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Original Research Article

# COMPARATIVE EVALUATION OF PROPOFOL AND ETOMIDATE ON HEMODYNAMIC STABILITY DURING INDUCTION FOR ELECTIVE CORONARY ARTERY BYPASS GRAFT SURGERY

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ABSTRACT

**Background:** Patients undergoing coronary artery bypass graft (CABG) surgery are highly susceptible to hemodynamic instability during induction of anesthesia and endotracheal intubation. The choice of induction agent plays a crucial role in minimizing cardiovascular fluctuations and ensuring perioperative safety. This study was designed to compare the effects of propofol and etomidate on hemodynamic parameters and their ability to attenuate the pressor response during elective CABG surgery.

**Materials and Methods:** This prospective observational study included 100 patients aged 45–65 years scheduled for elective CABG. Participants were equally divided into two groups: Group A received propofol (2 mg/kg) and Group B received etomidate (0.3 mg/kg) for induction. Hemodynamic parameters heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were recorded at baseline, post-induction, during intubation, and at 3 and 5 minutes post-intubation. Data were analysed using appropriate statistical methods.

**Results:** Propofol caused significant reductions in HR, SBP, DBP, and MAP following induction, along with marked fluctuations during intubation. Etomidate demonstrated greater hemodynamic stability with minimal variations across all time points. The pressor response to laryngoscopy and intubation was significantly attenuated in the etomidate group compared to the propofol group.

**Conclusion:** Etomidate provides superior hemodynamic stability and better attenuation of pressor response compared to propofol in patients undergoing CABG, making it a preferable induction agent in high-risk cardiac patients.

**Keywords:** Coronary artery bypass grafting, Propofol, Etomidate, Hemodynamic stability, Pressor response, Cardiac anesthesia.

## INTRODUCTION

Coronary artery disease (CAD) remains one of the leading causes of morbidity and mortality worldwide, accounting for a substantial proportion of cardiovascular-related deaths. It is characterized by progressive atherosclerotic narrowing of the coronary arteries, resulting in impaired myocardial perfusion and oxygen supply. Clinically, CAD manifests as a spectrum ranging from stable angina to acute coronary syndromes, including myocardial infarction, and often necessitates revascularization procedures in advanced stages.[1,2] Among the available treatment modalities, coronary artery bypass grafting (CABG) continues to be a well-established and effective surgical intervention for

restoring myocardial blood flow, particularly in patients with multivessel disease or left main coronary artery involvement.[3]

Despite advances in surgical techniques and perioperative care, patients undergoing CABG are particularly vulnerable to hemodynamic instability, especially during the induction of anesthesia and tracheal intubation. These phases are associated with intense sympathetic stimulation, leading to abrupt increases in heart rate and blood pressure, which can precipitate myocardial ischemia in patients with compromised coronary circulation.[4] Conversely, excessive depression of cardiovascular function during induction may result in hypotension, reduced coronary perfusion, and adverse perioperative outcomes. Therefore, the selection of an ideal anesthetic induction agent is critical in maintaining a delicate balance between preventing hypertensive responses and avoiding cardiovascular depression.

Intravenous agents such as propofol and etomidate are commonly used for induction of anesthesia in cardiac surgical practice. Propofol is widely favoured due to its rapid onset, smooth induction profile, and antiemetic properties. However, it is known to cause significant dose-dependent hypotension by reducing systemic vascular resistance and suppressing sympathetic activity.[5] In contrast, etomidate is recognized for its cardiovascular stability, as it preserves autonomic reflexes and maintains hemodynamic parameters within near-normal ranges, making it particularly suitable for high-risk cardiac patients.[6]

Several studies have compared the hemodynamic effects of these agents during cardiac surgery, with many suggesting that etomidate provides superior stability during induction and intubation, whereas propofol may be associated with greater fluctuations in blood pressure and heart rate.[7,8] However, variations in study design, patient populations, and anesthetic protocols necessitate further evaluation to establish optimal induction strategies, particularly in elective CABG settings.

In this context, the present study was undertaken to compare the hemodynamic responses of propofol and etomidate during induction of anesthesia in patients undergoing elective CABG surgery, with a specific focus on their ability to attenuate the pressor response to laryngoscopy and maintain perioperative cardiovascular stability.

## MATERIALS AND METHODS

The present prospective, comparative, observational study was conducted at Apollo Institute of Medical Sciences and Research, Hyderabad, Telangana in association with Sri Venkateshwara College of Pharmacy, Madhapur, Hyderabad from January 2025 to February 2026. A total of 100 adult patients scheduled for elective CABG surgery were enrolled in the study. Participants were recruited after obtaining informed written consent. The study population included both male and female patients within the age group of 45 to 65 years, representing a typical demographic affected by coronary artery disease.

**Inclusion Criteria:** Patients were considered eligible for inclusion if they met the following criteria i.e. aged between 45-65 years, scheduled for elective CABG surgery, diagnosed with coronary artery disease with preserved left ventricular function and willingness to provide informed consent

**Exclusion Criteria:** Patients were excluded from the study if they had known hypersensitivity or contraindications to propofol or etomidate, moderate to severe left ventricular dysfunction, significant hepatic or renal impairment, history of bleeding disorders or coagulopathies, and any condition that could interfere with hemodynamic assessment.

Written informed consent was obtained from study participants and study protocol was approved by the institutional ethics committee.

Participants were allocated into two equal groups (n=50 each) based on the induction agent administered. Group A received intravenous propofol at a dose of 2 mg/kg body weight and Group B received intravenous etomidate at a dose of 0.3 mg/kg body weight. All patients underwent standardized anesthetic protocols apart from the induction agent to minimize confounding variables.

Standard monitoring was applied to all patients in accordance with institutional protocols. The monitored parameters included are Heart rate (HR), Systolic blood pressure (SBP), Diastolic blood pressure (DBP), Mean arterial pressure (MAP), Electrocardiogram (ECG) and Oxygen saturation ($SpO_2$). Baseline measurements were recorded prior to induction. Induction of anesthesia was performed using the assigned study drug, followed by laryngoscopy and endotracheal intubation using standard techniques.

Hemodynamic parameters were recorded at predefined intervals to assess variations during different phases of anesthesia. Parameters were recorded at T1: Baseline (pre-induction), T2: Immediately after induction, T3: During laryngoscopy and endotracheal intubation, T4: 3 minutes post-intubation, T5: 5 minutes post-intubation. In addition to these parameters, any adverse events such as hypotension, bradycardia, arrhythmias, and need for add on dose support were documented.

**Statistical Analysis**

All collected data were systematically entered into Microsoft Excel spreadsheets and analysis was performed using SPSS v.26.0. Continuous variables were expressed as mean ± standard deviation (SD) and Categorical variables were presented as frequencies and percentages. Intergroup comparisons were performed using appropriate statistical tests (e.g., independent t-test). A p-value $< 0.05$ was considered statistically significant.

# RESULTS

**Table 1: Demographic and clinical profile of patients (n=100)**

| Demographic profile | Frequency | Percentage (%) |
|---|---|---|
| **Age (In years)** | | |
| 40-45 | 8 | 8% |
| 46-55 | 13 | 13% |
| 56-60 | 24 | 24% |
| 61-65 | 55 | 55% |
| **Gender** | | |
| Male | 80 | 80% |
| Female | 20 | 20% |
| **Diagnosis category** | | |
| CAD - Triple Vessel Disease | 48 | 48% |
| CAD - Single Vessel Disease | 43 | 43% |
| CAD - Double Vessel Disease | 5 | 5% |
| Others | 4 | 4% |

**Table 2: Mean heart Rate (BPM)**

| Time Point | Group A | Group B | p-value |
|---|---|---|---|
| | Mean ± SD | Mean ± SD | |
| T1 (Baseline) | 78 ± 6 | 76 ± 5 | 0.06 |
| T2 (Post-induction) | 65 ± 7 | 74 ± 6 | <0.0001 |
| T3 (Post-intubation) | 88 ± 8 | 80 ± 6 | <0.0001 |
| T4 (3 min) | 82 ± 7 | 77 ± 5 | 0.0002 |
| T5 (5 min) | 85 ± 6 | 76 ± 5 | 0.0001 |

Propofol produced a significant reduction in heart rate after induction, followed by a marked increase during intubation. In contrast, etomidate maintained relatively stable heart rate values throughout all stages.

**Table 3: Systolic blood pressure (mm of Hg)**

| Time Point | Group A | Group B | p-value |
|---|---|---|---|
| | Mean ± SD | Mean ± SD | |
| T1 | 132 ± 10 | 130 ± 9 | 0.29 |
| T2 | 95 ± 12 | 125 ± 10 | <0.0001 |
| T3 | 145 ± 15 | 135 ± 11 | 0.0004 |
| T4 | 118 ± 12 | 128 ± 10 | <0.0001 |
| T5 | 110 ± 11 | 122 ± 9 | <0.0001 |

A sharp fall in SBP was observed with propofol following induction, whereas etomidate maintained near-baseline levels. During intubation, propofol showed exaggerated hypertensive response compared to etomidate.

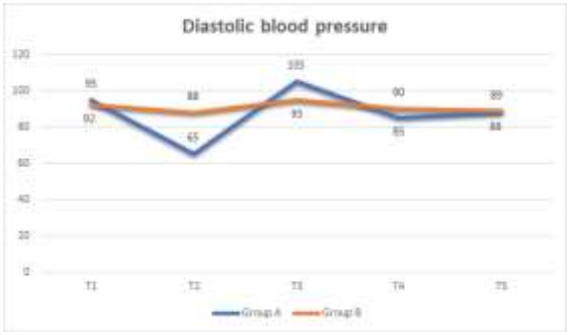


**Figure 1: Diastolic blood pressure (mm of Hg)**

Propofol caused marked diastolic hypotension post-induction, followed by rebound hypertension during intubation. Etomidate demonstrated minimal variation, indicating superior stability.

**Table 4: Mean arterial pressure (mm of Hg)**

| Time period | Group A | Group B | p-value |
|---|---|---|---|
| | Mean ± SD | Mean ± SD | |
| T1 | 95 ± 6 | 92 ± 5 | 0.01 |
| T2 | 65 ± 8 | 88 ± 6 | <0.0001 |
| T3 | 105 ± 9 | 95 ± 7 | <0.0001 |
| T4 | 85 ± 7 | 90 ± 6 | 0.0004 |
| T5 | 88 ± 6 | 89 ± 5 | 0.38 |

MAP showed significant fluctuations with propofol, including a steep fall after induction and a surge during intubation. Etomidate maintained MAP within a narrow physiological range, indicating better cardiovascular stability.

## DISCUSSION

The present study evaluated and compared the hemodynamic effects of propofol and etomidate during induction of anesthesia in patients undergoing elective coronary artery bypass grafting. The findings demonstrate that etomidate provides superior cardiovascular stability when compared to propofol, particularly during the critical phases of induction and endotracheal intubation.

Patients undergoing CABG represent a high-risk group due to compromised coronary perfusion and reduced myocardial reserve. Any fluctuation in heart rate or blood pressure during anesthesia induction may precipitate myocardial ischemia or adverse cardiac events. In this study, the majority of patients were older males with advanced coronary artery disease, consistent with epidemiological trends reported in previous cardiovascular studies.[1,2] The predominance of triple vessel disease further highlights the vulnerability of this cohort to hemodynamic perturbations.

A key observation in the present study was the significant reduction in heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) following induction with propofol. This hypotensive response can be attributed to propofol's known pharmacodynamic effects, including suppression of sympathetic nervous system activity, reduction in systemic vascular resistance, and impairment of baroreceptor reflexes.[9] Similar findings have been reported by Robinson et al., who demonstrated that propofol induces vasodilation and decreases preload and afterload, thereby contributing to hypotension during induction.[10]

In contrast, etomidate exhibited minimal alterations in hemodynamic parameters across all time points. The preservation of heart rate and blood pressure observed in the etomidate group is likely due to its minimal effect on sympathetic tone and its ability to maintain autonomic reflexes. Fragen et al. reported that etomidate maintains cardiovascular stability by exerting negligible effects on myocardial contractility and vascular resistance.[6] This pharmacological advantage makes etomidate particularly suitable for patients with limited cardiac reserve.

During laryngoscopy and tracheal intubation, a marked increase in heart rate and blood pressure was observed in the propofol group, reflecting a pronounced sympathetic response. Although propofol attenuates some stress responses, it may not adequately suppress the catecholamine surge associated with airway manipulation, especially when administered alone.[11] In contrast, the etomidate group demonstrated significantly attenuated pressor responses, indicating better control of peri-intubation stress. These findings are consistent with those reported by Pandey et al., who observed that etomidate provides more stable hemodynamics and reduced endocrine stress responses compared to propofol in CABG patients.[7]

Another important finding of this study was the greater variability in mean arterial pressure observed with propofol. Significant fluctuations in MAP can compromise coronary perfusion, particularly in patients with severe coronary artery disease. Etomidate, on the other hand, maintained MAP within a narrower physiological range, thereby ensuring more consistent organ perfusion. This observation aligns with previous studies that emphasize the role of etomidate in maintaining perioperative hemodynamic stability in cardiac surgical settings.[4]

The requirement for vasopressor support, although not quantitatively detailed in this study, was observed to be higher in the propofol group, further supporting the notion that propofol-induced hypotension may necessitate pharmacological intervention. This has important clinical implications, as excessive use of vasopressors may itself carry risks, including arrhythmias and increased myocardial oxygen demand.

Despite these findings, it is important to acknowledge certain limitations. The study was conducted at a single center with a relatively limited sample size, which may affect the generalizability of the results. Additionally, long-term outcomes such as postoperative cardiac complications and mortality were not evaluated. Future multicentric studies with larger sample sizes and extended follow-up periods are warranted to validate these findings and assess their impact on clinical outcomes.

In summary, the present study demonstrates that etomidate offers superior hemodynamic stability compared to propofol during induction of anesthesia in patients undergoing elective CABG. Its ability to maintain stable heart rate and blood pressure, attenuate the pressor response to intubation, and reduce the need for vasopressor support makes it a preferable induction agent in high-risk cardiac patients. These findings reinforce the importance of individualized anesthetic selection based on patient comorbidities and cardiovascular status.

## CONCLUSION

The present study demonstrates that the choice of induction agent significantly influences hemodynamic stability in patients undergoing elective coronary artery bypass graft surgery. Propofol was associated with marked reductions in heart rate, systolic and diastolic blood pressure, and mean arterial pressure following induction, along with pronounced fluctuations during laryngoscopy

and intubation. In contrast, etomidate maintained relatively stable hemodynamic parameters throughout the peri-induction period and effectively attenuated the pressor response to airway manipulation. These findings highlight the superior cardiovascular stability of etomidate, particularly in patients with compromised myocardial function. Given its minimal impact on systemic vascular resistance and preserved autonomic reflexes, etomidate appears to be a safer and more reliable induction agent in high-risk cardiac populations. Careful selection of anesthetic agents based on patient profile can improve intraoperative stability and potentially reduce perioperative complications.

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