https://doi.org/10.29309/TPMJ/2025.32.09.8914

The Professional Medical Journal
www.theprofesional.com
2025, Volume, 32 Issue, 09

ORIGINAL ARTICLE

Improvement of left ventricular function after CABG in patients with poor left ventricular function.

Muhammad Mujahid[1], Riaz ul Haq[2], Muhammad Farooq Ahmad[3], Muhammad Hussnain Raza[4], Muneeza Dilpazeer[5], Muhammad Azam[6]

Article Citation: Mujahid M, Riaz ul Haq, Ahmad MF, Raza MH, Dilpazeer M, Azam M. Improvement of left ventricular function after CABG in patients with poor left ventricular function. Professional Med J 2025; 32(09):1179-1184. https://doi.org/10.29309/TPMJ/2025.32.09.8914

ABSTRACT… Objective: To determine frequency of improvement of left ventricular ejection fraction (LVEF) after CABG surgery in patients with poor left ventricular function preoperatively. **Study Design:** Cross-sectional study. **Setting:** Department of Cardiac Surgery, Faisalabad Institute of Cardiology, Faisalabad. **Period:** 10th November 2022 to 9th October 2023. **Methods:** Patients with poor Left ventricular function (LVEF) determined by echocardiography or angiography were confirmed by Multigated Acquisition (MUGA) scan pre operatively. They were admitted in cardiac surgery ward, where baseline investigations were done for planned CABG. After surgery they were followed up and there LVEF was determined by repeat MUGA scan at 3 months. **Results:** Frequency of improvement of left ventricular function (LVEF) after CABG in patients with poor left ventricular function preoperatively was recorded in 13.85%(n=9). **Conclusion:** Frequency of improvement of left ventricular function (LVEF) was not very higher after CABG in patients with pre operative poor left ventricular function. However, our results need validation through multicenter trials.

Key words: CABG, Improvement, Left Ventricular Function.

INTRODUCTION

In 2015, cardiovascular disease (CVD) accounted for roughly one-third of worldwide deaths, affecting an estimated 422 million individuals.[1] The prevalence of CVD shows notable variation across nations. A significant proportion of the Pakistani population has been identified as having an increased likelihood of developing atherosclerotic cardiovascular disease. Accurate risk assessment plays a vital role in preventing sudden fatalities. Prevention efforts should focus on early recognition of risk factors, promoting healthier lifestyles, and ensuring appropriate pharmacological interventions in high-risk groups.[2]

CHD (coronary heart disease) is the number one entity and has major burden in cardiovascular disease. It may decrease LVEF when present for a long time or when acute cardiac event (MI) happens. There are two pathophysiological terms which explains the declining function of myocardium i.e hibernating and stunned myocardium. The term "hibernating myocardium" describes myocardial tissue with persistently reduced contractility due to prolonged inadequate blood supply, which can recover after revascularization. Stunned myocardium is a contractile dysfunction because of transient ischemia. In both, myocardial function is depressed although pathophysiology is different in either of them. Stunning is acute process and is likely due to the formation of oxyradicals and calcium deposition in the affected tissue. Hibernation is a slow process and is because of formation of atheroma slowly within the vessel walls.[3]

Both hibernation and stunning of the myocardium decrease the left ventricular function (left ventricular ejection fraction-LVEF). Revascularization can improve symptoms and even left ventricular function.

1. MBBS, FCPS (Cardiac Surgery), Senior Registrar, Punjab Institute of Cardiology, Lahore.
2. MBBS, MS (Cardiac Surgery), Senior Registrar, Sheikh Mohammad Bin Zayed Al Nahyan Institute of Cardiology, Quetta.
3. MD (RMP), MS (Cardiac Surgery), Senior Registrar, Faisalabad Institute of Cardiology, Faisalabad.
4. MBBS, MS (Cardiac Surgery), Senior Registrar, Wazirabad Institute of Cardiology, Wazirabad.
5. MBBS, IMM (Paediatric Medicine), ER Specialist, Children Life Foundation Civil Hospital, Quetta.
6. MBBS, FCPS (Cardiac Surgery), Senior Registrar, Rawalpindi Institute of Cardiology, Rawalpindi.

Correspondence Address:
Dr. Riaz ul Haq
Sheikh Mohammad Bin Zayed Al Nahyan Institute of Cardiology, Quetta.
riazulhaq87@yahoo.com

Article received on: 27/01/2025
Date of revision: 16/04/2025
Accepted for publication: 16/04/2025

Failure of recovery in patients with considerable viable tissue may be related to increase LV volume due to extensive ventricular remodelling.[4] There are multiple modalities to determine LVEF including angiography, SPECT, MUGA scan, CMR, echocardiography and PET scan. Echo has greater inter-observer variation. MUGA scan is more accurate than Echo in determining LVEF. PET is a gold standard for LVEF but not easily available. MUGA is most widely used modality.[3] In our study, we will use MUGA scan for determining the LVEF.

A study conducted by Rafaie et al at Al-Azhar university revealed that there is 20% increase in LVEF after 3 months of CABG(from 30±1.1 to 36±1.6).[5] In Another study carried out by Öztürk et al in Turkey revealed that there is improvement of LVEF after CABG by 10% (p=0.011) at 6 months and 30% (p=0.002) at 12 months.[6] A study conducted by Koene et al. found that LVEF improved by more than 5% in 24% of participants, remained within a ±5% range in 55%, and declined by greater than 5% in 21% of the population.[7]

Therefore, although there is evidence about improvement of LVEF after CABG but definite verdict is still conflicting, especially in developing countries. Moreover no study from Pakistan previously described any report over the behavior of left ventricular function in patients with poor LVEF pre-operatively. So, the rationale of our study is to determine the frequency of improvement of left ventricular function (LVEF) after CABG in patients with poor left ventricular function in a tertiary care hospital in our country. The study results will be useful for the practitioners owing to locally produced evidence.

METHODS

It was a cross-sections study conducted in cardiac surgery department, Faisalabad Institute of Cardiology Faisalabad which is a well equipped tertiary care cardiac centre. After approval from ethical review committee (FIC.No.18-2019/DME/FIC/FSD-9/11/19) of the hospital, 65 patients who underwent CABG surgery from 10thNovember 2022 to 9th August 2023were included in the study. Both male and female patients between 30 to 80 years of age with LVEF less than 35% undergoing isolated elective CABG were included.

Patients presenting in OPD were included in the study. Post graduate resident in the supervision of consultant took history and performed clinical examination. Patients with poor Left ventricular function (LVEF) determined by echocardiography or angiography was confirmed by Multigated Acquisition (MUGA) scan (as our study was based upon MUGA findings) pre operatively. They were admitted in cardiac surgery ward where baseline investigations were done and planned for CABG. After surgery they were followed up and their LVEF was determined by repeat MUGA scan at 3 months. Data was collected by researcher himself. All procedures were performed by consultant surgeons. MUGA scan was performed by technician and the results were interpreted by the consultant cardiologist in our hospital. All thedata was recorded in the Performa by the researcher.

The data was analyzed with the statistical analysis program (SPSS v-23). Quantitative variables like age, pre and post-operative LVEF were described as mean ±SD. Categorical variables like gender, diabetes mellitus, hypertension, smoking, family history of IHD (ischemic heart disease) and improvement of LVEF was presented as frequencies and percentages. Effect modifiers like age, gender, diabetes mellitus, hypertension, smoking and family history of IHD were stratified. Post stratification chi square test was used and P value less than or equal to 0.05 was considered significant.

RESULTS

Table-I provides an overview of the demographic and clinical characteristics of the study participants. The age distribution reveals that the majority of the participants (67.69%) were between 30 and 60 years old, while 32.31% were between 61 and 80 years old. In terms of gender, there was a nearly equal distribution, with 52.31% being male and 47.69% being female. The prevalence of comorbidities was notable, with 73.85% of participants having diabetes mellitus and 80.00% diagnosed with hypertension.

Additionally, 30.77% of the participants had a history of smoking. A significant proportion (40.00%) of the study population had a positive family history of ischemic heart disease (IHD). (Table-I)

Table-II presents the stratification analysis of improvement in left ventricular function concerning different demographic and clinical variables. Age-wise stratification showed that improvement was higher in the younger age group (18.2% in patients aged 30–50 years) compared to only 4.8% in those aged 51–80 years. However, the association was not statistically significant (p=0.14). Gender-based stratification revealed that male patients had a higher frequency of improvement (20.6%) compared to females (6.5%), but the difference did not reach statistical significance (p=0.09). Diabetes Mellitus (DM) stratification demonstrated that 12.5% of diabetic patients showed improvement in LVEF compared to 17.6% of non-diabetics, with no significant association (p=0.59). Similarly, in the hypertensive subgroup, improvement was noted in 11.5% of patients with hypertension versus 23.1% in non-hypertensive individuals (p=0.28). In terms of smoking history, a higher percentage of improvement was observed in smokers (20.0%) compared to non-smokers (11.1%), but the association was not statistically significant (p=0.33). Finally, the presence of a family history of IHD was associated with a relatively higher improvement rate (22.2%) compared to those without a family history (7.9%), though this difference did not achieve statistical significance (p=0.099).

DISCUSSION

Our study aimed to assess the improvement in left ventricular ejection fraction (LVEF) following coronary artery bypass grafting (CABG) in patients with preoperative left ventricular dysfunction. The results indicated that 13.85% of patients exhibited an improvement in LVEF, while 86.15% showed no improvement. The findings were further stratified by demographic and clinical variables to analyze potential factors influencing LVEF recovery.

Variable	Category	No. of Patients (%)
Age (years)	30-60	44 (67.69%)
	61-80	21 (32.31%)
Gender	Male	34 (52.31%)
	Female	31 (47.69%)
Diabetes Mellitus	Yes	48 (73.85%)
	No	17 (26.15%)
Hypertension	Yes	52 (80.00%)
	No	13 (20.00%)
Smoking	Yes	20 (30.77%)
	No	45 (69.23%)
Family History of IHD	Yes	26 (40.00%)
	No	39 (60.00%)
Improvement	Yes	9 (13.85%)
	No	56 (86.15%)

Table-I. Demographic and clinical characteristics of the study participants (n=65)

Variables		Improvement		P-Value
		Yes	No	
Age (years)	30-50	8 (18.2%)	36 (81.8%)	0.14
	51-80	1 (4.8%)	20 (95.2%)	
Gender	Male	7 (20.6%)	27 (79.4%)	0.09
	Female	2 (6.5%)	29 (93.5%)	
Diabetes Mellitus	Yes	6 (12.5%)	42 (87.5%)	0.59
	No	3 (17.6%)	14 (82.4%)	
Hyper-tension	Yes	6 (11.5%)	46 (88.5%)	0.28
	No	3 (23.1%)	10 (76.9%)	
Smoking	Yes	4 (20.0%)	16 (80.0%)	0.33
	No	5 (11.1%)	40 (88.9%)	
Family history of IHD	Yes	6 (22.2%)	21 (77.8%)	0.099
	No	3 (7.9%)	35 (92.1%)	

Table-II. Improvement of LVEF with regards to age, gender, DM, hypertension, smoking, family history of IHD (n = 65)

Our study findings demonstrate a lower improvement rate compared to previous studies. Rafaie et al[6] reported a 20% increase in LVEF within three months post-CABG, from 30 ± 1.1% to 36 ± 1.6%, suggesting a more substantial improvement in their cohort. Similarly, Öztürketal[7] observed a 10% improvement at six months (p=0.011) and a 30% improvement at 12 months (p=0.002), highlighting a progressive increase over time. Higashino[8] noted 28% to 39% improvement in their patients after CABG. While Qureshi[9] found 35% improvement in LVEF after 3-4 months of CABG. The discrepancy between our findings and these studies could be attributed to differences in patient selection, preoperative LVEF values, and postoperative follow-up duration.

Koene et al.[10] reported that 24% of their study population experienced an improvement of >5% in LVEF, whereas 55% had no significant change, and 21% exhibited worsening of LVEF. Perry[11] observed 19% improvement in LVEF and Ueki also Our results align more closely with this study, as 86.15% of our patients had no significant LVEF improvement, indicating that a considerable proportion of patients undergoing CABG may not experience early postoperative recovery of ventricular function.

For patients with severe left ventricular dysfunction (EF<35%), Haxhibeqiri-Karabdićetal[12] documented preoperative EF values ranging between 18–27%, which improved to 31.08% within 30 days. This suggests that CABG in patients with severe dysfunction remains a feasible option, potentially leading to improved myocardial function. Our study also found that patients with a family history of ischemic heart disease (IHD) had a higher improvement rate (22.2%), although statistical significance was not achieved (p=0.099). This aligns with previous findings suggesting that myocardial viability may influence recovery.[13]

Hashmi discloses noteworthy improvement in LVEF i.e., mean increase from 32% to 37%.[14] Findings from King Abdullah Medical City (KAMC) further support that CABG may lead to early improvements in ventricular function.[15] Their study reported a significant increase in mean LVEF from 29.76 ± 4.868% to 33.53 ± 9.655% within the first postoperative week. The majority of their patients demonstrated an increase in LVEF>5%, which contrasts with our findings, where only 13.85% showed improvement. Differences in sample size, surgical techniques, and patient selection criteria may contribute to these variations. Additionally, KAMC reported an early in-hospital mortality rate of 5.2–5.8%, while our study did not assess mortality outcomes.

The stratification of our data revealed several noteworthy trends. Age-wise analysis indicated that 18.2% of younger patients (30–50 years) exhibited improvement, compared to 4.8% in older patients (51–80 years), though the difference was not statistically significant (p=0.14). This suggests that younger patients may have better myocardial recovery potential, a trend supported by prior studies.[16]

Gender-based stratification demonstrated that male patients had a higher improvement rate (20.6%) compared to females (6.5%) (p=0.09). This aligns with previous research suggesting that male patients may experience better postoperative cardiac recovery, potentially due to differences in myocardial adaptation and hormonal influences. Diabetes and hypertension were associated with lower LVEF improvement rates. Among diabetic patients, 12.5% showed improvement, compared to 17.6% of non-diabetics (p=0.59). Similarly, hypertensive patients demonstrated an improvement rate of 11.5%, compared to 23.1% in non-hypertensive patients (p=0.28). These findings are in agreement with prior studies that highlight the adverse impact of metabolic and vascular risk factors on myocardial recovery following revascularization. Smoking history was also evaluated, revealing that 20.0% of smokers showed LVEF improvement, compared to 11.1% of non-smokers (p=0.33). Although not statistically significant, this trend suggests that smoking status alone may not be a decisive factor in predicting postoperative functional recovery. Finally, the presence of a family history of ischemic heart disease (IHD) was associated

with a relatively higher improvement rate (22.2%) compared to 7.9% in those without a family history (p=0.099). This observation is consistent with previous studies, which suggest that myocardial viability may influence post-CABG functional outcomes.[17,18]

One of the major strengths of our study is its well-defined population, specifically focusing on patients with poor preoperative left ventricular function undergoing CABG. By targeting this specific cohort, our findings provide valuable insights into the potential for myocardial recovery in a high-risk group. Additionally, the study incorporates a stratified analysis of LVEF improvement across various demographic and clinical variables, offering a comprehensive understanding of how different patient factors influence postoperative outcomes. This level of detail enhances the clinical relevance of our findings, particularly in settings where similar patient populations undergo surgical revascularization. Moreover, the study contributes to the existing literature by providing real-world data from a local population, which may help guide treatment expectations and postoperative monitoring strategies.

However, the study has several limitations that must be acknowledged. Firstly, the sample size was relatively small (65 patients), which may have limited the statistical power to detect significant differences in subgroup analyses. A larger sample could provide more definitive conclusions regarding predictors of LVEF improvement. Secondly, the follow-up duration was short, assessing LVEF only in the early postoperative period. Previous studies have demonstrated that myocardial recovery can continue over several months to a year postoperatively, and our study does not capture these potential long-term changes.

Another limitation is the lack of a control group, which prevents a direct comparison of LVEF changes with alternative treatment strategies, such as medical management or percutaneous coronary intervention (PCI). Without a non-surgical comparator, it is difficult to determine whether the observed improvements (or lack thereof) were solely attributable to CABG or influenced by other factors. Furthermore, the study did not control for preoperative medical therapy, myocardial viability, or intraoperative surgical techniques, all of which can significantly impact postoperative LVEF outcomes. These confounders may have contributed to variability in improvement rates.

Lastly, as a single-center study, our findings may not be fully generalizable to broader populations. Differences in surgical expertise, patient management protocols, and healthcare infrastructure can all affect CABG outcomes, making it important to interpret our results in the context of local clinical practice. Future research with multicenter studies, larger sample sizes, and extended follow-up periods is necessary to better understand the long-term impact of CABG on left ventricular function and identify key predictors of myocardial recovery.

CONCLUSION

Our study indicates that a relatively small proportion (13.85%) of patients exhibited LVEF improvement following CABG, with no statistically significant associations across demographic and clinical subgroups. Compared to previous studies, our findings suggest that LVEF recovery may vary based on patient characteristics, surgical factors, and follow-up duration. While several studies report substantial improvements in LVEF, our results are more aligned with studies indicating that a considerable proportion of patients experience minimal early postoperative recovery. Further research with larger sample sizes and extended follow-up periods is warranted to assess long-term cardiac functional outcomes post-CABG.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

1. Roth GA, Johnson C, Abajobir A, Abd-Allah F, Abera SF, Abyu G, et al. **Global, regional, and national burden of cardiovascular diseases for 10 causes, 1990 to 2015.** J Am Coll Cardiol. 2017; 70(1):1-25.

2. Ashraf T, AamirKF, Achakzai AS, Mengal N, Karim MT. **Burden of atherosclerosis risk among different ethinicity: A hidden health challenge.** J Ayub Med Coll Abbottabad. 2016; 28(4):788-92.

3. Löffler AI, Kramer CM. **Myocardial viability testing to guide coronary revascularization.** Interv Cardiol Clin. 2018; 7(3):355-65.

4. Hwang HY, YeomSY, Choi JW, Oh SJ, Park EA, Lee W, et al. **Cardiac magnetic resonance predictor of ventricular function after surgical coronary revascularization.** J Korean Med Sci. 2017; 32(12):2009-15.

5. Joergensen T, Hansson SH. **Evaluation of the left ventricular ejection fraction with gated IQ-SPECT myocardial perfusion imaging.** J Nucl Med Technol. 2015; 43(3):193-200.

6. Refaie M, Shehri M Al. **Early revascularization benefits in low cardiac function patients.** 2018; 47(3):467-73.

7. Öztürk C, Yavuz Ş. **Effect of coronary artery bypass surgery on ventricular functions in patients with poor left ventricular function.** Eur Res J. 2019; 5(3):502-9.

8. Higashino A, Tsuruta Y, Moriyama S, Miura S, Taketani T, Ohno T. **Does cardiac function improvement with coronary artery bypass grafting reduce all-cause mortality?** Ann Thorac Surg Short Rep. 2024; 2(4):737-41.

9. Qureshi MAI, Roomi FS, Abbas SQ. **Early outcome of left ventricular function after coronary artery bypass surgery: A single-center experience.** Biol Clin Sci Res J. 2024; 2024:772.

10. Koene RJ, Kealhofer JV, Adabag S, Vakil K, Florea VG. **Effect of coronary artery bypass graft surgery on left ventricular systolic function.** J Thorac Dis. 2017; 9(2):262-70.

11. Perry AS, Mann DL, Brown DL. **Improvement of ejection fraction and mortality in ischemic heart failure.** Heart. 2020; heartjnl-2020-316975.

12. Haxhibeqiri-Karabdic I, Hasanovic A, Kabil E, Straus S. **Improvement of ejection fraction after coronary artery bypass grafting surgery in patients with impaired left ventricular function.** Med Arch. 2014; 68(5):332-4.

13. Zhang K, Fu W, Dai Q, Liu T, Zheng H, Biekan J, et al. **Prediction of left ventricular ejection fraction improvement in patients with ischemic cardiomyopathy after coronary artery bypass grafting based on cardiac magnetic resonance.** Cardiovasc Diagn Ther. 2023; 13(6):1003-18.

14. Hashmi KA, Bashir M, Khattak MSK, Javaid MAA, Qureshi AE, Kabir HA. **Assessment of left ventricular function after coronary artery bypass grafting.** Biol Clin Sci Res J. 2024; 2024:809.

15. Khaled S, Kasem E, Fadel A, Alzahrani Y, Banjar K, Al-Zahrani W, et al. **Left ventricular function outcome after coronary artery bypass grafting, King Abdullah Medical City (KAMC)- single-center experience.** Egypt Heart J. 2019; 71(1):2.

16. Sharma P, Shahbaz A, Iqbal J, Moazam H. **Impact of coronary artery bypass grafting on left ventricular function in patients with low ejection fraction.** Ann Pak Inst Med Sci. 2020; 16(3):128-32.

17. Bianco V, Kilic A, Gleason TG, Aranda-Micheal E, Habertheur A, Wang Y, et al. **Reoperative cardiac surgery is a risk factor for long-term mortality.** Ann Thorac Surg. 2020; 110(4):1235-42.

18. Tariq M, Malik MW, Kifayat Ullah, Khan AH, Jamal K, Nasir A, et al. **Coronary artery bypass grafting in patients with left ventricular dysfunction presented at Peshawar Institute of Cardiology.** Professional Med J. 2023; 30(7):865-70. DOI: https://doi.org/10.29309/TPMJ/2023.30.07.7412

AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Muhammad Mujahid:** Data collection.
2	**Riaz ul Haq:** Data collection.
3	**Muhammad Farooq Ahmad:** Data collection, proof reading.
4	**Muhammad Hussnain Raza:** Data collection, writing manuscript.
5	**Muneeza Dilpazeer:** Data analysis.
6	**Muhammad Azam:** Proof reading.