



Comparative Evaluation Of Intravenous Propofol And Etomidate On Hemodynamic Responses During Laryngoscopy And Endotracheal Intubation In Trauma Patients.

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Abstract

Background: Hemodynamic fluctuations during anesthetic induction and tracheal intubation are potentially consequential in trauma patients. **Objective:** To compare intravenous propofol and etomidate for peri-intubation heart rate, blood pressure, and adverse effects. **Methods:** In this single-center randomized comparative study, 80 hemodynamically stable adult trauma patients (20–60 years, ASA I–II) received propofol 2 mg/kg (n=40) or etomidate 0.3 mg/kg (n=40). Heart rate (HR), systolic (SBP), diastolic (DBP) and mean arterial pressure (MAP) were measured at baseline, 1 and 2 minutes after induction, and 1, 3, 5 and 10 minutes after intubation. **Results:** Baseline parameters were similar. At 2 minutes after induction, SBP was 115.3±11.18 versus 125.83±10.44 mmHg and MAP was 88.7±7.68 versus 98.69±5.13 mmHg in propofol and etomidate groups, respectively (both p<0.0001). At 5 minutes after intubation, SBP was 100.6±11.21 versus 128.65±10.76 mmHg (p<0.0001). Injection pain occurred in 10/40 (25%) versus 1/40 (2.5%), and myoclonus in 0/40 versus 3/40 (7.5%). **Conclusion:** Etomidate was associated with smaller reductions in arterial pressure in this selected population, whereas propofol produced less myoclonus but more injection pain. Results should not be generalized to patients in shock.

Keywords: Propofol; etomidate; trauma; tracheal intubation; hemodynamics; induction of anesthesia.



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INTRODUCTION

Airway management is a fundamental component of emergency care and anesthetic management in trauma patients, particularly those requiring urgent surgical intervention or mechanical ventilation. Laryngoscopy and endotracheal intubation are frequently performed to secure the airway, maintain adequate oxygenation, and prevent aspiration. However, these procedures produce significant physiological responses due to mechanical stimulation of the oropharyngeal, laryngeal, and tracheal structures. The resulting sympathetic nervous system activation and catecholamine release may cause transient tachycardia, hypertension, and cardiac arrhythmias. Although these responses are generally well tolerated by healthy individuals, they may have serious consequences in trauma patients with hemodynamic instability, hypovolemia, traumatic brain injury, or compromised cardiovascular function [1,2].

Trauma patients represent a particularly vulnerable population because of the complex physiological alterations associated with blood loss, pain, tissue injury, and activation of the stress response. Maintaining adequate systemic blood pressure and tissue perfusion during induction of anesthesia is essential to prevent secondary organ injury. Hypotension during airway management may aggravate tissue hypoxia, reduce coronary and cerebral perfusion, and contribute to adverse clinical outcomes. Conversely, excessive increases in heart rate and blood pressure during laryngoscopy may increase myocardial oxygen demand and potentially worsen intracranial hypertension in susceptible patients. Therefore, selecting an appropriate intravenous induction agent that provides adequate anesthetic depth while minimizing hemodynamic fluctuations is an important consideration in trauma anesthesia [2,3].

Propofol is a widely used intravenous induction agent because of its rapid onset, predictable anesthetic effects, and favorable recovery profile. It produces hypnosis primarily through potentiation of gamma-aminobutyric acid type A (GABA-A) receptor-mediated inhibitory neurotransmission. Propofol can attenuate the sympathetic responses associated

with airway manipulation; however, it also causes dose-dependent reductions in systemic vascular resistance, myocardial contractility, and arterial blood pressure. These cardiovascular effects may be particularly undesirable in patients with hypovolemia or limited physiological reserve. Consequently, the use of propofol in trauma patients requires careful dose selection and hemodynamic monitoring [4,5].

Etomidate is another rapidly acting intravenous hypnotic agent commonly considered for induction of anesthesia in patients at increased risk of cardiovascular instability. Its principal advantage is relatively limited cardiovascular depression compared with several other induction agents. Etomidate generally preserves myocardial contractility and systemic vascular resistance, making it a potentially useful option in patients with impaired cardiovascular reserve.

Nevertheless, etomidate does not provide analgesia and may not adequately suppress the sympathetic response to laryngoscopy and intubation when used alone. Furthermore, its association with transient inhibition of adrenal steroid synthesis, particularly following a single induction dose, remains an important consideration in critically ill and severely injured patients [6,7].

The comparative cardiovascular effects of propofol and etomidate have been investigated in different surgical and critically ill populations. Previous studies have demonstrated that propofol is associated with a greater reduction in arterial blood pressure during induction, whereas etomidate generally provides better immediate hemodynamic stability. However, the magnitude of these differences may vary according to patient characteristics, baseline cardiovascular status, induction doses, concomitant medications, and the intensity of airway stimulation. Importantly, the preservation of blood pressure with etomidate does not necessarily imply complete attenuation of the pressor response during laryngoscopy and endotracheal intubation [5,8].

The present study was undertaken to compare the hemodynamic responses following intravenous propofol and etomidate administration during laryngoscopy and endotracheal intubation in trauma patients, with particular emphasis on changes in heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure at predefined intervals during induction and following intubation.

MATERIALS AND METHODS

Design and setting: Single-center randomized comparative study at the Trauma Centre of MDM Hospital, Department of Anaesthesiology, Dr. S. N. Medical College, Jodhpur. Participants: Eighty patients aged 20–60 years, weighing 30–80 kg, ASA physical status I–II, hemodynamically stable on presentation. Exclusions included shock, seizure history, drug allergy, major respiratory, cardiac, hepatic or renal dysfunction, ASA III–IV and refusal to participate. The thesis reports computer-generated random assignment, 40 participants per group.

Sample size: Based on a minimum between-group difference in mean heart rate of 8.64 beats/min at 3 minutes after intubation, pooled standard deviation 11.18, two-sided $\alpha=0.05$ and 90% power, 35 participants per group were estimated; 40 per group were enrolled.

Intervention: Monitoring included noninvasive blood pressure, ECG, oxygen saturation and end-tidal carbon dioxide. After preoxygenation, both groups received intravenous fentanyl 2 $\mu\text{g/kg}$ and midazolam 0.02 mg/kg. Group I received propofol 2 mg/kg; Group II received etomidate 0.3 mg/kg, administered over 30 seconds. Succinylcholine 2 mg/kg facilitated orotracheal intubation; tube placement was verified clinically and with exhaled CO_2 .

Outcomes: HR, SBP, DBP and MAP were measured at T0 (before premedication), T1 (1 minute after induction), T2 (2 minutes after induction), T3 (1 minute after intubation), T4 (3 minutes), T5 (5 minutes), and T6 (10 minutes). Injection pain and myoclonus were assessed; myoclonus was graded from 0 (none) to 3 (generalized).

Ethical status: Institutional ethics approval SNMC/IEC/2020/Plan/295, dated 9 July 2020; Clinical Trials Registry–India CTRI/2020/09/027812, registered 15 September 2020. The thesis states written informed consent was obtained.

Statistical analysis: The thesis reports SPSS version 22, between-group comparisons of quantitative measurements using t tests and categorical outcomes using Fisher exact tests, with $p<0.05$ considered significant. Reported summary statistics and p values are retained as presented; repeated-measures multiplicity adjustment was not documented.

RESULTS

Both groups included 40 patients. Mean ages were 37.82 ± 11.38 and 39.40 ± 13.29 years in propofol and etomidate groups, respectively. Male participants numbered 35 (87.5%) and 39 (97.5%). Baseline hemodynamic variables were comparable. The complete time-point comparisons extracted from the dissertation are shown below.

At T2, propofol showed a larger fall in SBP, DBP and MAP than etomidate. Differences in blood pressure persisted at several post-intubation assessments. At T5, HR was 68.95±9.31 versus 89.18±9.82 beats/min ($p<0.0001$), with higher HR in the etomidate group. These differences describe measured responses, not proven superiority on patient-centered clinical outcomes. The dissertation reports $p=0.006$ for injection pain. No patient experienced severe myoclonus or severe injection pain.

Table 1: Comparison of heart rate (beats/min) between the groups

Time	Propofol mean±SD	Etomidate mean±SD	p value
Baseline (T0)	87.6±11.15	89.23±9.93	0.493
Post induction in 1st min. (T1)	85.5±10.12	87.8±9.66	0.301
Post induction in 2min. (T2)	82.67±10.46	86.2±10.08	0.129
Post intubation in 1st min. (T3)	84±8.57	91.15±9.38	0.0006
Post intubation in 3rd min. (T4)	71.83±9.97	87.3±10.09	<0.0001
Post intubation in 5th min. (T5)	68.95±9.31	89.18±9.82	<0.0001
Post intubation in 10th min. (T6)	73.88±8.98	86.38±11.43	<0.0001

Baseline heart rate was comparable between groups. From T3 to T6, heart rate was lower in the propofol group than in the etomidate group.

Table 2: Comparison of Systolic blood pressure (mmHg) between the groups

Time	Propofol mean±SD	Etomidate mean±SD	p value
Baseline (T0)	130.3±10.02	129.75±12.68	0.83
Post induction in 1st min. (T1)	121.15±8.9	126.85±13.07	0.025
Post induction in 2min. (T2)	115.3±11.18	125.83±10.44	<0.0001
Post intubation in 1st min. (T3)	121±9.7	129.75±9.95	0.0002
Post intubation in 3rd min. (T4)	106.55±11.4	126.78±10.48	<0.0001
Post intubation in 5th min. (T5)	100.6±11.21	128.65±10.76	<0.0001
Post intubation in 10th min. (T6)	106.13±7.61	116.33±12.48	<0.0001

Baseline systolic blood pressure was comparable between groups. After induction and intubation, SBP remained lower in the propofol group, with the largest between-group difference at T5.

Table 3: Comparison of Diastolic blood pressure (mmHg) between the groups

Time	Propofol mean±SD	Etomidate mean±SD	p value
Baseline (T0)	86.3±6.76	87.95±5.22	0.225
Post induction in 1st min. (T1)	81.65±7.33	86.48±6.66	0.002
Post induction in 2min. (T2)	76.4±7.26	85.2±5.31	<0.0001
Post intubation in 1st min. (T3)	79.98±6.45	88.03±4.6	<0.0001
Post intubation in 3rd min. (T4)	70.9±6.76	86.15±5.1	<0.0001
Post intubation in 5th min. (T5)	67.3±6.54	88.03±4.9	<0.0001
Post intubation in 10th min. (T6)	74.75±6.54	78±5.2	0.016

Baseline diastolic blood pressure was comparable between groups. DBP was lower in the propofol group at all subsequent measurement points, with the largest difference at T5.

Table 4: Comparison of Mean arterial pressure (mmHg) between the groups

Time	Propofol mean±SD	Etomidate mean±SD	p value
Baseline (T0)	100.97±7.15	103.05±7.39	0.206
Post induction in 1st min. (T1)	94.82±7.09	99.18±7.59	0.009
Post induction in 2min. (T2)	88.7±7.68	98.69±5.13	<0.0001
Post intubation in 1st min. (T3)	93.65±6.71	101.93±4.96	<0.0001
Post intubation in 3rd min. (T4)	82.78±7.7	99.69±5.13	<0.0001
Post intubation in 5th min. (T5)	78.38±7.58	101.49±5.2	<0.0001
Post intubation in 10th min. (T6)	85.21±5.79	90.95±6.64	<0.0001

Baseline mean arterial pressure was comparable between groups. MAP was lower in the propofol group at all post-induction measurements, with the largest difference at T5.

Table 5: Recorded adverse effects between the groups

Time	Propofol (n=40)	Etomidate (n=40)
Any myoclonus	0 (0%)	3 (7.5%)
Mild myoclonus	0 (0%)	2 (5%)
Moderate myoclonus	0 (0%)	1 (2.5%)
Any injection pain	10 (25%)	1 (2.5%)
Mild injection pain	8 (20%)	1 (2.5%)
Moderate injection pain	2 (5%)	0 (0%)

Injection pain was more frequent in the propofol group (25%) than in the etomidate group (2.5%). Myoclonus was observed in three patients (7.5%) in the etomidate group, whereas no cases were observed in the propofol group.

DISCUSSION

The present study compared the hemodynamic effects of propofol and etomidate in 80 hemodynamically stable trauma patients undergoing laryngoscopy and endotracheal intubation. The principal finding was better preservation of heart rate and arterial pressure with etomidate, whereas propofol was associated with greater reductions in blood pressure.

Baseline hemodynamic parameters were comparable between the groups. However, following induction, SBP, DBP, and MAP declined more markedly in the propofol group. The differences persisted after intubation, with the largest differences in SBP and MAP observed at five minutes. These findings are consistent with Leede et al., who reported greater reductions in arterial pressure with propofol than with etomidate during induction of anesthesia in cardiac surgery patients [9]. Similarly, Gupta et al. reported more pronounced reductions in blood pressure with propofol and relatively better hemodynamic stability with etomidate [10]. A randomized study comparing propofol, etomidate, and their combination also demonstrated greater systemic hemodynamic reductions with propofol alone [11].

Heart rate differences became statistically significant after intubation and remained significant throughout the subsequent observation period. This pattern suggests different cardiovascular responses to the two induction agents, although the study did not establish whether these differences affected clinically important outcomes. Regarding adverse effects, injection pain occurred in 25% of patients receiving propofol compared with 2.5% receiving etomidate. Conversely, myoclonus occurred in 7.5% of the etomidate group and was absent in the propofol group. Gupta et al. reported a similar pattern of more injection pain with propofol and more myoclonus with etomidate [10]. A systematic review by Feng et al. also identified myoclonus as an important adverse effect associated with etomidate [12].

The findings should be interpreted in light of the study limitations, including the small sample size, single-center setting, exclusion of patients in shock, and lack of documented adjustment for multiple comparisons. Furthermore, adrenal function was not assessed, although etomidate-associated adrenal suppression remains a relevant consideration in critically ill patients [13]. Overall, etomidate was associated with better preservation of measured hemodynamic parameters in this selected trauma population; larger studies are needed to determine whether these differences improve clinical outcomes.

CONCLUSION

Etomidate was associated with better preservation of heart rate and arterial pressure than propofol during induction and after endotracheal intubation in hemodynamically stable trauma patients. Injection pain was more frequent with propofol, whereas myoclonus occurred only with etomidate. These findings support the relative hemodynamic stability of etomidate in the studied population; further research is needed to determine its effect on clinical outcomes.

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