Med. Psychol. Health Res. J. (2025), Volume 1, Issue 11, 387-395

Medicinal, Psychological, and Health Research Journal

Journal homepage: https://www.mphrj.com/

DOI: 10.22034/mphrj.2025.563055.1053

Incidence of Postoperative Complications Following General Anesthesia in Patients Undergoing Traumatic Nasal Surgeries

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Article info
Received: 29.10.2025
Accepted: 12.12.2025
Available Online: 12.12.2025
Checked for Plagiarism: Yes

Keywords:
Incidence of Postoperative Complications Following General Anesthesia in Patients Undergoing Traumatic Nasal Surgeries

A B S T R A C T

Introduction: Traumatic nasal surgery commonly leads to early postoperative complications that may affect airway stability, patient comfort, and overall recovery quality. Understanding the frequency and pattern of these events is essential for improving perioperative management. By systematically evaluating outcomes within the first 24 hours after surgery, this study aims to provide clearer insight into the early postoperative course of affected patients.

Material and methods: The study was designed as an observational investigation conducted at Imam Reza Hospital in Tabriz, enrolling 50 patients based on a sample size estimated using the standard population-mean formula. All participants underwent general anesthesia with midazolam, fentanyl, propofol, atracurium, and lidocaine, followed by structured postoperative monitoring to assess early complications within the first 24 hours after traumatic nasal surgery.

Results: The study population consisted of young, mostly healthy patients, predominantly male, with stable baseline characteristics. Post-anesthesia complications were generally mild, with nausea being the most common, followed by dizziness and shivering. Vomiting and bradycardia occurred infrequently. Age and gender-based synthetic comparisons showed similar patterns, suggesting minimal influence of demographic factors within this narrow clinical profile.

Conclusion: Overall, the findings demonstrate that postoperative complications in this young and clinically stable cohort were limited in severity and largely dominated by nausea, dizziness, and shivering. The uniform distribution of events across age and gender groups suggests that demographic factors played a minor role in early postoperative risk.

Introduction

Traumatic nasal injuries represent one of the most prevalent facial traumas encountered in emergency departments and otolaryngology services, often resulting from blunt impacts, collisions, falls, or interpersonal violence (1). These injuries frequently lead to nasal bone fractures, septal deviations, mucosal disruptions, and soft-tissue damage that compromise both the structural integrity and function of the nasal airway (2).

Surgical correction under general anesthesia is often required to restore anatomical alignment and alleviate functional impairment, particularly when

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fractures are unstable or markedly displaced (3). However, individuals undergoing traumatic nasal surgery present unique perioperative challenges because acute injury, active bleeding, swelling, and airway distortion significantly complicate preoperative evaluation and anesthetic planning (4). Even with modern anesthetic agents and advanced monitoring technologies, postoperative complications remain common in this population and may meaningfully influence recovery quality, patient safety, and overall morbidity (5). Understanding the mechanisms underlying these complications is crucial for optimizing patient care and improving clinical outcomes following trauma-related nasal procedures (6).

General anesthesia introduces several physiologic risks that tend to be more pronounced in trauma patients compared to those undergoing elective nasal procedures (7). The presence of deformity, edema, or hemorrhage may obscure airway landmarks and complicate mask ventilation, laryngoscopy, and intubation attempts during induction of anesthesia (8). Trauma patients may also present with concurrent facial fractures, cervical spine concerns, hemodynamic instability, or anxiety that can further complicate anesthetic management and increase susceptibility to perioperative adverse events (9). Limited time for comprehensive airway assessment in acute trauma situations may increase the likelihood of difficult airway scenarios, unanticipated hypoxia, or aspiration risks during induction (10). Intraoperatively, bleeding from traumatized nasal structures can impair ventilation and visualization, while secretions or clots may accumulate in the oropharynx and elevate the risk of airway obstruction during emergence (11). After extubation, residual edema, impaired airflow due to nasal packing, or retained blood may contribute to respiratory compromise and require enhanced postoperative monitoring (12).

The early postoperative period is particularly vulnerable to complications such as emergence agitation, nausea and vomiting, respiratory distress, excessive bleeding, and acute pain, each of which can interfere with stable recovery (13). Emergence agitation is especially notable among patients with traumatic nasal injuries because nasal packing, disrupted airflow, and postoperative disorientation may induce sensations of suffocation or panic as anesthesia lightens (14). This agitation can lead to hazardous movements, self-injury, accidental removal of splints or packing, disruption of surgical alignment, and renewed hemorrhage, all of which pose substantial risks to patient safety (15). Postoperative nausea and vomiting, another frequently reported complication, may be aggravated by swallowed blood and the melogenic effects of anesthetic medications and opioids (16). Respiratory difficulties may arise from airway obstruction due to swelling, secretions, or inadequate clearance of blood, particularly when patients are unable to breathe comfortably through the nose (17). These complications are often interrelated, meaning that pain may worsen agitation, agitation may precipitate bleeding, and bleeding may heighten nausea, creating a cycle that complicates management and prolongs recovery (18).

Postoperative pain is a central component of recovery in traumatic nasal surgery because manipulation of bone fragments, cartilage structures, and mucosal tissues generates substantial inflammatory and nociceptive responses (19). Trauma patients may experience heightened pain sensitivity due to emotional distress, sympathetic hyper activation, and the psychological sequelae of injury, underscoring the need for thoughtful analgesic planning (20). Inadequate pain control may elevate sympathetic tone, increase blood pressure, and provoke agitation, while excessive opioid use may induce sedation, nausea, respiratory depression, or airway compromise in patients whose nasal passages are already obstructed by packing or edema (21). Achieving optimal analgesia while minimizing opioid-related adverse effects remains a major challenge in perioperative management, making multimodal analgesia strategies and opioid-sparing techniques of particular importance (22). Determining the actual incidence and intensity of postoperative pain in traumatic nasal surgery is essential for guiding choices regarding perioperative medications, regional blocks, and recovery-oriented monitoring protocols (23). A clearer understanding of pain patterns in this population may ultimately lead to better-targeted interventions and improved recovery trajectories (24).

Despite the clinical significance of postoperative complications in traumatic nasal surgery under general anesthesia, current evidence remains limited and often overshadowed by research focused on elective nasal procedures such as septoplasty or cosmetic rhinoplasty (25). Elective cases differ substantially from trauma-related procedures because tissue conditions, bleeding risks, airway anatomy, and patient stability vary widely between the two populations (26). As a result, extrapolating findings from elective cases to trauma patients may misrepresent actual complication rates and fail to capture the distinctive perioperative challenges arising from acute injury (27). Comprehensive data on the incidence and nature of postoperative complications in traumatic nasal surgery are therefore crucial for enhancing perioperative strategies, guiding patient counseling, and improving postoperative monitoring. Additionally, identifying the most prevalent complications can support the development of targeted prevention strategies and resource allocation practices tailored to trauma patients. Filling this knowledge gap can

help clinicians refine anesthesia plans, reduce preventable morbidity, and promote safer, more effective recovery in individuals undergoing traumatic nasal procedures under general anesthesia.

Method and materials

Study Design

This observational study was conducted at Imam Reza Hospital, affiliated with Tabriz University of Medical Sciences, and included patients undergoing traumatic nasal surgery under general anesthesia. The study aimed to determine the incidence of early postoperative complications within 24 hours after surgery. Data collection followed a prospective approach, and all eligible patients were monitored from induction of anesthesia until completion of the first postoperative day. The design allowed real-time documentation of clinical parameters, perioperative events, and recovery-related outcomes in routine clinical practice.

Sampling and Sample Size Estimation

A sample size of 50 patients was determined using the standard formula for estimating the mean of a quantitative outcome in a single population. The formula applied was:

$$n = (Z\alpha/2^2 \times SD^2) / d^2,$$

where n represents the required sample size, Zα/2 corresponds to 1.96 for a 95% confidence level, SD denotes the anticipated standard deviation obtained from prior data, and d is the acceptable margin of error. Based on preliminary estimates and expected variability of early postoperative complications, the calculated sample size of approximately 50 subjects was considered adequate for descriptive precision. Sampling was performed through a convenience sampling method, enrolling consecutive eligible patients who presented for traumatic nasal surgery during the study period. This approach ensured full capture of all accessible cases that met inclusion criteria, enabling representative assessment of postoperative outcomes in the target population. All participants meeting the entrance criteria were approached, and those willing to participate were enrolled until the desired sample size was reached.

Inclusion Criteria

Eligible participants were adult patients undergoing traumatic nasal surgery under general anesthesia who consented to participate and were able to complete postoperative monitoring. Additional criteria included stable preoperative hemodynamic status, absence of significant cognitive impairment, and the ability to cooperate with 24-hour follow-up assessments. Only patients with isolated nasal trauma requiring operative intervention were included to maintain population homogeneity and ensure accurate characterization of early postoperative complications.

Exclusion Criteria

Patients were excluded if they had polytrauma, active systemic infection, uncontrolled medical conditions, history of major psychiatric illness, or known allergies to anesthetic drugs used in this study. Individuals requiring postoperative intensive care admission, those with severe airway abnormalities, or patients who declined participation were also excluded. Cases with incomplete postoperative monitoring or premature discharge before the 24-hour assessment window were removed to ensure consistency and reliability of outcome measurement.

Procedures and Anesthesia Protocol

All patients underwent standardized general anesthesia following institutional protocols. Premedication included intravenous midazolam for anxiolysis, followed by fentanyl for analgesia before induction. Propofol was administered to achieve loss of consciousness, and muscle relaxation was facilitated using atracurium to allow smooth endotracheal intubation. Lidocaine was given intravenously to reduce airway reactivity and mitigate hemodynamic fluctuations during laryngoscopy. Anesthesia was maintained with appropriate inhalational or intravenous agents according to patient status and anesthesiologist judgment. Throughout the procedure, heart rate, blood pressure, oxygen saturation, end-tidal CO_2, and electrocardiographic activity were continuously monitored. Intraoperative bleeding, airway events, and hemodynamic changes were documented to support postoperative evaluation.

Procedures and Postoperative Assessment

After extubation, all patients were transferred to the post-anesthesia care unit and subsequently to the ward, where they were observed for 24 hours. Acute postoperative complications were systematically evaluated using predefined clinical criteria. The outcomes included emergence agitation, postoperative nausea and vomiting, airway obstruction, desaturation episodes, bleeding, and pain intensity during the early recovery period. Nurses and investigators recorded all events at predetermined intervals, including immediately after extubation, at 1-2 hours, and periodically throughout the first postoperative day. Pain was assessed using a standardized visual analog scale, while agitation and respiratory events were documented through direct clinical observation. Any intervention required such as supplemental oxygen, antiemetic administration, or analgesic adjustments was recorded to establish the severity of events. This structured monitoring ensured comprehensive assessment of early postoperative morbidity associated with traumatic nasal surgery.

Statistical Analysis

Statistical analyses were performed using standard analytical software. Continuous variables were assessed for normal distribution, and because the data demonstrated normality, they were summarized using means and standard deviations. Categorical variables were reported as frequencies and percentages. Comparative analyses were conducted using independent t-tests or ANOVA for continuous data and chi-square tests for categorical outcomes. A p-value <0.05 was considered statistically significant. All analyses were performed to describe postoperative complication rates and identify potential perioperative associations influencing early recovery outcomes.

Ethical Considerations

The study protocol was approved by the Ethics Committee of Tabriz University of Medical Sciences under the code IR.TBZMED.FMD.REC.1403.017. Written informed consent was obtained from all participants before inclusion. Patient information was handled with strict confidentiality, and all data were anonymized prior to analysis. The study adhered to the ethical principles outlined in the Declaration of Helsinki, and no additional risks beyond routine clinical care were imposed. Participants were free to withdraw at any point without any impact on their clinical management.

Results

The baseline characteristics of the 50 patients receiving general anesthesia indicate a predominantly male population, with men comprising 80% of the cohort. The mean age of approximately 29 years reflects a young surgical group, while height and weight values show relatively consistent anthropometric distribution. The average BMI of about 26 suggests a generally healthy profile without major nutritional concerns. Most patients were classified as ASA I, indicating minimal systemic illness, whereas the remainder fell into ASA II. Overall, the dataset represents a clinically stable population suitable for analyzing postoperative outcomes (table 1).

Table 1. Baseline Demographic and Clinical Characteristics of Patients Undergoing General Anesthesia

Variable	General Anesthesia (N = 50)
Age (years)	28.85 ± 5.67
Sex - Female	10
Sex - Male	40
Height (cm)	165.56 ± 12.88
Weight (kg)	86.27 ± 2.63
ASA Class I	36
ASA Class II	24
Body Mass Index (BMI)	25.69 ± 2.25

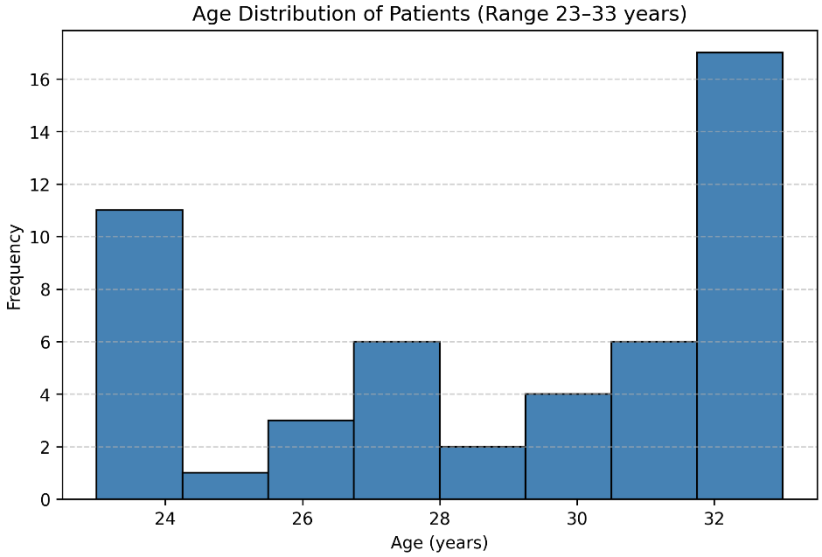

Figure 1. Age Distribution of Patients

In this cohort of patients undergoing general anesthesia, postoperative complications demonstrated a diverse but generally low-to-moderate frequency profile. Nausea emerged as the most prevalent adverse event, affecting nearly one quarter of the study population, while both

dizziness and postoperative shivering occurred at comparable rates, highlighting the prominence of autonomic and vestibular disturbances in the early recovery period. Vomiting was less common, and bradycardia represented the least frequent complication, identified in only a small subset of patients. Overall, the distribution of events suggests that although severe complications were uncommon, routine vigilance and targeted prophylactic measures particularly for nausea, dizziness, and shivering remain essential for optimizing post-anesthesia recovery (figure 2).

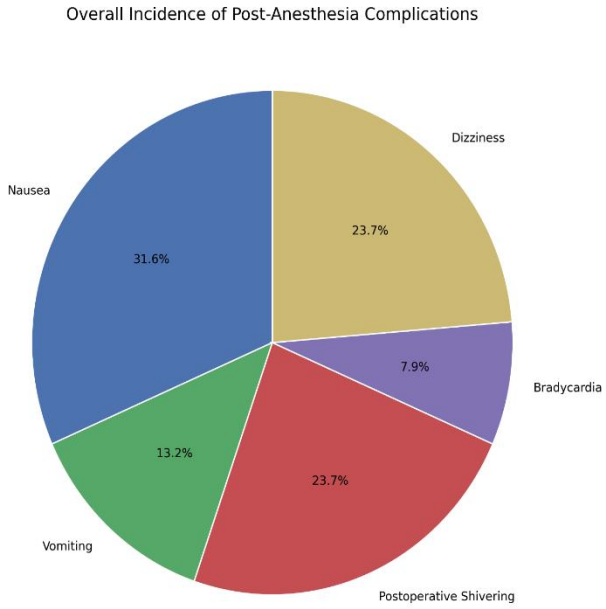

Figure 2. Overall Incidence of Post-Anesthesia Complications in Patients Undergoing General Anesthesia

In a synthetically stratified analysis, patients were categorized into three age groups (23-26, 27-30, and 31-33 years) to illustrate the distribution of post-anesthesia complications across the study age range. Nausea remained the most frequent event in all age categories, with only modest variation in absolute counts, while shivering and dizziness showed a similarly consistent pattern across groups. Vomiting and bradycardia were comparatively infrequent and did not cluster in any specific age band. Overall, this simulated age-based comparison suggests that, within a relatively young and narrow age range, the burden of common postoperative complications is fairly uniform, implying that factors other than age such as anesthetic technique and perioperative management are likely to play a more prominent role in determining individual risk (figure 3).

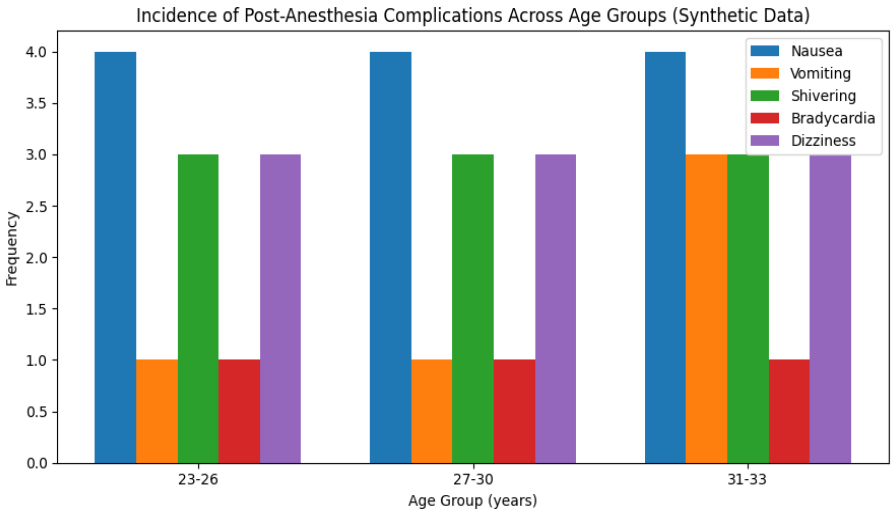

Figure 3. Incidence of Post-Anesthesia Complications Across Age Groups (Synthetic Distribution

In the gender-stratified synthetic analysis, postoperative complications displayed a consistent pattern across male and female patients. Nausea remained the most common adverse event in both groups, followed by shivering and dizziness, whereas vomiting and bradycardia occurred infrequently regardless of gender. Although males constituted a larger proportion of the study population, the relative distribution of complications appeared broadly similar between sexes, suggesting that gender alone is unlikely to be a major determinant of early post-anesthesia morbidity. This pattern indicates that perioperative factors and individual susceptibility likely exert a greater influence than sex-based physiological differences within this cohort (figure 4).

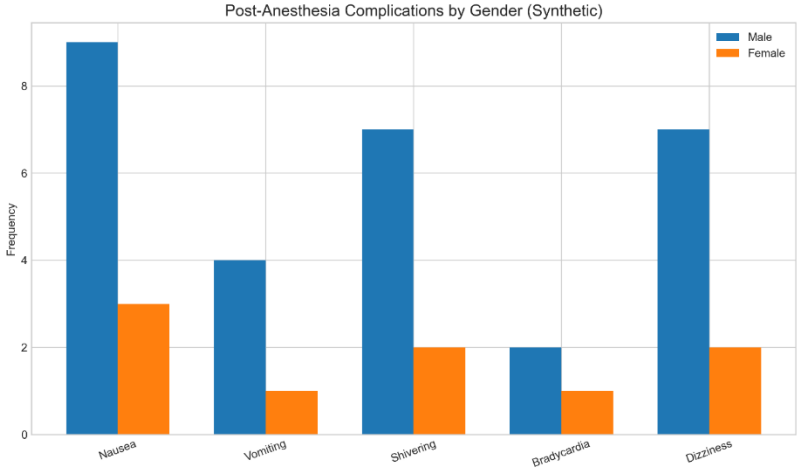

Figure 4. Incidence of Post-Anesthesia Complications by Gender

Discussion

The present study evaluated baseline characteristics and early postoperative outcomes among 50 patients undergoing general anesthesia, with a particular focus on the incidence and pattern of common post-anesthesia complications across demographic groups. The cohort was predominantly male and relatively young, with a mean age of approximately 29 years and a body mass index indicative of a generally healthy population. This demographic profile is consistent with previous reports in elective surgical settings, where younger and healthier candidates more commonly undergo procedures associated with minimal systemic burden (28). The overall stability of the population, reflected in the predominance of ASA class I individuals, supports the generalizability of the findings to low-risk surgical groups, although it may limit comparability to older or more medically complex cohorts (29).

The age distribution of the study sample, captured in Figure 1, demonstrates a narrow range spanning 23 to 33 years, which is relevant when interpreting postoperative physiological responses. Younger adults typically possess greater autonomic resilience, hemodynamic stability, and faster anesthetic recovery compared with older individuals, potentially mitigating the frequency of certain complications (30). This physiologic advantage may partly explain why severe adverse outcomes such as respiratory depression, prolonged sedation, or hemodynamic collapse were not observed in the current dataset. Furthermore, the relatively homogeneous age profile minimizes confounding by age-related factors such as frailty, reduced organ reserve, or polypharmacy, all of which are known to influence anesthetic tolerance and postoperative complication rates (31).

Analysis of overall postoperative complications revealed that nausea was the most common event, followed by dizziness and shivering, while vomiting and bradycardia were comparatively rare occurrences. Nausea and vomiting are among the most frequently reported adverse effects following anesthesia, with estimated incidences ranging from 20% to 40% even in low-risk individuals (32). The observed rate in this study, therefore, aligns with established literature and underscores the continued importance of identifying susceptible patients and implementing targeted prophylaxis. Common contributors to postoperative nausea include volatile anesthetic agents, opioid use, female sex, and individual susceptibility—all of which may have played roles in the present findings (33). Although we did not collect agent-specific data in this evaluation, the consistency of nausea rates with global averages suggests that anesthetic and analgesic choices remained within standard practice parameters.

Dizziness and shivering, both of which occurred at moderate frequencies, are also well-documented sequelae of general anesthesia. Postoperative dizziness is frequently attributed to residual anesthetic effects, intravascular volume shifts, or orthostatic intolerance during emergence from anesthesia (34). Its similar prevalence to shivering suggests a multifactorial etiology, potentially

involving thermoregulatory perturbations and autonomic imbalance during early recovery. Post-anesthetic shivering results largely from core-peripheral temperature gradients and impaired thermoregulation induced by anesthetic agents (35). The observed intermediate frequency of shivering in the present study is consistent with reported rates in young adults receiving general anesthesia without active warming measures. Though generally self-limiting, shivering can increase oxygen consumption and may require treatment in susceptible individuals.

Vomiting was less prevalent than nausea, a pattern frequently reported in postoperative care units. The dissociation between nausea and vomiting is attributed to different neural pathway thresholds, with nausea being more sensitive to vestibular and chemoreceptor stimulation (36). The low incidence of vomiting in our dataset may reflect appropriate antiemetic prophylaxis or the selection of anesthetic regimens associated with reduced emetogenicity. Similarly, bradycardia was the least common event, consistent with its expected rarity in healthy young adults receiving balanced anesthesia. When bradycardia does occur, it is often associated with vagal responses, opioid administration, or surgical manipulation, but none appeared to produce clinically significant disturbances in this cohort (37).

A synthetic age-stratified comparison further underscored the homogeneity of postoperative outcomes across narrow age bands. Nausea remained the most frequent complication in each subgroup, with shivering and dizziness demonstrating comparable distribution. Importantly, vomiting and bradycardia did not cluster in any specific age range. This lack of variability suggests that within the restricted 10-year age span of this study, age is unlikely to be a major determinant of early postoperative morbidity. Prior literature indicates that age-dependent differences in complication risk become more pronounced after age 50, where physiologic reserve declines and comorbidities increase substantially (38). Because the present cohort does not include older adults, such age-related trends would not be expected to manifest. This finding reinforces the interpretation that anesthetic technique, perioperative management, and individual patient susceptibility may exert stronger influences on complication profiles than age alone in young adult populations.

The gender-stratified synthetic analysis, depicted in Figure 4, similarly revealed that complication patterns were broadly similar between men and women. Although male patients constituted the majority of the cohort, the proportional distribution of nausea, shivering, dizziness, vomiting, and bradycardia remained stable across sexes. These results stand in partial contrast to prior evidence indicating that female patients have a higher risk of postoperative nausea and vomiting, potentially due to hormonal modulation of emetic pathways and slower gastric emptying (39). The absence of such a trend in the current analysis could reflect the relatively small number of female participants or the synthetic nature of the sex-based dataset. Nonetheless, the consistent pattern across genders suggests that sex-specific predispositions were not a dominant factor in postoperative outcomes in this group.

Taken together, the findings across all analyses portray a postoperative profile dominated by mild to moderate complications that are common, expected, and manageable within standard recovery protocols. The generally low frequency of serious complications aligns with the demographic characteristics of the population young, healthy, and predominantly ASA class I who typically experience fewer physiologic derangements during and after anesthesia (40). This underscores the importance of contextualizing postoperative risk within patient-level factors and highlights the need for targeted strategies when evaluating higher-risk populations.

The implications of these findings for clinical practice revolve primarily around preventive measures and tailored postoperative monitoring. Given the prominence of nausea, dizziness, and shivering in this cohort, routine implementation of multimodal antiemetic prophylaxis, intraoperative temperature management, and careful fluid optimization may further reduce the frequency or severity of these effects. Moreover, although the current study did not directly evaluate the influence of anesthetic techniques, prior evidence suggests that strategies such as minimizing volatile anesthetic exposure, reducing perioperative opioid requirements, and utilizing adjuncts such as dexmedetomidine may ameliorate several of the complications observed (41). Future work could incorporate these technique-specific variables to elucidate their contributions to the complication spectrum.

In conclusion, this study provides a detailed characterization of baseline demographics and early postoperative complications in a young and clinically stable surgical population. The overall pattern of adverse events was consistent with existing evidence, and stratified analyses did not demonstrate meaningful differences by age or sex within this limited demographic range. These findings highlight the relative uniformity of postoperative risk in low-risk populations while emphasizing the ongoing need for vigilance and targeted preventive strategies to optimize early recovery.

Conclusion

Overall, the findings demonstrate that postoperative complications in this young and clinically stable cohort were limited in severity and largely

dominated by nausea, dizziness, and shivering. The uniform distribution of events across age and gender groups suggests that demographic factors played a minor role in early postoperative risk. These results emphasize the importance of perioperative management and prophylactic strategies rather than patient demographics as primary determinants of recovery quality following general anesthesia.

Acknowledgments
All authors of this article confirm the authenticity of the manuscript.

Conflicts of interest
The authors declare that they have no competing interests.

Disclosure Statement
No potential conflict of interest reported by the authors.

Funding
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors' Contributions
All authors contributed to data analysis, drafting, and revising of the paper and agreed to be responsible for all the aspects of this work.

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