

# Comparison of Hemodynamic Changes and Blood Sugar Levels between Etomidate and Propofol Before and after Induction of General Anaesthesia

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**Abstract:** Sudden hypotension, arrhythmias, and cardiovascular collapse are threatening complications following injection of induction agent in hemodynamically unstable patients. This study aims to compare the hemodynamic changes and blood sugar levels between etomidate and propofol following the induction of general anaesthesia. **Methods:** This is a hospital based observational study, where 90 patients of either sex, between 18 - 60 years of age belonging to ASA grade I and II, scheduled for elective surgeries under general anaesthesia were selected consecutively. The patients were divided into two groups, Group E (n= 45) patients who received etomidate and Group P (n=45) patients who received propofol as induction agent. Study parameters including heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure were recorded during induction and then at 1, 2, 3, 4, 5, 10 and 15 minutes after induction. Blood sugar were recorded before and after induction. The side effects were observed. **Results:** Hemodynamic parameters at 2, 3, 4, and 15 minutes post induction were significantly more stable in Group - E than Group - P (p - value<0.05). After induction there is significantly rise in blood sugar in Group - E compared to Group - P (p - value=0.0090). Higher number of patients had hypotension and bradycardia in Group - P compared to Group - E though it was not statistically significant. And lower number of patients had nausea and vomiting in Group - P compared to Group - E which was also not statistically significant. **Conclusion:** Etomidate is hemodynamically more stable than propofol. After induction blood sugar levels in the etomidate group were found to be somewhat higher than the propofol group from the baseline level.

**Keywords:** Etomidate, propofol, hemodynamic changes, blood sugar

## 1. Introduction

Induction of general anaesthesia is a critical part of anaesthesia practice in the modern world. Following the injection of induction agent, there may be the occurrence of threatening complications like sudden hypotension, arrhythmias, and cardiovascular collapse in hemodynamically unstable patients.<sup>1</sup> General anesthetic induction agents may decrease arterial blood pressure via myocardial depression, vasodilatation and attenuation of autonomic nervous activity. Conversely, laryngoscopy and endotracheal intubation elicit unwanted cardiovascular responses such as hypertension, tachycardia and dysrhythmias.<sup>2, 3</sup> This sometimes results in "alpine hemodynamic response" to the induction of general anaesthesia.

Patients undergoing any types of surgery may also have concern about the stress response and metabolic reactions of the body, resistance to insulin and hyperglycemia being the most important.<sup>4</sup> An ideal induction should have amnesic properties and proper glycemic control, have active metabolites and shouldn't get accumulated. It should be compatible with all solutions and have longer shelf life. For induction propofol and etomidate are amongst the safest drugs that are used at present.<sup>5, 6</sup>

Etomidate is a short - acting hypnotic drug, which is usually used for induction and maintenance of anaesthesia. It has minimal side effects on cardiovascular and respiratory functions and is suitable for patients with compromised ventricular function.<sup>7</sup> However, it has been shown that etomidate administration can inhibit adrenal gland function by blocking  $11\beta$  - hydroxylase and  $17\alpha$  - hydroxylase enzymes.<sup>8</sup> There is a relation between etomidate administration and adrenal insufficiency, which is caused by reversible inhibition of cortisol synthesis. Reduced cortisol and aldosterone level following adrenal suppression, almost starts in less than 30 minutes after a single dose of etomidate and can last up to 72 hours.<sup>9</sup> On the other hand, it has been shown that relative adrenal insufficiency in septic patients may induce morbidity and mortality.

Propofol is an intravenous hypnotic agent, which is commonly used for induction due to its rapid onset, short duration of action, anti - nausea and vomiting effect and feeling comfortable after surgery. The most prominent effect of propofol is a decrease in arterial blood pressure during induction of anaesthesia and is associated with a decrease in cardiac output, stroke volume, and systemic vascular resistance and produces moderately respiratory depression.<sup>10</sup>

This study aims to compare the hemodynamic changes and blood sugar levels between etomidate and propofol before

and after induction of general anaesthesia and to observe any side effects following the use of these two drugs.

## 2. Materials and Methods

This is a hospital based observational study, carried out under the department of Anaesthesiology, Jorhat Medical College and Hospital, Jorhat in the study period of one year from July 2021 to June 2022 with prior permission and approval from the Institutional Ethical Committee. Study population is the adult patients of either sex, which were scheduled for elective surgeries under general anaesthesia at JMCH. The sample size was calculated using sample size calculation formula. Patients were divided into two groups, Group E (n= 45): Patients who received etomidate as induction agent and Group P (n= 45): Patients who received propofol as induction agent. Inclusion criteria are patients who are willing to give written informed consent, ASA (American Society of Anaesthesiologists) Grades I and II patients, Mallampati grade I and II, patients aged between 18 and 60 years of both the sex. And the patients with history of diabetes, cardiac, coronary, renal, hepatic, cerebral disease and peripheral vascular diseases, psychiatric disease and alcoholism. Patients with heart rate less than 60 /minute, baseline blood pressure less than 100/50 mm Hg, presence of 1st, 2nd or 3rd degree heart block, pregnant and lactating mother were excluded from this study

After shifting to operation theatre, patients were connected to standard monitor for continuous monitoring. The baseline heart rate, blood pressure, mean arterial pressure, ECG, SPO2 and Blood sugar were recorded. Premedication was done with injection palanosetron 0.075 mg, injection glycopyrrolate 0.2mg and injection tramadol 2mg/kg i. v stat. Group A patients received intravenous etomidate 0.3mg/kg. And group B Patients received intravenous propofol 2mg/kg as induction agent. Following successful placement of endotracheal tubecontrolled ventilation was maintained with 33% oxygen and 66% nitrous oxide and sevoflurane inhalation in titrated dose. Muscle relaxation was maintained with injection atracurium with loading dose of 0.5 mg /kg iv and intermittent dose of 0.1 mg/ kg when required. Intravenous fluid was given as Ringer's lactate and Normal Saline 0.9% at a rate of 4 - 6ml/kg/hr. Study parameters heart rate, systolic blood pressure (SBP), diastolic blood pressure DBP), mean arterial pressure (MAP), random blood sugar and any side effects were recorded during induction and then at 1 min, 2 min, 3 min, 4 min, 5 min, 10 min and 15 min after induction. Blood sugar were recorded just after induction.

For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5. Data had been summarized as mean and standard deviation for continuous numerical variables and were compared using student's t - test. Number or percentages are used for categorical variables and are analysed using Chi - square test or Fischer's exact test. The p - value was considered to be significant when less than 0.05.

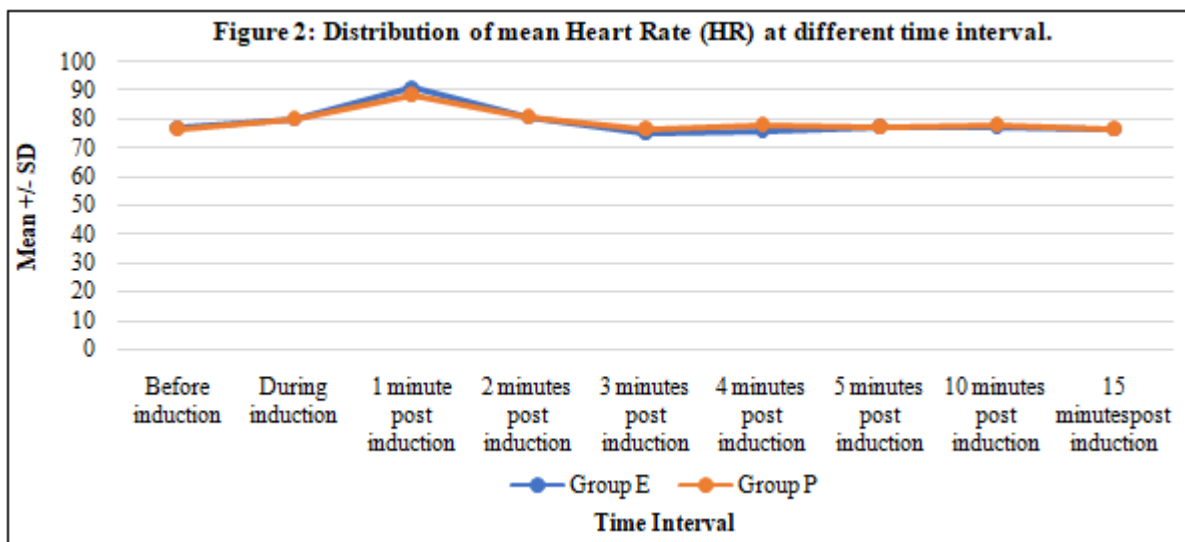
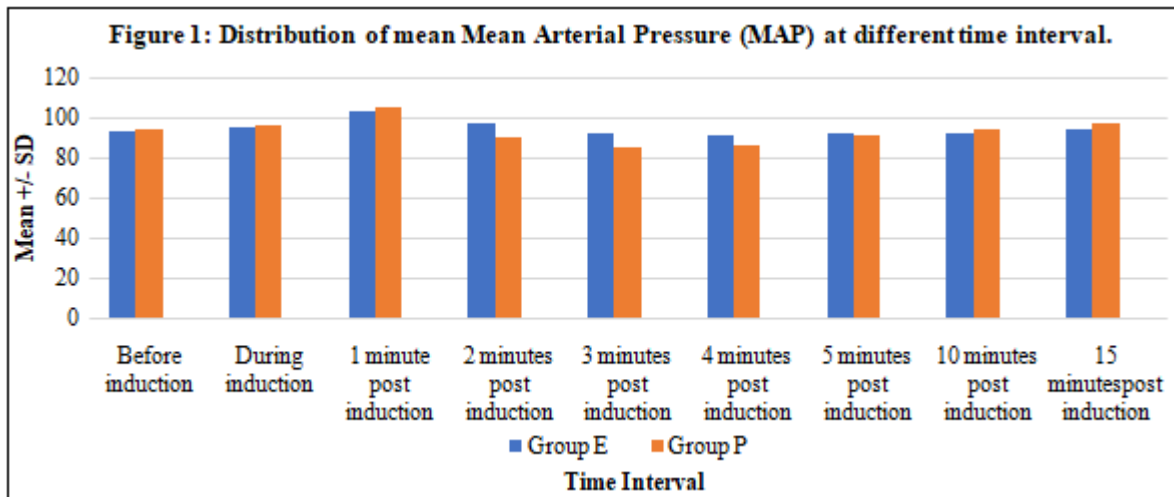
## 3. Results and Observations

It was observed that the demographic parameters of the two groups for this study were comparable. In our study, out of 90 patients, most of the patients were 31 - 40 years old [30 (33.3%) ].16 (35.6%) patients were 31 - 40 years of age in Group - E and 14 (31.1%) patients were 31 - 40 years of age in Group P. Age was not significantly associated with both in Group - E and Group P (p=0.8226). Female population [70 (77.8%) ] was higher than the male population [20 (22.2%) ]. Male: Female ratio was 3.5: 1. Sex was not significantly related with both in Group - E and Group P (p=0.3104). In our study, mean Weight was higher in Group - E [64.2667± 8.8070] compared to Group P [61.5111± 9.0945] which was not statistically significant (p=0.1478). We found higher number of patients had ASA 1 in Group P [38 (84.4%) ] compared to Group - E [38 (84.4%) ] which was not statistically significant (p=0.2918). And majority number of patients had MPS 2 in Group - E [30 (66.7%) ] compared to Group P [29 (64.4%) ] but this was not statistically significant (p=0.8244). (Table 1)

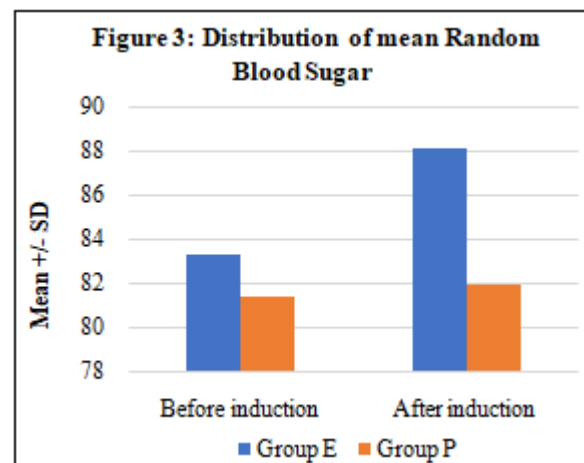
**Table 1: Demographic Profile**

Variables	Group E	Group P	p - value
Age (years)	39.51±11.52	36.88±10.47	0.2626
Weight (kgs)	64.26±8.80	61.51±9.09	0.1478
Sex	Male	12 (26.7%)	0.3104
	Female	33 (73.3%)	
ASA	ASA I	34 (75.6%)	0.2918
	ASA II	11 (24.4%)	
MPS	MPS 1	15 (33.3%)	0.8244
	MPS 2	30 (66.7%)	

We found that, mean SBP before induction (0.4953), during induction (0.7714), 1 minute (0.0725), 5 minutes (0.3837) and 10 minutes post induction (0.3487) were statistically not significant, whereas we observed that, SBP at 2 minutes (<0.0001), 3 minutes (<0.0001), 4 minutes (<0.0001) and 15 minutes post induction (0.0305) in Group E and Group P both was statistically significant. DBP at 2 minutes (0.0304), 3 minutes (0.0137) and 15 minutes post induction (0.0499) was statistically significant and we observed that, mean DBP before induction (0.2627), during induction (0.3416), 1 minute (0.0964), 4 minutes (0.0873) 5 minutes (0.9660) and 10 minutes post induction (0.1811) with Group E and Group P both was not statistically significant. The mean MAP at 2 minutes (0.0012), 3 minutes (<0.0001), 4 minutes (0.0029) and 15 minutes post induction (0.0275) was statistically significant and mean MAP before induction (0.6032), during induction (0.5892), 1 minute (0.0757), 5 minutes (0.7139) and 10 minutes post induction (0.1916) with Group E and Group P both was not statistically significant. (Figure - 1) The mean HR before induction (0.9202), during induction (0.8373), 1 minute (0.1756), 2 minutes (0.9253), 3 minutes (0.3761), 4 minutes (0.2216), 5 minutes (0.9535), (0.6396) and 15 minutes post induction (0.9219) with Group E and Group P both was not statistically significant. (Figure 2)



In Group - E, the mean random blood sugar before induction (in mg) (mean± s. d.) of patients was 83.2889± 9.7319. In Group P, the mean random blood sugar Before induction (in mg) (mean± s. d.) of patients was 81.4000± 11.5688. Distribution of mean random blood sugar before induction (in mg) was not statistically significant (p=0.4042). In Group - E, the mean random blood sugar after induction (in mg) (mean± s. d.) of patients was 88.1333± 12.4473. In Group P, the mean random blood sugar after induction (in mg) (mean± s. d.) of patients was 82.0000± 9.0729. Distribution of mean random blood sugar after induction (in mg) in between the two groups was statistically significant (p=0.0090). (Figure 3)



In our study, higher number of patients had hypotension in Group P [7 (15.6%) ] compared to Group E [3 (6.7%) ] though it was not statistically significant (p=0.1797). And more number of patients had bradycardia in Group - P [4 (8.9%) ] compared to Group - E [2 (4.4%) ] which was also not statistically significant (p=0.3980). (Table - 2)

We found that, higher number of patients had nausea in Group - E [11 (24.4%) ] compared to Group P [7 (15.6%) ] and higher number of patient had vomiting in Group - E [7

(15.6%) ] compared to Group P [4 (8.9%) ] which was not statistically significant ( $p=0.3343$ ). (Table - 2)

**Table 2:** Distribution of side effects between the groups

Side effects	Group E	Group P	p - value
Hypotension	3 (6.7%)	7 (15.6%)	0.1797
Bradycardia	2 (4.4%)	4 (8.9%)	0.3980
Nausea	11 (24.4%)	7 (15.6%)	0.2918
Vomiting	7 (15.6%)	4 (8.9%)	0.3343

#### 4. Discussion

It was observed that the demographic parameters of the two groups for this study were comparable. The age, sex, weight, ASA grade and MPS differences were statistically insignificant ( $p$  value  $> 0.05$ ) in both the group

In our study the mean SBP before induction, during induction, 1 min, 5 min and 10 minutes post induction were statistically not significant and SBP at 2 min, 3 min, 4 min and 15 minutes post induction between the groups were statistically significant. The mean DBP at 2 min, 3 min and 15 minutes post induction were statistically significant and mean DBP before induction, during induction, 1 min, 4 min, 5 min and 10 minutes post induction was not statistically significant. The mean MAP at 2 min, 3 min, 4 min and 15 min post induction were statistically significant and the mean MAP before induction, during induction, 1 min, 5 min and 10 min post induction in Group E and Group P both was not statistically significant. Heart rate at different time intervals in both the groups are not statistically significant

Shah SB *et al*<sup>11</sup> (2015), made the study based on induction agent Etomidate or Propofol. At T1 in both the groups there was a comparable fall in HR due to the anxiolytic action of midazolam and fentanyl premedication. In Group - P there was sustained increase in HR throughout induction and intubation. This was moderately significant statistically at T2 and T3 ( $P < 0.01$ ). ( $P < 0.01$ ). In Group - E, there was statistically insignificant increase in HR at T2, T3, T4, T5 and T6. There was no significant difference in between the groups with respect to HR, CVP and PCWP.

In the study done by Kaushal RP *et al*<sup>12</sup> (2015), there was significant decrease in SBP, DBP and MAP between the groups after induction, after intubation and 5 min post intubation in propofol group when compared to baseline values after induction, after intubation and 5 min after intubation, but not in etomidate group.

We found that, mean Blood Sugar Before induction in Group - E compared to Group P which was not statistically significant. But after induction there is significantly rise in mean Blood Sugar in Group - E compared to Group P. A. Ramakrishna Rao *et al*<sup>13</sup> (2015) found that in non - diabetic patients, RBS decrease at 5 min after intubation when induced with Propofol and also showed that response to surgical stress in surgeries of less than 2 hrs duration in non - diabetics and controlled diabetics can be minimized by using opioids like fentanyl and induction agents like Propofol.

In our study, higher number of patients had hypotension and bradycardia in Group P, compared to Group E, though it was not statistically significant. And higher number of patients had nausea and vomiting in Group - E compared to Group P, which was not statistically significant. In the study of Hug *et al*<sup>14</sup>, conducted on 25000 patients showed that Propofol lead to bradycardia in 4.2% of patients and hypotension in 15.7% of patients. At 5 and 10 minutes after induction HR was decreased significantly. In the studies done by Shah SB *et al*<sup>11</sup> and Kaushal RP *et al*<sup>12</sup>, showed that etomidate had more haemodynamic stability PONV scores were significantly higher in Group IIE compared to the other groups.

#### 5. Limitation

The sample size was small. Only 90 cases are not sufficient for this kind of study. Due to the availability of limited resources, intermittent recording of hemodynamics was used in this study. This could mean that some of the variations in hemodynamic which occurred in between the fixed record intervals may have been missed. and ongoing COVID 19 pandemic and lockdown has further hampered the study.

#### 6. Conclusion

From this observational study we concluded that etomidate is hemodynamically more stable than propofol, so it is a better inducing agent than propofol. After induction, blood sugar levels are affected by both etomidate and propofol, i. e., blood sugar levels in the etomidate group were found to be somewhat higher after induction than the baseline level, but blood sugar levels in the propofol group were slightly lower after induction than the baseline level. Side effects like hypotension, bradycardia, nausea and vomiting were present in both the groups, but they were not statistically significant.

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