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A PROSPECTIVE COMPARATIVE STUDY OF INJECTION ETOMIDATE AND INJECTION THIOPENTONE SODIUM FOR INDUCTION OF GENERAL ANAESTHESIA

Anaesthesiology

Dr. Sumit Alok Resident, Department of Anaesthesiology, KIMS, Karad, Maharashtra, India

Dr. P. B. Jamale* Professor, Department of Anaesthesiology, KIMS, Karad, Maharashtra, India *Corresponding Author

Dr. Vithal K Dhulkhed Professor and Head, Department of Anaesthesiology, KIMS, Karad, Maharashtra, India

Dr. Naseema V Kanase Professor, Department of Anaesthesiology, KIMS, Karad, Maharashtra, India

Dr. Shraddha Naik Associate Professor, Department of Anaesthesiology, KIMS, Karad, Maharashtra, India

ABSTRACT

Introduction: Hemodynamic stability is very much important during induction of general anaesthesia in surgical patients. Our present study was done to compare haemodynamic parameters and side effects (myoclonus and nausea / vomiting) for induction of general anaesthesia by etomidate and thiopentone in surgical patients.

Materials and Methods: The 80 patients aged between 18 to 60 years recruited for the study were allocated randomly to one of the two groups:- **Group 'T':-** comprised of 40 patients induced with injection thiopentone 5 mg/kg intravenous for induction of general anaesthesia. Group 'E':- comprised of 40 patients induced with injection etomidate 0.3 mg/kg intravenous for induction of general anaesthesia.

Results: The time of induction with injection etomidate was found to be significantly shorter in comparison to injection thiopentone. Etomidate is characterised by good cardiovascular stability compared to thiopentone. Post operative nausea and vomiting was less in thiopentone group as compared to etomidate group.

Conclusion: Etomidate can be used as a safe, haemodynamically stable and effective alternative to thiopentone for induction of general anaesthesia.

KEYWORDS

etomidate, haemodynamic parameters, induction, thiopentone.

INTRODUCTION

Hemodynamic stability is very much important during induction of general anaesthesia in surgical patients. Thus, anaesthetic agent with minimum effect on heart rate (HR) and blood pressure (BP) would be the agent of choice for general anaesthesia.[1] Use of inhalational anaesthetics can cause progressive cardiopulmonary depression. Thus, use of non-inhalational anaesthetic agents can decrease the requirement of inhalational anaesthetics which lead to less cardiovascular depression.[2] Intravenous anaesthetics have a faster onset with minimal side effects than inhalational anaesthetics and are used commonly in induction of general anaesthesia for most of the surgical procedures.[3]

The research for a better inducing agent which has good control of haemodynamic changes during intubation like etomidate have been tried. Etomidate is a short-acting IV anaesthetic drug used for the induction of general anaesthesia and sedation for short procedures such as cardioversion and tracheal intubation. It has a rapid onset of action and a safe cardiovascular profile and therefore is less likely to cause a significant drop in blood pressure than other induction agents. Etomidate is often used because of its easy dosing profile, lack of histamine release, limited suppression of ventilation and protection from cerebral and myocardial ischemia.[4] So etomidate is a good induction agent for people who are haemodynamically unstable. Our present study was done to compare haemodynamic parameters and side effects (myoclonus and nausea / vomiting) for induction of general anaesthesia by etomidate and thiopentone in surgical patients.

MATERIALS AND METHODS

Source of data, Approval and Consent:- After obtaining institutional ethical committee approval, 80 patients were selected aged between 18 to 60 years undergoing elective surgeries under general anaesthesia in KIMS Hospital, Karad, Maharashtra. A written and informed consent was obtained from all the patients.

Preoperative protocol:- Preanaesthetic check up of all patients were done prior to surgery. A thorough history and complete physical examination was done.

Laboratory investigations:- complete blood count, urine analysis, haemoglobin %, random blood sugar, blood urea, serum creatinine, coagulation profile (BT,CT), HIV status, HBsAg status, chest x-ray and ECG (if required) were done for all the patients.

Inclusion criteria: - Patients between the age group of 18 to 60 years of both the genders belonging to ASA physical status grade I and II undergoing elective surgery under general anaesthesia.

Exclusion criteria:-

i) Emergency surgeries
ii) History of hypersensitivity to thiopentone/etomidate
iii) Presence of known primary/secondary adrenal insufficiency or on steroid medication
iv) Behavioural and psychiatric disorders
v) History of arrhythmia

Study group:-

The 80 patients recruited for the study were allocated randomly to one of the two groups:-

A. Group 'T' comprised of 40 patients induced with injection thiopentone 5 mg/kg intravenous for induction of general anaesthesia.
B. Group 'E' comprised of 40 patients induced with injection etomidate 0.3 mg/kg intravenous for induction of general anaesthesia.

Technique of anaesthesia :-

Patients were transferred to the pre anaesthetic care room after 8 hours of fasting and intravenous access was secured using cannula of 20G 1 hour before surgery. Infusion of Ringer's lactate at 10ml/kg/hour was started in both group T and group E and maintained throughout the procedure. Injection ranitidine 50 mg and injection metoclopramide 10mg were given to the patients 45 minutes before surgery.

Patient was then positioned in the operating room and following parameters like pulse rate, non invasive blood pressure, oxygen saturation were monitored by using pulse oximeter, ECG and sphygmomanometer.

Prior to the induction of anaesthesia, all patients were pre-medicated

with injection midazolam 1mg and injection fentanyl 1.5 mcg/kg. Preoxygenation was done with 100% oxygen for 3 minutes. According to the group allocation patients were given either injection thiopentone 5 mg/kg (group T) or injection etomidate 0.3 mg/kg (group E) which was administered intravenous in 30 to 45 seconds. Patients were intubated after relaxation with injection succinylcholine 1 mg/kg with appropriate size cuffed endotracheal tube. After confirming the proper position of endotracheal tube in trachea (by auscultatory method and capnograph), tube was fixed and manual ventilation with closed circuit was carried out with nitrous oxide 50% and oxygen 50%.

Anaesthesia was maintained with 50% oxygen + 50% nitrous oxide + sevoflurane and a bolus dose of muscle relaxant (vecuronium 0.1 mg/kg) was given when the features of insufficient relaxation was noted.

At the end of the surgery, sevoflurane and nitrous oxide was discontinued, and all patients received 100% oxygen (6 lit/min) and IV diclofenac (1 mg/kg) with 100 ml normal saline. When the patient had respiratory efforts, reversal was done with injection neostigmine 2.5 mg + injection glycopyrrolate 0.5 mg and extubated .

On spontaneous eye opening with good muscle tone patients were transferred to the Post-Anaesthetic Care Unit (PACU).

Parameters observed:-

1. Pre-induction period:-

Heart rate, systolic blood pressure and diastolic blood pressure were recorded before induction of anaesthesia at the interval of 1, 3 and 5 minute.These values were taken as the base line values.

2. Induction period:-

i) Induction time was defined as the time from start of injection of induction agent till the loss of eye lash reflex (in seconds).

ii) Haemodynamic changes

Heart rate, systolic blood pressure and diastolic blood pressure were recorded at the interval of 1, 2 and 3 minute during induction.

3. Immediately after intubation:-

Heart rate, systolic blood pressure and diastolic blood pressure were recorded at the interval of 1, 2 and 3 minute.

Complications:- Myoclonus and nausea/vomiting were noted.

Rescue plan:- For the purpose of study, we defined hypotension as a decrease in systolic blood pressure > 20% of base line and was treated with incremental doses of injection ephedrine 5 mg IV. Bradycardia was defined as a heart rate < 50 beats/minute and was treated with IV injection atropine 0.6 mg. Apnoea was defined as the cessation of respiration for more than 10 seconds and it was treated by mask ventilation with 100% of oxygen. Incidence of nausea or vomiting was treated with IV injection metoclopramide 10 mg.

RESULTS

Mean induction time in group T was 32.95 ± 4.02 seconds and in group E was 23.50 ± 3.98 seconds. Time for induction in etomidate was significantly shorter compared to thiopentone group.

Table 1: Comparison of mean Induction time (IT) according to types of drugs

IT (in sec.)	Types of drug used		P Value
	Thiopentone (n=40)	Etomidate (n=40)	
Mean	32.95	23.5	<0.01
SD	4.02	3.98	

No significant changes in haemodynamic parameters were observed in both thiopentone and etomidate group after pre medication.

Table 2: Comparison of mean systolic blood pressure in mm Hg according to type of drugs.

Time of recording	Type of drug		P value
	Thiopentone	Etomidate	
Pre-induction			
1 minute	122.35 ± 10.26	120.45 ± 13.02	0.47
3 minute	120 ± 9.81	119.7 ± 12.26	0.90
5 minute	118.65 ± 10.18	117.25 ± 20	0.69
Induction			
1 minute	117.35 ± 13.33	121.25 ± 11.67	0.16
2 minute	117.30 ± 13.95	121.10 ± 11.94	0.34
3 minute	115.55 ± 16.39	120.85 ± 10.74	0.15
Post-intubation			
1 minute	138.7 ± 10.32	122.95 ± 9.94	<0.01
2 minute	139.5 ± 12.20	123.5 ± 9.87	<0.01
3 minute	136.5 ± 10.21	121.7 ± 9.38	<0.01

During induction there was a fall in systolic blood pressure in thiopentone group at 1 minute, 2 minute and 3 minute (p value > 0.05). This was statistically not significant. After intubation systolic blood pressure changes were very minimal in etomidate group while there was significant increase in thiopentone group. The systolic blood pressure in thiopentone groups were 138.70 ± 10.32mmHg at 1 min, 139.50 ± 12.20 mmHg at 2 min and 136.50 ± 10.29 mmHg at 3 min and 122.95 ± 9.94 mmHg, 123.50 ± 9.87 mmHg, 121.70 ± 9.38 mmHg at the interval of 1, 2 and 3 min in etomidate group respectively (p value < 0.05). This was found to be statistically significant.

Table 3: Comparison of mean diastolic blood pressure in mm Hg according to type of drugs.

Time of recording	Type of drug		P value
	Thiopentone	Etomidate	
Pre-induction			
1 minute	78.47 ± 6.71	76.45 ± 8.67	0.24
3 minute	76.85 ± 7.14	75.1 ± 8.54	0.32
5 minute	76.4 ± 7.63	75.8 ± 8.43	0.73
Induction			
1 minute	74.8 ± 8.93	76.35 ± 8.16	0.42
2 minute	73.25 ± 8.73	76.5 ± 7.62	0.08
3 minute	73.65 ± 8.26	75.95 ± 7.69	0.20
Post- intubation			
1 minute	89.6 ± 7.19	78.6 ± 7.58	<0.01
2 minute	88.6 ± 7.93	78.4 ± 7.72	<0.01
3 minute	88.2 ± 9.49	76.3 ± 12.83	<0.01

During induction there was a fall in diastolic blood pressure in thiopentone group at 1, 2 and 3 minute. This was statistically not significant (p value > 0.05). In thiopentone group mean diastolic blood pressure was 89.60 ± 7.19 mmHg at 1 min, 88.60 ± 7.93 mmHg at 2 min, 88.20 ± 9.49 mm Hg at 3 min and 78.60 ± 7.58 mmHg at 1 min, 78.40 ± 7.72 mmHg at 2 min, 76.30 ± 12.83 mmHg at 3 minute in etomidate group. Post intubation the mean diastolic blood pressure was found to be increased in thiopentone group in comparison to etomidate group (p value <0.05). This was found to be statistically significant.

Table 4: Comparison of mean heart rate (beats /min) according to type of drugs

Time of recording	Type of drug		P value
	Thiopentone	Etomidate	
Pre-induction			
1 minute	83.40 ± 12.05	81.15 ± 9.50	0.35
3 minute	82.67 ± 11.76	80.97 ± 9.59	0.48
5 minute	81.35 ± 14.99	81.12 ± 9.39	0.20
Induction			
1 minute	84.67 ± 12.65	82.4 ± 9.31	0.36
2 minute	84.86 ± 11.34	82.32± 10.09	0.29
3 minute	85.46 ± 13.64	82.85 ± 10.69	0.34
Post-intubation			
1 minute	105.45 ± 15.16	85.4 ± 10.13	<0.01
2 minute	105.5 ± 13.11	85.21 ± 9.21	<0.01
3 minute	99.4 ± 11	83.28 ± 9.12	<0.01

During induction, heart rate increased in both etomidate group and thiopentone group. This was statistically not significant (p value > 0.05). Increase in heart rate after intubation was observed in thiopentone group from base line value 83.40 ± 12.05 beats/min to 105.45 ± 15.16 beats/min at 1 minute, 105.50 ± 13.11 beats/min at 2 minute and 99.40 beats/min at 3 minute. This was statistically significant (p value ≤ 0.05).

Table 5: Distribution according to nausea/vomiting and myoclonus

Adverse effects	**Type of drug used**	
	Thiopentone (%)	**Etomidate (%)**
Nausea or vomiting	2 (5)	10 (25)

Myoclonus (MC)	0(0)	7(17.5)
Total	2	17

Compared to etomidate group post operative nausea and vomiting was less in thiopentone group. In thiopentone group nausea and vomiting was present in 2 patients (5%) while in etomidate group it was in 10 patients (25%). In etomidate group incidence of myoclonus was observed in 7 patients (17.50%) while there were none in the thiopentone group. Statistically it was significant for both nausea or vomiting and myoclonus. (Fisher exact test, $p < 0.05$).

DISCUSSION

This study was done to determine the features of etomidate as intravenous agent in elective surgeries when injected in a dose of 0.3 mg/kg compared to injection thiopentone 5 mg/kg. The following parameters were observed amongst the two groups- induction time, haemodynamic changes during preinduction, induction and immediately after intubation and complications (myoclonus and nausea/vomiting).

Induction Time:-

In this study the time of induction with injection etomidate was found to be significantly shorter in comparison to injection thiopentone. Etomidate has a fast and smooth induction. The average time of induction to loss of consciousness was 20 seconds.[5]

Haemodynamic changes after premedication:-

In the present study it was observed that there were no significant alterations in the haemodynamic changes in both thiopentone group and etomidate group after premedication, the p value >0.05 which is statistically not significant. In both thiopentone and etomidate groups there were no remarkable differences in arterial blood pressure and heart rate prior to induction.[6]

Haemodynamic changes after induction:-

Blood pressure:-

In the thiopentone group it was observed that there was decrease in both systolic blood pressure and diastolic pressure after induction. In the etomidate group increase in systolic and diastolic blood pressure was noted, p value > 0.05 which is not statistically significant. After induction systolic and diastolic blood pressure did not change significantly as compared to pre-induction in etomidate group but decreased in thiopentone group.[7]

Heart rate:-

In thiopentone group there was increase in heart rate in comparison to etomidate group. There was marginal increase in heart rate when compared to the pre induction value in etomidate group which is statistically not significant. After induction heart rate did not significantly change compared to pre-induction in etomidate group but in thiopentone group heart rate increased significantly.[7]

Haemodynamic changes after intubation:-

Blood pressure and Heart rate:-

In our study, there was significant rise in heart rate and blood pressure post intubation in the thiopentone group (p value< 0.01). These changes were clinically and statistically significant. The change in systolic and diastolic blood pressure was found to be insignificant in the etomidate group. Induction with etomidate lead to stable haemodynamic status of patients during laryngoscopy and intubation with respect to thiopentone group which caused an increase in blood pressure and heart rate (p value <0.05).[7]

Complications:-

Nausea or Vomiting:-

The episodes of nausea and vomiting were found to be more in the etomidate group compared to the thiopentone group. Post operative nausea and vomiting was recorded in 2 patients (5%) and 10 patients (25%) in thiopentone group and etomidate group respectively. The incidence of post operative nausea and vomiting was 12% in the thiopentone group and 25% in the etomidate group.[9]

Myoclonus:

In my study the frequency of myoclonus observed in etomidate group was 7 patients (17.5%) and there was no myoclonus observed in thiopentone group. No incidence of myoclonus was reported in thiopentone group where as it was 28% in the etomidate group.[9]

CONCLUSION

In our study it can be concluded that

i) The induction time was comparatively lesser in etomidate group.
ii) Etomidate is effective as a rapid acting induction anaesthetic agent compared to thiopentone.
iii) Etomidate is characterised by good cardiovascular stability compared to thiopentone.

So etomidate can be used as a safe, haemodynamically stable and effective alternative to thiopentone for induction of general anaesthesia.

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