

Comparison Of Post Operative Length Of Stay And Mortality On-Pump And Off-Pump Coronary-Artery Bypass Grafting In The Cardiac Icu Of Haji Adam Malik Hospital Medan

Mhd Abduh Rifai¹, Andriamuri Primaputra Lubis², Tasrif Hamdi²

¹Resident, Departement Anesthesiology and Intensive Care, Faculty of Medic, University of North Sumatera, Haji Adam Malik Central Hospital, Medan, Indonesia

²Departement Anesthesiology and Intensive Care, Faculty of Medic, University of North Sumatera, Haji Adam Malik Central Hospital, Medan, Indonesia.

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Abstract

Introduction: Coronary-Artery Bypass Grafting (CABG) is currently a heart bypass surgery procedure that is often performed and with developing technology. The most common CABG techniques are on-pump and off-pump. This difference in surgical technique affects the final postoperative outcome, namely the length of stay and mortality of patients in the cardiac ICU. On-pump CABG performed at cardiopulmonary bypass is one of the most commonly performed procedures and an excellent treatment for ischemic heart disease. However, the results of a recent retrospective study found that length of stay and postoperative mortality can be reduced when coronary artery bypass surgery is performed using the off-pump technique.

Purpose: This study aims to compare the length of stay and mortality of postoperative on-pump and off-pump CABG patients in the cardiac ICU of Haji Adam Malik General Hospital, Medan.

Methods: This study is an analytic study with a retrospective research method with secondary data sources obtained from cardiac ICU medical records for the period January 2016 – December 2021. Samples were on-pump and off-pump CABG postoperative patients undergoing treatment in the cardiac ICU who met the inclusion and exclusion criteria were collected by total sampling method.

Results: It was found that the ICU stay after on-pump surgery was significantly longer than off-pump, with the median value for ICU stay in the on-pump surgical technique was 2 days while in the off-pump it was 1 day (Mean = 2.335; SE = 0.103 vs. Mean = 1.709; SE = 0.140) with $p < 0.05$. There was no significant difference between on-pump and off-pump CABG postoperative mortality with $p > 0.05$.

Conclusion: The length of stay in the ICU after on-pump surgery is longer than off-pump. There was no difference in postoperative mortality between on-pump and off-pump CABG.

Keywords: CABG, ICU, Length of stay, Mortality.

INTRODUCTION

Coronary-Artery Bypass Grafting (CABG) is currently a heart bypass surgery procedure that is often performed and with technology that is increasingly developing. Currently, CABG operations are carried out using two techniques, namely on-pump and off-pump. On-pump CABG performed at cardiopulmonary bypass is one of the most commonly performed procedures and an excellent treatment for ischemic heart disease. However, results from a recent retrospective study suggest that length of stay and postoperative mortality may be reduced when coronary artery bypass surgery is performed using the off-pump technique. Advances in surgical technique, use of intracoronary shunts, and improvements in epicardial stabilization devices allow surgeons to routinely perform off-pump CABG.¹

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On-pump CABG is performed by connecting the patient to a CPB machine to replace heart and lung functions while the patient's heart is stopped so that it has greater side effects. Whereas the off-pump CABG technique has its own level of difficulty and requires special expertise because it does not use a heart-lung machine, and the patient's heart continues to function normally during surgery.²

Although CABG on a cardiopulmonary bypass machine (CPB) is currently performed with very low and acceptable morbidity and mortality (1.9%), the use of cardiopulmonary bypass is not without significant potential risks. On-pump CABG involves the use of cannulas in the ascending aorta and right atrium for cardiopulmonary bypass and cannulas in the ascending aorta and right atrium for cardioplegia. During on-pump CABG surgery, the myocardium was ischemic and retained with high potassium solutions and a cross clamp was placed on the ascending aorta to isolate the heart.³

Prolonged cross clamp time (CCT) is significantly associated with poor clinical outcomes in patients undergoing cardiac surgery in both low-risk and high-risk patients. These complications include death in hospital, prolonged hospitalization, prolonged mechanical ventilation, low cardiac output, side effects of blood transfusions, and complications in the kidneys. There is a significant relationship between cardiopulmonary bypass time and length of stay in ICU, length of postoperative stay in hospital, postoperative bleeding, red blood cell transfusion, reoperation caused by bleeding, respiratory complications, neurological complications, infectious complications, kidney complications, postoperative multiorgan failure, and death.⁴

During the last decade, several randomized controlled trials have addressed the postoperative outcome of on-pump and off-pump CABG. Differences in the incidence rate of postoperative atrial fibrillation, need for blood transfusion, release of biochemical markers of myocardial damage, and length of stay appear to favor the choice of an off-pump technique. On the other hand, several studies have shown that patients who undergo off-pump have a greater risk of partial revascularization and graft failure than patients who undergo on-pump CABG. The question of whether off-pump prevents postoperative cognitive dysfunction, stroke, and other organ dysfunction is still controversial.¹

The off-pump technique approach has been found to have several important early postoperative benefits. In particular, compared with standard CABG patients, off-pump patients were found to require significantly fewer transfusions in several studies. This may be secondary to decreased intraoperative bleeding from cannulation and the hemodilutional component of CPB. Likewise, off-pump techniques have been associated with reduced ICU and hospital stays, possibly secondary to reduced incidence of organ failure, including decreased use of mechanical ventilation and decreased severity of kidney injury. Reduced transfusion rates and postoperative end organ failure lead to reduced resource utilization. This, coupled with the absence of the need for specialized personnel to operate the CPB circuit, appears to reduce the direct costs associated with off-pump CABG compared to on-pump CABG.⁵

Initial enthusiasm that off-pump CABG would yield superior outcomes has recently been met with growing concern that it is associated with partial revascularization, suboptimal graft patency, and poorer long-term survival compared to on-pump CABG. This concern has fueled much skepticism about off-pump CABG as a recognized treatment option for coronary artery disease. The only way to combat this skepticism is to compare the effectiveness of off-pump and on-pump CABG through an explicit and rigorous assessment of the best available evidence.⁶

Previous studies comparing off-pump CABG with on-pump surgery did not show a significant difference in terms of length of intensive stay and incidence of postoperative mortality. Several studies have questioned the advantages of off-pump over on-pump surgery with some showing better outcomes and better survival expectations. However, all showed that the results were biased with <20 cases in the Randomized On/Off Bypass (ROOBY) study.⁷

METHOD

This research is analytic in nature with a retrospective research method with secondary data sources obtained from the

medical records of the cardiac ICU at Haji Adam Malik General Hospital Medan for the period January 2016 – December 2021.

Samples were

on-pump and off-pump CABG postoperative patients undergoing treatment in the ICU Hearts that met the inclusion and exclusion criteria were collected by total sampling method.

RESULT

This study was conducted on on-pump and off-pump CABG postoperative patients undergoing treatment in the cardiac ICU of HAM Hospital. The parameters assessed in this study were CABG surgical techniques, ICU length of stay and ICU mortality. The study began in November 2022 after an ethical due diligence was carried out by the Research Ethics Committee of the Faculty of Medicine, University of North Sumatra with a total sample of 408 postoperative CABG patients for the January 2016 - December 2021 period, which was sourced from secondary medical record data.

Table 1 Sample Characteristics

Variable	Frequency	Percentage (%)
Gender		
Man	351	86,0
Woman	57	14,0
Age		
36-45 year	17	4,2
46-55 year	158	38,7
56-65 year	190	46,6
>65 year	43	10,5
CABG Technique		
On-pump	346	84,8
Off-pump	62	15,2
Mortality		
Found	25	6,1
Not found	383	93,9
Total	408	100

Table 1 Subject characteristics which include gender, age, surgical technique and ICU mortality show that the majority of CABG patients at HAM Hospital are male (351 patients, 86.0%) with the largest age group in the age range 56-65 years (190 patients, 46.6%), the most commonly used surgical technique was on-pump (346 patients, 84.8%) and the data showed mostly no mortality in the ICU (383 patients, 93.9%).

Postoperative ICU Length of Stay

In this study, it was found that most patients were treated in the ICU for 1 day with a total of 156 patients (38.2%), with a ratio of 121 on-pump and 35 off-pump. Most on-pump CABG postoperative patients were treated for 2 days with a total of 132 patients with a length of stay between 0 to 18 days (mean=2.335), while the most off-pump patients were treated for 1 day with a total of 35 patients with a length of stay between 1 to 3 days (mean=1.709).

Table 2 Comparison of ICU Length of Stay and CABG Technique

Variable	On-pump	Off-pump	P value ^a
Length of Stay	2 (1;18)	1(1;3)	0,003

Note.: ^aMann-Whitney

Numerical data with non-normal distribution is presented in median form (minimum value ; maximum value)

Table 2 above provides information that there is a significant comparison between surgical technique and postoperative length of stay in the cardiac ICU ($p=0.003$), where the median value for ICU care in the on-pump surgical technique is 2 days while in the off-pump it is 1 day .

Postoperative ICU Mortality

During the period January 2016 - December 2021 there were a total of 25 post- operative CABG mortality, with a comparison of on-pump mortality of 24 patients and 1 patient off-pump. The highest number of CABG operations were carried out in 2019 with a total of 118 operations (28.9%). (28,9%).

Table 3 Comparison of ICU Mortality and CABG Technique

Surgical Technique	ICU Mortality		P value
	Found	Not found	

On-pump	322	24	0,150 ^a
Off-pump	61	1	
Total	383	25	

Note : ^a Fisher’s exact

The data is a 2x2 table calculation with a small and unbalanced number of samples.

Table 3 above provides information that there is no significant comparison between the two CABG surgical techniques with postoperative mortality in the cardiac ICU (p=0.150) and OR=0.219 with CI 0.029-1.656.

DISCUSSION

This study was conducted to assess the comparison of length of stay and postoperativemortality of on-pump and off-pump CABG in the cardiac ICU of Haji Adam Malik General

Hospital Medan. In this study, there was a significant comparison between on-pump and off- pump CABG postoperative length of stay, where the on-pump postoperative ICU stay was significantly longer than off-pump (p=0.003), with a median ICU stay the on-pump operatingtechnique was 2 days while the off-pump was 1 day (Mean = 2.335; SE = 0.103 vs. Mean = 1.709; SE = 0.140; p <0.05).

These results are consistent with Ibrahim and Joyo's study in 2022 which was conducted on 1569 patients where the results of their study showed that the length of ICU stay was significantly longer with the on-pump surgical technique compared to the off pump (Mean = 0.558; SE = 0.026 vs Mean = 0.408 ; SE = 0.633; p <0.001).⁸

In a 2022 study by Torregrossa et al., showed that of 731 samples undergoing CABG surgery, there was a difference in lower re-intervention rates for bleeding, intra- and postoperative blood transfusions, and shorter ICU length of stay with off-pump surgical techniques. compared to the on-pump operating technique.⁹

However, the results of this study did not show that there was a significant comparison between on-pump and off-pump CABG postoperative mortality in the cardiac ICU at Haji Adam Malik General Hospital Medan (p>0.05). There was no difference between the two CABG surgical techniques and postoperative mortality in cardiac ICU (OR= 0.219, 95% CI 0.029-1.656, P = 0.150).

This is in consistent with a 2017 study by Zhu et al., the risk of death associated with on-pump or off-pump CABG in randomized-control trial (RCT) data was similar (OR = 0.945, 95% CI = 0.652 to 1.371, P = 0.766).¹⁰

The research conducted by Ibrahim and Joyo showed that there was no significant difference in on-pump and off-pump mortality, both in the unadjusted model (OR = 1.165, 95%, CI = 0.485-2.8) and the adjusted model (OR = 1.165, 95% CI = 0.482–2.817).⁸

This study is also consistent with a 2018 study by Brewer et al., (on-pump, 1.8%; off- pump, 2.3%; p = 0.259). which involved 21,640 research subjects and found no significant relationship between surgical technique and patient mortality rates. However, patients who underwent the off-pump surgical technique had a lower incidence of major surgical complications including stroke, reoperation for bleeding, prolonged ventilation, transfusion, and atrial fibrillation. Off-pump patients are also extubated more quickly, transferred out of the intensive care unit more quickly, and have a shorter postoperative length of stay.¹¹

The most common factors influencing mortality in patients undergoing CABG surgery include surgical technique, patient tolerance to CABG surgery, natural course of disease, procedural complexity, and postoperative recovery. However, in this study there was

no significant difference in the postoperative mortality rate between the two groups in this study.

CONCLUSION

From this study it was found that the length of ICU stay after on-pump surgery was significantly longer than off-pump ($p < 0.05$), with the median value for ICU stay in on-pump surgery technique was 2 days while in off-pump it was 1 day. However, there was no significant difference between on-pump and off-pump CABG postoperative mortality in the cardiac ICU at Haji Adam Malik General Hospital Medan ($p > 0.05$).

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