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COMPARISON OF MORTALITY IN OFF PUMP VERSUS ON PUMP CABG IN PATIENTS WITH SIGNIFICANT LMS

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ABSTRACT:

INTRODUCTION: *At our institute, we frequently conduct both on pump and off-pump coronary artery bypass surgery (CABG). CABG performed with cardiopulmonary bypass (on-pump surgery) is a treatment that is both safe and successful. In case of on-pump CABG, it is important to note that it is associated with a notable risk of surgical complications. Despite, off-pump CABG has been recommended as a method to reduce surgical complications. So, we designed this study to compare post-operative mortality rates for off-pump versus on-pump coronary artery bypass grafting in patients with severe LMS disease.*

AIMS & OBJECTIVE: *To compare post-operative mortality rates for off-pump versus on-pump coronary artery bypass grafting in patients with severe LMS disease.*

MATERIAL & METHODS: *This was a cross sectional study in which 200 patients undergoing CABG were enrolled. Nonprobability purposive sampling technique used to select the patients. Patients were divided into two groups 100 patients in each group.*

RESULTS: *In this study the average age of the cases in Group A on-pump CABG patients was 54.40 ± 8.60 while in Group B off-pump CABG patients 54.20 ± 9.78. There were 68% males and 32% females found in Group A while 63% male and 37% females found in Group B. There were 44% diabetic, 65% hypertensive and 32% smokers found in Group A while 51% diabetic, 61% hypertensive and 28% smokers were found in Group B. The comparison of mortality was found significant (6% vs 1%) with p-value 0.05.*

CONCLUSION: *Off pump surgery has been accepted in the management of LMS illness despite reasonable apprehensions and disagreements, as it results in a lower death rate than on pump CABG.*

KEY WORDS: *CABG, Left Main Stem Disease, On Pump*

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INTRODUCTION

Coronary artery bypass grafting (CABG) performed with cardiopulmonary bypass (on-pump surgery) is a treatment that is both safe and successful. However, it is important to note that it is associated with a notable risk of surgical complications. Off-pump CABG has been recommended as a method to reduce surgical complications.[1] Off-pump surgery has seen resurgence in popularity over the last decade, thanks to improved stabilizing systems and other technological advancements. However, the long-term implications of off-pump surgery remain debatable.[2, 3, 4] The off-pump approach's increased technical complexity can lead to reduced graft patency and lower rates of full revascularization, particularly when administered by inexperienced surgeons [2, 3] This could potentially contribute to a decrease in long-term survival.[5] Patients with widespread myocardial ischemia, such as those with left main stem (LMS) disease, may be particularly affected by the consequences of partial revascularization following off-pump surgery.[6]

In 1982, a paper published by the Cleveland Clinics identified LMS disease as an independent risk factor for operational mortality following CABG.[7] In the presence of significant LMS stenosis, the prognostic indicators for CABG are well understood. The survival advantage of medical therapy alone is modest in comparison to surgical revascularization, and percutaneous revascularization approaches for severe LMS stenosis are still considered risky. There has been a recent surge in interest in the potential advantages of off-pump CABG, as there is positive evidence of clinical, angiographic, and economic superiority when contrasted with traditional CABG that employs cardiopulmonary bypass. The findings that cardiac surgery that does not employ cardiopulmonary bypass is most beneficial for high-risk and elderly patients are even more encouraging.[8] The LMCA is significantly constricted, which places patients at a high risk. LMS disease, which is defined as significant >70%, is subject to comparable ischemia burden considerations. Nevertheless, the impact of a single artery obstruction on left ventricular mass in these patients is significantly less severe than that of a genuine left main lesion [9]. The objective of this investigation is to contrast the postoperative mortality rates between off-pump and on-pump CABG in patients with LMS disease.

MATERIAL AND METHODS:

This study was carried out at the cardiac surgery department of the Punjab Institute of Cardiology in Lahore. The study included 200 individuals undergoing CABG. A nonprobability purposive sampling strategy was utilized to choose the patients. Patients were divided. Group A: On-pump. ii) Group B: Off-pump. The study comprised patients with LMS disease undergoing CABG. Inclusion criteria: Patients with LMS disease receiving CABG on and off pump. b) The exclusion criteria are: 1. Patients have CAD other than the LMS diasese. 2. Patients with EF below 35%. 3. Patients who have experienced unstable angina, a myocardial infarction, or another significant ischemic episode during the last 1 1/2 months. 4. Simultaneous procedures, such as valvular surgery. 5. A history of renal or pulmonary disease or coagulopathy.

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 54.40 ± 8.60, whereas in Group B it was 54.20 ± 9.78. In Group A, 68% of the individuals were male and 32% were female, while in Group B, 63% were male and 37% were female. In Group A, the average weight (kg), height (cm), BMI, and LVEF (%) were 74.51±12.24, 165.12 ± 8.83, 27.36 ± 4.30, and 50.40 ± 8.87, respectively. Similarly, in Group B, the corresponding values were 74.58±11.54, 165.04 ± 7.98, 27.39 ± 3.97, and 47.65 ± 9.06. (Table 1)

There were 44% diabetic, 65% hypertensive and 32% smokers found in Group A while 51% diabetic, 61% hypertensive and 28% smokers were found in Group B. (Table 2)

The mean of CPB and XCL time was

Table 1: Stratification of Demographics			
Type of Group		**On_Pump (Group-A)**	**Off Pump (Group-B)**
Age (Years)		54.40	54.20
Gender	**Male**	68 (68%)	63 (63%)
	Female	32 (32%)	37 (37%)
Weight (Mean)		74.51	74.58
Height (Mean)		165.12 ± 8.83	165.04 ± 7.98
BMI (Mean		27.36 ± 4.30	27.39 ± 3.97
LVEF (Mean)		50.40 ± 8.87	47.65 ± 9.06

Table 2: Descriptive statistics of risk factors		
Type of Group	**On_Pump**	**Off Pump**
Diabetes (Yes)	44 (44%)	51 (51%)
Hypertension (Yes)	65 (65%)	61 (61%)
Smoking (Yes)	32 (32%)	28 (28%)

Table 3: Comparison of Intra and Post-Operative variables.				
Type of Group		**On_Pump**	**Off Pump**	**P-Value**
CPB (Mean		96.39 ± 31.91	0	< 0.001
XCL (Mean)		49.62 ± 17.97	0	< 0.001
Number of Grafts		3.01 ± 0.61	2.92 ± 0.68	0.07
Mortality	**Yes**	6 (6%)	1 (1%)	0.05
	No	94 (94%)	99 (99%)	

96.39 ± 31.91 and 49.62 ± 17.97 in Group A. The mean number of grafts applied in on-pump CABG was 3.01 ± 0.61 and in on-pump CABG was 2.92 ± 0.68 with statistically insignificant p-value 0.07. The comparison of mortality was found significant (6% vs 1%) with p-value 0.05. (Table 3)

DISCUSSION:

The outcomes of off-pump surgery for managing patients with LMS are not as extensively recorded previously. Repositioning the heart during grafting has long been seen as a relative contraindication for off-pump surgery in cases with LMS disease due to the possibility of hemodynamic changes[10]. However, innovations in surgical technology (such as stabilizers and shunts) have made it possible to do off-pump surgery on patients with left main illness. To compare the post-operative mortality rates of off-pump versus on-pump coronary artery bypass grafting in patients with severe LMS disease.

In this study the mean age of the cases in Group A was 54.40 ± 8.60 while in Group B it was 54.20 ± 9.78. In another study, group I participants were of age 51.5 ± 7.3. In Group II, patients were of age 54.7 ± 6 years.[11]

In our data there were 44% diabetic, 65% hypertensive and 32% smokers present in Group A while 51% diabetic, 61% hypertensive and 28% smokers were present in Group B. In a prior study, 60% had a smoking background, 60% were diabetic,[12] individuals had hypertension and 1 individual in group I was diagnosed with peripheral vascular disease (PVD). Within group II, 46.7% were smokers, 80.0% were diabetic, 60.0% were hypertensive, and 2 patients (13.3%) had concurrent PVD.[11] The mean of CBP and XCL time was 96.39 ± 31.91 and 49.62 ± 17.97 in Group A. The comparison of mortality was found significant (6% vs 1%) with p-value 0.05. Benedetto et al. (2019) also reported a statistically significant mortality p-value of 0.02. Several studies have evaluated the rate of early death in patients with LMS disease who underwent off-pump CABG versus on-pump CABG.[12] The incidence

rates for Off Pump surgery range from 0% to 1.8%, while for On Pump surgery they range from 2.6% to 5%. [13]

Murzi et al. conducted a propensity matching analysis, resulting in 548 patients in each group who had similar preoperative characteristics. Off Pump surgery shown a tangible advantage by being linked to a reduced rate of death during the hospital stay (0.5% vs. 2.9%; P=0.001).[14]

Surgeons and cardiologists worldwide have been cautious about the potential dangers associated with treating coronary artery disease that involves a narrowing of the left main stem. This condition poses an additional risk for patients undergoing interventions such as CABG or percutaneous coronary intervention (PCI). [7] However, research conducted by Louagie et al. and Cartier et al. has demonstrated that Off-pump CABG is a viable and secure alternative to standard on-pump CABG for patients with LMS illness.[15]

CONCLUSION:

Off pump surgery has been accepted in the management of LMS illness despite reasonable apprehensions and disagreements, as it results in a lower death rate than on pump CABG.

References:

1. Deppe AC, Arbash W, Kuhn EW, Slottosch I, Scherner M, Liakopoulos OJ, Choi YH, Wahlers T. Current evidence of coronary artery bypass grafting off-pump versus on-pump: a systematic review with meta-analysis of over 16 900 patients investigated in randomized controlled trials. European Journal of Cardio-Thoracic Surgery. 2016 Apr 1;49(4):1031-41.
2. Shroyer AL, Hattler B, Wagner TH, Collins JF, Baltz JH, Quin JA, Almassi GH, Kozora E, Bakaeen F, Cleveland Jr JC, Bishawi M. Five-year outcomes after on-pump and off-pump coronary-artery bypass. New England Journal of Medicine. 2017 Aug 17;377(7):623-32.
3. Diegeler A, Börgermann J, Kappert U, Hilker M, Doenst T, Böning A, Albert M, Färber G, Holzhey D, Conradi L, Rieß FC. Five-year outcome after off-pump or on-pump coronary artery bypass grafting in elderly patients. Circulation. 2019 Apr 16;139(16):1865-71.
4. Lamy A, Devereaux PJ, Prabhakaran D, Taggart DP, Hu S, Straka Z, Piegas LS, Avezum A, Akar AR, Lanas Zanetti F, Jain AR. Five-year outcomes after off-pump or on-pump coronary-artery bypass grafting. New England journal of medicine. 2016 Dec 15;375(24):2359-68.
5. Smart NA, Dieberg G, King N. Long-term outcomes of on-versus off-pump coronary artery bypass grafting. Journal of the American College of Cardiology. 2018 Mar 6;71(9):983-91.
6. Benedetto U, Caputo M, Patel NN, Fiorentino F, Bryan A, Angelini GD. Long-term survival after off-pump versus on-pump coronary artery bypass graft surgery. Does completeness of revascularization play a role?. International Journal of Cardiology. 2017 Nov 1;246:32-6.
7. Jönsson A, Hammar N, Nordquist T, Ivert T. Left main coronary artery stenosis no longer a risk factor for early and late death after coronary artery bypass surgery—an experience covering three decades. European journal of cardio-thoracic surgery. 2006 Aug 1;30(2):311-7.
8. Sikder MA, Al-Miraj AK, Ullah MA, Khan MA, Haque MM, Hasan R, Ahammed MS, Zaher MA, Shaha SC. Comparison Of Short Term Outcome Between Two Group Off-Pump And On Pump Coronary Artery Bypass Grafting In Left Main Coronary Artery. British Journal of Medical & Health Sciences (BJMHS). 2021 Jan;3(1).
9. Mishra M, Shrivastava S, Dhar A, Bapna R, Mishra A, Meharwal ZS, Trehan N. A prospective evaluation of hemodynamic instability during off-pump coronary artery bypass surgery. Journal of cardiothoracic and vascular anesthesia. 2003 Aug 1;17(4):452-8.
10. Gan HL, Zhang JQ, Xiao W, Zhao S, Huang FJ, Gu CX, Lu CS, Wang PS. Ostial left main coronary artery stenosis as an additional risk factor in off-pump coronary artery bypass grafting. The Journal of thoracic and cardiovascular surgery.

2012 Jan 1;143(1):103-10.
11. Hlavicka J, Straka Z, Jelinek S, Budera P, Vanek T, Maly M, Widimsky P. Off-pump versus on-pump coronary artery bypass grafting surgery in high-risk patients: PRAGUE-6 trial at 30 days and 1 year. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2016 Jun 24;160(2):263-70.
12. Benedetto U, Puskas J, Kappetein AP, Brown WM, Horkay F, Boonstra PW, Bogáts G, Noiseux N, Dressler O, Angelini GD, Stone GW. Off-pump versus on-pump bypass surgery for left main coronary artery disease. Journal of the American College of Cardiology. 2019 Aug 13;74(6):729-40.
13. Athanasopoulos LV, Athanasiou T. Off-pump coronary artery bypass grafting in left main stem stenosis: outcomes, concerns and controversies. Journal of thoracic disease. 2016 Nov;8(Suppl 10):S787.
14. Murzi M, Caputo M, Aresu G, Duggan S, Miceli A, Glauber M, Angelini GD. On-pump and off-pump coronary artery bypass grafting in patients with left main stem disease: a propensity score analysis. The Journal of Thoracic and Cardiovascular Surgery. 2012 Jun 1;143(6):1382-8.
15. Lu JC, Grayson AD, Pullan DM. On-pump versus off-pump surgical revascularization for left main stem stenosis: risk adjusted outcomes. The Annals of thoracic surgery. 2005 Jul 1;80(1):136-42.