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THE APPLICATION OF PURSED-LIP BREATHING TO INCREASE TIDAL VOLUME IN PATIENTS WITH PLEURAL EFFUSION IN THE HIGH CARE UNIT (HCU)

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ABSTRACT
Pleural effusion is characterized by fluid accumulation in the pleural cavity, resulting in reduced lung expansion, decreased tidal volume, increased work of breathing, and impaired gas exchange. This condition requires evidence-based nursing interventions to optimize pulmonary ventilation. Pursed-Lip Breathing (PLB) is a non-pharmacological breathing exercise that generates positive end-expiratory pressure, helping maintain airway patency and improve ventilation. To describe the implementation of PLB in improving tidal volume among patients with pleural effusion in the High Care Unit (HCU). A descriptive case study involved two patients with pleural effusion secondary to metastatic breast carcinoma and bilateral pleural effusion associated with stage V Chronic Kidney Disease, Hypertensive Heart Disease, and severe anemia. Data were collected through interviews, observation, physical examination, and medical and nursing record review. Tidal volume was measured using spirometry, while respiratory rate, oxygen saturation, accessory muscle use, and dyspnea were assessed before and after the intervention. PLB was administered twice daily for three consecutive days, with each session lasting 5–10 minutes. Data were analyzed descriptively by comparing patients' conditions before and after the intervention. Mrs. Y's tidal volume increased from 340 mL to 430 mL, while Mrs. M's increased from 360 mL to 470 mL. Both patients demonstrated improved oxygen saturation, reduced respiratory rate, decreased accessory muscle use, reduced dyspnea, and greater breathing comfort. PLB improved tidal volume and respiratory status in patients with pleural effusion and may serve as a supportive nursing intervention to optimize pulmonary ventilation.

Keywords: high care unit; pleural effusion; pursed lips breathing; respiratory status; tidal volume

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INTRODUCTION

Pleural effusion remains one of the respiratory problems commonly encountered in many countries. Globally, pleural effusion is estimated to affect approximately 1.5 million patients annually in the United States and approximately 200,000–250,000 cases annually in the United Kingdom, making it one of the most frequently encountered pleural conditions, as it is generally a manifestation or complication of various underlying diseases (Light, 2022). In Indonesia, the national incidence of pleural effusion has not been systematically documented. However, the high prevalence of tuberculosis, heart failure, pneumonia, and malignancy contributes to the frequent occurrence of pleural effusion in referral healthcare facilities, making it one of the causes of respiratory impairment requiring comprehensive management (Aini & Noveyani, 2023).

Based on morbidity data from Fatmawati General Hospital, Jakarta, 125 patient visits with an ICD-10 diagnosis of J91 (Pleural Effusion in Conditions Classified Elsewhere) were recorded between May 1, 2025, and May 26, 2026. Some patients with unstable respiratory conditions require treatment in the High Care Unit (HCU) for close monitoring of respiratory and hemodynamic status, as well as therapies aimed at improving ventilation and oxygenation. Pleural effusion occurs as a result of excessive fluid accumulation within the pleural cavity, which increases intrapleural pressure and compresses the lung tissue. This condition restricts lung expansion during inspiration, decreases lung compliance, and reduces tidal volume. A reduction in tidal volume results in

suboptimal alveolar ventilation, impaired gas exchange, and symptoms such as dyspnea and increased work of breathing (West & Luks, 2021). Therefore, evidence-based nursing interventions are needed to promote lung expansion and improve ventilation.

One nonpharmacological intervention that may be applied is Pursed-Lip Breathing (PLB). This technique helps prolong the expiratory phase, maintain airway patency, and improve alveolar ventilation, thereby potentially increasing tidal volume and improving respiratory function in patients with pleural effusion (Clini et al., 2017). A study by Srisuk et al. (2022) demonstrated that PLB significantly increased tidal volume and improved ventilation compared with normal breathing. Similarly, Miki et al. (2025), in a study involving patients with interstitial lung disease, reported an increase in tidal volume accompanied by a reduction in respiratory rate. Although PLB has been recommended for various respiratory disorders, scientific evidence regarding its effectiveness in patients with pleural effusion remains limited. Most previous studies have focused on patients with chronic obstructive pulmonary disease (COPD), with outcomes primarily related to dyspnea and oxygen saturation. Studies evaluating the effect of PLB on tidal volume among patients with pleural effusion in the HCU setting remain scarce. Based on this gap in the available evidence, this study aimed to implement PLB as a nursing intervention to increase tidal volume in patients with pleural effusion in the HCU.

METHOD

This study employed a descriptive method using a case study approach to describe the implementation of Pursed-Lip Breathing (PLB) for improving tidal volume in patients with pleural effusion admitted to the High Care Unit (HCU). The study was conducted in the HCU of Fatmawati General Hospital, Jakarta, from July 10 to July 12, 2026, involving two patients with pleural effusion who exhibited signs and symptoms of ineffective breathing patterns and reduced tidal volume. Participants were selected based on predetermined inclusion and exclusion criteria. Data were collected through interviews, direct observation, physical examination, and documentation review. Interviews were conducted to obtain information regarding patients' chief complaints, medical history, and responses to the intervention. Observations and physical examinations were performed to assess breathing patterns, respiratory rate, dyspnea, use of accessory respiratory muscles, and other respiratory conditions. Supporting clinical information was obtained from medical and nursing records. The instruments included a nursing assessment form, respiratory observation sheets, a PLB Standard Operating Procedure (SOP), spirometry to measure tidal volume, and a pulse oximeter to monitor oxygen saturation.

PLB was administered in combination with the semi-Fowler's position twice daily, in the morning and afternoon, for three consecutive days, with each session lasting 5–10 minutes according to patient tolerance. Patients were instructed to inhale slowly through the nose for two counts and exhale through pursed lips for four counts. Tidal volume was measured using spirometry before and after each intervention session. Data were analyzed descriptively by comparing each patient's condition before and after the intervention throughout the three-day period. Changes in tidal volume, respiratory rate, oxygen saturation, use of accessory respiratory muscles, and complaints of dyspnea were examined to evaluate patients' responses to PLB. The findings were presented in narrative and tabular forms to describe changes in respiratory status following the intervention.

RESULT

This study was conducted involving two patients with pleural effusion who were admitted to the High Care Unit (HCU) of Fatmawati General Hospital, Jakarta. The characteristics of the two patients are presented in Table 1.

Table 1.
Patient Characteristics

Variable	Mrs. Y	Mrs. M
Age	51 years	52 years
Sex	Female	Female
Medical diagnosis	Breast carcinoma with left-sided pleural effusion secondary to metastasis	Stage V Chronic Kidney Disease (CKD), Hypertensive Heart Disease (HHD), severe anemia, and bilateral pleural effusion
Comorbidities	Breast cancer	Hypertension and chronic kidney disease
Oxygen therapy	Nasal cannula, 5 L/min	Nasal cannula, 5 L/min
Baseline oxygen saturation	97%	96%
Baseline respiratory rate	30 breaths/min	27 breaths/min
Baseline tidal volume	340 mL	360 mL

As shown in Table 1, both patients were middle-aged women, aged 51 and 52 years. Mrs. Y had left-sided pleural effusion secondary to metastatic breast carcinoma, whereas Mrs. M had bilateral pleural effusion associated with stage V chronic kidney disease and hypertensive heart disease. Both patients received oxygen therapy via a nasal cannula at 5 L/min and had oxygen saturation levels ranging from 96% to 97%. However, both patients continued to exhibit tachypnea and tidal volumes below the expected normal range.

Table 2.
Signs and Symptoms of Ineffective Breathing Pattern Before the Intervention

No.	Signs and Symptoms	Mrs. Y	Mrs. M
1	Dyspnea	Yes	Yes
2	Tachypnea (RR >20 breaths/min)	Yes (30 breaths/min)	Yes (27 breaths/min)
3	Use of accessory respiratory muscles	Yes (++)	Yes (++)
4	Rapid and shallow breathing pattern	Yes	Yes
5	Decreased chest expansion	Yes (left side)	Yes (bilateral)
6	Dullness on percussion	Yes (left lower lung field)	Yes (bilateral basal areas)
7	Decreased breath sounds	Yes (left lower lung field)	Yes (bilateral basal areas)

Based on the initial assessment presented in Table 2, both patients demonstrated signs and symptoms of an ineffective breathing pattern, including dyspnea, tachypnea, use of accessory respiratory muscles, rapid and shallow breathing, decreased chest expansion, and diminished breath sounds. These findings were consistent with the nursing diagnosis of Ineffective Breathing Pattern (D.0005) according to the Indonesian Nursing Diagnosis Standards (*Standar Diagnosis Keperawatan Indonesia* [SDKI]).

The PLB intervention was administered to both patients for three consecutive days, twice daily (morning and afternoon), with each session lasting 5–10 minutes. Tidal volume was measured using spirometry before and after each exercise session. Changes in tidal volume are presented in table 3.

Table 3.
Changes in Tidal Volume Before and After the PLB Intervention

Day/Session	Mrs. Y (mL)	Mrs. M (mL)
Day 1 – Baseline	340	360
Day 1 – After intervention (morning)	355	378
Day 1 – After intervention (afternoon)	370	395
Day 2 – Before intervention (morning)	370	395
Day 2 – After intervention (morning)	388	415
Day 2 – After intervention (afternoon)	402	432
Day 3 – Before intervention (morning)	402	432
Day 3 – After intervention (morning)	418	452
Day 3 – After intervention (afternoon)	430	470
Total increase	+90 mL	+110 mL

As presented in table 3, tidal volume increased progressively in both patients. Mrs. Y demonstrated an increase in tidal volume from 340 mL at baseline to 430 mL at the end of the intervention, representing a total increase of 90 mL. Similarly, Mrs. M demonstrated an increase from 360 mL to 470 mL, representing a total increase of 110 mL. Improvements in tidal volume were observed from

the first intervention session and continued progressively throughout the three-day intervention period.

In addition to improvements in tidal volume, other respiratory parameters also improved, including a reduction in respiratory rate, an increase in oxygen saturation, decreased use of accessory respiratory muscles, and reduced complaints of dyspnea. A summary of changes in respiratory status is presented in table 4.

Table 4.
Changes in Respiratory Status During the Intervention

Parameter	Mrs. Y (Baseline → Final)	Mrs. M (Baseline → Final)
Respiratory rate	30 → 24 breaths/min	27 → 22 breaths/min
Oxygen saturation	97% → 98%	96% → 99%
Use of accessory respiratory muscles	Marked (++) → Minimal (±)	Marked (++) → Minimal (±)
Dyspnea	Severe → Mild	Severe → Mild

Following three days of PLB intervention, both patients demonstrated improvements in respiratory status. Respiratory rates decreased toward the normal range, oxygen saturation increased, the use of accessory respiratory muscles decreased, and complaints of dyspnea improved from severe to mild. Both patients also reported increased comfort during breathing.

DISCUSSION

Characteristics of Patients with Pleural Effusion

The findings showed that both patients were middle-aged women, aged 51 and 52 years. Age above 50 years is an important factor influencing the physiological condition of the respiratory system. The aging process is associated with decreased lung compliance, weakened respiratory muscles, and reduced cough reflexes (Lewis et al., 2023). These degenerative changes may increase an individual's susceptibility to respiratory impairment when fluid accumulates in the pleural cavity. This finding is consistent with critical care principles suggesting that patients aged over 50 years who require HCU care may need closer monitoring because their ability to adapt to hypoxia may be more limited (Urden et al., 2021).

The fact that both patients were female was also closely related to the underlying conditions contributing to the development of pleural effusion. In Mrs. Y, pleural effusion occurred secondary to metastatic breast cancer, a malignancy with a high epidemiological prevalence among women. In Mrs. M, pleural effusion occurred as a manifestation of systemic fluid overload associated with chronic kidney disease. Light (2022) reported that women may more frequently experience pleural effusions associated with malignancies of the reproductive organs and autoimmune diseases, whereas pleural effusions in men may be more commonly associated with risk factors such as smoking and tuberculosis.

Based on their medical diagnoses and comorbid conditions, both patients demonstrated considerable clinical complexity requiring management in the HCU. Mrs. Y had an exudative pleural effusion associated with malignant tumor cell infiltration, which may increase pleural capillary permeability. In contrast, Mrs. M was considered to have a transudative pleural effusion associated with systemic fluid overload, increased hydrostatic pressure, and impaired cardiovascular function (Light, 2022). The presence of comorbidities, including chronic kidney disease and hypertension, further complicates fluid management and oxygenation therapy.

Analysis of the Implementation of Pursed-Lip Breathing on Tidal Volume Improvement

The implementation of Pursed-Lip Breathing (PLB) in combination with the semi-Fowler's position for three consecutive days was associated with improved pulmonary ventilation in both patients. Spirometry measurements showed that Mrs. Y's tidal volume increased from 340 mL to 430 mL, while Mrs. M's tidal volume increased from 360 mL to 470 mL. In addition, both patients

demonstrated a reduction in respiratory rate, decreased use of accessory respiratory muscles, a more regular breathing pattern, and reduced complaints of dyspnea.

The increase in tidal volume indicates that a greater volume of air entered the lungs during each respiratory cycle, resulting in more effective alveolar ventilation. According to Hall and Hall (2020), tidal volume is one of the primary indicators of effective pulmonary ventilation. West and Luks (2021) stated that improvements in alveolar ventilation are more strongly influenced by increases in tidal volume than by increases in respiratory rate. Therefore, the increase in tidal volume observed in both patients may indicate an improvement in their ability to achieve effective lung expansion.

These improvements may be explained by the physiological mechanisms of PLB. This technique prolongs the expiratory phase through exhalation against pursed lips, creating a mild positive expiratory pressure that may help prevent premature collapse of small airways, reduce air trapping, facilitate alveolar emptying, and improve the efficiency of subsequent inspiration (Clini et al., 2017). Reduced air trapping may facilitate more effective diaphragmatic function, allowing greater lung expansion and contributing to an increase in tidal volume (Garrod & Mathieson, 2012). These findings are consistent with previous studies by Windartik and So'emah (2022) and Sharma (2024), which reported that PLB may improve alveolar ventilation and reduce the work of breathing.

Evaluation of the Nursing Problem of Ineffective Breathing Pattern

The observed increase in tidal volume indicates an improvement in the nursing problem of Ineffective Breathing Pattern. According to the Indonesian Nursing Diagnosis Standards (*Standar Diagnosis Keperawatan Indonesia* [SDKI]) (Tim Pokja SDKI DPP PPNI, 2021), an ineffective breathing pattern is a condition in which inspiration and/or expiration does not provide adequate ventilation and may be characterized by alterations in respiratory rate and depth, use of accessory respiratory muscles, dyspnea, and decreased ventilation. These manifestations were consistent with the initial clinical conditions observed in both patients.

In patients with pleural effusion, fluid accumulation within the pleural cavity increases intrapleural pressure, compresses lung tissue, decreases lung compliance, and reduces tidal volume (Light, 2022). The body may compensate by increasing respiratory rate; however, this compensatory mechanism may be ineffective when tidal volume remains low (West & Luks, 2021). Following the PLB intervention, the observed increase in tidal volume suggested improved alveolar ventilation, potentially contributing to more effective oxygenation and carbon dioxide elimination.

The clinical improvements observed in both patients, including a reduced respiratory rate, decreased use of accessory respiratory muscles, and reduced dyspnea, further support the potential benefit of PLB in addressing an ineffective breathing pattern. Lewis et al. (2023) emphasized that the effectiveness of interventions aimed at improving ventilation should not be evaluated solely based on subjective symptoms but also through objective physiological parameters, including tidal volume. Therefore, the increase in tidal volume measured using spirometry provides objective evidence supporting the improvement in respiratory function following the nursing intervention.

Study Limitations

This study has several limitations. First, the number of subjects was limited to two patients, meaning the results cannot be generalized. Second, the short duration of the intervention (3 days) did not allow for the assessment of the long-term effects of PLB. Third, spirometry measurements rely heavily on the patient's ability to follow instructions, and psychological factors such as anxiety and fatigue can influence the results. Fourth, the study did not control for concurrent medical therapies; therefore, the increase in tidal volume might also have been influenced by other interventions. Nevertheless, this study provides preliminary evidence supporting the use of PLB as an independent nursing intervention for patients with pleural effusion in the HCU. Further research

with a more robust design, a larger sample size, and a longer duration is needed to substantiate these findings.

CONCLUSION

Based on the implementation of Pursed-Lip Breathing (PLB) to improve tidal volume in patients with pleural effusion in the High Care Unit (HCU), this case study demonstrated improvements in respiratory status following the intervention. Before the intervention, both patients exhibited signs and symptoms of an ineffective breathing pattern, including dyspnea, tachypnea, use of accessory respiratory muscles, rapid and shallow breathing, and reduced tidal volume (340 mL in Mrs. Y and 360 mL in Mrs. M). Following the implementation of PLB for three consecutive days, tidal volume increased to 430 mL in Mrs. Y (+90 mL) and 470 mL in Mrs. M (+110 mL), accompanied by reduced respiratory rate, improved oxygen saturation, decreased use of accessory respiratory muscles, and reduced dyspnea. These findings suggest that PLB may be a beneficial nonpharmacological nursing intervention for improving breathing mechanics and respiratory status in patients with pleural effusion. PLB is a simple, safe, and low-cost intervention that can be performed independently by patients following appropriate education and may be considered as part of nursing care in the HCU. Nurses play an essential role in providing education, motivation, supervision, and regular evaluation of objective respiratory parameters, including tidal volume, to assess the effectiveness of the intervention.

REFERENCES

Aini, A. F., & Noveyani, A. E. (2023). Gambaran efusi pleura pada pasien dengan penyakit sistemik. Indonesian Journal of Nursing Science, 5(1), 12-20.

Clini, E., Holland, A. E., Pitta, F., & Troosters, T. (2017). Textbook of Pulmonary Rehabilitation. Springer.

Garrod, R., & Mathieson, T. (2012). Pulmonary Rehabilitation. Wiley Blackwell.

Hall, J. E., & Hall, M. E. (2020). Guyton and Hall Textbook of Medical Physiology (14th ed.). Elsevier.

Lewis, S. L., Bucher, L., Heitkemper, M. M., Harding, M. M., Kwong, J., & Roberts, D. (2023). Medical Surgical Nursing: Assessment and Management of Clinical Problems (12th ed.). Elsevier.

Light, R. W. (2022). Light's Pleural Diseases (7th ed.). Wolters Kluwer.

Miki, K., et al. (2025). Effects of pursed lips breathing on tidal volume in interstitial lung disease. Respiratory Medicine, 210, 107-115.

Sharma, S. (2024). Pulmonary Rehabilitation Techniques and Patient Outcomes. Academic Press.

Srisuk, P., et al. (2022). Pursed lips breathing improves tidal volume and ventilatory efficiency in COPD. Journal of Cardiopulmonary Rehabilitation and Prevention, 42(3), 178-185.

Tim Pokja SDKI DPP PPNI. (2021). Standar Diagnosis Keperawatan Indonesia: Definisi dan Indikator Diagnostik (Edisi Revisi). DPP PPNI.

Urden, L. D., Stacy, K. M., & Lough, M. E. (2021). Critical Care Nursing: Diagnosis and Management (9th ed.). Elsevier.

West, J. B., & Luks, A. M. (2021). West's Respiratory Physiology: The Essentials (11th ed.). Wolters Kluwer.

Windartik, E., & So'emah, S. (2022). Efek latihan pernapasan bibir mengerucut terhadap penurunan udara terjebak (air trapping). Jurnal Rehabilitasi Medis, 4(2), 92-99.