

Executive Summary: Pulmonary Prehabilitation

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Main Points

- Pulmonary prehabilitation protocol utilizing aerobic physical activity, incentive spirometry, smoking cessation, and bronchodilator therapy implemented for thoracic lobectomy patients
- Seventeen patients were recruited with an attrition rate of 65%
- Significant improvement in lung function observed, evidenced by increased incentive spirometry volumes
- No statistically significant effect on exertional dyspnea (BORG dyspnea scale) was observed
- Several limitations were noted, including small sample size, logistical challenges, data collection difficulties, and inconsistent protocol duration.
- Recommendations for future investigation with larger sample sizes and standardized protocols

Background and Purpose

Lung cancer leads to the highest number of cancer-related deaths in the United States (Centers for Disease Control and Prevention, 2022). Surgical resection is the most effective treatment for localized lung cancer. However, it is associated with risks of compromised pulmonary function and postoperative pulmonary complications (PPCs), which may lead to adverse outcomes and increased healthcare costs (Liu et al., 2023; Zhou et al., 2020). The incidence of PPCs after surgical resection for non-small cell lung carcinoma ranges from 6% to 30% and 10% to 50% after lobectomy (Motono et al., 2021). This quality improvement project

aimed to develop, implement, and refine a prehabilitation protocol to enhance preoperative cardiopulmonary readiness for patients scheduled for elective thoracoscopic lobectomy at a rural teaching hospital. This project aligns with the Healthy People 2030 initiative and the Quadruple Aim, which seeks to enhance patient outcomes, reduce healthcare costs, and improve the work life of healthcare providers.

Methodology

This project utilized the Plan-Do-Study-Act (PDSA) methodology to develop and refine the prehabilitation protocol. It spanned four semesters, from May 2023 to July 2024, and included idea conception, literature review, implementation, data analysis, and dissemination of findings. The setting was a thoracic and foregut surgery clinic affiliated with a rural North Carolina university and teaching hospital. Seventeen patients scheduled for thoracoscopic lobectomy were recruited during their initial consultation.

The prehabilitation protocol included incentive spirometry (IS), aerobic physical activity, smoking cessation, and bronchodilator therapy. Data collection included pre- and post-protocol assessments of exertional dyspnea using the BORG scale and IS volumes. Due to logistical challenges, post-protocol assessments were conducted via telephone. Due to the paired nature of the data, the Wilcoxon signed-rank test was used to compare pre- and post-protocol measurements of BORG scale scores and IS volumes.

Results

Of the 17 recruited patients, 6 provided post-protocol data, resulting in a 65% attrition rate. The average age of participants was 69.8 years, with 14 out of 17 having a history of smoking or being current smokers.

The Wilcoxon signed-rank test revealed:

1. No significant difference in BORG scale scores pre- and post-protocol ($p = 0.257$)
2. Significant improvement in IS volumes post-protocol ($p = 0.028$)

These findings suggest that while the prehabilitation protocol effectively improved lung function, it may not sufficiently impact perceived exertional dyspnea.

Strengths and Limitations

The project's strengths include its prospective design, focus on subjective and objective measures, application of PDSA methodology for systematic protocol refinement, and integration of a tailored prehabilitation program for the targeted patient population. The Wilcoxon signed-rank test provided a robust analysis suitable for the small sample size and non-normally distributed data.

Limitations included the small sample size, incomplete post-protocol data from some participants, challenges in standardizing prehabilitation duration due to varying surgical schedules, and difficulties obtaining in-person follow-up data. The switch to telephone-based post-protocol assessments may have affected the accuracy of data collection. These limitations impacted the ability to draw definitive conclusions and highlight the need for further research.

Implications and Conclusion

The significant improvement in IS volumes suggests that the prehabilitation protocol can potentially enhance preoperative pulmonary readiness, contributing to better surgical outcomes and reduced healthcare costs. This improvement aligns with existing literature emphasizing the advantages of preoperative exercise and respiratory training on postoperative outcomes (Assouline et al., 2021; Rosero et al., 2019). However, the lack of significant change in

exertional dyspnea scores indicates that further protocol refinement may be necessary to address this aspect of patient preparation.

Future research should focus on increasing sample sizes, standardizing prehabilitation duration, and improving methods for post-protocol data collection. Long-term studies are needed to evaluate the sustained benefits of prehabilitation on patient outcomes, healthcare costs, and overall quality of life. Additionally, exploring the applicability of such programs across different surgical disciplines could provide valuable insights for broader implementation in healthcare settings.

In summary, this quality improvement project showcases the promise of implementing a comprehensive prehabilitation protocol to enhance lung function in patients undergoing thoroscopic lobectomy. Although obstacles persist, these results lay the groundwork for future studies and fine-tuning preoperative strategies in thoracic surgery and beyond, ultimately furthering the objectives of improving healthcare quality, patient satisfaction, and cost-effectiveness.

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