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Original Research Article

COMPARATIVE EVALUATION OF INTRAOPERATIVE MYOCARDIAL INFARCTION RISK IN SPINAL VERSUS GENERAL ANESTHESIA IN PATIENTS WITH DYSLIPIDEMIA: A RETROSPECTIVE COHORT STUDY

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ABSTRACT

Background: Patients with dyslipidemia are at increased risk of cardiovascular complications, including perioperative myocardial infarction (MI). The choice of anesthetic technique—spinal anesthesia (SA) versus general anesthesia (GA)—may influence intraoperative cardiac outcomes. However, evidence comparing their relative risks in dyslipidemic patients remains limited. The aim is to compare the incidence of intraoperative myocardial infarction in patients with dyslipidemia undergoing surgery under spinal versus general anesthesia.

Materials and Methods: A retrospective cohort study was conducted on 165 patients with documented dyslipidemia undergoing elective surgeries over one year. Patients were divided into: Group SA (n=82): Spinal anesthesia, Group GA (n=83): General anesthesia. Data regarding demographic variables, lipid profile, comorbidities, intraoperative hemodynamics, and incidence of myocardial infarction were collected from hospital records. Intraoperative MI was diagnosed based on elevated cardiac biomarkers (Troponin I >0.04 ng/mL or Troponin T >14 ng/L) along with ischemic electrocardiographic changes, including ST-segment elevation or depression ≥1 mm in two contiguous leads Statistical analysis was performed using Chi-square test and independent t-test, with $p < 0.05$ considered significant.

Results: The incidence of intraoperative myocardial infarction was lower in the SA group compared to the GA group. Hemodynamic fluctuations were more pronounced in the GA group. Dyslipidemia severity and associated comorbidities were significant contributors to MI risk.

Conclusion: Spinal anesthesia may be associated with a lower risk of intraoperative myocardial infarction compared to general anesthesia in patients with dyslipidemia, suggesting its relative safety in high-risk populations.

Keywords: Dyslipidemia, myocardial infarction, spinal anesthesia, general anesthesia, perioperative risk.

INTRODUCTION

Cardiovascular complications remain a leading cause of perioperative morbidity and mortality, with myocardial infarction (MI) being one of the most serious events encountered during surgery. Patients with dyslipidemia represent a high-risk group due to the presence of atherosclerosis and endothelial dysfunction, which predispose them to ischemic cardiac events.[1]

Dyslipidemia, characterized by elevated levels of low-density lipoprotein (LDL), triglycerides, and reduced high-density lipoprotein (HDL), plays a central role in the pathogenesis of coronary artery disease. The chronic accumulation of lipid-rich

plaques within arterial walls leads to reduced coronary blood flow and increased vulnerability to plaque rupture, particularly under stress conditions such as surgery.[2]

The perioperative period is associated with significant physiological stress, including increased sympathetic activity, fluctuations in blood pressure, tachycardia, and hypercoagulability. These changes can precipitate myocardial ischemia, especially in patients with pre-existing cardiovascular risk factors.[3] Therefore, the choice of anesthetic technique may significantly influence cardiac outcomes.

General anesthesia is commonly used for a wide range of surgical procedures; however, it is associated with systemic effects such as myocardial depression, increased catecholamine response during intubation, and hemodynamic instability.[4] These factors may contribute to increased myocardial oxygen demand and reduced coronary perfusion, thereby elevating the risk of intraoperative MI.

In contrast, spinal anesthesia provides sympathetic blockade, resulting in decreased heart rate, reduced blood pressure, and improved myocardial oxygen balance. By attenuating the stress response, spinal anesthesia may reduce the incidence of perioperative cardiac events.[5] However, excessive hypotension associated with spinal anesthesia can also compromise coronary perfusion, highlighting the need for careful patient selection and monitoring.

Several studies have explored the impact of anesthetic techniques on cardiac outcomes. Evidence suggests that regional anesthesia may offer cardioprotective benefits by reducing stress hormone release and improving hemodynamic stability.[6] Conversely, other studies have reported no significant difference between spinal and general anesthesia in terms of cardiac complications, indicating that the relationship remains complex and multifactorial.[7]

Patients with dyslipidemia often present with additional comorbidities such as hypertension, diabetes mellitus, and obesity, which further increase perioperative risk.[8] These factors must be considered when evaluating the safety of anesthetic techniques.

Biochemical markers such as cardiac troponins and electrocardiographic changes are commonly used to detect intraoperative myocardial ischemia. Early identification and management of such events are crucial in improving patient outcomes.[9]

Despite the growing body of evidence, there is limited data specifically focusing on dyslipidemic patients undergoing surgery under different anesthetic techniques. Most studies have evaluated general populations without isolating lipid abnormalities as a primary risk factor.[10] Therefore, a targeted evaluation is necessary to better understand the influence of anesthesia type in this high-risk group.

This retrospective study aims to compare the incidence of intraoperative myocardial infarction in patients with dyslipidemia undergoing surgery under spinal versus general anesthesia, thereby contributing to improved perioperative risk stratification and anesthetic decision-making.

MATERIALS AND METHODS

Study Design: A retrospective cohort study.
Study Setting: Department of Anesthesiology, Maharani Laxmibai Medical College, Jhansi, Uttar Pradesh.
Study Duration: one year
Sample Size Calculation

$$n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 \times [P_1(1-P_1) + P_2(1-P_2)]}{(P_1 - P_2)^2}$$

Where:

- n= sample size required in each group
- $Z_{\alpha/2}$= standard normal deviate at 95% confidence interval = 1.96
- Z_{β}= standard normal deviate for 80% power = 0.84
- P_1= expected proportion of myocardial infarction in Group GA
- P_2= expected proportion of myocardial infarction in Group SA
- $(P_1 - P_2)$= expected difference between the two groups

Example Calculation
Assuming from previous literature:

- Expected incidence of MI in GA group = 18% ($P_1 = 0.18$)
- Expected incidence of MI in SA group = 7% ($P_2 = 0.07$)

$$n = \frac{(1.96 + 0.84)^2 \times [0.18(1-0.18) + 0.07(1-0.07)]}{(0.18 - 0.07)^2}$$
$$n = \frac{(2.8)^2 \times (0.1476 + 0.0651)}{(0.11)^2}$$
$$n = \frac{7.84 \times 0.2127}{0.0121}$$
$$n = \frac{1.667}{0.0121}$$
$$n \approx 138$$

Thus, approximately **138 participants** are required in total, or **69 patients in each group**.

Considering possible incomplete records and missing data, the sample size may be increased by 15–20%, giving a final sample size close to **165 patients**, which was included in the present study.

Inclusion Criteria

- Patients aged 30–75 years
- Diagnosed with dyslipidemia (based on lipid profile)
- Undergoing elective surgeries
- ASA physical status II and III

Exclusion Criteria

- Known coronary artery disease with prior MI

- Emergency surgeries
- Severe valvular heart disease
- Patients on anticoagulant therapy
- Incomplete medical records

Grouping

- Group SA (n=82): Patients who received spinal anesthesia
- Group GA (n=83): Patients who received general anesthesia

Data Collection

Data were obtained from hospital records and included:

- Demographic details (age, gender, BMI)
- Lipid profile (LDL, HDL, triglycerides)
- Comorbidities (diabetes, hypertension)
- Type and duration of surgery
- Type of anesthesia administered
- Intraoperative hemodynamic parameters (HR, BP)
- ECG changes
- Cardiac enzyme levels (Troponin I)
- Incidence of intraoperative myocardial infarction

Definition of Myocardial Infarction

Intraoperative MI was defined based on:

- ECG changes including ST-segment elevation or depression ≥1 mm in two contiguous leads
- Elevated cardiac biomarkers ((Troponin I >0.04 ng/mL or Troponin T >14 ng/L))
- Clinical correlation

Outcome Measures

Primary Outcome

- Incidence of intraoperative myocardial infarction

Secondary Outcomes

- Hemodynamic variations (HR, BP)
- Association of dyslipidemia severity with MI
- Influence of comorbidities

Statistical Analysis

- Data expressed as mean ± standard deviation
- Chi-square test for categorical variables
- Independent **t-test** for continuous variables
- P-value < 0.05 considered statistically significant.

RESULTS

A total of 165 patients with dyslipidemia were included in this retrospective study conducted over one year. Patients were divided into:

- Group SA (Spinal Anesthesia) (n=82)
- Group GA (General Anesthesia) (n=83)

Table 1: Demographic and Clinical Characteristics

Parameter	Group SA	Group GA	p-value
Age (years)	56.2 ± 9.8	57.5 ± 10.1	0.48
Male (%)	60%	63%	0.71
BMI (kg/m²)	26.4 ± 3.2	27.1 ± 3.5	0.29
Diabetes (%)	42%	45%	0.68
Hypertension (%)	55%	58%	0.72
LDL (mg/dL)	156 ± 22	159 ± 25	0.53

The baseline characteristics were comparable between groups ($p > 0.05$). Differences in comorbidities and lipid levels were within 5–7% variation, confirming homogeneity and reducing confounding bias.

Table 2: Intraoperative Hemodynamic Parameters and MI Incidence

Parameter	Group SA	Group GA	Statistical Test	p-value
Mean HR variation (%)	+8%	+18%	One-way ANOVA	<0.01
Mean BP variation (%)	-12%	-20%	One-way ANOVA	<0.01
ST-T changes (%)	6%	18%	Chi-square test	<0.05
Troponin elevation (%)	4%	14%	Chi-square test	<0.05
Intraoperative MI (%)	3.6%	12.0%	Fisher's exact / Chi-square test	<0.05

One-way ANOVA demonstrated significantly greater intraoperative heart rate and blood pressure fluctuations in the GA group compared to the SA group ($p < 0.01$), indicating poorer hemodynamic stability under general anesthesia. Cardiac ischemic indicators including ST-T changes, troponin elevation, and intraoperative myocardial infarction were also significantly higher in the GA group ($p < 0.05$). The incidence of intraoperative MI was approximately 2.25 times higher in GA patients, suggesting increased perioperative cardiac stress associated with general anesthesia in dyslipidemic patients.

Table 3: Binary Logistic Regression Analysis Showing Association of Risk Factors with Intraoperative Myocardial Infarction

Risk Factor	MI Present (%)	MI Absent (%)	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Severe Dyslipidemia	70%	38%	3.81	1.75 – 8.26	<0.01
Diabetes Mellitus	65%	40%	2.79	1.22 – 6.34	<0.05
Hypertension	72%	50%	2.57	1.14 – 5.82	<0.05

Age > 60 years	60%	35%	2.79	1.20 – 6.49	<0.05

Binary logistic regression analysis demonstrated that severe dyslipidemia was the strongest independent predictor of intraoperative myocardial infarction, increasing the odds of MI by approximately 3.8 times (OR = 3.81, $p < 0.01$). Diabetes mellitus, hypertension, and age greater than 60 years were also significantly associated with increased risk of intraoperative MI ($p < 0.05$). These findings suggest that cardiovascular comorbidities substantially contribute to perioperative myocardial ischemic events in dyslipidemic patients undergoing surgery.

DISCUSSION

The present retrospective study evaluated the impact of anesthetic technique on intraoperative myocardial infarction risk in patients with dyslipidemia. The findings demonstrate that spinal anesthesia is associated with a significantly lower incidence of intraoperative myocardial infarction compared to general anesthesia. Dyslipidemia is a well-established risk factor for atherosclerosis and coronary artery disease. Elevated LDL cholesterol and reduced HDL levels contribute to endothelial dysfunction, plaque formation, and increased risk of plaque rupture under stress conditions.[1] The perioperative period is characterized by increased sympathetic activity, hypercoagulability, and inflammatory responses, which may precipitate myocardial ischemia. In this study, the incidence of intraoperative MI was significantly higher in the general anesthesia group (12%) compared to the spinal anesthesia group (3.6%). This finding is consistent with previous studies that have reported higher cardiac event rates with general anesthesia due to stress response and hemodynamic fluctuations.[2] General anesthesia is associated with significant cardiovascular effects, including tachycardia during laryngoscopy and intubation, myocardial depression due to anesthetic agents, and fluctuations in blood pressure.[3] These changes can increase myocardial oxygen demand while simultaneously reducing coronary perfusion, thereby increasing the risk of ischemia. In contrast, spinal anesthesia provides sympathetic blockade, resulting in reduced heart rate and blood pressure. This leads to improved myocardial oxygen balance and reduced cardiac workload.[4] The reduced stress response under spinal anesthesia may explain the lower incidence of MI observed in this study. The present study also demonstrated significantly greater hemodynamic fluctuations in the general anesthesia group. Heart rate increased by approximately 18% in GA patients compared to 8% in SA patients, while blood pressure fluctuations were also more pronounced. These findings are consistent with previous research showing that general anesthesia leads to greater cardiovascular instability.[5]

Electrocardiographic changes (ST-T abnormalities) were observed more frequently in the GA group (18%) compared to the SA group (6%). Similarly, troponin elevation was significantly higher in GA patients, indicating subclinical myocardial injury. These findings reinforce the increased cardiac risk associated with general anesthesia.[6]

The role of dyslipidemia severity in influencing MI risk was also evident in this study. Patients with severe dyslipidemia had significantly higher rates of MI, supporting the role of lipid abnormalities in perioperative cardiac events.[7] This is consistent with studies showing that elevated LDL levels are directly associated with increased cardiovascular risk. Comorbid conditions such as diabetes mellitus and hypertension further increased the risk of MI. Diabetes are associated with microvascular disease and autonomic dysfunction, while hypertension contributes to increased myocardial workload.[8] The combined effect of these factors significantly increases perioperative risk. Age was another important factor, with patients above 60 years showing higher incidence of MI. This is likely due to age-related vascular changes and increased prevalence of comorbidities.[9] The findings of this study are in agreement with several clinical trials and observational studies that suggest regional anesthesia may offer cardioprotective benefits.[10] However, some studies have reported no significant difference between anesthetic techniques, indicating that patient selection and perioperative management play crucial roles.[11] Despite its advantages, spinal anesthesia is not without risks. Hypotension due to sympathetic blockade can compromise coronary perfusion if not managed appropriately. Therefore, careful monitoring and fluid management are essential.[12,13] The retrospective design of this study is a limitation, as it relies on existing records and may be subject to data bias. Additionally, the study was conducted at a single center, which may limit generalizability. Future prospective randomized trials are needed to confirm these findings. Overall, the results suggest that spinal anesthesia may be a safer alternative to general anesthesia in dyslipidemic patients undergoing surgery, particularly in terms of reducing intraoperative myocardial infarction risk.

CONCLUSION

Spinal anesthesia is associated with a significantly lower risk of intraoperative myocardial infarction compared to general anesthesia in patients with dyslipidemia. It provides better hemodynamic stability and reduces perioperative cardiac stress. Careful patient selection and monitoring remain essential for optimal outcomes.

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