 DOI: 10.18231/2394-4994.2016.0012

Propofol or etomidate: Does it genuinely matter for induction in cardiac surgical procedures?

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Abstract

In the present study we compared propofol with etomidate in cardiac surgical procedures, in order to determine suitability of each agent for induction.

Aims: To compare propofol with etomidate with respect to hemodynamic stability during induction of anesthesia.

Settings and design: This prospective randomized study was carried out on 60 patients admitted for open cardiac surgical procedures.

Methods: The patients undergoing elective cardiac surgeries both on pump and off pump surgeries were randomly assigned to one of the two study groups, each group consisting of 30 patients.

Statistical analysis: The observations in both the groups were recorded. Statistical analysis was done using SPSS version 20, student's t test and chi square test.

Results: Fall in heart rate was more in propofol group. Hemodynamic stability was better in etomidate group.

Conclusion: Etomidate is a better agent in cases with limited cardiac reserve when compared to propofol. However both agents can be appropriate for induction of anesthesia in cardiac surgical procedures, if given judiciously.

Keywords: Anesthesia, Propofol, Etomidate, Cardiac surgery

Introduction

The hemodynamic instability and the exaggerated strain response of intubation, which results in myocardial oxygen supply demand mismatch, has made Induction of anaesthesia in patients with coronary artery disease and left ventricular dysfunction a challenging task.(1) Maintenance of myocardial supply demand balance is essential in these patients.

Induction agents like thiopentone, midazolam, propofol and etomidate have been used to anaesthetize patients. Of all the above mentioned agents, etomidate and propofol are usually preferred for induction of anaesthesia for patients undergoing cardiac surgeries.(2,3,4,5,6)

So, this study was done to assess and compare hemodynamic effects of etomidate and propofol for induction in cardiac surgeries.

Materials and Methods

This prospective randomized study was carried out after acquiring approval from institutional ethics committee and taking written Informed consent. Sixty patients, aged 20-60 years, posted for elective cardiac surgeries like coronary artery pass grafting, aortic and mitral valve substitute surgeries were included.

Patients posted for emergency cardiac surgical operation and with difficult airway were excluded from the study. They were divided into 2 groups consisting of 30 patients each randomly by closed envelop technique.

Group A: received propofol as an induction agent.

Group B: received etomidate as an induction agent.

One day prior to the surgery, pre-anesthetic evaluation and relevant investigations were done for all patients. Patients were premedicated with Tablet Ranitidine 50mg orally and Tablet. Diazepam orally 10mg on the preceding night and morning of the surgical procedure. After shifting the patients to the operation theatre and connecting the pulse oximeter and five lead electrocardiogram (ECG), invasive procedures namely peripheral, arterial and central lines were performed prior to the induction of anaesthesia. Cardiac output was measured by thermodilution technique.

The baseline values of HR (heart rate), SpO2 (oxygen saturation), SBP (systolic blood pressure), DBP (diastolic blood pressure), MAP (mean arterial pressure), CVP (central venous pressure), PCWP (pulmonary capillary wedge pressure), CO (cardiac output), CI (cardiac index), SVR (systemic vascular resistance), PVR (pulmonary vascular resistance) were recorded.

After preoxygenation, inj.fentanyl 5 µg/kg, Inj. midazolam 0.05 mg/kg was administered intravenously over one minute. Immediately induction was done with intravenous injection of propofol (1.5 mg/kg) in group A and etomidate (0.2 mg/kg) in group B patients respectively.

HR, SpO2, SBP, DBP, MAP, CVP, PCWP, CO, CI, SVR, PVR were recorded after the loss of eyelash reflex. Muscle relaxant Inj.vecuronium bromide (0.1 mg/kg IV) was given, patients were ventilated with 100% oxygen and 1% sevoflurane for three minutes and then endotracheal intubation was performed using a cuffed PVC tube of appropriate size. HR, SpO2, SBP,

DBP, MAP, CVP, PCWP, CO, CI, PVR and SVR were recorded yet again. Anaesthesia was maintained with inhalational agent sevoflurane and after 5 minutes all parameters were recorded once more.

Observations in both the groups were recorded and tabulated. Baseline values and continuous variables were compared with the usage of independent student's t-test. Statistical evaluation was done with the software program SPSS model 20. A probability value (p value) of <0.05 become was taken as statistically significant.

Results

The goal of our study was to compare hemodynamic variables between the propofol group and the etomidate group at induction and at intubation, which includes the HR, SBP, DBP, MAP, CVP, PCWP, CO, CI, SVR, PVR. (Fig. 1-10)

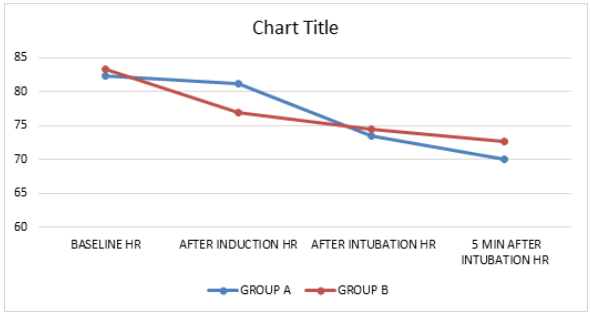


Fig. 1

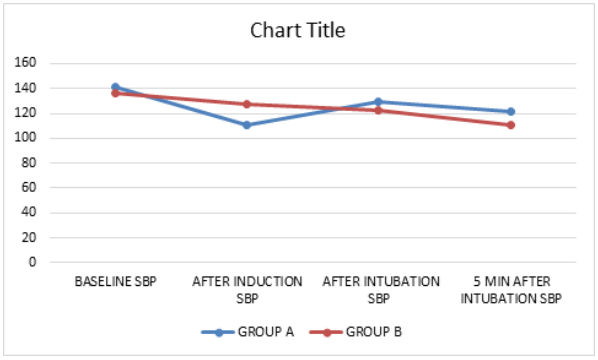
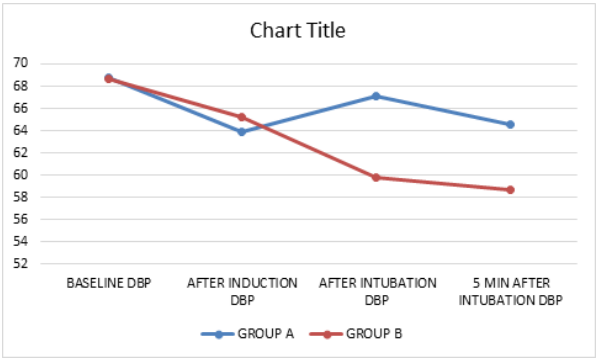


Fig. 2



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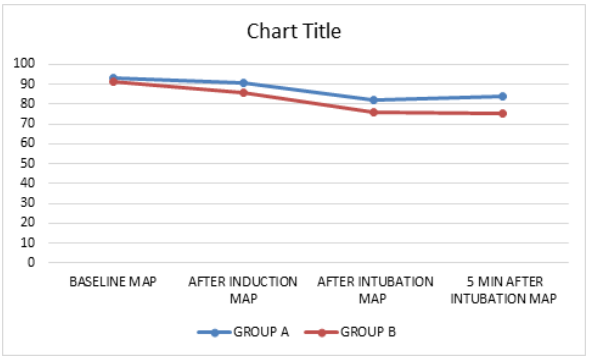

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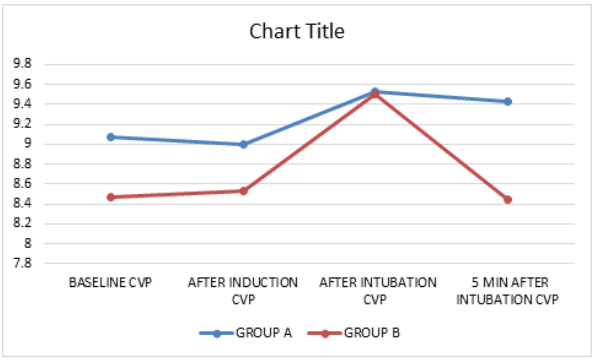

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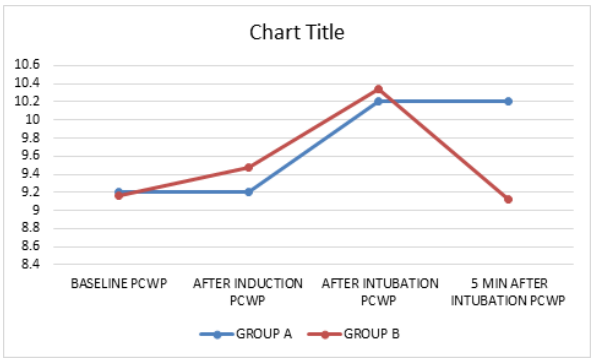

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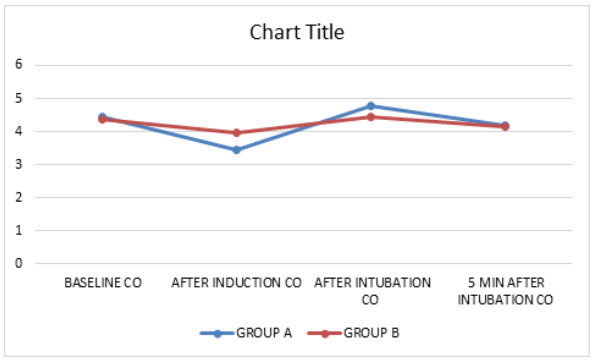

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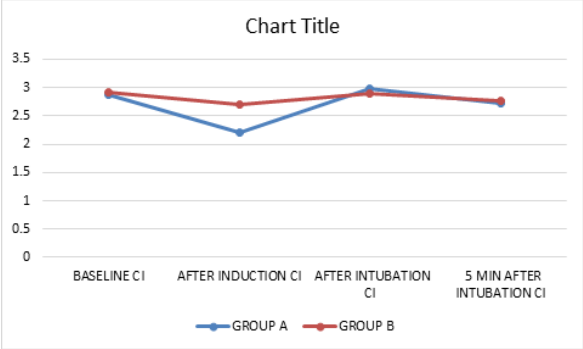
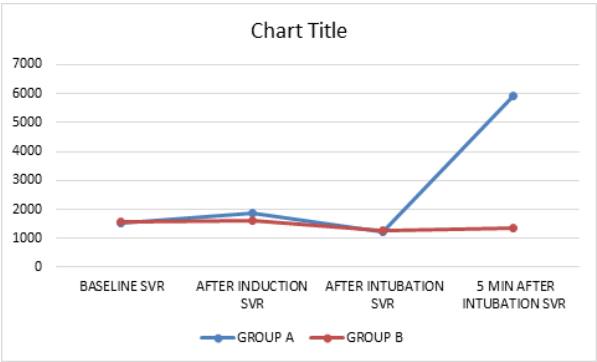


Fig. 8



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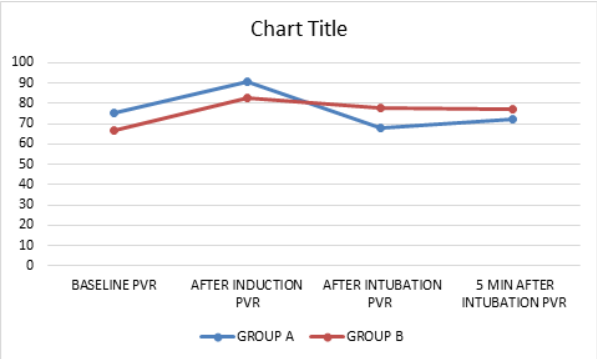

Fig. 10

No significant difference was found between the two groups with respect to demographics and echo findings which was done prior to the surgery. (Table 1)

Table 1: Demographic data

	Group A	Group B
Age (years)	50.3±16.532	44.97±14.946
Sex (male/female)	21/9	15/15
ASA (I/II)	1/15	0/12
ASA (III/ IV)	13/1	14/6
Height (cm)	162.063±9.329	159.506±10.025
Weight (kg)	57.67±10.768	53.22±11.042
ECHO (EF)	57.5±6.917	55.31±8.975
BSA	1.742±0.308	1.598±0.369

Difference in Baseline parameters of HR, SAP, PAP, PCWP, CVP, CO, CI, SVR and PVR between the two groups was found to be statistically insignificant. (Table 2)

Table 2: Baseline Haemodynamic parameters

	Group A	Group B
HR	82.37±24.841	83.34±21.815
SBP	140.87±26.452	136.28±32.169
DBP	68.77±17.387	68.69±16.247
MAP	92.97±19.904	91.38±19.779
CO	4.44±0.41	4.36±0.85
CI	2.88±0.424	2.91±0.710
SVR	1517.275±376.40	1586.966±486.25
PVR	75.246±12.738	66.993±25.063
CVP	9.07±3.172	8.47±2.724
PCWP	9.2±3.022	9.16±2.83

There was higher heart rate after induction in propofol group and after intubation in etomidate group, though it was not statistically significant.

Following induction, there was a fall in SBP, MAP, CO and CI in propofol group which was statistically significant as compared to etomidate group. There was no vast difference in DBP, CVP, PCWP, SVR and PVR between the 2 groups.

Following intubation, there was increase in DBP, CO and CI in propofol group which was statistically significant (p value of <0.05) compared to that in etomidate group. There was a statistically significant increase in the PVR in etomidate group. There was no significant difference in SBP, MAP, CVP, PCWP and SVR between the two groups.

Five minutes post intubation, there was increase in MAP, CVP and PCWP in propofol group which was statistically significant, and however, there was no difference in heart rate, SBP, DBP, CO, CI, SVR and PVR.

In our study none of the patients developed myoclonus in either of the two groups following induction and 8 patients had pain on injection following administration of propofol.

Discussion

It is an established fact that induction with anaesthetic agents has deleterious effects on hemodynamic in patients with coronary artery disease and special precautions have to be taken. Induction of general anesthesia is challenging during CABG and valve replacement surgery. The most important concern is not to cause myocardial oxygen supply and demand mismatch during induction of anaesthesia especially in presence of LV dysfunction.[1]

A wide variety of anaesthetic agents can be safely used in patients presenting for cardiac surgery. However etomidate and propofol have been found to be

superior induction agents in cardiac patients in the presence of left ventricular dysfunction.[7]

Propofol is an alkylphenol by-product with rapid onset and short duration of action when given intravenously. The mechanism of action is potentiating GABA receptor activity and also it acts as a sodium channel blocker. The advocated induction dose for propofol is 1.5-2.5mg/kg.[7] It usually causes reduction in systemic vascular resistance and arterial pressure by 15% to 40% after intravenous induction with 2mg/kg.[7] It can cause direct myocardial depression at doses above 0.75mg/kg.[7]

Etomidate is a carboxylated immidazole derivative which has rapid onset and brief period of action. Etomidate has very stable cardiovascular profile and is usually recommended for induction in patients with poor left ventricular reserve. The recommended dose for induction is 0.2-0.3mg/kg.[7] But it suppresses corticosteroid synthesis leading to suppression of the adrenals but it is nearly always limited to 24 hours.([8,9]

Numerous authors have used exceptional dosages of propofol and etomidate as induction drugs in patients undergoing cardiovascular surgical procedures.[1,2,10,11] Due to the fact that, we have given 5 µg/kg of fentanyl and 0.05 mg/kg of midazolam before induction with the study drug in contrast to the above studies, we decided on the lower most induction dose of 1.5 mg/kg for propofol and 0.2 mg/kg for etomidate in our study.

We did not monitor serum cortisol levels in our patients since many studies have proved that reduction in serum cortisol levels due to etomidate does not last for more than 24 hours.[9,10,12]

In our study, we observed that the demographic records were comparable between the two groups. We monitored HR, SBP, DBP, MAP, CO, CI, SVR, PVR, CVP and PCWP before induction, after induction and 5 minutes post induction among the two groups. We found that baseline parameters were comparable between the two groups. After induction there was significant fall in BP and cardiac output and cardiac index in propofol group. After intubation there was significant increase in DBP, CO and CI in propofol group. Five minutes after intubation there was increase in MAP in propofol group. There were no significant fluctuations in hemodynamic parameters in etomidate group at any time from induction till post intubation period.

Haessler R et al.[11] studied the hemodynamic effects of propofol and etomidate in patients with coronary artery disease. They observed that after induction, there was a decrease in arterial pressure and CI in both groups. Also there was a decrease in SVR in patients on propofol, and an increase in SVR and arterial pressure in patients on etomidate. HR decreased in both groups. After intubation, arterial pressure and heart rate were increased in both groups. They concluded that propofol causes a reduction in arterial pressure by 30% due to decrease in after load. Our study found that there was a significant fall in arterial pressure, CI and CO only in propofol group and no sizable change in SVR in either of the groups.

Singh R et al.[1] studied the hemodynamic effects thiopentone, midazolam, propofol, and etomidate in patients with coronary artery disease with decreased left ventricular function. They observed that there was a significant decrease in the variables compared to the baseline such as the HR, MAP, CI, and stroke volume index after induction in all these agents. They concluded that though all the above agents were suitable for induction in patients with coronary artery disease and left ventricular dysfunction, knowledge of potential drug interactions especially with prior opioid administration and clinical experience are very helpful in determining the hemodynamic stability during anesthetic induction.

A prospective, randomized study comparing the effects on hemodynamic and endocrine response following induction with either etomidate or propofol in patients undergoing cardiac surgery was conducted by Kaushal et al. They found no significant difference in HR, CVP and PCWP between the groups. There was significant decrease in SBP, DBP, MAP and CO in propofol group after induction, after intubation and 5 min post intubation. Myoclonus was not reported in any patients. They concluded that etomidate does not alter the hemodynamic parameters when used for induction of anesthesia when compared with propofol in patients with poor left ventricular function. They also found that in etomidate group serum cortisol levels were reduced but returned to normal within 24 hours without untoward effects.[9]

A study by Shivanna et al. showed that when compared to propofol, the hemodynamic parameters of patients undergoing coronary artery surgical operation were well maintained after induction with etomidate. They concluded that etomidate offers advanced hemodynamic stability all through induction.[7]

In a study comparing the consequences of etomidate and propofol induction on hemodynamic stability among patients undergoing coronary artery surgery on cardiopulmonary bypass, Anil et al. noted that the SBP, DBP and SVR were substantially decreased at five minutes post induction in the propofol group. They found that hemodynamics was more stable on induction with etomidate. Also there was no cortisol suppression lasting for more than twenty-four hours with ethomidate. Propofol required titration of dosage for countering the sudden decrease in hemodynamic parameters. Our study also has similar findings.

Conclusion

Etomidate has favorable hemodynamic profile when compared to propofol for induction in cardiac surgical procedures. However both are safe induction agents if used judiciously.

References

1. Singh R, Choudhury M, Kapoor PM, Kiran U. A randomized trial of anesthetic induction agents in patients with coronary artery disease and left ventricular dysfunction. Annals of Cardiac Anaesthesia 2010.13(3):217-23.
2. Bendel S, Ruokonen E, Polonen, Uusaro A. Propofol causes more hypotension than etomidate in patients with severe aortic stenosis: A double-blind, randomized study comparing propofol and etomidate. Acta Anaesthesiol Scand. 2007.51:284-9.
3. Boer F, Ros P, Bovill JG, Van BP, Van der KJ. Effect of propofol on peripheral vascular resistance during cardiopulmonary bypass. Br. J. Anaesth. 1990.65:184-9.
4. Ebert TJ, Muzi M, Berens R, Goff D, Kampine JP. Sympathetic responses to induction of anesthesia in humans with propofol or etomidate. Anesthesiology. 1992.76:725-33.
5. Hosten T, Solak M, Kilickan L, Ozdamar D, Toker K. The effects of etomidate and propofol induction on hemodynamic and endocrine responses in patients undergoing CABG surgery. Balkan Med J. 2007.24:114-26.
6. Gooding JM, Weng JT, Smith RA, Berninger GT, Kirby RR. Cardiovascular and pulmonary responses following etomidate induction of anesthesia in patients with demonstrated cardiac disease. Anesth Analg. 1979.58:40-1.
7. Shivanna S, Priye S, Jagannath S, Kadli C, Subhash V, Reddy D. A comparative study of hemodynamic effects of etomidate and propofol as an induction agent in coronary artery surgery. J. Evolution Med. Dent. Sci. 2012.4(4):598-607.
8. Karki G, Singh V, Barnwal A, Singh L. A comparative evaluation of hemodynamic characteristics of the three induction agents –etomidate, thiopentone and propofol. J. Evolution Med. Dent. Sci. 2014.3(34):9133-41.
9. Kaushal RP, Vatal A, Pathak R. Effects of etomidate and propofol induction on hemodynamic and endocrine response in patients undergoing coronary artery bypass grafting/ mitral valve and aortic valve replacement surgery on cardiopulmonary bypass. Annals of Cardiac Anesthesia. 2015.18(2):172-8.
10. Pandey A, Makhija N, Chauhan S, Das S, Kiran U, Bisoi KA, et al. The effects of etomidate and propofol induction on hemodynamic and endocrine response in patients undergoing coronary artery bypass graft surgery on cardiopulmonary bypass. World Journal of Cardiovascular Surgery 2012.2:48-53.
11. Haessler R, Madler C, Klasing S, Schwender D, Peter K. Propofol/fentanyl versus etomidate/fentanyl for the induction of anaesthesia in patients with aortic insufficiency and coronary artery disease. J Cardiothorac Vasc Anesth. 1992.6:173–80.
12. Umbarkar S, Verma AK, Sarkar M, Garasia M. The effects of single induction dose of etomidate on stress response in adult cardiac vascular surgeries with cardiopulmonary bypass. Bombay Hospital Journal. 2015.57(1):15-20.