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POSTOPERATIVE COMPLICATIONS IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA SYNDROME UNDERGOING GENERAL ANESTHESIA

Original Research

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ABSTRACT

Background: Obstructive sleep apnea (OSA) is a common but frequently undiagnosed sleep-related breathing disorder that increases perioperative risk due to recurrent upper airway obstruction, oxygen desaturation, and autonomic instability. Even in mild or unrecognized cases, OSA can significantly raise the likelihood of respiratory and cardiovascular complications following surgery. In light of evolving anesthesia techniques and perioperative care, understanding OSA's true clinical burden is essential for enhancing patient safety and recovery.

Objective: To determine the incidence and types of postoperative complications—particularly respiratory and cardiovascular—in patients with OSA undergoing general anesthesia, and to explore strategies that reduce perioperative morbidity and improve surgical outcomes.

Methods: This cross-sectional study was conducted over four months in the surgical departments of two tertiary hospitals in Lahore. A total of 80 adult patients (45 males, 35 females) diagnosed or suspected with OSA and undergoing general anesthesia for elective procedures were enrolled. Data collection involved preoperative screening using the STOP-BANG questionnaire, intraoperative anesthesia records, and postoperative complication tracking in the Post-Anesthesia Care Unit (PACU). Vital signs and the duration of anesthesia were also recorded. Statistical analysis was performed using SPSS version 26.

Results: Respiratory complications were observed in 30% of patients, including oxygen desaturation (15%), respiratory failure (10%), and respiratory arrest (5%). Cardiovascular events occurred in 20%, with hypertension and hypotension each affecting 10% and 5% respectively, along with arrhythmias (5%). Moderate to severe postoperative pain was reported in 80%, and postoperative nausea and vomiting (PONV) affected 40%. The mean hospital stay was 3.2 days. STOP-BANG scores ≥5 correlated with increased complication rates and prolonged anesthetic duration.

Conclusion: Patients with OSA undergoing general anesthesia face elevated risks of cardiorespiratory complications and postoperative morbidity. Structured preoperative screening, optimized airway strategies, and adherence to CPAP protocols are essential to improve patient safety and surgical outcomes.

Keywords: Anesthesia, Cardiovascular Complications, Continuous Positive Airway Pressure, Obstructive Sleep Apnea, Postoperative Pain, Respiratory Depression, STOP-BANG Questionnaire.

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INTRODUCTION

Obstructive Sleep Apnea (OSA) syndrome is a prevalent and underdiagnosed sleep-related breathing disorder marked by repeated episodes of upper airway obstruction due to pharyngeal collapse during sleep. These episodes can be partial (hypopnea) or complete (apnea), leading to disrupted sleep architecture and symptoms such as loud snoring, gasping, frequent nocturnal awakenings, and excessive daytime sleepiness (1). The condition is typically diagnosed when an individual experiences at least five apnea or hypopnea episodes per hour of sleep alongside clinical symptoms, or 15 or more events per hour regardless of symptoms (1,2). The apnea-hypopnea index (AHI) serves as the primary diagnostic metric, with higher values linked to greater disease severity and associated health risks. In recent years, accumulating evidence has established a strong association between OSA and significant health complications, including coronary artery disease, heart failure, arrhythmias, stroke, and neurocognitive dysfunction (3). Cognitive complaints such as impaired concentration, memory deficits, and depressive symptoms are frequently reported among OSA patients, contributing to a reduced quality of life and functional impairment (4). Despite its growing clinical relevance, OSA remains underrecognized, often due to its subtle and overlapping presentation with other common conditions. The global surge in obesity further compounds this issue, as obesity is a well-established risk factor for the development and worsening of OSA (4,5). The perioperative setting poses a unique challenge for individuals with OSA. These patients are at increased risk for complications during and after surgical procedures due to several physiological and pharmacological factors. Airway management can be complicated by anatomical changes associated with OSA, while the use of anesthetics, sedatives, and opioids may exacerbate upper airway collapsibility and impair ventilatory control (6,7).

Additionally, the supine positioning often required in surgical recovery and the rebound increase in REM sleep during the early postoperative period further elevate the risk of respiratory compromise (8). Unmonitored postoperative periods can thus result in severe hypoxemia, hypercapnia, and even cardiorespiratory arrest. Positional factors also play a critical role in the manifestation and severity of OSA. Individuals with positional OSA often experience fewer apneic events when sleeping laterally compared to supine, although this benefit tends to diminish in severe cases (9,10). Notably, apneic episodes and oxygen desaturations are more frequent during REM sleep, highlighting the need for vigilant monitoring during vulnerable sleep stages (11). Preoperative screening tools like the STOP-BANG questionnaire have proven effective in identifying patients at high risk of OSA who may otherwise remain undiagnosed, allowing for early intervention and perioperative planning (11). Studies have demonstrated a higher incidence of postoperative complications in patients with OSA, particularly those with more frequent nocturnal oxygen desaturation events (12,13). Given the wide-ranging implications of OSA in the surgical context and the increased perioperative risks it poses, early identification and risk stratification are essential components of surgical safety. While guidelines have previously addressed preoperative screening, current literature highlights a pressing need to evaluate intraoperative considerations, especially those directly affecting respiratory and cardiovascular stability in OSA patients (14). Therefore, the objective of this review is to explore intraoperative management strategies and associated risks in patients with obstructive sleep apnea, aiming to inform clinical practice and improve perioperative outcomes.

METHODS

This study employed a cross-sectional design and was conducted over a period of four months in the surgical units of Shalimar Hospital Lahore and Chaudhary Muhammad Akram Teaching and Research Hospital. The study population consisted of patients scheduled for elective surgical procedures under general anesthesia. A convenience sampling technique was applied to recruit participants based on their availability and fulfillment of the study's eligibility criteria. The estimated sample size was calculated using Slovin's formula: $n = N / (1 + Ne^2)$, yielding a target sample of approximately 109 participants (15,16). Participants were included if they were aged between 20 and 70 years, able to provide informed consent, medically stable for elective surgery, and monitored postoperatively in a recovery or intensive care unit setting (17). Exclusion criteria encompassed individuals below 20 or above 70 years of age, those with pre-existing respiratory disorders or lung diseases, and patients who had undergone upper airway surgery (18,19). The ethical approval for the study was obtained from the relevant Institutional Review Board (IRB), and written informed consent was obtained from each participant prior to data collection, ensuring ethical compliance with the Declaration of Helsinki.

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Data collection was carried out through a structured Performa designed to extract both intraoperative and postoperative information. Patient medical records were reviewed to confirm a diagnosis of obstructive sleep apnea (OSA). Standardized OSA assessment questionnaires were administered to further stratify risk. Intraoperative data were obtained from anesthesia documentation, while postoperative recovery data were sourced from Post-Anesthesia Care Unit (PACU) records. Follow-up assessments were conducted where necessary to complete data sets. All information was recorded in a customized data entry form. Statistical analysis was performed using IBM SPSS Statistics software, version 26 (20). Quantitative variables were presented as frequencies and percentages, and data visualization was achieved through tables and bar charts. Descriptive statistics were primarily used due to the observational nature of the study.

RESULTS

A total of 80 patients diagnosed with obstructive sleep apnea (OSA) undergoing general anesthesia were included in the analysis. The sample comprised 45 males (59%) and 35 females (41%). The mean hospital stay was recorded as 3.2 days. Postoperative complications were observed across four primary domains: respiratory, cardiovascular, postoperative pain, and postoperative nausea and vomiting (PONV). Respiratory complications were documented in 30% of the patients, with specific manifestations including respiratory failure in 10%, respiratory arrest in 5%, and oxygen desaturation in 15%. Cardiovascular complications were reported in 20% of the cases, comprising hypertension (10%), hypotension (5%), and cardiac arrhythmias (5%). Postoperative pain was the most frequently reported complication, with 80% of patients experiencing moderate to severe pain in the immediate postoperative period. Additionally, 40% of patients reported PONV, which in some cases was accompanied by airway obstruction, hypoxemia, and increased intrathoracic pressure. Age-wise stratification revealed that patients aged 20–30 years had a mean heart rate of 74.2 ± 10.5 bpm, systolic blood pressure of 124.5 ± 12.8 mmHg, and diastolic blood pressure of 79.3 ± 9.2 mmHg. In the 41–60 years group, the heart rate increased to 76.3 ± 11.1 bpm, systolic blood pressure was 132.1 ± 14.2 mmHg, and diastolic pressure was 83.2 ± 10.3 mmHg. Among patients aged 61–70 years, a decline in heart rate was noted (72.5 ± 10.2 bpm), alongside a progressive rise in systolic (140.3 ± 15.6 mmHg) and diastolic pressures (85.6 ± 11.4 mmHg).

Notably, males exhibited higher systolic and diastolic blood pressure readings across all age groups compared to females, while females demonstrated slightly elevated heart rates, particularly in the context of respiratory and cardiovascular complications. These trends suggest gender-specific differences in vital sign response among patients experiencing postoperative complications associated with OSA. The analysis revealed a strong correlation between the severity of obstructive sleep apnea (OSA), preoperative STOP-BANG scores, and the frequency of postoperative complications. Patients categorized as having severe OSA, with STOP-BANG scores ≥5, exhibited significantly longer anesthetic durations (mean: 115 minutes) and a higher incidence of complications compared to those with mild or moderate OSA. Specifically, 55% of patients with severe OSA experienced postoperative respiratory complications, while 40% encountered cardiovascular issues. Additionally, PONV was reported in 60% and moderate to severe postoperative pain in 90% of these patients. In contrast, patients with mild OSA had notably fewer complications across all domains, with only 10% experiencing respiratory issues and 5% cardiovascular events. Surgery type also influenced complication rates; orthopedic procedures were more common among severe OSA patients (45%) and appeared to correspond with higher complication profiles. These findings highlight the importance of considering OSA severity, preoperative risk scores, and surgical parameters in perioperative planning to optimize outcomes.

Table 1: Obstructive sleep apnea gender ratio in postoperative complications with vitals sign

Age Group (years)	Gender Ratio (M: F)	Heart Rate (bpm)	Systolic BP (mmHg)	Diastolic BP (mmHg)
20–30	25:20	74.2 ± 10.5	124.5 ± 12.8	79.3 ± 9.2
41–60	43:35	76.3 ± 11.1	132.1 ± 14.2	83.2 ± 10.3
61–70	31:24	72.5 ± 10.2	140.3 ± 15.6	85.6 ± 11.4

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Table 2: Postoperative Complications associated with obstructive sleep apnea

Complication Type	Specific Issues	Prevalence
Respiratory	Respiratory failure, oxygen desaturation, respiratory arrest	30%
Cardiovascular	Hypertension, hypotension, cardiac arrhythmias	20%
Postoperative Pain	Moderate and severe pain	80%
PONV and Related Issues	Postoperative nausea and vomiting, airway obstruction, hypoxemia, increased intrathoracic pressure	40%

Table 3: OSA Complication Breakdown

OSA Severity	STOP-BANG Score ≥ 5 (n)	Mean Anesthetic Duration (mins)	Type of Surgery – General (%)	Type of Surgery – Orthopedic (%)	Type of Surgery – ENT (%)	Postop Respiratory Complications (%)	Postop Cardiovascular Complications (%)	PONV (%)	Postop Pain (%)
Mild	10	75	40	30	30	10	5	15	60
Moderate	18	90	30	35	35	25	15	35	75
Severe	32	115	25	45	30	55	40	60	90

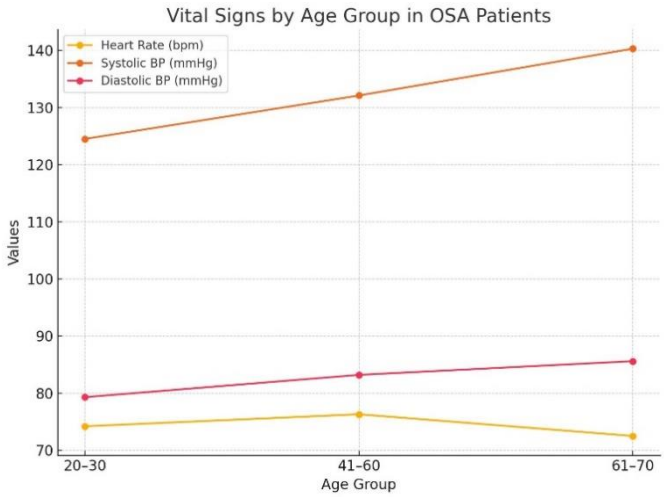

Figure 1 Vital Signs by Group in OSA Patients

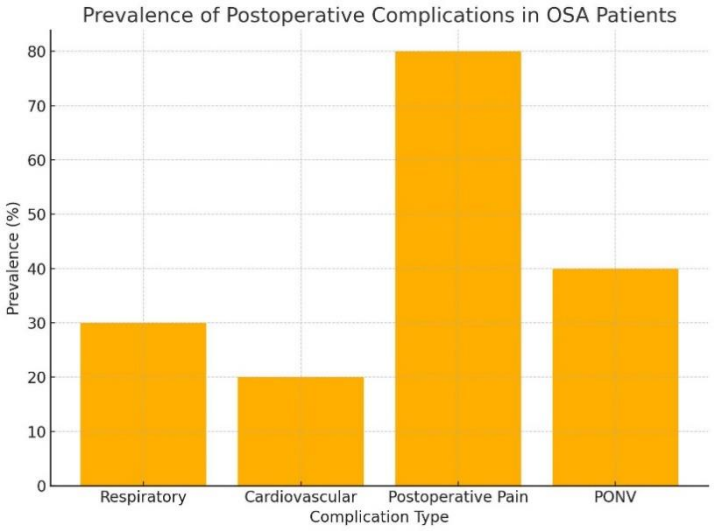

Figure 2 Prevalence of Postoperative Complications in OSA patients

DISCUSSION

The findings of this study reinforce the growing body of evidence that patients with obstructive sleep apnea (OSA) are at significantly heightened risk for a wide spectrum of postoperative complications. These include respiratory compromise, cardiovascular instability, postoperative pain, nausea, vomiting, and notably, postoperative headaches. Previous research has primarily focused on the relationship between OSA and headaches following airway surgeries, but newer investigations have extended this focus to encompass a broader range of surgical procedures. A retrospective analysis of OSA patients undergoing orthopedic surgeries, such as hip or knee replacements, identified a notable increase in postoperative headache incidence, alongside higher rates of ICU transfer and prolonged hospitalization (15,16). Similarly, studies in cardiac surgery cohorts demonstrated increased occurrences of postoperative encephalopathy and infection among patients with OSA, especially those presenting with an oxygen desaturation index ≥5 on home oximetry recordings (17,18). The

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present study complements and expands upon these findings by demonstrating that the severity of OSA, when stratified by STOP-BANG scores and anesthetic duration, correlates positively with complication prevalence. Higher STOP-BANG scores and longer anesthesia times were associated with increased rates of hypoxemia, cardiovascular events, and postoperative pain. This supports the view that OSA represents a systemic vulnerability rather than a condition limited to sleep-related breathing. Importantly, this study also draws attention to the underutilization of continuous positive airway pressure (CPAP) therapy in the postoperative setting. While guidelines from international anesthesia societies recommend the continued use of CPAP or nasal intermittent positive pressure ventilation in patients previously managed with home therapy, this protocol was followed in only 63% of such cases (19,20). This treatment gap reflects a critical area in perioperative care that requires improvement through targeted education and system-level interventions.

Mechanistically, the sedative and muscle-relaxant properties of general anesthesia further compromise upper airway patency and ventilatory control in OSA patients, particularly during the early postoperative period. This leads to increased risks of desaturation, unplanned ICU admissions, and extended recovery times (21). These risks were evident in the study, particularly in individuals with severe OSA and elevated preoperative risk scores. Addressing these issues requires the integration of multidisciplinary protocols that include anesthesiologists, surgeons, and nursing staff to ensure standardized postoperative monitoring, particularly during REM sleep when apnea events are most frequent (22). One of the strengths of the current study lies in its structured analysis of complications across varying degrees of OSA severity, using STOP-BANG scores and anesthesia duration to stratify risk. This approach allowed for a nuanced understanding of how baseline characteristics influence postoperative outcomes. Additionally, the incorporation of multiple surgical types enhanced the generalizability of findings across diverse patient populations (23). However, limitations must be acknowledged. The sample size, although adequate for preliminary analysis, restricts the statistical power for subgroup comparisons. Moreover, the use of convenience sampling may introduce selection bias, and the lack of polysomnographic confirmation of OSA severity could have led to misclassification in some cases.

Future research should focus on larger, multicenter cohorts with polysomnography-verified OSA staging and include detailed perioperative variables such as opioid dosages, type of anesthesia, and use of neuromuscular blockade reversal agents. Randomized controlled trials assessing standardized CPAP adherence protocols could help clarify their role in reducing postoperative complications. Moreover, further investigation into non-invasive biomarkers and real-time intraoperative monitoring tools may enable earlier detection of hypoventilation and apnea events, thereby improving intraoperative safety and postoperative recovery trajectories. Overall, the study underscores the necessity of proactive perioperative planning for patients with OSA. Integrating evidence-based monitoring strategies, optimizing anesthetic choices, and ensuring adherence to postoperative respiratory support can substantially improve outcomes and minimize complications in this high-risk population.

CONCLUSION

This study concludes that patients with obstructive sleep apnea undergoing general anesthesia are at heightened risk for a range of postoperative complications, particularly involving respiratory and cardiovascular systems, along with pain and nausea management challenges. These findings emphasize the critical need for structured perioperative care that begins with thorough preoperative screening and extends through tailored intraoperative and postoperative strategies. Implementing evidence-based approaches—such as optimized airway management, continuation of CPAP therapy, and individualized anesthetic plans—can play a pivotal role in reducing morbidity and enhancing recovery outcomes. The study underscores the importance of recognizing OSA as a significant perioperative risk factor and integrating preventive measures to improve patient safety and surgical success in this vulnerable population.

AUTHOR CONTRIBUTION

Author	Contribution
Sadia Saleem	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Faryal Falak*	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published

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Author	Contribution
Huma Ejaz	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muskan Amjad	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Faizan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Saman Riaz	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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