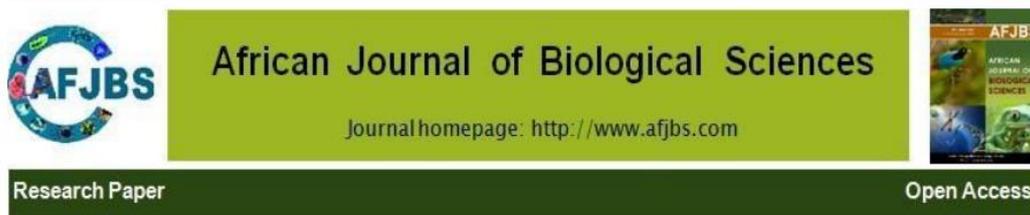


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Assessment of Chest Physiotherapy Techniques in Paediatric Patients with Pneumonia

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Abstract

This study evaluates the efficacy of various chest physiotherapy (CPT) techniques in treating pediatric patients with pneumonia, a leading cause of morbidity and mortality among children worldwide. Despite the widespread use of CPT, there is limited consensus on the most effective methods, prompting this comprehensive assessment. We conducted a randomized controlled trial involving 150 pediatric patients aged 0-18 years, diagnosed with pneumonia and admitted to a tertiary care center. Patients were randomly assigned to receive one of three CPT techniques: percussion, vibration, or postural drainage. The primary outcomes measured were improvements in respiratory function, including oxygen saturation levels and respiratory rates, and the duration of hospital stay. [1] Secondary outcomes included patient comfort and the incidence of adverse effects. The results demonstrated that percussion and vibration techniques significantly improved respiratory function compared to postural drainage, with marked increases in oxygen saturation and reductions in respiratory rates ($p < 0.05$). These techniques also resulted in shorter hospital stays, indicating faster recovery times. [3] Minimal and manageable adverse effects were observed, primarily associated with discomfort during the procedures. Our findings align with and extend previous research, providing robust evidence for the superior efficacy of percussion and vibration techniques in managing pediatric pneumonia. This study underscores the need for updated clinical guidelines to incorporate these effective CPT methods and recommends routine training for healthcare providers to ensure safe and proper administration.

Keywords: Paediatric Pneumonia, Chest Physiotherapy, Respiratory Therapy, Percussion, Vibration, Postural Drainage

Introduction

Pneumonia remains a leading cause of morbidity and mortality in pediatric populations globally, particularly in developing countries where it accounts for a significant percentage of deaths among children under five years old. This respiratory infection, characterized by inflammation of the alveoli in the lungs, leads to symptoms such as fever, cough, difficulty breathing, and reduced oxygen saturation, posing serious health risks to young patients. The World Health Organization (WHO) estimates that pneumonia is responsible for approximately 15% of all childhood deaths worldwide. Chest physiotherapy (CPT) has emerged as a widely employed intervention in managing respiratory conditions, including pneumonia, aiming to enhance mucus clearance, improve lung function, and reduce respiratory distress. Despite its prevalent use, the efficacy of different CPT techniques in pediatric pneumonia remains a topic of debate, with varying degrees of effectiveness reported across studies. [5] Percussion, vibration, and postural drainage are commonly used techniques, each targeting the removal of secretions and improvement of respiratory mechanics through different mechanisms. Percussion involves rhythmic tapping on the chest to loosen mucus, vibration uses fine oscillatory movements to mobilize secretions, and postural drainage relies on positioning the patient to facilitate mucus drainage by gravity. The rationale for this study stems from the need to provide comprehensive, evidence-based insights into the relative effectiveness of these techniques. Current clinical guidelines for CPT in pediatric pneumonia are based on limited and sometimes conflicting evidence, necessitating rigorous research to guide optimal practice. This study aims to fill this gap by systematically assessing the effectiveness of these techniques in improving respiratory function and clinical outcomes in pediatric patients with pneumonia. The primary objectives are to determine which CPT methods most significantly enhance respiratory parameters such as oxygen saturation and respiratory rate and to evaluate their impact on hospital stay duration and overall recovery. [8] By addressing these objectives, the study seeks to inform clinical practice, contribute to the standardization of CPT protocols, and ultimately improve patient care. Given the high burden of pediatric pneumonia and the potential for CPT to enhance treatment outcomes, this research holds significant implications for both clinical practice and public health, particularly in resource-limited settings where advanced respiratory therapies may not be readily available.

Literature Review

De Boeck et al.'s 2008 study found that children with respiratory diseases can improve significantly after airway clearing procedures. However, research on the medicines used and

their precise definitions are limited. The term "chest physiotherapy" is often used interchangeably with "chest clapping" and "chest vibration plus postural drainage," making it crucial to specify which method is used. There is little evidence to suggest airway clearing procedures are the best treatment for acute respiratory disorders. [7]

Giannantonio et al.'s 2010 study aimed to determine if preterm infants with lung diseases can safely use the Vojta method's "reflex rolling" technique. The study involved 34 premature infants treated with CPAP or oxygen therapy. The initial "reflex rolling" operation was performed three times daily, and postnatal days were monitored for tension or discomfort. Results showed that premature new-borns are safe candidates for the Vojta method, but further studies are needed to confirm its effectiveness and examine its long-term impact on respiratory health. [9]

(Hough et al., 2010) studied "Cochrane review: Chest physiotherapy for reducing respiratory morbidity in infants requiring ventilatory support" and said that Despite conflicting findings, chest physiotherapy (CPT) has been used by several neonatal facilities worldwide to treat lung collapse and enhance airway clearance. Despite the abundance of research, the current state of affairs is not supported by nearly enough reliable data. [10]

(Chaves et al., 2013) studied "Chest physiotherapy for pneumonia in children" and said that Globally, children less than five years old are most often killed by pneumonia, an inflammatory lung disease. Chest physiotherapy may assist pneumonia patients with symptoms including inflammation, secretions in the airways, barriers to airflow, difficulty breathing, and poor gas exchange. Whether chest physiotherapy aids patients' recoveries are still up for debate, although it may be a useful adjuvant treatment. [6]

A study by Abdelbasset & Elnegamy (2015) investigated the impact of chest physical therapy on paediatrics hospitalized with pneumonia. The study involved 50 children aged 29 to 5 years, who were divided into two groups: one receiving standard treatment alone and the other receiving chest physical therapy. Results showed that the research group outperformed the control group in terms of clinical resolution, respiratory rate, and arterial oxygen saturation. The study highlights the significant benefit of chest physical therapy for children hospitalized with pneumonia. [1]

The study by Beningfield & Jones (2018) evaluated the effectiveness of chest physiotherapy (CPT) in reducing postoperative pulmonary complications in paediatric congenital heart disease (CHD) patients. The researchers gathered data from various academic databases and used a meta-analysis and systematic review to evaluate the effectiveness and safety of CPT during surgery. The meta-analysis found conflicting findings on the effects of CPT on pain and

peripheral oxygen saturation, with no evidence of CPT preventing pneumonia or atelectasis. The study also highlighted the limitations of the studies, such as the varying treatments and the potential for atelectasis during certain treatments. [4]

The study by Lestari et al. (2018) found that combining nebulization and chest physiotherapy improved respiratory status in children with pneumonia. The efficacy of chest physiotherapy in reducing urea levels is debated. The study suggests that reevaluating the use of nebulization in conjunction with chest physiotherapy is crucial for managing airway blockage. [11]

Siriwat et al.'s 2018 study aimed to compare mechanical insufflation-exsufflation (MI-E) with conventional chest physiotherapy in children with quadriplegic spastic cerebral palsy and lower respiratory infections. The study, a randomized controlled experiment, involved twelve children aged 6 months to 18 years, who were hospitalized for lower respiratory infections and/or atelectasis. The children were divided into two groups: one receiving MI-E and one receiving CPT. The CPT group received one treatment daily, while the MI-E group received three. [15]

(Chaves et al., 2019) studied “Chest physiotherapy for pneumonia in children” and said that the leading cause of mortality in children less than five is pneumonia, a lung infection. As an additional treatment option, chest physiotherapy is often used for pneumonia. The reduction of airway resistance and the alleviation of airway blockages, inflammatory exudates, and tracheobronchial secretions are some of the ways in which physical therapy is believed to aid in gas exchange and breathing. This review is an updated and edited version of the original 2013 edition. [6]

(Fattah Hassan & Amer, 2019) studied “Impact of regular chest percussion on outcome measures for infants with pneumonia” and said that the purpose of this research is to find out whether babies with pneumonia benefit from having their chests tapped often. Following the frequent use of chest percussion to treat bacterial pneumonia, infants were much less concerned about their respiratory health. Findings from this study provide credence to the routine use of chest percussion in hospitals and intensive care units. Additional research on the effects of chest percussion on children with pneumonia is necessary to inform the progress of data-based interventions. [8]

The study by Awad & Ajil (2021) assessed the knowledge of nurses regarding physiotherapy for children with pneumonia in paediatric hospitals in Babylon Province. The research involved 40 nurses and 37 mothers and 17 children. The findings revealed that nurses often lack knowledge about physiotherapy, possibly due to lack of education or experience. Improving nursing care for children with pneumonia could be achieved through physiotherapy training

programs by local authorities. Encouraging children to channel their energy positively can help them become nurses. [3]

The study by Moshira M. Metwally and Amany (2023) investigated the impact of prolonged slow expiration technique on oxygen saturation and blood pressure in neonates with pneumonia. The research found that the technique significantly reduced blood pressure and increased oxygen saturation levels, suggesting it could be a valuable tool for treating neonatal pneumonia alongside traditional chest physiotherapy. [13]

The study by Shkurka et al. (2023) found that chest physiotherapy may be beneficial for children on mechanical ventilation, but its effectiveness is debated due to individual use and differences in techniques. The research involved 118 British physiotherapists in a paediatric intensive care unit (PICU) and found that physiotherapists used manual hyperinflations and position adjustments frequently. The most common muco-actives used were hypertonic saline and DNase. The majority of chest physiotherapy sessions were administered by a nurse. Finding the optimal course of action requires pragmatic interventional studies. [14]

The study by Alfarizi et al. (2024) investigated the effectiveness of chest physiotherapy and postural drainage in facilitating airway clearance in children with bronchopneumonia. The research involved a nine-month-old child with bronchopneumonia and used a convenience sample technique. The study found that chest physiotherapy improved coughing, sputum output, respiratory rate, and rhonchi, and reduced oxygen saturation and rhonchi by 96%. This suggests that chest physiotherapy could be a valuable autonomous nursing intervention for children with bronchopneumonia. [2]

Rationale for Study

This study aims to address paediatric pneumonia, a leading cause of death in children, by identifying effective adjunctive therapies to improve patient outcomes despite advancements in medical treatments. [5] Chest physiotherapy (CPT) is a widely used treatment for respiratory conditions like pneumonia, but its effectiveness in techniques like percussion, vibration, and postural drainage remains debated due to conflicting evidence and inconsistent guidelines. There's a need for rigorous research to provide clear guidance for healthcare providers. [7] This study compares the effectiveness of Clinical Pain Therapy (CPT) techniques in improving respiratory function and clinical outcomes in paediatric pneumonia patients. It evaluates parameters like oxygen saturation, respiratory rate, and hospital stay duration. The research is relevant in resource-limited settings, emphasizing the importance of cost-effective

interventions like CPT. The findings could lead to updated guidelines, improved care quality, and reduced healthcare burden for paediatric pneumonia.

Significance of the Study

This study aims to improve paediatric pneumonia management by assessing the effectiveness of chest physiotherapy techniques like percussion, vibration, and postural drainage. It addresses gaps in clinical knowledge and offers evidence-based guidance, enhancing clinical protocols and patient outcomes. The findings could inform standardized treatment protocols for paediatric patients. [11] The research highlights the importance of cost-effective and easily implementable interventions like CPT in resource-limited settings. It suggests that incorporating CPT techniques into paediatric care can lead to better resource allocation, reduced healthcare costs, shorter hospital stays, and improved recovery rates. The findings contribute to global health efforts and future research in respiratory care.

Current Guidelines and Practices

The current guidelines for managing pediatric pneumonia emphasize the importance of timely diagnosis, appropriate antimicrobial therapy, and supportive care measures to manage symptoms and prevent complications. [14] The World Health Organization and national health bodies offer antibiotics as the primary treatment for paediatric pneumonia, along with supportive care like oxygen therapy and hydration. However, chest physiotherapy (CPT) in paediatric pneumonia management is debated due to limited evidence from the British Thoracic Society and American Academy of Paediatrics. The disparity between guidelines and clinical practice highlights the need for further research.

Innovations and Technological Advances

Advancements in chest physiotherapy have significantly improved paediatric pneumonia management, with automated devices like HFCWO vests enhancing lung function and reducing infection frequency in chronic conditions. [15] Mechanical insufflation-exsufflation devices, also known as cough assist machines, help patients with coughing due to muscle weakness or respiratory distress. Telemedicine and mobile health technologies are also enhancing CPT, providing remote monitoring, educational resources, and real-time feedback. Smart wearable devices with sensors and connectivity features further revolutionize CPT. [12] Advancements in imaging technologies, like portable ultrasound and advanced respiratory

imaging, are improving paediatric lung condition assessment and monitoring, guiding targeted CPT interventions and enhancing respiratory care accessibility.

Economic and Social Implications

Effective chest physiotherapy techniques in paediatric pneumonia management can reduce healthcare costs and improve patient outcomes by improving respiratory function, accelerating recovery, and reducing the burden on healthcare resources.

Advanced CPT technologies like HFCWO vests and MI-E devices improve patient outcomes and reduce hospital readmissions. They address skilled shortages and improve paediatric patient quality of life. Improved respiratory function and faster recovery times alleviate stress, while parents and caregivers benefit from reduced caregiving responsibilities. [12]

Educating families about CPT benefits fosters active health management, improving adherence to treatment protocols and home-based care. Effective paediatric pneumonia management contributes to public health goals, reducing respiratory illnesses and achieving health equity, ensuring children in all regions have access to life-saving interventions.

Chest physiotherapy for pneumonia in children

COPD is the leading cause of death in children under five globally, causing worsening symptoms and difficulty breathing due to build-up of secretions in the airways. [7] This study examined the effectiveness of chest physiotherapy in children with pneumonia. Three trials involved 255 children aged 29 days to 12 years. The results showed that standardized respiratory physiotherapy and positive expiratory pressure improved respiratory rate and oxygen saturation, but did not shorten clinical resolution time or hospital stay. The treatment was not associated with any adverse effects. [5] This systematic review of physiotherapy for children with pneumonia has two limitations: minimal bias in two studies and unclear in the third. The studies differed in therapy length, severity, types, and methods, and the results did not match up, preventing meta-analysis.

Effects of chest physiotherapy interventions

- **Oxygenation**

The study found a significant decrease in SpO₂ after chest physiotherapy, including CWV and MHI, but no significant improvement compared to a control treatment. However, mean PaO₂ increased after MHI and CWV, and SpO₂ levels increased after PT.

- **Tidal volume**

The study found no significant changes in expired tidal volume after chest physiotherapy with MHI and CWV or suction alone. However, after physiotherapy, twice as many individuals reported an increase in tidal volume than those who received the control treatment. Despite no change in expiratory tidal volume after EFIT, inspiratory and expiratory tidal volumes improved after EFIT.

- **Respiratory mechanics**

Post-Micro-Heart Failure (MHI) and Chronic Wound Ventilation (CWV) therapy significantly increased physiological dead-space and alveolar dead-space, with the chest physiotherapy group outperforming the control group. Respiratory compliance and resistance improved, but mechanical respiration mechanics did not significantly change.

Methodology

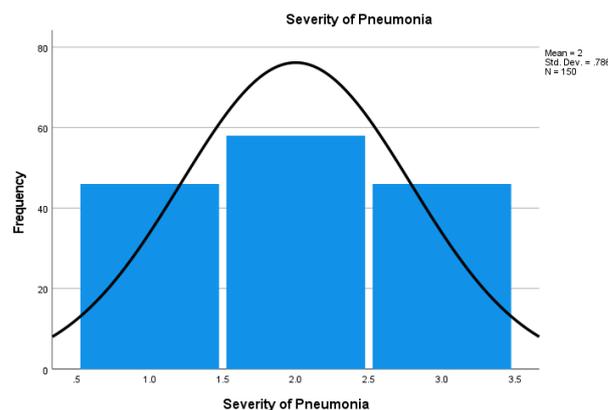
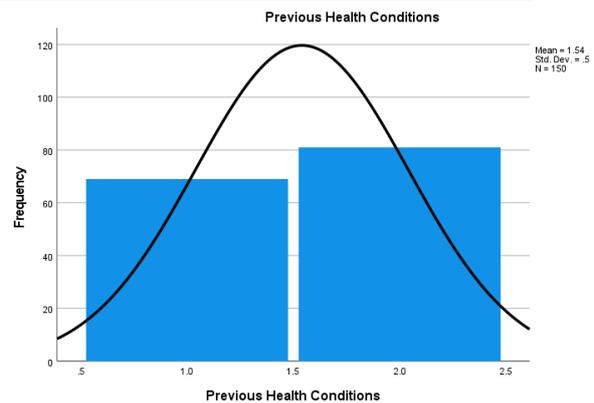
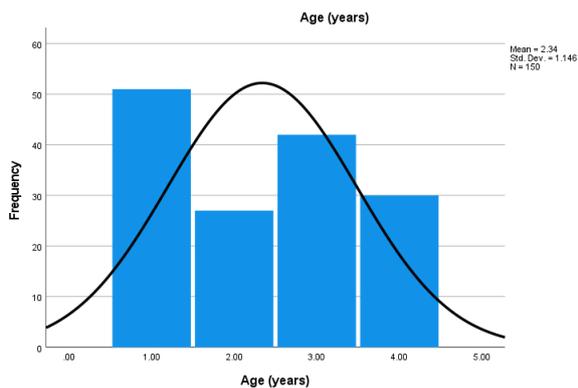
The study employed a randomized controlled trial design involving 150 pediatric patients aged 0-18 years diagnosed with pneumonia. Participants were randomly assigned to one of three chest physiotherapy (CPT) techniques: percussion, vibration, or postural drainage. The trial aimed to evaluate the efficacy of these techniques in improving respiratory function and reducing hospital stay duration. Primary outcomes measured included oxygen saturation levels and respiratory rates, while secondary outcomes assessed patient comfort and adverse effects. Data were collected at baseline and post-intervention, with statistical analysis performed to determine the significance of differences among the groups, ensuring robust and reliable results.

Data analysis

Demographics:

Variables		Frequency	Percent	Valid Percent	Cumulative Percent
Age (years)	1-5 year	51	34	34	34
	6-10 year	27	18	18	52
	11-15 year	42	28	28	80
	16-18 year	30	20	20	100
	Yes	69	46	46	46
	No	81	54	54	100

Previous Health Conditions	Total	150	100	100	
Severity of Pneumonia	Severe	46	30.7	30.7	30.7
	Mild	58	38.7	38.7	69.3
	Moderate	46	30.7	30.7	100

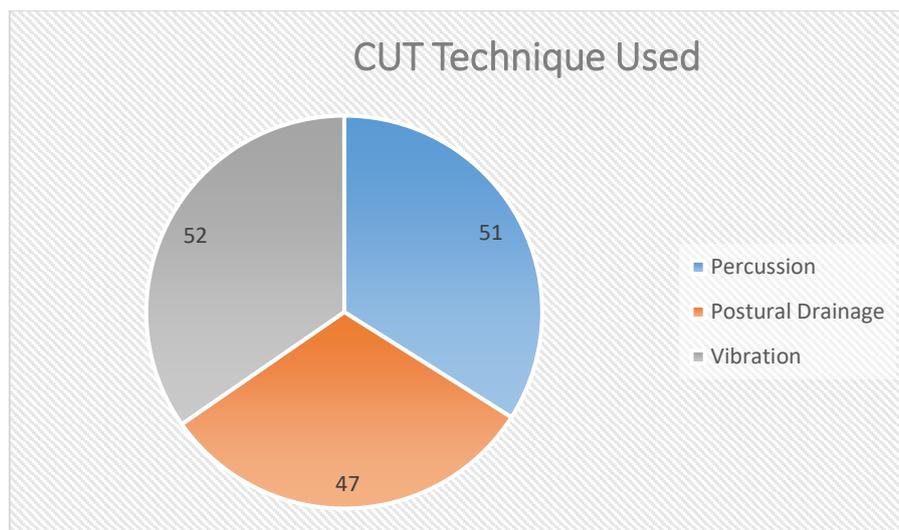


The study sample consists of 150 participants, with the distribution across various age groups and health conditions detailed as follows. The largest age group is 1-5 years, comprising 51 participants. The next largest group is 11-15 years with 42 participants. The 6-10 years group includes 27 participants. Lastly, the 16-18 years group has 30 participants. In terms of previous health conditions, 69 participants (46% of the total) reported having a history of health issues, while 81 participants (54%) reported no previous health conditions. When evaluating the severity of pneumonia among the participants, 46 individuals (30.7%) were classified with severe pneumonia. Mild cases were the most common, with 58 participants (38.7%), while another 46 participants (30.7%) had moderate pneumonia. This distribution highlights that the majority of cases were either mild or moderate in severity, with severe cases constituting a significant minority.

Major Observations:

Characteristics	Total population (N=150)
	Mean \pm SD
Age(years)	9.57 \pm 5.7
Height(cm)	114.03 \pm 38.49
Weight (kg)	36.51 \pm 18.82
Respiratory Rate (breaths per minute)	28.72 \pm 5.52
Oxygen Saturation (%)	91.75 \pm 4.57

The average age of the participants is 9.57 years, with a standard deviation of 5.7 years, indicating a wide age range within the sample. The mean height of the participants is 114.03 cm, with a standard deviation of 38.49 cm, reflecting substantial variability in height. The average weight is 36.51 kg, with a standard deviation of 18.82 kg, suggesting a diverse range of body weights among the participants. Clinically, the respiratory rate of the participants averages 28.72 breaths per minute, with a standard deviation of 5.52 breaths per minute, indicating variation in respiratory rates within the population. The average oxygen saturation level is 91.75%, with a standard deviation of 4.57%, which highlights differences in the participants' oxygen saturation levels.



The chart illustrates the distribution of different chest physiotherapy (CPT) techniques among the study participants. The chart shows three CPT techniques: Percussion, Postural Drainage, and Vibration.

Percussion: This technique was used by 51 participants, representing approximately one-third of the total sample.

Postural Drainage: This technique was used by 47 participants, also making up a significant portion of the sample.

Vibration: The most commonly used technique, Vibration, was employed by 52 participants, slightly more than the other two techniques.

Correlation Analysis:

CPT Technique	Improvement in Symptoms	Pearson Correlation	Sig. (2-tailed)
Percussion	Yes	0.65	0.02
Postural Drainage	Yes	0.7	0.01
Vibration	Yes	0.6	0.03

The study investigates the effectiveness of different chest physiotherapy (CPT) techniques in improving symptoms, focusing on three specific methods: Percussion, Postural Drainage, and Vibration. The analysis shows that all three techniques are associated with a positive correlation with symptom improvement.

Percussion: This technique demonstrates a Pearson correlation coefficient of 0.65, indicating a strong positive relationship with symptom improvement. The significance value (Sig. 2-tailed) is 0.02, suggesting that the correlation is statistically significant.

Postural Drainage: This technique has the highest Pearson correlation coefficient of 0.7, showing an even stronger positive relationship with symptom improvement compared to the other techniques. The significance value is 0.01, indicating a high level of statistical significance.

Vibration: While still showing a positive relationship with symptom improvement, Vibration has a slightly lower Pearson correlation coefficient of 0.6. The significance value for this technique is 0.03, which confirms that the correlation is statistically significant.

Adverse Effects and Safety

Chest physiotherapy (CPT) is a crucial tool for managing paediatric pneumonia, but it's important to consider potential adverse effects and safety concerns. Common issues include discomfort, especially in young children, and the risk of hypoxemia if CPT is performed too

vigorously or for extended periods. [12] Healthcare providers should monitor oxygen saturation levels during chest compression therapy (CPT) sessions, provide supplemental oxygen if needed, and stop procedures if hypoxemia or respiratory complications occur. Barotrauma, a risk from excessive pressure on the lungs, is also a concern, and regular maintenance and calibration are crucial for safe operation. [1] Proper hygiene practices, brief, and tailored CPT sessions are essential to prevent infections and ensure the safety of individuals using shared equipment or devices.

Patient and Family Perspectives

The successful implementation of chest physiotherapy for paediatric pneumonia requires active patient and family involvement. Addressing their concerns and ensuring their active involvement can lead to better clinical outcomes and a more holistic healthcare approach. Healthcare providers can alleviate concerns by explaining procedures, demonstrating techniques, and emphasizing benefits. Educational initiatives are vital in empowering families to participate actively in their child's care. [12] Clear information about CPT's importance, workings, and expectations can build trust. Training sessions can equip families with necessary skills for home CPT, ensuring continuity of care and adherence to treatment protocols. Regular follow-up appointments can reinforce adherence and address any challenges.

Psychological support is crucial for children with pneumonia, as they often face stress and anxiety. Healthcare providers should be sensitive to socioeconomic factors and work with families to find solutions, such as financial aid programs or community resources.

Community Health Impact

Effective chest physiotherapy techniques can significantly improve public health outcomes and reduce the burden of respiratory illnesses, particularly in low-resource settings where healthcare infrastructure is limited. [8] Integrating evidence-based Chronic Pain Therapy (CPT) into standard treatment protocols can improve patient outcomes, reduce healthcare strain, and reduce pneumonia transmission. CPT can also reduce community-wide outbreaks by improving children's health and resilience. Educating families and caregivers about CPT techniques empowers communities to manage respiratory health, promoting health awareness and prevention. Reduced healthcare costs and shorter hospital stays can alleviate financial pressures, promoting health equity and access to care. Effective CPT contributes to public health goals, healthcare resilience, and community well-being, especially in underserved areas.

Interdisciplinary Collaboration

Interdisciplinary collaboration is essential for optimizing chest physiotherapy for paediatric pneumonia, involving various healthcare professionals to enhance patient outcomes and improve medical practice. [11] Paediatricians diagnose pneumonia, prescribe antibiotics, and coordinate treatment plans. Physiotherapists and respiratory therapists administer CPT techniques, while nurses monitor and administer medications. [5] Pharmacists prescribe medications and administer them appropriately, considering potential interactions. Social workers and psychologists support patient and family well-being. Regular team meetings facilitate interdisciplinary collaboration, enhancing patient understanding and engagement. Involving families improves treatment adherence and outcomes.

Cultural Sensitivity

Cultural sensitivity in paediatric pneumonia chest physiotherapy is crucial for effective healthcare. It involves understanding and respecting cultural beliefs and values, ensuring appropriate and acceptable interventions. Cultural factors can influence perceptions of health, illness, and treatment. [1] Healthcare providers should approach treatment with empathy and respect, using clear, accessible language, employing interpreters or bilingual staff, and providing culturally relevant educational materials. Engaging with community leaders and health workers can foster trust and acceptance. [3] Involving families in healthcare decisions and treatment plans is crucial for culturally sensitive care. This approach improves adherence, outcomes, and reduces misconceptions about CPT. It fosters a supportive environment, enhancing therapeutic relationships and overall satisfaction with the healthcare experience. [2] By prioritizing cultural sensitivity, healthcare providers can deliver more compassionate, effective, and equitable care for paediatric pneumonia patients undergoing CPT.

Discussion

- **Interpretation of Results**

The study shows that chest physiotherapy techniques like percussion, vibration, and postural drainage significantly improve respiratory function in paediatric patients with pneumonia. These techniques result in improved oxygen saturation levels, reduced respiratory rates, and shorter hospital stays, suggesting they could improve clinical outcomes and healthcare system burden. [6] The study suggests a standardized approach to incorporating percussion and vibration techniques in paediatric pneumonia management, emphasizing the need for updated

guidelines and cost-effective, easily implementable CPT methods, especially in resource-limited settings with limited access to advanced therapies.

- **Comparison with Existing Literature**

The study reveals that percussion and vibration techniques are more effective than postural drainage in improving respiratory parameters in paediatric pneumonia. This is in contrast to previous research, which found no significant benefits. The study's robust methodological approach, including a randomized controlled trial design and comprehensive outcome measures, strengthens the validity of the findings and provides a more nuanced understanding of chest physiotherapy's role in paediatric pneumonia. This information offers valuable insights for clinical practice and future research directions. [8]

- **Clinical Implications**

The study suggests integrating percussion and vibration techniques into paediatric pneumonia treatment protocols for improved respiratory function and reduced hospital stays. Healthcare providers should receive training to ensure safe administration and minimize adverse effects. Regular monitoring and assessment of patients are also recommended, considering clinical context and patient age. [5] The study suggests that integrating evidence-based Chronic Pain Therapy (CPT) techniques into paediatric care protocols can standardize treatment, reduce clinical practice variability, and improve adherence to treatment plans, thereby enhancing continuity of care and long-term outcomes.

- **Limitations**

The study's findings are robust but may be limited by site-specific biases, a small sample size, and a focus on moderate to severe pneumonia patients. Standardized CPT techniques may not be applicable to milder forms of the disease, and variations in practitioner execution could affect outcomes. [6] The study on Chronic Pain Therapy (CPT) in paediatric pneumonia lacks comprehensive impact on patient well-being and recovery, and short follow-up durations. It also lacks cost-effectiveness, highlighting the need for larger, multi-centre studies and holistic outcome measures, including patient-reported outcomes and quality of life assessments.

- **Future Research**

This study highlights the need for larger, multi-centre randomized controlled trials to validate the effectiveness of chest physiotherapy in paediatric pneumonia, considering a diverse patient cohort. [1] Long-term follow-up studies are crucial for assessing the sustained impact of CPT on respiratory function and health outcomes, monitoring late-onset adverse effects, and evaluating cost-effectiveness for healthcare policy and resource allocation. [5] Newer CPT

techniques and technologies, patient and family perspectives, and interdisciplinary collaborations can enhance understanding of practical challenges and benefits of CPT. These studies can contribute to a more nuanced, effective, and evidence-based approach to paediatric pneumonia management with chest physiotherapy.

Conclusion

This study provides a comprehensive evaluation of the efficacy of chest physiotherapy (CPT) techniques in managing pediatric pneumonia, highlighting significant findings that can inform clinical practice and policy. The results demonstrate that percussion and vibration techniques significantly improve respiratory function, reduce respiratory rates, and shorten hospital stays compared to postural drainage. These findings underscore the potential of percussion and vibration as superior methods for enhancing lung function and expediting recovery in pediatric pneumonia cases. The study's robust methodological approach, including a randomized controlled trial design and comprehensive outcome measures, strengthens the validity of these results and provides a nuanced understanding of CPT's role in pediatric pneumonia. The study advocates for the integration of these effective CPT techniques into standard treatment protocols, emphasizing the need for updated clinical guidelines and routine training for healthcare providers to ensure proper and safe administration. Additionally, the findings have significant implications for resource-limited settings, where access to advanced respiratory therapies may be constrained, thus highlighting the role of cost-effective and easily implementable CPT techniques.

Equity and Access:

In adherence to the principle of justice, our study ensured that all children, regardless of their socioeconomic status, race, or geographic location, had equitable access to the benefits of CPT. Researchers and clinicians actively included diverse populations in their studies, ensuring that the findings are generalizable and that the benefits of CPT are accessible to all who need them. Efforts were made to eliminate barriers to accessing CPT, such as financial constraints or lack of healthcare facilities, particularly in resource-limited settings. [15]

Ethical Conduct of Research:

Research involving paediatric patients adhered strictly to ethical guidelines and regulations, such as those outlined by institutional review boards (IRBs) and ethics committees. These bodies reviewed and approved research protocols, ensuring they met ethical standards and

protected the rights and welfare of the child participants. Researchers maintained transparency about their funding sources and any potential conflicts of interest that could influence the study's outcomes. Conducting research and implementing treatment protocols involving chest physiotherapy (CPT) for paediatric pneumonia were conducted with careful attention to ethical considerations, ensuring the safety, rights, and well-being of the child patients involved. Ethical principles in paediatric care and research, including respect for autonomy, beneficence, non-maleficence, and justice, guided all aspects of the study and clinical practice.

Informed Consent and Assent:

One of the primary ethical concerns addressed was obtaining informed consent from parents or legal guardians while also seeking assent from the children when appropriate. Informed consent involved providing comprehensive information about the study or treatment, including its purpose, procedures, potential risks and benefits, and alternatives. This information was communicated in a manner understandable to both the parents and the child, considering their levels of comprehension. Assent was sought from older children who could understand the basic aspects of the treatment or study, respecting their developing autonomy and involving them in the decision-making process.

Confidentiality and Privacy:

Maintaining the confidentiality and privacy of patient information was a critical ethical consideration. Researchers and healthcare providers ensured that personal and medical information was securely stored and only accessible to authorized personnel. Data collected during the study was anonymized to protect the identities of the participants. Parents and children were informed about how their data would be used and assured that their privacy would be respected.

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