

Comparison of Early Outcomes in ONCAB (On-Pump) Vs OPCAB (off-Pump) Coronary Artery Bypass Surgery

MATIUR RAHMAN¹, AJWAD FAROGH², GOHAR BASHIR³, NASEEM AHMAD⁴, ASMA HASSAN⁵, SADAF IFTIKHAR⁶, AMINA SHAFQAT⁷, SHAMILA AFSHAN⁸

¹PGR Punjab Institute of Cardiology, Lahore

²Associate Professor Cardiac Center Bahawalpur

³PGR Cardiac Surgery Cardiac Center Bahawalpur

⁴Professor of Cardiac Surgery Sheikh Zayed Hospital, Rahim Yar Khan Matiur Rahman

⁵Consultant Pulmonologist Cardiac Center Bahawalpur

⁶PGR Cardiac Surgery Cardiac Center Bahawalpur

⁷Biostatistician, Punjab Institute of Cardiology, Lahore

⁸Biostatistician, Punjab Institute of Cardiology, Lahore

Correspondence to: Matiur Rahman¹, Email: drsaiify@yahoo.com, Cell: 03015272263

ABSTRACT

Objective: The aim of this study is to compare early outcomes in on-pump and off-pump cardiac surgery.

Methodology: All the patients undergoing CABG surgery were enrolled after taking informed consent. Demographic and postoperative variables were entered in the predesigned questionnaire and patients were followed for early outcomes after surgical procedure.

Results: A total of 470 patients was divided in two groups 235 in ONCAB and 235 in OPCAB. The mean age of patients was 54.85 ± 9.57 with minimum and maximum age (23-85). There were 400(85.1%) males and 70(14.9%) females. The diabetic patients were 218(46.38%), hypertensive patients were 271(57.70%), patients having family history of cardiac diseases were 268(57.02%) smoker patients were 273(58.09%) and hyperlipidemia found in patients as 210(44.68%). There was a significant difference between Pneumonia (0.014) and Stroke (0.022) in ONCAB versus OPCAB groups, while the p-values of neurological dysfunction was insignificant.

Conclusion: The results of current study showed that early complication in both procedures are nearly same. So we can say both techniques are equally safe and effective.

Keywords: Coronary artery Bypass grafting surgery, ONCAB, OPCAB

INTRODUCTION

Ischemic heart disease can be managed with CABG. CABG continues to be a valuable method of myocardial revascularization. Despite the increased prevalence of percutaneous coronary intervention to treat coronary disease, as well as improvements in medical therapy, surgical revascularization will continue to have a significant role in patients with IHD. Most surgeons prefer to conduct distal anastomoses on arrested hearts, therefore the majority of surgical revascularization is done with the aid of a heart lung machine. Beating surgery for IHD became possible after invention of specific equipment (Stunt, heart stabilizer). By arresting of heart and CPB, it was expected that side effects of heart lung machine could be reduced. ⁽¹⁾ CPB has been used to revascularize almost 80% of occluded coronary arteries all over the world. Revascularization by the help of CPB has catastrophic consequences, so Off-Pump adopted importance since the mid-1990, to avoid catastrophic side effect. ⁽²⁾

Supporter of OPCAB revascularization claim of low side effects (Stroke, Respiratory failure, Renal Dysfunction) even in patients with multiple comorbidities. Use of OPCAB technique is increasing day by day over the past decade. ⁽³⁾

The main reason of interest in OPCAB technique is awareness of disastrous effect of aortic manipulation in ONCAB technique, so OPCAB jumped to 22% in recent years. ⁽⁴⁾ Many surgeons complaining the lack of data to support OPCAB over conventional ONCAB has been an impediment to implementing this strategy in routine practice. ⁽⁵⁾ Furthermore, another problem in off-pump for

many surgeons is difficulty in grafting on beating heart. The aforementioned study has enrolled predominantly low-risk patients and has sample sizes that are inadequate to demonstrate differences between groups for infrequently occurring consequence. Nonetheless, randomized controlled trials have almost uniformly demonstrated reduced transfusion requirements, lower postoperative serum myocardial enzyme levels, and shorter length of stay. ⁽⁶⁾ Moreover, there are many retrospective trials showing a survival benefit as well as reduced morbidity with OPCAB. These retrospective database studies have much larger sample size and include mixed-risk patients. However, inherent selection bias may limit the explanation of these results, against advanced statistical methodology. ⁽⁷⁾ For many surgeons to consider implementing an off-pump approach, the following must be demonstrated:

- (1) Equivalent short-and long-term patency rates;
- (2) Complete revascularization;
- (3) Reduced morbidity and even reduced mortality specifically in high-risk patients;
- (4) Cost efficiency both in the operating room and during the entire hospitalization.

It would seem obvious that avoiding the systemic effects of cardiopulmonary bypass and aortic manipulation would minimize the likelihood of particular adverse effects in certain high-risk categories. ⁽⁸⁾ However, until conclusive studies show that one procedure is preferable than the other, the chosen method will be left to the surgeon's choice.

METHODS

After taking consent from the patients undergoing cardiac surgery at the Punjab Institute of Cardiology, Lahore between September, 2019 and April 2020, a prospective comparative study was conducted. 470 patients undergoing elective CABG on both Genders between age 23-85 years were involved in the study.

Patient refusal; patients undergoing Re-do, emergency CABG and having IHD with concurrent valvular heart were excluded. Patients were categorized into 2 sets A and B 235 in each set. Patients' related factors like age, gender, DM, HTN, Smoking, family history and hyperlipidemia presented in frequency and percentages, the data were compiled and analyzed using SPSS version 24. Chi-square test was used for comparison. P value ≤ 0.05 was considered as significant.

RESULTS

A total 470 patients equally divided into 2 groups, the mean age of cases was 54.85 ± 9.57 years with minimum and maximum age being 23 and 85 years. There were 400(85.1%) males and 70(14.9%) females. The diabetic patients were 218(46.38%), hypertensive patients were 271(57.70%), patients having family history of cardiac diseases were 268(57.02%) smoker patients were 273(58.09%) and hyperlipidemia found in patients as 210 (44.68%). **(Table 1)**

Neurological Dysfunction is post-operative risk factor. In our data there were 9(3.83%) patients of ONCAB and 7(2.98%) patients of OPCAB which suffered from this Table-2: Post-Operative Early Outcomes.

problem, difference was not statistically significant i.e. (p-value=0.611).In ONCAB 15(6.38%) patients suffered from Stroke after surgery while in OPCAB 5(2.13%)patients suffered from stroke with significant p-value (p-value =0.022). Current study showed 6(2.55%) patients of ONCAB while in OPCAB there were no patients (0%) who suffered from pneumonia with statistically significant p-value (0.014).**(Table 2)**

Table-1: Descriptive Statistic of Clinical History.

Variables		
Age (years)		
Mean \pm S.D	54.85 \pm 9.57 (23-85)	
Gender	Male	400(85.1%)
	Female	70(14.9%)
Diabetic Patients	Yes	218(46.38%)
	No	252(53.62%)
Hypertension	Yes	199(42.34%)
	No	271(57.70%)
Family History	Yes	202(42.98%)
	No	268(57.02%)
Smoking	Yes	197(41.91%)
	No	273(58.09%)
Hyperlipidemia	Yes	210(44.68%)
	No	260(55.32%)

Variables		Type of Surgery			p-value
		On Pump	Off Pump	Total	
Neurological Dysfunction	Yes	9(3.83%)	7(2.98%)	16(3.40%)	0.611
	No	226(96.17%)	228(97.02%)	454(96.40%)	
Pneumonia	Yes	6(2.55%)	0(0.00%)	6(1.28%)	0.014
	No	229(97.45%)	235(100%)	464(98.72%)	
Stroke	Yes	15(6.38%)	5(2.13%)	20(4.26%)	0.022
	No	220(93.62%)	230(97.87%)	450(95.74%)	

DISCUSSION

This current study was carried out to compare early outcomes in groups; ONCAB and OPCAB. In this study 470 patients undergoing CABG were studied. Patients were divided in two groups: 235 patients in ONCAB and 235 in OPCAB. The demographic findings showed that in our study there were 470 patients with the mean age of 54.85 ± 9.57 years with minimum and maximum age being 23 and 85 years. Okanoet al (2019) reported that 344 patients had off-pump surgery and 741 had on-pump surgery in their research. Both groups had a comparable mean age (about 41 years in both; p = 0.18), and both had a similar proportion of male patients. Off-pump participants had a higher incidence of one-vessel disease (15.99% off-pump vs. 6.34% on-pump). DM, hyperlipidemia, chronic obstructive pulmonary disease, stroke, PVD, HTN, previous MI, AF, pacemaker implantation, and renal dysfunction were all common in both groups prior to the surgery. There were 28.19 % of those in the off-pump group who had

previously undergone PCI, compared to 26.85 % in the on-pump group (p = 0.63). In both groups rate of emergency operations was similar, accounting for 13.95 %.

The findings of the current study showed that there were 400(85.1%) males and 70(14.9%) females. Out of 400 males 203 were in ONCAB and 197 were in OPCAB group. The results of research conducted by Janashia et al (2018) found that there were total 402 patients; in Off-Pump there were 194 men and 59 women whereas in On-Pump there were 149 men and 34 women.⁽⁹⁾

In a study by Fausto Biancari et al (2007) the comparison of ONCAB versus OPCAB shows an insignificant p-value 0.158 in term of neurological dysfunction. Similar results were computed in our study for neurological dysfunction.⁽¹⁰⁾

In this current study risk of pneumonia was higher in ONCAB as compared to OPCAB. A previous study by Michel et al (2020) also shows the significant p-value 0.018

which agreed with our findings and showed that risk of pneumonia is higher in ONCAB rather than OPCAB. ⁽¹¹⁾

Patients receiving On-Pump CABG had a greater risk of stroke than those getting Off-Pump CABG, according to studies. With a significant p-value of 0.022, stroke rate was greater in on-pump CABG compared to off-pump CABG in this research. Michel et al (2020) observed similar findings in a trial comparing On-Pump with Off-Pump CABG with a significant p-value less than 0.001. This information is consistent with our findings, which showed that the Off-Pump group had considerably lower rates of stroke after surgery than the ON-Pump CABG group. ⁽¹¹⁾

Conclusion: The results of current study showed that early complication in both procedures is nearly same. So we can say both techniques are equally safe and effective.

Limitation: These recommendations may decrease the disease and death as well will be able to predict which procedure is better to perform in our population. This will lead to a reduce hospital stay and saving in cost to both the patient and hospital.

REFERENCE

1. Brown JM, Poston RS, Gammie JS, Cardarelli MG, Schwartz K, Sikora JA, Yi S, Pierson III RN, Griffith BP. Off-pump versus on-pump coronary artery bypass grafting in consecutive patients: decision-making algorithm and outcomes. *The Annals of thoracic surgery*. 2016 Feb 1;81(2):555-61.
2. Spanuchart I, Cheungpasitporn W, Thongprayoon C, Ratanapo S, Srivali N. Off-pump versus on-pump coronary artery bypass surgery: an updated meta-analysis of randomized controlled trials on acute kidney injury and mortality outcomes. *Journal of the American College of Cardiology*. 2015 Mar 17;65(10S):A211-
3. Singh RS, Thingnam SK, Mishra AK, Verma I, Kumar V. Renal function after off-pump versus on-pump coronary artery bypass grafting. *Asian Cardiovascular and Thoracic Annals*. 2017 Oct;25(7-8):504-8.
4. Chivasso P, Guida GA, Fudulu D, Bruno VD, Marsico R, Sedmakov H, Zakkar M, Rapetto F, Bryan AJ, Angelini GD. Impact of off-pump coronary artery bypass grafting on survival: current best available evidence. *Journal of thoracic disease*. 2016 Nov;8(Suppl 10):S808.
5. Davierwala PM. Current outcomes of off-pump coronary artery bypass grafting: evidence from real world practice. *Journal of thoracic disease*. 2016 Nov;8(Suppl 10):S772.
6. Benedetto U, Caputo M, Vohra H, Davies A, Hillier J, Bryan A, Angelini GD. Off-pump versus on-pump coronary artery bypass surgery in patients with actively treated diabetes and multivessel coronary disease. *The Journal of thoracic and cardiovascular surgery*. 2016 Nov 1;152(5):1321-30.
7. Kones R. Primary prevention of coronary heart disease: integration of new data, evolving views, revised goals, and role of rosuvastatin in management. *A comprehensive survey. Drug design, development and therapy*. 2011;5:325.
8. Okano R, Liou YJ, Yu HY, Wu IH, Chou NK, Chen YS, Chi NH. Coronary artery bypass in young patients—on or off-pump ?. *Journal of clinical medicine*. 2019 Feb;8(2):128.
9. Janashia, G., Beselia, K. and Taboridze, I., Complications and In-Hospital Mortality After On-Pump Vs Off-Pump Coronary Artery Bypass Grafting
10. Fausto Biancari, Martti Mosorin, Elsi Rasinaho, Jarmo Lahtinen, Jouni Heikkinen, Eija Niemelä, Vesa Anttila, Martti Lepojärvi, Tatu Juvonen, : <https://doi.org/10.1016/j.jtcvs.2016.06.052>.
11. Michel Pompeu Barros de Oliveira SÁ, Leonardo Pontual LIMA, Fábio Gonçalves de RUEDA, Rodrigo Rendade ESCOBAR, Paulo Ernando Ferraz CAVALCANTI, Emmanuel Callou da Silva THÉ, Mozart Augusto Soares de ESCOBAR, Ricardo de Carvalho LIMA *Rev Bras Cir Cardiovasc* 2020; 25(2): 238-244.
12. Naseri, M. H., Pishgou, B., Ameli, J., Babaei, E., & Taghipour, H. R. (2019). Comparison of post-operative neurological complications between on-pump and off-pump coronary artery bypass surgery. *Pak J Med Sci* January-March, 25(1), 137-141
13. Puskas, J. D., Williams, W. H., Duke, P. G., Staples, J. R., Glas, K. E., Marshall, J. J., ... & McCall, S. A. (2013). Off-pump coronary artery bypass grafting provides complete revascularization with reduced myocardial injury, transfusion requirements, and length of stay: a prospective randomized comparison of two hundred unselected patients undergoing off-pump versus conventional coronary artery bypass grafting. *The Journal of thoracic and cardiovascular surgery*, 125(4), 797-808.
14. Ranjan, R., Adhikary, D., Mandal, S., Saha, S.K., Hasan, K. and Adhikary, A.B., 2019. Performance of EuroSCORE II and logistic EuroSCORE in Bangladeshi population undergoing off-pump coronary artery bypass surgery: A prospective cohort study. *JRSM cardiovascular disease*, 8, p.2048004019862125.
15. Red-Horse, K., Ueno, H., Weissman, I. L., & Krasnow, M. A. (2019). Coronary arteries form by developmental reprogramming of venous cells. *Nature*, 464(7288), 549.
16. Robertson, M.W., Buth, K.J., Stewart, K.M., Wood, J.R., Sullivan, J.A., Hirsch, G.M. and Friesen, C.L.H., 2013. Complete revascularization is compromised in off-pump coronary artery bypass grafting. *The Journal of thoracic and cardiovascular surgery*, 145(4), pp.992-998.