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Research Article

Induction properties of propofol and etomida: a clinical comparative study

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ABSTRACT

Background: Propofol is a non-opioid, non-barbiturate, sedative hypnotic agent with rapid onset and short duration of action. However induction of anaesthesia with propofol is associated with pain on injection and dose dependent hypotension especially in patients above 50 years and with pre-induction hypotension. Objective of the study was to compare the induction properties, hemodynamic variables and side effects of etomidate and propofol during induction of general anaesthesia.
Methods: 60 patients undergoing elective surgeries under general anaesthesia were randomly allocated into group P (n=30) who received propofol and group E (n=30) who received etomidate as intravenous induction agents. Induction time, hemodynamic variables like pulse rate, systolic blood pressure, diastolic blood pressure, mean blood pressure following induction were recorded. Side effects like pain on injection and myoclonus were noted.
Results: In this study we found that the onset of induction, pain on injection and incidence of myoclonus were statistically insignificant in both groups. Increase in pulse rate was statistically significant in propofol at 1 and 3 mins when compared with etomidate. Fall in mean arterial pressure at 1 min was statistically significant with etomidate and with propofol at 3 and 5 min.
Conclusions: Etomidate was a better alternative as an intravenous induction agent when compared with propofol.

Keywords: Etomidate, Propofol, Induction, Myoclonus

INTRODUCTION

Patient safety has always been a major concern for the practicing anaesthesiologist. The introduction of thiopental sodium into clinical practice in 1934 marked the advent of modern intravenous anaesthesia. Gradually newer intravenous anaesthetic induction agents with desirable effects and minimal side effects were available with variable degree of acceptance.

Propofol is a non-opioid, nonbarbiturate, sedative hypnotic agent with rapid onset and short duration of action. However induction of anaesthesia with propofol is associated with pain on injection and dose dependent hypotension especially in patients above 50 years and with preinduction hypotension.[1,2] Etomidate, an imidazole derivative used as an intravenous induction agent is considered a safer alternative with regard to hemodynamic stability.

Initially on introduction of the drug it was associated with a high incidence of pain on injection, thrombophlebitis, and post-operative nausea and vomiting.[3]

A small change in the chemical composition enabled to negate these side effects, thus increasing its popularity in recent days.[4] This study was undertaken to observe the induction time, hemodynamic stability and the side effects associated with etomidate and propofol during induction of anaesthesia.

METHODS

This study was conducted in a medical college hospital after ethics committee approval.

60 patients between the age of 20-50 years of ASA grade 1 and 2 who are scheduled for elective surgeries under general anaesthesia were included in the study. A thorough pre-anaesthetic evaluation was done a day prior to the surgery and informed written consent was taken. Exclusion criteria included patients ASA-3 or more, emergency surgeries, patients with history of hyper-sensitivity to either propofol or etomidate and presence of primary or secondary adrenal insufficiency.

All the patients were randomly allocated into 2 groups-group E (n=30) to be induced with injection etomidate 0.3 mg/kg and group P (n=30) to be induced with injection propofol 2mg/kg. On the day of surgery, appropriate sized I v line was secured and i.v. infusion was started. Monitors were connected and basal parameters of ECG, NIBP, SPO_2 and heart rate were noted. 10 min prior to induction all the patients were premedicated with intravenous injection glycopyrrolate 0.2mg, injection fentanyl 2mcg/kg, injection ondansetron 4mg and injection midazolam 1mg.

Patients were preoxygenated with 100% oxygen for 3 min. Propofol and etomidate were administered to group P and group E respectively over 20-30 secs. Induction time i.e., the time taken from the start of injection upto the loss of eyelash reflex was noted. Pain on injection of the drug was noted .When the patient became apnoeic, adequacy of ventilation was checked with the bag and mask.

Injection vecuronium bromide 0.01 mg/kg was given i.v. Meanwhile hemodynamic parameters of heart rate, NIBP, SPO2 were noted every 1 min, 3 mins and 5 min after induction. Occurrence of myoclonus was noted. 3 min after giving the muscle relaxant the patient was intubated with appropriate sized endotracheal tube. Anaesthesia throughout the surgery was maintained with oxygen, nitrous oxide, inhalational agent and muscle relaxant. At the end of the surgery patient was extubated when the criteria for extubation were met, following reversal agent.

Results were presented as the mean (SD) unless and otherwise stated. Between the groups statistical significance of the readings obtained during the study were compared using t test and p value<0.05 was considered significant.

RESULTS

A total of 60 patients undergoing elective surgery were enrolled for the study. There was no significant difference between the two groups in the demographic data as in Table 1. Induction time as recorded in the two groups is shown in Table 2 which also showed no statistical difference.

Table 1: Demographic variables.

Variables	Group E	Group P	p value
Age (mean)	46.07	41.93	0.2
Sex (M/F%)	56.7/43.3	46.7/52.3	0.4
ASA grading (1/2%)	10/90	13.3/86.7	0.5

Table 2: Induction time in the two groups.

Group	Mean	SD
E	19.2	2.5
P	20.1	2.3

The comparison of occurrence of pain on injection and myoclonus between the two drugs also showed no statistical difference as in Table 3. There was no myoclonus and pain on injection with propofol was experienced only by 2 patients. There was myoclonus in 4 patients and no pain on injection in etomidate group.

Table 3: Pain on injection and myoclonus on injection in two groups.

	Pain on injection %		Myoclonus %	
Group	Yes	No	Yes	No
E	0	100	13.3	86.7
P	6.7	93.3	0	100
	Chi-square test 0.3		Chi-square test 0.06	

After induction increase in pulse rate was found to be statistically significant in propofol group when compared to etomidate group at 1 and 3 min as shown in Table 4.

Following induction fall in mean arterial pressure at 1 min was found to be statistically significant in etomidate group. At 3 and 5 min decrease in mean arterial pressure was noticed in both etomidate and propofol group, but statistically significant fall was seen only in propofol group as shown in Table 4

DISCUSSION

An ideal intravenous anaesthetic induction agent should produce minimal disturbance of cardiovascular and respiratory functions, should induce sleep in one arm brain circulation time, should be chemically stable, nonirritant to the vein, nontoxic, non-allergenic, easy to administer and with rapid recovery properties.

Propofol and etomidate are two widely used induction agents with its own advantages. Hence this study is conducted to compare and evaluate the induction time, hemodynamic stability and side effects such as pain on injection and myoclonus when etomidate and propofol were used as induction agents.

According to present study the induction time when etomidate was used was lesser with a mean value of 19±2.5 sec when compared with propofol which was 20.1±2.3sec, but the difference was statistically insignificant. Similarly, a study done by S C Shah et al with etomidate 0.3mg/kg achieved induction time in 20 secs.[5] A study done by Fatma Saricaoglu et al comparing induction times using BIS monitor(time to reach BIS value of 40) with etofol (mixture of propofol and etomidate), propofol and etomidate showed faster induction time with etofol usage.[6]

Table 4: Comparison of pulse rate in the two study groups.

	PR	Paired differences				P
		Mean	SD	95% Confidence interval of the difference		
				Lower	Upper	
E	B-1 min	-2.367	9.445	-5.89	1.16	0.180
	B-3 min	-.600	12.050	-5.10	3.90	0.787
	B-5 min	3.200	10.443	-.70	7.10	0.104
P	B-1 min	-14.233	12.079	-18.74	-9.72	0.000
	B-3 min	-5.300	11.600	-9.63	-0.97	0.018
	B-5 min	-2.033	13.142	-6.94	2.87	0.404

The rapid induction time without any side effect is a valuable characteristic of an ideal induction agent.

In present study, pain on injection was noticed in only 2 patients of propofol group and none in etomidate group which is statistically insignificant. A similar study done by Y Nyman et al comparing incidence of pain on injection between propofol with added lidocaine and lipid emulsion etomidate formulation in paediatric patients showed significantly less pain in etomidate group.[7] Pain on injection, venous irritation and hemolysis have been abolished by the new fat emulsion formulation of etomidate. This small change in chemical composition has made a significant improvement in patient comfort.

Table 5: Comparison of map in the two groups.

Group	MAP	Paired Differences				P
		Mean	SD	95% Confidence interval of the difference		
				Lower	Upper	
E	B – 1 min	4.80	10.58	0.849	8.751	0.019
	B – 3 min	13.63	13.51	8.588	18.679	0.000
	B – 5 min	11.67	16.12	5.649	17.685	0.000
P	B – 1 min	-0.67	23.62	-9.487	8.154	0.878
	B – 3 min	23.13	23.08	14.514	31.753	0.000
	B – 5 min	19.53	18.38	12.672	26.395	0.000

Myoclonus was noticed in only 4 patients after induction with etomidate and none with propofol which was not statistically significant. This is further supported by a similar study conducted by Doenicke AW et al which concludes that incidence and intensity of myoclonus after induction with etomidate are dose related, suppressed by pretreatment and not associated with seizure like activity.[8,9]

However the new formulation of etomidate has not reduced the incidence of myoclonus which is a serious problem in patients with open globe injuries and non-fasting situations.[10] In present study, increase in heart rate after induction was found to be statistically significant in propofol group at 1 and 3 min when compared with etomidate group. Dr Anil Kumar et al observed an increase in the mean heart rate at 1 min after induction in group 1, when they compared propofol 2mg/kg in group 1 and priming dose (20% of calculated dose) followed by calculated dose in group 2.[11] In contrast to this, Hashaam B Ghafoor et al found no statistically significant difference in heart rate when propofol and etomidate was used for induction.[12]

Propofol has a biphasic effect on the cardiovascular system. Initially after injection of propofol, decrease in

both systemic vascular resistance and mean arterial pressure predominates which causes reflex tachycardia. Later within 2 minutes of injection the heart rate is decreased to less than normal by "resetting" of the baroreceptor reflex.

Present study concluded that fall in mean arterial pressure following induction at 1 min was statistically significant in etomidate group. At 3 and 5 min fall in mean arterial pressure was noticed in both the groups, but more statistically significant in propofol group. Similar results were obtained by Hashaam B Ghafoor et al and Fatma Saricaoglu et al when hemodynamic parameters were compared with etomidate and propofol at induction time.[6,12]

These hemodynamic effects were dose dependent, attributable to a decrease in sympathetic activity, direct vasodilation and myocardial depression.[13,14]

CONCLUSION

From this study it can be concluded that etomidate could be used as a safe alternative and effective intravenous induction agent with minimal side effects when compared to propofol.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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