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Differences in Recovery After Coronary Artery Bypass Grafting or Off-pump Coronary Artery Bypass

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ABSTRACT

Background. The main part of the study was to determine the lower frequency of postoperative complications and fewer days spent in hospital and in the intensive care unit postoperatively, among patients operated on using the OPCAB method, as opposed to those operated on using the CABG method.

Methods: In a cross-sectional, epidemiological study, data were collected and processed from the medical database. The parameters taken into consideration were: the incidence of postoperative complications, the number of days spent in the intensive care unit postoperatively and the number of days spent in the hospital postoperatively.

Main findings: From a total of 60 patients operated on at the Department of Cardiac Surgery, 8.33% of patients had postoperative complications. Half of the patients underwent CABG surgery and 13.3% had postoperative complications. The other half who underwent OPCAB surgery had 3.3% postoperative complications. CABG patients spent an average of 2.57 days in the intensive care unit, whereas OPCAB patients spent 2.17 days there.

Principal conclusion: There is no statistically significant difference in the number of days spent in the intensive care unit and the incidence of postoperative complications between patients operated ~~by~~ on using the CABG or the OPCAB method.

Key words: CABG method, OPCAB method, postoperative complication, intensive care unit

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INTRODUCTION

Coronary artery bypass transplantation is defined as an open-heart procedure in which a venous or arterial graft is placed between the aorta and the coronary artery distal to the narrowing, thus bypassing the coronary artery narrowing and improving arterial blood flow to the heart (1-3). Bypass coronary artery transplantation is a surgical procedure that can be performed with cardiopulmonary bypass (CABG) or without cardiopulmonary bypass (OPCAB) (4). On May 15, 1967, Dr. Rene Favaloro, an Argentine surgeon who worked at a clinic in Cleveland, performed the first bypass coronary artery transplant without using an extracorporeal circulation machine (5).

Nowadays, the most widespread surgical technique of bypass surgery is the use of a machine for extracorporeal circulation and medial sternotomy. Preoperative drug preparation typically involves the use of beta-adrenergic receptor blockers, calcium channel blockers and ACE inhibitors (6). Platelet aggregation inhibitors as well as ASA should be excluded preoperatively from therapy, in order to reduce the incidence of postoperative bleeding. After introducing the patient to general endotracheal anesthesia and a sterile body covering, the procedure begins. The goal of surgery is complete revascularization, bridging all severe stenoses. A common strategy involves anastomosing the left internal thoracic artery to the anterior descending branch of the left coronary artery and large saphenous vein segments to the remaining stenosed coronary arteries (6). The insertion sites of distal anastomoses are often individualized, depending on the location of the atherosclerotic plaques. Coronary angiography, as well as open blood vessel inspection on the operating table, give the surgeon information relating to which coronary artery and where to graft the graft (7).

The OPCAB technique as a routine operative method has been used in medicine for over 30 years. The introduction of OPCAB as a technique was based on certain benefits compared to the classical method (CABG), one of which is avoiding the trauma caused by the machine for extracorporeal circulation and reducing aortic manipulation to a minimum (8,9). Moreover, many were proponents of the OPCAB method, as the advantages of this procedure stated a reduced incidence of early and perioperative mortality, a reduced incidence of neurological strokes, a reduced incidence of renal failure and consequently shortened hospital stays postoperatively. Nevertheless, OPCAB critics continue to point out that with this method, revascularization is often incomplete and of poorer quality than that performed using the CABG method, which consequently, causes a lower long-term survival rate (10,11).

After the rapid development and improvement of the CABG method, primarily due to the development of the extracorporeal circulation machine, which peaked in terms of its frequency in 2000, there has been a slight decline in the prevalence of this procedure (12). Previous research has shown that the long-term survival and elimination of symptoms is much higher in CABG. However, CABG surgery is associated with frequent perioperative complications and longer hospital stays, which in turn increases treatment costs. Studies in patients have shown the negative effect of cardiopulmonary bypass on markers of coagulation inflammation, microembolization, acid-base balance and local perfusion (13). The aim of this study was to determine whether there is a lower frequency of postoperative complications and fewer days spent in hospital and in the intensive care unit postoperatively, in patients operated on using the OPCAB method as opposed to those operated on using the CABG method (14).

The main goal of this study was to prove that the recovery of patients operated on using the OPCAB method is faster, with fewer postoperative complications compared to patients operated on using the CABG method.

MATERIALS AND METHODS

Subjects

The study included solely elective patients, who had had coronary artery bypass surgery. Sixty patients were admitted to SKB Mostar, with a diagnosis of three-vessel coronary artery disease (CAD x3). In this study, all patients who had undergone emergency coronary artery bypass graft surgery and with previous pulmonary, hematological and renal diseases were excluded. Patients were divided into two groups, those operated on using the CABG method and those operated on using the OPCAB method.

Methods

The study included all patients admitted to SKB Mostar, with a diagnosis of three-vessel coronary artery disease (CAD x3), including solely elective patients who had undergone coronary artery bypass surgery. In this study, all patients who underwent emergency coronary artery bypass graft surgery and had had previous pulmonary, hematological and renal diseases were excluded. Patients were divided into two groups, those operated on using the CABG method and those operated on using the OPCAB method. These two groups were compared for the incidence of postoperative complications, the number of days spent in the intensive care unit and the number of days spent in the hospital postoperatively.

Statistical analysis

The arithmetic mean ± standard deviation (SD) for variables the distribution of which was normal and the median (interquartile range) for continuous variables, the distribution of which deviated from normal were used to show the values and measures of scattering. The chi-square (χ^2) test was used to compare the nominal variables. In the absence of the expected frequency, Fisher's exact test was used to compare the category variables. Student's t-test, and Mann-Whitney U test were used to compare the continuous variables. The possibility of error was accepted at $\alpha < 0.05$ and the differences between the groups were accepted as statistically significant for $p<0.05$. The statistical system SPSS for Windows (version 23.0, SPSS Inc, Chicago, Illinois, USA) and Microsoft Excel (version 10, Microsoft Corporation, Redmond, WA, USA) were used for statistical analysis.

RESULTS

The majority of subjects that underwent coronary artery bypass surgery did not have any postoperative complications; the statistical difference was significant (Figure 1).

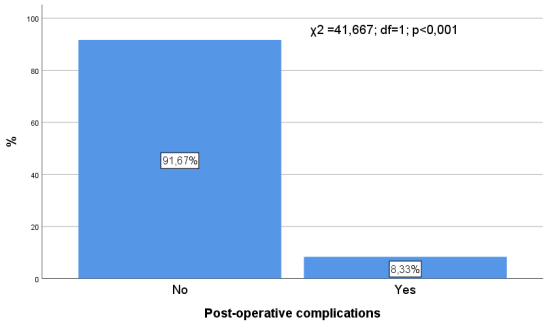

Figure 1. Incidence of postoperative complications

The statistical differences were not significant regarding the incidence of postoperative complications between OPCAB and CABG subjects (Figure 2).

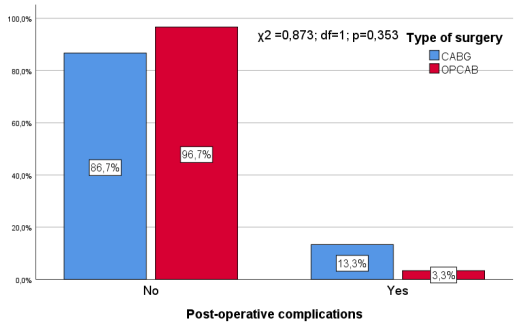

Figure 2. Incidence of postoperative complications between OPCAB and CABG subjects

There was no statistically significant difference between the variables compared in Table 1 regarding the operation methods.

Table 1. Age, days spent in hospital and in the intensive care unit regarding the operation method

	Type of surgery				t	p
	CABG		OPCAB			
	$\bar{X}$	SD	$\bar{X}$	SD		
Age	64.60	7.309	67.27	6.607	1.482	0.144
Days in hospital	7.37	2.760	7.07	1.799	0.499	0.620
Days in ICU	2.57	1.251	2.17	0.461	1.644	0.109

There were no statistically significant differences in age regarding the incidence of postoperative complications (Figure 3).

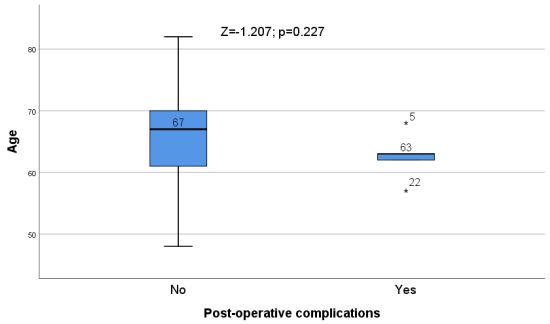

Figure 3. Age difference relating to the incidence of postoperative complications.

Subjects with postoperative complications statistically spent more days in the intensive care unit (Figure 4).

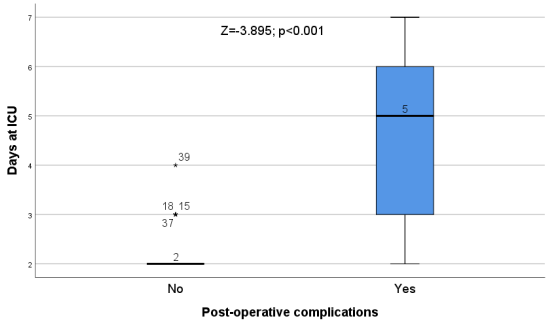

Figure 4. Difference of days spent in the intensive care unit in relation to the incidence of postoperative complications

DISCUSSION

This study showed that there was no significant difference in the incidence of postoperative complications, days spent in the postoperative intensive care unit or days spent in the hospital postoperatively between patients operated on using the CABG and the OPCAB method, which is in line with research worldwide. The theoretical benefits of OPCAB are based on the avoidance of cardiopulmonary bypass and less aortic manipulation. However, over the last few years, several randomized studies have failed to prove these theoretical advantages of the OPCAB method in practice (13).

In a study conducted by Afilalo et al. in 2012, using an extensive meta-analysis, they failed to prove the differences in the incidence of mortality and the incidence of postoperative complications between patients operated on using CABG and OPCAB (14). The only statistically significant difference in the analysis was the lower incidence rate of peri and postoperative cerebral insults in favor of OPCAB. The research of Forouzanni et al. from 2011 and its results are almost identical to the results of this study. Forouzanni et al. compared the days spent in the intensive care unit and the days spent in hospital postoperatively; the results of their study correlate with this study and prove that there is no statistically significant difference in the number of days spent in the hospital and the intensive care unit. Moreover, in this study, the incidences of postoperative complications were compared between the methods, and although the percentage incidence of complications was higher with the CABG method, the difference was insufficient to be statistically significant (13).

Given the higher incidence of incomplete and poor revascularization, as well as the lower incidence of long-term survival, the decline in enthusiasm for use of the OPCAB method worldwide seems justified, as no clear OPCAB benefit in terms of speed and quality has resulted in early recovery (10,12). If we were to discuss the possible shortcomings of this research, it would certainly be the number of respondents and the time period of the research. Therefore, future research on this topic should certainly be conducted on a larger sample and the research should be extended to

cover a longer period of time. Moreover, the quality of the procedure itself and consequently, recovery and long-term survival depend on the quality and experience of the surgeon who performs the procedure. Therefore, future research on this topic should be conducted in such a way that the patients of only one surgeon/operator enter the research. Nevertheless, this research is significant, as almost all the positive and negative aspects of both methods have been taken into account and as such can be helpful to other colleagues. In addition, from the results and the percentage of complications, it is evident that our department involved in this area does not lag behind the developed world, especially considering that the department has existed for only 10 years.

CONCLUSIONS

The results of this study show that there is no statistically significant difference in the number of days spent in the ward and in the intensive care unit or the incidence of postoperative complications between patients operated on using CABG and OPCAB method.

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CONFLICT OF INTEREST
The authors declare no conflict of interest.

AUTHORS' CONTRIBUTIONS
J.V., A.B. and I.R. conceived and designed the study; J.V. collected the data; J.V. and A.B. analyzed the data; J.V., A.B. and I.R. interpreted the results; J.V. prepared the figures; J.V. drafted the manuscript; J.V., A.B. and I.R. edited and revised the manuscript; I.R. approved the final version of the manuscript.

ETHICAL BACKGROUND

Institutional review board statement: The study protocol was approved by the Ethics Committee of the University of Mostar, School of Medicine. All the investigations were performed in accordance with the principles set out in the World Medical Association Declaration of Helsinki, Mostar July 7, 2020.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: We deny any restrictions on the availability of data, materials and associated protocols. Derived data supporting the findings of this study are available from the corresponding author on request.

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