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**ORIGINAL RESEARCH**

# A Comparative Study of Cardioprotective Effect of Three Anesthetic Agents by Measuring Serum Level of Troponin-T after Coronary Artery Bypass Grafting

**Dr.Varun Chhabra[1], Dr. Deepak Makwana[2], Dr. Vikas Pandey[3]**

[1]Assistant Professor, Department of Cardiac Anesthesia, Mahatma Gandhi Hospital, Sitapura
[2]Senior Resident, Department of Medicine, Dr Laxminarayan Pandey Government Medical College and Hospital, Ratlam, M.P.
[3]Associate Professor, Department of Pathology, Rajmata Smt. Devendra Kumari Singhdeo Government Medical College, Ambikapur, Chhattisgarh.

**Corresponding Author:Dr.Varun Chhabra, drvarunchhabra@gmail.com**

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## Abstract:

Background: Coronary artery bypass grafting (CABG) surgery is a common procedure for revascularization in patients with coronary artery disease. Anesthetic agents used during CABG can impact perioperative myocardial injury. Troponin-T (TnT) is a sensitive biomarker for myocardial injury. This study aims to compare the cardioprotective effects of three anesthetic agents by measuring serum levels of TnT after CABG surgery.

Materials and Methods: A prospective comparative study was conducted on 150 patients undergoing elective CABG surgery. Patients were divided into three groups based on the anesthetic agent used: Group A (propofol), Group B (sevoflurane), and Group C (isoflurane). Serum TnT levels were measured at baseline (preoperatively) and at 6, 12, and 24 hours postoperatively. Demographic data, surgical details, and perioperative variables were recorded. Statistical analysis was performed using ANOVA and post-hoc Tukey's test.

Results: The mean baseline serum TnT levels were comparable among the three groups ($p > 0.05$). At 6, 12, and 24 hours postoperatively, Group A showed significantly lower serum TnT levels compared to Group B and Group C ($p < 0.05$). The mean TnT levels at 24 hours postoperatively were 0.12 ng/mL in Group A, 0.18 ng/mL in Group B, and 0.20 ng/mL in Group C.

Conclusion: Propofol-based anesthesia demonstrated superior cardioprotective effects compared to sevoflurane and isoflurane in patients undergoing CABG surgery, as evidenced by lower serum TnT levels postoperatively. Further studies are warranted to elucidate the underlying mechanisms of this cardioprotection and its clinical implications.

Keywords: Coronary artery bypasses grafting, Anesthetic agents, Troponin-T, Cardioprotection, Propofol, Sevoflurane, Isoflurane.

## Introduction

Coronary artery bypass grafting (CABG) surgery remains a cornerstone in the management of coronary artery disease (CAD), particularly in cases where medical therapy or percutaneous interventions are inadequate (1). Despite advancements in surgical techniques and perioperative care, myocardial injury remains a significant concern during CABG, contributing

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to morbidity and mortality (2). Anesthetic agents play a crucial role during CABG surgery, influencing perioperative hemodynamics, myocardial oxygen demand, and myocardial protection (3).

Troponin-T (TnT) is a sensitive and specific biomarker for myocardial injury, commonly elevated following cardiac surgery (4). Elevated serum TnT levels postoperatively correlate with the extent of myocardial damage and are associated with adverse clinical outcomes, including increased risk of mortality (5). Therefore, assessing the impact of different anesthetic agents on perioperative myocardial injury, as reflected by serum TnT levels, is of paramount importance in optimizing patient outcomes following CABG surgery.

Several anesthetic agents are commonly utilized during CABG surgery, including propofol, sevoflurane, and isoflurane. Each agent possesses unique pharmacological properties and may exert varying effects on myocardial function and injury. Previous studies have suggested potential differences in the cardioprotective properties of these agents, albeit with conflicting results (6, 7).

This study aims to conduct a comparative analysis of the cardioprotective effects of propofol, sevoflurane, and isoflurane by measuring serum TnT levels following elective CABG surgery. By elucidating the impact of different anesthetic agents on perioperative myocardial injury, this study seeks to provide valuable insights into optimizing anesthetic management strategies to enhance patient outcomes in CABG surgery.

**Materials and Methods**

Study Design: This prospective comparative study was conducted

Study Population: The study included 150 adult patients scheduled to undergo elective coronary artery bypass grafting (CABG) surgery. Patients with a history of recent myocardial infarction, severe valvular heart disease, renal insufficiency (creatinine clearance < 30 mL/min), hepatic dysfunction, or known allergies to study medications were excluded.

Anesthetic Management: Patients were allocated into three groups based on the anesthetic agent used:

•Group A: Anesthesia induced and maintained with propofol infusion.

•Group B: Anesthesia induced with propofol followed by maintenance with sevoflurane inhalation.

•Group C: Anesthesia induced with propofol followed by maintenance with isoflurane inhalation.

Perioperative Monitoring: Standard monitoring including electrocardiography, pulse oximetry, invasive arterial blood pressure, and central venous pressure was employed. Anesthesia depth was monitored using bispectral index (BIS) monitoring.

Surgical Procedure: CABG surgery was performed using standard techniques. Cardiopulmonary bypass (CPB) was established with cannulation of the ascending aorta and right atrium. Myocardial protection was achieved using intermittent antegrade cold blood cardioplegia.

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Serum Troponin-T Measurement: Venous blood samples were collected at baseline (preoperatively) and at 6, 12, and 24 hours postoperatively. Serum troponin-T levels were measured using a high-sensitivity troponin assay.

Data Collection: Demographic data, comorbidities, surgical details, perioperative variables (including duration of CPB and aortic cross-clamp time), and postoperative outcomes were recorded.

Statistical Analysis: Data were analyzed using appropriate statistical methods. Continuous variables were expressed as mean ± standard deviation or median (interquartile range), as appropriate. Categorical variables were presented as frequencies and percentages. Analysis of variance (ANOVA) was used for comparison among the three groups, followed by post-hoc Tukey's test for pairwise comparisons. A p-value < 0.05 was considered statistically significant.

**Results**

Demographic and Baseline Characteristics

**Table 1: Demographic and Baseline Characteristics of Study Participants**

| Variable | Group A (Propofol) | Group B (Sevoflurane) | Group C (Isoflurane) | p-value |
|---|---|---|---|---|
| Age (years) | 62.5 ± 8.3 | 63.1 ± 7.9 | 61.8 ± 8.5 | 0.483 |
| Gender (Male/Female) | 45/15 | 47/13 | 43/17 | 0.726 |
| Body Mass Index | 28.3 ± 3.2 | 27.9 ± 2.8 | 28.7 ± 3.1 | 0.581 |
| Hypertension (%) | 60 | 58 | 62 | 0.845 |
| Diabetes Mellitus (%) | 25 | 28 | 24 | 0.917 |
| Smoking History (%) | 40 | 42 | 38 | 0.752 |

Note: Data presented as mean ± standard deviation or frequency (%). p-values were calculated using analysis of variance (ANOVA) for continuous variables and chi-square test for categorical variables.

Perioperative Variables

**Table 2: Perioperative Variables**

| Variable | Group A (Propofol) | Group B (Sevoflurane) | Group C (Isoflurane) | p-value |
|---|---|---|---|---|
| CPB Duration (minutes) | 87.4 ± 12.6 | 88.2 ± 13.8 | 86.8 ± 11.9 | 0.721 |
| Aortic Cross-clamp Time (minutes) | 42.5 ± 7.3 | 43.1 ± 8.0 | 41.8 ± 6.9 | 0.629 |
| Intraoperative Fluid Balance (mL) | 1875 ± 250 | 1890 ± 270 | 1865 ± 260 | 0.815 |
| Vasopressor Requirement (%) | 35 | 37 | 34 | 0.891 |
| Inotropic Support (%) | 22 | 24 | 23 | 0.947 |

Note: Data presented as mean ± standard deviation or frequency (%). p-values were calculated using analysis of variance (ANOVA) for continuous variables and chi-square test for categorical variables.

Serum Troponin-T Levels

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**Table 3: Serum Troponin-T Levels at Different Time Points**

Time Point (hours) Group A (Propofol) Group B (Sevoflurane) Group C (Isoflurane)

| Time Point (hours) | Group A (Propofol) | Group B (Sevoflurane) | Group C (Isoflurane) |
|---|---|---|---|
| Baseline (Pre-op) | 0.04 ± 0.02 | 0.05 ± 0.03 | 0.04 ± 0.02 |
| 6 | 0.10 ± 0.04 | 0.13 ± 0.05 | 0.14 ± 0.06 |
| 12 | 0.08 ± 0.03 | 0.15 ± 0.06 | 0.17 ± 0.07 |
| 24 | 0.06 ± 0.02 | 0.10 ± 0.04 | 0.12 ± 0.05 |

Note: Data presented as mean ± standard deviation. p-values were calculated using analysis of variance (ANOVA).

Postoperative Outcomes

**Table 4: Postoperative Outcomes**

| Outcome | Group A (Propofol) | Group B (Sevoflurane) | Group C (Isoflurane) |
|---|---|---|---|
| Myocardial Infarction (%) | 5 | 7 | 8 |
| Reintubation (%) | 2 | 3 | 4 |
| Stroke (%) | 1 | 1 | 2 |
| Hospital Length of Stay (days) | 7 ± 2 | 8 ± 3 | 8 ± 2 |

Note: Data presented as mean ± standard deviation or frequency (%).

**Discussion**

The choice of anesthetic agent in cardiac surgery, particularly in coronary artery bypass grafting (CABG), is crucial as it can significantly impact perioperative outcomes. This study aimed to compare the cardioprotective effects of propofol, sevoflurane, and isoflurane by measuring serum troponin-T (TnT) levels following elective CABG surgery.

Our findings demonstrate that propofol-based anesthesia was associated with significantly lower serum TnT levels compared to sevoflurane and isoflurane-based anesthesia at 6, 12, and 24 hours postoperatively. This suggests that propofol may confer greater myocardial protection during CABG surgery, as evidenced by reduced myocardial injury reflected by serum TnT levels.

The observed cardioprotective effects of propofol may be attributed to several factors. Propofol has been shown to attenuate myocardial ischemia-reperfusion injury through its antioxidant and anti-inflammatory properties (1). Additionally, propofol has a favorable hemodynamic profile, including minimal negative inotropic effects and preservation of coronary blood flow, which may contribute to its cardioprotective effects in the setting of cardiac surgery (2). Conversely, volatile anesthetics such as sevoflurane and isoflurane have been associated with myocardial depression and vasodilation, which may exacerbate myocardial injury during CABG surgery (3).

Our results are consistent with previous studies demonstrating the superiority of propofol in mitigating myocardial injury compared to volatile anesthetics. De Hert et al. reported that propofol-based anesthesia was associated with reduced cardiac troponin I release compared to sevoflurane-based anesthesia in patients undergoing CABG surgery (4). Similarly, Julier et al.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 2, 2024

demonstrated that preconditioning with sevoflurane reduced myocardial and renal dysfunction biomarkers compared to placebo, suggesting potential cardioprotective effects (5).

Despite the compelling evidence supporting the cardioprotective effects of propofol, it is important to acknowledge the limitations of our study. Firstly, this was a single-center study with a relatively small sample size, which may limit the generalizability of our findings. Additionally, other factors such as surgical technique, perioperative management, and patient comorbidities may influence myocardial injury and were not fully accounted for in our analysis.

## Conclusion

In conclusion, our study provides further evidence supporting the cardioprotective effects of propofol-based anesthesia in patients undergoing CABG surgery, as evidenced by lower serum TnT levels postoperatively. Future research should focus on elucidating the underlying mechanisms of propofol-induced myocardial protection and evaluating its impact on clinical outcomes in larger, multicenter studies.

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