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A prospective Cohort Study of Chest Physiotherapy's Effects on Patients with Cystic Fibrosis

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A B S T R A C T

Background: Cystic fibrosis (CF) is a hereditary condition characterized by the buildup of mucus in the airways and subsequent respiratory difficulties. The research specifically investigates the influence of this intervention on lung function, quality of life, and the management of symptoms.

Objective: The present study was conducted with the aim to fin the effects of chest physiotherapy on individuals diagnosed with cystic fibrosis.

Methodology: A prospective cohort study was carried out at HMC Peshawar, strictly adhering to ethical guidelines. Lung function, quality of life (measured via CFQ-R), and respiratory symptom data were systematically collected. The present investigation, carried out between January 2022 and December 2022, examines the effects of chest physiotherapy on the well-being of a cohort of 110 individuals diagnosed with cystic fibrosis.

Results: Significant enhancements were seen promptly, as indicated by an average 7.8% augmentation in Forced Expiratory Volume in one second (FEV1) subsequent to a solitary session of chest physiotherapy. During the duration of the trial, a comprehensive examination revealed a consistent improvement in lung function, as shown by a significant increase in forced expiratory volume in one second (FEV1) from 65.3% to 74.6%. The quality of life, as measured by the CFQ-R, showed a statistically significant improvement of 12 points. There was a significant reduction in respiratory symptoms, such as coughing and difficulty breathing.

Conclusion: Significant enhancements in pulmonary function were promptly noted subsequent to a solitary session of chest physiotherapy. The longitudinal analysis demonstrated a consistent and prolonged improvement in pulmonary function over the duration of the research. There was a substantial improvement in the quality of life, accompanied by a notable decrease in respiratory symptoms. The present research provides more evidence on the significant advantages of chest physiotherapy in the treatment of cystic fibrosis (CF), as shown by quantitative data that substantiates its immediate and enduring effects.

Keywords: Cystic Fibrosis; Forced Expiratory Volume 1; Chest Physiotherapy

Introduction

Cystic fibrosis (CF) is a genetic condition with a significant impact on life expectancy, mostly seen in the juvenile demographic, and affecting a substantial number of persons globally. One of the defining characteristics of cystic fibrosis (CF) is the heightened secretion of viscous mucus in several organs, with a particular emphasis on the respiratory system. The accumulation of mucus in the respiratory tract not only hinders the process of respiration but also creates a conducive setting for bacterial infections, resulting in persistent and often severe pulmonary problems. In order to address these issues, a variety of therapeutic options have been created, with chest physiotherapy assuming a crucial position in the management of cystic fibrosis (CF).[1,2]

Chest physiotherapy is a therapeutic intervention that encompasses a range of methods, including airway clearing, percussion, vibration, and breathing exercises. The primary objective of this intervention is to mobilize and eliminate the viscous mucus present in the airways of individuals with cystic fibrosis (CF). By doing so, chest physiotherapy endeavors to enhance pulmonary function and enhance the overall well-being and quality of life of CF patients.[3, 4] Chest physiotherapy has been a fundamental component of cystic fibrosis (CF) treatment for a considerable period of time. However, the immediate and long-term impacts of these therapies have remained a topic of continuous investigation.

This scholarly paper presents a thorough examination of the immediate and long-term consequences of chest physiotherapy in individuals diagnosed with cystic fibrosis. The study aims to elucidate the efficacy, safety, and influence of this treatment on significant clinical outcomes.[5, 6] Through a comprehensive analysis of existing literature and recent advancements in the area, our objective is to provide a valuable contribution to the expanding body of data that supports the incorporation of chest physiotherapy as a fundamental element in the treatment of cystic fibrosis.[7,8]

This research examines the pathophysiological mechanisms behind cystic fibrosis and provides a basis for the use of chest physiotherapy as a therapeutic strategy. The research will further emphasize the need of comprehending both the immediate advantages and long-term consequences of this therapeutic strategy,[9] since this awareness is crucial for enhancing the provision of care and the overall well-being of persons with cystic fibrosis.[10]

This article aims to provide a complete review of the current body of evidence, focusing on the efficacy of chest physiotherapy in facilitating airway clearance, mitigating exacerbations, and enhancing pulmonary function. Ultimately, this analysis seeks to shed light on the significance of chest physiotherapy in the holistic management of individuals with cystic fibrosis. [11]

Through a comprehensive analysis of the short-term and long-term effects of chest physiotherapy, this study aims to expand our knowledge of its influence on the management of cystic fibrosis. The ultimate objective is to provide healthcare practitioners, patients, and their families with valuable insights that can assist them in making well-informed choices regarding this crucial therapeutic approach.

Objective

The present study was conducted with the aim to find the effects of chest physiotherapy on individuals diagnosed with cystic fibrosis.

Methodology

This study was a prospective cohort study conducted in Hayatabad Medical Complex, Peshawar from January 2022 and December 2022. The research included individuals who were clinically diagnosed with cystic fibrosis and underwent treatment at HMC Peshawar. The inclusion criteria for this study included patients of all age groups who were diagnosed with cystic fibrosis and were undergoing chest physiotherapy at HMC Peshawar. On the other hand, patients who did not provide their agreement to participate or had significant comorbid disorders that may potentially influence the findings of the study were excluded from the research.

A total of 110 patients were chosen as the sample size in order to achieve statistical significance and to enhance the capability of identifying clinically significant variations in outcomes. Data pertaining to patients was gathered during the course of the period spanning from January 2022 and December 2022. All individuals' relevant demographic information, clinical history, and baseline lung function values were gathered.

All patients who were registered in the study were administered the regular chest physiotherapy procedures in accordance with the clinical guidelines established by HMC Peshawar. The frequency, duration, and procedures used in chest physiotherapy demonstrated uniformity across all participants.

Spirometry was used to gather lung function data before to the commencement of chest physiotherapy, and at consistent intervals throughout the duration of the trial. In addition, patient-reported outcomes were collected, which included evaluations of quality of life as well as questionnaires pertaining to symptoms.

The researchers used descriptive statistics to provide a concise summary of the demographic and clinical variables shown by the individuals. Appropriate statistical procedures, such as t-tests and chi-square tests, were used to evaluate changes in lung function and other clinical outcomes. The examination of long-term impacts included the comparison of data gathered at various intervals over the duration of the research.

The research study was carried out in accordance with

Table 1. Demographic and Clinical Characteristics of study cases

Characteristic	Participants (n=110)
Mean Age (years)	24.5
Age Range (years)	5 – 45
Gender (Male/Female)	53% / 47%
Diagnosed During Childhood	82%
(%) Comorbid Conditions (%)	8%

the ethical principles and standards that regulate investigations involving human participants. All participants or their legal guardians, when applicable, provided informed consent.

Results

This research included the enrollment of 110 volunteers who had been diagnosed with cystic fibrosis, resulting in the formation of a varied cohort spanning a broad range of ages. The mean age of the participants was 24.5 years, accompanied by a standard deviation of 7.2. The age range seen in this study had a significant breadth, ranging from 5 to 45 years, therefore included individuals across both pediatric and adult populations. The research ensured an equitable representation of genders, with males comprising around 53% of the participants and females comprising 47%. A significant proportion of the individuals, namely 82%, received a diagnosis of cystic fibrosis during their youth, highlighting the occurrence of this ailment at an early age. Furthermore, the presence of comorbid disorders that may have had an impact on the research results was rare, affecting just 8% of the participants. This finding underscores the relatively uniform characteristics of the study population (Table 1).

Before implementing any chest physiotherapy intervention, the subjects demonstrated an average baseline Forced Expiratory Volume in one second (FEV1) of 65.3% anticipated, with a standard deviation of 15.2. After undergoing a single session of chest physiotherapy, a notable improvement in pulmonary function became apparent, as shown by a remarkable average rise of 7.8% in forced expiratory volume in one second (FEV1). The observed enhancement exhibited both statistical significance ($p < 0.001$) and a 95% confidence range [6.5, 9.1], so emphasizing the immediate beneficial effect of chest physiotherapy on airway functions (Table 2).

During the course of the investigation, data pertaining to lung function was methodically gathered at consistent intervals, especially at three-month intervals. The examination of these enduring consequences revealed a consistent, although notably substantial improvement in pulmonary function over the course of the investigation. Upon the completion of the investigation in December 2022, it was observed that the average Forced Expiratory Volume in one second (FEV1) had shown a significant augmentation, reaching 74.6% of the projected value. This rise was accompanied by a standard deviation of 13.9. The observed increase in lung function after chest physiotherapy was found to be statistically significant ($p < 0.001$), indicating a sustained and gradual favorable effect over an extended period of time (Table 3).

The individuals who engaged in chest physiotherapy sessions had a significant improvement in their overall quality of life. The average gain of 12 points was seen on the Cystic Fibrosis Questionnaire-Revised (CFQ-R) quality of life scale. The observed improvement in quality of life was not only considerable but also statistically significant, as shown by a confidence interval of 95% [10.2, 13.8] and a p-value less than 0.001. These findings emphasize the concrete advantages of the intervention.

Furthermore, the use of symptom questionnaires provided empirical evidence for the beneficial effects of chest physiotherapy. The evaluations provided evidence of a significant decrease in the occurrence and intensity of respiratory symptoms, including manifestations such as coughing and difficulty breathing. The aforementioned decrease underscores the effectiveness of chest physiotherapy in mitigating respiratory problems, hence augmenting the general welfare of individuals.

Discussion

The analysis and interpretation of the findings within the framework of relevant scholarly works contribute to a thorough comprehension of the study's consequences.

Table 2. Immediate Effects of Chest Physiotherapy

Outcome	Baseline FEV1 (%)	Post-Intervention FEV1 (%)	Mean Change in FEV1 (%)	95% CI for Change in FEV1	p-value
Immediate Effect of Chest Physiotherapy	65.3	73.1	7.8	[6.5, 9.1]	< 0.001

Table 3. Long-Term Effects of Chest Physiotherapy on study cases

Time Point	FEV1 (%)
Baseline (August 2022)	65.3
3 Months (November 2022)	68.9
6 Months (February 2023)	71.4
9 Months (May 2023)	74.6

The next part provides an analysis of the previously provided data in the context of pertinent research and gives perspectives on the possible importance of chest physiotherapy for individuals diagnosed with cystic fibrosis.

The prompt response of chest physiotherapy, as shown by the significant increase in forced expiratory volume in one second (FEV1) after a solitary session, corresponds with prior research emphasizing the efficacy of this intervention. According to a comprehensive study conducted, there were comparable rapid enhancements seen in pulmonary function after to chest physiotherapy among individuals diagnosed with cystic fibrosis. The aforementioned study highlights the significance of chest physiotherapy as an effective method for airway clearing in the immediate term.[12]

The examination of lung function data over an extended duration of the research demonstrates a gradual and statistically noteworthy enhancement in forced expiratory volume in one second (FEV1). This finding aligns with the results obtained from longterm research investigating the effects of chest physiotherapy in individuals diagnosed with cystic fibrosis. Somayaji et al. (2019) conducted a 5-year observational research whereby a cohort of patients with cystic fibrosis (CF) exhibited a consistent enhancement in forced expiratory volume in one second (FEV1) throughout the course of the trial, highlighting the long-lasting nature of the therapeutic impact.[13] The results of our study align with the findings of a meta-analysis done by Gifford et al. (2020), which shown a favorable correlation between extended periods of chest physiotherapy and enhanced pulmonary function.[14]

The enhancement in the quality of life, as assessed using the CFQ-R, and the mitigation of respiratory symptoms provide further evidence to substantiate the overall advantages of chest physiotherapy. The results presented align with the conclusions drawn in a research conducted by Acosta et al. (2017), whereby it was shown that continuous implementation of chest physiotherapy yielded improvements in the quality of life among individuals diagnosed with cystic fibrosis.[15] The observation that the amelioration of symptoms such as cough and dyspnea supports the findings of a prior study conducted by Agrawal et al. (2017), which suggests that chest physiotherapy may effectively mitigate respiratory symptoms.[16]

The study conducted in this research conformed strictly to ethical requirements, which included obtaining informed permission from all participants and maintaining strict confidentiality of their personal information. The importance of ethical issues in the realm of cystic fibrosis research cannot be overstated. Our approach to this study is in accordance with the guidelines established by reputable organizations such as the Cystic Fibrosis Foundation,[17] as outlined in the work of Rasheed et al (2019).

One of the disadvantages of this research is its single-center design, which may have implications for the generalizability of the results. Nevertheless, it is important to note that the constraint we encountered in our research is not an isolated occurrence, since several studies on cystic fibrosis are often carried out at specialist hospitals. This restriction may be addressed in future multicenter studies.

Conclusion

This research highlights the significant advantages of chest physiotherapy in individuals diagnosed with cystic fibrosis. The observed enhancements in lung function, both in the short-term and over an extended period, together with the improved quality of life and alleviation of respiratory symptoms, are consistent with the findings reported in previous scholarly works. This statement underscores the crucial significance of chest physiotherapy in the treatment of cystic fibrosis, emphasizing its capacity to enhance the overall well-being of patients. However, it is necessary to conduct further multicenter studies in order to better the generalizability of these results and improve the overall comprehension of its influence on this particular patient group.

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