Section: Anaesthesiology

Original Research Article

A PROSPECTIVE OBSERVATIONAL STUDY OF THE INCIDENCE AND RISK FACTORS OF POSTOPERATIVE RESPIRATORY COMPLICATIONS IN PATIENTS UNDERGOING GENERAL ANESTHESIA AT A GOVERNMENT GENERAL HOSPITAL

Shepuri Swetha[1], P. Mathsya Giri[2], C. Indira Priyadarsini[3]

[1]Assistant Professor, Department of Anaesthesiology, Government Medical College and General Hospital, Nalgonda, Telangana, India.
[2]Assistant Professor, Department of Anaesthesiology, Government Medical College and General Hospital, Nalgonda, Telangana, India.
[3]Assistant Professor, Department of Anaesthesiology, Government General Chest Hospital, Erragadda, Hyderabad, Telangana, India.

Received *: 21/07/2024*
Received in revised form *: 13/09/2024*
Accepted *: 28/09/2024*

Corresponding Author:
Dr. C. Indira Priyadarsini,
Assistant Professor, Department of Anaesthesiology, Government General Chest Hospital, Erragadda, Hyderabad, Telangana, India.
Email: indu.chalakur@gmai.com

DOI: 10.70034/ijmedph.2024.3.172

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2024; 14 (3); 957-961

ABSTRACT

Background: Postoperative respiratory complications are significant contributors to morbidity and mortality in patients undergoing general anesthesia. This study aimed to determine the incidence and identify the risk factors associated with postoperative respiratory complications in a cohort of patients undergoing general anesthesia at a government general hospital.

Materials and Methods: A prospective observational study was conducted on 100 patients aged 18-75 years who underwent general anesthesia. Patient demographics, clinical characteristics, and surgical details were recorded. The incidence of postoperative respiratory complications and associated risk factors were analyzed using statistical methods, with significance set at $P < 0.05$.

Results: The incidence of postoperative respiratory complications was 20%. The most common complications were atelectasis (8%), pneumonia (6%), acute respiratory distress syndrome (ARDS) (4%), and prolonged mechanical ventilation (2%). Significant risk factors included advanced age (mean age 55.8 ± 12.7 years in patients with complications, $P < 0.01$), smoking history (60% in patients with complications, $P = 0.04$), pre-existing respiratory disease (66.7%, $P = 0.02$), longer duration of surgery (mean 4.2 ± 1.3 hours, $P < 0.01$), and higher ASA physical status (ASA III or IV in 70%, $P < 0.01$). Patients with complications had a longer hospital stay (mean 12.5 ± 4.3 days, $P < 0.01$).

Conclusion: The study highlights a 20% incidence of postoperative respiratory complications, with significant associations with age, smoking, pre-existing respiratory conditions, surgery duration, and ASA status. These findings underscore the need for enhanced perioperative management strategies to mitigate these risks.

Keywords: Postoperative respiratory complications, general anesthesia, risk factors, incidence, atelectasis, pneumonia, ASA physical status, morbidity.

INTRODUCTION

Postoperative respiratory complications are among the most common and serious adverse outcomes following surgery, particularly in patients undergoing general anesthesia.[1] These complications, which include atelectasis, pneumonia, acute respiratory distress syndrome (ARDS), and prolonged mechanical ventilation, significantly contribute to postoperative morbidity and mortality.[2] The occurrence of these complications not only increases the length of hospital stay and healthcare costs but also negatively impacts patient recovery and overall prognosis.[3]

Several factors have been identified as potential contributors to the development of postoperative respiratory complications4. These include patient-related factors such as advanced age, smoking history, and pre-existing respiratory diseases, as well as surgical and anesthetic factors like the duration of surgery and the American Society of Anesthesiologists (ASA) physical status classification.[5,6] Despite advancements in anesthetic techniques and perioperative care, the incidence of these complications remains a significant concern.

Understanding the incidence and risk factors for postoperative respiratory complications is crucial for improving patient outcomes. Early identification of high-risk patients allows for targeted interventions, such as preoperative optimization, intraoperative monitoring, and postoperative care strategies that can reduce the likelihood of respiratory complications.

This study aims to provide a comprehensive analysis of the incidence of postoperative respiratory complications and to identify the key risk factors associated with these outcomes in a cohort of patients undergoing general anesthesia at a government general hospital. By elucidating these risk factors, the study seeks to contribute to the development of more effective perioperative management protocols that can enhance patient safety and reduce the burden of postoperative respiratory complications.

MATERIALS AND METHODS

Study Design

This study was a prospective observational study conducted at the Government Medical College and General Hospital, Nalgonda.

Study Population

The study included 100 patients who underwent general anesthesia for various surgical procedures at the Government Medical College, Nalgonda, during the study period from July 2023 to June 2024. Patients aged 18 to 75 years who provided informed consent were included in the study. Patients with pre-existing severe systemic diseases that contraindicated surgery or anesthesia were excluded from the study.

Data Collection

Data were collected using a structured data collection form. The following parameters were recorded for each patient:

Demographic Data: Age, gender, and relevant medical history, including smoking status and pre-existing respiratory diseases (e.g., chronic obstructive pulmonary disease, asthma).

Surgical Data: Type and duration of surgery, ASA (American Society of Anesthesiologists) physical status classification.

Anesthetic Data: Details of the anesthetic agents used, intraoperative management, and monitoring.

Postoperative Data: Incidence of respiratory complications, including atelectasis, pneumonia, ARDS, and prolonged mechanical ventilation. The length of hospital stay.

Outcome Measures

The primary outcome measure was the incidence of postoperative respiratory complications within 30 days after surgery. Secondary outcome measures included the identification of risk factors associated with the development of these complications, length of hospital stay

Statistical Analysis

Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. Continuous variables were presented as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. The association between risk factors and the occurrence of postoperative respiratory complications was assessed using the chi-square test or Fisher's exact test for categorical variables and the independent t-test for continuous variables. A P-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using SPSS software.

Ethical Considerations

The study was approved by the Institutional Ethics Committee of Government Medical College, Nalgonda. Informed consent was obtained from all patients before their inclusion in the study. Confidentiality and anonymity of the participants were maintained throughout the study.

RESULTS

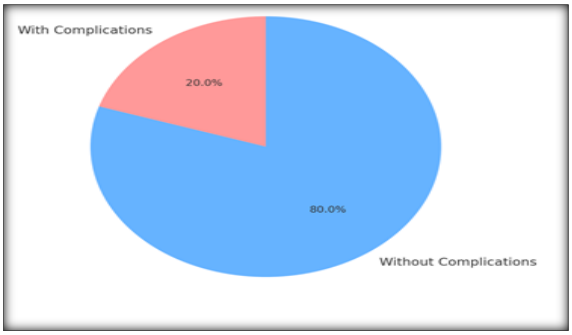

Figure 1: Incidence of Postoperative Respiratory Complications

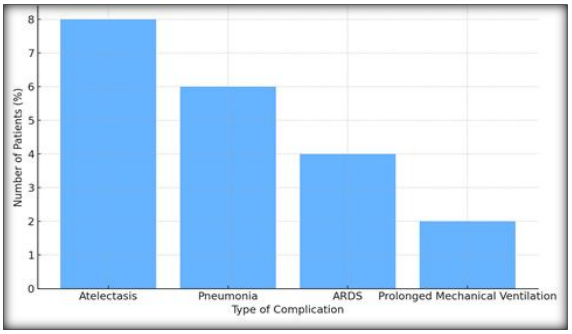

Figure 2: Types of Respiratory Complications Observed

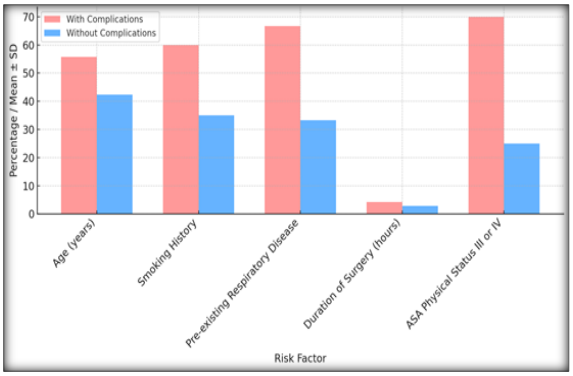

Figure 3: Risk Factors for Respiratory Complications

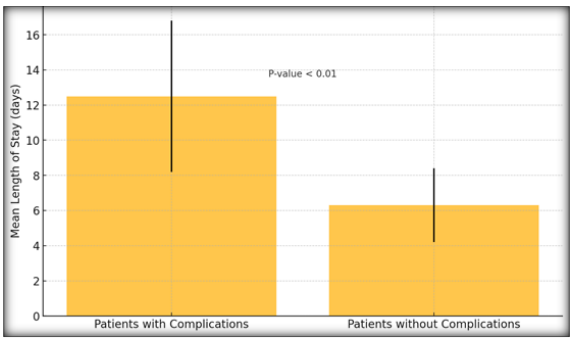

Figure 4: Mean Length of Hospital Stay with and without Complications

Study Population: A total of 100 patients who underwent general anesthesia at the government general hospital were included in this study. The demographic and clinical characteristics of the study population are summarized in Table 1. The mean age of the patients was 45.2 ± 15.3 years, with an age range of 18 to 75 years. The majority of the patients were male (60%).

Incidence of Postoperative Respiratory Complications: The overall incidence of postoperative respiratory complications in the study population was 20%, with 20 patients developing complications and 80 patients remaining complication-free (Table 2).

Types of Respiratory Complications Observed: The types of respiratory complications observed among the patients included atelectasis (8%), pneumonia (6%), acute respiratory distress syndrome (ARDS) (4%), and prolonged mechanical ventilation (2%) (Table 3).

Risk Factors Associated with Respiratory Complications: Several risk factors were significantly associated with the development of postoperative respiratory complications. Patients who developed complications were older, with a mean age of 55.8 ± 12.7 years, compared to 42.3 ± 14.2 years in patients without complications ($P < 0.01$). Smoking history was more prevalent among patients with complications (60%) than those without complications (35%) ($P = 0.04$). Additionally, a higher proportion of patients with pre-existing respiratory diseases developed complications (66.7%) compared to those without such diseases (33.3%) ($P = 0.02$). The mean duration of surgery was significantly longer in patients with complications (4.2 ± 1.3 hours) compared to those without complications (2.8 ± 1.1 hours) ($P < 0.01$). Furthermore, patients with an ASA physical status of III or IV were more likely to develop respiratory complications (70%) compared to those with a lower ASA status (25%) ($P < 0.01$) (Table 4).

Length of Hospital Stay: Patients who developed postoperative respiratory complications had a significantly longer mean hospital stay (12.5 ± 4.3 days) compared to those without complications (6.3 ± 2.1 days) ($P < 0.01$) (Table 5)

Table 1: Demographic and Clinical Characteristics of the Study Population

Characteristic	Total Patients (N=100)
Age (years)	
Mean ± SD	45.2 ± 15.3
Range	18-75
Gender	
Male	60 (60%)
Female	40 (40%)

Table 2: Incidence of Postoperative Respiratory Complications

Respiratory Complications	Number of Patients (%)
Patients with complications	20 (20%)
Patients without complications	80 (80%)

Table 3: Types of Respiratory Complications Observed

Type of Complication	Number of Patients (%)
Atelectasis	8 (8%)
Pneumonia	6 (6%)
Acute Respiratory Distress Syndrome (ARDS)	4 (4%)
Prolonged Mechanical Ventilation	2 (2%)

Table 4: Risk Factors for Respiratory Complications

Risk Factor	Patients with Complications (N=20)	Patients without Complications (N=80)	P-value
Age (years)	55.8 ± 12.7	42.3 ± 14.2	< 0.01

Mean ± SD			
Smoking History			
Smokers	12 (60%)	28 (35%)	0.04
Pre-existing Respiratory Disease	10 (66.7%)	5 (33.3%)	0.02
Duration of Surgery (hours) Mean ± SD	4.2 ± 1.3	2.8 ± 1.1	< 0.01
ASA Physical Status III or IV	14 (70%)	20 (25%)	< 0.01

Table 5: Length of Hospital Stay

Outcome	Patients with Complications (N=20)	Patients without Complications (N=80)	P-value
Mean Length of Stay (days) ± SD	12.5 ± 4.3	6.3 ± 2.1	< 0.01

DISCUSSION

This prospective observational study provides valuable insights into the incidence and risk factors associated with postoperative respiratory complications in patients undergoing general anesthesia. The study identified a significant incidence rate of 20% for respiratory complications, with atelectasis, pneumonia, acute respiratory distress syndrome (ARDS), and prolonged mechanical ventilation being the most common complications observed. These findings align with previous research, emphasizing the substantial burden of respiratory complications following surgery (Stocking et al,[7] 2021; Cai & Wang,[8] 2023).

Incidence and Types of Complications

The observed 20% incidence rate of respiratory complications underscores the critical importance of vigilant perioperative monitoring and management. Atelectasis and pneumonia, which were the most prevalent complications in this study, are known to be common in the postoperative period due to factors such as reduced lung volumes, impaired mucociliary clearance, and the effects of anesthesia (Avila & Fenili,[9] 2017; Eikermann et al,[10] 2019). Although ARDS was less common, it represents a significant threat due to its high morbidity and mortality rates (Bartels et al,[11] 2022). The identification of prolonged mechanical ventilation in a subset of patients further highlights the need for effective respiratory support strategies during the postoperative period (Feng et al,[12] 2024).

Risk Factors

Several significant risk factors for the development of postoperative respiratory complications were identified in this study, including advanced age, smoking history, pre-existing respiratory diseases, prolonged surgery duration, and higher ASA physical status. Age-related changes in respiratory function, coupled with the presence of comorbidities, likely contributed to the increased risk observed in older patients (Kiyatkin et al,[13] 2021). Smoking, a well-established risk factor for respiratory complications, likely exacerbated perioperative respiratory dysfunction (Stocking et al,[7] 2021). Patients with pre-existing respiratory diseases were also at increased risk, as these conditions may impair baseline lung function and reduce respiratory reserve during and after surgery (Avila & Fenili,[9] 2017). The prolonged duration of surgery, associated with extended exposure to anesthetic agents and longer periods of immobility, was a significant risk factor (Feng et al,[12] 2024). Additionally, the higher incidence of complications in patients with ASA III or IV status further underscores the importance of preoperative risk stratification (Ruscic et al,[14] 2017).

Length of Hospital Stay

Patients who developed postoperative respiratory complications had a significantly longer hospital stay compared to those without complications. This finding is consistent with previous research, indicating that respiratory complications contribute to delayed recovery and increased healthcare utilization (Bartels et al,[11] 2022; Feng et al,[12] 2024).

Clinical Implications

The identification of significant risk factors provides clinicians with essential information to guide preoperative assessment and intraoperative management. Patients identified as high-risk may benefit from targeted interventions, such as preoperative respiratory therapy, smoking cessation programs, optimized anesthetic techniques, and vigilant postoperative monitoring. Furthermore, these findings highlight the importance of a multidisciplinary approach involving anesthesiologists, surgeons, and respiratory therapists in the perioperative care of high-risk patients

Limitations

While this study provides valuable insights, several limitations must be acknowledged. The study was conducted at a single center, which may limit the generalizability of the findings. Additionally, the relatively small sample size of 100 patients, while adequate for detecting significant associations, may not capture the full spectrum of postoperative respiratory complications. Future studies with larger, more diverse populations are warranted to confirm these findings and explore additional risk factors.

CONCLUSION

This prospective observational study revealed a significant incidence of postoperative respiratory

complications in patients undergoing general anesthesia at a government general hospital, with an overall complication rate of 20%. The study identified several key risk factors associated with the development of these complications, including advanced age, a history of smoking, pre-existing respiratory diseases, prolonged duration of surgery, and a higher ASA physical status (III or IV). Patients who experienced respiratory complications also had a markedly longer hospital stay compared to those without complications. These findings highlights the importance of identifying high-risk patients and implementing targeted perioperative management strategies to mitigate the risk of postoperative respiratory complications and enhance patient outcomes.

REFERENCES

1. Karcz M, Papadakos PJ. Respiratory complications in the postanesthesia care unit: A review of pathophysiological mechanisms. Can J Respir Ther. 2013 Winter;49(4):21-9. PMID: 26078599; PMCID: PMC4456822.
2. Gebeyehu G, Eshetu A, Aweke S. Incidence and Associated Factors of Postoperative Pulmonary Complications after Abdominal Surgery in the Public Hospital, Addis Ababa, Ethiopia. Anesthesiol Res Pract. 2022 Jul 6; 2022:8223903. doi: 10.1155/2022/8223903. PMID: 35844807; PMCID: PMC9279106.
3. Bevilacqua Filho CT, Schmidt AP, Felix EA, Bianchi F, Guerra FM, Andrade CF. Risk factors for postoperative pulmonary complications and prolonged hospital stay in pulmonary resection patients: a retrospective study. Braz J Anesthesiol. 2021 Jul-Aug;71(4):333-338. doi: 10.1016/j.bjane.2021.02.003. Epub 2021 Feb 3. PMID: 34229858; PMCID: PMC9373437.
4. Fernandez-Bustamante A, Frendl G, Sprung J, Kor DJ, Subramaniam B, Martinez Ruiz R, et al. Postoperative Pulmonary Complications, Early Mortality, and Hospital Stay Following Noncardiothoracic Surgery: A Multicenter Study by the Perioperative Research Network Investigators. JAMA Surg. 2017 Feb 1;152(2):157-166. doi: 10.1001/jamasurg.2016.4065. PMID: 27829093; PMCID: PMC5334462.
5. Dharap SB, Barbaniya P, Navgale S. Incidence and Risk Factors of Postoperative Complications in General Surgery Patients. Cureus. 2022 Nov 1;14(11):e30975. doi: 10.7759/cureus.30975. PMID: 36465229; PMCID: PMC9714582.
6. Jin Y, Xie G, Wang H, Jin L, Li J, Cheng B, et al. Incidence and risk factors of postoperative pulmonary complications in noncardiac Chinese patients: a multicenter observational study in university hospitals. Biomed Res Int. 2015; 2015:265165. doi: 10.1155/2015/265165. Epub 2015 Mar 2. PMID: 25821791; PMCID: PMC4363533.
7. Stocking JC, Drake C, Aldrich JM, Ong MK, Amin A, Marmor RA, et al. Risk Factors Associated with Early Postoperative Respiratory Failure: A Matched Case-Control Study. J Surg Res. 2021 May; 261:310-319. doi: 10.1016/j.jss.2020.12.043. Epub 2021 Jan 20. PMID: 33485087; PMCID: PMC10062707.
8. Cai BB, Wang DP. Risk factors for postoperative pulmonary complications in neonates: a retrospective cohort study. World J Pediatr Surg. 2023 Nov 21;6(4):e000657. doi: 10.1136/wjps-2023-000657. PMID: 38025904; PMCID: PMC10668248.
9. Avila AC, Fenili R. Incidence and risk factors for postoperative pulmonary complications in patients undergoing thoracic and abdominal surgeries. Rev Col Bras Cir. 2017 May-Jun;44(3):284-292. Portuguese, English. doi: 10.1590/0100-69912017003011. PMID: 28767805.
10. Eikermann M, Santer P, Ramachandran SK, Pandit J. Recent advances in understanding and managing postoperative respiratory problems. F1000Res. 2019 Feb 18;8:F1000 Faculty Rev-197. doi: 10.12688/f1000research.16687.1. PMID: 30828433; PMCID: PMC6381803.
11. Bartels K, Frendl G, Sprung J, Weingarten TN, Subramaniam B, Martinez Ruiz R, et al. Perioperative Research Network (PRN) investigators. Postoperative pulmonary complications with adjuvant regional anesthesia versus general anesthesia alone: a sub-analysis of the Perioperative Research Network study. BMC Anesthesiol. 2022 May 3;22(1):136. doi: 10.1186/s12871-022-01679-5. PMID: 35501692; PMCID: PMC9063185.
12. Feng G, Jia Y, Zhao G, Meng F, Wang T. Risk factors for postoperative pulmonary complications in elderly patients undergoing video-assisted thoracoscopic surgery lobectomy under general anesthesia: a retrospective study. BMC Surg. 2024 May 14;24(1):153. doi: 10.1186/s12893-024-02444-w. PMID: 38745149; PMCID: PMC11091990.
13. Kiyatkin ME, Levine SP, Kimura A, Linzer RW, Labins JR, Kim JI, et al. Increased incidence of post-operative respiratory failure in patients with pre-operative SARS-CoV-2 infection. J Clin Anesth. 2021 Nov; 74:110409. doi: 10.1016/j.jclinane.2021.110409. Epub 2021 Jun 22. PMID: 34225188; PMCID: PMC8216857.
14. Ruscic KJ, Grabitz SD, Rudolph MI, Eikermann M. Prevention of respiratory complications of the surgical patient: actionable plan for continued process improvement. Curr Opin Anaesthesiol. 2017 Jun;30(3):399-408. doi: 10.1097/ACO.0000000000000465. PMID: 28323670; PMCID: PMC5434965.