Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v6i3.1657
*Biol. Clin. Sci. Res. J., Volume 6(3), **2025**: 1657*
Original Research Article

Multidisciplinary Approaches to Reducing Postoperative Pulmonary Complications in Abdominal Surgery Patients: A Prospective Observational Study

Khalida Ibraheem[1*], Agha Sajjad Hussain[2], Muhammad Asim Rana[3], Ahmed Hossameldin Ahmed Awad[4], Mujtaba Hasan Siddiqui[5], Mubashar Sultan Hashmi[3]

[1]Department of Nursing, Punjab Institute of Cardiology, Lahore, Pakistan
[2]Department of Cardiac Surgery, Rehmatul Lil Alameen Institute of Cardiology, Lahore, Pakistan
[3]Internal, Respiratory and Critical Care Medicine, Bahria International Hospital Lahore, Pakistan
[4]Rashid Hospital Dubai Health, Dubai
[5]Department of Medicine, Akhtar Saeed Medical and Dental College Lahore, Pakistan
**Corresponding author's email address:* khalidaibrahim741@gmail.com

(Received, 24th February 2025, Accepted 22nd March 2025, Published 31st March 2025)

Abstract: *Postoperative pulmonary complications (PPCs) are a major cause of postoperative morbidity, especially in abdominal surgeries. Multidisciplinary strategies have been shown to reduce the incidence of PPCs in high-risk surgical patients. This study evaluated the effectiveness of coordinated perioperative interventions involving physiotherapy, nursing care, and surgical practices in reducing PPCs in a Pakistani tertiary care hospital.* ***Methods:*** *This prospective observational study was conducted over six months from August 2024 to January 2025 in a tertiary care hospital in Pakistan. Eighty-six patients undergoing elective or emergency abdominal surgery under general anesthesia were enrolled. Interventions included preoperative respiratory physiotherapy, intraoperative positioning strategies, early postoperative mobilization, incentive spirometry, and standardized nursing protocols. Patients were monitored for seven days postoperatively for the development of PPCs. Data were analyzed using SPSS v26, with $p < 0.05$ considered statistically significant.* ***Results:*** *The overall incidence of PPCs was 26.7%, with atelectasis (12.8%) and pneumonia (8.1%) being the most common. Patients who received multidisciplinary interventions had significantly lower rates of PPCs than those who did not ($p < 0.01$). Preoperative physiotherapy, early mobilization, and use of incentive spirometry were strongly associated with reduced PPC incidence. Patients with PPCs had longer hospital stays (mean 11.6 ± 3.2 days vs. 6.3 ± 1.9 days; $p < 0.001$) and higher ICU admission rates (39.1% vs. 6.3%; $p = 0.001$).* ***Conclusion:*** *A multidisciplinary approach significantly reduces the incidence of postoperative pulmonary complications in abdominal surgery patients. Early physiotherapy, mobilization, and respiratory care should be integrated into routine perioperative protocols, especially in resource-limited settings like Pakistan.*

Keywords: Postoperative pulmonary complications, multidisciplinary care, abdominal surgery, physiotherapy, Pakistan, perioperative outcomes

[***How to Cite:*** Ibraheem K, Hussain AS, Rana MA, Awad AHA, Siddiqui MH, Hashmi MS. Multidisciplinary approaches to reducing postoperative pulmonary complications in abdominal surgery patients: a prospective observational study. *Biol. Clin. Sci. Res. J.*, **2025;** 6(3): 161-164. doi: https://doi.org/10.54112/bcsrj.v6i3.1657

Introduction

Postoperative pulmonary complications (PPCs) are a significant cause of morbidity and mortality among patients undergoing abdominal surgeries, especially in low- and middle-income countries such as Pakistan, where healthcare infrastructure and perioperative monitoring resources may be limited. PPCs—including atelectasis, pneumonia, bronchospasm, and respiratory failure—contribute to prolonged hospital stays, increased ICU admissions, and elevated healthcare costs (1). The incidence of PPCs after major abdominal surgery has been reported to range from 10% to 40%, depending on surgical type, patient risk factors, and the quality of perioperative care (2, 3).

In the Pakistani healthcare setting, abdominal surgeries are frequently performed under suboptimal conditions, particularly in emergency scenarios and among patients with poor baseline respiratory health, malnutrition, or comorbidities such as smoking and chronic obstructive pulmonary disease (4). Moreover, underutilization of preventive strategies such as preoperative physiotherapy, early ambulation, incentive spirometry, and optimal postoperative positioning often leads to a higher burden of pulmonary complications (5).

Implementing a multidisciplinary approach—combining the expertise of anesthesiologists, surgeons, physiotherapists, and nursing staff—has shown potential in reducing PPCs in various surgical populations. This strategy includes preoperative respiratory training, intraoperative protective ventilation, and postoperative measures like chest physiotherapy and early mobilization (6). While such collaborative care models have been widely promoted in high-income countries, evidence is scarce from South Asian and specifically Pakistani settings, where systemic resource constraints and fragmented care often hinder their implementation (7, 8).

Recent studies suggest that multidisciplinary perioperative interventions can significantly reduce the incidence of PPCs and improve overall surgical outcomes. For instance, preoperative education and physiotherapy have enhanced respiratory muscle function and reduced pulmonary complications in patients undergoing elective abdominal procedures (9). Similarly, using incentive spirometry and early mobilization in the postoperative period contributes to improved lung expansion, oxygenation, and reduced atelectasis (10, 11).

Despite these benefits, the adoption of structured multidisciplinary programs in Pakistani hospitals remains limited. Most public sector hospitals lack dedicated perioperative rehabilitation protocols or standardized criteria for pulmonary risk assessment. Additionally, awareness regarding the role of respiratory physiotherapists in surgical recovery remains low (12). Therefore, there is a need to assess the clinical impact of these multidisciplinary strategies within the local context to guide evidence-based surgical care.

This prospective observational study evaluated the effectiveness of multidisciplinary approaches in reducing PPCs in abdominal surgery

patients in a tertiary care hospital in Pakistan. By identifying the frequency of complications and assessing the impact of physiotherapy, nursing protocols, and early mobilization on outcomes, this study aims to generate data that can be used to support policy and practice changes to improve perioperative respiratory care.

Methodology

This prospective observational study was conducted at a tertiary care hospital in Pakistan over six months, from August 2024 to January 2025, to evaluate the effectiveness of multidisciplinary perioperative strategies in reducing postoperative pulmonary complications (PPCs) in patients undergoing abdominal surgery. Ethical approval was obtained from the hospital's Institutional Review Board, and informed written consent was acquired from all participants prior to inclusion in the study.

Eighty-six patients aged 18 years and above scheduled for elective or emergency abdominal surgery under general anesthesia were enrolled using non-probability consecutive sampling. To minimize confounding variables, patients with pre-existing pulmonary infections, neurological conditions impairing respiratory function, or those requiring ventilatory support preoperatively were excluded. Each eligible participant underwent a baseline preoperative assessment, including demographic data, clinical history, comorbidities, American Society of Anesthesiologists (ASA) classification, smoking status, and pre-existing respiratory conditions.

All patients received standard anesthetic care. In addition, a multidisciplinary perioperative care protocol was implemented in selected cases, comprising preoperative education and respiratory physiotherapy, intraoperative lung-protective ventilation strategies, and structured postoperative interventions including early mobilization, incentive spirometry, semi-recumbent positioning, and chest physiotherapy. The implementation of each intervention was documented, and compliance was monitored by the surgical, anesthetic, and physiotherapy teams.

Postoperatively, patients were followed daily for up to 7 days or until discharge for the development of PPCs, including atelectasis, pneumonia, bronchospasm, respiratory failure, or the need for unplanned ICU admission due to respiratory deterioration. Diagnostic criteria for PPCs were based on established clinical and radiological parameters. Secondary outcomes included hospital stay duration, ICU admission requirement, and 30-day mortality.

Data were collected using a pre-designed proforma and entered into SPSS version 26 for analysis. Categorical variables were expressed as frequencies and percentages, while continuous variables were reported as means with standard deviations. The Chi-square test or Fisher's exact test was used to analyze categorical associations between multidisciplinary interventions and PPC occurrence, and independent t-tests were applied to compare continuous variables between patients with and without PPCs. A p-value of less than 0.05 was considered statistically significant. The study followed STROBE guidelines to ensure transparency and completeness in observational research.

Results

A total of 86 patients were enrolled and followed postoperatively for up to 7 days for the development of clinically significant pulmonary complications. The majority of patients were male, aged between 45 and 65 years. Nearly one-third had a smoking history, and a quarter were categorized as ASA class III or higher, increasing their risk for PPCs. Elective surgeries were more common than emergency procedures.

The overall incidence of PPCs in the study cohort was 26.7%, with atelectasis being the most common complication, followed by pneumonia. Most patients (73.3%) had an uneventful postoperative respiratory course. (Table 2).

Patients who received preoperative physiotherapy, early mobilization, incentive spirometry, and head-elevated positioning had significantly lower PPC rates. The absence of these interventions was associated with higher complication incidence, emphasizing the importance of coordinated perioperative respiratory care. (Table 3).

Patients who developed PPCs had a significantly longer hospital stay and higher ICU admission rates. Although mortality was low, PPCs were associated with more intensive resource utilization and delayed recovery. (Table 4)

The overall PPC rate was 26.7%, with atelectasis and pneumonia being the most prevalent. Implementing multidisciplinary strategies—particularly respiratory physiotherapy and early mobilization—was associated with a statistically significant reduction in PPC rates. Patients who developed PPCs experienced longer hospital stays and higher ICU utilization.

Table 1: Demographic and Preoperative Characteristics of Patients (n = 86)

Variable	Frequency (n)	Percentage (%)
Mean Age (years ± SD)	52.7 ± 11.4	–
Gender		
– Male	48	55.8
– Female	38	44.2
Smoking History	29	33.7
ASA Class ≥ III	22	25.6
Pre-existing Pulmonary Disease	18	20.9
Type of Surgery		
– Elective	54	62.8
– Emergency	32	37.2

Table 2: Incidence and Types of Postoperative Pulmonary Complications

PPC Type	Number of Cases (n)	Percentage (%)
Atelectasis	11	12.8
Pneumonia	7	8.1
Bronchospasm	3	3.5
Respiratory Failure	2	2.3
No PPC	63	73.3

Table 3: Impact of Multidisciplinary Interventions on PPC Incidence

Intervention Received	PPC Developed (n=23)	No PPC (n=63)	p-value
Preoperative Physiotherapy	6 (26.1%)	42 (66.7%)	0.002*
Early Postoperative Mobilization	8 (34.8%)	49 (77.8%)	0.001*
Incentive Spirometry	7 (30.4%)	45 (71.4%)	0.003*
Head-Elevated Positioning	10 (43.5%)	57 (90.5%)	<0.001*

Table 4: Length of Hospital Stay and ICU Admission by PPC Status

Outcome	PPC Group (n=23)	Non-PPC Group (n=63)	p-value
Mean Hospital Stay (days ± SD)	11.6 ± 3.2	6.3 ± 1.9	<0.001*
ICU Admission Required (%)	9 (39.1%)	4 (6.3%)	0.001*
30-Day Mortality (%)	1 (4.3%)	0 (0%)	0.11

Discussion

This prospective observational study demonstrated that implementing a multidisciplinary perioperative care model significantly reduced the incidence of postoperative pulmonary complications (PPCs) among abdominal surgery patients in a tertiary care setting in Pakistan. The overall incidence of PPCs was 26.7%, with atelectasis and pneumonia being the most common complications observed. Adopting interventions such as preoperative physiotherapy, early postoperative mobilization, use of incentive spirometry, and appropriate patient positioning was strongly associated with better postoperative respiratory outcomes.

Our findings are consistent with previous literature supporting the role of respiratory physiotherapy and multidisciplinary care in preventing PPCs. A meta-analysis by Taito et al. concluded that preoperative respiratory physiotherapy significantly reduces the incidence of PPCs, particularly atelectasis and pneumonia, in abdominal and thoracic surgery patients (13). Similarly, a randomized controlled trial by Langer et al. demonstrated that preoperative inspiratory muscle training resulted in fewer pulmonary complications and shorter hospital stays after major abdominal surgery (14).

Early postoperative mobilization and head-elevated positioning were two of the most impactful strategies in our study. Patients mobilized within 24 hours of surgery had significantly lower rates of pulmonary complications, echoing findings from Prescott and Harris, who reported that early ambulation is one of the most cost-effective and practical strategies to prevent PPCs, especially in low-resource settings (15). Likewise, maintaining the head-elevated position postoperatively has improved lung volumes and reduced the risk of aspiration, minimizing the incidence of hypostatic pneumonia and atelectasis (16).

Our study's use of incentive spirometry was also associated with a significant reduction in PPCs. Although there is some debate about its standalone effectiveness, several recent studies, including a trial by Aslam et al., have shown that when combined with physiotherapy and education, incentive spirometry leads to improved pulmonary function and fewer complications in abdominal surgery patients (17).

Our study adds local evidence to the global literature, reinforcing the feasibility and effectiveness of multidisciplinary interventions in a Pakistani healthcare context. Previous studies in Pakistan have reported PPC rates as high as 35–40%, often due to the lack of structured respiratory care protocols (18). Our study's comparatively lower incidence of complications can be attributed to the systematic application of preventive strategies coordinated among surgeons, anesthetists, physiotherapists, and nursing staff.

Furthermore, we found that patients who developed PPCs had significantly longer hospital stays and higher ICU admission rates, corroborating global findings that PPCs contribute to increased healthcare resource utilization and delayed recovery (19). Although the 30-day mortality was low in our cohort, the association of PPCs with greater morbidity and economic burden underscores the importance of proactive perioperative planning.

One of the strengths of this study is its prospective design and real-world implementation in a public sector tertiary hospital. However, limitations include the relatively small sample size and the study's observational nature, which may limit causal inference. Despite this, the significant associations observed provide a strong basis for larger multicenter trials and support the integration of multidisciplinary care bundles into national surgical safety protocols.

Conclusion

This study demonstrates that multidisciplinary perioperative care significantly lowers the risk of pulmonary complications following abdominal surgery. Integrating physiotherapy, early mobilization, and standardized nursing protocols into routine practice can improve surgical outcomes and reduce hospital burden in low-resource settings.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-TCH-23)

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

KI (Charge nurse),
Manuscript drafting, Study Design,
ASH
Review of Literature, Data entry, Data analysis, and drafting article.
MAR (Consultant Physician**)**
Conception of Study, Development of Research Methodology Design,
AHAA (Senior Specialist**)**
Study Design, manuscript review, critical input.
MHS (Professor),
Manuscript drafting, Study Design,
MSH (Consultant Physician)
Review of Literature, Data entry, Data analysis, and drafting article.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

References

1. Jamal A, Rizvi M, Khan A, et al. Postoperative pulmonary complications in patients undergoing laparotomy: A clinical audit in a Pakistani tertiary care center. Pak J Med Sci. 2020;36(4):682–7.
2. Canet J, Gallart L. Postoperative pulmonary complications. Minerva Anestesiol. 2019;85(6):488–96.
3. Khattak MU, Akbar A, Sheikh T, et al. Pulmonary complications after emergency abdominal surgery: incidence and predictors in a tertiary hospital in Peshawar. J Ayub Med Coll Abbottabad. 2021;33(3):429–34.
4. Mahmood T, Khan MA, Iqbal Z, et al. Predictors of pulmonary complications in patients undergoing general anesthesia for abdominal surgery. Cureus. 2022;14(1):e21478.
5. Ahmed A, Farooq S, Tariq M. Role of respiratory physiotherapy in preventing PPCs following abdominal surgery: An evidence-based review. Pak J Health Sci. 2021;15(2):113–8.
6. Prescott HC, Harris AD. Collaborative perioperative care models and pulmonary outcomes in general surgery. Chest. 2020;158(3):1042–51.
7. Shafiq M, Waheed S, Mirza B. Evaluating the need for standardized postoperative physiotherapy protocols in Pakistani hospitals. Pak J Med Health Sci. 2021;15(5):932–6.
8. Bashir A, Nawaz A, Saleem S. Barriers to implementing multidisciplinary perioperative care in public hospitals of Pakistan. J Coll Physicians Surg Pak. 2022;32(7):892–6.
9. Taito S, Sanui M, Iizuka Y, et al. Impact of preoperative physiotherapy on postoperative pulmonary complications in abdominal surgery: A meta-analysis. BMC Pulm Med. 2020;20(1):110.
10. Langer D, Ciavaglia CE, Faisal A, et al. Inspiratory muscle training reduces PPCs and improves recovery in abdominal surgery

patients: A randomized controlled trial. Physiotherapy. 2020;106(3):160–8.
11. Aslam F, Rehman AU, Khattak A. Effectiveness of incentive spirometry in reducing postoperative pulmonary complications in laparotomy patients. J Pak Med Assoc. 2022;72(1):110–4.
12. Ali Z, Farooq A, Shahid A. Awareness and integration of respiratory physiotherapy in perioperative care among surgical teams in Pakistan. Ann Pak Inst Med Sci. 2023;19(2):94–9.
13. Taito S, Sanui M, Iizuka Y, et al. Impact of preoperative physiotherapy on postoperative pulmonary complications in abdominal surgery: A meta-analysis. BMC Pulm Med. 2020;20(1):110.
14. Langer D, Ciavaglia CE, Faisal A, et al. Inspiratory muscle training reduces PPCs and improves recovery in abdominal surgery patients: A randomized controlled trial. Physiotherapy. 2020;106(3):160–8.
15. Prescott HC, Harris AD. Collaborative perioperative care models and pulmonary outcomes in general surgery. Chest. 2020;158(3):1042–51.
16. Doğan N, Öztürk G, Çelebi S, et al. Effect of postoperative head elevation on respiratory function in major abdominal surgery. J Clin Anesth. 2019;55:36 41.
17. Aslam F, Rehman AU, Khattak A. Effectiveness of incentive spirometry in reducing postoperative pulmonary complications in laparotomy patients. J Pak Med Assoc. 2022;72(1):110–4.
18. Khattak MU, Akbar A, Sheikh T, et al. Pulmonary complications after emergency abdominal surgery: incidence and predictors in a tertiary hospital in Peshawar. J Ayub Med Coll Abbottabad. 2021;33(3):429–34.
19. Khurshid A, Tariq M, Shah S. Economic burden and length of hospital stay in patients with PPCs: An institutional experience. Pak J Med Sci. 2022;38(6):1545–50.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, http://creativecommons.org/licen ses/by/4.0/. © The Author(s) 2025