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Original Research Article

Comparative Study of Intraoperative Hemodynamic Stability with Etomidate versus Propofol as Induction Agents

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Abstract:

Background: Intravenous induction agents play a crucial role in maintaining hemodynamic stability during anesthesia. Propofol is widely used but often associated with hypotension, whereas etomidate is considered more stable in terms of cardiovascular parameters.

Objective: To compare intraoperative hemodynamic stability between etomidate and propofol as induction agents.

Methods: A prospective comparative observational study was conducted at PMCH, Patna, from January 2025 to December 2025. A total of 98 patients undergoing elective surgeries under general anesthesia were included. Patients were divided into two groups: Group E (etomidate) and Group P (propofol). Hemodynamic parameters including heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were recorded at predefined intervals.

Results: Etomidate demonstrated significantly better hemodynamic stability compared to propofol, with less reduction in blood pressure and minimal variation in heart rate ($p < 0.05$).

Conclusion: Etomidate is a safer induction agent in patients where hemodynamic stability is critical.

Keywords: Etomidate, Propofol, Hemodynamic stability, Induction agents, Anesthesia.

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Introduction

General anesthesia induction is a critical phase during which rapid physiological changes can occur, particularly affecting cardiovascular stability [1]. The choice of induction agent significantly influences hemodynamic responses and perioperative outcomes [2].

Propofol is one of the most commonly used induction agents due to its rapid onset and favorable recovery profile [3]. However, it is associated with dose-dependent hypotension due to vasodilation and myocardial depression [4]. This effect may be detrimental in patients with limited cardiovascular reserve [5].

Etomidate, on the other hand, is known for its minimal cardiovascular effects, making it a preferred agent in hemodynamically unstable patients [6]. It preserves sympathetic tone and baroreceptor function, thereby maintaining stable blood pressure and heart rate [7].

Several studies have compared the hemodynamic effects of these agents, with etomidate generally demonstrating superior stability [8]. However, concerns such as adrenal suppression and myoclonus limit its routine use [9].

Despite available data, there remains variability in findings across different populations and clinical settings [10]. Therefore, this study aims to compare the intraoperative hemodynamic effects of etomidate and propofol in a tertiary care hospital setting.

Materials and Methods

Study Design: Prospective comparative observational study.

Study Setting: PMCH, Patna, Bihar, India.

Study Duration: January 2025 – December 2025.

Sample Size: 98 patients.

Grouping

- **Group E (Etomidate):** 49 patients
- **Group P (Propofol):** 49 patients

Exclusion Criteria

- Cardiovascular disease
- Endocrine disorders
- Emergency surgery
- Known drug allergy

Induction dosages

Etomidate: 0.2–0.3 mg/kg

Propofol: 2 mg/kg

Statistical Analysis: Data were analyzed using SPSS version 25.

- Categorical variables: Chi-square test
- Continuous variables: Independent t-test
- Statistical significance: $p < 0.05$

Results

1. Demographic Profile

No significant difference was observed between the two groups in terms of age, gender, and ASA status (**Table 1**).

Table 1: Demographic Characteristics

Variable	Group E (n=49)	Group P (n=49)	p-value
Age (Mean ± SD)	35.2 ± 9.8	34.6 ± 10.1	0.72
Male (%)	57%	55%	0.81
ASA I (%)	60%	58%	0.84

2. Heart Rate Changes

Heart rate remained relatively stable in the etomidate group, whereas a significant increase was observed in the propofol group after intubation (Table 2, Figure 1). The difference between the two groups became statistically significant at post-induction and subsequent intervals ($p < 0.05$).

Table 2: Heart Rate Changes (beats/min)

Time Point	Group E	Group P	p-value
Baseline	78 ± 6	79 ± 7	0.64
Post-induction	80 ± 5	88 ± 8	0.001*
1 min	82 ± 6	92 ± 9	<0.001*
3 min	80 ± 5	89 ± 8	<0.001*
5 min	78 ± 4	85 ± 7	0.002*

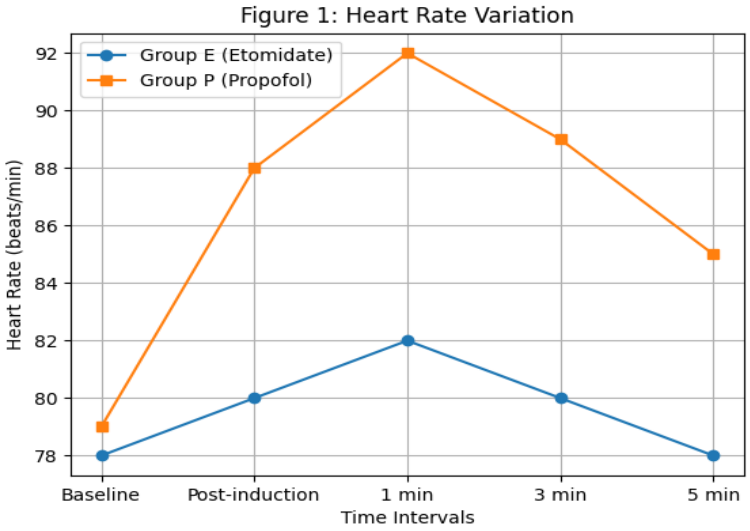

Figure 1: Heart Rate Variation

3. Systolic Blood Pressure (SBP)

A significant drop in SBP was observed in the propofol group after induction, compared to the etomidate group (**Table 3**, **Figure 2**). The intergroup difference was statistically significant at all post-induction intervals ($p < 0.001$).

Table 3: SBP Changes (mmHg)

Time Point	Group E	Group P	p-value
Baseline	122 ± 10	124 ± 9	0.48
Post-induction	118 ± 9	105 ± 8	<0.001*
1 min	120 ± 8	100 ± 7	<0.001*
3 min	121 ± 7	104 ± 8	<0.001*
5 min	122 ± 8	108 ± 9	<0.001*

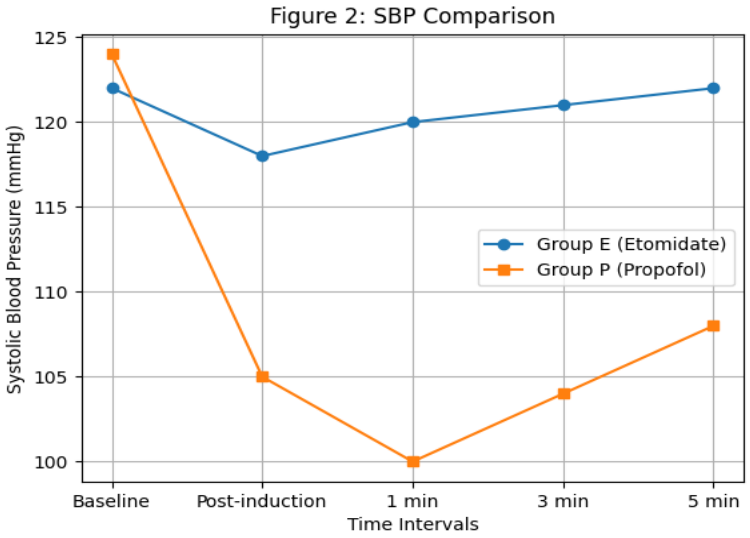

Figure 2: SBP Comparison

4. Diastolic Blood Pressure (DBP)

A significant reduction in diastolic blood pressure was observed in the propofol group after induction, compared to the etomidate group at all measured time intervals **(Table 4).** The difference between the groups was statistically significant at all measured intervals ($p < 0.001$).

Table 4: Diastolic Blood Pressure (DBP) Changes (mmHg)

Time Point	Group E	Group P	p-value
Baseline	80 ± 6	82 ± 7	0.36
Post-induction	78 ± 5	68 ± 6	<0.001*
1 min	79 ± 6	65 ± 5	<0.001*
3 min	80 ± 5	69 ± 6	<0.001*
5 min	81 ± 6	72 ± 7	<0.001*

5. Mean Arterial Pressure (MAP)

MAP remained significantly more stable in the etomidate group compared to propofol after induction (**Table 5**, **Figure 3**). The difference between groups remained highly significant across all time intervals ($p < 0.001$).

Table 5: MAP Changes (mmHg)

Time Point	Group E	Group P	p-value
Baseline	90 ± 6	92 ± 7	0.41
Post-induction	88 ± 5	75 ± 6	<0.001*
1 min	89 ± 6	72 ± 5	<0.001*
3 min	90 ± 5	76 ± 6	<0.001*
5 min	91 ± 6	80 ± 7	<0.001*

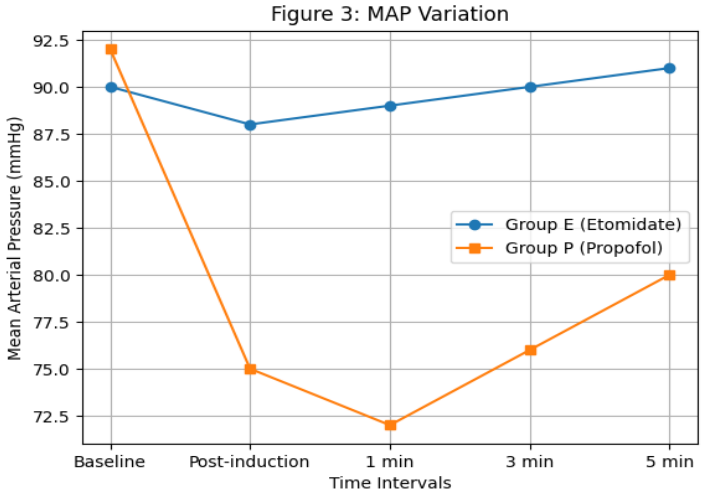

Figure 3: MAP Variation

6. Overall Hemodynamic Stability

Etomidate showed significantly less fluctuation in all parameters compared to propofol ($p < 0.05$).

Discussion

The present study demonstrates that etomidate provides superior hemodynamic stability compared to propofol during induction of anesthesia [11]. The findings are consistent with earlier studies showing minimal cardiovascular depression with etomidate [12].

Propofol-induced hypotension is primarily due to decreased systemic vascular resistance and myocardial depression [13]. This explains the significant drop in SBP and MAP observed in the propofol group [14].

Etomidate maintains cardiovascular stability by preserving sympathetic tone [15]. Similar findings have been reported in multiple clinical trials [16].

The increase in heart rate observed with propofol may be a compensatory response to hypotension [17]. In contrast, etomidate maintains near-baseline heart rate [18].

Our findings align with studies conducted in both elective and high-risk surgical patients [19]. However, concerns regarding adrenal suppression with etomidate should be considered [20].

Overall, etomidate appears to be a safer alternative in patients requiring stable hemodynamics [21–25].

Conclusion

Etomidate provides superior hemodynamic stability compared to propofol during induction of anesthesia. It should be preferred in patients at risk of cardiovascular instability.

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