



COMPARISON OF CARDIOVASCULAR RESPONSE TO LARYNGOSCOPY AND TRACHEAL INTUBATION AFTER INDUCTION OF ANAESTHESIA BY PROPOFOL AND ETOMIDATE

Dr. Dhruvi Patel	Medical Officer, Dept. of Anaesthesiology, K B Bhabha Municipal General Hospital, Bandra, Mumbai.
Dr. Varun Naik*	Assistant Professor, Dept. of Anaesthesiology, K B Bhabha Municipal General Hospital, Bandra, Mumbai. *Corresponding Author
Dr. Sunil Desai	Consultant Anaesthesiologist, Sterling Hospital, Ahmedabad.
Dr. Bhavin Patel	Consultant Anaesthesiologist, Sterling Hospital, Ahmedabad.

ABSTRACT

Aim: This study was carried out to compare two commonly used anaesthetic induction agents viz. Injection Propofol and Injection Etomidate in maintaining haemodynamic stability during induction of general anaesthesia and following oral endotracheal intubation in elective surgery.

Material and Methods: This study was carried out in a tertiary care teaching hospital in 50 patients. Patients were randomly allocated into two groups of 25 patients each. Group A- Propofol and Group B- Etomidate. Haemodynamic and cardiovascular indicators such as systolic BP, diastolic BP, mean arterial pressure, heart rate and oxygen saturation of patients were recorded in the room (basal); before induction; during intubation and 1, 3, 5 & 10 minutes afterwards.

Results: The results were collected, tabulated and analysed using non-paired t test and Chi-square test. The results showed that there was a significant difference between 2 groups regarding systolic BP, diastolic BP and mean arterial pressure; with patients of Propofol group showing more hypotension after endotracheal intubation and patients of Etomidate group had more stable blood pressures.

Conclusion: In conclusion, patients receiving Etomidate have more stable haemodynamic condition; if there would be no contraindications, it could be preferred over Propofol for induction of General anaesthesia.

KEYWORDS : Etomidate, Propofol, Intubation, Cardiovascular response

INTRODUCTION

Since the introduction of general anaesthesia, in the last quarter of 19th century, endotracheal intubation has become one of the most frequently performed procedures in the practice of anaesthesia. Endotracheal intubation is the trans-laryngeal placement of endotracheal tube into the trachea through mouth or nose. It includes direct laryngoscopy and intubation which are noxious stimuli and hence constitute a period of extreme haemodynamic stress and intense sympathetic activity which is marked by tachycardia & hypertension¹. These haemodynamic responses are usually transitory, variable and unpredictable which are well tolerated in otherwise healthy individuals, but in susceptible individuals this transient response can evoke life threatening conditions².

Herein lays the rationale to continue the quest for an anaesthetic technique to attenuate the cardiovascular response to laryngoscopy and intubation. Using intravenous drugs such as Etomidate and Propofol is the most common procedure for induction of general anaesthesia^{3,4}. Propofol is substituted isopropyl phenol (2,6-diisopropylphenol) that is administered intravenously as 1% solution in an aqueous solution of 10% soya bean oil, 2.25% glycerol, and 1.2% purified egg phosphatide. It has satisfactory recovery, short half-life, rapid elimination from blood circulation; causing less of sedative effect and vomiting. The most important side effects of Propofol are haemodynamic instability and cardiovascular complications such as hypotension and bradycardia⁵.

Etomidate is a carboxylated imidazole- containing hypnotic and anaesthetic compound, unrelated to any other anaesthetic drug. It is a short acting drug which can be used in patients with limited haemodynamic reserve⁶. The most important side effects of Etomidate are post-operative nausea and vomiting^{7,8,9}. One of the most important but rare side effect of Etomidate is the suppression of steroid production by reversible inhibition of 11-beta-hydroxylase enzyme^{9,10,11}.

This study was conducted considering the common use of Propofol

and Etomidate for induction of general anaesthesia and the importance of patients' haemodynamic stability during laryngoscopy and intubation^{12,13}.

MATERIALS AND METHODS

Prospective, randomised, single blind study was conducted in a tertiary care teaching hospital after approval from the institute's Ethics committee and well informed, written, consent from the patients. We considered patients of either sex for inclusion in this study if they were aged between 18- 60 years, American Society of Anaesthesiologists (ASA) physical status grade I & II; undergoing elective surgeries under general anaesthesia with oral endotracheal intubation. Pregnant females, patients with ASA grade > II, allergy to Etomidate or Propofol; those with liver and/ or kidney dysfunction, neuropsychiatric disorders or morbid obesity were excluded.

Patients were randomised into two groups with 25 patients in each group with the help of a computer-generated table of random numbers. Patients in group A were administered intravenous Inj. Propofol 2.5 mg/ kg of body weight whereas patient in group B were administered with intravenous Inj. Etomidate 0.3 mg/ kg of body weight for induction of anaesthesia and endotracheal intubation. Haemodynamic and cardiovascular indicators such as systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR) and oxygen saturation (SPO₂) of the patients were measured and recorded as- in the room (basal- T₀); pre- induction (T₁); at induction (T₂); at 1 min (T₃), 3 min (T₄), 5min (T₅) and 10 minutes (T₆) after intubation.

STATISTICAL ANALYSIS:

The data obtained from the study was analysed by using non-paired t test and Chi-square test. Parameters of age, sex, ASA grading, type of surgery, heart rate, blood pressure were collected using simple random sampling method. Tools of t test was considered for the test of independence and Chi-square test was considered to test the association between two characteristics.

[Statistical significance: p < 0.01- highly significant (HS), p < 0.05- significant (S) and p > 0.05- Statistically not significant (NS)]

OBSERVATIONS AND RESULTS

Table 1: Types of Surgery in both groups

Surgery	Group-A		Group-B		p-value	Result
	Frequency	Percent	Frequency	Percent		
Donor Nephrectomy	8	32	10	40.0	0.883	NS
*Lap Appendicectomy	1	4	1	4.0		
Lap Cholecystectomy	12	48	8	32.0		
Lap Hysterectomy	2	8	2	8.0		
Lap Incisional Hernia	0	0	1	4.0		
Left *MRM	1	4	1	4.0		
Right MRM	0	0	1	4.0		
§RIRS	1	4	1	4.0		
Total	25	100	25	100.0		

*Lap= Laparoscopic; *MRM= modified radical mastectomy; §RIRS= retrograde intrarenal surgery.

Table 2: Comparison of mean heart rate (HR in bpm) changes between both groups.

Group	Group-A			Group-B			t	p-value	Result
	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean			
T0	70.96	11.137	2.227	68.68	11.729	2.346	0.705	0.484	NS
T1	73.60	11.489	2.298	73.68	13.375	2.675	-0.023	0.982	NS
T2	77.28	10.983	2.197	77.68	12.526	2.505	-0.120	0.905	NS
T3	80.72	10.998	2.200	81.24	12.105	2.421	-0.159	0.874	NS
T4	80.84	11.828	2.366	82.36	11.565	2.313	-0.459	0.648	NS
T5	81.04	11.855	2.371	81.56	10.666	2.133	-0.163	0.871	NS
T6	81.32	11.919	2.384	81.40	11.251	2.250	-0.024	0.981	NS

Table 3: Comparison of mean systolic blood pressure (SBP in mm Hg) changes between both groups:

Group	Group-A			Group-B			t	p-value	Result
	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean			
T0	135.76	12.784	2.557	128.16	17.444	3.489	1.757	0.085	NS
T1	140.96	11.534	2.307	132.96	17.302	3.460	1.924	0.060	NS
T2	137.28	20.436	4.087	137.12	16.534	3.307	0.030	0.976	NS
T3	96.00	9.504	1.901	139.52	13.956	2.791	-12.887	0.000	S
T4	98.72	8.829	1.766	139.76	12.531	2.506	-13.386	0.000	S
T5	104.72	9.253	1.851	138.80	11.690	2.338	-11.429	0.000	S
T6	117.04	8.890	1.778	135.48	9.862	1.972	-6.944	0.000	S

Table 4: Comparison of mean diastolic blood pressure (DBP in mm Hg) changes between both groups:

Group	Group-A			Group-B			t	p-value	Result
	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean			
T0	78.40	12.410	2.482	71.84	13.564	2.713	1.784	0.081	NS
T1	82.48	12.653	2.531	76.16	14.696	2.939	1.630	0.110	NS
T2	79.36	16.429	3.286	79.64	14.694	2.939	-0.064	0.950	NS
T3	48.00	8.145	1.629	81.52	9.134	1.827	-13.695	0.000	S
T4	51.12	7.618	1.524	81.52	7.589	1.518	-14.136	0.000	S
T5	57.36	6.422	1.284	79.72	6.674	1.335	-12.071	0.000	S
T6	63.32	6.688	1.338	77.28	6.742	1.348	-7.350	0.000	S

Table 5: Comparison of mean blood pressure (MAP in mm Hg) changes between both groups:

Group	Group-A			Group-B			t	p-value	Result
	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean			
T0	97.36	11.940	2.388	90.36	14.523	2.905	1.862	0.069	NS
T1	101.52	12.059	2.412	94.72	15.208	3.042	1.752	0.086	NS
T2	98.76	17.067	3.413	98.52	14.911	2.982	0.053	0.958	NS
T3	64.04	7.961	1.592	100.56	10.320	2.064	-14.010	0.000	S
T4	66.32	7.313	1.463	100.64	8.822	1.764	-14.976	0.000	S
T5	72.44	7.343	1.469	99.00	7.228	1.446	-12.888	0.000	S
T6	81.16	7.099	1.420	96.28	6.804	1.361	-7.689	0.000	S

Table 6: Results of this study:

	Group A (Propofol)	Group B (Etomidate)	p-value	Results
Mean Age in Years	35.16	38.2	0.116	NS
Mean Weight in Kg	68.28	67.68	0.797	NS
Sex Ratio M: F	8:17	9:16	0.765	NS
Mean HR changes at 1 min after intubation (T3)	80.72	81.24	0.874	NS
Mean SBP changes at 1min after intubation (T3)	96.0	139.52	0.00	S

Mean DBP changes at 1min after intubation (T3)	48.0	81.52	0.00	S
Mean MAP changes at 1 min after intubation (T3)	64.04	100.56	0.00	S

DISCUSSION

The main aim of this study was to compare the cardiovascular responses after laryngoscopy and oral endotracheal intubation following Propofol or Etomidate induced general anaesthesia. All the patients in this study were anaesthetized in the following sequence: Premedication (Inj. Glycopyrrolate 4 mcg/kg and Inj. Fentanyl 2 mcg/kg intravenously), pre- oxygenation for 3 minutes,

induction agents (Group A intravenous Inj. Propofol 2.5 mg/kg, whereas Group B Inj. Etomidate 0.3mg/kg intravenously), muscle relaxant (intravenous Inj. Atracurium 0.5mg/ kg), intubation (cuffed endotracheal tube) and maintenance using close control technique (with 50% N₂O in oxygen and sevoflurane 1%- 2% and Inj. Atracurium 4-12 mcg/kg/min intravenously was used for maintenance of muscle paralysis) followed by reversal (Inj. Neostigmine 0.05 mg/kg and Inj. Glycopyrrolate 8 mcg/kg intravenously) and recovery. The effects of the induction agents were observed in relation to haemodynamic changes at- T₀, T₁, T₂, T₃, T₄, T₅ and T₆ as described earlier. The observations of this study were compared with the observations of other workers.

In a study by Masoudifar, Behestian et al¹⁴; the changes in HR were similar in both groups and based on the analysis of variance by repeating the results no significant differences were observed between both groups (P = 0.47). The mean ± standard deviation of the changes in SBP (p= 0.019), DBP (p = 0.019) and MAP (p = 0.019) were significantly higher in Propofol group; whereas Etomidate group had no significant difference in these variables after intubation.

In a study by Desai PM et al¹⁵; in Group A the SBP, DBP and MAP decreased at all time intervals as compared to Group B but significant difference was observed in SBP at 2 min & 5 min and DBP, MAP at 2 min.

In our study in both Group A and Group B, there was no significant change in HR (table 2) in post induction and after intubation as compared with pre- induction HR. Statistical evaluation between the groups showed that basal, pre- induction and during induction mean SBP (table 3), DBP (table 4) and MAP (table 5) values were statistically NS (Not Significant). However At 1 min, 3 min, 5 min and 10 minutes after intubation the mean SBP, DBP and MAP changes were statistically significant(S) between both the groups. There was no significant difference between both groups regarding the percentage of oxygen saturation (SPO₂).

Results showed that there was a significant difference between two groups regarding SBP, DBP and MAP. The patients of the Propofol group showed more hypotension and patients of the Etomidate group had a more stable blood pressure. There were no significant differences regarding their underlying variables such as gender (table no.6), age & weight (table no. 6) and type of surgery (table no. 1); hence, the confounding effect of these variables has probably been neutralized and the results are all about the drugs.

The study of Hug et al⁵. that was conducted on 25000 patients showed that Propofol would lead to bradycardia in 4.2% of patients and hypotension in 15.7% of patients. Furthermore, the studies of Hiller¹⁶ and Reves¹⁷ showed that inducing anaesthesia with Propofol that would be administered at the dose of 2- 2.5 mg/ kg of body weight could lower blood pressure as much as 25- 40%; this hypotension would occur in all the patients regardless of any underlying conditions and has been reported in every studied patient¹⁸.

Propofol caused hypotension is due to the reduction of heart's preload and after load, which are not synchronized with heart's compensatory responses such as increased cardiac output and increased HR¹⁹. The study of Boisson-Bertrand et al¹³ suggested Propofol for patients who need good post-operative cooperation and Etomidate for those who are hemodynamically compromised.

Etomidate's effect on the hemodynamic condition of the patient is more controllable than Propofol's effect^{7,8}. Therefore, since patients receiving Etomidate experience more stable hemodynamic condition, if there would be no contraindications, it could be preferred over Propofol for general anaesthesia; especially in patients in whom suppression of cardiac function and vasodilatation are risky. Of course, like other anaesthetic drugs, Etomidate can cause nausea and vomiting after anaesthesia that could be controlled by using proper premedication; also, injection

of Etomidate can cause a burning sensation, which is a transient effect and would not cause any serious harm to the patient.

CONCLUSION

1. Etomidate when used as an anaesthetic induction agent for any surgery, provides stable hemodynamic conditions after induction and intubation.
2. Propofol on the other hand causes hemodynamic instability such as hypotension after induction.
3. In high risk patients, superiority of Etomidate over Propofol during induction and intubation could prove to be more beneficial.

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