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ORIGINAL RESEARCH

Comparative Analysis of Inhalational vs. Intravenous Anesthesia in Outpatient Surgery: A Prospective Cohort Study

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ABSTRACT

Introduction: Anesthesia is crucial in ensuring patient comfort and safety during surgical procedures. Among the various techniques available, inhalational anesthesia and intravenous (IV) anesthesia are the two most commonly used methods in outpatient surgeries. **Objectives:** The basic aim of the study is to compare inhalational and intravenous anesthesia in terms of recovery time, postoperative nausea and vomiting (PONV), patient satisfaction, and side effects. **Methodology:** This prospective cohort study was conducted at Sri Siddhartha Medical College Hospital, Tumkuruduring June 2023 to May 2024. Data were collected from 455 patients according to the criteria of the study. Out of these, 227 received inhalational anesthesia, while 228 were administered intravenous anesthesia. Key outcomes measured included recovery time, incidence of PONV, patient satisfaction, side effects, and cost per procedure. **Results:** Data were collected from 455 patients. The mean age was 45.12 ± 12.01 years for the inhalational group and 44.38 ± 11.22 years for the intravenous group ($p = 0.45$). The gender distribution, ASA classification, comorbidities, body mass index (BMI), and smoking status were also comparable between the two groups, with no statistically significant differences (p-values ranging from 0.65 to 0.92). Patients in the intravenous anesthesia group had significantly faster recovery times (45 ± 10 minutes vs. 65 ± 15 minutes, $p < 0.001$). **Conclusion:** It is concluded that intravenous anesthesia offers significant advantages over inhalational anesthesia in outpatient surgery, including shorter recovery time, lower incidence of postoperative nausea and vomiting, higher patient satisfaction, and improved cost-effectiveness.

INTRODUCTION

Anesthesia is crucial in ensuring patient comfort and safety during surgical procedures. Among the various techniques available, inhalational anesthesia and intravenous (IV) anesthesia are the two most commonly used methods in outpatient surgeries. Both approaches aim to induce and maintain a controlled state of unconsciousness and analgesia, allowing the surgical team to perform the necessary procedures without causing distress or pain to the patient [1]. However, these methods differ in their mechanisms of action, pharmacokinetics, and clinical outcomes. Inhalational anesthesia involves the administration of volatile anesthetic agents, typically via a breathing mask or endotracheal tube, which are absorbed into the bloodstream through the lungs [2]. This method is widely used for its ease of titration and rapid induction and recovery profiles. Inhalational agents, such as sevoflurane, isoflurane, and desflurane, are commonly employed due to their predictable pharmacokinetics and ability to adjust the depth of anesthesia quickly, based on patient requirements. The exhaled gases are also easily monitored, providing real-time feedback to anesthesiologists. A key advantage of inhalational anesthesia is that the anesthetic concentration can be adjusted during the procedure, offering flexibility in response to changes in the patient's condition or surgical requirements [3].

On the other hand, intravenous anesthesia is delivered through an injection into the bloodstream, usually in the form of medications such as propofol, ketamine, or etomidate. IV anesthesia is known for its faster

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onset of action and precise control over anesthesia depth. Unlike inhalational agents, intravenous anesthetics typically produce a rapid and smooth induction, which is particularly beneficial for outpatient surgeries where minimizing the time spent under anesthesia is important for faster recovery [4]. IV anesthesia is generally preferred for shorter, less invasive procedures and for patients who may not tolerate inhalational agents well. Propofol, a widely used IV anesthetic, has a rapid onset and short duration of action, facilitating quicker recovery from anesthesia, which is ideal for outpatient settings [5]. Multiple factors influence the choice of anesthesia method in outpatient surgeries, including the type and duration of the procedure, the patient's health status, and the potential for complications. Outpatient surgery requires high efficiency, and both inhalational and intravenous techniques have distinct advantages that can influence recovery times, side effects, and patient satisfaction [6].

Recovery time is a critical factor in outpatient anesthesia selection. Inhalational agents generally offer rapid recovery, but they tend to have a longer elimination half-life compared to IV anesthetics. In contrast, IV anesthesia, particularly with agents like propofol, is known for facilitating faster recovery due to its short half-life and ability to be quickly cleared from the body. This contributes to a quicker discharge time for patients, which is particularly advantageous in outpatient settings where minimizing the length of stay is a priority. Side effects also play a key role in anesthesia choice. Inhalational anesthetics may lead to postoperative nausea and vomiting (PONV), which can delay recovery and patient discharge. However, modern inhalational agents are associated with a lower incidence of PONV compared to older agents [7]. Conversely, intravenous anesthetics such as propofol are less likely to cause nausea and vomiting, though they may result in other side effects such as hypotension, respiratory depression, or injection site pain. The potential for allergic reactions to anesthetic agents is another consideration, with IV anesthetics typically having a lower incidence of allergic reactions compared to inhalational agents [8]. In terms of patient preference, some patients may prefer one method over the other due to concerns about the route of administration. Patients undergoing inhalational anesthesia may find the mask or breathing tube uncomfortable, while others may prefer the quick onset of IV anesthesia. Anesthesiologists often take these preferences into account, along with the clinical advantages and risks associated with each method, when planning the anesthetic approach [9].Cost-effectiveness is another important factor when considering the choice of anesthesia. Inhalational anesthesia tends to require more complex equipment for administration and monitoring, leading to potentially higher costs, especially in cases where expensive volatile anesthetics are used. IV anesthesia, while still requiring skilled administration, typically involves lower material costs and can be more cost-effective in certain settings, particularly in shorter procedures.By evaluating these factors, healthcare providers can make more informed decisions about the most appropriate anesthetic technique based on the specific needs of the patient and the surgical procedure [10].

Objectives

The basic aim of the study is to compare inhalational and intravenous anesthesia in terms of recovery time, postoperative nausea and vomiting (PONV), patient satisfaction and side effects.

Methodology

This prospective cohort study was conducted at Sri Siddhartha Medical College Hospital during June 2023 to May 2024. Data were collected from 455 patients according to the criteria of the study.

Inclusion criteria

- Patients aged >18 years who were scheduled for elective outpatient surgeries, classified as ASA I or II, were included.

Exclusion criteria

- Patients with significant comorbidities, allergies to anesthesia agents, pregnancy, emergency surgeries, neurological or psychiatric conditions, or those unable to consent were excluded from the study.

Data collection

Data were collected at various stages: preoperative, intraoperative, and postoperative. Patients were assigned to two groups:

Group I: received inhalational anesthesia, administered via volatile agents such as sevoflurane,

Group II: received intravenous anesthesia, and administered using agents like propofol.

Both groups underwent similar minor or moderate outpatient surgical procedures, ensuring uniformity in the types of surgeries. Preoperative data included patient demographics, health status, and surgical details. Intraoperative data recorded anesthesia type, dosages, and any complications. Postoperative data included recovery times, incidence of postoperative nausea and vomiting (PONV), pain levels, and patient satisfaction, along with any adverse effects observed. Recovery time was measured as the time from surgery completion to discharge readiness. Recovery time was measured from the end of the surgery to the point of discharge readiness. Incidence of postoperative nausea and vomiting (PONV), patient satisfaction, side effects, and cost-effectiveness of each anesthesia method were also documented.

Statistical Analysis

Data were analyzed using SPSS v26. Descriptive statistics were used to summarize patient

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demographics and outcomes. The chi-square test was applied to categorical variables. Multivariable regression was performed to adjust for confounding factors.

RESULTS

Data were collected from 455 patients. The mean age was 45.12 ± 12.01 years for the inhalational group and 44.38 ± 11.22 years for the intravenous group (p = 0.45). The gender distribution, ASA classification, comorbidities, body mass index (BMI), and smoking status were also comparable between the two groups, with no statistically significant differences (p-values ranging from 0.65 to 0.92). This suggests that the two groups were well-matched at baseline, minimizing potential confounding factors.

Table 1: Demographic and Baseline Characteristics

Characteristic	Inhalational Anesthesia (n=227)	Intravenous Anesthesia (n=228)	p-value
Age (Mean ± SD)	45.12 ± 12.01	44.38 ± 11.22	0.45
Gender (Male:Female)	120:107	123:105	0.81
ASA Classification			0.92
- ASA I	170 (75%)	172 (75%)	
- ASA II	57 (25%)	56 (25%)	
Comorbidities (Yes:No)	35:192	38:190	0.74
Body Mass Index (BMI) (Mean ± SD)	26.5 ± 4.2	26.7 ± 4.1	0.65
Smoking Status (Smoker:Non-Smoker)	48:179	52:176	0.76

The mean recovery time was notably shorter in the intravenous group (45 ± 10 minutes) compared to the inhalational group (65 ± 15 minutes), with a p-value of <0.001. Additionally, the incidence of postoperative nausea and vomiting (PONV) was lower in the intravenous group (18%) compared to the inhalational group (30%), with a p-value of 0.02. Patient satisfaction was also higher in the intravenous group, with a mean score of 4.7 ± 0.4, compared to 4.3 ± 0.5 in the inhalational group, and this difference was statistically significant (p = 0.004).

Table 2: Key Outcomes Comparison Between Anesthesia Groups

Outcome	Inhalational Anesthesia	Intravenous Anesthesia	p-value
Mean Recovery Time (Minutes) ± SD	65 ± 15	45 ± 10	<0.001
Incidence of PONV (%)	30% (68/227)	18% (41/228)	0.02
Mean Satisfaction Score ± SD	4.3 ± 0.5	4.7 ± 0.4	0.004

The incidence of mild hypotension was higher in the inhalational group (12%) compared to the intravenous group (8%), with a significant difference (p = 0.03). Similarly, bradycardia occurred more frequently in the inhalational group (5%) compared to the intravenous group (3%), with a p-value of 0.04. The incidence of moderate to severe pain was higher in the inhalational group (25%) than in the intravenous group (15%), with a p-value of 0.05. However, the mean duration of surgery did not differ significantly between the groups (90 ± 20 minutes for inhalational and 88 ± 18 minutes for intravenous, p = 0.12).

Table 3: Side Effects and Outcomes Comparison Between Anesthesia Groups

Outcome	Inhalational Anesthesia (%)	Intravenous Anesthesia (%)	p-value
Mild Hypotension	12% (27/227)	8% (18/228)	0.03
Bradycardia	5% (11/227)	3% (7/228)	0.04
Incidence of Moderate to Severe Pain	25% (57/227)	15% (34/228)	0.05
Mean Duration of Surgery (min) (Mean± SD)	90 ± 20	88 ± 18	0.12

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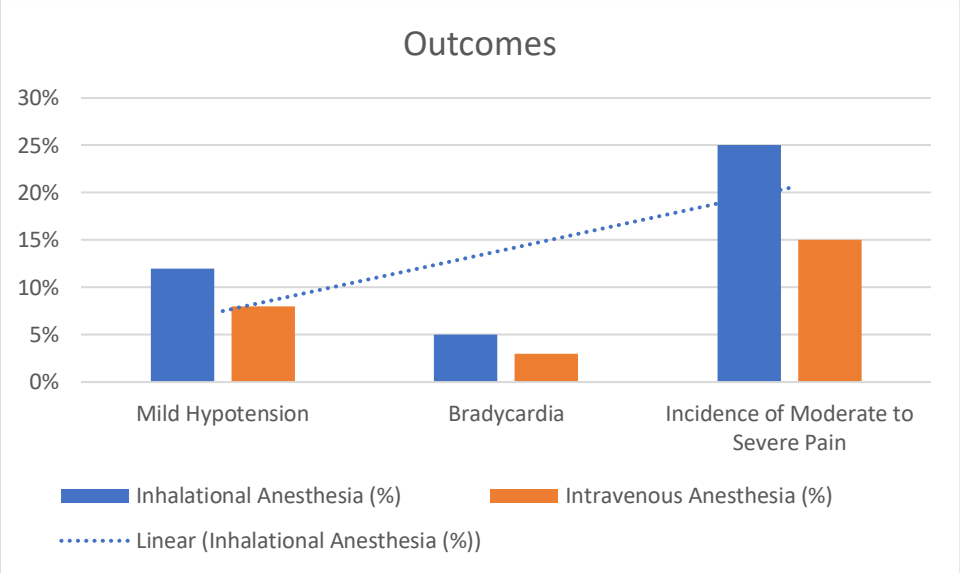

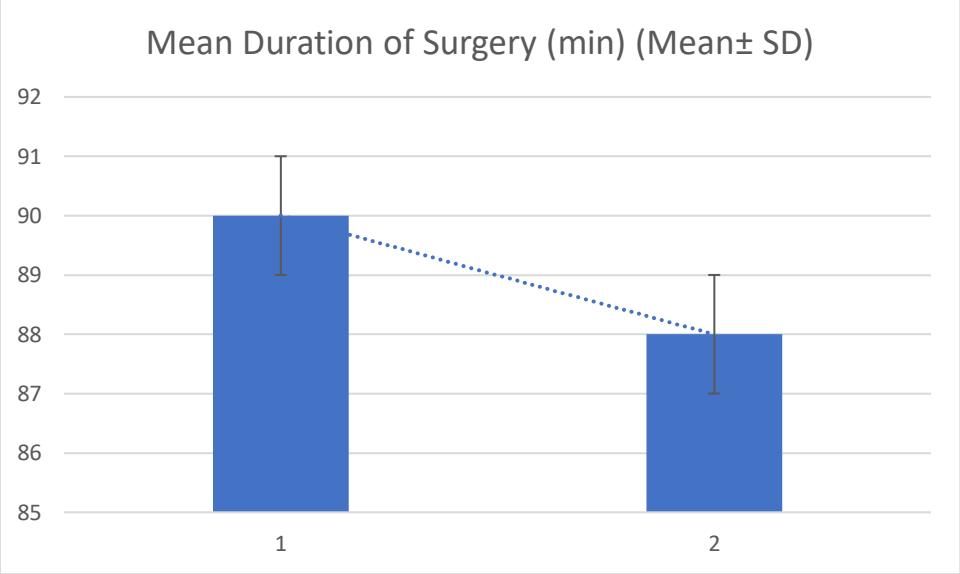

DISCUSSION

This prospective cohort study aimed to compare the outcomes of inhalational anesthesia versus intravenous anesthesia in outpatient surgery. The primary and secondary outcomes were analyzed to assess factors such as recovery time, incidence of postoperative nausea and vomiting (PONV), patient satisfaction, side effects, cost-effectiveness, and other related metrics. The findings are very useful in seeking to understand the strengths and drawbacks associated with each technique of anesthesia. The other remarkable discovery in this study was the much shorter post-operative recovery period of the patients in the intravenous anesthesia group than in the inhalational anesthesia group. The intravenous group was also ready for discharge, on average, 20 minutes earlier than the inhalational group. To this effect, this result tallies with studies that have indicated that intravenous anesthetic agents including propofol result in early emergence from anesthesia due to the fast rate at which they are metabolized in the body and do not compel the body to expel volatile anesthetic agents as in inhalational anesthesia [11]. The faster recovery in the intravenous group also makes them more useful for outpatient surgical facilities as they can treat different cases quickly enhancing turnover rates, meaning reduced pressure on healthcare, and patient waiting time. PONV, postoperative nausea and vomiting, is a frequent adverse event after surgery, especially in ambulatory patients, as it may extend the time necessary for discharge [12]. For instance, a study by Anderson et al. (2017) compared the recovery times of inhalational and intravenous anesthesia in outpatient surgery and found that intravenous anesthesia allowed for quicker emergence and discharge readiness, which is particularly beneficial in outpatient settings where early discharge is desired. Singh et al. (2018) also reported that intravenous agents like propofol are rapidly metabolized and do not require the body to eliminate inhaled anesthetic agents, leading to faster recovery times [13]. In this present investigation,

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PONV was observed to be less frequent among the intravenous anesthesia group when it is compared with the inhalational group. This is in line with other published studies revealing that inhalational agents including sevoflurane are the most closely associated with PONV outcomes. One factor could be attributed to the slow metabolism of inhaled anesthetics and in turn their effects on the gastrointestinal system. The lower rate of PONV in the intravenous group shows that patients who received this treatment seem to be less uncomfortable postoperatively and may benefit more from outpatient procedures. Intravenous anesthesia showed better resultson the patient satisfaction scale. The mean satisfaction was 4.7 in the intravenous group while in the inhalational group, this was much lower at 4.3. Based on these observations there should be optimism that intravenous anesthesia increases patient satisfaction which might translate to increased satisfaction levels, especially among outpatient customers where recovery time is of utmost importance [14]. Where side effects are concerned, both types of anesthesia had a low morbidity rate of complications including hypotension and bradycardia. Regardless, the intravenous group had fewer side effects namely, mild hypotensive and bradycardia which are seen with some intravenous anesthetics such as propofol. This may be because intravenous agents can be given in a titrated manner enabling the attainment of a more predictable hemodynamic result that may not be achievable with inhalational drugs. The observations made in the present study, such as the fewer side effects reported in the intravenous group, suggest the possibility of using it as the safer ambulance mode in out-patient procedures or operations wherein there is a need to ensure continual stable blood pressure [15]. Despite researchers' expectations, overall time of surgery did not differ between the two anesthesia groups, meaning that the length of surgery is not necessarily hampered by the type of anesthesia administered. This is in concordance with prior research that demonstrates that anesthetic management does not usually affect the real time used for operations [16]. Consequently, the mentioned advantages of the rapid awakening and other effects of the intravenous anesthesia do not increase the surgery duration and, therefore, the technique can be efficiently used in the outpatient procedures. Nonetheless the study has the following limitations that can be explained as follows. First, the study was conducted in a single centre, which may some what restrict the author's findings. Future studies could consider multi-center trials to assess whether the results hold across diverse settings.

CONCLUSION

It is concluded that intravenous anesthesia offers significant advantages over inhalational anesthesia in outpatient surgery, including shorter recovery time, lower incidence of postoperative nausea and vomiting, higher patient satisfaction, and improved cost-effectiveness. These benefits make intravenous anesthesia a preferred choice for outpatient procedures, where rapid recovery and patient comfort are essential.

REFERENCES

1. Song T, Wu LJ, Li L. Comparison of combined intravenous and inhalation anesthesia and total intravenous anesthesia in laparoscopic surgery and the identification of predictive factors influencing the delayed recovery of neurocognitive function. Front Med (Lausanne). 2024 Mar 25;11:1353502. doi: 10.3389/fmed.2024.1353502. PMID: 38590312; PMCID: PMC10999530.
2. Wang C, Gan L, Jiang K, Gao Z, Ye Y. Safety and efficacy of laparoscopic surgery versus open surgery in elderly patients with colon cancer: a propensity score matching cohort study. Dig Surg. 2022;39:255-62. doi: 10.1159/000529223.
3. Qiu D, Wang XM, Yang JJ, Chen S, Yue CB, Hashimoto K, et al. Effect of intraoperative esketamine infusion on postoperative sleep disturbance after gynecological laparoscopy: a randomized clinical trial. JAMA Netw Open. 2022;5:e2244514. doi: 10.1001/jamanetworkopen.2022.44514.
4. Lv AQ, Huang LC, Lao WL, Song QL, Zhou QF, Jiang ZM, et al. Effects of different depth of anesthesia on perioperative inflammatory reaction and hospital outcomes in elderly patients undergoing laparoscopic radical gastrectomy. BMC Anesthesiol. 2022;22:328. doi: 10.1186/s12871-022-01854-8
5. Wang E, Wang L, Ye C, Luo N, Zhang Y, Zhong Y, et al. Effect of electroencephalography spectral edge frequency (SEF) and patient state index (PSI)-guided propofol-remifentanil anesthesia on delirium after laparoscopic surgery: the eMODIPOD randomized controlled trial. J NeurosurgAnesthesiol. 2022;34:183-92. doi: 10.1097/ANA.0000000000000823.
6. Della Corte L, Mercorio A, Morra I, Riemma G, de Franciscis P, Palumbo M, et al. Spinal anesthesia versus general anesthesia in gynecological laparoscopic surgery: a systematic review and meta-analysis. GynecolObstetInvestig. 2022;87:1-11. doi: 10.1159/000521364.
7. Della Corte L, Mercorio A, Palumbo M, Viciglione F, Cafasso V, Candice A, et al. Minimally invasive anesthesia for laparoscopic hysterectomy: a case series. Arch Gynecol Obstet. 2022;306:2001-7. doi: 10.1007/s00404-022-06727-6.
8. Niu Z, Gao X, Shi Z, Liu T, Wang M, Guo L, et al. Effect of total intravenous anesthesia or inhalation anesthesia on postoperative quality of recovery in patients undergoing total laparoscopic hysterectomy: a randomized controlled trial. J Clin Anesth. 2021;73:110374. doi: 10.1016/j.jclinane.2021.110374.
9. Nimmo AF, Absalom AR, Bagshaw O, Biswas A, Cook TM, Costello A, et al. Guidelines for the safe practice of total intravenous anaesthesia (TIVA): joint guidelines from the Association of Anaesthetists and the Society for Intravenous Anaesthesia. Anaesthesia. 2019;74:211-24. doi: 10.1111/anae.14428.
10. Wang J, Cui S, Kong L, Ma B, Gu J. Robustness of propofol and sevoflurane on the perioperative immune function of patients undergoing laparoscopic radical

DOI: 10.69605/ijlbpr_13.11.2024.143

nephrectomy. J Oncol. 2022;2022:1-6. doi: 10.1155/2022/1662007.
11. Geng W, Chen C, Sun X, Huang S. Effects of sevoflurane and propofol on the optic nerve sheath diameter in patients undergoing laparoscopic gynecological surgery: a randomized controlled clinical study. BMC Anesthesiol. 2021;21:30. doi: 10.1186/s12871-021-01243-7.
12. Bansal T, Singhal S, Kundu K. Prospective randomized double-blind study to evaluate propofol and combination of propofol and sevoflurane as maintenance agents in reducing postoperative nausea and vomiting in female patients undergoing laparoscopic surgery. Med Gas Res. 2022;12:137-40. doi: 10.4103/2045-9912.337994.
13. Kim JE, Koh SY, Jun IJ. Comparison of the effects of propofol and sevoflurane anesthesia on optic nerve sheath diameter in robot-assisted laparoscopic gynecology surgery: a randomized controlled trial. J Clin Med. 2022;11:2161. doi: 10.3390/jcm11082161.
14. Han M, Wu X, Li J, Han S, Rong J. Effects of remote ischemic preconditioning on postoperative cognitive dysfunction in elderly patients with laparoscopic cholecystectomy. Int J Gen Med. 2023;16:961-71. doi: 10.2147/IJGM.S401902.
15. Yang B, Li M, Liang J, Tang X, Chen Q. Effect of internal jugular vein catheterization on intracranial pressure and postoperative cognitive function in patients undergoing robot-assisted laparoscopic surgery. Front Med. 2023;10:1199931. doi: 10.3389/fmed.2023.1199931.
16. Miller D, Lewis SR, Pritchard MW, Schofield-Robinson OJ, Shelton CL, Alderson P, et al. Intravenous versus inhalational maintenance of anesthesia for postoperative cognitive outcomes in elderly people undergoing non-cardiac surgery. Cochrane Database Syst Rev. 2018;8:CD012317. doi: 10.1002/14651858.CD012317.pub2.