

ORIGINAL RESEARCH

Impact of Preoperative Psychological Intervention on Postoperative Pulmonary Outcomes

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ABSTRACT

Aim: To investigate the effect of preoperative psychological intervention on postoperative pulmonary complications (PPCs), anxiety levels, hospital stay, and respiratory function in patients undergoing major elective abdominal surgery. **Materials and Methods:** This randomized controlled trial (RCT) included 120 patients, aged 18–70 years, classified as ASA I–III, who were scheduled for major elective abdominal surgery. Participants were randomized into two groups: an intervention group (n=60) receiving structured preoperative psychological intervention and a control group (n=60) receiving standard preoperative care. The psychological intervention consisted of three 45-minute sessions, covering psychoeducation, breathing and relaxation techniques, and cognitive-behavioral coping strategies. Primary outcomes were the incidence of PPCs (including pneumonia, atelectasis, and prolonged oxygen requirement), while secondary outcomes included anxiety levels, length of hospital stay, and respiratory function assessed via spirometry. **Results:** PPC incidence was significantly lower in the intervention group, with reductions in pneumonia (8.33% vs. 20%) and atelectasis (13.33% vs. 25%) (p=0.03 and p=0.04, respectively). Prolonged oxygen requirement was observed in 5% of the intervention group compared to 13.33% in the control group (p=0.02). Anxiety levels pre-surgery and post-surgery were significantly lower in the intervention group (p=0.01 to p=0.03). Hospital stay was shorter in the intervention group (6.4 ± 1.2 days vs. 8.1 ± 1.5 days, p=0.02). Respiratory function was consistently higher in the intervention group across postoperative days 1, 3, 5, and 7 (p=0.01 to p=0.04). **Conclusion:** Preoperative psychological intervention effectively reduces PPCs, lowers anxiety, shortens hospital stay, and improves respiratory function in patients undergoing major surgery. Integrating structured psychological preparation into preoperative care may enhance surgical outcomes and patient satisfaction.

Keywords: Preoperative psychological intervention, postoperative pulmonary complications, anxiety, respiratory function, abdominal surgery

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INTRODUCTION

Surgery is a complex medical intervention that, despite being essential for treating various health conditions, carries inherent risks of postoperative complications. Among these, postoperative pulmonary complications (PPCs) are especially prevalent and concerning. PPCs encompass a range of respiratory issues, including pneumonia, atelectasis, prolonged oxygen requirements, and in severe cases, respiratory failure. These complications not only lead to extended hospital stays and increased healthcare costs but also contribute significantly to patient morbidity and mortality rates. Reducing the incidence and severity of PPCs is therefore a critical goal in

perioperative care, and numerous strategies have been developed to address this need. Traditionally, perioperative approaches have focused on optimizing physical health and surgical readiness through interventions such as smoking cessation, respiratory exercises, and appropriate preoperative medications. However, recent research suggests that psychological factors may also play a vital role in influencing postoperative outcomes, including PPCs.^{1,2} Psychological factors, particularly stress and anxiety, have been shown to impact immune function, inflammatory responses, and overall physical resilience, all of which can influence surgical recovery. Surgery often induces significant

psychological stress, with many patients experiencing heightened anxiety, fear, and uncertainty. This psychological burden can activate the body's stress response, resulting in elevated levels of cortisol and catecholamines, which can have immunosuppressive and pro-inflammatory effects. These changes can impair wound healing, increase susceptibility to infections, and potentially compromise respiratory function. For patients undergoing major surgery, particularly abdominal or thoracic procedures associated with a high risk of PPCs, preoperative psychological interventions may offer a valuable tool to mitigate these risks. By preparing patients mentally and emotionally for surgery, psychological interventions aim to reduce stress responses, enhance coping skills, and promote behaviors that support respiratory health postoperatively.^{3,4}

Preoperative psychological interventions encompass a range of techniques designed to reduce anxiety, build coping mechanisms, and foster a sense of control and preparedness. Common approaches include cognitive-behavioral therapy (CBT), relaxation techniques such as deep breathing and progressive muscle relaxation, guided imagery, psychoeducation about the surgical process, and mindfulness practices. These interventions are often customized to the individual's needs and can vary in duration and intensity depending on the type of surgery, the patient's psychological state, and other risk factors. Cognitive-behavioral techniques, for example, help patients identify and modify anxiety-inducing thoughts, while relaxation techniques aim to lower physiological arousal by reducing heart rate, blood pressure, and muscle tension. Mindfulness-based approaches and guided imagery focus on increasing present-moment awareness and visualizing positive outcomes, which may also reduce preoperative anxiety.^{5,6}

The influence of preoperative psychological intervention on PPCs is an area of growing interest, as studies reveal promising links between reduced preoperative anxiety and improved postoperative outcomes. Lower preoperative anxiety has been associated with fewer respiratory complications, shorter recovery times, and reduced hospital stays, suggesting a potential pathway for psychological interventions to enhance surgical outcomes. There is evidence to suggest that patients who undergo psychological preparation for surgery are more likely to engage in beneficial behaviors, such as respiratory exercises and effective pain management, which support respiratory health and reduce the risk of PPCs. Additionally, psychological interventions may help patients adopt a proactive approach to their recovery, enhancing adherence to postoperative instructions and encouraging early mobilization, which are critical components in preventing PPCs.⁷

Despite its potential benefits, the implementation of preoperative psychological interventions is not yet widespread in surgical practice, partly due to logistical challenges and limited awareness of its

effectiveness among healthcare providers. Incorporating psychological preparation into standard preoperative care requires a shift in the traditional approach to surgical readiness, moving from a purely physical assessment to a more holistic model that includes mental and emotional health. Integrating psychological interventions into preoperative protocols also necessitates collaboration among multidisciplinary teams, including surgeons, anesthesiologists, psychologists, and nurses, to ensure that patients receive comprehensive support. Furthermore, the optimal type, timing, and intensity of psychological interventions for different surgical populations remain areas of ongoing research. Some patients may benefit from a brief session of relaxation training, while others may require multiple sessions of cognitive-behavioral therapy to address deeply rooted anxieties.⁸

The relationship between preoperative psychological intervention and PPCs is a relatively new field of study, and while initial findings are encouraging, further research is needed to establish standardized protocols and to identify the patient populations that would benefit most from these interventions. Studies examining the mechanisms by which psychological interventions impact respiratory health are also warranted, as understanding these pathways could lead to targeted strategies for preventing PPCs. Moreover, assessing the cost-effectiveness of implementing psychological interventions on a large scale is crucial, as healthcare systems strive to balance patient outcomes with resource allocation.⁸

PPCs represent a significant challenge in postoperative care, contributing to increased morbidity, prolonged recovery, and elevated healthcare costs. Preoperative psychological interventions offer a promising approach to mitigating these risks by addressing the mental and emotional aspects of surgical readiness. By reducing anxiety, enhancing coping skills, and encouraging proactive recovery behaviors, psychological interventions have the potential to improve respiratory outcomes and overall postoperative recovery. Expanding the role of psychological preparation in perioperative care may lead to a more comprehensive and patient-centered approach to surgery, ultimately improving the quality of care and patient satisfaction. As research in this field progresses, integrating psychological support as a standard component of preoperative care may become a valuable strategy in reducing the burden of PPCs and enhancing surgical outcomes.

MATERIALS AND METHODS

This study utilized a randomized controlled trial (RCT) design to investigate the effect of a preoperative psychological intervention on postoperative pulmonary complications (PPCs). The study was conducted in a tertiary care hospital over six months, with approval from the hospital's ethical review board. All participants provided informed

consent before participation. A total of 120 adult patients scheduled for major elective abdominal surgery were recruited for the study. Inclusion criteria included patients aged 18-70 years, who were classified as ASA physical status I–III, and who had no history of severe pulmonary disease or mental health disorders that could interfere with participation in the psychological intervention. Exclusion criteria included patients requiring emergency surgery, those unable to comprehend or follow psychological instructions, or those with previous experience of psychological interventions.

The 120 participants were randomly assigned into two groups:

1. **Intervention Group (n=60):** This group received a structured preoperative psychological intervention.
2. **Control Group (n=60):** This group received standard preoperative care without psychological intervention.

Methodology

Randomization was performed using a computer-generated sequence, with participants assigned in a 1:1 ratio to either the intervention or control group. The allocation sequence was concealed from researchers enrolling participants and was accessible only to the study coordinator, ensuring allocation concealment. The psychological intervention aimed to reduce anxiety and enhance coping mechanisms related to surgery. It included three 45-minute sessions conducted by a licensed psychologist. The sessions occurred over the three days prior to surgery and included:

1. **Psychoeducation:** Educating patients about the surgical procedure, typical postoperative experiences, and potential complications.
2. **Breathing and Relaxation Techniques:** Training in diaphragmatic breathing and progressive muscle relaxation to help manage anxiety and support postoperative pulmonary function.
3. **Cognitive-Behavioral Coping Strategies:** Introducing techniques to reframe anxiety-provoking thoughts and promoting positive self-statements.

The control group received standard preoperative information provided by the surgical team, covering the basics of the procedure and postoperative expectations but excluding psychological training.

Outcome Measures

The primary outcome measure was the incidence of postoperative pulmonary complications (PPCs), including pneumonia, atelectasis, and prolonged oxygen requirement (>48 hours post-surgery), assessed within the first 7 days following surgery. PPCs were evaluated using established clinical criteria and confirmed by a blinded respiratory specialist.

Secondary outcome measures included postoperative anxiety levels (measured with the State-Trait Anxiety Inventory [STAI]), length of hospital stay, and respiratory function, assessed by spirometry on postoperative days 1 and 3.

Demographic and baseline clinical characteristics were recorded preoperatively, including age, gender, ASA score, smoking history, and baseline respiratory function. Pulmonary outcomes were assessed daily during the first week post-surgery by a clinical team blinded to group allocation. Anxiety levels were measured at baseline and immediately before surgery.

Statistical Analysis

Data were analyzed using SPSS software 25.0. Continuous variables were compared using t-tests or Mann-Whitney U tests, depending on the data distribution. Categorical variables, such as the incidence of PPCs, were analyzed using chi-square tests. A p-value of <0.05 was considered statistically significant. Logistic regression analysis was conducted to adjust for potential confounders, including age, ASA score, and baseline respiratory function.

RESULTS

Demographic Characteristics (Table 1)

The intervention and control groups were largely comparable in demographic characteristics. The average age of participants was similar, with the intervention group at 45.3 ± 12.4 years and the control group at 46.1 ± 13.1 years. Gender distribution showed slight variations, with 53.33% of the intervention group and 50% of the control group being male. ASA scores, an indicator of physical health status prior to surgery, were fairly distributed across both groups, with 50% of the intervention group and 53.33% of the control group classified as ASA II. Smoking history was similar between groups, with 41.67% of the intervention group and 45% of the control group identified as current or past smokers. BMI also showed minor differences, with averages of 27.5 and 28.1 kg/m² for the intervention and control groups, respectively. In terms of previous surgeries, 16.67% of the intervention group and 20% of the control group had surgical histories, and physical activity levels were relatively evenly spread across high, moderate, and low levels in both groups.

Incidence of Postoperative Pulmonary Complications (Table 2)

Postoperative pulmonary complications were notably less frequent in the intervention group. For instance, only 8.33% of the intervention group developed pneumonia compared to 20% in the control group, yielding a statistically significant p-value of 0.03. Atelectasis was observed in 13.33% of the intervention group versus 25% in the control group (p=0.04). Similarly, prolonged oxygen requirement (>48 hrs) was needed by only 5% of the intervention group, whereas 13.33% of the control group required

it ($p=0.02$). Overall, 26.67% of the intervention group experienced any type of PPC, which was substantially lower than the 46.67% in the control group ($p=0.01$). Other complications, such as pleural effusion and bronchospasm, also had reduced incidences in the intervention group, with p -values of 0.05 and 0.04, respectively.

Postoperative Anxiety Levels (Table 3)

Postoperative anxiety levels were measured using the STAI scores, with results showing that the psychological intervention effectively reduced anxiety. Baseline anxiety levels were similar, with averages of 40.5 ± 5.6 and 41.1 ± 5.3 for the intervention and control groups, respectively ($p=0.52$). However, pre-surgery, the intervention group exhibited a significant reduction in anxiety levels (34.2 ± 6.3) compared to the control group (39.8 ± 5.9), with a p -value of 0.01. Post-surgery measurements also indicated lower anxiety in the intervention group, with scores consistently lower than those of the control group across days 1, 3, 5, and 7 (p -values ranging from 0.01 to 0.03).

Length of Hospital Stay (Table 4)

The intervention group experienced a shorter average length of hospital stay, with a mean of 6.4 ± 1.2 days compared to 8.1 ± 1.5 days in the control group. This reduction in hospital stay duration was statistically significant, with a p -value of 0.02, suggesting that the psychological intervention might contribute to more efficient postoperative recovery.

Respiratory Function (Table 5)

Respiratory function, assessed by spirometry, indicated better outcomes for the intervention group. On postoperative day 1, the intervention group had an average respiratory function of $80\% \pm 5\%$, which was significantly higher than the control group's $75\% \pm 6\%$ ($p=0.04$). This trend continued on days 3, 5, and 7, with the intervention group consistently demonstrating superior respiratory function (p -values ranging from 0.01 to 0.03). By day 7, respiratory function had improved to $89\% \pm 3\%$ in the intervention group, compared to $84\% \pm 4\%$ in the control group.

Table 1: Demographic Characteristics

Characteristic	Intervention Group (n=60)	Control Group (n=60)
Age (years)	45.3 ± 12.4	46.1 ± 13.1
Gender		
Male	32 (53.33%)	30 (50.00%)
Female	28 (46.67%)	30 (50.00%)
ASA Score		
I	20 (33.33%)	18 (30.00%)
II	30 (50.00%)	32 (53.33%)
III	10 (16.67%)	10 (16.67%)
Smoking History		
Yes	25 (41.67%)	27 (45.00%)
No	35 (58.33%)	33 (55.00%)
Baseline Respiratory Function	Good	Good
BMI (kg/m^2)	27.5 ± 4.3	28.1 ± 4.1
Previous Surgeries		
Yes	10 (16.67%)	12 (20.00%)
No	50 (83.33%)	48 (80.00%)
Physical Activity Level		
High		
Moderate	30 (50.00%)	28 (46.67%)
Low	15 (25.00%)	18 (30.00%)

Table 2: Incidence of Postoperative Pulmonary Complications (PPCs)

Complication Type	Intervention Group (n=60)	Control Group (n=60)	p-value
Pneumonia	5 (8.33%)	12 (20.00%)	0.03
Atelectasis	8 (13.33%)	15 (25.00%)	0.04
Prolonged Oxygen Requirement (>48 hrs)	3 (5.00%)	8 (13.33%)	0.02
Any PPC	16 (26.67%)	28 (46.67%)	0.01
Pleural Effusion	4 (6.67%)	10 (16.67%)	0.05
Bronchospasm	2 (3.33%)	5 (8.33%)	0.04

Table 3: Postoperative Anxiety Levels (STAI Scores)

Timepoint	Intervention Group (n=60)	Control Group (n=60)	p-value
Baseline	40.5 ± 5.6	41.1 ± 5.3	0.52
Pre-Surgery	34.2 ± 6.3	39.8 ± 5.9	0.01
Post-Surgery			
Day 1	32.0 ± 5.8	37.5 ± 6.1	0.02
Day 3	30.5 ± 5.2	36.2 ± 5.7	0.01
Day 5	29.1 ± 5.0	35.0 ± 5.4	0.03
Day 7	28.3 ± 4.8	33.8 ± 5.1	0.02

Table 4: Length of Hospital Stay

Group	Mean Length of Stay (days)	Standard Deviation (days)	p-value
Intervention Group	6.4	1.2	0.02
Control Group	8.1	1.5	

Table 5: Respiratory Function (Spirometry Results)

Postoperative Day	Intervention Group (n=60)	Control Group (n=60)	p-value
Day 1	80% ± 5%	75% ± 6%	0.04
Day 3	85% ± 4%	80% ± 5%	0.03
Day 5	87% ± 3%	82% ± 4%	0.02
Day 7	89% ± 3%	84% ± 4%	0.01

DISCUSSION

This study provides evidence supporting the benefits of preoperative psychological intervention in reducing postoperative pulmonary complications (PPCs), alleviating postoperative anxiety, decreasing length of hospital stay, and improving respiratory function following surgery. Each result aligns with or extends findings in recent literature, underscoring the role of psychological preparation as an adjunct to medical and surgical care.

The demographic characteristics were well-matched between the intervention and control groups, which strengthens the internal validity of the study. Both groups had comparable age, gender distribution, ASA scores, and smoking history. These characteristics are significant because older age, higher ASA scores, and smoking history are known risk factors for PPCs and prolonged recovery (Myles et al., 2017; Lugg et al., 2016).^{9,10} BMI and physical activity levels were also similar, which is relevant as higher BMI and lower activity levels are associated with an increased risk of PPCs (Canet et al., 2017). By maintaining balance in these characteristics, this study controlled for potential confounders, ensuring that differences in outcomes are more likely due to the intervention.¹¹

The incidence of PPCs was significantly lower in the intervention group compared to the control group, with notable reductions in pneumonia (8.33% vs. 20%) and atelectasis (13.33% vs. 25%). Cuthbert et al. (2018) reported similar results, showing that preoperative counseling reduced respiratory complications by 15%, highlighting how psychological support can improve outcomes by helping patients manage stress and adopt respiratory exercises more effectively.¹² This study's results reinforce the role of psychological interventions in reducing PPCs, possibly by lowering preoperative

anxiety, which is linked to a weakened immune response and increased risk of complications (Lee et al., 2019).¹³ Furthermore, the reduced need for prolonged oxygen requirements in the intervention group (5% vs. 13.33%) aligns with findings from Barnason et al. (2017), who demonstrated that relaxation techniques could enhance oxygenation and prevent hypoxemia in surgical patients. Barnason et al. observed a 10% improvement in oxygenation among patients receiving relaxation training.¹⁴

The significant reduction in anxiety levels among the intervention group, starting pre-surgery and continuing post-surgery, mirrors findings by Haller et al. (2018), who showed that structured psychological support before surgery could reduce patient anxiety by approximately 20% and improve the overall recovery experience.¹⁵ Lower anxiety scores in the intervention group across all postoperative days suggest that psychological preparation benefits patients preoperatively and helps manage anxiety during recovery. This finding is particularly relevant as reduced anxiety is associated with lower cortisol levels and less sympathetic activation, both of which promote wound healing and reduce PPCs (Doering et al., 2016). The substantial reduction in STAI scores in the intervention group thus indicates that psychological support may contribute to a more stable and less stressful recovery phase.¹⁶

The intervention group's reduced length of hospital stay (6.4 vs. 8.1 days) is consistent with the findings of similar studies. Vlisides et al. (2020) reported that preoperative anxiety reduction programs decreased hospital stay by 1.5 days on average, improving patients' preparedness for postoperative pain and mobility challenges.¹⁷ The reduction in hospital stay in this study highlights the economic benefit of psychological interventions, potentially reducing

healthcare costs and resource utilization (Edwards et al., 2019). Edwards et al. found that shorter hospital stays could reduce healthcare costs by 15%, with fewer days reducing the risk of hospital-acquired infections and other inpatient complications, emphasizing the importance of integrating psychological support in preoperative care.¹⁸

Improved respiratory function in the intervention group, as indicated by spirometry measurements on postoperative days 1, 3, 5, and 7, suggests that psychological intervention might positively impact respiratory muscle performance. A similar trend was observed by Hulsbosch et al. (2019), who found that respiratory function could be significantly enhanced, with an improvement rate of 12%, through preoperative breathing exercises and anxiety management, which prepared patients for effective breathing post-surgery.¹⁹ This study's results align with these findings, as the intervention group demonstrated significantly higher respiratory function percentages than the control group throughout the postoperative period. Improved respiratory outcomes may be due to the intervention's focus on breathing techniques and relaxation, which can mitigate postoperative atelectasis and enhance lung expansion (Tedesco et al., 2020). Tedesco et al. also showed a reduction in atelectasis by 10% when patients received respiratory-focused psychological interventions preoperatively.²⁰

CONCLUSION

In conclusion, this study demonstrates that preoperative psychological interventions can significantly reduce postoperative pulmonary complications, lower anxiety levels, shorten hospital stays, and enhance respiratory function in patients undergoing major surgery. The findings highlight the importance of addressing psychological readiness as part of comprehensive perioperative care, suggesting that psychological support may improve surgical outcomes by mitigating stress-related physiological responses and promoting adherence to postoperative recovery practices. Integrating structured psychological preparation into standard preoperative protocols could provide a valuable strategy for reducing PPCs and improving overall patient recovery and satisfaction.

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