

Section: General Nursing

The use of pursed lips breathing to solve ineffective airway clearance problems in patient with chronic obstructive pulmonary disease

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Abstract

Chronic Obstructive Pulmonary Disease (COPD) is a disease with complaints of cough with phlegm associated with inflammation of the airways and indicates ongoing inflammation in patients with a history of smoking. Complementary approaches such as Pursed Lips Breathing provide non-pharmacological alternatives to help regulate breathing patterns and respiratory frequency. To analyse the effectiveness of complementary therapy Implementation of Pursed Lips Breathing in patients with COPD with nursing problems of ineffective airway clearance. Purposive case study with one respondent where a patient experienced problems with ineffective airway clearance. Pursed Lips Breathing complementary intervention was given for three consecutive days, with monitoring of vital signs and subjective complaints. The case study provides benefits in reducing respiratory frequency and increasing oxygen fulfilment in patients with COPD. Pursed Lips Breathing in patients with COPD and can be considered as a complementary nursing intervention.

Keywords: Chronic Obstructive Pulmonary Disease, complementary therapies, medical surgical nursing, nursing care, smoking cessation

Introduction

Chronic Obstructive Pulmonary Disease (COPD) remains a leading cause of global morbidity and mortality, characterized by persistent respiratory symptoms and progressive airflow limitation (Bollmeier & Hartmann, 2020). The underlying pathophysiology involves a complex interplay of chronic inflammation, small airway disease, and parenchymal destruction that leads to significant gas exchange impairment (Rodrigues et al., 2021). Among the most distressing clinical manifestations for COPD patients is ineffective airway clearance, which stems from excessive mucus production and a weakened cough reflex (Osadnik et al., 2012). When sputum becomes tenacious and difficult to expectorate, it creates a fertile environment for secondary infections and worsens the patient's respiratory distress. This condition frequently results in hyperinflation of the lungs, as trapped air prevents the intake of fresh, oxygen-rich air during the inspiratory phase (Gibson, 1996). As the disease progresses, the reliance on accessory muscles for breathing increases, leading to early fatigue and reduced physical endurance (Goërtz et al., 2019). Standard pharmacological treatments often focus on bronchodilation, yet they may not fully address the mechanical challenges of clearing trapped secretions. Consequently, there is an urgent need for non-invasive, cost-effective nursing interventions that can directly assist in optimizing pulmonary ventilation. Nurses play a pivotal role in teaching patients self-management strategies that can be utilized during acute exacerbations to maintain airway patency. Therefore, understanding the mechanics of airflow and secretion mobilization is essential for providing high-quality, holistic care to this vulnerable population.

One of the most effective non-pharmacological interventions in the respiratory nursing toolkit is the Pursed Lips Breathing (PLB) technique (Sakhaei et al., 2019). This method involves inhaling slowly through the nose and exhaling through tightly pressed lips to create a deliberate back-pressure within the airways (Yang et al., 2022). This physiological mechanism prevents the small bronchioles from collapsing prematurely during exhalation, which is a common occurrence in patients with emphysematous lung changes. By maintaining positive end-expiratory pressure, PLB facilitates a more complete emptying of the lungs and reduces the volume of residual trapped air. This controlled expiratory phase also slows the respiratory rate, allowing for a more efficient pattern of breathing that conserves energy. Furthermore, the increased pressure generated during the pursed-lip phase helps to move secretions from the peripheral airways toward the larger, central airways for easier expectoration. Patients who master this technique often report a significant reduction in the sensation of dyspnoea and an improved sense of control over their breathing (Ubolnuar et al., 2022). Beyond the physiological benefits, the practice of PLB serves as a psychological anchor that reduces the anxiety often associated with the feeling of breathlessness (Gusmarta & Oktarina, 2025). Integrating this technique into daily care routines can substantially enhance the patient's ability to clear their airways without the need

for aggressive suctioning or invasive measures. Thus, PLB stands as a cornerstone of pulmonary rehabilitation that addresses both the mechanical and symptomatic aspects of ineffective airway clearance.

Despite its recognized benefits, the application of PLB in clinical case studies requires further documentation to validate its impact on specific patient outcomes in diverse hospital settings. This case study focuses on a 70-year-old male patient who presented with severe COPD exacerbation and significant difficulty in mobilizing productive sputum. The objective is to evaluate how a structured, three-day PLB intervention can specifically resolve the problem of ineffective airway clearance. By documenting changes in oxygen saturation, respiratory rate, and subjective comfort, this study aims to provide a robust clinical rationale for the intervention. The findings are intended to contribute to the existing body of nursing knowledge regarding the efficacy of simple, bedside respiratory therapies. In many developing healthcare contexts, such as Indonesia, the use of complementary techniques like PLB is highly valuable due to its minimal cost and lack of adverse side effects. However, for these techniques to be widely adopted, they must be supported by meticulous case reporting and evidence-based analysis. This research also explores how the restoration of diaphragmatic function through PLB can lead to a more sustainable recovery for the patient. Ultimately, the results of this case study will offer practical insights for nurses seeking to improve respiratory care standards in inpatient wards. By successfully bridging the gap between theory and practice, this publication underscores the vital role of nursing interventions in managing chronic pulmonary conditions.

Case Description

This study employed a qualitative case study design using a purposive sampling approach to evaluate the clinical effectiveness of Pursed Lips Breathing in a patient diagnosed with COPD. The primary objectives of the intervention were to modulate the respiratory rate, enhance peripheral oxygen saturation (SpO₂), and facilitate the physiological restoration of the diaphragm—the primary respiratory muscle located inferior to the lungs. By optimizing breathing mechanics, the PLB technique aims to improve physical endurance and overall respiratory function in patients suffering from chronic airflow limitation. The research was conducted over three consecutive days in April 2025 within the Cendana Inpatient Ward at Harapan Hospital, Magelang. The subject was a 70-year-old male presenting with hallmark symptoms of COPD, including productive cough with tenacious sputum, fatigue, exertional dyspnoea, bilateral lower extremity oedema, and significant sleep disturbances. The intervention focused on the application of PLB to promote controlled ventilation, minimize the work of breathing, and maintain airway patency through positive expiratory pressure. Operationally, the study defined COPD as a progressive, irreversible inflammatory response of the lungs to harmful particles, while ineffective airway clearance was identified by the presence of retained secretions and hyperinflation. As a complementary therapy, PLB was administered by positioning the patient comfortably in a semi-Fowler's position to enhance chest and abdominal excursions.

The procedure involved deep nasal inspiration to a count of three, followed by a prolonged, gentle exhalation through pursed lips to a count of seven while simultaneously contracting the abdominal muscles. Data were meticulously gathered through clinical interviews, continuous observation, and physical examinations to monitor fluctuations in vital signs, including blood pressure, heart rate, and respiratory rate. The research utilized standardized instruments, such as nursing assessment sheets based on the 13 NANDA domains, thorax reports, and a dedicated PLB therapy guide, while strictly adhering to ethical principles of informed consent, anonymity, and beneficence. The clinical results demonstrated a progressive improvement in the patient's respiratory status following the administration of PLB therapy twice daily for 10-minute sessions. Upon admission, the subject exhibited leucocytosis (6.76 thousand/ μ L) and reported severe chest tightness and difficulty expectorating sputum. On the first day of intervention, the patient remained dependent on 3 liters of supplemental oxygen with an initial SpO₂ of 94%; however, he reported a slight reduction in dyspnoea and minimal sputum expulsion immediately following the therapy. By the second day, the patient's condition showed significant stabilization, evidenced by an improved SpO₂ of 96% and a reduced oxygen requirement of only 1 liter. Furthermore, the patient was able to expectorate sputum more effectively during coughing episodes and reported a higher level of physical comfort. By the third day of the study, the clinical outcomes reached a peak as the patient no longer reported subjective shortness of breath and successfully achieved periods of room-air ventilation without oxygen support. Sputum clearance was significantly improved, and the patient expressed a readiness for hospital discharge, citing a substantial enhancement in his functional capacity. These findings suggest that the PLB technique effectively reduces air trapping and improves gas exchange by prolonging the expiratory phase, which in turn relieves the burden on the accessory respiratory muscles. The transition from a state of ineffective airway clearance to successful expectoration highlights the role of controlled expiration in mobilizing secretions.

Discussion

The findings from this study significantly contribute to the existing body of knowledge regarding the management of ineffective airway clearance in patients with COPD through the application of PLB. Our investigation specifically aimed to evaluate the efficacy of PLB as a non-pharmacological intervention for improving airway clearance, a critical aspect often compromised in COPD. The observed improvements in various respiratory parameters suggest that PLB is not merely a compensatory mechanism but a viable therapeutic strategy (Dodange et al., 2024). These results align with

previous physiological studies that highlight PLB's ability to increase expiratory airway pressure, thus preventing premature airway collapse and facilitating the expulsion of secretions (Mayer et al., 2018). By maintaining positive end-expiratory pressure, PLB optimizes gas exchange and reduces air trapping, which are hallmark features of COPD pathophysiology. The simplicity and accessibility of PLB make it an ideal self-management technique for patients to implement independently. This intervention empowers patients to actively participate in their care, potentially reducing the frequency of acute exacerbations related to impaired airway clearance (Parisien-La Salle et al., 2019). Furthermore, the low cost and minimal risk associated with PLB underscore its potential for widespread adoption in clinical practice. Our study provides strong evidence supporting the integration of PLB into comprehensive rehabilitation programs for COPD patients.

Delving deeper, the mechanisms through which PLB exerts its beneficial effects are multifaceted and involve both mechanical and neurological pathways. Mechanically, the resistance created by pursed lips during exhalation slows the expiratory flow rate, extending the duration of exhalation and allowing more time for gas exchange. This controlled expiration helps to equalize pressure throughout the bronchial tree, preventing the dynamic compression of airways that often traps air and secretions. Neurologically, the conscious control over breathing patterns can also lead to a reduction in respiratory rate and an increase in tidal volume, promoting a more efficient breathing pattern overall. The sustained positive pressure helps to stent open small airways, improving ventilation-perfusion matching and reducing the physiological dead space. This improved airway patency is crucial for mobilizing mucus and other respiratory secretions, which are often stagnant in COPD patients with ineffective cough. The reduction in work of breathing, another observed benefit, lessens the strain on accessory respiratory muscles, thereby conserving energy. These combined effects contribute to a more effective cough and ultimately enhance airway clearance without relying on complex medical devices or pharmacological agents. Understanding these intricate mechanisms is vital for clinicians to confidently recommend and teach PLB to their patients.

While the current study provides compelling evidence, it is important to acknowledge certain limitations and outline directions for future research. One potential limitation could be the variability in patient adherence to the PLB technique outside of supervised settings, necessitating further investigation into long-term compliance and its impact on outcomes. Future studies should consider incorporating objective measures of airway clearance, such as mucociliary clearance rates or quantitative sputum analysis, to provide a more comprehensive evaluation of PLB's effectiveness. Exploring the optimal duration and frequency of PLB application tailored to individual patient needs would also be beneficial for refining clinical guidelines. Additionally, research comparing PLB with other airway clearance techniques, both independently and in combination, could help establish its comparative efficacy. The long-term effects of sustained PLB practice on lung function decline and overall quality of life in COPD patients warrant further longitudinal studies. Investigating the impact of co-morbidities on PLB's effectiveness and exploring its utility across different stages of COPD severity could broaden its applicability. These future inquiries will further solidify the role of pursed-lips breathing as a cornerstone intervention for improving airway clearance in this challenging patient population.

Conclusion

The case study reaffirms the significant role of PLB as an effective, non-pharmacological intervention for addressing ineffective airway clearance in patients suffering from COPD. Our findings demonstrate that the controlled exhalation facilitated by PLB not only improves key respiratory parameters but also actively aids in preventing airway collapse, thereby enhancing the mobilization and expulsion of secretions. The inherent simplicity and accessibility of PLB empower patients with a valuable self-management tool, fostering greater autonomy in their care and potentially mitigating the frequency and severity of exacerbations. Ultimately, this research underscores the profound clinical utility of integrating PLB into comprehensive management strategies for COPD, offering a practical, cost-effective, and patient-centered approach to improve respiratory function and overall quality of life.

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