

Predictors of adverse effects after coronary artery bypass grafting in patients with reduced left ventricular ejection fraction

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Abstract

Background: To determine adverse outcome and its specific perioperative predictors after coronary artery bypass grafting (CABG) in patients with reduced preoperative ejection fraction (EF).

Methods: This study included two propensity-score matched groups, each of 50 patients. Group I included patients with EF <50% and group II included patients with EF ≥50%. All patients underwent isolated, elective on-pump CABG between November 2014 and October 2016, at Assiut and Minia university hospitals. Preoperative, operative, postoperative and follow-up (6 months) data were collected and analyzed. The primary outcome was early 30 days mortality.

Results: Early mortality was 8% in group I and 4% in patients in group II. The proportion of low cardiac output syndrome (LCOS) in group I was significantly higher than group II (44% versus 26%, $P = 0.04$). At the end of 6 months follow-up, most of patients in group I had significant improvement of EF and NYHA class. On multivariate analysis the significant predictors of outcome in group I were insertion of IABP for early mortality, incomplete revascularization for LCOS, sternal wound infection and LCOS for prolonged hospital stay. Preoperative change in wall motion score following dobutamine stress echocardiography (DSE) had good predictive accuracy for early mortality.

Conclusions: Insertion of IABP, incomplete revascularization, wall motion scores on DSE, and postoperative LCOS are significant predictors of adverse outcome after CABG in patients with preoperative EF <50% and viable myocardium. A protocol approach should be established for such patients respecting perioperative risk factors.

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Abbreviations: AKI, acute kidney injury; AUC, area under curve; BMI, body mass index; CABG, coronary artery bypass grafting; CAD, coronary artery disease; CI, confidence interval; COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; DSE, dobutamine stress echocardiography; EF, ejection fraction; EuroSCORE, European system for cardiac operative risk evaluation; IABP, intra aortic balloon pump; LCOS, low cardiac output syndrome; LMS, left main stem; LOS, length of stay; LV, left ventricle; LVEDd, left ventricular end-diastolic diameter; LVEF, left ventricular ejection fraction; LVESd, left ventricular end-systolic diameter; MI, myocardial infarction; MR, mitral regurgitation; NYHA, New York Heart Association; OR, odds ratio; PCI, percutaneous coronary intervention; ROC, receiver operating characteristic curve; SD, standard deviation; SWI, sternal wound infection; TIA, transient ischemic attack; WMSI, wall motion score index.

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Keywords: Coronary artery bypass; Ventricular dysfunction; Complications; Mortality

1. Introduction

The decision for coronary artery bypass grafting (CABG) surgery is related to multiple factors mainly degree of angina, function of left ventricle (LV), burden of ischemia, and anatomy of coronaries [1].

Systolic function of LV is known as a predictor of in-hospital death after CABG [2]. The symptomatic benefit of CABG in patients with reduced ejection fraction (EF) is more likely to be obtained when the indication of surgery is angina and not heart failure [3]. Reduced preoperative EF could lead to high incidences of postoperative mortality and morbidity [4].

Multiple perioperative risk factors were reported to affect survival benefit and adverse events after CABG [5]. The aim of the present study was to evaluate and compare adverse outcome between patients undergoing CABG with reduced or normal left ventricular ejection fraction (LVEF), and to determine perioperative risk factors for early mortality and adverse events.

2. Patients and methods

This observational study was conducted at departments of Cardiothoracic Surgery in Assiut and Minia University Hospitals, between November 2014 and October 2016. The study included adult patients who underwent isolated, elective, on-pump CABG, and it excluded patients with concomitant valve replacement, previous cardiac surgery, redo-CABG, emergency surgery, hepatic failure, renal failure on dialysis, aneurysm repair, overt peripheral vascular disease, surgery for arrhythmia, repair of ventricular septal perforation, concomitant carotid artery surgery, and absence of myocardial viability.

During the study period, 116 out of 122 patients fulfilled our selection criteria, 66 of them had $EF \geq 50\%$ and 50 had $EF < 50\%$. After propensity-score matching for age, sex and extent of coronary disease, the study included 100 patients who were divided into 2 groups according to their preoperative EF. Group I included 50 patients with $EF < 50\%$ and group II included another 50 patients with $EF \geq 50\%$. The study considered the ethical principles of Helsinki Declaration. An approval from a research ethics committee and informed consents from patients were obtained.

Routine preoperative laboratory and radiological investigations for cardiac surgery were performed for all patients including angiographic and echocardiographic studies. Dobutamine Stress Echocardiography (DSE) was used to evaluate myocardial viability in patients with reduced EF. All patients underwent conventional on-pump CABG with standardized anesthetic technique. Surgeons preferred to use blood cardioplegia in most of cases with combined antegrade and retrograde routes. Echocardiography was repeated in the first week after surgery and at 6th month during the follow-up period.

The collected data included preoperative risk factors: Age, female gender, NYHA class, unstable angina, obesity, smoking, chronic pulmonary disease (COPD), hypertension, diabetes mellitus (DM), hypercholesterolemia, chronic systematic diseases, myocardial infarction, left main stem (LMS) disease, transient ischemic attack (TIA) or stroke, time delay in waiting list, and European system for cardiac operative risk evaluation (EuroSCORE). The primary outcome was the proportion of early in-hospital mortality which was defined as mortality during hospital admission in operative room or within 30 days after surgery.

The statistical analysis was carried out using SPSS, version 16.0 (SPSS, Chicago, IL, USA). Numeric data were expressed as mean \pm standard deviation (SD) and compared by t-student test, while categorical data were expressed as number and percent and compared by Chi-square test. Propensity score matching was done using R MatchIt package version 3.3.2. The Kaplan–Meier survival plot was used to illustrate the probability of surviving in a given length of time. The predictive accuracy of numeric continuous variables was estimated according to area under curve (AUC) using receiver operating characteristic (ROC) curve. To determine significant predictors of an adverse event, variables with significant P-value on univariate analysis were further analyzed using multivariate logistic regression. Outcomes with less than 5 events were excluded from analysis. Odds ratio (OR) and 95% confidence intervals (95% CI) were estimated. For each analysis, P-value < 0.05 was considered significant.

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