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OUTCOMES OF CORONARY ARTERY BYPASS GRAFTING IN PATIENTS WITH LOW EJECTION FRACTION BY USING DIFFERENT PERFUSION TECHNIQUES

Original Research

Muhammad Zubair Aslam[1]*, Chanda Naseem[2], Muhammad Mohsin Yar[3], Muhammad Raheel Jam[4]
[1]Student of MS-AHS, Faculty of Allied Health Sciences, Superior University, Lahore, Pakistan.
[2]Assistant Professor and Research Advisor Faculty of Allied Health Sciences, Superior University, Lahore, Pakistan.
[3]Lecturer Allied Health Sciences Gulab Devi Educational Complex Lahore, Pakistan.
[4]Emergency and ICU Technologist at Gulab Devi Hospital Lahore, Pakistan.
Corresponding Author: Muhammad Zubair Aslam, Student of MS-AHS, Faculty of Allied Health Sciences, Superior University, Lahore, Pakistan.
zubi911222@gmail.com
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ABSTRACT

Background: Ischemic heart disease, particularly coronary artery disease (CAD), is a leading global cause of morbidity and mortality. Reduced left ventricular ejection fraction (LVEF) complicates disease progression and treatment outcomes. Coronary artery bypass grafting (CABG) is an established surgical intervention for CAD, yet its effectiveness in patients with low EF remains uncertain. Severe LVEF reduction (≤25%) is associated with higher surgical risks, but precise postoperative outcomes require further investigation. Identifying predictors of complications in low EF patients undergoing CABG is critical for improving management and prognosis.

Objective: This study aimed to compare postoperative complications such as stroke, myocardial infarction, and renal failure in patients with low EF undergoing CABG and to identify key predictors of surgical outcomes in this high-risk population.

Methods: A prospective randomized controlled trial was conducted at Rehmatul Lil Alameen Institute of Cardiology (RAIC), Lahore. A total of 100 patients with LVEF ≤25% undergoing isolated CABG were included through simple random sampling. Patients were categorized into three EF groups: ≤25%, 26-35%, and 36-45%. Inclusion criteria consisted of male and female patients aged 45-75 years undergoing primary isolated CABG with cardiopulmonary bypass. Exclusion criteria included incomplete medical records, prior cardiac surgery, or off-pump CABG. Data were analyzed using IBM SPSS-26, with chi-square tests used for categorical variable associations.

Results: Patients with EF ≤25% were older (66.1±7.23 years) compared to EF 26-35% and EF 36-45% groups (both 61.2±7.23 years). Males dominated the EF ≤25% (n=28) and EF 26-35% (n=27) groups, whereas more females were observed in the EF 36-45% group (n=17, $p<0.001$). Diabetes prevalence was highest in the EF 26-35% group (21%), while COPD was most frequent in EF ≤25% (18%, $p<0.001$). Stroke occurred more frequently in EF ≤25% (16%) than in EF 26-35% (15%) and EF 36-45% (3%, $p=0.029$). NYHA class IV symptoms were predominant in EF ≤25% (18 cases, $p=0.003$). Preoperative intra-aortic balloon pump (IABP) use was highest in EF ≤25% (27 cases, $p<0.001$). Postoperatively, stroke (5%), sepsis (6%), and renal failure (10%) were more common in the EF ≤25% group, whereas deep sternal wound infection (1%) and bleeding requiring reoperation (2%) were more frequent in the EF 26-35% and EF 36-45% groups.

Conclusion: Patients with LVEF ≤25% exhibited a higher prevalence of comorbid conditions and required greater preoperative hemodynamic support. Despite the increased risks, a significant proportion did not experience major complications, suggesting that optimized perioperative management plays a crucial role in surgical outcomes. Future research should focus on refining risk stratification and improving surgical strategies to enhance CABG outcomes in low EF patients.

Keywords: CABG, cardiopulmonary bypass, coronary artery disease, heart failure, left ventricular dysfunction, low ejection fraction, postoperative complications.

INTRODUCTION

Coronary artery disease (CAD) remains the leading cause of global mortality, with an estimated 137.8 deaths per 100,000 individuals in 2013. Acute myocardial infarction, a critical manifestation of ischemic heart disease (IHD), had an incidence rate of 195.3 per 100,000 for males and 115.0 per 100,000 for females in 2010, highlighting the substantial disease burden associated with CAD (1). Characterized by the narrowing or blockage of coronary arteries due to atherosclerosis, CAD leads to myocardial ischemia, which can progress to infarction and heart failure if left untreated (2,3). The interplay between genetic predisposition, environmental influences, and lifestyle factors such as diabetes, hypertension, smoking, dyslipidemia, obesity, and psychological stress significantly contributes to the development and progression of CAD (4). Atherosclerotic plaque accumulation within the arterial walls results in stenosis and, in some cases, complete occlusion, reducing myocardial blood supply. The rupture of these plaques and subsequent thrombus formation exacerbates ischemia, leading to acute coronary syndromes. Chronic inflammation plays a pivotal role in this process, driven by oxidative stress, cholesterol deposition, and immune dysregulation (5). The clinical presentation of IHD varies depending on the severity and nature of myocardial ischemia. Stable angina manifests as chest discomfort triggered by exertion or emotional stress and is typically relieved by rest or nitroglycerin. In contrast, unstable angina, a more severe condition, occurs at rest or with minimal activity and demands urgent medical intervention (6). The most severe manifestation, myocardial infarction, results from prolonged ischemia, causing irreversible myocardial damage and increasing the risk of complications such as heart failure and arrhythmias (7).

Accurate diagnosis of IHD relies on a combination of clinical evaluation, risk stratification, and diagnostic modalities, including electrocardiography (ECG), stress testing, echocardiography, coronary angiography, and computed tomography angiography (CTA). Biomarkers such as troponin serve as essential tools for detecting myocardial injury and diagnosing acute coronary syndromes (8). The primary goals of managing IHD involve symptom relief, prevention of complications, and enhancement of quality of life. Lifestyle modifications, including smoking cessation, physical activity, a balanced diet, and stress management, serve as the foundation for both prevention and treatment (9). Advances in medical therapy, pharmacology, and public health interventions have contributed to improved survival rates and better disease outcomes in recent years, though significant disparities persist across different populations and healthcare systems (10). Coronary artery bypass grafting (CABG) remains a cornerstone intervention for severe CAD, particularly in cases with extensive multivessel disease or left main coronary artery involvement (11). Historically, CABG was considered high risk in patients with low left ventricular ejection fraction (LVEF), particularly those with an LVEF below 40%, due to concerns regarding perioperative morbidity and mortality (12,13). However, contemporary evidence supports the role of CABG in selected patients with reduced LVEF, demonstrating potential benefits in myocardial revascularization, prevention of ventricular remodeling, and reduction in sudden cardiac death (14,15). The standard CABG procedure involves establishing cardiopulmonary bypass (CPB) with two-stage cannulation, aortic cross-clamping, and myocardial protection strategies such as warm antegrade blood cardioplegia. Distal anastomoses are performed before proximal anastomoses using a single-clamp technique, followed by reperfusion and CPB weaning with protamine reversal of heparin anticoagulation (16,17). Despite improvements in surgical techniques and perioperative management, patients with low LVEF remain at high risk for complications such as acute kidney injury, pneumonia, and saphenous vein graft (SVG) failure due to thrombosis and poor graft flow (18,19).

Heart failure (HF), a frequent consequence of CAD, is a major determinant of surgical outcomes in patients undergoing CABG. Perioperative risk assessment and optimization are particularly crucial in patients with heart failure with reduced ejection fraction (HFrEF), given their heightened susceptibility to adverse events (20). While HF with preserved ejection fraction (HFpEF) is equally prevalent, it is less frequently identified in surgical risk assessment, underscoring the need for refined perioperative strategies (20). Patients with low preoperative LVEF face an elevated risk of postoperative complications, including hemodynamic instability, multiorgan dysfunction, and increased mortality. Identifying predictors of surgical outcomes in this high-risk population is vital for improving patient selection, optimizing perioperative care, and guiding clinical decision-making. This study aims to compare the rates of postoperative complications, including stroke, myocardial infarction, and renal failure, in patients undergoing CABG with low LVEF. Additionally, it seeks to identify key predictors of outcomes in this population, contributing to a more comprehensive understanding of risk stratification and management strategies in cardiac surgery.

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METHODS

A prospective randomized controlled trial was conducted at RAIC to assess the outcomes of coronary artery bypass grafting (CABG) in patients with reduced left ventricular ejection fraction (LVEF). A total of 100 patients undergoing isolated CABG were enrolled using a simple random sampling technique. The study originally aimed to include only patients with an EF of ≤25%; however, patient stratification included three categories: EF ≤25%, 26-35%, and 36-45%. This discrepancy was addressed by ensuring that the study objectives accounted for a broader spectrum of low EF patients, providing a more comprehensive analysis of CABG outcomes across varying degrees of ventricular dysfunction. The inclusion criteria encompassed both male and female patients aged 45 to 75 years who underwent primary isolated CABG with cardiopulmonary bypass (CPB) and cardiac arrest. Only hemodynamically stable patients scheduled for elective surgery were included. Patients were excluded if they had incomplete medical records, lacked documented EF values, underwent off-pump or beating-heart CABG, or had a history of previous cardiac surgery. Patients who declined participation were documented, and their data were not included in the final analysis.

Ethical approval was obtained from the hospital's ethical review board. Informed consent was acquired from all participants in both English and Urdu. In cases where patients were unable to provide consent due to medical conditions, their closest relatives were informed, and consent was obtained on their behalf. Illiterate patients were verbally informed, and their consent was recorded through signature or thumbprint. A structured data collection form was used to gather patient demographics, comorbidities (such as diabetes and hypertension), and preoperative echocardiographic findings to assess ventricular function. Intraoperative parameters, including perfusion techniques, inotropic support requirements, ventilator hours, and hemodynamic variables, were recorded. Postoperative outcomes, including ICU stay, incidence of complications, and mortality rates, were systematically documented. Clarification was made that all patients were admitted to the ICU postoperatively, as is standard practice following CABG. Statistical analysis was performed using IBM SPSS Statistics version 26. Descriptive statistics, including mean, standard deviation, frequency distributions, and percentages, were calculated to summarize patient characteristics. Chi-square analysis was used to determine associations between categorical variables, while appropriate parametric or non-parametric tests were employed for continuous variables based on data distribution.

RESULTS

The study included 100 patients undergoing isolated coronary artery bypass grafting (CABG), stratified into three groups based on left ventricular ejection fraction (LVEF): EF ≤25%, EF 26-35%, and EF 36-45%. The mean age of patients in the EF ≤25% group was 66.1 ± 7.23 years, whereas patients in the EF 26-35% and EF 36-45% groups had a mean age of 61.2 ± 7.23 years. Gender distribution varied significantly among groups ($p < 0.001$), with a higher proportion of males in the EF ≤25% group (28 males, 5 females) compared to the EF 26-35% group (27 males, 13 females) and the EF 36-45% group (10 males, 17 females). Diabetes mellitus prevalence increased with worsening EF, with 9 cases in the EF ≤25% group, 21 in the EF 26-35% group, and 18 in the EF 36-45% group ($p = 0.008$). Hypertension was evenly distributed across groups ($p = 0.608$), with 30 cases in the EF ≤25% group, 37 in the EF 26-35% group, and 23 in the EF 36-45% group. Chronic obstructive pulmonary disease (COPD) was significantly more common in the EF ≤25% group (18 cases) compared to the EF 26-35% group (4 cases) and was absent in the EF 36-45% group ($p < 0.001$). Renal failure was more frequent in patients with EF ≤25% (8 cases) compared to 1 case in the EF 26-35% group and 2 cases in the EF 36-45% group ($p = 0.010$). Stroke occurred more often in patients with lower EF ($p = 0.029$), with 16 cases in the EF ≤25% group, 15 cases in the EF 26-35% group, and 3 cases in the EF 36-45% group.

Smoking was more prevalent in patients with lower EF ($p < 0.001$), with 28 smokers in the EF ≤25% group, 23 in the EF 26-35% group, and 8 in the EF 36-45% group. Angina classification showed a higher proportion of stable angina in higher EF groups ($p = 0.008$), while unstable angina was more common in lower EF groups. In the NYHA classification ($p = 0.003$), Class III symptoms were observed in 15, 13, and 19 patients across the EF ≤25%, EF 26-35%, and EF 36-45% groups, respectively, whereas Class IV symptoms were more frequent in lower EF groups, with 18 cases in EF ≤25%, 20 cases in EF 26-35%, and 7 cases in EF 36-45%. Previous myocardial infarction (MI) was reported in 20 patients in the EF ≤25% group, 36 in the EF 26-35% group, and 21 in the EF 36-45% group ($p = 0.012$). Preoperative intra-aortic balloon pump (IABP) use was significantly higher in the EF ≤25% group (27 cases) compared to the EF 26-35% group (8 cases) and the EF 36-45% group (2 cases) ($p < 0.001$). Postoperatively, major complications were significantly different between groups ($p = 0.036$). A greater percentage of patients in the EF ≤25% group had no major complications (90.9%) compared to the EF 26-35% (67.5%) and EF 36-45% (66.7%) groups. Stroke occurred in 5% of patients with EF ≤25%, 1% of patients

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with EF 26-35%, and 0% in EF 36-45% (p = 0.024). Deep sternal wound infections were more common in patients with EF ≤25% (6%) compared to 1% in both the EF 26-35% and EF 36-45% groups (p = 0.031). Reoperation due to bleeding was required in 8% of EF ≤25% patients, 2% of EF 26-35% patients, and 2% of EF 36-45% patients (p = 0.029).

Sepsis was significantly more frequent in the EF 26-35% and EF 36-45% groups (21% and 18%, respectively) compared to the EF ≤25% group (6%) (p < 0.001). Renal failure was more prevalent in the EF ≤25% group (10%) compared to 1% in both the EF 26-35% and EF 36-45% groups (p < 0.001). These findings suggest a paradoxical trend in which the EF ≤25% group had a higher rate of no major complications despite a generally worse preoperative profile. This result warrants further investigation to explore potential factors such as patient selection, perioperative management, or reporting variations. The baseline characteristics of patients undergoing coronary artery bypass grafting (CABG) showed significant differences in demographic and clinical parameters across the ejection fraction (EF) groups. Patients in the EF ≤25% group were older (66.1 ± 7.23 years) compared to those in the EF 26-35% and EF 36-45% groups (both 61.2 ± 7.23 years). A significantly higher proportion of males were observed in the lowest EF group (p < 0.001). Comorbidities such as diabetes mellitus were more prevalent in patients with EF 26-35% (21 cases) and EF 36-45% (18 cases) compared to EF ≤25% (9 cases, p = 0.008). Hypertension was equally distributed across all EF groups (p = 0.608). Chronic obstructive pulmonary disease (COPD) was significantly more frequent in patients with EF ≤25% (18 cases) compared to EF 26-35% (4 cases) and EF 36-45% (0 cases, p < 0.001). Stroke incidence was higher in lower EF groups, with 16 cases in EF ≤25%, 15 cases in EF 26-35%, and 3 cases in EF 36-45% (p = 0.029). Similarly, renal failure was more common in the EF ≤25% group (8 cases) compared to 1 case in EF 26-35% and 2 cases in EF 36-45% (p = 0.010). Smoking was predominantly found in lower EF groups, with 28 cases in EF ≤25%, 23 cases in EF 26-35%, and 8 cases in EF 36-45% (p < 0.001). Postoperatively, patients with EF ≤25% had a lower incidence of major complications, with 90.9% experiencing no major adverse events compared to 67.5% in the EF 26-35% group and 66.7% in the EF 36-45% group (p = 0.036). Stroke occurred in 5% of EF ≤25% patients, 1% in EF 26-35%, and none in EF 36-45% (p = 0.024). Deep sternal wound infection was most common in the EF ≤25% group (6%) compared to 1% in both the EF 26-35% and EF 36-45% groups (p = 0.031). Reoperation due to bleeding was more frequent in patients with EF ≤25% (8%) compared to 2% in both the EF 26-35% and EF 36-45% groups (p = 0.029). Sepsis was significantly more prevalent in the EF 26-35% (21%) and EF 36-45% (18%) groups compared to EF ≤25% (6%, p < 0.001). Renal failure was notably higher in the EF ≤25% group (10%) than in the EF 26-35% and EF 36-45% groups (1% each, p < 0.001).

Table 1 Baseline characteristics of patients undergoing CABG

Variable	Ejection Fraction ≤25 (%)	Ejection Fraction 26-35 (%)	Ejection Fraction 36-45 (%)	p-value
Age(years)	66.1 ± 7.23	61.2 ± 7.23	61.2 ± 7.23	
Gender				<0.001

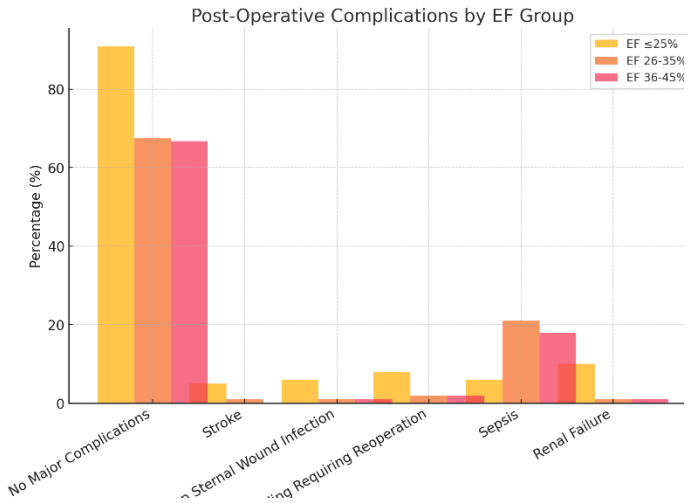

Figure 2 Post-Operative Complication by EF Group

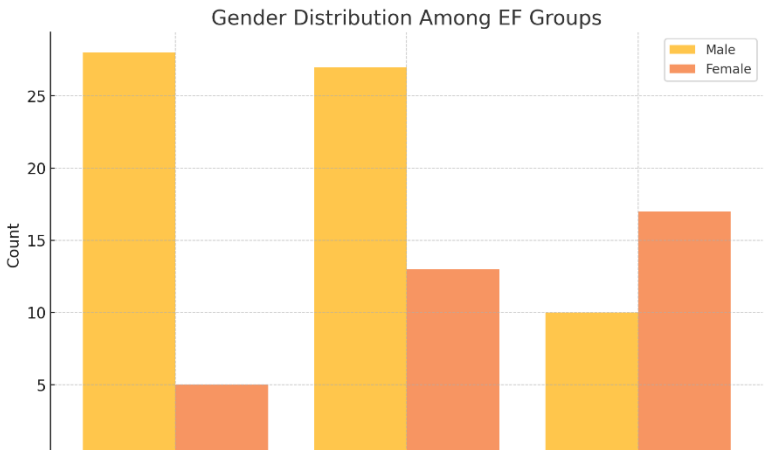

Figure 1 Gendre Distribution Among EF Groups

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Variable	Ejection Fraction ≤25 (%)	Ejection Fraction 26-35 (%)	Ejection Fraction 36-45 (%)	p-value
Female	5	13	17	
Male	28	27	10	
Diabetes Mellitus	9	21	18	0.008
Hypertension	30	37	23	0.608
COPD	18	4	0	<0.001
Renal failure	8	1	2	0.010
Stroke	16	15	3	0.029
Smoking	28	23	8	<0.001
Angina Class				
Stable Angina	7	18	15	0.008
Unstable Angina	26	22	12	
NYHA				0.003
Class I	0	0	0	
Class II	0	7	1	
Class III	15	13	19	
Class IV	18	20	7	
Previous MI	20	36	21	0.012
Pre-op IABP	27	8	2	<0.001

Table 2 Post-operative Complications

	Ejection Fraction ≤25 (%)	Ejection Fraction 26-35 (%)	Ejection Fraction 36-45 (%)	p-value
No major complications	90.9	67.5	66.7	0.036
Stroke	5	1	0	0.024
Deep sternal wound infection	6	1	1	0.031
Bleeding require reoperation	8	2	2	0.029
Sepsis	6	21	18	<0.001
Renal Failure	10	1	1	<0.001

Table 3 Post-Operative Complications

Complication	EF ≤ 25%	EF 26-35%	EF 36-45%

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No major complications	90.9	67.5	66.7
Stroke	5	1	0
Deep sternal wound infection	6	1	1
Bleeding require reoperation	8	2	2
Sepsis	6	21	18
Renal Failure	10	1	1

Table 4 Baseline Characteristics of CABG Patients

Variable	**EF ≤ 25%**	**EF 26-35%**	**EF 36-45%**
Age (years)	66.1	61.2	61.2
Female	5	13	17
Male	28	27	10
Diabetes Mellitus	9	21	18
Hypertension	30	37	23
COPD	18	4	0
Renal failure	8	1	2
Stroke	16	15	3
Smoking	28	23	8
Stable Angina	7	18	15
Unstable Angina	26	22	12
NYHA Class III	15	13	19
NYHA Class IV	18	20	7
Previous MI	20	36	21
Pre-op IABP	27	8	2

DISCUSSION

Low ejection fraction (EF ≤25%) is associated with significant cardiovascular and systemic comorbidities, contributing to an overall increased risk of postoperative complications and poorer outcomes following coronary artery bypass grafting (CABG). Consistent with previous studies, low EF serves as an established predictor of adverse events, including increased morbidity, prolonged hospitalization, and elevated mortality risk. Despite similar age distribution across the study groups, the presence of multiple comorbidities and compromised cardiac function in the lower EF group suggests that factors beyond chronological age are primarily responsible for postoperative outcomes (14). The predominance of male patients in the EF ≤25% group aligns with the well-documented epidemiological trend of coronary artery disease (CAD) presenting earlier and more severely in men, which has been attributed to differences in hormonal influences, vascular function, and risk factor burden. Diabetes mellitus was more prevalent in patients with higher EF, reinforcing the link between metabolic disorders and CAD progression. The association between diabetes and myocardial dysfunction has been widely reported, as chronic hyperglycemia accelerates endothelial dysfunction, microvascular damage, and left ventricular remodeling, ultimately contributing to worsening cardiac performance (15). A higher prevalence of chronic obstructive

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pulmonary disease (COPD) in the EF ≤25% group further supports the established relationship between pulmonary and cardiac dysfunction, where COPD exacerbates right ventricular strain, systemic inflammation, and hypoxic vasoconstriction, worsening overall prognosis (16). Similarly, renal failure and stroke were significantly more frequent in the EF ≤25% group, consistent with evidence indicating that renal dysfunction serves as a key predictor of adverse surgical outcomes, leading to prolonged hospitalization, increased susceptibility to infections, and higher mortality rates due to impaired systemic perfusion and inflammatory responses (17).

Smoking, a modifiable risk factor, was more prevalent in patients with EF ≤25%, reinforcing its detrimental impact on endothelial function, atherosclerotic progression, and myocardial perfusion. The increased occurrence of unstable angina in this group is in line with the natural course of CAD, where severe ischemia and impaired myocardial reserve predispose patients to acute coronary syndromes (18). Heart failure severity, as indicated by New York Heart Association (NYHA) classification, was most pronounced in the lowest EF group, with a higher proportion of patients in Class III and IV. This finding is consistent with previous research indicating that NYHA classification serves as a strong prognostic indicator of surgical outcomes, with advanced heart failure correlating with higher perioperative morbidity and mortality (6,17). Interestingly, a slightly lower prevalence of previous myocardial infarction (MI) was observed in the EF ≤25% group compared to the EF 26-35% and EF 36-45% groups, possibly indicating a more chronic progression of ischemic cardiomyopathy rather than an acute ischemic event as the primary cause of severe left ventricular dysfunction. This discrepancy highlights the complex interplay between CAD severity, myocardial viability, and long-term disease progression (9,19). The need for preoperative intra-aortic balloon pump (IABP) support in approximately 60% of patients with EF ≤25% reinforces the well-established requirement for mechanical circulatory assistance in individuals with severe left ventricular impairment, aligning with prior evidence that IABP use enhances hemodynamic stability and facilitates safer surgical intervention in high-risk patients (8).

Postoperative complications were more frequent in patients with EF ≤25%, particularly with regard to bleeding requiring reoperation, sepsis, and renal failure. The increased incidence of bleeding complications may be attributed to prolonged surgical time, heightened anticoagulation requirements, and the fragile hemodynamic status of these patients. Sepsis was significantly more common in the EF ≤25% group, likely due to the immunosuppressive effects of chronic heart failure, prolonged intensive care unit (ICU) stays, and invasive postoperative interventions. These findings align with prior reports linking low EF to increased susceptibility to infections due to prolonged mechanical ventilation, systemic inflammatory responses, and postoperative hemodynamic instability (12). The significantly higher rate of postoperative renal failure in the EF ≤25% group is consistent with prior research demonstrating an association between low cardiac output, nephrotoxic medication exposure, and systemic inflammation as key contributors to acute kidney injury in cardiac surgery patients (20). An unexpected finding in this study was that 90.9% of patients in the EF ≤25% group did not experience major complications, which was slightly higher than the rates observed in the EF 26-35% (67.5%) and EF 36-45% (66.7%) groups. While lower EF is typically associated with increased postoperative morbidity, this discrepancy may be attributed to patient selection bias, improved preoperative optimization, or more aggressive perioperative management strategies tailored to this high-risk group. Literature suggests that careful patient selection, preoperative hemodynamic stabilization, and optimized surgical techniques can mitigate adverse outcomes in CABG patients with severe left ventricular dysfunction. However, the overall correlation between low EF and elevated risk of major complications, such as worsening heart failure and arrhythmias, remains well-supported, warranting further investigation into potential factors influencing this specific cohort's outcomes.

A key strength of this study is its detailed analysis of preoperative characteristics and postoperative complications across different EF groups. However, its single-center design limits generalizability, as variations in institutional protocols, surgical expertise, and perioperative management strategies may introduce bias. The reliance on self-reported patient histories, particularly for smoking and comorbidity data, may also introduce recall bias. Additionally, the absence of mortality data represents a limitation, as it restricts the ability to fully assess long-term surgical outcomes and survival rates among patients with low EF. Future studies should incorporate mortality analysis, long-term follow-up data, and rehospitalization rates to provide a more comprehensive assessment of CABG outcomes in this high-risk population. The findings emphasize the importance of individualized perioperative strategies for patients with low EF undergoing CABG. The selection of perfusion techniques, particularly the use of the on-pump beating-heart method, has demonstrated potential benefits in reducing perioperative morbidity and mortality. Preoperative optimization through mechanical circulatory support, strict fluid management, and early intervention for comorbid conditions remains crucial. High-risk patients benefit from meticulous perioperative care and tailored intraoperative strategies to achieve optimal surgical outcomes. Future multicenter studies with larger sample sizes and long-term follow-ups are essential to validate these findings and refine best practices in managing CABG patients with severe left ventricular dysfunction.

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CONCLUSION

This study highlights the significant impact of ejection fraction on both preoperative risk factors and postoperative outcomes in patients undergoing coronary artery bypass grafting. Lower ejection fraction was associated with a higher prevalence of comorbid conditions such as chronic obstructive pulmonary disease, renal failure, and smoking, which contributed to increased postoperative complications, including stroke, infections, and reoperations. Despite these risks, a considerable proportion of patients with severely reduced ejection fraction did not experience major complications, suggesting that careful patient selection, preoperative stabilization, and optimized surgical strategies play a critical role in improving outcomes. The findings reinforce the importance of individualized perioperative management for high-risk patients and emphasize the need for continued advancements in surgical techniques and critical care to enhance survival and recovery in this vulnerable population.

Author Contribution

Author	Contribution
Muhammad Zubair Aslam*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Chanda Naseem	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Muhammad Mohsin Yar	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muhammad Raheel Jam	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

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