Section: Anaesthesiology

Original Research Article

A COMPARATIVE STUDY OF HAEMODYNAMIC EFFECTS OF PROPOFOL AND ETOMIDATE AS INDUCTION AGENTS IN CARDIAC PATIENTS FOR NON CARDIAC SURGERIES. A PROSPECTIVE RANDOMIZED CONTROLLED STUDY

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Abstract

Background: The aim of the study was to compare the safety of propofol and etomidate as induction agents of anaesthesia in cardiac patients for non-cardiac surgeries in terms of haemodynamic parameters and side effects. **Materials and Methods:** The study was conducted in 40 adult Cardiac patients between 20 – 60 years of age group for elective surgeries under general anaesthesia ASA III/IV by prospective randomized study. We compared the outcome of the two groups in terms of haemodynamic parameters and side effects. **Results:** There was no statistical significance between the two groups in terms of age, sex, body weight, oxygen saturation and heart rate changes post intubation. The systolic, diastolic and mean arterial blood pressure were comparable between the two groups. The decrease in systolic, diastolic and mean arterial pressure at 1,3,5.10 minutes was higher in propofol group I when compared to the etomidate group II where the reduction was lower or almost nil and was statistically significant with $p<0.05$ for decrease in systolic BP, $p < 0.001$ for decrease in diastolic BP for 1 min and 10 minutes and $p<0.016$, $p<0.004$ for 3min and 5 minutes respectively. The p value was $p< 0.001$ for decrease in MAP at 1,3,5. The incidence of pain on injection was higher with propofol when compared to etomidate ($p<0.05$). **Conclusion:** Etomidate was found to be an ideal induction agent for cardiac patients undergoing non cardiac elective surgeries under general anaesthesia when compared to protocol in terms of maintaining good haemodynamic stability with lesser side effects.

INTRODUCTION

An ideal induction agent for general anaesthesia should have haemodynamic stability, minimal respiratory side effects and rapid clearance. Presently Etomidate and Propofol are popular rapid acting inducing agents. Etomidate is a R-(+)-Pentylethyl-1H-imidazole -5carboxylate sulphate synthesized in 1964 characterized by haemodynamic stability, minimal respiratory depression and cerebral protective effects1. Its lack of effect of sympathetic nervous system, baroreceptor reflex regulatory system,[1,2] and its effect of increased coronary perfusion even on patients with moderate cardiac dysfunction makes it an induction agent of choice with the dose of 0.2 – 0.6 mg/kg IV. It is metabolised in the liver by ester hydrolysis and N-dealkylation. It is not ideal for prolonged period of sedation as it inhibits corticosteroid synthesis. It has initial distribution half-life of 2.7 minutes, redistribution half-life of 29 minutes and elimination half-life varying from 2.9 to 5.3 hours.

An induction dose of 0.3 mg/kg of etomidate given to cardiac patients for noncardiac surgery results in almost no change in heart rate, mean arterial pressure, mean pulmonary artery pressure, pulmonary capillary wedge pressure, central venous pressure, stroke volume, cardiac index, and pulmonary and systemic vascular resistance.[3,4]The myocardial oxygen supply-demand ratio is thus well maintained. It lacks analgesic effect, may not totally ablate the sympathetic response to laryngoscopy.

Propofol is 2,6-diisopropofol, one of the group of alkyl phenol. It is oil at room temperature, insoluble in water and highly lipid soluble. It contains 1% propofol,10% soyabean oil,2.25% glycerol,1.2% purified egg phosphatide,0.005% disodium edentate

as retardant of bacterial growth. It is rapidly metabolised in liver by conjugation with glucuronide and sulphate to produce water soluble compounds excreted by the kidney. Extra hepatic metabolism is seen in the kidney and the lung. It has initial distribution half-life of 2-8 minutes. Time of peak effect is 90 -100 seconds.

Propofol decreases blood pressure, cardiac output and systemic vascular resistance due to inhibition of sympathetic vasoconstriction and impairment of baroreceptor reflex regulatory system. This effect may be exaggerated in hypovolemic and elderly patients with compromised left ventricular function due to coronary artery disease. It produces dose dependent depression of ventilation. It causes apnoea after induction which depends on the dose and speed of the injection. However the adverse effects such as pain on injection, thrombophlebitis and myoclonus for both the agents have been corrected by premedicating with the fentanyl, an opioid. This study is an attempt to compare hemodynamic, respiratory and other effects of both the drugs so that we can choose a safe induction agent.

Aim of the Study

The aim of this study was to compare the efficacy of propofol and etomidate as induction agents of anaesthesia in cardiac patients for non-cardiac surgery in terms of haemodynamic parameters and side effects.

MATERIALS AND METHODS

This randomized study was conducted in Coimbatore medical college hospital, Coimbatore after obtaining institutional ethical committee approval and written informed consent from all the patient. The study population includes 40 adult cardiac patients between 20 years to 60 years of age group for elective surgeries under general anesthesia (ASA II/III) after thorough pre anesthetic checkup and airway assessment. Duration of the study was one year from February 2019 to February 2020.The study population was randomly allocated into two groups of I and II

Group I – 20 patients with Propofol 2mg/kg as induction agent

Group II - 20 patients with Etomidate 0.3 mg/kg as induction agent

Exclusion Criteria

- Patient refusal
- Airway diseases
- Difficult intubation
- Emergency surgery
- Coagulation abnormalities
- BMI >30
- Pregnanc
- Uncontrolled Diabetes Mellitus and Hypertension

Procedure

After shifting to operation theatre 18G Intravenous catheter secured and Ringer's lactate infusion started. Monitors for pulseoximeter, electrocardiogram and non-invasive blood pressure monitoring are connected and baseline vitals are recorded. Premedication with IV midazolam 0.02mg /kg and inj. fentanyl 2mcg/kg IV given. Patients induced with propofol 2 mg/kg in propofol group and Etomidate group received Etomidate 0.3 mg/kg. patient intubated with appropriate size ETtube connected with Bain's Circuit. Anaesthesia was maintained as per institutional protocol. Residual neuromuscular blockade was reversed with injNeostigmine 0.05 mg/kg, inj. Glycopyrolate 0.01 mg/kg Endotracheal tube was extubated after adequate recovery of muscle recovery of muscle power of patients and monitored post operatively

Statistical Analysis

The information collected for all the selected patients were recorded in a master chart. Data analysis was done with the help of computer by using SPSS 16 software. Using this software, percentages, means. Standard deviations 'p' values were calculated through Student 't' test for raw data and chi square test for consolidated data to the test the significance of difference between variables. A 'p' value less than 0.05 is taken to denote significant relationship.

RESULTS

The information collected for all the selected patients were recorded in a master chart. Data analysis was done with the help of computer by using SPSS 16 software. Using this software, percentages, means. Standard deviations 'p' values were calculated through Student 't' test for raw data and chi square test for consolidated data to the test the significance of difference between variables. A 'p' value less than 0.05 is taken to denote significant relationship [Table 1].

Majority of the study participants were above 50 years of age in both the groups (Propofol-10%, Etomidate-10%).Female preponderance was observed in our study (Propofol-14(70%), Etomidate-13(65%).Majority of the study participants were more than 60 Kg (Propofol-10(50%), Etomidate-13(65%).In popofol group majority of the patients were in Grade III 11(55%) and that of Group II most of them were in Grade II 11(55%).There were no statistically significant difference [Table 2].

In the group I(PROPOFOL) the basal value of SBP was 131.15 mm Hg. 3 minute following intubation, the SBP decreased by 116.8 mm Hg, representing a decrease of 14.37 mm Hg. In group II(ETOMIDATE) the basal value of SBP was 128.95 mm Hg. 3 minute following intubation, the SBP increased by 128.8 mm Hg, representing a decrease of 0.15 mm Hg. The decrease in SBP in group II was hemodynamically stable and statistically significant compared to decrease in SBP in group I ($p < 0.001$) at third minute post intubation [Table 3].

In group I (PROPOFOL) the basal value of DBP was 85.1mm Hg. At 3 minute following intubation, the

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DBP decreased to 77.65mm Hg, representing a decrease of 7.45mm Hg. In group II (ETOMIDATE) the basal value of DBP was 84.45mm Hg. At 3 minute following intubation, the DBP decreased by 82.1mm Hg, representing a decrease of 2.35 mm Hg Statistical evaluation between the groups showed that the decrease in DBP observed was statistically significant in GROUP II compared to group I (p=0.016) [Table 4].

In group I(PROPOFOL) the basal value of MAP was 100.45mm Hg. At 3 minute following intubation, the MAP decreased by 90.7mm Hg, representing a decrease of 9.75 mm Hg.In group II (ETOMIDATE) the basal value of MAP was

99.283mm Hg. At 3 minutes following intubation, the MAP decreased by 97.667 mm Hg, representing a decrease of 1.616 mm Hg. Statistical evaluation between the groups showed that the decrease in MAP observed statistically significant in group II compared to group I in the first and third minute after intubation and remained significant till tenth minute after intubation(pvalue<0.001) [Table 5].

Pain was reported more in Propofol group 12 and no cases were reported in Etomidate. Nausea and vomiting reported among 2 in Etomidate group and no such problem were reported in Etomidate group. There was a difference between the groups and it was found to be statistically significant [Table 6].

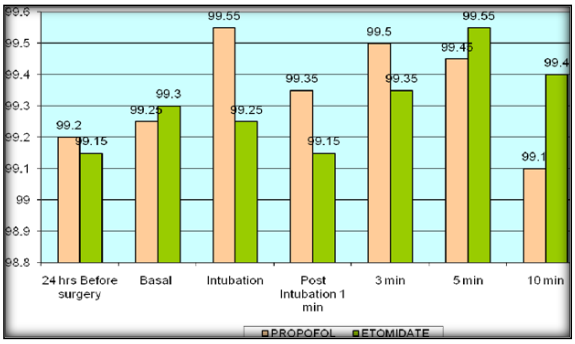

Figure 1: SPO2 Comparison between the groups

Table 1: Baseline characteristics of the study participants

Variables	Propofol	Etomidate	P value
Age			
<40	**3(15%)**	**4(20%)**	**0.7**
41-50	**7(35%)**	**6(30%)**	
>50	**10(50%)**	**10(50%)**	
Sex			
Male	**6(30%)**	**7(35%)**	**0.7**
Female	**14(70%)**	**13(65%)**	
Bodyweight(Kg)			
<60	**10(50%)**	**7(35%)**	
>60	**10(50%)**	**13(65%)**	
ASA			
Grade II	**9(45%)**	**11(55%)**	
Grade III	**11(55%)**	**9(45%)**	

Table 2: Heart Rate Comparison

Heart Rate	PROPOFOL		ETOMIDATE		P value
	Mean	SD	Mean	SD	
24 hrs Before surgery	84.25	5.973	86.1	6.181	0.342
Basal	84.65	6.002	86.45	6.039	0.35
Intubation	84.7	5.658	86.45	5.969	0.347
Post Intubation 1 min	87.6	4.946	88.6	5.826	0.562
3 min	93.05	5.68	93.9	5.015	0.619
5 min	87.85	6.572	88.45	4.915	0.745
10 min	81.15	6.243	84.65	7.095	0.106

Table 3: Changes in the mean systolic blood pressure (SBP)

Systolic BP	PROPOFOL		ETOMIDATE		P value
	Mean	SD	Mean	SD	
24 hrs Before surgery	130.5	4.085	128.7	5.704	0.258
Basal	131.15	4.133	128.95	5.568	0.164
Intubation	131.2	4.034	129.15	5.743	0.199
Post Intubation 1 min	109	5.813	117.5	5.916	<0.001
3 min	116.8	5.156	128.8	5.55	<0.001
5 min	105.5	6.962	118	5.477	<0.001
10 min	109.25	6.257	117.8	5.55	<0.001

Table 4: Changes in the diastolic blood pressure (DBP)

Diastolic BP	PROPOFOL		ETOMIDATE		P value
	Mean	SD	Mean	SD	
24 hrs Before surgery	84.7	5.723	83.85	5.528	0.636
Basal	85.1	5.73	84.45	4.989	0.704
Intubation	85.65	5.412	84.8	5.167	0.614
Post Intubation 1 min	66.7	5.555	74.2	5.197	<0.001

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3 min	77.65	5.696	82.1	5.495	0.016
5 min	70.15	5.518	75.65	5.696	0.004
10 min	71.8	5.55	78.85	5.518	<0.001

Table 5: Changes in the mean arterial pressure (MAP)

MAP	PROPOFOL		ETOMIDATE		P value
	Mean	SD	Mean	SD	
24 hrs Before surgery	99.967	4.262	98.8	4.72	0.417
Basal	100.45	4.249	99.283	4.306	0.394
Intubation	100.833	4.223	99.583	4.389	0.364
Post Intubation 1 min	80.8	3.586	88.633	4.114	<0.001
3 min	90.7	5.034	97.667	5.156	<0.001
5 min	81.933	5.536	89.767	4.038	<0.001
10 min	84.283	4.895	91.833	3.709	<0.001

Table 6: Side effects observed in both groups

Variables	Propofol	Etomidate	P value
Pain Present Absent	12(60%) 8(40%)	0(0%) 20(100$)	**<0.001***
Nausea and Vomiting Present Absent	0(0%) 20(100%)	2(10%) 18(90%)	**0.07***

DISCUSSION

The study involved propofol versus etimidate as induction agents of anaesthesia for cardiac patients and the groups were compared on the basis of hemodynamic parameters and adverse effects. In this study 40 ASA PS II and III patients of both sexes between 20- 60 years of age posted for elective surgeries were allocated into two groups of 20 each. Group I –received Propofol 2mg/kg and Group II received Etomidate 0.3 mg/kg as induction agent. Age, Sex distribution, body weight, ASA physical status and heart rate changes post intubatin were comparable and there were no statistically significant difference between the two groups. Systolic blood pressure changes from baseline at 1 min, 3 min, 5min, 10mins after intubation were compared between the groups. The fall in systolic blood pressure after intubation was significantly higher in propofol group when compared to etomidate group(P<0.001).

J.S.C. Mccollem et al,[4] observed that propofol produced significantly more hypotension and pain on injection. Thomas J Ebert,[8] observed well maintained systolic and diastolic pressures in etomidate compared to propofol. Diastolic blood pressure changes post intubation at 3rd and 5th minute was statistically significant(p<0.05) and 1st and 10th minute was highly significant (p<0.001 The fall in diastolic blood pressure after intubation was significantly higher in propofol group when compared to etomidate group (P<0.001). A. Gauss et al,[6] observed no change in diastolic pressure with etomidate. J.S.C. Mccollem et al,[4] observed propofol cause more hypotension and pain on injection (both systolic and diastolic decrease). Kumar A et al,[13] observed significant systolic and diastolic pressure decrease. Mean arterial pressure changes from baseline at 1 min, 3 min, 5 min after intubation were compared between the groups and found to be statistically significant.

The fall in mean arterial pressure after intubation was significantly higher in propofol group when compared to etomidate group(P<0.001). Yogeshkumar et al,[11] observed significant decrease in mean arterial pressure from baseline at induction with propofol group when compared to etomidate group. Aggarwal S et al,[12] observed pateints in etomidate group had little change in mean arterial pressure and heart rate compared to propofol group from baseline value. Heart rate from baseline at 1 min, 3 min, 5 min after intubation were compared between the groups and there was no statistically significant difference (p>0.05). This was similar to the study done by Gooding Jm,[9] where there was almost no change in heart rate in both the groups. A gauss,[6] noticed similar effect in heart rate. Amit kumar et al,[13] in their study, noted that heart rate did not significantly change in etomidate group after induction but in propofol group heart rate significantly decreased. Giese JL et al,[10] noted significant increase in heart rate in etomidate group. Oxygen saturation was well maintained in both the groups.

The incidence of pain on injection was observed only in propofol group (12 patients). Y. Nyman et al,[13] observed significantly low incidence of injection pain with etomidate compared to propofol. Nausea and Vomiting observed in two patients in Etomidate group and none in propofol group and the difference was found to be statistically insignificant (p>0.05). M.St pierre,[7] double blind randomized study on incidence of post-operative nausea and vomiting showed Etomidate does not produce nausea during early post-operative period. No incidence of myoclonus in our study in both the groups. R. Carlos et al,[1] observed that incidence of myoclonus in patients who received Etomidate group. Deonicke Aw et al,[2,21] observed decreased incidence of myoclonus with etomidate.

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CONCLUSION

Etomidate was found to be an ideal induction agent for cardiac patients undergoing non cardiac elective surgeries under general anaesthesia when compared to propofol in terms of maintaining good hemodynamic stability with leser side effects.

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Competing interest

There is no competing interest.

Authors Contribution

All authors in our study contributed to the data collection of the patients.

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