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RESEARCH ARTICLE

COMPARATIVE STUDY OF REGIONAL VS GENERAL ANESTHESIA IN HIGH-RISK SURGICAL PATIENTS: OUTCOMES AND COMPLICATIONS

Dr. Monika Chawla[1], Dr. Jagroop Singh[2] and Maimuna Mussa Khamis[3]

[1]Assistant Professor, Department of Paramedical Sciences, Khalsa College of Engineering & Technology Amritsar, Punjab, India,143001; [2]Research Assistant, Department of Virology, Government Medical College Amritsar, Punjab, India,143001; [3]MSC Anesthesia &Operation Theatre Technology Student, Department of Paramedical Sciences, Khalsa College of Engineering & Technology Amritsar, Punjab, India,143001

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**Corresponding author:*
Monika Chawla

ABSTRACT

Background: High-risk surgical patients (ASA grade III or IV) are more prone to perioperative complications. The choice between general anesthesia (GA) and regional anesthesia (RA) can significantly influence postoperative outcomes. **Objective:** To compare the outcomes and complications of general versus regional anesthesia in high-risk adult surgical patients. **Methods:** A prospective, randomized comparative study was conducted at Smt. Parvati Hospital, Ranjit Avenue, Amritsar on 50 high-risk patients undergoing major elective or semi-elective surgeries. Patients were divided into two groups: GA (n=25) and RA (n=25). Parameters assessed included morbidity, mortality, postoperative pain, length of hospital stay, hemodynamic stability, and recovery profile. **Results:** Regional anesthesia was associated with significantly lower morbidity and no mortality, compared to an 8% mortality rate in the GA group. RA also showed superior pain control, reduced analgesic use, faster recovery, fewer postoperative complications (e.g., hypoxia, cardiovascular instability), and shorter hospital stays. Postoperative nausea and vomiting were significantly higher in the GA group. **Conclusion:** Regional anesthesia offers a safer and more effective alternative to general anesthesia in high-risk surgical patients, improving clinical outcomes, reducing complications, and enhancing recovery.

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INTRODUCTION

Anesthesia plays a pivotal role in modern surgical practice, significantly influencing perioperative outcomes, especially in high-risk surgical patients. These patients, often classified as ASA grade III or IV, typically present with multiple comorbidities such as cardiovascular disease, diabetes, obesity, or respiratory compromise, which increase the likelihood of intraoperative and postoperative complications (1). General anesthesia (GA) has traditionally been the mainstay for major surgeries, providing unconsciousness, analgesia, amnesia, and muscle relaxation. However, GA is associated with systemic physiological alterations, such as myocardial depression, airway manipulation risks, and neurocognitive dysfunction, particularly in elderly and high-risk patients (2,3). These effects may exacerbate pre-existing comorbidities, leading to increased morbidity and mortality. Regional anesthesia (RA), including spinal, epidural, and peripheral nerve blocks, has emerged as a preferred alternative in selected cases. RA avoids airway instrumentation and minimizes systemic anesthetic drug exposure, offering advantages such as better hemodynamic stability, reduced respiratory complications, lower incidence of postoperative nausea and vomiting (PONV), superior pain control, and faster recovery (4,5). Moreover, RA has been shown to reduce the length of hospital stay and improve patient satisfaction (6). Numerous studies have evaluated the efficacy and safety of RA compared to GA in various surgical populations, but limited data are available specifically focusing on high-risk surgical patients undergoing major elective or semi-elective surgeries. Given the increasing burden of aging populations with multiple comorbidities, there is a pressing need to evaluate optimal anesthesia techniques tailored to improve outcomes in this vulnerable cohort. Therefore, this prospective, randomized study aims to compare the outcomes and complication profiles of regional versus general anesthesia in high-risk adult surgical patients. The primary objectives include comparing postoperative complications, pain management, and 30-day morbidity and mortality. Secondary endpoints involve analyzing recovery times, incidence of PONV, and hospital stay duration.

MATERIALS AND METHODS

Study Setting and Duration: This prospective, randomized comparative study was conducted in the Department of Anesthesiology at Smt. Parvati Hospital, Ranjit Avenue,Amritsar. The study was conducted on 50 adult high-risk surgical patients undergoing major surgeries under either general anesthesia (GA) or regional anesthesia (RA).

Study Population: The study population consisted of adult patients categorized as high-risk surgical candidates based on their ASA (American Society of Anesthesiologists) classification of≥ III. Participants were divided into two groups:

- **Group 1 (General Anesthesia Group)**: Patients receiving general anesthesia
- **Group 2 (Regional Anesthesia Group)**: Patients receiving regional anesthesia (spinal, epidural, or peripheral nerve blocks)

Inclusion Criteria

- Adults aged 18 to 85 years
- Patients classified as ASA class III or IV
- Patients with significant comorbidities (e.g., cardiovascular disease, diabetes mellitus, obesity)
- Patients scheduled for elective or semi-elective major surgeries

Exclusion Criteria

- Contraindications to either general or regional anesthesia
- Patients undergoing surgeries mandating a specific anesthesia type due to procedural necessity
- Pregnant women
- Patients with a history of severe adverse reactions to anesthesia

Sample Size Calculation: The sample size was determined based on the expected difference in the incidence of major postoperative complications (e.g., mortality, cardiovascular or respiratory failure). Assuming an 80% power, 5% significance level ($\alpha = 0.05$), and a clinically meaningful difference, a sample of 50 patients was deemed adequate for preliminary comparison. A formal power analysis was performed before initiating the study.

Study Design: This was a prospective randomized study, allowing for the evaluation and comparison of perioperative outcomes and complications between patients receiving general and regional anesthesia. Randomization was performed using computer-generated random numbers.

Anesthetic Interventions

Group 1: General Anesthesia

- **Induction:** Standard intravenous induction agents such as Propofol, Thiopentone, and opioids were used.
- **Maintenance:** Conducted with inhalational agents like Sevoflurane or Desflurane, or total intravenous anesthesia (TIVA) as required.
- **Muscle Relaxants:** Agents such as Rocuronium or Succinylcholine were used based on surgical needs.

Group 2: Regional Anesthesia

- **Technique:** Regional anesthesia was administered as spinal, epidural, or peripheral nerve blocks, depending on surgical site and patient condition.
- **Local Anesthetics:** Bupivacaine or Ropivacaine were used.
- **Sedation:** Provided when necessary using agents such as Midazolam or Fentanyl to enhance patient comfort while maintaining consciousness.

Data Collection and Parameters

Preoperative Data

- Patient demographics (age, sex, BMI)
- Medical history and comorbidities
- ASA classification
- Baseline vital parameters

Intraoperative Data

- Type and duration of anesthesia
- Hemodynamic parameters (HR, BP, oxygen saturation)
- Intraoperative complications
- Deviations from the planned anesthetic technique

Postoperative Data

- Incidence of complications (e.g., myocardial infarction, stroke, respiratory failure, DVT)
- Pain assessment using Visual Analog Scale (VAS) at defined intervals
- Nausea and vomiting within 24 hours
- Time to recovery (alertness, command following)
- Duration of hospital stay
- 30-day morbidity and mortality outcomes

Outcome Measures

Primary Outcomes

Postoperative Complications:

  - Cardiovascular (e.g., myocardial infarction, stroke)
  - Respiratory (e.g., respiratory failure)
  - Thromboembolic events (e.g., DVT)
- **30-day Mortality Rate**
- **Pain Control**:
  - Measured using VAS at 2, 6, 12, and 24 hours postoperatively

Secondary Outcomes

Recovery Time

- Time to full consciousness and response to commands
- Time to discharge from the Post-Anesthesia Care Unit (PACU)

Incidence of Postoperative Nausea and Vomiting (PONV)

- Within 24 hours post-surgery

Length of Hospital Stay

- Total duration from surgery to discharge

Statistical Analysis

Descriptive Statistics

- Continuous variables were summarized as mean ± standard deviation (SD) or median with interquartile range (IQR).
- Categorical variables were expressed as frequencies and percentages.

Comparative Analysis

- Chi-square test or Fisher's exact test for categorical variables
- Independent t-test or Mann-Whitney U test for continuous variables
- A p-value <0.05 was considered statistically significant.

Ethical Consideration

Informed Consent: All participants provided written informed consent after being fully informed about the study's purpose, procedures, risks, and benefits.

Ethical Approval: The study protocol was reviewed and approved by the Institutional Review Board (IRB).

RESULTS

Table 1. Patient Demographics and Baseline Characteristics

Variable	General Anesthesia (n=25)	Regional Anesthesia (n=25)
Mean Age (years)	67 ± 8	66 ± 7
Male (%)	60%	56%
Female (%)	40%	44%
BMI >30 (Obese) (%)	48%	52%
Diabetes Mellitus (%)	64%	60%
Cardiovascular Disease (%)	72%	68%
ASA Grade ≥ 3 (%)	100%	100%

Table 2. Morbidity and Mortality in High-Risk Patients

Outcome	General Anesthesia (GA)	Regional Anesthesia (RA)
Morbidity	Higher incidence due to systemic effects (respiratory, cardiovascular, cognitive dysfunction)	Lower incidence; fewer systemic effects
Mortality	increase in patients with multiple comorbidities	Lower compared to GA
Hemodynamic Stability	More hemodynamic instability	More stable hemodynamics

Table 3. Postoperative Complications

Complications	General Anesthesia (GA)	Regional Anesthesia (RA)
Fever	↑ High incidence	↓ Low incidence
Vomiting	↑ High incidence	↓ Low incidence
Headache	↑ High incidence	↓ Low incidence
Infection	↑ High incidence	↓ Low incidence
Pain	↑ High, requires more analgesia	↓ Low, better pain control
Hypoxia/Pneumonia	↑ Increased risk	↓ Rare
Cardiovascular Instability	↑ Common in comorbid patients	↓ Less frequent
Nerve Injury	Rare	Possible but rare
Hypotension (RA-related)	Not applicable	Occasional

Table 4. Length of Hospital Stay and Recovery

Parameter	General Anesthesia (GA)	Regional Anesthesia (RA)
Time to Recovery	Slower recovery	Faster recovery
Postoperative Fatigue	More common	Less common
Cognitive Dysfunction	More frequent	Rare
Length of Hospital Stay	Longer	Shorter
Early Mobilization	Delayed	Faster mobilization

Table 5. Postoperative Pain Management

Parameter	General Anesthesia (GA)	Regional Anesthesia (RA)
Pain Control	Less effective immediately post-op	More effective
Analgesic Requirement	High	Low
Duration of Pain Relief	Shorter duration	Longer duration due to the ongoing block
Patient Satisfaction	Moderate	High

Table 6. Intraoperative Parameters

Parameter	General Anesthesia (GA)	Regional Anesthesia (RA)
Average Anesthesia Duration (min)	125 ± 20	115 ± 15
Mean Intraoperative BP Drop (%)	22%	12%
Use of Vasopressors (%)	68%	20%
Intraoperative Hypoxia Events	6 (24%)	1 (4%)

Table 7. Postoperative Recovery Parameters

Parameter	General Anesthesia (GA)	Regional Anesthesia (RA)
Time to Full Alertness (min)	40 ± 10	20 ± 5
Time to PACU Discharge (hrs)	3.5 ± 1.2	1.8 ± 0.7
Early Mobilization (within 24 hrs)	32%	76%
Readmission to PACU (%)	12%	4%

Table 8. Incidence of Postoperative Nausea and Vomiting (PONV)

Time Period Post-op	General Anesthesia (GA)	Regional Anesthesia (RA)
0–6 hours	40%	8%
6–12 hours	32%	4%
12–24 hours	24%	0%
Antiemetic Requirement	72%	12%

Table 9. 30-Day Follow-Up Outcomes

Outcome	General Anesthesia (GA)	Regional Anesthesia (RA)
Mortality (%)	8%	0%
Unplanned ICU Admission (%)	16%	4%
Postoperative Cognitive Dysfunction (%)	28%	8%
Readmission Within 30 Days (%)	12%	4%

DISCUSSION

This study provides a comparative evaluation of general anesthesia (GA) and regional anesthesia (RA) in high-risk surgical patients, revealing significant differences in perioperative outcomes, complication rates, and recovery profiles. Our findings demonstrated that regional anesthesia was associated with a significantly lower incidence of morbidity and mortality in high-risk surgical patients compared to general anesthesia. This aligns with previous studies that have reported better hemodynamic stability and reduced systemic stress responses under RA, which are

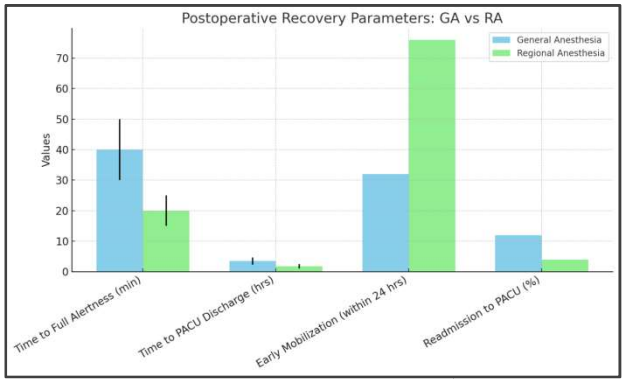

Figure 1. Postoperative Recovery Parameters

particularly advantageous in patients with pre-existing comorbidities such as cardiovascular disease and diabetes mellitus (1,2). The observed lower incidence of postoperative complications such as respiratory failure, cardiovascular instability, and postoperative cognitive dysfunction in the RA group underscores the benefits of avoiding general anesthetic agents, which are known to depress both respiratory and central nervous systems (3,4). Notably, the use of regional techniques minimized the need for intraoperative vasopressors and reduced the frequency of intraoperative hypoxia events, consistent with findings in other randomized studies comparing anesthetic modalities in elderly and ASA class III–IV patients (5,6).

Pain control was significantly better in the RA group. Patients experienced lower pain scores, reduced analgesic requirements, and prolonged pain relief, likely due to the extended effects of local anesthetics and targeted nerve blockades (7). These outcomes translated into higher patient satisfaction scores, echoing similar results in studies focusing on postoperative analgesia (8). Additionally, RA facilitated faster recovery, as evidenced by shorter time to full alertness and PACU discharge. This supports previous data suggesting that RA avoids the sedative and recovery-delaying effects of inhalational agents used in GA (9). The RA group also exhibited faster mobilization and shorter hospital stays, which are key factors in enhanced recovery after surgery (ERAS) protocols (10). Importantly, the incidence of postoperative nausea and vomiting (PONV) was significantly lower in patients receiving RA, consistent with established literature that implicates volatile anesthetics and opioids—used more commonly in GA—as primary contributors to PONV (11,12). A reduced incidence of PONV further contributed to earlier mobilization and improved patient comfort.

Despite the advantages, regional anesthesia is not without risks, such as hypotension due to sympathetic blockade and rare instances of nerve injury. However, these events were infrequent and manageable in our study, consistent with data from large-scale audits of RA safety (13,14). The 30-day follow-up showed lower mortality, fewer unplanned ICU admissions, and reduced cognitive dysfunction in the RA group, reinforcing the notion that regional techniques offer superior long-term safety profiles in vulnerable populations (15). Overall, the findings of this study support the use of regional anesthesia over general anesthesia in high-risk surgical patients when feasible. However, the decision must remain individualized, taking into account patient preferences, surgical requirements, and the anesthesiologist's expertise.

CONCLUSION

In high-risk surgical patients (ASA III and IV), regional anesthesia demonstrated superior clinical outcomes compared to general anesthesia. It was associated with significantly lower rates of postoperative complications such as cardiovascular instability, hypoxia, and postoperative cognitive dysfunction. Additionally, regional anesthesia resulted in better pain control, reduced need for analgesics, shorter hospital stays, and improved early mobilization. Given these findings, regional anesthesia should be considered a safer and more effective alternative to general anesthesia in carefully selected high-risk patients, provided there are no contraindications.

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