



Comparison of Duration of Intubation in Coronary Artery Bypass Graft Surgery With On-Pump and Off-Pump

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Abstract

Objective: Cardiovascular diseases especially coronary artery disease (CAD) is still the major cause of mortality in the world. Coronary artery bypass grafting (CABG) surgery is considered one of the most effective treatment methods for CAD. One of the essential cares after open heart surgery is extubation of patients. So the present study was performed with the aim of comparative research about duration of intubation in CABGs with on-pump (with cardiopulmonary bypass machine) and off-pump (without cardiopulmonary bypass machine) in 2014.

Materials and Methods: This study was a descriptive correlative investigation. Sampling among available samples and in the random form was done on 100 patients of CABG surgery with and without cardiopulmonary bypass in Madani Heart hospital, Tabriz, Iran in 2014. Data collection tool was a two-part questionnaire that included all demographic information and effective factors during intubation. These questionnaires were completed by a researcher beside the observation and written consent information contained in the patients' records. Data recording was analysed using SPSS software

Results: This study showed a significant difference ($P < 0.05$) in the duration of intubation and sternum openness. Also this study showed a significant difference ($P < 0.05$) in the duration of intubation and using cardiac pulmonary bypass.

Conclusion: This study showed that openness of the sternum and the use of cardiopulmonary bypass machine are crucial factors for increasing of duration of intubation of patients undergoing CABG surgery. So this group of patients was under mechanical ventilation longer than the others.

Keywords: Coronary artery bypass grafting, Coronary artery disease, Intubation

Introduction

The heart is one of the vital organs of man. If there is any disorder in heart operation, it may expose the man's life at risk the man's life. However, the prevalence of cardiovascular disease is increasing in the world (1,2) and annually thousands of people lose their life because of coronary heart disease (CHD). Coronary artery disease (CAD) is the most common life-threatening diseases in the world and the main cause of death in human societies (3). Now day's cardiovascular disease allocates 25%-45% of all deaths in the world, which has become a major public health problem. It is the first cause of death and the fifth leading cause of disability. About 51 million and 100 thousand deaths occur in the world of which about 12 million and 775 thousand is related to cardiovascular disease. In the United States, cardiovascular diseases are the cause of 34.5% of the deaths (4). According to the World Health Organization (WHO) report 41.3% of all deaths in Iran are because of cardiovascular disease and it was predicted to be increased by 2030 to 44.3% (5).

Coronary artery bypass surgery is one of the common treatments for CAD (3). Coronary artery bypass surgery began in 1977 in Iran and in 1989 was promoted both qualitatively and quantitatively. At first this method of

surgery was just used by cardiopulmonary bypass, but recently the number of surgical cases is increasing without the use of cardiopulmonary bypass (6). Care and treatment of patients undergoing this surgery is a complex task that needs skilled team and experienced nurses. The main goal of special care after coronary artery bypass grafting (CABG) surgery is the amendment of physiological systems which is injured during operation (7).

One of the main goals of nursing care of these patients is maintenance of respiration and help to wean from the mechanical ventilation and extubation (8). Extubation has a variety of complications such as decrease of gag reflex, cough which disposes the patient to pneumonia, hypertension, dysrhythmias, reduce cardiac output, decreased venous return and collapsed lung. In contrast, shortening of the intubation time reduces costs, increases job efficiency and reduces the need for nursing care (9). The quick isolation of patients is a safe method that reduces the length of stay in intensive care unit (ICU) and generally in hospital, reduce almost 50% in the cost of care after heart surgery, reduce the morbidity related with heart and lung complications, reduce nosocomial pneumonia, health care costs and also reduce the other side effects of mechanical ventilation. So nurses can have an important

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role in the proper care process along with other members of the treatment team (10).

Gall and colleagues in their study on the effects of early extubation on heart-lung function found that increased left ventricular filling pressure improves the performance of the ventricles and thus increase cardiac output. On the other hand, it would also have beneficial effects on the respiratory system including the reduction of the risk of nosocomial pneumonia and lung tissue damage (11). Zevola and Mairer also studied about other useful effects of early extubation — improvement in patient comfort, the reduction of respiratory complications, the easiness of control, management of patients and cost saving (12). Fast discharge of patient, easiness of carrying out activities (that will prevent from lot of complications) and early physical activity are among the benefits that have been enumerated by Goodwin et al (13).

Considering that one of the advanced skills of ICU nurses is the ability of patients' extubation, so, these skills should be based on clinical criteria and the recognition of other variables affecting the extubation line will help health care workers, especially nurses, to be able to recognize early extubation patients from those who are in danger; foreseeing the specific circumstances of each patient, they act in such a way that the process of patients extubation from ventilator becomes short, affordable and safe (1).

Despite the benefits of early extubation, still in many open heart surgery center, such as Iran, patients with clinical criteria for early extubation, stay long hours under mechanical ventilation. In addition to some decades after performing surgery with cardio-pulmonary in Iran, however far too little attention has been paid in this area. So the purpose of this study was to compare the intubation time in CABG surgery with and without cardiac-pulmonary bypass.

Materials and Methods

This descriptive-comparative study was done during 6 months, from October to March 2014 in ICU of Madani Heart hospital, Tabriz, Iran. Data collection consisted of two parts: the first part the demographic information and the second influential factors (blood transfusion, drainage, addiction, smoking, any kidney, lung and brain diseases) in intubation which was completed by researcher by observing and referring to patients' records.

To determine the validity of the tools a content validity was used. The reliability of tool was determined by internal consistency. Cronbach alpha was used and the reliability of tool with the result of 0.8 was confirmed.

Inclusion criteria included all patients (aged 20 to 85 years and both gender) who had CABG surgery with pump and without pump for the first time. With Pukkak formula 100 patients who had inclusion criteria for this study were selected as a sample.

SPSS version 21 was used for analyzing data. Descriptive statistics such as mean, standard deviation (SD), variance and mean intubation time were used by *t* test and covariance test in patients undergoing CABG with and

without pump.

Results

In this study the mean age of patients was 55.8 ± 39.1 years (max = 85 years, min = 20 years). The majority of patients were male (71 %). In 24% of cases the sternum was open after CABG surgery (sternum was not closed after surgery for 24 hours), 23% smokers and 10% had a history of addiction. Sixty-six percent of the cases used cardiopulmonary pump and 34% without pump. Thirty-five percent of cases after surgery received inotropic and 57% received blood products. In most cases of this study intubation period was more than 24 hours (39%) and average intubation time in this study was 6.5 hours. Twenty-five percent of patients had significant drainage of more than 2000 mL. Most cases had a history of pulmonary disease (50%) and 22% had kidney disease. About 44% had ejection fraction (EF) in left ventricular. Most cases (44%) had cardiac output around 50% and only 2% of cases had EF less than 25% (Table 1).

There was significant relationship between duration of intubation and opening of the sternum after surgery using *t* test ($P < 0.05$; Table 2). Comparison of intubation with and without cardiopulmonary bypass machine showed statistically significance during off-pump in CABGs using *t* test ($P < 0.05$; Table 3). Analysis of covariance was used

Table 1. Baseline Personal Characteristics and Risk Factors of Patients

Variable	Group	Number	Mean (SD)	P
Gender	Male	71	30.11(33.97)	0.3
	Female	29	23.58(17.36)	
Education	Cycle	33	23.69(15.31)	0.2
	Diploma	42	34.54(46.16)	
	Associate Degree	18	23.15(25.18)	
	BS	6	14.12(10.9)	
	MA	1	8.7(1.2)	
City	Tabriz	28	26.28(16.21)	0.5
	Other city	69	29.43(34.79)	
	Foreign	3	18.33(9.81)	
Smoking	Yes	66	1.65(0.5)	0.8
	No	33		
Addict	Yes	10	1.9(0.3)	0.5
	No	90		
Drainage	Yes	25	1.75(0.43)	0.5
	No	75		
Pump	Yes	66	27.46(15.31)	0.7
	No	34		
Medical history	Kidney	22	1.39(0.94)	0.7
	Lung	50		
	Brain	3		

Table 2. Relation of Intubation Time in Patients With Sternum Remaining Open After Surgery

Intubation Time	No.	Mean (SD)	Mean Difference (95% CI)	P
Sternum remaining open after surgery				0.04
Yes	24	31.70 ± 20.14	30.69 (17.97-43.41)	
No	75	21.01 ± 14.04	30.69 (9.3-52.07)	

Table 3. Relation of Intubation Time in Patients With On-Pump and Off-Pump

Intubation Time	No.	Mean (SD)	Mean Difference (95% CI)	P
Pump				0.04
Yes	66	27.46 ± 15.31	-2.20 (-14.9 to 10.48)	
No	34	29.67 ± 47.59	-2.20 (-19.18 to 14.77)	

Table 4. Confounding Variables Using Analysis of Variance

Variable	Degree of Freedom	Frequency	Mean (SD)	Mean Difference	CI Upper	CI Lower	P
Gender	1	0.88		6.31			0.3
Male			30.11(33.97)		37.2	22.9	
Female			33.58(17.36)		34.9	12.53	
City	2	0.65		7.46			0.8
Tabriz			26.28(16.21)		33.97	15.6	
Other City			29.43(94.79)		36.6	22.1	
Foreign			18.33(9.81)		54.06	15.9	
Age	1	-	55.8(1.39)	103.93	-	-	0.7
Education	1	-	2(0.92)	391.78	-	-	04

for confounding variables that showed statistically significant difference ($P > 0.05$; Table 4).

Discussion

This study showed there is a significant relationship between patients with the sternum remaining open after surgery (for 24 hours) and time of intubation after CABG which was consistent with Ahmadi et al study (4).

According to the results of this study, after surgery 25% of patients had notable drainage of more than 2000 ml which made them return to the operating room for cleaning the drainage; this factor increased the duration of intubation time in patients. It also caused reduction of hemoglobin and hematocrit and eventually the need for blood products increased in this way. Maluenda et al considered that the relationship between the open sternum with duration of intubation time and the necessity for blood products is because of the blood dilution during heart-lung bypass in patients undergoing CABG and increased rate of bleeding after operation which reduces hemoglobin and hematocrit levels, thus reducing the oxygen transportation capacity and the amount of oxygen reaching to body tissues (14). Doering et al and Johnson et al showed that bleeding in 36.7% of cases was one of the causes of inability for early extubation (15,16).

According to the results of Jafroudi et al study there is a significant relationship in the chest drainage after surgery with duration of intubation which matches in this study. Establishing proper chest drainage with proper discharge prevent pressure on the heart and lungs and improve the performance of these organs. This improves breathing and reduces the need for ventilation support and decreases the time of the endotracheal intubation (3). In this study, for

the control of confounding variables (age, sex, education, etc.), covariance analysis was used which was not statistically significant. This was similar to results of Walthall et al research (17). Also in Ji et al study demographic variables between duration of the intubation and gender, did not have significant relationship which was in accordance with our study (18).

Research results in the field of health and disease or clinical records showed that there is a statistically significant relationship between these variables and extubation time of CABG surgery, showing that this study is in line with Imanipour and Bassampour study (1). Walthall et al reported that there is no significant relationship between the lung function variables and extubation time. In fact, in their study, the average intubation time of asthma or chronic pulmonary disease was longer than other patients which is not in match with our study (17).

Ingersoll and Grippi also reported that pulmonary status before operation and precedent of smoking with extubation time after CABG surgery has no significant relationship, which matches with our study (19).

In our study to investigate the relationship between intubation time of CABG surgery with and without pump, independent *t* test indicated statistically significant differences. Patients who used cardiopulmonary bypass stayed under the ventilator longer than those who did not use it. This is due to the fact that patients undergoing cardiopulmonary bypass used heparin and blood products during surgery. As heparin causes blood dilution and the need of patients to blood products increases and additionally in order to control the bleeding after surgery, they need longer time to stay under ventilator compared with other patients.

Conclusion

According to the results of this study, sternum remaining open (for 24 hours after the surgery) and the use of cardiopulmonary bypass machine - were very significant factors for patients undergoing CABG surgery. So this group of patients was under mechanical ventilation for a longer time than the others. So nurses have to be careful and skillful enough about patients who undergo open sternum and are under ventilator to avoid other diseases such as pneumonia or nosocomial infections. Using the ventilator for a long time causes the need more time to achieve hemodynamic stability. So nurse's attention and clinical skills in this direction is very important.

Ethical issues

Written informed consent was obtained from the patients for publication of this study. The study has been approved by the local ethics committee.

Conflict of interests

Authors declare that there is no conflict of interest.

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