The Awareness Level of Pulmonary Rehabilitation and Compliance with Respiratory Exercises After COVID-19

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Abstract

Aim: Coronavirus Disease 2019 (COVID-19) is an infectious disease that can cause respiratory, physical, psychological, and generalized systemic dysfunction. COVID-19 can significantly impact the respiratory system. Pulmonary rehabilitation may be required for the appropriate person and at the appropriate time.

Methods: The study included 112 outpatients who were admitted to the Pulmonary Diseases and Physical Therapy and Rehabilitation Polyclinics after being diagnosed with COVID-19 between January 2021 and June 2021. The demographic data of the patients, their smoking behavior and duration, the Modified Charlson Comorbidity Index, clinical characteristics of the disease, the Modified Borg Scale were all assessed. The presence of information on respiratory exercises, the source of this information, and their compliance with the exercises were all evaluated.

Results: Of the patients, 30 (26,8%) of them reported that they have information on respiratory exercises. Only 11 (36,7%)'i of these patients were doing the respiratory exercises regularly. In the study, the history of hospitalization and high level of education were found positive correlated with the presence of information on pulmonary rehabilitation (p=0.001). Compliance with exercises was found low.

Conclusions: In the study, the history of hospitalization and high level of education were found to correlate with the presence of knowledge on pulmonary rehabilitation. Exercise compliance was found to be low. The number of awareness-raising activities for these patients and healthcare professionals should be increased to reduce their morbidity, mortality, and health expenditure.

Keywords: *Awareness, COViD-19, pulmonary rehabilitation, respiratory exercises*

1. Introduction

COVID-19, defined as coronavirus disease-2019 by the World Health Organization (WHO), is a respiratory tract infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The most apparent pathological alterations in early and later periods of COVID-19 are diffuse lung damage, and in some patients, additional fibrinous exudates in alveoli and pulmonary interstitial fibrosis were observed. These alterations contribute to all-body hypoxemia, and cardiopulmonary and organ dysfunctions[1,2].

Pulmonary rehabilitation during the acute management of COVID19 should be considered when possible and safe and may include nutrition, airway, posture, clearance technique, oxygen supplementation, breathing exercises, stretching, manual therapy, and physical activity.

The complications and dysfunctions can continue in discharged patients for up to 6 months and result in significant morbidity[3,4]. Fifty percent of the COVID-19 patients who were hospitalized required long-term care[4]. Because of lung fibrosis as a pneumonia sequela, especially among the patients suffering from severe COVID-19, with older age, obesity, multiple chronic illnesses and/or organ failures, respiratory deficiency or respiratory symptoms can persist, and pulmonary rehabilitation (PR) is required[1,5].

The long-term consequences of the disease in terms of damage and sequelae are not certain. For a suitable patient and an appropriate time will definitely arise for a pulmonary rehabilitation intervention[6].

This study aimed to evaluate the level of awareness of pulmonary rehabilitation and the compliance with respiratory exercises after COVID-19.

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2. Materials and methods

Between January and June 2021, the patients who were diagnosed COVID 19 with clinic, radiologic, and positive PCR (Polymerase Chain Reaction) test and applied to the Chest Diseases and Physical Medicine and Rehabilitation polyclinic within 1-4 months after the acute period were included the study. Patients under the age of 18 were excluded from the study. A cross-sectional study was performed and patients were selected consecutively.

A total of 112 consecutive patients (60 males and 52 females) over the age of 18 in the acute/chronic periods after COVID-19 were included in this study.

The age, gender, body mass index (BMI), education level, occupation, smoking habit, and smoking duration of the patients were evaluated. The clinical features of the disease (disease duration, hospitalization history, lung involvement on computed tomography (CT), presence of dyspnea), and respiratory functions were evaluated with the Modified Borg Scale. The Modified Borg Scale is one of the most reliable scales for determining the severity of dyspnea at rest and during exertion. It consists of 10 items describing the severity of dyspnea according to its degree. 0 means no dyspnea, and 10 means very severe dyspnea, and it evaluates the dyspnea of individuals in these two score ranges. It is a frequently used dyspnea evaluation parameter due to its ease of application and easy understanding by patients[7].

The comorbidity level was evaluated with the Modified Charlson Comorbidity Index. The Modified Charlson Comorbidity Index, which is calculated by the presence of comorbidities and is widely used to predict mortality, is an index valid all over the world. The index consists of 19 different items, and some of the same diseases have different ratings within these items. For example, mild liver disease has a score of 1, while the moderate or severe liver disease is a separate item and has a score of 3. These scores given to comorbid diseases are determined according to the relative risk values of the diseases, if " relative risk ≥1,2 " is taken into consideration, and if it is between 1.2 and 1.5, it is 1; 2 if it is between 1.5 and 2.5; Between 2.5 and 3.5, a score of 3 was given, and only two conditions (AIDS and 2nd homogeneous metastasis) were specifically given a score of 6 . A score is obtained by summing the scores of the patient's comorbid diseases and a score is added for the age of the patients. This age score is for patients older than 50; It is the increase of the age by one step in each decade, starting from 50, divided by decades, it is 1 for 50-59, 2 for 60-69, 3 for 70-79, 4 for 80-89 and 5 for 90-99 (8,9).

All patients were asked whether they knew about breathing exercises, the source of this information, and their compliance with the exercises.

Ethics committee approval for this study was received from Clinical Research Ethics Committee (dated 20.05.21 and numbered 1416). The study was conducted in accordance with the Declaration of Helsinki. Written informed consent regarding the use of their personal information was obtained from all patients.

2.1. Statistical Analysis:

Continuous variables were expressed as mean ± standard deviation and categorical data as numbers and percentages. In the intergroup analysis of continuous variables, normality analyses were performed with the Kolmogorov-Smirnov Goodness of Fit Test. Analyses between the two groups were performed with the Student's T-Test when the data were in a normal distribution, and with the Mann-Whitney U Test when they did not. Chi-square Test and/or Fisher's Exact Test were used to compare categorical data. The linear relationship between the scales was tested using Spearman's rho correlation analysis. IBM SPSS version 22.0 (IBM Corporation, Armonk, NY, USA) was used for the analyses. Statistical significance level was accepted as $p<0.05$.

3. Results

One hundred and twelve patients in the post-acute period after COVID-19 were included in the study with a mean age of 52.8 ±15, 52 (46.4%) years of them female and 60 (53.6%) of them male. All demographic and clinical characteristics of the patients were summarized in Table 1.

A statistically significant relationship was present between the education level and the presence of knowledge on breathing exercises ($p<0.001$). There was a history of hospitalization in 59 (52.7%) of the patients, and the presence of knowledge about breathing exercises was statistically significantly higher in these patients than in those without a history of hospitalization ($p=0.046$). It was found that lung involvement on CT was higher in those with breathing exercise knowledge, but this elevation was not significant (90% vs. 78%; $p=0.182$). It was determined that the presence of dyspnea did not reveal a significant difference according to exercise knowledge ($p=0.820$) (Table 2). In addition there was not statistically significant correlation between respiratory exercise compliance and the clinical and demographic characteristics of the patients.

The mean age of patients with compliance to breathing (49.09±12.10 vs 53.06±15.33; $p=0.409$) and their BMI levels were lower (26.44±3.14 vs 28.29±5.51; $p=0.280$), but it was determined that these differences were not significant and the duration of illness was similar [60 (25-180) vs 60 (1-180); $p=0.673$]. It was observed that the Charlson index and Modified Borg values and the rates of lung involvement and dyspnea on CT did not reveal a significant difference according to exercise compliance ($p=0.233$, $p=0.212$, $p=0.525$, and $p=0.120$).

Thirty (26.8%) patients who participated in the study reported that they knew breathing exercises. However, only 11 (36.7%) of these patients were regularly doing these exercises (Table 3).

Of the patients who stated that they know breathing exercises, 63% answered the question on the source of knowledge as a health institution, and there was no significant difference in the distribution of answers to this question in terms of their education.

Table 1

Demographic and Clinic Characteristics

Age, (years), (Mean ± SD)	52.8 ± 15
Number of patients	112 (60M, 52F)
Body Mass Index (BMI) (kg/m²)	28.08 ± 5.3
Education Level, n (%)	
• Illiterate	15 (13.4)
• Primary School graduate	42 (37.5)
• High School graduate	26 (23.2)
• University graduate	29 (25.6)
Profession, n (%)	
• Currently Employed	48 (42.9)
• Retired	27 (24.1)
• Never employed	37 (33)
Modified Charlson Comorbidity Index	17.76 ± 1.86
Smoking, n (%)	
• Currently smoking	8 (7.1)
• Quit smoking	23 (20.5)
• Never smoked	81 (72.3)
Smoking duration (packages/year)	5.8 ± 11
Duration of illness (day)	74 ± 48.4
Hospitalization, n (%)	59 (52.7)
Pulmonary Involvement on Computerized Tomography (CT), n (%)	91 (81.3)
Dyspnea, n (%)	69 (61.3)
Modified Borg Scale	2.57 ± 2.4

SD: Standart deviation, n: number, %: percentage

Table 2

Comparison of patients with and without respiratory exercise knowledge according to some socio-demographic and clinical parameters

Socio-demographic and Clinical parameters	No breathin exercise information (n=82)	Has respiratory exercise knowledge (n=30)	p
Age (years) (Mean±SD)	54,28±15,93	48,83±11,73	0.090*
BMI (kg/m^2) (Mean±SD)	28,17±4,04	26,80±3,24	0.023*
Duration of illness (day) (Mean±SD)	50 (1-180)	95 (20-180)	0.006**
Modified Charlson Comorbidity İndex [median (min-max)]	1.5 (0-7)	0 (0-5)	0.017**
Modified Borg Scale [median (min-max)]	2 (0-8)	4 (0-7)	0.412**
Education Level (n ,%)			
Illiterate	12(14,6)	3(10)	
Primary School graduate	37(45,1)	5(16,7)	0.001***
High School graduate	20(24,4)	6(20)	
University graduate	13(15,9)	16(53,3)	
Dyspnea (n ,%)			
• No	32 (%39,0)	11 (%36,7)	0.820***
• Yes	50 (%61,0)	19 (%63,3)	
Hospitalization (n,%)			
• No	43(54,4)	39(47,6)	0.046***
• Yes	10(33)	20(66,7)	
Pulmonary Involvement on CT (n,%)			
• No	18 (%22,0)	3 (%10,0)	0.182****
• Yes	64 (%78,0)	27 (%90,0)	

SD: Standart deviation, n: number, %: percentage* Student's T Test** Mann Whitney U Test*** Chi-square Test**** Fisher's Exact Test

Table 3

The level of information on and compliance with pulmonary exercises

Has information on pulmonary exercises, yes, n (%)	30 (26.8)
Information sources for respiratory exercises, n (%)	
• Health institution	19 (17)
• Family-friend	3 (2.7)
• Social Media	8 (7.1)
Doing respiratory exercises regularly? , yes, n (%)	11 (9.8)

n: number, %: percentage

4. Discussion

In this study, pulmonary rehabilitation awareness levels and compliance with breathing exercises were evaluated in the follow-up of outpatients and inpatients after COVID-19. According to the results of the research, patients with a history of hospitalization after COVID-19 and with a high level of education knew breathing exercises. One of the most interesting results was that the level of exercise compliance was low in patients with breathing exercise knowledge.

Impediments to pulmonary rehabilitation in low- and middle-income countries include low awareness, limited resources, COVID-19, and patient access-related costs[10]. It has reported low awareness or recognition of PR in chronic respiratory diseases by the public, including healthcare professionals and governments. All individuals are less aware of physiotherapy services in their country, including PR. Low awareness of pulmonary rehabilitation results in decreased participation in PR in chronic respiratory diseases[11]. Also, this decrease in awareness and education has been observed in health professionals such as physicians who need to refer their patients to PR[12]. Our findings are also consistent with this study.

Despite its benefits in chronic obstructive pulmonary disease (COPD), studies have reported low participation rates in PR (pulmonary rehabilitation) programs by reporting barriers such as transportation problems, the severity of symptoms, acute exacerbations, lack of energy, and disruption of daily routines[13-16]. Indeed, PR continues to be underused worldwide, and growing evidence highlights that many patients have limited access to PR, and many do not complete rehabilitation programs. Spitzer et al.[17] reported that only 2.7% of their patients were referred to a PR program within 12 months of a COPD exacerbation. In another study, the PR compliance rate of patients with COPD was 76% (18), whereas, in other studies, compliance ranged between 56% and 88%[19-21]. Although there is a study showing that education level did not affect compliance with the PR program[22], the education level was found to be lower in patients who did not complete the PR program in many studies. Our findings are also consistent with those of these studies.

Smoking is considered one of the factors that negatively affect patients' compliance with the PR program[23]. According to a study on the consequences of those who quit the program, it was shown that the majority of smokers could not complete the program[24]. In our study, the rate of smoking was 7%.

It is not possible to change the education and income levels of the patients, but it is possible to increase participation rates by providing social support. It should be underlined that PR is a patient-specific program. Patients' sociodemographic and clinical characteristics should be considered when determining the type of program. Home programs and programs related to physical activity development strategies are needed for patients who cannot attend the program due to economic problems, transportation problems, or personal problems[25]. Physicians and other health practitioners have a great responsibility to improve the program compliance of COVID-19 patients.

The literature review based on the recent 40 publications emphasizes the importance of PR in COVID-19. However, rehabilitation associations, including the Turkish Society of Physical Medicine and Rehabilitation, have published PR recommendations that include diaphragmatic breathing, pursed lip breathing, and resistant breathing exercises in COVID-19 pneumonia with productive cough[26]. There are studies that show that the PR improved the exercise capacity, life quality, and respiratory functions of inpatients with post-COVID-19 symptoms[27]. The studies evaluating the changes in symptom severity and frequency after COVID-19 reported improvements in shortness of breath, fatigue, anxiety, and depression after PR[28].

The increase in opportunities with developed technologies makes rehabilitation programs more comprehensive. The important thing is that the physicians should first inform the patients and direct them to these programs. There are no studies in the literature to measure the level of pulmonary rehabilitation information and compliance with breathing exercises after COVID-19. Our work will be beneficial in terms of raising awareness about PR, especially in patients in the risk group after COVID-19, as well as raising awareness about PR that is not known enough by physicians and other healthcare professionals in primary care and directing patients in need to centers providing services in this regard[29].

A healthy control group should be included in this study and patients should be compared with this group. This is a limitation of the

current study. This is because even healthy individuals with the same education level in society may have limited knowledge about pulmonary rehabilitation.

5. Conclusions

In the study, the history of hospitalization and high level of education were found to correlate with the presence of knowledge on pulmonary rehabilitation. Exercise compliance was found to be low. The number of awareness-raising activities for these patients and healthcare professionals should be increased to reduce their morbidity, mortality, and health expenditure.

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Statement of ethics

Ethics committee approval for this study was received from Clinical Research Ethics Committee (dated 20.05.21 and numbered 1416). The study was conducted in accordance with the Declaration of Helsinki. Written informed consent regarding the use of their personal information was obtained from all patients.

Conflict of interest statement

The authors declare that they have no financial conflict of interest with regard to the content of this report.

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Author contributions

All authors contributed to the study conception and design.

All authors read and approved the final manuscript.

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