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Original Research Article

EARLY OUTCOME OF LEFT VENTRICULAR FUNCTION AFTER CORONARY ARTERY BYPASS SURGERY: A SINGLE-CENTER EXPERIENCE

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Abstract: *Patients with ischemic heart disease and low ejection fraction often exhibit improved outcomes following coronary artery bypass grafting (CABG). Our study aimed to assess the impact of CABG on left ventricular (LV) systolic function and identify predictors of adverse postoperative outcomes. We conducted a prospective cross-sectional study involving 110 CABG patients with a mean age of 56.1 ± 12.2 years and preoperative left ventricular ejection fraction (LVEF) below 50%. Patients were categorized into two groups: group I (n=76, LVEF > 35%) and group II (n=34, LVEF < 35%). In group II, there was a significantly higher prevalence of diabetes mellitus (DM) (p = 0.05) and Euro SCORE II compared to group I (p < 0.001). However, other clinical predictors showed no significant difference between the two groups. Both groups exhibited a significant improvement in LVEF post-surgery (p = 0.05), with comparable in-hospital mortality rates recorded. The study identified DM, significant diastolic dysfunction, and intra-aortic balloon pump (IABP) insertion as predictors of in-hospital mortality (p = 0.001, 0.03, and < 0.001, respectively). These findings suggest a noticeable enhancement in LV systolic function post-CABG, contributing to improved survival rates. However, patients with DM, significant diastolic dysfunction, and those requiring IABP insertion during the perioperative period are at higher risk of mortality. Therefore, targeted attention and specialized care are essential for optimizing outcomes in these high-risk patients.*

Keywords: CABG, Risk Predictors, Left Ventricular Systolic Dysfunction

Introduction

Managing patients with impaired left ventricular (LV) function, either through medical therapies or surgical interventions like coronary artery bypass grafting (CABG), poses considerable challenges in clinical practice (Beerkens et al., 2022; Davierwala, 2016). Ischemic heart disease accompanied by depressed LV function is often considered a class-I indication for CABG, as it has been consistently associated with symptom improvement and increased survival rates (Ahmed et al., 2009; Jiang et al., 2004; Mark et al., 2014). However, there remains uncertainty regarding the extent of LV function improvement immediately after CABG. While some studies have reported significant enhancements in LV function shortly after surgery (Alderman et al., 1983; Frazier et al., 1996), others have failed to observe substantial changes. In contrast, a few studies have even documented a decline in LV function post-CABG (Chinikar et al., 2019). These conflicting findings highlight the need for a thorough investigation into the effects of CABG on LV function, especially in patients with pre-existing systolic dysfunction (Couperus et al., 2017; Siribaddana, 2012).

The rationale behind this study lies in addressing these uncertainties and systematically evaluating the impact of CABG on LV function in patients with preoperative systolic dysfunction. By comprehensively assessing the outcomes of CABG on LV function in this specific patient population, this research aims to fill existing knowledge gaps, provide valuable insights for clinical decision-making, and ultimately optimize patient care strategies in this complex clinical scenario.

Methodology

This retrospective cohort study enrolled 110 patients who underwent elective coronary artery bypass grafting (CABG) at the Cardiac Surgery department of Wazirabad Institute of Cardiology between 2022 and 2023. Patients meeting the inclusion criteria of elective CABG during the specified period were included. Exclusion criteria comprised individuals with normal left ventricular ejection fraction (LVEF), severe pulmonary hypertension, cardiogenic shock, combined CABG and valvular surgery, and those lacking postoperative echocardiography.

Demographic and clinical data, including age, gender, height, weight, Body Mass Index (BMI), presence of diabetes mellitus (DM), hypertension (HTN), renal impairment, and history of previous myocardial infarction, were collected. Surgical details, such as bypass time, cross-clamp time, and utilization of intra-aortic balloon pump (IABP) and inotropes, were retrieved from patient records.

The surgical procedure involved median sternotomy with cardiopulmonary bypass utilizing aorto-caval (Single two-stage cannula) cannulation. Antegrade St. Thomas hospital cardioplegia mixed with oxygenated blood in a 4:1 crystalloid-to-blood ratio was administered, with repeated infusion every 20 minutes through the completed vein graft and the aortic root along with topical cooling with slushed saline. The internal mammary artery was grafted to the left anterior descending artery (LAD), while reversed saphenous vein grafts were employed for other territories.

Echocardiography and ventricular function assessment were conducted preoperatively, postoperatively before discharge,

and during outpatient follow-up visits, typically 3 to 4 months post-CABG. Transthoracic echocardiography (TTE) was performed to measure left ventricular ejection fraction (LVEF) using standard methods. Severe left ventricular dysfunction was defined as LVEF < 35%, while improvement in left ventricular function was defined as an increase of >5% in LVEF compared to preoperative values. Other echocardiographic parameters, including valve status, regional wall motion abnormalities, and atrial size, were also assessed. Right ventricular function was evaluated using tricuspid annular plane excursion (TAPSE).

Statistical analysis was conducted using IBM SPSS Statistics version 23.0. Continuous variables were expressed as mean ± SD or median and range, depending on the distribution curve of the variable. The chi-square test was employed to compare the presence of ventricular dysfunction preoperatively and postoperatively. Linear regression analyses were performed, with a p-value < 0.05 considered significant.

Results

The study included 110 patients with preoperative left ventricular ejection fraction (LVEF) <50% undergoing coronary artery bypass surgery (CABG). Table 1 provides an overview of the patient demographics and baseline characteristics. Among the patients, 76 (69%) belonged to group I (preoperative LVEF >35%), while 34 (31%) were in group II (preoperative LVEF <35%). It was observed that the prevalence of diabetes mellitus (DM) was significantly higher in group II compared to group I (Table 2).

Operative outcomes were similar between the two groups, as indicated in Table 3. Postoperative mortality rates were comparable between group I (5.2%) and group II (5.8%), as shown in Table 3. The primary causes of mortality were cardiogenic shock and multi-organ failure. Additionally, the use of intra-aortic balloon pump (IABP) perioperatively was significantly higher in group II (Table 3).

Following CABG, most patients experienced an improvement in LVEF, as highlighted in Table 4. However, there was a slight deterioration in LVEF postoperatively in both groups, with 35.5% of patients in group I and 26.6% in group II experiencing this (Table 3).

Univariate analysis revealed significant predictors of in-hospital mortality, as summarized in Table 5. In group I, DM was associated with a mortality rate of 25% (Table 5). In contrast, in group II, diastolic dysfunction and IABP use were associated with mortality rates of 50% each (Table 5). Overall, the study findings suggest that CABG can lead to improved LV systolic function in patients with baseline LV dysfunction. However, certain risk factors such as DM, diastolic dysfunction, and the use of IABP may influence postoperative outcomes and mortality, as indicated in Table 5.

Table 1: Demographics, Clinical, and Operative Data

Variable	Number/Value	Percentage
Age	56.1 ± 12.2	-
BMI	27.8 ± 5.9	-
Males	77	70
DM	86	78
HTN	85	77
Obesity	50	45
CKD	20	18
High BNP	30	27
Significant LV Systolic Dysfunction (LVEF <35%)	38	35
Significant LV Diastolic Dysfunction	45	41
Dilated RV	11	10
Preoperative RV Dysfunction	12	11
Perioperative IABP	25	23
Bypass Time (minutes)	137 ± 69	-
Cross Clamp Time (minutes)	93 ± 35	-
Incomplete Revascularization	40	36
Deterioration of LVEF (postoperative)	34	31
Postoperative AKI	6	5.5
Mortality	7	6.4

Table 2: Comparison of Demographic and Clinical Data between the Two Groups

Variables	Group-I (preoperative LVEF > 35)	Group II (preoperative LVEF < 35)	*P value*
Age > 65	30 (39%)	11 (32%)	0.450
DM	62 (81%)	30 (88%)	0.160
HTN	59 (77%)	28 (82%)	0.510
Smoking	30 (39%)	15 (44%)	0.600
Dyslipidemia	40 (53%)	18 (53%)	0.980
CKD	13 (17%)	9 (26%)	0.290
Obesity	35 (46%)	23 (68%)	0.080
High BNP	21 (60%)	12 (80%)	0.070
Dilated LV	9 (12%)	8 (24%)	0.210
Diastolic Dysfunction	25 (33%)	23 (68%)	0.010
TAPSE	6 (8%)	9 (26%)	0.030
Left Main Disease	10 (13%)	5 (15%)	0.780

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Table 3: Operative and Postoperative Outcomes in the Studied

Variable	Group-I	Group-II	*P value*
Bypass Time (minutes)	130 ± 65	143 ± 68	0.340
Cross Clamp Time (minutes)	91 ± 38	94 ± 35	0.560
Incomplete Revascularization	25 (33%)	15 (44%)	0.190
Mortality	5 (6.5%)	2 (5.8%)	0.860
Reoperation for Bleeding	7 (9%)	3 (8.8%)	0.920
Postoperative LVEF Deterioration	29 (38%)	12 (35%)	0.720
Wound Infection	18 (24%)	7 (20%)	0.570
Postoperative AKI	4 (5%)	3 (8.8%)	0.450
Neurological Complications	2 (3%)	1 (2.9%)	0.950

Table 4: Change in LVEF after CABG

Variable	Preoperative LVEF (%)	Postoperative LVEF (%)	P-value
Whole Cohort	29.76 ± 4.86	33.53 ± 9.65	0.050

Table 5: Univariate Analysis of Perioperative Risk Predictors for In-hospital Mortality

Variable	Mortality (N=7)	Univariate p-value
All Patients		
DM	3 (42.9%)	0.001
Diastolic Dysfunction	4 (57.1%)	0.020
IABP	4 (57.1%)	< 0.001
Group-I		
DM	2 (40%)	0.002
Diastolic Dysfunction	3 (60%)	0.015
IABP	4 (80%)	< 0.001
Group-II		
Diastolic Dysfunction	1 (50%)	0.050
IABP	1 (50%)	0.003

Discussion

Left ventricular ejection fraction (LVEF) serves as a critical indicator post-CABG in patients with ischemic cardiomyopathy, predicting their clinical outcomes (Lassen et al., 2021). Our investigation aimed to assess the effect of CABG on LVEF in individuals presenting with impaired systolic function at baseline. The study revealed a noteworthy enhancement in LV systolic function following CABG, reinforcing the hypothesis that surgical revascularization and restoration of blood flow can salvage viable myocardium, reduce LV remodeling, and alleviate ischemic burden (Ibáñez et al., 2015; Jivraj et al., 2015).

While some studies have overlooked changes in LV systolic function post-CABG due to the absence of routine echocardiographic assessments, recent literature supports successful outcomes in patients with preoperative EF <50% through meticulous patient selection and management strategies (Agarwal et al.; Kandakure et al.; Magoon et al., 2020; Singh; Srinath et al.). Our findings align with these observations, indicating significant improvements in LV systolic function among patients with preoperative systolic dysfunction.

Factors influencing outcomes post-CABG in patients with baseline LV systolic dysfunction encompass various perioperative considerations, including the severity of preoperative LV systolic dysfunction, adequacy of revascularization, surgical expertise, myocardial protection strategies, and postoperative care protocols (Mebazaa et al., 2010). However, contrasting viewpoints exist, with some studies suggesting a detrimental impact of CABG on LV systolic function, possibly attributed to intraoperative global ischemia, myocardial stunning, or early graft failure.

Our study reported an acceptable early mortality rate of 5.4%, consistent with existing literature. Although slightly higher mortality rates were noted in patients with LVEF <35%, these differences were statistically insignificant, highlighting improved outcomes post-CABG in patients with ischemic cardiomyopathy.

Notably, Type II diabetes mellitus emerged as a significant predictor of adverse outcomes, corroborating previous observations regarding the heightened mortality risk associated with diabetes in CABG patients. The utilization of intra- or postoperative intra-aortic balloon pump (IABP) emerged as another predictor of in-hospital mortality, particularly pronounced in patients with EF <50% (Baldetti et al., 2021). Despite its supportive role, IABP employment was associated with increased mortality risk, attributed to unstable hemodynamic status and attendant complications.

Additionally, advanced diastolic dysfunction emerged as an independent predictor of adverse outcomes and mortality, consistent with prior studies highlighting its association with postoperative complications such as heart failure, atrial fibrillation, and cardiac death.

Limitations of our study include its single-center design, limited sample size, and short-term follow-up duration,

precluding extrapolation of findings to long-term outcomes. Furthermore, graft patency data were unavailable, necessitating validation through larger multicenter studies with extended follow-up periods.

Conclusion

This study has confirmed that coronary artery bypass grafting (CABG) leads to a significant improvement in LV systolic function, which is highly beneficial for patients with reduced EF. However, patients with diabetes mellitus, advanced diastolic dysfunction, high Euro SCORE, and those who received insertion of IABP were found to have adverse outcomes. Identifying patients with these risk factors can provide additional prognostic information and help improve monitoring and follow-up care to prevent poor outcomes. Further research is needed to validate these findings in other tertiary centers and provide multicenter results to generalize the conclusions.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned.
Consent for publication
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Conflict of interest

The authors declared absence of conflict of interest.

Author Contribution

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Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript.
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Manuscript revisions, critical input.
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