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Case Series

HRCT chest in COVID-19 patients: An initial experience from a private imaging center in western India

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Abstract

The COVID-19 pandemic began in late December in 2019 and has now reached to 216 countries with 1,08,42,028 confirmed cases and 5,21,277 deaths according to the WHO reports and 6,49,666 confirmed cases in india alone with 18,679 deaths (as on 04th july 2020) . RT-PCR has been considered the standard test for diagnosis of COVID 19. However, there has been reported a high false negative rate. This high false negative rate increases the risk of further transmission as well as delays the timely management of suspected cases. We have conducted HRCT chest of various (200 patient case study) proven and suspected cases of COVID-19 infection in the months of April, May and June 2020. Out of 200 scanned patients with clinical complains and suspicion, positive HRCT chest findings were seen in 196 patients, showing clinical-radiological correlation and an accuracy of 98%. The sensitivity of chest CT in suggesting COVID-19 was 98.6% (146/148patients) based on positive RT-PCR results. In patients with negative RT-PCR results and high clinical suspicion, 90% (18/20) had positive chest CT findings. HRCT chest is very sensitive and accurate in picking up lung parenchymal abnormalities in laboratory negative RT-PCR cases with high clinical suspicion of COVID-19 infection and also in all symptomatic patients where RT-PCR was not done. HRCT can also be very sensitive, cost effective and time effective in screening patients with high clinical suspicion. HRCT scores over RT-PCR in giving immediate results, assessing severity of disease and prediction of prognosis. We suggest HRCT chest for detection of early parenchymal abnormalities, assessing severity of disease in all patients with clinical symptoms and suspicion of COVID infection irrespective of laboratory RT-PCR status.

Key words: HRCT chest in COVID-19; Imaging in COVID-19; Radiology in COVID-19; CT scan COVID-19; Diagnosis COVID-19

Introduction

The COVID-19 pandemic began in late December in 2019 and has now reached to 216 countries with 1,08,42,028 confirmed cases and 5,21,277 deaths according to the WHO reports[1] and 6,49,666 confirmed cases in India alone with 18,679 deaths.[2]

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Reverse transcription polymerase chain reaction (RT-PCR) has been considered the standard test for diagnosis of COVID-19. However, there has been reported a high false-negative rate. This high false-negative rate increases the risk of further transmission as well as delays the timely management of suspected cases. The current situation in the country is such that a large amount of the population is waiting for the RT-PCR test to be performed, due to a shortage of kits or a considerable delay in the results.

We have conducted high-resolution computed tomography (HRCT) chest of various (200 patient case study) proven and suspected cases of COVID-19 infection in the months of April, May, and June 2020.

This paper of 200 cases study suggests that HRCT chest can be considered as a major means to diagnose COVID-19 infection even before receiving the RT-PCR test results.

In the largest cohort of 1014 cases from Wuhan, China, the sensitivity of chest CT imaging for Covid-19 was 97% (580/601) with RT-PCR as a reference[3]

We present our initial experience of 200 clinically proven and suspected patients of COVID infection, their imaging findings of HRCT chest and their correlation with RT-PCR tests showing high accuracy of HRCT findings.

Methodology

Patients with complaints of fever, cough, throat pain, anosmia, and breathlessness (at least two of these symptoms) were subjected to HRCT chest on a 16 slice CT scanner.

Acquisition protocol - KVp-100 mAS-80 Pitch-1.2. Slice thickness-1.2 mm. Matrix 512 × 512. A total of 200 patients were scanned.

RT- PCR for Covid-19 was performed for 168 patients. In 68 patients, RT-PCR was performed before HRCT chest (1–3 days before the scan) and in 100 patients, RT-PCR was performed after the HRCT chest (within 72 h of scan).

HRCT chest was evaluated independently by two radiologists with 8-year experience in chest imaging independently for ground-glass opacities (GGOs), reticular thickening, focal consolidations, fibrosis, pleural effusion, nodules, and hilar lymphadenopathy.

Results

Out of 200 scanned patients with clinical complaints and suspicion, positive HRCT chest findings were seen in 196 patients, showing clinical-radiological correlation and an accuracy of 98% [Chart 1].

HRCT chest was done in all 200 patients; RT-PCR was done before imaging in 68 patients and after imaging in 100 patients (total 168 patients). RT-PCR was not performed in 32 mildly symptomatic patients who were advised isolation and treatment on CT findings.

Out of 68 patients with RT-PCR done before imaging, 60 patients had positive RT-PCR and 8 patients had negative RT-PCR. 58 out of 60 positive RT-PCR patients had positive HRCT chest findings showing 96.6% correlation. Eight negative RT-PCR patients with clinical symptoms, all eight had positive HRCT findings.

100 patients with positive HRCT chest findings were subsequently tested with laboratory RT-PCR out of which 88 tested positive (88% correlation) and 12 tested negative.

Initially 16 patients with positive HRCT chest findings, RT-PCR turned out to be negative. RT-PCR was repeated in four of the patients later on and turned out to be positive. In two negative pretested RT-PCR patients with mild clinical symptoms, HRCT did not show any findings. In 20 negative RT-PCR patients with high clinical suspicion, CT scan showed positive findings in 18 patients.

Out of 168 symptomatic patients who got both HRCT chest and RT-PCR done, 146 patients (86.9%) showed a correlation between both the tests with positive findings.

Of 168 symptomatic patients who got both RT-PCR and HRCT chest, 88% (148/168) had positive RT-PCR results, and 98.8% (166/168) had positive chest CT scans. The sensitivity of chest CT in suggesting COVID-19 was 98.6% (146/148 patients) based on positive RT-PCR results. In patients with negative RT-PCR results and high clinical suspicion, 90% (18/20) had positive chest CT findings; of 18 cases, 14 cases (77.7%) were considered as high likely cases.

Thus, HRCT chest was found more sensitive than RT-PCR in clinically suspected patients.

Discussion

Symptoms

Signs and symptoms[4,5] of coronavirus disease 2019 (COVID-19) may appear 2 to 14 days after exposure. Common signs and symptoms can include fever, cough, and tiredness. Early symptoms of COVID-19 may include a loss of taste or smell. Other symptoms can include shortness of breath or difficulty breathing, muscle aches, chills, sore throat, runny nose, headache, and chest pain. This list is not all inclusive; other less common symptoms have been reported, such as rash, nausea, vomiting, and diarrhea. Children have similar symptoms to adults and generally have mild illness.

The severity of COVID-19 symptoms can range from very mild to severe. Some people may have only a few and mild symptoms (like low-grade fever, cough, tiredness, anosmia, and throat pain) and some people may have no symptoms at all. Some people may experience worsened symptoms, such as worsened shortness of breath and pneumonia, about a week after symptoms start. Older people have a higher risk of serious illness from COVID-19, and the risk increases with age. People who have existing chronic medical conditions also may have a higher risk of serious illness.

Spectrum of Imaging Findings

The findings of HRCT chest

- GGO was the most common finding in all (present in 194 out of 200 patients)
- GGO + underlying interstitial reticular thickening and focal consolidations (present in patients with more severe clinical symptoms)
- Fibrosis (more in later stages) and traction bronchiectasis
- Distribution was predominantly bilateral, multifocal, subpleural, peripheral and more in both lower lobes
- Pleural effusion was rare (three cases out of 200, also correlated with more severe clinical symptoms)
- Complication of partial pulmonary thromboembolism was present in one case.

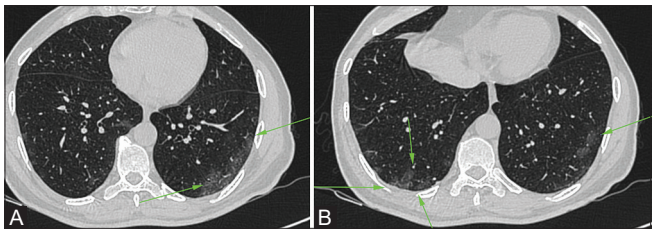

Figure 1 (A and B): (A) Mildly symptomatic patient with low-grade fever and throat pain showing classic peripheral GGOs consistent with viral pneumonitis. This patient tested RT-PCR positive done after imaging. (B) Mildly symptomatic patient with low-grade fever and throat pain showing classic peripheral GGOs consistent with viral pneumonitis. This patient tested RT-PCR positive done after imaging

Figure 3: An elderly patient with multiple comorbidities and severe breathlessness and fever showing bilateral GGOs, underlying interstitial fibrosis and traction bronchiectasis. Patient had tested positive with RT-PCR after the scan and unfortunately, this patient died due to respiratory complications after 4 days of scans. ARDS type of imaging findings is not typical and frequent finding in COVID-19 infection

Patients with mild clinical symptoms (like low-grade fever, cough, tiredness, anosmia, and throat pain) showed classic peripheral GGO [Figures 1A, B and 2]. As the severity and duration of symptoms increased, dense focal consolidations, reticular thickening, and fibrosis were seen [Figures 3 and 4]. CT thorax with contrast and pulmonary angiography was done in one patient with high suspicion for pulmonary thromboembolism [Figure 5A and B] which showed partial pulmonary thromboembolism along with other typical and atypical HRCT chest findings. Atypical and less common findings in our study included pleural effusions and acute respiratory distress syndrome (ARDS) type of HRCT chest findings [Figure 3].

Figure 2: Mildly symptomatic patient with fever and mild chest pain showing classical sign of bilateral GGO. RT-PCR was not done on this patient and the patient was asked to remain in isolation and receive treatment at home. The patient's condition has improved since

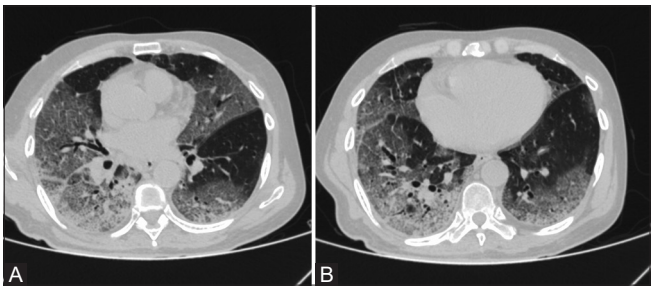

Figure 4 (A and B): (A) GGO, interstitial thickening, crazy paving and traction bronchiectasis in markedly symptomatic patient having high-grade fever and breathlessness. RT-PCR proven case of COVID infection. (B) GGO, interstitial thickening, crazy paving and traction bronchiectasis in markedly symptomatic patient having high-grade fever and breathlessness. RT-PCR proven case of COVID infection

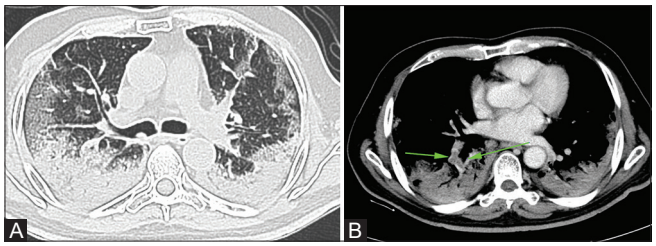

Figure 5 (A and B): (A) This patient had severe breathlessness with fever and increased D-dimer. Imaging findings showed peripheral GGOs and consolidations on lung window. In this patient, initial RT-PCR was negative; however, after high clinical suspicion and positive imaging findings, repeat RT-PCR was done which turned out to be positive. (B) This patient had severe breathlessness with fever and increased D-dimer. Contrast images in soft tissue window showed partial pulmonary thromboembolism (arrow marks). In this patient, initial RT-PCR was negative; however, after high clinical suspicion and positive imaging findings, repeat RT-PCR was done which turned out to be positive

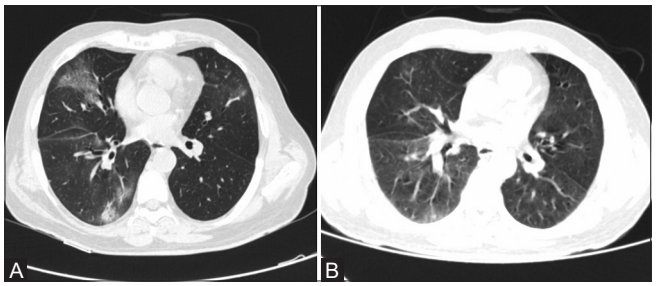

Figure 6 (A and B): (A) Initial HRCT chest of a symptomatic RT-PCR proven COVID patient showing GGOs, focal consolidation, and mild fibrosis in bilateral lungs. (B) HRCT chest of the same patient done 10 days later shows marked resolution of GGO and fibrosis. Patient had improved clinically

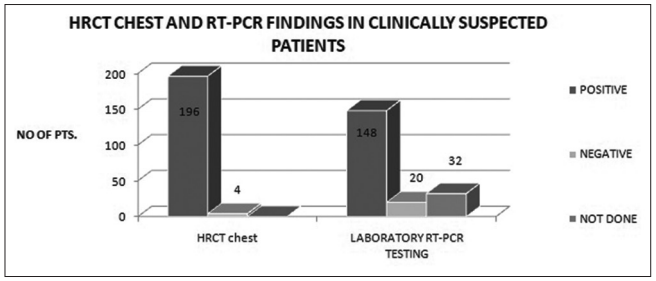

Chart 1: Results of HRCT findings and laboratory RT-PCR findings of 200 patients

Role of CT in diagnosis and follow-up?

RT-PCR has been considered the gold standard test for diagnosis of COVID-19. There has been reported a high false-negative rate[6] this high false-negative test increases the risk of further transmission as well as delays the timely management of suspected cases.

CT plays a major role in the detection of parenchymal pneumonic patches. The detection of patches of viral pneumonia/pneumonitis is one of the most important diagnostic criteria for the suspected cases.

CT has been reported to have high accuracy in reference to the RT-PCR.[3]

It is suggested that if the patient is found to have an epidemiological history, clinical features, and viral pneumonia features suspicious for COVID-19 on HRCT chest, then they should be considered as positive for COVID-19 infection, despite having a negative RT-PCR test.

In our view, HRCT chest can be considered as a major means to diagnose COVID-19 infection even before receiving the RT-PCR tests results.

HRCT chest can be considered if a large amount of the population is waiting for the RT-PCR test to be performed, due to shortage of kits or a delay in the results, as well as in cases of false-negative results.

HRCT chest can also give us the extent of lungs involved and thus further help in managing the patient. Patients with moderate and severe lung involvement on HRCT chest were generally hospitalized and higher aggressive treatments were used (steroids, low-molecular weight heparin or similar drugs, tocilizunab, remdesivir, etc.).

Follow-up HRCT chest was done in eight patients with improving symptoms after an interval of 7–12 days and showed improvement in HRCT chest findings [Figure 6A and B].

Chest X-ray was done in 70 of these patients, 1–2 days prior to CT scan and had positive findings in 42 patients (most of them having significant CT scan findings).

Conclusion and Suggestions

Our study showed HRCT chest scan to be positive in 98% cases with clinical suspicion and symptoms.

The sensitivity of chest CT in suggesting COVID-19 was 98.6% based on positive RT-PCR results.

HRCT chest is very sensitive and accurate in picking up lung parenchymal abnormalities in laboratory negative RT-PCR cases with high clinical suspicion of COVID-19 infection and also in all symptomatic patients where RT-PCR was not done.

HRCT can also be cost-effective and time-effective in screening patients with high clinical suspicion. HRCT scores over RT-PCR in giving immediate results, assessing severity of disease, and prediction of prognosis.

We suggest HRCT chest for detection of early parenchymal abnormalities, assessing severity of disease in all patients with clinical symptoms and suspicion of COVID infection irrespective of laboratory RT-PCR status.

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Conflicts of interest

There are no conflicts of interest.

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