Original Article

Factors affecting the outcomes after coronary artery bypass grafting

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Abstract

Background: Several factors affect the outcome after coronary artery bypass grafting (CABG). We reported CABG's short- and long-term outcomes and factors affecting the length of hospital stay and event-free survival.

Methods: We conducted a retrospective cohort including 195 consecutive CABG patients from 2010 to 2022. Study endpoints were the length of hospital stay and event-free survival.

Results: Males presented most of our cohort (n= 142, 72.82%); the mean age was 65.19 ±9.20 years. The associated comorbidities were diabetes mellitus (28.72%), peripheral arterial disease (18.45%), cerebrovascular disease (3.08%), and myocardial infarction (52.31%). The prevalence of left-main disease was 28.21%. The mean ejection fraction was 57.27± 13.23, and the median EuroSCORE was 2.96. Nineteen patients had emergency surgery, 65.13% had off-pump CABG, and 84.62% had total arterial revascularization. The median length of hospital stay was 9 days (8-11). Hospital stay was longer in patients with a history of cerebrovascular disease (β: 1.19 (95% CI: 0.79- 1.60), P<0.001), older age (β:0.16 (95% CI: 0.007- 0.024), P<0.001), and diabetics (β: 0.29 (95% CI: 0.12- 0.46), P= 0.001). The risk of events increased in patients with previous cardiovascular disease (P= 0.025), peripheral arterial disease (p<0.001), and patients with diabetes (P= 0.025).

Conclusion: Patients' specific risk factors and comorbidities were the main determinants of the length of hospital stay and long-term outcomes after coronary artery bypass grafting.

Introduction

Coronary artery bypass grafting (CABG) is one of the commonest cardiac surgery procedures in adults worldwide [1]. Several factors affect CABG outcomes, and continuous refinement of the technique is going on to improve the outcomes. Preoperative patients' risk factors, such as age and comorbidities, could increase the risk of surgery [2]. Infectious complications might increase in diabetics and with the use of bilateral internal mammary arteries [3]. Moreover, disease characteristics may affect the outcomes, such as the number of diseased vessels and the left-main disease [4].

Furthermore, CABG techniques directly affect short- and long-term outcomes. Total arterial revascularization could improve graft patency and event-free survival [5,6]. Off-pump CABG could bear short-term benefits reflected in shorter hospital stay and better renal and neurological outcomes [7]. In this study, we reported CABG's short- and long-term outcomes and factors

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affecting the length of hospital stay and event-free survival.

Patients and Methods
Design

We conducted a retrospective cohort including 195 consecutive CABG patients from 2010 to 2022. We excluded patients with poor left ventricular function, those with end-organ failures, minimally invasive surgery, and those with concomitant procedures, such as valve and aortic surgery. The Local Ethics Committee approved data collection for this study.

Data and outcomes:

Preoperative data included patients' demographics (age and gender), comorbidities (diabetes mellitus, peripheral arterial disease, cerebrovascular disease, and myocardial infarction), and angiographic data (left-main disease, number of vessels affected). Operative data included surgical emergency, total arterial revascularization, off-pump CABG, and distal anastomoses.

Hospital outcomes were neurological, renal, and pulmonary complications (), myocardial infarction (MI), and hospital mortality. Study endpoints were the length of hospital stay and even free survival (freedom from death, recurrent angina, MI, congestive heart failure, coronary revascularization, and stroke). Renal impairment was defined as a postoperative elevation of serum creatinine of more than 2g/dl or the need for dialysis. Pulmonary complications were defined as prolonged ventilation for more than 18 hours or ventilation-acquired pneumonia or pulmonary embolism.

Techniques

All patients had median sternotomy and left internal mammary artery (LIMA) to left anterior descending artery (LAD). The second conduits used were the saphenous veins, radial artery, and the right internal mammary artery.

Statistical analysis

Descriptive analysis was used to describe our cohort. Continuous variables were expressed as mean, standard deviation, or median and interquartile range. Binary data were expressed as numbers and percentages. Factors affecting event-free survival were evaluated using stepwise multivariable Cox regression with a forward selection and a stay p-value of less than 0.05. Kaplan-Meier was used to plot the distribution of event-free survival. Factors affecting the length of hospital stay were evaluated using negative binomial analysis. Variables selection was performed using the same way as the time to events. Stata 17 (Stata Corp- College Station- TX-USA) was used for the analysis.

Results
Preoperative and operative data:

The study included 195 patients. Males presented most of our cohort (n= 142, 72.82%); the mean age was 65.19 ±9.20 years. The associated comorbidities were diabetes mellitus (28.72%), peripheral arterial disease (18.45%), cerebrovascular disease (3.08%), and myocardial infarction (52.31%). The prevalence of left-main disease was 28.21%. The mean ejection fraction was 57.27± 13.23, and the median EuroSCORE was 2.96. Nineteen patients had emergency surgery, 65.13% had off-pump CABG, and 84.62% had total arterial revascularization. (Table 1)

Table 1: Preoperative and operative data. Data were presented as mean± standard deviation, median (IQR), or numbers and percentages

Factors	All patients (n= 195)
Age (years)	65.19 ± 9.20
Males	142 (72.82%)
Diabetes mellitus	56 (28.72%)
Peripheral arterial disease	36 (18.46%)
Cerebrovascular disease	6 (3.08%)
Previous myocardial infarction	102 (52.31%)
Ejection fraction (%)	57.27 ± 13.23
Unstable angina	96 (49.23%)
Number of diseased vessels	2.75 ± 0.5
Left main disease	55 (28.21%)
Euro Score	2.96 (1.72- 6.61)
Emergency	19 (9.74%)
Off-pump surgery	127 (65.13%)
Distal arterial conduit	3.07 ± 0.84
Total arterial revascularization	165 (84.62%)

Postoperative complications

The most frequent postoperative complications were renal impairment (11.28%),

pulmonary complications (6.15%), and infections (2.65%). Hospital mortality occurred in 3 patients (1.54%). The median length of hospital stay was 9 days (8- 11). (Table 2)

Table 2: Postoperative outcomes. Data were presented as mean± standard deviation, median (IQR), or numbers and percentages

Outcomes	(n= 195)
Perioperative myocardial infarction	4 (2.05%)
Neurologic	2 (1.03%)
Renal insufficiency	22 (11.28%)
Pulmonary complications	12 (6.15%)
Infection	5 (2.65%)
Hospital death	3 (1.54%)
Hospital stay (days)	9 (8- 11)

Factors affecting the length of hospital stay

Hospital stay was longer in patients with a history of cerebrovascular disease (β: 1.19 (95% CI: 0.79- 1.60), P<0.001), older age (β:0.16 (95% CI: 0.007- 0.024), P<0.001), and diabetics (β: 0.29 (95% CI: 0.12- 0.46), P= 0.001). (Table 3)

Table 3: Factors affecting the length of hospital stay

	β (95% C)	P-value
Cerebrovascular disease	1.19 (0.79- 1.60)	<0.001
Age	0.16 (0.007- 0.024)	<0.001
Diabetes mellitus	0.29 (0.12- 0.46)	0.001

Long-term outcomes

Recurrent angina occurred in 15 patients, MI in 3, coronary reintervention in 6, heart failure in 1, stroke in 2, and mortality in 7 patients. Event-free survival at 5 years was 87%. The event-free survival is presented in Figure 1. The risk of events increased in patients with previous cardiovascular disease, peripheral arterial disease, and diabetes. (Table 4)

Table 4: Cox regression for factors affecting event-free survival

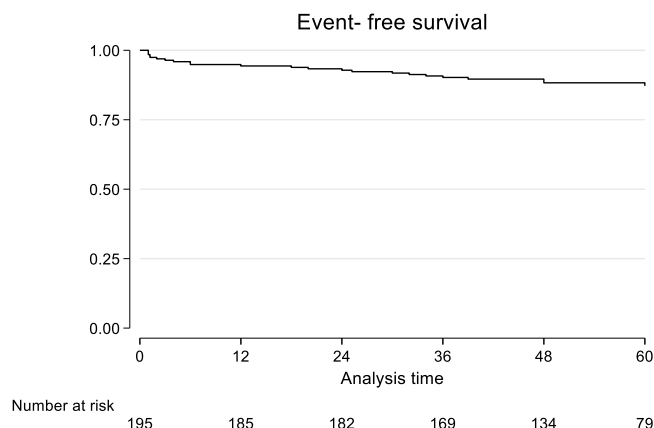|	HR (95% C)	P-value
Peripheral arterial disease	2.72 (1.14- 6.53)	0.025
Cerebrovascular disease	9.76 (3.27- 29.19)	<0.001
Diabetes mellitus	2.58 (1.13- 5.91)	0.025

Figure 1: Event-free survival after coronary artery bypass grafting

Discussion

In the study, we included 195 patients who had CABG. Renal impairment occurred in 11.28%, pulmonary complications in 6.15%, and infections in 2.65%. The median hospital stay was 9 days, which increased in elders and diabetics. Event-free survival at 5 years was 87%, and it was lower in patients with diabetes, peripheral arterial disease, and cerebrovascular disease.

Diabetes is a major risk factor for coronary artery disease and a major determinant of the outcome [8]. CABG is the preferred revascularization strategy in diabetic patients [9,10]. Diabetes was found as a risk factor for coronary restenosis after myocardial revascularization in several studies [11]. This finding is similar to our study, since we found that diabetes was a risk factor for follow-up events (mortality, recurrent angina, coronary revascularization, MI, heart failure, and stroke). Orbach and colleagues found that diabetes was a strong predictor of repeated revascularization [12].

Diabetes was found to be a risk factor for sternal wound infections after CABG [13]. Several strategies were proposed to improve the outcomes in diabetic patients. Cardona and associates evaluated the intensive insulin therapy before CABG and found that it was associated with lower use of hospitalization resources and cost [14]. HbA1c was associated with an increased risk of sternal infections, and it is proposed that proper preoperative control of HbA1c could decrease the

risk of infection and improve surgery outcomes [15].

Preoperative cerebrovascular disease increases the risk of CABG, and concomitant carotid disease is a risk factor for stroke after CABG [16,17]. Postoperative stroke is a risk factor for increased mortality after CABG [18]. Efird and associates found that the risk of death increased in patients with the peripheral arterial disease [19]. Patients with cerebrovascular and peripheral vascular disease may indicate the severity of coronary artery disease; therefore, the risk of postoperative stroke, MI, and recurrent stenosis could increase. Bonacchi and colleagues found that off-pump CABG had better outcomes in patients with the peripheral arterial disease [20].

Surgical outcomes in old patients are not optimal compared to young patients [21,22]. However, there is no age limit that defines patients with increased risk [23]. Old patients are fragile, and the effect of surgical trauma is huge compared to that in young patients [24].

This study showed that patient's specific risk factors were associated with longer hospital stay and lower event-free survival. Optimizing these risk factors before surgery could improve the outcome of CABG.

Study limitations
The study is retrospective, and it is possible that other risk factors that could independently affect the outcomes were not included in the analysis. Another limitation is the small sample size and the low event numbers. Several other risk factors could be significant if tested on a large scale of patients.

Conclusion
Patients' specific risk factors and comorbidities were the main determinants of the length of hospital stay and long-term outcomes after coronary artery bypass grafting.

Conflict of interest: Authors declare no conflict of interest.

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