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Assessing the Safety and Efficacy of Intravenous Anesthetics in Elderly Patients: A Retrospective Cohort Study.

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ABSTRACT

Elderly patients undergoing surgery present unique challenges due to age-related physiological changes and multiple comorbidities. The choice of intravenous anesthetic agents in this population is crucial, as it influences hemodynamic stability, recovery, and overall outcomes. To evaluate the safety and efficacy of four intravenous anesthetic agents—propofol, etomidate, ketamine, and midazolam—in elderly surgical patients. This retrospective cohort study included 60 patients, who underwent surgery under general anesthesia at a tertiary care hospital over two years. Data were collected on demographics, comorbidities, anesthetic agents, and perioperative outcomes. Outcomes assessed included hemodynamic parameters, time to extubation, postoperative sedation, and complications like delirium or respiratory depression. Statistical analysis was performed using SPSS software, with $p < 0.05$ considered significant. Propofol showed a higher incidence of hypotension (35.7%) and faster extubation (8.5 ± 2.0 min), while etomidate demonstrated better hemodynamic stability (12.3 ± 2.8 mmHg BP drop). Ketamine showed the least hemodynamic compromise but moderate sedation (40%). Midazolam had prolonged sedation (80%) and respiratory depression (20%). Propofol and etomidate provide faster recovery, but ketamine and etomidate ensure better hemodynamic stability. Anesthetic choice should be individualized based on patient profiles to enhance safety.

Keywords: Elderly patients, intravenous anesthetics, hemodynamic stability

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INTRODUCTION

The aging population presents unique challenges in anesthesia management, as elderly patients often exhibit altered pharmacodynamics and pharmacokinetics due to comorbidities, polypharmacy, and age-related physiological changes [1]. This makes the selection of appropriate anesthetic agents crucial to ensure patient safety and improve outcomes. Intravenous anesthetics, widely used for induction and maintenance of anesthesia, offer several advantages, including rapid onset and titratable effects [2-4].

However, their use in elderly patients requires careful consideration of potential adverse effects, such as hypotension, prolonged sedation, and cognitive dysfunction, which can complicate postoperative recovery [5].

Despite extensive use, there is limited data specifically addressing the safety and efficacy of intravenous anesthetics in the elderly, especially in real-world clinical settings. This study aims to retrospectively assess the safety and efficacy of various intravenous anesthetic agents in patients aged 65 and above, focusing on perioperative outcomes, including hemodynamic stability, depth of anesthesia, and recovery profile [6]. By analyzing data from a cohort of elderly patients who underwent surgery under general anesthesia, this study seeks to provide insights into optimal anesthetic management strategies for this high-risk population [7]. Ultimately, the findings may contribute to evidence-based guidelines and individualized anesthetic care, minimizing complications and enhancing perioperative safety in elderly patients.

METHODOLOGY

This retrospective cohort study was conducted to evaluate the safety and efficacy of intravenous anesthetics in elderly patients undergoing surgery. The study was carried out at a tertiary care hospital over a period of 24 months. A total of 60 patients, who underwent surgery under general anesthesia with intravenous agents, were included in the study.

Patients' medical records were reviewed to collect data related to demographics, comorbidities, preoperative medication use, and anesthetic agents administered. Inclusion criteria consisted of patients aged 65 years or older who received intravenous anesthetics for elective or emergency surgeries. Patients with incomplete records or those who received a combination of intravenous and inhalational anesthetics were excluded from the analysis. The study aimed to evaluate outcomes such as hemodynamic stability, depth of anesthesia, adverse events, and postoperative recovery profiles.

The primary outcome of the study was the incidence of hemodynamic fluctuations, specifically hypotension and bradycardia, during and immediately after anesthesia administration. Secondary outcomes included the duration of anesthesia, time to extubation, postoperative sedation scores, and any complications such as postoperative delirium or respiratory depression. Data were collected from anesthesia records, postoperative recovery room notes, and patient charts using a standardized data collection form.

Descriptive and inferential statistical analyses were performed using SPSS software. Continuous variables, such as blood pressure and heart rate, were expressed as mean \pm standard deviation, while categorical variables, such as the occurrence of complications, were presented as frequencies and percentages. Comparative analysis of outcomes among different intravenous anesthetics was conducted using Chi-square tests for categorical variables and t-tests for continuous variables, with a significance level set at $p < 0.05$. Results were then analyzed to identify any significant trends or associations between intravenous anesthetic use and patient outcomes.

RESULTS

Table 1: Demographic and Clinical Characteristics of Patients (N=60)

Characteristic	Frequency (%) or Mean \pm SD
Age (years)	62.3 \pm 5.8
Gender	
- Male	32 (53.3)
- Female	28 (46.7)
Comorbidities	
- Hypertension	42 (70.0)
- Diabetes Mellitus	35 (58.3)
- Chronic Kidney Disease	18 (30.0)
ASA Grade	
- Grade I-II	15 (25.0)
- Grade III	36 (60.0)
- Grade IV	9 (15.0)

Table 2: Distribution of Intravenous Anesthetic Agents Used (N=60)

Anesthetic Agent	Frequency (%)
Propofol	28 (46.7)
Etomidate	12 (20.0)
Ketamine	10 (16.7)
Midazolam	10 (16.7)

Table 3: Perioperative Hemodynamic Parameters

Parameter	Propofol (n=28)	Etomidate (n=12)	Ketamine (n=10)	Midazolam (n=10)
Mean BP Drop (mmHg)	20.5 \pm 3.5	12.3 \pm 2.8	8.6 \pm 2.1	15.4 \pm 3.2
Bradycardia (%)	6 (21.4)	2 (16.7)	0 (0)	3 (30.0)
Hypotension (%)	10 (35.7)	3 (25.0)	1 (10.0)	4 (40.0)

Table 4: Postoperative Outcomes

Outcome	Propofol (n=28)	Etomidate (n=12)	Ketamine (n=10)	Midazolam (n=10)
Time to Extubation (min)	8.5 \pm 2.0	6.8 \pm 1.5	9.3 \pm 2.3	12.4 \pm 2.7
Postoperative Sedation (%)	12 (42.9)	3 (25.0)	4 (40.0)	8 (80.0)
Delirium (%)	2 (7.1)	1 (8.3)	0 (0)	1 (10.0)
Respiratory Depression (%)	1 (3.6)	0 (0)	0 (0)	2 (20.0)

DISCUSSION

Our study aimed to assess the safety and efficacy of intravenous anesthetics in elderly patients undergoing surgery. The study involved 60 patients and analyzed various perioperative outcomes associated with four commonly used intravenous anesthetic agents: propofol, etomidate, ketamine, and midazolam. The results highlighted the differences in patient responses to these agents, focusing on hemodynamic stability, postoperative recovery, and complications. This discussion explores the implications of the findings and provides insights for anesthetic management in elderly patients, emphasizing individualized care based on clinical characteristics [8].

The demographic characteristics of the patient cohort revealed that the majority had multiple comorbidities, with hypertension (70%) and diabetes mellitus (58.3%) being the most prevalent conditions. This aligns with existing literature, which shows that elderly patients often present with significant comorbidities that can influence anesthetic management and outcomes. The American Society of Anesthesiologists (ASA) grades indicated that 60% of patients were classified as Grade III, reflecting a

moderate-to-severe level of systemic disease. This reinforces the need for cautious anesthetic selection and monitoring in this population, given their increased susceptibility to anesthetic-related adverse effects, particularly hemodynamic instability [9].

Among the intravenous agents, propofol was the most frequently used (46.7%), followed by etomidate (20.0%), ketamine (16.7%), and midazolam (16.7%). The preference for propofol could be attributed to its rapid onset and short duration of action, making it suitable for induction and maintenance of anesthesia in various procedures. However, propofol was associated with the highest incidence of hypotension (35.7%), a finding consistent with previous studies that identify hypotension as a common adverse effect of propofol due to its vasodilatory properties. The mean drop in blood pressure among propofol users was 20.5 ± 3.5 mmHg, significantly higher than that observed with other agents. This finding suggests that propofol, while effective, requires careful titration and may necessitate preemptive measures like fluid loading or vasopressor support to mitigate hypotension in elderly patients.

Etomidate demonstrated better hemodynamic stability compared to propofol, with a lower mean drop in blood pressure (12.3 ± 2.8 mmHg) and reduced incidence of hypotension (25%). These results align with existing evidence that supports etomidate as an agent of choice in patients with cardiovascular compromise, given its minimal effects on blood pressure and heart rate. The use of etomidate was also associated with a lower incidence of bradycardia (16.7%) compared to propofol and midazolam, making it a safer option for elderly patients at higher risk of hemodynamic fluctuations. However, the potential for adrenal suppression, even though not directly assessed in this study, remains a concern with etomidate, necessitating its judicious use, especially in patients with critical illness.

Ketamine, known for its unique mechanism of action that preserves airway reflexes and induces sympathetic stimulation, was associated with the least hemodynamic compromise among the four agents. The mean drop in blood pressure was 8.6 ± 2.1 mmHg, and no cases of bradycardia or hypotension were reported. These findings suggest that ketamine may be a safer alternative for elderly patients prone to hypotension or those with baseline low blood pressure. However, ketamine was associated with a moderate incidence of postoperative sedation (40%), indicating a need for caution in patients where rapid recovery is essential. The use of ketamine in elderly patients also requires consideration of potential neuropsychiatric effects, such as hallucinations or delirium, although these were not prominently observed in this study.

Midazolam, primarily used as an adjunct or for sedation, showed the highest incidence of postoperative sedation (80%) and respiratory depression (20%), along with a significant mean drop in blood pressure (15.4 ± 3.2 mmHg). These results suggest that while midazolam can be effective for sedation, its use in elderly patients may lead to prolonged recovery times and increased risk of respiratory complications. The higher sedation and respiratory depression rates observed with midazolam may be due to its longer duration of action compared to the other agents, emphasizing the need for careful dose adjustment and monitoring when used in elderly patients. Midazolam may still be useful for specific cases, such as when deeper sedation is required, but its benefits must be weighed against the risk of prolonged sedation and respiratory depression.

Postoperative outcomes further illustrated the differences in recovery profiles among the anesthetic agents. Propofol and etomidate showed faster extubation times, averaging 8.5 ± 2.0 and 6.8 ± 1.5 minutes, respectively, compared to ketamine (9.3 ± 2.3 minutes) and midazolam (12.4 ± 2.7 minutes). The rapid recovery associated with propofol and etomidate supports their use in settings where timely postoperative recovery is critical. However, propofol's propensity for hypotension and etomidate's potential for adrenal suppression must be considered when deciding on the agent. The overall incidence of postoperative delirium was low, with only 7.1% in the propofol group, 8.3% in the etomidate group, and no cases reported with ketamine. This finding is significant, as delirium is a common postoperative complication in elderly patients, often leading to prolonged hospital stays and increased morbidity. The low delirium rates may reflect careful patient selection and monitoring in this study.

CONCLUSION

In conclusion, our results suggest that while propofol and etomidate offer faster recovery times, etomidate and ketamine provide better hemodynamic stability. Midazolam, although effective for

sedation, carries a higher risk of prolonged sedation and respiratory depression. These findings underscore the importance of individualized anesthetic choice based on the clinical profile of elderly patients, aiming to balance efficacy with safety.

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