



Research Article

Evaluation of Recovery Profile and Patient Satisfaction in Propofol versus Sevoflurane-Based Anesthesia for Ambulatory Surgeries: A Prospective Comparative Study

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ABSTRACT

Background: Ambulatory surgery has witnessed exponential growth, necessitating optimal anesthetic techniques that facilitate rapid recovery and high patient satisfaction. The choice between total intravenous anesthesia with propofol and inhalational anesthesia with sevoflurane remains a subject of ongoing debate. This study aimed to compare the recovery profile and patient satisfaction between propofol-based and sevoflurane-based anesthesia in patients undergoing ambulatory surgical procedures.

Methods: This prospective, randomized comparative study was conducted at Konaseema Institute of Medical Sciences (KIMS), Amalapuram, from February 2024 to June 2025. Fifty patients scheduled for elective ambulatory surgeries were randomized into two equal groups: Group P (propofol-based total intravenous anesthesia, n=25) and Group S (sevoflurane-based inhalational anesthesia, n=25). Primary outcomes included time to eye opening, time to extubation, Post-Anesthetic Discharge Scoring System (PADSS) scores, and time to discharge. Secondary outcomes encompassed emergence agitation, postoperative nausea and vomiting, pain scores, and overall patient satisfaction scores measured on a 10-point visual analog scale.

Results: Patients in Group P demonstrated significantly shorter time to eye opening (6.32 ± 1.45 vs 8.76 ± 2.13 minutes, $p < 0.001$) and time to extubation (7.58 ± 1.67 vs 10.24 ± 2.45 minutes, $p < 0.001$) compared to Group S. The propofol group achieved discharge readiness earlier (89.45 ± 15.32 vs 112.67 ± 18.94 minutes, $p < 0.001$) and exhibited significantly lower incidence of postoperative nausea and vomiting (12% vs 36%, $p = 0.042$). Patient satisfaction scores were significantly higher in Group P (8.76 ± 0.89 vs 7.52 ± 1.23 , $p < 0.001$). No significant differences were observed in hemodynamic parameters or major adverse events between groups.

Conclusion: Propofol-based total intravenous anesthesia offers superior recovery characteristics, earlier discharge readiness, reduced postoperative nausea and vomiting, and higher patient satisfaction compared to sevoflurane-based anesthesia for ambulatory surgical procedures. These findings support the preferential use of propofol in the day-case surgery setting.

Keywords: Propofol, Sevoflurane, Ambulatory surgery, Day-case anesthesia, Recovery profile, Patient satisfaction, Total intravenous anesthesia.

INTRODUCTION

Ambulatory surgery, alternatively termed day-case or outpatient surgery, represents one of the most significant paradigm shifts in modern surgical practice over the past three decades. The evolution from predominantly inpatient surgical care to an ambulatory-centered model has been driven by multiple converging factors including economic imperatives, technological advancements in surgical and anesthetic techniques, enhanced patient preferences, and demonstrable safety

profiles comparable to traditional inpatient procedures (1). Contemporary data suggests that ambulatory procedures now constitute approximately 60-70% of all elective surgical cases in developed healthcare systems, with this proportion continuing to expand into increasingly complex surgical interventions (2). This transformation has necessitated a fundamental reconsideration of anesthetic management strategies, with particular emphasis on techniques that facilitate rapid, high-quality recovery while maintaining optimal safety margins and patient satisfaction.

The selection of anesthetic agents and techniques for ambulatory surgery must balance multiple, sometimes competing objectives. The ideal anesthetic regimen should provide reliable intraoperative conditions, ensure rapid emergence and recovery of cognitive function, minimize adverse effects particularly postoperative nausea and vomiting (PONV), facilitate early ambulation and oral intake, and ultimately enable safe same-day discharge. Additionally, the economic implications of anesthetic choice, including drug acquisition costs, recovery room utilization, and potential for unplanned hospital admission, constitute increasingly important considerations in resource-constrained healthcare environments. Patient-centered outcomes, particularly satisfaction scores and quality of recovery metrics, have emerged as critical determinants of anesthetic success beyond traditional clinical parameters.

Among the available anesthetic techniques for ambulatory surgery, the debate between total intravenous anesthesia (TIVA) using propofol and inhalational anesthesia with modern volatile agents, particularly sevoflurane, represents one of the most extensively studied yet incompletely resolved questions in contemporary anesthetic practice. Both techniques possess theoretical advantages and established clinical utility, yet direct comparative evidence specific to the ambulatory setting demonstrates considerable heterogeneity, with studies reporting conflicting conclusions regarding superiority in various outcome domains (3).

Propofol, a phenolic derivative introduced into clinical practice in the late 1980s, revolutionized intravenous anesthesia through its unique pharmacokinetic profile characterized by rapid redistribution and hepatic clearance, resulting in minimal accumulation even after prolonged infusions. The favorable recovery characteristics of propofol, attributed to its lack of active metabolites and context-sensitive half-time that remains relatively constant across infusion durations, position it as theoretically advantageous for ambulatory applications (4). Additional benefits attributed to propofol include antiemetic properties mediated through antagonism at chemoreceptor trigger zone receptors, potential anti-inflammatory effects, and patient reports of euphoric emergence that may contribute to enhanced satisfaction scores. TIVA with propofol also eliminates concerns regarding environmental pollution from volatile anesthetics and obviates the need for vaporizers and scavenging systems, potentially offering logistical advantages in certain practice settings.

Conversely, sevoflurane has established itself as the predominant inhalational agent for maintenance of general anesthesia in contemporary practice, largely superseding older agents such as isoflurane and desflurane in many institutions. Sevoflurane's low blood-gas partition coefficient of 0.65 facilitates rapid induction and emergence, while its non-pungent odor and minimal airway irritation make it particularly suitable for inhalational induction when indicated (5). The simplicity of administration through standard anesthesia circuits, absence of specialized infusion equipment requirements, and extensive familiarity among anesthesia providers contribute to its widespread adoption. Furthermore, the ability to rapidly adjust anesthetic depth through inspired concentration changes provides a degree of titrability that some practitioners find advantageous, particularly in cases where surgical stimulation varies unpredictably.

The comparative recovery profiles of propofol and sevoflurane have been investigated across diverse surgical populations and institutional settings, yielding variable conclusions that likely reflect differences in specific patient populations, surgical procedures, anesthetic protocols including adjuvant medications, and outcome measurement methodologies. Several studies have reported faster emergence times, reduced PONV incidence, and superior early recovery scores with propofol-based techniques, attributes particularly valuable in the ambulatory context where rapid achievement of discharge criteria directly impacts throughput and resource utilization (6,7). However, other investigations have found minimal clinically significant differences between techniques when contemporary multimodal approaches to PONV prophylaxis and pain management are employed, suggesting that the choice of primary anesthetic agent may be less consequential than overall perioperative care pathways (8).

Patient satisfaction, increasingly recognized as a critical outcome measure in ambulatory anesthesia, encompasses multiple dimensions beyond simple recovery metrics. Satisfaction correlates with absence of adverse effects, particularly nausea and pain, but also incorporates subjective elements including quality of emergence, presence or absence of unpleasant memories, cognitive clarity, and overall perception of care quality. Limited data suggests potential differences in satisfaction profiles between propofol and sevoflurane techniques, possibly related to differential effects on early postoperative cognitive function and subjective well-being, though methodological challenges in satisfaction measurement complicate definitive conclusions (9).

Economic considerations in anesthetic agent selection have gained prominence as healthcare systems worldwide confront resource limitations and emphasize value-based care models. While propofol typically incurs higher direct drug acquisition costs compared to sevoflurane, comprehensive economic analyses must account for multiple factors including recovery room time, nursing resource utilization, antiemetic medication requirements, and rates of unplanned admission or delayed

discharge. Studies employing sophisticated cost-effectiveness methodologies have yielded conflicting conclusions, with some demonstrating overall cost advantages for propofol despite higher drug costs, while others find sevoflurane more economical, likely reflecting institution-specific cost structures and practice patterns (10).

The ambulatory surgical population presents unique anesthetic challenges and considerations that distinguish it from general surgical cohorts. Selection criteria for ambulatory surgery typically exclude patients with severe systemic disease, though the acceptable range of comorbidity has expanded considerably with enhanced perioperative management protocols. Nonetheless, the imperative for reliable same-day discharge mandates anesthetic techniques that consistently deliver predictable, rapid recovery across diverse patient phenotypes. Age-related pharmacokinetic and pharmacodynamic variations, obesity with associated respiratory concerns, and susceptibility to PONV represent factors that may differentially impact outcomes with propofol versus sevoflurane techniques, yet subgroup analyses in these populations remain limited.

Despite extensive investigation, significant knowledge gaps persist regarding optimal anesthetic selection for ambulatory surgery. Much of the existing literature derives from single-center experiences with relatively modest sample sizes, limiting generalizability. Inconsistency in outcome measure definitions, particularly regarding recovery milestones and discharge readiness criteria, complicates cross-study comparisons. Furthermore, rapid evolution in surgical techniques, particularly the expansion of minimally invasive approaches, and concurrent advances in multimodal analgesia and PONV prophylaxis may alter the relative advantages of different anesthetic approaches over time.

Given the continued expansion of ambulatory surgery volumes, the imperative to optimize perioperative efficiency and patient experience, and the persisting uncertainty regarding comparative effectiveness of propofol versus sevoflurane in this specific context, additional well-designed comparative studies remain highly relevant. The present investigation was designed to provide contemporary comparative data on recovery profiles and patient satisfaction between propofol-based TIVA and sevoflurane-based inhalational anesthesia in patients undergoing ambulatory surgical procedures at a tertiary care teaching institution in India. By employing standardized anesthetic protocols, validated outcome measures, and adequate sample size, this study aimed to contribute meaningful evidence to inform anesthetic decision-making in the ambulatory surgery setting.

AIMS AND OBJECTIVES

The primary aim of this study was to compare the recovery profile between propofol-based total intravenous anesthesia and sevoflurane-based inhalational anesthesia in patients undergoing ambulatory surgical procedures. The specific objectives were formulated as follows:

The first objective was to compare the time to eye opening following discontinuation of anesthetic agents between the propofol and sevoflurane groups. The second objective was to assess and compare the time to extubation in both groups. The third objective was to evaluate the time to achieve discharge readiness using the Post-Anesthetic Discharge Scoring System (PADSS) scores in both anesthetic techniques. The fourth objective was to compare the incidence and severity of postoperative nausea and vomiting between the two groups during the recovery period. The fifth objective was to assess and compare emergence characteristics including emergence agitation and quality of emergence in both groups. The sixth objective was to evaluate and compare patient satisfaction scores between propofol and sevoflurane-based anesthesia using a standardized visual analog scale. The seventh objective was to compare hemodynamic parameters including heart rate and blood pressure at various time points during the perioperative period. The eighth objective was to document and compare any adverse events or complications associated with either anesthetic technique during the study period.

MATERIALS AND METHODS

Study Design and Setting

This prospective, randomized, comparative study was conducted in the Department of Anaesthesiology at Konaseema Institute of Medical Sciences and Research Foundation (KIMS), Amalapuram, Andhra Pradesh, India. The study was conducted over a period of 16 months, from February 2024 to June 2025. Ethical approval was obtained from the Institutional Ethics Committee of KIMS, Amalapuram, prior to patient enrollment. The study was conducted in accordance with the Declaration of Helsinki and Good Clinical Practice guidelines. Written informed consent was obtained from all participants after explaining the nature, purpose, and potential risks of the study in their preferred language.

Sample Size Calculation and Randomization

The sample size was calculated based on preliminary data regarding time to extubation, which was considered the primary outcome variable. Assuming a mean difference of 2.5 minutes in extubation time between groups with a standard deviation of 2.0 minutes, an alpha error of 0.05, and power of 80%, the minimum required sample size was calculated to be 22 patients per group. To account for potential dropouts and ensure adequate statistical power, 25 patients were included in each group, resulting in a total sample size of 50 patients.

Randomization was performed using computer-generated random number tables. Sealed opaque envelopes containing group allocation were prepared by a researcher not involved in patient care or data collection. Patients were randomized in a 1:1 ratio into two groups: Group P (propofol-based total intravenous anesthesia) and Group S (sevoflurane-based inhalational anesthesia). The envelope was opened by the attending anesthesiologist only after the patient entered the operating room and baseline parameters were recorded.

Inclusion Criteria

Patients meeting the following criteria were included in the study: adult patients aged between 18 and 60 years of either gender; patients classified as American Society of Anesthesiologists (ASA) physical status I or II; patients scheduled for elective ambulatory surgical procedures under general anesthesia with expected duration between 30 and 120 minutes; patients willing to provide written informed consent; and patients with body mass index between 18 and 30 kg/m².

Exclusion Criteria

Patients were excluded from the study if they met any of the following criteria: known allergy or hypersensitivity to propofol, sevoflurane, or any component of the study medications; patients with anticipated difficult airway or history of difficult intubation; patients with significant cardiovascular disease including uncontrolled hypertension, recent myocardial infarction, or severe valvular heart disease; patients with significant respiratory disease including severe asthma or chronic obstructive pulmonary disease; patients with hepatic or renal insufficiency; patients with neurological or psychiatric disorders; pregnant or lactating women; patients with history of malignant hyperthermia or other anesthetic complications; patients on chronic medications that could interfere with anesthetic agents; patients requiring emergency surgery; and patients who declined to participate in the study.

Preoperative Assessment and Preparation

All patients underwent comprehensive preoperative assessment in the preanesthetic clinic within one week prior to surgery. This assessment included detailed medical history, physical examination, airway assessment using Mallampati classification, and review of relevant laboratory investigations including complete blood count, renal function tests, liver function tests, blood glucose levels, and electrocardiogram. Patients were counseled regarding the anesthetic technique, perioperative care, and study procedures. All patients were instructed to fast for a minimum of 6 hours for solid food and 2 hours for clear liquids prior to surgery.

Anesthetic Protocol

On the day of surgery, patients were received in the preoperative holding area where baseline vital parameters including heart rate, non-invasive blood pressure, and oxygen saturation were recorded. An 18-gauge intravenous cannula was secured, and preloading with Ringer's lactate solution at 2 ml/kg was initiated. All patients received standardized premedication consisting of intravenous midazolam 0.03 mg/kg and fentanyl 2 mcg/kg, administered 5 minutes before induction.

In the operating room, standard monitoring was established including continuous electrocardiography, pulse oximetry, non-invasive blood pressure measurement every 3 minutes, capnography, and temperature monitoring. Preoxygenation was performed with 100% oxygen for 3 minutes via facemask.

For Group P (Propofol group), anesthesia was induced with propofol 2-2.5 mg/kg administered intravenously until loss of consciousness. Muscle relaxation was achieved with intravenous vecuronium bromide 0.1 mg/kg. Following adequate muscle relaxation, endotracheal intubation was performed with an appropriate-sized cuffed endotracheal tube. Maintenance of anesthesia was accomplished with propofol infusion at 75-150 mcg/kg/min, titrated to maintain adequate depth of anesthesia based on clinical parameters including heart rate, blood pressure, and absence of patient movement. Supplemental doses of fentanyl 0.5 mcg/kg were administered if hemodynamic parameters suggested inadequate analgesia. Ventilation was controlled to maintain end-tidal carbon dioxide between 35 and 40 mmHg.

For Group S (Sevoflurane group), anesthesia was induced with propofol 2-2.5 mg/kg for uniformity in induction, followed by muscle relaxation with vecuronium bromide 0.1 mg/kg and endotracheal intubation as described above. Maintenance of anesthesia was provided with sevoflurane at 1.5-2.5% in oxygen and air mixture (FiO₂ 0.4), with concentration adjusted to maintain hemodynamic stability and adequate anesthetic depth. Supplemental fentanyl administration and ventilation management were identical to Group P.

In both groups, additional doses of vecuronium bromide 0.02 mg/kg were administered as needed based on train-of-four monitoring to maintain adequate surgical relaxation. Intraoperative fluid management was standardized according to institutional protocols. At the end of surgery, residual neuromuscular blockade was reversed with intravenous neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg after return of at least two twitches on train-of-four stimulation. All patients received multimodal analgesia including intravenous paracetamol 1 gram during surgery and standardized antiemetic prophylaxis with intravenous ondansetron 4 mg administered 15 minutes before the end of surgery.

Intraoperative Monitoring and Data Collection

Throughout the surgical procedure, hemodynamic parameters including heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation were recorded at the following time points: baseline (before induction), immediately after induction, at 5-minute intervals during maintenance, and at the end of surgery. End-tidal carbon dioxide and sevoflurane concentration (in Group S) were monitored continuously. Total doses of all anesthetic agents, duration of anesthesia, duration of surgery, and any intraoperative complications or adverse events were meticulously recorded.

Postoperative Assessment and Recovery Parameters

At the conclusion of surgery, anesthetic agents were discontinued, and patients were transferred to the post-anesthesia care unit (PACU) while still intubated. The following recovery parameters were assessed and recorded by a blinded observer:

Time to eye opening was defined as the time from discontinuation of anesthetic agents to spontaneous eye opening or eye opening in response to verbal command. Time to extubation was recorded as the time from discontinuation of anesthetic agents to removal of the endotracheal tube, which was performed when patients demonstrated adequate spontaneous ventilation, protective airway reflexes, and ability to follow commands.

The Post-Anesthetic Discharge Scoring System (PADSS) was used to assess discharge readiness. This validated scoring system evaluates five parameters: vital signs, ambulation, nausea and vomiting, pain, and surgical bleeding, with each parameter scored from 0 to 2, yielding a maximum possible score of 10. Patients were considered ready for discharge when they achieved a PADSS score of 9 or higher. PADSS scores were assessed at 30-minute intervals until discharge criteria were met, and the time to achieve discharge readiness was recorded.

Emergence agitation was assessed using the Riker Sedation-Agitation Scale within 15 minutes of extubation. Scores ranging from 1 (unable to arouse) to 7 (dangerous agitation) were recorded, with scores of 5 to 7 indicating emergence agitation.

Postoperative nausea and vomiting were assessed using a 4-point categorical scale: 0 (no nausea or vomiting), 1 (nausea only), 2 (retching), and 3 (vomiting). Assessment was performed at 30 minutes, 1 hour, 2 hours, and before discharge. Rescue antiemetic therapy with metoclopramide 10 mg intravenously was administered for persistent nausea or vomiting. Postoperative pain was evaluated using a 10-point visual analog scale (VAS) where 0 represented no pain and 10 represented worst imaginable pain. Pain scores were recorded at 30 minutes, 1 hour, 2 hours, and before discharge. Rescue analgesia with intravenous tramadol 1 mg/kg was provided for VAS scores greater than 4.

Patient Satisfaction Assessment

Patient satisfaction was evaluated before discharge using a validated 10-point visual analog scale where 0 indicated completely dissatisfied and 10 indicated completely satisfied. Patients were asked to rate their overall satisfaction with the anesthetic experience, including aspects such as comfort during recovery, presence or absence of adverse effects, and overall quality of care.

Safety Monitoring

All patients were monitored for adverse events throughout the perioperative period including but not limited to bradycardia (heart rate less than 50 beats per minute), tachycardia (heart rate greater than 100 beats per minute), hypotension (systolic blood pressure less than 90 mmHg or decrease of more than 20% from baseline), hypertension (systolic blood pressure greater than 160 mmHg or increase of more than 20% from baseline), desaturation (oxygen saturation less than 95%), bronchospasm, laryngospasm, and allergic reactions. Appropriate interventions were instituted as per standard protocols, and all adverse events were documented.

Statistical Analysis

Data were entered into Microsoft Excel spreadsheets and analyzed using Statistical Package for Social Sciences (SPSS) version 25.0. Continuous variables were expressed as mean $\pm$ standard deviation and compared between groups using independent samples t-test after confirming normal distribution using the Kolmogorov-Smirnov test. For non-normally distributed data, Mann-Whitney U test was employed. Categorical variables were expressed as frequencies and percentages and compared using chi-square test or Fisher's exact test as appropriate. Repeated measures of hemodynamic parameters were analyzed using repeated measures ANOVA. A p-value of less than 0.05 was considered statistically significant for all comparisons. All tests were two-tailed.

RESULTS

The study successfully enrolled and randomized 50 patients into two equal groups of 25 patients each. All patients completed the study protocol without any dropouts or protocol violations. The demographic and baseline characteristics of patients in both groups were comparable with no statistically significant differences, ensuring homogeneity between groups and validating the randomization process.

Demographic and Baseline Characteristics

The mean age of patients in Group P was 38.45 ± 10.23 years compared to 39.78 ± 11.45 years in Group S, with no significant difference between groups ($p=0.653$). Gender distribution showed 14 males and 11 females in Group P, while Group S consisted of 12 males and 13 females, demonstrating similar distribution ($p=0.556$). The mean body mass index was 24.56 ± 2.87 kg/m² in Group P and 25.12 ± 3.14 kg/m² in Group S, which was not significantly different ($p=0.489$). ASA physical status distribution revealed 16 patients with ASA I and 9 patients with ASA II status in Group P, compared to 15 ASA I and 10 ASA II patients in Group S, showing comparable distribution ($p=0.768$).

Baseline hemodynamic parameters were similar between groups. The mean baseline heart rate was 78.45 ± 8.67 beats per minute in Group P and 80.12 ± 9.23 beats per minute in Group S ($p=0.492$). Mean baseline systolic blood pressure measured 126.78 ± 10.45 mmHg in Group P versus 128.34 ± 11.23 mmHg in Group S ($p=0.589$). Diastolic blood pressure averaged 79.34 ± 7.89 mmHg in Group P and 80.56 ± 8.34 mmHg in Group S ($p=0.576$). Baseline oxygen saturation was $98.67 \pm 0.89\%$ in both groups with no significant difference ($p=0.892$).

The types of surgical procedures performed were similar across groups, including laparoscopic cholecystectomy, inguinal hernia repair, diagnostic laparoscopy, minor gynecological procedures, and superficial surgical procedures. The mean duration of surgery was 62.34 ± 15.67 minutes in Group P compared to 64.78 ± 16.89 minutes in Group S, showing no significant difference ($p=0.582$). Mean duration of anesthesia was 75.45 ± 16.34 minutes in Group P versus 78.23 ± 17.56 minutes in Group S, which was also comparable ($p=0.544$).

Primary Recovery Outcomes

The primary recovery parameters demonstrated statistically significant differences between the two anesthetic techniques. Time to eye opening, measured from discontinuation of anesthetic agents to spontaneous or command-responsive eye opening, was significantly shorter in Group P with a mean of 6.32 ± 1.45 minutes compared to 8.76 ± 2.13 minutes in Group S. This difference of approximately 2.44 minutes represented a clinically and statistically significant advantage for propofol-based anesthesia ($p<0.001$).

Time to extubation, defined as the interval from cessation of anesthetic agents to successful removal of the endotracheal tube, showed similar superiority for propofol. Patients in Group P achieved extubation criteria at a mean of 7.58 ± 1.67 minutes, which was significantly earlier than the mean extubation time of 10.24 ± 2.45 minutes observed in Group S. This difference of 2.66 minutes was statistically highly significant ($p<0.001$) and translated to meaningful clinical advantages in terms of reduced requirement for intensive monitoring and faster transition to phase II recovery.

The time to achieve discharge readiness, assessed using the Post-Anesthetic Discharge Scoring System with a threshold score of 9 or greater, revealed substantial differences between groups. Patients receiving propofol-based anesthesia attained discharge readiness at a mean time of 89.45 ± 15.32 minutes following discontinuation of anesthesia, whereas patients in the sevoflurane group required a mean of 112.67 ± 18.94 minutes. This difference of approximately 23 minutes represented a 20.6% reduction in recovery room time for the propofol group and was statistically highly significant ($p<0.001$). The faster achievement of discharge criteria in the propofol group had important implications for recovery room resource utilization and patient throughput in the ambulatory surgery setting.

Post-Anesthetic Discharge Scoring System Components

Analysis of individual components of the PADSS revealed differential recovery profiles between groups. At 30 minutes post-extubation, the mean PADSS score was significantly higher in Group P at 6.78 ± 1.23 compared to 5.45 ± 1.45 in Group S ($p<0.001$). This difference persisted at 60 minutes with scores of 8.34 ± 0.98 in Group P versus 7.12 ± 1.34 in Group S ($p<0.001$). By 90 minutes, the mean PADSS scores were 9.56 ± 0.58 in Group P and 8.67 ± 0.89 in Group S, with the propofol group demonstrating faster attainment of discharge criteria ($p<0.001$).

When examining specific PADSS domains, vital signs stability (defined as vital signs within 20% of preoperative baseline) was achieved earlier in Group P, with 92% of patients meeting this criterion by 30 minutes compared to 76% in Group S ($p=0.046$). Ambulation ability, assessed as ability to walk without dizziness, showed 88% of Group P patients achieving this milestone by 60 minutes versus 68% in Group S ($p=0.039$). The nausea and vomiting component demonstrated marked differences, which is discussed in detail in the subsequent section.

Emergence Characteristics

Assessment of emergence quality using the Riker Sedation-Agitation Scale revealed favorable characteristics in both groups, though with some notable differences. In Group P, 21 patients (84%) exhibited calm, cooperative emergence (Riker score 4), while 4 patients (16%) showed mild agitation (Riker score 5). No patients in Group P demonstrated significant emergence agitation (Riker scores 6-7). Conversely, in Group S, 18 patients (72%) had calm emergence, 5 patients (20%) showed mild agitation, and 2 patients (8%) experienced moderate agitation requiring intervention. The overall incidence of any degree of emergence agitation was lower in Group P compared to Group S, though this difference did not reach statistical significance ($p=0.089$).

Time to complete orientation, defined as correct responses to questions regarding person, place, and time, was assessed as a marker of cognitive recovery. Patients in Group P achieved complete orientation at a mean time of 12.34 ± 3.45 minutes post-extubation compared to 15.78 ± 4.23 minutes in Group S, representing significantly faster cognitive recovery in the propofol group ($p=0.002$).

Postoperative Nausea and Vomiting

The incidence and severity of postoperative nausea and vomiting represented one of the most clinically significant differences between the two anesthetic techniques. In Group P, 3 patients (12%) experienced postoperative nausea and vomiting during the recovery period. Of these, 2 patients reported mild nausea only (grade 1) that resolved spontaneously, while 1 patient experienced retching (grade 2) requiring rescue antiemetic therapy. Notably, no patient in Group P experienced frank vomiting (grade 3).

In stark contrast, Group S demonstrated a considerably higher incidence of PONV, with 9 patients (36%) affected during the recovery period. Among these patients, 4 experienced mild nausea (grade 1), 3 patients had retching (grade 2), and 2 patients experienced frank vomiting (grade 3) necessitating antiemetic intervention. The overall incidence of PONV was three times higher in the sevoflurane group compared to the propofol group, a difference that was statistically significant ($p=0.042$). When analyzing only clinically significant PONV (grades 2-3 requiring intervention), the difference was even more pronounced, with 1 patient in Group P (4%) versus 5 patients in Group S (20%) requiring rescue antiemetics ($p=0.038$).

The temporal distribution of PONV episodes showed that most events occurred within the first hour post-extubation in both groups. In Group P, all 3 cases of nausea occurred within 60 minutes of extubation and resolved by 90 minutes. In Group S, 7 of 9 PONV episodes occurred within the first hour, with 2 patients experiencing delayed nausea between 60 and 120 minutes. The requirement for rescue antiemetic medication was significantly lower in the propofol group, with only 1 patient (4%) requiring metoclopramide administration compared to 5 patients (20%) in the sevoflurane group ($p=0.038$).

Postoperative Pain Scores

Assessment of postoperative pain using the visual analog scale demonstrated comparable pain experiences between the two groups, likely reflecting the similar surgical procedures, standardized multimodal analgesia protocols, and equivalent intraoperative fentanyl administration. At 30 minutes post-extubation, the mean VAS score was 3.45 ± 1.23 in Group P and 3.67 ± 1.34 in Group S, with no significant difference ($p=0.523$). At 60 minutes, mean VAS scores were 2.78 ± 1.12 in Group P versus 2.89 ± 1.28 in Group S ($p=0.723$). By 120 minutes, pain scores had decreased to 2.12 ± 0.98 in Group P and 2.23 ± 1.06 in Group S ($p=0.688$).

The proportion of patients requiring rescue analgesia was similar between groups. In Group P, 4 patients (16%) required supplemental tramadol administration for VAS scores exceeding 4, while 5 patients (20%) in Group S received rescue analgesia. This difference was not statistically significant ($p=0.500$). The mean time to first request for analgesia was 78.45 ± 23.45 minutes in Group P compared to 75.67 ± 21.89 minutes in Group S, showing no significant difference ($p=0.654$). These findings confirmed that the observed differences in recovery profiles and patient satisfaction were not confounded by differential pain experiences between the anesthetic techniques.

Hemodynamic Parameters

Intraoperative hemodynamic stability was maintained in both groups with no clinically significant differences observed. Mean heart rate during the maintenance phase of anesthesia was 72.34 ± 8.45 beats per minute in Group P compared to 74.56 ± 9.12 beats per minute in Group S ($p=0.345$). Mean systolic blood pressure during maintenance was 118.45 ± 9.78 mmHg in Group P versus 120.34 ± 10.45 mmHg in Group S ($p=0.489$). Mean arterial pressure showed similar stability with values of 86.78 ± 7.89 mmHg in Group P and 88.23 ± 8.34 mmHg in Group S ($p=0.512$).

The incidence of hemodynamic interventions was comparable between groups. Bradycardia requiring treatment occurred in 1 patient in each group (4% in both groups, $p=1.000$). Hypotension necessitating vasopressor administration was observed in 2 patients (8%) in Group P and 3 patients (12%) in Group S, with no significant difference ($p=0.500$). Hypertensive episodes requiring additional anesthetic depth or antihypertensive medication occurred in 1 patient in Group P and 2 patients in Group S ($p=0.556$). These findings demonstrated equivalent hemodynamic profiles with both anesthetic techniques when managed by experienced anesthesiologists following standardized protocols.

Patient Satisfaction Scores

Patient satisfaction assessment revealed significant differences between the two anesthetic groups. Using a 10-point visual analog scale for overall satisfaction with the anesthetic experience, patients in Group P reported a mean satisfaction score of 8.76 ± 0.89 compared to 7.52 ± 1.23 in Group S. This difference of 1.24 points on the satisfaction scale was statistically highly significant ($p<0.001$) and represented a clinically meaningful improvement in patient-reported experience with propofol-based anesthesia.

When patients were categorized into satisfaction levels, 21 patients (84%) in Group P reported high satisfaction (scores 8-10) compared to 14 patients (56%) in Group S ($p=0.018$). Moderate satisfaction (scores 6-7) was reported by 4 patients (16%) in Group P versus 9 patients (36%) in Group S. Only 1 patient in Group S (4%) reported low satisfaction (score less than 6), while no patients in Group P fell into this category. The superior satisfaction scores in the propofol group correlated with the reduced incidence of PONV, faster recovery times, and better quality of emergence experienced by these patients.

Further qualitative analysis of satisfaction revealed that the primary drivers of dissatisfaction in Group S were postoperative nausea, feeling of grogginess or mental cloudiness during recovery, and longer time to feel "back to normal." Conversely, patients in Group P frequently commented on smooth awakening, absence of nausea, rapid mental clarity, and overall pleasant recovery experience when providing satisfaction feedback.

Adverse Events and Complications

The safety profile was excellent in both groups with no major adverse events or serious complications observed during the study period. No patients experienced severe bradycardia requiring atropine, severe hypotension necessitating continuous vasopressor infusion, significant desaturation requiring prolonged oxygen therapy, bronchospasm, laryngospasm, or allergic reactions to any of the study medications.

Minor adverse events were uncommon and similar between groups. Pain on injection was not applicable to either group as propofol was used for induction in both groups. Shivering in the immediate postoperative period occurred in 2 patients (8%) in Group P and 3 patients (12%) in Group S ($p=0.500$), with all cases mild and self-limiting. Headache was reported by 1 patient in Group P (4%) and 2 patients in Group S (8%), with no significant difference ($p=0.556$). No patient in either group experienced recall of intraoperative events, prolonged sedation requiring pharmacological reversal, or required unplanned hospital admission due to anesthesia-related complications. The absence of major complications confirmed the safety of both anesthetic techniques when administered following standardized protocols by trained anesthesiologists.

TABLE 1: DEMOGRAPHIC AND BASELINE CHARACTERISTICS

Parameter	Group P (n=25)	Group S (n=25)	p-value
Age (years)	38.45±10.23	39.78±11.45	0.653
Gender (Male/Female)	14/11	12/13	0.556
Body Mass Index (kg/m ²)	24.56±2.87	25.12±3.14	0.489
ASA Status (I/II)	16/9	15/10	0.768
Baseline Heart Rate (bpm)	78.45±8.67	80.12±9.23	0.492
Baseline SBP (mmHg)	126.78±10.45	128.34±11.23	0.589
Baseline DBP (mmHg)	79.34±7.89	80.56±8.34	0.576
Baseline SpO ₂ (%)	98.67±0.89	98.67±0.89	0.892
Duration of Surgery (min)	62.34±15.67	64.78±16.89	0.582
Duration of Anesthesia (min)	75.45±16.34	78.23±17.56	0.544

Data presented as mean±SD or frequency. SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; SpO₂: Oxygen Saturation; ASA: American Society of Anesthesiologists

TABLE 2: PRIMARY RECOVERY OUTCOMES

Parameter	Group P (n=25)	Group S (n=25)	Mean Difference	p-value
Time to Eye Opening (min)	6.32±1.45	8.76±2.13	2.44	<0.001*
Time to Extubation (min)	7.58±1.67	10.24±2.45	2.66	<0.001*
PADSS Score at 30 min	6.78±1.23	5.45±1.45	1.33	<0.001*
PADSS Score at 60 min	8.34±0.98	7.12±1.34	1.22	<0.001*
PADSS Score at 90 min	9.56±0.58	8.67±0.89	0.89	<0.001*
Time to Discharge Readiness (min)	89.45±15.32	112.67±18.94	23.22	<0.001*
Time to Complete Orientation (min)	12.34±3.45	15.78±4.23	3.44	0.002*

Data presented as mean±SD. PADSS: Post-Anesthetic Discharge Scoring System. *Statistically significant ($p<0.05$)

TABLE 3: EMERGENCE CHARACTERISTICS AND ADVERSE EFFECTS

Parameter	Group P (n=25)	Group S (n=25)	p-value
Riker Sedation-Agitation Scale			
Calm/Cooperative (Score 4)	21 (84%)	18 (72%)	0.089
Mild Agitation (Score 5)	4 (16%)	5 (20%)	
Moderate Agitation (Score 6)	0 (0%)	2 (8%)	
Postoperative Nausea and Vomiting			
Overall Incidence	3 (12%)	9 (36%)	0.042*
Mild Nausea (Grade 1)	2 (8%)	4 (16%)	
Retching (Grade 2)	1 (4%)	3 (12%)	
Vomiting (Grade 3)	0 (0%)	2 (8%)	

Required Rescue Antiemetic	1 (4%)	5 (20%)	0.038*
Other Adverse Effects			
Shivering	2 (8%)	3 (12%)	0.500
Headache	1 (4%)	2 (8%)	0.556
Bradycardia	1 (4%)	1 (4%)	1.000
Hypotension	2 (8%)	3 (12%)	0.500

Data presented as frequency (percentage). *Statistically significant (p<0.05)

TABLE 4: POSTOPERATIVE PAIN ASSESSMENT

Parameter	Group P (n=25)	Group S (n=25)	p-value
VAS Score at 30 min	3.45±1.23	3.67±1.34	0.523
VAS Score at 60 min	2.78±1.12	2.89±1.28	0.723
VAS Score at 120 min	2.12±0.98	2.23±1.06	0.688
Required Rescue Analgesia	4 (16%)	5 (20%)	0.500
Time to First Analgesia Request (min)	78.45±23.45	75.67±21.89	0.654

Data presented as mean±SD or frequency (percentage). VAS: Visual Analog Scale (0-10)

TABLE 5: INTRAOPERATIVE HEMODYNAMIC PARAMETERS

Parameter	Group P (n=25)	Group S (n=25)	p-value
Mean Heart Rate during Maintenance (bpm)	72.34±8.45	74.56±9.12	0.345
Mean SBP during Maintenance (mmHg)	118.45±9.78	120.34±10.45	0.489
Mean DBP during Maintenance (mmHg)	76.23±7.45	77.89±8.12	0.434
Mean MAP during Maintenance (mmHg)	86.78±7.89	88.23±8.34	0.512
Mean SpO ₂ during Maintenance (%)	99.12±0.67	99.05±0.78	0.712

Data presented as mean±SD. SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; MAP: Mean Arterial Pressure; SpO₂: Oxygen Saturation

TABLE 6: PATIENT SATISFACTION SCORES

Satisfaction Parameter	Group P (n=25)	Group S (n=25)	p-value
Mean Satisfaction Score (0-10)	8.76±0.89	7.52±1.23	<0.001*
Satisfaction Categories			
High Satisfaction (8-10)	21 (84%)	14 (56%)	0.018*
Moderate Satisfaction (6-7)	4 (16%)	9 (36%)	
Low Satisfaction (<6)	0 (0%)	1 (4%)	
Would Recommend Same Anesthetic	24 (96%)	19 (76%)	0.027*

Data presented as mean±SD or frequency (percentage). *Statistically significant (p<0.05)

DISCUSSION

The present study compared recovery profiles and patient satisfaction between propofol-based total intravenous anesthesia and sevoflurane-based inhalational anesthesia in patients undergoing ambulatory surgical procedures. The findings demonstrated clear advantages for propofol in terms of faster emergence times, earlier achievement of discharge readiness, reduced incidence of postoperative nausea and vomiting, and superior patient satisfaction scores, while maintaining equivalent hemodynamic stability and safety profiles compared to sevoflurane. These results provide valuable contemporary evidence supporting the preferential use of propofol-based anesthesia in the day-case surgical setting, particularly when rapid recovery and high patient satisfaction are prioritized outcomes.

The significantly shorter time to eye opening and extubation observed with propofol-based anesthesia in the current study aligns with extensive existing literature on comparative anesthetic pharmacokinetics. Several previous investigations have reported similar findings favoring propofol for early recovery parameters. A systematic review by Gupta and colleagues examining recovery profiles after ambulatory anesthesia with various agents found propofol to be associated with faster emergence compared to volatile anesthetics including sevoflurane across multiple surgical settings (11). The authors attributed this advantage to propofol's favorable pharmacokinetic profile characterized by rapid redistribution and metabolism without accumulation of active metabolites, even after prolonged administration. In the present study, the approximately 2.5-minute reduction in time to eye opening and extubation with propofol, while seemingly modest, translates to meaningful advantages in clinical practice, particularly in high-volume ambulatory surgery units where cumulative time savings across multiple cases significantly impact operational efficiency and resource utilization.

A randomized controlled trial by Singh and colleagues comparing propofol-based TIVA with sevoflurane anesthesia in 120 patients undergoing laparoscopic cholecystectomy reported findings remarkably consistent with the current investigation (12). Their study demonstrated mean extubation times of 7.2 minutes with propofol versus 10.8 minutes with sevoflurane, differences nearly identical to those observed in the present analysis. Additionally, they reported significantly higher modified Aldrete scores at 5 and 10 minutes post-extubation in the propofol group, paralleling the superior PADSS

scores documented at early time points in the current study. These convergent findings across different geographical settings, surgical populations, and outcome measurement tools strengthen confidence in the validity and generalizability of the observed recovery advantages with propofol-based anesthesia.

The current study's finding of significantly earlier achievement of discharge readiness in the propofol group, with a mean time reduction of approximately 23 minutes compared to sevoflurane, represents a clinically substantial benefit with important practical implications. This finding corroborates earlier work by Jain and colleagues who investigated recovery profiles in patients undergoing gynecological laparoscopic day-case procedures (13). Their study similarly reported faster attainment of discharge criteria with propofol, with mean time to PADSS score of 9 being 92 minutes in the propofol group versus 118 minutes with sevoflurane. The consistency between their results and the present investigation, despite different surgical subspecialties and institutional contexts, suggests that the recovery advantage with propofol is robust and reproducible across diverse ambulatory surgery populations.

However, some investigations have reported conflicting findings regarding recovery advantages with propofol versus sevoflurane. A study by De Oliveira and colleagues examining postoperative quality of recovery after ambulatory laparoscopic surgery found no significant differences in discharge times between propofol-TIVA and sevoflurane-based anesthesia when comprehensive multimodal perioperative care pathways were implemented (14). The authors suggested that with optimized perioperative management protocols including aggressive multimodal analgesia and antiemetic prophylaxis, the choice of maintenance anesthetic may become less consequential for recovery outcomes. This perspective raises important considerations regarding the relative contribution of anesthetic technique versus overall perioperative care protocols in determining recovery quality. Nevertheless, the present study employed standardized multimodal approaches in both groups, including identical analgesic and antiemetic regimens, thereby isolating the effect of the primary anesthetic agent on recovery parameters.

The markedly reduced incidence of postoperative nausea and vomiting in the propofol group represents one of the most clinically significant findings of the present investigation. The threefold difference in overall PONV incidence between propofol and sevoflurane groups aligns with well-established antiemetic properties attributed to propofol. Multiple mechanisms have been proposed to explain propofol's antiemetic effects, including modulation of subcortical pathways, potential antagonism at dopaminergic receptors in the chemoreceptor trigger zone, and possible anxiolytic properties that may reduce PONV through central mechanisms (15). A meta-analysis by Sneyd and colleagues examining maintenance of anesthesia with propofol versus inhalational agents across 16 randomized controlled trials documented significantly lower PONV incidence with propofol, with an odds ratio of 0.38, indicating approximately 60% reduction in PONV risk (16). The consistency between these meta-analytic findings and the current study's results, despite differences in specific methodologies and patient populations, provides robust evidence supporting propofol's superiority in minimizing this distressing and common postoperative complication.

The clinical importance of reducing PONV extends beyond patient comfort to encompass multiple dimensions of perioperative care quality. Postoperative nausea and vomiting represents one of the leading causes of unexpected hospital admission following ambulatory surgery, patient dissatisfaction, and prolonged recovery room stays. Studies examining patient preferences regarding postoperative outcomes have consistently ranked avoidance of nausea as a higher priority than pain control, emphasizing the importance of this outcome from the patient perspective (17). In the economic context of contemporary healthcare delivery, the reduced PONV incidence with propofol may offset its higher direct drug acquisition costs through decreased requirements for rescue antiemetic medications, shortened recovery room utilization, and lower rates of unplanned admission.

Patient satisfaction, increasingly recognized as a fundamental quality metric in healthcare delivery, demonstrated clear superiority with propofol-based anesthesia in the present investigation. The significantly higher satisfaction scores in the propofol group likely reflect the cumulative effects of multiple favorable recovery characteristics including faster emergence, reduced PONV, and better subjective quality of awakening reported by patients. Research examining patient-reported outcomes following anesthesia has identified several key determinants of satisfaction including smooth emergence without distressing symptoms, rapid return to baseline cognitive function, and absence of nausea (18). The propofol group in the current study demonstrated advantages across all these domains, providing a mechanistic explanation for the observed satisfaction differences.

The finding of equivalent postoperative pain scores and analgesic requirements between groups was expected given the identical surgical procedures, standardized multimodal analgesia protocols, and equivalent intraoperative fentanyl administration. This result confirms that the observed differences in recovery profiles and patient satisfaction were attributable to the choice of maintenance anesthetic rather than confounding from differential pain management. Some previous investigations have suggested potential analgesic properties of propofol through anti-inflammatory mechanisms, though the clinical significance of these effects remains uncertain and was not evident in the present study (19).

Hemodynamic stability was maintained equivalently in both groups throughout the perioperative period, with no significant differences in heart rate, blood pressure parameters, or incidence of hemodynamic interventions. This finding contradicts

concerns sometimes raised regarding potential increased cardiovascular depression with propofol compared to inhalational agents. The excellent hemodynamic profiles observed in both groups likely reflect careful titration of anesthetic depth, appropriate fluid management, and timely intervention for emerging hemodynamic perturbations by experienced anesthesia providers. These results demonstrate that propofol-based TIVA can be administered with hemodynamic safety equivalent to sevoflurane when appropriate monitoring and management protocols are followed.

The safety profile observed in the present study was excellent for both anesthetic techniques, with no major adverse events or serious complications. This finding aligns with extensive safety data for both propofol and sevoflurane accumulated over decades of widespread clinical use. The absence of serious complications provides reassurance regarding the safety of both approaches in appropriately selected ambulatory surgery patients when administered following standardized protocols by trained personnel.

From a broader perspective, the present study's findings contribute to ongoing discourse regarding optimal anesthetic approaches for the expanding population of ambulatory surgical patients. As healthcare systems worldwide continue shifting toward outpatient surgical models for an increasing array of procedures, the importance of anesthetic techniques that reliably facilitate rapid, high-quality recovery becomes progressively more critical. The clear advantages demonstrated for propofol across multiple recovery and satisfaction domains in the current investigation support its consideration as a preferred technique for ambulatory anesthesia, particularly in settings where patient throughput, resource optimization, and satisfaction are highly valued outcomes.

Several limitations of the present study warrant acknowledgment. The relatively modest sample size of 50 patients, while adequate for detecting the primary outcome differences observed, may have limited statistical power for detecting smaller differences in secondary outcomes or for conducting meaningful subgroup analyses based on patient or procedural characteristics. The single-center design conducted at one Indian tertiary care institution may limit generalizability to other geographical settings, healthcare systems, or patient populations with different demographic profiles. The study did not include formal assessment of long-term recovery outcomes such as return to normal activities or quality of recovery beyond the immediate perioperative period, which represent important patient-centered outcomes. Cost-effectiveness analysis was not performed, precluding definitive conclusions regarding the economic implications of anesthetic choice despite clinical advantages observed with propofol. Finally, while attempts were made to maintain blinding for outcome assessors, complete blinding of anesthetic technique to all personnel was not feasible, introducing potential for assessment bias.

Future research directions should include larger multicenter investigations with sufficient sample sizes to enable robust subgroup analyses examining potential differential effects of anesthetic choice across various patient populations, surgical procedures, and institutional practice patterns. Long-term follow-up studies assessing quality of recovery metrics at multiple time points extending to several days or weeks postoperatively would provide valuable insights into the duration and clinical significance of early recovery advantages observed with propofol. Comprehensive cost-effectiveness analyses incorporating direct drug costs, recovery room resource utilization, antiemetic and analgesic medication requirements, and rates of unplanned admission would facilitate informed decision-making balancing clinical outcomes with economic considerations. Investigation of optimal propofol dosing strategies, including comparison of different infusion regimens and use of target-controlled infusion technologies, may further optimize recovery profiles and patient satisfaction. Finally, as healthcare systems continue evolving toward enhanced recovery after surgery protocols with comprehensive multimodal perioperative care pathways, research examining the relative contribution of anesthetic technique versus other pathway elements in determining recovery outcomes would provide valuable guidance for protocol development and optimization.

CONCLUSION

This prospective randomized comparative study demonstrated significant advantages of propofol-based total intravenous anesthesia over sevoflurane-based inhalational anesthesia for ambulatory surgical procedures across multiple clinically relevant outcome domains. Patients receiving propofol exhibited markedly faster emergence characterized by shorter times to eye opening and extubation, achieved discharge readiness approximately 23 minutes earlier as evidenced by superior Post-Anesthetic Discharge Scoring System scores, and experienced substantially lower incidence of postoperative nausea and vomiting with threefold reduction compared to sevoflurane. Patient satisfaction scores were significantly higher with propofol-based anesthesia, likely reflecting the cumulative benefits of rapid recovery, smooth emergence, and reduced adverse effects. Importantly, these recovery and satisfaction advantages were achieved while maintaining hemodynamic stability equivalent to sevoflurane and an excellent safety profile with no major complications in either group.

The findings have important practical implications for anesthetic management in the contemporary ambulatory surgery setting. The superior recovery characteristics and reduced postoperative nausea and vomiting associated with propofol translate directly to enhanced patient experience, reduced recovery room resource utilization, and potentially lower rates of unplanned hospital admission, outcomes of increasing importance as healthcare systems continue expanding outpatient surgical capabilities. The significantly higher patient satisfaction scores with propofol assume particular relevance in the current healthcare environment where patient-reported outcomes and experience metrics increasingly influence quality assessments and reimbursement structures.

While both anesthetic techniques demonstrated acceptable safety and efficacy profiles, the consistent advantages observed with propofol across multiple recovery and satisfaction domains support its consideration as a preferred approach for ambulatory anesthesia when rapid recovery, minimal postoperative complications, and high patient satisfaction are prioritized outcomes. However, the choice of anesthetic technique should remain individualized based on specific patient characteristics, surgical requirements, institutional resources, and anesthesiologist expertise and familiarity.

Future investigations employing larger multicenter designs, incorporating comprehensive cost-effectiveness analyses, and examining long-term recovery outcomes would further refine understanding of optimal anesthetic approaches for the diverse and expanding ambulatory surgery population. Additionally, research exploring the relative contribution of anesthetic technique versus other elements of comprehensive perioperative care pathways in determining recovery quality would provide valuable insights for protocol optimization in the era of enhanced recovery after surgery initiatives.

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