

A Comparative Study of Etomidate and Propofol as Induction Agent for Intubation in Patients coming to Emergency Medicine Department

Dr. Mittal A. Meghraj¹, Dr. Jigarkumar B. Gosai^{2*}, Dr. Chirag J Patel³, Dr. Arunjith G⁴, Dr. Himanshu Dhanrajbhai Ramchandani⁵, Dr Pathan Uzma parvin⁶

¹ Assistsnt Professor, Department of Emergency Medicine, Parul University. ² Associate

Professor, ³ Professor and Head, ^{4,5,6} Resident doctor, Department of Emergency Medicine, B.J Medical College, Ahmedabad

*Corresponding author: Dr Jigarkumar B. Gosai

Email: drjigargosai81@gmail.com

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ABSTRACT

Background & Aims: An ideal induction agent for intubation in the emergency department should have hemodynamic stability, minimal respiratory side effects and rapid clearance. Etomidate and Propofol are popular rapid-acting inducing agents; our aim is to compare hemodynamic changes and adverse effects occurring between them when used as induction agents in the emergency department. **Material and Methods:** A study sample of 200 patients who required intubation in the emergency department were enrolled after satisfying the inclusion and exclusion criteria and were divided into two equal groups. After assessing the primary survey of airway, baseline hemodynamic parameters, Group A was given Inj. Etomidate 0.3–0.5 mg/kg iv and Group B was given Inj. Propofol 0.5–1.5 mg/kg iv as an induction agent, followed by that Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), respiratory rate (RR), oxygen saturation, myoclonus, nausea, and vomiting were monitored after induction and intubation at one, five and fifteen minutes. **Result:** The mean changes in HR, SBP, DBP, and MAP of groups A and B were compared, there was significant reduction in all three parameters in Propofol compared to Etomidate. In group A, out of 100 patients, 25 had myoclonus, 15 had vomiting, and no side effect was observed in the other 60 patients. In group B, out of 100 patients, 22 had apnea, 14 had vomiting, and no side effect was observed in the remaining 64 patients. **Conclusion:** This study concludes that Etomidate is a better agent for induction than Propofol in view of hemodynamic stability. The incidence of apnea was higher with Propofol, and myoclonus more with Etomidate.

Keywords:-Etomidate, Propofol, Intubation

INTRODUCTION

An ideal induction agent for intubation in the emergency department should demonstrate hemodynamic stability, minimal respiratory side effects, and rapid clearance. Currently, Etomidate and Propofol are popular choices for rapid-acting inducing agents. Etomidate, a carboxylate imidazole-containing compound, is characterized by hemodynamic stability, minimal respiratory depression, and cerebral protective effects¹. Notably, it does not affect the sympathetic nervous system or the baroreceptor reflex regulatory system^{1,2}. Its ability to increase coronary perfusion, even in patients with moderate cardiac dysfunction, positions it as a preferred induction agent¹.

In contrast, Propofol induces a decrease in blood pressure, cardiac output, and systemic vascular Resistance^{3,4}. This is attributed to the inhibition of sympathetic vasoconstriction and impairment of the baroreceptor reflex regulatory system^{1,5}. The impact of Propofol may be more pronounced in hypovolemic and elderly patients with compromised left ventricular function due to coronary artery disease. Additionally, Propofol produces a dose-dependent depression of ventilation. Both agents, however, have associated adverse effects such as pain on injection, thrombophlebitis, and myoclonus, which can be mitigated by pre-medicating with fentanyl, an opioid⁶.

This study aims to compare the hemodynamic, respiratory, and other effects of both drugs to facilitate the selection of a safe induction agent for intubation in the emergency department.

MATERIALS AND METHOD

This study commenced after receiving approval from the institutional ethical committee. All patients admitted to the emergency department requiring intubation were considered for inclusion in this single-center, prospective cohort study conducted from December 2018 to June 2020 in Civil Hospital Ahmedabad. A study sample of 200 patients was selected based on specific inclusion criteria: individuals of both sexes aged between 20 and 90 requiring emergency intubation, providing proper verbal and written consent, with a mouth opening greater than 2.5 cm and Mallampati grades 1 and 2.

Exclusion criteria encompassed patients or their relatives who did not consent to the study, those with a mouth opening less than 2.5 cm, Mallampati grades 3 and 4, and individuals with comorbidities such as acute attacks of bronchial asthma, ischemic heart disease, hypertension, hypotension, allergies to the study drugs, diagnosed pathologies in the larynx and pharynx, gastroesophageal reflux disease

(GERD), a history of a seizure disorder, the presence of primary and secondary steroid insufficiency, or currently on steroid medication. Upon admission to the emergency department, following an

assessment of the airway's primary survey, baseline measurements of heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation were recorded. Patients were connected to a multiparameter monitor, including an electrocardiogram (ECG), non invasive blood pressure (NIBP), and pulse oximeter (SpO₂), and hemodynamic parameters were documented. Intravenous access was then secured. For induction, Group A received Inj. Propofol at a dose of 0.5–1.5 mg/kg IV, while Group B was administered Inj. Etomidate at a dose of 0.3–0.5 mg/kg

IV. Subsequently, endotracheal intubation was performed under aseptic precautions. Confirmation of the endotracheal tube position was ensured through direct visualization and five-point auscultation. Simultaneously, monitoring of various parameters, including heart rate, blood pressure, oxygen saturation, respiratory rate, myoclonus, nausea and vomiting, and apnea, occurred after induction and at 1 minute, 5 minutes, and 15 minutes post-intubation. All patients received premedication with Inj. Ondansetron at a dose of 0.1 mg/kg, Inj. Glycopyrrolate at a dose of 0.005–0.01 mg/kg, and Inj. Fentanyl at a dose of 3 mcg/kg 10 minutes before induction. Statistical analysis and comparison of hemodynamic parameters between Etomidate and Propofol were conducted using the mean and standard deviation, presented graphically with the assistance of Z-score.

RESULT

In our study, the age group ranged from 20 to 90 years, with the highest number of male patients falling between 60 and 79 years and females between 50 and 89 years. Substance abuse history, including chronic alcoholism and smoking, was present in 16% of patients. Comorbidities such as chronic obstructive airway disease (4.5%), diabetes mellitus (8%), hypertension (16%), ischemic heart disease (3.5%), chronic kidney disease (2.5%), and hypothyroidism (5.5%), were noted in our study group.

Among all intubations, 98.5% were performed using rapid sequence intubation. Eighty-four percent of patients had a Glasgow Coma Scale (GCS) score below 8, and 49% were intubated for airway protection. Forty-six percent had respiratory failure, and 5% were intubated prophylactically. Most male patients (62.87%) were intubated with an 8mm endotracheal tube, while females (68.29%) used a 7mm tube. Of those requiring intubation for airway protection, 49% had type 1 respiratory failure, 14% had type 2 respiratory failure, and 5% were intubated prophylactically.

In our study, 92% of patients were intubated within 10 minutes on their first attempt, while the remaining 8% required more than 10 minutes and two to three attempts for intubation.

Regarding side effects, after administering Etomidate (Group A), 25 out of 100 patients experienced myoclonus, 15 had vomiting, and no side effects were observed in the remaining 60 patients. For Propofol (Group B), out of 100 patients, 22 had apnea, 14 experienced vomiting, and no side effects were observed in the remaining 64 patients.

In Group B (Propofol induction), a significant reduction in heart rate of 7.41 beats per minute and 9.41 beats per minute, as well as a decrease in systolic blood pressure (SBP) by 10.6 mmHg and 17.32 mmHg after 5 and 15 minutes, was observed. No significant changes were noted in heart rate or SBP after 1 minute. Diastolic blood pressure (DBP) decreased by 6.34 mmHg and 8.96 mmHg, and mean

arterial pressure (MAP) fell by 3.4 mmHg, 7.73 mmHg, and 11.71 mmHg at 1, 5, and 15 minutes after Propofol administration.

In comparison, Group A (Etomidate induction) showed a reduction in heart rate by 3.74 beats per minute and 6.55 beats per minute, a decrease in SBP by 4.4 mmHg and 4.27 mmHg at 5 and 15 minutes, a drop in DBP by 2.84 mmHg and 6.34 mmHg, and a decrease in MAP by 2.1 mmHg, 2.1 mmHg, and 3.06 mmHg at 1, 5, and 15 minutes after Etomidate administration. No significant difference was noted in the fall of oxygen saturation between the two study group.

Figure 1

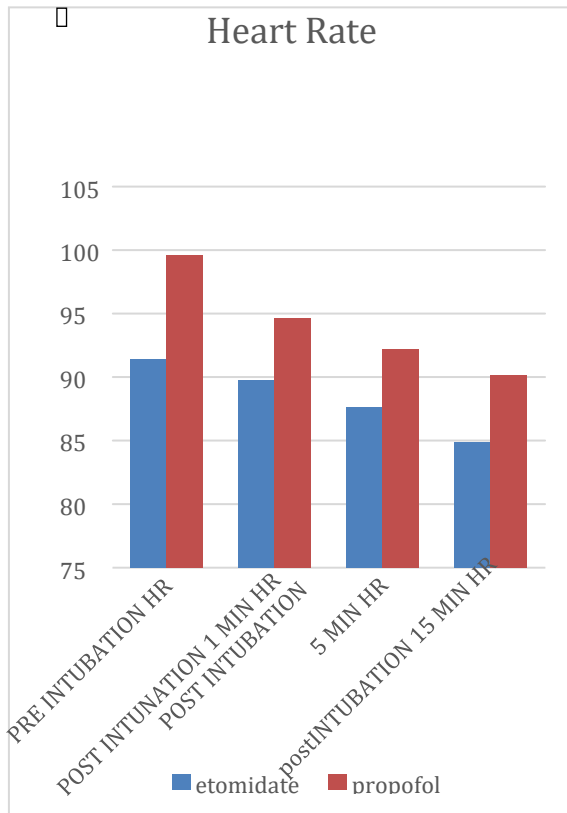


Figure 2

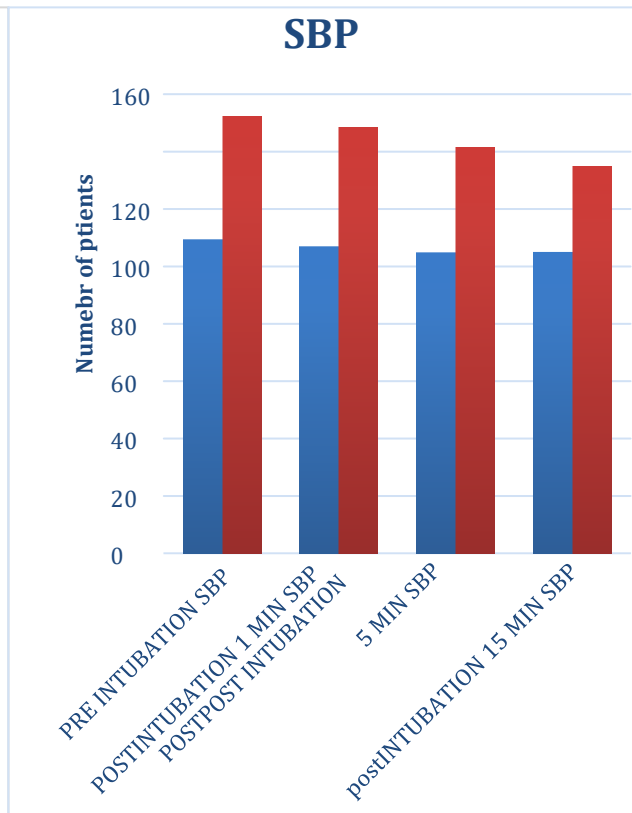


Figure 3

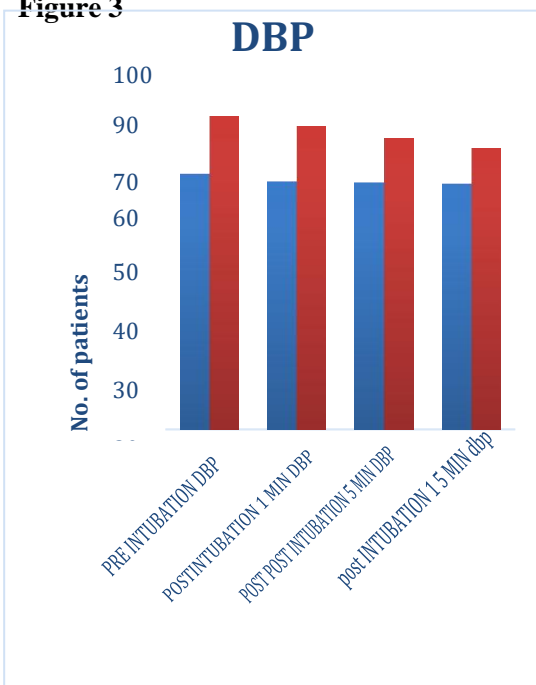
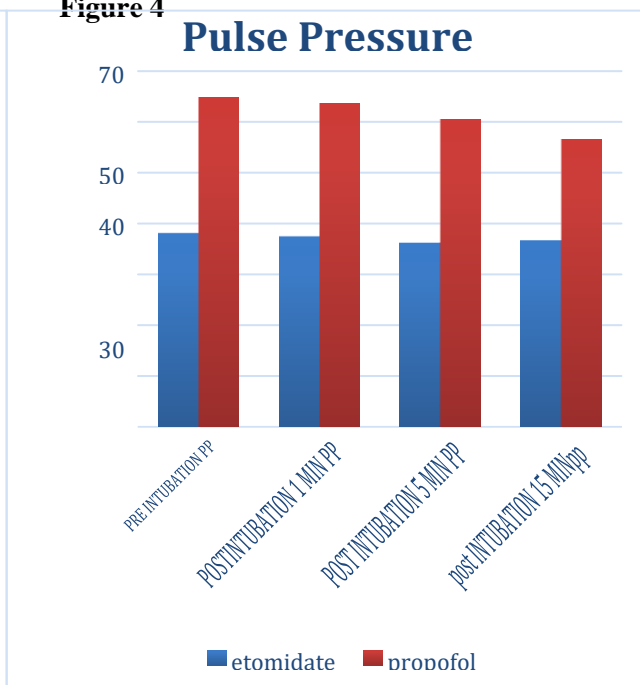


Figure 4



DISCUSSION

Hypotension is recognized to occur during propofol induction due to various factors such as the reduction of sympathetic activity leading to vasodilatation, the direct effect on intracellular calcium mobilization, and the inhibition of prostaglandin synthesis in endothelial cells¹¹. Sudden hypotension can have detrimental effects on maintaining circulation to vital organs, especially in conditions such as ischemic heart disease, valvular heart disease, systemic hypertension, and shock. The observed hemodynamic stability with etomidate may be attributed in part to its unique lack of effect on the sympathetic nervous system and baroreceptor function^{1,2}. In patients with valvular heart disease, reductions in pulmonary artery and pulmonary capillary wedge pressures suggest a decrease in preload and afterload. Although the decrease in systemic pressure after a propofol induction is attributed to vasodilatation, the direct myocardial depressant effects of propofol remain a subject of controversy¹¹. Propofol's cardiovascular effects have been extensively studied in the context of anesthesia induction and maintenance. The most prominent effect of propofol is a reduction in arterial blood pressure during anesthesia induction¹¹. The heart rate does not exhibit significant changes after a propofol induction dose. Propofol may either reset or inhibit the baroreflex, thereby reducing the tachycardic response to hypotension². The most common side effect during induction is hypotension, and this effect is amplified by the concurrent administration of opioids. Etomidate, on the other hand, is characterized by its properties of hemodynamic stability, minimal respiratory depression, cerebral protection, and pharmacokinetics that facilitate rapid recovery after a single dose or continuous infusion. Induction with etomidate typically results in a brief period of hyperventilation, sometimes followed by a similarly brief period of apnea¹¹. In contrast, apnea after propofol induction is common, and its incidence is higher compared to etomidate. Myoclonus is more frequently observed with etomidate, while the incidence of post-induction nausea and vomiting is similar in both study group.

CONCLUSION

Patients induced with propofol experienced a significant decrease in systolic and diastolic blood pressure as well as mean arterial pressure at 5 to 15 minutes after induction compared to patients induced with etomidate. This characteristic suggests that etomidate maintained hemodynamic stability. Changes in heart rate were not significant between the two groups. The incidence of apnea was higher in the propofol group; however, etomidate caused more myoclonus than propofol. There was no significant difference with regard to nausea and vomiting between the two groups.

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