

## Comparative Effect of Etomidate and Thiopentone on the Heart Rate and Respiratory Rate for Induction of General Anaesthesia

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### Abstract

**Introduction:** Etomidate is recommended for induction in patients with poor left ventricular (LV) function. Thiopentone has been the routine induction agent of anaesthesia since 1930's because of its rapid and predictable action. Hence the present study allows evaluation of Etomidate in comparison with Thiopentone sodium as an induction agent.

**Materials and Methods:** Total of 120 patients between the age ranges of 20 to 70 years were included in the study. All the patients were scheduled to undergo the elective surgery under general anaesthesia. They were divided into two groups: *Group A*: comprised of 60 patients induced with injection etomidate 0.3 mg/kg IV for general anaesthesia. *Group B*: comprised of 60 patients induced with injection Thiopentone 5 mg/kg IV for general anaesthesia.

**Results:** The mean induction time for etomidate for group A was found to be 23±5 seconds and the mean induction time for Thiopentone for group B was found to be 33±6 seconds. There is significant increase in heart rate after intubation in thiopentone group as compared to etomidate group. During induction there was decrease in respiratory rate in both groups and when the comparison was done the more decrease was found in group B that is in patients with thiopentone group.

**Conclusion:** By the present study it can be concluded the induction time was lesser in Etomidate and the incidence of apnoea was more in Thiopentone. Etomidate is an effective and rapid acting induction anesthetic agent with good cardiovascular stability and respiratory stability. Its side effects can be reduced to minimum by proper premedication and suitable IV Anaesthetic techniques.

**Keywords:** Anaesthesia; Complications; Etomidate; Thiopentone.

### Introduction

The considerations for induction of anaesthesia in patients undergoing cardiac surgery include hemodynamic stability, attenuation of the stress responses and maintenance of balance between myocardial oxygen demand and supply.<sup>1</sup> The Induction of general anaesthesia allowed Surgeons

to operate with careful deliberation on patients made totally unaware and pain free. With this arose the problem of inducing quick and reversible unconsciousness with minimal side effects. This was initially tried with inhalation agents and later intravenous agents.<sup>2</sup>

Hemodynamic stability is very much important during induction of general anaesthesia in surgical patients. Thus, anaesthetic agent with minimum

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effect on heart rate (HR) and blood pressure (BP) would be the agent of choice for general anesthesia.<sup>3</sup> 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.<sup>4,5</sup>

Etomidate, first introduced in the seventies, was withdrawn, because of anaphylactic reactions to Cremaphore EL. There were also concerns about reductions in the serum cortisol levels, which lasts for up to 24 h. However, it has a very stable cardiovascular profile and has been reintroduced in India. Etomidate is recommended for induction in patients with poor left ventricular (LV) function.<sup>6,7</sup>

Thiopentone has been the routine induction agent of anaesthesia since 1930's because of its rapid and predictable action. The main drawbacks are cardiovascular and respiratory depression, increased incidence of Laryngospasm, bronchospasm, allergic reactions.<sup>8</sup> Thiopentone has survived the test of time as an intravenous anaesthesia drug. The different agents like Etomidate have been tried with varied success.<sup>8,9</sup> Hence the present study allows evaluation of Etomidate in comparison with Thiopentone sodium as an induction agent. This study aims an attempt to compare heart rate and respiratory rate.

## Materials and Methods

The present clinical study was done in the medical college and associated hospital. Total of 120 patients between the age ranges of 20 to 70 years were included in the study. All the patients were scheduled to undergo the elective surgery under general anaesthesia. The institute ethical committee was informed about the study and the clearance certificate was obtained from them. All the included patients were evaluated thoroughly on the previous day of surgery.

Thorough history and complete physical examination was under taken. All the patients who were included in the study were explained about the study and the written informed consent was obtained from them. The patients who were of lesser age of 20 years and more than 70 years were excluded in the study. All those patients who were unable to give the inform consent, patients belonging to ASA grade III and IV patients, those who require emergency surgeries, patient with history of hypersensitivity to thiopentone and

etomidate, all those on steroid medication were excluded in the study.

The included 120 patients belonged to ASA I or II grade and were divided into two groups:

*Group A:* comprised of 60 patients induced with injection etomidate 0.3 mg/kg IV for general anaesthesia.

*Group B:* comprised of 60 patients induced with injection Thiopentone 5 mg/kg IV for general anaesthesia.

All the patients were positioned in the operating room and IV line was started into a suitable vein. The infusion line was started and continued throughout the procedure. Pulse oximeter and ECG was used to check the following parameters like pulse rate, oxygen saturation and pulse saturation. Prior to the induction of anaesthesia, all patients were pre-medicated with Injection fentanyl 2 microgram per kg and Inj. Glycopyrrolate 0.2 mg I.V 10 minutes before induction Patients were pre-oxygenated with 100% O<sub>2</sub> for 3 minutes.

All the patients were asked to take deep breaths. The induction time was calculated from the start of injection of either of the drug to the time of loss of eyelash reflex. Patient intubated after relaxing with injection succinylcholine 2 mg/kg, with appropriate size endotracheal tube. Anaesthesia was maintained with 33% Oxygen + 66% nitrous oxide + non depolarizing muscular relaxants (vecuronium 0.05 mg/kg). At the end of surgery when the patient had respiratory efforts, patients were reversed with injection Neostigmine 0.05 mg/kg + injection glycopyrrolate 0.01 mg/kg and extubated. Patient was shifted to the recovery room later.

Before the induction of anaesthesia, during the pre induction period the blood pressure and the respiratory rate were recorded. These values formed the base line values for the future comparison. Induction period starts from the injection of induction agent upto the period of loss of eye lash reflex. During the induction period the parameters like heart rate, blood pressure and respiratory rate were measured at regular interval. Pain on injection was assessed by visual analogue scale was graded as 0 – no pain, 1 – slight pain, 2 – moderate pain, 3 – severe pain. Immediately after intubation the blood pressure, heart rate and respiratory rate were recorded at regular intervals. The occurrences of the adverse effects were noted as vomiting and nausea. Results are presented as the mean (SD) unless and otherwise stated. Between the groups, statistical significance of the readings obtained during the

study is compared using t-test and p value was calculated to know its significance. P value < 0.05 was considered significant.

## Results

In the present study total of 120 patients belonging to the ASA Grade I and II scheduled to undergo the elective surgeries under general anaesthesia were included in the study. All the patients were equally divided into the two groups; Group A consist of 60 patients were induced with injection etomidate and Group B consist of 60 patients were induced with injection Thiopentone.

The average mean weights were  $58.9 \pm 9.7$  kg in group A and  $62 \pm 6.5$  kg in group B. The mean weight in the group A who were induced with etomidate was slightly lesser than other group and the difference was not found to be significant. The age wise distribution of the patients was in range of 20 to 70 years. The minimum age was found to be 20 years and maximum age was found to be 70 years. The average mean age in group A was found to be 35 years and that in group B was 33 years. The distribution of males and females in different groups are as follows: there were 28 males and 32 females in group A and there were 34 males and 26 female in group B.

The patients included in the study were scheduled to undergo submucosal resection, septoplasty, tonsillectomy or general surgical procedures. Majority of the surgeries scheduled for patients in both the groups were ENT surgeries.

The mean induction time for etomidate for group A was found to be  $23 \pm 5$  seconds and the mean induction time for Thiopentone for group B was found to be  $33 \pm 6$  seconds. The time of induction for etomidate in group A was found to be significantly shorter compared to thiopentone in group B. The induction time was calculated from the start of induction of the anaesthetic drug to the loss of reflex of eye lashes. The difference was found to be statistically significant with  $p < 0.005$ .

During induction, the heart rate increased in group A and group B values form the base value. There is significant increase in heart rate after intubation in thiopentone group as compared to etomidate group. Post intubation there was decrease in heart rate in group A and there was increase in heart rate in group B. The difference was found to be statistically significant. (Table 1).

During induction there was decrease in respiratory rate in both groups and when the

comparison was done the more decrease was found in group B that is in patients with thiopentone group. The respiratory rate was fixed at one rate after the intubation in both the groups. (Table 2).

Apnoea occurred more frequently in group B compared to the group A. Pain on injection was present in 20 patients in the group A but there was none in group B. The post operative complication like nausea and vomiting were low especially in the group B. In the group B nausea and vomiting was present in 6 patients and 10 patients in group A. Incidence of side effect like myoclonus occurred in group A 16 patients but there was none in group B. (Table 3).

**Table 1:** Comparison of heart rate in two groups.

Time of assessment	Group A	Group B	T value	P value
Pre induction	73±10	73±16	0.60	0.33
Induction	75±16	78±14	1.49	0.10
Post induction	74±19	82±19	3.20	0.003

**Table 2:** Comparison of respiratory rate in two groups.

Time of assessment	Group A	Group B	T value	P value
Pre induction	12±2	11±1	0.60	1.71
Induction	10.2±3.1	12±2.1	0.9	1.20
Post induction	12	12	-	-

**Table 3:** Adverse effects in two study groups.

Adverse effects	Group A	Group B
Apnea	6	52
Myoclonus	16	0
Pain on injection	20	0
Nausea- vomiting	10	6

## Discussion

The deleterious effects of anaesthetic agents in patients suffering from coronary artery disease are well-known. Induction of general anaesthesia may be a critical period during CABG and valve replacement surgery, especially in presence of LV dysfunction.<sup>10</sup> There is a paucity of literature regarding the choice of suitable agent to avoid deleterious effects in such patients. Anaesthetic induction techniques for cardiovascular surgery are based on considering hemodynamic stability and effects on myocardial oxygen supply and demand.<sup>11</sup>

Thiopentone is reliable, safe and inexpensive hence its considered as gold standard for the induction in the clinical practice. There are some contraindications for its uses like hereditary intermittent porphyria and sensitivity to barbiturate. In the cardio respiratory diseases

person the thiopentone is not the drug of choice as it causes the cardio respiratory depressive effects.<sup>12</sup> Etomidate has properties which suggest that it is a useful alternative to thiopentone. Etomidate is a short acting non barbiturate IV anesthetic agent with cardiovascular stability and with minimal respiratory depression.<sup>13</sup>

The similar study which was done by Shah et al showed that induction of etomidate achieved fast and smooth anaesthesia. The average time of induction of anaesthesia was found to be 20 seconds.<sup>14</sup> Hence the results are in consistent with the result with our study. In the study with Batra et al<sup>15</sup> showed that means induction with thiopentone and etomidate anaesthesia onset were found to be identical. The faster induction time of Etomidate can be explained by the rapid distribution and short elimination half life. Etomidate has a large volume of distribution (160 lt) and high plasma clearance of 1600ml/min resulting in a relatively short elimination half life of about 70 minute, and rapid distribution from blood in to CNS with substantial tissue uptake.

There is increase in heart rate in Thiopentone group compared to the Etomidate group. During the 1<sup>st</sup> min tachycardia was seen in Thiopentone group. The heart rate showed marginal increase when compared to the pre induction value in Etomidate group which is not statistically significant. Studies by Harris, et al., found Thiopentone increases the heart rate and returns to the preinduction level just prior to the intubation. The respiratory rate showed a decrease in the Thiopentone group.<sup>16</sup> The Etomidate group showed increase in respiratory rate after the induction. Our study correlates with the study conducted by S V Korgaonkar, et al.,<sup>17</sup> reported that there was increase in Respiratory rate 80% and did not change in 19.1% at 5 and 7 min after induction in Etomidate group.

## Conclusion

By the present study it can be concluded the induction time was lesser in Etomidate and the incidence of aponea was more in Thiopentone. Etomidate is an effective and rapid acting induction anesthetic agent with good cardiovascular stability and respiratory stability. Its side effects can be reduced to minimum by proper premedication and suitable IV Anaesthetic techniques.

*Conflict of Interest:* None

*Source of Support:* Nil

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