International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2015): 6.391

A Comparative Study of Effect of Propofol, Etomidate and Propofol Plus Etomidate Induction on Hemodynamic Response to Laryngoscopy and Endotracheal Intubation:

Dr. Hitesh S. Patel[1], Dr. Bina B. Patel[2], Dr. Divyang V. Shah[3], Dr. Pragna N. Vachhrajani[4]

[1]3rd Year Resident, Department of Anaesthesia, Surat Municipal Institute of Medical Education and Research, Surat

[2]Assistant Professor, Department of Anaesthesia, Surat Municipal Institute of Medical Education and Research, Surat

[3]Associate Professor, Department of Anaesthesia, Surat Municipal Institute of Medical Education and Research, Surat

[4]Professor and Head, Department of Anaesthesia, Surat Municipal Institute of Medical Education and Research, Surat

Abstract: ***Introduction:*** *In general anesthesia, stress response during laryngoscopy and intubation leads to hemodynamic changes especially in patients with cardiac risk factors like hypertension and ischemic heart disease. Propofol is commonly used drug for induction of general anesthesia. Propofol can lead to bradycardia and hypotension. Etomidate is hypnotic agent with better cardio stability.* ***Background & Objective:*** *The primary objective of this study is to compare the efficacy of 3 different anesthesia approach (Propofol, Etomidate and Propofol plus Etomidate) in maintaining hemodynamic stability during induction and following endotracheal intubation in elective surgery.* ***Material and method:*** *After taking institutional approval and informed consent, 60 patients aged 15-60 years of either sex and ASA(American society of anaesthesia) class I or II were studied. Group I induced with Propofol (2.5 mg/kg), Group II with Etomidate (0.3 mg/kg) and Group III with Propofol (1 mg/kg) plusEtomidate (0.2 mg/kg) intravenously. Heart rate (HR), systolic blood pressure, Diastolic blood pressure, Mean arterial blood pressure (MAP), Oxygen saturation were noted.* ***Results:*** *HR and MAP decreased after induction in all groups and it was more in group I than group II and III. HR increased in all groups but more in group II after intubation. Significant increase in MAP was seen at 1 min after intubation in all groups but this increase was not sustained and returned to baseline in group II and III.* ***Conclusion:*** *The combination of Etomidate plus Propofol was proved to be significantly better than either Propofol or Etomidate alone.*

Keywords: Propofol; Etomidate; Mean arterial pressure; Heart rate; Laryngoscopy

1. Introduction

In general anaesthesia, airway management and patient safety is the most important aspect of patient management. Endotracheal intubation is the gold standard and safest method for protecting the airway, delivering anaesthetic gases and ensuring protection against aspiration [10].

The unavoidable effects of laryngoscopy and tracheal intubation includes dysrhythmia, hypertension, myocardial ischemia, infarction, hypoxia, hypercapnia, laryngospasm, bronchospasm, and some rare side effects such as increased intracranial and intraocular pressure[7]. Since the introduction of general anaesthesia, no ideal induction agent has yet been discovered in term of providing a stable hemodynamics during endotracheal intubation. Also there are very few published studies in the literature that have compared the physiological effect of various induction agents during laryngoscopy and intubation.

Propofol, 2, 6-diisopropylphenol is popular short acting induction agent (1-2.5 mg/kg) havingfavourable characteristics of rapid smooth induction and recovery with decrease incidence of nausea and vomiting. Unwanted effects associated with Propofol is hemodynamic instability cardiovascular complications and pain at injection site [9].

Etomidate, short acting carboxylated imidazole is characterized by hemodynamic stability, minimal respiratory depression and cerebral protective effects [2]. Its lack of effect on sympathetic nervous system, baroreceptor reflex regulatory system and its effect of increased coronary perfusion even on patients with moderate cardiac dysfunction makes it an induction agent of choice in cardiac disease patients. The important side effects of Etomidate are nausea, vomiting and myoclonus and burning sensation at injection site. One of the most important, but rare side effects of Etomidate is the suppression of steroid production by reversible inhibition of 11-betahydroxylase enzyme [5].

In past, many studies have been comparing different anaesthetic induction agents but studies regarding combination of Propofol and Etomidate are only few. This study is an attempt to evaluate the effects of Propofol,Etomidate and Propofol plus Etomidate by comparing parameters like change in MAP and HR during induction and intubation so that we can choose a safer induction agent.

2. Material and methods

After approval from institutional ethical committee, 60 patients aged between 15 to 60 years of either sex and ASA

physical status I and II scheduled for elective surgery under general anesthesia were taken for this prospective observational study. Written informed consent was taken from all patients.

Patient refusal, emergency surgery, patient with history of hypersensitivity to Propofol /Etomidate, mouth opening <2.5 cm, patients with cardiovascular diseases like ischemic heart disease or hypertension, bronchial asthma, mallampatti grade 3 and 4, existence of considerable pathology in pharynx / larynx, patient with GERD were excluded from study.

Apart from thorough clinical examination likeAirway assessment, mouth opening, Mallampatti grading, dentition, neck flexion and extension of all patients were recorded during pre-anesthetic checkup. Basic hematological and laboratory investigations like complete hemogram, blood sugar, renal function test, etc. were reviewed. ECG and CHEST X-RAY were asked for and reviewed in indicated patients.

The patients were kept nil per orally for 8 hours prior to surgery. All patients were premedicated with inj.Glycopyrolate 0.2 mg i.m. 45 minutes before induction in the preoperative ward.

On arrival at Operation Theater standard anesthesia monitors including electrocardiogram (ECG), non-invasive blood pressure (NIBP) and pulse-oximetry were attached and hemodynamic parameters were recorded.Intravenouscannula of 18 G was secured in left hand and ringer lactate infusion was started. Inj. Midazolam 0.025 mg/kg i.v. and Inj. Fentanyl 2 µg/kg i.v. was given 2 minutes before induction. For induction, group I received inj. Propofol 2.5 mg/kg IV, group II received inj. Etomidate 0.3 mg/kg IV and group III received inj. Propofol 1 mg/kg plus inj. Etomidate 0.2 mg/kg IV. All study drugs were prepared by an anesthesiologist who was blinded to the details of the study. Volume of drug and speed of injection (10 seconds) were equal in all the three groups. After induction of anesthesia, hemodynamic variables were recorded. Later 60 seconds after of loss of consciousness, which was confirmed by inability to respond to verbal commands and loss of eyelash reflex, Inj. vecuronium (0.1 mg/kg) was given and patients were ventilated. Laryngoscopy and endotracheal intubation was done by experienced anesthesiologist. Duration of laryngoscopy was kept less than 10 seconds. Trachea was intubated with adequate size endotracheal tube. Proper placement of endotracheal tube was confirmed by capnography and bilateral auscultation of chest. Following successful placement of endotracheal tube anesthesia was maintained by isoflurane 1-1.5% and equal mixtures of oxygen-nitrous oxide (4 L/ min) along with intermittent bolus of vecuronium as required throughout the surgery.

At the end of the surgery residual neuromuscular block was antagonized with inj. Neostigmine (0.05 mg/kg) i.v. and inj. Glycopyrolate (0.01 mg/kg) i.v. and extubation was performed when respiration was adequate and patient was able to obey verbal commands. HR, SBP, DBP, MAP and SPO_2 were continuously monitored and recorded before induction, after induction and at 1, 2 and 5 minutes after intubation.

Statistical analysis was done usingSPSS 16; descriptive data was compared and presented as Mean ± SD for continuous variables. The various categorical variables studied during observation period were compared using Chi-square test. The various hemodynamic variable parameters studied during observation period were compared using ANOVA test and intergroup comparison of hemodynamic variable were made by post hoc test. The critical value of p indicating the probability of significantdifference was taken as <0.05 for comparison.

3. Results and Discussion

Data of 60patients were evaluated. There was no statistically significance difference observed between the groups regarding patient characteristic and ASA score (Table I).

Baseline and pre-induction HR were comparable among all three groups with no statistical significant differences (p>0.05) Inter group comparison showed that there were significant differences (p<0.05) in heart rate among all the three groups at time interval (after induction and 1, 2 min after intubation). At 5min after intubation there were significant differences among groups except between group II and group III (Table II).

Baseline and pre-induction SBP were comparable among all the three groups with no statistical significant differences (p>0.05). But SBP of three groups after induction and at 1, 2, 5 minute after intubation were different both clinically and statistically, with p value <0.05. Inter group comparison of SBP (mean ± SD) revealed significant differences among various groups at different points of time except that among group II and group III. Between group II and group III there was significant difference only at 1 min after intubation (Table III).

Baseline and pre-induction DBP were comparable among all the three groups with no statistical significant differences (p>0.05). But DBP of three groups after induction and at 1, 2, 5 minute after intubation were different both clinically and statistically, with p value <0.05.

There were significant differences (p<0.05) in inter group comparison of DBP (mean ± SD) among the groups except group II and III. But there was significant difference between group II and III only at 1 min after intubation. At 5 min after intubation there were no significant differences between group I vs. II and group II vs. III (Table IV).

Baseline and pre-induction MAP were comparable among all the three groups with no statistical significant differences (p>0.05). But MAP of three groups after induction and at 1, 2, 5 minute after intubation were different both clinically and statistically, with p value <0.05. Inter group comparison of MAP (mean ± SD) revealed significant differences among various groups at different points of time except that among group II vs. group III. Between groups II vs. group III there was significant difference only at 1 min after intubation (Table V).

4. Discussion

Combinations of various anaesthetic agents have been used for induction of general anaesthesia. These combinations have created separate beneficial sedative, amnestic and hypnotic effect in anaesthesia induction. With this combination technique there has been evident reduction in anaesthetic medication, significant reduction in side effect and cost [Morgan M. et al (1977), Anderson L. et al (1998)][1].

The present study demonstrated that combination of Propofol and Etomidate gives better hemodynamics during induction and after intubation in comparison with Etomidate and Propofol alone.

This is in agreement with Hosseinzadeh et al in 2013, who concluded that more stable hemodynamics was provided by combination of Propofol and Etomidate compared to Propofol and Etomidate alone[4].

Moreover the same results were reported byYagan O et al in 2015, in their study to compare Propofol, Etomidate and Etomidate-Propofol Combination in anaesthesia Induction and after intubation for hemodynamics. They concluded that Etomidate-Propofol combination may be a valuable alternative when extremes of hypotensive and hypertensive responses due to Propofol and Etomidate respectively are best to be avoided [14].

Another study reported by Weiss-Bloom LJ et al. (1992) that after anaesthesia induction with Etomidate (0.3 mg/kg), the ideal Fentanyl dose was 5-10 µg/kg to prevent a hemodynamic response to laryngoscopy and intubation, hence stable hemodynamics in their study was contributed by high dose of Fentanyl.However, it can be predicted that use of such high dose of Fentanyl may cause increased hypotension, nausea and vomiting [13].

Similar study was done by Harris et al. (1988)they concluded that afterPropofol alone, there was a significant decrease in arterial blood pressure, which did not increase above control value after intubation. Significant increase in arterial pressure was observed after intubation in patients induced with thiopentone or Etomidate alone. Increases in heart rate occurred with all agents after laryngoscopy and intubation. The use of Fentanyl resulted in arterial pressure lower than those after the induction agent alone and in an attenuation, but not abolition, of responses to laryngoscopy and intubation [3].

We got similar results in our study with significant decrease in arterial blood pressure, after induction with Propofol which did not increase above baseline value after intubation, while, with Etomidate, there was significant increase in arterial pressure following intubation. Also, increase in heart rate occurred with all agents after laryngoscopy and intubation

Schmidt et al. (1999) observed in their study that, hypotension caused by Propofol is due to the reduction of heart's preload and afterload, which are not synchronized with heart's compensatory responses such as increased cardiac output and increased HR. This hemodynamic drop would be intensified by high doses of the drug and high speed injection of the drug. In our study we got similar results in group I i.e. after induction with Propofol there was hypotension and not synchronized with increased HR [12].

Masoudifar M et al. (2013) concluded that patients receiving Etomidate have more stable hemodynamic condition, if there would have been no contraindications; it could be preferred over Propofol for general anaesthesia. Our study demonstrated similar results of better hemodynamic conditions with Etomidate as compared to Propofol [6].

In the current study, the MAP values after induction in the Propofol group were significantly lower than those of the other two groups. Following intubation, the MAP and HR values of the Etomidate group were statistically significantly higher than those of the other two groups. These results confirm with those in literature. There was added advantage of combining Etomidate with Propofol for attenuating intubation reflex as compared to Etomidate alone, and had obvious advantage than using Propofol or Thiopentone alone. Not using BIS to measure the depth of anesthesia is a major limitation of our study. Another limitation is not measuring plasma cortisol and adreno-corticotropin hormone level. But it has been reported that adrenal suppression after single dose of Etomidate is transient and clinically unimportant [11].

5. Conclusion

Induction with Propofol alone is acceptable in patients with stable hemodynamics. However, Propofol may cause hypotension in volume depleted patients. The combination of Etomidate plus Propofol has better hemodynamic stability than Etomidate alone at 1 min after intubation, though Etomidate was equally stable at other points of time. And, the combination proved to be significantly better than either Propofol or Etomidate alone.

References

[1] Anderson L, Robb H (1998) A comparison of Midazolam co-induction with Propofolpredosing for induction of anaesthesia. Anaesthesia 53:1117-1120.
[2] Cuthbertson BH, Sprung CL, Annane D, Chevret S, Garfield M, et al. (2009) The effects of Etomidate on adrenal responsiveness and mortality in patients with septic shock. Intensive Care Med 35: 1868-1876.
[3] Harris CE, Murray AM, Anderson JM, Grounds RM, Morgan M (1988) Effects of thiopentone, Etomidate and Propofol on the haemodynamic response to tracheal intubation. Anaesthesia 43 Suppl: 32-36.
[4] Hosseinzadeh H, Golzari SE, Torabi E, Dehdilani M (2013) Hemodynamic Changes following Anesthesia Induction and LMA Insertion with Propofol, Etomidate, and Propofol + Etomidate. J CardiovascThorac Res 5: 109-112.
[5] Lipiner-Friedman D, Sprung CL, Laterre PF, Weiss Y, Goodman SV, et al. (2007) Adrenal function in sepsis: the retrospective Corticus cohort study. Crit Care Med 35: 1012-1018.

[6] Masoudifar M, Beheshtian E (2013) Comparison of cardiovascular response to laryngoscopy and tracheal intubation after induction of anesthesia by Propofol and Etomidate. J Res Med Sci 18: 870-874.
[7] Montes FR, Giraldo JC, Betancur LA, Rincón JD, Rincón IE, et al. (2003) Endotracheal intubation with a lightwand or a laryngoscope results in similar hemodynamic variations in patients with coronary artery disease.Can J Anaesth 50: 824-828.
[8] Morgan M, Lumley J, Whitwam JG (1977) Respiratory effects of Etomidate. Br J Anaesth 49: 233-236.
[9] Riznyk L, FijaÅ‚kowska M, Przesmycki K (2005) Effects of thiopental and Propofol on heart rate variability during Fentanyl-based induction of general anesthesia. Pharmacol Rep 57: 128-134.
[10] Sakles JC, Laurin EG, Rantapaa AA, Panacek EA (1998) Airway management in the emergency department: a one-year study of 610 tracheal intubations. Ann Emerg Med 31: 325-332.
[11] Sawano Y, Miyazaki M, Shimada H, Kadoi Y (2013) Optimal Fentanyl dosage for attenuating systemic hemodynamic changes, hormone release and cardiac output changes during the induction of anesthesia in patients with and without hypertension: a prospective, randomized, double blinded study J Anesth 27: 505-511
[12] Schmidt C, Roosens C, Struys M, Deryck YL, Van Nooten G, et al. (1999) Contractility in humans after coronary artery surgery. Anesthesiology 91:58-70.
[13] Weiss-Bloom LJ, Reich DL (1992) Haemodynamic responses to tracheal intubation following Etomidate and Fentanyl for anaesthetic induction. Can J Anaesth 39: 780-785.
[14] Yagan O, Tas N, Kucuk A, Hanci V, Yurtlu BS (2015) Haemodynamic Responses to Tracheal Intubation Using Propofol, Etomidate and Etomidate-Propofol Combination in Anaesthesia Induction.JCardiovascThorac Res 7: 134-140.

Table I: Demographic Data

	Group I	Group II	Group III	P value
Age(y)	33.46±6.7	32.6±6.2	33.2±7.6	0.178
BMI(kg/m)	21.6±2.6	20.9±1.9	21.5±2.3	0.82
Gender(M/F)	12/8	10/10	13/8	0.3
BMI=Body Mass Index; M/F: Male/Female ;data presented as Mean± SD				

Table II: Comparison of Heart rate

Time interval	Group I	Group II	Group III	P value
HR Baseline	79.46±4.37	80±8.03	81.33±3.9	>0.05
HR Pre induction	86.13±4.03	88.53±7.0	85.6±2.02	>0.05
HR After induction	73.6±8.65	85.93±10.08	81.6±0.82	<0.05
HR 1 min After Intubation	79.2±5.89	95.8±8.54	88.5±0.91	<0.05
HR 2 min After Intubation	81.06±4.52	93.86±8.54	89.93±1	<0.05
HR 5 min After Intubation	84.133±3.66	91.6±4.05	89.7±2.64	<0.05

Table III: Comparison of Systolic blood pressure

Time interval	Group I	Group II	Group III	P value
SBP Baseline	126.4±6.7	125.06±6.6	126±4.14	>0.05
SBP Pre induction	125.6±2.5	123.2±7.3	122±4.14	>0.05
SBP After induction	103.3±6.99	113.06±6.27	117.3±3.9	<0.05
SBP 1 min After Intubation	113.067±4.7	125.86±10.72	119.6±5.1	<0.05
SBP 2 min After Intubation	116±5.70	124.6±9.83	122.4±3.3	<0.05
SBP 5 min After Intubation	120±9.471	123.8±8.87	122.6±3.5	<0.05

Table IV: Comparison of Diastolic blood pressure

Time interval	Group I	Group II	Group III	Pvalue
DBP Baseline	78.13±2.44	77.73±3.76	77.07±3.28	>0.05
DBP Pre induction	75.3±2.46	77.33±4051	71.2±1.65	>0.05
DBPAfter induction	65.3±2.46	72.67±5.27	70.4±4.968	<0.05
DBP 1 min After Intubation	67.3±3.67	74.5±3.15	70.8±3.687	<0.05
DBP 2 min After Intubation	68.93±3.10	74.73±4.13	72.867±1.4	<0.05
DBP 5 min After Intubation	71.867±3.8	73.267±4.52	72.73±1.486	<0.05

Table V: Comparison of Mean arterial blood pressure

Time interval	Group I	Group II	Group III	P value
MBP Baseline	94.22±3.24	91.51±3.67	93.37±3.29	>0.05
MBP Pre induction	92.08±1.466	91.28±424	90.13±2.48	>0.05
MBP After induction	75.95±5.94	86.13±4	86.04±2.06	<0.05
MBP 1 min After Intubation	82.577±3.94	94.31±4.57	88.75±2.98	<0.05
MBP 2 min After Intubation	84.62±3.495	91.02±4.68	89.37±1.87	<0.05
MBP 5 min After Intubation	85.24±5.59	88.44±4.84	89.37±1.97	<0.05