**(4):316-22. doi: [10.1093/ehjci/jes288](https://doi.org/10.1093/ehjci/jes288). [PubMed: [23288896](https://pubmed.ncbi.nlm.nih.gov/23288896/)].
29. Jones D, Mitchell I, Hillman K, Story D. Defining clinical deterioration. *Resuscitation*. 2013;**84**(8):1029-34. doi: [10.1016/j.resuscitation.2013.01.013](https://doi.org/10.1016/j.resuscitation.2013.01.013). [PubMed: [23376502](https://pubmed.ncbi.nlm.nih.gov/23376502/)].
30. Haanschoten MC, van Straten AH, ter Woorst JF, Stepaniak PS, van der Meer AD, van Zundert AA, et al. Fast-track practice in cardiac surgery: results and predictors of outcome. *Interact Cardiovasc Thorac Surg*. 2012;**15**(6):989-94. doi: [10.1093/icvts/ivs393](https://doi.org/10.1093/icvts/ivs393). [PubMed: [22951954](https://pubmed.ncbi.nlm.nih.gov/22951954/)].