

Successful Anesthetic Management of Coronary Artery Bypass Graft Patients with Very Low Ejection Fraction: Two Case Reports

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Abstract

Introduction: The incidence of patients posted for coronary artery bypass graft (CABG) with low ejection fraction (EF) is on the rise. These patients present a challenge for the attending anesthesiologist in the perioperative period as they have a poor tolerance to the stress of anesthesia as well as surgery. Maintaining forward flow with avoidance of arrhythmias and hypotension is the primary goals of balanced anesthesia.

Case Report: We describe successful anesthetic management in two adult male patients with Very low EF undergoing CABG.

Conclusion: Both patients were successfully managed with pre-operative dobutamine infusion which improved the EF and intraoperative use of intra-aortic balloon pump which led to stable hemodynamics.

Keywords: Coronary artery bypass graft, low ejection fraction, dobutamine, intra-aortic balloon pump

Introduction

Providing safe anesthesia to patients posted for coronary artery bypass graft (CABG) has always been challenging in view of an already compromised cardiac status due to coronary insufficiency. Advanced age and comorbidities such as hypertension, diabetes mellitus, and hepatic and renal diseases further complicate smooth anesthetic induction and maintenance. Most of these patients with triple vessel disease have low ejection fraction (EF) (i.e., <30–35%) which require special precautions during perioperative period for safe outcome. Anesthetic management of two such cases with very low EF (20–25%) is presented here who underwent off-pump CABG (OPCABG) without any major adverse events.

Case Report

Case - 1

A 65-year-old, diabetic and hypertensive male, was admitted for CABG with a history of anterior wall myocardial infarction 4 months before admission. He had Grade 3

angina on exertion (AOE) for past 2 weeks, and his electrocardiogram depicted ST elevation in lead V1, V2, and T wave elevation in V3-V6. His coronary angiography report showed triple vessel disease with the right coronary artery 40% stenosed, left circumflex artery 90% (proximal), and left anterior descending (LAD) 100% (proximal) blockade. His blood sugar was well controlled with oral hypoglycemic agents, and blood pressure was controlled with antihypertensive agents. Echocardiography revealed failing left ventricular systolic function with an EF of 20–25% and hypokinetic anterolateral and inferior walls of the left ventricle. To optimize the patient for surgery, he was shifted to cardiothoracic and vascular surgery intensive care unit (CTVS-ICU) from ward 2 days prior surgery. Low-dose dobutamine (1 mcg/kg/min) was initiated through central venous catheter under intensive cardiac monitoring. 2 days after continuous dobutamine infusion, the patient's cardiac contractility improved considerably as revealed by a repeat

echocardiography. The patient had improved EF of 30–35% with a heart rate of 70 beats per minute before surgery.

Case - 2

A 62-year-old, hypertensive, non-diabetic male patient was admitted with chief complaint of Grade 3 AOE. Coronary angiography revealed coronary artery disease with triple vessel disease (with LAD artery, main 80% blocked). Echocardiogram showed trivial mitral regurgitation, tricuspid regurgitation, global hypokinesia, severe pulmonary artery hypertension, dilated cardiomyopathy with the left ventricular EF (LVEF) of 20–25%. He was planned for CABG. His blood pressure was controlled with medications. All his biochemical and hematological investigations were within normal limits. He was also shifted to CTVS-ICU, 2 days before surgery, and a low-dose dobutamine infusion (1 mcg/kg/min) was started to improve his cardiac contractility under strict cardiac monitoring. 2 days later, his echo showed improvement in LVEF of 30–35%. Both patients were on beta-

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blockers, statins, and aspirin, of which beta-blockers and statins were continued till the morning of surgery. The patients were taken to operation theater with continuous dobutamine infusion on flow. For induction of general anesthesia, injection fentanyl (4 mcg/kg), injection morphine (0.15 mg/kg), and etomidate (0.2 mg/kg) were used. Injection vecuronium bromide was used for muscle relaxation (0.1 mg/kg) and airway was secured for intraoperative ventilation. Anesthesia was maintained with oxygen-air mixture and isoflurane. After anesthetic induction, intra-aortic balloon pump (IABP) was inserted through the femoral artery and started at 1:1 mode in both the cases. An off-pump CABG was performed using arterial as well as venous grafts as required. The total duration of anesthesia was about 5.5 h. Additional inotropes such as epinephrine, dopamine, or norepinephrine were not required, rather nitroglycerin infusion was started intraoperatively which was continued even in post-operative period. Low-dose dobutamine was continued till the end of surgery and then stopped. IABP was continued in post-operative period for approximately 48 h and then removed. Patients were gradually weaned off ventilator in ICU without any major adverse event and were transferred to ward on the 3rd post-operative day.

Discussion

Dobutamine is predominantly beta-1-adrenergic agent, making it a potent inotrope useful in stimulating the rate and the force of cardiac contraction with less arrhythmogenic potential. It has been utilized in the treatment of acute myocardial and congestive heart failure as it causes marked improvement in cardiac output and stroke volume without increase in heart rate [1]. Dobutamine in low doses reduces afterload, whereas doses above 5 mcg/kg produce coronary and peripheral

vasoconstriction, thus leading to excessive tachycardia [2]. CABG in patients with low EF along with perioperative arrhythmias invites higher post-operative complications and mortality [3, 4]. Low EF is included in all scoring systems predicting morbidity and mortality, and per se, it is the strongest predictor of a poor outcome. Therefore, all the attempts should be made to improve and stabilize the EF before surgery. Low EF not only predicts a poor surgical outcome but also is a nightmare for the anesthesiologist during induction as well as intraoperatively in OPCABG. In our pursuit, for a smooth and event-free induction of general anesthesia, we give high-dose opioids (morphine and fentanyl) and cardiostable induction agents like etomidate, still there are episodes of hypotension and sometimes arrhythmias. Patients with failing heart or decreased systolic contractility can have an adverse outcome in such a scenario. A prospective, non-randomized, observational study was conducted at a French cardiac surgery center in 2008, to estimate the influence of perioperative (intra- and post-operative) use of dobutamine on major cardiac morbidity and mortality after cardiac surgery [5]. The authors concluded that perioperative use of dobutamine based on the clinical judgment of the attending anesthesiologist is associated with adverse post-operative cardiac outcome. However, the drawbacks of this study, as the authors themselves explained that it was a non-randomized study and all the patients were low-risk patients, where the hemodynamic instability could be because of hypovolemia or sometimes isolated vascular dysfunction, where the use of dobutamine is not required [5]. Moreover, all these cases were done using CPB, whereas our two cases were done OP. We started low-dose dobutamine in our patients prophylactically 2 days before surgery to improve the cardiac contractility preoperatively, thereby

increasing the EF without any chronotropic effect. Both these patients were on chronic beta-blocker therapy which also helped them in offsetting any tachycardia. Increased and stabilized EF helped us during the induction of anesthesia, as there was no undue decrease in blood pressure or heart rate. A heart rate of 70–80 beats per minute and mean arterial pressure of 70 mmHg were maintained throughout induction and intubation. Soon after induction, IABP was inserted which further helped us in maintaining BP during OP cardiac surgery. The functioning of IABP involves inflation during diastole leading to increased diastolic pressure and reduced afterload during systole because of deflation of balloon. This improves myocardial perfusion and cardiac output along with decreased myocardial oxygen consumption [6]. Role of pre-operative insertion of IABP in reducing hospital mortality and low cardiac output syndrome has already been proved by meta-analysis of randomized controlled trials [7, 8, 9].

Conclusion

In our experience of these two cases where pre-operative EF was very low, the use of dobutamine infusion and IABP preoperatively helped us in achieving a smooth induction and stable intraoperative hemodynamics. Whether routine use of dobutamine preoperatively in patients with low EF optimizes the myocardial function and improves the outcome requires randomized controlled studies.

Clinical Message

Patients with very low EF can be successfully managed with pre-operative dobutamine infusion and early use of IABP to maintain stable hemodynamics perioperatively.

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