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Original Research Article

# ASSESSING THE SAFETY AND EFFICACY OF INTRAVENOUS ANAESTHETIC IN ELDERLY PATIENTS: A PROSPECTIVE STUDY OF 50 CASES

*Prasad Deshpande[1], Sneha Anirudha Mandhane[2], Mayuri Pore[3]*

[1]*Assistant Professor, Department of Anaesthesiology, JIIU's IIMSR Medical College, Warudi, Badnapur, Maharashtra, India.*
[2,3]*Associate Professor, Department of Anaesthesiology, JIIU's IIMSR Medical College, Warudi, Badnapur, Maharashtra, India.*

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**Corresponding Author:**
**Dr. Prasad Deshpande,**
Assistant Professor, Department of Anaesthesiology, JIIU's IIMSR Medical College, Warudi, Badnapur, Maharashtra, India..
Email: pdeshpande74@gmail.com

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ABSTRACT

**Background:** Intravenous anaesthesia is frequently used in elderly patients due to its rapid onset and titratability. However, advanced age is associated with increased sensitivity to anaesthetic agents and higher risk of adverse effects. This study aims to assess the safety and efficacy of commonly used intravenous anaesthetics—Propofol, Etomidate, and a combination of Propofol with Ketamine—in elderly patients undergoing minor surgical procedures.

**Materials and Methods:** A prospective observational study was conducted on 50 elderly patients (≥60 years) undergoing minor surgical procedures under total intravenous anaesthesia (TIVA). Patients were allocated into three groups: Propofol (n=18), Etomidate (n=16), and Propofol+Ketamine (n=16). Haemodynamic stability, incidence of intraoperative apnoea, recovery profile, and perioperative complications were assessed.

**Results:** Incidence of intraoperative apnoea was highest in the Propofol group (33.3%), compared with Etomidate (12.5%) and Propofol+Ketamine (6.3%). Haemodynamic stability was best maintained in the Etomidate group, whereas the Propofol+Ketamine group showed balanced safety with fewer respiratory and haemodynamic adverse events. Recovery time was shortest in the Propofol group (mean 7.5 ± 2.1 min) but was associated with higher apnoea incidence.

**Conclusion:** While Propofol provides rapid recovery, it is associated with a higher risk of apnoea and heamodynamic changes in elderly patients. Etomidate offers superior haemodynamic stability, whereas the Propofol+Ketamine combination provides a favourable safety profile with reduced respiratory compromise.

**Keywords:** Safety and efficacy, intravenous anaesthetics—Propofol, Etomidate, and a combination of Propofol with Ketamine, elderly patients, minor surgical procedures.

## INTRODUCTION

The elderly population poses unique challenges in anaesthesia due to altered pharmacokinetics, comorbidities, and reduced physiological reserve. Intravenous anaesthetics such as Propofol, Etomidate, and Ketamine are commonly employed for induction and maintenance of anaesthesia in this group. However, the balance between efficacy, haemodynamic stability, and safety remains a concern.[1] Propofol is widely used for its rapid onset and smooth recovery but is associated with hypotension and apnoea. Etomidate provides cardiovascular stability but may cause myoclonus and adrenal suppression. Ketamine has sympathomimetic effects that help maintain haemodynamics but may lead to hypertension and emergence reactions; when combined with Propofol, it offers a balanced anaesthetic profile.[2,3]

Major postoperative complications contribute to adverse outcomes and high resource use in older patients.[4] Etomidate and propofol are widely used general anesthetics. Although etomidate may be advantageous for induction of anesthesia in patients at high risk for perioperative morbidity and mortality because of its hemodynamic stability, concerns regarding relative adrenal insufficiency and its potential impact on outcomes may lead many

anesthesiologists and anesthesia practitioners to instead favor propofol in this setting. However, there is limited evidence regarding outcomes of etomidate in high-risk patients, especially when used for anesthesia maintenance.[5]

This study was undertaken to evaluate and compare the safety and efficacy of Propofol, Etomidate, and a Propofol+Ketamine combination in elderly patients undergoing minor procedures under TIVA.

**Objectives**

1. To compare the incidence of intraoperative apnoea with different intravenous anaesthetics.
2. To evaluate haemodynamic stability during anaesthesia.
3. To assess recovery time and postoperative complications.

## MATERIALS AND METHODS

**Study design:** Prospective observational study.

**Study setting:** Department of Anaesthesiology, JIIU's IIMSR, Warudi, Badnapur, Maharashtra.

**Duration: From:** Dec 2024 to June 2025

**Sample size:** 50 elderly patients (≥60 years).

**Inclusion Criteria**

- Age ≥ 60 years
- ASA I–II patients
- Undergoing minor surgical procedures like closed reduction for fracture and abscess drainage under TIVA

**Exclusion Criteria**

- Known allergy to study drugs
- Severe cardiac, respiratory, hepatic, or renal dysfunction
- Emergency surgeries
- Surgical duration more than 20 min.
- Morbidly obese patients (weight >85 kg.)

**Grouping of Patients**

- Group A (Propofol): 18 patients.
- Group B (Etomidate): 16 patients.
- Group C (Propofol+Ketamine): 16 patients.

**Surgeries Included**

Incision & drainage for abscess

Closed reduction for fractures

Dilatation and curretage

Anaesthesia technique

All patients were premdicated with Inj. MIdazolam 1.5mg, Inj Emeset 4mg, Inj. Fentanyl 2mcg/kg.( max dose 100 mcg.)

Group A patients were induced with Propofol 1.5 mg/kg.

Group B patients were induced with induction with Etomidate 0.2 mg/kg.

Group C patients were induced with Propofol 1.0 mg/kg + Ketamine 0.5 mg/kg.

Wherever required intermittent dose of respective drug as per group was given for maintenance. Perioperative complications like apnoea/hypotension were treated if needed as per standard protocols.

**Parameters Observed**

- Haemodynamic changes (HR, SBP, DBP)
- Incidence of intraoperative apnoea
- Number of top ups required during maintenance.
- Recovery time (time from discontinuation to response to verbal command)
- Postoperative complications (nausea, vomiting, delirium, myoclonus, etc.)
- Hypotension was defined as fall in SAP more than 30%

**Statistical Analysis:** Data analysed using descriptive statistics, Chi-square test, and ANOVA.

## RESULTS

The table presents the demographic and clinical baseline characteristics of patients enrolled in three groups: Group A (Propofol, n=18), Group B (Etomidate, n=16), and Group C (Propofol + Ketamine, n=16). The mean age of patients was comparable across the groups, ranging from 65.7 ± 5.2 years in Group B to 66.5 ± 4.8 years in Group C, indicating no major age-related differences. The gender distribution was relatively balanced. Group A had 10 males and 8 females, Group B had 9 males and 7 females, while Group C had an equal distribution (8 males and 8 females). Regarding ASA Grade II patients, the majority in each group belonged to this category: 72.2% in Group A, 75.0% in Group B, and 68.8% in Group C, suggesting that the three groups were comparable in terms of baseline physical status.

**Table 1: Baseline Characteristics of Patients (n=50)**

| Parameter | Group A (Propofol, n=18) | Group B (Etomidate, n=16) | Group C (Prop+Keta, n=16) |
|---|---|---|---|
| Mean Age (years) | 66.2 ± 4.5 | 65.7 ± 5.2 | 66.5 ± 4.8 |
| Male: Female | 10:8 | 9:7 | 8:8 |
| Mean ASA Grade (II) | 13 (72.2%) | 12 (75.0%) | 11 (68.8%) |

**Table 2: Distribution according to blood pressure readings**

| Group | Parameter | T1 (Mean ± SD) | T2 (Mean ± SD) | T3 (Mean ± SD) | T4 (Mean ± SD) | T5 (Mean ± SD) |
|---|---|---|---|---|---|---|
| A | SAP | 139. ± 20.6 | 106 ± 12 | 120 ± 10 | 115 ± 11 | 130 ± 13 |
| | DAP | 90 ± 9 | 60 ± 7 | 80 ± 8 | 75 ± 7 | 85 ± 9 |
| | HR | 80 ± 7 | 84 ± 6 | 90 ± 7 | 88 ± 6 | 85 ± 7 |
| B | SAP | 140 ± 12 | 125 ± 10 | 130 ± 11 | 132 ± 10 | 135 ± 12 |
| | DAP | 90 ± 8 | 80 ± 7 | 85 ± 8 | 84 ± 8 | 90 ± 9 |
| | HR | 76 ± 6 | 74 ± 5 | 82 ± 6 | 80 ± 6 | 78 ± 6 |
| C | SAP | 140 ± 11 | 120 ± 10 | 122 ± 9 | 130 ± 10 | 130 ± 11 |
| | DAP | 90 ± 8 | 78 ± 7 | 82 ± 7 | 85 ± 8 | 85 ± 8 |
| | HR | 79 ± 6 | 84 ± 7 | 85 ± 6 | 82 ± 6 | 80 ± 6 |

(T1- Before induction, T2- After induction, T3- Surgical stimulus, T 4- Maintenance, T5 –Recovery)

This table presents the mean ± standard deviation (SD) values of systolic arterial pressure (SAP), diastolic arterial pressure (DAP), and heart rate (HR) across five time points (T1–T5) for three groups (A, B, C).

**Systolic Arterial Pressure (SAP):**

- At baseline (T1), SAP was comparable across groups: 139.9 ± 20.6 mmHg (Group A), 140 ± 12 mmHg (Group B), and 140 ± 11 mmHg (Group C).
- Group A showed a marked reduction at T2 (106 ± 12 mmHg) followed by gradual recovery to 130 ± 13 mmHg at T5.
- Groups B and C demonstrated relatively stable SAP across time points with only minor fluctuations.

**Diastolic Arterial Pressure (DAP):**

- Baseline DAP was 90 mmHg in all groups.
- Group A had a sharp fall at T2 (60 ± 7 mmHg) with subsequent recovery toward baseline by T5 (85 ± 9 mmHg).
- Groups B and C showed moderate decreases at T2 (80 ± 7 mmHg and 78 ± 7 mmHg, respectively) but remained closer to baseline throughout the study period.

**Heart Rate (HR):**

- HR in Group A increased from 80 ± 7 bpm at T1 to a peak of 90 ± 7 bpm at T3, then declined slightly to 85 ± 7 bpm at T5.
- Group B demonstrated relatively stable HR, ranging between 74–82 bpm.
- Group C showed mild fluctuations, peaking at 85 ± 6 bpm at T3 and then stabilizing around 80 bpm at T5.

**Table 3: Intraoperative Events**

| Event | Group A (Propofol) | Group B (Etomidate) | Group C (Prop+Keta) |
|---|---|---|---|
| Apnoea (%) | 6 (33.3%) | 2 (12.5%) | 1 (6.3%) |
| Hypotension (%) | 4 (22.2%) | 1 (6.3%) | 2 (12.5%) |
| Myoclonus (%) | 0 | 2 (6.6%) | 0 |
| Nausea/Vomiting (%) | 1 (3.3%) | 1 (3.3%) | 2 (6.6%) |
| Avg number of top ups required | 2 (6.6%) | 3(9.9%) | 1(3.3%) |

The table compares the incidence of adverse intraoperative events among patients receiving Propofol (Group A), Etomidate (Group B), and Propofol + Ketamine (Group C). Apnoea was most frequent in Group A (33.3%), while it was less common in Group B (12.5%) and least observed in Group C (6.3%). Hypotension occurred more often with Propofol (22.2%), whereas it was less frequent in Group B (6.3%) and Group C (12.5%). Myoclonus was reported only in the Etomidate group (18.8%), with no cases in the other two groups. Nausea and vomiting were relatively uncommon, seen in 0% of Group A, and in 6.6% of both Group B and Group C. Overall, propofol was associated with higher rates of apnoea and hypotension, while etomidate showed a notable incidence of myoclonus. The propofol + ketamine group had the lowest overall adverse event rates, suggesting better hemodynamic stability and fewer complications.

The Propofol+ketamine group showed lowest variability in the heart rate, followed by etomidate group. This can be due to lack of analgesic effect in both Propofol and etomidate group, which caused increase in heart rate post-surgical stimulus.

The Etomidate group required the highest number of top ups for maintenance while Propofol+ Ketamine group required the lowest number of top ups.

**Table 4: Recovery Profile**

| Parameter | Group A (Propofol) | Group B (Etomidate) | Group C (Prop+Keta) |
|---|---|---|---|
| Mean Recovery Time (min)[Eye opening] | 7.5 ± 2.1 | 9.0 ± 2.4 | 8.3 ± 2.2 |
| Smooth Recovery (%) | 17 (56.66%) | 13 (43.33%) | 15 (50%) |

The table summarizes recovery characteristics in patients administered Propofol (Group A), Etomidate (Group B), and Propofol + Ketamine (Group C). The mean recovery time was shortest in Group A (7.5 ± 2.1 min), followed by Group C (8.3 ± 2.2 min), and longest in Group B (9.0 ± 2.4 min). The majority of patients across all groups experienced a smooth recovery, with high proportions: 56.66% in Group A, 43.33% in Group B, and 50% in Group C. Overall, recovery was rapid and smooth in all three groups, with Propofol showing the fastest recovery time, while Propofol and Propofol + Ketamine had the highest proportion of smooth recoveries.

## DISCUSSION

This study demonstrated that intravenous anaesthetic choice significantly influences intraoperative and postoperative outcomes in elderly patients. Propofol, though associated with rapid recovery, showed the highest incidence of apnoea and hypotension. These findings align with earlier studies reporting dose-related respiratory depression with Propofol in elderly patients.

Etomidate offered excellent haemodynamic stability, supporting previous literature that highlights its cardiovascular safety. However, myoclonus was observed in some patients, consistent with known side effects. The Propofol+Ketamine combination provided a favourable balance, minimizing both respiratory depression and haemodynamic instability. This synergistic effect is well-documented and may make this combination particularly suitable for elderly patients undergoing minor procedures.

The baseline profile of our cohort—mean age of approximately 65–67 years, balanced gender distribution, and predominance of ASA II status—closely mirrors that of older populations typically examined in comparative anaesthesia studies. For instance, the EPIC randomized trial involving 1,917 patients aged 65–80 years demonstrated similar demographic characteristics and found that etomidate did not increase major in-hospital postoperative morbidity compared with propofol, underscoring the relevance of such cohorts to our findings.[6]

Our observation of similarly rapid and smooth recovery with propofol relative to etomidate also aligns with existing literature. A retrospective study in the context of electroconvulsive therapy reported that propofol delivered faster induction and shorter recovery time (mean 8.67 ± 2.45 min) compared with etomidate (10.79 ± 2.73 min).[7] These findings reflect propofol's rapid redistribution and clearance, which underpin its favorable recovery profile.[8]

Furthermore, the combination of anaesthetic agents appears beneficial for hemodynamic stability. A 2016 study comparing propofol, etomidate, and a propofol-plus-etomidate induction found that the combination group exhibited superior hemodynamic stability post-induction. Simillarly studies have proven the beneficial synergistic effects of propofol +ketamine, further supporting the potential advantages of combining agents in elderly populations.[9]

Taken together, these observations reinforce the internal validity of our study: groups were well-matched at baseline and our recovery data are consistent with established pharmacokinetic and clinical outcomes. Propofol's faster recovery and the advantageous hemodynamic profile of combined protocols support the rationale for considering multimodal induction strategies—particularly in elderly or physiologically vulnerable patients.

**Etomidate vs. Propofol**

Etomidate is well-known for hemodynamic stability and lower respiratory depression compared to Propofol. A double-blind RCT in elderly gastroscopy patients reported a lower incidence of apnea (14% with etomidate vs. 42% with propofol) and hypotension (12% vs. elevated in Propofol).[10] Similarly, another perioperative study noted that patients induced with etomidate had smaller fluctuations in mean arterial pressure and heart rate than those receiving propofol.[11]

**Etomidate-Induced Myoclonus**

Etomidate's known propensity to cause myoclonus contrasts with the near absence of such events with Propofol. A meta-analysis affirmed that Propofol significantly reduces myoclonus when used prior to Etomidate.[10] In studies, the incidence of myoclonus with Etomidate induction reached nearly 20%, which is higher than the 6.6 % we observed.[12]

**Propofol and Ketamine:** Propofol and Ketamine both are commonly used drugs in TIVA. They both have antagonistic effects to each other. Propofol causes fall in blood pressure whereas ketamine causes hypertension due to its sympathomimetic action. Also, ketamine has very good analgesic effect in contrast to Prpofol. So logically if you combine both the drugs, they can attenuate each other's side effects, giving a balanced anaesthesia. The main aim of this study was to evaluate low dose ketamine use with low dose propofol to find if the combination is synergistic.

## CONCLUSION

Propofol ensures rapid recovery but carries higher risk of apnoea. Etomidate provides superior haemodynamic stability but can cause myoclonus. Propofol+Ketamine combination in low dose offers good safety with minimal adverse effects, making it an effective choice in elderly patients.

**Recommendation:** The Propofol+Ketamine low dose combination may be considered as the preferred regimen for minor procedures in elderly patients requiring TIVA.

## REFERENCES


1. Fragen RJ. Propofol: a new intravenous anesthetic. Anesth Analg. 1985;64(7):689-95.
2. Gooding JM, Weng JT. Etomidate: an ultrashort-acting nonbarbiturate agent for anesthesia induction. Anesth Analg. 1979;58(3):291-8.
3. White PF, Way WL, Trevor AJ. Ketamine–its pharmacology and therapeutic uses. Anesthesiology. 1982;56(2):119-36.
4. Vuyk J, Sitsen E, Reekers M. Intravenous anesthetics. In: Miller's Anesthesia. 8th ed. Philadelphia: Elsevier; 2015. p. 821-63.
5. Singh R, Kumar N, Sood J. Ketamine as an adjunct to propofol for short gynecological procedures. J Anaesthesiol Clin Pharmacol. 2013;29(4):491-5.
6. Langer T, Santini A, Zadek F, Cozzi S, Guarnieri M, Pugni P, et al. Effect of etomidate vs propofol for induction of anaesthesia on postoperative morbidity and mortality among patients undergoing major surgery: the EPIC randomized clinical trial. JAMA. 2021;326(20):1952–62. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC9366659/
7. Mostafa M, Abdelfattah I, Elwan S, Hassan A. Propofol versus etomidate in electroconvulsive therapy: a retrospective study of recovery profile and adverse effects. Middle East Curr Psychiatry. 2025;32(1):29. Available from: https://mecp.springeropen.com/articles/10.1186/s43045-025-00529-7
8. Propofol [Internet]. Verywell Health. 2024 [cited 2025 Sep 9]. Available from: https://www.verywellhealth.com/propofol-for-surgery-how-do-they-wake-you-up-8415025
9. Propofol [Internet]. Wikipedia. 2024 [cited 2025 Sep 9]. Available from: https://en.wikipedia.org/wiki/Propofol
10. Luan HF, Zhao ZB, Feng JY, Cui JZ, Zhang XB, Zhu P, et al. Propofol vs etomidate on cardiovascular and respiratory adverse effects in elderly patients undergoing gastroscopy: a randomized, double-blind study. World J Gastroenterol. 2016;22(46):10323-9. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC4998221/
11. Sun J, Li Y, Zhang Y, Liu J. Etomidate vs propofol for induction of general anesthesia in elderly patients: effects on hemodynamics. Exp Ther Med. 2016;12(3):1515-20. Available from: https://www.spandidos-publications.com/etm/12/3/1515
12. Aggarwal S, Goyal VK, Chaturvedi SK, Mathur V, Baj B, Kumar A. A comparative study of etomidate and propofol for induction of anesthesia in patients undergoing elective cardiac surgery. Ann Card Anaesth. 2016;19(2):324-30. Available from: https://pubmed.ncbi.nlm.nih.gov/27108818/.