

Original Research

Hemodynamic changes and complications occurring with Propofol and etomidate during general anesthesia

Bhriagu Nath Singh¹, Parag Agarwal²

^{1,2} Associate Professor, Department of Anaesthesia, Autonomous state Medical College, Ayodhya

ABSTRACT

Background: The goal of inducing anaesthesia with minimum significant side effects continues to occupy the minds of anaesthesiologist. Etomidate and propofol are two ultra-short-acting sedative agents thought to provide these characteristics. Hence; the present study was undertaken for comparing the hemodynamic changes and complications occurring with Propofol and etomidate during general anesthesia. **Materials and methods:** A total of 100 patients were enrolled in the present study and were broadly divided into two study groups with 50 patients in each group: Propofol group and Etomidate group. Patients who were scheduled to undergo elective surgical procedure under general anesthesia with endotracheal intubation were enrolled. After enrolling the patients and obtaining their informed consent, complete demographic and clinical details of all the patients was obtained. Preoperative hemodynamic assessment of all the patients was done. Premedication of all the patients was done with alprazolam 0.25 mg and ranitidine 150 mg one night before the surgery. Anesthesia was given to all the patients according to their respective groups. Pain on injection and myoclonic movements were recorded, if any at induction. All the hemodynamic parameter was recorded during the surgery procedure. **Results:** In comparison to etomidate, propofol showed significant variation in MAP at different time intervals (p- value < 0.05). In comparison to etomidate, propofol showed significant variation in heart rate at the time of induction of anesthesia (p- value < 0.05). Significant higher incidence of pain on injection and myoclonic movements was seen among patients of the Propofol group in comparison to the patients of the Etomidate group (P- value < 0.05). **Conclusion:** In terms of hemodynamic stability and pain of injection, the efficacy of etomidate as an anesthetic agent is superior in comparison to propofol.

Keywords: Hernia, Inguinal, Repair

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Corresponding author: Dr. Parag Agarwal, Associate Professor, Department of Anaesthesia, Autonomous state Medical College, Ayodhya, India

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INTRODUCTION

The goal of inducing anaesthesia with minimum significant side effects continues to occupy the minds of anaesthesiologist. Various researchers prefer intravenous anaesthetic agents to induce anaesthesia, as induction is usually smoother and more rapid than that associated with most of the inhalational agents.^{1,2} Other uses of Intravenous (IV) induction agents other than induction of general anaesthesia (GA) are to provide sedation in critical care unit and along with various type of peripheral nerve block and neuroaxial block, (TIVA) total intravenous anaesthetic agents to maintain anaesthesia, sole drug in day care anaesthesia and also along with local infiltration.^{3,4}

Etomidate and propofol are two ultra-short-acting sedative agents thought to provide these characteristics. Propofol, 2,6-diisopropylphenol is most popular induction agent and provides rapid and smooth anesthesia with quick recovery. The incidence of vomiting is also less.⁵

Hence; under the light of above mentioned data, the present study was undertaken for comparing the hemodynamic changes and complications occurring with Propofol and etomidate during general anesthesia.

MATERIALS AND METHODS:

The present study was undertaken in the department of general anesthesia of the medical institute and it included assessment and comparison of hemodynamic changes and

complications occurring with Propofol and etomidate during general anesthesia.

Sample size

A total of 100 patients were enrolled in the present study and were broadly divided into two study groups with 50 patients in each group: Propofol group and Etomidate group.

Type of study

Comparative prospective study

Ethical clearance

Obtained from institutional ethical committee in written consent was obtained after explaining in detail the entire research protocol.

Inclusion criteria

- Patients within the age group of 20 to 60 years
- Patients who gave informed consent
- Patients who were scheduled to undergo elective surgical procedure under general anesthesia with endotracheal intubation

Exclusion criteria

- Patients with history of presence of any co-morbid condition
- Diabetic and hypertensive patients
- Patients with any known drug allergy

METHODOLOGY

After enrolling the patients and obtaining their informed consent, complete demographic and clinical details of all the patients was obtained. Preoperative hemodynamic assessment of all the patients was done. Premedication of

all the patients was done with alprazolam 0.25 mg and ranitidine 150 mg one night before the surgery. Anesthesia was given to all the patients according to their respective groups. Pain on injection and myoclonic movements were recorded, if any at induction. All the hemodynamic parameter was recorded during the surgery procedure.

STATISTICAL ANALYSIS

All the results were analyzed by SPSS software. Chi-square test was used for assessment of level of significance. P- value of less than 0.05 was taken as significant.

RESULTS

The present study was undertaken for comparing the hemodynamic changes and complications occurring with Propofol and etomidate during general anesthesia. Mean age of the patients of the propofol group and the etomidate group was 42.8 years and 43.8 years. Majority of the patients of both the study groups belonged to the age group of 25 to 45 years. Majority of patients of both the study groups were males. Mean BMI of patients of propofol group and the etomidate group was 26.5 and 25.8 Kg/m². Table 2 shows the comparison of variation occurring in MAP in between the two groups at different time intervals. In comparison to etomidate, propofol showed significant variation in MAP at different time intervals (p- value < 0.05). Table 3 shows the comparison of variation occurring in heart rate in between the two groups at different time intervals. In comparison to etomidate, propofol showed significant variation in heart rate at the time of induction of anesthesia (p- value < 0.05).

Significant higher incidence of pain on injection and myoclonic movements was seen among patients of the Propofol group in comparison to the patients of the Etomidate group (P- value < 0.05).

Table 1: Demographic profile of patients of both the study groups

Parameter		Propofol group	Etomidate group
Number of patients		50	50
Age group (years)	Less than 25	12	15
	25 to 45	20	18
	More than 45	18	17
Mean age (years)		42.8	43.8
Gender	Males	28	29
	Females	22	21
Mean BMI (Kg/m ²)		26.5	25.8
ASA grade	I	28	27
	II	22	23

Table 2: Comparison of mean arterial pressure at different time intervals

Mean arterial pressure	Propofol group	Etomidate group	p- value
At baseline	94	92	0.52
At induction	75	88	0.00*
At laryngoscopy	110	101	0.02*
At 1 minute	102	99	0.58
At 3 minute	86	88	0.16
At 10 minute	90	92	0.28

*: Significant

Table 3: Comparison of heart rate at different time intervals

Mean arterial pressure	Propofol group	Etomidate group	p- value
At baseline	86	89	0.42
At induction	93	84	0.01*
At laryngoscopy	85	86	0.65
At 1 minute	86	85	0.45
At 3 minute	84	88	0.25
At 10 minute	82	83	0.11

*: Significant

Table 4: Incidence of complications

Complications	Propofol group (n=50)	Etomidate group (n=50)	p- value
Pain on injection	23	12	0.03*
Apnea on induction	18	20	0.15
Myoclonic movements	33	22	0.04*

*: Significant

DISCUSSION

Induction agents are used to induce anesthesia prior to other drugs being given to maintain anesthesia, as the sole drug for short procedures, to maintain anesthesia for longer procedures by intravenous infusion, to provide conscious sedation during procedures undergoing in local anesthesia and intensive care unit.⁶⁻⁸ Propofol is an intravenous anesthetic that is used for procedural sedation, during monitored anesthesia care, or as an induction agent for general anesthesia. It may be administered as a bolus or an infusion or some combination of the two. Like most general anesthetic agents, the mechanism of action for propofol is poorly understood but thought to be related to the effects on GABA-mediated chloride channels in the brain.⁷ Etomidate is an ultrashort-acting, non-barbiturate hypnotic intravenous anesthetic agent. Etomidate does not have any analgesic properties. It is administered only by intravenous route. Etomidate has a very favorable hemodynamic profile on induction, with a minimal amount of blood pressure depression making it an ideal choice for shock trauma, hypovolemic patients, or patients with significant cardiovascular disease.^{8,9} Hence; under the light of above mentioned data, the present study was undertaken for comparing the hemodynamic changes and complications occurring with Propofol and etomidate during general anesthesia.

In the present study, mean age of the patients of the propofol group and the etomidate group was 42.8 years and 43.8 years. Majority of the patients of both the study groups belonged to the age group of 25 to 45 years. Majority of patients of both the study groups were males. Mean BMI of patients of propofol group and the etomidate group was 26.5 and 25.8 Kg/m². A systematic review and meta-analysis was conducted by Ye Li et al, for comparing the efficacy and safety of Etomidate and Propofol. PubMed, Embase, Web of science, EBSCO, and Cochrane library databases were systematically searched. Randomized controlled trials assessing the effect of etomidate versus propofol for the anesthesia of patients undergoing gastrointestinal endoscopy were included. Two

investigators independently searched articles, extracted data, and assessed the quality of included studies. The primary outcomes were anesthesia duration and recovery time. Meta-analysis was performed using random-effect model. Six randomized controlled trials involving 1115 patients were included in the meta-analysis. Between etomidate and propofol, no significant difference was revealed regarding anesthesia duration, recovery time, mean arterial pressure at intubation, heart pulse at intubation, SPO2 at intubation, patient satisfaction, hypotension, changes of heart rate and nausea-vomiting.¹⁰

In the present study, in comparison to etomidate, propofol showed significant variation in MAP at different time intervals (p- value < 0.05). Propofol may work by decreasing dissociation from GABA receptors in the brain and potentiating the inhibitory effects of the neurotransmitter. Propofol is contraindicated in any patient that has any known hypersensitivity reaction to the drug. Caution should be taken in any patient with abnormally low blood pressure.⁸ Etomidate contains a carboxylated imidazole ring-containing anesthetic compound (R-1-ethyl-1-[a-methylbenzyl] imidazole-5-carboxylate) and is structurally unrelated to other anesthetic agents. The imidazole ring provides water solubility in acidic solutions and lipid solubility at physiological pH. Therefore, etomidate is dissolved in propylene glycol, which often causes pain on injection but can be reduced by a prior intravenous injection of lidocaine.^{8,9}

In the present study, in comparison to etomidate, propofol showed significant variation in heart rate at the time of induction of anesthesia (p- value < 0.05). Significant higher incidence of pain on injection and myoclonic movements was seen among patients of the Propofol group in comparison to the patients of the Etomidate group (P- value < 0.05). In a previous study conducted by Ko YK et al, authors compared the intubating conditions and the onset time associated with administration of cisatracurium, according to prior injection of one of two intravenous anesthetic agents: propofol or etomidate. Forty-six female patients, undergoing general anesthesia and endotracheal

intubation for elective surgery, were randomized to two groups; group P were administered propofol (2 mg/kg) prior to cisatracurium (0.2 mg/kg); group E were administered etomidate (0.3 mg/kg) prior to cisatracurium (0.2 mg/kg). They measured intubating conditions and the onset time according to the types of intravenous anesthetic administered. Measurements of heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) were taken immediately prior to induction; immediately and 1 min after IV anesthetic administration; and immediately and 1, 2, 3, 4, 5, 7, and 15 min after endotracheal intubation. Intubating conditions were superior in group E compared with group P ($P = 0.009$). The average onset time of cisatracurium was more rapid in group E. There were no group differences in SBP, DBP, and HR following intravenous anesthetic drug injection and endotracheal intubation. However, SBP and DBP were substantially higher in group E after endotracheal intubation. Etomidate improves intubating conditions and provide a more rapid onset time of cisatracurium during anesthetic induction compared to propofol.¹¹

CONCLUSION

Under the light of above obtained results, the authors conclude that in terms of hemodynamic stability and pain of injection, the efficacy of etomidate as an anesthetic agent is superior in comparison to propofol. However; further studies are recommended.

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