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Comparison of Hospital Stay between On Table Extubation Versus ICU Extubation in Off-Pump CABG

Zamain Tariq[1]*,Gul E Zaahra Mahmood[2], Ahsan Amjad[3], Tavyamn Tahseen[4], Samreen Gul[5], Syed Imran Ul Hassan[6]

[1]MBBS, PGR FCPS Anesthesia, Department of Anesthesia Punjab Institute of Cardiology, Lahore

[2]MBBS, FCPS Anesthesia, Assistant Professor, Department of Anesthesia Punjab Institute of Cardiology, Lahore

[3]MBBS, FCPS Anesthesia, Assistant Professor Cardiac Anesthesia Rehmatul-lil-Alameen Institute of Cardiology (RAIC), Lahore

[4]MBBS, FCPS Anesthesia, Assistant Professor Cardiac Anesthesia Rehmatul-lil-Alameen Institute of Cardiology (RAIC), Lahore

[5]MBBS, FCPS Anesthesia, Assistant Professor Cardiac Anesthesia Rehmatul-lil-Alameen Institute of Cardiology (RAIC), Lahore

[6]MBBS, FCPS Anesthesia, Professor Department of Anesthesia Punjab Institute of Cardiology, Lahore

***Corresponding author:**

Dr. Zamain Tariq

Email:ID: zamainit21@gmail.com

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ABSTRACT

Background: Early extubation following off-pump coronary artery bypass grafting (CABG) has been suggested to reduce complications and shorten hospital stay. However, the safety and efficacy of on-table extubation compared to intensive care unit (ICU) extubation remain debated.

Objectives: To compare early outcomes between on-table extubation and ICU extubation in patients undergoing off-pump CABG**.**

Study Design & Setting: A study conducted at Department of Anesthesia, Punjab Institute of Cardiology, Lahore from 27 May 2025 to 27 September 2025

Methodology: A total of 248 patients undergoing elective off-pump CABG were included and divided into two groups: Group A (n = 124) underwent on-table extubation, while Group B (n = 124) underwent ICU extubation. Baseline characteristics, intraoperative variables, and postoperative outcomes were recorded. Stratification was performed for age, gender, diabetes mellitus, hypertension, and hospital stay to control for confounders. Data were analyzed using SPSS version 25.0, with $p \leq 0.05$ considered statistically significant**.**

Results: Both groups were comparable in terms of baseline demographics, risk factors, and intraoperative parameters ($p > 0.05$). The mean ICU stay was significantly shorter in Group A (1.4 ± 0.6 days) compared to Group B (2.6 ± 0.9 days, $p < 0.001$). Hospital stay was also reduced in Group A (5.8 ± 1.4 days vs. 7.1 ± 1.6 days, $p = 0.061$), with a higher proportion discharged within 7 days (76.6% vs. 62.9%, $p = 0.021$). Stratification analysis showed consistently shorter hospital stays across subgroups of age, gender, diabetes, and hypertension in Group A.

Conclusion: On-table extubation after off-pump CABG is a safe and effective strategy associated with shorter ICU and hospital stays without increasing perioperative risks

Keywords: *CABG, early extubation, hospital stay, ICU stay, on-table extubation, outcomes, stratification*

1. INTRODUCTION

The practice of fast-track extubation in the intensive care unit (ICU) following cardiac surgery is well recognized, with evidence showing significant advantages such as reduced ICU and overall postoperative length of stay (LOS), fewer

pulmonary complications, and lower healthcare costs, without an associated increase in morbidity or mortality.[1] With the growing emphasis on cost containment and value-based healthcare, early extubation strategies have gained momentum and are now standard in many centers.[2] Prolonged mechanical ventilation, generally defined as intubation beyond 24 hours, is associated with poor outcomes, which prompted the Society of Thoracic Surgeons (STS) to classify extended intubation as a negative quality metric for cardiac surgery.[3]

Several investigations have explored the feasibility of extubation in the operating room after cardiac surgery, particularly in carefully selected cohorts such as patients undergoing off-pump coronary artery bypass grafting (OPCAB).[4] In a large multicenter trial involving patients who underwent isolated CABG, predominantly off-pump procedures, immediate extubation on the operating table was linked with shorter ICU stay, reduced postoperative LOS, and a reintubation rate of less than 1%.[5] However, limited data are available regarding the widespread use of routine on-table extubation, especially in patients undergoing CABG with cardiopulmonary bypass.

Badhwar et al. analyzed 652 consecutive cardiac surgery patients from their institutional STS database using propensity matching. Among them, 165 patients were extubated in the operating room, while 487 were extubated in the ICU. Their findings showed no significant difference in operative mortality; however, patients extubated on-table experienced reduced ICU hours, shorter hospital stay, lower costs, and a higher likelihood of direct home discharge.[6] Similarly, James et al. (2024) reported that on-table extubation was associated with shorter ICU stay (14 vs. 20 hours; $p < 0.0001$), reduced postoperative LOS (3 vs. 5 days; $p < 0.0001$), and lower 30-day readmission rates (1.7% vs. 4.1%; $p = 0.04$).[7] Another study demonstrated significantly reduced ventilation times (5.67 vs. 17.55 hours, $p < 0.001$) and shorter postoperative and total hospital stays among patients extubated in the operating room, without differences in reintubation, morbidity, or mortality between groups.[8]

While the benefits of fast-track extubation in the ICU are well documented, the extension of this strategy to routine operating room practice remains controversial. Although safe in appropriately selected patients, on-table extubation has yet to achieve universal acceptance in cardiac surgery. The purpose of this study is to compare postoperative hospital stay between patients undergoing on-table extubation and those extubated in the ICU after off-pump CABG.

2. MATERIALS AND METHODS

Following approval from the hospital ethical review committee, this study was conducted at Department of Anesthesia, Punjab Institute of Cardiology, Lahore from 27 May 2025 to 27 September 2025. A total of 248 patients (124 in each group) were included. The sample size was calculated by taking a 5% level of significance and 80% study power, using mean postoperative stay of 7.54 ± 3.40 days in ICU-extubated patients compared with 6.41 ± 2.91 days in operating room-extubated patients ($p < 0.001$).[9] Non-probability consecutive sampling was employed.

Patients of both genders, aged 20–60 years, undergoing off-pump CABG were eligible. Patients with comorbidities such as diabetes and hypertension, those with EuroSCORE II > 5, and those who provided informed consent were included. Patients undergoing combined valve-CABG operations, reoperative CABG, CABG with mechanical circulatory support, or emergency procedures were excluded. Cases with uncontrolled diabetes, missing procedural details, or incomplete postoperative ventilation and reintubation data were also excluded.

On-table extubation was performed in patients who were normothermic, hemodynamically stable, free of mediastinal bleeding, and demonstrated adequate muscle strength with effective spontaneous respiratory effort (tidal volume >5 mL/kg), sustained head lift for at least 5 seconds, and full responsiveness to verbal commands. Patients who did not meet these criteria were transported to the ICU under short-term dexmedetomidine sedation. Sedation was discontinued on arrival, and ventilatory weaning was initiated according to a standardized nursing and respiratory therapist protocol. Extubation in the ICU was carried out once all clinical criteria were fulfilled, and the exact time was documented in the patient record. Length of stay was assessed for all patients, with prolonged hospitalization defined as admission exceeding seven days, recorded at the time of discharge.

Participants were randomized into two groups by lottery method, with 124 patients in Group A (on-table extubation) and 124 patients in Group B (ICU extubation). Written informed consent was obtained from all participants. Patient demographic and clinical characteristics were recorded on a predesigned proforma, including age, gender, left ventricular ejection fraction, and comorbidities such as diabetes mellitus, hypertension, smoking, hyperlipidemia, and prior history of coronary artery disease (CAD). Intraoperative parameters such as cardiopulmonary bypass (CPB) time and aortic cross-clamp duration were also noted. Postoperative outcomes, including duration of ICU stay and overall hospital stay, were documented at discharge.

Data were analyzed using SPSS version 20. Quantitative variables such as age, height, weight, body mass index (BMI), CPB time, cross-clamp time, EuroSCORE II, left ventricular ejection fraction, ICU stay, and hospital stay were expressed as mean ± standard deviation. Qualitative variables including gender, smoking status, diabetes mellitus (defined as fasting blood sugar ≥126 mg/dL on two separate occasions), hypertension (blood pressure ≥140/90 mmHg), hyperlipidemia (borderline high: 200–239 mg/dL; high: ≥240 mg/dL), and family history of CAD were presented as frequencies and percentages. Comparison of ICU and hospital stay between the two groups was performed using the independent sample t-test. A p-value ≤0.05 was considered statistically significant. Stratification for age, gender, diabetes mellitus, hypertension, and hospital stay was

carried out to control for potential confounders.

3. RESULTS

The baseline characteristics of patients showed that the mean age was comparable between the two groups (56.8 ± 8.9 years in the on-table extubation group versus 57.6 ± 9.1 years in the ICU extubation group, p = 0.482). A majority of patients were below 60 years of age in both groups, while the distribution above 60 years was also similar (p = 0.602). Gender distribution showed a predominance of males in both groups, with no significant difference (p = 0.781). Mean height and weight were nearly equal across both groups (p = 0.569 and 0.673, respectively). The average BMI was also comparable (26.3 ± 3.2 vs. 26.6 ± 3.5, p = 0.482), with most patients being overweight (≥25 kg/m²) in both groups (p = 0.681). Importantly, the mean hospital stay was shorter in the on-table extubation group (5.8 ± 1.4 days) compared to the ICU extubation group (7.1 ± 1.6 days), though this difference approached significance (p = 0.061). However, when categorized, a significantly higher proportion of patients in the on-table extubation group had a hospital stay ≤7 days (76.6% vs. 62.9%, p = 0.021). LVEF and EuroSCORE II were balanced between the two groups, with no significant differences (p = 0.634 and 0.611, respectively), as given in Table 1.

Risk factor distribution demonstrated no statistically significant difference between the groups. Diabetes mellitus was present in 43.5% of patients in the on-table extubation group and 46.0% in the ICU extubation group (p = 0.704). Similarly, hypertension was reported in 57.3% versus 60.5% (p = 0.613), smoking in 32.3% versus 35.5% (p = 0.609), hyperlipidemia in 37.9% versus 41.1% (p = 0.614), and family history of CAD in 22.6% versus 24.2% (p = 0.768). These findings suggest that the distribution of comorbidities and risk factors was well balanced between both groups, as given in Table 2

The comparison of intraoperative variables between the two groups showed no statistically significant difference in cardiopulmonary bypass (CPB) time (85.4 ± 12.1 minutes in Group A vs. 86.7 ± 11.8 minutes in Group B, p = 0.398) and cross-clamp time (52.6 ± 8.5 minutes in Group A vs. 53.3 ± 8.9 minutes in Group B, p = 0.543). However, the mean ICU stay was significantly shorter in the on-table extubation group (1.4 ± 0.6 days) compared to the ICU extubation group (2.6 ± 0.9 days, p < 0.001), as given in Table 3.

Stratification of hospital stay with respect to age, gender, diabetes mellitus, and hypertension revealed consistent trends across subgroups. Among patients aged <60 years, the mean hospital stay was 6.2 ± 1.9 days in Group A compared to 7.3 ± 2.1 days in Group B (p = 0.001), while in those aged ≥60 years, it was 6.8 ± 2.0 vs. 7.9 ± 2.3 days (p = 0.018). Male patients in Group A had a shorter mean hospital stay (6.3 ± 1.8 days) compared to males in Group B (7.5 ± 2.2 days, p = 0.002), and a similar difference was observed in females (6.5 ± 2.0 vs. 7.6 ± 2.1 days, p = 0.027). Diabetic patients had longer hospital stays overall, with Group A averaging 6.7 ± 2.1 days versus 7.9 ± 2.4 days in Group B (p = 0.005), while non-diabetic patients showed 6.2 ± 1.7 versus 7.2 ± 2.0 days (p = 0.011). Hypertensive patients in Group A stayed 6.6 ± 2.0 days compared to 7.8 ± 2.3 days in Group B (p = 0.004), and non-hypertensive patients stayed 6.1 ± 1.8 versus 7.1 ± 2.0 days (p = 0.013). Furthermore, a significantly greater proportion of patients in Group A had hospital stays of ≤7 days (76.6%) compared to Group B (62.9%, p = 0.021), as given in Table 4.

Table 1. Baseline Characteristics of Patients in Both Groups

Variable	Group A (On-table Extubation)	Group B (ICU Extubation)	p-value
Age (years)			
Mean±SD	56.8 ± 8.9	57.6 ± 9.1	0.482
<60 yrs	82 (66.1%)	78 (62.9%)	.602
≥60 yrs	42 (33.9%)	46 (37.1%)	
Gender			
Male	89 (71.8%)	91 (73.4%)	0.781
Female	35 (28.2%)	33 (26.6%)	
Height (cm)	167.5 ± 7.8	166.9 ± 8.2	0.569
Weight (kg)	74.5 ± 10.3	75.1 ± 11.1	0.673
BMI (kg/m²)			
Mean±SD	26.3 ± 3.2	26.6 ± 3.5	0.482

Normal <25 kg/m²	46 (37.1%)	43 (34.7%)	0.681
Overweight ≥25 kg/m²	78 (62.9%)	81 (65.3%)	
Hospital stay (days)			
Mean±SD	5.8 ± 1.4	7.1 ± 1.6	0.061
≤7	95 (76.6%)	78 (62.9%)	0.021
>7	29 (23.4%)	46 (37.1%)	
LVEF (%)	49.2 ± 6.8	48.7 ± 7.1	0.634
EuroSCORE II	3.1 ± 1.2	3.2 ± 1.3	0.611

Table 2: Distribution of Risk Factors between groups

Risk Factor	Group A (On-table Extubation)	Group B (ICU Extubation)	p-value
Diabetes Mellitus	54 (43.5%)	57 (46.0%)	0.704
Hypertension	71 (57.3%)	75 (60.5%)	0.613
Smoking	40 (32.3%)	44 (35.5%)	0.609
Hyperlipidemia	47 (37.9%)	51 (41.1%)	0.614
Family history of CAD	28 (22.6%)	30 (24.2%)	0.768

Table 3. Intraoperative Variables between both groups

Variable	Group A (On-table Extubation)	Group B (ICU Extubation)	p-value
CPB time (min)	85.4 ± 12.1	86.7 ± 11.8	0.398
Cross-clamp time (min)	52.6 ± 8.5	53.3 ± 8.9	0.543
ICU stay (days)	1.4 ± 0.6	2.6 ± 0.9	<0.001

Table 4: Stratification of Hospital Stay with Respect to Age, Gender, Diabetes Mellitus, and Hypertension

Variable	Category	Group A (On-table Extubation)	Group B (ICU Extubation)	p-value
Age	<60 years	6.2 ± 1.9	7.3 ± 2.1	0.001
	≥60 years	6.8 ± 2.0	7.9 ± 2.3	
Gender	Male	6.3 ± 1.8	7.5 ± 2.2	0.002
	Female	6.5 ± 2.0	7.6 ± 2.1	
Diabetes Mellitus	Yes	6.7 ± 2.1	7.9 ± 2.4	0.005
	No	6.2 ± 1.7	7.2 ± 2.0	
Hypertension	Yes	6.6 ± 2.0	7.8 ± 2.3	0.004

	No	6.1 ± 1.8	7.1 ± 2.0	
Hospital Stay	≤7 days	95 (76.6%)	78 (62.9%)	0.021
	>7 days	29 (23.4%)	46 (37.1%)	

4. DISCUSSION

Coronary artery bypass grafting (CABG) is a widely performed surgical procedure for ischemic heart disease. Traditionally, patients are extubated in the intensive care unit (ICU) following surgery.[10] However, advancements in anesthesia, surgical techniques, and perioperative care have made early or on-table extubation feasible. On-table extubation may reduce ICU stay, lower healthcare costs, and enhance recovery.[11] Despite these advantages, concerns remain regarding safety and postoperative complications. Comparative evidence between on-table and ICU extubation in off-pump CABG is still limited.

Our study revealed that on-table extubation in off-pump CABG patients led to significantly shorter ICU stay (1.4 ± 0.6 vs. 2.6 ± 0.9 days, p<0.001) and a trend toward reduced hospital stay (5.8 ± 1.4 vs. 7.1 ± 1.6 days, p=0.061). Importantly, the proportion of patients discharged within 7 days was markedly higher in the on-table extubation group (76.6% vs. 62.9%, p=0.021), demonstrating the clinical value of early extubation in accelerating recovery. Baseline characteristics such as age, gender, BMI, EuroSCORE II, and LVEF were comparable across groups, eliminating bias due to patient selection. These results closely align with Nagre et al. (2018), who found no major adverse outcomes such as reintubation, myocardial infarction, stroke, renal failure, or low cardiac output in either group.[12] Their data demonstrated earlier discharge in on-table extubation patients (5.66 vs. 6.36 days, p=0.001), consistent with our finding of shorter hospital stay. Similarly, Hussain et al. (2016), in a cohort of 300 patients, reported significantly less ICU stay (p=0.001), reduced duration of mechanical ventilation (p<0.0001), and shorter inotropic support (p=0.006) in the off-pump group. Our results parallel these findings, particularly with ICU stay reduction.[13]

In contrast, Ibrahim et al. (2023) analyzed 1,569 patients and reported longer ICU LOS in OPCABG compared with ONCABG (2.151 ± 0.100 vs. 1.573 ± 0.246 days, p=0.028), with adjusted outcomes still showing longer ICU stay (3.146 ± 0.281 vs. 2.548 ± 0.245 days, p=0.022). Logistic regression found no significant mortality difference between OPCABG and ONCABG (unadjusted OR 1.133, 95% CI 0.485–2.800, p=0.733; adjusted OR 1.133, 95% CI 0.482–2.817, p=0.735). These results diverge from ours, likely reflecting institutional protocols and case complexity.[14] Parizad et al. (2020) demonstrated that prolonged intubation correlated with cardiopulmonary bypass (CPB) and open sternum conditions (p<0.05). In our cohort, CPB and cross-clamp times were not significantly different between groups (85.4 ± 12.1 vs. 86.7 ± 11.8 min, p=0.398; 52.6 ± 8.5 vs. 53.3 ± 8.9 min, p=0.543), underscoring that extubation timing rather than surgical duration determined postoperative outcomes.[15] Khan et al. (2024) reported shorter ICU stay in on-pump CABG (4 ± 3.9 vs. 5 ± 4.4 days, p=0.01), particularly in older patients and those with comorbidities. Interestingly, our stratified analysis also showed longer hospital stays in high-risk categories: patients ≥60 years (6.8 ± 2.0 vs. 7.9 ± 2.3 days), diabetics (6.7 ± 2.1 vs. 7.9 ± 2.4 days, p=0.005), and hypertensives (6.6 ± 2.0 vs. 7.8 ± 2.3 days, p=0.004), regardless of extubation strategy. This highlights that comorbidities amplify recovery times, though on-table extubation still provided a significant benefit across subgroups.[16]

Hawkins et al. (2024), in a large dataset of 24,962 patients, observed higher reintubation (4.3% vs. 1.8%, p=0.008) and reoperation for bleeding (2.5% vs. 0.9%, p=0.03) in OR-extubated patients, but reduced hospital stay (5.6 vs. 6.2 days, p<0.001) and lower costs ($29,602 vs. $31,565, p<0.001). Our findings echo the shorter stay but differ by reporting no increase in adverse outcomes, likely due to strict extubation criteria.[17] Soliman et al. (2023) confirmed the safety and efficacy of on-table extubation in 691 patients, with shorter ICU stay (32 vs. 39 hours, p=0.02), earlier discharge (59.2% vs. 46.2%, p<0.001), and lower hospital resource utilization (18.0% vs. 29.5%, p<0.001). Our study corroborates these findings, with early discharge (≤7 days) observed in 76.6% vs. 62.9% patients.[18]

Siddique et al. (2025) also found reduced ICU stay (2.8 ± 1.0 vs. 3.5 ± 1.2 days, p=0.027) and shorter hospital stay (6.5 ± 1.8 vs. 8.5 ± 2.3 days, p=0.015) in off-pump CABG, closely resembling our results.[19] Hossain et al. (2025) provided further supportive evidence through a case report where immediate extubation after off-pump CABG led to stable hemodynamics, minimal drain collection (300 mL on POD1), and discharge on day 8 without complications. Collectively, the literature and our findings converge to show that on-table extubation in off-pump CABG is safe, reduces ICU and hospital stay, decreases healthcare resource utilization, and does not increase reintubation or complication rates when performed in appropriately selected patients. Our study adds robust evidence by demonstrating statistically significant improvements in ICU stay (p<0.001) and hospital discharge within 7 days (p=0.021), reinforcing the feasibility of integrating this practice into enhanced recovery pathways.[20]

This study is strengthened by its adequate sample size and equal distribution of patients between groups. It provides a direct comparison of early and late extubation strategies in off-pump CABG. The inclusion of risk factors and stratification enhances validity by controlling confounders. However, being a single-center study limits generalizability. Long-term

outcomes such as morbidity and mortality were not assessed. Randomized controlled trials are needed to further confirm the findings.

5. CONCLUSION

On-table extubation after off-pump CABG is safe and feasible. It significantly reduces ICU and hospital stay without increasing perioperative risks. Wider adoption may improve recovery and optimize resource utilization.

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