TANAFFOS

Endotracheal Tube Duration in Elderly Patients after the Coronary Artery Bypass Grafting Surgery

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Background: In elderly patients, the management of the endotracheal tube after coronary artery bypass graft (CABG) can be challenging because they often have complex comorbidities. This study was done to determine endotracheal tube duration in elderly patients after CABG.

Materials and Methods: This retrospective study was conducted on 397 patients aged over 65 years under mechanical ventilation after CABG. Patients in two groups of endotracheal tube duration of less than 8 h and more than 8 h were compared. Medical records were used for data gathering. Descriptive statistics, Mann-Whitney U, Kruskal-Wallis test, and logistic regression model were used for data analysis.

Results: Endotracheal tube duration was 9.9± 5.89 h in elderly patients. According to the results of the Mann-Whitney U test, there was a significant difference between the two groups in terms of the history of smoking (p = 0.023), history of diabetes (p= 0.062), left ventricular ejection fraction (p= 0.028), and type of operation in terms of emergency and non-emergency (p= 0.069). The logistic regression model showed predictive variables of the endotracheal tube duration after CABG in elderly patients over 65 years, including the history of smoking (1.179- 4.543, CI: 95%, β=0.839, and , p=0.015), history of myocardial infarction (0.188- 1.019, CI: 95%, p= 0.055, β= -0.827), and the left ventricular ejection fraction less than 50% (0.202-0752, CI: 95%, p= 0.005, β= -0.943).

Conclusion: Considering the predictive factors, the duration of the postoperative endotracheal tube can play an important role in the careful care of elderly patients after CABG.

Key words: Age; Intubation; Endotracheal; Coronary Artery Bypass

INTRODUCTION

Aging is associated with an increase in cardiovascular diseases, and coronary artery disease is a major cause of death or inability in the elderly. The elderly patients are an important subgroup of high-risk patients (1-3). Coronary artery disease can be treated with different therapeutic methods according to the arterial involvement and underlying factors. The coronary artery bypass graft (CABG) is a common therapeutic option and a major method for patients with coronary artery stenosis (1, 4-6). On the other hand, the management of symptoms and treatment of elderly patients is difficult and aging is along with short- and long-term undesirable consequences after CABG in the vast majority of patients with coronary artery diseases. The elderly experience more complications and hospital deaths than younger patients (3, 7-10).

After the CABG and the patient transfer to the intensive care unit (ICU), the patient's connection to the mechanical ventilation device is essential and it is an important part of intensive care. Elderly patients are also covered by this law (11, 12). Long-term mechanical ventilation is a common problem in CABG in elderly patients; thus, recognizing different factors related to the duration of the endotracheal tube can help to provide better health care and a shorter ICU stay (13, 14). The accurate identification of the risk level and prediction of surgical mortality are necessary for the proper clinical decision-making and help to estimate the need for resources properly (15). The duration of mechanical ventilation after surgery is different in elderly patients. In different studies, aging has different effects on the duration of mechanical ventilation. According to the results of a study by Dermot Frengley et al., despite the fact that age is not the main predictor of consequences of mechanical ventilation, it can reduce the necessary criteria for successful separation of mechanical ventilation (16). On the other hand, Aikawa et al. found that the duration of mechanical ventilation in patients over 65 years of age was not different from those under 65 years of age (17).

Despite doubts about the CABG in the elderly, this kind of surgery is still one of the proffered treatment choices in these people, and on the other hand, because the duration of the endotracheal tube is an important and effective factor in the treatment process, patients with longer endotracheal tube duration- due to its complications- may need a longer stay in the ICU and hospital. Therefore, the present study was done to determine the duration of the endotracheal tube in elderly patients after CABG and its relevant factors.

MATERIALS AND METHODS

This cross-sectional study was conducted on 397 patients aged over 65 years undergoing CABG. The

research was a part of a large study, which was approved by the Deputy of Research and Technology of Guilan University of Medical Sciences with the Ethics Committee code of 960715075, under which 1202 cases of CABG patients were investigated. The inclusion criteria were all patients undergoing CABG with heart-lung pump without a history of previous cardiac surgery. They received no intra-aortic balloon pump during and after surgery, they also did not need heart valve surgery or structural heart repair or no need to return to the operation room, cardiopulmonary resuscitation, and re-intubation during the admission to the ICU.

The research tool consisted of a developed questionnaire based on the researcher's review of the literature and related books, and its validation was performed by assessing the content and formal validity so that the validity of the tool was confirmed by 10 faculty members and nurses working in the ICU after the cardiac surgery. In this two-part questionnaire, the first part consisted of demographic characteristics and variables related to the disease, including age, gender, height, weight, history of smoking and drug use, history of drug allergy, history of underlying diseases (high blood pressure, high blood lipids, chronic respiratory disease, and history of arrhythmia), and left ventricular drainage fraction prior to surgery (recorded in angiography report). The second part of intraoperative variables included the amount of arterial oxygen saturation at the end of the cardiac and pulmonary pump, the amount of arterial oxygen saturation at the entrance to the operating room, the duration of aortic cross-clamp, the mean glucose during the pump, and the duration of the endotracheal tube in hours.

The tool was completed based on the patient's medical records, the nursing report of ICU, the pump report sheet, and the anesthetic process report sheet in the operating

room according to each patient's file. The duration of the endotracheal tube was considered from the patient entry to the ICU until the removal of the endotracheal tube based on the anesthetist's order. The length of the tracheal tube duration for up to 8 h was considered as the short duration and the longer duration as the long tracheal tube duration (18-20). The collected data were statistically analyzed using SPSS 22. The Kolmogorov-Smirnov test was used to determine the normality of endotracheal tube duration. Given the non-normality of distribution, the nonparametric Mann-Whitney U test and the Kruskal-Wallis test were utilized. Finally, a logistic regression model was used to determine the most important factors related to the length of duration.

RESULTS

Based on the obtained results, the intubation duration was 9.9±5.89 h in elderly patients. Also, 83 (21.9%) out of 397 elderly patients were assigned to the mechanical ventilation of less than 8 h and 314 (79.1%) patients to the mechanical ventilation group of longer than 8 h. The majority of samples of both groups were males (60.2% in the mechanical ventilation group of less than 8 h and 65.3% in the mechanical ventilation group of greater than 8 h). The majority of samples in both groups had underlying hypertension (83.1% in the mechanical ventilation group of less than 8 h and 76.8% in the mechanical ventilation group of greater than 8 hours) and hyperlipidemia (72.3% in the mechanical ventilation group of less than 8 h and 63.1% in the mechanical ventilation group of greater than 8 h). According to the results of both groups, the majority of samples in both groups had no history of diabetes, myocardial infarction, renal problems, stroke, transient ischemic attack, chronic obstructive pulmonary disease, preoperative arrhythmias, associated valve problems, and other surgeries. In both groups, the majority of samples had a left ventricular ejection fraction of less than 50%

(84.3% in the mechanical ventilation group of less than 8 h and 72.6% in the mechanical ventilation group of greater than 8 h). The mean body mass index (BMI) was 27.04± 3.69 in the mechanical ventilation group of less than 8 h; and the majority of samples (53%) had a BMI of 25-29.9. The mean BMI was 26.57± 3.96 in the mechanical ventilation group of greater than 8 h, and the majority of samples (45.9%) had a BMI of 25-29.9. In the mechanical ventilation group of less than 8 h, the mean of the transversal aortic clamp was 36.45± 12.19%, and 50.6% of the subjects had transversal aortic clamp duration of less than the mean of cardiopulmonary bypass (60.15 ± 17.39), and also 53% of the subjects had a pulmonary artery bypass of less than the average. In the mechanical ventilation group of more than 8 h, the mean transverse aortic valve duration was 36.76±12.16%. 52.9% of subjects had the aortic valve duration of less than the mean of cardiopulmonary bypass of 60.54±17.30, and 55.1% of the subjects had the pulmonary artery bypass duration of less than the average. According to the results of the Mann-Whitney U test, there was a significant difference between the two groups in terms of the history of smoking (p= 0.023), history of diabetes (P= 0.062), left ventricular drainage fraction (P= 0.028), and the type of operation in terms of being an emergency and non-emergency (P=0.069). All variables, which were measured by relation assessment, entered into the model to determine the most important predictive variables of mechanical ventilation duration (Table 1).

Predictive variables of endotracheal tube duration after cardiac surgery in elderly patients of over 65 years of age based on the logistic regression model included the smoking history (95% CI: 1.179-4.543, p=0.015, and β= 0.839), history of myocardial infarction (95% CI: 0-188-1.019, p= 0.055, and β= -0.827), left ventricular ejection fraction of less than 50% (95% CI: 0.202-0752, p= 0.005, and β= -0.943) (Table 2).

Table 1. One-variable analysis of demographic characteristics and their significant level

Groups	Qualitative variables	Intubation time≤8 h N (%)	Intubation time>8 h N (%)	Sig.
Sex	Male	50(60.2%)	205(65.3%)	0.394*
	Female	33(39.8%)	109(34.7%)	
Smoker	Yes	12(14.5%)	83(26.4%)	0.023*
	No	71(85.5%)	231(73.6%)	
Opium	Yes	10(12%)	44(14%)	0.643*
	No	73(88%)	270(86%)	
Medical allergy	Yes	5(4%)	13(4.1%)	0.464*
	No	78(96%)	301(95.9%)	
HTN[1]	Yes	69(83.1%)	241(76.8%)	0.212*
	No	14(16.9%)	73(23.2%)	
HLP[2]	Yes	60(72.3%)	198(63.1%)	0.117*
	No	23(27.7%)	116(36.9%)	
DM[3]	Yes	40(48.2%)	116(36.9%)	0.062*
	No	43(51.8%)	198(63.1%)	
MI[4]	Yes	7(8.4%)	51(16.2%)	0.074*
	No	76(91.6%)	263(83.8%)	
TIA[5]	Yes	1(1.2%)	3(1%)	0.840*
	No	82(98.8%)	311(99%)	
CVA[6]	Yes	4(4.8%)	15(4.8%)	0.987*
	No	79(95.2%)	299(95.2%)	
History of arrhythmia	Yes	-	3(1%)	0.372*
	No	83(100%)	311(99%)	
COPD[7]	Yes	83(96.4%)	10(3.2%)	0.845*
	No	3(3.6%)	304(96.8%)	
RENAL	Yes	6(7.2%)	28(8.9%)	0.625*
	No	77(92.8%)	286(91.1%)	
Surgical history	Yes	22(26.5%)	98(31.2%)	0.407*
	No	61(73.5%)	216(68.8%)	
Obstruction of LEFT MAIN	Yes	13(15.7%)	75(23.9%)	0.109*
	No	70(84.3%)	239(76.1%)	
Ejection fraction	<50%	70(84.3%)	228(72.6%)	0.028*
	>50%	13(15.7%)	86(27.4%)	
Type of surgery	Emergency	13(15.7%)	75(23.9%)	0.069*
	Non-emergency	70(84.3%)	239(76.1%)	
Graft	1	1(1.2%)	3(1%)	0.681**
	2	8(9.6%)	36(11.5%)	
	3	38(45.8%)	165(52.5%)	
	4	32(38.6%)	97(30.9%)	
	5	4(4.8%)	13(4.1%)	
Pack cell on pump	No	20(24.1%)	53(16.9%)	0.529**
	1	7(8.4%)	61(19.4%)	
	2	31(37.3%)	118(37.6%)	
	3	25(30.1%)	77(24.5%)	
	4	-	5(1.6%)	
MAP[8] mean on pump	>53mmhg	39(47%)	140(44.6%)	0.696*
	<53mmhg	44(53%)	174(55.4%)	
Urine out put on pump	>730cc	28(33.7%)	115(36.6%)	0.626*
	<730cc	55(66.3%)	199(63.4%)	
Duration of cross clamp	>36 min	41(49.4%)	148(47.1%)	0.714*
	<36 min	42(50.6%)	166(52.9%)	
Duration of CPB[9]	>60 min	39(47%)	141(44.9%)	0.735*
	<60 min	44(53%)	173(55.1%)	
Groups	Quantitative variables	Intube time<8 h mean±SD	Intube time>8 h mean±SD	
BMI[10]		27.07±3.96	26.57±3.96	
Duration of cross clamp		36.45±12.99	36.76±12.16	0.393**
Duration of CPB		60.15±17.39	60.54±17.30	

* Mann-Whitney test   ** Kruskal – Wallis test

1: Hypertension, 2: Hyperlipidemia ,3:Diabetes Mellitus, 4:Myocardial Infarction,5:Transient Ischemic Attack,6:Cerebral vascular Accident,7:Chronic Obstructive Pulmonary diseases,8:Mean Arterial Pressure,9:Cardiopulmonary Pump,10: Body Mass Index

Table 2. Predictive variables: The duration of tracheal tube survival after cardiac surgery in elderly patients based on logistic regression model

Variable	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI for Exp(B)
Smoker history	0.839	0.344	5.941	1	0.015	2.314	1.179-4.543
Myocardial infarction	-0.827	0.432	3.669	1	0.055	0.437	0.188-1.019
Ejection fraction <50%	-0.943	0.335	7.907	1	0.005	0.390	0.202-0.752
Emergency surgery	0.543	0.335	2.625	1	0.105	1.721	0.892-3.317

DISCUSSION

The results of the present study indicated that the majority of samples had a mechanical ventilation duration of greater than 8 h. In a study by Miśkowiec et al., who studied the effects of age and risk factors on the incidence of complications and post-CABG morbidity, the duration of mechanical ventilation after cardiac surgery was significantly longer in patients over 65 years of age (21). Most outcomes of cardiac surgery in the elderly are more complex and significant than younger patients. According to the results of the study by Safaie et al., mechanical ventilation of more than 48 h is one of the most common post-cardiac complications in people over 70 years of age (22). According to a study by Gumus et al. on long-term mechanical ventilation after the CABG, patients who had undergone mechanical ventilation for a long time (more than 24 h), were more than 65 years old (13). In the present study, the majority of samples required mechanical ventilation of longer than 8 h, but on the contrary, there was no statistically significant difference between the group aged over 65 years and those under 65 years in terms of mechanical ventilation duration in a study by Aikawa et al. (17). This difference in obtained results can be due to differences in various definitions for considering long mechanical ventilation or different protocols for isolating patients from mechanical ventilation in different centers and may be largely due to comorbidities in the elderly. Aging makes significant changes in vital organs and the immune system. Given that the surgical complications can be severe in elderly patients (23). Perhaps different results can be due to different effects of the diseases and their associated complications on patients' recovery after cardiac surgery. In a study by Miśkowiec et

al., the comorbidities were more in people over 65 years of age than the group of people under the age of 65 (21).

The findings of this study indicated that smoking history is an important predictor of endotracheal tube duration after cardiac surgery in patients over 65 years of age based on the logistic regression model. Smokers are expected to have reduced respiratory capacity and increased respiratory dead space volume, more mucosal secretions, and more sputum, which all can delay the removal of the endotracheal tube because smokers postpone deep breathing after surgery; thus, the length of stay can be affected.

According to a study by Ji et al., who compared smokers and non-smokers undergoing the cardiac surgery, there was no significant difference in terms of duration of mechanical ventilation between non-smokers and those who had a history of smoking in the past (19), which is consistent with the results of the present study. In a study by Piotto et al., there was no statistically significant relationship between the history of smoking and the endotracheal tube duration (1). Probably, the obtained results were different in many cases because when patients became candidates for CABG, they gave up smoking before the operation, resulting in slightly improved pathological changes due to smoking. However, neither the mentioned studies nor the present study mentioned the duration of giving up smoking; hence, the effects of smoking on respiratory parameters had different degrees. Although the majority of people were over the age of 65 in both mentioned studies, the duration of smoking was not always precisely known in the elderly, and consequently, the rate of destruction of respiratory units could not be detected.

We also found that the history of myocardial infarction was another predictive variable of endotracheal tube duration. The left ventricular dysfunction following the acute myocardial infarction is an important predictor of mortality and morbidity and up to 50% of the patients in the early months after myocardial infarction do not show any improvement in the left ventricular drainage fraction (24, 25). Therefore, it is likely that the left ventricular drainage fraction is also decreased in a patient with a history of myocardial infarction before the cardiac surgery. It is difficult to make decisions about surgery in these patients (26). Therefore, it is expected that patients with a history of myocardial infarction or left ventricular drainage fracture will have different surgery consequences. In this regard, Hsu et al. found that long-term mechanical ventilation risk factors are age and left ventricular drainage fraction (27). In a study by Acosta et al. about one-third of patients had a history of myocardial infarction in the last 3 months; and nearly half of patients with the left ventricular drainage fraction of less than 50%, had longer mechanical ventilation (11). Pieri et al. also found that the patients with low left ventricular drainage fraction had a greater risk of postoperative complications (28). The results of the present study are consistent with the above-mentioned results.

The findings of various studies are different about intubation duration after CABG. Differences in the type of care provided before, during, and after CABG may be one of the reasons for the differences in the findings of various studies. In addition, the duration of the cardiopulmonary pump of less than 60 min is a factor that may cause side effects for the elderly patients after surgery, especially if they have a history of myocardial infarction and reduced left ventricular drainage fraction.

The intended definition for the left ventricular ejection fraction is another reason for the difference in the obtained results. In the present study, the cut-off point was 50% of the average left ventricular ejection fraction in patients. The values less than this present the low left ventricular ejection fraction; however, the left ventricular ejection fraction of less than 40% was defined as a low left ventricular drainage fraction in a study by Pieri et al (28). It is clear that in cases where the left ventricular ejection fraction is less than 40%, the heart will be less able to cope with surgical complications.

According to the obtained results of the present study, paying attention to variables affecting the endotracheal tube duration while admitting the elderly patients for CABG is suggested in order to provide better and more efficient health and nursing care. This research had some limitations; for instance, because our information was obtained based on the patients' medical files and the data might not be accurately recorded in some cases, conducting cross-sectional or prospective studies is suggested to determine the complications of cardiac surgery, and especially the endotracheal tube duration in elderly patients. According to another limitation of the present study, the removal of the endotracheal tube was performed by an anesthetic specialist in the studied center and studied samples had different anesthesiologists, which can affect the endotracheal tube duration. Elderly patients often have underlying diseases and conditions that can change surgical outcomes; hence, studying the factors associated with the postoperative endotracheal tube duration can provide valuable information for the healthcare team.

Conflict of interest

There is not conflict of interest in this study.

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