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COVID-19 Through the Eyes of a Physiatrist: Back Pain Can Be a Symptom and May Predict Pneumonia in COVID-19

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Abstract
The study aimed to determine whether back pain is a clinical manifestation in patients with COVID-19 and whether several demographic and disease characteristics could be an effective indicator of back pain.
Materials and Methods. A total of 99 patients with COVID-19 were recruited from the Department of Infectious Diseases of the Kirikkale High Specialized Hospital in Turkey and divided into two groups depending on the presence (n=50) or absence of back pain (n=49). The primary outcomes included were demographic and disease characteristics, the Nord-Trøndelag Health Study Physical Activity Level for Work (HUNT), and the 6-minute walking test.
Results. The most common symptom was fatigue (n=63, 63.6%), followed by back pain (n=50, 50.5%). In the back pain group, the number of patients with sedentary lifestyle, oxygen requirement, pneumonia, and typical pneumonia pattern were significantly higher (p=0.009, p=0.026, p=0.001, p=0.001, respectively), while aerobic capacity was lower (p=0.001). In a logistic regression analysis, back pain was found to be associated with pneumonia presence.
Conclusions. Back pain may be associated with the presence of COVID-19 pneumonia and should be evaluated as its early warning symptom.

Keywords
Coronavirus Disease 2019 (Covid-19); SARS-CoV-2; Back Pain; Pneumonia

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Introduction

Coronavirus disease 2019 (COVID-19) is a disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which continues to spread increasingly all over the world [1]. This virus is new, and there are many unknowns. Studies are carried out worldwide to shed light on the unknown details of COVID-19, and researchers are one step closer to better options for diagnosis and treatment of those with COVID-19.

The SARS-CoV-2 virus is mainly transmitted through droplets, and studies have found clear evidence of human-to-human transmission, but SARS-CoV-2 remains viable in aerosols with no ventilation for up to three hours. Moreover, the SARS-CoV-2 virus was detected on plastic and stainless steel for up to 72 hours [2]. Since the SARS-CoV-2 virus is a resistant and highly contagious virus, the number of confirmed COVID-19 infection cases in the world has exceeded 20 million since the beginning of the pandemic and continues to spread increasingly worldwide. However, the actual prevalence of COVID-19 is still unknown due to the large number of asymptomatic and mildly symptomatic patients. The clinical characteristics of the disease may vary from asymptomatic infection to respiratory failure [3].

In patients with Covid-19, clinical findings may progress from mild to severe over the course of the disease, especially in the elderly and patients with comorbidities. Although symptoms may start mildly, they may progress and increase the mortality rate, especially in the elderly and patients with comorbidities. An increase in the number of new hospitalizations due to COVID-19 progression to the severe stage may cause the healthcare system to strain or even collapse [4]. Therefore, it will be necessary to have early diagnostic and treatment plans to mitigate the challenges.

The most common distinctive symptoms of COVID-19 are fever, dry cough, and difficulty breathing; less commonly, patients may also present with conjunctivitis, dermatitis, diarrhea, and stroke [5–8]. However, to the best of our knowledge, there are limited data on back pain as a symptom of COVID-19, which is frequently reported by COVID-19 patients in our clinical practice.

Therefore, the present **study aimed** to determine whether back pain is a clinical manifestation in patients with COVID-19, to investigate disease characteristics in COVID-19 patients, and to determine whether any of these measures could act as an effective indicator of back pain.

Materials and Methods

Study Design

The present study was a single-center cross-sectional analysis conducted on 128 PCR-positive symptomatic patients who were followed up in the department of the COVID-19 clinic of Kırıkale High Specialized Hospital in Turkey between June and August 2021. At the time of the study, there was no lockdown in the country.

In accordance with the principles of the Local Committee, each PCR-positive symptomatic patient was hospitalized until their tests were negative and their symptoms resolved at the time of the study.

Inclusion Criteria

- Patients between 18-65 years of age, who were not bedridden.
- Patients who were cognitively intact and cooperative.
- Patients who were not on mechanical ventilation.
- Patients who were ambulatory, with or without support.

Exclusion Criteria

- Patients with pre-diagnosed (clinical record review) chronic back pain (more than three months).
- Patients with cervical/thoracic disc herniation/spondylosis/osteoarthritis, scoliosis, kyphosis.
- Patients who were bedridden or wheelchair bound.
- Patients who were on mechanical ventilation.
- Patients who were unable to cooperate, with known progressive/non-progressive neurological disease.
- Patients who were previously diagnosed with pulmonary disease, those who underwent surgery or had a trauma history of the lower extremities and vertebrae, as well as those with a history of malignancy and inflammatory disease.

Back Pain Definition

Back pain describes a feeling of pain or discomfort in the thoracic region.

Study Population

Twenty-nine patients were excluded because of chronic back pain (n: 23), pre-diagnosed cervical/thoracic deformities, including scoliosis (n: 2), kyphosis (n: 1), and spondylosis/osteoarthritis (n: 3), which might cause back pain, and the remaining 99 patients were included in the study.

Data Collection

All symptomatic patients who tested positive and were hospitalized to the COVID-19 clinic were asked open-ended questions about their acute symptoms on their first day in the clinic. The duration of symptoms until admission was not recorded, but most patients were admitted to the hospital within the first three days of their onset. Answers were regarded as positive only if patients experienced an acute symptom at that time.

Demographic Data

Patients' demographic characteristics, including age, gender, body mass index (BMI), comorbidities, smoking status, and occupation, were recorded.

HUNT Score

Pre-illness activity levels were scored with the Nord-Trøndelag Health Study Physical Activity Level for Work (HUNT) [9]. This scale scores physical activity level at work. According to this, patients were grouped depending on their work status and physical activity level. The stages were defined as: Level 1: sedentary work; Level 2: work involving walking but no heavy lifting; Level 3: work predominantly involving walking; Level 4: work involving heavy lifting and particularly strenuous physical work.

Clinical and Radiological Data

During the hospitalization period, the type of treatment given to patients, the presence of pneumonia (all patients were screened using computed tomography (CT) on the first day and repeated, if needed), oxygen requirement at any time during hospitalization, the patterns and stage of pneumonia, chest CT findings were recorded.

As suggested by a collaborative partnership between the Radiological Society of North America (RSNA), the Society of Thoracic Radiology (STR), and the American College of Radiology (ACR) [10–12], chest CT findings were grouped as typical, indeterminate, atypical, and negative [10, 11].

The 6-Minute Walking Test

The 6-Minute Walking Test (6MWT) was conducted with two cones placed 30 meters apart on a flat hard walking surface to assess patients' aerobic capacity on the first or second days of hospitalization. After patients had two trial walks and rested for 30 minutes, the longest distance was recorded in meters.

Demographic characteristics and symptoms were recorded within the first day in the clinic. Aerobic capacity was measured during the first three days of hospitalization. Treatment, oxygen requirement, pneumonia presence and pattern were recorded during the hospitalization period.

Finally, patients were questioned about their symptoms and divided into two groups: patients with back pain and those with no back pain; thereafter, their demographic and disease characteristics were compared. In addition, it was investigated whether back pain was related to demographic or disease characteristics.

Statistical Analysis

All statistical analyses were carried out using the IBM SPSS Statistics 20.0 software package. The variables were investigated using the Kolmogorov-Smirnov test to assess whether they were normally distributed. Descriptive statistics were demonstrated as the mean ± standard deviation (SD) for continuous variables and a percentage (%) for nominal variables. For comparison between the groups, the independent samples T-test and χ^2 test were performed. Point-biserial correlation, Phi and Cramer's V correlation tests were used to examine the association between back pain, demographic characteristics, and disease characteristics. The relationship between the dependent variable (back pain) and independent variables (the 6MWT HUNT level, oxygen requirement, and pneumonia presence) was evaluated using univariate logistic regression analysis for the parameters determined to be significant. A p-value of less than 0.05 was considered statistically significant.

Results

Ninety-nine PCR-positive symptomatic patients (48 males, 51 females) followed up in the inpatient clinic were enrolled in this study. The mean patients' age was 51.60 ± 15.58 years. The most common symptom was fatigue (n=63, 63.6%), followed by back pain (n=50, 50.5%). In 44 (44.4%) patients, there was pneumonia on CT. Demographic and disease characteristics of patients are presented in Tables 1 and 2.

Table 1. Demographic characteristics of patients (n=99).

Age (years), mean±SD	51.60±15.58
Gender, n (%)	
Female	51 (51.5)
Male	48 (48.4)
BMI, mean±SD	26.18±3.1
Comorbidity, n (%)	45 (45.4)
Comorbidities, n (%)	
Diabetes mellitus	24 (24.2)
Hypertension	13 (13.1)
Congestive heart failure	7 (7.07)
Coronary artery disease	6 (6.06)
Gastritis	3 (3.03)
Smoking, n (%)	
Yes	28 (28.2)
No	61 (61.6)
Quitted	10 (10.01)
Occupation status, n (%)	
Housewife	23 (23.2)
White-collar	18 (18.1)
Blue-collar	34 (34.3)
Retired	17 (17.1)
Unemployed	8 (8.08)
HUNT level, n (%)	
Level 1	34 (34.3)
Level 2	40 (40.4)
Level 3	18 (18.1)
Level 4	7 (7)

All the patients were divided into two groups: patients with back pain (n=50, 50.5%) and those with no back pain (n=49, 49.5%). The comparison of demographic and disease characteristics of the two groups is shown in Table 3.

Table 2. Disease characteristics of patients (n=99).

Treatment duration (days), mean±SD	8.20±2.6
Treatment, n (%)	
Hydroxychloroquine	96 (96.9)
Clexane	94 (94.9)
Azithromycin	12 (12.1)
Favipiravir	8 (8)
Moxifloxacin	2 (21)
Symptoms, n (%)	
Fatigue	63 (63.6)
Back pain	50 (50.5)
Fever	35 (35.5)
Sore throat	10 (10.1)
Arthralgia	34 (34.3)
Myalgia	14 (14.1)
Cough	15 (15.2)
Shortness of breath	38 (38.4)
Diarrhea	9 (9.1)
Loss of smell/taste	11 (11.1)
Nausea/vomiting	33 (33.3)
Asthenia	7 (7.1)
Oxygen requirement, n (%)	15 (15.1)
Pneumonia, n (%)	44 (44.4)
Pneumonia pattern	
Typical	29 (29.2)
Indeterminate	4 (4)
Atypical	8 (8.1)
Negative	3 (3)
6MWT (meters)	428.42±247.15

In the back pain group, the number of patients with sedentary lifestyle, oxygen requirement, pneumonia, and typical pneumonia pattern were significantly higher (p=0.009, p=0.026, p=0.001, p=0.001, respectively), while aerobic capacity was lower (p=0.001). In the back pain group, pneumonia was diagnosed in 35 (35/50, 70%) patients, whereas in the non-back pain group, only 9 (9/49, 18.3%) patients developed pneumonia.

When evaluating the relationship between back pain, demographic characteristics, and disease characteristics, the presence of back pain was found to be positively correlated with physical activity level at work (p=0.008) and aerobic capacity level (p=0.009) and negatively correlated with oxygen requirement, pneumonia presence, and aerobic capacity level (p=0.022 and p=0.001, respectively) (Table 4).

In a logistic regression analysis of these factors, it was observed that back pain continued to be associated with the presence of pneumonia and reduced aerobic capacity (p=0.008, p=0.005) (Table 5).

Discussion

This study aimed to determine the frequency of back pain symptoms other than known common symptoms in COVID-19 patients and to investigate the associated factors. In patients with low back pain, lack of aerobic capacity and

Table 3. Comparison of demographic and disease characteristics of patients with and without back pain.

	Back pain (+), n=50	Back pain (-), n=49	p
Age (years), mean±SD	51.32±14.59	46.40±14.29	0.085
Gender			
Female	26 (52)	25 (51)	0.923
Male	24 (48)	24 (49)	
BMI, mean±SD	26.45±3.24	27.09±4.11	0.970
Comorbidity, n (%)	20 (40)	25 (51)	0.327
Smoking			
Yes	13 (26)	15 (30.6)	
No	32 (64)	29 (59.1)	0.435
Quitted	5 (10)	5 (10.2)	
HUNT level, n (%)			
Level 1	24 (48)	10 (20.4)	
Level 2	17 (34)	23 (46.9)	0.009
Level 3	6 (12)	12 (24.4)	
Level 4	3 (6)	4 (8.1)	
Oxygen requirement, n (%)	11 (22)	4 (8.1)	0.026
Pneumonia, n (%)	35 (70)	9 (18.3)	0.001
Pneumonia pattern			
Typical	26 (52)	3 (6.1)	
Indeterminate	2 (4)	2 (4)	0.001
Atypical	6 (12)	2 (4)	
Negative	1 (4)	2 (4)	
6MWT (meters), mean±SD	328.68±111.53	531.01±374.04	0.001

Table 4. Correlation analysis between the presence of back pain and evaluation parameters.

	r	p-value
Age	–0.047 §	0.126
Gender (male)	0.018 Φ	0.843
BMI	0.008 §	0.571
Presence of comorbidity	–0.091 Φ	0.058
Presence of smoking	–0.079 Φ	0.654
HUNT level	0.261 ¥	**0.008**
Oxygen requirement	–0.182 Φ	**0.022**
Presence of pneumonia	–0.427 Φ	**0.001**
6MWT (meters)	0.369 §	**0.009**

Notes: r – correlation coefficient; § – point-biserial correlation test; ¥ – Cramer's V test; Φ – Phi correlation test.

Table 5. Logistic regression analysis for presence of back pain.

	R^2	β	SE	p-value	95% CI (lower-upper bound)
HUNT level	0.094	-0.002	0.066	0.075	-0.134_0.130
Oxygen requirement	0.033	-0.057	0.162	0.124	-0.379_0.264
Pneumonia	0.121	-0.174	0.081	**0.008**	-0.334_-0.014
6MWT (meters)	0.136	0.001	0.000	**0.005**	0.000_0.001

Notes: CI – confidence interval;
Dependent variable: back pain.

especially the presence of pneumonia, as well as the previous activity level and oxygen requirement, were correlated with the presence of back pain.

SARS-CoV-2 replicates efficiently in epithelial cells of the respiratory tract, with replication in the lower respiratory tract fitting with lung disease development [12]. Thus, COVID cases may progress to severe pneumonia and may end with acute respiratory distress syndrome (ARDS), septic shock, and multiple organ failure [13]. The most common symptoms include fever (44-88.9%), cough (68-76.5%), fatigue (32.5%), and shortness of breath (13.3-22.1%). In the present study, the most prominent symptom was fatigue (63.6%), followed by back pain (50.5%). However, the comorbidity rates and the mean age of patients in the present study were similar to those in patients of those studies; fever and cough were found in 35-38% of patients in the present study. This might be due to genetic and sociocultural differences between countries and a potential virus mutation. Moreover, all symptomatic and PCR-positive patients were hospitalized at the time of the study. All patients had mild disease or pneumonia; no patients had severe pneumonia or ARDS requiring respiratory support other than oxygen.

Typical pulmonary findings associated with COVID-19 are bilateral, peripheral, and basal predominant ground-glass opacities, consolidation, or both [14]. When peripheral involvement extends to the parietal pleura and stimulates the intercostal nerves, it can cause pleuritic chest pain, their respective dermatomes on one or both sides of the chest, shoulders, and back [15].

In the present study, patients with back pain had significantly higher pneumonia rates than those without it. These data are in concordance with the clinical data of 15% of patients with pneumonia having back pain [16]. However, the number of patients with back pain was higher as compared to patients with pneumonia. This result suggests that back pain cannot be explained only by lung involvement in COVID-19 as infections or low physical activity levels can cause acute myalgia, arthralgia, and fatigue as well. Back pain may indicate pneumonia; thus, it may be considered a symptom of COVID.

In this study, the 6MWT was used to evaluate patients' aerobic capacity, and the HUNT staging was used to obtain information on the levels of patients' pre-illness activity. Accordingly, patients with back pain had lower levels of pre-illness physical activity and lower aerobic capacity than those without back pain.

Physical activity has therapeutic and protective effects on the cardiovascular, pulmonary, musculoskeletal, neurological, immune, and endocrine systems. Lack of physical activity can cause muscle weakness, osteoarthritis, osteoporosis, hypertension, diabetes mellitus, venous thrombosis, stroke, and immune system disorders [17]. Studies have reported that physical inactivity can lead to respiratory dysfunction and decrease aerobic capacity even in patients without underlying pulmonary conditions [18–20]. Other studies have stated that the lack of physical activity due to quarantine practices to prevent the spread of the pandemic reduces the aerobic capacity of people, and the need to exercise at home during quarantine is obvious [21–23]. Although COVID-19 typically presents with respiratory manifestations, there is an increased prevalence of thromboembolic disease and pulmonary embolism in critically ill patients lacking physical activity [24, 25]. This can explain that the increased risk of back pain may be due to physical inactivity in both groups. Another significant result of this study is that patients with back pain required more oxygen; hence, it is essential to evaluate the respiratory risks this population is exposed to.

Limitations

Firstly, the study was conducted at a single center of a secondary hospital with unique national Covid-19 diagnostic, hospitalization, and treatment algorithms; therefore, the association of back pain and disease characteristics of hospitalized COVID-19 patients should be confirmed by a multicenter study. Nevertheless, this study had a prospective observational design, including symptomatic COVID-19 patients, and excluded patients with chronic back pain. Secondly, patients admitted to the intensive care unit were excluded because of challenges of patient assessment and diagnosis. However, depending on the medical circumstances, the criteria for intensive care unit admission vary among different facilities and countries. Thirdly, no patient died or had to be transferred to the intensive care unit, meaning that these patients had relatively mild/moderate disease; therefore, the results should be carefully considered. Fourthly, other respiratory diseases could potentially include back pain as well. Finally, although multivariate analysis can be adjusted for variables between the two groups, we could only change the included variables.

Conclusions

These findings were obtained over two months under harsh clinical conditions, and the hope is that these and other results will point the way to a more thorough understanding of COVID-19. All healthcare professionals regardless of the branch of medicine they specialize in have some responsibilities in this severe illness. The good news in this situation is that COVID-19 disease can be viewed from a slightly different perspective - through the eyes of a physiatrist. Back pain, which is common in physiatrists' daily practice, may be associated with the presence of pneumonia, and patients presenting with back pain should be questioned as a matter of routine for a history of exposure to COVID-19. Accordingly, back pain should be evaluated as an early warning symptom of COVID-19 pneumonia.

Ethical Statement

The Institutional Ethics Committee approved the study at the beginning of the study period. All procedures were conducted according to the relevant principles of the Declaration of Helsinki.

Informed Consent

Before the evaluation, all the patients were given verbal and written information on the nature of the study. Written informed consent for diagnostic procedures was obtained from each patient.

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Data Availability

The data that support the findings of this study are available from the author upon reasonable request.

Conflict of Interest

The author declares that no conflicts exist.

Financial Disclosure

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