Original Research

ASSESSMENT OF HEMODYNAMIC CHANGES AND RECOVERY PROFILE USING PROPOFOL VERSUS ETOMIDATE FOR INDUCTION OF GENERAL ANESTHESIA

Dr. Payal Uikey[1], Dr. Pravin Kanoje[2], Dr. Syed Zeb Raza[3*]
[1]Senior Resident, Department of Anaesthesiology, Mahaveer Institute of Medical Sciences, Bhopal, M.P.
[2]Assistant Professor, Department of Anaesthesiology Mahaveer Institute of Medical Sciences, Bhopal, M.P.
[3*]Senior Resident, Department of Anaesthesiology, Mahaveer Institute of Medical Sciences, Bhopal, M.P.
Corresponding Author: Dr. Syed Zeb Raza
Email: sahil.naqvi91@gmail.com

ABSTRACT

Background: Intravenous induction agents play a vital role in maintaining hemodynamic stability during general anesthesia. Propofol is commonly preferred because of its rapid onset and smooth recovery profile, although it frequently causes hypotension and cardiovascular depression. Etomidate is considered more hemodynamically stable and is often used in patients with compromised cardiovascular status.

Aim: To assess and compare the hemodynamic changes and recovery profile following induction of general anesthesia using propofol and etomidate.

Materials and Methods: A prospective comparative study was conducted among 120 adult patients undergoing elective surgeries under general anesthesia. Patients were randomly divided into two groups of 60 each. Group A received propofol 2 mg/kg intravenously, while Group B received etomidate 0.3 mg/kg intravenously for induction. Hemodynamic parameters including heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were recorded at baseline, after induction, and after intubation. Recovery profile and adverse effects were also evaluated.

Results: Group B demonstrated significantly greater hemodynamic stability compared to Group A. The reduction in MAP after induction was significantly higher in Group A ($p<0.001$). Recovery time was shorter in Group A than Group B ($p<0.05$). Injection pain was more common in Group A, whereas myoclonus was observed predominantly in Group B.

Conclusion: Etomidate provided superior hemodynamic stability during induction of general anesthesia, whereas propofol showed a faster recovery profile. Etomidate may be considered a safer induction agent in patients where cardiovascular stability is a major concern.

Keywords: General Anesthesia, Propofol, Etomidate, Hemodynamic Stability, Recovery Profile, Intravenous Induction Agents.

INTRODUCTION

General anesthesia induction agents significantly influence perioperative cardiovascular stability and postoperative recovery outcomes. An ideal induction agent should provide rapid onset, adequate hypnosis, cardiovascular stability, and smooth recovery with minimal adverse effects. Propofol and etomidate are among the most frequently used intravenous induction agents in modern anesthetic practice [1].

www.ajmrhs.com
eISSN: 2583-7761

Date of Received: 12-04-2026
Date Acceptance: 19-04-2026
Date of Publication: 13-05-2026

Propofol is widely utilized because of its rapid induction, antiemetic properties, and smooth recovery characteristics. However, it commonly produces dose-dependent hypotension and myocardial depression due to decreased systemic vascular resistance and suppression of sympathetic activity [2]. These hemodynamic effects may become clinically significant in elderly individuals and patients with limited cardiac reserve.

Etomidate is an imidazole-derived intravenous anesthetic agent known for preserving cardiovascular stability during induction. It causes minimal changes in heart rate, cardiac output, and blood pressure, making it especially useful in critically ill and hemodynamically unstable patients [3]. Nevertheless, etomidate has been associated with adverse effects such as myoclonus,

postoperative nausea and vomiting, and transient adrenal suppression [4].

Laryngoscopy and endotracheal intubation are associated with sympathetic stimulation leading to tachycardia and hypertension. The choice of induction agent therefore becomes important in minimizing these stress responses and maintaining stable perioperative hemodynamics [5]. Several recent comparative studies have evaluated propofol and etomidate regarding their cardiovascular effects and recovery profiles, with etomidate consistently demonstrating superior hemodynamic stability [6,7].

Despite the widespread use of these agents, there remains variability in clinical preference due to differences in recovery characteristics and adverse effect profiles.

Therefore, the present study was undertaken to compare propofol and etomidate with respect to hemodynamic changes and postoperative recovery during induction of general anesthesia.

MATERIALS AND METHODS

This prospective comparative study was conducted in the Department of Anesthesiology at Mahavir Institute of Medical Sciences, Bhopal, over a period of one year after obtaining written informed consent from all patients. A total of 120 patients undergoing elective surgeries under general anesthesia were included in the study.

Patients were randomly divided into two groups:

- Group A (n=60): Received propofol 2 mg/kg intravenously for induction
- Group B (n=60): Received etomidate 0.3 mg/kg intravenously for induction

Inclusion Criteria

- Patients aged between 18 and 60 years, Either gender
- ASA physical status I and II
- Elective surgical procedures under general anesthesia
- Patients willing to provide informed consent

Exclusion Criteria

- ASA physical status III and IV
- Known cardiac disease, Hepatic or renal dysfunction
- History of allergy to study drugs
- Pregnant and lactating women
- Patients receiving corticosteroids or beta blockers
- Patients not willing to provide informed consent

Anesthetic Technique: All patients were kept nil per oral for 8 hours before surgery. Standard monitoring including ECG, pulse oximetry, and non-invasive blood pressure was applied. Baseline hemodynamic parameters were recorded.

Patients were premedicated with glycopyrrolate, midazolam, and fentanyl intravenously. Induction was performed using the assigned study drug according to group allocation. Endotracheal intubation was facilitated with succinylcholine.

Hemodynamic parameters were recorded at:

- Baseline
- After induction
- One minute after intubation
- Five minutes after intubation

Recovery profile was assessed by:

- Time to spontaneous eye opening
- Response to verbal commands
- Recovery score

Adverse effects including hypotension, bradycardia, injection pain, myoclonus, nausea, and vomiting were recorded.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using SPSS software version 25. Quantitative variables were expressed as mean ± standard deviation (SD), while qualitative variables were expressed as percentages. Student's t-test was used for comparison of continuous variables, and Chi-square test was applied for categorical variables. A p-value less than 0.05 were considered statistically significant.

RESULTS

A total of 120 patients were included in the study and were equally divided into Group A and Group B, with 60 patients in each group. Both groups were comparable with respect to demographic characteristics and baseline hemodynamic parameters. Hemodynamic changes, recovery profile, and adverse effects were assessed and compared between the two groups.

Table 1: Demographic Characteristics of Study Participants

Parameter	Group A (n=60)	Group B (n=60)	p-value
Mean Age (years)	41.6 ± 10.2	42.1 ± 9.7	0.78
Male/Female	34/26	36/24	0.71
Mean Weight (kg)	64.3 ± 8.5	63.8 ± 7.9	0.74
ASA I/II	38/22	40/20	0.69

Both groups were comparable regarding age, gender distribution, body weight, and ASA grading, indicating uniform baseline characteristics.

Table 2: Comparison of Mean Arterial Pressure (MAP)

Time Interval	Group A (n=60)	Group B (n=60)	p-value

Baseline	95.4 ± 7.2	94.9 ± 6.8	0.73
After Induction	71.8 ± 5.7	88.3 ± 5.6	<0.001
1 Minute After Intubation	82.1 ± 6.4	92.2 ± 5.9	<0.001
5 Minutes After Intubation	86.4 ± 6.1	91.0 ± 5.5	0.002

Group A demonstrated a significantly greater fall in MAP following induction compared to Group B, indicating better hemodynamic stability with etomidate.

Table 3: Recovery Profile and Adverse Effects

Parameter	Group A (n=60)	Group B (n=60)	p-value
Recovery Time (minutes)	8.3 ± 2.0	11.1 ± 2.5	<0.001
Injection Pain (%)	31.7%	8.3%	0.002
Myoclonus (%)	1.7%	21.7%	<0.001
Nausea/Vomiting (%)	6.7%	11.7%	0.34

Recovery was significantly faster in Group A, whereas myoclonus occurred more frequently in Group B. Injection pain was significantly higher in Group A.

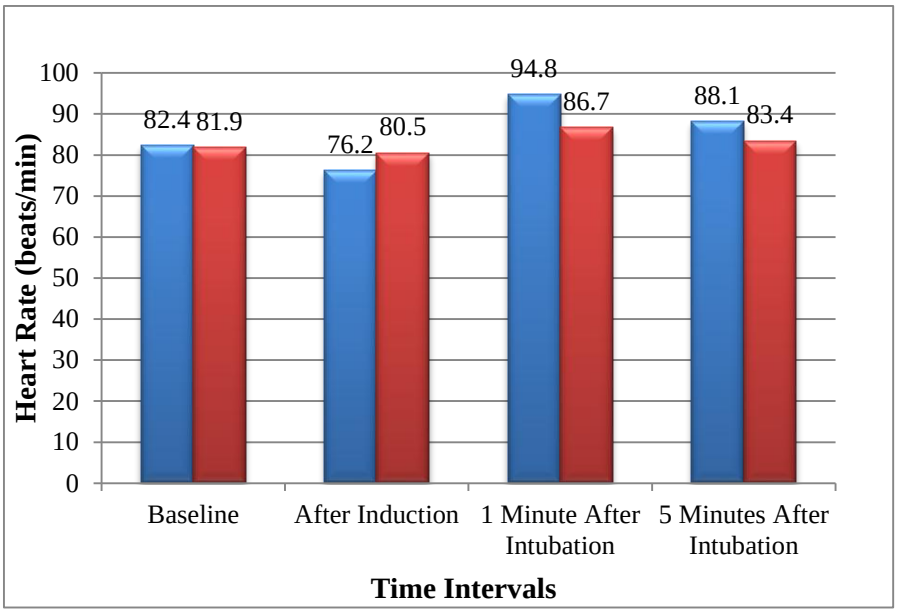

Figure 1: Comparison of Heart Rate Changes between Groups

Heart rate increased significantly after intubation in Group A compared to Group B, indicating better attenuation of intubation-induced stress response in Group B.

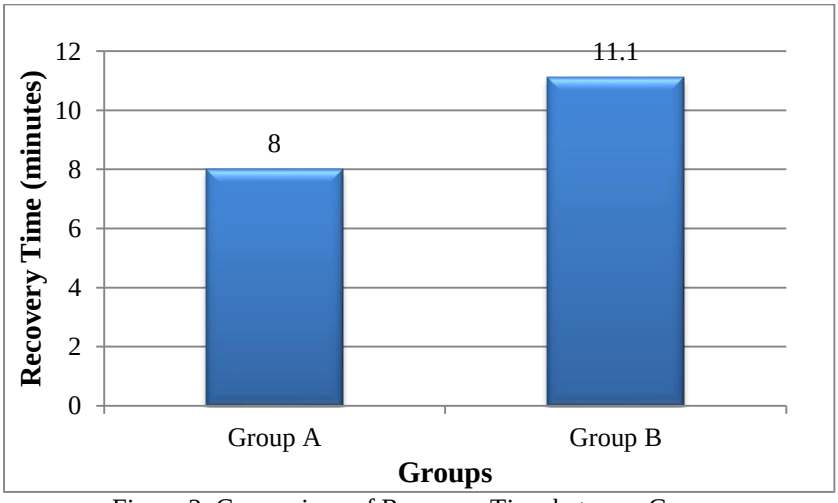

Figure 2: Comparison of Recovery Time between Groups

Patients in Group A achieved earlier recovery compared to those in Group B following induction of anesthesia.

DISCUSSION

The choice of intravenous induction agent plays a crucial role in determining perioperative hemodynamic stability and postoperative recovery. In the present study, propofol and etomidate were compared with regard to cardiovascular responses, recovery characteristics, and adverse effects during induction of general anesthesia.

The findings demonstrated that etomidate maintained significantly greater hemodynamic stability compared to propofol. Patients receiving propofol showed a marked reduction in mean arterial pressure immediately after induction, whereas those induced with etomidate maintained relatively stable blood pressure values throughout the observation period. These results are comparable with the findings reported by Dai et al. [8], who observed superior cardiovascular stability with etomidate in patients undergoing major surgical procedures. The minimal effect of etomidate on myocardial contractility and sympathetic tone may contribute to its stable hemodynamic profile.

Heart rate changes following laryngoscopy and endotracheal intubation were also less pronounced in the etomidate group. Laryngoscopy and intubation are associated with sympathetic stimulation, resulting in tachycardia and hypertension, which may be harmful in patients with limited cardiac reserve. Similar observations were reported by Ye et al. [9], who found that etomidate provided better attenuation of stress responses and improved cardiovascular stability compared to propofol during anesthetic procedures.

Recovery analysis in the present study revealed significantly faster recovery in patients receiving propofol. This may be attributed to the rapid redistribution and clearance characteristics of propofol, leading to earlier awakening and smoother recovery. Comparable findings were reported by Giri et al. [10], who demonstrated improved postoperative recovery characteristics and shorter recovery duration with propofol-based induction.

With regard to adverse effects, injection pain was observed more frequently in the propofol group, whereas myoclonus occurred predominantly in patients receiving etomidate. Propofol-associated injection pain is a well-recognized adverse effect related to vascular irritation, while etomidate-induced myoclonus is believed to result from transient subcortical disinhibition during induction. Similar patterns of adverse effects were described by Aggarwal et al. [11] in their comparative evaluation of propofol and etomidate.

The present findings further support the view that etomidate is a valuable induction agent in patients where preservation of cardiovascular stability is important. On the other hand, propofol continues to offer advantages in terms of rapid recovery and smoother emergence from anesthesia. Therefore, the selection of induction agent should be individualized according to patient characteristics, perioperative risk factors, and anesthetic requirements [4,12].

CONCLUSION

Etomidate demonstrated significantly better hemodynamic stability during induction and intubation compared to propofol. Propofol, however, was associated with faster postoperative recovery. Although injection pain was more common with propofol, etomidate showed a higher incidence of myoclonus. Based on the present study, etomidate may be considered the preferred induction agent in patients with cardiovascular compromise or anticipated hemodynamic instability, whereas propofol remains an excellent choice for procedures requiring rapid recovery and smooth emergence from anesthesia.

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How to cite this article: Dr. Payal Uikey, Dr. Pravin Kanoje, Dr. Syed Zeb Raza, ASSESSMENT OF HEMODYNAMIC CHANGES AND RECOVERY PROFILE USING PROPOFOL VERSUS ETOMIDATE FOR INDUCTION OF GENERAL ANESTHESIA, Asian J. Med. Res. Health Sci., 2026; 4 (2):-194-198.
Source of Support: Nil, Conflicts of Interest: None declared.