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Attenuation of stress response during Laryngoscopy and Endotracheal intubation in controlled hypertensive patients: a comparison between Etomidate and Propofol

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Abstract

Background: Laryngoscopy and tracheal intubation is gold standard for surgeries under general anesthesia, but are associated with side effects like hemodynamic stress response. Hypertensive patients are at greater risk of variations in heart rate and blood pressure which may be associated with higher morbidity. Etomidate and propofol are two drugs frequently used for smooth induction of general anesthesia.

Context: Comparison of etomidate with propofol for induction of anesthesia in controlled hypertensive patients.

Aim: This study aims to compare two induction agents i.e. Etomidate and Propofol for controlled hypertensive patients on hemodynamics stress response during laryngoscopy and intubation.

Subjects and Methods: In this study 80 controlled hypertensive adult patients were divided into two groups of 40 each ,Group A –etomidate group and Group B –propofol group. After induction with either agent hemodynamics parameters were noted at 2 minutes interval till 10 minutes and compared with the baseline. Blood sample for serum cortisol levels were also taken at 1 and at 10 minutes post intubation and values were compared with the base line.

Results: The mean heart rate fluctuation were less in etomidate group as compared to propofol group though not significant statistically. Fall in Systolic, Diastolic and mean blood pressure were much more in propofol group ($p < 0.0001$). Cortisol levels were maintained in both the groups and no adrenocortical suppression was seen etomidate group.

Conclusion: Etomidate provides better hemodynamics stability as compared to propofol for controlled hypertensive patients requiring endotracheal intubation and etomidate does not cause significant adrenal suppression after single bolus induction dose.

Keywords: Etomidate, Propofol, Stress Response, Cortisol, Controlled hypertension.

Introduction

Hypertension (HT) affects more than 1 billion people worldwide and is a major risk factor for coronary artery disease, myocardial infarction, stroke etc. It is also associated with dyslipidemia, diabetes and obesity(1).Controlled hypertension is defined as an average systolic Blood Pressure(SBP) < 140mmHg and

an average diastolic blood pressure(DBP) < 90mm Hg among adults with HT on medication.HT patients who are controlled on more than two drugs are more prone to hypotension on induction(2),and a fall in mean blood pressure of more than 30% may jeopardize coronary circulation(3).Therefore concerns for induction of anesthesia in hypertensive patients include hemodynamics stability ,attenuation of stress response and maintenance of balance between myocardial oxygen demand and supply . Etomidate is an induction agent having rapid onset of action and it maintains cardiovascular stability (4), but according to some studies it suppresses the corticosteroid synthesis in adrenal cortex (5).Propofol is one of the most frequently used sedative hypnotic agent (6) but it has been shown to decrease preload, afterload and myocardial contractility (7-9).Propofol does not significantly affect corticosteroid synthesis. This study was conducted to compare the effects of these two induction drugs on hemodynamic parameters and serum cortisol levels during laryngoscopy and intubation in controlled hypertensive patients.

Materials and Methods

This prospective randomized controlled study was conducted after approval from Institutional Review Board and Hospital Ethics Committee. Written informed consent was taken from 80 controlled hypertensive patients (ASA II) aged 18-65 yrs. who were divided into 2 groups of 40 patients each. GroupA (Etomidate) and Group B (Propofol).Patients already on corticosteroids, having other comorbidities (like Diabetes mellitus, dyslipidemia etc.), difficult airway, coagulopathy or morbid obesity were excluded from this study.

All patients were premedicated with Tab. Alprazolam 0.5 mg at night and in the morning of surgery. Antihypertensive medications were continued till the morning of surgery .Inside the operation room, patients' baseline parameters were noted viz .ECG, SpO_2 , SBP, DBP, Mean BP and blood sample for serum cortisol level was taken.

Induction of anesthesia was done with inj. midazolam 0.025mg/kg ,inj. fentanyl 2mcg/kg, 1ml of 2%lignocaine followed by etomidate(0.25mg/kg)in group A and with propofol(1.5mg/kg)in groupB. Muscle relaxation was achieved with vecuronium 0.1 mg/kg followed by laryngoscopy and endotracheal intubation in both the groups.Anesthesia was maintained with O_2 40% and N_2O 60%. Haemodynamic parameters were noted after induction, 1,3,5,7 and 9 minutes post intubation. Blood samples were also taken at 1 & 10 minutes post intubation for serum cortisol levels.

Statistical Analysis

Categorical variables were presented in number and percentage (%) and continuous variables as mean ± SD and median. Normality of data was tested by Kolmogorov-Smirnov test. If the normality was rejected then non parametric test was used.

Quantitative variables were compared using unpaired t-test/Mann-Whitney Test (when the data sets were not normally distributed) between the two groups and paired T test/WIlcoxon rank sum test was used for comparison within the group across follow up. Qualitative variables were correlated using Chi-Square test /Fisher's exact test. p value of <0.05 was considered statistically significant. Analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

Observations and Results

The demographic profiles (age, sex and weight) were comparable in the two groups and were statistically

non-significant. Maximum cases were done for general surgery (65%) whereas others like gynecology (15%), burns and plastic (7.5%), orthopedic (7.5%) and ENT surgeries (5%) cases were also there. On comparing the mean heart rate(HR), both the groups showed a fall in HR when compared to the baseline but it was not statistically significant (Table1)

Table 1: Comparison Of Mean Heart Rate Between Two Groups

HR	Etomidate group (n=40)	Propofol group (n=40)	P Value
	Mean ± SD	Mean ± SD	
HR1(Base line)	86.15 ± 13.74	90.78 ± 11.1	0.102
HR2(post induction)	82.1 ± 10.47	84.25 ± 8.76	0.322
HR3(01 minute)	82.22 ± 9.95	80.5 ± 8.81	0.414
HR4(03 minute)	87.52 ± 11.3	85.58 ± 8.52	0.386
HR5(05 minute)	84.1 ± 10.3	85.4 ± 7.44	0.520
HR6(07 minute)	82.98 ± 10.57	84.65 ± 6.95	0.405
HR7(09 minute)	82.28 ± 10.01	83.08 ± 7.03	0.643

On comparison of mean SBP there was 18% fall in SBP from baseline in propofol group as compared to etomidate which showed only 8%fall(p value<0.0001). In propofol group fall in mean SBP at 1,3,5,7 and 9 minutes after intubation was 22%,19%,21%,21% and 22% respectively whereas this fall in etomidate group was 7%,5%,6%,6% and 5% when compared to baseline. In propofo group 14 patients (35%) had significant Hypotension (fall of more than 20 %.)Whereas only 2 patients (5%)had this fall in etomidate group (p value< 0.0001) table 2.

Table 2: Comparison Of Mean Systolic Blood Pressure Between Two Groups

SBP	Etomidate group (n=40)	Propofol group (n=40)	P Value
	Mean ± SD	Mean ± SD	
SBP1(Base line)	142.4 ± 9.38	143.9 ± 8.73	0.461
SBP2(post induction)	131.2 ± 6.88	119.12 ± 7.16	<0.0001
SBP3(01 minute)	133.62 ± 6.64	113.28 ± 13.61	<0.0001
SBP4(03 minute)	136.07 ± 9.82	116.92 ± 12.56	<0.0001
SBP5(05 minute)	134.9 ± 6.17	115.08 ± 11.01	<0.0001
SBP6(07 minute)	134.4± 7.78	113.95 ± 11.05	<0.0001
SBP7(09 minute)	136.02 ± 8.55	113.6 ± 11.95	0.259

The mean fall in DBP was more in propofol group (10%) as compared to etomidate group (6%) after induction but the difference was not significant. The mean fall in DBP at 1,3,5,7 and 9 minutes in propofol group was 12%, 9%, 11%, 14% and 16% respectively as compared to etomidate group where the fall was 4%, 4%, 4%, 5% and 4% after induction indicating stable profile in etomidate group.Table3.

Table 3: Comparison Of Mean Diastolic Blood Pressure Between Two Groups

DBP	Etomidate group (n=40)	Propofol group (n=40)	P Value
	Mean ± SD	Mean ± SD	
DBP1(Base line)	91.28 ± 5.89	92.88 ± 6.67	0.259
DBP2(post induction)	86.65 ± 6.2	84.48 ± 7.63	0.165
DBP3(01 minute)	87.95 ± 6.5	82.1 ± 11.23	<0.006
DBP4(03 minute)	88.18± 6.88	84.55 ± 8.93	0.046
DBP5(05 minute)	87.4 ± 6.64	83.58 ± 10.95	0.063
DBP6(07 minute)	87.6 ± 5.63	80.47 ± 9.15	0.0001
DBP7(09 minute)	88.12 ± 5.31	78.3 ± 10.18	<0.0001

Similarly the mean blood pressure (MBP) showed a fall of 18% in propofol group as compared to 5 % in

etomidate group after induction which was statistically significant (Table 4).

Table 4: Comparison Of Mean Blood Pressure (Mbp) Between Two Groups

MBP	Etomidate group (n=40)	Propofol group (n=40)	P Value
	Mean ± SD	Mean ± SD	
MBP1(Base line)	99.65 ± 5.93	100.55 ± 9.94	0.923
MBP2(post induction)	95.2 ± 6.17	82.52 ± 6.17	<0.0001
MBP3(01 minute)	94.22 ± 8.74	91.2 ± 13.92	0.714
MBP4(03 minute)	99.82± 11.37	94.98 ± 8.29	0.014
MBP5(05 minute)	95.7 ± 8.08	91.52 ± 9.98	0.002
MBP6(07 minute)	93.52 ± 6.69	89.28 ± 8.1	0.013
MBP7(09 minute)	92.75 ± 7.48	90.08 ± 9.64	0.023

Both the groups were comparable with respect to ST segment deviation in lead I, II and V5 at all the intervals. The serum cortisol levels at 1 and 10 min intervals post intubation were stable in both the groups when compared to baseline and the difference was not statistically significant.

Discussion

Induction of anesthesia is a critical part where sudden hypotension, arrhythmias and cardiovascular collapse are serious complications. It is desirable to use a safe agent with fewer adverse effects. The present study was designed to compare etomidate and propofol for their effects on hemodynamics parameters and serum cortisol levels in controlled hypertensive patients during laryngoscopy and intubation.

The two patient groups had no significant differences regarding variables like gender, age, weight so the results are primarily the effects of drugs under study. Preoperative hemodynamic parameters were comparable in both the groups .It was found that variation in heart rate was there in both the groups but not significant statistically. Clinically also, no significant tachycardia or bradycardia was observed .These results were similar to studies by Kaushal RP et al (10) and Mosoudifar M et al (11) where they studied hemodynamic parameters at laryngoscopy and intubation and found no difference in heart rate variations in etomidate and propofol groups.

There was fall in SBP, DBP and MBP in propofol group after intubation and this was statistically significant. These results were consistent with the findings of SaricaogluF et al(12) where they attributed this fall in BP to negative inotropic effect of propofol.Weisenberg M et al (13) concluded that entropy guided lower doses of propofol and etomidate induction result in lesser hemodynamic changes than propofol and etomidate induction with standard doses. Etomidate is more cardiostable than propofol at equipotent doses (14).

Ebert T J et al(15) found that propofol induced hypotension is mediated by an inhibition of the sympathetic nervous system and impairment of baroreflex regulatory mechanism. Etomidate, conversely maintains hemodynamic stability through preservation of both sympathetic outflow and autonomic reflexes.

The timing of induction of anesthesia in both the groups was maintained between 9-10am to avoid diurnal variation of serum cortisol levels in the study. In both the groups the cortisol levels remained within normal limits of reference range of 123-626

nmoles/litre. This was in accordance with a study by Siebal PS et al(16) where they saw no difference in serum cortisol levels between thiopentone and etomidate at induction of general anesthesia.

Although there are studied (17,18)which show severe falls in serum cortisol levels with etomidate as induction agent and concluded that it could be major risk factor for the development of adrenal insufficiency but it was not so in our study.

We could not find any evidence in medical literature which comments on the immediate effect of etomidate on serum cortisol levels more so within 10 minutes of induction and so we conclude that etomidate is a safe induction agent, provides better hemodynamics stability as compared to propofol especially in controlled hypertensive patients .With single bolus induction dose of etomidate adrenal insufficiency could not be ascertained.

Conclusion: Etomidate provides better hemodynamics stability as compared to propofol for controlled hypertensive patients requiring endotracheal intubation and etomidate does not cause significant adrenal suppression after single bolus induction dose.

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