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COMPARISON OF INTRAVENOUS ETOMIDATE, PROPOFOL AND ETOMIDATE - PROPOFOL COMBINATION ON HAEMODYNAMIC RESPONSE DURING LARYNGOSCOPY AND ORAL INTUBATION

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ABSTRACT **Background:** Laryngoscopy and endotracheal intubation commonly produce significant haemodynamic alterations due to sympathetic stimulation, including tachycardia, hypertension, and changes in perfusion pressure. These fluctuations may be harmful in patients with cardiovascular vulnerability. Intravenous induction agents such as Propofol and Etomidate are widely used to attenuate these responses; however, each has specific limitations. Combining Etomidate and Propofol has been proposed as a balanced approach to optimize stability while minimizing adverse effects. **Aims and Objectives:** The primary aim of this study was to compare the haemodynamic responses to laryngoscopy and intubation following induction with Etomidate, Propofol, and an Etomidate–Propofol combination. The objectives were to assess variations in heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure. Secondary objectives included evaluating adverse effects such as pain on injection, myoclonus, and postoperative nausea and vomiting. **Methods:** A prospective comparative study was conducted on 90 adult patients undergoing elective surgery under general anaesthesia. Participants were randomized into three equal groups: Group E (Etomidate 0.3 mg/kg), Group P (Propofol 2 mg/kg), and Group E+P (Etomidate 0.2 mg/kg + Propofol 1 mg/kg). Standard premedication, oxygenation, induction, neuromuscular blockade, and intubation techniques were used across all groups. Haemodynamic parameters were recorded at baseline, during induction, at intubation, and up to ten minutes post-intubation. **Results :** The Propofol group demonstrated significant hypotension and bradycardia following intubation. The Etomidate group showed better blood pressure preservation but exhibited a sympathetic rise in HR and SBP, along with a higher incidence of myoclonus. The Etomidate–Propofol combination group displayed the most stable haemodynamic pattern, with minimal deviations in HR, SBP, DBP, and MAP from baseline values. Adverse effects were lowest in the combination group, with reduced pain on injection compared to Propofol and markedly lower myoclonus compared to Etomidate alone. **Conclusion :** The combination of Etomidate and Propofol provides superior haemodynamic stability during laryngoscopy and intubation compared with either agent alone. It minimizes hypotension, attenuates tachycardic and hypertensive surges, and reduces the incidence of adverse effects, making it a clinically favourable induction technique, especially in patients at cardiovascular risk. This balanced co-induction approach should be considered as an effective strategy in routine anaesthetic practice.

KEYWORDS : Etomidate; Propofol; Co-induction; Haemodynamic Stability; Laryngoscopy; Endotracheal Intubation; General Anaesthesia.

INTRODUCTION

Endotracheal intubation is a fundamental procedure in anaesthesia, performed to secure the airway, prevent aspiration, and facilitate ventilation throughout surgery. The process begins with laryngoscopy, which involves direct visualization and mechanical manipulation of the airway structures. This stimulation triggers intense activation of the sympathoadrenal system through afferent pathways of the glossopharyngeal and vagus nerves, resulting in acute elevations in heart rate and blood pressure. These haemodynamic changes cause increased myocardial oxygen demand and may precipitate cardiac ischemia, arrhythmias, left ventricular failure, or cerebrovascular events in susceptible individuals.

Various pharmacological agents—beta-blockers, calcium channel blockers, vasodilators, opioids, alpha-2 agonists, and intravenous lignocaine—have been explored to attenuate these responses. However, the induction agent remains central to achieving haemodynamic control because it initiates loss of consciousness and modulates cardiovascular responses throughout intubation.

Propofol has been widely adopted due to its rapid onset, smooth induction, and antiemetic benefit. Despite these advantages, its use is frequently limited by significant hypotension, bradycardia, and reduced baroreceptor reflexes-effects that pose risks in hypovolaemic, elderly, cardiac, and critically ill patients. Etomidate, introduced as a haemodynamically stable alternative, provides excellent cardiovascular preservation but lacks sufficient suppression of airway reflexes and is associated with myoclonus and transient adrenal suppression. These opposing profiles have driven interest in co-induction strategies.

The Etomidate–Propofol combination is hypothesized to produce a synergistic balance: Etomidate counters Propofol-induced hypotension, while Propofol suppresses the sympathetic response inadequately controlled by Etomidate alone. Additionally, combining both agents reduces total drug dosage, potentially lowering the incidence of dose-related adverse effects such as injection pain, myoclonus, and endocrine suppression. Early clinical trials have demonstrated promising outcomes, with several studies reporting improved haemodynamic stability and reduced side-effect profiles during induction and intubation when using this combination.

However, variations in methodology, patient selection, and monitoring endpoints across published studies have produced inconsistent conclusions, creating ongoing debate regarding the superiority of the combination approach. This study aims to address this gap by systematically comparing haemodynamic responses-heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure-across three induction protocols: Etomidate alone, Propofol alone, and Etomidate–Propofol combination. The analysis also includes evaluation of adverse effects such as pain on injection, myoclonus, and postoperative nausea and vomiting, offering insight into the most clinically effective and physiologically stable induction strategy for general anaesthesia.

AIMS AND OBJECTIVES

Aim

To compare the haemodynamic response to laryngoscopy and oral endotracheal intubation following induction with intravenous Etomidate, intravenous Propofol, and a combination of intravenous Etomidate and Propofol during general anaesthesia.

Primary Objective

To evaluate and compare the efficacy of the three induction approaches in maintaining haemodynamic stability by monitoring:

- Heart rate (HR)
- Systolic blood pressure (SBP)
- Diastolic blood pressure (DBP)

- Mean arterial pressure (MAP)

during and after laryngoscopy and intubation.

Secondary Objective

To assess and compare the incidence of adverse effects associated with each induction method, including:

- Pain on injection
- Myoclonus
- Nausea and vomiting
- Other clinically relevant side effects

MATERIALS AND METHODS

Study Design

This study was conducted as a **prospective, comparative, observational study**, following approval from the Institutional Ethics Committee and Review Board. Written informed consent was obtained from all participants prior to enrolment.

Study Duration

The study was carried out over a period of **12 months**.

Sample Size

A total of **90 patients** scheduled for routine elective surgeries under general anaesthesia were included. Patients were randomly divided into **three equal groups**, each consisting of 30 participants:

- **Group E** — Intravenous Etomidate (0.3 mg/kg)
- **Group P** — Intravenous Propofol (2 mg/kg)
- **Group E+P** — Intravenous Etomidate (0.2 mg/kg) + Intravenous Propofol (1 mg/kg)

Inclusion Criteria

Patients meeting the following criteria were included:

- Age 18–65 years
- ASA Grade I, II, or III
- Body weight 40–80 kg
- Mallampati grade I–III
- Either sex
- Patient consent obtained

Exclusion Criteria

Patients were excluded if they presented with:

- Refusal to participate
- Age below 18 or above 65 years
- ASA Grade > III
- Known drug allergy
- Hypotension and/or hypovolemia
- Pregnancy or lactation

Ethical Considerations

All participants signed informed consent, confirming voluntary participation, understanding of procedure, and confidentiality protection.

TECHNIQUE

All patients underwent a standardized anaesthetic protocol to ensure consistency in induction conditions, intubation response, and haemodynamic monitoring. The process included structured premedication, oxygenation, induction with assigned study drugs, neuromuscular blockade, airway instrumentation, and maintenance of anaesthesia under controlled monitoring parameters.

Premedication

Prior to induction, all participants received the following medications intravenously:

- **Ondansetron (80 mcg/kg)**
- **Glycopyrrolate (4 mcg/kg)**
- **Midazolam (20 mcg/kg)**

This regimen was administered to reduce anxiety, suppress secretions, minimize vagal responses, and prevent postoperative nausea and vomiting.

Preoxygenation

Each patient was preoxygenated with **100% oxygen for 5 minutes** to denitrogenate the lungs and extend safe apnoea time during induction and intubation.

Induction With Study Drugs

Participants received induction agents according to their randomized group allocation:

Group E

- **Etomidate 0.3 mg/kg IV**, administered slowly

Group P

- **Propofol 2 mg/kg IV**, administered slowly

Group E+P

- **Etomidate 0.2 mg/kg IV** plus
- **Propofol 1 mg/kg IV**, administered slowly in combination

All study drugs were given intravenously at a controlled rate to reduce adverse effects such as hypotension, pain on injection, or myoclonus.

Neuromuscular Blockade

Following loss of consciousness, neuromuscular relaxation was achieved using:

Succinylcholine 1.5–2 mg/kg IV bolus to facilitate smooth and rapid intubation.

Endotracheal Intubation Procedure

Once muscle relaxation was confirmed, oral intubation was performed under direct laryngoscopy using:

- **Macintosh curved blade**
- **Portex cuffed endotracheal tube**
- Appropriate tube size selected per patient anatomy
- Correct tube placement was verified by: Bilateral equal air entry Stabilization and fixation of tube in position

Maintenance Of Anaesthesia

Anaesthesia was maintained using:

1. IPPV with

- Nitrous Oxide (67%)
- Oxygen (33%)

2. Sevoflurane traces for inhalational supplementation

3. Atracurium 0.5 mg/kg loading dose IV, followed by **0.1 mg/kg IV as required** for ongoing neuromuscular blockade

4. Dexmedetomidine

- Loading dose: **1 mcg/kg IV slowly**
- Maintenance infusion: **0.5 mcg/kg/hr IV**

Intraoperative Monitoring

Haemodynamic parameters were recorded at predefined intervals:

- Baseline
- Pre-induction
- Post-induction
- At intubation
- 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 minutes post-intubation

Parameters Monitored Included:

- Heart Rate (HR)
- Systolic Blood Pressure (SBP)
- Diastolic Blood Pressure (DBP)
- Mean Arterial Pressure (MAP)

OBSERVATION

Demographic Data

	Group E	Group P	Group E+P	P value
AGE (Yrs.)	33.07 ± 12.57	35.37 ± 12.87	34.40 ± 13.42	0.788
WEIGHT (Kgs)	60.03±6.09	59.53±6.15	58.10±5.71	0.435

As shown in Table 1, the mean age of patients in Group E was 33.07 ± 12.57 years, in Group P was 35.37 ± 12.87 years, and in Group E+P was 34.40 ± 13.42 years. The intergroup comparison showed no statistically significant difference in age ($P = 0.788$; $P > 0.05$), indicating that the study groups were well matched in terms of age. This ensured that age was not a confounding factor in the assessment of haemodynamic responses among the three groups.

COMPARISON OF PARAMETERS

Heart Rate (HR)

Comparison Of Heart Rate

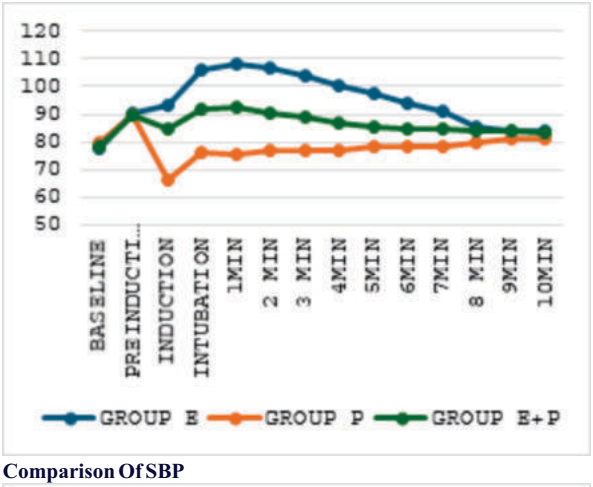
Group P demonstrated the greatest reduction in HR following induction and intubation.

Parameter	Stage	Group E (Etomidate)	Group P (Propofol)	Group E+P (Combination)	p- value
Heart Rate (HR)	Pre-induction	90.53 7.06	89.90 8.52	89.70 5.57	0.895
	Induction	93.17 6.98	66.20 7.23	84.80 6.69	<0.001
	Intubation	105.80 6.30	76.07 7.74	91.93 5.56	<0.001
Systolic Blood Pressure (SBP)	Pre-induction	126.40 4.84	125.47 5.51	126.37 4.24	0.705
	Induction	117.53 6.22	101.90 4.92	122.80 4.72	<0.001
	Intubation	138.70 4.81	115.73 5.79	136.13 3.39	<0.001
Diastolic Blood Pressure (DBP)	Pre-induction	82.03 5.11	81.53 4.26	83.57 3.07	0.158
	Induction	77.27 4.05	65.80 4.70	80.90 4.89	<0.001
	Intubation	90.10 4.19	74.00 4.32	87.37 3.47	<0.001
Mean Arterial Pressure (MAP)	Pre-induction	96.80 4.44	96.13 3.66	97.90 3.00	0.188
	Induction	90.70 3.89	77.80 3.93	94.83 3.49	<0.001
	Intubation	106.27 3.84	87.97 3.85	103.57 3.05	<0.001

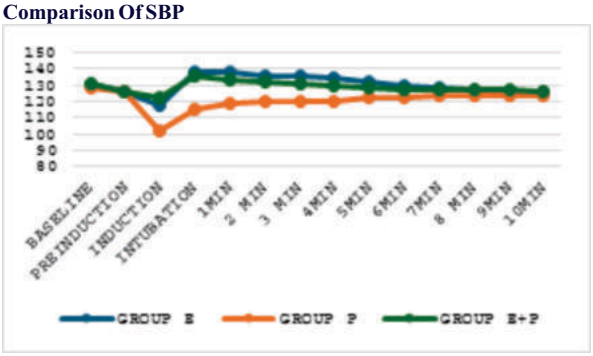
Group E showed a significant increase in HR, particularly after intubation.

Group E+P showed more stable HR changes, with less fluctuation from baseline, indicating improved haemodynamic moderation.

Thus, the Etomidate-Propofol combination (Group E+P) provided a more balanced heart rate profile throughout the peri-intubation period.



Comparison Of SBP



Group P showed the most pronounced hypotensive response during and after induction.

Group E exhibited a hypertensive response, especially post-intubation.

Group E+P achieved a more moderated SBP profile with less extreme fluctuations.

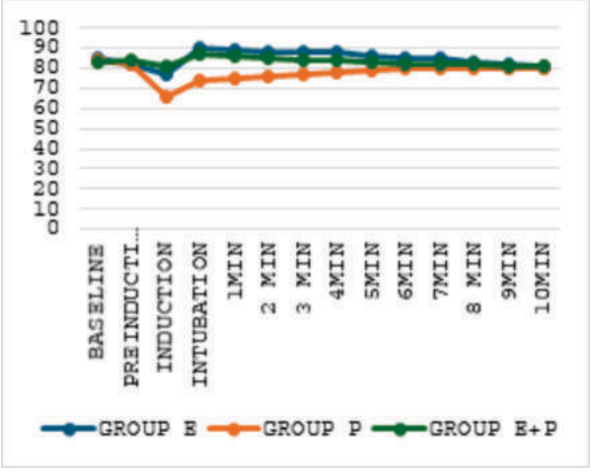
This suggests that the combination of Etomidate and Propofol in Group E+P resulted in superior SBP control compared to either agent used alone.

Diastolic Blood Pressure (DBP) Observations

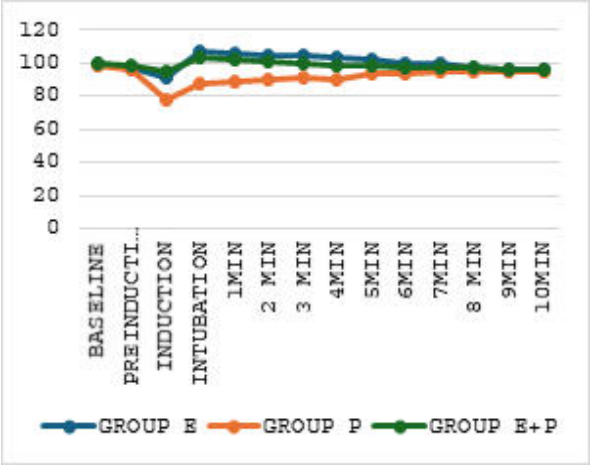
Group P consistently exhibited the lowest DBP values post-induction and throughout the early intubation period.

Group E displayed a significant rise in DBP following intubation.

Group E+P maintained intermediate values with relatively smaller fluctuations, suggesting improved diastolic pressure control compared to either drug alone.



Mean Arterial Pressure (MAP) Observations



Group P showed the most pronounced drop in MAP post-induction and maintained the lowest values throughout the early intubation period.

Group E displayed a strong hypertensive response post-intubation.

Group E+P maintained a more balanced MAP profile with moderate variations, indicating more stable haemodynamic control.

These findings support the conclusion that the Etomidate-Propofol combination resulted in superior MAP stabilization compared to either drug alone.

Incidence Of Pain

Pain at the injection site was assessed using a three-grade scale:

Incidence Of Pain	Group E	Group P	Group E+P
0	22 (73.33%)	5 (16.67%)	26 (86.67%)
1	8 (26.67%)	15 (50.00%)	4 (13.33%)
2	0 (0%)	10 (33.33%)	0 (0%)

Grade 0: No pain
Grade 1: Verbal complaint of pain
Grade 2: Withdrawal of arm

The incidence of pain was highest in **Group P** (Propofol group), where a significant number of patients reported either verbal complaints or withdrawal responses. In contrast, **Group E** (Etomidate) and **Group E+P** (Etomidate + Propofol combination) showed a considerably lower incidence of injection-related pain. The difference among the groups was statistically significant ($P < 0.001$).

Propofol alone causes significantly more injection site discomfort. The combination of Etomidate and Propofol reduces the incidence and severity of pain compared to Propofol alone.

Incidence Of Myoclonus

MYOCLONUS	GROUP E	GROUP P	GROUP E+P
0	12 (40%)	30 (100%)	26 (86.67%)
1	18 (60%)	0 (0.00%)	4 (13.33%)

Table 7 shows incidence of Myoclonus between three groups.

Myoclonic movements were evaluated on a binary scale:
Grade 0: No myoclonus
Grade 1: Myoclonus present

Myoclonus was observed most frequently in **Group E** (Etomidate), with a high percentage of patients showing involuntary muscle activity. The **Group E+P** showed a substantial reduction in the incidence of myoclonus, and **Group P** (Propofol) had the least. The difference among the groups was statistically significant ($P < 0.001$).

Etomidate alone is associated with a high incidence of myoclonus. Combining Etomidate with Propofol significantly mitigates this effect.

This randomized, clinical study compared the haemodynamic responses and adverse effects associated with three different induction regimens-Etomidate alone (Group E), Propofol alone (Group P), and a combination of Etomidate and Propofol (Group E+P)-in 90 patients undergoing general anaesthesia.

DISCUSSION:

The present study compared the haemodynamic responses to laryngoscopy and endotracheal intubation using Etomidate, Propofol, and a combination of both agents. The findings clearly demonstrate that Propofol alone leads to significant hypotension and bradycardia during induction and intubation, consistent with its well-established vasodilatory and negative inotropic properties. This haemodynamic depression is clinically undesirable, particularly in patients with compromised cardiovascular status. Etomidate, on the other hand, preserved systolic, diastolic, and mean arterial pressures more effectively but produced a higher sympathetic response at intubation, reflected by elevated HR and SBP values. This aligns with previously reported literature highlighting Etomidate's haemodynamic stability but its incomplete suppression of airway reflex–induced sympathetic stimulation.

The Etomidate–Propofol combination provided the most favourable haemodynamic profile across all measured intervals, including pre-induction, induction, and intubation. The combination minimized hypotension associated with Propofol while attenuating the hypertensive and tachycardic responses seen with Etomidate. This synergistic effect likely arises from dosage reduction of both agents, which decreases their adverse effects while enhancing their strengths. The combination group also demonstrated fewer side effects, with reduced pain on injection compared to Propofol and drastically fewer myoclonic movements compared to Etomidate. Such a balanced profile is clinically advantageous, particularly in high-risk or cardiac patients where stable haemodynamics are essential.

These findings corroborate earlier research advocating co-induction strategies to achieve optimal cardiovascular stability during airway manipulation. The results affirm that neither Propofol nor Etomidate alone offers an ideal induction profile; however, their combination effectively mitigates the limitations of each drug. Given the reduced haemodynamic fluctuations, better tolerability, and improved safety profile, the Etomidate–Propofol combination appears to be a superior induction technique and should be considered a valuable alternative in routine anaesthetic practice, especially for patients vulnerable to haemodynamic instability.

In this randomized study involving 90 patients, we compared the haemodynamic responses and adverse effects of Propofol, Etomidate, and their combination during induction and intubation. Our findings showed that the combination of Etomidate (0.2 mg/kg) and Propofol (1 mg/kg) resulted in the most stable cardiovascular profile, with a post-intubation MAP rise of only 5.8% compared to a 9.8% rise with Etomidate alone and an 8.5% decrease with Propofol alone. the heart rate increase was more controlled in the combination group, with only a 2.5 % rise post-intubation, in contrast to a 16.9% rise in the Etomidate group and a 15.4% fall in the Propofol group. Myoclonus and pain on injection were significantly reduced in the combination group to 13.33% compared to the Etomidate and Propofol groups.

CONCLUSION

In conclusion, this comparative study demonstrates that the combination of Etomidate and Propofol provides a balanced and effective alternative for intravenous anaesthetic induction. The admixture of Etomidate 0.2 mg/kg and Propofol 1 mg/kg resulted in better haemodynamic stability compared to either agent alone. It minimized the hypotensive episodes and injection pain commonly associated with Propofol and significantly reduced the incidence of myoclonus typically seen with Etomidate. Statistically significant improvements in MAP, SBP, DBP, and HR values were observed in the combination group compared to monotherapy groups ($p < 0.05$ to $p < 0.001$ at various time intervals). No cases of PONV were noted, which may be attributed to the antiemetic property of Propofol and prophylactic administration of ondansetron. These findings support the use of Etomidate-Propofol co-induction, especially in patients where haemodynamic stability is a priority. However, further studies with larger sample sizes and extended postoperative hormonal monitoring may help reinforce these conclusions.

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