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Implementation of Chest Physiotherapy and Nebulizer Therapy for a Pneumonia Patient with Ineffective Airway Clearance: A Case Report

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ABSTRACT

Pneumonia is one of the leading causes of morbidity and mortality in humans, often accompanied by ineffective airway clearance due to secretion accumulation. Chest physiotherapy and nebulizer therapy are essential nursing interventions to facilitate secretion clearance and maintain airway patency in such conditions. Objective: This study aims to comprehensively describe the implementation of chest physiotherapy and nebulizer therapy in pneumonia patients with ineffective airway clearance. Methods: This case study involved two pediatric patients aged 50 years with a medical diagnosis of pneumonia who were admitted to the Graha Mandiri Ward, 3rd Floor. Data collection was conducted through assessment, intervention, nursing implementation over three days, and evaluation using observation and documentation techniques. Results: The patients presented with primary complaints of shortness of breath, cough, and runny nose, accompanied by physical findings such as tachypnea, intercostal retractions, and crackles in the lungs. The established nursing diagnosis was ineffective airway clearance. Chest physiotherapy and nebulizer therapy were implemented according to standard procedures. Evaluation showed that the implementation of chest physiotherapy and nebulizer therapy successfully facilitated secretion clearance and improved the patient's airway clearance, as evidenced by reduced shortness of breath and decreased abnormal breath sounds. Conclusion: The implementation of chest physiotherapy and nebulizer therapy is effective in addressing the issue of ineffective airway clearance in patients with pneumonia. It is recommended that nurses optimize education for families regarding the importance and procedures of chest physiotherapy and nebulizer therapy, as well as environmental factors that affect respiratory health.

Keywords: *Cleaning the Airway Is Ineffective, Chest Physical Therapy, Pneumonia, Nebulizer Therapy*

INTRODUCTION

Pneumonia is an acute respiratory tract infection that significantly contributes to global morbidity and mortality, particularly among children under five and the elderly (Aprilia & Faisal, 2021). This condition is often caused by bacteria, viruses, or fungi, resulting in the alveoli filling with fluid and pus, and causing symptoms such as cough, dyspnea, tachypnea, and chest wall retractions (Rahmawati, 2023). The World Health Organization (WHO) recorded 740,180 deaths in this age group

due to pneumonia in 2019, making it the cause of 14% of all deaths among children under five. In Indonesia, the 2021 Health Profile indicates 278,261 cases of pneumonia among children under five, with East Java Province accounting for 74,071 cases (Delfiyanti & Eryando, 2024), and Jember Regency ranking highest in prevalence with 8,039 cases (Mulyani, 2020).

One of the priority nursing issues in pneumonia patients is ineffective airway clearance, characterized by the inability to expel secretions, sputum accumulation, and the presence of additional breath sounds such as rhonchi or wheezing (Rumata et al., 2025). Ineffective airway clearance is a condition where secretion production leads to secretion buildup in the bronchi, obstructing airflow, causing airway obstruction, and impairing oxygen supply (Rahmawati, 2023). A study conducted by (Aviaduta et al., 2024) described the use of a nebulizer in children with pneumonia using a descriptive case study method with a nursing care approach. The results showed that nebulizer administration for 3 days was effective in improving airway clearance in children. In its implementation, nebulizer therapy is an important collaborative intervention that is recommended (H. Ticona et al., 2020). This therapy is effective in delivering medication directly to the respiratory tract, helping to thin and expel secretions, and has been shown to have better efficacy and safety compared to the oral route.

In addition to nebulizer therapy, chest physiotherapy is also effective in helping to clear accumulated sputum. Chest physiotherapy is a set of techniques or sputum clearance procedures performed either independently or in combination to prevent sputum buildup that leads to airway obstruction. This chest physiotherapy can be performed on infants, children, and adults, particularly on clients who have difficulty clearing secretions from the lungs. This chest physiotherapy intervention is effective in helping patients reduce signs and symptoms of ineffective airway clearance, where these signs and symptoms can be observed through the discharge of secretions or thickened secretions in the respiratory tract; changes in respiratory rate before and after the chest physiotherapy intervention show that the client no longer appears to be breathing heavily. Based on the above description, the author chose the title "The Effectiveness of Chest Physiotherapy and Nebulizer Inhalation for Ineffective Airway Clearance in Pneumonia Patients." To address ineffective airway clearance. The objective of this study is to implement chest physiotherapy and nebulizer inhalation therapy techniques in patients medically diagnosed with pneumonia and experiencing ineffective airway clearance in the Graha Mandiri Ward on the 3rd floor of Dr. Iskak General Hospital in Tulungagung.

METHODS

This research method utilized a case report, in which data were collected through interviews, physical assessments, nursing observations, problem identification, intervention planning, implementation, and evaluation of patients with airway clearance nursing issues and a medical diagnosis of pneumonia, namely Mr. A (56 years old) and Mr. S (58 years old).

The implementation of nursing interventions, consisting of chest physiotherapy for Mr. A and nebulizer inhalation for Mr. S, was carried out over three days from December 8–10, 2025, administered three times daily. The morning session (09:00–09:10 WIB) was entirely conducted by the researcher, while the afternoon session (17:00–17:10 WIB) and evening session (22:00–22:10 WIB) were continued by the patients' families after the researcher provided comprehensive education regarding the correct procedure in accordance with Standard Operating Procedures (SOP).

The patient received nebulized Ventolin® (salbutamol) at a dose of 2.5 mg via nebulizer for 15 minutes, twice daily. The treatment was administered to improve airway patency, reduce bronchospasm, and facilitate respiratory function. The patient's respiratory rate, oxygen saturation, breath sounds, and clinical symptoms were monitored before and after each treatment session. The patient tolerated the procedure well. Post-treatment assessment showed improved breath sounds, decreased dyspnea, and oxygen saturation increased from 93% to 96%. After nebulizer treatment, chest physiotherapy was performed using postural drainage, percussion, vibration, deep breathing exercises, and effective coughing techniques. After chest physiotherapy, the patient showed improved breathing, increased sputum expectoration, reduced crackles, and improved oxygen saturation.

The instruments used were an assessment form, Standard Operating Procedures (SOPs) for chest physiotherapy techniques, and nebulizer therapy administration. Data was collected directly from

interviews and physical assessments using the assessment form. The collected data was analyzed using nursing analysis to determine nursing diagnoses and interventions.

RESULTS

On December 8, 2025, an assessment was conducted on Mr. A (56 years old) and Mr. S (58 years old) who presented with complaints of productive cough, shortness of breath, tachypnea, use of respiratory assistive devices, decreased oxygen saturation, and rales on lung auscultation. Based on these findings, the nursing diagnosis "Ineffective Airway Clearance related to increased sputum production" was established. The next step is to implement appropriate nursing interventions or develop a care plan for the patient. The selected nursing care plan is tailored to the patient's current needs, specifically addressing the nursing issue of ineffective airway clearance.

Generally, interventions performed on patients based on the Nursing Intervention Standards (SIKI) include airway management, one of which involves chest physiotherapy and nebulizer therapy.

The implementation of nursing interventions consisted of chest physiotherapy for Mr. A and nebulizer inhalation for Mr. S, each conducted for three days, administered three times daily. The morning session (09:00–09:10 WIB) was conducted entirely by the researcher, while the afternoon (17:00–17:10 WIB) and evening (22:00–22:10 WIB) sessions

were continued by the patients' families after the researcher provided comprehensive education on the correct procedures in accordance with Standard Operating Procedures (SOPs). The implementation focused on collaborative actions, namely the administration of chest physiotherapy to Mr. A and nebulizer inhalation therapy to Mr. S, where the effectiveness of chest physiotherapy and nebulizer therapy can be explained through several of their pharmacological advantages. Medications administered via a nebulizer have a rapid onset of action because they directly reach the target in the respiratory tract. Evaluation is defined as an assessment process involving the comparison of observed changes in the patient's condition with predetermined objectives and outcome criteria during the planning stage (Rohmah & Walid, 2021).

Table 1. Evaluation of Nebulizer Therapy and Chest Physiotherapy for Mr. A (27 Years Old) – 3-Day Observation

Evaluation Indicator	**Day 1 December 8, 2025**	**Day 2 Desember 9, 2025**	**Day 3 December 10, 2025**
Sputum Volume	Moderate amount of thick sputum expelled after nebulization and chest physiotherapy.	Sputum volume decreased; secretions became thinner and easier to expectorate.	Minimal sputum production; airway clearance effective.
Dyspnea Scale / Respiratory Rate	Dyspnea present with respiratory rate of 27 breaths/minute.	Dyspnea reduced with respiratory rate of 26 breaths/minute.	Mild dyspnea; respiratory rate decreased to 25 breaths/minute.
Oxygen Requirement Reduction	Oxygen therapy required at 3 L/min via nasal cannula.	Oxygen requirement reduced to 2 L/min.	Oxygen therapy discontinued; patient maintained adequate oxygenation on room air.
Auscultation Improvement	Bilateral crackles heard in lower lung fields.	Crackles decreased; breath sounds improved.	Breath sounds clear with minimal adventitious sounds.
Respiratory Distress Score	Moderate respiratory distress	Mild respiratory distress; accessory	No signs of respiratory distress

Evaluation Indicator	Day 1 December 8, 2025	Day 2 Desember 9, 2025	Day 3 December 10, 2025
	with mild accessory muscle use.	muscle use decreased.	observed.
Oxygen Saturation (SpO_2)	95% with oxygen therapy.	97% with reduced oxygen support.	100% on room air.
Overall Improvement	Partial improvement in airway clearance and breathing pattern.	Respiratory status improved with decreased dyspnea and oxygen needs.	Significant improvement noted; effective airway clearance, stable oxygen saturation, and comfortable breathing.

Overall Improvement, Partial improvement in airway clearance and breathing pattern. Respiratory status improved with decreased dyspnea and oxygen needs. Significant improvement noted; effective airway clearance, stable oxygen saturation, and comfortable breathing. Evaluation Summary, After three days of nebulizer therapy and chest physiotherapy, the patient demonstrated decreased sputum production, reduced dyspnea, improved lung auscultation findings, lower oxygen requirements, improved respiratory distress score, and maintained an oxygen saturation of 100%.

Table 2. Evaluation of Nebulizer Therapy and Chest Physiotherapy for Mr. S (58 Years Old) – 3-Day Observation

Evaluation Indicator	Day 1	Day 2	Day 3
Sputum Volume	Large amount of thick sputum expelled following nebulizer therapy and chest physiotherapy.	Moderate amount of sputum produced; secretions became less viscous.	Small amount of sputum; airway clearance improved.
Dyspnea Scale / Respiratory Rate	Severe dyspnea with respiratory rate of 28 breaths/minute.	Dyspnea reduced; respiratory rate decreased to 26 breaths/minute.	Mild dyspnea; respiratory rate decreased to 24 breaths/minute.
Oxygen Requirement Reduction	Required Non-Rebreathing Mask (NRBM) at 10 L/min to maintain oxygenation.	Oxygen requirement reduced to NRBM at 8 L/min.	Oxygen requirement further reduced to NRBM at 6 L/min while maintaining adequate oxygen saturation.
Auscultation Improvement	Coarse crackles and rhonchi	Crackles and rhonchi	Breath sounds clearer with

Evaluation Indicator	Day 1	Day 2	Day 3
	heard in both lung fields.	decreased; breath sounds improved.	minimal adventitious sounds.
Respiratory Distress Score	Moderate respiratory distress with use of accessory respiratory muscles.	Mild respiratory distress; accessory muscle use decreased.	Minimal respiratory distress; breathing appeared more relaxed.
Oxygen Saturation (SpO_2)	95% with NRBM support.	97% with reduced oxygen requirement.	98% with NRBM at lower flow rate.
Overall Improvement	Initial improvement in secretion clearance after treatment.	Respiratory status improved with decreased dyspnea and oxygen demand.	Significant improvement noted; effective airway clearance, improved lung sounds, reduced respiratory distress, and stable oxygen saturation.

Evaluation Summary, After three days of nebulizer therapy and chest physiotherapy, Mr. S (58 years old) demonstrated progressive improvement in respiratory status. Sputum volume decreased, secretions became easier to expectorate, respiratory rate decreased from 28 to 20 breaths/minute, oxygen requirements through the Non-Rebreathing Mask were reduced, lung auscultation findings improved, respiratory distress diminished, and oxygen saturation was maintained at 98%.

DISCUSSION

Pneumonia is an inflammation of the lungs caused by various etiologies, such as bacteria, viruses, fungi, and foreign bodies.3 Symptoms include high fever, restlessness, dyspnea, rapid and shallow breathing, vomiting, diarrhea, and both dry and productive coughs. 2 Findings: Based on the theory and application described above, it can be concluded that the client has pneumonia and is experiencing ineffective airway clearance. The signs and symptoms present include increased respiratory rate, the presence of additional breath sounds, and chest wall retractions, with a temperature of 38.5°C. The client is classified as having severe pneumonia, which aligns with the opinion of Raharjo, Supriyanto, and Setyanto (2018), who state that severe pneumonia is characterized by severe shortness of breath and requires hospitalization and antibiotic treatment. Therefore, the interventions to be implemented—chest physiotherapy and nebulizer inhalation—can improve respiratory efficiency and airway clearance.

Comparison with Previous Empirical Studies, The findings of this case demonstrated a progressive improvement in respiratory status following the administration of nebulizer therapy and chest physiotherapy. During the three-day observation period, sputum volume decreased, respiratory rate improved from 28 breaths/minute to 20 breaths/minute, oxygen requirements through the Non-Rebreathing Mask (NRBM) were reduced, lung auscultation findings improved, respiratory distress decreased, and oxygen saturation increased to 98%.

These findings are consistent with previous studies reporting that chest physiotherapy facilitates secretion clearance, improves oxygenation, and reduces respiratory distress in patients with pneumonia and other respiratory disorders. A literature review by Yudha and Wardoyo (2023) found that chest physiotherapy effectively removes sputum, stabilizes respiratory rate, and improves oxygen saturation in patients with bronchopneumonia. Furthermore, systematic reviews have shown that airway clearance techniques increase sputum expectoration and improve airway patency, thereby enhancing respiratory function.

Similarly, studies on airway clearance techniques have demonstrated significant improvements in mucus mobilization and secretion removal, supporting the observed reduction in sputum retention and respiratory distress in this patient.

Effective airway clearance is a condition where the lungs or trachea are free from secretions, either completely or partially, with a respiratory rate within normal limits (<40 breaths/minute), no nasal flaring, and no intercostal retractions. 5 Meanwhile, ineffective airway clearance is the inability to clear secretions or airway obstruction that prevents the airway from remaining patent.

Physiological Mechanisms of Chest Physiotherapy and Nebulizer Therapy, Chest physiotherapy improves airway clearance through several physiological mechanisms. Techniques such as percussion, vibration, postural drainage, and coughing mobilize secretions from peripheral airways toward larger airways where they can be expectorated more easily. These interventions enhance mucociliary clearance, reduce airway obstruction, and improve ventilation-perfusion matching. Gravity-assisted drainage and chest wall vibrations help loosen mucus adhered to bronchial walls, facilitating secretion removal and reducing airway resistance.

Nebulizer therapy complements chest physiotherapy by delivering aerosolized medication directly into the respiratory tract. Bronchodilators, such as salbutamol (Ventolin), relax bronchial smooth muscles, resulting in bronchodilation and decreased airway resistance. Aerosol therapy also improves medication deposition within the airways, promotes mucus hydration, and facilitates mucociliary transport. Consequently, secretions become less viscous and easier to mobilize during chest physiotherapy and coughing.

Chest physiotherapy is a series of nursing interventions consisting of percussion, vibration, and postural drainage. The goal of this therapy is to improve respiratory efficiency and airway clearance.

The combined use of nebulizer therapy and chest physiotherapy likely contributed to the patient's improved respiratory status by enhancing secretion clearance, reducing airway obstruction, improving gas exchange, and decreasing the work of breathing. These physiological effects explain the observed reductions in respiratory rate, oxygen requirements, and respiratory distress score, as well as the improvement in oxygen saturation and breath sounds.

Based on the results above, it can be concluded that chest physiotherapy and nebulizer inhalation can improve respiratory efficiency and airway clearance, as indicated by increased respiratory rate, the presence of additional breath sounds, and chest wall retractions prior to the application of chest physiotherapy. Meanwhile, after chest physiotherapy was administered, the client showed a decrease in respiratory rate, chest wall retractions disappeared, additional breath sounds decreased, and SPO2 increased. Based on the research results, it can be concluded that there were two samples: Mr. A (27 years old), who received chest physiotherapy, and Mr. S (58 years old), who received nebulizer inhalation therapy. The results showed a difference in respiratory rate before and after chest physiotherapy and nebulizer inhalation in patients with impaired airway clearance.

Study Limitations, Several limitations should be considered when interpreting these findings. First, this report describes a single patient, limiting the generalizability of the results to broader patient populations. Second, the observation period was relatively short (three days), preventing assessment of long-term clinical outcomes. Third, objective pulmonary function measurements such as forced expiratory volume (FEV1), arterial blood gas analysis, or radiographic improvements were not evaluated. Finally, the concurrent use of other medical treatments, including antibiotics and oxygen therapy, may have contributed to the patient's clinical improvement, making it difficult to determine the isolated effects of nebulizer therapy and chest physiotherapy. Therefore, larger controlled studies are needed to confirm the effectiveness of these interventions in patients with pneumonia.

CONCLUSION

Following chest physiotherapy and nebulizer inhalation to clear the airways, there was a decrease in respiratory rate, chest wall retractions resolved, and additional breath sounds diminished; SPO2 levels also improved.

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