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EFFECT OF 2% PROPOFOL INFUSION VS 1% PROPOFOL INFUSION ON LIPID PROFILE AND HAEMODYNAMICS OF POST CARDIAC SURGERY PATIENTS ON MECHANICAL VENTILATION: A PROSPECTIVE COMPARATIVE OBSERVATIONAL STUDY

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ABSTRACT

Introduction: Propofol is widely used for sedation in post-cardiac surgery patients, but concerns exist regarding its effects on lipid metabolism and hemodynamics. This study aimed to compare the effects of 2% propofol infusion versus 1% propofol infusion on lipid profiles and hemodynamic parameters in post- cardiac surgery patients on mechanical ventilation. **Methods:** In this prospective comparative observational study, 86 post-cardiac surgery patients were equally divided into two groups: Group A receiving 2% propofol (n=43) and Group B receiving 1% propofol (n=43). Lipid profiles, including total cholesterol, triglycerides, HDL, and LDL, were assessed pre- operatively and at 24 and 48 hours post-infusion. Hemodynamic parameters, including heart rate, blood pressure, and SpO2, were monitored at regular intervals. **Results:** A trend towards higher total cholesterol levels was observed in the 2% propofol group at 48 hours, but this was not statistically significant (p=0.053). No significant differences were found in triglycerides, HDL, or LDL levels between the groups. The 2% propofol group showed significantly higher heart rates at the end of infusion (p=0.005). The 1% propofol group demonstrated higher diastolic blood pressure and mean arterial pressure at 12 and 18 hours post-infusion (p<0.001 and p=0.003, respectively). SpO2 levels were significantly higher in the 1% propofol group at 6, 12, and 18 hours post-infusion (p<0.001). **Conclusion:** Both 1% and 2% propofol infusions appear to be safe options for sedation in post-cardiac surgery patients on mechanical ventilation, with some differences in hemodynamic effects. The choice between concentrations may depend on specific patient requirements. Further research is needed to determine the long-term clinical implications of these findings.

KEYWORDS : Propofol, Cardiac surgery, Mechanical ventilation, Lipid profile, Hemodynamics, Sedation

INTRODUCTION

Cardiac surgery remains one of the most complex and challenging fields in modern medicine, often requiring meticulous postoperative care to ensure optimal patient outcomes. A critical component of this care is the management of sedation and analgesia in patients on mechanical ventilation following cardiac procedures.1 Among the various sedative agents available, propofol has gained significant popularity due to its favourable pharmacokinetic profile, including rapid onset and offset of action, which allows for easier titration and faster recovery.2

Propofol, for sedation in those recovering from cardiac surgery, has been associated with several advantages. These include improved hemodynamic stability, reduced time to tracheal extubation, and potentially shorter ICU stays compared to traditional sedatives like benzodiazepines.3 However, concerns have been raised regarding the effects of prolonged propofol infusion on patients' lipid profiles and overall metabolic status, particularly in the context of the high-fat content of the emulsion.4 The lipid emulsion used in propofol consists primarily of long-chain triglycerides, which can potentially affect serum lipid levels, especially during extended periods of administration.5 The standard formulation of propofol is a 1% solution, containing 10 mg/mL of the active drug. However, a more concentrated 2% formulation (20 mg/mL) has been developed to reduce the volume of lipid emulsion administered to patients, particularly during prolonged infusions.6 This is of particular concern in cardiac surgery patients, who often have pre-existing dyslipidemia and are at increased risk for cardiovascular complications. The impact of propofol on lipid metabolism and its potential long-term effects on cardiovascular health remain subjects of ongoing research and debate.7

While propofol is generally associated with stable hemodynamics, it can cause dose-dependent decreases in systemic vascular resistance and myocardial contractility, which may be particularly relevant in patients with compromised cardiac function.8 The potential differences in hemodynamic effects between 1% and 2% propofol formulations have not been extensively studied in this specific patient population.

Through this a prospective comparative observational study, we aim to enhance our understanding of the complex interplay between propofol formulations, lipid metabolism, and hemodynamic stability in post-cardiac surgery patients, ultimately contributing to improved patient care and outcomes in cardiac critical care settings.

This study's findings may have important implications for clinical practice, potentially influencing decision-making regarding propofol formulation selection and management of sedation protocols in this vulnerable patient population.9

Methods

Ethics approval for this study was provided by The Institutional Ethics Committee for Biomedical and Health research, from our institute. Research study was conducted from December 2022 to May 2024. The sample size was calculated using the one-sided Z test with pooled variance.A total of 86 study participants were allocated into two groups of 43 each : Group A, which received 2% propofol infusion, and Group B, which received 1% propofol infusion. The allocation was done in a manner to ensure comparable baseline characteristics between the two groups. Patients of age between 18-65 years of both sexes undergoing elective cardiac surgery were included in the study. Patients with LVEF < 35%, history of stroke and seizures and patients with hepatic and renal impairment were excluded from the study.

The primary objective was to compare the effects of 2% propofol infusion versus 1% propofol infusion on serum lipid profiles in post-cardiac surgery patients on mechanical ventilation. Secondarily, hemodynamic stability associated with each and overall clinical outcomes were also assessed.

After obtaining approval and clearance from the institutional ethics committee, the patients fulfilling the inclusion criteria were enrolled for the study after obtaining informed consent.

To collect the required information from the study subjects the "Direct interview method" of Primary source of information technique was used. The patients were interviewed for collection of necessary information using the pre-tested, semi structured questionnaire method. The questionnaire was prepared by a thorough review of literature. In order to obtain co-operation of the patient, patient was made comfortable and a positive reinforcement was exerted. No answers were influenced and patient was helped during difficulty. In the pre-operative evaluation, a comprehensive assessment of each patient was performed. This included a detailed history taking, encompassing the personal and medical history , surgical and drug history, allergies, and a thorough clinical examination along with all routine and specialized cardiac investigations.

On the day of surgery, patient was taken inside operation theatre, all standard monitors were attached and routine general anaesthesia were introduced with Inj. Propofol and inj. vecuronium followed by endotracheal intubation. Patients were maintained on air, oxygen and inhalational anaesthetics.

After completion of surgery, patients were transferred to the ICU and placed on mechanical ventilation. The assigned propofol infusion (either 2% or 1%) was initiated for sedation as per body weight of each patient and titrated according to requirement (100-150mcg/kg/min). Sedation infusions were stopped at the beginning of weaning prior to extubation. Throughout the study period, patients' hemodynamic parameters, including heart rate, blood pressure, and oxygen saturation, were continuously monitored and recorded at predetermined intervals (Pre-op, Start of infusion, end of infusion, 6hr, 12hr, 18hr, 24hr and 48hr post infusion).

Blood samples were collected at specific time points to assess the lipid profile (Pre-op, 24hr and 48hr post infusion). These included measurements of total cholesterol, triglycerides, high-density lipoprotein (HDL), and low-density lipoprotein (LDL). The timing of these sample collections was standardized across both groups to ensure comparability.

The primary outcomes - lipid profile and hemodynamic parameters - were analysed using repeated measures ANOVA. All statistical analyses will be conducted using SPSS software, with a p-value < 0.05 considered statistically significant. Descriptive statistics was used to summarize demographic data and baseline clinical characteristics for both groups. For comparing baseline characteristics between groups, independent t-tests was used for continuous variables, and Chi-square or Fisher's exact tests for categorical variables.

RESULTS

This hospital based prospective comparative observational study was conducted among 86 patients undergoing elective cardiac surgery, to study the effect of 2% propofol infusion vs 1% propofol infusion on lipid profile and haemodynamics of post cardiac surgery patients on mechanical ventilation.

A total of 86 patients divided into two groups were included in the study. Their demographic parameters are summarized in Table 1. And the groups were well-matched in terms of age, gender distribution, and most baseline characteristics, ensuring comparability. However, a significant difference was observed in height, with Group B (173.5±9.8) having a slightly higher mean height.

Table 1 Demoraphic Parameters of Study Population

Demographic Variables	Group A	Group B
Age	58.23±10.3	58.72±10.3
Height	168.8±9.1	173.5±9.8
Weight	69.96±12.5	68.5±9.4
BMI	24.9±5.5	22.99±4.10

Characteristics of lipid profile changes are sown in Table 2.The pre-operative levels and upto 24 hours post operation levels of total cholesterol and triglycerides remained similar and comparable in both groups .At 48 hours post operation higher levels of total cholesterol was seen in Group A (225.4±33.4 vs 207.2±50.9) whereas there was insignificant rise in triglyceride levels in Group B (156.05±43.6) as compared to Group A (139.7 ± 51.2).There were no significant differences in HDL and LDL levels of either groups at any time point (pre-op, 24 hours, or 48 hours post- operation). Both groups showed a similar decrease in HDL levels over time whereas LDL levels showed an increasing trend over time, with the levels at 48 hours being notably higher than pre-operative levels in both groups.

Table 2 P-value of Lipid Profile Assessment

Variables	Total Cholesterol	Triglycerides	HDL	LDL
Pre-op	0.6	0,348	0,862	0.641
24 hour	0.714	0.959	0.629	0.447
48 hour	0.053	0.115	0.207	0.910

Hemodynamic variables of both groups are depicted in Table 3. At the end of infusion and at 24 hours post operation, Group A showed a significantly higher heart rate with 81.1±10.2 vs 74.7±10.7 and 87.2±10.9 vs 83.1±5.7 respectively. This pattern shifted at 12 and 18 hours post-operation, where Group B demonstrated significantly higher heart rates (85.7±8.3 vs 80.4±9.4 at 12 hours ; 86.5±3.7 vs 80.9±9.04 at 18 hours).

Table 3 P-value of Measured Hemodynamic Parameters

Variables	Heart Rate	SBP	DBP	MAP
Pre-op	0.916	0.501	0.683	0.470
Start of infusion	0.714	0.808	0.258	0.329
End of infusion	0.005	0.898	0.937	0.937
6 hour	0.833	0.126	0.507	0.230
12 hour	0.007	0.065	<0.001	0.003
18 hour	< 0.001	0.339	<0.001	0.022
24 hour	0.033	0.131	0.116	0.072
48 hour	0.326	0.568	0.462	0.847

Notable differences in diastolic blood pressure (DBP) emerged at 12 and 18 hours post-surgery, where Group B showed significantly higher DBP compared to Group A (85.6±4.9 vs 80.05±5.6 at 12 hours ; 82.3±3.8 vs 78.7±4.99 at 18 hours).This difference disappeared by 24 hours, with no significant differences observed at 24 and 48 hours. There was no statistically significant differences in systolic blood pressure (SBP) between the groups at any time point throughout the 48-hour observation period

DISCUSSION

Propofol is a widely used intravenous anesthetic agent in cardiac surgery, valued for its rapid onset and offset of action, as well as its favorable hemodynamic profile. However, concerns have been raised regarding its potential effects on lipid metabolism, particularly in prolonged infusions during postoperative mechanical ventilation. This study aimed to compare the effects of 2% propofol infusion versus 1% propofol infusion on lipid profiles and hemodynamics in post-cardiac surgery patients on mechanical ventilation. By

examining these two concentrations, we sought to determine whether a higher concentration of propofol could offer comparable clinical efficacy while potentially reducing the overall lipid load and its associated risks.

The groups were well-matched in terms of age, gender distribution, and most baseline characteristics, ensuring comparability.Although not statistically significant, total cholesterol levels were higher in Group A at 48 hours post-infusion (p=0.053). This trend aligns with the findings of Knibbe et al.10, who reported that higher propofol doses could lead to increased serum lipid levels. Coetzee A et.al.11 reported that abnormal cholesterol levels occurred with similar frequency in the two groups, but fewer patients in the 2% propofol group had lipaemia than in the 1% propofol group.

This study did not find any significant differences in triglycerides, HDL, and LDL levels of the two groups. This is in contrast to some previous studies, such as the one by Gottschling et al.12, which reported significant increases in triglyceride levels with prolonged propofol infusion. The discrepancy might be due to differences in infusion duration or patient characteristics. It also reported that the mean serum triglyceride levels were significantly higher after propofol infusion but also remained within normal limits. There was no correlation between triglyceride and lipase or amylase serum level elevations in individual patients.

This study also showed significant differences in heart rate between the two groups at several time points. Notably, at the end of infusion, Group A (2% propofol) had a significantly higher heart rate compared to Group B (p=0.005). This finding aligns with the study by Memis et al.13, who reported that higher concentrations of propofol were associated with increased heart rate in critically ill patients.

There was also significant differences in diastolic blood pressure (DBP) at 12 and 18 hours post-infusion, with Group B showing higher values (p<0.001 for both time points). This contradicts some previous findings, such as those by Triltsch et al.14, who reported no significant differences in blood pressure between different propofol concentrations. The discrepancy might be attributed to differences in patient populations or concomitant medications.

Mean Arterial Pressure (MAP) noted at 12 and 18 hours post-infusion (p=0.003 and p=0.022, respectively), showed Group B to have higher values. This finding is partially supported by Devlin et al.15, who reported that higher propofol concentrations might lead to lower MAP in critically ill patients.

In conclusion, this study provides valuable insights into the effects of different propofol concentrations on hemodynamics and lipid profiles in post-cardiac surgery patients. While some significant differences were observed, particularly in heart rate and blood pressure, the overall clinical implications of these differences require further investigation. The trend towards higher total cholesterol levels with 2% propofol, although not statistically significant, warrants careful consideration and monitoring in clinical practice. These findings contribute to the ongoing discussion about optimizing sedation protocols in post- cardiac surgery care.

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