



A Comparative Study between the Effects of Propofol and Etomidate in Adults Undergoing Surgeries Under General Anaesthesia.

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ABSTRACT:

BACKGROUND:

The aim of the study is to compare haemodynamic effects of propofol and etomidate in adult's surgeries under general anesthesia.

METHODS: 60 patients were enrolled in the study who underwent elective surgeries under general anesthesia and has been assessed individually both intraoperatively and post-operatively. Induction with calculated dose of propofol and etomidate. Pain on injection and myoclonic movements at induction, if occurred were recorded. The heart rate and mean arterial pressure is monitored continuously and recorded before induction, at induction and laryngoscopy followed by 1st, 3rd, 5th and 10th minute after intubation. Episodes of apnoea noted. The obtained result is sent for statistical analysis.

RESULTS: It is observed that propofol (group 1) caused significant hypotension and tachycardia induction in comparison to etomidate. In study, etomidate had showed less cardiovascular depression and minimized the uses of vasopressor agents than other induction agents in sepsis and critically ill patients.

CONCLUSION: Etomidate was found ideal for its hemodynamic stability when compared to propofol along with less incidence of pain on injection, the only drawback being high incidence of myoclonus. The study suggest that etomidate is a better option in patients particularly vulnerable to hemodynamic fluctuation during induction like uncontrolled hypertension, sepsis, critically ill and patients with coronary artery disease.

Introduction

Intravenous induction agents form the cornerstone of modern general anaesthesia. An ideal induction agent should provide rapid and smooth induction, maintain cardiovascular and respiratory stability, suppress airway reflexes, and allow rapid recovery with minimal

adverse effects¹. Since no single agent fulfils all these criteria, the choice of induction agent is guided by patient factors, surgical requirements, and the anticipated physiological stress response.

Propofol (2,6-diisopropylphenol) is one of the most widely used intravenous induction agents because of its



rapid onset of action, smooth induction, short duration of action, and antiemetic properties². Despite these advantages, Propofol is associated with several undesirable effects, including hypotension, bradycardia, respiratory depression, and significant pain on injection³. These hemodynamic effects may be particularly problematic in patients with compromised cardiovascular reserve.

Etomidate is a carboxylated imidazole derivative known for its excellent cardiovascular stability and minimal effect on sympathetic tone and baroreceptor reflexes⁴. Because of these properties, Etomidate is often preferred for induction of anaesthesia in patients with cardiac disease, hypovolemia, sepsis, and other conditions associated with hemodynamic instability⁵. However, Etomidate is associated with adverse effects such as pain on injection, myoclonic movements, postoperative nausea and vomiting, and transient suppression of adrenal steroidogenesis⁶.

Given the contrasting pharmacodynamic profiles of Propofol and Etomidate, a comparative evaluation of their hemodynamic effects and peri-induction adverse events is clinically relevant. The present study was undertaken to compare the effects of Propofol and Etomidate in adult patients undergoing surgeries under general anaesthesia with respect to hemodynamic changes, pain on injection, apnoea, and myoclonic movements.

Methodology

This prospective, non-randomized, double-arm, single-blind comparative study was conducted on 60 adult patients undergoing elective surgeries under general anaesthesia at Shri Ram Murti Smarak Institute of Medical College, Uttar Pradesh, after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all patients.

Patients aged between 18 and 50 years, belonging to American Society of Anesthesiologists (ASA) physical status I and II, and scheduled for elective surgery under general anaesthesia were included. Patients with known allergy to Propofol or Etomidate, seizure disorders, adrenal insufficiency, steroid therapy, pregnancy, hypotension, severe systemic illness, or inability to communicate effectively were excluded.

Patients were allocated into two groups of 30 each. Group P received Propofol 2 mg/kg intravenously for induction, while Group E received Etomidate 0.3

mg/kg intravenously. Standard monitoring including electrocardiography, pulse oximetry, and non-invasive blood pressure measurement was instituted in all patients. Intravenous access was secured using an 18-gauge cannula.

Premedication consisted of glycopyrrolate 0.2 mg intravenously, midazolam 0.02 mg/kg intravenously, and fentanyl 2 µg/kg intravenously. Patients were preoxygenated with 100% oxygen for 5–8 minutes. Induction of anaesthesia was carried out using the allocated study drug. Pain on injection and myoclonic movements were observed and recorded during induction. Neuromuscular blockade was achieved using vecuronium 0.1 mg/kg intravenously, and endotracheal intubation was performed after 3 minutes.

Anaesthesia was maintained with oxygen and nitrous oxide in a 70:30 ratio, isoflurane, and intermittent doses of vecuronium as required. At the end of surgery, residual neuromuscular blockade was reversed using neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg intravenously, and patients were extubated after meeting standard extubation criteria.

Heart rate and mean arterial pressure were recorded at baseline, during induction, at laryngoscopy, and at 1, 3, 5, and 10 minutes after intubation. Episodes of apnoea, pain on injection, and myoclonic movements were documented. Statistical analysis was performed using SPSS version 16. Continuous variables were analysed using the unpaired t-test and ANOVA, while categorical variables were analysed using the chi-square test. A p-value <0.05 was considered statistically significant.

Results

Sixty patients completed the study, with 30 patients in each group. Demographic variables were comparable between the two groups.

Table 1: Demographic Profile of Patients

Parameter	Propofol (n=30)	Etomidate (n=30)	p-value	Parameter
Age (years)	36.93 ± 10.56	39.00 ± 10.15	0.442	Age (years)
Male/Female	17 / 13	18-Dec	0.551	Male/Female
Weight (kg)	59.27 ± 5.79	58.40 ± 5.49	0.553	Weight (kg)

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

Time Interval	Propofol	Etomidate	P-value
Baseline	78.67	79.2	0.721
Induction	76.33	78.13	0.182
Laryngoscopy	96.73	101.27	<0.05
1 min	94.2	95.47	0.418
3 min	86.47	87.8	0.364
5 min	82.73	83.27	0.705
10 min	80.13	79.87	0.812

Heart rate changes were comparable between the two groups except during laryngoscopy.

Table 3: Comparison of Mean Arterial Pressure (mmHg)

Time Interval	Propofol	Etomidate	p-value
Baseline	87.23	88.87	0.09
Induction	69.67	86.13	<0.0001
Laryngoscopy	100.23	108.2	<0.0001
1 min	98.67	98.87	0.866
3 min	91.8	93.33	0.098
5 min	89.8	91	0.183
10 min	91.67	90.67	0.25

Mean arterial pressure values were comparable at baseline. A significant fall in mean arterial pressure was observed during induction in the Propofol group, whereas Etomidate maintained better hemodynamic stability.

Table 4: Myoclonic Movements

Grade	Propofol n (%)	Etomidate n (%)
0 (Absent)	30 (100%)	6 (20%)
1 (Mild)	0 (0%)	14 (46.7%)

2 (Moderate)	0 (0%)	10 (33.3%)
3 (Severe)	0 (0%)	0 (0%)

Myoclonic movements were absent in the Propofol group and common in the Etomidate group.

Table 5: Pain on Injection

Grade	Propofol n (%)	Etomidate n (%)
0 (No pain)	0 (0%)	20 (66.7%)
1 (Mild)	17 (56.7%)	10 (33.3%)
2 (Moderate)	13 (43.3%)	0 (0%)
3 (Severe)	0 (0%)	0 (0%)

Pain on injection was significantly more frequent in the Propofol group.

Table 6: Incidence of Apnoea

Apnoea	Propofol n (%)	Etomidate n (%)	p-value
Present	11 (36.7%)	7 (23.3%)	0.26
Absent	19 (63.3%)	23 (76.7%)	

Apnoea was observed more frequently with Propofol, though the difference was not statistically significant.

Discussion

The present study compared Propofol and Etomidate as intravenous induction agents with special emphasis on hemodynamic stability and peri-induction adverse effects. The two groups were comparable in demographic characteristics, allowing meaningful comparison.

A significant reduction in mean arterial pressure following Propofol induction was observed. This hypotensive effect has been widely reported and is attributed to inhibition of sympathetic vasoconstrictor activity, direct vasodilation, and reduced myocardial contractility.^{3,7} Muzi et al. demonstrated that venodilation plays a major role in Propofol-induced hypotension by reducing venous return⁷.

Etomidate demonstrated superior hemodynamic stability during induction, with minimal changes in



mean arterial pressure and heart rate. Similar observations have been reported by Aono et al. and Hughes and MacKenzie, who emphasized the cardiovascular safety of Etomidate.^{4,9} Preservation of baroreceptor reflexes and sympathetic tone explains this stability.

Both groups exhibited an increase in hemodynamic parameters during laryngoscopy, reflecting the sympathetic response to airway manipulation¹⁰. The response was more pronounced in the Etomidate group, likely due to the absence of sympathetic suppression. These changes were transient and resolved within minutes.

Pain on injection was significantly higher in the Propofol group, consistent with previous studies.^{2,11} Etomidate caused less injection pain, particularly when administered in lipid formulations.¹²

Myoclonic movements were observed predominantly with Etomidate. These movements are believed to result from subcortical disinhibition before cortical depression⁶. Although usually benign, they may be undesirable in patients with raised intracranial pressure or open-globe injuries.^{13,14}

Respiratory depression and apnoea were more common with Propofol, reflecting its dose-dependent suppression of ventilatory drive³. Etomidate caused minimal respiratory depression, making it advantageous in patients with limited respiratory reserve.⁵

Although Etomidate is associated with transient adrenal suppression, the clinical significance after a single induction dose remains controversial.^{6,15} Adrenal function was not assessed in this study.

Conclusion

Both Propofol and Etomidate are effective intravenous induction agents for general anaesthesia. Propofol provides smooth induction but is associated with significant hypotension, pain on injection, and respiratory depression. Etomidate offers superior hemodynamic stability with minimal respiratory effects, though it is associated with myoclonic movements.

Etomidate may be preferred in patients at risk of hemodynamic instability, while Propofol remains suitable for hemodynamically stable patients. The choice of induction agent should be individualised to optimise patient safety and outcomes.

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