

Comparative Study of Etomidate and Propofol for Induction of General Anesthesia

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Abstract

Background and Objectives: Induction of anesthesia is a critical part of anesthesia practice. Sudden hypotension, arrhythmias, and cardiovascular collapse are threatening complications following injection of induction agent in hemodynamically unstable patients. Present prospective randomized study is designed to compare propofol and etomidate for their effect on hemodynamics in patients undergoing general anesthesia.

Methods: Hundred ASA I and II patients of age group 18-60 years scheduled for elective surgical procedure under general anesthesia were randomly divided into two groups of 50 each receiving propofol (2 mg/kg) and etomidate (0.3 mg/kg) as an induction agent. Vital parameters at induction, laryngoscopy and thereafter recorded for comparison.

Results: Demographic variables were comparable in both the groups. Patients in etomidate group showed little change in mean arterial pressure (MAP) and heart rate (HR) compared to propofol ($p > 0.05$) from baseline value.

Conclusions: This study concludes that etomidate is a better agent for induction than propofol in view of hemodynamic stability.

Keywords: Etomidate; General anesthesia, Hemodynamic stability.

INTRODUCTION

An ideal induction agent for general anesthesia should have hemodynamic stability, minimal respiratory side effects and rapid clearance. Etomidate is a carboxylate imidazole containing

compound characterized by hemodynamic stability, minimal respiratory depression and cerebral protective effects.¹ Its lack of effect on sympathetic nervous system, baroreceptor reflex regulatory system^{1,2} and its effect of increased coronary perfusion even on patients with moderate cardiac dysfunction makes it an induction agent of choice in cardiac disease patients.³⁻⁶ However, transient adrenocortical suppression, postoperative nausea and vomiting, myoclonus, pain on injection are the side effects.¹

Propofol, 2,6-diisopropylphenol is most popular induction agent with its favourable characteristics of rapid and smooth induction and recovery, decrease incidence of nausea and vomiting, etc.^{1,2} While on other side decrease blood pressure, dose dependent depression of ventilation, pain on injection are the

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major drawbacks.^{1,2}

This study is an attempt to compare haemodynamic parameters between Etomidate and Propofol and compare effect of Etomidate and Propofol on heart rate, systolic blood Pressure, diastolic blood pressure and mean arterial pressure.

METHODS

This prospective randomized double blind study is conducted on 100 patients of American Society of Anesthesiologist (ASA) grade I and II between 18 and 60 years of age of either sex, scheduled for elective surgical procedure under general anesthesia with endotracheal intubation. After approval from institutional ethical committee, written informed consent was obtained from all the patients. The total 100 patients were randomly assigned into 2 groups of 50 patients each according to a computer generated table of random numbers.

- Group A (n = 50): received Inj. Propofol 1% (2 mg/kg of bodyweight)
- Group B (n = 50): received Inj. Etomidate (0.3 mg/kg of body weight)

All patients were kept on fasting for at least six hours before the procedure. Once the patient is shifted to operation theatre, Intravenous access was secured with an 18G cannula. Patients were Monitored with Electrocardiography, Non Invasive Blood Pressure, Pulse oxymeter and End tidal carbon dioxide. Baseline readings taken.

Patient was premedicated with Glycopyrrolate 0.2 mg, inj. midazolam 0.02 mg/kg and ondansetron 0.08 mg/kg, inj. Fentanyl 2 mcg/kg, Intravenous 7 was injected ten minutes before induction and the patients were randomised into two groups, Group A and Group B for patients receiving Etomidate and Propofol respectively.

Induction of anesthesia was either with Propofol 2 mg/kg or Etomidate 0.3 mg /kg⁸, loss of eye lash reflexes was considered to be the end point. This was followed by injection succinyl choline 2mg/kg. ventilation was assisted manually using a face mask with N₂O and O₂. After the administration of muscle relaxant intubation was attempted by same anesthesiologist. Observation made for heart rate, systolic blood pressure and diastolic blood pressure post induction and 2 mins, 5 mins,

10 min, 20 min and 30 min after intubation. Once intubation is confirmed the patient was connected to Bain's circuit and intermittent positive airway pressure ventilation was continued until the completion of surgery with 66% N₂O and O₂ maintenance of anesthesia done by inhalational drug like Halothane/Isoflurane/Sevoflurane and intravenous muscle relaxant vecuronium / atracurium.

At the end of the surgery neuromuscular blockade was reversed by using intravenous neostigmine 0.05 mg/kg and glycopyrrolate 10 mcg/kg. The extubation was performed after the patient was fully awake.

STATISTICAL ANALYSIS

Collected data was entered into Microsoft excel spreadsheet. Continuous variable were presented as Mean SD. Categorical variables were expressed into frequency and percentages. Continuous variables were compared between Propofol and Etomidate at different time point by performing independent t-test. Effect of drugs of Propofol and Etomidate was compared at different time point by performing Wilcoxon rank sum test for non normalized data. Categorical variables were compared between 3 group by performing chi-square test. P<0.05 was considered as statistical significance whereas a p value <0.001 was considered as highly significant. Statistical software STATA version 14.0 was used for data analysis.

RESULTS

Both groups were comparable in age, sex, weight and ASA physical status, with no statistically significant differences (p > 0.05) (Table 1). Pre-operative vitals (HR, SBP, DBP and MAP) were comparable in both groups with no statistically significant differences (p > 0.05).

Table 1: Demographic characteristic of patients (p > 0.05).

Variable	Group A	Group B
Age (years) mean± SD	42.2±12.09	37±12.43
Gender (Male: Female)	27:23	23:27
Weight (kg) mean± SD	62.48±7.77	60.08±7.71

Table 2: Comparison of Heart rate between Propofol and Etomidate at different time point.

Time	Group - A		Group - B		p-value
	Mean	SD	Mean	SD	
Basal	83.76	7.97	86.32	7.61	0.1040,NS
1 min After Induction	85.24	7.85	86.84	8.09	0.3194,NS
2 min after induction	93.32	7.51	90.8	7.85	0.1043,NS
5 min after induction	93.32	7.00	93.56	8.19	0.8752,NS
10 min after induction	85.96	7.90	88.42	7.29	0.1090,NS
20 min after induction	83.44	7.57	86.2	6.98	0.0612,NS
30 min after induction	83.84	7.73	86.28	6.83	0.0736,NS

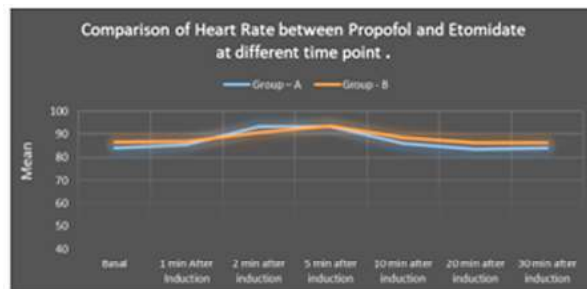


Fig. 1: Showing changes in HR at different time intervals between Group A and Group B.

The heart rate in group A was increased by 2 bpm after induction and in group B no change in HR after induction from baseline. After intubation heart rate increases in both groups but not statistically significant (p value >0.05).

Table 3: Comparison of Systolic blood pressure between Propofol and Etomidate at different time point.

Time	Group - A		Group - B		p-value
	Mean	SD	Mean	SD	
Basal	133	14.03	129.4	10.30	0.1469,NS
1 min After Induction	112.52	12.20	117.24	10.45	0.0007,HS
2 min after induction	115.8	11.29	122.64	12.92	0.0010,HS
5 min after induction	117.18	15.58	127.84	14.20	0.0352,S
10 min after induction	109.24	18.63	120.08	16.62	0.0028,HS
20 min after induction	110.28	14.58	117.70	16.24	0.0181,S
30 min after induction	111.28	14.67	118.18	19.56	0.0488,S

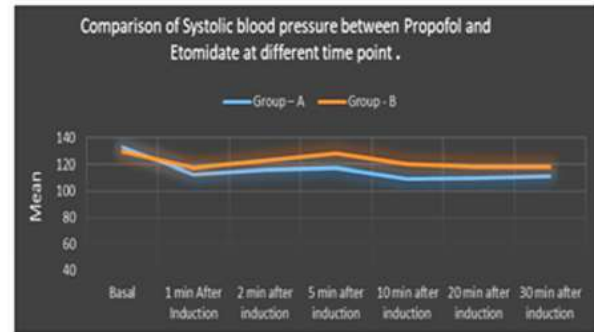


Fig. 2: Showing changes in Systolic Blood Pressure (SBP) at different time intervals between group A and group B.

The SBP in group A and group B decreased by 20.44 and 12.16 mm of Hg respectively after induction which is statistically significant. Two minute after intubation fall in SBP in group A by 17.2 and in group B by 6.76 mm of Hg with significant p-value. Changes in SBP between group A and Group B remains statistically significant at 5 mins, 10 mins, 20 mins and 30 mins after intubation. The fall in SBP is more with Group A than Group B. (p value<0.05).

Table 4: Comparison of Diastolic blood pressure between Propofol and Etomidate

Time	Group - A		Group - B		p-value
	Mean	SD	Mean	SD	
Basal	85.4	10.65	84.2	7.24	0.5117,NS
1 min After Induction	73.18	8.24	76.18	3.75	0.0212,S
2 min after induction	75.98	11.93	82.28	11.52	0.0446,S
5 min after induction	72.48	8.78	75.36	7.27	0.1028,NS
10 min after induction	72.96	8.76	76.36	8.73	0.2464,NS
20 min after induction	72.76	9.30	75.22	6.56	0.1297,NS
30 min after induction	72.16	9.72	75.64	8.29	0.0544,NS

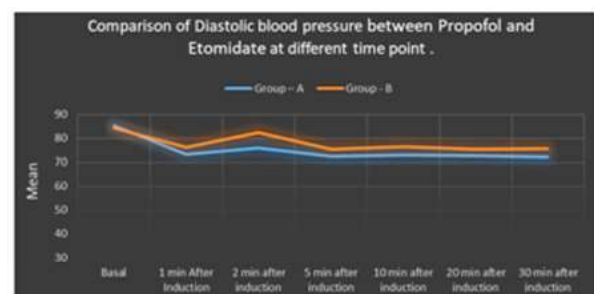


Fig. 3: Showing changes in Mean Diastolic Blood Pressure (DBP) at different time intervals between Group A and Group B.

The DBP in group A and group B decreased by 12.22 mm and 8 mm of Hg Respectively after induction with significant p-value. Two minute after intubation fall in DBP in group A by 9.42 and in group B by 1.92 mm of Hg which remains statistically significant. Changes in DBP in group A and group B, after 5 minutes of intubation starts settling with no statistically significant changes at 5min, 10 min, 20 min and 30 min after intubation. The fall in DBP after induction is more with Group A than Group B. (pvalue<0.05). At 5 mins, 10 mins, 20min, 30 min after intubation changes are not significant. (p value> 0.05).

Table 5: Comparison of Mean arterial pressure between Propofol and Etomidate

Time	Group - A		Group - B		p-value
	Mean	SD	Mean	SD	
Basal	101.26	11.16	99.26	7.02	0.2866, NS
1 min After Induction	86.29	6.04	89.86	3.41	0.0004, HS
2 min after induction	89.25	7.88	95.73	5.19	<0.0001, HS
5 min after induction	87.38	8.68	92.85	7.47	0.0010, HS
10 min after induction	85.05	9.08	90.93	7.52	0.0007, HS
20 min after induction	85.27	9.25	89.38	6.06	0.0100, S
30 min after induction	85.2	9.63	89.84	6.54	0.0058, HS

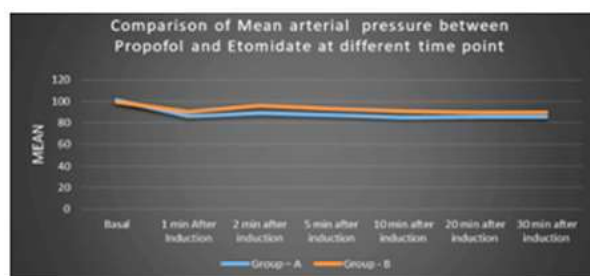


Fig. 4: Showing changes in Mean Arterial Pressure (MAP) at different time intervals between Group A and Group B.

The MAP in group A and group B decreased by 14.97 and 9.4 mm of Hg respectively after induction with significant p-value. Two minute after intubation fall in MAP in group A by 12.01 and in group B by 3.53 mm of Hg. Changes in MAP between group A and Group B remains statistically significant at 2 min, 5min, 10 min, 20min and 30 min after intubation. The significant fall in MAP is more with Group A than Group B. (p value <0.05).

DISCUSSION

The cardiovascular effects of Propofol have

been evaluated after its use for induction and for maintenance of anesthesia. The most prominent effect of Propofol is a decrease in arterial blood pressure during induction of anesthesia.⁹

Heart rate does not change significantly after an induction dose of Propofol. Propofol either may reset or may inhibit the baroreflex, reducing the tachycardic response to hypotension.² The most common side effect during induction of anesthesia is hypotension, which is augmented by the concomitant administration of opioids.¹⁰

The properties of Etomidate include hemodynamic stability, minimal respiratory depression, cerebral protection, and pharmacokinetics enabling rapid recovery.⁹

Ram Kaushal et al (2015) study, baseline HR for Inj. Propofol group was 91.03±2.07 and for Etomidate group 80.66±23. After induction, HR with Propofol was 88.53±18.2 and for Etomidate group 80.6±12.92 with p-value<0.056 which is not significant. It shows fall in HR by 2 bpm with Propofol induction and no change in HR for Etomidate induction.

After intubation HR was 96.93±20.34 with Propofol induction and 85.83±23.53 with Etomidate induction with p-value= <0.0501 which is not significant. Similarly, 5 min after intubation results between 2 groups are not significant with p value 0.119.65.

After induction SBP with Propofol induction was 80.63±8.63 and for Etomidate group 98.5±14.73 with p-value<0.001. It shows fall in SBP in both groups but more with Propofol induction.

After intubation SBP was 86.53±15.65 with Propofol induction and 103.4±12.286 with Etomidate induction with p-value= <0.001 which is significant. Similarly, 5 min after intubation SBP was 95.86±3.51 for Propofol and 103.7±6.22 for Etomidate with p-value= <0.001, which is significant.

Baseline DBP for Inj. Propofol group was 73.93±11.41 and for Etomidate group 72.53±8.16.

After induction DBP with Propofol induction was 59.7±7.28 and for Etomidate group 69.4±8.2 with p-value=0.007. It shows fall in DBP in both groups but more with Propofol induction. This study finding is similar to our study finding after induction.¹¹

After induction MAP with Propofol induction was 67.97±5.79 and for Etomidate group 80.54±9.39 with p-value<0.001. It shows fall in MAP in both groups but more with Propofol induction. After intubation MAP was 72.79±5.54 with Propofol induction and 82.07±7.09 with Etomidate induction with p-value= <0.001 which is significant. Similarly, 5 min after

intubation MAP was 76.46 ± 3.47 for Propofol and 82.05 ± 3.92 for Etomidate with p -value = <0.001 , which is significant. This study finding is similar to our study finding.¹¹

Anil K. Pandey et al (2012), study on, The Effects of Etomidate and Propofol Induction on Hemodynamic and Endocrine Response in Patients Undergoing Coronary Artery Bypass Graft Surgery on Cardiopulmonary Bypass. In their results at 5 min post induction, Heart rate (per min) for Etomidate (73.66 ± 16.36) and Propofol (75.46 ± 17.09) with P value = 0.77. Heart rate changes between two groups were not statistically significant with p -value >0.05 , similar to our study.

At 5 min post induction, systolic blood pressure (mm of Hg) for Etomidate (120.2 ± 17.11) and Propofol (99.66 ± 10.86) with P value = 0.0005.

5 min post induction, diastolic blood pressure (mm of Hg) for Etomidate (72.66 ± 10.34) and Propofol (59.8 ± 8.92) with P value = 0.0011.

They found systolic blood pressure, the diastolic blood pressure, were significantly different the two groups at five minutes post induction and were statistically significantly, lower in the Propofol group.¹²

A. Criado et al (1980), noticed HR increased significantly after administration of Etomidate. Heart rate (beat/min) basal was 83.1. 3 minute after induction it was 91.5 and 10 minute after induction it was 87.5 that is increase in 8.4 and 4.4 bpm respectively. In our study there is no change in HR after induction with Etomidate.

They noticed 18 mmHg decrease in SBP, 10 mmHg decrease in MAP and 6 mmHg decrease in DBP after induction with Etomidate.

In our study also there is fall in systolic blood pressure and diastolic blood pressure after Propofol is more than Etomidate similar to above studies.¹³

Gooding JM (1979) gave 0.3 mg/kg of Etomidate to cardiac patients for noncardiac surgery resulted in almost no change in heart rate, MAP, mean pulmonary artery pressure, pulmonary capillary wedge pressure, central venous pressure, stroke volume, cardiac index, and pulmonary and systemic vascular resistance.¹⁴

CONCLUSION

We conclude that Etomidate provides more stable haemodynamic parameters (SBP, DBP and MAP) when used for induction of anesthesia whereas Propofol produced a significant fall in systolic

and diastolic blood pressure and Mean arterial pressure after induction. Heart rate changes were not significant between the two groups.

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