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ORIGINAL ARTICLE

THE EFFECT OF LOW EJECTION FRACTION ON MORTALITY IN CORONARY ARTERY BYPASS GRAFTING (CABG) PATIENTS

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ABSTRACT

Background: Despite advancements in medication therapy and surgical procedures, it is still challenging to treat individuals with coronary artery disease having a poor ejection fraction (EF). The aim of this study was to compare patients having less than 40% ejection fraction with those patients having more than 40% ejection fraction undergoing coronary artery bypass graft surgery in terms of in hospital morbidity and mortality.

Material and Methods: This was a descriptive study done from 1st January to 30th March 2022. This study included all the patients' record from year 2017 till 2021, which got coronary artery bypass graft (CABG) surgery. All those having concomitant valve or congenital anomalies along with CABG were excluded from study. Qualitative variables were analyzed as frequency and percentages, while quantitative variables as mean and standard deviations. We utilized the SPSS software version 23 for data entry and analysis. For statistical analysis, the Chi-squared test was employed. P-values lower than 0.05 were deemed significant.

Results: Total 1902 patients were equally divided into 2 groups depending on their EF. Group A had low EF (<40%) patients while Group B had >40% EF. The age, gender, weight, height, renal and lipid profile, number of diseased coronary vessels and co existing vascular conditions were matching in both groups. The in hospital mortality for group A was 6.2% as compared to group B i.e. 3.3% with 0.005 p value. The use of Intra-Aortic Balloon Pump (IABP) was strongly associated with patients of group A in our study with 22.2% vs 2.6% in group B and a p value of 0.00001.

Conclusion: Patients with <40% ejection fraction is strongly associated with increased in hospital mortality and morbidity undergoing isolated CABG. The perioperative use of IABP is more in low ejection fraction patients undergoing CABG surgery.

KEY WORDS: Ejection fraction; Coronary artery bypass graft; Mortality; Cardiac surgery; Intra-aortic balloon pump.

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INTRODUCTION

Globally, ischemic heart disease is on the rise and is a leading cause of mortality and disability.[1] With an annual volume of almost 200,000 isolated instances in the US and an average incidence rate of 62 per 100,000 people in western European nations, coronary artery bypass grafting (CABG) continues to be the most frequently done heart surgery technique globally.[2] The care of patients with coronary artery disease and a poor ejection fraction (EF) is still difficult despite advancements in medication therapy and surgical procedures.[3] According to several studies, patients with drastically diminished cardiac function should be viewed as high-risk surgical candidates as opposed to those with normal ejection fraction.[4] Due to repeated ischemia, patients with low EF are more likely to experience abrupt death, ventricular arrhythmia, and progressive heart failure[5]

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and are more susceptible to postoperative complications and mortality.[6]

In terms of clinical improvement and long term survival, coronary artery bypass grafting (CABG) has shown to be more effective than only medical treatment with reduced EF.[7] Improvements in surgical methods have produced better results, making CABG a relatively safe operation in some high-risk patients.[8] Therefore in order to quickly institute necessary support, the early identification of patients who could suffer worse outcomes is essential in the decision-making process.[9] The aim of our study was to compare patients having less than 40% ejection fraction with those patients having more than 40% ejection fraction undergoing coronary artery bypass graft surgery in terms of in hospital morbidity and mortality.

MATERIALS AND METHODS

This cross sectional study was conducted after approval by The Ethical Review Committee of our hospital. A database on cardiac surgery is kept at the facility where this study was carried out. Through this procedure, we were able to retrospectively gather all patients' record having heart surgery's pre-operative, intraoperative, and post-operative data.

All patients who underwent isolated CABG at our facility between 1st July 2017 to 31st December 2021 had their data retrieved from this database. We compared patients having EF below 40 % with patients whose EF was above 40%. All the patients who underwent a simultaneous surgical intervention, such as a valve replacement or repair, or ASD/VSD closure, were not included in the study. A total of 1902 patients fulfilled our inclusion criteria.

We categorized these patients into two groups based on their ejection fraction. The total sample size (1902) was divided into 2 groups equally. Group A had low EF (<40%) patients and, Group B had EF > 40%.

The pre-operative, intra-operative, and post-operative variables were created from the data we acquired for these groups. Age, gender, NYHA and CCS classes, COPD, dyslipidemia, diabetes mellitus, myocardial infarction, LMS illness, and stroke were all included in the data.

The term "in-hospital mortality" refers to fatalities that occur during the hospital stay following surgery within the index hospital admission.

Regular on-pump CABG with standard anesthetic approach was performed on the patients. The Left Internal Mammary Artery served as our sole arterial conduit, while our venous conduit was created via a Reverse Great Saphenous Vein Graft. We utilized the SPSS version 23 software for data entry and analysis. For statistical analysis, the Chi-squared test was employed. P-values lower than 0.05 were deemed significant.

RESULTS

A total of 1902 patients were included in our study, 951 patients belonged to group A with impaired EF (less than 40%) and 951 patients in group B with mildly impaired to normal ejection fraction (EF more than 40%). The average age of group A was 58.11 ±9.098 years and for group B 57.78± 9.310 years.

Table-I shows the demographic variables of the individuals undergoing isolated CABG with comparison done between the two groups, and are almost same.

Table 2 compares the different perioperative parameters of both the groups. The results showed that the Cross clamp time in group A was 54.72 minutes while it was 54.98 minutes in group B. The perfusion time on cardiopulmonary bypass during CABG surgery being 101.15 minutes in group A while it was 97.78 minutes in group B with insignificant p values. The re intubation rate was 2.9 % and 1.2% in group A and B respectively with p value of 0.01. The rate of reopening for bleeding/ tamponade was 5 % in group A and 7.9% in group B. The incidence of post-operative stroke being 1.7% in group A and 0.8% in group B. The use of IABP was 22.2% in group A and 3.9% in group B with p value of 0.00. Prolonged ventilation rate in group A was 4.8% and 1.5% in group B. The rate of atrial fibrillation was 1.9% in group A and 1.8% in group B. Multi organ failure was found 0.8% in group A patients and 0.1% in group B patients. The in hospital mortality for low EF in our study was 6.2% as compared to moderately impaired to normal EF group i.e. 3.3% with p value of 0.005.

The study results showed that low ejection fraction is a significant risk factor for many perioperative complications such as the requirement for an intra-aortic balloon pump, prolong ventilation, atrial fibrillation and was a leading cause of in hospital mortality as well.

DISCUSSION

Although medicinal treatments and surgical procedures have improved,[10] managing individuals with coronary artery disease and reduced ejection fraction (EF) is still difficult.[11] The gold standard in intervention is considered coronary artery bypass grafting (CABG) with well-established and reliable results.[12] The degree of left ventricular EF deterioration in CABG patients is a well-known significant risk factor for poor short- and long-term prognosis.[13] Mortality rates were 15% in the 1970s and 10% in the 1980s, respectively. For CHD patients undergoing CABG with an EF between 10% and 30%, the fatality rate is currently less than 5%.

A study that was conducted by Awan et all to compare patient death rates while hospitalized who underwent CABG surgery discovered that individuals with an EF of 35 percent had a six fold higher mortality rate than individuals whose EF was 50 percent.[14]

Table 1: Showing demographic variables of the two groups.

S.No.	VARIABLE	GROUP A (n=951) Low EF <40% Mean ± Std	GROUP B (n=951) Mildly Impaired To Normal EF (EF > 40 %)
1	Age in years	58.11±9.098	57.78± 9.310
2	Weight in kgs	73.364 ± 13.5435	75.56 ± 21.81
3	Height in cms	164.18±11.428	165.10 ± 39.35
	Derranged Renal Profile		
	Pre op raised creatinine	1.12 ±.34	1.09 ± 2.66
	Dyslipidemia		
1	With statins use	1.00±.000	1.00±.000
2	Without statins use	1.00±.000	1.00±.000
3	Chronic lung disease	0.01± .107	0.012 ± 0.11
4	Hypertension	0.63±0.483	0.67 ± 0.47
5	Diabetes	0.53± 0.500	0.44 ± 0.497
	Preop medications		
1	Beta blockers	0.52±0.500	0.54 ± 0.499
2	Ace inhibitors	0.16±0.364	0.02 ± 0.151
3	Nitrates	0.42±0.494	0.46 ± 0.49
4	Aspirin	0.45±0.498	0.65 ± 0.47
5	Warfarin	0.01±0.088	0.00 ± 0.044
6	Statins	1.00±0.000	1.00 ± 0.00
7	Anti platelets	0.26±0.438	0.25 ± 0.43
8	Oral hypoglycemic	1.00±0.00	1.00±0.00
	Number of Diseased Coronary Vessels		
1	One vessel	1.00±0.00	1.00±0.00
2	Two vessels	1.00±0.00	1.00±0.00
3	Three vessels	1.00±0.00	1.00±0.00
4	Left main disease	0.15±0.358	0.115 ± 0.320
	Co-existng valvular conditions		
1	Aortic stenosis	0.01±0.088	0.00± 0.057
2	Mitral stenosis	0.01±0.116	0.00± 0.067

Table 1: Abbreviations (Std : Standard Deviation, Kgs : Kilograms, Cms : Centimeters)

Table 2: Intra operative and post operative parameters

Variables	Group A	Group B	P Value
Cross Clamp Time	54.72 ±19.404	54.98±18.63	0.786
Perfusion time	101.15± 30.775	97.78±28.56	0.23
Re intubated during hospital stay	15(2.9%)	19(1.2%)	0.011
Re opening for bleeding/tamponade	26(5.0%)	123(7.9%)	0.015
Post Operative Stroke	9(1.7%)	12(0.8%)	0.055
IABP	115(22.2%)	61(3.9%)	0.000
Prolong Ventilation	25(4.8%)	24(1.5%)	0.000
Atrial Fibrillation	10(1.9%)	28(1.8%)	0.486
Multi Organ Failure	4(0.8%)	1(0.1%)	0.015
In Hospital Mortality	32(6.2%)	52(3.3%)	0.005

Table 2 : Abbreviations (Std : Standard Deviation, IABP : Intra-Aortic Balloon Pump)

In a study done by Anneke Neuman and his colleagues showed that the in hospital mortality rates for patients with OPCAB and ONCAB were both 6.2 percent and 6.5 percent, respectively.[15] The results of patients who had low EF been proven to be much poorer than those of high-EF patients, despite the fact that CABG offers higher benefits in terms of survival and quality of life compared to medicinal therapy.[16] In review from our own database, individuals with low ejection fraction had drastically greater in-hospital mortality rates than those with normal or reasonable ejection fraction that was 6.2% vs 3.3% with significant p value, which is comparable to studies done in other centers.

A study done in Dhaka medical college measured the length of time spent in the ICU following surgery in hours. The mean and standard deviation of the ICU stays for patients in group 1 and 2 were 30.85 and 7.44 hours and 32.36 and 7.31 hours, respectively. This comparison revealed statistically significant results (p 0.001).[17] The re intubation rate and prolonged ventilation that is more than 24 hours on ventilator in our study was 2.9% and 4.8% in low EF group with p value of 0.01 and 0.00 respectively validating the above study results.

The 2011 Coronary Artery Bypass Graft Surgery Guideline from the American College of Cardiology, which was founded upon the findings of multiple randomized trials (RCTs), suggested implementing the application of IABP in order to lower hospital mortality among individuals who were at high risk with chronic left main CAD, LVEF of less than 30%, and a body mass index (BMI) of less than 30.[18] In our study 22.2% patients who had EF less than 40% required IABP peri-operatively with p value of 0.000. Preoperative IABP use and requirement for inotropes, COPD, and chronic renal disease were found to be independent predictors of death in patients with EF 40%.[19]

Age greater than 65 years, surgery not done electively, procedure intricacy, previous heart surgery, organ damage, CARE grade 3, NYHA class III, and poor right ventricular function were also possible causes for mortality after surgery in a study done in Indonesia.[20]

The results of our study showed that there is no statistically significant difference in perfusion and cross clamp time in both groups. Low ejection fraction is a significant risk factor for perioperative complications like prolonged ventilator support, reopening for bleeding within 24 hours of surgery, use of IABP, re intubation during the same hospital stay, post-operative stroke, atrial fibrillation and multi organ failure. The in hospital mortality is clearly increased i.e. 6.2% in low ejection fraction patients undergoing CABG as compared to mildly impaired and normal EF patients i.e. 3.3%.

CONCLUSION

Low ejection fraction is strongly associated with increased in hospital mortality and morbidity in patients undergoing isolated CABG. The perioperative use of IABP is more in low ejection fraction patients undergoing CABG surgery.

REFERENCES

1. Trends of coronary artery disease in Khyber Pakhtunkhwa, Pakistan: A retrospective study. Khyber Medical University Journal. 2019:11(4); 432-37.
2. Melly L, Torregrossa G, Lee T, Jansens J-L, Puskas JD. Fifty years of coronary artery bypass grafting. Journal of Thoracic Disease. 2018;10(3):1960-7. https://doi.org/10.21037/jtd.2018.02.43
3. Soliman Hamad MA, van Straten AHM, Schönberger JPAM, ter Woorst JF, de Wolf AM, Martens EJ, et al. Preoperative ejection fraction as a predictor of survival after coronary artery bypass grafting: Comparison with a matched general population. Journal of Cardiothoracic Surgery. 2010;5(1). https://doi.org/10.1186/1749-8090-5-29
4. Maltais S, Ladouceur M, Cartier R. The influence of a low ejection fraction on long-term survival in systematic off-pump coronary artery bypass surgery. European Journal of Cardio-Thoracic Surgery. 2011;39(5). https://doi.org/10.1016/j.ejcts.2010.12.022
5. Shende SP, Inamdar AK, Inamdar SA. Outcome of coronary artery bypass graft surgery in patients with low ejection fraction. Medical Journal of Dr DY Patil University. 2017;10(2):162. https://doi.org/10.4103/0975-2870.202107
6. Pieri M, Belletti A, Monaco F, Pisano A, Musu M, Dalessandro V, et al. Outcome of cardiac surgery in patients with low preoperative ejection fraction. BMC Anesthesiology. 2016;16(1). https://doi.org/10.1186/s12871-016-0271-5
7. Topkara VK, Cheema FH, Kesavaramanujam S, Mercando ML, Cheema AF, Namerow PB, et al. Coronary artery bypass grafting in patients with low ejection fraction. Circulation. 2005;112(9_supplement). https://doi.org/10.1161/CIRCULATIONAHA.104.526277
8. MS S. Short term outcome of off pump coronary artery bypass grafting in patients with low ejection fraction. Insights in Chest Diseases. 2017;02(01). https://doi.org/10.21767/2577-0578.10004
9. Heijmans JH, Maessen JG, Roekaerts PMHJ. Risk stratification for adverse outcome in cardiac surgery. European Journal of Anaesthesiology. Cambridge University Press; 2003;20(7):515-27. https://doi.org/10.1097/00003643-200307000-00002
10. Cao J, Dong R, Zhang K, Zhang H. Effects of myocardial viability and left ventricular remodeling on survival of patients with heart failure and reduced ejection fraction after coronary artery bypass grafting. Cardiovascular Diagnosis and Therapy. 2020;10(2):183-92. https://doi.org/10.21037/cdt.2020.01.11

11. Shende SP, Inamdar AK, Inamdar SA. Outcome of coronary artery bypass graft surgery in patients with low ejection fraction. Medical Journal of Dr DY Patil University. 2017;10(2):162. https://doi.org/10.4103/0975-2870.202107
12. Caputti GM, Palma JH, Gaia DF, Buffolo E. Off-pump coronary artery bypass surgery in selected patients is superior to the conventional approach for patients with severely depressed left ventricular function. Clinics. 2011;66(12):2049-53. https://doi.org/10.1590/S1807-59322011001200009
13. Dalén M, Lund LH, Ivert T, Holzmann MJ, Sartipy U. Survival after coronary artery bypass grafting in patients with preoperative heart failure and preserved vs reduced ejection fraction. JAMA Cardiology. 2016;1(5):530. https://doi.org/10.1001/jamacardio.2016.1465
14. Awan NI, Jan A, Rehman MU, Ayaz N. The effect of ejection fraction on mortality in coronary artery bypass grafting (CABG) patients. Pakistan Journal of Medical Sciences. 2020;36(7). https://doi.org/10.12669/pjms.36.7.3266
15. Neumann A, Serna-Higuita L, Detzel H, Popov AF, Krüger T, Vöhringer L, et al. Off-pump coronary artery bypass grafting for patients with severely reduced ventricular function-a justified strategy? Journal of Cardiac Surgery. 2021;37(1):7-17. https://doi.org/10.1111/jocs.15259
16. Gupta M, Mishra PK, Shoeb M, Agarwal A, Prasad J. A comparison of clinical outcomes of LVEF ≤35% versus LVEF>35% in off-pump coronary artery bypass graft surgery. International Surgery Journal. 2017;4(6):1908. https://doi.org/10.18203/2349-2902.isj20172011
17. Salekin MS. Short Term Outcome of Off Pump Coronary Artery Bypass Grafting in Patients with Low Ejection Fraction. Insights Chest Dis. 2017: 2:1;1-5. Available at: https://insightsinchestdiseases.imedpub.com/short-term-outcome-of-off-pump-coronaryartery-bypass-grafting-in-patients-with-low-ejection-fraction.pdf
18. He X-Y, Gao C-Q. Peri-operative application of intra-aortic Balloon Pumping reduced in-hospital mortality of patients with coronary artery disease and left ventricular dysfunction. Chinese Medical Journal. 2019;132(8):935-42. https://doi.org/10.1097/CM9.0000000000000178
19. Pieri M, Belletti A, Monaco F, Pisano A, Musu M, Dalessandro V, et al. Outcome of cardiac surgery in patients with low preoperative ejection fraction. BMC Anesthesiology. 2016;16(1):712-15. https://doi.org/10.1186/s12871-016-0271-5
20. 20 -Kurniawaty J, Setianto BY, Supomo -, Widyastuti Y, Boom CE. The effect of low preoperative ejection fraction on mortality after cardiac surgery in Indonesia. Vascular Health and Risk Management. 2022; 18:131-7. https://doi.org/10.2147/VHRM.S350671

CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	HA, MSK, RS
Acquisition, Analysis or Interpretation of Data:	HA, MSK, RS, AJ, BK, MUI,
Manuscript Writing & Approval:	HA, MSK, RS, AM, ZA, WHK, NAS

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.