

Impact of Reduced Pre-Operative Ejection Fraction on Early Clinical Outcomes After Coronary Artery Bypass Grafting

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Abstract

Objective: While a reduced left ventricular ejection fraction (EF) is a well-known risk factor for adverse outcomes following coronary artery bypass grafting (CABG), its specific impact on the immediate post-operative recovery phase, such as the likelihood of an extended hospital stay or the need for mechanical circulatory support, is still not fully understood.

Methods: We reviewed the records of 482 patients who underwent isolated CABG at our center in this retrospective cohort study. Patients were stratified into two categories based on their pre-operative EF: those with an EF <40% and those with an EF ≥40%. Our primary focus was observing prolonged hospital stays, defined as lasting more than 6 days. We also examined secondary recovery metrics, including time spent in the intensive care unit (ICU), duration of mechanical ventilation, and the utilization of an intra-aortic balloon pump (IABP). To pinpoint the true independent predictors of a prolonged stay, we applied multivariate logistic regression analysis.

Results: Patients entering surgery with an EF <40% (n=25) experienced noticeably longer hospitalizations compared to the higher EF group (median 7 [6–10] days vs. 6 [5–7] days, p=0.001). They also required IABP support at a significantly higher rate (28.0% vs. 5.9%, p<0.001). While these patients tended to spend more time in the ICU, this trend narrowly missed statistical significance (p=0.057). After adjusting for other variables, having an EF <40% remained a strong, independent predictor of a prolonged hospital stay (odds ratio [OR]: 4.42, 95% confidence interval [CI]: 1.67–11.74, p=0.003). In addition, the duration of cardiopulmonary bypass emerged as another independent risk factor for extended hospitalization (OR: 1.007, 95% CI: 1.002–1.012, p=0.008).

Conclusion: A reduced pre-operative EF is an independent driver of delayed hospital discharge and a heightened need for mechanical heart support following CABG. Tracking EF provides clinicians with a highly practical tool for anticipating early post-operative challenges and tailoring patient care accordingly.

Keywords: Cardiac surgery; coronary artery bypass grafting; ejection fraction; hospital length of stay; left ventricular dysfunction; post-operative morbidity.

Düşük Preoperatif Ejeksiyon Fraksiyonunun Koroner Arter Bypass Cerrahisi Sonrası Erken Dönem Klinik Sonuçlara Etkisi

Özet

Amaç: Sol ventrikül ejeksiyon fraksiyonundaki (EF) düşüklük, koroner arter baypas greft (KABG) operasyonları sonrasında gelişebilecek komplikasyonlar açısından kabul görmüş bir risk unsurudur. Bununla birlikte, bu durumun erken postoperatif dönemdeki iyileşme sürecine (örneğin uzamış hastanede kalış süresi veya mekanik destek gereksinimi) etkileri literatürde henüz tam olarak netlik kazanmamıştır.

Yöntem: Bu çalışmada, kliniğimizde yalnızca KABG operasyonu geçirmiş 482 hastanın verileri geriye dönük olarak analiz edildi. Hastalar, ameliyat öncesi ölçülen EF değerlerine göre iki gruba ayrıldı: EF <%40 ve EF ≥%40. Birincil sonlanım ölçütü, altı günden uzun süren yatış olarak tanımlanan uzamış hastanede kalış süresiydi. Ayrıca

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yoğun bakım ünitesinde (YBÜ) kalış süresi, mekanik ventilasyon süresi ve intraaortik balon pompası (İABP) kullanımı gibi ikincil iyileşme ölçütleri de değerlendirildi. Uzun hastanede yatışın bağımsız öngörücülerini belirlemek amacıyla çok değişkenli lojistik regresyon analizi uygulandı.

Bulgular: Cerrahiye EF'si ≤ 40 ($n=25$) ile giren hastalar, yüksek EF grubuna kıyasla anlamlı olarak daha uzun süre hastanede kaldı (ortanca 7 [6–10] güne karşılık 6 [5–7] gün, $p=0,001$). Ayrıca bu hastalarda İABP desteği gereksinimi anlamlı düzeyde daha yüksekti (%28.0'a karşılık %5.9, $p<0,001$). Bu hastalar YBÜ'de daha uzun süre kalma eğiliminde olsalar da bu fark istatistiksel anlamlılık sınırında kaldı ($p=0,057$). Diğer değişkenler açısından düzeltme yapıldıktan sonra, EF'nin ≤ 40 olması uzun hastanede yatışın güçlü ve bağımsız bir öngörücüsü olmaya devam etti (OR: 4.42, %95 GA: 1.67–11.74, $p=0,003$). Ayrıca kardiyopulmoner baypas süresi de uzun hastanede yatış için bağımsız bir risk faktörü olarak belirlendi (OR: 1.007, %95 GA: 1.002–1.012, $p=0,008$).

Sonuç: Düşük preoperatif ejeksiyon fraksiyonu, KABG sonrasında hastaneden taburculuğun gecikmesi ve mekanik dolaşım desteği gereksiniminin artması açısından bağımsız bir belirteçtir. EF'nin değerlendirilmesi, klinisyenlere erken postoperatif dönemde karşılaşılabilecek güçlükleri öngörmeye ve hasta bakımını buna göre planlamada pratik bir araç sunmaktadır.

Anahtar sözcükler: Kardiyak cerrahi; koroner arter baypas cerrahisi; ejeksiyon fraksiyonu; hastanede kalış süresi; sol ventrikül disfonksiyonu; postoperatif morbidite.

Introduction

The surgical treatment of complex coronary artery disease still heavily relies on coronary artery bypass grafting (CABG).^[1] Although surgical techniques and perioperative management have significantly improved over the years, ensuring a seamless post-operative healing phase continues to be a demanding task for clinicians.^[2]

Conventionally, left ventricular ejection fraction (EF) has functioned as a dependable indicator of cardiac health, commonly employed to assess the overall risks associated with heart surgery.^[3] A diminished EF renders patients more susceptible to substantial perioperative challenges, such as low cardiac output syndrome, heightened dependence on mechanical circulatory support, and elevated mortality rates.^[4,5] Nonetheless, its precise influence on the daily experiences of early recovery, particularly regarding hospital length of stay and resource allocation, remains somewhat unclear.^[6]

A protracted hospitalization following CABG not only escalates healthcare expenses but also heightens the risk of hospital-acquired complications and prolongs the patient's reintegration into normal life.^[7] Consequently, recognizing the pre-operative indicators that suggest an extended recovery is essential. Therefore, EF serves not merely as an indicator of mechanical heart function, but as a reflection of a patient's overall resilience and potential for recovery.^[6]

Moreover, patients with a diminished EF seldom exhibit a singular problem; they often endure a greater prevalence of comorbidities, such as diabetes mellitus, which inherently complicates recovery.^[8] It is essential to disentangle these variables to determine whether EF independently predicts early clinical outcomes, excluding these associated factors. This study seeks to elucidate the effects of diminished pre-operative EF on the immediate post-operative experience, particularly regarding extended hospitalizations in patients undergoing isolated CABG.

Materials and Methods

Study Design and Population

This research was designed as a retrospective observational study at a single institution, evaluating the surgical outcomes

of 482 individuals who underwent strictly isolated CABG procedures from January 2023 to February 2026. To maintain our focus, we excluded patients necessitating emergency surgeries, those undergoing concurrent cardiac interventions (such as valve repairs), and those with incomplete critical data.

Data Collection

We constructed our dataset by meticulously extracting data from the hospital's electronic medical records. This encompassed demographic profiles, baseline comorbidities (particularly diabetes mellitus and chronic obstructive pulmonary disease), pre-operative renal function (serum creatinine), and essential surgical parameters such as cardiopulmonary bypass duration. The pre-operative EF was assessed through transthoracic echocardiography and documented as a simple percentage.

Study Groups and Outcomes

To facilitate meaningful comparisons, we categorized the cohort into two distinct groups according to their pre-operative cardiac function:

- The Low EF Group: Patients with an EF below 40%
- The Preserved EF Group: Patients with an EF of 40% or greater.

The primary endpoint was an extended hospital stay, defined as remaining hospitalized for over 6 days. We also monitored secondary recovery metrics: the duration of intensive care unit (ICU) admission, the hours on mechanical ventilation, and the requirement for intra-aortic balloon pump (IABP) assistance.

Statistical Analysis

All analyses were conducted using IBM Statistical Package for the Social Sciences Statistics (Version 22.0). Following the evaluation of data distribution, we reported continuous variables as means with standard deviations or medians with interquartile ranges, contingent upon their normality. Group comparisons were conducted utilizing standard statistical tests, including Student's t-test, Mann–Whitney U test, Chi-square test, or Fisher's exact test.

We constructed a multivariate logistic regression model to identify the genuine determinants of an extended hospital stay. We incorporated variables demonstrating a trend in the prelim-

Table 1. Baseline characteristics

Variable	EF <40 (n=25)	EF ≥40 (n=457)	p
Age (years)	63.1±7.5	61.7±9.3	0.382
EF (%)	32.0±4.0	59.6±8.9	<0.001
Diabetes mellitus (%)	76.0	50.5	0.023
COPD (%)	24.0	11.6	0.126
Creatinine (mg/dL)	1.11±0.34	1.00±0.60	0.143
CPB duration (min)	116.9±41.7	112.6±38.1	0.631

EF: Ejection fraction; COPD: Chronic obstructive pulmonary disease; CPB: Cardiopulmonary bypass.

inary analysis ($p<0.10$) in conjunction with recognized clinical risk factors such as age, sex, diabetes, chronic obstructive pulmonary disease, and bypass duration. The findings are presented as odds ratios (OR) accompanied by 95% confidence intervals (CI). A $p<0.05$ was our criterion for statistical significance. Patients lacking data for the dependent variable were excluded from the regression analyses.

Ethical Approval

The Institutional Ethics Committee approved this retrospective study (Approval No. 2026/08/1445; April 21, 2026). Due to the retrospective design of the study, the necessity for explicit patient consent was appropriately waived.

Results

Ultimately, the study included 482 individuals (average age: 61.8 ± 9.2 years; mean baseline EF: $58.2\pm10.6\%$). A significant portion of these subjects suffered from concurrent conditions, notably diabetes mellitus (51.9%) and chronic obstructive pulmonary disease (12.2%).

Stratification by cardiac performance placed 25 subjects into the reduced EF cohort ($<40\%$), while the remaining 457 patients formed the preserved EF group ($\geq40\%$). Both cohorts were comparable regarding baseline kidney function, pulmonary status, age, and total bypass times ($p>0.05$). However, diabetic patients were notably more frequent in the reduced EF arm (76.0% vs. 50.5%, $p=0.023$). Baseline demographic and clinical characteristics of the study groups are summarized in Table 1.

Post-operative progress varied considerably between the two strata. Subjects presenting with compromised EF had substantially longer inpatient stays compared to their counterparts (median: 7 vs. 6 days, $p=0.001$; mean: 10.8 ± 9.0 vs. 6.7 ± 4.3 days, $p=0.032$). Furthermore, the necessity for mechanical circulatory assistance was far more pronounced among those with reduced EF, as IABP insertion rates reached 28.0%, compared to merely 5.9% in the preserved EF cohort ($p<0.001$). Early post-operative clinical outcomes according to pre-operative EF status are shown in Table 2.

Our preliminary univariate analysis identified a low EF as a significant risk factor for an extended hospital stay (OR: 4.24, 95% CI: 1.74–10.36, $p=0.001$). This result persisted in the multivariate regression model; even after adjusting for elevated diabetes rates and other variables, an EF $<40\%$ continued to be an

Table 2. Clinical outcomes

Variable	EF <40 (n=25)	EF ≥40 (n=457)	p
Hospital stay (days), median [IQR]	7 [6–10]	6 [5–7]	0.001
Hospital stay (days), mean±SD	10.8±9.0	6.7±4.3	0.032
ICU stay (hours), median [IQR]	68 [23–97]	41 [25–59.5]	0.057
Ventilation duration (hours), median [IQR]	9 [5–15]	7 [6–11]	0.650
IABP use (%)	28.0	5.9	<0.001

EF: Ejection fraction; IQR: Interquartile range; SD: Standard deviation; ICU: Intensive care unit; IABP: Intra-aortic balloon pump.

Table 3. Multivariate logistic regression analysis

Variable	OR	95% CI	p
EF <40	4.42	1.67–11.74	0.003
CPB duration	1.007	1.002–1.012	0.008
Diabetes mellitus	1.09	0.62–1.90	0.757
Male sex	1.60	0.96–2.66	0.071
COPD	1.66	0.93–2.99	0.073
Age	1.02	0.99–1.04	0.165

OR: Odds ratio; CI: Confidence interval; EF: Ejection fraction; CPB: Cardiopulmonary bypass; COPD: Chronic obstructive pulmonary disease.

independent predictor of delayed discharge (OR: 4.42, 95% CI: 1.67–11.74, $p=0.003$). The duration of cardiopulmonary bypass was identified as an independent factor contributing to an extended hospital stay (OR: 1.007, 95% CI: 1.002–1.012, $p=0.008$). The results of the multivariate logistic regression analysis are presented in Table 3.

Discussion

Our findings indicate that patients undergoing isolated CABG with impaired baseline EFs face a rougher and more protracted initial healing phase. Specifically, individuals with an EF under 40% are not only hospitalized for longer durations but also require mechanical circulatory assistance at a substantially higher rate. This diminished EF serves as an independent predictor of delayed discharge, demonstrating its significance despite the consideration of other potential confounding variables. Although our low-EF cohort was comparatively small, it reflects the actual clinical distribution and signifies a fundamental limitation of retrospective designs rather than a selection bias.

It has long been established that EF is a crucial factor in the risk stratification of patients undergoing cardiac surgery.^[9] Prior research has consistently demonstrated that diminished EF correlates with heightened perioperative morbidity and mortality, primarily due to a compromised heart’s difficulty in maintaining adequate cardiac reserve and hemodynamic stability.^[10] Our data introduce this concept into the immediate post-operative context, affirming that patients with diminished EF constitute a higher-risk demographic even during the initial phases of recovery.^[11] We opted to consider EF as a binary threshold for immediate applicability of the results, although subsequent research examining EF as a continuous variable may provide more profound dose-response insights.

The primary takeaway from our analysis is the strong predictive link between a compromised pre-operative EF and delayed hospital discharge. Remaining in the hospital for more than 6 days implies a slower physiological rebound, alongside increased clinical workload and greater financial burden on healthcare systems. Since low EF independently predicts this delay, it serves as a dependable forecasting instrument for surgical teams to establish realistic expectations for the post-operative recovery trajectory.^[11] The 6-day threshold employed in our study was a data-driven methodology derived from the median length of stay within our cohort.

The significant dependence on IABP support in low-EF patients highlights their precarious hemodynamic reserve. When the heart's functional capacity is inadequate, patients are predisposed to low cardiac output syndrome, necessitating mechanical assistance.^[9,10] The significantly elevated incidence of IABP utilization noted in our study corresponds with prior findings and underscores the clinical importance of EF in perioperative decision-making.^[11] Nonetheless, the lack of strict standardization regarding the timing and clinical indications for IABP may have marginally affected the observed association.

Notably, although there was a tendency for prolonged ICU admissions among these patients, the data did not achieve statistical significance, probably due to the reduced sample size in the low-EF group, which constrained our statistical power. The similarity in ventilation times indicates that although EF significantly impacts overall recovery, it may not solely determine every specific post-operative variable.

We observed a significant correlation between low EF and diabetes mellitus, a relationship extensively documented in the progression of left ventricular dysfunction.^[12] Nonetheless, the predictive value of EF as a prognostic indicator was demonstrated in our multivariate analysis: even after accounting for the confounding factors of diabetes and other variables, a low EF continued to forecast an extended hospital stay. This suggests that the influence of EF on post-operative results cannot be attributed solely to accompanying comorbidities.

The independent effect of cardiopulmonary bypass duration must not be overlooked. Prolonged bypass durations are correlated with heightened inflammatory responses, organ dysfunction, and protracted recovery.^[13,14] The independent influence of both EF and bypass duration indicates that early post-operative recovery is ultimately determined by a combination of the patient's baseline health and procedural factors.

The results of this study possess significant clinical ramifications. Pre-operative identification of patients with diminished EF may enhance perioperative management, inform resource allocation, and refine post-operative care planning.^[9] Moreover, EF can be seamlessly integrated into predictive models designed to identify patients at elevated risk for extended hospitalization.

Limitations

The observational and retrospective nature of this analysis carries built-in risks for selection bias, limiting our ability to draw strict causal inferences. While the relatively small sample size

of the low-EF cohort accurately reflects real-world clinical distributions, it may have restricted the statistical robustness of specific comparisons. Moreover, as a single-center investigation, these results may not universally apply to all hospital environments. Certain potentially significant variables, such as operative urgency or intraoperative complications, were excluded. Future research employing alternative analytical methodologies, such as time-to-event models, may provide a more refined understanding of length-of-stay dynamics.

Conclusion

To summarize, impaired cardiac function before surgery independently forecasts a slower recovery trajectory following CABG procedures. Actively incorporating EF data into the initial surgical workup provides a clearer picture for risk stratification, allowing clinical teams to proactively adjust perioperative strategies and ensure a smoother recovery for vulnerable patients.

Disclosures

Ethics Committee Approval: The study was approved by the Koşuyolu High Specialization Training and Research Hospital Clinical Research Ethics Committee (no: 2026/08/1445, date: 21/04/2026).

Informed Consent: Due to the retrospective design of the study, the necessity for explicit patient consent was appropriately waived.

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