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Comparison of Etomidate and Propofol Induction on Hemodynamic Response in Patients of Open Cardiac Surgeries on Cardiopulmonary Bypass (CPB)

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Abstract

Introduction: Induction of anaesthesia in cardiac surgery include concern for hemodynamic stability, attenuation of stress response and maintenance of balance between myocardial oxygen demand and supply. Various Intravenous anaesthetic agents like Thiopentone, Etomidate, Propofol, Midazolam, and Ketamine have been used for anesthetizing patients for cardiac surgeries. However, many authors have expressed concerns regarding induction with thiopentone, midazolam and ketamine. Hence, Propofol and Etomidate are preferred for induction in these patients. However, these two drugs have different characteristics. Etomidate is preferred for patients with poor left ventricular (LV) function as it provides stable cardiovascular profile. Propofol, on the other hand may cause a reduction in systemic vascular resistance and subsequent hypotension. Thus, this study was conducted to compare induction with these two agents in cardiac surgeries.

Methods: Patients were induced either with etomidate or propofol & haemodynamic variables HR,SBP,DBP,MAP ,CVP were notified periodicaly. Etomidate provides more stable hemodynamic parameters as compared to Propofol. Propofol causes vasodilation and may result in drop of systematic BP. Etomidate can therefore be safely used for induction in patients with good LV function for open cardiac surgeries.

Conclusion: Etomidate provided more stable hemodynamic induction as compared to propofol in patients for open cardiac surgeries on CPB.

Keywords: Cardiac Anesthesia; CPB; Etomidate; Propofol

Abbreviations: CPB: Cardiopulmonary Bypass; LV: Left Ventricular; IV: Various Intravenous; NIBP: Noninvasive Blood Pressure; ECG: Electrocardiograms; MAP: Mean Arterial Pressure; CVP: Central Venous Pressure.

Introduction

Induction of anesthesia in patients undergoing cardiac surgery include hemodynamic stability, attenuation of the

stress responses and maintenance of balance between myocardial oxygen demand and supply. Various intravenous (IV) inducing agents like thiopentone, etomidate, propofol and midazolam have been used for anesthetising these patients Pandey AK, et al. [1-5] have expressed concerns regarding induction of anesthesia with agents such as thiopentone, midazolam, ketamine.

Propofol and etomidate,both are well-known anesthetic agents routinely used for the induction of anesthesia for cardiac surgeries [6-10]. The two drugs however have different induction characteristics [11-14].

Hence, this study was conducted to compare the effect of anesthetic induction with single dose etomidate versus propofol induction on haemodynamics.

Materials and Methods

Inclusion Criteria

After talking written informed consent from the patients & their relatives, 60 patients (age: 20–60 years, weight: 40–70 kg) of American Society of Anesthesiologists Grade II and III scheduled for elective cardiac surgeries on cardiopulmonary bypass (CPB) were enrolled in study design: This Retrospective observational study was conducted in cardiothoracic & vascular surgery department of our tertiary care hospital, during study period of 2018-2019.

Exclusion Criteria

Patients undergoing emergency surgery, having congestive cardiac failure, low LV function EF<40%,Renal dysfunction (serum creatinine >2 mg/dl), on mechanical ventilation or on long-term steroid therapy, known adrenal or endocrine dysfunction were excluded from the study.

Proper preanesthetic check-up and all relevant investigations were done for all patients according to standered protocol.

The all 60 patients were randomly divided into two groups of 30 patients each.

Group I: Injection Propofol group (2 mg/kg) IV.
Group II: Inj.Etomidate a group (0.2 mg/kg) IV.

In the operation theater, pulse oximeter, noninvasive blood pressure (NIBP) apparatus and five lead electrocardiograms (ECG) were connected to the patient.

Patient was premeditated with injection glycopyrrolate 0.2 mg IV, injection midazolam 0.02 mg/ kg, injection fentanyl 1 mcg/ lg, injection ranitidine 50 mg and injection ondansetron 4 mg.

After premedication, Intra-arterial radial cannulation, central venous line placement was done under local infiltration. After stabilization period of 5 min, the baseline values of heart rate, systolic and diastolic BP (SBP and DBP) (invasive BP), mean arterial pressure (MAP), central venous pressure (CVP), SpO2, were recorded and ECG was monitored.

Intravenous fentanyl 2 mcg/kg was given 3 min prior to induction. After preoxygenation, Group I received 2 mg/ kg propofol and Group II received 0.2 mg/kg etomidate for induction.After the loss of eyelash reflex in both groups, again HR, SBP, DBP, MAP, CVP were recorded. Injection vecuronium bromide 0.1 mg/kg IV was given, and endotracheal intubation was performed. Intraoperative analgesia was provided with injection fentanyl up to total dose of 20 mcg/kg as intermittent bolus doses. Anesthesia was maintained with sevoflurane (1–3%) and injection 0.1 mg/kg vecuronium was administered as IV bolus followed by 0.02 mg/kg every 30–40 min. Femoral artery catheterization was done. Haemodynamic variables recorded periodicaly.

Haemodynamic Data collected was periodicaly, at a time of

- Baseline/before induction
- After the induction (loss of eyelash reflex and verbal response)
- Immediately after intubation
- After 5 min of intubation.
- **5 min after intubation was endpoint for induction pf anaesthesia

Statistical Analysis

Data was summarized as the number (%) or mean ± standard deviation/median (range) as appropriate. Baseline categorical and continuous variables were compared between the groups using Fisher's exact test and Student's t-test respectively. Hemodynamic variables were compared between the groups using Student's t-test for independent samples. $p< 0.05$ was considered as Significant

Observations and Results

Parameters	Gr.I(n=30)	Gr.II,(,n=30)	p value	Inference
Age	37.3+/-10.2	38.2+/-9.7	>0.05	NS
Height	158.5+/-2.6	155.5+/-3.2	>0.05	NS
Weight	56.4+/-4.2	55.4+/-3.8	>0.05	NS
Duration of surgery	96.6+/-3.2	95.2+/-4.1	>0.05	NS
Duration of Cardiopulmonary Bypass(CPB)	30.6+/-12.2	30.8+/-11.8	>0.05	NS

Table 1: Demographic Parameters.

parameter	Gr.I(n=30)	Gr.II(n=30)	p Value	Inference
HR	78.2+/-3.2	76.4+/-2.5	>0.05	NS
SBP	110.4+/-5.2	114.4+/-4.3	>0.05	NS
DBP	70.8+/-2.5	72.0+/-2.8	>0.05	NS
MAP	86.7+/-2.4	87.6+/-2.2	>0.05	NS
CVP	6.0+/-1.1	5.9+/-0.9	>0.05	NS

Table 2: Baseline hemodynamic parameters.

Table 2 showed baseline comparable haemodynamic parameters in each group (p>0.05). Various Hemodynamic parameters (Hearte Rate HR, Systolic Blood pressure SBP, Diastolic Blood Pressure DBP, Mean Arterial Pressure MAP, between the two groups.

Time of parameter reading	Gr. I(n=30)	Gr. II(n=30)	p value	Inference
HR at 1 min induction	86.3+/-1.4	80+/-1.1	<0.05	S
HR at 3 min after induction	96.7+/-2.8	87.0+/-2.2	<0.05	S
HR at 5 min after induction	92.2+/-3.6	84.0+/-2.6	<0.05	S
SBP at 1 min induction	96.2+/-2.3	110.4+/-2.2	<0.001	HS
SBP at 3 mins after induction	86.6+/-3.6	108.6+/-3.2	<0.001	HS
SBP at 5 min after induction	88.4+/-2.7	108.4+/-2.8	<0.001	HS
DBP after 1 min induction	58.8+/-2.2	71.2+/-1.8	<0.001	HS
DBP 3 mins after induction	57.5+/-2.1	70.5+/-1.2	<0.001	HS
DBP after 5 mins of induction	58.2+/-1.2	72.4+/-1.6	<0.001	HS
MAP after 1 min induction	67.4+/-1.8	80.3+/-2.6	<0.001	HS
MAP at 3 mins of induction	72.2+/-2.4	82.3+/-1.8	<0.001	HS
MAP at 5 mins of induction	76.4+/-2.2	85.8+/-1.6	<0.001	HS

Table 3: Induction Harmodynamics.

There was a significant decrease in SBP, DBP and MAP between the groups after1 min, 3 min & 5 min post intubation when compared to baseline values in Propofol group, but not in the etomidate group. (P<0.001) Whereas HR was increase in Gr I at 1, 3, 5 mins(p<0.05).

CVP	Gr l(n=30)	Gr ll(n=30)	p value	Inference
At time of induction	6.4+/-0.5	6.3+/-0.6	>0.05	NS
At 3 mins of induction	5.8+/-1.2	5.7+/-1.3	>0.05	NS
At 5 mins of induction	6.7+/-1.1	6.6+/-1.2	>0.05	NS

Table 4: Central Venous Pressure CVP changes.
The CVP changes were comparable in both group (p>0.05).

parameter at 10 mind	Gr.l(n=30)	Gr.ll(n=30)	p Value	Inference
HR	78.2+/-3.2	76.4+/-2.5	>0.05	NS
SBP	110.4+/-5.2	114.4+/-4.3	>0.05	NS
DBP	70.8+/-2.5	72.0+/-2.8	>0.05	NS
MAP	86.7+/-2.4	87.6+/-2.2	>0.05	NS
CVP	6.0+/-1.1	5.9+/-0.9	>0.05	NS

Table 5: Haemodynamic parameters at 10 mins of Induction.

Discussion

Anesthetic induction techniques for cardiovascular surgery are based on considering hemodynamic stability and effects on myocardial oxygen supply and demand.

Various authors have concern regarding induction of anesthesia with agents such as etomidate, thiopentone, propofol, ketamine and midazolam. However, the use of etomidate and propofol has been considered superior to other IV anesthetic agents in these group of patients [5-9].

Selection of inducing agent
Etomidate is a short acting IV anesthetic agent used for the induction of general anesthesia which,has a safe cardiovascular risk profile, and lack of histamine release a rapid onset of action and therefore is less likely to cause a significant drop in BP than other induction agents. It is an ideal induction agent for patients who are hemodynamically unstable.

Propofol is a short-acting, intravenously administered hypnotic agent. Propofol has been proposed to have several mechanisms of action, both through potentiation of GABA receptor activity, thereby slowing the channel-closing time, and also acting as a sodium channel blocker.

Selection of dose for etomidate and propofol induction
Different doses of the two drugs used by Pandey AK, et al. [1] have selected an induction dose of 2 mg/kg for propofol and 0.2 mg/kg for Etomidate for Morel J, et al. [16] study.

Haemodynamic changes
Our findings of intra& inter group comparision as well as baseline & after induction1,3,5 min comparision showed that Etomidate group provided stable haemodynamic parameters at 1,3,5 mins after induction [15,16].

Adverse actions
Various authors have encounter various adverse reactions with both drugs.

In our study, No patient in any group has myoclonus, pain on injection or other adverse reactions, as we have choosen large vein for induction,& induction agent was given slowly.

Limitations

-Unavailability of monitoring of Cardiac output, PCWP, Cardiac index, SVR, PVR during study.
-Unavailability of epinephrine & norepinephrine levels as well as steroid levels.

Conclusion

In nutshell, Etomidate provided more stable hemodynamic induction as compared to propofol in patients for open cardiac surgeries on CPB.

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