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### COMPARISON OF HEMODYNAMIC CHANGES DURING INDUCTION WITH MODIFIED PROPOFOL PROTOCOL IN NORMAL AND LOW LV FUNCTION PATIENTS UNDERGOING CABG SURGERY

Gaurav Goyal<sup>1</sup>, Murtaza A. Chishti<sup>2</sup>, Kushwath K. K<sup>3</sup>, Premraj Nagarwal<sup>4</sup>, Varun Chhabra<sup>5</sup>, Ajay Meena<sup>6</sup>

#### HOW TO CITE THIS ARTICLE:

Gaurav Goyal, Murtaza A. Chishti, Kushwath K. K, Premraj Nagarwal, Varun Chhabra, Ajay Meena. "Comparison of Hemodynamic Changes during Induction with Modified Propofol Protocol in Normal and Low LV Function Patients Undergoing CABG Surgery". Journal of Evidence based Medicine and Healthcare; Volume 2, Issue 40, October 05, 2015; Page: 6806-6812, DOI: 10.18410/jebmh/2015/928

**ABSTRACT:** Numerous studies suggested that propofol anesthesia is intuitively appealing for its simplicity, stability and safety, permitting the rapid recovery of patients undergoing cardiac surgery. However, its use for induction of anesthesia is often results in transient hypotension. The aim of this study was to determine the safety of modified propofol protocol for induction in low ejection fraction cardiac patients undergoing CABG surgery. Fifty patients with ejection fraction between 30% - 60% who were planned for coronary artery bypass graft surgery were included in this study. Patients were divided into two groups of 25 patients each, according to their left ventricular ejection fractions (EF). Group N (EF between 60%-45%) and Group L (EF between 30%-45%). All the patients were given midazolam/fentanyl/vecuronium and propofol for induction according to pre-defined protocol to prevent hypotension and facilitate early intubation. Hemodynamic variables were registered at fixed points. To prevent hemodynamic compromised situation rescue noradrenaline in 5µg/ml aliquots was kept ready. Amount of propofol used, time taken for successful intubation and grading of jaw relaxation was also done. **RESULTS:** Four patients in Group L and one patients in Group N encountered significant hypotension (>20% of preoperative value). Amount of vasoconstriction agents used were high in group L. Cardiac index was changed 17.4% from preoperative value and returned to baseline values within 6 min in group L while in group N cardiac index was changed 12.9% from preoperative value and also returned to baseline values within 6 min. Propofol 0.5-1 mg/kg was used to induce hypnosis and all patients were intubated in less than ninety seconds. **CONCLUSION:** Propofol as induction agent is safe in both low and normal ejection fraction cardiac patients when used judiciously and in titrated doses. Immediate changes in hemodynamic changes can be corrected with mild doses of vasoconstriction agents. **BACKGROUND:** Total intravenous anesthesia with propofol and low-dose opioids for CABG surgery is now commonly used and is one of the methods that allows early extubation. Fixed dose propofol induction may cause hypotension for about 5–10 min, which is mainly due to the decrease in sympathetic activity and direct vascular smooth muscle relaxation without any direct negative inotropic effect.<sup>1</sup> Even minor haemodynamic changes during induction may lead to severe circulatory problem in patients posted for CABG surgery. This effect is more profound in patients with low left ventricular ejection fraction. Therefore propofol is not routinely used as sole induction agent in that situation. Modified induction technique judicious doses of propofol along with rescue vasopressor agent was described in literature for non-coronary artery cardiac surgery.<sup>2</sup> Preoperative optimization of intravascular fluid status, trendelenburg position

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and slow titrated dose of induction agents are the some strategies to prevent acute hemodynamic changes during anesthesia induction. We have designed noval protocol for anesthesia induction with propofol and using it routinely for our cardiac patients successfully. In current study we had compared hemodynamic changes during modified propofol induction in two different LV function groups undergoing coronary artery bypass grafting (CABG) surgery.

**KEYWORDS:** Propofol, Hemodynamic changes during induction, Low LV function.

**INTRODUCTION: MATERIALS AND METHODS:** After approval from the institutional ethics committee and written informed consent from the patients, this study was conducted on 50 patients with coronary artery disease having left ventricular ejection fraction between 30% to 60%.

Patients were divided into two groups: group N (ejection fraction 60%-45%), and group L (ejection fraction 45%-30%). Patients with anticipated difficult intubation, associated heart disease, combine procedures, cardiac failure, on mechanical ventilation, IABP, emergency surgery and those with severe systemic non-cardiac disease were excluded from the study. All preoperative cardiac medications were continued till the morning of the surgery. All the patients received oral clonazepam 0.5 mg on the night before surgery.

Initial monitoring inside the operation theater included five lead electrocardiograms, NIBP and pulse oximetry. Under local anesthesia an arterial line was placed in the femoral artery and pulmonary artery catheter with central venous line was inserted in the right internal jugular vein. Base line values ( $T_{base}$ ) of vital parameters, cardiac index (CI), stroke volume (SV), stroke volume index (SVI), and stroke volume variation (SVV) were recorded. Intravenous crystalloid fluid was given before induction of general anesthesia when the baseline PAOP < 10 mmHg and/or CVP < 8mmHg.

Intravenous fentanyl 5 mcg/Kg was then administered over a period of one minute to all patients.

As fentanyl takes 5-7 minutes for its plasma concentration to equilibrate with that of brain concentration, we waited for 5 minutes after giving inj. fentanyl. Nasal oxygen cannula with oxygen flow rate of 2l/min was attached. After a period of five minutes, the  $T_{ind}$  data in the form of heart rate, systolic, diastolic, and mean systemic arterial pressures and CI were recorded in all the patients. Subsequently, nasal cannula was removed and general anesthesia was induced with intravenous vecuronium 0.2mg/kg and midazolam 0.05 mg/kg and propofol 10 mg every 10 seconds till lack of response to verbal command was documented. All the vital parameters were recorded by independent observer now onwards every 2 minutes and were allowed to use rescue nordrenalline 5µg/ml aliquots for significant (more than 20% of basal) drop in vital parameters. Patient's ventilation was supported with bag - mask and with achievement of good jaw relaxation, tracheal intubation was attempted. Intubation condition and quality of induction of anesthesia was assessed and graded as described by gore et al<sup>3</sup> (table 1). The response to laryngoscopy and tracheal intubation was recorded along with hemodynamic data every two minutes up to ten minutes after intubation( $T_2$ ,  $T_4$ ,  $T_6$ ,  $T_8$  and  $T_{10}$ ), which was the end point of the study. Throughout this period the lungs were mechanically ventilated with 50% air-oxygen mixture, to maintain an end-tidal carbon dioxide between 30 and 40mmHg.

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Patient characteristics and hemodynamic variables are expressed as a mean (standard deviation). Data were analyzed using the SPSS software (SPSS version 15; SPSS, Chicago, IL).

**RESULTS:** Both the groups were comparable in terms of demographic data (Table 2). All patients of both the groups completed the study without adverse event. Patient characteristics including age, sex, weight and BSA were similar in two groups. There was statistical significant difference in amount of propofol used during induction (group N 64.2 ( $\pm 7.8$ ) mg, group L 51.7 ( $\pm 9.6$ ) mg) without any significant difference in intubation time. Intubation status was satisfactory in majority of patients. Only one patient in group N and three patients in group L had intubation assessment scores of more than seven which is significant. Time for attempted intubation was not different in two groups but amount of propofol used was significantly less than group N. To maintain hemodynamics four patients in group L and one patient in group N needed rescue noradrenaline 5 $\mu$  bolus.

Heart rate (HR) and blood pressure changes during  $T_{base}$ ,  $T_{ind}$ ,  $T_2$ ,  $T_4$ ,  $T_6$ ,  $T_8$  and  $T_{10}$  were remained within physiological range. Heart rate was maximally increased from base line values at  $T_2$  (6%) in group N during intra-group comparison and in group L there was less than 10% change in heart rate during study period. There was only minimal statistical significant change during intergroup comparison.

Mean arterial blood pressure (MAP) changes were significant during intra group comparison most of the times ( $T_{base}$ ,  $T_{ind}$ ,  $T_2$ ,  $T_4$ ,  $T_6$ , and  $T_{10}$ ) but maximal change from base line was 24.4% in group N at  $T_8$  while in group L but maximal change from base line value was 30.1% at  $T_2$  time. This observation suggests that changes of MAP are similar in from base line values in both the groups, though changes were seen earlier in group L.

Cardiac index (CI) values were significantly different baseline which was in accordance to left ventricular ejection fraction (EF) of respective groups. But on analyzing these values during different study points, intra group changes were 17.4% in group L and 12.9 % in group N.

Despite of all these changes in two groups, all patients underwent cardiac surgery uneventful without any complications. In literature preoperative ephedrine has been used for countering hypotension during propofol anesthesia for valve surgery.<sup>2</sup> The use of a controlled rate propofol induction has been described in low cardiac output states during cardiac surgery.<sup>4</sup> Though it is well documented that propofol anesthesia induction diminished LV and atrial contraction<sup>5</sup>, studies had also proved that most of the anesthetic techniques caused some hemodynamic changes during induction of low EF cardiac patients. There is sufficient data in literature which suggest propofol-fentanyl anesthesia is an acceptable technique for CABG surgery.<sup>6,7</sup> A randomized trial of anesthetic induction agents in patients with coronary artery disease and left ventricular dysfunction was done by Singh R<sup>8</sup> comparing the four anesthetic agents Etomidate, Midazolam, Thiopentone and propofol concluded that all four drugs were acceptable for induction in patients with coronary artery disease and left ventricular dysfunction despite a 30 - 40% decrease in the cardiac index. They found significant decrease in the heart rate in comparison to the baseline (-7 to -15%), mean arterial pressure (-27 to -32%) and cardiac index (-36 to -38%) after induction in all four groups with their technique of induction<sup>8</sup>. They concluded that hemodynamic effects of anesthetic induction agents in cardiac patients

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depend to a great extent, on the technique, skill, and experience of drug administration by the clinician (e.g., slow infusion vs. rapid bolus). We had used modified propofol anesthesia induction technique successfully in both normal and low left ventricular ejection fraction patients without significant decrease (less than 20%) in the hemodynamic parameters in comparison to the baseline values.

Criteria	Conditions	Score
Jaw Relaxation	Full Relaxed	1
	Mild Resistance	2
	Tight but open	3
	Impossible	4
Vocal Cord Position	Widely Open	1
	Mid Position	2
	Moving but open	3
	Closed	4
Intubation Response	None	1
	Diaphragmatic movements	2
	Slight Coughing	3
	Severe Coughing	4
Excellent = score < 3 Good = score 4-6 Inadequate = score > 7		

**Table 1: Assessment of conditions for intubation<sup>3</sup>**

	Group N (n=25) (±sd)	Group L (n=25)(±sd)	P value	Significance
Age in years (±SD)	54.6 (±13.7)	50.68(±10.68)	0.265	NS
M/F ratio	15/10	17/8	0.43	NS
Weight in Kg (± SD)	70.75(±6.04)	67.26(±6.51)	0.055	NS
Body surface area (BSA)	1.71(±0.7)	1.69(±0.5)	0.98	NS
Propofol used in mg(± SD)	64.2(±7.8) mg	51.7(±9.6)	0.00	s
Rescue NE 5µg/ml aliquots used (no. of patients)	1/25	4/ 25	0.00	s
Intubation time in sec. (±SD)	89.02(25.18)	76.4(20.7)	0.058	NS
Quality of intubation conditions(intubation score >7)	1/25	3/25	0.00	S

**Table 2: Demographic Data**

Mean heart rate (HR), Mean arterial blood pressure [MAP] (mmHg) and Mean cardiac index (CI) changes at different T points.

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	HR (bpm)			MAP (mmHg)			CI(L/min./m <sup>2</sup> )		
	Group N	Group L	P val.	Group N	Group L	P val	Group N	Group L	P val
Tbase	86.7 (±12.9)	89.2 (±11.7)	0.47ns	104.7 (±10.7)	96.3 (±13.6)	0.02s	2.7 (±0.43)	2.3 (±0.36)	0.00s
T ind	78.2 (±15.3)	80.6 (±14.3)	0.56ns	101.3 (±13.4)	90.1 (±11.9)	0.04s	3.1 (±0.64)	2.3 (±0.34)	0.00s
T2	90.3 (±7.9)	76.7 (±12.9)	0.00S	87.6 (±12.6)	67.3 (±14.7)	0.00s	2.9 (±0.62)	2.0 (±0.23)	0.00s
T4	84.9 (±11.7)	80.4 (±13.7)	0.21NS	89.8 (±13.9)	69.6 (±12.7)	0.00s	2.7 (±0.46)	1.9 (±0.18)	0.00s
T6	80.4 (±12.8)	84.8 (±14.1)	0.21NS	86.5 (±12.1)	74.2 (±13.1)	0.00s	2.9 (±0.16)	2.0 (±0.33)	0.00s
T8	82.7 (±15.9)	74.3 (±16.2)	0.07ns	79.2 (±14.9)	86.1 (±12.6)	0.08ns	2.8 (±0.46)	2.1 (±0.22)	0.00s
T10	86.3 (±11.6)	78.4 (±14.7)	.04s	84.1 (±11.9)	88.2 (±14.4)	0.00s	2.9 (±0.56)	2.1 (±0.17)	0.00s

Table 3: Hemodynamic Data

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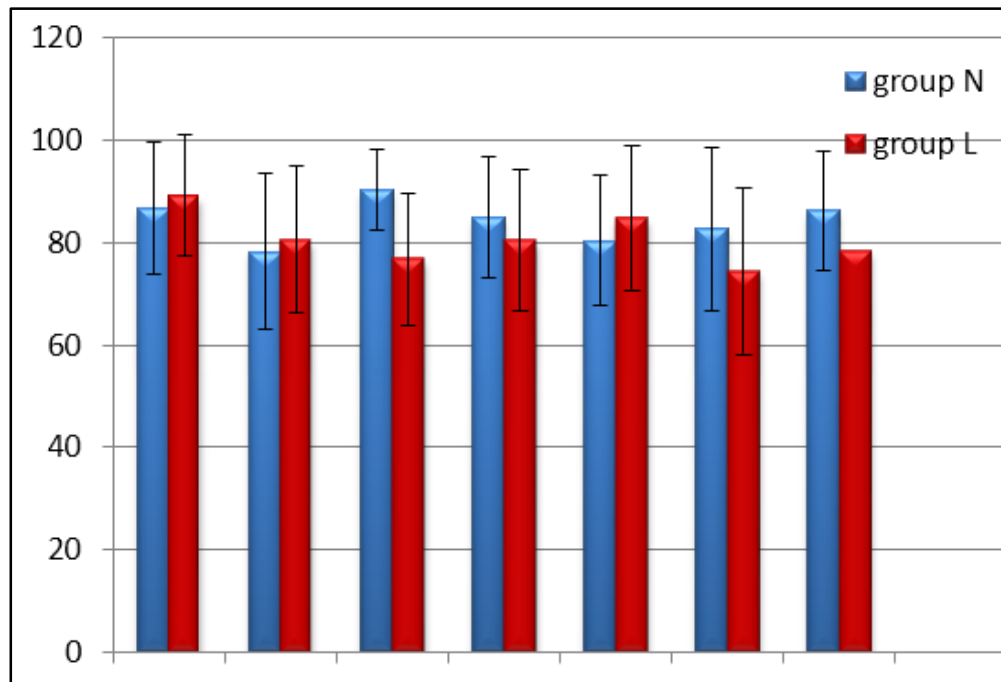
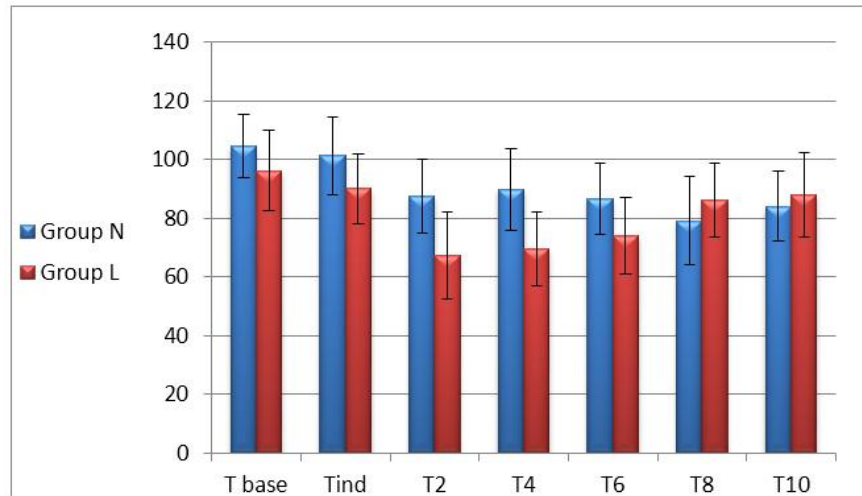
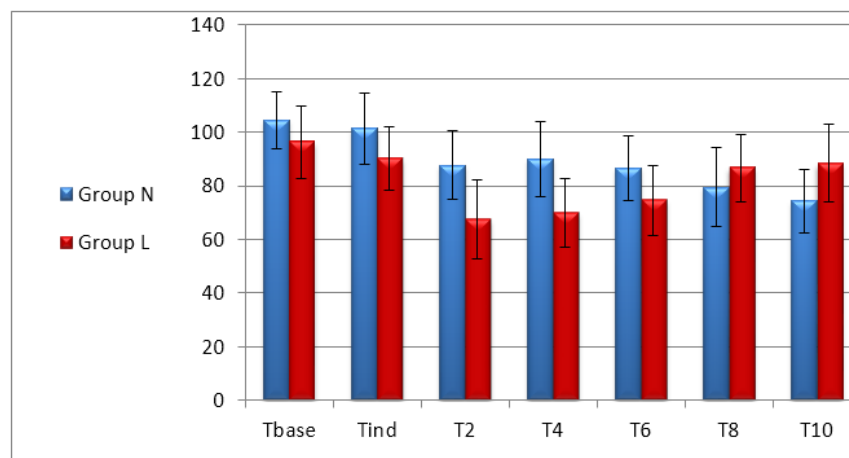


Figure 1: Heart rate variation with standard deviation

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**Figure 2: Mean Arterial Pressure variations with standard deviation in groups**



**Figure 3: Cardiac index variations with standard deviation in groups**

**CONCLUSION:** Modified propofol induction technique appears to be a valuable alternative to conventional induction agents without adverse effects on the cardiovascular system. This technique can be used safely in both normal and low LV function patients undergoing CABG surgery without causing significant hemodynamic compromise. Few patients may encounter rapid reduction in mean arterial pressures, which can be corrected by vasopressor agents.

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## AUTHORS:

1. Gaurav Goyal
2. Murtaza A. Chishti
3. Kushwath K. K.
4. Premraj Nagarwal
5. Varun Chhabra
6. Ajay Meena

## PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Cardiac Anesthesia, Mahatma Gandhi Medical College & Hospital, Sitapura, Jaipur.
2. Assistant Professor, Department of CTVS, Mahatma Gandhi Medical College & Hospital, Sitapura, Jaipur.
3. Professor, Department of CTVS, Mahatma Gandhi Medical College & Hospital, Sitapura, Jaipur.
4. Assistant Professor, Department of Cardiac Anesthesia, Mahatma Gandhi Medical College & Hospital, Sitapura, Jaipur.

5. Assistant Professor, Department of Cardiac Anesthesia, Mahatma Gandhi Medical College & Hospital, Sitapura, Jaipur.
6. Assistant Professor, Department of CTVS, Mahatma Gandhi Medical College & Hospital, Sitapura, Jaipur.

## NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Gaurav Goyal,  
Department of Cardiac Anesthesiology,  
Mahatma Gandhi Medical College & Hospital,  
Sitapura, Jaipur-302022,  
Rajasthan.  
E-mail: drgauravgoyal@gmail.com

Date of Submission: 18/09/2015.  
Date of Peer Review: 19/09/2015.  
Date of Acceptance: 28/09/2015.  
Date of Publishing: 05/10/2015.