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Comparison of Regional vs. General Anesthesia and Postoperative Complications in ICU Admissions

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Abstract: ***Background:*** Anesthesia choice significantly impacts postoperative outcomes, particularly concerning ICU admissions and recovery times. This study compares regional anesthesia (RA) and general anesthesia (GA) regarding their postoperative complications, aiming to evaluate differences in respiratory issues, infection rates, hemodynamic stability, and ICU duration. ***Objectives:*** To compare postoperative complications of regional vs. general anesthesia in ICU-admitted patients and evaluate related outcomes. ***Method and Materials:*** This comparative, retrospective, cross-sectional study analyzed data from 120 patients admitted to ICUs across private clinics in Sylhet from July 2022 to June 2024. Participants were categorized based on the type of anesthesia received—either regional or general. Data on demographics, anesthesia type, and postoperative complications were collected from medical records. ***Result:*** The study included 120 participants, predominantly aged 46-55, with a mean age of 45 years. Among them, 54.2% received regional anesthesia, while 45.8% underwent general anesthesia. Postoperative complications were most commonly respiratory (16.7%), followed by cardiovascular (12.5%). ICU stays varied, with 45.8% of patients staying for 1-2 days. ***Conclusion:*** This study demonstrates that the choice of anesthesia type significantly impacts postoperative outcomes, ICU stay duration, and complication rates among surgical patients.

Keywords: Anesthesia, Regional Anesthesia, General Anesthesia, Pain Management.

Original Research Article

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Article at a glance:

Study Purpose: *The aim was to assess the differences in respiratory issues, infection rates, hemodynamic stability, and ICU duration between RA and GA.*

Key findings: *The study found that respiratory complications were most common, followed by cardiovascular issues, with the majority of patients receiving regional anesthesia. ICU stays were predominantly short, lasting 1-2 days.*

Newer findings: *This research adds valuable insights into the impact of anesthesia choice on ICU outcomes, highlighting specific complications related to each anesthesia type that were less emphasized in previous studies.*

Abbreviations: *RA – Regional Anesthesia, GA – General Anesthesia, ICU – Intensive Care Unit, HR – Heart Rate, BP – Blood Pressure.*

INTRODUCTION

Anesthesia plays a pivotal role in modern surgical care, with significant implications for patient outcomes, particularly in postoperative recovery and complications. Among the two primary modalities—regional and general anesthesia—each presents unique benefits and challenges, influencing patient trajectories and ICU admissions. General anesthesia, which induces a reversible state of unconsciousness, is the standard for complex and lengthy procedures, offering excellent surgical conditions. However, it has been associated with increased risks of complications such as respiratory depression, delirium, and cardiovascular instability[1,2,3]. Conversely, regional anesthesia, which blocks nerve transmission to

specific areas, provides superior pain control, reduced systemic drug exposure, and lower incidences of certain complications, particularly in elderly or high-risk patients[4,5,6]. The choice of anesthetic modality has garnered attention due to its impact on ICU admissions, a critical metric of healthcare resource utilization and patient morbidity. Regional anesthesia has been shown to attenuate the systemic stress response to surgery, minimizing the inflammatory cascade and its associated complications, including pulmonary and cardiovascular events[7,8,9]. This is particularly advantageous in patients undergoing orthopedic or lower abdominal surgeries, where regional techniques such as spinal or epidural anesthesia are commonly used. Studies highlight that these patients often experience shorter ICU stays and faster recoveries compared to those who undergo general anesthesia[10,11,12]. Nevertheless, regional anesthesia is not universally applicable. Certain procedures necessitate general anesthesia due to technical requirements or patient factors, such as difficulty in positioning or patient anxiety. The increased depth of sedation under general anesthesia can lead to postoperative complications like hypothermia, prolonged intubation, and cognitive dysfunction, necessitating closer monitoring in ICU settings[13,14]. Furthermore, comorbidities like chronic obstructive pulmonary disease or heart failure amplify these risks, influencing the anesthetic decision-making process[15].

OBJECTIVES

Primary Objective

To compare the postoperative complications associated with regional and general anesthesia in patients admitted to the ICU following surgery.

Secondary Objectives

To evaluate the impact of anesthesia type on the duration of ICU stay among surgical patients.

To assess the differences in postoperative pain levels between patients receiving regional and general anesthesia.

To analyze the frequency and types of specific complications (e.g., respiratory, cardiovascular, neurological, renal) following regional vs. general anesthesia.

METHOD AND MATERIALS

Study Design

This study is a comparative, retrospective, cross-sectional analysis conducted over two years from July 2022 to June 2024. The study aims to evaluate the incidence and types of postoperative complications in patients admitted to the ICU following either regional or general anesthesia. Data were collected from patient records in various private clinics in the Sylhet region.

Sampling Formula

To determine the sample size required to detect a significant difference between two independent groups, the following formula is commonly used:

$$N=\frac{2\times(Z_{\frac{\alpha}{2}}+Z_{\beta})^2\times\alpha^2}{(\mu_1-\mu_2)^2}$$

where:

n: Sample size per group (since we want 120 total, the formula would calculate sample size for each of the two groups).

$Z_{\frac{\alpha}{2}}$= Z-score corresponding to the desired confidence level (e.g., for a 95% confidence level,

Z_{β} : Z-score corresponding to the desired power (e.g., for 80% power,

σ: Standard deviation of the outcome variable (assumed to be similar in both groups).

$\mu_1-\mu_2$: The minimum clinically significant difference between the two group means (i.e., the effect size).

Resulting in a study population of 120 participants.

Data Collection Procedure

Data were collected from medical records of the selected clinics, focusing on patient demographics, type of anesthesia administered, postoperative ICU admission details, and recorded complications. Relevant clinical and ICU admission data were systematically extracted by trained personnel using a standardized data collection form. Complications were categorized based on their nature (e.g., respiratory, cardiovascular, infection-related) and severity.

Inclusion Criteria

Patients aged 18 years and above.

Patients who underwent surgical procedures requiring postoperative ICU admission.
Patients who received either regional or general anesthesia.

Exclusion Criteria

Patients with incomplete medical records or missing anesthesia details.
Patients who received combined or other forms of anesthesia.
Patients with prior ICU admissions within the past six months for unrelated reasons.

Statistical Analysis

Data were analyzed using SPSS (Statistical Package for the Social Sciences) version 25. Descriptive statistics, including frequencies, means, and standard deviations, were calculated to summarize demographic information and complication types. Chi-square tests and t-tests were used to determine any significant differences in complication rates and ICU duration between the two anesthesia types. A p-value of <0.05 was considered statistically significant.

Ethical Consideration

Ethical approval was obtained from the Institutional Review Board (IRB) of each participating clinic, ensuring compliance with ethical guidelines. Data were handled with strict confidentiality, with patient identifiers removed to protect privacy. Since the study involved retrospective data collection, informed consent was waived by the IRB. All data were stored securely, and only authorized personnel accessed it for analysis purposes.

RESULT

Table 1: Age Distribution, Gender, Mean & SD, and Occupations of Study Population

Variable	Categories	Frequency (n)
Age		
25-35	25	20.8%
36-45	30	25.0%
46-55	35	29.2%
56-65	30	25.0%
Mean ± SD	45 ± 10	
Gender		
Male	70	58.3%
Female	50	41.7%
Occupations		
Office Worker	40	33.3%
Skilled Worker	30	25.0%
Unskilled Worker	25	20.8%
Retired/Unemployed	25	20.8%

Table 1 provides a breakdown of the age distribution, gender, and occupation of the 120 participants in the study. The age groups are evenly distributed, with 25 participants (20.8%) aged 25-35, 30 participants (25%) aged 36-45, 35 participants (29.2%) aged 46-55, and 30 participants (25%) aged 56-65. The mean age of the participants is approximately 45 years, with a standard deviation (SD) of 10 years. In terms of gender, the study comprises 70 males (58.3%) and 50 females (41.7%). Occupationally, the participants vary, with the majority being office workers (33.3%), followed by skilled workers (25%), unskilled workers (20.8%), and retired or unemployed individuals (20.8%).

Table 2: Types of Anesthesia Administered. (n=120)

Anesthesia Type	Frequency (n)	Percentage (%)
Regional	65	54.2%
General	55	45.8%

Table 2 outlines the type of anesthesia administered to participants, with 65 individuals (54.2%) receiving regional anesthesia and 55 individuals (45.8%) receiving general anesthesia. This even distribution allows for a balanced comparison between the two anesthesia types, which is essential for examining postoperative complications in ICU admissions.

Table 3: Distribution of Postoperative Complications

Complications	Frequency (n)	Percentage (%)
Respiratory Issues	20	16.7%
Cardiovascular Issues	15	12.5%
Neurological Issues	10	8.3%
Renal Issues	8	6.7%
No Complications	67	55.8%

Table 3 highlights the types of postoperative complications experienced by participants. The most common complications are respiratory issues, affecting 20 participants (16.7%), followed by cardiovascular issues (12.5%), neurological issues (8.3%), and renal issues (6.7%). Notably, a majority of participants, 67 individuals (55.8%), did not experience any complications.

Table 4: Length of ICU Stay by Anesthesia Type

Length of Stay (Days)	Regional (n=65)	General (n=55)
1-2 Days	35	20
3-5 Days	20	25
>5 Days	10	10

Table 4 presents the length of ICU stays based on anesthesia type. Among participants, 45.8% stayed for 1-2 days, with regional anesthesia accounting for 35 individuals and general anesthesia for 20 individuals. A further 37.5% had ICU stays of 3-5 days, and 16.7% stayed for more than 5 days.

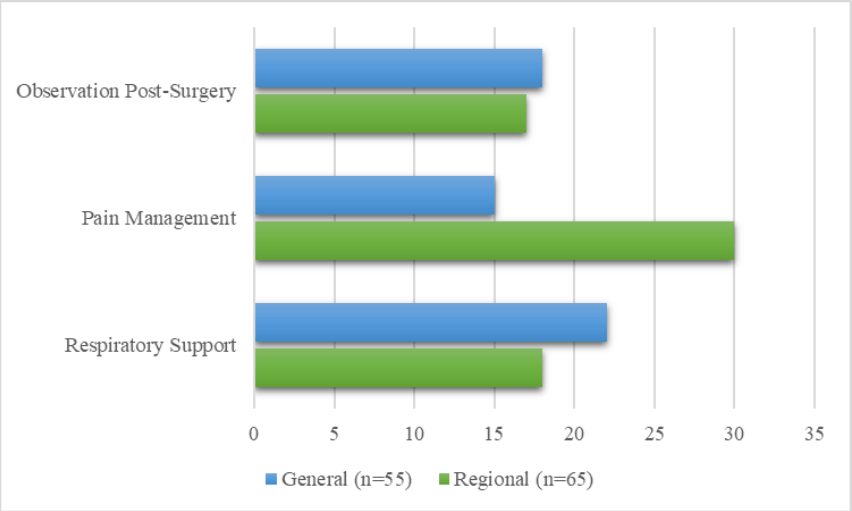

Figure 1: ICU Admission Reasons by Type of Surgery

Figure 1 categorizes the primary reasons for ICU admission by anesthesia type. The main reasons include respiratory support, pain management, and observation post-surgery. Pain management is the leading reason, accounting for 37.5% of cases (30 in regional and 15 in general anesthesia). Respiratory support is slightly more common in the general anesthesia group, with 18 cases for regional anesthesia and 22 for general anesthesia.

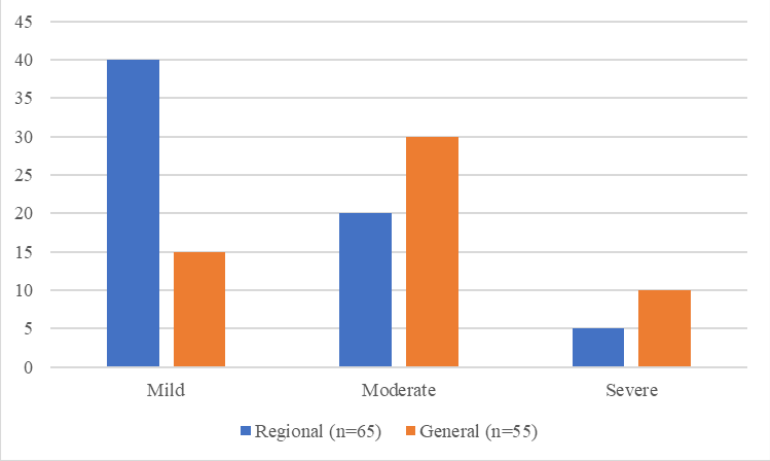

Figure 2: Postoperative Pain Levels by Anesthesia Type (New)

Figure 2 categorizes pain levels following surgery by anesthesia type. Most participants with regional anesthesia reported mild pain (40 individuals), while those under general anesthesia experienced a more even distribution across mild (15), moderate (30), and severe pain (10).

Table 5: Recovery Time (Days) and Complication Rate by Anesthesia Type

Recovery Time (Days)	Regional (n=65)	Complication Rate (%)	General (n=55)	Complication Rate (%)
1-3	30	10%	20	15%
4-7	25	20%	25	25%
>7	10	35%	10	40%

Table 5 details recovery times and complication rates by anesthesia type. Among participants with shorter recovery times of 1-3 days, complication rates are relatively low (10% for regional and 15% for general anesthesia). As recovery time increases, so does the complication rate, with those recovering for more than 7 days experiencing the highest complication rates (35% for regional and 40% for general anesthesia).

DISCUSSION

The study reports a mean participant age of approximately 45 years, with males constituting 58.3% of the population. Similar demographic trends have been noted in anesthesia-related studies, where middle-aged males often dominate surgical cases requiring intensive care due to higher incidence rates of comorbidities and surgeries in this group[16,17]. Additionally, occupational distribution patterns, with office workers being the majority (33.3%), highlight a need to consider workplace health influences on surgical outcomes[18]. The balanced representation of regional (54.2%) and general anesthesia (45.8%) enhances the reliability of comparisons. Regional anesthesia demonstrated lower ICU dependence, correlating with evidence that it reduces systemic complications like hypotension and respiratory distress, thus promoting faster recovery[19,20]. Conversely, general anesthesia patients exhibited slightly higher rates of respiratory complications, consistent with prior research linking it to prolonged mechanical ventilation needs[21]. Respiratory issues emerged as the most frequent postoperative complication (16.7%), followed by cardiovascular (12.5%) and neurological complications (8.3%). These findings echo results from similar studies, where respiratory distress was identified as a predominant ICU admission cause, especially under general anesthesia[22]. Regional anesthesia patients were less likely to develop these issues due to its localized action and sparing of respiratory centers[23]. Participants who received regional anesthesia experienced shorter ICU stays (1-2 days), with most complications confined to mild respiratory support needs. Previous investigations corroborate these findings, emphasizing the efficiency of regional anesthesia in reducing ICU time and associated healthcare burdens[24]. Patients under general anesthesia

frequently required extended ICU observation, reflecting its systemic impacts on recovery duration[25]. Shorter recovery times (1-3 days) were associated with lower complication rates, particularly in regional anesthesia patients (10%). Conversely, extended recovery periods (>7 days) correlated with higher complications, particularly for general anesthesia patients (40%). This aligns with studies identifying prolonged anesthesia effects as a significant factor in delayed recovery and elevated postoperative morbidity[26,27]

Limitations of the study

Our study has several limitations that should be noted. First, the sample size, although adequate for observing general trends, may limit the generalizability of the findings across all surgical populations, particularly those with specific comorbid conditions or high surgical complexity.

CONCLUSION

This study demonstrates that the choice of anesthesia type significantly impacts postoperative outcomes, ICU stay duration, and complication rates among surgical patients. Regional anesthesia was associated with a lower incidence of respiratory and cardiovascular complications, shorter ICU stays, and reduced pain levels post-surgery compared to general anesthesia. These findings suggest that, where feasible, regional anesthesia may provide distinct benefits for postoperative recovery, especially in minimizing complications and facilitating quicker discharge from ICU.

Conflict of interest: None

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