

High-Resolution Computed Tomography (HRCT) Thorax in Covid-19 Pneumonia.

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Abstract

Background: Covid-19 disease has become a dreadful and deadly disease over last one year with numerous methods described in recent medical literature for early diagnosis and monitoring the course of disease. High-resolution computed tomography (HRCT) thorax findings in Covid-19 pneumonia have been described with high specificity & moderate sensitivity.

Aims & Objectives: We conducted this study with the aim and objectives of determining the common pulmonary radiological findings in HRCT thorax of Covid-19 patients and their relationship with category of clinical symptoms as well as correlation with CT severity score.

Materials and Methods: This retrospective, observational & cross-sectional study included HRCT thorax of 100 cases proven to be RT-PCR positive for Covid-19 disease. The spectrum of pulmonary findings was noted along with their frequency in different symptom category of patients. CT severity score was also correlated with category of symptoms.

Results: Approximately two-third patients in our study revealed radiological findings on HRCT thorax with GGO being the commonest finding followed by consolidation & characteristic signs in the decreasing order of frequency. More than half of patients in mild and more than 90% patients in moderate category revealed findings on HRCT thorax with average CT severity score of <10 in mild and >11 in moderate category of symptoms.

Conclusions: Though HRCT thorax cannot be used as a screening tool for diagnosis of Covid-19 disease owing to its moderate sensitivity yet its high degree of specificity especially in moderate category of patients makes it useful in objective assessment during treatment as well as in predicting the prognosis of patients high CT severity score.

Key words: High-resolution, computed tomography, thorax, Covid-19, pneumonia

Introduction

It has been more than a year since the pandemic of Covid-19 has gripped the entire world. The organ most commonly related to Covid-19 morbidity is lung which reveals a rapidly progressive disease manifesting in form of breathing difficulty or poor oxygen saturation of the blood. Radiologically, a constellation of imaging findings has been demonstrated to be characteristic though non-specific to Covid-19 [1]. Though reverse transcription polymerase chain reaction (RT-PCR) is considered as a gold-standard test for diagnosis of Covid-19 disease, yet it has a moderate

sensitivity especially early in disease [2]. During this period, it has been shown by multiple studies that characteristic imaging findings on high-resolution computed tomography (HRCT) thorax in right clinical settings can help diagnose Covid-19 disease and suggest the likelihood of the disease [3,4]. Also, if imaging findings are characteristic, it can help stage the disease and its prognosis [5,6].

Based on the above facts, we conducted this study to evaluate the frequency of these characteristic imaging findings in Covid-19 disease.

Aim

To determine the common pulmonary findings in high-resolution computed tomography thorax in Covid-19 patients.

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Objectives

- To determine the common pulmonary findings of Covid-19 disease on high-resolution computed tomography thorax.
- To determine the frequency of common pulmonary findings of Covid-19 disease on high-resolution computed tomography thorax

Materials and Methods

This retrospective, hospital-based, observational, cross-sectional study included 100 patients that underwent high resolution computed tomography of thorax over a period of six months using strict inclusion criteria.

Inclusion Criteria

All RT-PCR positive Covid-19 patients with HRCT thorax of optimal quality within 5 days of clinical presentation.

There were no exclusion criteria

Besides the demographic data, the category of Covid-19 disease based on symptoms was noted as mild, moderate or severe. The radiological findings were recorded in a predesigned format with calculation of CT severity score (maximum score is 25) as given in Image 1 [4]. Finally, the frequency of the common radiological pulmonary findings was calculated and compared with that existing in the medical literature.

Image 1 shows CT severity score system [5]

Severity Score	Pulmonary involvement (Based upon summation of the affected portions of all lungs lobes)
1	Less than 5%
2	5-25 %
3	25-50 %
4	50-75 %
5	More than 75%
0	No evidence of pulmonary involvement

Observations, Results and Analysis (Image 1-3)

Age & Gender - Distribution

In our study, the median age was of patient population was 47 years while mean age was 51 years with majority being males (65/100).

Table 1 shows the distribution of patients based on the category of symptoms. Our study group had majority of patients in mild category followed by moderate with no representation of severe category.

Table 2 shows the distribution of patients showing

radiological findings according to category of symptoms in our study population. It is evident that only 68% patients in our study revealed radiological findings with majority in the mild category. It is also evident that a significant number of patients with mild symptoms i.e. 45% did not reveal any significant radiological findings while majority of the patients in moderate category revealed radiological findings.

Table 3 and images 2-5 show the various common pulmonary radiological findings noted in our study population with their frequencies. It is evident that the bilateral, peripheral, ground glass haziness (GGO) was the commonest findings noted in all 68 patients (100%) followed by patchy areas of consolidation (nearly 31%) and various characteristic signs (vascular dilatation or thickening sign - thickening or dilatation of vessels within GGO and reverse-halo sign - lucent area surrounded by ground glass haziness) seen in only 28%.

Table 1: Shows distribution of patients based on category of symptoms

Category of Symptoms	No. of Patients
Mild	67
Moderate	33
Severe	0
Total	100

Table 2: Shows distribution of patients with radiological findings based on category of symptoms

Category of Symptoms	No. of Patients with Radiological Findings
Mild	37 (55%)
Moderate	31 (94%)
Total	68 (68%)

Table 3: Shows distribution of patients showing various radiological findings

Radiological Findings	No. of Patients
GGO	68
Consolidation	21
Characteristic Sign	19

Table 4 shows distribution of radiological findings in the mild and moderate category of patients in our study. It is evident that the GGO was seen in 37/67 patients with mild symptoms and 31/33 of moderate symptoms. Consolidation was seen only in patients with moderate symptoms (17/31). Characteristic signs were commoner in patients with moderate symptoms.

Table 5 shows the distribution patients in mild & moderate

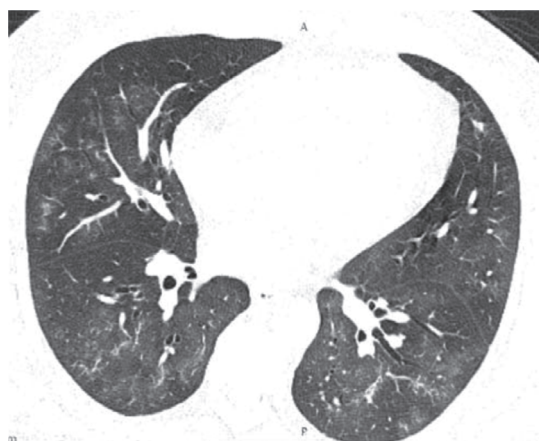


Image 2: HRCT Thorax showing multifocal GGO in both lungs in Covid-19 patient with mild category of symptoms

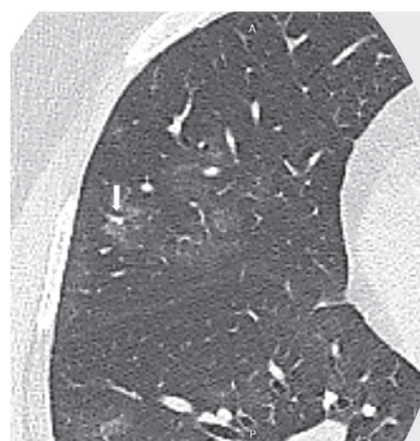


Image 3: HRCT Thorax showing vascular thickening in Covid-19 patient

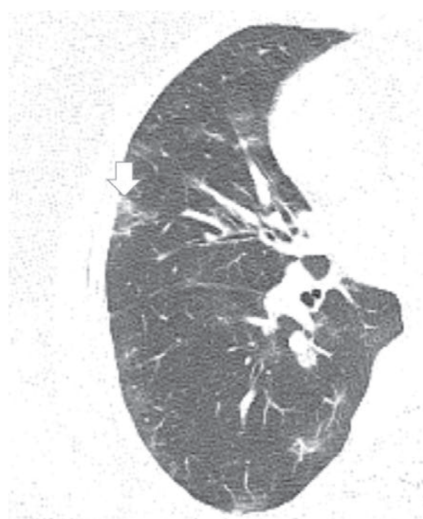


Image 4: HRCT Thorax showing reverse halo sign in Covid-19 patient

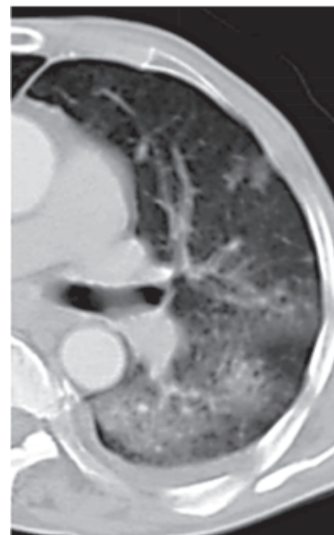


Image 5: HRCT Thorax showing GGO progressing to consolidation in Covid-19 patient

Table 4: Shows distribution of radiological findings based on category of symptoms

Radiological Findings	Mild Symptoms	Moderate Symptoms
GGO	37	31
Consolidation	0	17
Characteristic Sign	4	15

Table 5: Shows distribution of patients based on CT severity score and category of symptoms

CT Severity Score	Mild Symptoms	Moderate Symptoms
1-5	22	0
6-10	15	6
11-15	0	23
16-20	0	2

category of symptoms based on CT severity score. It is evidence that all patients with mild symptoms had a CT severity of <10 while majority, 23/31 (74%) of moderate category patients had CT severity score of 11-15.

Discussion

Covid-19 disease is commonly associated with pulmonary involvement manifesting radiologically as characteristic bilateral, diffuse, peripherally-located GGO that may progress to consolidation in moderate to severe category [7]. Significant number of patients with covid-19 pneumonia show vascular thickening within GGO [5]. These findings are commonly seen in patients who are symptomatic with progressive increase in CT severity score with increasing severity of symptoms [6].

In our study, a significant number of patients (31/67-45%) with mild disease had no radiological findings similar to that reported in literature indicating that HRCT thorax cannot be used as a screening tool for suspected cases of Covid-19 pneumonia owing to its low to moderate sensitivity [5,8,9]. In contrast, approximately 94% of patients with moderate category of symptoms revealed radiological findings.

Furthermore, GGO was the commonest findings seen in mild as well as moderate category of symptoms followed by consolidation similar to that reported in my studies in review articles [3]. Consolidation was a feature of moderate category only. Characteristic signs like vascular thickening or dilatation signs and reverse halo sign were however seen in nearly one-quarter of patients with radiological findings [5].

We also noted that the average CT severity score increased from mild to moderate category of symptoms. In our study, the average score in mild category was less than or equal to 10 while in moderate category, it was 11-15. Again, the results of our study are similar to that reported by Francone M. et al [6]. They also reported that CT severity score of >18 is associated with grave prognosis in Covid-19 pneumonia, the parameter that could be evaluated in our study owing to non-representation of group of patients with severe category of symptoms. CT severity score hence can be used as an objective tool for monitoring patients with score in moderate category of symptoms.

Limitations of the study

- Our study is a retrospective, hospital-based and cross-sectional study.
- Asymptomatic Covid-19 patients were not included in the study.
- Severe symptomatic patients were not represented in our study.

Conclusions

- Covid-19 disease is commonest in 5th decade and in males.
- Multifocal, bilateral peripheral areas of ground glass haziness is the commonest finding followed by pneumonic consolidation.
- Vascular dilatation and reverse halo sign are seen in less than one-quarter of symptomatic patients with Covid-19 disease.
- Covid-19 patients in mild category may show HRCT findings in slightly more than 50% while those with moderate disease show findings in nearly all cases.
- CT severity score increases with severity of symptoms.

Summary

Covid-19 disease shows a high degree of morbidity and mortality related to pulmonary affection. The latter may be in form of variable degrees of multifocal, bilateral, peripheral areas of ground glass haziness and patchy pneumonic consolidation. Vascular dilatation and reverse halo sign though characteristic but are seen in less than quarter of patients. Characteristic imaging findings on HRCT thorax may help diagnose Covid-19 disease in early stages especially when RT-PCR test is negative, but patient is typically symptomatic. Imaging findings also help in predicting the prognosis of disease as well as in monitoring the patient

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