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Original Article

# Investigating the Compatibility of Lung CT Scan Findings and Molecular Diagnosis Test of Patients With COVID-19 in Shahid Beheshti Hospital in Hamedan

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**Abstract**

**Background:** This study aimed to investigate the diagnostic value of computed tomography (CT) scan based on the results of reverse transcription polymerase chain reaction (RT-PCR) molecular diagnosis test in the diagnosis of COVID-19 diseases.

**Methods:** In this study, 451 files related to hospitalized patients with initial diagnosis of COVID-19 were examined. Demographic information, symptoms, and results of both tests were extracted from the files. After collecting information by sampling method, the data were analyzed by SPSS software. In order to describe the data, mean and standard deviation statistics were used for qualitative data. Moreover, the Kappa test was used to measure the compatibility of the three methods.

**Results:** The concordance rate of PCR and CT scan was calculated at 66%, of which 55.3% were positive, and 10.7% were negative. The results were obtained with an accuracy of 68.9%, a precision of 91.5%, a sensitivity of 69.1%, a specificity of 68%, and an F1-score of 95.10%. In general, based on the statistical criteria, the calculated percentage is an acceptable value.

**Conclusion:** According to the appropriate matching percentage of CT scan and RT-PCR molecular diagnosis test, both techniques can be used as a diagnosis criterion according to the patient's symptoms.

**Keywords:** CT scan, RT-PCR, COVID-19, Compatibility

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## Introduction

On January 9, 2020, the World Wellbeing Organization declared the determination of a strain of coronavirus that had not been already distinguished in people, under the title of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Disease with this infection is transmitted (1,2). Afterward, a wide range of clinical manifestations such as fever, fatigue, muscle pain, lack of sense of smell, shortness of breath, sore throat, nasal congestion, cough, nausea, vomiting, or diarrhea were observed (3,4).

Gradually, with the increase in the number of infected places around the world, the coronavirus disease 2019 (COVID-19) turned from an epidemic to a pandemic, so more than 72 million people around the world were infected with it, and more than a million people died of this disease (5). In addition, the high spread of this disease has brought with it unprecedented health, medical, economic, and social challenges for societies. Therefore, correct diagnosis in the early stages of infection is important to quickly separate infected people from the healthy population and break the transmission chains of society.

COVID-19 infection is mainly diagnosed by viral nucleic acid test (reverse transcription polymerase chain reaction, RT-PCR), immune tests, and radiological examination (3). The RT-PCR test is the gold standard for confirming the infection of COVID-19. However, its sensitivity is insufficient, and it ranges from 50% to 62% according to previous reports. Errors in sampling and transfer of samples, the efficiency of the used kits, as well as the quality of the test performed by the operator are among the reasons that led to false negative results of this test. Currently, it is not known how many times false negative results may occur; on the other hand, it takes several hours to obtain RT-PCR results. Therefore, to prevent possible errors and reduce diagnosis time, it is important to check radiological images, especially computed tomography (CT) scans (6-8). CT has been a vital imaging strategy for the determination and administration of patients

with viral pneumonia because it was unequivocal within the far-reaching flare-up of intense respiratory disorder (SARS-CoV) and Center East respiratory disorder.

Among the radiographic highlights of tainted lungs, ground glass opacities, multifocal inconsistent solidification, or interstitial changes with fringe conveyance can be specified. It was thought that this highlight might be seen in symptomatic patients with negative RT-PCR results (9).

Later research has uncovered that the CT filter of suspected patients with COVID-19 includes an affectability of 60% to 98% and has the ordinary appearance of a viral lung disease. Although a few analysts advocate chest CT filtering for screening patients, imaging is not suggested for therapeutic triage in asymptomatic or symptomatic patients, concurring with the Fleischner Society articulation. Instead, CT is suggested in patients with more regrettable respiratory status or direct to extreme highlights. In expansion, chest imaging is reasonable for assessment in patients who confront effective impedance or hypoxemia after recuperation (10-13). The tall affectability of CT check has essentially expanded its use to analyzing this disease, so it is essential to pay consideration to its restrictions and impediments.

In a CT scan of the chest, the radiation dose is 100 times higher than the routine face-to-face radiography of the chest. It is undoubtedly one of the biggest risks that the world community will have to deal with after the coronavirus. Individuals will struggle with the side effects caused by the CT scan rays during the Corona period (14). Another disadvantage of CT scans is the increase in the workload of the radiology department and the absorption dose of the personnel. Therefore, many doctors prefer simple chest X-ray (CXR) for initial diagnosis, which unfortunately does not have enough sensitivity (15).

Given the advantages and disadvantages of corona diagnostic methods, comparing the test results of patients can determine the degree of agreement between CT scan and RT-PCR reference test and can help determine the best method for diagnosing the infection of COVID-19.

## Materials and Methods

This study was conducted to help quickly diagnose the COVID-19 disease through a lung CT scan in the form of a retrospective cross-sectional study in Hamedan. In this cross-sectional and retrospective descriptive study, 451 cases of patients with suspected COVID-19 who were admitted to Shahid Beheshti Hospital in Hamedan in 1400 were examined. The criteria for the inclusion of patients in this study was the presence of CT scans and RT-PCR results at the same time in the medical record. After visiting the hospital, a list of the names of the included patients in the form of two final positive and negative COVID reports was prepared by the medical record expert, and we randomly selected the samples from both reports equally. Statistic data, indications, chest CT, check discoveries, and RT-PCR were extricated from the patients' therapeutic records. However, 55 tests were excluded from the this study due to deficient data in their records.

### *Eligibility Criteria*

Individuals who came to the clinic with one or more suspected clinical indications of corona were eligible to be included in the study. Furthermore, suspicious clinical side effects included fever, weakness, muscle torment, need for sense of scent, shortness of breath, sore throat, nasal blockage, cough, shortness of breath, queasiness, heaving, or loose bowels.

### *Study Exclusion Criteria*

1. The time interval between the RT-PCR test and chest CT check should be more than 7 days. (Since the patient's condition does not alter.)
2. Incomplete clinical or laboratory information (if the results of each of the three tests are not available in the file)

Measurable analyses were performed utilizing SPSS computer program version 26, and a *P* value of less than 0.05 was considered significant. In the end, the kappa test of the outcomes of both tests was calculated.

## Results

The outcomes of the survey of 451 cases related to patients referred to Beheshti Healing Center indicated that the normal age of the patients is 58.45 years (±17.56), and the foremost common side effects are shortness of breath (53.2%), cough (51.1%), weakness and laziness (42%), myalgia (31%), and fever (27%). Figure 1 shows the most common symptoms.

Moreover, 256 people (60.8%) were PCR positive, of which 126 were men and 130 were women. In addition, 376 people (83.4%) had a positive CT scan, which contrary to the PCR test results, positive test numbers of the male patients (n = 190) were higher than women (Figure 2 and Figure 3).

The results of PCR and CT scans were negative in 10.7% of the patients because of clinical and epidemiological criteria, while the results of both tests were reported positive in 55.4% of the patients. In general, the concordance between PCR and CT scan was calculated to be 66%, which is an acceptable percentage based on

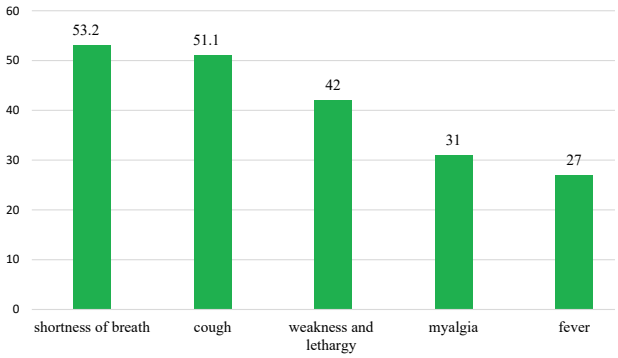


**Figure 1.** The Most Common Symptoms Examined in This Study

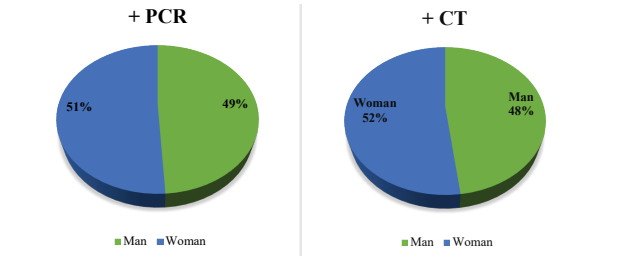


**Figure 2.** Positive CT and Positive PCR Results Based on Gender in the Examined Cases. *Note*. PCR: Polymerase chain reaction; CT: Computed tomography

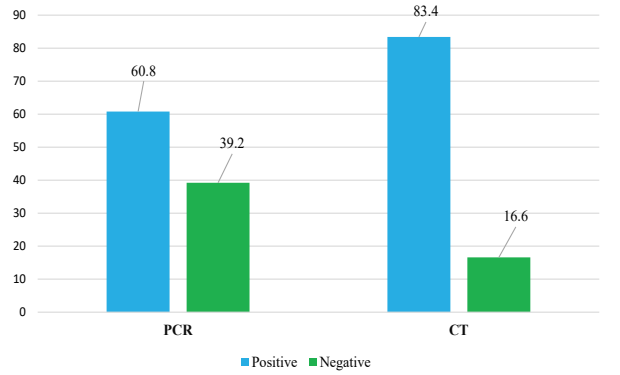


**Figure 3.** Positive and Negative CT and PCR in the Examined Cases. *Note*. PCR: Polymerase chain reaction; CT: Computed tomography

statistical criteria.

Furthermore, a critical relationship was observed between a number of clinical indications and PCR test outcomes, including fever, cough, shortness of breath, and myalgia. Moreover, cough, sickness, and myalgia were related to the outcomes of the chest CT test (Figure 4).

## Discussion

According to recent studies, the importance of the role of CT scans and radiological images in COVID-19 infections such as intense respiratory disorder and Center East respiratory disorder has not been secured. In this study, the agreement rate of the CT scan and PCR molecular diagnosis test was calculated to be 66%. In Ai and colleagues' study, which included the results of 1014 patients who underwent both tests, RT-PCR was used as the reference standard. According to the test results, 59% of patients had positive RT-PCR, and 88% had positive CT scans. In 75% of patients who had negative RT-PCR results, a CT scan showed the presence of COVID-19 infection (16). Despite the difference in the number of examined patients, a good agreement was noticed between the results of our study and those obtained from the study by Ai and colleagues.

Falaschi et al conducted a study on 773 patients who underwent both tests at less than a week interval due to suspicious clinical symptoms. In this study, the sensitivity, specificity, and accuracy of CT in diagnosing this infection were estimated as 78.9%, 90.7%, and 85.9%, respectively. Further, 6.37% of patients had positive CT with negative RT-PCR, 4.9% of patients had clinical and epidemiological

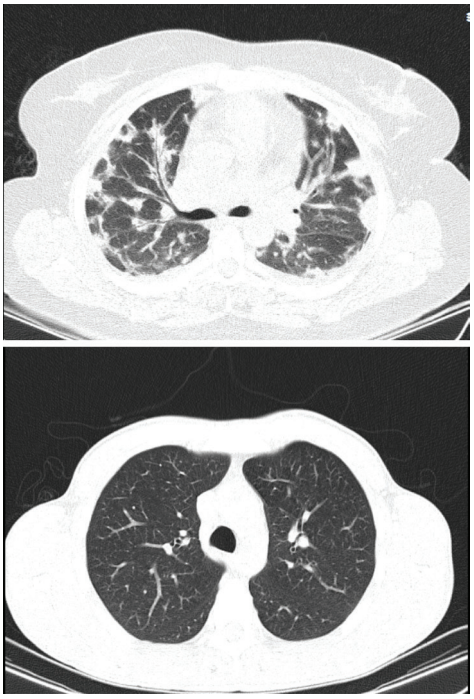

**Figure 4.** Examples of Lung CT Scan Images That Were Reported to Be Positive and Negative. *Note*. CT: Computed tomography

criteria, and both tests were negative (17). Comparing the results of this study and our study indicates the results of both tests were negative in 10 patients (10.7%) with clinical and epidemiological criteria, which was significantly higher than the study conducted by Falaschi et al. Out of 465 hospitalized patients with suspected COVID-19, 227 were positive, and 44 were negative, which is an acceptable percentage based on clinical criteria.

In a retrospective study (18), considering the RT-PCR test as a reference standard, 234 patients (153 men and 81 women) with an average age of 66.04 years had a positive result, and 13 patients had a negative CXR (5.6%). Moreover, the sensitivity of CXR in their experience was about 68.1%, and most of the affected patients were men in the age group of 60-79 years. The results of this study were also in good agreement with the results of our study. This suggests the appropriate quality of the diagnostic kits as well as the sufficient knowledge and skill of the relevant experts and doctors. Taking this into consideration, each of these tests can be recognized as a standard according to the condition of each patient and the opinion of the attending physician. Of course, attention should be paid to the mentioned defects.

In addition, the data analysis results were based on a significant relationship between PCR results and symptoms such as fever, cough, myalgia, and loss of consciousness. CT scan results were also related to cough, nausea, and myalgia with a $P$ value < 0.005.

## Conclusion

According to the appropriate matching percentage of CT scan and RT-PCR molecular diagnostic test, which indicates the appropriate quality of the diagnostic kits as

well as the sufficient knowledge and skills of the relevant experts and doctors, the treating physician can choose any of the techniques based on the patient's appearance symptoms. CT scan and PCR tests were the criteria for diagnosis.


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## Authors' Contribution

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## Competing Interests

There is no conflict of interests.


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## Patient Consent Form

All participants were informed about the subject of the study.

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