




Combination of Chest Physiotherapy and Postural Drainage for Airway Clearance in Bronchopneumonia: A Case Study

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ABSTRACT

Background: Respiratory diseases such as bronchopneumonia contribute to the highest cause of death in children aged less than two years. Airway clearance becomes a problem due to the accumulation of secretions, resulting in airway obstruction. Independent nursing interventions such as chest physiotherapy can be carried out to free the airway and reduce the burden of breathing. **Objective:** This study aimed to analyze the application of chest physiotherapy intervention in bronchopneumonia children with airway clearance problems. **Method:** The research design uses a case study with a nursing process approach. The sample for this study was one child patient aged nine months with bronchopneumonia who was taken using a convenience sampling technique. Data was collected using interviews, observation, and documentation studies using pediatric nursing care format instruments. Chest physiotherapy intervention was carried out three times with a duration of 10-15 minutes with a combination of postural drainage, which was then evaluated before and after the procedure. **Results:** Chest physiotherapy intervention in patients can improve coughing ability, increase sputum production and respiratory rate 40 times per minute, and decrease rhonchi and oxygen saturation by 96%. **Conclusion:** Chest physiotherapy can be an effective independent nursing intervention to overcome the problem of ineffective airway clearance nursing in children with bronchopneumonia. **Keywords:** Bronchopneumonia, Chest Physiotherapy, Postural Drainage, Airway Clearance

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I. INTRODUCTION

Respiratory disease in children is a serious problem that contributes to

morbidity and mortality rates in children (Setyaningsih et al., 2017). Bronchopneumonia in children is a global

burden because it contributes to the highest number of deaths in children aged less than five years (Kevat et al., 2022). Children under five are vulnerable because their immunity is still low. The increase in child deaths due to bronchopneumonia is mainly found in developing countries (von Mollendorf et al., 2022) due to several factors such as economic status, immunization, exclusive breastfeeding, environmental pollution, residential density, the environment, including maternal knowledge (Wardani et al., 2023). Bronchopneumonia impacts the body's metabolic system in children, which causes a decrease in the child's appetite and inadequate nutritional intake (Dewana et al., 2017). In addition, bronchopneumonia in children causes metabolic disorders due to inflammation, which impacts the regulatory system. Proinflammatory cytokines affect chondrocytes directly. It obstructs the bone formation process, which causes the child's growth and development process (Himawati & Fitria, 2020).

One of the causes of respiratory tract infections often found in children is bronchopneumonia (Wishaupt et al., 2017). Symptoms of bronchopneumonia in children usually include cough, runny nose, fever and severe shortness of breath. Bronchopneumonia usually causes

symptoms of secondary infection in the respiratory tract, which causes a decrease in the child's immune system (Sukma et al., 2020). Respiratory tract infections in children impact the body's metabolic system, which causes a decrease in the child's appetite, resulting in inadequate nutritional intake. (Dewana et al., 2017). In addition, respiratory tract infections in children cause metabolic disorders due to inflammation, which impacts the regulatory system. Proinflammatory cytokines affect chondrocytes directly, this results in obstruction of the bone formation process, which causes the child's growth and development process (Himawati & Fitria, 2020).

UNICEF and WHO report that bronchopneumonia is the highest cause of death in children under five compared to other diseases such as measles, malaria, and AIDS. (Siregar, 2020). Bronchopneumonia in children and toddlers in Indonesia is one of the ten most significant diseases in Indonesia, reaching a percentage of 22.23%. Meanwhile, bronchopneumonia in Indonesia is ranked 6th in the world as the highest tropical disease (Alaydrus, 2018). The discovery of pneumonia cases, including bronchopneumonia, in East Java reached a percentage of 50.3%, with a total of 77,203 children. Sidoarjo Regency was at the top in the incidence of childhood

bronchopneumonia, which reached 8,412 cases, followed by Surabaya City with 6,248 cases and Malang Regency with 5,556 cases.

The main nursing problem most often found in cases of children with bronchopneumonia is ineffective airway clearance. This problem occurs due to the infection process, allergic response, and secretions stuck in the respiratory tract, resulting in obstruction, dyspnea, and fatigue, making it difficult to expel the secretions (Lan et al., 2020). Apart from that, the ability to expel phlegm is lacking because the cough reflex is lacking and weak, making it difficult for children to expel phlegm. Nurses can use non-pharmacological interventions, including chest physiotherapy, to overcome the buildup of secretions in children (Lestari et al., 2018). Chest physiotherapy is essential in the treatment of most respiratory diseases in children. Chest physiotherapy can help the secretion of tracheobronchial secretions, thereby reducing airway resistance and improving gas exchange (Chaves et al., 2019). Apart from that, according to Manurung et al. (2022), chest physiotherapy helps facilitate ventilation, increase hemoglobin levels, increase oxygen saturation, and reduce shortness of breath in children.

Based on data from an assessment of Bronchopneumonia patients in the Children's Room of one of the Situbondi Regency Hospitals on March 15 2022, it was obtained that the patient was a nine-month-old child experiencing shortness of breath, respiratory frequency 58 times per minute with 2 liters per minute oxygen nasal cannula installed, oxygen saturation 94%, crackles throughout the lung fields and a weak cough reflex. Based on these problems, it is necessary to carry out a case study of nursing care for patients with a combination of chest physiotherapy and postural drainage interventions as an evidence-based independent nursing intervention, namely to determine the therapeutic effect on patients.

2. METHODS

The research design uses a case study with a nursing process approach, from assessment to evaluation. The sample for this study was 9-month-old pediatric patients accompanied by their parents, who were taken using a convenience sampling technique. Data was collected by interviews, observations, and documentation studies using pediatric nursing care format instruments. This research was conducted for three days (16-18 March 2022) at a hospital in Situbondo Regency. The nursing process in this study

starts from assessing the patient and parents, determining priority diagnoses, preparing the main intervention plan based on evidence-based nursing, implementing chest physiotherapy and a combination of postural drainage, which is carried out once a day (10-15 minutes) for three days, and carrying out nursing evaluations.

3. RESULTS

The results of nursing care for patients with bronchopneumonia found three nursing diagnoses, namely as follows:

- 1) Ineffective airway clearance (D.0001) b.d airway hypersecretion
- 2) Nutritional deficit (D.0019) b.d increased metabolic needs
- 3) Growth and development disorders (D.0106) related to the effects of physical disability

This study discovered that the main nursing diagnosis for patients with bronchopneumonia was ineffective airway

clearance. This diagnosis was confirmed based on the findings of major and minor data. The patient's mother said that the patient appeared to be experiencing shortness of breath, rhonchi in all lung fields, inadequate coughing, dyspnea, respiratory rates of 58 times per minute, and oxygen saturation of 94%.

The main nursing intervention on patients was airway management, which consisted of observation, therapy, and collaboration. The observation intervention plan includes (assessing breathing patterns such as frequency, depth, and effort of breathing, additional breath sounds, and the amount of sputum coming out. The therapeutic intervention plan consists of (giving warm drinks, giving nasal oxygen 2 liters per minute, and carrying out a combination of chest and postural physiotherapy drainage. Meanwhile, collaborative intervention is nebulizing the expectorant.

Table 1. Outcomes and Evaluation of Priority Nursing with Ineffective Airway Clearance Problems in Patients

No.	Result Criteria	Day 1	Day 2	Day 3
1.	Sputum production	3 (moderate)	4 (moderately decreased)	4 (moderately decreased)
2.	Ronchi	4 (moderately decreased)	4 (moderately decreased)	4 (moderately decreased)
3.	Dyspnea	3 (moderate)	4 (moderately decreased)	5 (decreased)
4.	Breathing pattern	3 (moderate)	4 (moderately improved)	5 (improved)
5.	Respiratory frequency	3 (moderate)	3 (moderate)	5 (improved)

Nursing outcomes in this study are related to airway clearance achieved within 3x24 hours. This outcome is used to evaluate priority nursing actions carried out on patients. Table 1 shows changes in patients' clinical signs based on previously determined outcomes. Nursing evaluation is carried out after implementation based on the priority interventions, namely chest physiotherapy and postural drainage. The final evaluation showed that the patient's clinical signs, such as sputum production, rhonchi, dyspnea, breathing pattern, and respiratory frequency, were improving on the first to the third day.

4. DISCUSSIONS

In this study, the priority nursing problem was airway ineffectiveness, determined by determining the main intervention, namely airway management and a combination of chest physiotherapy and postural drainage. The evaluation results showed a change in the patient's clinical signs for the better after intervention for three days.

Analysis of patient characteristics based on Bronchopneumonia risk factors

Based on the patient's assessment results, it was found that the patient's age was nine months. According to Siregar (2020), age is related to the incidence of

respiratory tract diseases such as bronchopneumonia in babies. Other studies also obtained the same results, that 75% of babies with bronchopneumonia occurred in children aged 0-2 years. It is associated with lower immunity in younger babies compared to older babies (Fikri, 2017). Apart from that, Hartati et al (2012) explained that babies are susceptible to developing bronchopneumonia because their respiratory tract is still imperfect and narrow.

The gender of the patients being managed is male. Research conducted by Efni et al (2016) showed that respondents who experienced bronchopneumonia were boys, with a percentage of 63%. Men are susceptible to bronchopneumonia because the diameter of men's respiratory tract is narrower than women's, and there are differences in body resistance (Rigustia et al., 2019)

When taking an anamnesis, the patient's mother explained that the child did not want to drink breast milk until now, even though it is essential to give exclusive breast milk to babies up to 0-6 months of age (Fikri, 2017). Babies who are not given exclusive breast milk are eight times more likely to develop bronchopneumonia than babies who are exclusively breastfed. Infant deaths aged 0-

5 months due to bronchopneumonia are often found due to not receiving exclusive breast milk, even though breast milk contains colostrum in the form of 16% protein and lactoferrin, IgA (Immunoglobulin A), and white blood cells which play a role in preventing infection. (Sutriana et al., 2021).

From data obtained from the mother, the patient experienced a weight loss of 0.4 kg to 5.4 kg. The child's weight did not match his age. From measurements of anthropometric status, body weight and age, a value of < -3 SD is obtained, which means that the body weight is meagre; the Antopometric status of body length and age is obtained with a value of < -3 SD, very short, the Antopometric status of body weight and body length is obtained a value of < -3 SD, which means thin, in babies at nine months old. Even though a baby should weigh 7.7 kg to 9.5 kg at nine months (Yuliastati & Arnis, 2016), Insufficient nutritional status will cause a decrease in body protein and cause the immune mechanism to worsen. Children will easily experience infections (Rigustia et al., 2019).

The results of the patient's environmental assessment showed that the patient's father was an active smoker, the home environment was near the main road, which allowed dust and dirt to infect the

child, and the house had low ventilation and minimal lighting sources during the day. Research by Rigustia et al (2019) the fact was that children with pneumonia lived with family members who smoked. Cigarettes contain dangerous substances that can damage the ciliary epithelium, reduce the mucociliary, and inhibit the phagocytosis process, thereby disrupting the immune system in the respiratory tract. In addition, poor ventilation and overcrowding cause the environment to become humid and make it easier for microorganisms to develop and spread (Fikri, 2017).

Analysis of ineffective airway clearance problems

The priority nursing problem in bronchopneumonia patients is ineffective airway clearance. Previous studies found that around 91.1% of children experienced respiratory tract infections, many of whom had problems with ineffective airway clearance on the first examination on the day of hospital admission. (Pascoal et al., 2020). The respiratory infections most commonly found in children are pneumonia and bronchiolitis, which is consistent with similar studies that found pneumonia to be the principal medical diagnosis frequently found in children (Andrade et al., 2014). Good airway

clearance is a clinical prognosis warning sign for complications in children with respiratory infections (Pascoal et al., 2020). Respiratory infections will cause discharge in children. Ineffective coughing is one of the triggers for children having difficulty expelling secretions, especially as the response of the child's respiratory system to secretions is still lacking, making it difficult for them to cough (D. B. R. Chaves et al., 2016).

Analysis of airway management interventions

Good airway clearance is a clinical prognosis warning sign for complications in children with respiratory infections (Pascoal et al., 2020). Respiratory infections will cause discharge in children. Ineffective coughing is one of the triggers for children having difficulty expelling secretions, especially since the child's respiratory system responds less to secretions, making it difficult for them to cough (D. B. R. Chaves et al., 2016). Observing, therapy, and collaboration are carried out to overcome airway clearance nursing problems. Observations are carried out to determine changes in clinical signs in patients and the presence of new problems. According to the Indonesian Nursing Intervention Standards, observations are the patient's breathing

pattern (breath frequency, depth of breath, and respiratory effort), additional breath sounds, and amount of sputum. Therapeutic intervention is carried out as a form of independent nursing action. The nursing actions are giving warm milk, giving oxygen, and carrying out chest physiotherapy (PPNI, 2018a). Chest physiotherapy is a group therapy to mobilize pulmonary secretions Potter & Perry (2016). Collaborative administration of expectorant medication via a nebulizer can thin phlegm. According to Potter & Perry (2016), administering a nebulizer increases mucociliary clearance, the body's normal mechanism for removing mucus and dead cells from the respiratory tract. Other research also reveals that using nebulizer therapy in children can increase the humidity and eliminate pulmonary secretions (Valji et al., 2021).

Analysis of the implementation of a combination of chest physiotherapy and postural drainage

Chest physiotherapy is carried out to eliminate secretions in the respiratory tract and loosen the patient's airways. Chest physiotherapy is widely applied to pediatric pneumonia patients which provide modal benefits in the form of removing secretions in the tracheobronchial tract, preventing airway

obstruction and airway resistance, increasing gas exchange, and reducing respiratory burden (Abdelbasset & Elnegamy, 2015). Supported by research, chest physiotherapy, when combined with appropriate body position, can increase mucociliary clearance, re-expansion, and ventilation of the lungs (Chaves et al., 2019). Other research adds that physiotherapy can reduce patients' length of stay in the hospital and improve the patient's respiratory status (Corten et al., 2015). The techniques used to implement chest physiotherapy in children use manual techniques, namely percussion and vibration. Percussion is performed by tapping the chest wall over the drainage area with cupped hands. The force of percussion must be done according to the patient's needs and response and not cause discomfort. The recommended percussion frequency is between 4.6 and 8.5 Hz. Vibration is carried out using a vibrating technique on the chest wall when the patient exhales (Belli et al., 2021). When carrying out percussion, the nurse carries out an assessment first to find out contraindications for the patient. According to Potter & Perry (2016), percussion is contraindicated in patients with bleeding disease, osteoporosis, and rib fractures.

Combination of chest physiotherapy and postural drainage. According to Freitas et al. (2015), postural drainage is carried out in children with the principle of not causing harm and not causing aspiration. The Modified Postural Drainage (MDP) technique prevents reflux episodes after reducing gastroesophageal reflux in children under 12 months. Combining postural drainage with conventional chest physiotherapy can increase airway clearance, phlegm per day, SaO₂, SpO₂, and improve arterial blood oxygen (AbdelHalim et al., 2016). Other research adds that postural drainage, in combination with chest physiotherapy, can improve coughing and gas exchange (Phillips et al., 2020).

Evaluation analysis of the results of applying a combination of chest physiotherapy and postural drainage

Nursing evaluation of managed patients is based on clinical conditions according to a combination of the Indonesian Nursing Outcome Standards. The outcome determined for patients with airway clearance problems is expected to increase airway clearance with outcome criteria including sputum production, presence of rhonchi, dyspnea, breathing pattern, and respiratory frequency (PPNI, 2018b). The parameters resulting from the

evaluation of the implementation of chest physiotherapy are increasing SpO₂, and normalizing breathing (Chaves et al., 2016). The latest research conducted by Chaves et al (2019) added that the parameters in airway management are chest radiographs, tachypnea, nostril breathing, peripheral oxygen saturation, and respiratory rate. Apart from that, the parameters for the success of chest physiotherapy are reduced purulent sputum, decreased sputum volume, and dyspnea (Navaratnam et al., 2019). Gomes and Donadio (2018) also revealed that success in providing chest physiotherapy interventions includes respiratory clinical signs such as increasing SpO₂, decreasing pulse pressure, and reducing oxygen dependence. Evaluations are carried out on patients every time it is implemented. The final evaluation showed that sputum could come out through cough and nose, rhonchi decreased, dyspnea decreased, the respiratory rate was 44 times per minute with a regular pattern, and oxygen saturation increased by 96% on the third day. Research results also prove chest physiotherapy can improve oxygenation status, such as oxygen saturation, breathing patterns, and tachypnea, and reduce tachypnea and sputum production (Abdelbasset & Elnegamy, 2015). From these data, it can be concluded that the

problem of airway clearance nursing is resolved with a combination of chest physiotherapy and postural drainage.

5. CONCLUSION

Nursing care results show that the nursing problem in children suffering from bronchopneumonia is ineffective airway clearance. Combination intervention of chest physiotherapy and postural drainage can be carried out according to the patient's clinical condition. This combination of interventions could improve the patient's clinical condition in this study by increasing sputum production, reducing crackles and dyspnea, and improving breathing patterns and respiratory frequency. Combination techniques of chest physiotherapy and postural drainage can be applied to children with airway clearance problems according to their condition. Hopefully, this intervention can be carried out in the nursing care process as a nurse's independent nursing intervention in a clinical setting.

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AUTHOR CONTRIBUTIONS

Substantial contributions to conception, data collection, and analysis: Muhammad Alfarizi, Peni Perdani Juliningrum, and Lantin Sulistyorini. Irmarawati Dia Primirti. Writing manuscript and revisions: Muhammad Alfarizi.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

DATA AVAILABILITY STATEMENT

The data are not publicly available due to privacy or ethical restrictions.

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