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### Corresponding Author

V. Venkateshwar Reddy,  
Department of General Surgery RVM  
Institute Of Medical Sciences and  
Research Center, Laxmakkapally  
Village, Siddipet District, Telangana,  
India  
venkatvaddula@yahoo.com

### Author Designation

<sup>1-4</sup>Associate Professor

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## Post-Gastrointestinal Surgery Pulmonary Outcomes: A Comparative Analysis of Infection Types and Surgical Approaches

<sup>1</sup>Talluri Suresh Babu, <sup>2</sup>Kamisetty Kishore Kumar, <sup>3</sup>Prashanth Kumar Patnaik and <sup>4</sup>V. Venkateshwar Reddy

<sup>1,4</sup>Department of General Surgery, RVM Institute Of Medical Sciences and Research Center, Laxmakkapally Village, Siddipet District, Telangana, India

<sup>2</sup>Department of Respiratory Medicine, RVM Institute Of Medical Sciences and Research Center, Laxmakkapally Village, Siddipet District, Telangana, India

<sup>3</sup>Department of Pharmacology, RVM Institute Of Medical Sciences and Research Center, Laxmakkapally Village, Siddipet District, Telangana, India

### ABSTRACT

Patients undergoing gastrointestinal surgery are at greater risk of suffering from pulmonary problems, which can have a significant adverse impact on their ability to recover. Both the type of surgical method (elective versus emergency treatments) as well as the kind of post-operative infection affects the outcomes. Understanding these aspects is essential in employing the best treatment methods. In this observational and retrospective study, data of 280 individuals who experienced pulmonary problems after gastrointestinal surgery was collected. Details on patient demographics, microbiological culture results and type of surgeries were gathered through medical records. The role of these factors in the recovery was evaluated. Out of 280 patients, 64 (22.9%) patients developed pulmonary complications, whereas 216 (77.1%) did not experience such complications. Gram-positive infections accounted for 35.2% of cases, Gram-negative infections for 46.0% and polymicrobial infections for 18.8% among these patients. The recovery period for patients with single-pathogen infections is 9.1 days, 11.7 days for those with polymicrobial infections involving two pathogens and 13.5 days for those with three or more pathogens. Compared to elective procedures (37.5%), emergency surgeries were linked to a greater prevalence of pulmonary complications (62.5%). Post-operative pulmonary problems were more common in patients with a history of pulmonary disease(65.6%) than in those without previous lung disease (34.4%). According to the study, those who underwent gastrointestinal surgeries are more susceptible to experiencing pulmonary complications, especially because of emergency surgical procedures and polymicrobial infections. These issues are also more likely to occur in patients who have previous histories of pulmonary diseases. Improving postoperative care and enhancing patient outcomes require an understanding of these risk factors.

## INTRODUCTION

Complications from major gastrointestinal procedures, such as infections, anastomotic leaks and serious pulmonary problems, are common and can prolong recovery and raise morbidity<sup>[1]</sup>. Multiple factors, including the surgical method used, patient comorbidities and perioperative care procedures, may contribute to these problems. The pulmonary complications following surgery are alarming as they increase the chances of both delay the hospital stay and early mortality<sup>[2]</sup>.

The method of surgery, either elective or emergency, is crucial in deciding the postoperative outcomes<sup>[3]</sup>. Elective surgeries have proper preoperative time, which allows for better postoperative outcomes, while emergency procedures are done in a quick manner and are associated with multiple complications. Further research is needed to understand the impact of surgery timing and preparation on postoperative pulmonary issues due to variations in surgical circumstances.

One of the main causes of poor outcomes after gastrointestinal procedures is postoperative infections, especially those that impact the respiratory system<sup>[4]</sup>. Pulmonary complications are greatly impacted by bacterial infections, which can range from single-pathogen instances to more complicated polymicrobial infections. The duration and challenges of recovery are frequently determined by the type and variety of microorganisms involved<sup>[5]</sup>. To reduce the risk of prolonged respiratory complications, clinicians can better adjust antibiotic regimens by knowing the microbiological profile of infections in surgical patients. Pre-existing lung diseases like asthma and chronic obstructive pulmonary disease (COPD) are other known risk factors for the development of postoperative complications, in addition to infections<sup>[6]</sup>. Because of their impaired lung function, patients with underlying respiratory conditions are more vulnerable to further pulmonary impairment following surgery<sup>[7]</sup>. To prevent worsening respiratory conditions and enhance recovery rates, a comprehensive preoperative assessment and postoperative management plan are necessary.

This study aims to analyse the factors influencing pulmonary complications in gastrointestinal surgery patients, focusing on the type of surgery, postoperative infection microbiology and the presence of underlying lung disorders. In this retrospective study, we reviewed 280 patient medical records to find associations and trends that can guide future strategies for lowering the frequency and seriousness of postoperative respiratory issues.

**Aim of the Study:** The study aims to understand the factors influencing pulmonary complications in post gastrointestinal surgeries, including surgery type,

microbiological infections and pre-existing lung conditions.

### Objectives:

- To determine the prevalence of pulmonary complications following gastrointestinal surgery.
- To analyse the microbiological profile of infections in patients who have pulmonary problems following gastrointestinal surgery.
- To compare the period of recovery according to the type of infection in patients with post operative pulmonary complications.
- To evaluate the outcomes of surgical methods on the frequency of pulmonary complications.
- To assess the impact of pulmonary conditions that already exist on the emergence of pulmonary complications following gastrointestinal surgery.

## MATERIALS AND METHODS

**Study Setting:** The study was conducted at RVM Institute of Medical Sciences, situated in Laxmakkapalli Village, Siddipet District which offers comprehensive medical services. With advanced facilities and a multidisciplinary approach, the hospital is well-equipped to evaluate postoperative complications and patient outcomes.

**Study Design:** This observational retrospective study aims to examine the correlation between pulmonary complications, surgical procedures, and postoperative infections in individuals who underwent gastrointestinal surgery.

**Study Population:** The study included 280 individuals who had gastrointestinal surgery, of which 64 experienced lung problems after the procedure.

**Study Period:** The study analysed from January 2022 to December 2023, providing a comprehensive review over a two-year period.

**Inclusion Criteria:** Patients having pulmonary problems after gastrointestinal surgery were included in this study. Complete medical records detailing each individual's surgeries, postoperative infections and any lung diseases they may have had beforehand were required.

**Exclusion Criteria:** Patients who did not have gastrointestinal surgery or whose medical records were insufficient were not included in this study. The study excluded individuals with serious comorbidities that could complicate the investigation of postoperative pulmonary problems, such as advanced malignancy or severe renal failure.

**Data Collection:** This study analysed patient records to gather information on postoperative pulmonary issues,

surgical details (elective vs. emergency), demographics (age, gender, etc.) and the presence of infections (bacterial culture results). Data included hospital stays, recovery periods and post-operative treatments. Gram-positive, Gram-negative, or polymicrobial infections were identified and their severity was noted. The analysis aimed to understand how surgical techniques, infection types and pulmonary complications affected patient outcomes by identifying connections between these variables.

**Statistical Analysis:** The study used descriptive statistics to analyse patient demographics, pulmonary complications and infection types. Comparative analysis was conducted to compare recovery periods for single pathogen and multi-pathogen infections. Correlation analysis was used to investigate the relationship between surgical procedures, pulmonary disease history and postoperative complications. The study also examined the impact of infection type and severity on hospital stay length.

**Ethical Considerations:** The study protocol was assessed and approved by the RVM Institute of Medical Sciences' Institutional Ethics Committee. All information was anonymised to maintain privacy and confidentiality.

**RESULTS AND DISCUSSIONS**

This study evaluated 280 patients who had gastrointestinal surgeries and developed pulmonary complications. We studied in detail about the types of infections, the impact of different surgeries and their effect on recovery. These results are presented in table 1-5.

Table 1: Incidence of Pulmonary Complications in Patients Undergoing Major Gastrointestinal Surgeries (N=280)

Outcome	Number of Patients	Percentage (%)
Experienced Pulmonary Complications	64	22.9
Did Not Experience Pulmonary Complications	216	77.1

The incidence of pulmonary complications in patients who underwent major gastrointestinal surgeries is compiled in Table 1. Of the 280 patients that were part of the study, 64 (22.9%) experienced pulmonary complications after surgery, whereas 216 (77.1%) did not. According to this distribution, which was statistically significant ( $p < 0.05$ ), most patients did not experience pulmonary complications during their recovery.

Table 2: Type of Infections in Patients with Pulmonary Complications (N=64)

Infection Type	Number of Patients	Percentage (%)
Gram-Positive	23	35.20%
Gram-Negative	29	46.00%
Polymicrobial	12	18.80%

Table 2 indicates the distribution of different types of infections contributed to the pulmonary complications. Gram-negative infections accounted for 46.0% of patients, Gram-positive infections for 35.2% and polymicrobial infections for 18.8%. The prevalence of Gram-negative infections was statistically significant ( $p < 0.01$ ), suggesting that Gram-negative bacteria have a major role on post operative infections.

Table 3: Variation in Recovery Time Based on Infection Type

Infection Type	Average Recovery Time (Days)
Single pathogen	9.1
Polymicrobial (2 pathogens)	11.7
Polymicrobial (3+ pathogens)	13.5

Variation in the recovery time based on whether a single or multiple pathogens are involved is shown in Table 3. The average recovery time for patients with single-pathogen infections was 9.1 days, whereas the recovery time for patients with polymicrobial infections involving two pathogens was 11.7 days and the recovery time for patients with infections involving three or more pathogens was 13.5 days. The influence of polymicrobial infections on delayed recovery was emphasized by the statistically significant increase in recovery time with infection complexity ( $p < 0.01$ ).

Table 4: Incidence of Pulmonary Complications Based on Surgical Urgency (N=64)

Surgical Urgency	Number of Patients	Percentage (%)
Emergency Surgery	40	62.50%
Elective Surgery	24	37.50%

Table 4 illustrates the association between the incidence of respiratory issues and the surgical urgency. The frequency of pulmonary complications was significantly higher in patients undergoing emergency surgery 40(62.5%) than in those undergoing elective surgery 24(37.5%). This difference is statistically significant ( $p < 0.05$ ), indicating that there is a greater probability of postoperative pulmonary problems following emergency procedures.

Table 5: Pulmonary Complications in Patients with and without Pre-Existing Pulmonary Disease (N=64)

Condition	Number of Patients	Percentage (%)
Without Pre-Existing Pulmonary Disease	22	34.40%
With Pre-Existing Pulmonary Disease	42	65.60%

The incidence of pulmonary complications in patients with and without a history of pulmonary disease is shown in Table 5. Compared to patients without a history of lung problems (34.4%), those with a history of lung disease had a higher chance of developing complications (65.6%). For patients with pre-existing lung conditions, this association is statistically significant.

( $p < 0.01$ ) and demonstrated a modest correlation ( $r = 0.35$ ), underscoring the possible advantages of preoperative evaluations and specialist care.

Previous studies have shown that postoperative pulmonary problems are a major factor in increasing total perioperative morbidity and mortality rates<sup>[8,9]</sup>. The findings of our study highlight the complex relationship that exists between pulmonary complications and other clinical variables in individuals undergoing gastrointestinal surgery.

**Prevalence of Pulmonary Complications:** Our study highlights the high risk of pulmonary complications in patients undergoing major gastrointestinal surgeries, emphasizing the need for vigilant postoperative monitoring. The majority of patients recovered without any complications, despite a small percentage having respiratory problems. These results are consistent with previous research showing that improved recovery procedures may have a beneficial effect on outcomes for this surgical population<sup>[10,11]</sup>. We can continue to enhance recovery outcomes and encourage improved respiratory health in patients after gastrointestinal procedures by emphasizing risk assessment and customized postoperative treatment.

**The Prevalence of Infections that Results in Pulmonary Complications:** This study shows that postoperative pulmonary complications are associated with a high prevalence of Gram-negative bacterial infections, which is in line with previous research on the high risk of this bacterial group<sup>[12,13]</sup>. Nearly half of the cases were caused by Gram-negative infections, although Gram-positive and polymicrobial infections also had a significant role. Developing an understanding of the microbiological environment can help develop better management and preventative strategies, which will ultimately enhance patient outcomes and postoperative recovery times.

**Recovery Time and Infection Complexity:** Our results highlight how recovery times might differ greatly depending on whether a single pathogen or several pathogens have been responsible for the infection. Patients with infections involving multiple bacteria in our study had significantly longer recovery times, which is consistent with earlier research showing that complicated infections can put an impact on recovery resources and affect patient outcomes<sup>[14,15]</sup>. These findings suggest that reducing recovery durations may be significantly improved by the early detection and focused treatment of polymicrobial illnesses.

**The Association of Surgical Urgency and Pulmonary Complications:** The relationship between pulmonary problems and surgical urgency that we found in our

study supports results in the literature about the increased risk of emergency surgeries<sup>[16]</sup>. Previous studies have shown that patients undergoing emergency treatments frequently experience more difficulties, most likely because of the rapid intervention needed and the lack of preoperative preparation<sup>[17]</sup>. These findings emphasize the significance of providing emergency patients with specialized perioperative care in order to minimize respiratory complications following surgery.

**Impact of Pre-Existing Pulmonary Conditions on postoperative Outcomes:** Our results highlighted the correlation between patients with pre-existing lung diseases and higher risk of postoperative pulmonary complications which is in consistent with earlier studies<sup>[18]</sup>. Preoperative evaluations for lung disorders can uncover limitations and customize preventive measures which can lower surgical outcomes. Prior studies revealed that these preoperative targeted approaches to evaluate the severity of existing lung diseases will influence the recovery and hospital stay<sup>[19,20]</sup>.

**Limitations and Future Directions:** Despite having an adequate sample size, our study was limited in its ability to be applied to larger populations because it was only carried out in one institution. In addition, the cross-sectional design limits our capacity to establish significant causal associations between pre-existing lung problems, surgical urgency, infection types and pulmonary complications. Future research should concentrate on multicentre longitudinal studies with a range of patient demographics to understand the long-term impacts of certain procedures on the results of gastrointestinal procedures.

## CONCLUSION

Our study highlights the complex relationship between important clinical variables and postoperative pulmonary complications in patients undergoing gastrointestinal surgery. The results show the prevalence of Gram-negative bacterial infections are in producing such problems, which emphasizes the need for focused infection control strategies. Furthermore, the prolonged recovery periods for patients with polymicrobial infections and the higher likelihood of emergency procedures highlight the necessity of effective infection control and appropriate perioperative treatment. Preoperative respiratory evaluations are crucial in reducing risks, since our study showed that patients with pre-existing lung diseases were more likely to experience complications. To enhance postoperative outcomes and lower morbidity, these insights encourage improved preventative interventions, risk assessments and personalized treatment regimens.

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