

Application of Postural Drainage and Chest Physiotherapy To Increase Airborne Clearance in Children With Bronchopneumonia

Susi Hartati^{1*}, Nidia Ainun Rindiani²

^{1,2}Department of Nursing, Sekolah Tinggi Ilmu Kesehatan Mitra Keluarga Bekasi, Indonesia

*Correspondence author : susi@stikesmitrakeluarga.ac.id

Abstract

There is still a high incidence of pneumonia in toddlers. Pneumonia is an infectious disease of microorganisms that affects one or both lungs, pneumonia that inflames the alveoli (tiny air sacs) inside the lungs is a type of bronchopneumonia. This disease causes symptoms of productive cough and shortness of breath with ineffective airway clearance nursing problems. This study aims to analyze the application of postural drainage and chest physiotherapy to improve airway clearance in toddlers with bronchopneumonia. This research uses a descriptive case study with three subjects according to the inclusion criteria is toddlers aged 1-5 years, have medical diagnosis of bronchopneumonia, with problem ineffective airway clearance nursing, and The family signed informed consent to do the therapy. The researcher also determined the exclusion criteria such as patients who suffered chest drain, haemodynamic instability, bone fragility or rib fractures, and any other contraindication to chest physical therapy. Three case studies were carried out in X private hospital in East Bekasi. The interventions with postural drainage is a technique laying to certain positions to drain secretions from your airways using gravity, the position is adjusted based on the location of the rhonchi sound. Also with chest physiotherapy is a nursing action include percussion (clapping) and vibration. Postural drainage and chest physiotherapy interventions were carried out twice a day in the morning and evening for 3 days. The results are two cases out of three, there was a decrease in the respiratory distress score and there were no additional breath sounds and they were able to cough effectively. In conclusion, Postural drainage and chest physiotherapy are effective in improving airway clearance in toddlers with bronchopneumonia. For this reason, nurses are expected to be able to provide postural drainage therapy and chest physiotherapy to increase airway clearance.

Keywords: *Postural drainage, chest physiotherapy, Airway clearance, Toddlers with bronchopneumonia*

Introduction

In Indonesia, pneumonia is the leading cause of death for toddlers with a percentage of 5.05% (Kemenkes RI, 2021). Pneumonia case finding among toddlers in Indonesia reached 50-70% from 2015 to 2019, which is a significant increase compared to the pneumonia coverage among toddlers from 2010 to 2014, which was 20-30%. In 2020, pneumonia coverage among toddlers in Indonesia decreased to 34.8%, due to the Covid 19 stigma, which resulted in a 30% decrease in visits to health centers for children coughing or having difficulty breathing. In Indonesia, the province of West Java has the 10th highest number of pneumonia cases in toddlers with a coverage of 31.2%, namely 4,898,913 incidence cases, 68 deaths and 987,630 nonpneumonia cough cases in 2020 (Kemenkes RI, 2021). In Bekasi city, there were 1,544 pneumonia cases among toddlers (4.6%) and 55 children suffered from severe pneumonia (Kemenkes, 2020).

Pneumonia is caused by viral, bacterial and pathogenic infections that cause peripheral alveolar inflammation and consolidation due to the filling of the alveoli cavity by exudates (Chronos, 2017). Pneumonia is classified based on the location of the infection, namely lobar pneumonia where infection occurs in one or both lung lobes, lobular pneumonia or bronchopneumonia, which often occurs at the end of the bronchioles, with spots due to mucopurulent exudate blockage, and interstitial pneumonia or bronchiolitis where the inflammatory process occurs in the alveolar wall and peri and interlobular tissues (Wahyuni *et al.*, 2023). Pneumonia in children results in an increase in excessive mucus production in the lungs due to the inflammatory process. Airway clearance is a condition in which the respiratory tract is free from the accumulation of secretions (Hanafi & Arniyanti, 2020). Children do not have the ability to cough perfectly so that airway clearance is not perfect. Complications that occur if the ineffectiveness of airway clearance is not treated will result in hypoxia (Sukma, 2020).

Pharmacological therapy of pneumonia in children is antibiotic therapy, antipyretic analgesics, bronchodilators and mucolytics (Meriyani *et al.*, 2016). In addition, there are non-pharmacological therapies in the form of passive postural drainage and active chest physiotherapy to improve children's airway clearance. (Kusuma *et al.*, 2022). According to researches Nurhayati *et al.*, (2022) that the application of chest physiotherapy is effective in improving

airway clearance in children. In the study Shutes *et al.* (2019) explained that physiotherapy as an effective measure to overcome airway clearance problems, therefore researchers evaluated airway clearance in children using scoring *Airway Clearance and Expansion Index* (ACE-I). Researcher Nayani *et al.* (2018) also make evaluations using scoring *The Clinical Respiratory Score* (CRS) to measure respiratory distress by categorizing mild, moderate and severe respiratory distress. In addition, international studies have also shown that chest physiotherapy is effective as a non-pharmacological therapy in children with respiratory distress (Chaves *et al.*, 2019).

Based on a preliminary study, the incidence of toddlers with pneumonia at Mitra Keluarga Hospital in East Bekasi from January to April 2023 was 182 children. Meanwhile, 126 toddlers with bronchopneumonia were recorded. In the study, postural drainage and chest physiotherapy were effective in reducing additional ronchi sounds, breathing frequency and nasal lobe breathing (Andersson-Marforio *et al.*, 2020). The application of postural drainage and chest physiotherapy in the room has not been a routine action by nurses because chest physiotherapy is an action in the physiotherapist room. However, based on the Indonesian Nursing Intervention Standards, physiotherapy becomes a nursing therapeutic intervention. Therefore, as a nurse who plays a role as a care giver, this nursing intervention can be done to overcome the problem of ineffective airway clearance in toddlers with pneumonia.

Methods

The analysis method used is the case study method. The data obtained from the nursing care approach, consisting of assessment, determining diagnoses based on the Indonesian Nursing Diagnosis Standards (SDKI), nursing interventions, implementation of postural drainage and chest physiotherapy and nursing evaluation. Nursing care was carried out on 3 toddlers with inclusion criteria, namely the medical diagnosis of bronchopneumonia, the nursing problem of ineffective airway clearance, children aged 1-5 years and the family agreed. The exclusion criteria were refusing to be treated and there were contraindications to chest physiotherapy such as heart failure, asthmatic status, shock and massive bleeding, severe lung infections, rib fractures, postoperative wounds and lung tumors. Postural drainage given position with sitting head held by pillow with 30 degrees and chest physiotherapy given with clapping and percussion. Implementation carried out is postural drainage and chest physiotherapy effective to be given 2x/day for 15 minutes at 1.5 - 2 hours before or after meals in three days. The evaluation used uses the Airway Clearance and Expansion Index/ACE-I evaluation instrument, ACE-I scoring indicators consist of sound breath score 0 normal or vesikuler, score 1 ronchi, score 2 ronchi with effective cough and score 3 ronchi with ineffective cough (Shutes *et al.*, 2019) also the respiratory distress category The Clinical Respiratory Score/CRS, the CRS assessment indicators consist of Respiratory rate score 0 is less than 30x/minute, score 1 is 30-40x/minute, score 2 is over 40x/minute, indicators auscultation score 0 is good air movement expiratory scattered ronchi, score 1 is depressed air movement, ronchi rales/crackles, score 2 is severe ronchi, indicators use of accessory muscles score 0 is no use retractions, score 1 is moderate intercostal retractions, score 2 is severe intercostal retractions, indicators of mental status score 0 is normal, score 1 is irritable, agitated, restless, score 2 lethargic, indicators of spO₂ score 0 is more than 95%, score 1 is 90-95%, score 2 is less than 90 %, the last is indicators of color score 0 is normal, score 1 is pale to normal, score 2 is cyanotic. The CRS was analysed as a continuous variable less than 3 is mild respiratory distress, 4-7 is moderate respiratory distress and 8-12 is severe respiratory distress (Nayani *et al.*, 2018) evaluated before and after the action is taken. Case studies were conducted from May 23, 2023 - June 03, 2023. The results of nursing care that has been carried out are then analyzed qualitatively by comparing theory and previous research.

Results and Discussions

Based on age and gender, the case studies conducted in this research are shown in the table below:

Table 1. Respondent Characteristics

No.	Initials	Gender	Age
1	An.S	Male	3 years old
2	An.A	Male	3 years old
3	An.N	Female	5 years old

The number of respondents in this case study were 3 children with a medical diagnosis of bronchopneumonia and a nursing problem of airway clearance, namely An. S, male, 3 years old, An. A, male gender, age, 3 years and An. N,

female, 5 years old. After postural drainage and chest physiotherapy with a frequency of twice a day for 3 days, an evaluation was carried out before and after the action using an assessment score. Clinical Respiratory Score / CRS (Shutes *et al.*, 2019) and using Airway Clearance and Expansion Index / ACE-I (Nayani *et al.*, 2018) the results are as follows:

Table 2. Evaluation of Respiratory Distress Level and Breathing Sounds on Day 1

No.	Initials	Before Interventions	After Interventions
1	An.S	Score CRS: Mild Distress Respiratory Score ACE-I 3: Ronchi with ineffective cough	Score CRS: Mild Distress Respiratory Score ACE-I 3: Ronchi with ineffective cough
2	An.A	Score CRS: Mild Distress Respiratory Score ACE-I 3: Ronchi with ineffective cough	Score CRS: Mild Distress Respiratory Score ACE-I 3: Ronchi with ineffective cough
3	An.N	Score CRS: Mild Distress Respiratory Score ACE-I 3: Ronchi with ineffective cough	Score CRS: Mild Distress Respiratory Score ACE-I 3: Ronchi with ineffective cough

Based on the table above in An.S before the postural drainage and chest physiotherapy actions the results of the assessment of RR 21 \times /minute, oxygen saturation 98% with a CRS score of mild respiratory distress and an ACE-I Ronchi score with an ineffective cough. Then after performing postural drainage and chest physiotherapy, the results of the assessment of RR 21 \times /minute, oxygen saturation 100% with a CRS score of mild respiratory distress and an ACE-I Ronchi score with an ineffective cough. In An.A before the action of postural drainage and chest physiotherapy, the results of the assessment of RR 24 \times /min, oxygen saturation 98% with a CRS score of mild respiratory distress and an ACE-I Ronchi score with an ineffective cough. After the action of postural drainage and chest physiotherapy, the results of the assessment of RR 24 \times /minute, oxygen saturation 100% with a CRS score of mild respiratory distress and an ACE-I Ronchi score with an ineffective cough. Also in an.N before the postural drainage and chest physiotherapy measures were carried out the results of the assessment of RR 25 \times /min, oxygen saturation 98% with a CRS score of mild respiratory distress and an ACE-I Ronchi score with an ineffective cough. Then after performing postural drainage and chest physiotherapy the results of the assessment of RR 25 \times /minute, 100% oxygen saturation with a CRS score of mild respiratory distress and an ACE-I Ronchi score with an ineffective cough.

Table 3. Evaluation of Respiratory Distress Level and Breathing Sounds Day 2

No.	Initials	Before Interventions	After Interventions
1	An.S	Score CRS: Mild Distress Respiratory Score ACE-I 3: Ronchi with ineffective cough	Score CRS: Mild Distress Respiratory Score ACE-I 3: Ronchi with ineffective cough
2	An.A	Score CRS: Mild Distress Respiratory Score ACE-I 3: Ronchi with ineffective cough	Score CRS: Mild Distress Respiratory Score ACE-I 2: Ronchi with effective cough
3	An.N	Score CRS: Mild Distress Respiratory Score ACE-I 3: Ronchi with ineffective cough	Score CRS: Mild Distress Respiratory Score ACE-I 2: Ronchi with effective cough

Based on the table above in An.S before the postural drainage and chest physiotherapy actions the results of the assessment of RR 25 \times /minute, oxygen saturation 98% with a CRS score of mild respiratory distress and an ACE-I Ronchi score with an ineffective cough. Then after performing postural drainage and chest physiotherapy, the results of the assessment of RR 21 \times /minute, oxygen saturation 100% with a CRS score of mild respiratory distress and an ACE-I Ronchi score with an ineffective cough. In An.A before the action of postural drainage and chest physiotherapy, the results of the assessment of RR 24 \times /min, oxygen saturation 98% with a CRS score of mild respiratory distress and an ACE-I Ronchi score with an ineffective cough. After performing postural drainage and chest physiotherapy, the results of the assessment of RR 23 \times /min, oxygen saturation 100% with a CRS score of mild respiratory distress and an ACE-I Ronchi score with an effective cough. Also in an.N before the postural drainage and chest physiotherapy measures were carried out the results of the assessment of RR 25 \times /min, oxygen saturation 98% with a CRS score of Mild Disturbance of Breathing and an ACE-I Ronchi score with an ineffective cough. Then after performing postural drainage and chest physiotherapy the results of the assessment of RR 23 \times /min, 100% oxygen saturation with a CRS score of mild respiratory distress and an ACE-I Ronchi score with an effective cough.

Table 3. Evaluation of Respiratory Distress Level and Breathing Sounds on Day 3

No.	Initials	Before Interventions	After Interventions
1	An.S	Score CRS: Mild Distress Respiratory Score ACE-I 3: Ronchi with ineffective cough	Score CRS: Mild Distress Respiratory Score ACE-I 3: Ronchi with ineffective cough
2	An.A	Score CRS: Mild Distress Respiratory Score ACE-I 2: Ronchi with effective cough	Score CRS: Normal Respiratory Score ACE-I 0: Normal/Vesikuler
3	An.N	Score CRS: Mild Distress Respiratory Score ACE-I 2: Ronchi with effective cough	Score CRS: Normal Respiratory Score ACE-I 0: Normal/Vesikuler

Based on the table above in An.S before the postural drainage and chest physiotherapy actions the results of the assessment of RR 25 ×/minute, oxygen saturation 98% with a CRS score of mild respiratory distress and an ACE-I Ronchi score with an ineffective cough. Then after performing postural drainage and chest physiotherapy the results of the assessment of RR 20 ×/minute, 100% oxygen saturation with a CRS score of mild respiratory distress and an ACE-I Ronchi score with an ineffective cough. In An.A before the action of postural drainage and chest physiotherapy the results of the assessment of RR 22 ×/minute, oxygen saturation 98% with a CRS score of mild respiratory distress and an ACE-I Ronchi score with an ineffective cough. After the action of postural drainage and chest physiotherapy, the results of the assessment of RR 20 ×/minute, oxygen saturation 100% with CRS score No Breathing Disorders and ACE- I Normal / Vesicular score. Also in an.N before the postural drainage and chest physiotherapy measures were carried out the results of the assessment of RR 23 ×/min, oxygen saturation 98% with a CRS score of Mild Disturbance of Breathing and an ACE-I Ronchi score with an effective cough. Then after the action of postural drainage and chest physiotherapy the results of the assessment of RR 20 ×/minute, 100% oxygen saturation with CRS score No Breathing Disorders and ACE- I Normal / Vesicular score.

In two of the three cases, the assessment results before postural drainage and chest physiotherapy showed an increase in airway clearance. After the action of postural drainage and chest physiotherapy, two of the three children experienced an increase in airway clearance. The application of position, percussion and vibration in children can mobilize secret in the airway so as to increase airway patency. Increased airway patency where RR is normal, regular breathing rhythm, no ronchi and able to remove sputum are indicators of increased airway clearance (Febriyani *et al.*, 2021). In addition, physiologically, percussion techniques in chest physiotherapy cause waves in the chest wall, namely amplitude and frequency so that the consistency and location of the secret changes (Tehupeiory & Sitorus, 2022). Percussion technique is a manual technique in the form of a pat on the chest / back under the patient's arm with the aim of loosening thick and sticky mucus from the side of the lungs. While the vibration technique is a vibration technique to push the secret out. Then in the application of postural drainage where the position is adjusted to the secret retained in the child, the position setting is opposite to the location of the segment where the secret accumulation occurs (Hanafi & Arniyanti, 2020). Research Wardiyah *et al.* (2022) showed that the application of chest physiotherapy was effective in clearing airway secretions. In the study Pangesti & Setyaningrum, (2020) showed similarly that non-pharmacological techniques of chest physiotherapy effectively address airway clearance in children with airway disease. In the study Ken *et al.*(2022) showed that chest physiotherapy therapy was effective in overcoming airway clearance problems in patients with pneumonia. In the study Syafiati & Nurhayati (2021) also showed that chest physiotherapy is effective for children aged 3-6 years with ineffective airway clearance problems. Other studies have shown that postural drainage and chest physiotherapy have an effect on improving airway clearance with differences in sputum production and ronchi sounds that become vesicular in children with bronchopneumonia (Sarina & Widiastuti, 2023).

In the first case, An.S, the evaluation of the child still did not experience an increase in airway clearance, this was due to the intensity of providing chest physiotherapy which was not continuous due to the child who was not cooperative during the implementation due to the impact of hospitalization experienced by the child (Tehupeiory & Sitorus, 2022). In addition, the child's inability to cough effectively is to inhale through the nose and exhale through the mouth to form the letter (Hanafi & Arniyanti, 2020). The ability to cough effectively is also influenced by age, where age is a factor in whether the patient can be taught to cough effectively or not. In addition, there is the factor of long treatment or entering the last month of treatment (Widiastuti & Siagian, 2019). Similar to the case of An.S due to the age of 3 years who have not been able to follow the direction of effective coughing and a long history of lung infection. Therefore, the application of postural drainage and physiotherapy in this case should be longer because the longer the intervention is carried out, the more changes in airway clearance will be shown (Tehupeiory & Sitorus, 2022). The application of postural drainage and chest physiotherapy is a recommendation for independent nursing actions in the room to improve airway clearance effectively.

Conclusions

Based on the results of the case study analysis of the application of postural drainage and chest physiotherapy in three bronchopneumonia children with ineffective airway clearance problems, it was found that two children out of three children who performed postural drainage and chest physiotherapy 2 times a day for 3 days had an impact on the score of respiratory distress to decrease and additional breath sounds were absent and could cough effectively so that the goal of improved airway clearance was achieved. Whereas one child did not experience significant improvement which was influenced by factors of the child's condition, history of recurrent lung infections and the length of chest physiotherapy itself. It can be concluded that the application of postural drainage and chest physiotherapy is effective in improving airway clearance in children with bronchopneumonia.

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