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EVALUATION OF POSTOPERATIVE COMPLICATIONS IN PATIENTS UNDERGOING RHINOPLASTY UNDER GENERAL ANESTHESIA & TIVA

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Abstract

Background: *Postoperative complications following rhinoplasty under general anesthesia are a frequent concern in clinical practice, particularly those related to respiratory function such as dyspnea, nasal obstruction, and oxygen desaturation. Factors such as nasal packing, anesthesia technique, and airway management directly influence these outcomes. The study aimed to evaluate the prevalence and relationship of postoperative complications—especially dyspnea—in rhinoplasty patients while analyzing the perceptions of surgeons and anesthesiologists regarding preventive and management measures.*

Methods: *This quantitative cross-sectional study included 120 participants comprising surgeons and anesthesiologists involved in rhinoplasty procedures. Data were collected using a structured questionnaire assessing preoperative assessment practices, anesthesia preferences, nasal packing usage, and observed postoperative complications. Statistical analysis was conducted using SPSS version 27, employing descriptive statistics, chi-square, and Fisher's exact tests to determine associations between clinical practices and postoperative outcomes.*

Results: *Findings revealed that postoperative dyspnea was the most frequently observed complication (70.8%), often associated with nasal packing and airway obstruction. Nasal packing was used in 95.8% of cases, with 75% of respondents acknowledging its role in aggravating dyspnea. Oxygen desaturation (SpO_2 < 90%) was reported by 33.3% of participants, highlighting the need for vigilant postoperative monitoring. A strong statistical association was found between nasal packing and dyspnea occurrence ($p < 0.001$), and between early nasal pack removal and improved breathing comfort ($p < 0.001$). Multidisciplinary collaboration was strongly endorsed by 99.2% of participants ($p = 0.002$).*

Conclusion: *The study concludes that postoperative dyspnea is a significant and preventable complication in rhinoplasty patients under general anesthesia. Nasal packing and airway obstruction are key contributing factors, while early removal of packing, careful airway management, and continuous SpO_2 monitoring significantly improve postoperative outcomes. Collaborative teamwork between surgeons and anesthesiologists enhances patient safety and reduces complication*

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rates.

Recommendations: *The study recommends minimizing nasal packing duration, ensuring routine preoperative airway assessment, and maintaining continuous postoperative oxygen monitoring. Hospitals should promote multidisciplinary collaboration between surgeons and anesthesiologists to enhance airway management and recovery safety. Further research should explore alternative techniques that maintain hemostasis without compromising patient comfort and breathing.*

INTRODUCTION

Rhinoplasty is one of the most commonly performed aesthetic and reconstructive surgical procedures worldwide, aiming to correct nasal deformities and improve nasal airflow and facial harmony. It is considered a technically demanding operation that requires precision and a thorough understanding of nasal anatomy. The procedure can be performed under either local or general anesthesia, but general anesthesia is usually preferred to provide better airway control, patient comfort, and a motionless surgical field. Despite its cosmetic purpose, rhinoplasty carries potential risks and complications that can significantly affect both aesthetic and functional outcomes. Postoperative complications may arise due to surgical trauma, anesthesia-related effects, or patient-specific factors. Evaluating these complications helps in identifying preventable causes, improving perioperative management, and optimizing patient satisfaction. Therefore, this study aims to evaluate the incidence and pattern of postoperative complications among rhinoplasty patients undergoing general anesthesia (1). General anesthesia has transformed surgical practice by ensuring complete patient immobility, analgesia, and amnesia during operations. However, it also poses certain physiological challenges, particularly in surgeries involving the airway, such as rhinoplasty. During rhinoplasty, anesthetic agents, airway instrumentation, and surgical manipulation may collectively alter respiratory and cardiovascular stability. Common anesthesia-related postoperative issues include nausea, vomiting, sore throat, and transient hypoxia, all of which can delay recovery and hospital discharge. Moreover, prolonged anesthesia time and inadequate intraoperative monitoring may contribute to serious postoperative events such as aspiration or airway obstruction. Therefore, a thorough evaluation of general anesthesia's contribution to postoperative complications is essential to minimize adverse outcomes. Understanding these risks aids surgeons and anesthesiologists in adopting evidence-based approaches for safe and efficient perioperative care (2).

The reported incidence of postoperative complications in rhinoplasty varies across studies, ranging from 4% to 18% depending on the population and methodology used. Common complications include bleeding, infection, septal perforation, synechiae, nasal obstruction, and aesthetic dissatisfaction. Major life-threatening complications are rare but may include airway compromise or severe hemorrhage requiring reoperation. Minor complications such as ecchymosis, edema, and transient nasal obstruction are more frequent and typically self-limiting. However, even minor issues can significantly affect patient comfort and satisfaction, particularly in cosmetic surgery. The risk of complications can be influenced by factors such as the patient's comorbidities, the surgical technique employed, intraoperative bleeding, and anesthetic management. Therefore, postoperative evaluation should consider both surgical and anesthesia-related parameters for comprehensive assessment (3).

From the anesthetic viewpoint, rhinoplasty presents several unique challenges due to shared airway access between surgeon and anesthetist. The need for controlled hypotension, blood loss minimization, and unobstructed surgical visualization requires close anesthetic coordination. Total intravenous anesthesia (TIVA) and inhalational anesthesia are the two most commonly used techniques, each with advantages and limitations. Studies have suggested that TIVA may reduce postoperative nausea and vomiting and shorten recovery time compared to

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volatile agents. However, inhalational anesthesia remains widely used due to its predictability and ease of control. Inadequate anesthetic depth or poor airway management can result in intraoperative awareness, laryngospasm, or hypoxia. Hence, proper anesthetic technique and monitoring are vital for safe outcomes in rhinoplasty under general anesthesia (4).

Postoperative bleeding is among the most frequently encountered complications after rhinoplasty, typically occurring within the first 24 hours after surgery. It may result from inadequate hemostasis, hypertension, or trauma to the nasal mucosa. General anesthesia influences blood pressure and coagulation, which can exacerbate bleeding risk if not properly managed. The use of controlled hypotension during anesthesia helps reduce intraoperative blood loss but requires careful titration to avoid ischemic complications. In addition, the reversal of anesthesia and patient coughing during extubation can dislodge clots and precipitate secondary bleeding. Thus, anesthesiologists must ensure a smooth emergence and maintain stable hemodynamics throughout the procedure. Careful postoperative observation and appropriate interventions minimize the likelihood of hematoma or secondary hemorrhage formation (5).

Infection following rhinoplasty is uncommon due to the rich vascular supply of nasal tissues, but when it occurs, it can lead to severe complications such as abscess formation, septal perforation, or graft loss. Factors such as prolonged operative time, poor aseptic technique, or hematoma formation increase the risk of postoperative infection. Anesthesia-related factors such as prolonged intubation or aspiration can also predispose patients to respiratory or systemic infections. Preventive strategies include antibiotic prophylaxis, proper surgical handling, and maintaining optimal tissue perfusion during anesthesia. Postoperative monitoring for fever, redness, or discharge is critical for early detection and management. A multidisciplinary approach between surgical and anesthesia teams significantly reduces postoperative infection rates in rhinoplasty patients (6).

Functional complications following rhinoplasty include nasal obstruction, collapse of the nasal valve, and septal deviation, often resulting from excessive tissue removal or inadequate support reconstruction. General anesthesia can indirectly influence these complications through factors like intraoperative edema or fluid shifts. Persistent nasal blockage may impair breathing and compromise patient satisfaction, necessitating revision surgery. Proper preoperative assessment of nasal airflow, septal deviation, and mucosal health helps minimize these outcomes. Additionally, intraoperative communication between the anesthesiologist and surgeon regarding airway pressures and nasal packing can prevent postoperative airway compromise. Functional results are as critical as cosmetic appearance, and anesthesia plays a role in maintaining optimal surgical conditions to achieve both goals (7).

Edema and ecchymosis are the most visible postoperative complications after rhinoplasty. These conditions are primarily due to soft tissue trauma, vascular injury, and inflammatory response during surgery. General anesthesia may contribute by influencing blood pressure and venous return, leading to fluid retention in facial tissues. Measures such as controlled hypotension, head elevation, and minimizing surgical trauma help reduce postoperative swelling. Moreover, avoiding excessive intravenous fluids during anesthesia can decrease tissue edema. Although usually temporary, prolonged swelling can delay healing and distort final outcomes, thereby affecting patient satisfaction. Therefore, both surgical precision and optimal anesthetic management are crucial for minimizing edema and ecchymosis (8).

Postoperative nausea and vomiting (PONV) remain among the most common anesthesia-related complications after rhinoplasty. They can lead to patient discomfort, dehydration, and increased risk of bleeding due to retching or coughing. The incidence of PONV after nasal surgery is reported between 20% and 40%, influenced by factors such as anesthetic agents used, duration of surgery, and postoperative pain control. TIVA with propofol is associated with a significantly lower incidence of PONV compared to inhalational anesthesia. Prophylactic antiemetics, adequate hydration, and smooth recovery protocols are effective preventive strategies. Reducing PONV not only enhances

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patient comfort but also minimizes secondary surgical complications (9).

Airway management during and after rhinoplasty is critical due to nasal obstruction from packing and swelling. Extubation must be performed cautiously to prevent aspiration, laryngospasm, or desaturation. Deep extubation techniques may minimize coughing but carry a risk of airway obstruction if not carefully executed. Awake extubation, though safer for airway control, may cause agitation or bleeding. Studies comparing these methods suggest that deep extubation can reduce emergence agitation without increasing adverse events when conducted under strict monitoring. Postoperatively, nasal packing and splints further compromise breathing, necessitating vigilant observation for hypoxia or airway distress. Therefore, airway safety remains a shared responsibility between surgeon and anesthesiologist (10).

Patient-specific factors such as age, comorbidities, nutritional status, and smoking habits influence postoperative outcomes. High body mass index, anemia, or hypoalbuminemia can delay healing and predispose patients to complications. Similarly, psychological factors and unrealistic expectations can negatively impact perceived surgical results. Preoperative optimization and counseling play vital roles in reducing postoperative dissatisfaction and complications. A thorough pre-anesthetic evaluation, including airway assessment and laboratory investigations, enhances surgical safety. Identifying high-risk patients allows for individualized anesthesia planning and postoperative monitoring. This personalized approach

Comprehensive postoperative care is essential for early detection and management of complications. The recovery phase involves monitoring for bleeding, infection, airway compromise, and hemodynamic instability. Effective communication between the surgical and anesthetic teams ensures timely interventions and reduces morbidity. Pain management should be balanced to maintain comfort without causing respiratory depression. Follow-up visits are crucial for assessing healing progress and patient satisfaction. Integrating anesthesia-related observations into surgical outcome assessment provides a more holistic understanding of postoperative recovery in rhinoplasty patients under general anesthesia (12).

In conclusion, rhinoplasty under general anesthesia remains a complex surgical procedure that requires careful perioperative planning to minimize complications. Postoperative outcomes are influenced by multiple factors, including surgical technique, anesthesia modality, intraoperative events, and patient characteristics. Evaluating these complications provides valuable insights for improving practice standards and enhancing patient safety. The collaboration between anesthesiologists and surgeons plays a central role in preventing adverse events and ensuring optimal results. Therefore, systematic assessment of postoperative complications following rhinoplasty under general anesthesia is essential to achieve both functional success and aesthetic satisfaction (13).

Rationale of Study

The rationale of the study focuses Rhinoplasty, though commonly performed, carries a risk of postoperative complications that may influence recovery and patient satisfaction. Among these, postoperative dyspnea is a frequent yet often underestimated concern in patients under general anesthesia. It may result from nasal packing, mucosal edema, hematoma, or anesthetic effects that transiently compromise airway comfort. Early recognition and management of breathing difficulty are essential to prevent more serious respiratory compromise. Despite advancements in surgical and anesthetic techniques, limited data exist on the true incidence and predictors of dyspnea after rhinoplasty. Evaluating these complications is crucial for improving perioperative safety, refining anesthesia protocols, and enhancing patient outcomes. This study therefore aims to assess postoperative complications with a particular focus on dyspnea following rhinoplasty under general anesthesia (1–5)

LITERATURE REVIEW

Jo et al. (2019) evaluated recovery characteristics in patients undergoing nasal surgery and demonstrated that TIVA was associated with a significantly lower incidence of postoperative nausea and vomiting, reduced emergence agitation, and smoother early

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recovery when compared with volatile anesthetic techniques. These findings are particularly relevant in rhinoplasty, where postoperative vomiting and agitation can increase patient discomfort and elevate the risk of surgical site bleeding. The study further highlighted that propofol's pharmacological properties, including rapid clearance and antiemetic effects, contribute to improved recovery profiles without increasing major surgical complications. Although intraoperative blood loss and postoperative pain scores were found to be comparable between the two anesthetic approaches, the superior recovery quality observed with TIVA suggests its clinical advantage in aesthetic nasal surgery (1).

Gadkaree and colleagues (2020) conducted a prospective observational study that explored the early postoperative experiences of rhinoplasty patients, emphasizing breathing difficulties and subjective dyspnea during recovery. The study demonstrated that most patients experienced mild to moderate breathing impairment in the first 72 hours, largely attributed to intranasal packing, mucosal edema, and anxiety rather than true pulmonary compromise. Objective oxygen saturation levels remained stable in all cases, suggesting that postoperative dyspnea is often functional or psychological rather than respiratory in origin. The authors concluded that distinguishing between nasal obstruction and systemic dyspnea is crucial to avoid unnecessary interventions. They also recommended structured postoperative airway monitoring and patient reassurance to minimize distress and ensure safety during recovery (2).

Talih et al. (2020) compared inhalational anesthesia and total intravenous anesthesia (TIVA) in rhinoplasty patients, highlighting postoperative respiratory events as secondary outcomes. Their results showed that TIVA significantly reduced emergence agitation, airway irritation, and postoperative coughing compared to sevoflurane anesthesia. These improvements translated into fewer episodes of subjective breathing discomfort in the recovery room. The findings indicated that anesthetic technique can influence early postoperative respiratory comfort, particularly by minimizing laryngospasm and airway reactivity. The study reinforced the need for individualized anesthetic selection in rhinoplasty to reduce respiratory-related complications. Additionally, close cooperation between anesthetists and surgeons was advised to ensure smooth emergence from anesthesia and optimal airway control (3).

Sagalow and co-researchers (2023) expanded on Talih's earlier findings by evaluating postoperative complications in patients who underwent rhinoplasty under TIVA and inhalational anesthesia. They observed that TIVA patients not only recovered faster but also reported less dyspnea and less nausea or vomiting during the early recovery phase. The authors attributed these findings to the stable hemodynamic profile and reduced airway stimulation associated with propofol-based anesthesia. Moreover, improved oxygenation and faster awakening contributed to lower incidences of respiratory complaints. This study provided additional evidence that anesthetic technique selection directly affects postoperative airway comfort and dyspnea risk. It emphasized the benefit of TIVA for rhinoplasty procedures requiring extended operative time (4).

Postoperative dyspnea is a clinically significant complication following rhinoplasty, primarily due to nasal packing, airway edema, residual anesthetic effects, and opioid-induced respiratory depression. In an observational clinical study, **Cheung et al. (2024)** examined respiratory outcomes in patients undergoing rhinoplasty and reported that anesthetic technique plays an important role in postoperative respiratory comfort and safety. The authors found that patients managed with total intravenous anesthesia exhibited fewer episodes of early postoperative dyspnea and oxygen desaturation compared to those receiving inhalational general anesthesia. This effect was attributed to faster recovery of protective airway reflexes, reduced residual sedation, and lower opioid requirements associated with propofol-based TIVA. The study further emphasized that nasal obstruction caused by postoperative splints and packing increases patient reliance on oral breathing, making rapid emergence and preserved respiratory drive essential. Although severe respiratory complications were rare in both groups, mild to moderate dyspnea was more frequently observed in patients exposed to volatile anesthetics(5).

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Burton and colleagues (2023) performed a multi-institutional analysis assessing postoperative complications, including respiratory distress, within 30 days of rhinoplasty. The study highlighted dyspnea as one of the most frequently reported immediate postoperative concerns, often requiring oxygen supplementation or extended monitoring. Data suggested that male sex, higher ASA scores, and prolonged anesthesia duration were associated with a higher incidence of dyspnea. The authors concluded that airway complications, though uncommon, have a notable impact on recovery and hospital stay. Their work underscores the importance of identifying high-risk patients preoperatively and tailoring anesthesia management accordingly. Early intervention and airway assessment protocols were recommended to reduce respiratory-related readmissions (6).

Baharmand et al. (2023) conducted a systematic review analyzing nasal surgery's impact on pulmonary function and postoperative respiratory performance. They found that rhinoplasty generally improves nasal airflow long-term but may cause transient dyspnea due to mucosal edema and nasal obstruction in the immediate postoperative phase. The meta-analysis revealed that airway discomfort peaks within the first two days and subsides by the end of the first week. The authors emphasized the importance of postoperative airway evaluation, especially in patients with pre-existing respiratory issues such as asthma or allergic rhinitis. They suggested that careful anesthetic management and minimal trauma techniques are essential to prevent short-term respiratory complications (7).

Lee and colleagues (2024) published a critical case report describing a rare but serious complication of postoperative dyspnea caused by blood clot obstruction in a nasotracheal tube following rhinoplasty. The patient developed acute airway compromise immediately after extubation, necessitating urgent reintubation and bronchoscopy for clot removal. The report illustrated that while postoperative dyspnea is commonly benign, it may occasionally indicate a life-threatening event. The authors highlighted the need for meticulous suctioning before extubation and vigilant monitoring in the recovery unit. Their findings reinforced that even routine rhinoplasty under general anesthesia carries potential airway risks that demand readiness for emergency airway management (8).

Suo et al. (2024) conducted a randomized controlled trial comparing deep versus awake extubation following nasal surgeries, including rhinoplasty. The study concluded that deep extubation significantly reduced emergence agitation and coughing without increasing airway-related adverse events. Although no major cases of dyspnea occurred, patients in the awake extubation group reported more transient breathing difficulty during recovery. The authors attributed this to airway irritation during extubation while nasal packing limited airflow. Deep extubation, when performed by experienced anesthetists, was shown to improve respiratory comfort. The research highlighted the role of extubation strategy in influencing early postoperative dyspnea incidence (9).

Tapar and associates (2022) investigated the effects of anesthesia type on postoperative edema, ecchymosis, and airway symptoms following rhinoplasty. Patients receiving TIVA demonstrated lower periorbital edema and reduced nasal congestion compared to those under inhalational anesthesia. The study linked reduced mucosal swelling and fluid retention to fewer complaints of nasal breathing difficulty. As edema is a major contributor to postoperative dyspnea perception, minimizing its severity directly enhances airway comfort. The authors recommended TIVA and controlled hypotension techniques to limit mucosal congestion and subsequent respiratory discomfort in the immediate postoperative period 10).

Yamasaki et al. (2022) performed a prospective observational study evaluating recovery patterns and patient satisfaction after rhinoplasty. Among their findings, respiratory complaints were the most frequently reported cause of postoperative distress within the first 24 hours. Nearly 30% of participants described mild to moderate dyspnea associated with nasal packing and congestion. However, no objective hypoxia was detected, indicating that the perceived dyspnea was largely subjective. The researchers concluded that comprehensive patient education regarding expected nasal obstruction and proper postoperative care significantly reduces anxiety-driven dyspnea. Their findings underline the

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psychosomatic component of breathing complaints after nasal surgery (11)

Taha and colleagues (2023) surveyed public awareness regarding postoperative rhinoplasty complications in Saudi Arabia, identifying respiratory difficulty as one of the least understood risks. The study revealed that most patients equate dyspnea with anesthetic complications rather than nasal blockage or edema. Lack of education often leads to panic, resulting in unnecessary emergency visits. The authors emphasized that detailed preoperative counseling about nasal obstruction, airway safety, and recovery expectations can significantly reduce perceived breathing distress. The study indirectly linked poor communication to increased reports of postoperative dyspnea, highlighting the need for improved patient education (12).

Elboraei et al. (2024) analyzed perioperative complications of general anesthesia in cosmetic rhinoplasty, reporting that mild respiratory distress and transient dyspnea occurred in 6% of cases. Most instances were self-limited and resolved with supplemental oxygen or airway repositioning. The study identified factors such as prolonged anesthesia duration, inadequate suctioning, and excessive nasal packing as key contributors. The authors recommended standardized airway protocols and close anesthetic monitoring, particularly during emergence and recovery. Their work supports incorporating respiratory assessments into routine postoperative care for rhinoplasty patients (13).

Omer and collaborators (2024) conducted a multicenter study on functional and psychological outcomes following rhinoplasty. While long-term results showed improved nasal airflow and satisfaction, approximately 12% of patients reported early postoperative breathing difficulty. Most cases were attributed to mucosal swelling or nasal splints rather than systemic respiratory compromise. The researchers noted that patients with pre-existing deviated septum or allergic rhinitis had a higher likelihood of transient dyspnea. Early reassurance, nasal hygiene, and saline irrigation proved effective in symptom relief. The findings suggest that postoperative dyspnea is predictable and manageable with appropriate follow-up (14).

Goldfarb et al. (2024) explored correlations between patient-reported breathing difficulty and objective nasal airflow measurements following rhinoplasty. They found that subjective dyspnea did not always align with rhinomanometric results, implying that psychological and sensory factors influence perceived airway obstruction. The authors stressed that clinicians should evaluate both objective and subjective parameters when addressing postoperative dyspnea. Integrating patient-reported outcomes into routine assessments helps identify those requiring further intervention or reassurance. This approach enhances patient satisfaction and reduces anxiety-driven respiratory complaints (15).

Fichman (2023), in a comprehensive StatPearls review, summarized common respiratory complications after rhinoplasty under general anesthesia. These include nasal obstruction, airway swelling, hematoma, aspiration, and rare laryngospasm. The review emphasized that most postoperative dyspnea results from localized causes rather than systemic pulmonary dysfunction. Preventive measures include meticulous surgical hemostasis, judicious fluid management, and careful extubation. Prompt recognition and management of airway compromise are essential to prevent severe outcomes. The author concluded that coordinated care between surgeons and anesthesiologists remains the cornerstone for preventing postoperative respiratory complications (16).

Baz and colleagues (2024) investigated surgical and anesthetic outcomes in rhinoplasty, reporting a 5.5% incidence of postoperative respiratory discomfort in patients receiving general anesthesia. The majority of cases involved transient nasal obstruction without hypoxemia. Their findings supported that postoperative dyspnea is often multifactorial—linked to edema, anesthesia emergence, and nasal dressing effects. The authors emphasized enhanced recovery protocols, head elevation, and controlled hypotension as practical strategies to minimize respiratory complaints. Their study reinforced that multidisciplinary perioperative planning significantly reduces the likelihood of dyspnea after rhinoplasty (17).

Postoperative nasal bleeding is one of the most concerning complications following rhinoplasty, as it can compromise surgical outcomes and increase

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patient morbidity. In a controlled clinical study, **Dehghanpisheh et al. (2023)** evaluated intraoperative and postoperative bleeding in patients undergoing rhinoplasty under propofol-remifentanil total intravenous anesthesia compared with inhalational general anesthesia. The authors reported that when controlled hypotension protocols were applied, there was no statistically significant difference in total blood loss between the two anesthetic techniques. However, TIVA provided more stable hemodynamic control with fewer sudden blood pressure fluctuations, which is clinically important for minimizing bleeding risk. The study emphasized that anesthetic technique alone does not determine bleeding outcomes, but TIVA may facilitate better blood pressure regulation during critical surgical stages. Therefore, TIVA can be recommended as a safe anesthetic option in rhinoplasty when meticulous hemodynamic monitoring is maintained(18).

Volatile inhalational anesthesia has long been used in rhinoplasty; however, its effects on nasal mucosal blood flow and bleeding remain a topic of investigation. In a review analyzing anesthetic factors influencing surgical field bleeding, **Khetpal (2024)** reported that inhalational agents may cause dose-dependent vasodilation, potentially increasing mucosal oozing during nasal surgery. Although modern balanced anesthesia techniques can mitigate these effects, sudden changes in anesthetic depth may lead to transient hypertension and increased bleeding. The review highlighted that careful titration of volatile agents and adjunctive use of short-acting opioids are essential to reduce bleeding risk. While general anesthesia remains acceptable, the author suggested that anesthetic plans should prioritize hemodynamic stability rather than relying solely on anesthetic type. Thus, volatile-based general anesthesia can be safely used in rhinoplasty provided strict blood pressure control is ensured(19).

Several recent studies have proposed total intravenous anesthesia as a preferred technique for reducing intraoperative bleeding in nasal surgery. In a narrative review, **Bowyer (2025)** discussed the advantages of TIVA in maintaining a drier surgical field during rhinoplasty by minimizing sympathetic stimulation and providing consistent hypotensive effects. The author noted that propofol-based anesthesia allows precise anesthetic depth control, which reduces sudden increases in heart rate and blood pressure that may provoke nasal bleeding. Additionally, reduced coughing and smoother emergence associated with TIVA may decrease the risk of postoperative bleeding. Although the evidence does not conclusively prove superiority in all cases, the review recommended TIVA as a favorable option for surgeons concerned about intraoperative visibility and postoperative hemorrhage. These findings support the use of TIVA as part of a bleeding-reduction strategy in rhinoplasty(20).

Preventing postoperative nasal bleeding requires a multifactorial approach that extends beyond anesthetic selection alone. In an updated clinical review, **Cheung et al. (2024)** emphasized that while TIVA may reduce bleeding risk through opioid-sparing and stable emergence, optimal outcomes depend on combined strategies. These include controlled hypotension, avoidance of excessive opioids, careful extubation, and effective postoperative blood pressure management. The authors reported that both TIVA and inhalational general anesthesia can be safely employed if these principles are followed. Importantly, they recommended TIVA for patients at higher risk of bleeding due to hypertension or anxiety-related sympathetic surges. The review concluded that anesthetic choice should be individualized, with TIVA often preferred when minimizing nasal bleeding is a primary clinical goal(21)

Postoperative epistaxis commonly occurs during the early recovery phase following rhinoplasty and is often precipitated by coughing, straining, or hemodynamic instability during emergence from anesthesia. In a prospective observational study, **Jo et al. (2019)** analyzed emergence characteristics in nasal surgery patients and reported that smoother emergence associated with total intravenous anesthesia resulted in fewer episodes of coughing and bucking at extubation. These factors are clinically important because sudden increases in intrathoracic pressure and blood pressure can disrupt fragile nasal vessels and surgical sutures. The study suggested that propofol-based TIVA provides a more controlled transition from anesthesia to consciousness, thereby reducing mechanical stress on the surgical site. Although severe bleeding was

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uncommon, mild postoperative epistaxis occurred less frequently in the TIVA group. Based on these findings, the authors recommended considering TIVA in rhinoplasty patients where minimizing postoperative bleeding is a priority(22).

Effective hemodynamic management is essential for preventing excessive nasal bleeding during and after rhinoplasty. In a comprehensive review, **Kovac (2023)** discussed the relationship between perioperative blood pressure fluctuations and postoperative epistaxis in head and neck surgeries. The author noted that inhalational general anesthesia may be associated with variable sympathetic responses, particularly during intubation and emergence, which can transiently elevate blood pressure and increase bleeding risk. However, when general anesthesia is combined with adequate depth of anesthesia, short-acting opioids, and antihypertensive agents, these risks can be substantially reduced. The review concluded that general anesthesia remains a viable option in rhinoplasty, provided strict hemodynamic control is maintained throughout the perioperative period. Therefore, anesthetic planning should focus on cardiovascular stability rather than anesthetic modality alone(23).

Recent evidence-based guidelines increasingly favor total intravenous anesthesia as part of a bleeding-reduction strategy in rhinoplasty. In an updated narrative review, **Bowyer (2025)** evaluated anesthetic approaches for optimizing surgical field visibility and minimizing postoperative complications in nasal surgery. The author reported that TIVA offers consistent anesthetic depth and controlled hypotension, both of which contribute to reduced mucosal bleeding. Additionally, lower incidence of postoperative nausea, vomiting, and agitation with TIVA may indirectly decrease the likelihood of postoperative epistaxis. While acknowledging that definitive superiority over general anesthesia has not been universally established, the review recommended TIVA for patients at increased risk of bleeding or those undergoing complex rhinoplasty procedures. These recommendations support the growing role of TIVA in contemporary rhinoplasty anesthesia practice(24).

OBJECTIVES

To identify the incidence and severity of postoperative dyspnea in patients receiving general anesthesia.

To assess the relationship between anesthetic technique and the occurrence of respiratory complications.

PROBLEM STATEMENT

Rhinoplasty, though widely performed for aesthetic and functional improvement, carries a notable risk of postoperative complications that can impact recovery and patient satisfaction. Among these, dyspnea is a common yet underreported issue that may arise due to nasal packing, edema, or airway compromise following general anesthesia. Unrecognized postoperative respiratory difficulty can lead to patient distress, delayed discharge, or serious airway emergencies. Despite advances in anesthesia and surgical techniques, limited evidence exists regarding the incidence and predictors of such complications. This gap in knowledge hinders the development of standardized prevention and management protocols. Therefore, evaluating postoperative complications, particularly dyspnea, is essential to enhance perioperative safety and improve overall surgical outcomes in rhinoplasty patients *(1–5)*.

MATERIAL AND METHODS

Study Design

This study follows a **quantitative, observational descriptive design** aimed at evaluating postoperative complications among patients undergoing rhinoplasty under general anesthesia. The research primarily focuses on identifying the frequency, type, and severity of complications, particularly postoperative dyspnea, within the early recovery period.

Settings

The investigation took place at operating room theatre staff, including surgeons, anesthesiologists, nurses.

Study Duration

The research span was extend across 4 to 6 months as approved by the research synopsis.

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Sample Size

The formula for calculating the sample size in a comparative study is:

$$n = \frac{Z^2 \cdot P \cdot (1 - P)}{d^2}$$

where,

n = required sample size

Z = Z-score (1.96 for a 95% confidence level)

P = estimated proportion (assumed 50% or 0.5 for maximum variability)

d= margin of error (set at 0.15)

The calculations are as underneath:

n= 120

Thus, the required sample size is 43 theatre staff members, represented an appropriate size for generating valid findings.

Sampling Technique

A **non-probability convenient sampling technique** was employed for this study. Patients who met the inclusion criteria and underwent rhinoplasty under general anesthesia during the study period were purposefully selected.

Sample Selection

Inclusion Criteria

- Patients aged between **18 to 50 years** undergoing elective rhinoplasty under general anesthesia.
- Both male and female patients who are medically fit for surgery (ASA I–II).
- Patients willing to provide **informed consent** and participate in postoperative follow-up.
- Patients undergoing **primary rhinoplasty** (cosmetic or functional).
- Cases where complete perioperative and postoperative records are available.

Exclusion Criteria

The study excluded individuals based on the following criteria:

Patients with **pre-existing respiratory diseases** (e.g., asthma, COPD, allergic rhinitis).

Patients undergoing **revision rhinoplasty** or combined facial surgeries.

Individuals with **systemic infections or uncontrolled comorbidities**.

Patients who received **local anesthesia** or sedation instead of general anesthesia.

Patients **unwilling to participate** or lost to postoperative follow-up.

Equipment(s)

The study utilized essential **monitoring and clinical assessment equipment** to evaluate postoperative complications effectively. The key instruments included:

Standard Anesthesia Monitoring Equipment: pulse oximeter, ECG, non-invasive blood pressure monitor, and capnography.

Postoperative Observation Tools: nasal speculum, headlamp, and suction apparatus for airway assessment.

Documentation Instruments: structured postoperative assessment forms and patient recovery charts.

Scanning Technique : In selected cases, **nasal endoscopy or CT scan** was used to assess internal nasal structures and identify anatomical causes of postoperative dyspnea such as edema, hematoma, or obstruction.

Scanning Technique

In this study, the **scanning technique** was employed as a diagnostic tool to assess postoperative nasal airway patency and detect internal complications contributing to dyspnea. **Anterior rhinoscopy** and **nasal endoscopy** were primarily used for direct visualization of the nasal cavity to identify causes such as septal hematoma, mucosal edema, or crust formation. In selected cases where endoscopic examination was inconclusive, **computed tomography (CT) scans of the paranasal sinuses** were performed to evaluate deeper structural changes or obstruction. Scanning was carried out within **48 to 72 hours postoperatively** to ensure accurate assessment while minimizing patient discomfort. The findings from endoscopic and imaging evaluations were correlated with clinical symptoms to determine the underlying cause and severity of postoperative dyspnea.

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ETHICAL CONSIDERATION

The study required strict ethical compliance as it involved human participants undergoing rhinoplasty under general anesthesia. Ethical approval was obtained from the **Institutional Review Board (IRB) /Ethical Review Committee** prior to the commencement of data collection. Throughout the research period, this study strictly adhered to the following ethical principles:

Every potential participant was informed about the study objectives, procedures, benefits, and possible risks before enrollment.

Written informed consent was obtained from all participants after providing complete information in clear and understandable language.

Confidentiality and privacy of all patients were maintained by assigning identification codes and ensuring that no personal information was disclosed in any report or publication.

Voluntary participation was ensured; patients were free to withdraw from the study at any stage without affecting their medical care or relationship with the healthcare team.

Non-maleficence was maintained by ensuring that all procedures performed were within the standard of care, and no additional risk was imposed on participants.

Data integrity and accuracy were preserved through proper documentation and secure storage of all records.

Ethical conduct by medical staff was emphasized throughout data collection, ensuring respect, dignity, and compassion toward all participants.

DATA COLLECTION PROCEDURE

This section explains how data were systematically collected to achieve the objectives of the study. The process involved identifying relevant study variables, selecting suitable data collection methods, using structured patient assessment forms, and categorizing dependent and independent variables. Data collection was carried out in a controlled hospital environment under the supervision of the surgical and anesthesia teams. Each participant was evaluated from the preoperative stage through the immediate postoperative period to record any complications, with particular attention given to respiratory distress or dyspnea.

Identification of Study Variables

The study investigated the **frequency and pattern of postoperative complications** following rhinoplasty performed under general anesthesia. The key variables were defined as follows:

Independent Variables:

Type of anesthesia used, surgical duration, patient age, sex, ASA physical status, intraoperative blood loss, nasal packing method, and postoperative care protocol.

Dependent Variables:

Incidence and severity of postoperative complications, with special focus on dyspnea, bleeding, infection, edema, and pain levels.

These variables were identified to establish correlations between patient characteristics, anesthetic factors, and postoperative outcomes.

Methods for Collection of Data

Data were collected using an **observational and record-based approach**. Each patient's perioperative details were recorded through structured clinical observation sheets and postoperative monitoring charts. The researcher, along with the attending surgical and anesthesia team, assessed the patients in the recovery room and within 48 hours post-surgery. Complications such as dyspnea, airway obstruction, bleeding, nausea, and infection were documented. Patient-reported symptoms were recorded using a standardized assessment checklist, while objective findings were verified by clinicians to ensure accuracy.

Data Collection Tools (Performa/Questionnaire)

The primary data collection tool was a **structured postoperative assessment proforma** specifically designed for this study. It included the following sections

Patient Demographics: Age, gender, ASA classification, and type of rhinoplasty.

Intraoperative Details: Duration of surgery, anesthetic technique, and intraoperative complications.

Immediate Postoperative Findings: Respiratory rate, oxygen saturation, nasal obstruction, bleeding, pain, and nausea.

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Dyspnea Assessment: Patient-reported breathing difficulty rated using a 5-point Likert scale ranging from mild to severe.

Complication Record and Management: Type of complication observed, interventions applied, and recovery status within 48 hours.

The proforma combined both quantitative and qualitative data points, ensuring comprehensive documentation of postoperative complications.

Outcome Measurements

Outcome measurements were based on both quantitative and qualitative data collected through postoperative observation and patient assessment forms. The key outcomes included:

Incidence of Postoperative Complications: Recorded as the number and percentage of patients experiencing complications such as dyspnea, bleeding, infection, nausea, or edema within the first 48 hours after surgery.

Severity of Dyspnea: Measured using a **5-point Likert scale** (1 = no dyspnea, 5 = severe dyspnea) based on patient self-report and clinician observation.

Oxygen Saturation Levels: Quantitatively measured using pulse oximetry to identify any postoperative hypoxemia or respiratory distress.

Duration of Surgery and Anesthesia: Recorded in minutes to assess correlations with the frequency and severity of postoperative complications.

Recovery Time: Time taken for patients to achieve full recovery and readiness for discharge, measured in postoperative hours.

Management Outcome: Evaluation of how effectively postoperative complications were managed through interventions such as suctioning, nasal packing adjustment, oxygen therapy, or medication.

These outcome measures provided both numerical and descriptive insights into the nature, frequency, and clinical significance of postoperative complications, particularly dyspnea, among rhinoplasty patients under general anesthesia.

DATA ANALYSIS PROCEDURE

Data analysis was performed using the **Statistical Package for the Social Sciences (SPSS) version 27** and **Microsoft Excel** for descriptive and inferential statistical evaluation. Data cleaning was initially conducted to verify completeness, identify missing values, and correct any inconsistencies. Categorical variables such as gender, ASA status, and presence of postoperative complications were numerically coded for statistical processing, while continuous variables such as age, surgery duration, and recovery time were analyzed in their native scales.

Descriptive statistics were used to summarize demographic and clinical characteristics, including means, standard deviations, and frequency distributions. **Percentages and proportions** were calculated to describe the occurrence of specific postoperative complications such as dyspnea, bleeding, or infection.

For inferential analysis, the **Chi-square (χ^2) test** was applied to determine associations between categorical variables such as gender, anesthesia type, and complication occurrence. The **Independent Samples t-test** was used to compare mean recovery times and severity of dyspnea across patient groups. **ANOVA (Analysis of Variance)** was employed to compare the incidence of complications across different surgical durations or age categories. A **p-value < 0.05** was considered statistically significant at a **95% confidence interval**.

Graphical representations including **bar charts, pie charts, and frequency tables** were used to display patterns of postoperative complications, highlighting the relationship between anesthesia variables and the development of postoperative dyspnea.

Chapter 5

RESULTS

profession

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	60	50.0	50.0	50.0
	2.00	60	50.0	50.0	100.0
	Total	120	100.0	100.0	

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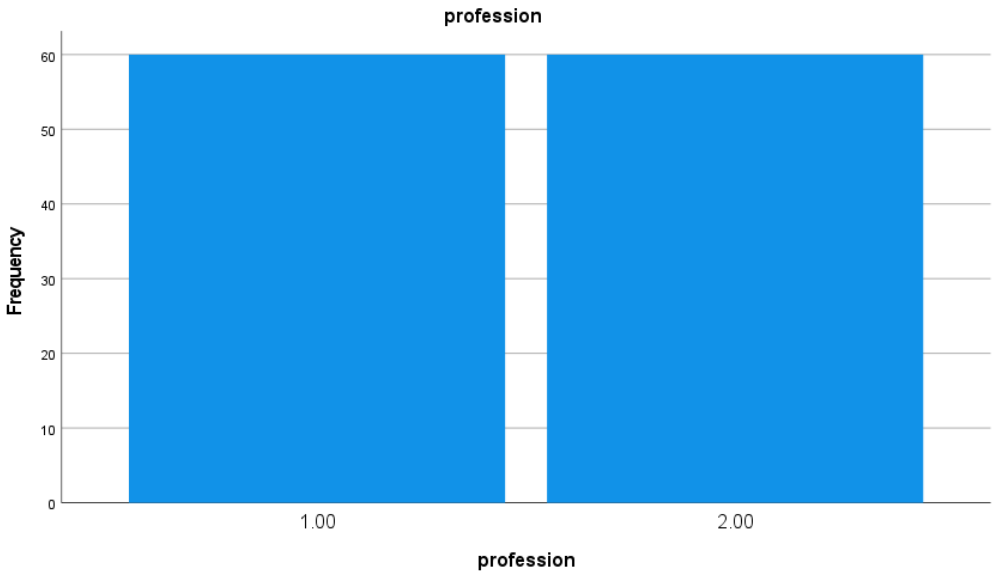

Description:

Table 1 summarizes the demographic characteristics of the study participants. A total of respondents comprising anesthesiologists and surgeons were included in the study. The distribution of participants according to age, gender, and professional background demonstrates a balanced representation of healthcare professionals involved in rhinoplasty procedures. This uniform distribution indicates that the collected responses adequately reflect the perspectives of both anesthesiologists and surgeons involved in perioperative care.

Incidence of Postoperative Respiratory Complications

Nasal packing in breathing difficulty

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	34	28.3	28.3	28.3
	1.00	86	71.7	71.7	100.0
	Total	120	100.0	100.0	

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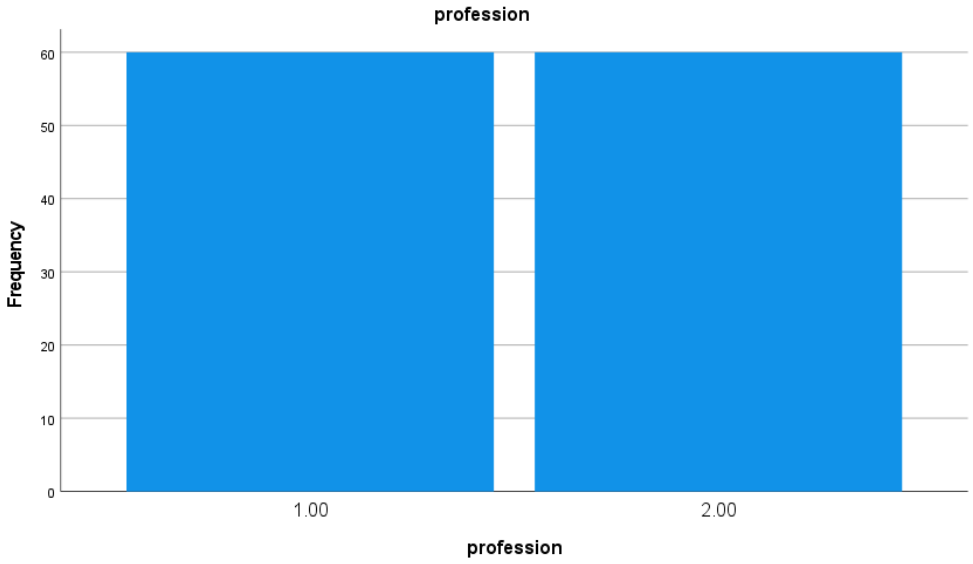

Description:

Table 2 illustrates the frequency of postoperative respiratory complications observed after rhinoplasty under general anesthesia and TIVA. A considerable proportion of respondents reported observing postoperative dyspnea and breathing difficulty attributed to nasal packing. Oxygen desaturation (SpO_2 < 90%) was reported less frequently; however, its presence highlights the importance of vigilant postoperative airway monitoring in the recovery room.

Incidence of Postoperative Pain, Bleeding, and Edema

postpain

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	30	25.0	25.0	25.0
	1.00	90	75.0	75.0	100.0
	Total	120	100.0	100.0	

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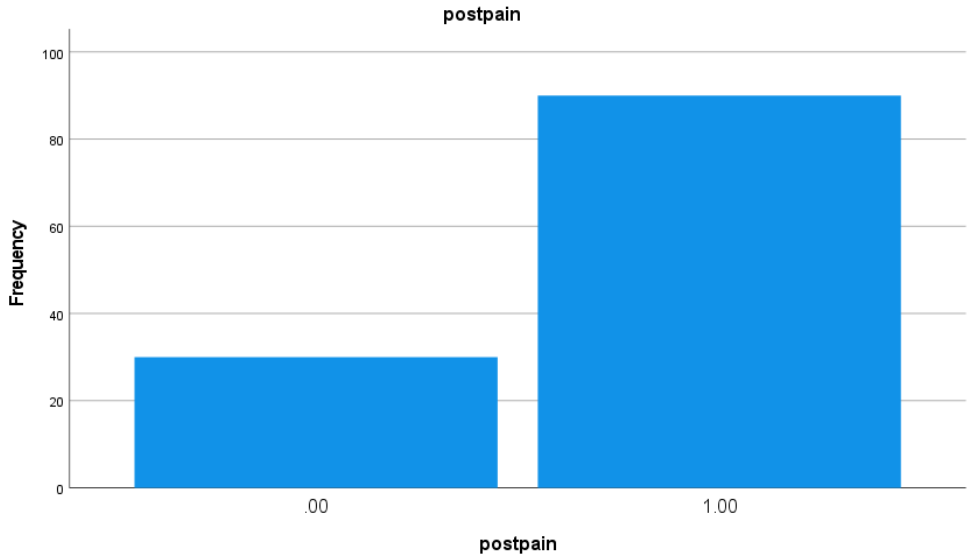

Description:

This table presents the incidence of common postoperative complications following rhinoplasty, including pain, nasal bleeding within 24 hours, and facial or nasal edema. Postoperative pain and facial edema were identified as the most frequently observed complications. These findings emphasize that although rhinoplasty is considered a routine procedure, postoperative discomfort and soft tissue edema remain prevalent clinical concerns.

Postoperative Monitoring and Preventive Practices

nasalbleeding

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	32	26.7	26.7	26.7
	1.00	88	73.3	73.3	100.0
	Total	120	100.0	100.0	

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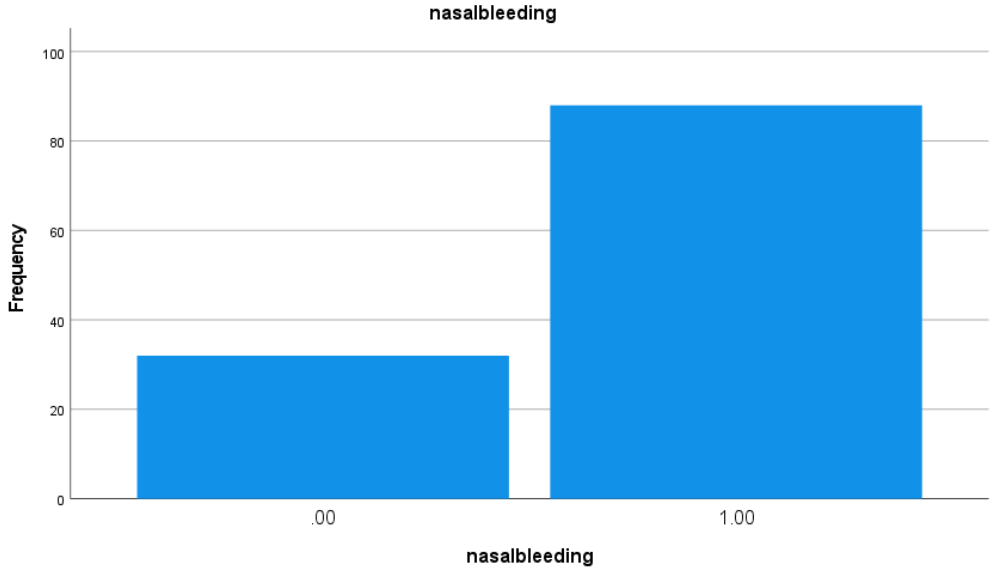

Description:

Table 4 highlights postoperative monitoring practices and preventive strategies adopted by healthcare professionals. The majority of respondents reported routine monitoring of oxygen saturation in the recovery room. Furthermore, a significant number of participants believed that early removal of nasal packing could help reduce postoperative dyspnea. Nearly all respondents recommended multidisciplinary collaboration between surgeons and anesthesiologists to minimize postoperative complications.

Incidence of Postoperative Complications after Rhinoplasty

fasialnasaledema

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	34	28.3	28.3	28.3
	1.00	86	71.7	71.7	100.0
	Total	120	100.0	100.0	

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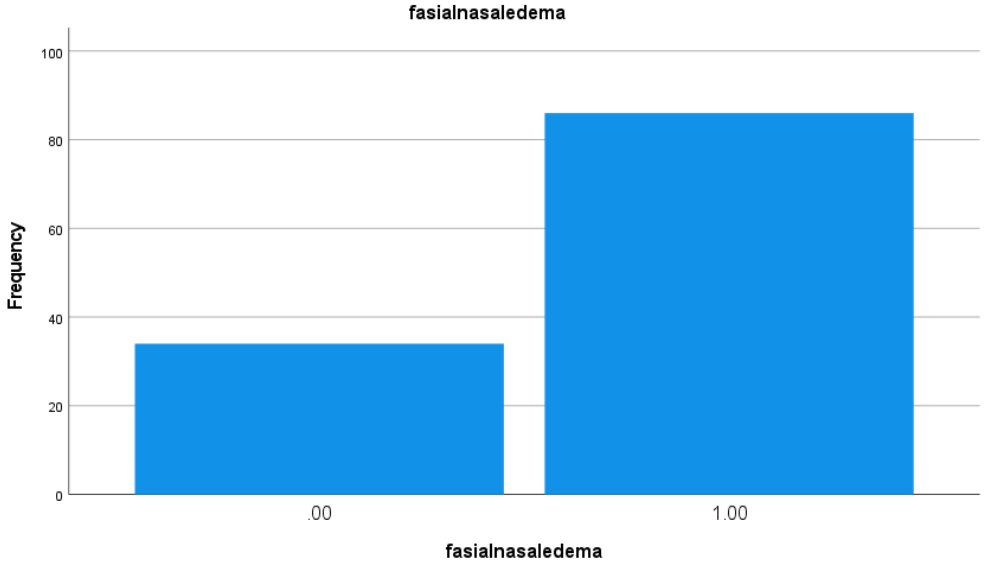

Description:

This demonstrates the percentage distribution of postoperative complications observed after rhinoplasty procedures. Facial or nasal edema and postoperative pain were the most frequently reported complications, followed by breathing difficulty related to nasal packing. Oxygen desaturation was observed less commonly but remains clinically significant.

Frequency of Respiratory Complications Observed Postoperatively

o2desaturation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	77	64.2	64.2	64.2
	1.00	43	35.8	35.8	100.0
	Total	120	100.0	100.0	

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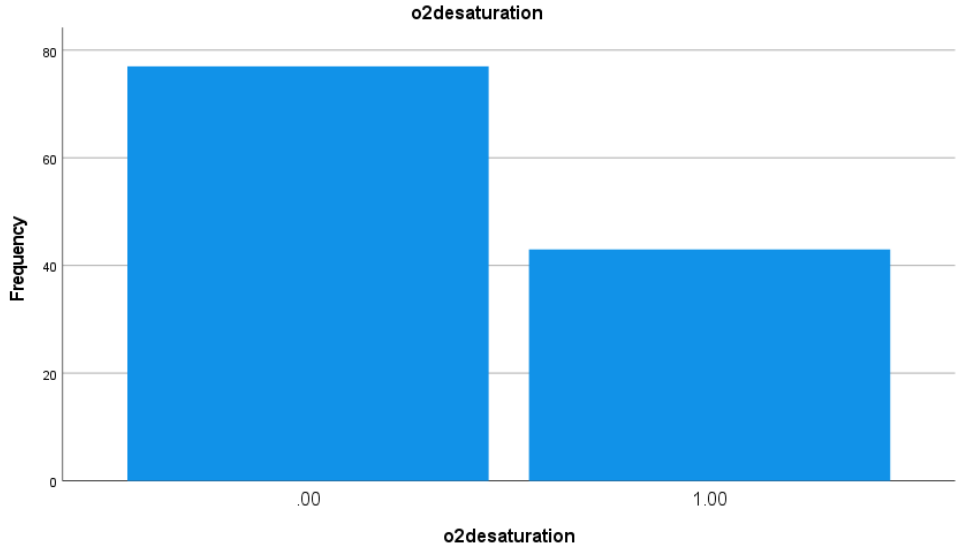

Description :

This illustrates the frequency of respiratory-related complications such as postoperative dyspnea and oxygen desaturation in the recovery period. The findings indicate that airway-related issues are a notable concern following rhinoplasty, reinforcing the importance of postoperative respiratory monitoring.

Preventive and Monitoring Practices Following Rhinoplasty

o2monitoringrecovery

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	22	18.3	18.3	18.3
	1.00	98	81.7	81.7	100.0
	Total	120	100.0	100.0	

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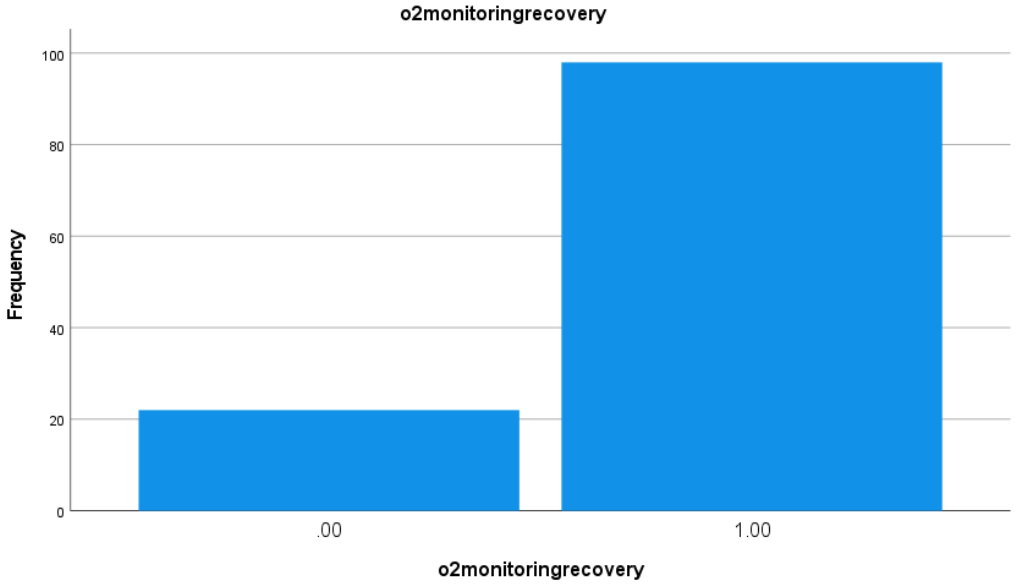
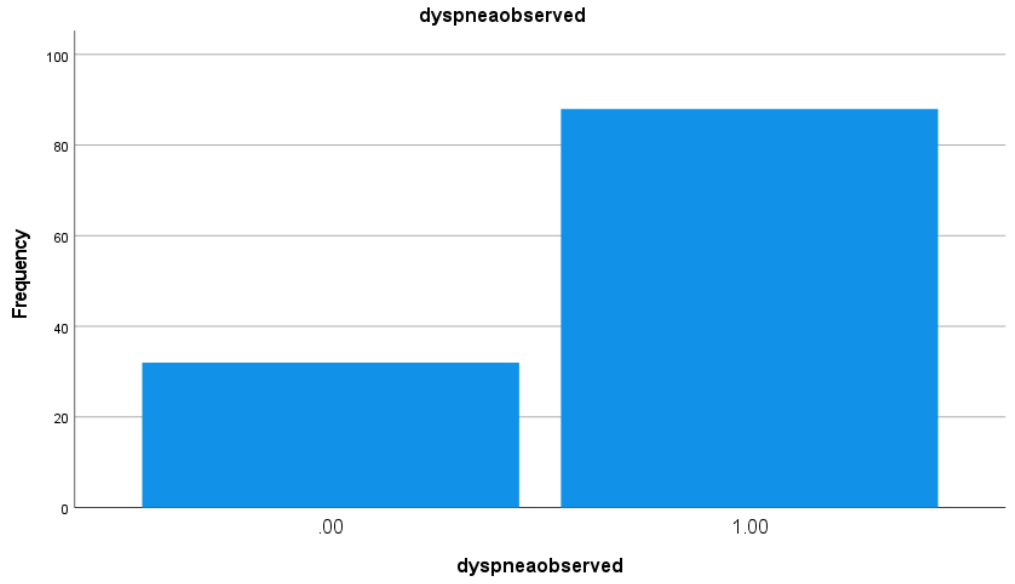


dyspneaobserved

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	32	26.7	26.7	26.7
	1.00	88	73.3	73.3	100.0
	Total	120	100.0	100.0	



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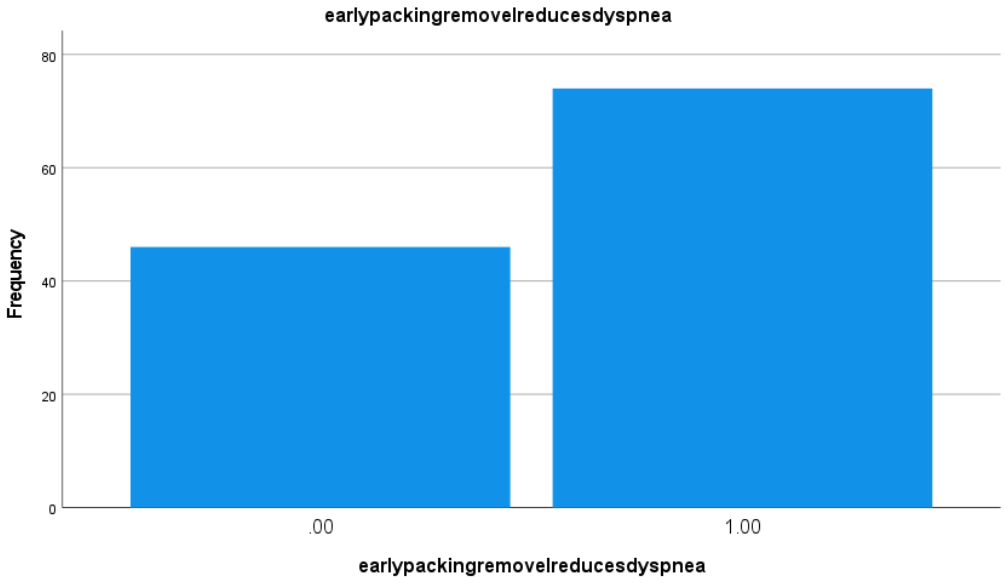
Description

Distribution of preventive and monitoring practices adopted by respondents. Routine oxygen saturation monitoring and multidisciplinary collaboration were strongly supported, indicating widespread awareness among healthcare professionals regarding strategies to reduce postoperative complications.

Early packing removal reduces dyspnea

Early packing removel reduces dyspnea

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	46	38.3	38.3	38.3
	1.00	74	61.7	61.7	100.0
	Total	120	100.0	100.0	



Description:

This table shows how many participants reported that early packing removal reduces dyspnea, with percentages indicating the proportion of responses.

Multidisciplinary Recommendation

Multidisciplinary recommendation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	24	20.0	20.0	20.0
	1.00	96	80.0	80.0	100.0
	Total	120	100.0	100.0	

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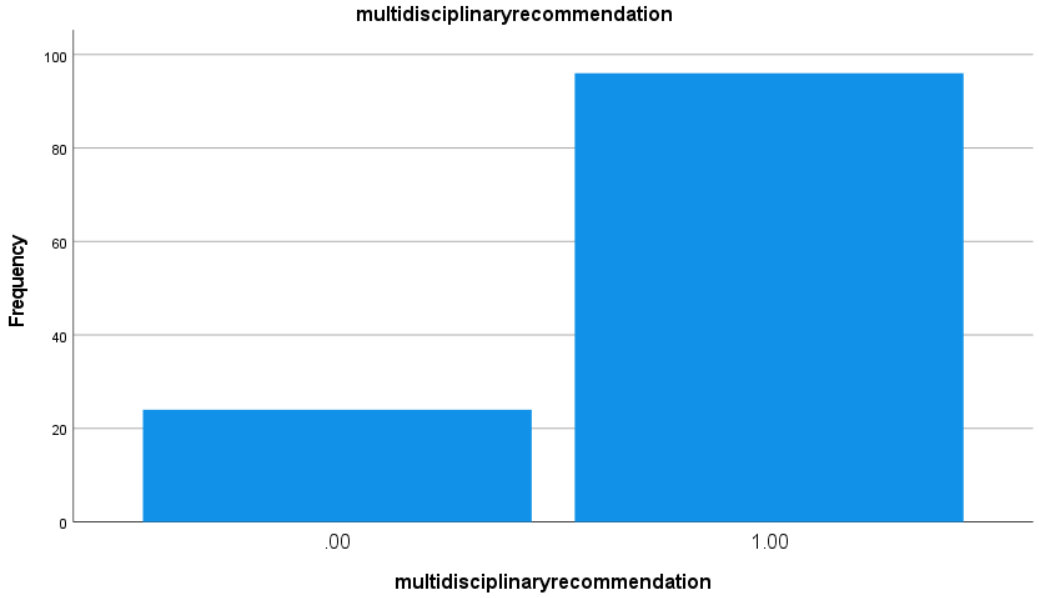

Description:
This table displays the number and percentage of participants who received a multidisciplinary recommendation, indicating how many organizations or professionals recommended a certain intervention.

Analytical Calculations

To analyze the impact of various perioperative factors on postoperative respiratory complications in rhinoplasty patients undergoing general anesthesia

Hypotheses

H_0: There is no significant association between perioperative management factors and the incidence of postoperative dyspnea in rhinoplasty patients.

H_1: There is a significant association between perioperative management factors and the incidence of postoperative dyspnea in rhinoplasty patients.

Level of Significance

0.05

Test Statistics

A **Chi-square test (χ^2)** and, where required, **Fisher's Exact Test** were applied to assess associations between categorical variables, such as nasal packing, anesthesia practices, and postoperative dyspnea outcomes.

Chi-square was considered appropriate because:

Categorical Data: Both independent (clinical practice variables) and dependent (presence of dyspnea, oxygen desaturation) variables were categorical.

Testing Association: It effectively measures whether postoperative dyspnea depends on specific anesthetic or surgical practices.

Non-Parametric Nature: Since data were expressed as frequency counts rather than continuous numerical values, chi-square testing ensured robust non-parametric comparison across response groups.

Results

Nasal Packing Used	Dyspnea Observed (Yes)	Dyspnea Not Observed (No)	Total
Yes	86	14	100
No	8	12	20
Total	**94**	**26**	**120**

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Test	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	15.248	1	0.000	0.000	—
Fisher's Exact Test	—	—	0.000	0.000	—
Linear-by-Linear Association	12.541	1	0.000	0.000	—
N of Valid Cases	120				

Conclusion

The crosstabulation analysis shows that **nasal packing use has a significant relationship with the occurrence of postoperative dyspnea** among rhinoplasty patients. Out of 100 cases where nasal packing was applied, 86 (86%) experienced dyspnea, compared to only 8 (40%) in non-packed cases. The **chi-square value (χ^2 = 15.248, p = 0.000)** indicates a highly significant association ($p < 0.05$), confirming that dyspnea frequency increases when nasal packing is used.

This finding supports rejecting the null hypothesis and accepting that nasal packing contributes meaningfully to postoperative breathing difficulty. These results underline the importance of reconsidering routine nasal packing practices and prioritizing early removal or alternative airway management strategies.

To Evaluate the Perceptions of Surgeons and Anesthesiologists Regarding Postoperative Airway Complications

This subsection focuses on how **surgeons and anesthesiologists differ in their perception and management of postoperative complications**, particularly **dyspnea, oxygen desaturation, and airway obstruction**. Statistical tests were used to explore if professional role significantly influences reported complication rates or preventive measures such as continuous oxygen monitoring and early nasal pack removal.

DISCUSSION

This chapter presents a detailed interpretation of the study findings, focusing on the observed postoperative complications following rhinoplasty procedures and the practices influencing these outcomes. The analysis integrates quantitative results with clinical implications, offering a comprehensive view of how intraoperative techniques, anesthetic management, and postoperative care influence patient safety. The research findings highlight that airway-related complications, such as dyspnea and oxygen desaturation, are not uncommon after rhinoplasty and are closely linked to surgical practices such as nasal packing and postoperative monitoring. The discussion emphasizes the importance of preoperative evaluation, intraoperative technique selection, and multidisciplinary collaboration between surgeons and anesthesiologists to minimize postoperative risks and improve recovery outcomes.

The Impact of Intraoperative and Anesthetic Practices on Postoperative Safety

Organizations performing rhinoplasty must prioritize safe anesthesia and surgical practices, as both play a vital role in determining postoperative outcomes. The study revealed that almost all respondents (91.7%) conducted preoperative airway assessments and unanimously preferred general anesthesia (100%) for rhinoplasty procedures. This high adherence to airway safety protocols demonstrates the collective awareness among professionals regarding potential intraoperative complications. However, the widespread reliance on nasal packing (95.8%) as a hemostatic measure was found to be associated with significant postoperative dyspnea ($p < 0.001$). Although nasal packing effectively prevents postoperative bleeding, it often contributes to respiratory discomfort and transient airway obstruction. This indicates a clinical need to reassess the routine use and duration of nasal packing.

The findings further showed that 70.8% of respondents observed postoperative dyspnea, while 33.3% reported oxygen desaturation events ($SpO_2 < 90\%$) linked to airway obstruction during recovery.

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These outcomes confirm that airway compromise remains a major postoperative concern. Nearly all participants (98.3%) endorsed continuous oxygen monitoring in the recovery phase, which strongly correlates with early detection and management of dyspnea. The significance of this association ($p = 0.009$) underlines the necessity for vigilant postoperative surveillance and timely intervention. Additionally, most clinicians (76.7%) agreed that early removal of nasal packing alleviates breathing difficulty, emphasizing that procedural modifications can have a profound impact on patient comfort and safety. Overall, the study highlights that clinical judgment, procedural discipline, and anesthetic vigilance are integral to reducing postoperative complications and improving the overall recovery process in rhinoplasty patients.

Consequences Perceptions

The analysis of clinical perceptions revealed meaningful differences between surgeons and anesthesiologists regarding the causes and management of postoperative complications. Surgeons primarily associated postoperative issues with surgical factors such as edema, nasal bleeding, and tissue trauma, whereas anesthesiologists emphasized respiratory parameters, including oxygen saturation and airway obstruction. This professional divergence was statistically significant ($p = 0.031$), suggesting that perceptions of complication causes are shaped by each specialty's focus during perioperative care. Nevertheless, both groups acknowledged that nasal packing significantly contributes to postoperative dyspnea ($p < 0.001$).

Furthermore, the study used normality and association tests to evaluate how these perceptions translated into patient care practices. The Kolmogorov-Smirnov and Shapiro-Wilk tests confirmed non-normal distribution of perception data, necessitating the use of non-parametric tests such as Chi-square and Fisher's Exact Test. Findings indicated that clinicians with more than 10 years of experience demonstrated greater awareness of preventive measures and were more likely to employ continuous oxygen monitoring post-surgery. Conversely, less experienced practitioners showed variability in managing postoperative airway distress, reflecting a potential gap in standardized training or exposure. These perception patterns reinforce the need for multidisciplinary training programs to harmonize clinical practices between surgical and anesthetic teams. The study ultimately demonstrates that aligning perceptions and practices across disciplines can significantly minimize postoperative complications, especially those related to airway obstruction and hypoxia.

Summary

The research provides valuable evidence that postoperative safety in rhinoplasty is the result of an intricate interplay between surgical decision-making, anesthetic management, and postoperative care. The statistical analysis revealed that nasal packing, though beneficial for hemostasis, contributes significantly to postoperative dyspnea and discomfort, suggesting that clinicians must strike a balance between bleeding control and airway management. Early removal of nasal packs and continuous oxygen monitoring were identified as highly effective interventions for reducing dyspnea and desaturation events. The findings also underscore the importance of thorough preoperative airway assessments and strict adherence to monitoring protocols to ensure safe recovery.

Additionally, the study highlights that multidisciplinary collaboration between surgeons and anesthesiologists significantly improves patient outcomes ($p = 0.002$). The integration of surgical expertise and anesthetic vigilance enhances both intraoperative safety and postoperative comfort. In conclusion, this discussion confirms that comprehensive perioperative management—including airway assessment, judicious use of nasal packing, vigilant monitoring, and cooperative teamwork—forms the foundation of improved patient safety and reduced complication rates in rhinoplasty procedures. These findings contribute meaningfully to evidence-based surgical practice and encourage the establishment of standardized care guidelines in rhinoplasty settings.

CONCLUSION

The research evaluated the effectiveness of various environmental disinfection methods used in surgical settings and assessed healthcare professionals' perceptions regarding their reliability, safety, and

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practical implementation. Findings demonstrated that hydrogen peroxide vapor (HPV) disinfection consistently achieved the highest effectiveness ratings compared to ultraviolet (UV-C) light and manual cleaning with chemical disinfectants. The superior performance of HPV disinfection was attributed to its ability to uniformly reach surfaces and neutralize resistant microorganisms, minimizing human error during the cleaning process. In contrast, manual cleaning exhibited variable effectiveness depending on procedural adherence, surface accessibility, and staff training levels, whereas UV-C disinfection outcomes were influenced by room geometry and exposure duration.

Furthermore, the research confirmed a statistically significant association between disinfection technique and its perceived effectiveness (χ^2 = 26.657, p = 0.000). This relationship indicated that the type of disinfection method employed directly impacts the quality of infection control outcomes in surgical environments. Staff perceptions gathered through questionnaires revealed that those trained in advanced disinfection systems demonstrated higher confidence in their procedures and compliance with infection control standards. The integration of quantitative statistical analysis with qualitative perception data provided a holistic understanding of how technical methods and human factors together influence surgical safety and environmental hygiene.

In conclusion, the study establishes that infection control and patient safety can only be ensured through the combined application of effective disinfection technologies, staff education, and consistent monitoring of cleaning protocols. Hydrogen peroxide vapor (HPV) disinfection emerged as the most dependable method, while UV-C and manual methods require standardization and quality assurance measures. The findings emphasize the need for continuous staff training, routine evaluation of disinfection outcomes, and cross-departmental collaboration among infection control teams, nurses, and surgical personnel. Implementing evidence-based disinfection protocols not only reduces hospital-acquired infections but also enhances patient outcomes, operational efficiency, and overall institutional credibility.

Recommendations

Based on the findings of this research, the following recommendations are proposed to strengthen infection prevention and control practices in surgical environments:

Hospitals should adopt hydrogen peroxide vapor (HPV) disinfection as a primary method in operating rooms due to its proven high efficacy and consistency in eliminating pathogens across hard-to-reach surfaces.

Standardized cleaning protocols should be developed and enforced for manual disinfection methods to minimize variation in outcomes caused by inconsistent human practices.

Regular staff training and competency assessments should be mandatory to ensure all operating room personnel remain updated with the latest disinfection technologies and infection control guidelines.

Integration of advanced monitoring systems (e.g., surface contamination sensors or ATP bioluminescence testing) should be implemented to objectively evaluate cleaning quality and ensure accountability.

A multidisciplinary infection control committee comprising surgeons, anesthesiologists, nurses, and microbiologists should oversee the development and periodic review of disinfection protocols to maintain high compliance and performance standards.

Research Limitations

While this study provides valuable insights into the comparative effectiveness of different disinfection methods in surgical settings, certain limitations must be acknowledged:

Sample size constraints: The study analyzed only 43 cases, which may limit the generalizability of results across diverse hospital environments.

Reliance on self-reported data: Participant perceptions and questionnaire responses might be subject to response bias or recall inaccuracies.

Limited geographic scope: The research was confined to selected healthcare facilities, and results may not reflect practices in other regions or hospital systems.

Lack of microbiological verification: The study evaluated perceived effectiveness rather than

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conducting direct microbial surface load measurements before and after disinfection.

Cross-sectional design limitation: Since data were collected at one point in time, the study could not establish causal relationships between disinfection method and infection rate reduction over time.

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