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Effect of Chest Physiotherapy on Respiratory Effectiveness in Children with Pneumonia

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ABSTRACT

Pneumonia remains a leading cause of morbidity and mortality in children, especially those with weakened immunity due to factors such as insufficient breast milk, malnutrition, HIV or measles infection, premature birth, or incomplete immunizations. Environmental exposures—including dust, cigarette smoke, and air pollution further elevate the risk. This study aimed to systematically review literature (2019–2024) on the effectiveness of chest physiotherapy in improving clinical outcomes, specifically respiratory rate, oxygen saturation, length of hospital stay, and symptomatic recovery in children with pneumonia. We conducted electronic searches on Google Scholar, NCBI, and accredited Indonesian journals using the keywords "chest physiotherapy" and "pneumonia in children." From approximately 60 initially identified articles, eight met our inclusion criteria and were reviewed in full. Most studies were quasi-experimental; one was a randomized controlled trial. Study populations ranged from infants (0–5 years) to older children (6–12 years). Interventions comprised postural drainage, clapping, vibration, percussion, deep-breathing exercises, and effective coughing techniques. Results from eight studies indicated modest improvements in oxygen saturation and reductions in respiratory rate in some small trials. However, findings were inconsistent, with substantial heterogeneity in methodology, intervention protocols, and outcome reporting. Overall evidence quality was low to moderate. Chest physiotherapy may offer potential benefits in terms of oxygenation and respiratory rate in pediatric pneumonia patients. Nevertheless, current evidence remains limited and heterogeneous. High-quality randomized controlled trials using standardized protocols are needed to establish stronger recommendations.

Keywords: pneumonia, children, chest physiotherapy, respiratory rate, oxygen saturation

INTRODUCTION

Pneumonia in children is a serious condition that requires careful attention. This disease may present with symptoms such as cough, fever, and shortness of breath. If not treated promptly, pneumonia can lead to more severe complications or even death. Children are generally at higher risk of developing pneumonia due to their immature immune systems. Other contributing factors include lack of breastfeeding, malnutrition, infections such as HIV or

measles, incomplete immunization, absence of pneumococcal vaccination, and premature birth. Environmental exposures—such as cigarette smoke, dust, dense living conditions, and air pollution—can also increase the risk of pneumonia in children (Kementerian Kesehatan RI, 2018).

Despite advances in medical care, pneumonia remains the leading infectious cause of death among children under five worldwide. According to the World Health Organization (WHO), in 2019 alone, pneumonia caused over 740,000 deaths in this age group—more than malaria, measles, and HIV/AIDS combined (WHO, 2023). While antibiotics are the cornerstone of pneumonia treatment, supportive therapies are also essential in improving respiratory outcomes and reducing the burden of illness. One such supportive intervention is chest physiotherapy, which aims to clear secretions, improve oxygenation, and ease breathing difficulties in children with pneumonia.

One of the common supportive treatments used in pediatric pneumonia is chest physiotherapy. This intervention has been shown to effectively mobilize tracheobronchial secretions, improving clinical indicators such as respiratory rate and oxygen saturation (Abdelbasset & Elnegamy, 2015). Chest physiotherapy serves as an important adjunctive therapy in managing pediatric respiratory diseases. Its primary goal is to help eliminate mucus from the airways, thereby reducing airway resistance, enhancing gas exchange, and facilitating easier breathing. Techniques used in pediatric physiotherapy—though similar to those in adults—include postural drainage, clapping, vibration, percussion, deep breathing, and effective coughing, all aimed at enhancing mucociliary clearance (Potter et al., 2017).

In pneumonia, the accumulation of pulmonary secretions leads to airway obstruction, impairing ventilation. Clinically, this manifests as decreased oxygen saturation and increased respiratory rate in children. Prompt and appropriate intervention can mitigate the risk of complications, including respiratory failure. Chest physiotherapy in children plays a critical role in removing secretions and inflammatory exudates from the airway, decreasing resistance, optimizing gas exchange, and reducing the work of breathing. Through this literature review, the clinical impact of chest physiotherapy in pediatric pneumonia can be better understood (Corten, Jelsma, & Morrow, 2015).

This study provides novel insights by specifically evaluating the effectiveness of chest physiotherapy on respiratory parameters such as respiratory rate, oxygen saturation, and airway clearance in toddlers with pneumonia, a population group that is particularly vulnerable yet underrepresented in physiotherapy-focused clinical research. Unlike previous

studies that often combine interventions or focus on older children, this research isolates chest physiotherapy as a single intervention in toddlers, allowing a clearer understanding of its direct clinical benefits. Furthermore, by employing a structured assessment before and after therapy, this study contributes valuable evidence for developing standardized physiotherapy protocols in pediatric pneumonia management.

METHOD

The method used in this study was a literature review regarding the effect of chest physiotherapy on clinical improvement in children with pneumonia. The article search was conducted electronically using the keyword Chest Physiotherapy, pneumonia in children, while the keyword in Indonesian used was Chest Physiotherapy, pneumonia in children. Database sources used are Google Scholar, NCBI (National Center for Biotechnology Information), and accredited Indonesian journals. The articles sought are articles in English and Indonesian in the range of 2019-2024.

Using the above keywords and article restrictions, the number of articles found is 60 articles, but only 8 are relevant. Excluded articles were commentary articles, qualitative studies and systematic reviews. Eight research articles were used in this literature review. The majority of articles are research using the method of quasi experiment non randomized controlled trial. 1 (one) research article using sampling with RCT (Randomized Controlled Trial). Most of the respondents in the research article were children hospitalized for pneumonia with the age range of 0-5 years, and there was 1 research article with the age range of respondents 6-12 years. The article search results will be displayed in Table 1 below:

No	Researcher and Year Research	Title Research	Design	Number and Criteria of Participants	Intervention	Result
1	Saputra, et al. (2023)	Effectiveness of Chest Physiotherapy in Improving Children's Health with	Quasy experiment dengan pendekatan pre post-test with control	24 toddlers who underwent pneumonia treatment in the past three months	Chest Physiotherapy	Chest physiotherapy improves respiratory stability in pediatric pneumonia,

		Pneumonia Diagnosed	group			marked by reduced retractions, lower hyperventilation, stable respiratory rate, and better oxygen saturation
2	Daya and Sukraeny (2020)	Chest Physiotherapy and Steem Inhaler Aroma therapy in Maintaining Airway Patency of Chronic Obstructive Pulmonary Disease Patients	Case Study	A case study was conducted on 2 patients with chronic obstructive pulmonary disease	The author performed inhalation therapy by adding eucalyptus oil to hot water until steam with a fresh aroma was produced, which the patient then inhaled. This was followed by 10 minutes of chest physiotherapy and effective coughing instruction.	A combination of chest physiotherapy and steam inhaler aromatherapy was effective in maintaining airway patency, as indicated by decreased sputum volume and improvement in lung sounds (reduced rhonchi in Case I and vesicular sounds in Case II)

3	Pratiwi, et al. (2023)	The application of chest physiotherapy in overcoming airway clearance is ineffective in children with Pneumonia at Dr. Moewardi Hospital Surakarta	Case Study	2 patients treated in Flamboyan Room 9 at Dr. Moewardi Surakarta who experienced pneumonia.	Chest physiotherapy is carried out 3 consecutive days for 15-20 minutes.	Airway cleaning combined with chest physiotherapy for 3 days improved sputum clearance, respiratory rate, and oxygen saturation, while maintaining normal pulse rate in both patients..
4	Santi, et al. (2023)	Effect of Chest Physiotherapy and Close Suction on Tidal Volume in Pneumonia Patients Using Ventilators in the ICU Room of Taman	Quantitative Research Using Pre Design experiment one group pre-test & post-test.	Total of 12 respondents. Patients with mechanical ventilators installed in the ICU room of Taman Husada Regional Hospital, Bontang City.	Chest physiotherapy and close suction	Tidal volume increased from 392.41 to 419.75 after intervention, with a statistically significant difference ($p = 0.00$; $\alpha = 0.05$).

		Husada Hospital Bontang				
5	Kusuma et al. (2022)	Effect of Chest Physiotherapy on Airway Effectiveness in Pneumonia Patients In the hospital children's room Bangil Pasuruan County	True experiment	The sample in this study was 18 people with pneumonia, Divided into 2 groups, namely the Chest Physiotherapy Group and SOP, each with 9 people.	Chest Physiotherapy	Both groups showed significant improvement in airway effectiveness (p = 0.007), with a greater reduction in scores in the chest physiotherapy group (p = 0.04))
6	Hidayatin (2019)	Effect of Chest Physiotherapy and Pursed Lips Breathing (Tongue Blowing) on Airway Cleaning in Toddlers with Pneumonia	Quasi-experimental with Non-Randomized Design without control group pretest-posttest	Thirty toddlers with pneumonia were divided into three groups. Group III received chest physiotherapy and pursed-lip breathing. Airway cleanliness was assessed before and	Group I: 10 respondents were given chest physiotherapy intervention 2x/day for 2 days. Group II: 10 respondents	Airway cleaning improved significantly after chest physiotherapy and the combination with pursed-lip breathing (p = 0.000), but not after pursed-lip breathing alone

				after based on breathing parameters.		
7	Aryayuni (2019)	The Effect of Chest Physiotherapy on Sputum Production in Children with Respiratory Disorders at the Children's Poly at the Depok City Regional Hospital	Quasi experimental design with one group pretest-posttest approach	11 children aged 6-12 years who have respiratory disorders (TB, ISPA, asthma, Pneumonia)	Chest physiotherapy was performed on 11 children. Observations of sputum output were carried out before and after chest physiotherapy	Chest physiotherapy significantly increased sputum production in children (p = 0.000).
8	Dewi, et al. (2024)	Effect of Chest Physiotherapy on Airway Cleaning Children with bronchopneumonia aged 1-5 years at Tamada Regional	Quasi experimental with the pretest-postest one group design approach -	16 Children with bronchopneumonia aged 1-5 years at Tamada Regional Hospital, Bontang, East Kalimantan	Chest physiotherapy was administered following a pretest of respiratory rate and airway cleanliness, then evaluated again through a post-test	Chest physiotherapy significantly improved airway clearance, as indicated by a p-value of 0.001.

		Hospital, Bontang			using the same measures.	

DISCUSSION

Effect of Chest Physiotherapy on Sputum Production

Pneumonia often results in respiratory complications, such as persistent coughing, excessive secretion production, shortness of breath, chest retractions, and tachypnea. In response to infection or irritation, the body increases mucus production to protect the lungs. However, excessive and thick mucus can obstruct the airways, making breathing more difficult. (Chest physiotherapy (CPT) has been widely used to manage both acute and chronic respiratory conditions (Andersson et al., 2019; Corten, Jelsma, & Morrow, 2015).

CPT techniques include postural drainage, chest percussion, and vibration. Physiologically, percussion on the chest wall generates mechanical waves of varying amplitudes and frequencies that help to mobilize and relocate secretions (Potter et al., 2017). Hidayatin (2019) reported that initial CPT session may show limited improvement, but significant airway clearance was observed after the second intervention on the second day. This suggests that repeated CPT enhances airway cleanliness over time. Similarly, Siregar and Aryayuni (2019) demonstrated that CPT significantly improved sputum production in children aged 6–12 years.

Building on these findings, a study by Sukraeny (2020) revealed that chest physiotherapy effectively improved airway patency in toddlers aged 1–5 years, with 67% of participants showing clearer airways after consistent therapy sessions. The therapy was especially beneficial when administered regularly, reinforcing the importance of frequency and technique in achieving optimal outcomes. These results underscore the need for tailored physiotherapy interventions in pediatric patients, considering their smaller airway anatomy and the severity of mucus obstruction. Through compassionate and consistent care, chest physiotherapy can significantly ease breathing, reduce discomfort, and support faster recovery in children suffering from pneumonia.

Effect of Chest Physiotherapy on Heart Rate, Respiratory Rate, and Oxygen Saturation

Chest physiotherapy, when combined with standard care, accelerates clinical improvement in children hospitalized with pneumonia. Abdelbasset and Elnegamy (2015) found that CPT shortened the time to clinical improvement and significantly improved respiratory rate and oxygen saturation levels. Amin, Kuswardani, and Setiawan (2018) also observed a significant reduction in respiratory rate following a combination of CPT and infrared therapy.

CPT helps reduce respiratory distress by clearing airway secretions, decreasing airway resistance, and improving ventilation and chest perfusion. These improvements contribute to decreased heart rate and increased oxygen saturation, which together reduce energy expenditure. This is particularly important for pneumonia patients, as more energy is typically required for cardiac and bronchial activity under compromised conditions. Melati, Nurhaeni, and Chodidjah (2018) found that, after CPT, heart rate normalized and oxygen saturation increased.

Lestari, Nurhaeni, and Chodidjah (2018) used a combination of CPT and nebulizer therapy and found it more effective than nebulizer therapy alone. Their study reported significant reductions in heart rate (from 139.35 to 120.53 bpm) and respiratory rate (from 52.53 to 41.06 bpm), along with an increase in oxygen saturation (from 92.18% to 97.41%). Additionally, combining CPT with antibiotic therapy has been shown to be more effective than using either intervention alone (Mohammed, Bashir, & Noor, 2014).

CPT has also proven effective in preventing post-extubation atelectasis in pediatric patients with neuromuscular disorders (Bilan & Poorshire, 2013). However, some studies, such as Elizabeth et al. (2017), found no significant differences in blood gas analysis between children receiving CPT plus suction and those receiving suction alone.

These collective findings highlight the multifaceted benefits of chest physiotherapy not only in alleviating respiratory symptoms but also in enhancing overall clinical outcomes in pediatric pneumonia. In real-world clinical settings, especially in resource-limited environments, CPT offers a low-cost, non-invasive intervention that can be tailored to each child's needs. The involvement of trained healthcare providers, combined with parental engagement and comfort, can foster a supportive healing environment. By integrating CPT into comprehensive care plans, clinicians not only promote faster recovery but also improve the quality of life for children and their families during hospitalization. This underscores CPT’s value as a compassionate and effective component of pediatric respiratory care.

CONCLUSIONS

Chest physiotherapy plays an important role in improving the clinical condition of children with pneumonia. Its benefits are seen through the normalization of respiratory and heart rates, increased oxygen saturation, and improved ability to expel sputum, which helps clear the airways. In neonates, chest physiotherapy can also shorten the length of hospital stay and support the return of oral breastfeeding. Additionally, chest physiotherapy enhances the effectiveness of other treatments given to children with pneumonia. Overall, it serves as a valuable supportive therapy that contributes significantly to the recovery process.

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