



EARLY AND MIDTERM OUTCOME OF CORONARY REVASCULARISATION IN PATIENTS WITH LEFT VENTRICULAR DYSFUNCTION

Cardiovascular

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ABSTRACT

Aim: The purpose of this study was to evaluate the effectiveness of CABG in patients with LVD who underwent isolated CABG. **Materials and Methods :** This retrospective study included 40 patients who had a left ventricular ejection fraction (LVEF) $\leq 45\%$ determined by echocardiography and underwent elective isolated CABG between 2020 to 2023 in our institute ABVIMS and Dr RML Hospital, Delhi. Pre-operatively 7 patients were in New York Heart Association functional class III or IV. Patients who had LV aneurysm, prior CABG, or CABG with other valve interventions were excluded from this study. Routine follow-up was done via monthly periodical examinations in the first three months, and six monthly for next three years. Transthoracic echocardiography (TTE) was done during follow-up. **Results:** Out of total 40 patient, hospital mortality was 2.5% (1 patients) and 5% (2 patient) patients died during follow up period. Mean LVEF increased significantly from $35.8 \pm 6.36\%$ to $39.7 \pm 7.8\%$ in post-operative period. LV Systolic function also improved in post-operative period. **Conclusion:** From our study, we conclude that patient with LV dysfunction can undergo CABG with low morbidity and mortality rates and good clinical outcome. CABG in these patients could be beneficial in terms of improved LV function.

KEYWORDS

LVD-left ventricular dysfunction, LVEF-left ventricular ejection fraction

INTRODUCTION:

Left ventricular (LV) dysfunction presents significant challenges in the outcome of coronary artery bypass grafting (CABG) surgery and adds to the surgical challenge in achieving safe, effective, and complete coronary revascularization [1]. This subset of patients is more amenable to surgical revascularization rather than guideline-directed medical therapy (GDMT) or catheter-based intervention, in accordance to the latest 2021 American Heart Association (AHA) recommendations [2]. However, it is prudent to consider a tailored, patient-specific heart team-guided management plan for optimal outcomes [3].

Both on pump as well as off pump revascularisation strategies can be opted in cases with concomitant LV dysfunction. Performing an off-pump CABG in such cases demands careful handling of the heart, optimal hemodynamic balance and a lower threshold for on-pump conversion. Also, an on-pump CABG in such cases demands careful hemodynamic balance, managing an optimal perfusion pressure and a gradual staged weaning from cardiopulmonary bypass. Concurrent mitral regurgitation (MR), a common entity coexisting with a history of infarction and ischemic cardiomyopathy, further complicates predicting postoperative morbidity and mortality [4,5]. Despite these challenges, a clear verdict on optimal management remains unclear, sparking debates between GDMT-based medical management versus surgical intervention and whether to prefer an off-pump approach or opt for on pump surgery [6,7].

In our study, we aimed to retrospectively analyze our center-specific early and midterm results in following up on such patients of coronary artery disease with concomitant LV dysfunction to understand the usefulness of surgical revascularization in these patients and evaluate the outcomes. Our study involved extensive pre-operative and post-operative echocardiographic (ECHO) evaluations, emphasizing assessment of LV remodelling and changes in LV function. We also assessed functional improvement in patient after revascularisation and compared it to pre operative functions in accordance to New York

Heart Association (NYHA) criteria for angina and symptom relief post CABG. This comprehensive analysis aims to elucidate the rationale behind opting for CABG in these specific patient subgroups in term of functional improvement and LV remodelling gained from surgical intervention.

MATERIALS AND METHODS

This retrospective study was conducted at our tertiary care centre, ABVIMS and Dr RML Hospital in New Delhi, from May 2019 to May 2023. Patients undergoing CABG with left ventricular ejection fraction (LVEF) $\leq 45\%$, as determined by echocardiography were included in our study.

Demographic analysis, New York Heart Association (NYHA) classification-based symptom stratification, pre- and post-operative echocardiographic (ECHO) evaluations encompassing LV dimension and functional assessment, and early and midterm follow-up involving morbidity and mortality assessments were included in the data analysis. Patients with LV aneurysms, prior CABG, or combined CABG with concurrent valve interventions were excluded from our study. The indication for bypass surgery was determined by established clinical and angiographic criteria directed by AHA guidelines. Evaluation of left ventricular function was conducted by transthoracic echocardiography preoperatively and subsequently 6 monthly and 2 yearly after discharge from hospital on follow up. The ECHO study was done independently from department of cardiology with parasternal, apical and subcostal windows for the evaluation of left ventricular function using commercially available systems.

To ensure comprehensive monitoring, routine follow-up procedures were implemented, comprising weekly visits for six weeks post-surgery, followed by monthly visits for the subsequent six months. Subsequently, all patients underwent half-yearly follow-up assessments, incorporating detailed echocardiographic studies. Data interpretation was procured from 6 monthly and 2 years follow up to compile mid term outcomes.

RESULTS:

In the given study duration, a total of 40 patients were included according to our inclusion criteria of CABG with LV dysfunction. Baseline characteristics of the study population are presented in Table 1. Mean age group of patients undergoing CABG with ventricular dysfunction was 56.3±2.4 years. Majority of our study population were male (33 out of 40) while 7 patients were female.

Mean preoperative LVEF was 35.82±6.05% (range 25 to 45), A total of 7 patients (17.5%) were severely symptomatic with New York Heart Association (NYHA) functional class III-IV. All the patients were managed medically by drugs under standard treatment protocols.

As per our Institutional policy, a standard off pump surgery was the preferred approach and a successful off-pump CABG was performed in 31(77.5%) patients. The decision to on-pump was based on clinical and diagnostic findings including elevated pulmonary artery (PA) pressures, hemodynamic instability refractory to inotropic agents, increased airway pressure on ventilator, transoesophageal echo (TEE) findings indicating moderate to severe myocardial dysfunction and regional wall motion abnormalities, severe arrhythmias, and heart distension with poor contractility. The number of patients who underwent on pump CABG was 9 (22.5%),

Detailed pre operative trans thoracic echocardiographic data of patients were collected and left ventricular functional assessment based on ejection fraction (EF), left ventricular end systolic dimension (LVESD) and left ventricular end diastolic dimension (LVEDD) were carefully measured and charted for comparison in post operative period for evaluation of functional improvement.

Table 1: Demographic and echocardiographic characteristics

Age(>65years)	12(30%)
Sex(Male)	33(82.5%)
NYHA Class I,II	33(82.5%)
III,IV	7(17.5%)
Echocardiographic parameters	
LVEF(%)	35.82+/-6.05
LVEDD(mm)	4.86 +/-0.17
LVESD(mm)	2.78 +/-0.30

The early and late postoperative outcomes of all patients are presented in Table 2. Overall, in-hospital mortality rate was 2.5% (n=1). The patient had recurrent ventricular fibrillation in immediate post op period and could not be resuscitated. Three patients (7.5%) had sepsis, and five (12.5%) patients required intraaortic balloon pump support in view of overt intra op and post op LV dysfunction for support.

During midterm follow up , we had one mortality during follow up. The patient had features of failure during follow up with pedal oedema, ascites and had multiple ectopic on ECG with severe bi ventricular dysfunction on echocardiogram. He was admitted and started on inotropic support and was planned for coronary angiogram but arrested and was unsuccessfully revived subsequently.

Table 2: Early and Late Complications

Early complications	
Intra-aortic balloon pump	5(12.5%)
Inotropic support > 24 hours	2(5%)
Respiratory complication	1(2.5%)
Mortality	1(2.5%)
Late complications	
Heart Failure(NYHA III,IV)	0
Mortality	2(5%)

Echocardiographic evaluation on midterm follow-up (Table 3) showed that the mean postoperative LVEF (39.75±7.8%) was significantly better than that of the preoperative period (35.82±6.05%) (P-value < 0.001). However, changes were not significant in early LV remodelling indicated by LVSD and LVDD after CABG (P=0.066 and 0.133 respectively). Also, seven (17.5%) patients who were in the NYHA functional class III-IV got relief from congestive heart failure in post operative period.

Table 3: Changes in Echocardiographic parameters and Functional status in post operative period

Echocardiographic parameters	Preoperative	Postoperative	P-Value
LVEF(%)	35.82+/-6.36	39.75+/-7.8	<0.001
LVSD(mm)	2.78+/-0.30	2.74+/-0.30	0.066
LVDD(mm)	4.86+/-0.17	4.84+/-0.20	0.133
NYHA	2.12+/-0.46	1.50+/-0.50	<0.001

DISCUSSION:

Ischemic cardiomyopathy commonly associates with left ventricular dysfunction. Transient reversible left ventricular dysfunction can result from myocardial stunning/hibernation. Revascularization in these cases promptly alleviates symptoms, as evident from our study, showcasing excellent midterm 3-year survival rates in these high-risk patients.

Our investigation revealed a positive correlation and a noteworthy 3.93% mean improvement in LVEF during midterm follow-up. This reaffirms data from studies by Soliman et al. and Ji Q et al., supporting echocardiographic and functional assessments that establish the benefits of CABG in this subgroup [10,11].

Angina relief and functional improvement were notably optimal post-surgical revascularization, aligning with findings from Qiang Ji et al.'s study comparing normal LV function and impaired LV function subgroups. Both subgroups exhibited similar morbidity and mortality ratios, as observed in our study, where immediate post-operative and delayed post-operative mortalities were comparable [12].

While left ventricular remodeling post-coronary revascularization often leads to positive outcomes in the midterm and long term, our study did not detect statistically significant changes in LV geometry during our early and midterm follow-ups. This emphasizes the necessity for long-term follow-up in establishing definitive positive changes in LV geometry and remodeling [13,14].

The subset of CABG with concurrent LV dysfunction is considered high-risk. Yet, based on our center's specific experience, surgical revascularization offers safe and optimal symptomatic relief, yielding comparable results in risk stratification and surgical outcomes when compared to patients with normal LV function.

CONCLUSION:

Our study emphasizes the significant role of coronary revascularization in managing left ventricular dysfunction secondary to ischemic cardiomyopathy. Demonstrating immediate and midterm benefits, CABG led to notable symptom relief, improved survival rates, and enhanced functional status over three years in this high-risk patient group.

The observed improvements in left ventricular function and symptomatic relief reinforce the advantages of surgical intervention, highlighting CABG as a valuable therapeutic option. However, the need for extended monitoring for conclusive assessment of long-term left ventricular remodeling post-revascularization remains crucial.

Despite the perceived high risk, our center's experience supports surgical revascularization as a safe and effective approach, providing comparable outcomes to patients with normal LV function. In conclusion, our findings underscore the significance of CABG in alleviating symptoms and improving functional outcomes in patients with ischemic cardiomyopathy-related LV dysfunction.

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