



Original Research Article

A prospective comparative study to know the haemodynamic response of thiopentone, propofol and etomidate on laryngoscopy and intubation in adult patients posted for elective surgeries under general anaesthesia

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ABSTRACT

Laryngoscopy and endotracheal intubation is the most commonly employed technique for the safe conduct of general anesthesia. However both laryngoscopy and intubation are noxious stimuli that are associated with hemodynamic responses in patients who are undergoing surgery under general anesthesia. Hence the present study is to know the hemodynamic response to laryngoscopy and intubation with different induction drugs which are used for general anesthesia.

90 patients of ASA class I and II, between 18-45yrs of age group, who were scheduled for various elective surgeries under general anesthesia were randomly divided into 3 groups of 30 each (n=30).

Results: There was no much increase in the heart rate after induction and intubation (from 3rd minute onwards in group P and group T, ($p < 0.05$), whereas no change was observed in group E, which was statistically significant. The increase in MAP following induction and intubation was very minimal in group P when compared to group T and it was still more less when compared to group E, which was statistically significant ($P < 0.000$).

Conclusion: Propofol is acceptable as an induction agent with stable haemodynamics for laryngoscopy and intubation but, Etomidate is still a better choice for its haemodynamic stability over Propofol and Thiopentone.

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1. Introduction

Laryngoscopy and endotracheal intubation still remains the gold standard technique in airway management under general anesthesia as it is the safest method to protect the airway under general anesthesia.¹ However, both laryngoscopy and intubation are noxious stimuli which causes the sympathetic stimulation that leads to changes in hemodynamic response in the form of hypertension, tachycardia and arrhythmias.² The magnitude of hemodynamic response may depend on various factors such as premedicants used during anesthesia, the depth of anesthesia, specific drugs administered prior to airway manipulation, anesthetic agents used at the time of induction

and the duration of laryngoscopy and intubation.

The principle mechanism in hemodynamic changes are sympathetic stimulation, which results in increased release of catecholamines which leads to increase in heart rate and blood pressure which is usually transitory, variable and unpredictable. These hemodynamic responses are very well tolerated by healthy individuals but it is proved to be hazardous to those with pre-existing hypertension, coronary artery disease or cerebrovascular disease.^{3,4} Induction is a critical phase of anesthesia especially in patients with limited cardiac reserve, hence induction agent should alleviate the stress response and cause minimal haemodynamic response. An ideal induction agent should have hemodynamic stability, minimal respiratory side effects and rapid clearance.⁵ Hence the present study

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is to compare the haemodynamic response of different induction agents like Thiopentone, Propofol and Etomidate for induction and intubation in patients who were scheduled for elective surgeries under general anaesthesia.

2. Methodology

Study was undertaken at K.R. Hospital affiliated to Mysore Medical College and Research Institute, after obtaining ethical committee clearance as well as informed consent from patients. 90 patients of ASA Class 1 and 2, aged between 18 to 45 years of either sex, scheduled for various elective surgeries under general anaesthesia were randomly grouped into 3 groups (n=30). They were selected for study by using shuffled closed opaque enveloped technique. A thorough pre anaesthetic evaluation of all the subjects were done on the previous day with necessary basic investigations. All the subjects were given Tab Alprazolam 0.5mg, Tab. Ranitidine 150mg orally on the night before surgery. The patients were kept nil per oral for 6 hours for solids and 2 hours for clear fluids. On the day of surgery in the operation theatre, IV line was taken with 18G cannula on the non dominant hand and preloaded with Ringer Lactate 500ml, 30 min prior to induction. The subjects were connected to multi parameter monitor, for SpO₂, NIBP, ECG and ETCO₂. Patients were pre oxygenated with 100% oxygen for 3 minutes. Simultaneously subjects were pre medicated with Inj. Midazolam 0.02mg/kg and Inj. Fentanyl 2mcg/kg. At the end of third minute of preoxygenation, Inj. Lidocaine 2% (preservative free) 3ml IV was injected to all subjects. At the end of fourth minute patients were induced with Inj. Thiopentone 5mg/kg BW slowly for group T, Inj. Propofol 2mg/kg BW slowly for Group P and Inj. Etomidate 0.3mg/kg BW slow IV for Group E. Inj. Vecuronium 0.1mg/kg BW was given IV and patient was mask ventilated for 3 minutes with oxygen + N₂O+ 1% Isoflurane. All patients were intubated with appropriate sized cuffed endotracheal tube after gentle laryngoscopy. Tracheal position of the tube was confirmed by capnography. Anaesthesia was maintained with oxygen and nitrous oxide and Inj. Vecuronium, 0.2-1% of Isoflurane. In those patients where laryngoscopy and intubation took more than 15 seconds, they were excluded from the study. Subsequently heart rate (HR), Blood pressure (BP), MAP and SpO₂ were recorded at 1, 2, 3 minutes after induction and at 1, 3, 5, 10 minutes after intubation.

The primary objectives of the study such as heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), ease of intubation were noted. Secondary objectives such as pain on injection, myoclonus, post operative nausea and vomiting and allergic reactions to the drug were noted.

3. Results

The demographic data such as Age, Sex, Height, Weight and BMI were noted among the groups, which was not statistically significant.

As shown in Table 1, there is no statistically significant changes in HR at 1 and 2 minutes after induction in all the 3 groups. In third minute, there was a slight increase in HR in group T but there was decrease in HR in Group P which was statistically significant, whereas no significant change in the HR was observed in Group E. There was slight increase in HR at first minute after laryngoscopy and intubation in all the 3 groups compared to baseline readings but was not statistically significant. At 5th and 10th minute, HR was near basal in Group P and T but was slightly increased in Group T.

As shown in Table 2, there was not much change in SBP in Group T and Group E at 1,2 and 3 minutes after induction but there was a slight decrease in SBP in Group P following induction which was statistically significant. Following intubation there was an increase in SBP at 1,3,5 and 10 minutes in Group T but there was a decrease in SBP in Group P while in Group E not much changes were observed, which was statistically significant. Similar trends were noted in DBP and MAP among the 3 groups.

4. Discussion

Stress response during laryngoscopy and intubation leads to haemodynamic changes especially for patients who have pre-existing cardiac conditions like hypertension and ischemic heart disease.⁶

The unavoidable effects of laryngoscopy and tracheal intubation includes arrhythmias, infarction, myocardial ischemia, hypertension, hypoxia, hypercapnia, laryngospasm, bronchospasm, increased intracranial and intra ocular pressure.

Induction is the critical phase of anaesthesia especially in patients with limited cardiac reserve. Hence induction agents should alleviate the stress response and should have minimal effect on hemodynamic response. An ideal induction agent for general anaesthesia should have haemodynamic stability, minimal respiratory side effects and rapid clearance.⁵

Thiopentone sodium is a short acting phenobarbitone and is one of the most commonly used intravenous induction agent because of its rapid onset and predictable action. It causes respiratory depression and reduction in cardiac output. Special care is needed in patients with hypovolemia, cardiovascular disease, status asthmaticus and myasthenia gravis.⁷

Propofol is an alkyl phenyl derivative with rapid onset of action, which attenuates upper airway reflexes and also decreases post operative nausea and vomiting and post operative shivering. One of the drawbacks of Propofol is that

Table 1: Showing the intergroup comparison of mean heart rate (bpm) changes in response to laryngoscopy and intubation between all the groups

	Group T	Group P	Group E	p-value
Basal	76.46± 6.20	81.40±11.45	80.56±12.97	0.162
IND-1 st min	77.63± 6.61	76.8±10.28	80.93±13.89	0.298
IND-2 nd min	77.86±6.51	74.03±8.44	77.70±19.48	0.428
IND-3 rd min	79.60±5.64	72.63±10.23	79.76±13.41	0.011
INT-1 st min	85.53±8.24	82.76±11.71	80.13±12.84	0.176
INT-3 rd min	88.26±7.67	80.63±9.34	80.46±12.77	0.004
INT-5 th min	90.13±7.27	78.30±9.57	80.86±12.55	0.000
INT-10 th min	90.06± 7.09	76.30±10.48	81.46±12.52	0.000

Table 2: Showing the intergroup comparison of Systolic Blood Pressure (mmHg) changes in response to laryngoscopy and intubation between all three groups

	Group T	Group P	Group E	P-value
Basal	124.26±8.65	126.13±7.67	127.83±9.42	0.281
IND-1 st min	124.53±7.23	117.76±7.81	127.60±7.88	0.000
IND-2 nd min	125.80±7.13	113.06±7.89	127.73±7.60	0.000
IND-3 rd min	128.60±7.96	106.46±8.81	126.13±7.94	0.000
INT-1 st min	136.73±5.69	126.60±6.34	129.50±8.47	0.000
INT - 3 rd min	138.43±5.90	123.10±7.09	128.66±7.68	0.000
INT - 5 th min	136.93±5.19	119.33±6.91	128.03±6.94	0.000
INT - 10 th min	135.86±4.89	118.13±7.33	126.30±7.9	0.000

Table 3: Showing the intergroup comparison of Systolic Blood Pressure (mmHg) changes in response to laryngoscopy and intubation between Group T and Group P

	Group t	Group p	p-value
Basal	124.26±8.65	126.13±7.67	0.381
IND-1 st min	124.53±7.23	117.76±7.81	0.001
IND-2 nd min	125.80±7.13	113.06±7.89	0.000
IND-3 rd min	128.60±7.96	106.46±8.81	0.000
INT-1 st min	136.73±5.69	126.60±6.34	0.000
INT-3 rd min	138.43±5.90	123.10±7.09	0.000
INT - 5 th min	136.93±5.19	119.33±6.91	0.000
INT - 10 th min	135.86±4.89	118.13±7.33	0.000

Table 4: Showing the intergroup comparison of Diastolic Blood Pressure (mmHg) changes in response to laryngoscopy and intubation between all three groups

	Group T	Group P	Group E	p-value
Basal	80.46±7.13	77.76±7.62	78.00±8.50	0.334
A IND-1 st min	81.80±6.69	73.06±7.35	78.46±8.65	0.000
A IND-2 nd min	81.86±6.25	69.10±5.79	78.33±8.43	0.000
A IND-3 rd min	83.20±6.44	69.56±6.66	77.93±7.81	0.000
A INT-1 st min	87.53±5.42	76.06±6.09	78.86±6.83	0.000
A INT-3 rd min	88.93±6.46	75.93±5.32	79.03±6.87	0.000
A INT-5 th min	89.06±6.59	73.76±4.69	79.06±6.76	0.000
A INT-10 th min	88.00±5.58	71.90±3.52	79.46±7.37	0.000

Table 5: Showing the intergroup comparison of Mean Arterial Pressure (mmHg) changes in response to laryngoscopy and intubation between all three groups

	Group T	Group P	Group E	p-value
Basal	94.96±5.80	93.86±6.62	94.63±6.89	0.796
IND-1 st min	95.96±4.90	87.88±6.44	94.70±6.67	0.000
IND-2 nd min	96.46±4.67	83.80±5.14	94.76±6.50	0.000
IND-3 rd min	98.33±5.27	81.96±6.00	93.96±6.28	0.000
INT-1 st min	103.93±4.25	93.00±4.75	95.60±5.87	0.000
INT-3 rd min	105.43±4.86	91.73±4.64	95.56±5.63	0.000
INT-5 th min	105.00±4.77	89.03±3.42	95.40±5.66	0.000
INT-10 th min	103.90±4.24	87.33±2.65	95.06±6.22	0.000

it decreases the systemic vascular resistance and hence the cardiac output. Hence it is not advised in patients who are hypovolemic and in those who are in shock.⁸

Etomidate is a carboxylated imidazole compound. Its properties include rapid onset of anaesthesia, haemodynamic stability and lack of respiratory depression and rapid recovery.⁸ Propofol and Thiopentone are routinely used induction agents in our institution. Since Etomidate was introduced recently in India, not many studies have been done to know its hemodynamic response during laryngoscopy and endotracheal intubation. Hence the present study is aimed at comparing these three agents regarding their effects on haemodynamic responses to laryngoscopy and endotracheal intubation.

In Yagan O et al study there was a decrease in HR after induction, before intubation in all the 3 groups. Immediately after intubation there is rise in HR in all 3 groups but the rise in Group E is statistically significant when compared to Group P and Group T.⁸ In Masoudifar M et al study they have noticed changes in HR in both Group P and Group E after intubation but it was not statistically significant ($p < 0.47$). In Agarwal S et al study,⁸ they have also observed no significant changes in HR after intubation both in Group P and Group E.

In the present study there was no significant difference among the 3 groups with regards to age, sex, height and weight. In our study HR of 3 groups after induction and at 1, 2, 3, 5 and 10 minutes after intubation were significant both clinically and statistically with $p < 0.05$. Inter group comparison showed significant differences in HR among all 3 groups at various time intervals ($p < 0.05$). In Group T there was significant rise in HR from 3rd to 10th minute after intubation which is more than basal rate, whereas in Group P there is a fall in HR but not much change was noted in Group E, which was statistically significant.

In present study, baseline MAP were comparable among all 3 groups with no statistical significance ($p > 0.05$). But MAP of 3 groups after induction and at 1st, 2nd, 3rd, 5th and 10th minute after intubation were significant both clinically and statistically ($p < 0.05$). In Group P MAP decreased from 93.86±6.62mmHg to 81.96±6.00mmHg

after induction. It increased to 93.00±4.75mmHg after intubation but it didn't increase above the baseline. In Group T MAP increased from 94.96±5.80mmHg to 98.33±5.27mmHg after induction and increased to 103.93±4.25mmHg after intubation, whereas in Group E there was no much statistically significant change in MAP from 94.63±6.89mmHg to 93.96±6.28mmHg after induction, and increased to 95.96±5.87mmHg after intubation. Intergroup comparison of MAP among Group T and Group P were statistically significant at various point of time of induction and intubation except at baseline ($p < 0.000$). Among Group P and Group E, MAP is statistically significant after induction and at 3rd, 5th, 10th minute after intubation ($p < 0.001$).

Our study is comparable with Meena et al study in this regard among all 3 groups with no statistical significance at pre induction time but it is statistically significant after induction and intubation ($p < 0.05$). In contrast to our study, Agarwal et al⁸ found that patients in Etomidate group showed little change in mean arterial pressure (MAP) and heart rate (HR) compared to propofol ($p > 0.05$) from baseline value.

Regarding adverse events, the incidence of pain on injection was higher in Group P (3 patients) as compared to Group E which was not statistically significant. This was comparable to Agarwal et al study⁸ which showed similar results.

5. Conclusion

Propofol is acceptable as an induction agent with stable haemodynamics for laryngoscopy and intubation but Etomidate is still a better choice for its haemodynamic stability over Propofol and Thiopentone.

6. Source of Funding

None.

7. Conflict of Interest

None

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