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Research Article

Comparison Between Early Versus Delayed Extubation In Patients Undergoing Coronary Artery Bypass Graft Surgery

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Abstract: ***Introduction*** Early extubation post cardiac surgery has been demonstrated to be a critical component of post surgical care that leads to better outcomes, decreased expense, improved rehab, and faster intensive care unit (ICU) discharge. The purpose of this study was to find out when extubation should be performed in a patient undergoing a coronary artery bypass grafting (CABG) and to compare doing so early versus later. A case control study conducted at the department of cardiac surgery, National institute of cardiovascular diseases (NICVD), Karachi, for a period of six months (from already 3rd December, 2023 to 2nd June, 2024). A total of 100 patients eligibility selected were included. Patients were subjected to the conventional anaesthetic method and median sternotomy procedure. When extubation wastime to time, patients where 100 percent awake and met the criteria for extubation. Time to extubation was defined as time in hours, and patients were divided into early and delayed extubation group. The median time to extubation was 8.8 hours (interquartile range [IQR]: 5.3–10.7 hours). The 100 patients were divided into 33 early extubated (33%) and 67 late extubated (67%). Time of extubation was shorter with early extubation group (4.5 hours; IQR: 3.5 to 5.25 hours) as compared to delayed extubation group (9.75 hours; IQR: 8.8 to 14.6 hours) ($p< 0.001$). There were significant relationships with extubation time for gender, age, body mass index, heart disease and hypertension history. No significant association of extubation time was found to residential status, smoking or type-II diabetes mellitus.

Keywords: Coronary artery bypass grafting, early extubation, delayed extubation, mechanical ventilation, intensive care unit, cardiac surgery.

INTRODUCTION

To offer high-quality care to the cardiac surgical patient, the creation and cultivation of evidence-based postoperative management are of paramount importance. Coronary artery bypass grafting (CABG), is a surgical procedure that deliberately diverts blood around the blocked or narrowed coronary arteries to restore blood flow to the myocardium in patients with severe coronary artery disease. Proper management of the postoperative period is required following surgery to assist recovery and minimize complications and optimal use of health care resources. An important component of post-operative care is the timely extubation (removal of the endotracheal tube). Clinical outcomes after cardiac surgery are improved with early extubation; and the benefits of early extubation have been demonstrated including: early hospital rehabilitation, reduction in intensive care unit (ICU) length of stay, decreased hospital expenses, and improved clinical outcomes. In cardiac surgical units with high ventilation bed and specific postoperative monitoring needs, the benefits of earlier extubation are especially significant, including reduced risk for ventilator associated pneumonia, reduced sedative medication use, increased mobilization and decreased length of stay in the intensive care unit. [1]

Patients are in general anesthesia for CABG surgery and need mechanical ventilation during and right after the procedure. Once surgery has been completed, the patient is moved to an intensive care unit where the patient's pulmonary function, hemodynamic status, neurological recovery and other clinical parameters are closely watched. Extubation should be considered when the patient is awake enough and has clinical criteria for extubation met that would allow the airway to be extubated without problems. Each patient, however, has a different extubation time which could be influenced by either his or her condition before the surgery, his or her recovery after surgery, or the clinical practices of the surgical team.[2] In an active Intensive Care Unit (ICU), a doctor or nurse finds himself or herself in a situation where his/her time and attention has priority on the most critical clinical issues. This occasionally postpones mundane interventions such as decreasing sedation and

determining readiness for extubation. However, opportunities for early extubation may be missed even in patients who are clinically bedside ready for extubation. Consistent extubation protocols and collaborative multidisciplinary care can contribute to the solutions to minimise such delays and promote timely postoperative recovery.

Poor outcome has also been associated with a prolonged postoperative ventilation. The US National Quality Forum uses ventilation of more than 24 hours as a performance indicator following cardiac surgery. Moreover, the time to extubation after CABG, aortic valve replacement (AVR) and combined CABG/AVR surgery has been highlighted as an important quality indicator in cardiac surgery.[9,10] These help to qualify the time required for recovering from surgery and how it can be reduced without impacting patient safety. A number of cardiac surgical centers have designed multidiscipline extubation plans to facilitate extubation. The procedures will be those where the cardiac surgeon, anaesthetist, intensivist, nurses and respiratory therapist co-ordinated. Whereas, though previous studies have shown efficacy in decreasing time on mechanical ventilation and length of stay in the ICU after elective cardiac surgery, early extubation should only be attempted under specific clinical requirements and at a time the treating experts deem appropriate. There have been several studies which have studied the timing of extubation post cardiac surgery. Imanipour et al. have stated that the mean time of extubation was 7.19 hours ± 3.00 hours (93 patients) [2]. The results of that study indicate that there are likely significant differences in extubation time between cardiac surgery patients, and that a significant percentage might still be mechanically ventilated beyond the first 6 hours.[3]

Rationale of the Study

Even though it has been shown to be beneficial to early extubation devices, extubation after a CABG can occur at varying times depending on patient characteristics and institutional practice. Data on early and delayed extubation and the relation between the two and demographic- and clinical characteristics is relevant to assess postoperative care. This was the reason for conducting the present study.The rationale behind the present study was the scarcity of the local data on the timing of extubation of a patient subjected to CABG. Therefore the study aimed to find the time to extubate and to identify the difference between early extubation versus delayed extubation in the patients undergone CABG in National Institute of Cardiovascular Diseases (NICVD), Karachi.

Objectives

1. To determine the mean time to extubation in patients undergoing coronary artery bypass graft surgery.
2. To compare extubation time between early and delayed extubation groups.

2. Literature Review

2.1 Coronary Artery Surgery and Coronary Artery Bypass Grafting

Coronary Artery Disease (CAD) is one of the leading causes of mortality and morbidity related to cardiovascular diseases. It is mainly due to atherosclerotic narrowing of coronary arteries resulting in decreased blood supply to the heart muscle (myocardium). Patients can suffer with myocardial ischemia/angina, myocardial infarction, or reduced ventricular function, depending on the location and extent of the obstruction. The surgical treatments of coronary artery diseases have dramatically progressed over the years. Initial therapies consisted of symptoms (sympathectomy) or the target organ (thyroidectomy), the internal mammary (ligation) and their wrapping (abrasion of the pericardium). There are other techniques that helped develop the history of coronary operations but did not reach the success and level of usage of contemporary revascularisation surgery.[4] Modern coronary artery surgery was based upon additional progress made in the art of the vascular anastomosis and on the development of the cardiopulmonary bypass. The studies of Alexis Carrel, John Gibbon, John Kirklin and others led the way in developing surgical techniques that would enable a surgeon to perform a controlled operation in a surgical field and make a dependable anastomosis between blood vessels. These advances paved the way for increasing the use of coronary artery bypass grafting (CABG) in the late 1950s and 1960s.[5]

Coronary artery bypass surgery is a significant operation in which patched-up blocks in the coronary arteries are resorted around with conduits (joints), which are either arteries or veins. The procedure's aim is to improve the blood circulation in regions of myocardium that are fed by damaged coronary arteries. In the appropriate patient population, CABG can reduce the symptoms of angina and enhance the results. There are two methods used to perform a CABG, cardiopulmonary bypass (CPB) and non-cardiopulmonary bypass (ACPB). The on-pump surgery uses a cardiopulmonary bypass circuit temporarily to maintain circulation whilst the grafting procedure is being completed. Off-pump surgery is when the grafting occurs without the use of the standard cardiopulmonary bypass circuit along the beating heart. Technique selection will depend on patient factors, coronary anatomy, surgical skills and clinical context. Commonly used grafts are the left internal mammary artery (LIMA) and saphenous vein grafts (SVG). As a result of its long-term patency the LIMA is often planted into the left anterior descending artery. There are other passages such as the right internal mammary, the radial and gastroepiploic arteries. The selection of the conduit and target vessel would depend on the type and degree of coronary disease.[6]

2.2 Coronary Anatomy, Indications, and Clinical Significance of CABG

Main blood supply to the myocardium is provided by left and right coronary artery. Left main coronary generally splits into left anterior descending (LAD) coronary artery and circumflex artery. LAD supplies most of the anterior myocardial sheet and the interventricular septum, and circumflex artery supplies the branches of the lateral myocardial sheet. The right coronary supplies the right side of the heart and typically is the origin of the posterior descending artery in a right-dominant heart. Patients' coronary circulation can be right-dominant, left-dominant or co-dominant (mixed right and left-dominant) regarding the origin of the posterior descending artery. Coronary artery obstruction leads to a decrease in blood delivery to the myocardial territory that it supplies, and if it does not open, it creates myocardial ischemia or permanent myocardial damage.[7] CABG should be offered to a patient with substantial coronary artery disease if the procedure is likely to offer clinical benefit. Indications are massive LMCA stenosis, multivessel disease, some patients with poor LV function and failure to respond to medical treatment effectively.

Both interventions (CABG or PCI) come with risks and benefits, and the decision will depend on the anatomy of the coronary arteries, the complexity of the coronary disease, the function of the left ventricle, presence of other diseases and surgical risk, as well as benefits expected from revascularization.[8] The knowledge gained from clinical trials has been a major factor in the understanding of the benefits of CABG. Previous randomized studies involving comparison of CABG with medical care demonstrated survival benefit in certain patients especially left main disease and triple-vessel disease patients. Further randomized studies have demonstrated CABG superiority compared with PCI for complex multivessel disease. For the primary composite endpoint, the FREEDOM trial found CABG to be superior to PCI in diabetic patients with multivessel coronary disease, but to have a higher risk of stroke.[8] The SYNTAX trial was another study that enhanced the evidence of CABG for patients with complex LAD/LM or triple-vessel disease (TVD). In this population, PCI was correlated with a higher requirement for repeat revascularization, supporting the role of CABG as an important treatment choice in appropriately selected patients. [8] But CABG has some potential complications such as stroke, wound infection, graft failure, kidney problem, arrhythmia (afib) following surgery and death. Patient selection, surgical planning, and postoperative care are, therefore, key aspects of CABG care that can affect the risk of complications.

2.3 Postoperative Extubation After Cardiac Surgery

Postoperative extubation is an important stage in the recovery of patients undergoing cardiac surgery. After general anesthesia and a CABG, the patient will continue on a mechanical ventilator until they are recovering well and are able to breathe on their own and protect their airway. Until recently patients undergoing cardiac surgery had to be mechanically ventilated for a long time. Recent trials have focused on some of the "fast-track" methods and earlier sedation withdrawal and extubation of clinically appropriate patients. Most cardiac surgical studies use a cut-off of approximately 6–12 hours from the time of surgery to consider early extubation.Early extubation is generally anything within the first 6 to 12 hours postoperatively, although this may differ between studies and institutions. Extubation within 6 hours has been an important quality measure utilized by the Society of Thoracic Surgeons. This demonstrates that a feature recognized to be associated with poor outcomes and waste of health care resources when patients are mechanically ventilated for longer periods.[9]

The risks involved are possible prolonged sedative use, later mobility, necessity to use mechanical ventilation for longer periods, and longer stay within the Intensive Care Unit (ICU).[10] These associations should not, however, be regarded as an indication for early extubation; the patients' clinical status will still be considered as a primary concern. The goal of fast-track extubation protocols is to coordinate the post-op assessment and reach a quick extubation. These can be carried out by utilising appropriate selection of anaesthetic and sedation, careful ventilatory management, monitoring the level of ventilatory function and early assessment of readiness for extubation. Important factors to successful implementation are the availability and coordination of the surgical, anesthesia, nursing and respiratory therapy teams.

Extubation Criteria

The following clinical criteria for extubation are described in the dissertation:

- The patient should be awake, responsive, alert and able to follow commands.
- Hemodynamic stability (mean arterial pressure > 70 mmHg; central venous pressure < 15 cm H_2O; and heart rate, 50 to 100 beats per minute).
- The objective of assessment should be based on the following arterial blood gas parameters: Adequate oxygenation and adequate ventilation.
- The spontaneous respiratory rate should be from 10 to 30 breaths per minute.
- The amount of chest-drain bleeding from the mediastinum should not exceed 100 mL in the last 30 minutes.

The following are used to judge a patient's stability for removal of the ET tube. All extubations decisions should be made according to the clinical assessment and NOT any single parameter.

2.4 Previous Studies on Extubation Timing

There are reported differences in the timing of extubation after cardiac surgery. Imanipour et al analysed 93 patients with a mean extubation time reported at 7.19 hours ± 3.00 hours. In this study, 43% of patients were

extubated by the end of the 6 hour period, and 57% by the end of 6 hours.[10] This can be compared with other cardiac surgical populations to assess the timing of extubation. Other research studies have examined variables that could affect the length of time it takes for patients to be extubated after surgery. These include age, gender, body mass index, smoking status, and hypertension, diabetes mellitus, other pre and/or peri-operative factors.[11] The results of the various studies have been somewhat variable, which may be related to the number of patients evaluated, patient selection, clinical protocol, or to different statistical analysis techniques applied to the data.

The patient's postoperative recovery is a factor that affects the decision on when to extubate. Mechanical ventilation may need to be used long-term in the case of hemodynamic instability, limited respiratory efforts, post-anesthetic lethargy, bleeding peritoneum, and other clinical issues. Hence, it is important to consider the age as well as the clinical condition of the patient. Even though rapid-track protocols are developed, the number of patients that are extubated within 6 hours might differ between cardiac surgical centers.[12] Some variation may be attributable to differences in postoperative care pathways, in patient populations, and in staffing and institutional procedures. Assessment of local data is therefore essential in order to appreciate current practice and opportunities for improvement of the efficiency of postoperative care. The present study was carried out at NICVD, Karachi, to evaluate the extubation timing in patients having CABG & to compare the difference between early and delayed extubation. The study also explored the relationship of the selected demographic and clinical factors like the gender, age, residential status, BMI, smoking, history of heart disease, type-II diabetes mellitus, and hypertension with the extubation time.[13]

MATERIALS AND METHODS

3.1 Study Design, Setting, and DurationVenturing analysis had been formulated as Descriptive cross sectional and the study was conducted in the National Institute of Cardiovascular Diseases (NICVD), Karachi. The study period was six months long, that is from 03rd December 2023 to 02nd June 2024. During the study period, patients who fulfilled the predesigned criteria were included in the study who were undergoing CABG.3.2 Sample Size and Sampling Technique

In all, 100 patients who were undergoing CABG were included in the study. The sample size was determined by WHO sample size calculator. Average extubation time reported previously was 7.19 ± 3.00 hours, a 95% confidence interval, and an absolute precision of 0.6 were used for this calculation. The sample size of the patient population was calculated to be n = 97 with n = 100 patients rounded up. Consecutive sampling was employed (non-probability). Patients were approached for inclusion in the study for the study period until the desired sample size was obtained.

3.3 Eligibility Criteria

Patients aged between 18-60 years of either sex could be included. The patients had to have stenosis 50% or more of the main coronary artery or stenosis 70% or more in at least one coronary vessel. Only those patients who were undergoing elective CABG and were undergoing standard cardiopulmonary bypass at median sternotomy were included.[22] Eligible patients were those that were ASA (American Society of Anesthesiologists) physical status I and II. Patients who were not included were those requiring re-exploration, not wanting to participate, having incompatible coronary arteries and having no myocardium available for grafting. The list of criteria was developed to define the study population and minimize the variance of patients that had clinical situations that were significantly different from the subjects of the study.

3.4 Operational Definitions

Extubation: This is when the endotracheal tube is removed when the patient is suitably ready for it as detailed in the dissertation.

Early extubation: Total extubation at or before 6 hrs post surgery.

Delayed extubation: If extubation was attempted at the end of the procedure that was delayed for more than 6 hours.

Time to extubation (TT): Hours from surgery to extubation (measured.

The study made a comparison and analysis of the timing of extubation between patients with early extubation and patients with delayed extubation.

Note: The term "mean clamp time" is included in the dissertation title; the objectives and results of the study emphasize the measurement of time to extubation. The terminology is to be verified with the original research synopsis at the point of submission of the final journal.

3.5 Data Collection Procedure

This study had been conducted after approval of the research synopsis by the institutional ethical review committee and the College of Physicians and Surgeons Pakistan. The patients admitted to the ward fulfilled the inclusion criteria were included after the aims, method, risks, and benefits of the study were explained. Informed consent and confidentiality was provided. Data were collected on demographic and clinical characteristics by the researcher.[14] The variables consisted of age, gender, smoking history, previous diagnosis of hyper tension and type-2 diabetes mellitus, and heart disease. BMI was also documented and classified, based on the same classifications used in the dissertation.

Median sternotomy surgery was performed on all the patients who had received CABG with a standard anesthetic technique. The patients were treated with postoperative care and mechanical ventilation once surgery, and clinical facility practice. When patient had

recovered sufficiently from anesthesia, they were evaluated for extubation readiness. Consciousness and responsiveness, hemodynamic stability, respiratory rate, arterial blood gas (ABG) findings, and the amount of mediastinal chest drain bleeding were assessed. All patients who fulfilled the extubation criteria were considered for the removal of the endotracheal tube and made decision by the in-charge of the unit. Extubation time (in hours) was recorded.[23] The patients were then divided into early extubation and delayed extubation groups based on the pred defined time-cutoff of 6 h. They were compared with respect to demographic and clinical variables recorded during data collection for their times of becoming extubated.

3.6 Statistical Analysis

The data collected were input and analysed by the Statistical Package for Social Sciences (SPSS), version 20. Normality of continuous variables was tested with Shapiro–Wilk test. Means and standard deviations or medians and interquartile ranges were used to present the data for continuous variables, depending on the distribution of the data. Categorical variables such as gender, residence, smoking habit, history of type-II diabetes mellitus, hypertension and heart disease were presented by frequency and percentage.[15] The extubation time was compared between early group and delayed group and Demographic and clinical specify. Both independent-samples t-test and Mann–Whitney U test were employed depending on distribution and nature of the variables as specified in the statistics analysis plan of the study. A p-value of <0.05 was deemed to be statistically significant. The analysis was planned to determine whether any differences were found between the study groups in terms of time needed to extubate and describe the characteristics that were found to be associated with early or late extubation.[24]

RESULTS

A total of 100 patients undergoing coronary artery bypass grafting (CABG) who met the inclusion criteria were included in this study. Demographic, clinical data and time to extubation were collected and analysed. Extubation time has been compared between early extubation and delayed extubation, and between different genders, ages, residential status (home or hospital), body mass index (BMI), smoking history, history of heart disease, diabetes Type-II and hypertension.

4.2 Energy Expenditure

The majority of subjects in this study were male (65 patients 65%) and female (35 patients 35%). Patients' median age was 45 years (IQR: 38–54.3 years) and 54 (54%) patients were 45 years or below.

For residence 61 patients (61%) resided in urban areas and 39 (39%) in rural areas. 54 patients (54%) admitted that they were smokers.

The median BMI was 31.2 kg/m² (IQR: 29.4–35 kg/m²). A majority of the patients were obese (72%) while 20% were overweight and 8% had a normal weight.

To answer the question on comorbidities, 48 patients (48%) had a history of heart disease, 58 (58%) patients had type-II diabetes mellitus and 52 (52%) patients had hypertension.

Table 1. Comorbidities in the study population (n = 100)

Comorbidity	Present, n (%)	Absent, n (%)
History of heart disease	48 (48%)	52 (52%)
Type-II diabetes mellitus	58 (58%)	42 (42%)
Hypertension	52 (52%)	48 (48%)

4.2 Overall Time to Extubation

Extubation was achieved in all 100 patients at a median time of 8.8 hours (IQR: 5.3–10.7 hours). Of these patients, 67 (67%) underwent delayed extubation, defined in the study as extubation after 6 hours, while 33 (33%) underwent early extubation. The median extubation time in the early extubation group was 4.5 hours (IQR: 3.5–5.25 hours), compared with 9.75 hours (IQR: 8.8–14.6 hours) in the delayed extubation group. The difference between the two groups was statistically significant ($p < 0.001$).

4.3 Comparison of Extubation Time by Body Mass Index

Extubation time differed significantly among BMI categories ($p = 0.016$). Patients with normal weight had the highest median extubation time of 15.2 hours (IQR: 8.9–17.5 hours). This was followed by overweight patients, with a median of 9.5 hours (IQR: 5.1–14 hours), and obese patients, with a median of 8 hours (IQR: 5.2–9.8 hours).

Table 2. Comparison of extubation time by body mass index (n = 100)

BMI category	Median time (hours)	IQR (hours)	p-value
Normal weight	15.2	8.9–17.5	0.016
Overweight	9.5	5.1–14.0	
Obese	8.0	5.2–9.8	

IQR: Interquartile range. Normal weight: BMI 18.5–24.9 kg/m²; overweight: BMI 25–29.9 kg/m²; obese: BMI >30 kg/m². The reported p-value compares BMI categories.

4.4 Comparison of Extubation Time by Smoking Status and Comorbidities

Extubation time was compared according to smoking status and the presence of selected comorbidities. Smokers had a median extubation time of 9.0 hours (IQR: 5–11.3 hours), compared with 8.3 hours (IQR: 5.3–10.6 hours) among nonsmokers. This difference was not statistically significant (p = 0.937). Patients with a history of heart disease had a median extubation time of 9.5 hours (IQR: 6.3–12 hours), compared with 6.6 hours (IQR: 4.3–9.9 hours) among patients without such a history. The difference was statistically significant (p = 0.006). For type-II diabetes mellitus, the median extubation time was 9.3 hours (IQR: 5.3–12.4 hours) among patients with diabetes and 6.7 hours (IQR: 5.1–9.9 hours) among those without diabetes. The difference was not statistically significant (p = 0.243). Patients with hypertension had a median extubation time of 9.4 hours (IQR: 6.1–12.7 hours), compared with 6.3 hours (IQR: 4.6–9.5 hours) among patients without hypertension. This difference was statistically significant (p = 0.007).

Table 3. Comparison of extubation time by smoking status and comorbidities (n = 100)

Characteristic	Status	Median time (hours)	IQR (hours)	p-value
Smoking	Yes	9.0	5–11.3	0.937
	No	8.3	5.3–10.6	
History of heart disease	Yes	9.5	6.3–12.0	0.006
	No	6.6	4.3–9.9	
Type-II diabetes mellitus	Yes	9.3	5.3–12.4	0.243
	No	6.7	5.1–9.9	
Hypertension	Yes	9.4	6.1–12.7	0.007
	No	6.3	4.6–9.5	

IQR: Interquartile range. Comparisons were performed using the Mann–Whitney U test.

In this study, 33% of patients underwent early extubation, while 67% underwent delayed extubation. The overall median time to extubation was 8.8 hours. Statistically significant differences in extubation time were observed according to gender, age, BMI category, history of heart disease, and hypertension. Residential status, smoking status, and type-II diabetes mellitus were not significantly associated with extubation time in the reported analyses.

DISCUSSION

For patients needing cardiac surgery, the sleepy state of anaesthetic has been the gold standard and they have been kept sleeping and breathing with a ventilator until they wake up the next morning. This was done to give the cardiovascular system and other organ systems the chance to recover from the changes that affect their physiology during cardiopulmonary bypass. Because prolonged mechanical ventilation can also cause atelectasis, decrease lung volumes, increase ventilator-associated pneumonia and also delay mobilization of the postoperative period, several studies have examined the safety and feasibility of early extubation after CABG surgery. Randomized controlled trials have shown that early extubation may be a safe alternative to traditional (long term) ventilation in suitable patients.17

In this current study, extubation was delayed a median of 8.8 hours (IQR 5.3-10.7 hours). The 100 patients included in this study had a 67% delayed extubation group (extubated after 6 hours) and a 33% early extubation group (extubated within 6 hours). The present data suggest that the study population had more cases of delayed extubation. Results are consistent with those of other studies. A total of 93 patients had CABG and had mean extubation time of 7.19 ± 3.00 hours, which is reported by Imanipour et al. The differences between these studies and the present study may be due to variations in patient characteristics, institutional practices, clinical protocols, and studies methods.25

5.1 Association of Demographic Characteristics with Extubation Time

This present study showed that there was statistically significant differences between the expectation of gender and extubation time. The median extubation time was 5.5 hours (IQR 4.5–9.5 hours) for the female patients vs 9.3 hours (IQR 6.5–11.5 hours) for the male (p = 0.004). age was also a significant variable in the extubation time. Patients > 45 years of age had a median time extubated of 9.25 hours (IQR: 6.3–11.3 hours) while those 45 years or less had a median time extubated of 6.32 hours (IQR: 4.75–9.8 hours), p was found to be 0.047. There have been varying reports of the impact of age and gender on post-operative extubation. Christian, Engel, and Smith showed a significant difference in presence of age in multivariable analysis, but not those of the other preoperative variables used in the univariate analysis.18 In a different study, Suematsu et al. demonstrated a significant difference in age, but not the other examined preoperative variables in multivariable analysis.[65] These differences suggest that demographic characteristics and extubation time may differ between various patient populations and settings. In the current study, there was no significant association between the time required for extubation and residential status. Urban residents slept median 6.75 hours/night compared to median 9.2 hours/night for rural residents (p = 0.139). The difference

between urban and rural residents was not statistically significant, however the median was higher amongst the urban dwellers.

5.2 Body Mass Index and Comorbidities

Extubation time was found to be significantly different between the BMI categories (p = 0.016). Normal weight patients had the longest median time for extubation (15.2 hours); overweight patients were next (9.5 hours) and obese patients were last (8 hours). The results need to be drawn with caution as only 8% of subjects had normal weight, while 20% were overweight and 72% obese. Observed association is not an indication of independence of BMI determining time to extubation. A history of hypertension and heart disease was another factor noted for significantly longer extubation times. Extubation time was significantly longer, 9.5 hours compared with 6.6 hours (p = 0.006), among patients with and without a history of heart disease, respectively. The median time to extubation in patients with hypertension was 9.4 hours, while it was 6.3 hours in patients that did not have hypertension (p = 0.007). Smoking status and type-II diabetes mellitus did not, however, significantly interact with extubation time.19 The present results closely corroborate the varied relationships reported in earlier research. Other studies have reported conflicting findings about how various perioperative factors correlate with prolonged post operative ventilation, although age, gender, BMI, and comorbid illnesses may affect the outcome of the postoperative recovery in different ways for various populations.

5.3 Clinical Implications

The results of present study reveal that the delayed extubation was more prevalent among the patients who were undergoing CABG at NICVD, Karachi, as compared to early extubation. These correlations with age, gender, BMI, past of heart disease and hypertension relate to the characteristics of patients with a longer extubation time in this population. In general, however, this should be decided on a case-by-case basis taking into account awareness, respiratory function, hemodynamic stability and postoperative bleeding.20 Age, sex or any other demographic factors should not influence decision to extubate or not extubate. Because consumption of blood products and inotropic support might prolong the extubation interval and interventions that can positively improve either mean arterial pressure or hematocrit levels may shorten the interval in the intensive care unit, the study discussion of the original dissertation also mentions these factors. These observations indicate that pre- or peri- and post-operation conditions could play an important role besides pre-Operation factors.21

5.4 Limitations

Results should be evaluated taking into account the design and sample of the study. The survey adopted non-probability consecutive sampling and had 100 patients from one hospital that specializes in cardiac surgery in the study. Results might, therefore, not be applicable to other institutions' entire patients with CABG. Moreover, all the associations observed do not prove causation. In isolation, the reported comparisons do not provide evidence of an independent effect of demographics and comorbidities on extubation time. More research with larger samples and proper multivariable analysis is necessary to determine independent risk factors for delayed extubation.

CONCLUSION

In this study, 33% of the population extubated early and 67% delayed extubation. The overall median MTET was 8.8 hours (IQR: 5.3–10.7 hours). The median time was 4.5 hours in early extubation group and 9.75 hours in delayed extubation group. The longer extubation times the reported analyses were significantly associated with older age, male gender, normal weight, and history of heart disease or hypertension. The association was not significant between residential status, smoking status and extubation time type-II diabetes mellitus. The above results demonstrate the need to more carefully examine the extubation practices after CABG. Early extubation can help facilitate recovery from surgery and facilitate the use of ICU resources when clinically appropriate. When making extubation decisions, however, the overall clinical condition and established extubation criteria ought to play a role.

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