Research Article

In-Hospital Outcomes of Early Extubation in Post CABG Patients: A Retrospective Study from a Tertiary Care Hospital in Karachi, Pakistan

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Abstract: Background: The Society of Thoracic Surgeons established extubation within six hours of surgery as a standard quality of care supported by clear national registry information on positive effects. This is evident that clinical profile of patients undergoing coronary artery bypass grafting (CABG) is changing over the time and there is paucity of such data from Pakistan.

Objective: To determine in-hospital outcomes of early extubation among CABG patients in a tertiary care hospital.

Materials and Methods: This retrospective chart review was performed by Cardiac Surgery Department at Liaquat National Hospital during March to August, 2025. Data was retrospectively retrieved and reviewed for year 2023 and 2024. Early extubation was defined as extubation within six hours of surgery. Data was retrieved for patients' demographics, clinical features and in-hospital outcomes from patients' medical record files.

Result: A total of 206 records were reviewed. Mean age of patients was 58.8 ± 8.5 years. Early extubation was seen in 36.4% patients. Intubation time (hours) (5.3 ± 0.3 versus 9.8 ± 3.7, p<0.001), ICU stay (days) (26.8 ± 1.8 versus 35.7 ± 6.9, p<0.001) and overall hospital stay (days) (6.5 ± 0.5 versus 7.4 ± 0.5, p<0.001) were significantly lower among patients who underwent early extubation. Reintubation rate (1.3% versus 3.8%, p=0.420), respiratory complication rate (2.7% versus 8.4%, p=0.140) and death rate (2.3% versus 5.3%, p=0.260) were not significantly different among early and late extubated patients.

Conclusion: The findings of the present study support that the practice of early extubation was safe and beneficial in post CABG patients with lower ICU days and overall hospital stay in contrast to the patients with prolonged intubation.

Keywords: Cardiac surgery, Coronary artery bypass grafting, Fast-track cardiac care, Intubation, Extubation, Anesthesia.

INTRODUCTION

Patients may be admitted to critical care units with an endotracheal tube after surgery or anesthesia on account of multiple reasons. These include hypothermia, hemodynamic instability, airway compromise, need for additional resuscitation, respiratory insufficiency and the ongoing effects of neuromuscular and anesthetic agents [1-3].

Long-term intubation and mechanical ventilation may be necessary for patients whose critical functions are consistently disrupted. On the other hand, after being admitted to intensive care and having the underlying causes corrected, patients who are still tracheally intubated after surgery for more quickly reversible reasons may be extubated right away. Health care providers must make their own decisions regarding the time of extubation, even though guidelines have been established [4-6]. Thus the final verdict of maintaining intubation after surgery is generally varies from cases to case, taking into consideration patients' coexisting diseases, intraoperative events and overall postoperative response. Vigilant examination by anesthesiologist and critical care team for individual patients are crucial for reaching the decision to wean off the ventilator for patients' safety and optimal outcomes.

Prakash *et al.* originally described fast-track cardiac treatment, sometimes known as early extubation, in 1977 [7]. In cardiac care, "fast-tracking" refers to a complicated strategy that includes early extubation (EE), anesthetic treatment, mobilization, and hospital discharge in order to decrease perioperative morbidity, expenses, and duration of stay in the hospital and critical care unit. Efforts have continued to lower the incidence of respiratory problems owing to tracheal intubation, mechanical ventilation and other risk variables including age and numerous thoracic surgical methods [8, 9].

The Society of Thoracic Surgeons established extubation within six hours of surgery as a standard quality of care supported by clear national registry information on positive effects [10]. In order to reduce opioid dosage, the objectives of all early extu-

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bation regimens have been centered on cost reduction, effective resource use, and value-based healthcare. These objectives have most obviously been met by the application and compliance of fast-track extubation methods [11, 12]. Additionally, there is evidence linking intubation for longer than 12 hours to increases in length of stay, morbidity, and mortality [2, 10]. However, given that patients may not experience a significant rise in operative mortality and morbidity until they have been intubated for more than 12 hours, some have argued that the 6-hour standard may not be solely founded on physiological data [13].

It is clear that patients undergoing coronary artery bypass grafting (CABG) have a shifting clinical profile over time, with increased concomitant illnesses among CABG patients [14, 15]. The creation of fast track algorithms for early post-CABG extubation has been one tactic suggested to reduce CABG resource usage. Many of the researches have been conducted in past decades to determine the outcomes of early extubation among CABG patients [16-18]. However, the profile of CABG patients is changing and there is paucity of such data from Pakistan. Thus, in such scenario it becomes of utmost priority to determine outcomes of early extubation among CABG patients in present time.

MATERIALS AND METHODS

This retrospective chart review was performed in Cardiac Surgery Department at Liaquat National Hospital during March to August, 2025. The data was retrieved after acquiring ethical approval from Ethics Committee of Liaquat National Hospital (App#1022-2024-LNH-ERC, Dated: February 11, 2025).

Data was retrieved for year 2023 and 2024. Inclusion criteria was patients of age 18 years and above of either gender and underwent for elective CABG. Exclusion criteria was cases with known respirator and pulmonary diseases, patients requiring advance circulator support other than intra-aortic balloon pump, patients with lactic acidosis or with excessive bleeding (>200mL in first post-operative phase), redo CABG cases and missing data in medical record files.

Patients were extubated on confirming absence of apnea, no negative change in patients hemodynamic stability and end-tidal carbon dioxide <50 mmHg, peripheral oxygen saturation >90% with a fraction of inspired oxygen 0.4, patient able to lift head off pillow, patient able to lift both hands, up and able to give "peace sign," patient able to stick tongue out of mouth, positive cuff leak noted, and no active bleeding. Based on Enhanced Recovery after Surgery (ERAS) guidelines, early extubation was defined as extubation within 6 hours following surgery and this criteria was uniformly considered for all patients [19].

Data was retrieved for patients' demographics including age and gender, clinical features such as comorbidity, presenting symptoms, ejection fraction (EV) and surgical details including operative time, use of intra-aortic balloon pump, day or night surgeries. Following in-hospital outcomes were determined including intubation time, reintubation rate, respiratory complication, ICU stay, overall hospital stay and death rate.

STATISTICAL ANALYSIS

Data was analyzed using SPSS version 27. Categorical variables were summarized in terms of frequency and percentage. Numerical variables were first subjected to normality assumption using Shapiro-Wilk test. Normally distributed numerical variables were expressed as mean ± standard deviation. Non-normal variable were presented as median with inter-quartile range (IQR). Chi-square test was applied to compare categorical variables among patients with early and late extubation. While independent t-test was applied to compare numerical variables among the two groups. Statistical significant was set at $p \leq 0.05$.

RESULT

A total of 206 records were reviewed. Mean age of patients was 58.8 ± 8.5 years. Age range was 21-81 years. Average BMI was 27.1 ± 5.7 Kg/m^2. BMI range was 16.4-40 Kg/m^2. Mean operative time was 5.2 ± 0.7 hours with range of 4-6.5 hours. Mean EV was 48.2 ± 1.81% with range of 45%-50%. Majority of patients were males (77.2%), having diabetes (63.1%) and hypertension (76.7%). Most of the patients presented with symptoms of chest pain (52.9%) and generalized weakness (51%) (Table **1**).

Table 1. Summary Features of Sociodemographic and Clinical Parameters.

Variables	Frequency (%)
Demographic Features	
Gender	
Male	159(77.2)
Female	47(22.8)
Clinical Features	
Comorbid	
Diabetes	130(63.1)
Hypertension	158(76.1)
Dyslipidemia	166(80.6)
Asthma	18(8.7)
COPD	14(6.8)
Presenting Symptoms	
Chest pain	109(52.9)
Generalized weakness	105(51)
Shortness of breath	45(21.8)
Palpitations	20(9.7)
Surgical Features	
Operative Time	
4-5 hours	79(38.3)
5-5.9 hours	41(19.9)

Continue

Continue

>6 hours	86(41.7)
Intra-Aorticballoon Pump	
Yes	21(10.2)
No	185(89.8)
Intraoperative Complication	
Yes	4(1.9)
No	202
Surgery Schedule	
Morning to Afternoon	180(87.4)
Evening / Night	26(12.6)

Median intubation time was 8.2 ± 3.7 hours. Intubation time ranges from 4.5-24 hours. Early extubation was seen in 36.4% patients. Dylipidemia was signfiicantly higher among patients who were extubated after six hours (p<0.001). Frequency of palpitation (p=0.021) and morning to after noon surgeries (p<0.001) were higher in patients who underwent early extibation (p=0.021). Proportion of patients who underwent morning to after noon surgeries was significantly higher among those extubated after six hours(p<0.001) (Table **2**).

Table 2. Comaprison of Patients' Features among those who Underwent Early and Late Extubation.

Variables	Early Extubation	Late Extubation	p-value
Age (years)			
Mean ± SD	60.0 ± 8.1	58.2 ± 8.7	0.153
Ejection fraction (%)			
Mean ± SD	48.4 ± 1.7	48.1 ± 1.8	0.367
Body Mass Index (Kg/m²)			
Mean ± SD	26.6 ± 5.7	27.3 ± 5.6	0.404
Operative Time (hours)			
Mean ± SD	5.1 ± 0.3	5.2 ± 0.7	0.528
Gender, n(%)			
Male	57(35.8)	102(64.2)	0.759
Female	18(38.3)	29(61.70	
Comorbid, n(%)			
Diabetes	47(36.2)	83(63.8)	0.921
Hypertension	58(36.7)	100(63.3)	0.871
Dyslipidemia	70(42.2)	96(57.8)	<0.001*
Asthma	10(55.6)	8(44.4)	0.458
COPD	8(57.1)	6(42.9)	0.603
Presenting Symptoms, n(%)			
Chest pain	44(40.4)	65(59.6)	0.211
Generalized weakness	48(38.1)	65(61.9)	0.608
Shortness of breath	16(35.6)	29(64.4)	0.893
Palpitations	12(60)	8(40)	0.021*
Intra-aorticballoon Pump, n(%)			
Yes	11(52.4)	10(47.6)	0.108
No	64(34.6)	121(65.4)	
Intraoperative Complication, n(%)			
Yes	1(25)	3(75)	ǂ1.000
No	74(36.6)	128(63.4)	
Surgery Schedule, n(%)			
Morning to Afternoon	105(58.3)	75(41.7)	<0.001*ǂ
Evening / Night	26(100)	0(0)	

*Significant at p<0.05, ǂFisher-exact test is reported.

Average intubation time (p<0.001), ICU stay (p<0.001) and over hospital stay (p<0.001) was significantly higher in patients underwent delayed extubation. While reintunation rate (p=0.420), respiratory complication rate (p=0.140) and death rate (p=0.260) were not significantly different among the two study groups (Table **3**).

Table 3. Comaprison of Patients' in-Hospital Outcomes among those who UNDERWENT Early and Late Extubation.

Outcomes	Early Extubation	Late Extubation	p-value
Intubation Time in Hours			
mean ± SD	5.3 ± 0.3	9.8 ± 3.7	<0.001*
Reintubation rate			
n(%)	1(1.3)	5(3.8)	0.42
Respiratory Complication			
n(%)	2(2.7)	11(8.4)	0.14
ICU Stay in Hours			
mean ± SD	26.8 ± 1.8	35.7 ± 6.9	<0.001*
Overall Stay in Days			
mean ± SD	6.5 ± 0.5	7.4 ± 0.5	<0.001*
Death Rate,			
n(%)	3(2.3)	4(5.3)	0.26

*Significant at p<0.05.

DISCUSSION

In cardiac surgery procedures, EE is considered as important clinical decision, as length of intubation of id directly related to post-operative recovery outcomes [20]. In recent years practice of EE has gain attention and rise. In our study, EE rate was 36.4%. this finding corroborates with findings of Nguyen Q, *et al.* [21] and Guller U, *et al.* [22]. Nguyen Q, *et al.* [21] performed a larger study with 8872 patients and reported that one third of patients (2950) were extubated within six hours following cardiac surgery. Guller U, *et al.* [22] also studied a large number of patients

(6446) underwent CABG and found that 29% of them were extubated early (<6 hours). In one study, L Xia *et al.* [23] found that only 13.6% of patients had delayed extubation, which was a contradictory finding. However, their criteria of delayed extubation was postoperative mechanical ventilation lasting >48 h. A scoping review analyzing 8 articles reported that prevalence of delayed extubation ranges from 13.6-91.9%. The authors summarized that reasons of this variations could be patients' demographic, clinical and surgical findings, concomitant diseases, use of different intra-operative devices, and incidence of postoperative events [24]. Different thresholds for defining late extubation, different surgical practice and ICU protocols are main factors that may influence extubation rate beside patients' demographic and clinical features.

Re-intubation is a serious concern following cardiac procedures. Re-intubation needs to be performed in case developing respiratory failure or airway obstruction. This situation poses a significant post-operative challenge directly impacting the patients' outcomes. In this study, re-intubation was minimal however, still an incidence was higher in delayed group than EE group without any significant difference (3.8% versus 1.3%). Helwani MA, investigating the effect of 3 hour fast track extubation protocol also demonstrated the similar finding of rare incidence of reintubation rate with no significant differences among delayed versus fast track extubation patients in terms of reintubation rate [25]. Brovman EY, [26] examining the association between timing of extubation and reintubation following cardiac surgery also reported lower incidence of reintubation; 1.6% after CABG with no significant association between timing of extubation and reintubation incidence. Lower reintubation incidence makes sense because decision to wean patients off the ventilator is carefully made after detailed assessment of their respiratory and hemodynamic status.

Following the cardiac surgery ICU stay and overall hospital stay are key indicators of post-operative course and overall recovery. ICU stay indicates mainly surgical complexity, intubation time whereas hospital stay reflect duration of post-operative complications and speedy recovery as a whole. In this study, early extubated differed to late extubated in terms of both ICU days and overall hospital stay with lesser stay in EE cohort. In contrast, to our findings, Helwani MA, did not significant difference in ICU stay between two cohorts [25]. Richey M, [27] implemented the protocol of EE at their facility and compared the data parameters including ventilation time, ICU stay and overall stay before and after the protocol. Surprisingly authors found that EE (<6 hours) protocol resulted in higher ICU stay after protocol implementation as compared to before protocol implementation (49.45 hours versus 40.3 hours) while there was no difference in overall hospital stay [27]. Every facility has their own internal protocols including nursing care, ICU management. There could also be difference of surgical complexity and patient selection influencing patients' outcomes. Moreover, there could be different administration protocols for transferring patients from ICU towards resulting in conflicting findings among the studies.

Generally death rate is not high following isolated CABG procedures and favorable outcomes are achieved as expected. Deaths are usually seen in cases with significant morbidities like having multiple other uncontrolled diseases or developing post-operative complications. However, difference in death rate among early and late extubated patients can be expected based on the fact that late extubation is performed in patients with complex surgical procedure or delayed recovery. Thereby such patients are at higher risk because of developing various complications which may influence mortality. In this study, we have seen this trend, a higher mortality rate among late extubated patient than early extubated ones but it did not reach to statistical significance. The finding is corroborated with existing literature reporting higher mortality among late extubated patient but without significant differences [21, 22, 25]. The simple reason of consistently non-significant difference in various studies is low mortality rate.

LIMITATIONS

The current investigation suffers with few serious limitations. The study was carried out in a single center tertiary care hospital study where the surgical team is more comfortable to attempt for early extubation because of availability multidisciplinary teams for patient care than heart specialized hospitals. This study was based on a retrospective chart review compromising completeness of data because missing documentation. The analysis was descriptive and exploratory with limited number of cases. A future study may be conducted addressing all of the limitations of this study for validating the findings of current study.

CONCLUSION

The findings present study support the practice of early extubation was safe and beneficial in post CABG patients with lower ICU days and overall hospital stay in contrast to the patients with prolonged intubation.

ABBREVIATIONS

CABG: Coronary Artery Bypass Grafting.

EE: Early extubation.

ERAS: Enhanced Recovery After Surgery.

EV: Ejection Fraction.

ICU: Intensive Care Unit.

AUTHORS' CONTRIBUTION

Qaiser Aziz Khan: Conceptualization, Critical Review and revision the manuscript, Final approval, final proof to be published.

Latifa Haidari: Conceptualization, Study design, Writing draft, Final approval, final proof to be published.

Imran Khan Sandeelo: Study design, Methodology, Data analysis and interpretation, Final approval, final proof to be published.

Marium Nastaeen Sarhandi: Methodology, Data analysis and interpretation, Writing draft, Final approval, final proof to be published.

Sarib Bin Yasir: Writing draft, Final approval, final proof to be published.

Mariam Amir: Methodology, Data analysis and interpretation, Final approval, final proof to be published.

ACKNOWLEDGEMENTS

Declared none.

ETHICAL DECLARATIONS

Data Availability Statement

Data will be available from the corresponding author upon a reasonable request.

Ethical Approval

The study was commenced with the approval of Ethical Committee of Liaquat National Hospital (App#1022-2024-LNH-ERC, Dated: February 11, 2025).

Consent to Participate

Not applicable as the study was retrospective in nature.

Consent for Publication

All authors give consent for the publication of this work.

Conflict of Interest

Declared none.

Competing Interest/Funding

Declared none.

Use of AI-Assisted Technologies

The authors declare that no generative artificial intelligence (AI) or AI-assisted technologies were utilized in the writing of this manuscript, in the creation of images/graphics/tables/captions, or in any other aspect of its preparation.

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Received: October 01, 2025 Revised: November 27, 2025 Accepted: November 30, 2025