

A Comparative Study between Isoflurane and Propofol in Fast Track Cardiac Anaesthesia for Patients Undergoing Coronary Artery Bypass Grafting.

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Abstract

Introduction

Fast tracking is an early tracheal extubation of patients after cardiac surgery i.e within 4 hours. It helps in early recovery and discharge from ICU. In this study Propofol and Isoflurane were compared as a maintenance agent for patients undergoing coronary artery bypass grafting (CABG).

Method

Around 100 patients posted for elective CABG surgery were included in the study after approval from the hospital ethical committee. A randomized controlled, prospective study was conducted. In one group Isoflurane and in the other group Propofol was used for maintenance of anaesthesia and rest of the technique was similar in both the groups. Data was analyzed using epi-info 6 statistical software. Statistical tests used were Mann-Whitney or Wilcoxon Two-Sample Test (Kruskal-Wallis test for two groups).

Result

On analysis no significant variation in haemodynamics was observed from baseline data. Statistically significant differences were observed in Isoflurane vs Propofol group regarding tidal volume (413.5 ± 90.4 ml vs 460.4 ± 83.7 ml ($P < 0.01$), Eye Opening (82.9 ± 11.6 min vs 10.9 ± 1.5 ($P < 0.01$), Response to Verbal Commands (112.9 ± 17.5 min vs 16.5 ± 2.3 ($P < 0.01$), extubation time (140.6 ± 18.9 min vs 21.3 ± 3.2 ($P < 0.01$) after reversal and hence fast tracking was better in Propofol group as compare to Isoflurane.

Conclusion

Fast track anaesthesia using potent and short acting narcotics combined with short acting anaesthetics facilitates early extubation as compared to conventional anaesthetic techniques.

Keywords

Fast tracking, Coronary artery bypass grafting, Extubation

INTRODUCTION

Dr. John Gibbon of Philadelphia performed the first successful intracardiac operation with the aid of heart lung machine on 6th May 1953. Initially patients were kept on ventilatory support for days altogether contrary to practice of fast tracking, which is quite a practice nowadays. First time early extubation was carried out as early as in 1983 by Christopher Aps and was described as fast tracking in 1985. It is possible as a result of

aggressive intraoperative management leading to improved postoperative status, reduction in requirement of cardiorespiratory support and good intensive care unit facilities [2].

Fast track anaesthesia using potent and short acting narcotics combined with short acting anaesthetics might be a good option to facilitate early tracheal extubation as compared to conventional fast track anaesthetic techniques using morphine, thiopentone and isoflurane provided haemodynamic stability is maintained. Morbidity and mortality have not been shown to be affected by early extubation. In this randomized controlled trial Propofol and Isoflurane were used a maintenance agent and were compared for haemodynamic stability and early extubation.

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Material and Methods

A randomized, double blinded study was carried out with total of 100 adults of age less than 65 years of both sexes. These patients were posted for routine elective coronary artery bypass grafting surgery. Patients who were undergoing combined coronary artery bypass grafting with valvular replacement, on inotropes prior to surgery, on mechanical ventilation prior to surgery, with Pre existing left bundle branch block, Pacemaker in situ, history of chronic obstructive airway disease and with hepatic and renal impairment were excluded from the study. The patients who received more than three grafts and in whom aortic cross clamp time exceeded more than 100 minutes were also excluded from the study.

After informed written consent from patients and approval of Hospital ethical committee, selection of patients was done. The patients were randomly divided into two groups by computer generation. Group A consisting of 50 patients were the control group where conventional fast track technique was used with Isoflurane as maintenance anaesthetic agent and Group B consisting of 50 patients was the study group where maintenance of anaesthesia was done with Propofol. Premedication, induction and muscle relaxant used for securing endotracheal intubation was standardized in both the groups.

All patients were premedicated with tab larpose 2mg HS and 2 hours prior to the surgery. All patients were advised to take all preoperative cardiac drugs and other drugs (if any), with a sip of water on morning of the surgery. The diabetics were advised not to consume antidiabetics on the morning of surgery since they were fasting overnight.

On arrival in the operation theatre, all patients were connected to 5 lead ECG, pulse oximetry and pre oxygenated with 100% oxygen for at least three minutes. Base line heart rate, non-invasive blood pressure and SpO₂ were recorded. Venous access was obtained with a 16 gauge or 18 gauge cannula under local anaesthesia with a fine 26 gauge needle. Radial artery was cannulated with 20 gauge arterial cannula after infiltrating with local anaesthesia and was used for measuring invasive blood pressure.

Patients in both the groups were administered morphine 0.15 mg/kg intravenously on the operation table. Both the groups were induced with Thiopentone 3 to 5 mg/kg (or till loss of eyelash reflex). Xylocard 1mg/kg was given 1 minute before intubation and intubation was done with vecuronium 0.15 mg/kg in both the groups.

In **Group A** patients, anaesthesia was maintained with

oxygen, air and Isoflurane at the concentration of 0.8 % to 1.0% and in **Group B** with oxygen, air and Propofol infusion at the rate of 5 mg/kg/hour. Right internal jugular vein was cannulated and pulmonary artery catheter was passed through it. Before sternotomy morphine 3 mg intravenous stat was given in both the groups as a standard protocol.

During cardiopulmonary bypass, a warm heart surgery was performed and the core body temperature was not allowed to drift more than 1°C. The same cardioplegic solutions and priming fluids were used in both the groups. **Group A** patients were maintained with Isoflurane at the concentration of 0.8% to 1.0% and in **Group B** with Propofol at the rate of 3 mg/kg/hour which continued till the end of the surgery.

During the surgery, before and after cardiopulmonary bypass, mechanical ventilation was adjusted to maintain end tidal carbon dioxide between 30 to 35 mm Hg. The Isoflurane inhalation and Propofol infusion were stopped when the skin closure was done by the surgeon. This was followed by giving reversal with neostigmine 50 µg/kg and glycopyrrolate 10 µg/kg. The patients in the isoflurane group were electively ventilated in the ICU till the time they met the extubation criteria.

Invasive Blood Pressure, Heart Rate and SpO₂ were monitored before and after cardiopulmonary bypass. These were determined 1 minute before intubation, 1 minute and 5 minutes after intubation. Then continuous monitoring was done of all these parameters along with central venous pressure and pulmonary artery pressure.

The extubation criteria used for fast tracking were respiratory and cardiac parameters. The respiratory parameters were end tidal carbon dioxide to be less than 45 mm of Hg, SpO₂ to be between 95 to 100%, minimal tidal volume of 5ml/kg and respiratory rate less than 25 per minute. Cardiac parameters were heart rate to be within 10% of base line levels and invasive blood pressure to be within 10% of base line levels.

The data obtained was subjected to one way analysis of variance with multiple range tests to see the significant pairs. The t test, paired t test were used for statistical analysis. The two-way analysis of variance to see the change over the period of time. The Chi-square test was used for non-parametric data. P< 0.05 was regarded as significant.

Result

Analysis of collected data was done to compare the results in term of haemodynamic impact and early extubation, in Isoflurane versus Propofol when used as anaesthetic agent.

Table 1: Depicts number of patients in demographic characteristics, pre-operatively consuming antianginal, antihypertensive drugs, pre-operative ejection fraction of the patients in the Isoflurane and Propofol group

	Group A (Isoflurane)	Group B (Propofol)
Age (yrs)	54.8 ± 6.1	54.7 ± 4.7
Wt (kg)	64.0 ± 11.9	64.4 ± 8.0
Gender - Male	26	24
Gender - Female	24	26
Nitrates	43	45
β Blockers	26	25
Ca channel blockers	44	45
ACE inhibitors	15	15
Ejection Fraction	0.50 ± 0.04	0.50 ± 0.05

Regarding demographic profile of 100 patients selected for study on analysis of patients in term of age, gender ratio, drug intake and ejection fraction there was no significant inter group variation noticed $P > 0.05$ (ref Table1)

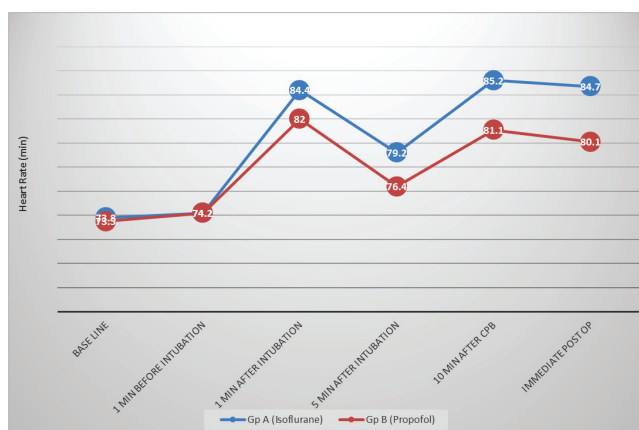


Fig. 1: Line diagram showing the trends in heart rate during intubation, cardiopulmonary bypass and immediate post operative period.

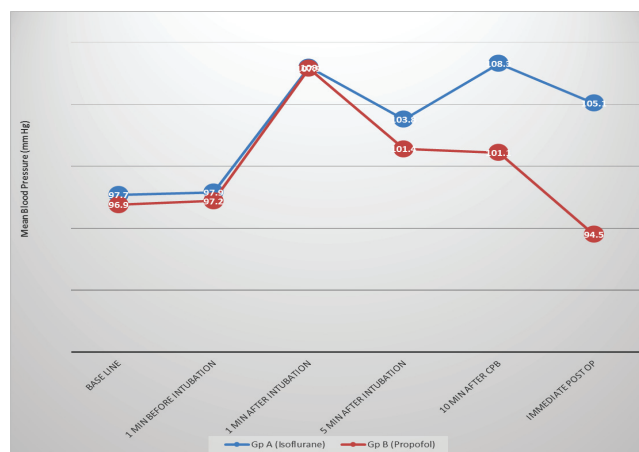


Fig. 2: Line diagram: Showing the trends in mean blood pressure during intubation, cardiopulmonary bypass and immediate post operative period.

Table-2 : Heart rate, Mean PAP, Mean Blood Pressure and CVP (cm of H₂O) changes in the Isoflurane and Propofol groups during intubation, CPB and post operative period. {Mean (SD)}

Variable	Time	Group A	Group B	P Value
Heart Rate	Baseline	73.8 ± 7.3	73.5 ± 8.0	0.83
	1 min before intubation	74.2 ± 7.4	74.2 ± 8.1	0.98
	1 min after intubation	84.4 ± 7.9	82.0 ± 8.2	0.14
	5 min after intubation	79.2 ± 8.0	76.4 ± 8.6	0.10
	10 min after CPB	85.1 ± 7.5	81.1 ± 7.6	0.01*
	Post Op	84.7 ± 8.3	80.1 ± 8.4	0.00*
Mean BP	Baseline	97.7 ± 8.4	96.9 ± 7.2	0.60
	1 min before intubation	97.9 ± 8.6	97.2 ± 7.3	0.65
	1 min after intubation	108.0 ± 9.6	107.9 ± 9.1	0.98
	5 min after intubation	103.8 ± 8.6	101.4 ± 6.7	0.11
	10 min after CPB	108.3 ± 9.4	100.1 ± 6.8	0.00*
	Post Op	105.1 ± 11	94.5 ± 9.5	0.00*
Mean PAP	5 min after intubation	23.4 ± 2.1	23.0 ± 2.7	0.42
	10 min after CPB	23.6 ± 2.1	23.4 ± 2.4	0.40
	Post Op	23.9 ± 1.8	23.4 ± 2.5	0.40
CVP (cm H ₂ O)	5 min after intubation	12.1 ± 1.4	11.9 ± 1.9	0.44
	10 min after CPB	12.2 ± 1.5	12.0 ± 1.7	0.14
	Post Op	12.3 ± 1.4	12.0 ± 1.7	0.26

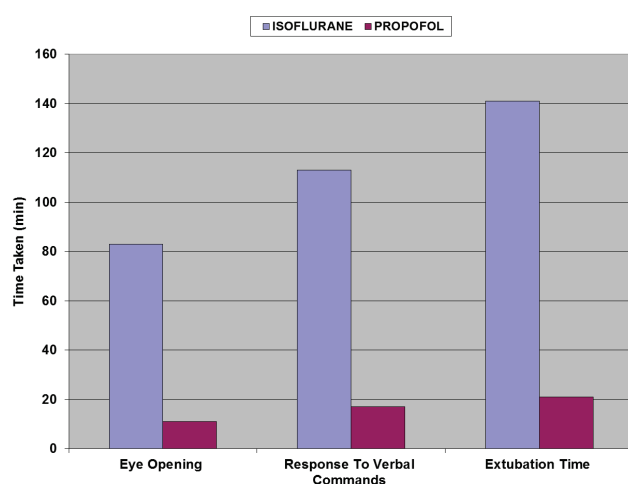
During cardiac surgery, analysis of intraoperative monitoring showed significant difference among both groups regarding Heart rate, Mean BP, Mean PAP and CVP. Refer Table No 2. ($p > 0.05$)

There was no significant difference among both groups regarding duration of surgery, cardiopulmonary bypass, duration of application of cross clamp on aorta and number of grafts used in both groups. (Refer Table No 3 ($p > 0.05$))

As shown in Table No 4 and Fig no 1, post cardiac surgery significant difference was observed in tidal volume at the end of the surgery after giving reversal ($413.5 ± 90.4$ ml)

Table 3: Duration of surgery, CPB and aortic cross clamp in both Isoflurane and Propofol groups. {Mean (SD)}

	Group A (Isoflurane)	GroupB Propofol)	p Value
Duration of Surgery (min)	180 ± 15.1	178 ± 13.5	0.74
Duration of CPB (min)	65 ± 8.0	64 ± 7.7	0.86
Duration of cross clamp (min)	71 ± 4.0	70 ± 3.9	0.90
Number of grafts	2.5 ± 0.5	2.5 ± 0.5	1.0
Tidal Volume at the end of the surgery after giving reversal (ml)	413.5 ± 90.4	460.4 ± 83.7	0.01*

**Table 4 :** Post cardiac surgery significant difference

	GROUP A (ISOFLURANE)	GROUP B (PROPOFOL)	p VALUE
Eye Opening (Min)	82.9 ± 11.6	10.9 ± 1.5	0.01*
Response to Verbal Commands (Min)	112.9 ± 17.5	16.5 ± 2.3	0.01*
Extubation Time (Min)	140.6 ± 18.9	21.3 ± 3.2	0.01*

in Isoflurane group whereas it was more in Propofol group (460.4 ± 83.7 ml) (p < 0.01). Eye Opening on command was 82.9 ± 11.6 minutes in Isoflurane group whereas it was much quicker in Propofol group (10.9 ± 1.5 minutes) (p < 0.01). Response to Verbal Commands was 112.9 ± 17.5 minutes in Isoflurane group whereas it was much less in Propofol group (16.5 ± 2.3 minutes) (p < 0.01) and post surgery extubation time was 140.6 ± 18.9 minutes in Isoflurane group whereas it was much early in propofol around 21.3 ± 3.2 minutes (p < 0.01). These all results indicate that for fast tracking Propofol is better than Isoflurane as maintenance agent in cardiac surgery.

Discussion

Cheng et al. defined fast tracking as a perioperative anaesthetic management that aims to facilitate tracheal extubation of patients within 1-6 hr after cardiac surgery,

although most centres consider fast-track extubation up to 8-10 hr postoperative [1].

But how safe is early extubation and how early is early? Various studies support that extubation can be safely attempted after coronary artery bypass grafting (CABG) in the operating room with the use of modified anaesthesia technique and with minimum adverse effects [3].

The term Ultra Fast Track Anaesthesia (UFTA) technique was coined by Djaiani et al which provides adequate haemodynamic control and facilitates operating room extubation [4].

Various studies debate, approach of extubation in operating room and risks vs cost saving benefits and strongly felt that secured airway is desirable in the event of excessive mediastinal bleeding requiring re-exploration, difficult intubation or any condition predicting prolonged ventilation. First hour after extubation is most crucial in respiratory care as reflected by apnea index and does not justify operating room extubation. They enumerated predictors of prolonged intubation as intraoperative and postoperative complications, decreased FEV1%, decreased cardiac index, use of temporary pacemaker, early hemodynamic instability, age > 75 years, use of intra aortic balloon pump, female sex and arrhythmias [3,5].

Also there is increasing evidence that prolonged respiratory support does not improve patient outcome, and may actually increase the incidence of postoperative cardiac morbidity. Montes et al showed operating room extubation did not provide any benefit compared to extubation 1-6 hours later and felt that the risk of pushing the limit to extubate on pump CABG patient in operating room outweighs the potential marginal gain [6].

Studies have observed the successful use of Propofol in patients undergoing coronary artery bypass grafting and thus helping in fast tracking. Propofol is a rapid and short acting intravenous anaesthetic agent. It can be used for maintenance of anaesthesia and can be an alternative to volatile anaesthetic agents for cardiac surgery. The major benefit of Propofol when compared with Isoflurane, an inhalational agent during maintenance of anaesthesia in CABG is associated with shorter recovery time, leading to reduction in time to tracheal extubation. Several workers have studied the use of Propofol in fast tracking in patients undergoing coronary artery bypass grafting. Propofol anaesthesia helps in preventing nausea and vomiting, has less endocrine response and has better cerebral protection [7].

Various anaesthetic agents have been tried in fast tracking of patients undergoing cardiac surgery. In most studies,

Propofol has been tried with different agents in different combination and dosages viz ketamine, dexmedetomidine, short acting opioids like fentanyl, alfentanil, sufentanil, remifentanil versus thiopental, enflurane, isoflurane and large dose fentanyl. They concluded that these combinations have similar incidence of pre cardiopulmonary bypass hypotension and ischaemia, a decreased need for inotropes after cardiopulmonary bypass and early time to tracheal extubation, reduced incidence of myocardial infarction compared with controls. It was seen that propofol was able to block the sympathetic responses to surgical stimulation when combined with the suitable analgesic. Effects of propofol infusion on the stress response in patients undergoing coronary artery bypass grafting surgery shown significantly reduced blood levels of cortisol, adrenaline and noradrenaline. Also the amount of sodium nitroprusside used during cardiopulmonary bypass was significantly reduced. Induction of anaesthesia was associated with significant decreases in systolic and diastolic pressures, systemic vascular resistance and left ventricular stroke work index [3,5,8].

LVF impairment is not an important factor to be considered in the timing of postoperative extubation after fast track cardiac surgery. Only age, intraoperative inotropic use and intra-aortic balloon pump (IABP) and postoperative rapid atrial arrhythmias were found to be independent predictors of failing to meet extubation criteria.

Propofol strongly attenuates lipid peroxidation during coronary artery bypass grafting surgery. Propofol can scavenge free radicals because it has a chemical structure similar to antioxidants. Although around 0.3% incidence of awareness was reported during fast track cardiac anaesthesia using low dose narcotics combined with short acting anaesthetic and sedative agents. Preoperative education, respiratory training and active physical training from postoperative day one, in patients undergoing coronary artery bypass grafting can safely allow extubation in 1 - 2 hours in most patients [8,9].

It was observed postoperative acute physiology status was a powerful predictor of morbidity. Use of epidural and intrathecal analgesia techniques versus conventional parenteral opioids allow early weaning from mechanical ventilation but may not affect hospital discharge time. High thoracic epidural analgesia provides good haemodynamic stability and recovery characteristics when used for induction and maintenance of anaesthesia during elective coronary artery bypass grafting surgery [10].

Patients receiving propofol based anaesthesia in coronary artery bypass grafting surgery, recovers faster compare to volatile agents, hence early extubation is possible than traditional method when inhalational based anaesthesia, IV thiopental and large dose opioids. It also reported minimum

haemodynamic adverse effects, hence is a good agent for fast track anaesthesia as shown in this study also [7,9,10].

Conclusion

Propofol can be used safely in patients undergoing coronary artery bypass grafting surgery for maintenance of anaesthesia in the dose of 5 mg/kg/hr before cardiopulmonary bypass and 3 mg/kg/hr during and after cardiopulmonary bypass along with opioids. Propofol maintains haemodynamic stability, lesser risk of perioperative myocardial ischaemia when compared with isoflurane. Recovery with propofol was better with earlier extubation and discharge from ICU, hence substantial cost benefits [1,7,10].

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