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Anxiety Levels of Children with Primary Ciliary Dyskinesia and Their Mothers at the Beginning of the COVID-19 Pandemic and Change in the First Year

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Abstract

We aimed to assess anxiety of children with primary ciliary dyskinesia (PCD) and their primary caregivers at the beginning of Coronavirus disease-2019 (COVID-19) pandemic and change in levels of anxiety in first year with prolongation of pandemic. This was a two-step study; first step was questionnaire-based, conducted via teleconference. In first step, 29 patients and 105 healthy children and their mothers were participated; 25 children with PCD and their mothers were in second step. Demographic characteristics, clinical informations were recorded. Children's and mothers' state and trait anxiety levels were assessed and compared. Anxiety levels of mothers of patients were assessed according to clinical characteristics of children. Mothers' knowledge of COVID-19 and effect of teleconference on their anxiety was evaluated. State anxiety levels in the first year of pandemic of children with PCD and their mothers were also compared. Compared to control group, state anxiety of children in 13-18 age group and trait anxiety of their mothers were lower ($p<0.05$). In both groups, trait and state anxiety of 13-18 years old children and mothers positively correlated. Trait anxiety of mothers of patients negatively correlated with patients' FEV_1 and MEF_{25-75}. Patients' mothers reported feeling less anxiety at the end of teleconference. Anxiety of mothers of patients (especially under 9 years old) had increased as pandemic continued. At the beginning of pandemic, children with PCD were less anxious than healthy children, and their mothers had lower trait anxiety than mothers of healthy children. Being followed for chronic disease and obtaining information about COVID-19 may have reduced anxiety of children with PCD and their mothers. However, as pandemic continues, need to protect their children with PCD from infection, especially of mothers with younger children, may have raised their concerns.

Keywords: Anxiety, children, COVID-19, pandemic, primary ciliary dyskinesia

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Introduction

Primary ciliary dyskinesia (PCD) is a rare chronic genetic disease, and generally presents with recurrent and chronic infections of upper and lower respiratory tracts.[1,2] The diagnosis of a chronic disease in children has a dramatic impact on well-being of themselves and their families, and can be associated with anxiety and depression in both children and their family.[3,4]

In addition to variable respiratory findings, the Coronavirus disease-2019 (COVID-19) pandemic also affected mental health widely in the world, causing psychological problems such as stress, anxiety, depression, insomnia and fear.[5-7] Containment measures caused by pandemic can have destructive effects on mental health, affecting the social health of children as well.[8,9] The stress created by pandemic has increased over time, not only from the risk of infection and death, but also from the disruption of daily routine and social communication.[10]

Highlights

- Primary ciliary dyskinesia (PCD) patients were less anxious than healthy children at beginning of pandemic.
- PCD patients are accustomed to chronic diseases, so they better cope with pandemic.
- Healthy children have never experienced the threat of a serious disease before.
- Mothers of PCD patients exhibited lower trait anxiety than healthy children's.
- Anxiety of mothers of PCD patients may increase as pandemic continues.

The purpose of this study was to measure anxiety of children with PCD and their primary caregivers, as pandemic may increase their anxiety levels, and to evaluate relationship between anxiety levels and clinical and demographic characteristics. Since anxiety levels may increase during pandemic, it was also aimed to see change in anxiety levels in the first year with prolongation of pandemic.

Material and Methods

This study was cross-sectional and two-step. The first step was conducted at the beginning of COVID-19 pandemic between May 23 and June 3, 2020. Patients with PCD aged 0-18 years, who were followed up regularly in pediatric pulmonology department, those who wanted to participate in the study and their primary caregivers were included as the study group. PCD was diagnosed under the guidance of the guidelines published by the European Respiratory Society and the American Thoracic Society for diagnosis of PCD.[11,12] In both guidelines, no single gold standard test has been defined for a definitive diagnosis; and it was stated that nasal nitric oxide, high-speed video microscopy, transmission electron microscopy, immunofluorescence microscopy and genetic analysis could be used in the diagnosis of those with suspected PCD due to their clinical features.[11,12] Control group was populated using snowball sampling since there were restrictions due to COVID-19 pandemic and the implementation of curfews created difficulties in reaching the healthy child group in study time. Children without chronic diseases, any complaints or symptoms, and their primary caregivers included as controls. None of primary caregivers in control group were health workeras. The mothers of all children were their primary caregivers. In all cases, children's primary caregivers were their mothers. Contact with anyone with severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection and COVID-19 was queried, and those who had a COVID-19 case in their families and/or relatives were excluded from the study.

On March 16, 2020, schools were closed, and strict stay-at-home policies were implemented in Turkey due to COVID-19 pandemic. For this reason, first step of this study was conducted via teleconference. All children and primary caregivers were informed about study. After the aim of the study was explained to all participants, they were informed that they had right to withdraw at any time and not allow their data to be used. Teleconferences were conducted to all participants by the doctor regularly examining each PCD patient and lasted about 20 minutes. During each teleconference, demographic data of children and their caregivers were collected, their anxiety levels, mothers' knowledge of COVID-19, and the impact of teleconference on their anxiety was evaluated.

For both groups, demographic data such as age, gender of children and primary caregiver's age, education level, self-reported health status (obtained by verbally asking whether primary caregiver had a health problem) were recorded. For study group, clinical data including follow-up duration (time between the first admission to the pediatric pulmonology department and the last follow-up), number of hospitalizations during follow-ups, number of referrals to policlinics and sputum cultures positive for any bacteria in the last year, and results of pulmonary function tests (PFT) upon last admission, were noted. PFT data included forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), mid-expiratory flow between 25-75% of forced vital capacity (MEF_{25-75}) as the percentage of predicted, and FEV_1/FVC ratio.

The State-Trait Anxiety Inventory for Children (STAI-C) was used for children aged 9-12 years, whose Turkish validity and reliability were approved by Özusta.[13] Children under age of 9 were not surveyed, only their caregivers were surveyed. STAI whose Turkish validity and reliability were confirmed by Oner and Le Compte[14] was used for all caregivers and children aged 13-18 years. Trait subscales measured permanent anxiety; state subscales measured anxiety during COVID-19 pandemic. There are two separate scores for each of the direct and reverse statements in survey. A predetermined and unchanging value is added to the number obtained by subtracting the total score for the reverse statements from the total score for the direct statements. The resulting value is the individual's anxiety score. Higher scores indicated higher anxiety levels.[13-16] In the initial development, the test-retest reliability coefficients ranged from 0.31 to 0.86 (at intervals ranging from 1

hour to 104 days).[16] Permission had been obtained for use these scales.

To assess caregivers' knowledge about COVID-19, a questionnaire based on the "myth busters" section on World Health Organization (WHO) website regarding advice for public related to COVID-19 was prepared by the authors.[17] The statements concerned the weather conditions under which SARS-CoV-2 can survive and spread, the effectiveness of treatment with antibiotics, the prevalence of the disease according to gender, the incidence and mortality risk in children, and the effects of comorbidities and nutrition. The correct answers were recorded as numbers and percentages.

At the end of each teleconference, caregiver was provided with information about the advice provided on the WHO website.[18] Caregivers were then asked to evaluate the effect of the teleconference on their anxiety to categorize as "decreased," "increased," or "unchanged".

Demographic and clinical characteristics of children and caregivers, caregivers' knowledge about COVID-19, and state and trait anxiety scores were compared between two groups, and correlations were investigated.

The second step was conducted between May and June 2021 at the time of their admission to hospital as pandemic restrictions were removed. The state anxiety levels of children with PCD and their caregivers in the first year of pandemic were noted and compared. The number and reason of hospital admissions and hospitalizations of patients during the first year of pandemic were recorded. Therewithal, PFTs of children with PCD were compared before pandemic and in the first year.

This study was conducted with the permission of Gazi University Faculty of Medicine Ethics Committee (date: 22.05.2020, no: 342). All procedures in this study were performed in convenient with the ethical rules and the principles of the Declaration of Helsinki. Since the study was started during the period when the COVID-19 pandemic was widespread, verbal informed consent was obtained in order not to put the individuals at risk, and ethics committee approval was obtained in the form of verbal consent from the individuals.

Statistical Analysis

The IBM SPSS Statistics version 22.0 for Windows (IBM, Armonk, NY, USA) was used for statistical analysis. The conformity of variables to the normal distribution was examined using visual (histogram and probability graphs) and analytical methods (Shapiro-Wilk test). For descriptive statistics, categorical variables were expressed as absolute numbers and percentages, and continuous variables were expressed as means ± standard deviations or medians (minimum-maximum). For comparisons between two independent variables, Mann-Whitney U test was used for data not normally distributed, and independent samples t-test was used for normally distributed data. For correlations, Spearman's correlation test was used for data not normally distributed, and Pearson's correlation test was used for normally distributed data. Chi-square tests were used for comparisons of categorical variables between independent groups. Since numerical variables did not normally distribute comparisons between both dependent groups were analyzed with Wilcoxon signed-rank test. It was considered statistically significant when $p<0.05$.

Results

In study and control groups, there were 29 and 105 children and their mothers, respectively. All mothers' and children's demographic characteristics, and clinical data of study group are presented in **Table 1** and **Table 2**, state and trait anxiety levels of children aged over 9 years and all mothers at the beginning of pandemic are in **Table 3** and comparison of mothers' anxiety levels at the beginning of pandemic according to their educational level and self-reported health status were in **Table 4**, respectively.

The percentages of correct answers regarding COVID-19 were 63.8±17.8 in study group and 73.5±13.2 in control group (p=0.009). A statistically significant difference was found in the percentages of correct answers regarding COVID-19 given by mothers according to their education level (below high school vs. high school or above) in both groups [64.3% (range: 28.6-85.7%) vs. 82.1 (57.1-92.9%), p=0.012 and 57.1% (28.6-78.6%) vs. 78.6% (50-100%), p=0.001, respectively].

At the beginning of pandemic, a positive correlation between state and trait anxiety levels of 9-12 years old children was observed in control group (r=0.501, p=0.015). No significant correlation was found in study group (r=0.232, p=0.658). There were positive correlations between state and trait anxiety levels of 13-18 years old children in study and control group (r=0.744, p=0.001 and r=0.484, p=0.008, respectively).

Positive correlations between the mothers' trait and state anxiety levels were found in study and control group (r=0.644, p=0.001 and r=0.557, p=0.001, respectively). The correlations of children's and mothers' anxiety at the beginning of pandemic are presented in **Table 3**.

At the beginning of pandemic, in study group, there was negative correlation between mothers' trait anxiety scores and children's FEV_1 and MEF_{25-75}, although FEV_1 and MEF_{25-75} were within normal limits (r=-0.484, p=0.031 and r=-0.546, p=0.013, respectively). There were no significant correlations between state and trait anxiety scores of mothers and children's clinical features.

In study group, there were no correlations between state and trait anxiety scores of mothers and knowledge about COVID-19 (r=0.100, p=0.605 and r=-0.075, p=0.700, respectively). In control group, no correlation was observed between state anxiety score and knowledge about COVID-19 (r =-0.070, p=0.476), but trait anxiety score positively correlated with knowledge about COVID-19 (r=0.192, p=0.049).

In the first step of the study, at the end of the teleconference, 82.8% of mothers in study group and 39% of mothers in control group reported a reduction in their anxiety levels (p=0.001).

In the second step of this study, two of 29 children with PCD and their mothers who participated in the first

Table 1.
Comparison of children's and mothers' demographic characteristics between the two groups at the beginning of pandemic

	Study group (n=29)	Control group (n=105)	p-value
Children's age (years), mean ± SD	12.2±4.5	8.7±5.3	0.002[a*]
Gender, n (%)			
Female	16 (55.2)	53 (50.5)	>0.05[b]
Male	13 (44.8)	52 (49.5)	
Mothers' age (years), mean ± SD	38.1±7.2	38.2±8.2	>0.05[a]
Mothers' education level, n (%)			
Below high school	23 (79.3)	15 (14.3)	0.001[b*]
High school and above	6 (20.7)	90 (85.7)	
Mothers with health problems[#], n (%) (Allergic, cardiological, gastroenterological, musculoskeletal, rheumatological)	8 (27.6)	12 (11.4)	0.041[b*]

SD; Standard deviation, [a]Independent samples t-test, [b]Chi-square test, *Statistically significant, [#]Obtained by verbally asking

Table 2.
Clinical data of children with primary ciliary dyskinesia at the beginning of pandemic (n=29)

Duration of follow-up (months) (mean ± SD)	60.5±40.3
Number of total hospitalizations during follow-up [median (range)]	1 (0-2)
Number of hospital admissions in the past year [median (range)]	2 (0-3)
Positive sputum cultures in the past year [n (%)]	
Yes	6 (42.8)
No	8 (57.2)
Pulmonary function tests [mean ± SD]	
FEV_1 (%)	90.1±15.4
FVC (%)	91.1±13.4
MEF_{25-75} (%)	97.0±8.8
FEV_1/FVC	85.5±25.2

FEV_1; Forced expiratory volume in one second, FVC; Forced vital capacity, MEF_{25-75}; Mid-expiratory flow between 25 and 75% of forced vital capacity, SD; Standard deviation

Table 3a.
Comparison of children's and mothers' anxiety scores at the beginning of pandemic between two groups

			Study group	Control group	p-value
State anxiety score	**Children**	**Aged 9-12 [median (range)]**	(n=6) 26 (22-30)	(n=33) 29 (21-44)	0.057[a]
		Aged 13-18 [median (range)]	(n=15) 33 (25-51)	(n=39) 40 (23-63)	0.014[a*]
	All mothers (mean ± SD)		(n=29) 37.7±6.5	(n=105) 36.5±8.5	0.479[b]
Trait anxiety score	**Children**	**Aged 9-12 [median (range)]**	(n=6) 27 (24-37)	(n=33) 32 (23-47)	0.094[a]
		Aged 13-18 [median (range)]	(n=15) 34 (24-44)	(n=39) 36 (20-55)	0.130[a]
	All mothers (mean ± SD)		(n=29) 34.0±5.2	(n=105) 47.0±12.7	0.001[b*]

SD: Standard deviation, [a]Mann-Whitney U test, [b]Independent samples t-test, *Statistically significant

Table 3b.
Correlations of children's and mothers' anxiety scores at the beginning of pandemic in two groups

	State anxiety of mothers				Trait anxiety of mothers			
	Study group		Control group		Study group		Control group	
	R_S	P	R_S	P	R_S	P	R_S	P
Children's state anxiety								
Ages 9-12	0.029	0.956	0.233	0.284	-0.058	0.913	-0.010	0.964
Ages 13-18	0.408	0.131	-0.014	0.941	0.092	0.744	0.108	0.577
Children's trait anxiety								
Ages 9-12	-0.433	0.391	-0.084	0.704	0.088	0.868	-0.490	0.018*
Ages 13-18	0.550	0.034*	-0.037	0.847	0.085	0.763	-0.087	0.653

*Statistically significant

survey did not want to participate. The other two had COVID-19 infection during the first year of pandemic. All of 25 children with PCD and their mothers were evaluated. Seven children were under 9, 6 children 9-12, 12 children 13-18 years and 13 (52%) were female in the second step.

The comparison of state anxiety levels of children with PCD and their mothers between beginning and the first year of pandemic was shown in **Table 5**. In addition, state anxiety levels of mothers according to age groups were also shown in **Table 5**.

During the first year of pandemic, 19 (76%) children with PCD admitted to the hospital. Five had admitted only once, the rest more than once. Median number of hospital admission during the first year of pandemic was 2.0 (1.0-8.0). The most common reason (63.6%) for admission was cough and increased sputum. The other reasons were exercise intolerance (18.2%), stomach ache (9.1%) and trauma (9.1%). Sputum analysis was performed on 17 children. While no microorganisms were found in sputum of 16 of them, *Pseudomonas aeruginosa* was detected in one. Only one child was hospitalized during the first year of pandemic for surgery for repair of urethral cord, and there were no other hospitalized children.

PFT could be performed in 15 children. Medians of last FEV_1, FVC, FEV_1/FVC and MEF_{25-75} of patients before pandemic were 88% (67-119), 89% (68-123), 97 (86-110) and 74% (47-129), respectively. Medians of FEV_1, FVC, FEV_1/FVC and MEF_{25-75} of patients in the first year of the pandemic were 83% (62-111), 86% (65-115), 94 (62-107) and 72% (41-119), respectively. No statistically significant difference was observed between the last PFTs before pandemic and PFTs in the first year of pandemic (FEV_1: p=0.132, FVC: p=0.346, FEV_1/FVC: p=0.300 and MEF_{25-75}: p=0.798). The results and comparison of PFTs according to age groups were shown in **Table 6**. No correlations were found between anxiety levels of children and mothers and hospital admission and PFTs of children (p>0.05).

Discussion

The sudden and world-threatening COVID-19 pandemic outbreak has caused considerable anxiety.[19] This study showed that children with PCD aged 13-18 years had lower anxiety levels at the beginning of the pandemic than healthy children. Similarly, their mothers had lower trait anxiety than mothers of healthy children. The state and trait anxiety of all mothers and 13-18 years old children correlated. There was a relationship between trait anxiety levels of 13-18 years old patients with PCD and state anxiety of their mothers. The trait anxiety levels of 9-12 years old healthy children aged also correlated with their mothers' anxiety. The anxiety of mothers of children with PCD has increased as the COVID-19 pandemic continues, and it has been observed that anxiety of mothers with younger children has increased according to age groups in our study.

The studies conducted among children with chronic lung diseases it was noted that these children and their mothers had more anxiety due to COVID-19 pandemic.[20,21] A recent study showed that children with cystic fibrosis had lower anxiety levels than healthy children in COVID-19 pandemic.[22] In Italy, it was shown that during the pandemic, patients with PCD were

Table 4.
Comparison of mothers' anxiety levels at the beginning of pandemic according to educational level and self-reported health status in two groups

		Mothers' educational level			Mothers' self-reported health status#		
		Below high school	High school and above	p	With health problem	No health problem	p
State anxiety	Study group (n=29)	37 (32-59)	34 (30-35)	0.024[a*]	36 (34-53)	35 (30-59)	0.570[a]
	Control group (n=105)	33 (23-56)	35 (23-60)	0.883[a]	33 (23-42)	35 (23-60)	0.397[a]
Trait anxiety	Study group (n=29)	35 (24-45)	29 (28-40)	0.066[a]	35.8±5.0	33.3±5.1	0.315[b]
	Control group (n=105)	36 (24-64)	46.5 (21-78)	0.097[a]	43.1±10.1	47.5±12.9	0.318[b]

[a]Mann-Whitney U test, [b]Independent samples t-test, *Statistically significant, #Obtained by verbally asking

Table 5.
Comparison of state anxiety levels between the beginning of the pandemic and the first year

	State anxiety levels		
	Beginning of the pandemic [median (min-max)]	First year of the pandemic [median (min-max)]	p
Children aged 9-12 years (n=6)	26 (22-30)	28 (23-40)	0.104
Children aged 13-18 years (n=12)	33 (25-51)	37.5 (28-47)	0.055
All mothers (n=25)	35 (30-59)	41 (32-47)	0.025*
Mothers of children:			
aged under 9 years (n=7)	36 (30-42)	42 (35-43)	0.027*
aged 9-12 years (n=6)	34 (33-46)	43 (32-47)	0.207
aged 13-18 years (n=12)	36 (32-59)	39 (32-46)	0.562

Min-max; Minimum-maximum, *Statistically significant

psychologically well, with no increase in parental stress levels; quarantine was thought to give patients with PCD a great sense of security.[23] Similarly, in our study, children with PCD exhibited lower anxiety levels than healthy children at the beginning of pandemic. Children with PCD may cope better because they are more accustomed to living with a disease. Healthy children, on the other hand, had never experienced the fear of a serious disease before. This may explain their higher anxiety levels during the pandemic.

Anxiety is a very easily transmissible emotion. Our findings suggest that children may be affected by their mothers' anxiety, as mothers are role models for their children. It was reported that anxiety levels of both healthy children and children with chronic diseases were associated with their mothers.[24,25] We observed a positive correlation between the trait anxiety levels of 13-18 years old children with PCD and COVID-19-related anxiety of their mothers. Anxiety of both children and mothers interacted each other. Higher levels of trait anxiety in children with PCD may have contributed to increase anxiety of their mothers during the pandemic.

Frequent respiratory tract infections and hospitalizations can cause significant stress and anxiety in families of patients with PCD.[26] Studies showed that children with chronic lung diseases and their parents had higher anxiety levels than the general population.[20,27] We found that mothers of children with PCD had lower trait anxiety than mothers of healthy children. Regular follow-ups may have contributed to reducing their trait anxiety. Mothers of children with PCD are more familiar with diseases and hospitalizations and may have developed coping strategies that help them control their anxiety related to pandemic. Mothers of healthy children, on the other hand, lack such coping strategies; thus, the pandemic may be a more stressful experience for them. In addition, the lower mean age of children in the healthy group than children with PCD may be a reason for the higher level of anxiety in their mothers.

In our study, mothers of children with PCD had lower education levels. Their trait anxiety was lower than that of healthy children's mothers. Emin et al.[28] showed that mothers of children with allergic rhinitis exhibited higher levels of anxiety, although their education levels were not significantly different from mothers of healthy children. Behmanesh et al.[29] found no significant correlation between the education and anxiety levels of mothers of children with asthma. Our findings suggest that mothers with higher education levels may be more aware of public health issues, which can increase their anxiety levels.

Other studies reported no association between FEV_1 and their or their parents' anxiety levels.[30,31] In our study, it was shown that a worsening of FEV_1 and MEF_{25-75} may increase their mothers' anxiety, although FEV_1 and MEF_{25-75} were within normal limits.

In the first step of study, at the end of the teleconference, mothers of patients with PCD reported a greater decrease in their anxiety levels than healthy children's mothers. Talking to the doctor who examined their children regularly and being informed about COVID-19 pandemic may have contributed to this effect.

Researches on the children's mental health and their parents during the COVID-19 pandemic, it was shown that anxiety levels increased.[32-37] In another study, there was no significant relationship between anxiety and the COVID-19 pandemic among adolescents, and it was determined that anxiety was significantly related to gender, not age.[38] It was thought that although children normally do not have any health problems, their anxiety may have increased and their families may be more anxious during the pandemic. Studies showed that the mental health status of parents of children with any disease or disorder may also be affected during COVID-19 pandemic.[10,39] It was also reported that the anxiety levels of caregivers of children with respiratory disorders increased with the COVID-19 lockdown.[40] It was thought that the addition an unknown global situation such as COVID-19 pandemic to these respiratory disorders could have a profound impact on caregivers.[40] Similarly, in our study, it was observed that the anxiety of mothers of children with PCD increased significantly as COVID-19 pandemic continued. It was thought that the anxiety of the mothers due to their children may have

Table 6.
The results and comparison of pulmonary function tests according to the age groups

	Children aged 9-12 years (n=4)			Children aged 13-18 years (n=8)		
	Last before pandemic	First year of pandemic	p	Last before pandemic	First year of pandemic	p
FEV_1 (%) median (min-max)	92.0 (87.0-103.0)	86.0 (76.0-111.0)	0.715	82.5 (67.0-119.0)	70.5 (62.0-99.0)	0.176
FVC (%) median (min-max)	93.0 (85.0-105.0)	83.5 (78.0-115.0)	0.465	83.5 (68.0-102.0)	85.5 (65.0-103.0)	0.933
FEV_1/FVC median (min-max)	96.0 (94.0-103.0)	94.5 (83.0-103.0)	0.593	98.5 (86.0-110.0)	95.0 (62.0-103.0)	0.161
MEF_{25-75} (%) median (min-max)	80.5 (66.0-91.0)	100.0 (72.0-119.0)	0.068	68.0 (47.0-126.0)	54.5 (41.0-89.0)	0.141

FEV_1; Forced expiratory volume in one second, FVC; Forced vital capacity, MEF_{25-75}; Mid-expiratory flow between 25 and 75% of forced vital capacity, min-max; Minimum-maximum, SD; Standard deviation

increased as the pandemic continued, since PCD was especially accompanied by respiratory symptoms and because the respiratory findings of COVID-19 were at the forefront.

The anxiety of children with PCD was expected to increase in our study, however there was no significant change in the anxiety of children with PCD in the first year of COVID-19 pandemic. Since children with PCD felt safer when they stayed at home during pandemic, it was thought that although the pandemic continued, their anxiety might not have increased. In addition, the fact that most of the children with PCD and their families who participated in this study did not have the COVID-19 infection during this period may have caused the anxiety of children to not increase. In our study, no significant change in the anxiety levels of children with PCD according to age groups in the first year of pandemic was observed, while the anxiety of mothers with younger children increased significantly. Recent studies predicted that parents were concerned about the need to protect their children from infection.[10] Therefore, it can be thought that mothers who have children with PCD at a younger age may have higher anxiety as they may have difficulty in protecting their children. At the same time, repeated exposure to news about COVID-19 pandemic could raise anxiety about pandemic.[41]

Restrictions applied during the pandemic (such as social distancing, using a mask) may reduce respiratory symptoms and improve lung function.[42] In the study of asthmatic children by Taytard et al.,[42] less exacerbations, better asthma symptom control during the pandemic period and improved lung function detected after reopening. In our study, last PFT before the pandemic and PFT in the first year of pandemic of patients were similar. Implemented pandemic restrictions may have preserved the lung function, since the patients did not have symptoms such as respiratory tract infection that would affect the lung function.

Our study has some limitations. The sample size was small in both steps of study, and the difference in age distribution of the children in the two groups in the first step of study caused difficulties in evaluating the results. Despite these limitations, our findings may support guiding psychosocial assessment and, if necessary, interventions for children with chronic diseases and their caregivers during such times.

Conclusion

At the beginning of the COVID-19 pandemic, children with PCD had less anxiety than healthy children. Mothers of children with PCD also had lower trait anxiety than mothers of healthy children. In contrast, worsening of FEV_1 and MEF_{25-75} of children may increase trait anxiety of their mothers, although these were within normal limits. Although all mothers were concerned about pandemic, mothers of children with PCD experienced a greater reduction in their anxiety after our teleconference at the beginning of pandemic. Communicating with and obtaining information about COVID-19 from their follow-up doctor may have had a positive effect. Larger, longitudinal studies could provide more information to guide psychosocial assessment and interventions for children with chronic diseases and their caregivers in such extraordinary situations as COVID-19 pandemic.

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