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Investigation of the Usability of CT in Clinical Decision Making by Comparing COVID-19 Positive and Probable Patients Diagnosed According to CT Imaging Findings

BT Görüntüleme Bulgularına Göre Tanı Alan COVID-19 Pozitif ve Olası Hastaları Karşılaştırarak Klinik Karar Vermede BT'nin Kullanılabilirliğinin Araştırılması

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ABSTRACT

Aim: In this study, the usability of thoracic computed tomography (CT) in clinical decision making was investigated by comparing laboratory results of patients with probable and definite coronavirus disease 2019 (COVID-19) diagnosis according to CT imaging features.
Material and Methods: Within the scope of this single-center retrospective clinical study, data of possible and definite cases of COVID-19 were scanned from the hospital electronic database and patient files. Laboratory and CT imaging results of the patients were obtained. Patients were divided into two groups as positive and negative according to their CT imaging results, and compared.
Results: Of the 995 patients included in the study, 57% (n=567) were male, and the mean age was 45.7±20.2 years. It was found that 65.1% (n=648) of the patients had positive CT. Real-time polymerase chain reaction (RT-PCR) test result was found positive in 22.2% (n=144) of the CT positive patients, and 32.0% (n=111) of the CT negative patients, and it was statistically significant (p<0.001). In the logistic regression analysis, it was determined that C-reactive protein (CRP), lymphocyte count, ferritin, procalcitonin, D-dimer, lactate and RT-PCR were statistically significant with CT positivity.
Conclusion: In this study, COVID-19 positive and probable patients were compared according to thoracic CT findings and the usability of CT for clinical decision making was investigated. It has been determined that thorax CT can be used to initiate the treatment of COVID-19 in patients with negative RT-PCR test results but positive CT findings and high biochemical parameters such as CRP, D-dimer, ferritin and lactate.
Keywords: COVID-19; computed tomography; SARS-CoV-2; pneumonia; pandemic.

ÖZ

Amaç: Bu çalışmada bilgisayarlı tomografi (BT) görüntüleme özelliklerine göre olası ve kesin koronavirüs hastalığı 2019 (coronavirus disease 2019, COVID-19) tanısı alan hastaların laboratuvar sonuçları karşılaştırılarak, klinik karar verme sürecinde torasik BT'nin kullanılabilirliği araştırılmıştır.
Gereç ve Yöntemler: Tek merkezli retrospektif klinik çalışma kapsamında olası ve kesin COVID-19 vakalarının verileri hastanenin elektronik veri tabanından ve hasta dosyalarından taranmıştır. Hastaların laboratuvar ve BT görüntüleme sonuçları elde edilmiştir. Hastalar BT görüntüleme sonuçlarına göre pozitif ve negatif olmak üzerek iki gruba ayrılmış ve karşılaştırılmıştır.
Bulgular: Çalışmaya dahil edilen 995 hastanın %57'si (n=567) erkekti ve hastaların yaş ortalaması 45,7±20,2 yıl idi. Hastaların %65,1'inde (n=648) BT pozitifliği saptandı. Gerçek zamanlı polimeraz zincir reaksiyonu (real-time polymerase chain reaction, RT-PCR) testi sonucu BT pozitif hastaların %22,2'sinde (n=144) ve BT negatif hastaların %32'sinde (n=111) pozitif olarak bulundu ve istatistiksel olarak anlamlı idi (p<0,001). Lojistik regresyon analizinde C-reaktif protein (CRP), lenfosit sayısı, ferritin, prokalsitonin, D-dimer, laktat ve RT-PCR'nin BT pozitifliği ile istatistiksel olarak anlamlı olduğu tespit edildi.
Sonuç: Bu çalışmada, torasik BT bulgularına göre COVID-19 pozitif ve olası hastalar karşılaştırılmış ve BT'nin klinik karar verme amaçlı kullanılabilirliği araştırılmıştır. RT-PCR test sonucu negatif ancak BT bulguları pozitif olan ve CRP, D-dimer, ferritin ve laktat gibi yüksek biyokimyasal parametreleri olan hastalarda, COVID-19'un tedavisine başlanmasında toraks BT'nin kullanışlı olduğu tespit edilmiştir.
Anahtar kelimeler: COVID-19; bilgisayarlı tomografi; SARS-CoV2; pnömoni; pandemi.

INTRODUCTION

Coronaviruses are large, enveloped, positive single-stranded RNA viruses that are transmitted from animals to humans. Seven subtypes of these viruses cause serious illness and death in humans (1). Coronaviruses have led to two major pandemics in recent years; severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) (1). Today, the novel agent was named as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) as the causative of coronavirus disease 2019 (COVID-19) (2). COVID-19 was seen for the first time in Wuhan, China, in December 2019 and spread all over the world in a short time (3,4). The World Health Organization (WHO) declared this epidemic as a global health emergency and declared as a pandemic in March 2020 (5). In Turkey, the first COVID-19 positivity was seen on March 11th, 2020 (6).

The first case of COVID-19 associated with SARS-CoV-2 was identified as pneumonia. In subsequent follow-ups, it was determined that the disease appeared with many clinical symptoms and even in some people the disease could be asymptomatic. In symptomatic patients, clinical signs of the disease mostly, but not only consist of upper respiratory tract infection symptoms such as fever, cough, fatigue, common muscle and joint pain, and nasal congestion. Moreover, the patients can present with a wide spectrum of other clinical symptoms such as shortness of breath, headache, gastrointestinal symptoms and progressive respiratory failure (1,2). Pneumonia is usually seen 2-3 weeks after the symptoms appear. As in viral pneumonias, lymphopenia is common in COVID-19 and inflammatory markers such as C-reactive protein (CRP) and cytokines are elevated. In imaging of the disease, findings such as ground glass appearance, irregular consolidations, linear opacities, and pleural effusion are seen in computed tomography (CT) (7,8).

Real-time polymerase chain reaction (RT-PCR) analysis is routinely used to detect acute respiratory pathogens, and COVID-19 is diagnosed with this method (9). Despite the high specificity of this test, it has been observed that it frequently causes false negative results to be reported due to the incorrect and inappropriate swab samplings (7,10). To overcome this situation, the use of the thoracic CT imaging to detect the presence of pulmonary disease in patients with suspected COVID-19, may avoid delaying the chance of diagnosis and treatment in these patients, regardless of the RT-PCR test result. For this purpose, it was aimed to compare the sociodemographic, clinical and laboratory characteristics of the patients according to thoracic CT findings of possible/definite cases of COVID-19.

MATERIAL AND METHODS

Study Design and Setting

This study is a retrospective clinical study examining possible/definite patients with COVID-19. This study was conducted in a tertiary university hospital in Erzurum, Turkey. The study was carried out between 01.06.2020-01.10.2020. The required permission for the study was obtained from the Scientific Research Platform of the Ministry of Health, General Directorate of Health Services, and then the approval of the local ethics committee (28.05.2020, 06/15). Our study was conducted in accordance with the Declaration of Helsinki.

Patients

Clinical and epidemiological data of patients diagnosed with COVID-19 were obtained from the hospital electronic data system and file scanning. These patients consisted of patients who applied to the COVID-19 polyclinics established in our hospital during the pandemic period. The records of patients with symptoms (such as cough, fever, shortness of breath, headache, sore throat, muscle-joint pains, diarrhea and nausea-vomiting) who were pre-diagnosed or definitively diagnosed with COVID-19 by RT-PCR test were scanned according to ICD-10 codes. Patients with these symptoms who were not tested for COVID-19 by RT-PCR tests were excluded from the study. In addition, patients younger than 18 years of age and patients with insufficient medical data were excluded.

In our hospital, the swab samples from COVID-19 probable/definite patients were taken by nasopharyngeal swap sampling and the diagnosis was made by RT-PCR analysis. RT-PCR analyzes were performed in the reference laboratory of the Ministry of Health. Furthermore, in our hospital, patients with pulmonary symptoms and signs with possible/definite cases of COVID-19 were mostly scanned with thoracic CT. Thorax CTs were reported according to Radiological Society of North America expert consensus document on reporting chest CT findings related to COVID-19 (8).

The RT-PCR test results of the patients at the first admission to the hospital were included in the study and evaluated. According to the Ministry of Health COVID-19 guideline, patients with positive RT-PCR test are considered as definite cases, patients with negative RT-PCR tests as possible cases (11). For the study, thorax CT reports of the patients were scanned from the hospital data system, and if there were more than one, only first CTs of the patients were included in the study. The patients whose thorax CT report were compatible with COVID-19 disease, constituted the CT positive group, and the patients who were not compatible, constituted the CT negative group.

According to the inclusion and exclusion criteria of the study, 1261 patients were examined as probable/definite cases of COVID-19. Of these patients, 266 persons were excluded from the study because thorax CT was not performed. As a result, 995 patients who had RT-PCR results with nasopharyngeal swap were included in the study. Sociodemographic data such as age, gender, comorbidities, and laboratory test results, thorax CT reports and RT-PCR results of the patients were compared and analyzed.

Test Methods

Biochemical test levels of the patients included in the study were studied by chemical immunoassay method with Unicel DXI 600 Access Immunoassay System device (Beckman Coulter, Porterville, CA, USA). Swab samples were studied with the Bio-Rad CFX96 TouchTM Real-Time PCR device (Agilent Technologies, Inc. US) in the reference laboratory and the Bio-Speedy® SARS-CoV-2 + VOC202012 / 01 RT-qPCR kit (Bioeksen R&D Technologies, Inc. Turkey) in the reference laboratory.

Statistical Analysis

Statistical analyzes were performed by using SPSS v.25.0 program (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY, USA).

Kolmogorov-Smirnov test was used to evaluate normal distribution. Categorical variables were defined as frequencies and percentages. Continuous variables were defined by using mean and standard deviation if normally distributed, and median and interquartile range (IQR) values if not normally distributed. For the comparison of continuous variables, Student's t-test was used if the data were normally distributed, and the Mann-Whitney U test was used if it was not normally distributed. Categorical variables were compared using the Pearson's Chi-squared test if the minimum expected number was greater than 25; Fisher's exact test if the minimum expected count is less than 5; or Continuity correction was used if the minimum expected count is between 5 and 25. Logistic regression analysis was used to determine independent predictors of thoracic CT positive patients. For whole study, $p<0.05$ was considered as statistically significant.

RESULTS

Of the 995 patients included in the study, the mean age of the patients was 45.7±20.2 years, and 57% (n=567) were male. The sociodemographic characteristics and clinical characteristics of the groups are shown in Table 1. It was found that 65.1% (n=648) of the patients had positive CT. The mean age was 46.59±20.52 years in CT positive group, and 44.02±19.38 years in CT negative group and it was not statistically significant (p=0.055). Similarly, when CT positivity was compared with the gender of the patients, no statistically significant difference was found in terms of gender (p=0.761). When the patients admitted to the hospital were examined and compared in terms of whether they were CT positive or not, it was seen that the patients with low oxygen saturation level (p=0.003), and with the comorbidities together with hypertension + diabetes + chronic renal failure (p=0.017) were found to be statistically significant, whereas other physical examination findings and presence of comorbidities were not statistically different between CT groups.

The comparison of the laboratory findings of the groups is given in Table 2. Accordingly, it was found that CRP, D-dimer, ferritin, lactate values were high in the CT positive group, and they were statistically significant (all $p<0.001$). Alanine aminotransferase (ALT) value was found to be low and statistically significant (p=0.038). In addition, the RT-PCR test result was found to be positive in 22.2% (n=144) of the CT positive patients and 32.0% (n=111) of the CT negative patients and it was found to be statistically significant ($p<0.001$).

The logistic regression analyses were performed by applying all independent and categorical factors, in terms of sociodemographic, clinical characteristics and laboratory findings and CT positivity of the patients included in the study. Logistic regression was performed using the Enter model. The independent predictors with significant difference obtained as a result of logistic regression analyses are presented in Table 3, but other insignificant data were discarded and not presented.

Accordingly, it was determined that CRP (Odds Ratio (OR)=1.201, 95% CI=1.024-1.432, $p<0.001$), lymphocyte count (OR=1.917, 95% CI=1.155-3.183, p=0.012), ferritin (OR=1.001, 95% CI=1.001-1.002, $p<0.001$), procalcitonin (OR=0.957, 95% CI=0.917-0.998, p=0.039), D-dimer (OR=1.001, 95% CI=1.001-1.001, p=0.019), lactate (OR=1.303, 95% CI=1.067-1.592, p=0.009) and RT-PCR (OR=1.646, 95% CI=1.229-2.204, p=0.001) were statistically significant with CT positivity.

Table 1. Comparison of demographic and clinical characteristics of patients with positive and negative CT findings

	CT Positive (n=648)	**CT Negative (n=347)**	**p**
Age (years), mean±SD	46.59±20.52	44.02±19.38	0.055[a]
Gender (male), n (%)	367 (56.6)	200 (57.6)	0.761[b]
Comorbidity, n (%)			
Absent	348 (53.7)	183 (52.7)	0.771[b]
COPD	35 (5.4)	12 (3.5)	0.169[b]
CAD	30 (4.6)	20 (5.8)	0.435[b]
HT	14 (2.2)	9 (2.6)	0.832[c]
DM	21 (3.2)	19 (5.5)	0.087[b]
Malignancy	26 (4.0)	10 (2.9)	0.464[c]
CRF	8 (1.2)	4 (1.2)	0.999[d]
Autoimmune diseases	1 (0.2)	2 (0.6)	0.280[d]
HT + DM	31 (4.8)	10 (2.9)	0.204[c]
COPD + HT	8 (1.2)	6 (1.7)	0.577[d]
HT + CAD	20 (3.1)	8 (2.3)	0.611[c]
CAD + DM	18 (2.8)	10 (2.9)	0.999[c]
COPD + CAD	7 (1.1)	7 (2.0)	0.263[d]
HT + DM + CAD	28 (4.3)	12 (3.5)	0.623[c]
HT + DM + CRF	14 (2.2)	18 (5.2)	**0.017**[c]
COPD + CAD + DM	8 (1.2)	6 (1.7)	0.577[d]
COPD + HT + DM + CRF	31 (4.8)	11 (3.2)	0.298[c]
Physical Examination on Arrival, median (IQR) [min-max]			
Systolic blood pressure (mmHg)	134 (12) [124-143]	135 (14) [123-150]	0.062[e]
Diastolic blood pressure (mmHg)	79 (6) [74-89]	81 (7) [77-90]	0.125[e]
Heart rate (per minute)	86 (11) [68-98]	90 (13) [70-101]	0.464[e]
Fever (°C)	36.4 (0.5) [36.2-36.8]	36.3 (0.6) [36.2-36.7]	0.143[e]
Respiratory rate (per minute)	18 (5) [14-25]	17 (4) [15-27]	0.245[e]
Oxygen saturation level (%)	81 (8) [72-97]	92 (6) [86-99]	**0.003**[e]

CT: computed tomography, SD: standard deviation, COPD: chronic obstructive pulmonary disease, CAD: coronary artery disease, HT: hypertension, DM: diabetes mellitus, CRF: chronic renal failure, IQR: interquartile range, [a]: Student's t-test, [b]: Pearson chi-square test, [c]: continuity correction test, [d]: Fisher's exact test, [e]: Mann-Whitney U test

Table 2. Comparison of the laboratory findings of patients with positive and negative CT findings

Median (IQR) [min-max]	CT Positive (n=648)	CT Negative (n=347)	p
WBC ($\times10^3/\mu L$)	7.5 (5.9) [2.5-35.7]	8.5 (6.1) [2.0- 26.5]	0.710[a]
Neutrophil count ($\times10^3/\mu L$)	5.0 (6.0) [0.3-30.0]	5.2 (6.3) [0.0-23.8]	0.817[a]
Lymphocyte count($\times10^3/\mu L$)	1.6 (1.6) [0.0-13.8]	1.6 (1.6) [0.0-10.9]	0.379[a]
C-reactive protein (mg/L)	84.3 (14.2) [5.3-212.5]	16.7 (8.4) [3.1-82.3]	**<0.001[a]**
Albumin (g/dl)	3.34 (0.7) [3.28-3.92]	3.35 (0.8) [3.32-4.05]	0.425[a]
GGT (U/L)	14.0 (15.5) [8.0-899.0]	14.0 (19.0) [8.0-859.0]	0.948[a]
CK (U/L)	87.0 (51.0) [10.0-9354.0]	73.0 (37.0) [14.0-1065.0]	0.394[a]
AST (U/L)	24.0 (14.0) [10.0-1111.0]	25.0 (21.0) [7.0-714.0]	0.240[a]
ALT (U/L)	18.0 (23.0) [9.0-976.0]	19.0 (34.0) [9.0-882.0]	**0.038[a]**
LDH (U/L)	260.0 (114.0) [147.0-4014.0]	263.0 (116.0) [150.0-1190.0]	0.211[a]
Total bilirubin (mg/dL)	0.51 (0.54) [0.12-27.25]	0.50 (0.57) [0.13-3.90]	0.400[a]
Direct bilirubin (mg/dL)	0.11 (0.12) [0.00-17.48]	0.13 (0.14) [0.02-1.86]	0.516[a]
Glucose (mg/dL)	99.0 (40.0) [69.0-591.0]	100.0 (36.0) [76.0-501.0]	0.223[a]
BUN (mg/dL)	13.6 (8.9) [6.1-166.4]	13.1 (5.6) [6.5-106.5]	0.261[a]
Creatinine (mg/dL)	0.88 (0.36) [0.25-8.06]	0.78 (0.39) [0.26-7.06]	0.099[a]
Na (mmol/L)	138.0 (6.0) [129.0-167.0]	138.0 (6.0) [123.0-158.0]	0.870[a]
K (mmol/L)	3.9 (0.7) [3.1-5.8]	3.9 (0.6) [3.2-5.4]	0.399[a]
Cl (mmol/L)	102.0 (3.0) [89.0-127.0]	102.0 (3.0) [88.0-116.0]	0.841[a]
Troponin (ng/L)	7.1 (11.1) [0.3-2208.7]	7.2 (7.0) [0.4-299.6]	0.155[a]
D-dimer (ng/mL)	821.0 (1442.5) [37.0-10435.0]	568.0 (662.0) [61.0-6360.0]	**<0.001[a]**
Ferritin (ng/mL)	1780.0 (2057.0) [1100.0-13185.0]	196.0 (533.0) [7.0-2858.0]	**<0.001[a]**
Procalcitonin (ng/mL)	(n=325) 0.1 (0.7) [0.0-84.6]	(n=192) 0.1 (0.7) [0.0-831.0]	0.118[a]
Lactate (mmol/L)	1.6 (1.1) [0.6-12.4]	1.2 (0.8) [0.6-6.1]	**<0.001[a]**
RT-PCR test positive, n (%)	144 (22.2)	111 (32.0)	**<0.001[b]**

CT: computed tomography, WBC: white blood cell count, GGT: gamma glutamyl transferase, CK: creatine kinase, AST: aspartate aminotransferase, ALT: alanine aminotransferase, LDH: lactate dehydrogenase, BUN: blood urea nitrogen, Na: Sodium, K: Potassium, Cl: Chlorine, IQR: interquartile range, [a]: Mann-Whitney U test, [b]: Pearson chi-square test

Table 3. Logistic regression analysis results for CT positive patients

	OR	95% Cl	p
C-reactive protein	1.201	1.024-1.432	**<0.001**
Lymphocyte count	1.917	1.155-3.183	**0.012**
Ferritin	1.001	1.001-1.002	**<0.001**
Procalcitonin	0.957	0.917-0.998	**0.039**
D-dimer	1.001	1.001-1.001	**0.019**
Lactate	1.303	1.067-1.592	**0.009**
RT-PCR	1.646	1.229-2.204	**0.001**

OR: odds ratio, CI: confidence interval, Hosmer and Lemeshow test $p<0.001$; $\chi^2=41.218$, $p<0.001$, percentage correct=80.6%, Nagelkerke R square: 0.412

DISCUSSION

In this study, sociodemographic, clinical and laboratory characteristics of probable and definite cases were compared according to the positive and negative thorax CT findings according to the COVID-19 guideline of the Ministry of Health in Turkey. The first thorax CT reports of all patients included in the study were evaluated and compared with the RT-PCR test results and laboratory test results of the patients. CRP, D-dimer, ferritin and lactate values were found to be higher in the CT positive group compared to the CT negative group. RT-PCR positivity was higher in the CT negative group.

Furthermore, low lymphocyte count and procalcitonin levels, increased CRP, ferritin, D-dimer, lactate levels and negative RT-PCR test results were found as independent predictors for CT positivity in the logistic regression model created with the CT positive group. However, other laboratory tests, demographic features and comorbidities of the patients were not found to be statistically significant. Among these results, the detection of PCR negativity and low procalcitonin levels as predictors for CT positivity were very interesting results. This reveals the importance of screening for CT positivity, especially in patients with negative PCR test results and negative procalcitonin levels.

The RT-PCR test results obtained from nasopharyngeal, oropharyngeal or swap samples from lower respiratory tract such as sputum, tracheal aspirate, or bronchoalveolar lavage are considered variable and potentially unstable (10,12). RT-PCR is the primary method for the diagnosis of COVID-19, but it can cause false negativity (7,13,14). In a study in which Li et al. (10) investigated the positivity of the RT-PCR test in patients diagnosed with COVID-19 clinically, they emphasized that there was a high rate of false negativity in the RT-PCR test. According to the results of the RT-PCR test, which is commonly used in the world, the isolation, discharge or transfer of COVID-19 patients are performed. The isolation of the patient with false negativity can be terminated or discharged. Therefore, even if the RT-PCR result is negative, clinical status and radiological imaging should guide clinical decision-making about these patients. In this study, the negative RT-PCR test results of the majority of patients with positive thoracic CT findings support the necessity of CT in decision-making.

Thorax CT is a useful method that detects changes in the lungs at an early stage and plays an important role in the evaluation and management of COVID-19 patients (15). Even thorax CT findings can be seen before RT-PCR positivity (8,16). In addition, thorax CT is used both for diagnosis and to determine the severity of the disease (17,18). In a meta-analysis on the thoracic CT findings of COVID-19, due to the variability of the RT-PCR test positivity, it is recommended that clinicians perform CT scans and combine with RT-PCR to detect high probability COVID-19 patients (19).

In the study of Song et al. (20) comparing the thoracic CT findings and clinical features of 211 COVID-19 patients, 163 patients were diagnosed with viral pneumonia by thoracic CT. It was determined that 66.3% (n=108) of these patients were RT-PCR positive, and 33.7% (n=55) were RT-PCR negative. They were also emphasized that thorax CT has a high sensitivity compared to the RT-PCR test in COVID-19. In our study, 65.1% (n=648) of the patients had signs of COVID-19 disease pneumonia in CT, and only 22.2% (n=144) of these patients were RT-PCR positive. In other words, although 225 of the patients had positive RT-PCR test, 648 patients had CT positivity. This means that although the RT-PCR test is widely used for diagnosis, the diagnosis of COVID-19 disease will increase with thoracic CT scan and these symptomatic patients will be caught, especially in RT-PCR negative patients.

In a study conducted by Alanli et al. (21) in 114 patients in Turkey, the compatibility of PCR with thoracic CT findings was investigated and they found similar imaging changes in both PCR negative and PCR positive groups. Since the study group was smaller than our study, also, they did not grade CT findings with radiological evaluations. In our study, CT findings of 995 patients were classified and graded according to the North American expert consensus document of the Society of Radiology. After the patients were categorized as CT positive and CT negative, RT-PCR test results were found to be statistically significant between the groups.

Luo et al. (7) investigated the relationship between the thorax CT findings and the clinical course of COVID-19 patients and found that the lymphocytes and CRP levels were higher; white blood cells, neutrophil and albumin levels were lower, and they were statistically significant. They emphasized that this is related to the clinical course of the patients. On the contrary, in our study, lymphocyte levels were lower and neutrophil levels were higher in the CT positive group.

In another study, CT findings were found to be correlated with the severity and duration of the symptoms of COVID-19, and similar to our study, lymphocyte count was found to be negatively correlated with lung involvement (22). Again, there are studies showing that laboratory findings, such as CRP, ferritin, D-dimer, and lactate are elevated in COVID-19 patients and correlate with the disease severity and mortality (4,23-25).

One of the important results of our study is that, by logistic regression analysis, it is determined that low lymphocyte count, CRP, D-dimer, ferritin and lactate elevations in patients can be used to predict the probability of CT positivity in COVID-19 patients. This situation shows us that it is possible to predict lung involvement and disease positivity in COVID-19 by combining these biochemical test results. This is particularly critical for early prediction of COVID-19 and early treatment of patients.

Limitations: Our study has some limitations. The first of these is that our study was single-center and designed retrospectively. Another point is that the second test results of the patients with the first negative RT-PCR test were not included in the study, even if they were performed. The fact that, the RT-PCR tests were mostly repeated after the first test, the subsequent results, even if different from the first, were ignored in our study. The relationship between the CT positivity at the time of first presentation was investigated in patients who were found to be positive for the subsequent tests, would be a further support for our study. As another limitation, the treatments, prognosis and the outcomes of the patients were not investigated and not included in our study. This study focused on the initial diagnosis of COVID-19 to catch the opportunity to start treatment earlier.

CONCLUSION

It is important to detect COVID-19 disease early to start treatment quickly. The possibility of a false negative result of the RT-PCR test result should be considered. For this reason, the diagnostic effectiveness of thoracic CT has been investigated in this study in terms of its usability in clinical decision making. According to the results we have achieved, it has been determined that CT can be used for decision-making in the immediate initiation of treatment due to the possibility of being positive for COVID-19 in patients with negative RT-PCR test results but positive CT evaluation and high biochemical parameters.

Ethics Committee Approval: The study was approved by the Clinical Research Ethics Committee of Atatürk University Faculty of Medicine (28.05.2020, 06/15).

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