

Hemodynamic properties and respiratory efforts: A comparative study between etomidate and propofol

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Abstract

Background: A successful general anaesthesia is defined as a reversible triad of hypnosis, analgesia and abolition of reflex activity. Over years, there has been a continuous search for better and safer intravenous agent. Presently etomidate and propofol are popular, rapid acting and safe induction agent, however these two drugs have different induction characteristics. **Objectives:** To compare the hemodynamic parameters and respiratory efforts between etomidate and propofol. **Methodology:** In this prospective randomized double blinded study, we studied 60 patients randomly allocated into either group P (propofol group) or to group E (Etomidate group) of 30 each. All patients premedicated with inj. midazolam 0.02mg/kg IV, inj. Fentanyl 2 microgm/kg IV. Group P received propofol infusion at 0.5 mg/kg/hr and group E at 0.05mg/kg/hr until BIS value dropped to 50. Then patients were intubated with vecuronium 0.1mg/kg and anaesthesia maintained according to institutional protocol followed by extubation after adequate recovery. Hemodynamic parameters and side effects during induction were recorded between both groups until the infusion of study drug. **Results:** The difference in mean HR at 15 and 30 minutes between both groups was found to be significant ($p<0.05$). Mean SBP in Etomidate group at 15 minutes was 120.87 ± 10.28 and in Propofol group was 111.27 ± 11.26 . Mean SBP in Etomidate group at 30 minutes was 120.03 ± 10.87 and in Propofol group was 105.10 ± 12.26 . ($p<0.05$). Mean DBP at 10 minutes in Etomidate 76.07 ± 9.5 and Propofol 70.6 ± 11.24 . Mean DBP at 15 minutes Etomidate 75.4 ± 10.39 and Propofol 66.13 ± 9.89 . Mean DBP at 30 minutes Etomidate 76.17 ± 10.41 and Propofol 61.4 ± 8.71 . The difference in mean DBP at 10, 15 and 30 minutes between both groups was found to be significant ($p<0.05$). The difference in mean MAP at 10, 15 and 30 minutes between both groups was found to be significant ($p<0.05$). Etomidate and Propofol causes same effect on SPO₂ in our study. **Conclusion:** Etomidate maintained hemodynamic stability. Heart rate changes were not significant between the two groups.

Key Word: Etomidate; Propofol, hemodynamic parameters

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INTRODUCTION

An ideal induction agent for general anesthesia should have hemodynamic stability, minimal respiratory side

effects and rapid clearance. A successful general anaesthesia is defined as a reversible triad of hypnosis, analgesia and abolition of reflex activity.¹ Over years there has been a continuous search for better and safer intravenous agent. Presently etomidate and propofol are popular, rapid acting and safe induction agent, however these two drugs have different induction characteristics.¹ The discovery of IV anaesthetics has long been an important milestone in the development of anaesthesia. Prior to this, induction of general anaesthesia necessarily required inhalation of gases or vapour which was an unpleasant experience to most of the patients. Presently Etomidate and Propofol are popular rapid acting inducing agents.² In 1970 a new inducing agent 2, 6- di-isopropofol was discovered and introduced in clinical practice in

1977. Propofol was introduced clinically by Kay and Rolly in 1977. As a new anaesthetic agent, it provides faster onset of action, anti emesis, potent attenuation of pharyngeal, laryngeal, tracheal reflex and adequate depth of anaesthesia during intubation and a clear and smooth recovery. It is a commonly used IV induction agent in recent years.^{3,4,5} The effect of etomidate on cardiac output and myocardial oxygenation and its wide therapeutic index, which is approximately 6 fold better than thiopentone and propofol, have logically served to maintain niche use in patients of all age groups. However in 1983, an increase in mortality of critically ill patients associated with the use of etomidate infusions for sedation in ICU was reported. It is attributed to etomidate induced inhibition of an enzyme 11 beta hydroxylase involved in steroidogenesis. With this background we planned the study in Navodaya Medical College and Hospital, Raichur in order to assess the hemodynamic characteristics between propofol and etomidate in patients undergoing surgeries under general anaesthesia.

MATERIALS AND METHODS

This double blind prospective randomized study was done from November 2016 to May 2018 on patients who were admitted to Navodaya Medical College and Hospital, Raichur and posted for elective surgeries requiring general anaesthesia. These patients were undergoing gynecological surgery, general surgery, or orthopedic surgery.

The study has been conducted after obtaining clearance from ethical committee of the institution. Informed consent was taken from all the patients who participated within the study.

Inclusion criteria:

1. Patients between the age group of 20 and 60 years belonging to American society of anesthesiology grade I to III undergoing surgery under general anaesthesia.
2. Those who are willing to participate after informed consent

Exclusion criteria:

1. Patients allergic to any drugs
2. History of seizure disorder.
3. Presence of primary and secondary steroid deficiency or on steroid medication
4. Presence of hypotension.

Data analysis: Data entered in MS excel sheet and analysed by using SPSS 19.0 version IBM USA. Comparison of mean and SD between two groups was done by using unpaired t test to assess whether the mean difference between groups is significant or not

RESULTS

Table 1: Distribution according to age group

	Etomidate		Propofol	
	Frequency	Percent	Frequency	Percent
Age in years	21 to 30	17	9	30.0
	31 to 40	6	7	23.3
	41 to 50	5	8	26.7
	51 to 60	2	6	20.0
	Total	30	30	100.0

In our study we included 30 subjects in each group. In group receiving Etomidate as intervention, majority were from 21-30 years age i.e. 17(56.7%) followed by 6 from 31-40 years age group(20%). In group receiving Propofol as intervention, majority were from 21-30 years age i.e. 9(30%) followed by 8 from 41-50 years age group(26.7%).

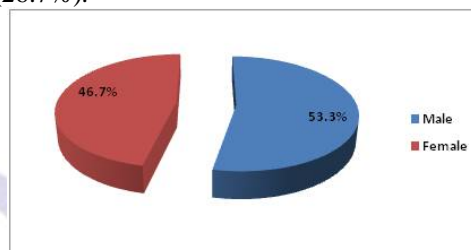


Figure 1: Distribution according to gender

In our study 53.3% were males and 46.7% were females.

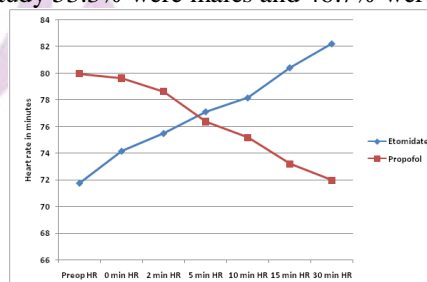


Figure 2: Bar diagram showing Comparison of heart rate between Etomidate and Propofol

Comparison of heart rate between Etomidate and Propofol at different time interval reveals that the difference in mean heart was not significant right from preoperative time till 10 minutes after operation. (Preop Etomidate 71.77 ± 9.21, Propofol 79.97 ± 12.99) until 10 minutes after operative procedure (Etomidate 75.17 ± 12.89, Propofol 80.43 ± 8.53) Mean HR in Etomidate group at 15 minutes was 80.43 ± 8.53 and in Propofol group was 73.20 ± 12.89. Mean HR in Etomidate group at 30 minutes was 82.23 ± 9.04 and in Propofol group was 71.97 ± 12.80. The difference in mean HR at 15 and 30 minutes between both groups was found to be significant (p < 0.05)

Table 2: Comparison of SBP between Etomidate and Propofol

	GP	N	Mean	SD	t	p	Inference
Preop SBP	Etomidate	30	125.07	11.26	-.49	.625	Not significant
	Propofol	30	126.57	12.37		(>0.05)	
0 min SBP	Etomidate	30	123.37	11.59	-.60	.552	Not significant
	Propofol	30	125.20	12.17		(>0.05)	
2 min SBP	Etomidate	30	121.23	11.94	-.91	.367	Not significant
	Propofol	30	124.00	11.60		(>0.05)	
5 min SBP	Etomidate	30	121.50	10.91	-.98	.329	Not significant
	Propofol	30	157.93	202.44		(>0.05)	
10 min SBP	Etomidate	30	122.03	10.44	1.95	.056	Not significant
	Propofol	30	116.53	11.34		(>0.05)	
15 min SBP	Etomidate	30	120.87	10.28	3.45	.001	Highly significant
	Propofol	30	111.27	11.26		(<0.001)	
30 min SBP	Etomidate	30	120.03	10.87	4.99	.0001	Highly significant
	Propofol	30	105.10	12.26		(<0.001)	

Comparison of SBP between Etomidate and Propofol at different time interval reveals that the difference in mean heart was not significant right from preoperative time till 10 minutes after operation. (Preop Etomidate 125.07± 11.26, Propofol 126.57± 12.37) until 10 minutes after operative procedure (Etomidate 122.03±10.44, Propofol 116.53±11.34). Mean SBP in Etomidate group at 15 minutes was 120.87±10.28 and in Propofol group was 111.27±11.26. Mean SBP in Etomidate group at 30 minutes was 120.03±10.87 and in Propofol group was 105.10±12.26. The difference in mean SBP at 15 and 30 minutes between both groups was found to be significant (p<0.05). It means Propofol causes more reduction in SBP as compared to Etomidate

Table 3: Comparison of DBP rate between Etomidate and Propofol

	GP	N	Mean	SD	t	p	Inference
Preop DBP	Etomidate	30	81.07	10.55	-.73	.470	Not significant
	Propofol	30	83.17	11.76		(>0.05)	
0 min DBP	Etomidate	30	79.93	10.38	-.63	.531	Not significant
	Propofol	30	81.67	10.92		(>0.05)	
2 min DBP	Etomidate	30	77.97	10.49	-1.18	.858	Not significant
	Propofol	30	78.47	11.00		(>0.05)	
5 min DBP	Etomidate	30	77.13	9.91	1.09	.278	Not significant
	Propofol	30	74.17	11.06		(>0.05)	
10 min DBP	Etomidate	30	76.07	9.50	2.03	.046	Significant
	Propofol	30	70.60	11.24		(<0.05)	
15 min DBP	Etomidate	30	75.40	10.39	3.54	.001	Highly significant
	Propofol	30	66.13	9.89		(<0.001)	
30 min DBP	Etomidate	30	76.17	10.41	5.96	.0001	Highly significant
	Propofol	30	61.40	8.71		(<0.001)	

Comparison of DBP between Etomidate and Propofol at different time interval reveals that the difference in mean heart was not significant right from preoperative time till 10 minutes after operation. (Preop Etomidate 81.07±10.55, Propofol 83.17±11.76) until 5 minutes after operative procedure (Etomidate 77.13±9.91, Propofol 74.17±11.06). Mean DBP at 10 minutes in Etomidate 76.07±9.5 and Propofol 70.6±11.24. Mean DBP at 15 minutes Etomidate 75.4±10.39 and Propofol 66.13±9.89. Mean DBP at 30 minutes Etomidate 76.17± 10.41 and Propofol 61.4±8.71 The difference in mean DBP at 10, 15 and 30 minutes between both groups was found to be significant (p<0.05). It means Propofol causes more reduction in DBP as compared to Etomidate

Table 4: Comparison of MAP between Etomidate and Propofol

	GP	N	Mean	SD	t	p	Inference
Preop MAP	Etomidate	30	95.73	9.82	-.70	.485	Not significant
	Propofol	30	97.63	11.10		(>0.05)	
0 min MAP	Etomidate	30	94.41	9.72	-.67	.504	Not significant
	Propofol	30	96.18	10.60		(>0.05)	
2 min MAP	Etomidate	30	92.39	9.93	-.48	.633	Not significant
	Propofol	30	93.64	10.31		(>0.05)	
5 min MAP	Etomidate	30	91.92	9.30	-.80	.424	Not significant
	Propofol	30	102.09	68.60		(>0.05)	
10 min MAP	Etomidate	30	91.39	8.79	2.24	.029	Significant

15 min MAP	Propofol	30	85.91	10.09		(<0.05)	Highly significant
	Etomidate	30	90.56	9.28	3.94	.0001	
	Propofol	30	81.18	9.14		(<0.001)	
30 min MAP	Etomidate	30	90.79	8.98		.0001	Highly significant
	Propofol	30	75.97	7.97	6.76	(<0.001)	

Comparison of MAP between Etomidate and Propofol at different time interval reveals that the difference in mean heart was not significant right from preoperative time till 10 minutes after operation. (Preop Etomidate 95.73 ± 9.82, Propofol 97.63 ± 11.10) until 5 minutes after operative procedure (Etomidate 91.92 ± 9.30, Propofol 102.09 ± 68.60) Mean MAP at 10 minutes in Etomidate 91.39 ± 8.79 and Propofol 85.91 ± 10.09. Mean MAP at 15 minutes in Etomidate 90.56 ± 9.28 and Propofol 81.18 ± 9.14. Mean MAP at 30 minutes in Etomidate 90.79 ± 8.98 and Propofol 75.97 ± 7.97. The difference in mean MAP at 10, 15 and 30 minutes between both groups was found to be significant (p < 0.05). It means Propofol causes more reduction in MAP as compared to Etomidate.

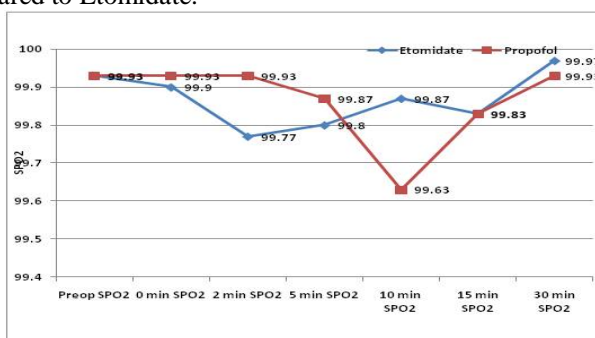


Figure 3: Bar diagram showing Comparison of SPO2 between Etomidate and Propofol

Comparison of SPO2 between Etomidate and Propofol at different time interval reveals that the difference in mean heart was not significant right from preoperative time till 30 minutes after operation. It means Etomidate and Propofol causes same effect on SPO2 in our study.

DISCUSSION

Heart rate: The difference in mean HR at 15 and 30 minutes between both groups was found to be significant (p < 0.05). It means Propofol causes more reduction in HR as compared to Etomidate. **Supriya Agarwall et al⁶** in 2014, which showed that 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.

Blood pressure: The difference in mean SBP at 15 and 30 minutes between both groups was found to be significant (p < 0.05). It means Propofol causes more reduction in SBP as compared to Etomidate. The difference in mean DBP at 10, 15 and 30 minutes between both groups was found to be significant (p < 0.05). It means Propofol causes more reduction in DBP as compared to Etomidate. **Vijaykumar, T. K et al⁷** observed that fall in SBP after two minutes of induction was 21.3 mmHg, 30.7 mmHg in group E and group P respectively, a more fall in SBP in group P when compared to group E. The change in mean SBP between the groups during first and second minute immediately after induction were statistically significant (p < 0.001). Fall in SBP after two and five minutes after intubation was 11.2 mmHg, 10 mmHg in group E and 23.1 mmHg,

16.3 mmHg in group P respectively. The decrease in SBP in group P was statistically significant compared to decrease in SBP in group E at 2 min (p < 0.001) and remained significant even up to 5 minutes post intubation. Fall in DBP in group P was more when compared to group E. The change in mean DBP between the groups at induction (p < 0.006) and during first minute immediately after induction were statistically significant (p < 0.047). The fall in DBP observed in both groups was statistically significant (p < 0.001) at intubation, post intubation 2 min and 5 min. **Poornima shivanna et al⁸** in her study observed that there was statistically significant fall in heart rate in propofol group (Group P) from the baseline starting from 3 minutes of induction upto 10 minutes with p value < 0.05 and systolic, diastolic and mean arterial pressure with p value < 0.01. There was no significant change in heart rate and blood pressure in Etomidate (Group E) starting from baseline. 32 patients (91.5%) in propofol group had pain compared to 9 patients (28.5%) in etomidate group with p value < 0.001. **Anil K Pandey⁹** and colleagues concluded in their study that systolic blood pressure and diastolic blood pressure were significantly different between 2 groups at 5 minutes post induction and were statistically significantly lower in propofol group (SBP-p=0.005, DBP-p=0.0011) which is similar to

findings in our study where both systolic blood pressure and diastolic blood pressures were lower in propofol group with significant p value of <0.01 indicating that etomidate is associated with more stable hemodynamics on induction of anesthesia. Similarly Moller petrun *et al*¹⁰ found in their study that the incidence of hypotension was higher in the propofol group than that in the etomidate group (8 vs 3; $P=0.08$) which was similar to our study with the p value of <0.01 . A.Gauss¹¹ noticed the change in SBP by 1 mm Hg, DBP by 1mmHg with Etomidate and SBP decreased by 13 mmHg, DBP by 4 mmHg in Propofol group. Thomas Brussel¹² found no change in SBP, 1 mm Hg decrease in DBP, no change in MAP with Etomidate and 20 mmHg decrease in SBP, 15 mmHg decrease in DBP, 16 mmHg decrease in MAP with Propofol. A study by Shagun Bhatiashah¹³ on comparison of hemodynamic effects of propofol versus etomidate reported that the percentage fall in SBP was 30% in propofol group compared to 17% in etomidate group and the fall in DBP was much sharper in Group-P (27%) as compared to Group-E (17%) respectively and the fall in MAP is much sharper for Group-P (24.3%) as compared with Group-E (15.87%) with p value <0.001 which is comparable with our study where fall in blood pressure in propofol group was statistically significant with p value <0.01 compared to etomidate group.

Mean Arterial Pressure: The difference in mean MAP at 10, 15 and 30 minutes between both groups was found to be significant ($p<0.05$). It means Propofol causes more reduction in MAP as compared to Etomidate. Supriya Agarwall *et al*⁶ in 2014, which showed that patients in etomidate group showed little change in mean arterial pressure (MAP) compared to propofol ($p<0.05$) from baseline value. Vijaykumar, T. K *et al*⁷ observed that changes in Mean Arterial Blood Pressure shows fall in MAP in group P was more when compared to group E. The change in mean MAP between the group at induction ($p<0.001$) and during first minute immediately after induction were statistically significant ($p<0.009$). Fall in MAP was statistically significant ($p<0.001$) at intubation, post intubation 2min and 5min.

CONCLUSION

Patients induced with Propofol had significant decrease in systolic, diastolic blood pressure and mean arterial pressures at 2 to 3 minutes after induction compared to Etomidate. This characteristic indicates that Etomidate maintained hemodynamic stability. Heart rate changes were not significant between the two groups.

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