

ORIGINAL RESEARCH

Study of High-Resolution Computed Tomography Findings in Covid -19

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ABSTRACT

Background: Coronavirus Disease 2019 (COVID-19) is caused by a novel corona virus called SARS-CoV. Reverse transcription–polymerase chain reaction (RT-PCR) test remains the reference standard to make a definitive diagnosis. However few COVID-19 patients with pulmonary involvement on computed tomography have negative results of RT-PCR, owing to limitation of nucleic acid detection technologies, sampling errors and low virus load. Therefore, the aim of this study was to analyse the key features of HRCT imaging in patients with COVID 19. **Aims and objectives:** To study various HRCT findings in COVID 19 patients.

Materials and Methods: A descriptive study was done from January 2021 to June 2021 at department of Respiratory medicine at tertiary care hospital in Mysore. The study included 100 patients who were laboratory confirmed cases of Covid 19 and who were subjected to HRCT chest as per guidelines.

Results: In our study, we found that, 24 (24%) patients had 0 lobe involvement and the rest 75 (75%) had at least one lobe being involved. 48 (48%) patients had all 5 lobes involved. Of the 76 patients, who had abnormality in HRCT, showed sub pleural 48 (63.1%) involvement, Centro parenchymal involvement in 2 (2.6%), both were involved in 26 (34.2%). The most common pattern being GGOs with or without consolidation with a total distribution of (71%), other findings included to be interseptal thickening [22%], pure consolidation with air bronchogram [8%], nodular thickening [3%], cavities [3%].

Conclusion: Presence of GGO with or without consolidation should be considered as a strong suspicion of COVID 19 and patients be treated accordingly.

Keywords: COVID 19, HRCT, Ground glass opacity, consolidation.

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INTRODUCTION

On 31st December 2019, there was an outbreak of mysterious infection in the city of Wuhan belonging to Hubei province of China.^[1] The causative factor of this infection was identified to be a new type of corona virus, which was named as 2019-nCoV temporarily.^[2,3] On February 11, 2020, the International Committee on Taxonomy of Viruses (ICTV) proposed to name the new virus SARS-CoV-2 and the infection caused by this virus as SARS-CoV-2 infection COVID-19.^[4] It has been 2 years since the outbreak of the pandemic affecting all

countries in the world. Approximately 17 crore people have been affected globally of which 3 crore Indians have been affected with total deaths 3.9 lakhs.^[5,6] The human-to-human transmission of virus occurs through respiratory droplets, direct contact, and even a fecal–oral route.^[7,8] The symptoms of this disease include running nose, fever, cough, myalgia, headache, fatigue, certain set of people have also experienced pain abdomen, diarrhea, generalized weakness.^[7-9]

Currently, reverse transcription–polymerase chain reaction (RT-PCR) test of upper and lower respiratory tract is considered as gold standard for diagnosis of COVID-19 infection.^[10] The principle of the test is to qualitatively detect nucleic acid of SARS-CoV-2 from the collected specimens.^[10] However, several studies claimed that individuals who had pulmonary infiltrates in chest xray and symptomatology of COVID-19 showed negative for RT PCR initially and later were turned out positive when repeated.^[11] There could be multiple factors owing to false-negative RT-PCR results, early sample collection, inappropriate methods of sample collection, low viral load in patients, limitation of nucleic acid detection technologies are few to name.^[11] These limitations cause an increase spread by free movement of highly suspected cases who are not yet identified and quarantined.^[11] Hence, imaging plays a novel role in the diagnosis and follow-up of patients. CT is preferred imaging modality in clinically suspected cases because of its high-definition images when compared with chest Xray. CT helps in diagnosis, classifying severity and in monitoring prognosis during treatment.^[12-16] Therefore, CT has been considered as an effective diagnostic tool for clinically suspected COVID-19.^[17] Hence, this study is set out to highlight the importance of use of CT scan in ongoing pandemic crisis for the efficient diagnosis of the infection so that the patients can be isolated and treated early, which in turn will improve the prognosis, decrease mortality and ultimately improve the outcome of the disease.

MATERIALS & METHODS

Study Design: This study is a descriptive study done at Department of Respiratory Medicine in collaboration with Department of Radiodiagnosis, Mysore Medical College and Research Institute, Mysore for a duration of 6 months from January 2021 to June 2021.

Study Population: The study population included both male and female patients of more than 18 years' age group who were tested SARS-CoV-2-positive by RT-PCR. Care was taken to see that study population met the inclusion and exclusion criteria.

Inclusion Criteria:

- Age >18 years
- Laboratory confirmed covid-19 positive status
- Willing to give informed consent

Exclusion criteria:

- Age <18 years
- Not willing to give informed consent

A detailed history was taken from the patients. After obtaining informed consent from the patients, they were subjected to High Resolution Computed Tomography of thorax.

Scanning protocol: The scan orientation was cranio caudal, that is, the scanning was done from both apices of the lung to adrenals using High Resolution Computed Tomography of thorax with 128 slice single source dual energy Somatom Definition Edge Siemens MDCT (Multidetector CT) machine. Patient was in supine position with arms above head during the procedure and following parameters were used: 20 mA, 100 kV, slice thickness 0.6mm. The images were reconstructed to obtain 0.6mm section in sagittal and coronal planes.

All the scans were evaluated for number of lobes involved, patterns, its distribution in each lobe.

Statistical analysis:

The collected data were entered in Microsoft excel sheet. The results were presented in figures, tables, frequency graphs and pie charts. The statistical analysis was done using SPSS 21.0.

RESULTS

HRCT findings:

In this study, the total number of patients was 100. After statistical analysis the results were as follows: Of these 100 patients, 76 (76%) patients showed abnormalities in HRCT and 24 (24%) had normal HRCT. In this study the youngest patient was 19 years old and the eldest patient was 77 years old. The most common age group affected was the 4th decade (41-50years). Of these 100 patients 67 (67%) were male and 33 (33%) were females, male preponderance was found in our study. In our study, we found that, 24 (24%) of patients had 0 lobe involvement and the rest 75 (75%) had at least one lobe being involved, and 48 (48%) patients had all 5 lobes involved. Of the 76 patients, who had abnormality in HRCT, showed sub pleural 48 (63.1%) involvement, Centro parenchymal involvement in 2 (2.6%), both were involved in 26 (34.2%). The most common pattern being GGOs with or without consolidation with a total distribution of (71%), other findings included to be interseptal thickening [22%], pure consolidation with air bronchogram [8%], nodular thickening [3%], cavities [3%], lymphadenopathy [41%], crazy-pavement appearance [3%], bronchial wall thickening [3%], linear opacities [1%] and pleural effusion [8%] and pericardial effusion [1%]. The CT scoring in our study, had a distribution of, 50 (50%) to have mild score in HRCT with a scoring of [0-7], 32 (32%) belonged in the moderate group (8-17) and 18 (18%) had severe disease with severity of score (>18).

HRCT findings in correlation with co morbidities:

Of the 100 patients in our study, 69 (69%) of patients had no history of comorbidities, 8 (8%) had only diabetes mellitus, 3 (3%) had only hypertension, 20 (20%) had both diabetes and hypertension. Of 69 patients without comorbidities, 44 (63.8%) were males and 25 (36.2%) were females. Of 8 patients who suffered from T2DM, 4 (50%) were males and 4 (50%) were females. Of 3 patients who suffered with HTN 2 (66.7%) were male and 1 (33.3%) was female. Of 20 patients who suffered from both 17 (85%) were male and 3 (15%) were females. The lobar involvement was described as follows, of 69 patients with no co morbidities 20 (29%) had normal HRCT, while 28 (40.6%) had all 5 lobes involved. Whereas, in patients who had T2DM alone and HTN alone had at least one lobe involved, and of patients who had both the comorbidities only 4 (20%) showed normal HRCT and 14 (70%) showed all 5 lobes were involved. While most common lobe to be involved was bilateral lower lobes with Right Lower Lobe being involved in 67 (67%) cases and Left Lower lobe being involved in 69 (69%) cases. There was no significant change in the pattern was observed in individuals' with co morbidities with GGOs being as predominant feature in their scans too. Out of 69 patients without co morbidities, 42 (60.9%) had mild scoring of [0-7], 17 (24.6%) had moderate scoring of [8-17], 10 (14.5%) had severe disease with a score of [<18]. Out of 8 people who had HTN only, 4 [50%] had mild disease, 3 [37.5%] had moderate disease, 1 [12.5%] had severe disease. Out of 3 only T2DM patients 0% had mild disease, 2 had [66.7%] moderate disease, 1 [33.3%] had severe disease. Out of 20 patients

who have both T2DM and HTN, 4 [20%] had mild disease, 10 [50%] had moderate disease, 6 [30%] had severe disease.

Table 1: Pattern of HRCT in Covid 19 patients

GGOs	71%
Lymphadenopathy	41%
Consolidation with air bronchogram	8%
Nodular thickening	3%
Cavities	3%
Crazy pavement pattern	3%
Bronchial wall thickening	3%
Pleural effusion	8%
Pericardial effusion	1%
Linear opacities	1%

Table 2: CT Severity Score

Mild	50%
Moderate	32%
Severe	18%

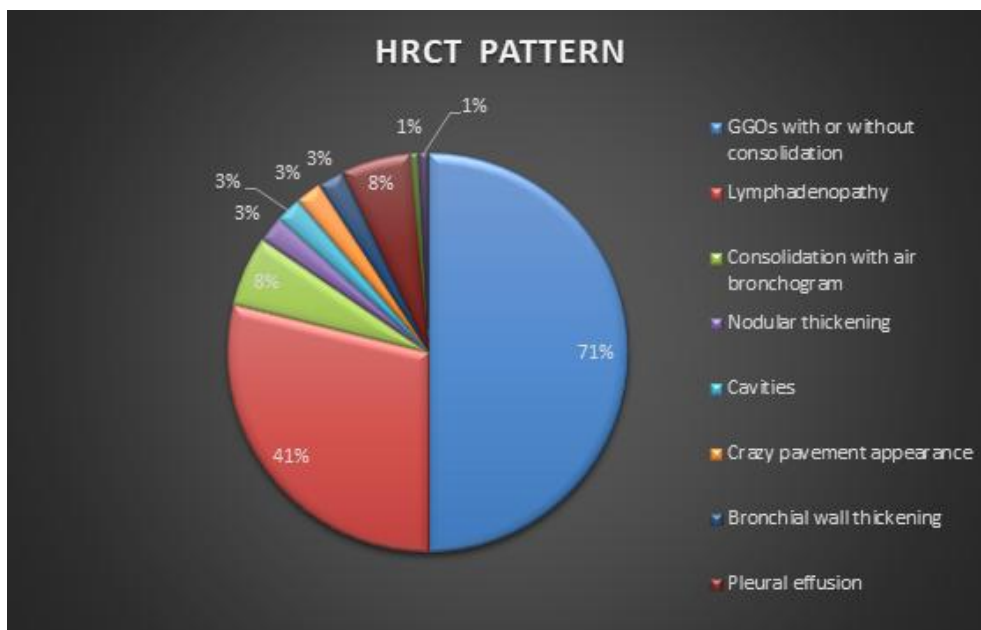


Figure1: Distribution of HRCT pattern in Covid 19 patients.

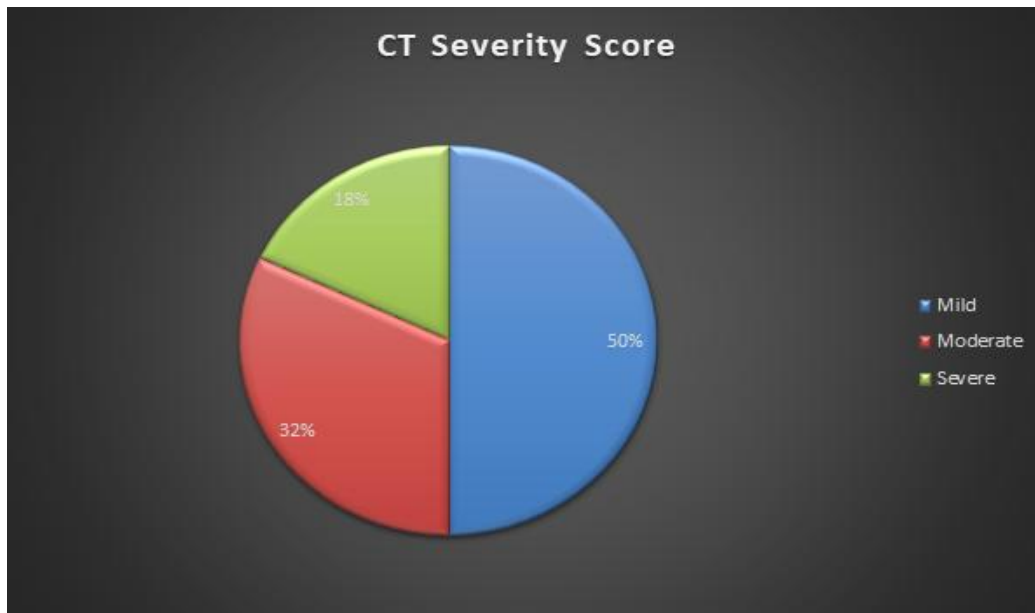


Figure 2: Distribution of CT Severity Score in Covid 19 patients.

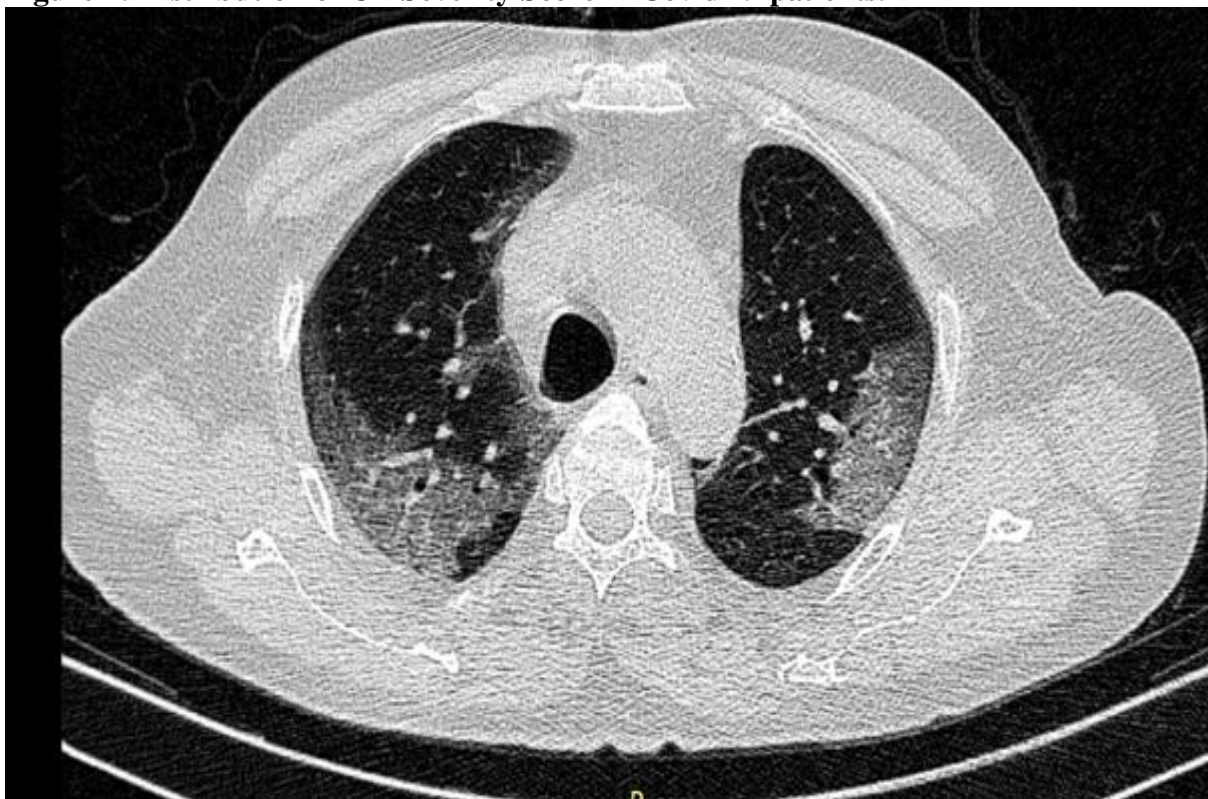


Figure3: CT chest showing ground glass opacities

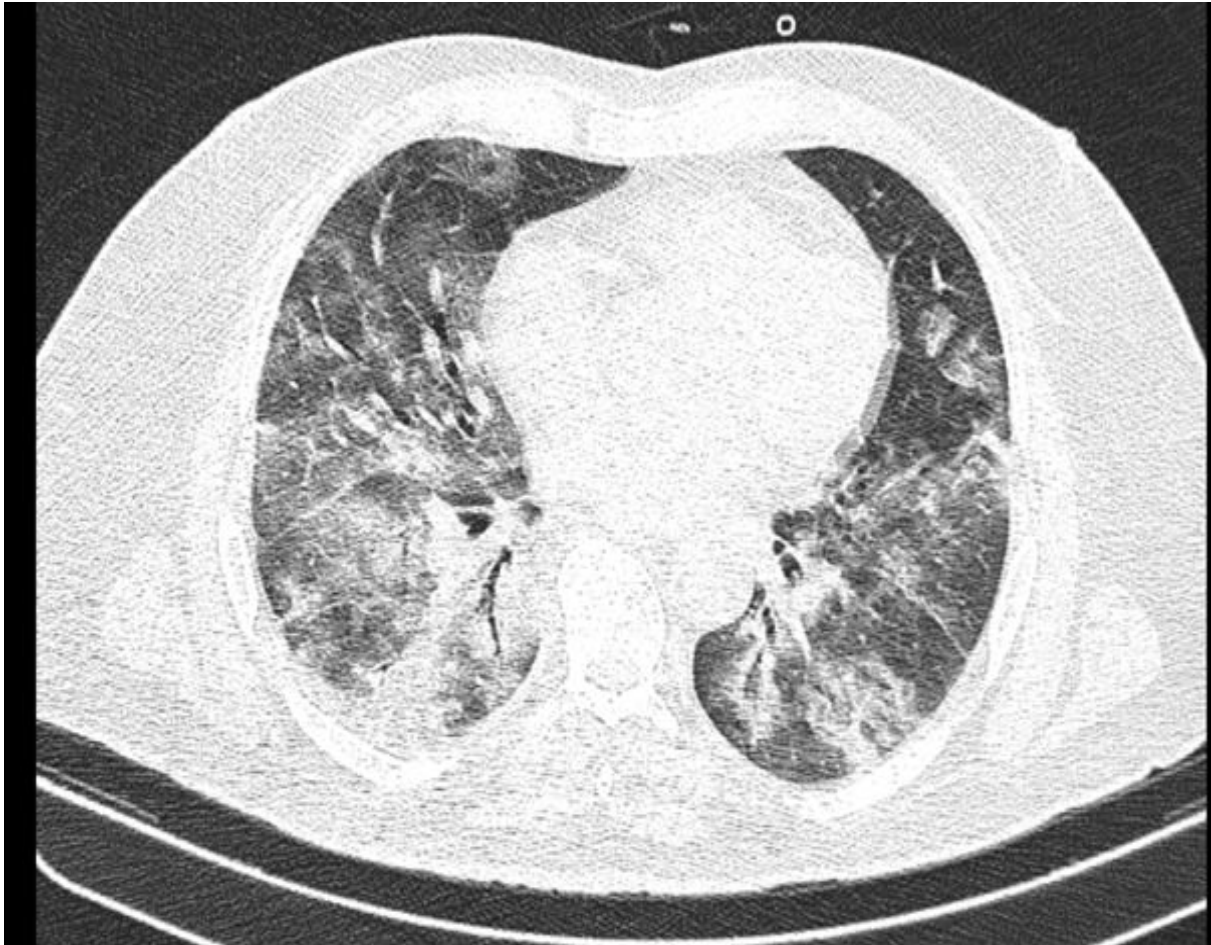


Figure4: CT chest shows consolidation with air bronchogram



Figure 5: CT chest showing crazy pavement pattern

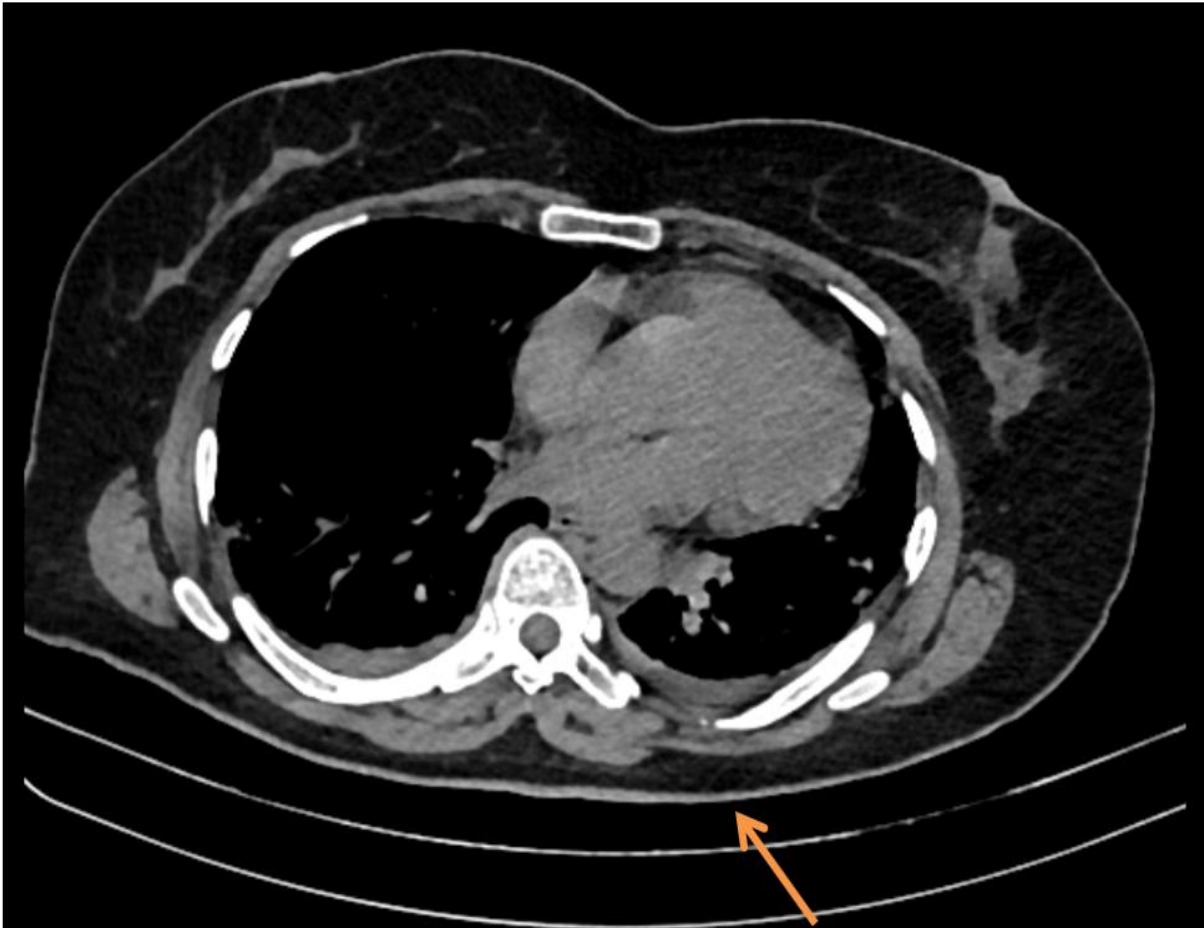


Figure 6: CT chest showing bilateral pleural effusion

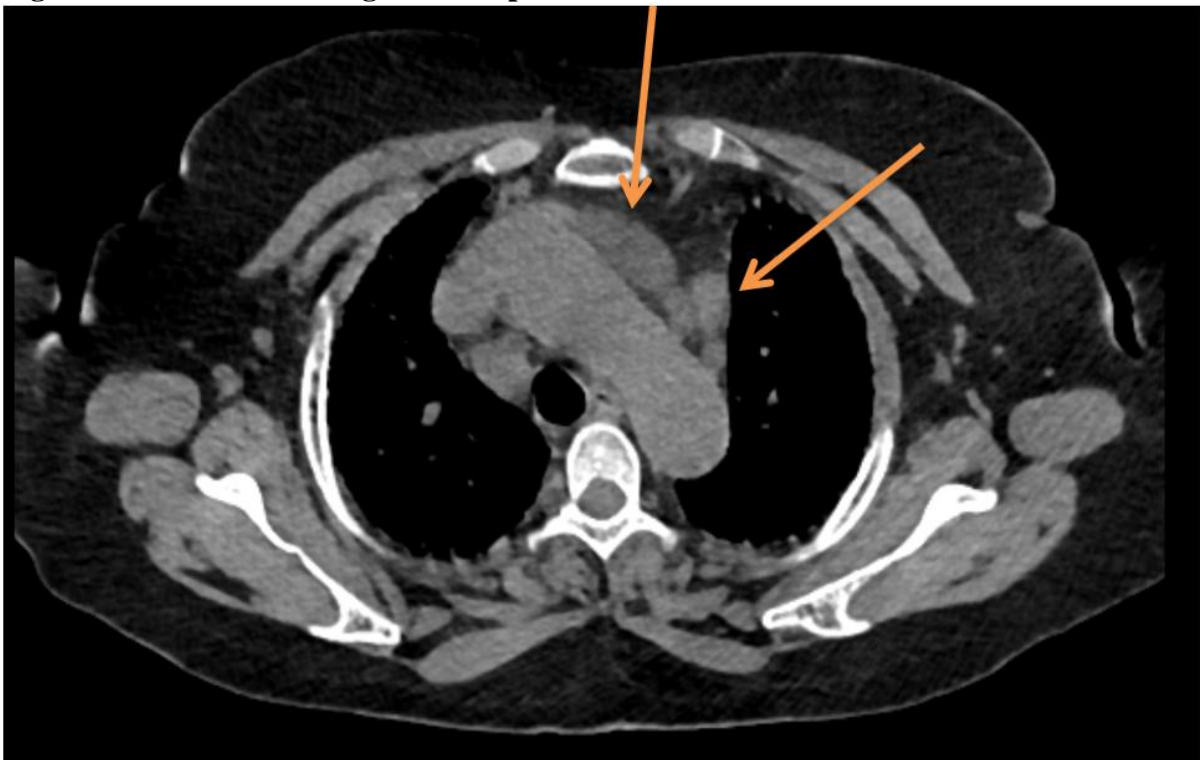


Figure 7: CT chest shows minimal pericardial effusion and mediastinal lymphadenopathy

DISCUSSION

In the current ongoing pandemic of COVID 19 infection, CT imaging can be utilised in early diagnosis, stratification, and follow-up of patients with COVID-19. Our preliminary objective of the study was to demonstrate HRCT features of COVID-19, which involves the presence of ground glass opacities (GGOs) in bilateral lungs with a predominantly sub pleural distribution that may coalesce into dense, consolidative lesions as the infection progresses, which is consistent with other studies.^[18-21] As the disease progresses, the number of lesions increase exponentially and extend to central areas often involving more than one lobe, with the left lower lobe being more often involved as compared to other study.^[21]

Alongside the above-mentioned pattern, the findings included, interseptal thickening, pure consolidation with air bronchogram, nodular thickening, cavities, lymphadenopathy, crazy-pavement appearance, bronchial wall thickening, linear opacities, pleural effusion and pericardial effusion, in contrast to one study done by Wang et al, where all the 138 patients included in the study had GGOs.^[22]

Halo and reverse halo sign which were encountered in studies were not documented in our study.^[23,24]

Of note, the HRCT pattern in COVID-19 closely resemble those of MERS and SARS leading to a notion that it is a part of the acute lung injury caused by viral pneumonia who belong to the same class as that of corona virus.^[25]

It is to be noted that, the current reference standard for the diagnosis is RT-PCR of the nasopharyngeal swabs for the diagnosis of COVID-19. However, one can anticipate delay in the reports owing to the burden caused by the ongoing pandemic, also the high false negative rate can easily contribute to the free spread of the virus. Moreover, patients with pneumonia due to COVID-19 may have lung abnormalities on chest CT but an initially negative RT-PCR.^[25] Hence, HRCT thorax serves as an addition to RT-PCR and has been shown to have high sensitivity to diagnose this condition early. Currently according to Indian guidelines, imaging is not routinely indicated in asymptomatic patients for screening or in low-risk patients with mild clinical symptoms. Imaging is indicated in a patient with COVID-19 only if he/she has moderate to severe pneumonia or worsening respiratory status or is at risk of progression or those with functional impairment or hypoxemia after recovery. In these subsets, CT in combination with laboratory testing should be used judiciously to diagnose and monitor the response to treatment.

CONCLUSION

In conclusion, HRCT can be utilized as screening, prognostic tool in the diagnosis of COVID 19. The predominant finding on HRCT images included multiple ground-glass opacities with or without consolidation, with bilateral lung involvement, with multiple lobe involvement and the lower lobe affected the most irrespective of comorbid status. The individuals devoid of co morbid status had lower score with less severe disease when compared to individuals with co morbid conditions. Alongside history, clinical examination HRCT can be used not only in diagnosis but also in the prognosis of COVID 19. RTPCR can merely diagnosis the disease, but HRCT can point out the severity and also help in follow up of the patient. However, the need of exposure to radiation has to be kept in mind especially in asymptomatic individuals.

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