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Addressing the Challenge of Ineffective Airway Clearance in Toddler-Aged Children: The Role of Chest Physiotherapy in Arjawinangun Hospital

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Abstract. The health problems often experienced by *toddler-age* children are the respiratory system, with nursing problems, namely ineffective airway cleaning caused by bacteria, viruses, fungi, and protozoa that infect the lungs. Handling ineffective airway cleaning nursing problems in children can be done by medical and nursing measures, including chest physiotherapy. **Objectives:** To describe the implementation of chest physiotherapy measures, define the response and results of chest physiotherapy, and analyze the difference in outcomes in two pediatric patients with ineffective airway clearance performed by chest physiotherapy. **Methods:** A comparative descriptive research design will be used to compare two subjects with the same criteria and conditions. **Results:** After five days of intervention, there was a difference in response in the two subjects; namely, airway clearance in subject one could be resolved with four indicators: sputum, rakhi, dyspnea, and respiratory rate. In subject 2, it could be partially resolved with 2 indicators that were resolved, namely dyspnea and respiratory rate, and this intervention was by the nursing problem that was enforced. **Conclusion:** The application of chest physiotherapy in *toddler* children can provide improvements in sputum, dyspnea, Ronchi, and respiratory rate within normal limits.

Keywords: Ineffective airway clearance, *toddler*, chest physiotherapy

INTRODUCTION

Respiratory system disorders are still the main problem in toddlers; there were 740,180 toddlers who died due to respiratory system disorders in 2019 because the immune system in children, especially in babies, is still not fully developed, so it can cause children to be susceptible to respiratory disorders (WHO, 2019). In 2018, 19,000 children died due to respiratory system disorders (Ministry of Health, 2020).

Cases of respiratory system disorders in West Java province in 2020 were 31.2% of cases found in toddlers under 5 years old. Several respiratory system disorders are commonly

experienced by toddlers, namely pneumonia, asthma, bronchitis, emphysema, pharyngitis, and pulmonary tuberculosis, with symptoms that are often felt, namely shortness of breath due to secretions, rapid breathing, additional breathing sounds (ronchi, *wheezing*, stridor, etc.), restlessness, decreased appetite, nausea, and vomiting. Ineffective airway cleaning experienced by children can cause symptoms felt by children with respiratory system disorders.

Airway clearance is the inability to clear airway obstructions to maintain airway plasticity. (Rahmayani et al., 2023). Ineffective airway cleaning experienced by children will inhibit the fulfillment of oxygen supply to the brain and body tissues due to inflammation in the child's pulmonary parenchyma, which can result in imperfect lung development due to the accumulation of secretions in the lungs. There are several nurses' self-actions that can be taken to remove secretions from children with ineffective airway clearance, such as practical cough exercises, semi-fowler or Fowler positioning, chest physiotherapy, giving warm drinks, and sucking mucus (PPNI, 2016b).

Chest physiotherapy is a nurse's self-medication that aims to remove secretions so that there is no buildup in the lungs and does not cause airway obstruction and other medical complications. There are several stages when doing chest physiotherapy, starting from adjusting the child's position with *the postural drainage* position, doing percussion with *cupping hands*, doing vibrations, and providing opportunities for parents to do chest physiotherapy on children (Maidartati, 2014).

Research conducted by Maidartati (2014) showed that there is a difference in breathing frequency before and after chest physiotherapy nursing is carried out. In a study conducted by (Rahmayani et al., 2023), the results were obtained that when nursing treatment was carried out for three days, the complaints of cough effectively improved, sputum production decreased, the menstrual cramps decreased, and the respiratory frequency improved. In the study of Aryayuni et al. (2015), there is an effect of chest physiotherapy on sperm production in children, and there is a difference between sputum removal before chest physiotherapy and after chest physiotherapy.

This study aims to describe the implementation of chest physiotherapy in toddler-age children with ineffective airway cleaning nursing problems, describe the response and results to chest physiotherapy, and analyze the gap between the two subjects who underwent chest physiotherapy.

METHOD

The design used in this study is comparative descriptive with a case study approach that will compare two child subjects with the same intervention, namely chest physiotherapy, with the main nursing problem, namely ineffective airway clearance. The subjects used in this study were children of *toddler* age (1-3 years) with a cough with phlegm, additional breathing sounds (rhonchi,

wheezing), and a buildup of lung secretions. The subjects to be studied are two with the same problems and criteria in the children's room of Arjawinangun Hospital.

The researcher used data collection techniques to prepare this study, including interviews, observations, and documentation. Data analysis uses an unstructured qualitative approach with a narrative form format. The researcher will analyze the data by assessing both subjects with the same problems and criteria given chest physiotherapy intervention for 5 days. After collecting all the data, the researcher will analyze the difference in outcomes before and after the chest physiotherapy intervention.

DISCUSSION

Subject description

The subjects used in this study were *toddlers*; Subject 1 was 27 months old, and Subject 2 was 28 months old. They had the same medical diagnosis, namely bronchopneumonia, and were given chest physiotherapy intervention. The subject used in this study is in line with Alya Syafiati et al. (2021) research that chest physiotherapy can be done to improve airway clearance, which is not effective and can be done in toddler-age children. This is the plan in this study. The complaints that occurred in both subjects were the same, as for the complaints, namely cough and there was a secretion that was difficult to excrete, rakhi in both lungs, chest wall retraction, dyspnea, and 3LPM oxygen installed; the incidence of cough in subject 1 An. N occurred five days before being admitted to the hospital, and the coughing incident occurred in subject 2, An. K occurred 13 days ago before being admitted to the hospital and had experienced bronchopneumonia at the age of 11 months. Based on this data, both subjects have the same nursing problem, namely ineffective airway cleaning, this is by the theory of PPNI (2016) in the book Indonesia Nursing Diagnostic Standards that in the book on the diagnosis of ineffective airway cleaning nursing there are significant symptoms and signs such as ineffective cough, there is excess sputum, there is additional breathing sound wheezing or groping and there are minor symptoms and signs, namely dyspnea, restlessness, altered breathing frequency.

Overview of Chest Physiotherapy Implementation

The implementation of chest physiotherapy in both subjects was carried out for five days. The implementation stage of chest physiotherapy consists of the patient preparation stage, equipment preparation, pre-orientation stage, and implementation stage, starting from reviewing the respiratory system and positioning the child in a postural *drainage position* according to the location of the secretion; there is a similarity in the location of the secretion in the two subjects, namely in the superior segment of the lungs, so that the subject is positioned in a pronation position with the modification of the subject on the lap of the researcher or the subject's parents from day 1 Until the fifth day, percussion and vibration are carried out according to the location of the secretion, which is under the shoulder blades. Percussion is carried out simultaneously with

vibration, with 25 claps in 10 seconds and vibration with one hand, according to Setiawati's theory (2023) and the PPNI DPP SPO Guidelines Working Group (2021). The time implementation of chest physiotherapy in this study was carried out two times a day after nebu, namely at 12.00 WIB and 20.00 WIB for 20 minutes, in line with the research of Azahra et al. (2022)

Implementation of chest physiotherapy in subject 1 An. N was carried out from March 23, 2024, to March 27, 2024; on the first day of the implementation of the chest physiotherapy intervention, subject 1 was still uncooperative, so when positioning subject 1 in a pronation position by the researcher or the subject's parents, subject 1 refused, so that chest physiotherapy was carried out directly on the bed in a semi-fowler position, This is in line with research with research (Melati et al., 2018) chest physiotherapy is carried out in toddler-age children by being positioned directly on the bed. Percussion is carried out simultaneously with vibration, with a total of 25 claps in 10 seconds, and vibration is carried out with one hand. Subject 1 was willing and began to be cooperative in the postural *drainage position* with the pronation position with the modification of the subject on the lap of the parents on the second day by being persuaded by the researcher and the support of both parents and providing distractions to the subject's favorite toys so that the implementation of chest physiotherapy on subject one on the 2nd to fifth day could run well. Researchers suspect that children need to adapt first to nurses; therefore, researchers often invite children to play and bring children's favorite toys so that children can quickly adapt to researchers; this method is in line with research (Santos et al., 2020)

Implementation of chest physiotherapy in subject 2 An. K was carried out from March 30, 2024, to April 3, 2024, on the 1st and second days. Subject 2 was still uncooperative and often rebellious in chest physiotherapy, so the postural *drainage position* was carried out in a semi-fowler position; percussion was carried out simultaneously with vibration with a total of 25 claps, and vibration was carried out with one hand. Both parents of the subject helped the researcher to calm their child when his child rebelled. On the 3rd, fourth, and 5th days, the subjects have begun to be cooperative and want to do a postural position of drainage and calm down when percussion and vibration are carried out with the help of both parents of the subject by distracting the subject's favorite toy.

Response and Results of Chest Physiotherapy Intervention

Based on the table below, there were improvements before and after the intervention of chest physiotherapy—sputum in subject 1 An. N on the first day does not come out, but sputum can come out on the second day, and there is no sputum on the fifth day. The researcher suspects this is because on the first day, chest physiotherapy is carried out before the administration of the nebulizer. However, on the second day the secretion can come out because the implementation of chest physiotherapy is carried out after administering the nebulizer. This is in line with the research of Aryayuni et al. (2015) & and Azahra et al. (2022) that the implementation of chest physiotherapy

is more effective after the administration of a nebulizer because the nebulizer is an action by providing steaming so that the secretions become thinner and more accessible to expel by chest physiotherapy through postural *drainage*, percussion, and vibration. Sputum is no longer present on the fifth day.

Table 1. Response and Results of Chest Physiotherapy Intervention

No.	Time	Assessed aspects	Subject 1				Subject 2			
			Morning		Afternoon		Morning		Afternoon	
			Before	After	Before	After	Before	After	Before	After
1.	Day 1	Sputum	Not out	Not out	Not out	Not out	Not out	out	Not out	Out
		Ronkhi	Ronkhi	Ronkhi	Ronkhi	Ronkhi	Ronkhi	Ronkhi	Ronkhi	Ronkhi
		Dyspnoea	Already	Already	Already	Already	Already	Already	Already	Already
		Respiratory rate	56x/mnt	52x/mnt	54x/mnt	49x/mnt	62x/mnt	58x/mnt	60x/mnt	56x/mnt
2.	Day 2	Sputum	Not out	Out	Not out	Out	Not out	out	Not out	Out
		Ronkhi	Ronkhi	Ronkhi	Ronkhi	Ronkhi	Ronkhi	Ronkhi	Ronkhi	Ronkhi
		Dyspnoea	No	No	No	No	Already	Already	Already	Already
		Respiratory rate	48x/mnt	45x/mnt	43x/mnt	40x/mnt	54xmnt	51x/mnt	52x/mnt	49x/mnt
3.	Day 3	Sputum	Not out	Out	Not out	Out	Not out	out	Not out	Out
		Ronkhi	Ronkhi	Samar	Samar	Samar	Ronkhi	Ronkhi	Ronkhi	Ronkhi
		Dyspnoea	No	No	No	No	No	No	No	No
		Respiratory rate	37x/mnt	34x/mnt	35x/mnt	30x/mnt	49x/mnt	47x/mnt	46x/mnt	42x/mnt
4.	Day 4	Sputum	Not out	Out	Not out	Out	Not out	out	Not out	Out
		Ronkhi	Samar	Samar	Samar	Samar	Ronkhi	Samar	Samar	Samar
		Dyspnoea	No	No	No	No	No	No	No	No
		Respiratory rate	32x/mnt	29x/mnt	29x/mnt	27x/mnt	40x/mnt	36x/mnt	38x/mnt	34x/mnt
5.	Day 5	Sputum	None	None	None	None	Not out	out	Not out	Out
		Ronkhi	Vesicles	Vesicles	Vesicles	Vesicles	Samar	Samar	Samar	Samar
		Dyspnoea	Not	No	No	Not	Not	Not	Not	Not
		Respiratory rate	30x/min	27x/min	29x/min	26x/min	33x/min	31x/min	31xmin	29x/min

Ronkhi in subject 1 began to decrease on day three and began to sound vesicular on day 5; this is in line with the research of Alya Syafiati et al. (2021), where there were results that rakhi improved on day three after the implementation of chest physiotherapy measures. Dysparnia in subject 1 improved on day 2 with spo 2 96%, and the child was no longer on oxygen; this is in line with research (Polapa et al., 2022) that there was a significant effect on oxygen saturation in subjects after chest physiotherapy was performed. The respiratory rate in subject 1 improved on day 3 with a respiratory rate of 30x/minute; this is in line with the research of Alya Syafiati et al. (2021) and Maidartati (2014) that respiratory rate can improve on day 3 of the implementation of chest physiotherapy. Chest physiotherapy can help improve respiratory rate in children with ineffective airway clearance.

Sputum in subject 2 came out on day one because the implementation of chest physiotherapy was carried out after the administration of a nebulizer; this is to the research of Aryayuni et al. (2015) and Azahra et al. (2022). In subject 2 on the 5th day there was still sputum and ronkhi began to be faintly heard on the 4th day but on the 5th day the breath sound of subject 2 was not heard vesicular sounds, the researcher suspected that this was because subject 2 was less cooperative and often browsed during the implementation of chest physiotherapy and the parents of the subject who did not follow the researcher's recommendations on days 1 and 2 such as giving

warm water and positioning the semi-fowler child and subject 2 had a history of Bronchopneumonia with the same complaint at the age of 11 months is one of the factors causing the long recovery process in subject 2 so that on the 5th day there is still sputum and breath sounds that have not been vesicular yet, this is supported by research by Azahra et al., (2022) that drinking warm water can help secretions be removed more effectively during the implementation of chest physiotherapy and children who have a history of previous diseases with the same disease, namely bronchopneumoniaia can being the cause of a longer recovery process.

Dyspnea in subject 2 improved on day 3 with a saturation of 97%, and the respiratory rate improved on day 4, which was 34x/minute. The researcher suspected this because on days 1 and 2, subject two was still uncooperative in the implementation of chest physiotherapy and often removed oxygen tubes, and at the time of nebulizer administration, subject two often removed the nebulizer mask, Subject 2 lacked maximum in doing therapy in the hospital so that dyspnea improved on day three and respiratory rate improved on day 4.

Overview of Gap Analysis

After chest physiotherapy for five days and seeing the results and responses of the actions that have been carried out on the two subjects, there is a gap between subject one and subject 2, namely in subject 1 when the implementation is more cooperative than subject two. The problem of ineffective airway clearance in subject one can be solved, and subject two can be partially resolved. This is because of the cooperation of subject One during the implementation of chest physiotherapy and carrying out therapy in the hospital so that airway clearance in subject one can be resolved on the fifth day, in line with the research of Anggraini Subekti et al. (2023) said that ineffective airway clearance can be resolved on day six after the implementation of chest physiotherapy.

CONCLUSION

Both subjects underwent chest physiotherapy intervention in the hospital for five days, starting from postural *drainage*, percussion, and vibration. Subject 1 began cooperating and wanted to do a postural *drainage position* on the second day. Subject 2 began cooperating and wanted to do the postural drainage position on the third day. Subject 1, after chest physiotherapy was carried out, the results were obtained that sputum production decreased, raunchy decreased, dyspnea improved, and respiratory frequency improved so that nappies road cleaning could be resolved. Subject 2, after chest physiotherapy for five consecutive days, obtained the result that the sputum was still present, the rakhi was still faintly heard, dyspnea improved, and the respiratory frequency improved so that airway clearance could be partially resolved.

SUGGESTION

The results of this study can be used as an initial basis for continuing further research. They can develop this research by conducting follow-up research on chest physiotherapy using toy

distractions and children's music in subjects who experience respiratory system disorders, especially with ineffective airway cleaning problems.

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