e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(1); 691-696

Original Research Article

Propofol versus Etomidate for Induction of Anesthesia in Adult Surgical Patients: A Randomized Study

Sachin Ramesh Gondane[1], Rashmi Shankarrao Jawanjal[2], Nitin Ramesh Gondane[3]

[1]Assistant Professor, Department of Anaesthesia, Dr. Rajendra Gode Medical College and hospital, Amravati, Maharashtra, India

[2]Assistant Professor, Department of Anaesthesia, Dr PDMMC hospital Amravati, Maharashtra India

[3]Senior Resident, Department of Anaesthesia, Rajmata Jijau Maternity and Child Hospital, Airoli, Navi Mumbai, Maharashtra India

Received: 26-11-2025 / Revised: 25-12-2025 / Accepted: 26-01-2026

Corresponding Author: Dr. Sachin Ramesh Gondane

Conflict of interest: Nil

Abstract:

Background: Induction of general anesthesia is frequently associated with hemodynamic fluctuations, which may be clinically significant, particularly in susceptible patients. Propofol and etomidate are commonly used intravenous induction agents with differing cardiovascular effects. This study aimed to compare the hemodynamic responses and adverse effect profile of propofol and etomidate during induction of anesthesia in adult surgical patients.

Material and Methods: This prospective, randomized study included 60 adult patients (ASA physical status I–II) scheduled for elective surgery under general anesthesia. Patients were randomly allocated into two equal groups: Group P received propofol (2 mg/kg) and Group E received etomidate (0.3 mg/kg) for induction. Heart rate and mean arterial pressure were recorded at baseline, after induction, immediately after intubation, and at 1, 3, 5, and 10 minutes post-intubation. Adverse events such as hypotension, bradycardia, pain on injection, myoclonus, and need for vasopressor support were documented. Statistical analysis was performed using appropriate parametric and non-parametric tests, with a p value <0.05 considered significant.

Results: Demographic variables and baseline hemodynamic parameters were comparable between the two groups. Following induction, heart rate and mean arterial pressure were significantly lower in the propofol group compared to the etomidate group. Post-intubation increases in heart rate and means arterial pressure were observed in both groups, with significantly higher values in the propofol group during the early post-intubation period. Hypotension and pain on injection were significantly more frequent with propofol, whereas myoclonus occurred exclusively in the etomidate group. A higher proportion of patients in the propofol group required vasopressor support, although this difference was not statistically significant.

Conclusion: Etomidate provides superior hemodynamic stability during induction of anesthesia compared to propofol, while propofol is associated with a higher incidence of hypotension and pain on injection. Etomidate may therefore be preferred when cardiovascular stability is a priority.

Keywords: Propofol; Etomidate; Induction of Anesthesia; Hemodynamic Stability; Randomized Study.

DOI: 10.25258/ijcpr.18.1.116

Introduction

Induction of general anesthesia is a vulnerable period marked by rapid transitions in autonomic tone and vascular capacitance, during which clinically meaningful hypotension can occur even in elective surgical populations. Contemporary randomized evidence in higher-risk elective surgery patients has shown that propofol-based total intravenous anesthesia is associated with a greater burden of post-induction hypotensive events and more frequent vasopressor administration compared with an alternative hypnotic strategy, underscoring the clinical relevance of induction-related blood pressure reductions and their management in routine practice [1]. Given that peri-induction hemodynamic perturbations are common and potentially consequential, selection of an induction agent remains a practical modifiable factor for anesthesiologists.

Propofol is widely used because it provides rapid, smooth induction and favorable recovery characteristics; however, it is well recognized for dose-dependent vasodilation and myocardial depression, translating into peri-induction hypotension in susceptible patients. In a randomized controlled trial in cardiac surgical patients, propofol

produced a substantially greater reduction in mean arterial pressure after induction than etomidate, supporting the perception that etomidate offers superior immediate hemodynamic stability in settings where cardiovascular reserve may be limited [2]. Consistent with this, a recent systematic review and meta-analysis of randomized trials in adult cardiac surgery found that etomidate was associated with a more stable hemodynamic profile and a reduced likelihood of vasopressor requirement after induction and intubation compared with other induction agents, although clear improvements in "hard" clinical outcomes were not demonstrated [3].

Despite these hemodynamic advantages, etomidate has specific adverse effect concerns that influence its use. Transient adrenocortical suppression after etomidate is a well-described pharmacologic effect and continues to be debated with respect to its clinical implications in perioperative populations [4]. Importantly, large randomized clinical trial data in older adults undergoing elective abdominal surgery showed that an etomidate-based anesthetic approach did not increase the overall rate of major in-hospital postoperative complications compared with propofol, while still demonstrating biochemical evidence of transient adrenocortical suppression [5]. In addition, etomidate is associated with involuntary myoclonic movements during induction, and randomized work has specifically evaluated strategies to reduce this effect, reflecting its practical relevance during routine induction [6]. Conversely, propofol is frequently accompanied by pain on injection, and systematic review-level evidence confirms that propofol injection pain is common enough to warrant preventive pharmacologic measures in many protocols [7].

In this context, the present randomized study was designed to compare propofol and etomidate for induction of anesthesia in adult surgical patients, focusing on peri-induction hemodynamic responses and clinically relevant adverse effects during induction and early post-intubation period.

Material and Methods

Study Design and Setting: This prospective, randomized, comparative study was conducted at a tertiary care teaching hospital. Written informed consent was obtained from all participants prior to enrollment. The study adhered to the principles outlined in the Declaration of Helsinki.

Study Population: Adult patients aged 18–60 years of either sex, scheduled to undergo elective surgical procedures under general anesthesia, were assessed for eligibility. Only patients classified as American Society of Anesthesiologists (ASA) physical status I or II were included.

Inclusion Criteria

- Age between 18 and 60 years
- ASA physical status I or II
- Patients scheduled for elective surgery requiring general anesthesia with endotracheal intubation

Exclusion Criteria

- Known allergy or hypersensitivity to propofol or etomidate
- Anticipated difficult airway
- History of adrenal insufficiency, epilepsy, or seizure disorders
- Significant cardiovascular, hepatic, renal, or endocrine disease
- Pregnant or lactating women
- Patients receiving chronic steroid therapy or sedative medications

Sample Size Calculation: The sample size was calculated based on the expected difference in mean arterial pressure following induction between the two groups, as reported in previous studies. Assuming a confidence level of 95% and a study power of 80%, a minimum of 54 patients were required. To account for potential dropouts, a total of 60 patients were enrolled and randomly allocated into two equal groups of 30 patients each.

Randomization and Group Allocation: Patients were randomly assigned into one of two groups using a computer-generated randomization sequence. Allocation concealment was ensured using sealed opaque envelopes opened immediately before induction of anesthesia.

- **Group P (Propofol group):** Patients received propofol for induction of anesthesia
- **Group E (Etomidate group):** Patients received etomidate for induction of anesthesia

Preoperative Preparation: All patients underwent a thorough preanesthetic evaluation one day prior to surgery, including detailed history, physical examination, and routine laboratory investigations. Patients were kept nil per oral according to standard fasting guidelines. No sedative premedication was administered on the morning of surgery.

Anesthesia Protocol: Upon arrival in the operating room, standard monitoring was instituted, including electrocardiography, non-invasive blood pressure, pulse oximetry, and capnography. Baseline heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation were recorded. All patients received intravenous premedication with glycopyrrolate 0.004 mg/kg, midazolam 0.02 mg/kg, and fentanyl 2 μg/kg.

Induction of anesthesia was performed as follows:

- **Group P:** Propofol administered intravenously at a dose of 2 mg/kg
- **Group E:** Etomidate administered intravenously at a dose of 0.3 mg/kg

The induction agent was injected slowly over 30–60 seconds until loss of verbal response. After confirmation of adequate mask ventilation, neuromuscular blockade was achieved using vecuronium bromide 0.1 mg/kg to facilitate endotracheal intubation. Anesthesia was maintained with oxygen, nitrous oxide, and a volatile anesthetic agent as per institutional protocol. Ventilation was adjusted to maintain normocapnia throughout the procedure.

Hemodynamic Monitoring: Heart rate and blood pressure parameters were recorded at the following time points:

- Baseline (before induction)
- After induction
- Immediately after endotracheal intubation
- At 1, 3, 5, and 10 minutes post-intubation

Any episodes of hypotension, bradycardia, myoclonus, pain on injection, or other adverse events were noted and managed according to standard clinical practice.

Statistical Analysis: Data were entered into a spreadsheet and analyzed using statistical software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as numbers and percentages. Intergroup comparisons were performed using the independent Student's t-test for continuous variables and the chi-square test for categorical variables. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 60 patients were enrolled and randomized equally into the propofol group (Group P, n = 30) and the etomidate group (Group E, n = 30). All patients completed the study and were included in the final analysis.

The two groups were comparable with respect to age, sex distribution, body weight, ASA physical status, and duration of surgery. No statistically significant differences were observed between the groups for any of the baseline demographic or perioperative variables ($p > 0.05$), indicating homogeneity of the study population (Table 1).

Baseline heart rate values were similar between the two groups ($p = 0.81$). Following induction of anesthesia, a statistically significant reduction in heart rate was observed in Group P compared to Group E ($p = 0.01$). After endotracheal intubation, heart rate increased in both groups; however, Group P demonstrated significantly higher values compared to Group E ($p = 0.04$). At 1 minute post-intubation, the difference between the groups approached statistical significance ($p = 0.05$). No statistically significant differences were noted at 3, 5, and 10 minutes post-intubation ($p > 0.05$ for all) (Table 2).

Baseline mean arterial pressure was comparable between the two groups ($p = 0.67$). Following induction, Group P exhibited a marked reduction in mean arterial pressure compared to Group E, which was statistically significant ($p < 0.001$). Mean arterial pressure values remained significantly lower in Group P immediately after intubation and at 1 minute post-intubation ($p = 0.01$ for both). No statistically significant differences were observed at 3, 5, and 10 minutes following intubation ($p > 0.05$) (Table 3).

The incidence of hypotension was significantly higher in Group P compared to Group E ($p = 0.02$). Pain on injection was also more frequently observed in Group P ($p = 0.01$). Myoclonus occurred exclusively in Group E, with a statistically significant difference between the groups ($p = <0.01$). The incidence of bradycardia and postoperative nausea and vomiting did not differ significantly between the two groups ($p > 0.05$) (Table 4).

A greater proportion of patients in Group P required vasopressor support compared to Group E; however, this difference did not reach statistical significance ($p = 0.07$) (Table 5).

Table 1: Demographic Characteristics of the Study Population

Parameter	Group P (Propofol) (n = 30)	Group E (Etomidate) (n = 30)	p value
Age (years)	42.1 ± 9.6	41.4 ± 10.2	0.78
Gender (M/F)	18 / 12	17 / 13	0.79
Weight (kg)	64.8 ± 7.9	65.3 ± 8.1	0.81
ASA I / II	19 / 11	20 / 10	0.79
Duration of surgery (min)	74.5 ± 18.6	76.2 ± 17.9	0.71

Table 2: Comparison of Heart Rate (beats per minute) Between Groups

Time Point	Group P (Propofol)	Group E (Etomidate)	p value
Baseline	82.6 ± 8.4	83.1 ± 7.9	0.81
Post-induction	76.2 ± 7.6	81.4 ± 7.2	**0.01**
Post-intubation	92.8 ± 9.1	88.6 ± 8.5	0.04
1 min	90.3 ± 8.8	86.2 ± 7.9	0.05
3 min	87.1 ± 8.2	84.1 ± 7.6	0.12
5 min	84.5 ± 7.9	83.2 ± 7.4	0.52
10 min	82.9 ± 7.6	82.1 ± 7.2	0.68

Table 3: Comparison of Mean Arterial Pressure (mmHg) Between Groups

Time Point	Group P (Propofol)	Group E (Etomidate)	p value
Baseline	93.4 ± 6.8	94.1 ± 7.1	0.67
Post-induction	78.6 ± 6.2	89.7 ± 6.5	**<0.01**
Post-intubation	88.9 ± 7.4	93.8 ± 7.2	0.01
1 min	87.2 ± 6.9	92.1 ± 6.8	0.01
3 min	89.6 ± 6.5	91.3 ± 6.2	0.28
5 min	91.2 ± 6.3	92.4 ± 6.1	0.46
10 min	92.6 ± 6.1	93.1 ± 5.9	0.73

Table 4: Incidence of Adverse Effects

Adverse Event	Group P (n = 30)	Group E (n = 30)	p value
Hypotension	9 (30.0%)	2 (6.7%)	**0.02**
Bradycardia	4 (13.3%)	2 (6.7%)	0.38
Pain on injection	8 (26.7%)	1 (3.3%)	**0.01**
Myoclonus	0 (0%)	7 (23.3%)	**<0.01**
Nausea/Vomiting	3 (10.0%)	2 (6.7%)	0.64

Table 5: Requirement of Vasopressor Support

Parameter	Group P	Group E	p value
Patients requiring vasopressor	7 (23.3%)	2 (6.7%)	0.07

Discussion

In the present randomized comparison, etomidate produced a more stable hemodynamic profile during induction than propofol, with a significantly smaller fall in mean arterial pressure immediately after induction and fewer hypotensive events. This pattern aligns with contemporary clinical evidence showing higher hypotension rates with propofol-based induction compared with etomidate in adult populations, including older surgical patients, where propofol has been associated with a greater frequency of induction-related hypotension while etomidate preserves blood pressure more consistently [8]. A similar direction of effect has been reported in patients with coronary heart disease undergoing major non-cardiac surgery, where an etomidate-based anesthetic approach was associated with smaller hemodynamic changes than propofol-based anesthesia [9]. Although our cohort comprised ASA I–II adults, the observed early post-induction divergence in mean arterial pressure is concordant with evidence from more physiologically vulnerable groups, suggesting that the principal difference between these agents is most apparent in the immediate induction window rather than later intraoperative time points.

The heart rate response in our study also differed mainly around induction and immediately after tracheal intubation, after which values converged. In a neuroanesthesia context, etomidate has been reported to reduce post-induction hypotension compared with propofol in patients with cerebral cavernous malformations and impaired autonomic regulation, emphasizing that etomidate's relative stability may be particularly relevant when autonomic compensation is limited [10]. Taken together, these data support the view that propofol-associated vasodilation and myocardial depressant effects translate clinically into greater early blood pressure reduction, whereas etomidate tends to preserve systemic pressure during induction.

Despite these hemodynamic advantages, etomidate's adverse-effect profile remains an important practical consideration. In our study, myoclonus was observed only with etomidate. This is consistent with the broader randomized literature addressing etomidate-induced myoclonus as a common induction-related phenomenon requiring preventive strategies, summarized in a recent systematic review and Bayesian network meta-analysis of randomized trials evaluating pharmacologic interventions to prevent etomidate-

induced myoclonus [11]. In addition, an esketamine pretreatment trial demonstrated a significant reduction in both incidence and severity of etomidate-induced myoclonus compared with control, reinforcing that the event is frequent enough to be clinically targeted and modifiable [12]. Although we did not test preventive regimens, the direction of our findings supports anticipating myoclonus when etomidate is selected and considering mitigation measures in appropriate settings.

Propofol, conversely, was associated with a higher rate of pain on injection in our cohort. Contemporary observational work has characterized clinical factors associated with propofol injection pain, reflecting the ongoing relevance of this adverse effect in routine practice and supporting the need for procedural or pharmacologic prevention depending on patient and setting [13]. Our results are therefore consistent with established clinical experience that injection pain is more prominent with propofol formulations, while etomidate's immediate tolerability concerns more often relate to myoclonus.

A further consideration with etomidate is transient adrenocortical suppression. A detailed pharmacokinetic/pharmacodynamic review describes that even a single bolus dose can suppress adrenal steroidogenesis for hours, with typical suppression reported in the range of approximately 6–8 hours after a bolus dose [14]. Supporting biochemical evidence from elective surgery has also demonstrated postoperative cortisol suppression following an induction bolus of etomidate in laparoscopic cholecystectomy patients [15]. While our study did not assess cortisol dynamics or postoperative outcomes, these published data indicate that the hemodynamic benefits of etomidate should be balanced against endocrine effects—particularly in contexts where adrenal reserve is clinically relevant.

Finally, although a greater proportion of patients in the propofol group required vasopressor support in our results tables, the difference did not reach statistical significance. This direction is nevertheless consistent with literature in which propofol-based induction is frequently highlighted as a common setting for post-induction hypotension, particularly in older or higher-risk surgical populations [16], and with trial-level data documenting hypotension as a frequent complication after propofol induction in geriatric anesthesia [17]. Larger samples or higher-risk cohorts may be required to detect statistically robust differences in vasopressor requirement when the baseline risk of hypotension is modest.

Overall, our findings reinforce that etomidate provides superior early hemodynamic stability compared with propofol during induction, while adverse effects differ by agent—primarily myoclonus with etomidate and injection pain and hypotension with propofol. Agent selection should therefore be individualized according to cardiovascular reserve, the clinical consequences of transient hypotension, and the relative importance of preventing myoclonus and other adverse effects.

Conclusion

In adult patients undergoing elective surgery under general anesthesia, etomidate demonstrated greater hemodynamic stability during induction when compared with propofol, as evidenced by smaller reductions in heart rate and mean arterial pressure. Propofol was associated with a higher incidence of hypotension, pain on injection, and a greater requirement for vasopressor support, whereas etomidate showed a significantly higher occurrence of myoclonus. Overall, both agents were effective for induction of anesthesia; however, etomidate may be preferable in patients where maintenance of cardiovascular stability is of clinical importance.

References

1. Fechner J, El-Boghdadly K, Spahn DR, Motsch J, Struys MMRF, Duranteau O, et al. Anaesthetic efficacy and postinduction hypotension with remimazolam compared with propofol: a multicentre randomised controlled trial. Anaesthesia. 2024 Apr;79(4):410-422. doi: 10.1111/anae.16205.
2. Hannam JA, Mitchell SJ, Cumin D, Frampton C, Merry AF, Moore MR, et al. Haemodynamic profiles of etomidate vs propofol for induction of anaesthesia: a randomised controlled trial in patients undergoing cardiac surgery. Br J Anaesth. 2019 Feb;122(2):198-205. doi: 10.1016/j.bja.2018.09.027.
3. Xia Z, Kamra K, Dong J, Harp KA, Xiong Y, Lisco SJ, et al. Comparison of efficacy and safety of etomidate with other anesthesia induction drugs for patients undergoing cardiac surgery: A systematic review and meta-analysis of randomized controlled trials. Heliyon. 2024 Sep 21;10(22):e38274. doi: 10.1016/j.heliyon.2024.e38274.
4. Dalia AA, Raines DE. Etomidate and Adrenocortical Suppression: Should We Take the Concerns to Heart? J Cardiothorac Vasc Anesth. 2021 Apr;35(4):1086-1088. doi: 10.1053/j.jvca.2021.01.034.
5. Lu Z, Zheng H, Chen Z, Xu S, Chen S, Mi W, et al. Effect of Etomidate vs Propofol for Total Intravenous Anesthesia on Major Postoperative Complications in Older Patients: A Randomized Clinical Trial. JAMA Surg. 2022 Oct 1;157(10):888-895. doi: 10.1001/jamasurg.2022.3338.
6. Moningi S, Reddy GP, Nikhar SA, Chikkala R, Kulkarni DK, Ramachandran G. Comparison of

the influence of low dose etomidate and propofol as priming dose on the incidence of etomidate induced myoclonus: a randomised, double-blind clinical trial. Braz J Anesthesiol. 2022 Mar-Apr;72(2):261-266. doi: 10.1016/j.bjane.2021.02.047.
7. Bakhtiari E, Mousavi SH, Gharavi Fard M. Pharmacological control of pain during propofol injection: a systematic review and meta-analysis. Expert Rev Clin Pharmacol. 2021 Jul;14(7):889-899. doi: 10.1080/17512433.2021.1919084.
8. Chen Y, He Y, Zhang J, Zhang Y. Differential impacts of propofol and etomidate on hemodynamic stability and postoperative cognition in elderly surgical patients: A retrospective observational analysis. Medicine (Baltimore). 2026 Jan 2;105(1):e45674. doi: 10.1097/MD.0000000000045674.
9. Dai ZL, Cai XT, Gao WL, Lin M, Lin J, Jiang YX, et al. Etomidate vs propofol in coronary heart disease patients undergoing major noncardiac surgery: A randomized clinical trial. World J Clin Cases. 2021 Feb 26;9(6):1293-1303. doi: 10.12998/wjcc.v9.i6.1293.
10. Lakshminarasimhaiah G, Mohan AK, Perikal PJ, Bhat SK, Gangadhar U, Manoj A. Etomidate versus propofol as induction agents in patients undergoing decompressive procedures for cervical compressive myelopathy with and without impaired heart rate variability. J Neuroanaesth Crit Care. 2023;10(3):175–182. doi:10.1055/s-0043-1771219.
11. Chen L, Zhou P, Li Z, Wu Z, Zhai S. Comparative efficacy and safety of 20 intravenous pharmaceutical intervention for prevention of etomidate-induced myoclonus: a systematic review and Bayesian network meta-analysis. Front Pharmacol. 2025 Jan 23; 15:1507616. doi: 10.3389/fphar.2024.1507616.
12. Wang J, Zhu M, Cao Y, Zhang L, Chen L. Pretreatment with Esketamine Reduces Etomidate-Induced Myoclonus During the Induction of Anesthesia: A Randomized Controlled Trial. Ther Clin Risk Manag. 2024 Dec 5; 20:829-836. doi: 10.2147/TCRM.S485626.
13. Leff PJ, Dinner BA, Chuang KY, Leff DB. Characteristics that increase the risk for pain on propofol injection. BMC Anesthesiol. 2024 May 28;24(1):190. doi: 10.1186/s12871-024-02573-y.
14. Valk BI, Struys MMRF. Etomidate and its Analogs: A Review of Pharmacokinetics and Pharmacodynamics. Clin Pharmacokinet. 2021 Oct;60(10):1253-1269. doi: 10.1007/s40262-021-01038-6.
15. Charuvi S, Sahajananda H, Dwajani S. Suppression of Cortisol Levels by a Bolus Dose of Etomidate in Patients Undergoing Laparoscopic Cholecystectomy. J Med Sci 2020;6(3):41–46.
16. Chen B, Pang QY, An R, Liu HL. A systematic review of risk factors for postinduction hypotension in surgical patients undergoing general anesthesia. Eur Rev Med Pharmacol Sci. 2021 Nov;25(22):7044-7050. doi: 10.26355/eurrev_202111_27255.
17. Takaki R, Yokose M, Mihara T, Saigusa Y, Tanaka H, Yamamoto N, et al. Hypotension after general anaesthesia induction using remimazolam or propofol in geriatric patients undergoing sevoflurane anaesthesia with remifentanil: a single-centre, double-blind, randomised controlled trial. Br J Anaesth. 2024 Jul;133(1):24-32. doi: 10.1016/j.bja.2024.04.013.