Original Article

Immediate Clinical Outcomes in Patients with Multi-Vessel Coronary Artery Disease and Left Ventricular Dysfunction following Off-Pump CABG

Multi-Vessel Coronary Artery Disease and Left Ventricular Dysfunction

Muhammad Yasir Khan, Shafqat Hussain, Muhammad Moeen, Iftikhar Paras, Muhammad Hamid Ch and Muhammad Kamran Khan

ABSTRACT

Objective: To determine the immediate clinical outcomes in patients with Multi-vessel coronary artery disease and left ventricular dysfunction following off-pump coronary artery bypass graft surgery.

Study Design: A Prospective observational study

Place and Duration of Study: This study was conducted at the department of Cardiac Surgery in Ch.Pervaiz Elahi Institute of Cardiology Multan from May 2019 to May 2021 for a period of two years.

Materials and Methods: Eighty-nine patients who were treated with OPCAB were included as study participants. The patients who intraoperatively underwent on-pump CABG were excluded from the study. Procedures were performed by "consultant cardiothoracic surgeons". The demographic variables of the patients were collected. Preoperative care was provided to the patient till the day of surgery. Proper technique of OPCABG was followed. The immediate clinical outcomes that included all the in-hospital outcomes till 30 days follow-up were recorded.

Results: The prospective observational study included 89 participants. Among these 89 patients, 54% (48) were male and 46% (41) were female. The mean age and standard deviation were 58±8.2 & 60±8.5 of the male and female groups respectively. History of the patients revealed that 60% (53) were hypertensive, 61% (68) had a previous history of myocardial infarction, 16% (14) had peripheral vascular disease, 63% (56) were known cases of diabetes. Moreover, 45% (41) has a deranged lipid profile, 16% (14) had chronic kidney disease while 5% (4) had severe LV dysfunction. The mean hospital stay in days was reported as 4 ± 2 days while the mean time spent on a ventilator was recorded as 9.2 ± 7.8 hrs. It was seen that factors like post-operative atrial fibrillation, severe left ventricular dysfunction, and end-stage renal failure contributed to mortality. Among Postoperative outcomes stroke & sternal infections were witnessed in 2.24% (2), atrial fibrillation in 13.4% (12), and re-exploration was done in 2.24% (2) of cases. Septicemia occurred in 8.9% (8), 16.8% (15) patients were readmitted following CABG. Total 5 deaths were reported.

Conclusion: In conclusion, off-pump CABG for patients with Multi-vessel coronary artery disease and left ventricular dysfunction had better in-hospital/immediate clinical outcomes with long-term survival rates.

Key Words: Left Ventricular dysfunction, Multi-vessel coronary artery disease, Off-pump CABG, Post-operative atrial fibrillation

Citation of article: Khan MY, Hussain S, Moeen M, Paras I, Ch MH, Khan MK. Immediate Clinical Outcomes in Patients with Multi-Vessel Coronary Artery Disease and Left Ventricular Dysfunction following Off-Pump CABG. Med Forum 2021;32(11):137-140.

INTRODUCTION

Multivessel coronary artery disease (MVD) is more often associated with cardiovascular risks. Consequently, it also leads to a higher prevalence of left ventricular dysfunction as compared to single-vessel coronary artery disease [(1)]. Coronary artery bypass grafting (CABG) is a standard treatment regimen used to revascularize coronary artery in patients with Multi vessel coronary artery disease. In comparison to percutaneous coronary intervention (PCI), CABG has been proved to be more efficacious in treating left main disease, left ventricular dysfunction & multivessel disease [(2)].

Cardiopulmonary bypass & cardioplegic arrest are the usual ways by which patients underwent CABG. It has been estimated that with the use of cumulative approach 10% reduction has occurred in major adverse outcomes following CABG. It can be performed using a bypass machine or on a beating heart that is off-pump coronary

Department of Cardiology, Chaudhry Pervaiz Ellahi Institute of Cardiology (CPEIC), Multan.

Correspondence: Dr. Muhammad Yasir Khan, Assistant professor of Cardiology, Chaudhry Pervaiz Ellahi Institute of Cardiology (CPEIC), Multan.
Contact No: 0333 6187409
Email: dryasir_khan@yahoo.com

Received: July, 2021
Accepted: August, 2021
Printed: November, 2021

artery bypass grafting (OPCAB) [3]. In the 1990s, with the use of cardiac stabilizers, a shift took place in the technical application of the procedure (without CPB). The studies based on comparative analysis revealed that OPCAB resulted in less postoperative morbidity & mortality than on-pump CABG [4]. If we take a look at associated complications "OPCAB patients had less transfusion requirement, less inotropic support, shorter ventilation time, lower stroke rate, lower incidence of acute kidney injury, and shorter intensive care unit stay" [5].

The reports based on the correlation of age with substantial advantages of OPCAB demonstrate a positive correlation. It means it is quite possible that generally, OPCAB results in excellent treatment outcomes however it has shown enhanced efficacy in high-risk & elderly individuals. Despite this, a significant decrease in CABG practice can be seen worldwide [6]. The most stated reasons include the technical difficulties along with the high probability of "incomplete vascularization, lower graft patency & reduced long term survival following OPCABG". In addition, comparatively fewer benefits of OPCABG have been acknowledged in patients with depressed left ventricular function [7].

Although these studies are mostly based on the study population from the west. There can be considerable differences following OPCABG in the Asian population [8]. Hereby we designed a study to analyze the clinical outcomes in patients with Multivessel coronary artery disease and left ventricular dysfunction following Off-Pump CABG.

MATERIALS AND METHODS

We designed a prospective observational study to analyze immediate clinical outcomes in patients following OPCABG. The study was carried out from 1st May 2019 to 1st May 2021 at department of Cardiac Surgery in Ch. Pervaiz Elahi institute of cardiology Multan. Eighty-nine patients who were treated with OPCAB were included as study participants. The patients who intraoperatively underwent on-pump CABG were excluded from the study. Procedures were performed by "consultant cardiothoracic surgeons".

Written approval was taken by the ethical review committee of the Hospital. The participants were informed of the details and purpose of the study and informed consent was taken into consideration. The demographic variables of the patients were collected. The variables included age, gender, and detailed history including complications. Preoperative care was provided to the patient till the day of surgery. Proper technique of OPCABG was followed. The immediate clinical outcomes that included all the in-hospital outcomes till 30 days follow-up were recorded.

The variables like age gender history and associated health conditions were expressed through mean and standard deviation. The early clinical outcomes were expressed with the help of n numbers and percentages. The Chi-square test was applied and p-value of <0.001 was considered significant. SPSS version 20.0 was used to do the Statistical analysis.

RESULTS

The prospective observational study included 89 participants. Among these 89 patients, 54% (48) were male and 46% (41) were female. The mean age and standard deviation were 58±8.2 & 60±8.5 of the male and female groups respectively. History of the patients revealed that 60% (53) were hypertensive, 61% (68) had a previous history of myocardial infarction, 16% (14) had peripheral vascular disease, 63% (56) were known cases of diabetes. Moreover, 45% (41) has a deranged lipid profile, 16% (14) had chronic kidney disease while 5% (4) had severe LV dysfunction. (Table I)

Table No.1: Demographic variables of the patients undergoing OPCABG

Variables	%/Mean/Standard deviation
Male	54% (48)
Female	46% (41)
Age	
Male	58 ± 8.2
Female	60 ± 8.5
Other complications (History)	
Hypertension	60% (53)
Myocardial infarction	61% (68)
Peripheral vascular disease	16% (14)
Diabetes mellitus	63% (56)
Dyslipidemia	46% (41)
Kidney disease (GFR < 60)	16% (14)
Severe LV dysfunction	5% (4)

Table No.2: Immediate clinical outcomes in patients who underwent OPCABG

Clinical outcomes	% (n)	P value
Hospital stay (in ICU)	4 ± 2 (days)	<0.001
Time spent on ventilator	9.2 ± 7.8 (hrs)	<0.001
Post-operative		
Stroke	2.24% (2)	<0.001
Dialysis	3.37% (3)	<0.001
Sternal infections	2.24% (2)	>0.001
Atrial fibrillation	13.4% (12)	>0.001
Re-exploration	2.24% (2)	>0.001
Septicemia	8.9% (8)	>0.001
Readmissions	16.8% (15)	>0.001
Deaths	5	>0.001

The mean hospital stay in days was reported as 4 ± 2 days while the mean time spent on a ventilator was

recorded as 9.2 ± 7.8 hrs. Immediate clinical outcomes are listed in (Table II). It was seen that factors like post-operative atrial fibrillation, severe left ventricular dysfunction, and end-stage renal failure contributed to mortality. Among Post-operative outcomes stroke & sternal infections were witnessed in 2.24% (2), atrial fibrillation in 13.4% (12), and re-exploration was done in 2.24% (2) of cases. Septicemia occurred in 8.9% (8), 16.8% (15) patients were readmitted following CABG. Total 5 deaths were reported.

DISCUSSION

The current study revealed that "severe LV dysfunction, post-operative atrial fibrillation & dialysis-dependent renal failure were the factors associated with mortality". Many previous studies also show the factors like emergency surgery, chronic kidney disease, post-operative atrial fibrillation, and severe left ventricular factors increase the chances of deaths in cardiac failure [(9)]. In the present study atrial fibrillation turns out to be a lethal factor. It was considered in the past that post-operative atrial fibrillation is a kind of benign arrhythmia and mostly a self-limiting condition [(10)]. However, the recent reports are in accordance with the results of our study as these studies regard post-operative atrial fibrillation as a cause of morbidity & mortality either in short or long term duration [(11)].

The pathophysiology behind this clinical outcome is the hemodynamic instability among patients with diastolic and systolic dysfunction leading towards low cardiac output ultimately enhancing the risk of mortality [(12)].

It is really important to assess the risk factors that contribute to mortality. The quality of the CABG performance, the role of the hospital, and the expertise of the surgeon can be evaluated by measuring the steps taken to minimize the risk associated [(13)]. The results obtained from the study reveal that there are considerable differences between the data published in western countries. For instance, the incidence of diabetes mellitus reported in studies from developed countries is lower than 63% (56) as reported in our study. Contrary to this comparatively higher incidence of post-operative atrial fibrillation has been reported in the west than the one seen in our study group [(14)].

Factors like age, race, and BMI are more likely to contribute to the occurrence of this phenomenon. More accurate detection of these incidence can be done by doing continuous monitoring through ECG instead of only monitoring the patients during their ICU stay [(15)]. Although factors like reexploration due to excessive bleeding, post-operative need for dialysis, septicemia have shown lower incidence but are still valuable to consider. Another significant outcome of cardiac surgery is stroke. It is directly related to morbidity, has a bad impact on lifestyle, and also increases the hospital stay and overall expenses [(16)]. Hereby we reported a 2.24% (2) stroke rate which is similar to the one reported in several studies. Age often correlates to stroke incidence.

Some studies have demonstrated that OPCABG can reduce the risk of stroke. Worst outcomes are also linked to the intra-operative conversion of surgery to on-pump CABG. Improvement is needed to reduce ventilator hours, readmitted cases, and to enhance the quality of life [(17)]. Several studies measure clinical outcomes of CABG only in the context of factors like morbidity & mortality however it should be considered a "multidimensional phenomenon" with long-term effects on survival, lifestyle, physical activity, and cognitive abilities [(18)].

CONCLUSION

In conclusion, off-pump CABG for patients with Multi-vessel coronary artery disease and left ventricular dysfunction had better in hospital/immediate clinical outcomes with long-term survival rates.

Author's Contribution:

Concept & Design of Study:	Muhammad Yasir Khan
Drafting:	Shafqat Hussain, Muhammad Moeen
Data Analysis:	Iftikhar Paras, Muhammad Hamid Ch, Muhammad Kamran Khan
Revisiting Critically:	Muhammad Yasir Khan, Shafqat Hussain
Final Approval of version:	Muhammad Yasir Khan

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Zubarevich A, Kadyraliev B, Arutyunyan V, Chragyan V, Askadinov M, Sozkov A, et al. On-pump versus off-pump coronary artery bypass surgery for multi-vessel coronary revascularization. J Thoracic Disease 2020;12(10):5639.
2. Chikwe J, Sun E, Hannan EL, Itagaki S, Lee T, Adams DH, et al. Outcomes of second arterial conduits in patients undergoing multivessel coronary artery bypass graft surgery. J Am Coll Cardiol 2019;74(18):2238-48.
3. Kerwin M, Saado J, Pan J, Ailawadi G, Mazimba S, Salerno M, et al. New-onset atrial fibrillation and outcomes following isolated coronary artery bypass surgery: A systematic review and meta-analysis. Clin Cardiol 2020;43(9):928-34.
4. Lan NS, Ali U, Fegan PG, Larbalestier R, Hitchen SA, Hort A, et al. Short-term outcomes following coronary artery bypass graft surgery in insulin treated and non-insulin treated diabetes: A tertiary hospital experience in Australia. Diabetes &

Metabolic Syndrome: Clinical Research & Reviews 2020;14(4):455-8.
5. Mohamed W, Mohamed MO, Hirji S, Ouzounian M, Sun LY, Coutinho T, et al. Trends in sex-based differences in outcomes following coronary artery bypass grafting in the United States between 2004 and 2015. Int J Cardiol 2020;320:42-8.
6. Mauldon H, Dieberg G, Smart N, King N. Effect of Age on Clinical Outcomes Following On-/Off-Pump Coronary Artery Bypass: Meta-Analysis and Meta-Regression. Brazilian J Cardiovascular Surg 2020;35:797-814.
7. Bianco V, Kilic A, Aranda-Michel E, Serna-Gallegos D, Ferdinand F, Dunn-Lewis C, et al. Complete revascularization during coronary artery bypass grafting is associated with reduced major adverse events. J Thoracic Cardiovascular Surg 2021.
8. Ma WQ, Sun XJ, Wang Y, Han XQ, Zhu Y, Liu NF. Does body mass index truly affect mortality and cardiovascular outcomes in patients after coronary revascularization with percutaneous coronary intervention or coronary artery bypass graft? A systematic review and network meta-analysis. Obesity Reviews 2018;19(9): 1236-47.
9. Thorén E, Wernroth ML, Christersson C, Grinnemo KH, Jidéus L, Ståhle E. Compared with matched controls, patients with postoperative atrial fibrillation (POAF) have increased long-term AF after CABG, and POAF is further associated with increased ischemic stroke, heart failure and mortality even after adjustment for AF. Clin Res Cardiol 2020;109(10):1232-42.
10. Lin MH, Kamel H, Singer DE, Wu YL, Lee M, Ovbiagele B. Perioperative/postoperative atrial fibrillation and risk of subsequent stroke and/or mortality: a meta-analysis. Stroke 2019;50(6): 1364-71.
11. Chau YLA, Yoo JW, Yuen HC, Waleed KB, Chang D, Liu T, et al. The impact of post-operative atrial fibrillation on outcomes in coronary artery bypass graft and combined procedures. J Geriatric Cardiol JGC 2021;18(5):319.
12. Greenberg JW, Lancaster TS, Schuessler RB, Melby SJ. Postoperative atrial fibrillation following cardiac surgery: a persistent complication. Eur J Cardio-Thoracic Surg 2017;52(4):665-72.
13. Yoon SS, Bang JH, Jeong SS, Jeong JH, Woo JS. Risk factors of on-pump conversion during off-pump coronary artery bypass graft. Korean J Thoracic Cardiovascular Surg 2017;50(5):355.
14. Lim J, Lee WY, Ra YJ, Jeong JH, Ko HH. Analysis of risk factors for conversion from off-pump to on-pump coronary artery bypass graft. Korean J Thoracic Cardiovascular Surg 2017;50(1):14.
15. Velioglu Y, Yuksel A. Predictors of postoperative atrial fibrillation after beating-heart coronary artery bypass surgery: is cardiopulmonary bypass a risk factor? Acta Cardiologica Sinica 2019;35(5):468.
16. Shah RM, Zhang Q, Chatterjee S, Cheema F, Loor G, Lemaire SA, et al. Incidence, cost, and risk factors for readmission after coronary artery bypass grafting. Annals Thoracic Surg 2019;107(6): 1782-9.
17. Modolo R, Chichareon P, Kogame N, Dressler O, Crowley A, Ben-Yehuda O, et al. Contemporary outcomes following coronary artery bypass graft surgery for left main disease. J Am Coll Cardiol 2019;73(15):1877-86.
18. Zhang W, Sun Y, Liu Y, Qiu W, Ye X, Zhang G, et al. A nursing protocol targeting risk factors for reducing postoperative delirium in patients following coronary artery bypass grafting: Results of a prospective before-after study. Int J Nursing Sci 2017;4(2):81-7.