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A STUDY ON THE COMPARISON OF ISOFLURANE AND SEVOFLURANE FOR THE MAINTENANCE OF GENERAL ANESTHESIA FOR GENERAL SURGERIES

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ABSTRACT

The aim of this prospective randomized comparative study was to measure and compare the use of isoflurane and sevoflurane in maintenance of general anesthesia among patients having general surgical operations. Sixty adult ASA physical status I and II patients were randomly assigned to two groups of 30 patients each, whereby Group I was getting isoflurane and Group II was being exposed to sevoflurane as the mode of anesthetic maintenance. The research evaluated the baseline demographic factors, intraoperative hemodynamic and the postoperative adverse effects to establish the effectiveness and safety of the two inhalational agents. The findings indicated that the groups were similar on the demographic variables, which guaranteed homogeneity of the study population. Regarding intraoperative heart rate and systolic blood pressure, as well as mean arterial pressure, were stable and were not significantly different in the two groups, the hemodynamic stability of maintaining anesthesia was similar. But the adverse reactions that occurred after surgery like nausea, vomiting, and cough occurred more frequently in the isoflurane group compared to sevoflurane group, and the latter had few complications and a smooth recovery curve. Therefore, both agents were both useful in general anesthesia maintenance, but sevoflurane showed better results regarding a better postoperative recovery and less adverse effects without a significant difference in intraoperative hemodynamic stability.

Keywords: *Isoflurane, Sevoflurane, General Anesthesia, Hemodynamic Stability, Postoperative Recovery, Inhalational Anesthetic Agents*

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1. INTRODUCTION

General anesthesia is an inseparable element of contemporary surgery, and it allows the safe and efficient conduct of a broad spectrum of elective and emergency surgery. The general anesthesia maintenance period is especially problematic because maintenance of sufficient anesthetic depth and cardiovascular stability, maintenance of optimal operating conditions, and timely and easy recovery are essential conditions. The use of volatile inhalational anesthetic agents during this stage is highly desirable due to their well-known pharmacokinetic characteristics, simplicity in controlling, and capability to carry out any changes in the anesthetic depth depending on the surgical stimulation. Among other inhalational agents used, isoflurane and sevoflurane are typical agents of maintenance of general anesthesia in the ordinary surgical practice because they are proven to be effective, safe, and clinically reliable. They have become part of the balanced anesthesia of the modern practice of anesthesia because of their pharmacological characteristics and their influence on perioperative physiology.

Maintaining hemodynamic stability is one of the essential conditions in general anesthesia maintenance because changes in the heart rate and arterial blood pressure could negatively affect the result of the perioperative process and patient safety. Isoflurane and sevoflurane differ in their cardiovascular effects which can potentially have implications in the intraoperative hemodynamic reactions. Isoflurane has been known to induce dose-dependent systemic vascular relaxation resulting in decreases in systemic vascular resistance and arterial blood pressure and at times with reflex tachycardia. Conversely, sevoflurane is usually linked to a more stable cardiovascular reaction and a more beneficial maintenance of heart rate, and therefore, it is a preferable choice in the situation where little variation in hemodynamics is required. Since surgeries subject the human body to different levels of physiological stress, the inhalational anesthetic used is a significant factor that guarantees stability of the cardiovascular system and sufficient tissue perfusion during the operative phase.

The quality and speed of postoperative recovery is another factor that is vital in the maintenance of general anesthesia as it has a direct relationship with patient comfort, operating room efficiency, and overall results of the perioperative. Even in the case of isoflurane, though it is cost-effective

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and commonly used, the blood-gas solubility coefficient is relatively high, which can be a contributing factor to slower emergence and delayed recovery after ending anesthesia. On the contrary, sevoflurane has a lower blood gas partition coefficient, which allows it to leave the body faster, awaken faster, respond faster to verbal orders, and have an easier time extubation. These pharmacokinetic benefits render sevoflurane especially appropriate in the circumstances when fast assessment of the postoperative and prompt restoration is required. The choice of an inhalational anesthetic agent, thus, has a profound impact on the intraoperative stability as well as the postoperative care and patient satisfaction efficiency.

The inhalational anesthetic agents should offer an ideal balance between the anesthetic depth, cardiovascular stability and a quick recovery in order to have safe and effective surgical anesthesia. Isoflurane is appreciated because of its high potency, low rates of metabolism, and affordability, which contribute to its suitability in long surgical operations but could be accompanied by delayed anesthesia, and increased occurrences of postoperative side effects. Sevoflurane, however, has low blood-gas solubility, low airway irritability, and is easily titratable, making it easy to maintain and recovery faster than is possible with isoflurane. Based on these differences in pharmacological and clinical characteristics, a comparative analysis of isoflurane and sevoflurane would be necessary to evaluate their comparative efficacy and hemodynamic consequences as well as postoperative outcomes in patients under general surgical operations. The current research was thus conducted to compare between isoflurane and sevoflurane in the maintenance of general anesthesia in patients undergoing general surgeries with intraoperative hemodynamic stability, recovery nature and postoperative complications.

2. LITERATURE REVIEW

Alshami et al. (2023) carried out a prospective comparative study in which they assessed the application of isoflurane and sevoflurane as inhalational anesthetics and they concluded that both the agents were effective in ensuring that there was sufficient anesthetic depth during the surgical procedures. The researchers noted that sevoflurane has more stable hemodynamic parameters and fewer changes in heart rate and arterial blood pressure as compared to isoflurane. Moreover, the analysis has shown that the recovery patterns were better in the sevoflurane group, and the patients

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were introduced to the postoperative condition sooner and easier. The authors made a conclusion that both anesthetic agents had been shown to be clinically effective and safe in maintenance of general anesthesia, but sevoflurane had some advantages of hemodynamic stability and rapid recovery properties.

Jones et al. (2016) carried out a randomized non-inferior comparative efficacy trial of intraoperative and postoperative outcomes of isoflurane and sevoflurane in cardiac surgical patients. Both anesthetic drugs were reported to have exhibited satisfactory cardiovascular stability as well as sufficient depth of anesthesia during surgery. Nevertheless, sevoflurane was linked with better endpoints of early recovery and fewer postoperative complications in patients in some of the subsets. The results indicated that although isoflurane was still suitable in terms of maintenance anesthesia, sevoflurane could provide an advantageous effect in regard to quicker recovery and improved perioperative recovery without damaging hemodynamic safety.

Kurhekar et al. (2017) conducted a randomized trial comparing isoflurane, sevoflurane, and desflurane in ventilation of ambulatory anesthesia and determined that all of the three volatile anesthetes would allow maintenance of a consistent intraoperative anesthetic environment. However, the authors noted that the recovery milestones like opening of eyes, responding to command, and readiness to extubation came much sooner among the patients who received sevoflurane than among those who received isoflurane. The study highlighted that the reduced blood-gas solubility of sevoflurane was associated with a faster elimination and a shorter postoperative period and, therefore, was especially beneficial in brief-lasting and ambulatory surgery.

Rawat et al. (2024) performed a comparative clinical study of adult surgical patients to compare the physiological effects of isoflurane and sevoflurane in the postoperative period by analyzing the liver function parameters after general anesthesia. According to the investigators, the two anesthetic agents were safe and neither of them caused clinically significant hepatic dysfunction during the postoperative period. Nevertheless, the sevoflurane group proved to show a relatively better overall recovery in the postoperative period having lesser adverse symptoms like nausea and vomiting. The authors made the conclusion that both isoflurane and sevoflurane were effective

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and safe as inhalational anesthetics, but sevoflurane demonstrated a better postoperative profile and provided more comfortable experiences to patients after general surgery.

3. RESEARCH METHODOLOGY

This investigation took an organized system of clinical research in order to compare the efficacy and perioperative consequences of the application of isoflurane and sevoflurane in the maintenance of general anesthesia in patients undergoing general surgeries. The methodology was tailored to provide consistency in technique of anesthesia, monitoring and postoperative assessment in order to be able to make dependable comparison between the two inhalational agents. All the process was developed according to the institutional ethical approval, and informed consent of each of the participants was taken before he/she was enrolled into the study. The methodological approach was aimed at assessing the intraoperative hemodynamic stability, recovery profile and postoperative adverse outcomes of both anesthetics.

3.1 Research Design

The research was done as a randomized, prospective, and comparative, double-blind study. Adult patients who were to undergo elective general surgical operations were selected randomly to be divided into two equal groups to either be administered with isoflurane or sevoflurane to sustain general anesthesia. Randomization that was used made the groups comparable and reduced the selection bias. The anesthetic protocols used were standardized and intraoperative and postoperative parameters were measured in a systematic manner to enable objective comparison of the results between the two study groups.

3.2 Sample Size and Population

The target population was comprised of sixty adult patients aged 20-60 years belonging to American Society of Anesthesiologists (ASA) physical status I and II and were due to day-care general surgical operations. The sample size of sixty participants was split in two groups of thirty participants each. Group A included those patients that were undergoing anesthesia maintenance using isoflurane and Group B considered patients that were undergoing anesthesia maintenance under sevoflurane. It exclusion criteria included patients who have an expected difficult airway, a

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known allergy to anesthetic drugs, pregnancy, severe cardiac or respiratory comorbidities, the pediatric age group, ASA grade III and IV, and patients who were on anticoagulant treatment to ensure homogeneity and patient safety.

3.3 Data Collection

The data were collected in the Department of Anesthesia of Noora Hospital, Srinagar, Jammu and Kashmir, between the years April 2025 and October 2025. Each patient underwent a comprehensive examination including the clinical history, physical and systemic examination, and routine laboratory tests (hemoglobin, blood sugar, blood urea, serum creatinine, bleeding time, and clotting time). The preoperative examination included electrocardiography and a chest radiography. All the participants were taken to baseline demographic parameters including age, height, weight, gender, ASA grading and duration of surgical procedures before being induced into anesthesia.

3.4 Data Collection Tools and Instruments

Intraoperative and postoperative parameters were measured with the help of standard non-invasive monitors (i.e. ECG, non-invasive blood pressure, pulse oximetry, and capnography). Endotracheal intubation was performed after the induction of anesthesia using intravenous propofol and neuromuscular blockage using vecuronium or atracurium. Oxygen and nitrous oxide or air and the allocated inhalational agent (isoflurane or sevoflurane) were used as maintenance agents to ensure that the required depth of anesthesia was maintained. The pressure variables were documented at fixed time points during the surgery and the postoperative observations were in terms of the vital signs and adverse events like nausea, vomiting, cough, as well as shivering. The level of pain was evaluated by visual analogue scale and rescue analgesia was given according to the institutional protocol.

3.5 Data Analysis

The obtained data were summarized and presented as a mean with standard deviation of continuous variable and frequency with percentage of categoric variables. The statistical comparative analysis was conducted in the groups of isoflurane and sevoflurane to determine the differences in

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demographic features, operation time, baseline, perioperative and postoperative data about hemodynamics, and side effects. The p-value of 0.05 was taken as statistically non-significant, that is, similar results in both groups. This method of analysis was able to objectively interpret the efficacy, safety and recovery profile of both inhalational anesthetic agents when each was used in sustaining general anesthesia in general surgical procedures.

4. RESULTS AND DISCUSSION

Findings of the current research were reviewed to conduct a comparison of the effectiveness and safety of isoflurane and sevoflurane in keeping patients under general anesthesia during general surgical procedures. The comparison was based on baseline demographic qualities, intraoperative and postoperative adverse effects, as well as hemodynamic variables. These were parameters that were compared to ascertain the hemodynamic stability, recovery profile, and general tolerability of each of the inhalational anesthetic agents.

Table 1 shows the demographic variables of patients at the baseline in both groups (Isoflurane group and Sevoflurane group) of 30 patients each. The variables were the age, weight, and body mass index (BMI), which were taken to determine the similarity of the two groups of study before the inhalational anesthetic agents were administered. These baseline parameters were assessed in order to achieve homogeneity of the sample as well as to reduce the effect of confounder demographic factors on the study results. The distribution of these demographic variables between the two groups in the study is given in the form of a graph in Figure 1.

Table 1: Baseline Demographic Characteristics

Variable	**Isoflurane Group (n=30)**	**Sevoflurane Group (n=30)**	**p-value**
Age (years)	27.5 ± 4.2	28.1 ± 4.5	>0.05
Weight (kg)	65.2 ± 5.3	66.1 ± 6.0	>0.05
BMI (kg/m^2)	26.8 ± 2.1	27.0 ± 2.3	>0.05

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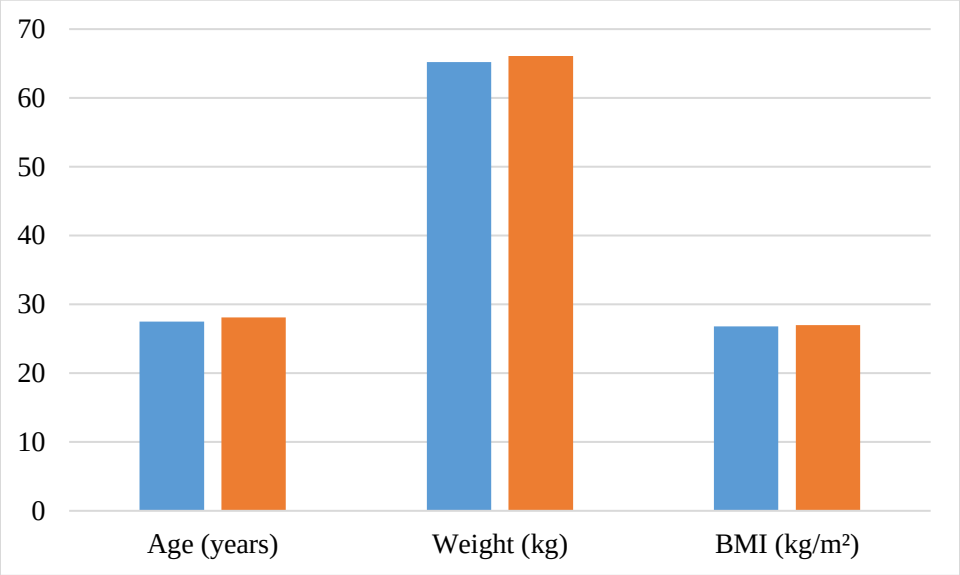

Figure 1: Graphical Representation of Baseline Demographic Characteristics

The average age of patients undergoing Isoflurane was 27.5 ± 4.2 years and the average age of patients undergoing Sevoflurane was 28.1 ± 4.5 years, this did not show any significant difference between the two groups ($p > 0.05$). In the same manner, the average weight was found to be 65.2 ± 5.3 kg in Isoflurane group and 66.1 ± 6.0 kg in Sevoflurane group which was not significant ($p > 0.05$). The average BMI in the Isoflurane group was thus 26.8 ± 2.1 kg/m^2 and the average BMI in the Sevoflurane group was 27.0 ± 2.3 kg / m^2 again showing no significant difference ($p > 0.05$). The similar distribution of these demographic factors in both groups as depicted in Figure 1 is graphic evidence that at the baseline, the study population was well matched.

Table 2 presents the comparison of the intraoperative hemodynamic variables in the Isoflurane and rest Sevoflurane groups when the general anesthesia was maintained. The parameters measured were the heart rate, systolic blood pressure (SBP) and mean arterial pressure (MAP) to determine cardiovascular stability in the operating theater. The graphical comparison of these intraoperative hemodynamic parameters between the two groups is given in figure 2.

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Table 2: Intraoperative Hemodynamic Variables

Parameter	Isoflurane Group	Sevoflurane Group	p-value
Heart Rate (bpm)	82.3 ± 6.5	83.1 ± 7.0	>0.05
SBP (mmHg)	100.6 ± 9.3	95.9 ± 8.7	>0.05
MAP (mmHg)	70.9 ± 7.1	72.3 ± 6.8	>0.05

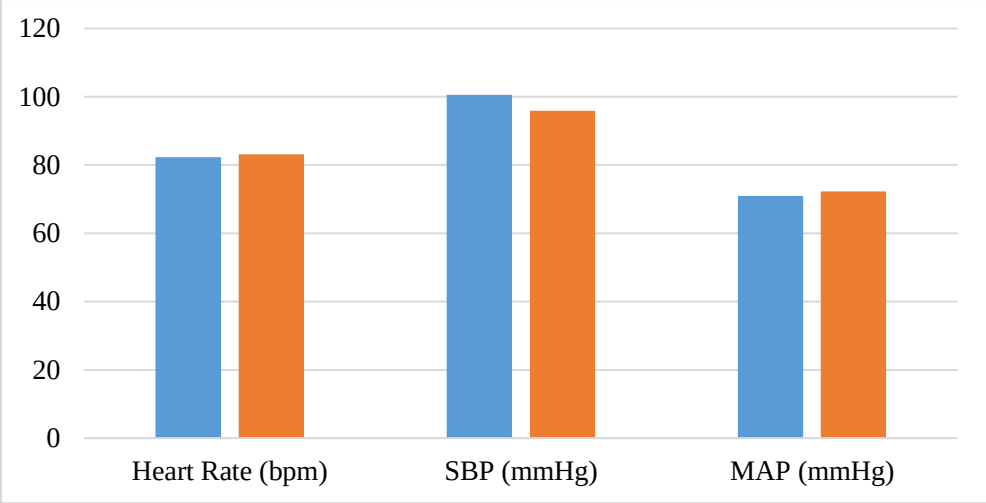

Figure 2: Graphical Representation of Intraoperative Hemodynamic Variables

The mean intraoperative heart rate in the Isoflurane group was 82.3 ± 6.5 bpm, while the Sevoflurane group showed a mean heart rate of 83.1 ± 7.0 bpm, with no statistically significant difference between the groups ($p > 0.05$). The mean systolic blood pressure was 100.6 ± 9.3 mmHg in the Isoflurane group and 95.9 ± 8.7 mmHg in the Sevoflurane group, which was also not statistically significant ($p > 0.05$). Similarly, the mean arterial pressure was 70.9 ± 7.1 mmHg in the Isoflurane group compared to 72.3 ± 6.8 mmHg in the Sevoflurane group, again showing no significant difference ($p > 0.05$). Figure 2 graphically demonstrates that intraoperative hemodynamic variables remained comparable between the two groups, indicating that both anesthetic agents provided stable cardiovascular conditions during maintenance of general anesthesia.

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In Table 3, the comparison of adverse effects experienced by the patient following surgery after maintenance of general anesthesia by the use of Isoflurane and Sevoflurane is brought out. The complications that were measured were nausea, vomiting, and cough during the postoperative period to determine the tolerability and the recovery profile of the two anesthetic agents. The graphical representation of the distribution of these adverse effects of the postoperative between the two groups has been given in Figure 3.

Table 3: Postoperative Adverse Effects

Complication	Isoflurane Group (n=30)	Sevoflurane Group (n=30)
Nausea	3 (10%)	0
Vomiting	2 (6.7%)	0
Cough	1 (3.3%)	0

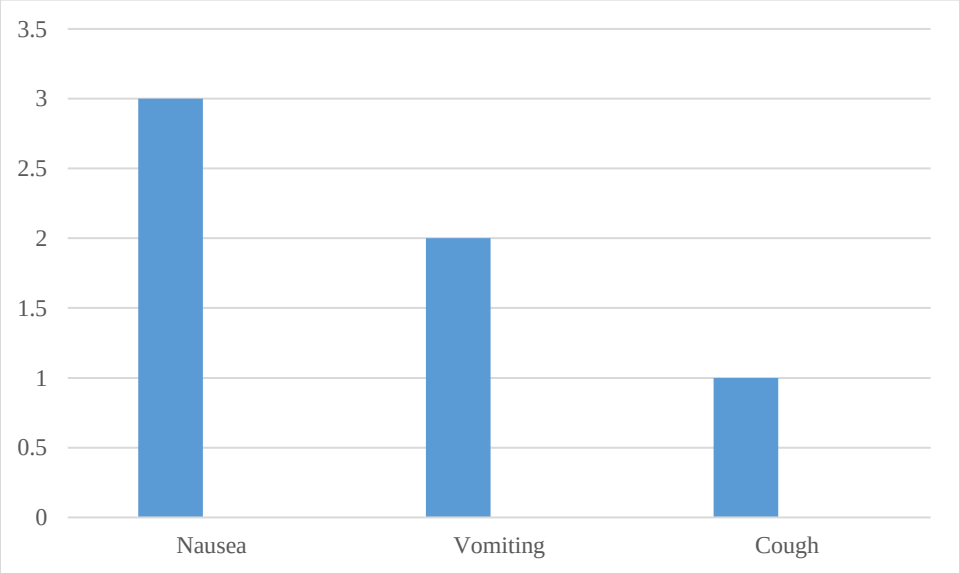

Figure 3: Graphical Representation of Postoperative Adverse Effects

The Isoflurane group had a higher number of postoperative adverse effects than the Sevoflurane group. The patients experiencing nausea (10%), vomiting (6.7%), and cough (3.3%) in the Isoflurane group did not experience any of these complications in the Sevoflurane group. The

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reduced cases of postoperative adverse effects of sevoflurane as shown in Figure 3 in a graphical way demonstrates a relatively smooth profile of recovery.

On the whole, the results of the research showed that isoflurane and sevoflurane were both effective in preserving the intraoperative hemodynamics of the state under general anesthesia. The two groups were similar in terms of the demographic variables of baseline, which confirmed that the study population was also homogeneous. Although there were no significant differences in the intraoperative cardiovascular parameters using the two agents, there were more instances of postoperative adverse outcomes that included nausea, vomiting, and cough in the isoflurane group. These findings indicated that sevoflurane offered a relatively more favorable recovery profile and fewer complications postoperative, and that it was as stable as that of sevoflurane during surgery.

5. CONCLUSION

To conclude, the current research revealed both isoflurane and sevoflurane to be safe and effective as inhalational agents of maintenance of general anesthesia in patients undergoing general surgery, since the two offered similar intra-operative hemodynamic stability and sufficient depth of anesthesia. The two groups had similar baseline demographic features and surgical variables, which proved the homogeneity of the study population. Whereas intraoperative cardiovascular parameters were statistically similar, the rate of postoperative adverse effects including nausea, vomiting, and cough were found to be greater in isoflurane group. Contrastingly, sevoflurane was linked with fewer postoperative complications and easier recovery pattern, which points at increased postoperative tolerance and patient comfort. Hence, although isoflurane can be a reliable and cost-effective anesthetic, sevoflurane can be a better option in the case of general anesthesia of the operation and a faster recovery rate and better postoperative results are needed.

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