Original Research Article

Comparative study of intravenous etomidate versus propofol during induction and intubation

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Abstract

Introduction: Safe induction of anesthesia is important part of anesthesia practice as life threatening hemodynamic variations may occur during induction and intubation in hemodynamically unstable patients. Present prospective randomized observational study was conducted to compare the hemodynamic effects of etomidate and propofol during induction and intubation.**Material and Methods:** This study was conducted on 90 patients of ASA grade I and II scheduled for elective surgical procedure under general anesthesia with endotracheal intubation. Patients were randomly assigned into 2 groups of 45 patients each.Group E (n = 45) received Inj. Etomidate (0.3 mg/kg of body weight) and Group P (n = 45): received Inj. Propofol 1% (2 mg/kg of body weight). Vital parameters at induction, laryngoscopy and thereafter recorded for comparison. Adverse effects like pain on injection, apnea and myoclonus were carefully noted.**Results:**Both groups have comparable demographic variables.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. Pain on injection was more in propofol group while myoclonus activity was higher in etomidate group.**Conclusion:**Through this study, we concluded that etomidate is hemodynamically more stable than propofol with less incidence of pain on injection.

Keywords: Induction, intubation, etomidate, propofol, hemodynamic stable.

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Introduction

One of the foremost steps in general anesthesia is smooth and stable induction. Induction agents are the drugs that causes rapid loss of consciousness. To be ideal, an induction agent should be hemodynamic stable with minimal respiratory depression and have rapid clearance with minimal side effects and drug interactions. Etomidate as inducing agent is hemodynamically stable with minimal respiratory depression and have cerebral protective effects. Having no effects on sympathetic nervous system and its ability to increase coronary perfusion even in patients with moderate cardiac dysfunction makes it an induction agent of choice[1-4]. However pain on injection, thrombophlebitis and myoclonus are some undesirable drawbacks[5-6]. Propofol provides rapid but smooth induction and recovery. While decrease in blood pressure, dose dependent respiratory depression and pain on injection are the major adverse effects[7].Aim of this study was primarily to compare the effects of etomidate and propofol on blood pressure and heart rate during induction and intubation. Pain at injection site and myoclonic movements were also assessed.

Material and Methods

Etomidate and propofol are well established and routinely used drugs for induction. We had not tried any new drug but collected patient data from surgeries under general anesthesia performed in our different operation theaters on daily basis using etomidate or propofol as induction agent.

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Institutional ethical committee approval and written informed consent from all patients were taken. This prospective randomized double-blind observational study was conducted on 90 patients of ASA grade I and II scheduled for elective surgical procedure under general anesthesia with endotracheal intubation.Patients were randomly assigned into 2 groups of 45 patients each.

Group E (*n* = 45): received Inj. Etomidate (0.3 mg/kg of body weight) and

Group P (*n* = 45): received Inj. Propofol 1% (2 mg/kg of body weight)

Inclusion Criteria

- ASA grade I, II.
- Age group between 20-60 years.
- Either sex.

Exclusion criteria

- Hemodynamically unstable patient.
- Patient refusal.
- Patient allergic to any drug.
- History of seizure disorder.
- Presence of known primary and secondary adrenal insufficiency or on steroid medications.

Only those patients who cleared pre-anesthetic evaluation were taken to Operation Theater. Oral alprazolam 0.5 mg and oral ranitidine 150 mg were given as premedication night before surgery. 18G IV cannula and ringer's lactate was started (@ 10 ml/kg/hr) in the operation theatre. All monitoring cables were attached to patient and baseline vital parameters were recorded. Midazolam 0.03 mg/kg i.v, 2 minutes before induction and fentanyl 2 μ/kg i.v,1 minute prior to induction were injected. Induction was done with either propofol or etomidate. Pain on injection and myoclonic movements were recorded, if any at induction. Trachea was intubated with appropriate size of endotracheal tube after 3 minutesof intubating dose of inj. atracurium (0.5 mg/kg of body weight) given intravenously and positive pressure ventilation was initiated after securing endotracheal tube. Anesthesia was maintained with oxygen and nitrous oxide (60:40) in sevoflurane along with intermittent boluses of i.v atracurium.

Rescue drugs utilized were: mephentermine 6 mg i.v bolus was given if the mean arterial pressure (MAP) dropped by >20% from baseline, diltiazem 2.5 mg i.v was used if MAP increased >20% from baseline and esmolol 10 mg i.v was used in case the heart rate (HR) rose above 100 beats/min.

Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), MAP were continuously recorded at baseline and T1-T6 till upto 3 min post-intubation, where: T0 =

Baseline (before midazolam and fentanyl), T1 = Induction,T2 = 1 min post-induction,T3 = 3 min post-induction,T4 = Laryngoscopy, T5 = 1 min post-intubation, T6 = 3 min post-intubation (volatile anesthetic started at this point).

Pain on injection was measured using 4 graded scale; 0 - no pain, 1-verbal complaint of pain, 2-withdrawal of arm, 3-both verbal complaint and withdrawal of arm. The incidence and degree of myoclonic movements was also recorded as follows: 0- no myoclonic movements, 1 - minor myoclonic movements, 2 - moderate myoclonic movements, 3 - major myoclonic movements. Episode of apnea, if occurred was also recorded.

Statistical analysis

Data are expressed as mean ± SD. Patient's data was analysed with one-way ANOVA for continuous variables and chi-square test for categorical variables. Statistical analysis was done using SPSS 20 (IBM SPSS Statistics). *p*-Value <0.05 was considered significant.

Results

A total of 90 patients registered for surgery from June 2019 to December 2019 were included in this studyand randomized in to two groups.

Demographic data (Table 1) andpre-operative baseline vital parameters (HR, SBP, DBP and MAP) (Table 2) were comparable in both groups with no statistically significant differences ($p > 0.05$).

Table 1: Demographic data of patients

Variable	Group E (n=45)	Group P (n=45)
Sex (M: F)	27:18	30:15
Age (years) mean ±SD	28.75 ± 9.89	29.23 ± 10.01
Weight (Kg) mean ±SD	55.6 ± 11.33	57.2 ± 9.53

There was a comparable fall in HR due to the anxiolytic action of midazolam and fentanyl premedicationat T1 in both the groups, as seen in Table 2. There was sustained increase in HR throughout induction and intubationin Group-P. This was statistically significant at T2 and T3

(P < 0.01). In Group-E also, there was increase in HR at T2, T3, T4, T5 and T6 but statistically insignificant.

At 1st and 3rd min after induction, there was a fall in MAP in case of both Group-E and Group-P. The fall in MAP is much sharper for Group-P (approximately 23.21% and 25.97%) as compared with Group-E (approximately 16.76% and 17.47%). The stimulus of laryngoscopy and intubation failed to bring the MAP above baseline levels of Group-P (approximately 6.44% below baseline) while in case of Group-E there is approximately7.52% rise in MAP above baseline at T4 (laryngoscopy) [Table 2].

Table 2:Hemodynamic parameters during induction and intubation with etomidate and propofol

Hemodynamic parameter	T_0	T_1	T_2	T_3	T_4	T_5	T_6
HR (Group E) Mean ±SD P value	78.4±8.5	71.3±7.2 0.05	81.4±9.9 0.24	81.3±8.5 0.22	78.9±12.3 0.29	77.3±12.1 0.39	81.6±10.7 0.20
HR (Group P) Mean ±SD P value	81.4±11.22	77.7±8.3 0.08	86.7±8.1 0.002	88.7±7.7 0.001	84.9±9.1 0.29	85.5±10.1 0.24	85.9±8.3 0.22
MAP (Group E) Mean ±SD P value	98.4±8.6	88.4±8.5 < 0.001	81.9±8.4 < 0.001	81.2±7.2 < 0.001	105.8±8.7 0.001	96.9±5.2 0.59	90.3±7.2 0.001
MAP (Group P) Mean ±SD P value	97.8±7.2	84.9±7.3 0.00	75.1±5.8 0.00	72.4±4.8 0.00	91.5±10.1 0.04	89.3±8.8 0.00	82.6±10.2 0.00

40 patients (88.8%), who received propofol complained pain, while only 3 patients (6.6%) in etomidate group. Also, the severity of pain was more with propofol (Table 3). Incidence of apnea was similarin both groups ($p > 0.05$). Myoclonic movements were only seen in etomidate group ($p > 0.05$). Severity of myoclonus was noted as grade 1 (8.9%), grade 2 (2.2%) andgrade 3 (0%) (Table 4).

Table 3: Incidence and grading of pain on injection

Group	Pain on injection		
	Grade 0	Grade 1	Grade 2
Group E (n=45)	42 (93.3%)	3 (6.7%)	0
Group P(n=45)	5 (11.2 %)	22 (48.8 %)	18 (40 %)

Table 4: Incidence and grading of myoclonic movements

Group	Myoclonic movements			
	Grade 0	Grade 1	Grade 2	Grade 3
Group E(n=45)	40 (88.9%)	4 (8.9%)	1 (2.2%)	0
Group P(n=45)	45 (100%)	0	0	0

Etomidate provided hemodynamic stability without the requirement of any rescue drug in 40/45 patients whereas rescue drug likemephentermine and esmolol played a role in maintaining hemodynamic stability in 26/45 of patients employing propofol for induction [Table 5].

Table 5: Requirement of rescue drugs

Group	Rescue drug		
	Mephentermine	Diltiazem	Esmolol
Group E (n=45)	0	4 (8.9%)	1 (2.2%)
Group P (n=45)	19 (42.2%)	0	7 (15.5%)

Discussion

There is always mild to moderate degree of variation in hemodynamic parameters during induction of anesthesia, depending on the plasma concentration of the induction agent which in turn depends on many factors like age, gender, body weight, dose, infusion rate, cardiac output etc. As fentanyl is known to blunt the pharyngo-laryngeal reflex on endotracheal intubation and decrease the incidence of myoclonus associated with etomidate, we used fentanyl for i.v premedication for all cases in our study[8-10]. There was sustained rise of HR throughout induction and intubation in propofol group whereas HR was stable in etomidate group. Variation in MAP (hypotension) was more with propofol then with etomidate in comparable doses. Sudden hypotension and tachycardia have deleterious effects in patients of coronary artery disease, valvular stenosis, uncontrolled hypertension and shock. The hemodynamic stability seen with etomidate may be due to lack of its effect on both the sympathetic nervous system and baroreceptor function[1,8] and capacity to bind and stimulate peripheral alpha-2B adrenergic receptors with a subsequent vasoconstriction[9].Mayer et al[13] and Wu et al[14] also concluded the hemodynamic stability during etomidate anesthesia. After bolus injection of propofol, decrease in systemic blood pressure is mainly due to reduction of sympathetic activity leading to vasodilation with reduced preload and afterload and myocardial depression (negative inotropic action)[8,10-12]. Pain is always a bad experience for patient and embarrassing situation for an anesthesiologist during injection of anesthetic agent. Favorable outcome with Etomidate was very well supported by Saricaoglu et al[10] and Wu et al [14] in their studies. Respiratory depressant effectswere similar in both agents. Boysen et al[15] in their study concluded that there was no significant difference between two groups as regard to apnea following induction. The drawback noted with etomidate was its association with myoclonic jerks. Miner et al[16] also concluded high incidence of myoclonus (20% vs. 1.8%) in etomidate and propofol group respectively.

Conclusion

Through this study, we came to the conclusion that etomidate is hemodynamically stable over propofol along with less incidence of pain on injection. Only drawback was high incidence of myoclonus. Etomidate is a better option in patients particularly prone to hemodynamic fluctuations at induction.

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