

EARLY OUTCOMES OF ON PUMP VERSUS OFF PUMP CABG IN PATIENTS WITH LEFT VENTRICULAR DYSFUNCTION

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ABSTRACT:

BACKGROUND:

There is little data available on the application of an on-pump technique for surgical revascularization in patients with significant left ventricular (LV) dysfunction. It is still debatable whether patients with severe left ventricular failure should have coronary artery bypass grafting (CABG) done on-pump or off-pump to restore blood flow. So, this study aims to assess the early clinical outcomes of patients undergoing surgical revascularization using either an on-pump or an off-pump approach in patients with an LVEF of $\leq 35\%$.

AIMS & OBJECTIVE:

The aim of the study was to assess the early clinical outcomes of patients undergoing surgical revascularization using either an on-pump or an off-pump approach in patients with an LVEF of $\leq 35\%$.

MATERIAL & METHODS:

This was a cross sectional study in which 180 patients undergoing CABG were enrolled. Nonprobability purposive sampling technique used to select the patients.

RESULTS:

The average age of the individuals in Group A was 54.86 ± 8.49 , whereas in Group B it was 53.94 ± 9.68 . In Group A, 67.8% of the individuals were male while in Group B, 64.4% were male. The comparison of mortality, pulmonary complications, neurological complications and renal complications was found insignificant with respective p-values being as 0.560, 0.351, 0.312 and 0.155.

CONCLUSION:

In this study both groups experienced comparable rates of mortality, neurologic, pulmonary, and renal complications so, it is challenging to determine whether off-pump or on-pump CABG can serve as a standard treatment for patients with significant left ventricular failure.

KEY WORDS:

CABG, Mechanical ventilation, ICU

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INTRODUCTION

Improvements in surgical tools, myocardial protection, and overall technology have led to better short- and long-term results after surgical revascularization. Therefore, surgical revascularization is anticipated to be used more frequently to treat high-risk patients with coronary artery disease¹.

The use of off-pump coronary artery bypass grafting (OPCAB) has caught the attention of cardiac surgeons and patients undergoing surgical revascularization more and more. This technique eliminates CPB, cardioplegic arrest, and aortic cross-clamp (ACC)^{2,3}. While the majority of individuals who support off-pump surgery perceive it as a good way to revascularize the heart, patients with severe LV dysfunction who have OPCAB surgery run a risk of hemodynamic worsening during the procedure and incomplete revascularization, which can lead to more complications and even death after the operation⁴. Even with the concurrent use of an intra-aortic balloon pump (IABP), mortality and morbidity during OPCAB may be significant in patients with severe LV dysfunction^{5,6}.

On-pump CABG (ONCAB), a procedure that uses CPB without requiring an ACC or cardioplegic arrest, has recently proven beneficial for high-risk patients⁷⁻⁸. CPB ensures hemodynamic stability during surgery and provides enough circulatory support in comparison to IABP assistance. With the use of CPB, the target coronary artery can be exposed to its fullest potential through ideal cardiac decompression, paving the way for successful revascularization. Postoperative complications from CPB can occur with ONCAB, even though it avoids

the drawbacks of cardioplegic arrest and ACC⁹. There is also a lack of data on the efficacy of surgical revascularization using an ONCAB approach in high-risk patients who have significant LV failure.

MATERIAL AND METHODS:

This study was carried out at the cardiac surgery department of the Punjab Institute of Cardiology in Lahore. The research study included 180 patients receiving isolated non-emergency CABG and significant LV failure. An echocardiographic estimated LVEF of $\leq 35\%$ was considered as severe LV dysfunction. A nonprobability purposive sampling strategy was utilized to choose the patients. Patients were divided into Group A: 90 patients undergoing CABG with On Pump while Group B: 90 patients undergoing CABG with Off Pump. Subjects who had incomplete clinical record data, those who were in a coma, or had previously undergone cardiac surgery were not included in the study.

STATISTICAL ANALYSIS OF DATA:

The data was analyzed using SPSS (Statistical Program for Social Science). The analyzed data were presented in the form of tables. To compare mortality chi-square test was used. A p-value of less than 0.05 was deemed significant.

RESULTS:

The average age of the individuals in Group A was 54.86 ± 8.49 , whereas in Group B it was 53.94 ± 9.68 . In Group A, 67.8% of the individuals were men and 32.2% were women, while in Group B, 64.4% were men and 35.6% were women. In Group A, the average weight, height, BMI, and LVEF were 73.42 ± 12.24 , 165.08 ± 9.11 , 26.96 ± 4.17 , and 33.06

Table 1: Stratification of Demographics.

Type of Group		On_Pump (90)	Off Pump (90)
Age		54.86 ± 8.49	53.94 ± 9.68
Gender	Male	61 (67.8%)	58 (64.4%)
	Female	29 (32.2%)	32 (35.6%)
Weight (Mean)		73.42 ± 12.24	76.17 ± 11.33
Height (Mean)		165.08 ± 9.11	164.92 ± 7.37
BMI (Mean)		26.96 ± 4.17	28.03 ± 4.07
LVEF (Mean)		33.06 ± 2.45	32.72 ± 2.50

Table 2: Descriptive statistics of risk factors.

Type of Group	On_Pump (90)	Off Pump (90)
Diabetes (Yes)	41 (45.6%)	40 (44.4%)
Hypertension (Yes)	62 (68.9%)	50 (55.6%)
Smoking (Yes)	27 (30%)	33 (36.7%)

Table 3: Comparison of Intra and Post-Operative variables.

Type of Group	On_Pump	Off Pump	P-Value
CPB (Mean)	97.40 ± 32.99	0	< 0.001
XCL (Mean)	50.51 ± 18.32	0	< 0.001
Number of grafts	2.99 ± 0.65	2.78 ± 0.48	0.06
Mortality	Yes	2 (2.2%)	0.560
	No	88 (97.8%)	
Pulmonary Complications	Yes	7 (7.8)	0.351
	No	83 (92.2%)	
Neurological Complications	Yes	3 (3.3%)	0.312
	No	87 (96.7%)	
Renal Complications	Yes	2 (2.2%)	0.155
	No	88 (97.8%)	

± 2.45 respectively. Similarly, in Group B, the corresponding values were 76.17 ± 11.33, 164.92 ± 7.37, 28.03 ± 4.07, and 32.72 ± 2.50. (Table 1)

There were 45.6% diabetic, 68.9% hypertensive and 30% smokers in Group A while 44.4% diabetic, 55.6% hypertensive and 36.7% smokers were in Group B. (Table 2)

The mean of CPB and XCL time was 97.40 ± 32.99 and 50.51 ± 18.32 in Group A. The comparison of number of grafts, mortality, pulmonary complications, neurological complications and renal complications was found insignificant with respective insignificant p-values being as 0.06, 0.560, 0.351, 0.312 and 0.155. (Table 3)

DISCUSSION:

Coronary artery bypass grafting has been widely employed as a surgical procedure to restore blood flow in patients with CAD over an extended period of time. In recent times, certain skilled surgeons have chosen to adopt OPCABG as a means to circumvent the drawbacks associated with CPB and aorta clamp. Nevertheless,

the ongoing discussion revolves around determining the most effective treatment, taking into account both the immediate health risks and the long-term results.

Two sizable randomised trials, ROOBY and CORONARY, have documented the long-term results of both on- and off-pump CABG¹⁰. However, the number of patients with LV dysfunction included in these trials was rather modest. In patients with significant left ventricular failure (EF ≤ 35%), the best course of action for surgical revascularization is still up for debate.

The average age of the individuals in Group A was 54.86 ± 8.49, whereas in Group B it was 53.94 ± 9.68. In a prior study by Xia et al, (2017) the mean age in On-Pump group was 66.0 ± 7.9 and in Off-Pump it was 65.2 ± 8.2. In our study in Group A, 67.8% of the individuals were men and 32.2% were women, while in Group B, 64.4% were men and 35.6% were women. Similarly, Xia et al, (2017) enrolled 18 (20.5%) versus 27 (21.1%) females in on-pump versus off pump groups.¹

There were 45.6% diabetic, 68.9% hypertensive and 30% smokers found in

Group A while 44.4% diabetic, 55.6% hypertensive and 36.7% smokers were found in Group B. Similarly, Xia et al, (2017) enrolled 33 (37.5%) diabetic, and 48 (54.5%) hypertensive patients in on-pump group while 31 (24.2%) diabetic and 73 (57.0%) hypertensive in off-pump group.¹

In our results the comparison of mortality, pulmonary complications, neurological complications and renal complications was found insignificant with respective insignificant p-values being as 0.560, 0.351, 0.312 and 0.155. Similarly, mortality, pulmonary complications, and renal complications were found insignificant with p-values, 0.741, 0.653 and 1.00 respectively in a study by Xia et al, (2017).¹ In another study there was no significant difference found in mortality, pulmonary, neurological and renal complications. The patients in the ONCAB group exhibited a significantly greater occurrence of postoperative pulmonary problems in comparison to the OFF group. The use of extracorporeal circulation during on-pump beating-heart surgery may be the reason for the high incidence of pulmonary issues.¹¹

This study had multiple constraints. Initially, it was a study conducted at a single center, with a limited number of participants, which could have affected the applicability of the findings to a broader population. To

reach a conclusive decision, it would be necessary to conduct a multi-center study with a bigger sample size. Furthermore, due to the fact that these patients had a high risk of complications and substantial impairment of the left ventricle, it is possible that this particular group of patients may have introduced significant bias into the results. In the end, this study merely examined at how the off-pump method for surgical revascularization differed from the on-pump in terms of how it affected the early clinical outcomes in patients with an LVEF \leq 35%. Additional monitoring is required to assess the medium and long-term clinical results.

Varying results are shown by different studies. Forouzannia et al showed that in multivessel disease on-pump CABG is equivalent to off-pump CABG in terms of MACE.¹² In individual with LV dysfunction off-pump CABG is better than on-pump CABG as shown by Qadeer et. al.¹³ Shen et al demonstrated in their study that there is no significant difference in Off-pump vs on-pump CABG in patients with left ventricle ejection fraction of 35% or less.¹⁴

CONCLUSION:

In this study both groups experienced comparable rates of mortality, neurologic, pulmonary, and renal complications so, it is challenging to determine whether off-pump or on-pump CABG can serve as a standard treatment for patients with significant left ventricular failure.

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