Original Research Paper ANAESTHIOLOGY

A Comparitive Study of Induction Characteristics of Propofol Versus Etomidate in Patients Udergoing Surgeries Under General Anaesthesia

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KEYWORDS Etomidate ; propofol ; bispectral index ; fentanyl

INTRODUCTION

Propofol was 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.However high doses can cause side effects like hypotension due to direct myocardial depression and decreased peripheral vasodilatation along with venodilatation, respiratory depression/ apnea. It also causes pain on injection when injected into smaller veins . Pain is due to concentration of free propofol in the aqueous phase of emulsion.Etomidate is used for induction of general anaesthesia and sedation introduced into clinical practice . Preclinical experiments demonstrated that etomidate injection was associated with minimal hemodynamic changes or respiratory depression, features that were presumed to result in its unusually safety profile. However pain on injection and myoclonus are the most common side effects of this drug.Pain on injection, venous irritation and hemolysis have been abolished by a new fat emulsion of etomidate but the new solvent has not reduced the incidence of myoclonus after etomidate injection.The effect of etomidate on cardiac output and myocardial oxygenation and its wide theraupetic index, which is approximately 6 fold better than thiopentone and propofol , have logically served to maintain niche use in patients of all age groups.

OBJECTIVES

1. To compare hemodynamic parameters of both drugs during induction.

Propofol

Induction of anaesthesia - 2.5-3.5mg/kg(children) ,

1.0-2.5mg/kg(adult)

Maintenance of anaesthesia- 50-150mg/kg/min

Sedation- 25-75 mg/kg/min

Anti - emetic dose - 10-15mg IV ,Anti- pruritic dose- 10-30 mg

Etomidate

Available as 2mg/ml emulsion in 10 ml vial. lipid emulsion is also available which contains medium and long chain triglycerides.

Induction – 0.2-0.6mg/kg IV

Maintenance – 10mcg/kg/min IV

Sedation – 5-10mcg/kg/min IV

STUDY GROUP:

The minimum sample has been calculated at 5% level of significance and power of study 95% to detect atleast 15% difference in mean arterial pressure between each group .we included 35 patients in each group with total sample size of 70.

INCLUSION CRITERIA:

1. Patients with ASA status 1 & 2

2. Patients between 18-50 yrs

3. Patients who gave informed written consent

EXCLUSION CRITERIA:

1. Patients with cardiovascular and respiratory disease

2. Patients with chronic abuse of alcohol, drugs and psychotropic agents

3. Patients with hepatic, renal disease and epilepsy

RESULTS

Patients were divided into 2 groups, group P (propofol) and group E (etomidate).

Objective of the study was to compare the hemodynamic effects of propofol with that of etomidate and also the side-effects during induction of general anaesthesia.

The hemodynamic parameters were compared just before induction, during induction and every minute thereafter for first ten minutes

TABLE 1: AGE DISTRIBUTION OF PATIENTS STUDIED

Age in Years	Propofol (P)		Etomidate (E)	
	No	%	No	%
<20	2	5.7	1	2.9
31-30	15	42.9	8	22.9
31-40	11	31.4	12	34.3
41-50	5	14.3	14	40.0
>50	2	5.7	0	0.0
Total	35	100.0	35	100
Mean + SD	33.09+9.31		37.20+8.89	

Samples are age matched with P=0.100 , the mean age in Group P was 33.09±9.31 and in Group E was 37.20±8.89with the p=0.100. Hence both groups are comparable with respect to age.

FIGURE 11 : AGE DISTRIBUTION OF PATIENTS STUDIED

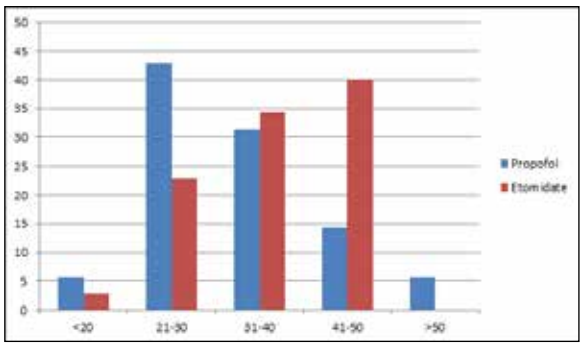
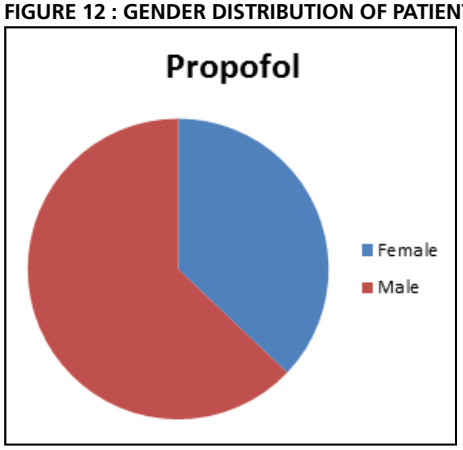


TABLE 2 : GENDER DISTRIBUTION OF PATIENTS STUDIED

Gender	Propofol		Etomidate	
	No	%	No	%
Female	13	37.1	15	42.9
Male	22	62.9	20	57.1
Total	35	100.0	35	100.0

Samples are gender matched with P=0.626 ,From the above table it is noted that the both Group P and Group E are comparable with respect to gender.

FIGURE 12 : GENDER DISTRIBUTION OF PATIENTS STUDIED



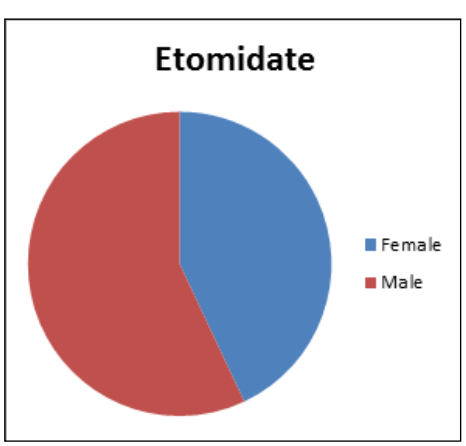
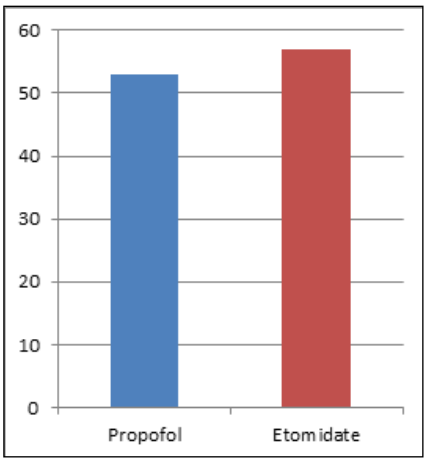


TABLE 3: WEIGHT AND HEIGHT DISTRIBUTION OF PATIENTS IN BOTH GROUPS

	Propofol	Etomidate	P value
Height (cm)	157.43+4.93	161.37+9.01	0.026*
Weight (kg)	52.63+7.17	56.31+8.24	1.050+

From the above table it is noted that both groups are comparable with respect to weight and height.

FIGURE 13&14 : WEIGHT AND HEIGHT DISTRIBUTION OF PATIENTS



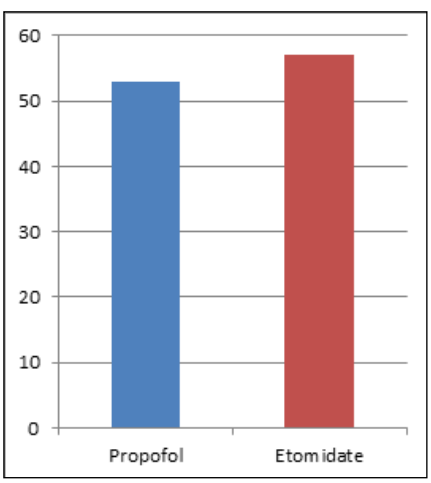


TABLE 4 : PROCEDURE

DIAGNOSIS	PROPOFOL		ETOMIDATE	
	No	%	No	%
1. Appendicectomy	6	17.1	8	22.9
2. Lap Cholecystectomy	9	25.7	5	14.3
3. Lipoma excision	4	11.4	2	5.7
4. Thyrodectomy	1	2.9	2	5.7
5. Cholecystectomy	0	0.0	2	5.7
6. Gall bladder polyp removal	0	0.0	2	5.7
7. vagatomy	2	5.7	0	0.0
8. Hydatid cyst excisio	2	5.7	0	0.0
9. Laproscopicherniorhappy	0	0.0	2	5.7
10. Lateral pancreaticojejunostomy	0	0.0	2	5.7
11. Right lung lobectomy	0	0.0	2	5.7
12. Thyroidectomy	0	0.0	2	5.7
13. Modified radical mastectomy	1	2.9	0	0.0
14. Chet wall tumour removal	1	2.9	0	0.0
15. Fibroadenoma exci	0	0.0	1	2.9
16. Gist exc	1	2.9	0	0.0
17. Anatomical hernia repa	1	2.9	0	0.0
18. Lymph node excision	1	2.9	0	0.0
19. Mastectomy	0	0.0	1	2.9
20. hemithyroidectomy	1	2.9	0	0.0
21. Paraumblical hernia mesh repair	1	2.9	0	0.0
22. Rectal polyp removal	0	0.0	1	2.9
23. Retropritoneal sarcoma excision	1	2.9	0	0.0
24. Sarcoma excision	1	2.9	0	0.0
Total	35	100.0	35	100.0

TABLE 5: ASA GRADE DISTRIBUTION OF PATIENTS IN BOTH GROUPS

ASA GRADE	Propofol		Etomidate	
	No	%	No	%
ASA 1	13	37.1	15	42.9
ASA 2	22	62.9	20	57.1
TOTAL	35	100.0	35	100.0

ASA grade distribution is statistically similar in two groups with P=0.315

FIGURE 15: ASA GRADE DISTRIBUTION OF PATIENTS IN BOTH GROUPS

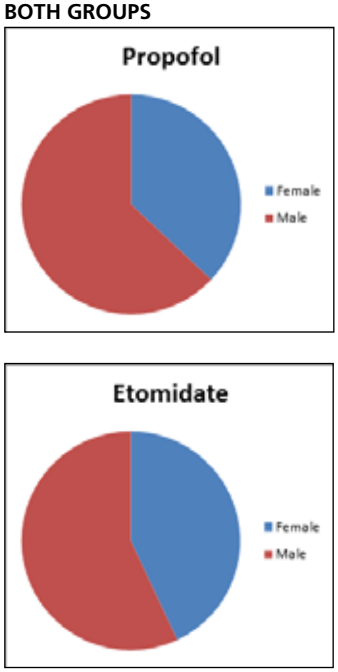


TABLE 6: MPG OF PATIENTS STUDIEDMPG GRADE

	Propofol		Etomidate	
	No	%	No	%
1	20	57.1	15	42.9
2	13	37.1	19	54.3
3	2	5.7	1	2.9
TOTAL	35	100.0	35	100.0

P=0.410, Not significant, Fisher Exact test

FIGURE 16: MPG OF PATIENTS STUDIED.

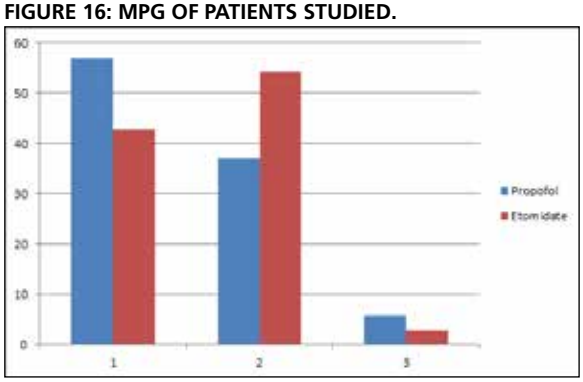


TABLE 7: COMPARISON OF BIS VALUES BETWEEN TWO GROUPS STUDIED

Time For BIS 50	Propofol		Etomidate	
	No	%	No	%
2 min	2	5.7	6	17.1
3 min	17	48.6	12	34.3
4 min	12	34.3	10	28.6
5 min	4	11.4	6	17.1
7 min	0	0.0	1	2.9
TOTAL	35	100.0	35	100.0

P=0.343, Not significant, Fisher Exact test

Time to achieve BIS 50 was not statistically significant between both groups

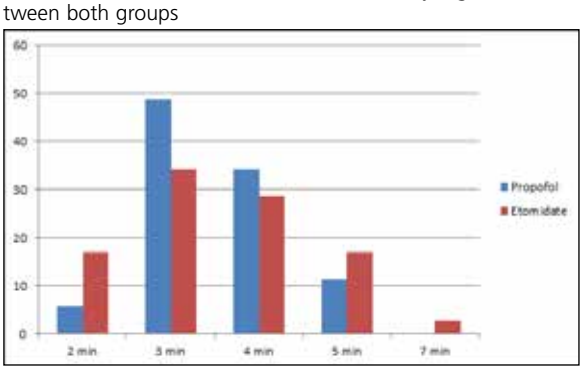


FIGURE 17: COMPARISON OF BIS VALUES BETWEEN TWO GROUPS STUDIED

TABLE 8: COMPARISON OF HEART RATE (BPM) IN TWO GROUPS STUDIED

HEART RATE (BPM)	PROPOFOL	ETOMIDATE	P VALUE
Basal	87.60+13.72	86.14+12.75	0.647
Premed	88.89+20.09	84.97+12.25	0.329
Induction	89.34+16.04	85.20+14.43	0.260
1 min	85.20+15.23	82.17+15.77	0.417
2 min	82.11+12.11	84.94+17.25	0.430
3 min	81.23+11.88	84.11+16.37	0.402
4 min	81.20+12.52	85.97+17.87	0.200
5 min	80.03+10.84	89.00+21.59	0.031*
6 min	81.46+12.42	94.11+21.59	0.004*
7 min	83.09+9.68	92.49+24.20	0.036*
8 min	80.54+11.59	93.97+22.94	0.003**
9 min	77.66+9.31	94.91+19.97	<0.001**
10 min	77.03+8.52	91.11+19.40	<0.001**

Student t test and paired t test

Paired t test was applied and it was recorded that there was statistically significant fall in heart rate in propofol group from the baseline starting from 3 minutes of induction upto 10 minutes with p value < 0.05. There was no significant change in heart rate in etomidate group starting from baseline.

FIGURE 18: COMPARISON OF HEART RATE (BPM) IN TWO GROUPS STUDIED

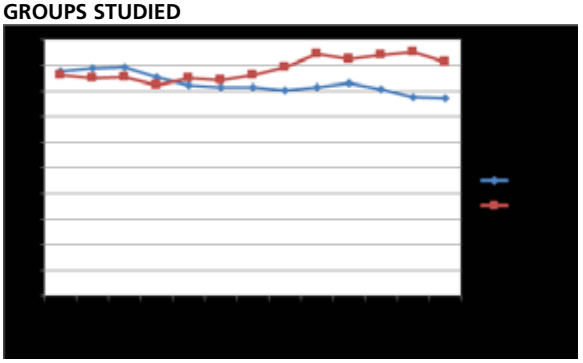


TABLE 9: COMPARISON OF SBP (MM HG) IN TWO GROUPS STUDIED

SPB (mm Hg)	PROPOFOL	ETOMIDATE	P VALUE
Basal	130.49+10.94	125.37+12.98	0.079+
Premed	125.94+8.36	122.60+12.37	0.190
Induction	123.34+12.51	119.77+22.48	0.414
1 min	118.49+10.21	121.63+13.04	0.266
2 min	108.60+9.45	122.40+11.82	<0.001**
3 min	104.11+10.77	124.66+18.50	<0.001**
4 min	103.14+12.16	127.74+20.92	<0.001**
5 min	105.20+11.84	138.86+27.18	<0.001**
6 min	109.63+14.92	132.40+22.07	<0.001**
7 min	109.71+12.41	139.83+24.34	<0.001**
8 min	108.06+10.23	136.80+21.59	<0.001**
9 min	105.51+7308	132.91+19.48	<0.001**
10 min	108.94+17.13	131.74+15.19	<0.001**

Student t test and paired t test . There is a significant fall in systolic blood pressure from baseline in propofol group starting from induction until 10 minutes with p value <0.01, whereas there was a significant increase in systolic blood pressure in etomidate group compared to baseline from 7th minute of induction till 10th minute with p value <0.05

FIGURE 19: COMPARISON OF SBP (MM HG) IN TWO GROUPS STUDIED

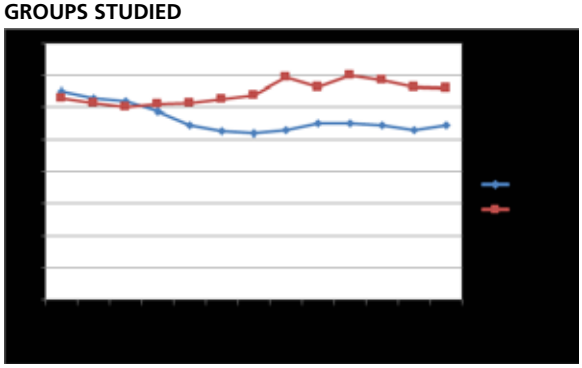


TABLE 10 : COMPARISON OF DBP (MM HG) IN TWO GROUPS STUDIED

HEART RATE (BPM)	PROPOFOL	ETOMIDATE	P VALUE
Basal	79.63+11.36	77.51+9.34	0.398
Premed	75.63+1075	72.94+19.31	0.475
Induction	74.54+1063	75.57+10.00	0.678
1 min	69.89+13.05	73.89+8.73	0.136
2 min	63.17+9.71	74.51+10.64	<0.001**
3 min	60.06+8.75	77.91+14.77	<0.001**
4 min	58.51+12.87	78.89+19.46	<0.001**
5 min	64.26+12.89	88.63+23.14	<0.001**
6 min	66.03+15.92	86.23+17.66	<0.001**
7 min	63.86+13.45	83.31+15.60	<0.001**
8 min	63.49+12.62	80.94+12.80	<0.001**
9 min	61.54+8.27	81.69+10.70	<0.001**
10 min	63.03+11.09	79.66+10.53	<0.001**

Student t test and paired t test

There is a significant fall in diastolic blood pressure from baseline in propofol group starting from induction until 10 minutes with p value <0.01 whereas there was no significant change in diastolic blood pressure in etomidate group compared to baseline. (paired t test)

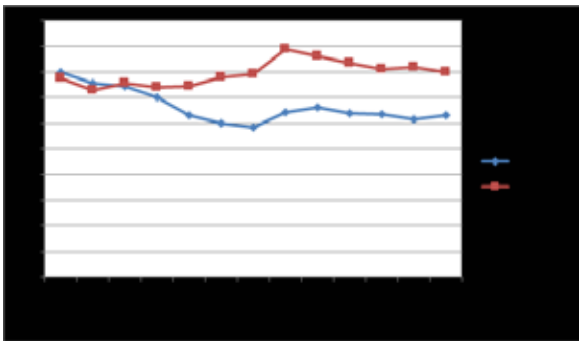


TABLE 11 : COMPARISON OF MAP (MM HG) IN TWO GROUPS STUDIED

MAP (mm Hg)	PROPOFOL	ETOMIDATE	P VALUE
Basal	96.97+14.44	95.03+10.44	0.521
Premed	89.63+10.57	93.37+10.12	0.135
Induction	90.60+12.41	92.29+10.29	0.538
1 min	86.43+11.87	92.86+11.28	0.023*
2 min	77.83+7.64	91.29+9.06	<0.001**
3 min	74.86+8.45	94.29+16.18	<0.001**
4 min	73.34+9.05	93.63+14.4	<0.001**
5 min	76.03+12.52	99.66+20.98	<0.001**
6 min	79.43+17.03	102.77+17.55	<0.001**
7 min	76.29+13.23	104.17+19.09	<0.001**
8 min	76.57+12.07	96.23+13.59	<0.001**
9 min	71.91+7.37	93.29+12.84	<0.001**
10 min	74.03+14.40	92.77+9.44	<0.001**

Student t test and paired t test

As per paired T test there is a significant fall in mean arterial blood pressure from baseline in propofol group starting from induction until 10 minutes with p value <0.01 whereas there was no significant change in mean arterial blood pressure in etomidate group compared to baseline.

FIGURE 21 : COMPARISON OF MAP (MM HG) IN TWO GROUPS STUDIED

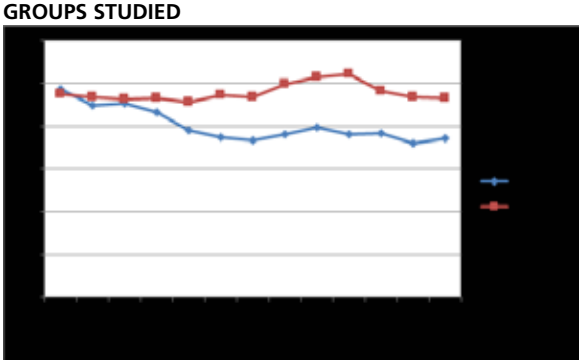


TABLE 12: COMPARISON OF SPO2% IN TWO GROUPS STUDIED

SpO2%	PROPOFOL	ETOMIDATE	P VALUE
Basal	100.00+0.00	100.00+0.00	-
Premed	99.83+0.45	99.97+0.17	0.358
Induction	99.83+0.51	100.00+0.00	0.052+
1 min	99.97+0.17	99.94+0.24	0.562
2 min	99.97+0.17	99.97+0.17	1.000
3 min	99.97+0.17	99.83+0.71	0.249
4 min	100.00+0.00	99.94+0.34	0.321
5 min	100.00+0.00	100.00+0.00	-
6 min	100.00+0.00	99.97+0.17	0.321
7 min	99.97+0.17	99.97+0.17	1.000
8 min	97.14+16.90	99.83+057	0.351
9 min	99.86+0.43	99.91+0.28	0.514
10 min	100.00+0.00	100.00+0.00	-

Student t test, There was no statistically significant difference of saturation between the two groups studied.

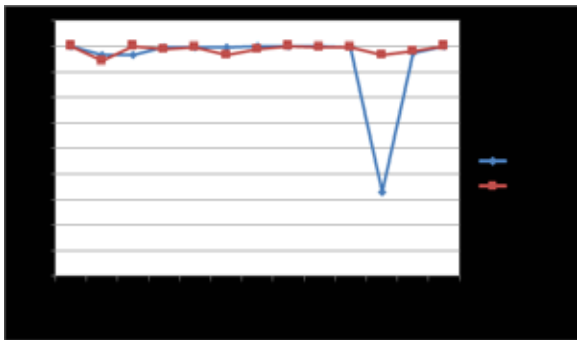


FIGURE 22 : COMPARISON OF SPO2% IN TWO GROUPS STUDIED

TABLE 13: PAIN ON INJECTION OF PATIENTS STUDIED

Pain on injection	Propofol		Etomidate	
	No	%	No	%
No pain	3	8.6	26	74.3
Mild pain	12	34.3	8	22.9
Moderate Pain	17	48.6	1	2.9
Severe pain	3	8.6	0	0.0
TOTAL	35	100.0	35	100.0

P<0.001**, significant, Fisher Exact test ,There is a statistically significant incidence of pain on injection in Group P as compared with Group E.

FIGURE 23: PAIN ON INJECTION OF PATIENTS STUDIED

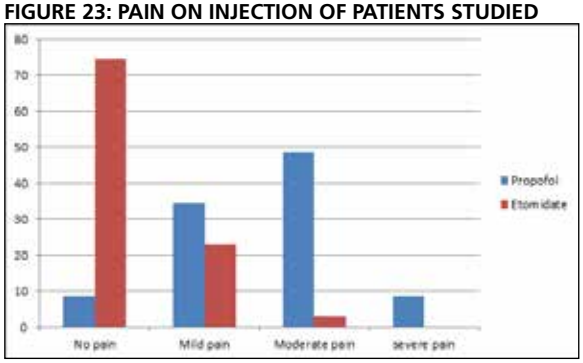


TABLE 14: MYOCLONUS IN TWO GROUPS OF PATIENTS STUDIED

Myoclonus	Propofol		Etomidate	
	No	%	No	%
Nil	31	88.6	8	22.9
Mild	4	11.4	13	37.1
Moderate	0	0.0	10	28.6
Severe	0	0.0	4	11.4
TOTAL	35	100.0	35	100.0

P<0.001**, significant, Fisher Exact test ,There is statistically significant incidence of myoclonus among patients induced with etomidate than with propofol.

FIGURE 24 : MYOCLONUS IN TWO GROUPS OF PATIENTS STUDIED

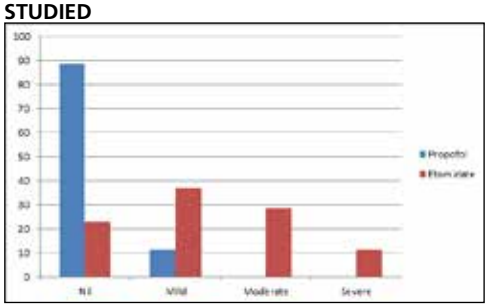


TABLE 15 : NAUSEA IN TWO GROUPS OF PATIENTS STUDIED

Myoclonus	Propofol		Etomidate	
	No	%	No	%
Nil	27	77.1	10	28.6
Mild	7	20.0	15	42.9
Moderate	1	2.9	6	17.1
Severe	0	0.0	4	11.4
TOTAL	35	100.0	35	100.0

P<0.001**, significant, Fisher Exact test ,The incidence of nausea is more in Group E compared with Group P with statistically significant ***p*** value of 0.001.

FIGURE 25 : NAUSEA IN TWO GROUPS OF PATIENTS STUDIED

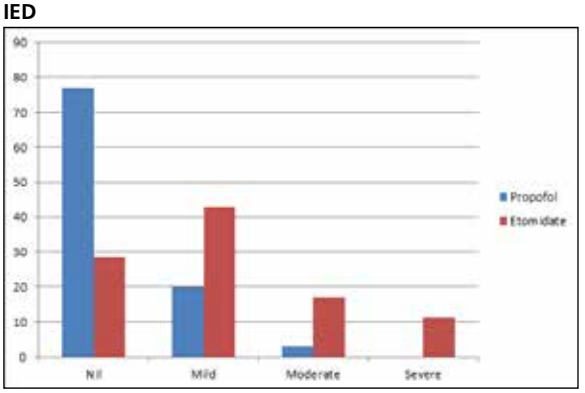
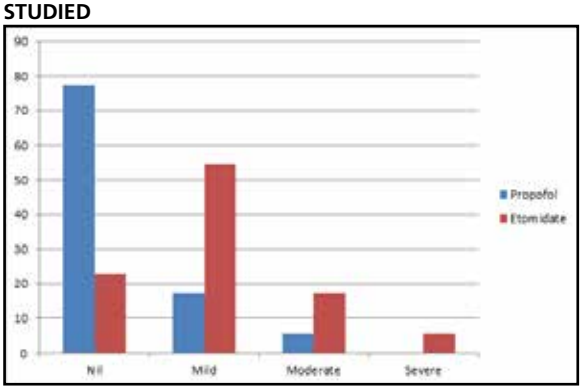


TABLE 16 : VOMITING IN TWO GROUPS OF PATIENTS STUDIED

Vomiting	Propofol		Etomidate	
	No	%	No	%
Nil	27	77.1	8	22.9
Mild	6	17.1	19	54.3
Moderate	2	5.7	6	17.1
Severe	0	0.0	2	5.7
TOTAL	35	100.0	35	100.0

P<0.001**, significant, Fisher Exact test,The incidence of vomiting is more in Group E compared with Group P with statistically significant ***p*** value of 0.001.

FIGURE 26 : VOMITING IN TWO GROUPS OF PATIENTS STUDIED



DISCUSSION

Pain on injection was observed more in the propofol group (91.5%) as compared to etomidate group (25.8%) in our study. we observed that propofol caused significant hypotension at induction in comparison to etomidate. Hypotension occurs with propofol mainly due to reduction of sympathet-

ic activity causing vasodilation or its direct effect on vascular smooth muscles. Sudden hypotension has deleterious effects on maintaining the circulation to vital organs in patients of coronary artery disease, valvular stenosis ,uncontrolled hypertension and shock. In contrast hemodynamic stability observed with etomidate may be due to its unique lack of effect on the sympathetic nervous system and on baroreceptor functions.Pain on injection was observed more with propofol than etomidate which can be minimized by using larger veins with rapid carrier infusion rates, wide bore IV cannula, by injecting lidocaine before or with propofol emulsion, or by injecting a synthetic opoid before propofol, formulation in medium chain rather than long chain triglycerides also reduce pain.The negative characteristics noted with etomidate was high incidence of myoclonic jerks and post-operative nausea and vomiting

CONCLUSION

Etomidate is better for its hemodynamic stability over propofol along with less incidence of pain on injection. Only drawback was incidence of myoclonus and post-operative nausea and vomiting which can be prevented by pretreatment with opioids and anti-emetics respectively. We therefore conclude that etomidate is a better option in patients particularly prone to hemodynamic fluctuation at induction like in coronary artery disease , valvular heart disease, hypertensives, patients with shock and critically ill patients.

SUMMARY

All patients were pre-oxygenated with 100% oxygen for 3 minutes before induction of anaesthesia and all patients were premedicated with inj. Midazolam 0.02mg/kg IV and inj.fentanyl 2 microgm/kg IV. Two minutes after fentanyl administration, infusion of study drug was started. Propofol group received propofol at an infusion rate of 0.5mg/kg/min and etomidate group received etomidate at an infusion rate of 0.05mg/kg/min. As soon as BIS value reached 50 , infusion was stopped and infusion was restarted if BIS value reached above 50. Tracheal intubation was facilitated using vecuronium 0.1 mg/kg and anaesthesia was maintained as per institutional protocol. Residual neuromuscular blockade was reversed with neostigmine 0.05mg/kg and glycopyrolate 0.008mg/kg. Trachea was extubated after adequate recovery of muscle power and patients wasmonitored post operatively. Vital parameters like heart rate , Spo_2 recorded every minute for first ten minutes, also side-effects like pain on injection, myoclonus, nausea and vomiting were recorded. gender. We found that heart rate and blood pressure reduction was statistically significant in propofol group whereas both heart rate and blood pressure was stable in etomidate group. Pain on injection was more in propofol group with $p < 0.001$ whereas incidence of myoclonus and post-operative nausea and vomiting was high in etomidate group with $p<0.001$.

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