



# The Relation Between Otolaryngology-Specific Symptoms and Computed Tomography Findings in Ambulatory Care COVID-19 Patients

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## Abstract

**Objective:** This study aimed to conduct a study to evaluate the relation between otolaryngology-specific symptoms and computed tomography findings in ambulatory care COVID-19 patients. **Patient and Methods:** The study was conducted with medical records of 987 (82%) patients with confirmed COVID-19 virus via real-time reverse transcription-polymerase chain reaction between March 11, 2020, and April 21, 2020. Patients were divided into 2 groups as computed tomography (CT)-negative and CT-positive groups considering the presence of the CT findings depicting COVID-19 disease. **Results:** The mean age was significantly higher in CT-positive group than CT-negative group ( $41.53 \pm 12.82$  vs  $36.61 \pm 11.81$ ,  $P < .001$ ). Cough and shortness of the breath were observed with a significantly higher rate in CT-positive group than that of CT-negative group (44% vs 29.9%,  $P = .001$  and 18.4% vs 9.7%,  $P = .002$ , respectively). **Conclusions:** In conclusion, advanced age, cough, and shortness of breath could be related to CT scan positivity.

## Keywords

anosmia, computed tomography, coronavirus, pandemics, smell disorders

## Introduction

The novel COVID-19 disease, which has announced as a pandemic in March 2020 by World Health Organization, is a contagious disease that affects mainly respiratory systems.<sup>1</sup> It was first described in December 2019 in Wuhan, Hubei Province, China.<sup>1</sup> The highly infectious disease occurs due to a virus defined “Severe Acute Respiratory Syndrome Coronavirus 2.” The virus spreads through respiratory droplets during sneezing and coughing among individuals.<sup>2</sup>

The disease’s main symptoms are fever, dry cough, shortness of breath, runny nose, nasal congestion, sore throat, fatigue, headache, muscle pain, and arthralgia.<sup>2,3</sup> In the diagnosis of the disease, clinical symptoms, history of contact with patients, polymerase chain reaction (PCR) test, and presence of ground-glass opacities in computed tomography (CT) scan are essential.<sup>4</sup>

Chest imaging is of great importance for the diagnosis and management of patients with COVID-19 infection.<sup>5</sup> Computed tomography scans have enabled us to detect COVID-19 disease earlier and accurately, especially in suspicious patients and in the delay of PCR results. Therefore, the wide use of thorax CT

scans has been observed during the pandemic period.<sup>5</sup> However, overuse of CT scans in ambulatory care patients has raised concerns due to expose patients to ionizing radiation, a known human carcinogen.<sup>5</sup>

Recent studies have focused on evaluating the relation between serum levels of C-reactive protein (CRP), monocytes, lymphocytes, homocysteine levels, and prognosis of the disease in addition to the generally observed symptoms.<sup>6,7</sup> Besides, there are also cumulating data evaluating the relationship between the otolaryngology-specific symptoms such as sudden loss of smell and taste and the mild stage of the

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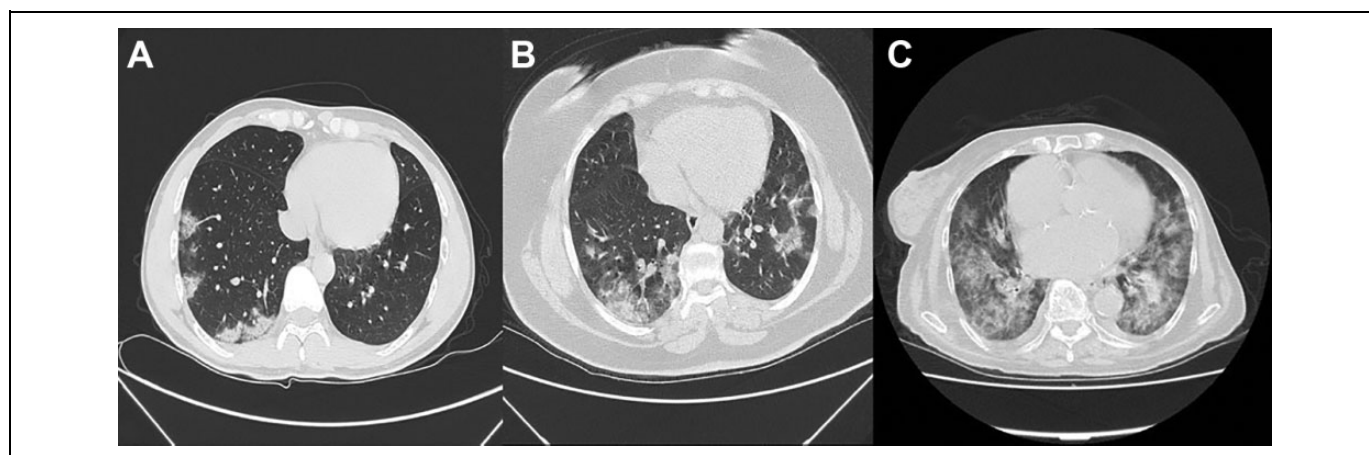
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**Figure 1.** Computed tomography (CT) scan findings of the COVID-19 disease. A, Minimal, peripheral, pure ground glass opacities in the right lower lobe. B, Bilateral mild pulmonary infiltration located in the basal layer of lungs with ground glass opacities and consolidation. C, Bilateral reticular pattern superimposed on the background of ground glass opacities, depicting the sign of crazy paving pattern.

COVID-19 disease.<sup>8</sup> However, there are no studies reporting the relation between otolaryngology-specific clinical symptoms and CT findings yet.

In this study, we aimed to conduct a study to determine the relation between otolaryngology-specific symptoms and CT scan findings in ambulatory care COVID-19 patients.

## Materials and Methods

### Compliance With Ethical Standards

Ethical approval was obtained from the institutional review board of the local ethics committee of our hospital (IRB:2020/514/177/25). The research was conducted ethically in accordance with the World Medical Association Declaration of Helsinki. The patients (or their parents or guardians) have given their informed consent.

### Study Design and Patients

The clinical data of 1197 patients with confirmed COVID-19 virus via real-time reverse transcription-polymerase chain reaction (rRT-PCR) who were admitted to a tertiary referral hospital between March 11, 2020 and April 21, 2020, were analyzed.

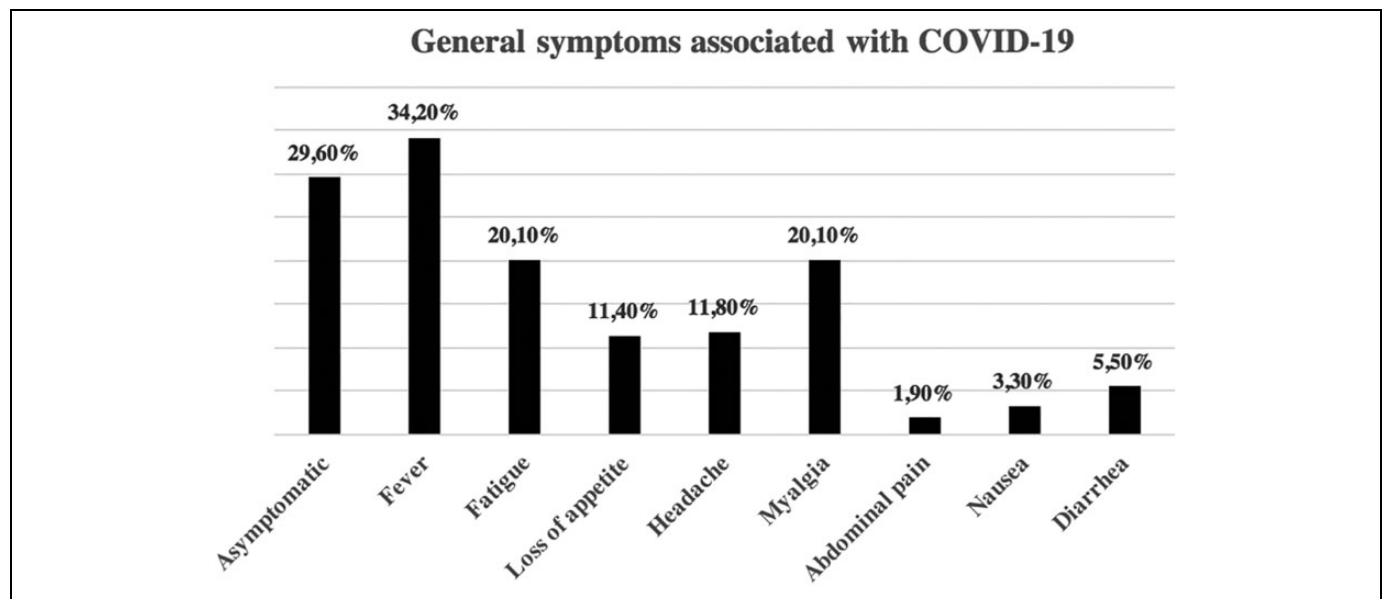
Patients who were followed as ambulatory care, over 18 years old, and had confirmed the COVID-19 virus by rRT-PCR tests of oropharyngeal swabs were included in the study. According to the national guidelines, patients who had persistent fever and had a history of contact with a COVID-19 positive person are recommended to perform a CT scan since PCR results may delay around 1 to 4 days.<sup>9</sup> SpO<sub>2</sub> levels of all patients were measured in room air with a pulse oximeter on admission. The exclusion criteria were defined as patients with previous olfactory or gustatory dysfunctions, patients without a laboratory-confirmed COVID-19 disease, and patients who were in inpatient care at the time of the study conducted. The study was conducted with medical records of 987 (82%) patients who comply with the inclusion criteria.

**Table 1.** The Basic Characteristics and Comorbidities of Patients.

Study Variables	n	%
Age (years) mean $\pm$ SD	37.31 $\pm$ 12.08	
Gender		
Male	580	58.8
Female	407	41.2
Smoking		
None	727	73.7
1-10/day	170	17.2
10-20/day	66	6.7
>20/day	24	2.4
Diabetes mellitus		
No	931	94.3
Yes	56	5.7
Hypertension		
No	913	92.5
Yes	74	7.5
Chronic sinusitis		
No	977	99
Yes	10	1
Rhinitis		
No	980	99.3
Yes	7	0.7
COPD		
No	984	99.7
Yes	3	0.3
Asthma		
No	959	97.2
Yes	28	2.8
Cardiac problems		
No	974	98.7
Yes	13	1.3

Abbreviations: COPD, chronic obstructive pulmonary disease; SD, standard deviation.

The following clinical data of patients, such as age, gender, smoking, and the presence of systemic comorbidities (diabetes mellitus, hypertension, the presence of chronic sinusitis, rhinitis, cardiac problems, chronic obstructive pulmonary disease [COPD], and asthma) were recorded. The symptoms related explicitly to daily otolaryngology practice include cough, shortness of breath, sputum, nasal obstruction, rhinorrhea, sore throat, postnasal drip, smell, and taste loss, and ear pain were recorded. General symptoms such as headache, dysphagia, fatigue, myalgia, abdominal pain, vomiting, and diarrhea were also recorded. Computed tomography scan results (Philips



**Figure 2.** The distribution of general symptoms associated with the COVID-19 disease.

Ingenuity 128 CT Scanner, 128 cross-sections, noncontrast, low-dose  $5 \times 5$  mm slices thorax CT) of patients were recorded.

Patients were divided into 2 groups as CT-negative and CT-positive groups considering the presence of the CT scan findings depicting COVID-19 disease such as consolidation, linear opacities, crazy-paving pattern, and bronchial wall thickening<sup>5</sup> (Figure 1). As recommended for asymptomatic management of patients with positive COVID-19 PCR results, and with SpO<sub>2</sub>>92%, supportive care, and hydroxychloroquine administration was started (200 mg bid  $\times$  2 doses, then 100 mg bid for 5 days).<sup>9</sup>

### Statistical Analysis

Data analysis was performed with SPSS version 20.0 (SPSS Inc). All continuous data were presented as means and standard deviations. The categorical data were presented as numbers and percentages. A 1-sample Kolmogorov-Smirnov test was performed to analyze the distribution of the continuous variables. Student *t* test was used to analyze of parametric variables and Mann-Whitney *U* test for nonparametric variables. A  $\chi^2$  test was used to compare the categorical variables. Multivariate regression analysis was performed to analyze the relation between CT findings and presenting symptoms. A primary regression model was generated using a stepwise procedure and included all potential interaction variables. This model was constructed from independent variables achieving  $P = .10$  during bivariate analysis, and then the best-fit model was generated without interaction variables. Computed tomography findings were considered as a dependent variable. Independent variables tested as age, hypertension, diabetes mellitus, chronic

sinusitis, cough, and shortness of breath. For all calculations, a  $P$  value of <.05 was considered as statistically significant.

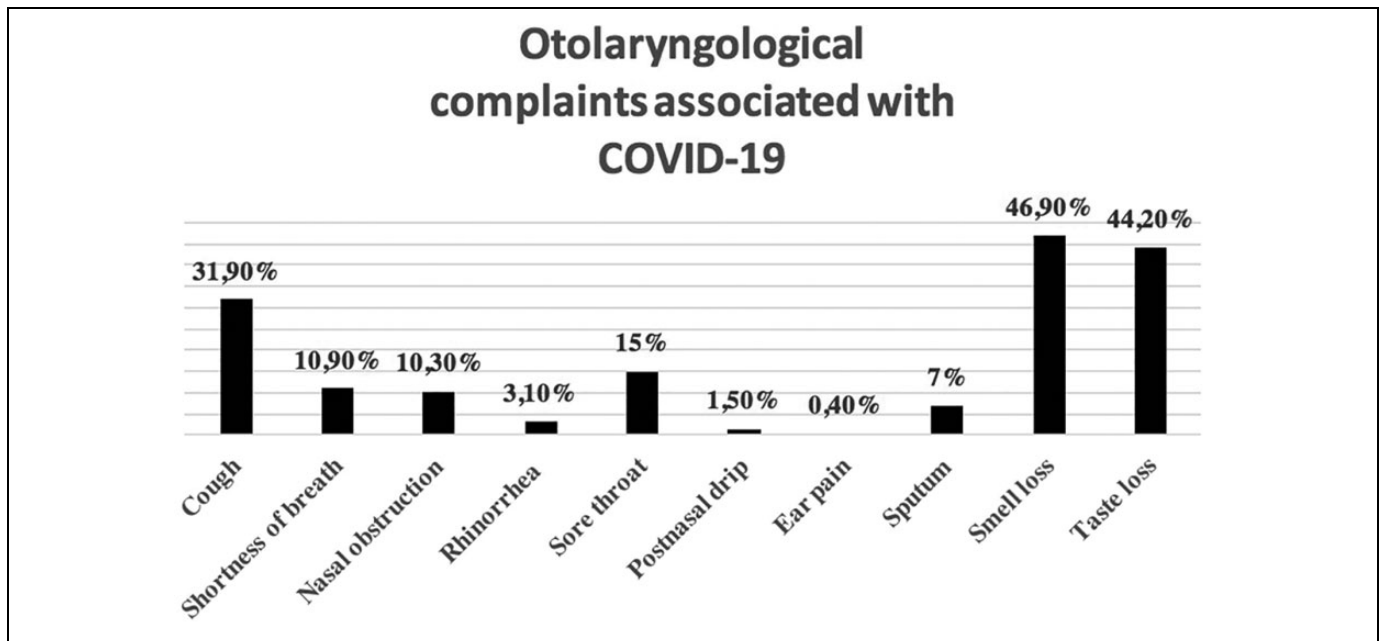
### Results

The study population comprised of 580 (58.8%) male and 407 (41.2%) female patients. The most common observed comorbidity was hypertension in 74 (7.5%) patients and diabetes mellitus in 56 (5.7%) patients. A total of 170 (17.2%) patients were smoking 1 to 10 per day (Table 1).

There were 29.6% asymptomatic patients, despite rRT-PCR test positivity. In regard to the general symptoms, fever (34.2%), fatigue (20.1%), and myalgia (20.1%) were the most common symptoms (Figure 2). Considering the otolaryngology complaints associated with COVID-19, smell loss and taste loss were the most observed symptoms as 46.9% and 44.2%, respectively. The presence of cough (31.9%), sore throat (15%), and shortness of breath (10.9%) was the other related symptoms (Figure 3).

There were 846 patients in CT-negative group and 141 patients in CT-positive group. The mean age was significantly higher in CT-positive group than CT-negative group ( $41.53 \pm 12.82$  vs  $36.61 \pm 11.81$ ,  $P < .001$ ). The presence of diabetes mellitus, hypertension, and chronic sinusitis was significantly higher in CT-positive group ( $P < .001$ ,  $P < .001$ , and  $.04$ , respectively). No significant difference was observed between the study groups regarding gender, smoking habit, SpO<sub>2</sub> levels, rhinitis, COPD, asthma, and cardiac problems (Table 2).

The study groups were compared regarding presenting otolaryngology-related symptoms and general symptoms. Cough and shortness of the breath were observed with a significantly higher rate in CT-positive group compared to that of CT-negative group (44% vs 29.9%,  $P = .001$  and 18.4% vs 9.7%,  $P = .002$ , respectively). The specific symptoms of the remaining



**Figure 3.** The distribution of otolaryngology-associated symptoms of the COVID-19 disease.

**Table 2.** Comparison of Basic Characteristics and Medical History of the Study Groups.

Study Variables		CT negative (n = 846), n (%)	CT positive (n = 141), n (%)	P value
Age (years)	Mean ± SD	36.61 ± 11.81	41.53 ± 12.82	<b>&lt;.001</b>
Gender	Male	488 (57.7%)	92 (65.2%)	.09
	Female	358 (42.3%)	49 (34.8)	
Smoking	None	621 (73.4%)	106 (75.2%)	.856
	1-10/day	146 (17.3%)	24 (17%)	
	10-20/day	57 (6.7%)	9 (6.4%)	
	>20/day	22 (2.6%)	2 (1.4%)	
SpO2		96.6 ± 1.52	96.7 ± 1.66	.386
Diabetes mellitus	No	814 (96.2%)	117 (83%)	<b>&lt;.001</b>
	Yes	32 (3.8%)	24 (17%)	
Hypertension	No	793 (93.7%)	120 (85.1%)	<b>&lt;.001</b>
	Yes	53 (6.3%)	21 (14.9%)	
Chronic sinusitis	No	840 (99.3%)	137 (97.2%)	<b>.04</b>
	Yes	6 (0.7%)	4 (2.8%)	
Rhinitis	No	839 (99.2%)	141 (100%)	.602
	Yes	7 (0.8%)	0 (0%)	
COPD	No	844 (99.8%)	140 (99.3%)	.371
	Yes	2 (0.2%)	1 (0.7%)	
Asthma	No	822 (97.2%)	137 (97.2%)	.630
	Yes	24 (2.8%)	4 (2.8%)	
Cardiac problems	No	837 (98.9%)	137 (97.2%)	.101
	Yes	9 (1.1%)	4 (2.8%)	

Abbreviations: COPD, chronic obstructive pulmonary disease; SD, standard deviation.  
 Bold values indicate statistical significance ( $p < .05$ ).

otolaryngology symptoms and all general symptoms were not significantly differed between the study groups (Table 3).

Binary logistic regression analysis showed that age (odds ratio [OR]: 1.01, 95% CI: 1-1.03), cough (OR: 0.65, 95% CI: 0.44-0.96), and shortness of breath (OR: 0.58, 95% CI: 0.34-0.98) were significantly related to positive CT results (Table 4).

## Discussion

Otolaryngologists are candidates of COVID-19 virus contamination since they deal with the upper respiratory tract disorders, which is the main reservoir of the COVID-19 virus.<sup>2</sup> In our study, we observed that in addition to the general symptoms otolaryngology-specific symptoms such as cough and

**Table 3.** Comparison of the Presenting Clinical Symptoms of the Study Groups.

Study Variables		CT negative (n = 846), n (%)	CT positive (n = 141), n (%)	P value
<b>Symptoms related to otolaryngology</b>				
Fever	No	566 (66.9%)	83 (58.9%)	.06
	Yes	280 (33.1%)	58 (41.1%)	
Cough	No	593 (70.1%)	79 (56%)	<b>.001</b>
	Yes	253 (29.9%)	62 (44%)	
Shortness of breath	No	764 (90.3%)	115 (81.6%)	<b>.002</b>
	Yes	82 (9.7%)	26 (18.4%)	
Nasal obstruction	No	765 (90.4%)	120 (85.1%)	.06
	Yes	81 (9.6%)	21 (14.9)	
Rhinorrhea	No	819 (96.8%)	137 (97.2%)	.539
	Yes	27 (3.2%)	4 (2.8%)	
Sore throat	No	725 (85.7%)	114 (80.9%)	.136
	Yes	121 (14.3%)	27 (19.1%)	
Postnasal drip	No	833 (98.5%)	139 (98.6%)	.635
	Yes	13 (1.5%)	2 (1.4%)	
Ear pain	No	842 (99.5%)	141 (100%)	.539
	Yes	4 (0.5%)	0(0)	
Sputum	No	842 (99.5%)	138 (97.9%)	.06
	Yes	4 (0.5%)	3 (2.1%)	
Smell loss	No	442 (52.2%)	82 (58.2%)	.193
	Yes	404 (47.8%)	59 (41.8%)	
Taste loss	No	474 (56%)	77 (54.6%)	.754
	Yes	372 (44%)	64 (45.4%)	
<b>Symptoms related to other systems</b>				
Fatigue	No	678 (80.1%)	111 (78.7%)	.697
	Yes	168 (19.9%)	30 (21.3%)	
Dysphagia	No	841 (99.4%)	141 (100%)	.462
	Yes	5 (0.6%)	0 (0%)	
Headache	No	742 (87.7%)	129 (91.5%)	.197
	Yes	104 (12.3%)	12 (8.5%)	
Myalgia	No	669 (79.1%)	120 (85.1%)	.09
	Yes	177 (20.9%)	21 (14.9%)	
Abdominal pain	No	829 (98%)	139 (98.6%)	.475
	Yes	17 (2%)	2 (1.4%)	
Vomiting	No	816 (96.5%)	138 (97.9%)	.282
	Yes	30 (3.5%)	3 (2.1%)	
Diarrhea	No	798 (94.3%)	135 (95.7%)	.493
	Yes	48 (5.7%)	6 (4.3%)	

Bold values indicate statistical significance ( $p < .05$ ).

shortness of breath were significantly associated with CT scan positivity.

The early diagnosis of the disease and prevention of infection may help reduce complications and mortality rates.<sup>10</sup> However, due to nonspecific symptoms of the disease and false-negative and delayed results of the PCR test, chest CT scan is one of the main diagnostic tools to determine the severity of the COVID-19 disease.<sup>8</sup> However, it is also known that repeated doses of ionizing radiation could have potential harm to blood cells, reproductive organs, and the growing fetus.<sup>7</sup>

To obtain an easy use and achievable diagnostic tool, especially in developing countries, as an alternative to PCR and chest CT scan, recent studies evaluated some laboratory markers such as a decrease of lymphocytes, elevated CRP,

procalcitonin, and Erythrocyte Sedimentation Rate (ESR) levels.<sup>6,7,10</sup> According to the results of the study by Tan et al, elevated CRP and ESR levels were significantly observed at the early stage of severe COVID-19 patients.<sup>7</sup> These results suggested that CRP and ESR could be used to identify patients who might become severely ill in the early stage of the disease before the occurrence of CT findings.<sup>7,11</sup>

The current data have reported that patients with influenza-like symptoms are 6 to 10 times more related to test positivity of COVID-19 infection.<sup>12,13</sup> In the aspect of otolaryngology perspective, it was reported that olfactory and gustatory dysfunctions were associated with mild-to-moderate COVID-19 disease due to the infectious process of the virus in olfactory epithelia resulting localized inflammation in the olfactory

**Table 4.** Binary Logistic Regression Analysis of the Presenting Symptoms and Comorbidities Related to CT Positivity.<sup>a</sup>

Study variables	B (SE)	P value	Exp(B)	95% CI	
				Lower	Upper
Age (years)	0.01 (0.008)	.02	1.01	1	1.03
Hypertension	-0.28 (0.31)	.365	0.75	0.4	1.3
Diabetes mellitus	-1.24 (0.31)	<.001	0.28	0.15	0.52
Chronic sinusitis	-0.82 (0.69)	.238	0.44	0.11	1.72
Cough	-0.42 (0.19)	<b>.03</b>	0.65	0.44	0.96
Shortness of breath	-0.54 (0.26)	<b>.04</b>	0.58	0.34	0.98

<sup>a</sup>Constant: 0.264 (1.302).

Bold values indicate statistical significance ( $p < .05$ ).

cleft.<sup>8,12</sup> It was also suggested that smell loss seems to be an independent risk factor and may be utilized as a marker for the detection of patients with the mild presentation of COVID-19 infection and were not associated with any other risk factors.<sup>12</sup> In our study group, 46.9% of patients presented with smell loss and 44.2% of them with taste loss. However, there was no significant difference between the study groups in terms of smell loss and taste loss. The presence of these variable results may be due to the difference in the methods used in the diagnosis of smell and taste loss, the design of studies in different ethnicities, and the use of different techniques in the diagnosis of COVID-19 disease.

It was reported that cough (76%) and dyspnea (55%) were also highly associated with presenting symptoms of the COVID-19 disease.<sup>13-15</sup> In our study, cough (31.9%) and shortness of breath (10.9%) were the other related symptoms considering the daily otolaryngology practice. These symptoms were also higher in CT-positive group than those of CT-negative group, and in regression analysis, they were significantly related to positive CT findings. These findings could be associated with the severe damage of pulmonary alveoli in patients with positive CT findings.

In a study evaluating the general presenting symptoms of COVID-19 patients, fever (98%), myalgia, fatigue (44%), and intestinal symptoms were the most frequently observed symptoms.<sup>14,15</sup> In our study, the majority of patients presented with fever, fatigue, headache, and myalgia. However, no significant difference was observed between the study groups for these parameters, since these nonspecific symptoms could be observed in any stage of the disease.

The most common concomitant diseases with the COVID-19 virus were reported as hypertension (30%), diabetes (19%), and coronary heart disease (8%).<sup>14</sup> In our study, hypertension (7.5%), diabetes (5.7%), and cardiac problems (1.3%) were the most accompanying diseases. Besides, the presence of hypertension, diabetes, and chronic sinusitis was significantly higher in CT-positive group. Our results may be lower than previous studies since our population was comprised of patients followed up in ambulatory care. The presence of these comorbidities is with the severe presentation of the disease due to the disruption of the immune system.

The strength of our study is that it was performed with a large group of patients diagnosed with the COVID-19 virus. However, the present study has several limitations. First, the nasopharyngeal samples were studied via an rRT-PCR test, although an rRT-PCR test confirms the diagnosis of COVID-19 in the majority of cases, false-negative results may also be possible. Second, we did not evaluate the long-term progress of symptoms of patients.

## Conclusions and Recommendations

Our study demonstrated that advanced age, the presence of cough, and shortness of breath could be related to CT scan positivity; however, to confirm the predictive value of these parameters, more studies are needed.

## Authors' Note

All authors have read and agreed with the content of this study and no part of this work has been published previously or is under consideration for publication elsewhere and is an original article. H.A. and B.K. conceptualized the study design, writing of the paper, collection of sample, and interpretation of data. H.A. did the statistical analysis of data.


## Declaration of Conflicting Interests


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