

Role of HRCT & Chest Radiograph in COVID19 RT-PCR Positive Cases in Assessing the Severity of Lung Involvement

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Abstract

Background: As COVID 19 infection is a pandemic affecting millions of lives all over the world, creating a lot of psychological burden to the families of affected individuals & has become one of the common causes of death in the older population at present due to its severe lung involvement. CT helps in determining presence of lung involvement, categorizing the extent of lung involvement and prognosis based on CT severity score. **Methods:** This is a prospective study in which we included 500 patients who tested positive for COVID19 infection. Examination performed in 16 slice CT GE scanner and sanitized table and CT room with 0.1 % sodium hypochlorite and UV light disinfection. We graded involvement of the lung in COVID19 positive patients based on CT imaging findings. Chest x ray radiography was taken as a first line investigation in all COVID 19 positive patients who were then referred to CT. **Results:** Results Out of 500, CT severity score >15 is seen in 48 males, 15 females, CT severity score 8-15 is seen in 83 males and 18 females, CT severity score <8 is seen in 121 males and 69 females, no lung involvement is seen in 101 males and 45 females. **Conclusions:** CT was found as a sensitive tool in assessing the involvement of lung and prognosis in COVID19 positive patients.

Keywords: COVID 19 RT PCR positive cases, HRCT, CT severity score.



INTRODUCTION

In December 2019, an outbreak of respiratory illness of unknown causation emerged in Wuhan, China spreading through human-to human contact. Later rapidly spreading to abroad, which was declared as a pandemic by WHO in March 2020. In Jan 2020, it was temporarily named novel coronavirus by WHO. Severe acute respiratory syndrome coronavirus (SARS-CoV-2) was named by the International Committee on Taxonomy of Viruses caused a pneumonia outbreak in China.^[1] Analysis of throat swab & bronchopulmonary lavage fluid samples revealed the culprit to be a coronavirus.

COVID19 infection has created a lot of psychological burden to the families of affected individuals & has become one of the common causes of death in the older population at present due to its severe lung involvement. According to current diagnostic criteria, swab test, RT-PCR is a standard & formative assessment in the diagnosis of SARS-CoV 2 infection. In February 2020, the China health commission released the guidance diagnosis & treatment of pneumonia caused by a coronavirus, which included imaging features of pneumonia & the results showed a huge increase in COVID19 cases in Hubei, indicating that HRCT had a higher detection rate.^[2]

HRCT is a non-invasive tool for assessing lung involvement, unlike RT-PCR, & is easily accessible in all well-

equipped hospitals providing monitoring to lung lesions & timely diagnosis. Chest radiograph plays a useful role in finding the presence of pathology affecting the lung. However, small lesions may not be detected in the chest radiograph. The greater resolving power of HRCT is very important for the early diagnosis of asymptomatic patients with a negative chest radiograph.^[3] The most typical clinical presentation of COVID-19 is an acute febrile respiratory infection with a dry cough, dyspnea, fatigue, and myalgia.

Aims & Objectives

The present study is aimed to assess the severity of lung involvement (i.e., no lung involvement, mild, moderate & severe lung involvement) in COVID19 RT-PCR positive patients using computed tomography, and we compared the efficacy of chest radiography and HRCT.

MATERIALS & METHODS

This present study was done in the department of radiology, Konaseema institute of medical sciences & RF, Amalapuram from 01-08- 2020 to 25-11-2020. It is an institution based, prospective study. This study is done on 500 patients with RT-PCR positive diagnosed as COVID-19 infection, which were referred for HRCT scan to the department of radiology.

Sample size calculation:

We categorized the patients into four groups children & adolescents (below 18), young adults (18-34 years old), middle-aged adults (35-54 years old),

and older adults (55 years & above) who were referred to our department of radiology, Kona Seema Institute of Medical Sciences and Research Foundation, Amalapuram during the period of Study.

Selection criteria:

All COVID-19 patients who tested positive with RT-PCR are included in this study whereas RT-PCR negative patients are excluded from this study.

Procedure & CT Protocol:

All the COVID-19 positive patients who were admitted to the Kona Seema Institute of Medical Sciences (COVID-19) Hospital & routinely underwent non-contrast HRCT examinations were screened for eligibility. The eligible patients were administered informed consent. The consented participants were enrolled in the present study. A complete clinical history of the was recorded on predesigned & pretested proforma, which included age, sex, principal presenting complaints. The machine used for the Study was GE Revolution series 16 Slice spiral CT scanner.

All patients were examined in the supine position. HRCT images were then acquired during a single inspiratory breath-hold. The scanning range was from the apex of the lung to the upper abdomen. HRCT scan parameters are X-ray tube parameters - 140KVp, 145mAs; rotation time - 0.5 second; pitch - 1.0; section thickness - 5 mm; intersection space - 5mm. Reconstruction was performed

with a slice thickness of 0.625 mm, along window with a width of 1200HU and a level of -600HU, and a mediastinal window with a width of 350 HU and a level of 40HU.

Typical findings of HRCT include multifocal ground-glass opacities,^[5] peripheral & basal distribution, vascular thickening, crazy paving pattern with or without consolidation. Atypical findings are lymphadenopathy, pleural effusion, tree-in-bud nodules.

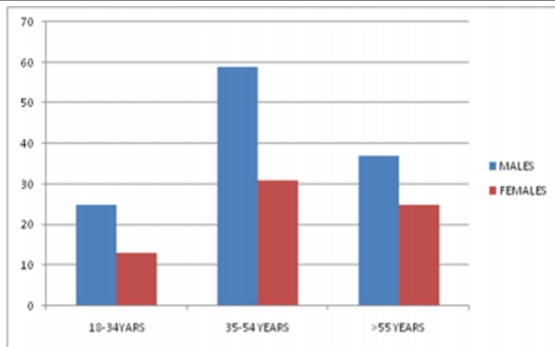
Chest radiograph findings include normal lung fields in patients with mild or no symptoms, unilateral /bilateral peripheral, basal ground-glass haze/consolidation & diffuse lung involvement in patients with severe lung involvement.

RESULTS

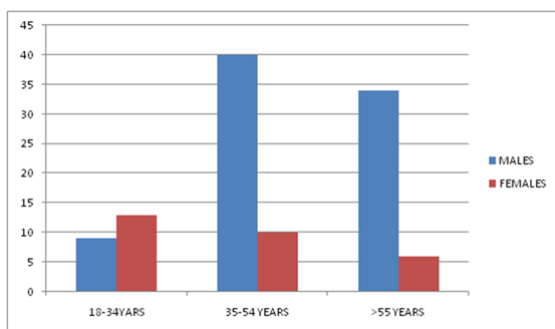
SEX	NO.OF.CASES	PERCENTAGE
MALES	353	70.6%
FEMALES	147	29.4%
TOTAL	500	



Figure 1: Categorization of patients based on sex

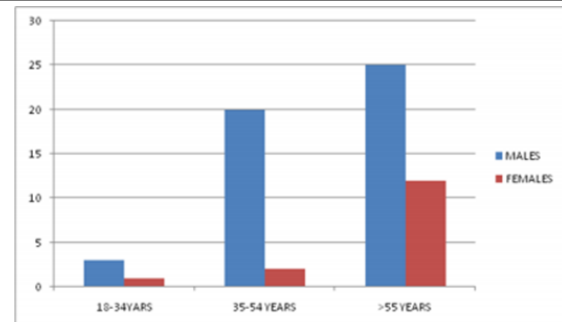


CT SEVERITY SCORE <8



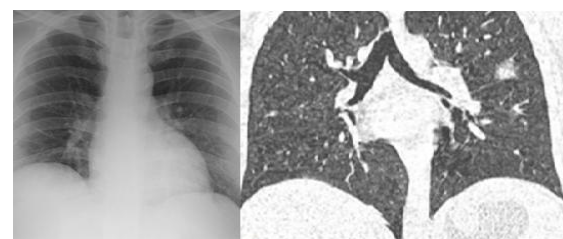
CT SEVERITY SCORE 8-15

In the present study lung involvement on the basis of CT severity score was taken & it was seen that mild infection, i.e., CT-SS < 8 was seen in 25 Males & 13 females among young adults (18-34 years old), 59 males & 31 females among middle-aged adults (35-54 years old), 37 males & 25 females among older adults (55 years & above). In case of moderate infection, i.e., CT-SS 8- 15 included 9 males & 2 females among young adults (18-34 years old), 40 males & 10 females among middle-aged adults (35-54 years old), 34 males & 6 females among older adults (55 years & above).



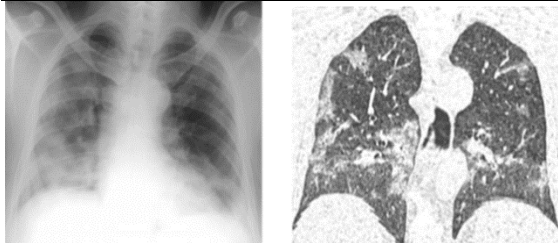
CT SEVERITY SCORE >15 Patients with no lung involvement

In case of Severe infection, i.e., CT-SS >15 included 3 males & 1 female among young adults (18-34 years old), 20 males & 2 females among middle-aged adults (35-54 years old), 25 males & 12 females among older adults (55 years & above). NO LUNG INVOLVEMENT was seen in 3 males & 3 females (under 18 years), 55 males & 22 female among young adults (18-34 years old), 26 males & 14 females among middle-aged adults (35-54 years old), 17 males & 6 females among older adults (55 years & above).

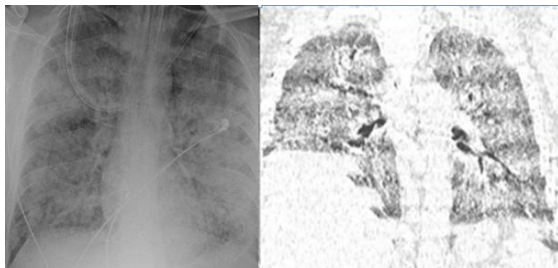


RT-PCR COVID19 positive patients showed normal frontal chest radiograph, and subsequent HRCT in coronal reformat shows

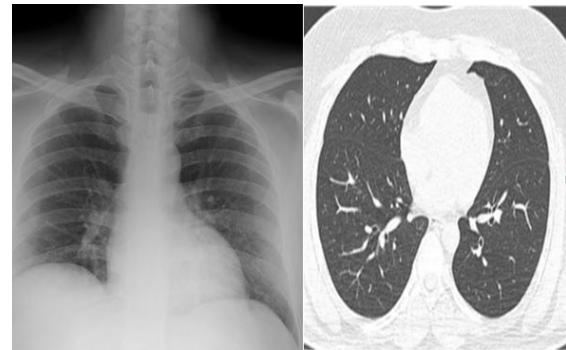
focal consolidation with surrounding ground-glass opacity in the posterior segment of left upper lobe (<5% of lung involvement)- CT severity score 1/25.



69 years old male RT-PCR positive patient with frontal chest radiograph shows multiple patchy consolidations scattered in the bilateral lung parenchyma. HRCT in coronal reformat shows multifocal peripheral & peribronchovascular ground glass opacities in right upper lobe, middle lobe, left lingula & bilateral lower lobes & associated. Interlobular septal thickening. CT SS-10/25-moderate infection



36 years male RT-PCR positive patient, frontal chest radiograph shows diffuse homogenous opacity in bilateral lung parenchyma with air bronchogram. HRCT of the same patient in coronal reformat shows diffuse ground opacity with vascular engorgement-CT severity score 25/25.



40 years male RT-PCR positive patient, frontal chest radiograph and chest HRCT shows no lung involvement

DISCUSSION

An outbreak of coronavirus disease 2019 with a zoonotic origin (COVID-19) infection began in December 2019 in Wuhan, the capital of central China's Hubei province, related to the city's Huanan Seafood Market, with the widespread human-to-human transmission. The most typical clinical presentation of COVID-19 is an acute febrile respiratory infection with a dry cough, dyspnea, fatigue, and myalgia. It was declared a global health emergency on January 30, 2020, by WHO. As per a study conducted by Suzan Omar et al.^[4] chest imaging is strongly recommended for both initial evaluation and follow-up for COVID-19 positive patients. In the early stages or in mild lung involvement, chest radiographs are of less value in the diagnosis; hence in HRCT, findings may be present early even before the onset of the symptoms. In this study also it is shown that chest radiograph, which was taken as the first line of investigation in all positive patients, is of less importance in patients who have no symptoms or



mild lung involvement in HRCT. Chest radiographs maybe helpful in the intermediate to advanced stages of COVID-19. The features of COVID-19 on chest radiograph are those of atypical pneumonia or organizing pneumonia. It is used as a modality of choice because it is cheap, readily available, and can easily be cleaned. Chest radiographs are normal in early or mild disease. According to a study by Wong et al,^[6] a chest radiograph showed abnormality with the progression of disease & with prolonged hospital stay. So the present study shows that the changes in chest radiograph were more in patients with intermediate or severe disease. Mostly chest radiograph changes were seen in patients with CT-SS > 8. The COVID-19 lung HRCT findings were described by using internationally standard nomenclature defined by the Fleischner Society glossary using terms including peripheral/focal/diffuse ground-glass opacity (GGO), crazy-paving pattern, and consolidation. Pan F et al.^[7] used a semiquantitative scoring system to quantitatively estimate the pulmonary involvement of the COVID-19 lung findings on the basis of the area involved. Each of the five lung lobes was visually scored on a scale of 0 to 5, with 0 indicating no involvement; 1, less than 5% involvement; 2, 5%–25% involvement; 3, 26%–49% involvement; 4, 50%–75% involvement; and 5, more than 75% involvement. The total CT score was the sum of the individual lobar scores and ranged from 0 (no involvement) to 25 (maximum involvement).

In this study, we have taken the patients with RT-PCR positive & studied their lung involvement by grading on the basis of CT severity score and also evaluated chest ray taken for every patient. It was found that in the patients with no lung involvement, CT-SS < 8, in few patients with CT-SS 8-15, the chest radiographs were normal, showing no abnormalities in the lung fields; however in HRCT in those patients showed some lung involvement proving that HRCT is more sensitive than chest radiograph in detecting early lung lesions. It was thus helping the treating physician for better & in time treatment. Lung involvement is seen to be more in middle-aged adults & older adults than compared to young adults. No lung involvement was mostly seen among young adults. This can help the treating physician to triage the patients based on the lung involvement & symptoms & treat them according to the priority.

CONCLUSION

Chest HRCT has a high sensitivity & low rate of missed diagnosis in patients with COVID-19 and may be useful as a standard method for the rapid diagnosis of COVID-19 to optimize the management of patients & it can improve diagnostic accuracy when compared with a chest radiograph.^[9]



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