



Implementation of 3% Hypertonic Saline Inhalation Therapy and Chest Physiotherapy for Managing Ineffective Airway Clearance in Pediatric Bronchopneumonia: A Case Study

Rizma Amalia^{1*}, Ai Mardhiyah² and Fanny Adistie³

¹²³ Universitas Padjadjaran, Sumedang, Indonesia

Article Information	ABSTRACT
Received : 10 July 2026 Revised : 03 August 2026 Accepted : 12 August 2026	Bronchopneumonia remains a leading cause of morbidity and mortality among children. Airway secretion retention may result in ineffective airway clearance. The combination of 3% NaCl inhalation therapy and chest physiotherapy provides complementary mechanisms to liquefy, mobilize, and facilitate the removal of airway secretions. This study aimed to describe changes in airway clearance following the implementation of combined 3% NaCl inhalation therapy and chest physiotherapy in a child with bronchopneumonia. A single-case study was conducted involving a 22-month-old child diagnosed with bronchopneumonia and the nursing diagnosis of ineffective airway clearance. The intervention consisted of nebulized 4 mL of 3% NaCl combined with chest physiotherapy, administered twice daily for three consecutive days. Nebulization was performed for 15 minutes, followed by 10–15 minutes of chest physiotherapy. Clinical evaluations were conducted before and after each intervention. Primary outcomes included oxygen saturation, respiratory rate, heart rate, adventitious breath sounds, and secretion clearance. After three days of intervention, oxygen saturation increased from 87% to 97%, respiratory rate decreased from 47 to 32 breaths/min, and heart rate decreased from 106 to 98 beats/min. Bilateral rhonchi diminished, signs of increased work of breathing were no longer observed, and cough effectiveness and secretion clearance improved. The combination of 3% NaCl inhalation therapy and chest physiotherapy may improve respiratory status and airway clearance in children with bronchopneumonia and ineffective airway clearance when used as an adjunct to standard medical treatment.
Keywords: Bronchopneumonia, Chest Physiotherapy, 3% NaCl Inhalation Therapy, Ineffective Airway Clearance, Pediatric Nursing.	
Corresponding Author Corresponding author: (Rizma Amalia) email: Rizma21001@mail.unpad.ac.id	

Introduction

Respiratory diseases are among the most common health problems affecting children and contribute substantially to morbidity and mortality, particularly in developing countries (Nashira et al., 2026). Common respiratory diseases among children include upper respiratory tract infections, asthma, tuberculosis, and pneumonia (Atira et al., 2022). Among these conditions, pneumonia remains a major public health concern because early clinical manifestations, such as cough, rhinorrhea (runny nose), and fever, often resemble those of mild respiratory tract infections. However, without prompt and appropriate management, pneumonia may rapidly progress to severe respiratory distress, serious complications, and even death.

This concern is supported by the World Health Organization (WHO), which identifies pneumonia as the leading single infectious cause of death among children under five years of age worldwide. In 2019, pneumonia caused approximately 740,180 deaths, accounting for about 14% of all deaths among children in this age group (World Health Organization, 2022). In Indonesia, the Ministry of Health of the Republic of Indonesia reported 416,435 identified cases of pneumonia among children under five, with 522 associated deaths in 2023 (Kementerian Kesehatan RI, 2023). West Java Province is among the regions with a relatively high number of cases of childhood pneumonia, reporting approximately 102,576 cases. These data indicate that pneumonia remains a significant public health problem among children globally and nationally, including in West Java Province, where the number of cases remains relatively high.

Bronchopneumonia is a form of pneumonia characterized by inflammation of the terminal bronchioles and alveoli caused by bacterial, viral, or fungal infections (Wardani et al., 2023). Pathologically, the inflammatory process may increase mucus production, cause edema of the airway mucosa, and promote the accumulation of secretions within the respiratory tract. These changes can lead to airway narrowing or obstruction, thereby impairing ventilation and reducing the efficiency of gas exchange (Nishak & Maksum, 2025). As a result, children with bronchopneumonia commonly present with various clinical manifestations, including fever, productive cough, tachypnea, dyspnea, adventitious breath sounds (rhonchi), and increased work of breathing, as evidenced by nasal flaring and chest wall retractions (Pascoal et al., 2022; Sekararum et al., 2025).

Children under five years of age are particularly vulnerable to bronchopneumonia because of their immature immune system, narrower airway lumen, and underdeveloped cough reflex (Hasanah et al., 2024). These conditions reduce their ability to clear airway secretions

effectively, making the accumulation of respiratory secretions more likely. The inability to clear accumulated secretions adequately may lead to the nursing diagnosis of ineffective airway clearance, which is characterized by the inability to clear secretions effectively, resulting in impaired airway patency and respiratory function (Tim Pokja SDKI DPP PPNI, 2017). In addition to infection as the primary cause, the occurrence of bronchopneumonia in children is also influenced by several risk factors, including air pollution, exposure to cigarette smoke, poor nutritional status, household overcrowding, and incomplete immunization, all of which increase children's susceptibility to respiratory tract infections (Pulungan et al., 2025).

The management of bronchopneumonia in children involves both pharmacological and non-pharmacological approaches. Pharmacological treatment includes the administration of antibiotics when indicated, bronchodilators, mucolytic agents, oxygen therapy, and inhalation therapy (Sauteur, 2024). In children with bronchopneumonia, excessive accumulation of airway secretions frequently results in ineffective airway clearance, thereby requiring interventions that facilitate mucus dilution and effective secretion removal (Pieterse & Hanekom, 2018). Therefore, inhalation therapy has become one of the most widely used approaches to maintain airway patency and improve respiratory function. One commonly used inhalation therapy is nebulization with 3% hypertonic saline (NaCl) (Triyani et al., 2024). Hypertonic saline exerts its therapeutic effect by drawing water into the airway lumen, thereby diluting airway secretions, reducing mucus viscosity, and facilitating secretion clearance. In addition, this therapy helps reduce airway mucosal edema and improve ventilation (Baeti & Mardhiyah, 2023).

The selection of 3% hypertonic saline for nebulization is based on its superior ability to improve airway conditions compared with 0.9% normal saline. Nadhifanny & Perdani (2017) reported that nebulized 3% hypertonic saline was more effective in reducing disease severity by decreasing airway edema, reducing mucus viscosity, enhancing mucociliary clearance, and improving mucus transport. Furthermore, the use of 3% hypertonic saline was associated with a shorter length of hospital stay than 0.9% normal saline.

The effectiveness of nebulization therapy in improving ineffective airway clearance among children with bronchopneumonia has been demonstrated in several studies. Riana et al. (2022) reported that nebulization with 3% hypertonic saline combined with a bronchodilator improved children's clinical condition by reducing respiratory symptoms, such as cough, and improving

respiratory parameters. Similarly, Triyani et al. (2024) reported that nebulization with 3% hypertonic saline effectively facilitated secretion mobilization and improved clinical indicators, including a reduction in adventitious breath sounds (rhonchi) and an increase in oxygen saturation after several days of therapy. However, differences in the therapeutic approaches used across these studies, particularly the addition of bronchodilators in some protocols, should be considered when interpreting their findings, as these differences may influence the reported clinical outcomes. Overall, these studies demonstrate that nebulization with 3% hypertonic saline contributes to improving airway clearance in children with bronchopneumonia.

In addition to pharmacological treatment, non-pharmacological interventions also play an important role in the management of bronchopneumonia in children, particularly by facilitating the mobilization and removal of airway secretions. One of the most commonly implemented interventions is chest physiotherapy (Azmy et al., 2022). Chest physiotherapy is a nursing intervention that consists of postural drainage, percussion, and vibration techniques designed to mobilize secretions from the peripheral airways to the larger airways, where they can be more effectively expelled through coughing (Sekararum et al., 2025). This intervention has been shown to improve pulmonary ventilation, preserve respiratory muscle function, enhance airway clearance, and prevent further secretion accumulation in children with respiratory disorders (Tehupeiory & Sitorus, 2022).

Several studies have reported the benefits of chest physiotherapy as a supportive therapy for improving the respiratory status of children with bronchopneumonia. Budi (2025) reported that regular chest physiotherapy facilitated secretion mobilization, as evidenced by a gradual reduction in rhonchi and cough frequency over the course of the intervention. Similarly, Azmy et al. (2022) reported that chest physiotherapy contributed to improvements in respiratory parameters, including a reduced respiratory rate, increased oxygen saturation, and improvements in children's comfort and activity levels. Nevertheless, variations in intervention protocols and the clinical outcomes evaluated across previous studies should be considered when interpreting these findings, as they may influence the comparability and applicability of the reported results. Overall, these studies demonstrate that chest physiotherapy contributes to improving airway clearance through effective secretion mobilization and improved respiratory function in children with bronchopneumonia.

Although each intervention can be administered independently according to the patient's clinical condition and therapeutic needs, the combination of 3% hypertonic saline nebulization and chest physiotherapy is often considered because the two interventions have complementary mechanisms of action in improving respiratory function. Nebulization with 3% hypertonic saline facilitates the dilution of airway secretions and reduces mucus viscosity, thereby promoting secretion mobilization, whereas chest physiotherapy assists in moving secretions from the peripheral airways to the larger airways, allowing them to be expelled more effectively (Azmy et al., 2022; Baeti & Mardhiyah, 2023). This combination is particularly important for children under five years of age, who are generally unable to cough effectively or clear airway secretions independently (Chaves et al., 2019).

The effectiveness of combining these two interventions in improving the respiratory status of children with pneumonia has been reported in several studies. Lestari et al. (2018) reported that the combination of nebulization and chest physiotherapy resulted in greater improvements in respiratory status than nebulization alone, particularly in terms of increased oxygen saturation and reduced respiratory rate among children with pneumonia. Similarly, Helena et al. (2023) reported that administering chest physiotherapy following nebulization also contributed to more effective airway clearance than a single intervention, as evidenced by a higher proportion of successful outcomes in the intervention group. However, the available evidence should be interpreted with caution, as several previous studies employed quasi-experimental designs and relatively limited sample sizes, which may affect the strength and generalizability of the reported findings. Overall, these studies demonstrate that the combination of nebulization and chest physiotherapy is more effective than either intervention alone in improving airway clearance and respiratory status among children with bronchopneumonia.

Although previous studies have demonstrated the effectiveness of nebulized 3% hypertonic saline, chest physiotherapy, and their combination in improving respiratory status among children with bronchopneumonia, evidence regarding the implementation of these combined interventions in toddlers with the nursing diagnosis of ineffective airway clearance remains limited. Furthermore, although both interventions have complementary mechanisms of action that may theoretically enhance airway clearance, evidence describing their combined application within nursing care for this specific population is still limited. The novelty of this case study lies not in the intervention itself, but in its systematic implementation as a

complementary nursing intervention, accompanied by repeated clinical evaluations before and after each intervention session over three consecutive days. This approach allowed comprehensive monitoring of changes in respiratory status, including oxygen saturation, respiratory rate, breath sounds, oxygen requirement, and the patient's overall clinical condition in a toddler with bronchopneumonia and ineffective airway clearance. Documentation of the clinical implementation of this combined intervention may provide practical evidence to support nursing care strategies for improving airway clearance in children with bronchopneumonia. Therefore, this case study aimed to describe the changes in airway clearance and respiratory status following the implementation of combined 3% hypertonic saline nebulization and chest physiotherapy in a toddler with bronchopneumonia.

Method

This study employed a single-case study design with a nursing care approach and was conducted in October 2025 in the pediatric ward of a regional general hospital in Sumedang, West Java, Indonesia. The study subject was a toddler-aged boy with a medical diagnosis of bronchopneumonia and a nursing diagnosis of ineffective airway clearance, who was selected through purposive sampling based on criteria aligned with the study's objectives. Data collection instruments and techniques included interviews, direct observation, physical examination, medical records, a pulse oximeter, a vital signs monitor, a stethoscope, and an observation sheet based on indicators from the Indonesian Nursing Outcome Standards (SLKI). The intervention consisted of nebulization with 4 mL of 3% hypertonic NaCl for approximately 15 minutes, followed by chest physiotherapy for 10–15 minutes, administered twice daily for three days. Data analysis was conducted descriptively by comparing patients' clinical conditions before and after the intervention in each session during the study period, with primary indicators including oxygen saturation (SpO₂), respiratory rate, and airway clearance, as well as secondary indicators such as heart rate, sleep quality, activity level, and patient comfort. Interpretation of the results was based on changes in patients' clinical conditions and indicators of improved airway clearance in the SLKI.

Research Results

Throughout the three-day intervention period, the patient received 3% NaCl inhalation therapy combined with chest physiotherapy. Continuous evaluations were performed to assess changes in respiratory status. The evaluation included physiological parameters and clinical

manifestations as indicators of improved airway clearance. The findings demonstrated a gradual improvement in the patient's respiratory status throughout the intervention period. Detailed changes in the physiological parameters are presented in Table 1.

Tabel 1.1 Changes in Patient's Physiological Parameters During The Three-Day Intervention

Parameter	Day 1		Day 2		Day 3	
	(11/10/25)		(12/10/25)		(13/10/25)	
	Before	After	Before	After	Before	After
SpO ₂ (%)	87	90	86	90	94	97
Respiratory Rate (breath/min)	47	43	45	40	36	32
Heart Rate (beats/min)	126	120	115	113	93	98
Oxygen Support (L/min)	2.0	2.0	1.5	1.5	0.5	0.5

Table 1 summarizes the serial changes in the patient's physiological parameters observed before and after each intervention session throughout the three-day intervention period. In addition to these physiological findings, clinical evaluation revealed several improvements in the patient's respiratory status that were not fully reflected by the numerical parameters presented in Table 1.

On the first day, the patient continued to exhibit tachypnea with a rapid, shallow breathing pattern, use of accessory respiratory muscles, and bilateral rhonchi on auscultation. Although the cough reflex emerged after the intervention, secretion clearance remained suboptimal, and clinical signs of airway obstruction were still present. On the second day, further clinical improvement was observed. The cough reflex became more effective and was accompanied by the expectoration of a greater volume of thick, yellowish-white, odorless sputum. Correspondingly, bilateral rhonchi decreased on auscultation, the use of accessory respiratory muscles became less pronounced, and the breathing pattern became more regular than on the previous day.

On the third day, the patient's respiratory condition showed further improvement. According to the family, the patient appeared more active, was less irritable, no longer required constant carrying, and experienced better sleep quality at night. Physical examination also revealed that the use of accessory respiratory muscles and the rapid, shallow breathing pattern had resolved. However, mild bilateral rhonchi were still detected on auscultation, indicating the

presence of residual airway secretions, although these had markedly decreased compared with the previous days.

Overall, the three-day evaluation demonstrated that the combination of 3% NaCl inhalation therapy and chest physiotherapy resulted in progressive improvement in the respiratory status of the patient with the nursing diagnosis of ineffective airway clearance. These improvements were reflected not only in the physiological parameters presented in Table 1.1 but also in the clinical findings, including a more effective cough reflex, reduced adventitious breath sounds (rhonchi), resolution of accessory respiratory muscle use, and increased patient activity and comfort.

These findings suggest that the combination of 3% NaCl inhalation therapy and chest physiotherapy contributed to improved airway clearance throughout the intervention period. The progressive nature of the improvement indicates that the therapeutic response was gradual rather than immediate, reflecting the reduction of retained airway secretions and the subsequent improvement in respiratory function. However, these clinical improvements cannot be attributed solely to the nursing interventions, as the patient also received concurrent standard medical treatment during the intervention period. These findings provide the basis for the following discussion on the pathophysiology of ineffective airway clearance in children with bronchopneumonia and the mechanisms underlying the therapeutic effects of the interventions

Discussion

In this case, the patient with bronchopneumonia was diagnosed with ineffective airway clearance, defined as the inability to effectively clear secretions or airway obstructions, resulting in compromised airway patency (Tim Pokja SDKI DPP PPNI, 2017). In children with bronchopneumonia, inflammation and excessive mucus production promote the accumulation of airway secretions, leading to clinical manifestations such as dyspnea, rapid and shallow breathing, bilateral rhonchi on auscultation, and increased work of breathing, including nasal flaring and the use of accessory respiratory muscles (Sekararum et al., 2025). This condition poses an even greater risk in children younger than two years because their relatively narrow airways allow even a small amount of retained secretions to substantially increase airflow resistance (Chuang et al., 2022). Furthermore, the immature cough mechanism and limited ability to expectorate sputum predispose young children to secretion retention and partial airway obstruction, thereby increasing respiratory effort (Hasanah et al., 2024).

The patient received pharmacological treatment as prescribed by the attending physician, including antibiotics, antipyretics, gastroprotective agents, corticosteroids, bronchodilators, and mucolytics, all of which contributed to the patient's clinical improvement (Atira et al., 2022; Sauteur, 2024). Respiratory management specifically targeted airway function through nebulized Ventolin and Pulmicort. Ventolin, a bronchodilator, promotes bronchodilation to improve airflow, whereas Pulmicort, an inhaled corticosteroid, reduces airway inflammation. Despite receiving these standard medical therapies, the patient continued to experience difficulty clearing retained airway secretions. This may be explained by the immature cough reflex commonly observed in young children, which limits effective secretion clearance and predisposes them to airway retention (Atira et al., 2022; Chuang et al., 2022). These findings suggest that pharmacological therapy alone may be insufficient to adequately resolve ineffective airway clearance in pediatric patients with bronchopneumonia.

Therefore, supportive nursing interventions, including 3% NaCl inhalation therapy and chest physiotherapy, were implemented to facilitate airway secretion clearance (Tim Pokja SDKI DPP PPNI, 2017). As a hypertonic solution, 3% NaCl reduces mucus viscosity through an osmotic mechanism. This hydration process effectively liquefies thick airway secretions, thereby facilitating mucociliary clearance and improving airway patency (Restrepo & Serrato, 2016). Chest physiotherapy complements this effect by mobilizing retained secretions from the peripheral airways toward the central airways, allowing them to be more effectively expelled through coughing (Chaves et al., 2019). Consequently, the combination of these interventions may produce a synergistic effect in promoting airway clearance and improving the patient's respiratory status.

The gradual clinical improvement observed from the first to the third day suggests that the expected therapeutic outcomes of the interventions were achieved. One of the most notable findings was the progressive increase in oxygen saturation, accompanied by reductions in respiratory rate, heart rate, and signs of increased work of breathing. These findings indicate that ventilation and gas exchange improved as airway obstruction caused by retained secretions gradually resolved. Lazarowski & Boucher (2021) reported that adequate mucus hydration is a key factor in enhancing airway clearance because less viscous secretions can be transported more efficiently to the larger airways and subsequently removed through coughing. The progressive improvement observed throughout the intervention period further suggests that the

therapeutic effects were not immediate but developed gradually as airway secretion retention decreased and respiratory function recovered. This finding is consistent with the study by Beal et al. (2019), which demonstrated that the clinical benefits of hypertonic saline inhalation become more apparent after several consecutive days of treatment.

The findings of this case study are consistent with those reported by Indriani et al. (2024), who found that children with bronchopneumonia receiving a combination of 3% NaCl nebulization and chest physiotherapy achieved faster improvement in airway clearance than those who received nebulization alone. Following three days of intervention, the study reported a reduction in respiratory rate from 42 to 33 breaths/min, decreased rhonchi on auscultation, and an increase in oxygen saturation from 97% to 99%.

These findings are further supported by the study conducted by Irshad et al. (2025), which included 108 children with pneumonia. Participants were equally allocated to either a control group receiving nebulization alone or an intervention group receiving nebulization combined with chest physiotherapy. In the combination group, significant improvement in respiratory status was observed following the intervention, as evidenced by a reduction in the mean respiratory rate from 49.02 to 31.13 breaths/min and an increase in mean oxygen saturation from 74.72% to 93.98%. In contrast, the nebulization-only group showed a decrease in mean respiratory rate from 44.89 to 27.69 breaths/min and an increase in mean oxygen saturation from 82.87% to 90.76%. Although respiratory status improved in both groups, the increase in oxygen saturation was greater in the combination therapy group. The authors concluded that adding chest physiotherapy to nebulization therapy enhanced oxygenation and pulmonary function more effectively, particularly in children with hypoxemia before treatment.

Although most studies have reported favorable outcomes, conflicting evidence remains. In a Cochrane systematic review that included six randomized controlled trials (RCTs) involving 559 children, Chaves et al. (2019) found that chest physiotherapy did not consistently reduce the length of hospital stay or improve respiratory rate in children with pneumonia. The authors concluded that the available evidence remained insufficient to establish the effectiveness of chest physiotherapy in pediatric pneumonia conclusively. These inconsistent findings may be attributable to differences in patient characteristics, chest physiotherapy techniques, intervention frequency, and the clinical outcomes assessed across studies. Furthermore, improvements in respiratory status among children with pneumonia are generally achieved

through a multimodal treatment approach involving concurrent interventions, such as antibiotics, bronchodilators, oxygen therapy, and inhalation therapy. Consequently, the individual contribution of each intervention to the overall clinical outcome is difficult to determine. Therefore, the respiratory improvement observed in this case study was likely the result of the synergistic effects of multiple interventions administered throughout hospitalization, making it impossible to attribute the observed clinical outcomes to any single intervention with certainty.

In addition to improvements in respiratory status, the effectiveness of the multimodal treatment approach was also reflected in the patient's overall clinical condition. By the third day of treatment, the family reported that the patient was more active, less irritable, no longer required constant carrying, and experienced better sleep quality than during the previous days of illness. These observations suggest that improved respiratory function contributed to greater comfort and enhanced functional activity. This finding is consistent with the study by Lubis et al. (2025), which reported that improvements in respiratory status in pediatric patients were associated with better sleep quality, increased activity, and greater comfort during hospitalization. These improvements may be explained by the reduction in the work of breathing, allowing energy previously expended on respiratory effort to be redirected toward physical activity and the body's recovery process.

The observed improvements in the patient's overall clinical condition and respiratory status indicate that the patient's basic physiological needs were being met more effectively. According to Virginia Henderson's Theory of Basic Needs, breathing normally is one of the fundamental human needs required to maintain life and health. In children with bronchopneumonia, the accumulation of airway secretions compromises airway clearance, thereby interfering with the fulfillment of this essential need. Within Henderson's framework, the nurse's role is to assist individuals in meeting needs that they are temporarily unable to fulfill independently until they regain optimal independence. In this case, the administration of 3% NaCl inhalation therapy combined with chest physiotherapy represented a nursing intervention aimed at facilitating normal breathing by reducing retained airway secretions, improving ventilation, and enhancing respiratory function. Therefore, the improvement in the patient's respiratory status reflects the effectiveness of these nursing interventions in supporting the fulfillment of the patient's

fundamental need for normal breathing, which had previously been impaired by airway secretion retention (Agudelo-Cifuentes et al., 2015).

Based on the evaluation conducted throughout the intervention period, the nursing diagnosis of ineffective airway clearance was considered partially resolved. This conclusion was based on the substantial improvement in the patient's respiratory status, although several clinical indicators suggested that airway clearance had not yet been fully restored. These findings indicate that, despite the effectiveness of the interventions in improving respiratory function, continued efforts to maintain airway patency and facilitate secretion clearance remain necessary (Alfarizi et al., 2024). Therefore, ongoing monitoring and continuation of appropriate therapy are recommended to prevent the reaccumulation of airway secretions and to support complete respiratory recovery.

This case study has several limitations that should be acknowledged. First, the intervention was conducted in a single patient; therefore, the findings cannot be considered representative of the broader pediatric population with bronchopneumonia. Second, the patient received 3% NaCl inhalation therapy and chest physiotherapy concurrently without a comparison group, making it impossible to determine the individual contribution of each intervention to the observed clinical improvement. In addition, the relatively short observation period precluded evaluation of the long-term therapeutic effects and the potential recurrence of respiratory symptoms following the intervention. Consequently, the findings cannot be generalized but may provide preliminary clinical evidence regarding the potential benefits of combining 3% NaCl inhalation therapy with chest physiotherapy to improve respiratory status in children with bronchopneumonia.

Chest physiotherapy may be considered for pediatric patients who exhibit signs of retained airway secretions, including rhonchi on auscultation, ineffective cough, and increased mucus production, particularly when they are hemodynamically stable and maintain adequate oxygen saturation (Sekararum et al., 2025). Conversely, this intervention is not recommended for patients with severe hypoxemia, severe respiratory distress, or other clinical contraindications that may worsen their condition (Roqué-Figuls et al., 2023). Throughout the intervention, nurses should comprehensively monitor the patient's clinical response, including respiratory rate and breathing pattern, oxygen saturation, breath sounds, the quantity and characteristics of airway secretions, and any signs of discomfort or fatigue (Lubis et al., 2025; Pascoal et al., 2022).

In this case, the nurse's role extended beyond implementing the intervention to ensuring that each procedure was performed according to appropriate clinical indications and accompanied by comprehensive monitoring to maintain patient safety and maximize therapeutic effectiveness. In addition to providing direct nursing care, nurses also served as educators by providing family-centered education on the importance of treatment adherence, recognition of the signs and symptoms of respiratory distress, and simple home-based techniques to facilitate secretion clearance and maintain the child's comfort during recovery. Such education is expected to strengthen the family's ability to support ongoing care and to recognize early signs of respiratory deterioration. Family involvement is particularly important because young children remain highly dependent on their caregivers to meet their healthcare needs. Therefore, successful management of pediatric bronchopneumonia depends not only on appropriate clinical interventions but also on effective collaboration among nurses, family members, and other healthcare professionals to support the child's recovery.

Conclusion

This case study demonstrated that the combination of 3% NaCl inhalation therapy and chest physiotherapy contributed to gradual improvements in the respiratory status of a child with bronchopneumonia and ineffective airway clearance. The clinical improvements were reflected by increased oxygen saturation, reduced respiratory rate, decreased work of breathing, improved secretion clearance, and better overall patient condition. The novelty of this study lies in the systematic implementation of this combined nursing intervention with repeated clinical evaluations to monitor changes in airway clearance over three consecutive days. These findings suggest that the combination of 3% NaCl inhalation therapy and chest physiotherapy may serve as a supportive evidence-based nursing intervention to facilitate airway clearance in children with bronchopneumonia when implemented alongside standard medical treatment and based on appropriate clinical indications.

Acknowledgments

The authors would like to express their sincere gratitude to the management and nursing staff of the regional public hospital in Sumedang, West Java, Indonesia, for their support and assistance throughout the implementation of this case study. The authors also extend their appreciation to the patient and the patient's parents for their cooperation, trust, and willingness to participate in the intervention process. Special thanks are given to the academic institution,

supervisors, and colleagues who provided valuable guidance, support, and constructive feedback during the preparation and completion of this study. The authors also acknowledge all individuals who contributed directly or indirectly to the successful completion of this case study.

Reference

- Alfarizi, M., Juliningrum, P. P., Sulistiyorini, L., & Primirti, I. D. (2024). Combination of Chest Physiotherapy and Postural Drainage for Airway Clearance in Bronchopneumonia : A Case Study. *Jurnal Kegawatdaruratan Medis Indonesia*, 3(1), 76–89. <https://ebsina.or.id/journals/index.php/jkmi/article/view/222/141>
- Atira, Aryanto, A., & Sandi, M. S. M. (2022). *Respiratory Tract Infections in Toddlers Aged 1-5 Years*. 15(1), 583–586. <https://doi.org/10.62817/jkbl.v15i1.13>
- Azmy, N., Lestari, N. E., & Rokhmiati, E. (2022). Analysis of Chest Physiotherapy Actions in Children with Bronchopneumonia and the Problem of Ineffectiveness of Airway Cleaning: A Case Study. *Journal of Nursing Care, Department of Nursing, Gorontalo Health Polytechnic*, 8(1), 10. <https://doi.org/10.52365/jnc.v8i1.418>
- Baeti, R. N., & Mardhiyah, A. (2023). The Use of NaCl 3% as Inhalation Therapy in Toddlers with Bronchopneumonia: A Case Study. *Malahayati Health Student Journal*, 3, 2646–2658. <https://doi.org/10.33024/mahesa.v3i9.1089>
- Beal, G., Barbier, C., Thoret, S., Rubio, A., Bonnet, M., Mazet, R., Ego, A., & Pin, I. (2019). Nebulized Hypertonic Saline 3 % for 1 Versus 3 Days in Hospitalized Bronchiolitis : A Blinded Non-inferiority Randomized Controlled Trial. 1–7. <https://doi.org/10.1186/s12887-019-1804-0>
- Budi, F. A. K. S. (2025). Evaluating the Ineffectiveness of Chest Physiotherapy in Airway Clearance for Pneumonia Patients in the Hospital. *Jurnal Kegawatdaruratan Medis Indonesia (JKMI)*, 4(1), 43–50.
- Chaves, G. S. S., Freitas, D. A., Santino, T. A., Nogueira, P. A. M. S., Fregonezi, G. A. F., & Mendonça, K. M. P. P. (2019). Chest Physiotherapy for Pneumonia in Children. *Cochrane Database of Systematic Reviews*, 2019(1). <https://doi.org/10.1002/14651858.CD010277.pub3>
- Choudhury, J., & Rath, D. (2018). Thrombocytosis in Under-Five Children with Lower Respiratory Tract Infection. *Archives of Pediatric Infectious Diseases*, 6(1), 1–5. <https://doi.org/10.5812/pedinfect.61605>
- Chuang, Y. J., Hwang, S. J., Buhr, K. A., Id, C. A. M., Avey, G. D., Story, B. H., & Vorperian, H. K. (2022). Anatomic Development of the Upper Airway During the First Five Years of Life : A Three- Dimensional Imaging Study. <https://doi.org/10.1371/journal.pone.0264981>

- Hasanah, N., Sari, R. P., & Basri, H. (2024). *Family Nursing Care for the Adolescent Development Stage with Intervention of Warm Water Vapor Therapy and Eucalyptus Oil on the Smooth Airway in Children with ISPA's*. 3(9), 54–61. <https://doi.org/10.59003/nhj.v3i9.1094>
- Helena, D. F., Nurhayati, S., & Khotimah, N. I. H. H. (2023). Effectiveness of Nebulization Therapy with Chest Physiotherapy After Nebulization on Airway Clearance in Children with Bronchopneumonia. *International Journal of Global Operations Research*, 4(2), 74–78. <https://doi.org/https://doi.org/10.47194/ijgor.v4i2.215>
- Indriani, D., Ghraha Ramdhanie, G., & Yuyun Rahayu Fitri, S. (2024). NaCl 3% inhalation therapy and chest physiotherapy in pediatric patients with bronchopneumonia with nursing problems with ineffective airway nursing: case report. *JINTAN: Journal of Nursing Sciences*, 4(1), 150–159. <https://doi.org/10.51771/jintan.v4i1.640>
- Irshad, A., Sajjad, A., Lata, P., Chaudhary, S. T., Fahim, M. F., Shaikh, F., Liaquat, M., Jamil, K., & Jamil, K. (2025). *Effect of Nebulization and Chest Physical Therapy to Improve Respiratory Status Among Pediatric Pneumonia Patients in a Tertiary Care Hospital*. 3(5), 13–22. <https://doi.org/10.5281/zenodo.17062662>
- Ministry of Health of the Republic of Indonesia. (2023). *Health Profile of Indonesia 2023*.
- Lazarowski, E. R., & Boucher, R. C. (2021). Purinergic Receptors in Airway Hydration. *Biochemical Pharmacology*, 187(October 2020), 114387. <https://doi.org/10.1016/j.bcp.2020.114387>
- Lestari, N. E., Nurhaeni, N., & Chodidjah, S. (2018). The Combination of Nebulization and Chest Physiotherapy Improved Respiratory Status in Children with Pneumonia. *Enfermeria Clinica*, 28, 19–22. [https://doi.org/10.1016/S1130-8621\(18\)30029-9](https://doi.org/10.1016/S1130-8621(18)30029-9)
- Lubis, L., Siregar, P. S., Sucahyo, D., & Nurhayati, E. (2025). *Effect of Chest Physiotherapy on Effectiveness in Children with Pneumonia*. 9(2). <https://doi.org/10.34012/jkpi.v9i2.7419>
- Nadhifanny, D. D., & Perdani, R. R. W. (2017). *NaCl Nebulization 3% Is More Effective Than NaCl 0.9% in Acute Bronchiolitis. See also Psalm 136*.
- Nashira, I. P., Indriati, G., & Ernawaty, J. (2026). Effect of Paper Ball Therapy on Oxygen Saturation in Children with Respiratory System Disorders. *Scott*, 408–417. <https://doi.org/10.61878/bnj.v8i2.542>
- Nishak, L. K., & Maksum. (2025). Overview of Ineffective Management of Airway Clearance with Chest Physiotherapy and Inhalation of Oleum Cajeputi in Pneumonia Patients (Case Study). *Journal of Healthy Cultured Nursing*, 3(1), 2986–8548. <https://doi.org/10.35473/jkbs.v3i1.3312>
- Pascoal, L. M., Lopes, M. V. de O., Diniz, C. M., Nunes, M. M., Guedes, N. G., Menezes, A. P. de, & Neto, M. S. (2022). Content Validity of Ineffective Airway Clearance

Clinical Indicators. *Acta Paulista de Enfermagem*, 1–9.
<https://doi.org/10.37689/acta-ape/2022AO007434>

- Pieterse, A., & Hanekom, S. D. (2018). *Criteria for Enhancing Mucus Transport : a Systematic Scoping Review*. 1–11. <https://doi.org/10.1186/s40248-018-0127-6>
- Pulungan, N. S., Sulistyorini, L., & Razizah. (2025). A Literature Review on Risk Factors for Pneumonia in Toddlers. (1). <https://doi.org/10.60074/visikes.v24i2.12444>
- Restrepo, R. D., & Serrato, D. M. (2016). Should we nebulize hypertonic saline prophylactically in our pediatric intubated patients? *Respiratory Care*, 61(5), 716–718. <https://doi.org/10.4187/respcare.04812>
- Riana, K. R., Rizki, A. S., & Roro, S. L. (2022). Giving Nebulizer Therapy to Overcome the Ineffectiveness of Airway Clearance in Children. A with Bronchopneumonia in the Parikesit Room of RST. Wijayakusuma Purwokerto. *Journal of Self-Service*, 1(7), 1239–1246. <https://doi.org/https://doi.org/10.53625/jpm.v1i7.2818>
- Roqué-Figuls, M., Giné-Garriga, M., Granados Rugeles, C., Perrotta, C., & Vilaró, J. (2023). Chest Physiotherapy for Acute Bronchiolitis in Paediatric Patients Between 0 and 24 Months Old. *Cochrane Database of Systematic Reviews*, 2023(4). <https://doi.org/10.1002/14651858.CD004873.pub6>
- Sauteur, P. M. M. (2024). Childhood Community Acquired Pneumonia. *European Journal of Pediatrics*, 1129–1136. <https://doi.org/10.1007/s00431-023-05366-6>
- Sekararum, D. A., Nurameylia, S., Fatimatuzahroh, & Alpiah, D. N. (2025). *Management of Pediatric Physiotherapy in Cases of Bronchopneumonia*. 2(2), 924–937. <https://doi.org/10.61722/jirs.v2i2.5907>
- Tehupeiory, G. A., & Sitorus, E. (2022). Ineffectiveness of Airway Clearance with Chest Physiotherapy in Children Experiencing Bronchopneumonia at UKI Jakarta Hospital: Case Study. *Journal of Biology, Biology, and Genetics Education*, 9(1), 365–375. <https://doi.org/10.33541/pro-life.v9i1.3755>
- SDKI DPP PPNI Working Group Team. (2017). *Indonesian Nursing Diagnosis Standards (SDKI) (1st ed.)*. Central Board of Directors of the Indonesian National Nurses Association (DPP PPNI).
- Siki DPP PPNI Working Group Team. (2018). *Indonesian Nursing Intervention Standards (SIKI) (1st ed.)*. Central Board of Directors of the Indonesian National Nurses Association (DPP PPNI).
- SLKI DPP PPNI Working Group Team. (2019). *Indonesian Nursing Output Standards (SLKI) (1st ed.)*. Central Board of Directors of the Indonesian National Nurses Association (DPP PPNI).

- Triyani, D., Rukmasari, Em. A., & Hendrawati, S. (2024). Nebulation Therapy Intervention Using 3% NaCl with Respiratory Failure: A Case Study. 3(4). <https://doi.org/10.55681/sentri.v3i4.2570>
- Wardani, A. C., Kalsum, U., & Andraimi, R. (2023). *The Analysis of Factors Associated with Bronchopneumonia in Children Aged 1-5 Years*. 2(5), 1215–1230. <https://doi.org/10.55927/fjst.v2i5.4023>
- World Health Organization. (2022). Pneumonia in Children. <https://www.who.int/news-room/fact-sheets/detail/pneumonia>
- Agudelo-Cifuentes, M. C., Berbesi-Fernández, D. Y., & Salazar-Maya, Á. M. (2022). Preparation of a Scale for Assessing Nursing Care Needs in Dependent People. *Aquichan*, 22(3), e2235. <https://doi.org/10.5294/aqui.2022.22.3.5>