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Article

Functional Changes of the Respiratory System in Children During the Post-COVID Period

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Abstract: The long-term effects of coronavirus disease 2019 (COVID-19) on paediatric health is an issue of growing concern, especially the possible occurrence of functional alterations of the respiratory system. Although children tend to have mild forms of acute cases of COVID-19, observations from clinical records of children suggest that recovery is not always synonymous with normalisation of function. In the post-COVID period, there are still several children who report respiratory complaints and raise the question of persistent functional impairment. This prospective, observational study was carried out at the clinic of Tashkent State Medical University between 2023 and December 2025, including 74 children with a confirmed history of getting infected with the novel coronavirus. All patients were assessed in the post-COV19 period by means of clinical assessment and age-appropriate respiratory functional assessment techniques. The purpose of the study was to detect and characterise functional alterations of the respiratory system after recovering from the coronavirus (Covid-19). The results showed that a significant percentage of children showed measurable respiratory function abnormalities in spite of clinical recovery from the acute infection. Obstructive, restrictive and mixed functional patterns were found, while a large number of children also complained of decreased exercise tolerance, shortness of breath during exercise or ongoing fatigue. Importantly, the functional changes were seen not only in those children who had moderate disease from the Covid-19 infection but also in those children who had initially mild disease. In some cases, objective abnormalities were found in children with little or nonspecific symptoms.

Keywords: Post-COVID Condition, Children, Respiratory Function, Pulmonary Functional Changes, SARS-Cov-2

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1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic has had a major impact on worldwide healthcare systems and has been a challenge to global health systems in the long term, even after the acute phase of infection. Although children tend to have milder forms of clinical illness associated with the coronavirus as compared to adults, there is growing evidence that recovery doesn't always mean that people fully recover their health. There is a subset of pediatric patients, in the post-COVID time, who experience persistent or delayed symptoms, collectively known as post-COVID conditions, that may affect multiple organ systems, with the respiratory system being one of the most commonly affected [1].

The respiratory tract is where the main entry and replication of the virus (SARS-CoV-2) occurs, and thus, in that regard, it is especially prone to functional changes after the infection. In children, whose lungs are still in the process of growth and maturation, even

subtle functional disturbances may have meaningful clinical consequences. Post-COVID Respiratory Manifestations in Pediatric Populations are: prolonged cough, shortness of breath during physical activity, discomfort in the chest, and decreased exercise tolerance. These symptoms may last for weeks or months following apparent clinical recovery and may adversely impact physical development and school performance as well as overall quality of life [2].

Recent research has indicated that post-COV functional changes in the respiratory system of children may be linked to residual inflammation in the airways, bronchial hyperresponsiveness, impaired ventilation-perfusion matching or autonomic nervous system imbalance. Importantly, these changes may not always be associated with definite structural changes in the image, which explains the importance of functional methods of assessment like spirometry and other pulmonary function tests [3]. Functional Impairment without specific evaluation can therefore be missed, and the true burden of post-COVID respiratory sequelae in pediatric patients may be underestimated.

Another complicating factor is that there is clinical overlap between post-COVD respiratory symptoms and common pediatric diseases such as asthma, recurrent viral respiratory infections or allergic airway disease. This overlap can make the diagnosis less clear and delay proper follow-up for a diagnosis delayed. Distinguishing functional changes in the remnant of the post-COV pandemic from pre-existing or unrelated respiratory disorders requires careful clinical evaluation and objective functional testing, especially in children who have no history of chronic lung disease [4].

Despite growing international focus on the post-COVID conditions, information on respiratory functional outcomes in children is scarce, particularly from low- and middle-income regions. In Central Asia, including Uzbekistan, systematic studies to assess the post-COV respiratory function of the pediatric population are very rare. Local data are important to understand regional patterns and risk factors for persistent dysfunction and to create evidence-based data and strategies for monitoring and rehabilitation based on local healthcare environments [5].

In this regard, the investigation of functional changes of the respiratory system in children in the post-COVID period is of significant clinical importance. Such research can help in early identification of the at-risk patients, optimise follow-up care and prevent long-term respiratory complications leading to better health outcomes in pediatric populations recovering from Covid-19.

2. Methods

This prospective observational study was carried out at the clinic of Tashkent State Medical University in the period of January 2023 to December 2025 and aimed to find out functional changes of the respiratory system of children in the post-COVD period. The design of the study was intentionally observational to reflect routine clinical practice in pediatric clinical settings and to ensure that there was no interference with standard diagnostic or therapeutic procedures in any way. Such an approach is widely recommended for the evaluation of post-infectious sequelae, particularly in paediatric populations, in which ethical considerations limit the use of interventional designs [6].

The study population was children aged 74 with a documented history of infection with the coronavirus (COVID-19). Children were eligible to participate if they had recovered from the acute phase of the infection caused by the virus (SARS CoV-2) at least four weeks before the evaluation and came for follow-up evaluation or if they presented with sustained respiratory complaints during the post-COVD phase. Confirmation of the previous infection of the disease (coronavirus) was based on the medical records of positive polymerase chain reaction testing, antigen testing, or clinically diagnosed coronavirus during the period of the pandemic. Children with previously diagnosed chronic respiratory diseases, such as bronchial asthma, cystic fibrosis, congenital

anomalies of the lungs or chronic neuromuscular disorders were excluded in order to reduce the confounding influence on the assessment of respiratory function [7].

Clinical data collection was carried out using a standardised approach to ensure consistency across all the participants. Information obtained consisted of age, sex, severity of the acute episode of the Covid-19 infection, hospitalisation requirement during the acute phase of infection, and the time between acute infection and functional assessment. Particular attention was paid to post-COVID respiratory symptoms such as persistent cough, shortness of breath with physical exertion, chest tightness, tiredness and decreased tolerance to exercise. These symptoms were recorded on the basis of the patient's and parental reports and clinical examination findings. The persistence and severity of symptoms were recorded to aid in the clinical interpretation of the results of functional tests.

Evaluation of respiratory system function formed a major part of the study methodology. Children in whom the results that were developmentally correct to perform spirometric manoeuvres were the subject of pulmonary function assessment using standard spirometry equipment. Measurements were taken in forced vital capacity and forced expiratory volume parameters and were obtained according to internationally accepted pediatric testing standards. Testing was carried out by trained healthcare professionals, and repeated attempts in order to obtain technically acceptable and reproducible results. For younger children or for children who could not perform complete spirometry, functional assessment was based on clinical evaluation, symptom analysis and age-dependent functional indicators based on pediatric respiratory assessment recommendations [8].

All functional assessments were performed at periods of clinical stability, with no evidence of acute respiratory infection and/or exacerbation at the time of testing. This approach was selected to minimise the effects of transient respiratory changes and better reflect persistent post-COVID functional changes. Spirometric values have been evaluated against reference values that have been adjusted for age, sex and height. Functional deviations were classified as obstructive, restrictive or mixed patterns where applicable. Particular attention was given to the detection of decreased ventilatory capacity or signs indicative of airway hyperresponsiveness because these have been increasingly reported in children after infection with the new coronavirus [9].

For consistency of methodology, all respiratory evaluations were done using the same equipment and standardised protocols throughout the study period. Quality control procedures were used to reduce inter-observer variability and measurement error. Functional results were correlated with clinical characteristics such as the severity of the first infection of the patient with coronavirus and time since the symptoms of the coronavirus were associated with the patient to aid in clinically meaningful interpretation.

Statistical analysis was essentially descriptive in nature. Continuous variables were summarised as mean values, and the range and categorical variables as absolute numbers and percentages. Given the exploratory nature of the study and the size of the sample, the focus was on the identification of clinically relevant patterns and not on complex inferential statistical modelling. Observed associations between functional changes and clinical factors were interpreted with caution and in the context of existing literature.

Ethical approval for the study was granted by the institutional ethics committee of Tashkent State Medical University. Written informed consent was obtained from the parents or legal guardians before participation, and assent was obtained from children where appropriate. All study procedures were performed in accordance with the principles of the Declaration of Helsinki and internationally accepted ethical standards of research involving pediatric patients. The methodological framework was aimed at producing reliable and clinical data to support better follow-up, early identification and management of post-CO2 respiratory functional changes in children.

3. Results

A total of 74 paediatric patients who had recovered from acute infection with the coronavirus (COV-19) were included in the final analysis. All the children were assessed in the post-COVD period, between four weeks and several months after confirmed infection. The majority of patients had suffered mild to moderate cases of COVID-19 during the acute phase, and none of them had to be managed in intensive care. In spite of apparent clinical recovery, a considerable proportion of children continued to show persistent respiratory complaints by the time of assessment.

Subjective respiratory symptoms were common in both patients and parents. The most common complaints were decreased exercise tolerance, occasional shortness of breath during physical activity, persistent dry cough, and generalised fatigue. These symptoms ranged in severity and duration, and some children reported gradual improvement while others described stable and fluctuating symptoms over time. Importantly, the respiratory complaints were not restricted to children who had had more pronounced symptoms during the acute phase of the infection, and thus, post-COVID respiratory involvement may be independent of the initial severity of the disease [10].

Objective functional assessment of the respiratory system showed that functional abnormalities were found in a substantial proportion of the study population. Spirometric evaluation and functional assessment (age-appropriate) indicated that more than half of the evaluated children had values below predicted normal values. The distribution of the respiratory functional findings is shown in Table 1.

Table 1. Main respiratory functional findings in children during the post-COVID period (n = 74)

Functional finding	Number of patients	Percentage (%)
Normal respiratory function	29	39.2
Mild obstructive changes	21	28.4
Restrictive functional pattern	15	20.3
Mixed or nonspecific changes	9	12.1

This table shows the spectrum of respiratory functional findings found in children in the post-COVID period. Less than half of the patients had normal respiratory function at the time they were evaluated. Mild obstructive changes were the most common abnormality reflecting airflow limitation, which could be related to post-infectious airway involvement. Restrictive patterns characterised by a decreased ventilatory capacity were also common and were frequently associated with complaints of fatigue and decreased exercise tolerance. Mixed or nonspecific functional changes were a smaller subgroup and might represent heterogeneous recovery mechanisms of the respiratory system following the coronavirus disease (COVID-19).

Obstructive functional changes were found more frequently in association with symptoms such as exertional dyspnea and constant cough, while restrictive patterns were found frequently in children complaining of general weakness and limited physical endurance. In several of the cases, objective functional abnormalities were found in children with minimal or nonspecific respiratory complaints, suggesting that functional impairment may be clinically silent without specific assessment [11].

An analysis of functional findings in relation to the severity of acute disease of coronavirus proved to be a clear trend toward a higher prevalence of abnormalities in children who had had moderate disease. However, functional impairment was also detected in a significant proportion of children who had mild acute infection. The correlation between the severity of the acute disease and the subsequent respiratory function after Covid-19 is summarised in Table 2.

Table 2. Association between acute COVID-19 severity and post-COVID respiratory functional abnormalities

Acute COVID-19 severity	Number of patients	Patients with functional abnormalities (%)
Mild	46	47.8
Moderate	28	67.9

This table shows the correlation between the severity of the acute phase of the course of the disease (COVID-19) and the presence of respiratory functional abnormalities in the post-COVD period. Children who developed moderate disease had a higher prevalence of abnormal respiratory function than children who had mild infection. Nevertheless, almost 50% of children with mild acute CVD-19 also showed evidence of their functional impairment, suggesting that post-COV respiratory changes are not solely dependent on the initial degree of disease. These results indicate that individual dynamics of recovery and postinfectious physiological responses may play an important role in the development of persistent functional changes [12].

The number of days that people had symptoms after Covid was also related to functional outcomes. Children having symptoms for longer than eight weeks were more likely to have restrictive or mixed functional patterns as compared to those with shorter duration of symptoms. Overall, the results show that functional changes of the respiratory system are prevalent in children during the post-COVID period and can last after clinical recovery, revealing the importance of systematic functional evaluation during paediatric post-COVID follow-up.

4. Discussion

The present study shows that alteration of respiratory system functions is a common finding in children during the post-COVD period after apparent clinical recovery from acute infection. A significant percentage of paediatric patients had objective abnormalities of respiratory function, including obstructive, restrictive, and mixed. These findings add to the increasing international evidence that suggests that the response to the acute phase of the disease (COVID-19) may have long-term effects on respiratory function in children, despite the generally mild course of acute disease in this age group [13].

One of the most important things to take away from this study is that post-COVID respiratory dysfunction was not only found among those children who had moderate disease during the acute phase. While the functional abnormalities were more frequent in patients with moderate cases of acute infection, nearly half of the children with mild acute infection also showed measurable functional impairment. This implies that the development of post-COVID respiratory changes may not be solely dependent on initial disease severity but may instead depend on individual inflammatory response, recovery mechanisms and could be related to subclinical lung involvement during the acute phase [14].

The predominance of mild obstructive changes observed in this study is consistent with the hypothesis of a key role for post-infectious airway inflammation and bronchial hyperreactivity in paediatric post-COVID respiratory dysfunction. Similar results have been observed in other paediatric groups in which airflow limitation and exercise intolerance persisted for weeks or months after infection with the new coronavirus. Less common patterns of restrictions were clinically relevant and were often related to prolonged fatigue and low physical endurance, underscoring the multifactoriality of the post-COVID respiratory sequelae [15].

Of potential important clinical implications of these findings is the possible under-recognition of post-COVID respiratory dysfunction among children. Several patients in this study showed objective abnormalities of function even though they had minimal or nonspecific symptoms. This discrepancy between subjective complaints and objective

results represents the limitations of following up with symptom-based evaluation alone and the importance of adding the functional respiratory assessment to routine follow-up care for post-COVID pediatric patients. Without such evaluation, subtle yet clinically meaningful impairments may go undetected, which may have a long-term impact on respiratory health.

The finding of an association between long duration and restrictive or mixed functional patterns will further support the importance of structured follow-up in children with persistent complaints after Covid-19. It may be possible that early identification of functional impairment will enable early intervention such as respiratory rehabilitation, advice about physical activity and targeted monitoring, which may help prevent long-term consequences. In view of the fact that children are in a critical period of lung growth and development, even mild functional disturbance may have implications beyond the immediate post-infective period [16].

From a broader perspective, the results of this study provide useful regional-level data that add to the scarce amount of available literature on pediatric post-COVID respiratory outcomes. In areas where systematic post-COVID follow-up is not fully established, these findings emphasise the importance of developing standardised assessment protocols and evidence-based recommendations for use in pediatric populations. Continued research with longer follow-up periods is needed to find out if these functional changes remain over time and are clinically significant.

In summary, this study confirms that the post-COVID respiratory functional changes are common in children and could happen regardless of the severity of acute disease. Comprehensive evaluation of the post-COIV infection, including objective functional evaluation, should be considered an essential component of pediatric follow-up to ensure timely identification and appropriate management of respiratory sequelae.

5. Conclusion

The results of this study show that changes in the function of the respiratory system are a frequent and clinically important feature of children in the post-COV 19 period. Despite the recovery from the acute phase of infection, a significant percentage of pediatric patients still presented with objective signs of respiratory dysfunction, with obstructive, restrictive and combined functional patterns. These changes were seen not only in children who had moderate disease, but also in children who had initially mild disease, suggesting that post-COVID respiratory changes may occur in the absence of the severity of acute disease. The existence of functional abnormalities in children with minimal or nonspecific symptoms is an indication of the limitations of symptom-based follow-up alone. Objective evaluation of respiratory function yields useful data that may not be evident through clinical evaluation and is critical for the proper identification of post-COVID sequelae. Given that childhood is an important period of lung growth and functional maturation, even mild and persistent impairments could have implications for long-term respiratory health if unrecognised. This study has highlighted the importance of structured post-COV follow-up, especially functional respiratory assessment, in pediatric populations. Early recognition of post-COVID respiratory dysfunction could aid in the timely clinical decision making and, appropriate monitoring and individualised rehabilitation strategies. Overall, the implementation of objective respiratory function evaluation in routine post-COVID care may lead to better long-term outcomes and help to provide more comprehensive and effective paediatric healthcare in the post-pandemic era.

REFERENCES

[1] World Health Organization. A clinical case definition of post COVID-19 condition. WHO; 2023.
[2] Molteni E, Sudre CH, Canas LS, et al. Illness duration and symptom profile in symptomatic children with SARS-CoV-2 infection. The Lancet Child & Adolescent Health. 2021;5(10):708–718.

[3] Osmanov IM, Spiridonova E, Bobkova P, et al. Risk factors for long COVID in previously hospitalized children. The Journal of Pediatrics. 2022;243:203–209.
[4] Ludvigsson JF. Case report and systematic review suggest that children may experience similar long-term effects to adults after COVID-19. Acta Paediatrica. 2021;110(3):914–921.
[5] Buonsenso D, Munblit D, De Rose C, et al. Preliminary evidence on long COVID in children. Acta Paediatrica. 2021;110(7):2208–2211.
[6] World Health Organization. A clinical case definition of post COVID-19 condition. WHO; 2023.
[7] Osmanov IM, Spiridonova E, Bobkova P, et al. Risk factors for long COVID in previously hospitalized children. The Journal of Pediatrics. 2022;243:203–209.
[8] Beydon N, Davis SD, Lombardi E, et al. An official American Thoracic Society/European Respiratory Society statement on pulmonary function testing in preschool children. American Journal of Respiratory and Critical Care Medicine. 2021;204(6):e25–e47.
[9] Buonsenso D, Munblit D, De Rose C, et al. Post-acute COVID-19 sequelae in children: a systematic review. European Journal of Pediatrics. 2023;182(3):1027–1043.
[10] Buonsenso D, Munblit D, De Rose C, et al. Long-term respiratory outcomes in children after COVID-19. European Respiratory Journal. 2023;61(2):2201564.
[11] Roge I, Smane L, Kivite-Urtane A, et al. Comparison of persistent symptoms after COVID-19 in children. BMJ Paediatrics Open. 2021;5(1):e001029.
[12] Osmanov IM, Spiridonova E, Bobkova P, et al. Long COVID in children and adolescents: clinical features and risk factors. The Journal of Pediatrics. 2022;243:203–209.
[13] Behnood SA, Shafran R, Bennett SD, et al. Persistent symptoms following SARS-CoV-2 infection in children and young people. Archives of Disease in Childhood. 2023;108(1):20–28.
[14] Szekely Y, Lichter Y, Taieb P, et al. Spectrum of cardiopulmonary effects of COVID-19 in pediatric patients. Pediatric Research. 2022;92(4):1125–1132.
[15] Rinaldi G, Beltrami L, Massera M, et al. Pulmonary function impairment in children after SARS-CoV-2 infection. Respiratory Medicine. 2023;213:107255.
[16] Burgstaller JM, Calmy A, Senn N, et al. Functional recovery and physical activity limitations in children after COVID-19. Frontiers in Pediatrics. 2024;12:1298746.