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HRCT as a tool in assessing the effectiveness of COVID vaccine.

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Abstract:
SARS-CoV-2 was declared pandemic by WHO in 2020 march. Apart from the varied clinical features and laboratory diagnosis, HRCT of lungs played a major role in diagnosis, grading the severity of the disease, associated complications and sequelae changes. Here, we present a study done at our institute showing the imaging findings of covid pneumonia, safety and efficacy of covid vaccination. Also, how High Resolution Computed Tomography (HRCT) of lungs played a major role in conducting and analyzing this study.
Keywords: *Covid vaccine, safety and efficacy, HRCT covid pneumonia.*

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I. Introduction:

Covid 19 disease had varied clinical features ranging from cough, fever, abdominal discomfort, anosmia, flu like illness, breathlessness etc. were present in number of patients. Since it caused severe acute respiratory distress syndrome, pneumonia developed in patients having moderate to severe disease, leading to breathlessness being one of the commonest symptoms. Laboratory diagnosis involving rapid antigen testing (RAT), reverse transcriptase-polymerase chain reaction (RT-PCR) was used for detecting the disease. High Resolution Computed Tomography (HRCT) of lungs played a major role in diagnosis, grading of the disease, associated complications and sequalae changes(1). On HRCT, ground glassing was one of the most common manifestations of covid 19 pneumonia. Many of them had typical subpleural and central peri-broncho vascular distribution(2). Adjacent consolidation and interstitial septal thickening were also found in considerable number of patients(3). Depending upon the percentage of lung involves grading is done. Ever since the 2-dose vaccination drive was implemented, the population had different opinions on safety and efficacy of vaccination. The recommended dosage is two doses given intramuscularly (0.5ml each) at an interval of 8 to 12 weeks.

II. Learning Objectives:

1. To detect the involvement of lungs in covid-19 disease.
2. To grade the severity of disease on HRCT.
3. To describe the imaging findings of covid-19 pneumonia.
4. To compare the lung findings in non-vaccinated versus first dose vaccinated and second dose vaccinated cases.
5. To describe the importance of high resolution computed tomography as an imaging modality for detecting, describing, grading the severity of disease.

III. Materials And Methods:

This study was done in Apollo institute of medical sciences and research, Jubilee hills, Hyderabad, Telangana, India. 50 patients including all age groups (>18 years), both genders non-vaccinated, RT-PCR/RAT proven or having the clinical suspicion of covid-19 were taken. Another 50 patients including all age groups (>18 years), both genders first dose vaccinated, RT-PCR/RAT proven or having the clinical suspicion of covid-19 were taken. And 50 patients including all age groups (>18 years), both genders two complete doses vaccinated, RT-PCR/RAT proven or having the clinical suspicion of covid-19 were taken. HRCT was done in all patients on GE 128 slice computed tomogram (CT) machine employing 5mm slice thickness of the images. Detecting the presence of disease, if present severity of disease was studied. Study comparison was done between different groups and results were obtained. For grading of disease, scoring of the disease was done by

dividing the lungs into 5 lobes and a score of 5 each was given, adding to the maximum of 25. And upon the basis of lung involvement mild, moderate, severe grading is done(4).

PERCENTAGE OF LUNG INVOLVED IN A GIVEN SINGLE LOBE	SCORE GIVEN
<5% involvement	**1**
5-25% involvement	**2**
26-50% involvement	**3**
51-75% involvement	**4**
>75% involvement	**5**

- **Score of 1-8 = Mild disease**
- **Score of 9-15 = Moderate disease**
- **Score of 15-25 = Severe disease**

IV. Results:

Out of the 50 non-vaccinated cases, only 13 patients had normal lung findings on HRCT, whereas 37 patients had covid findings of which 30 patients had moderate to severe disease (DIAGRAM- A). On the other hand out of the 50 first dose vaccinated patients 21 patients had normal lung findings, 29 patients had lung findings of covid pneumonia of which 21 patients had moderate to severe disease(DIAGRAM - B). Out of the 50 two dose vaccinated patients 40 patients had normal lungs, whereas 10 patients had findings for covid out of which 6 patients had moderate to severe disease(DIAGRAM - C). Some of the patients had complications such as pneumothorax in severe cases. A smaller proportion of patients showed sequelae changes. Some of the patients had an overlap of other infective/non-infective etiology(Fig.4).

DIAGRAM – A

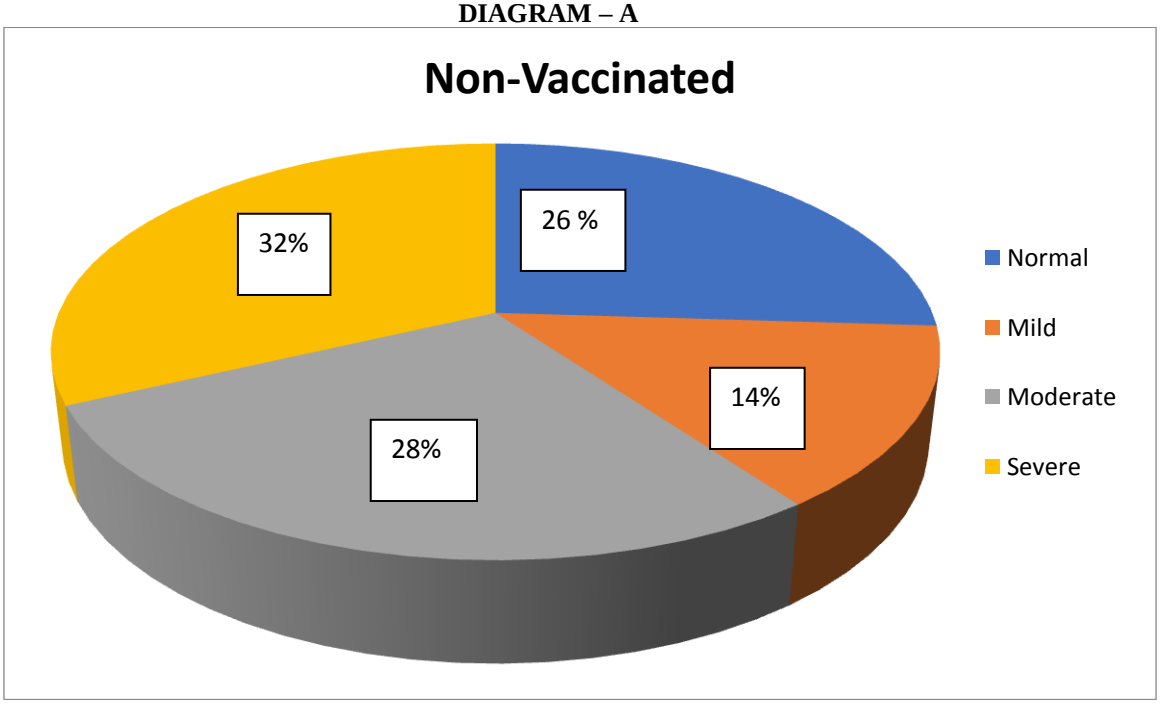


DIAGRAM – B

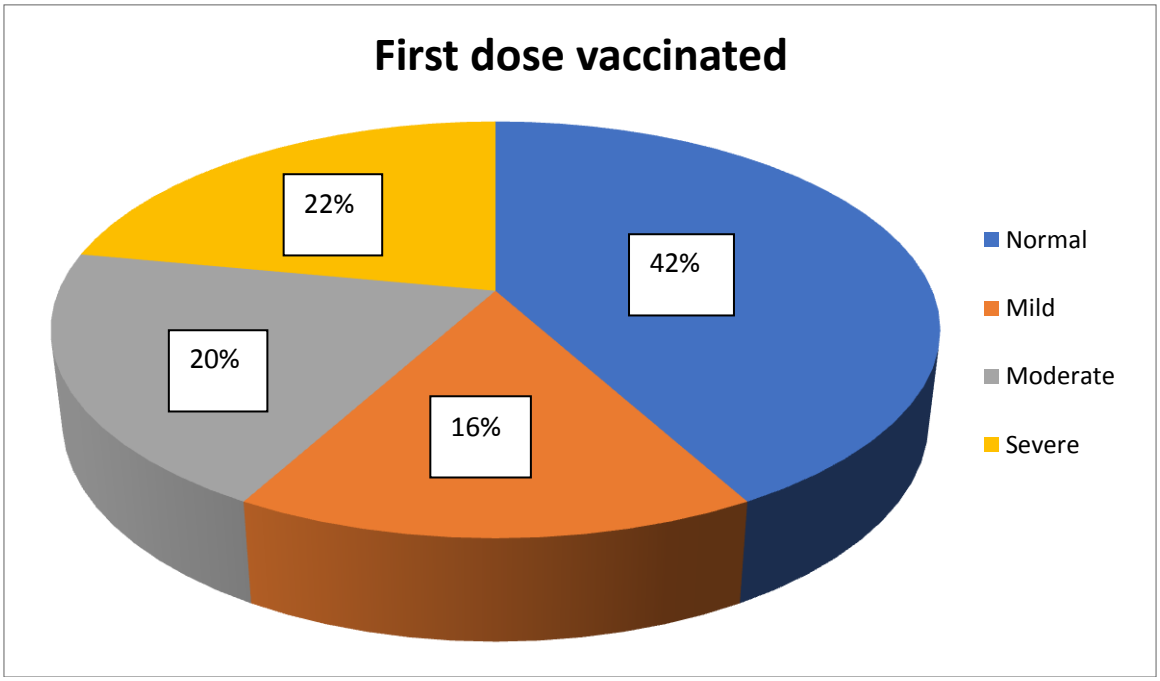
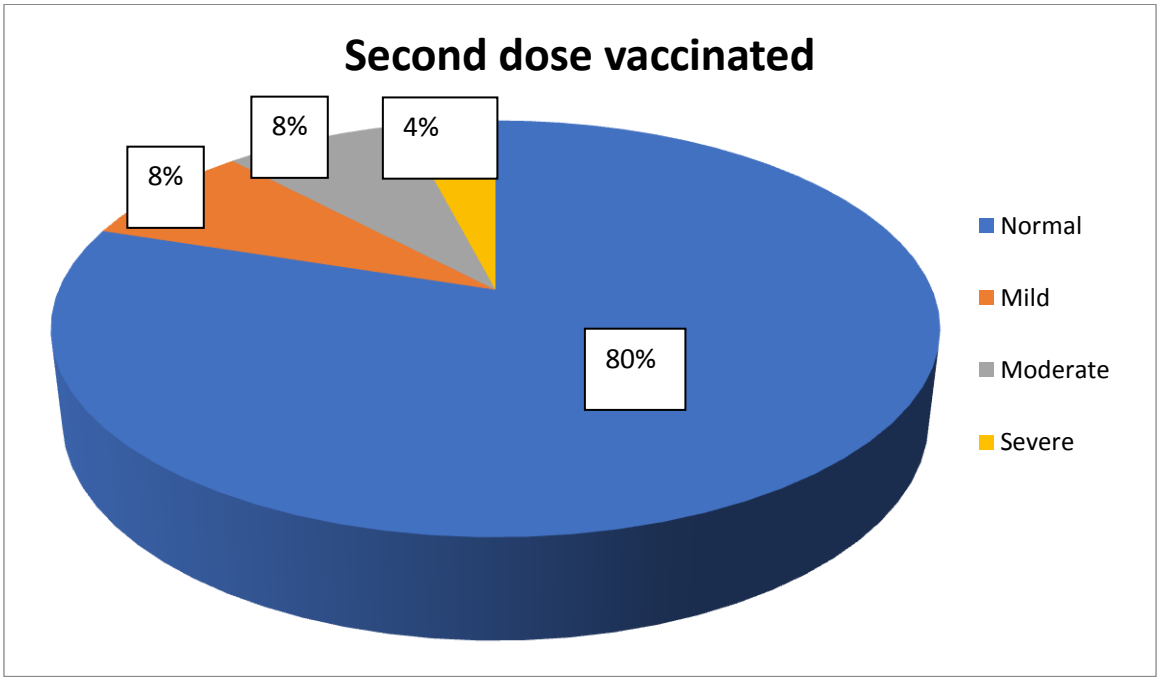
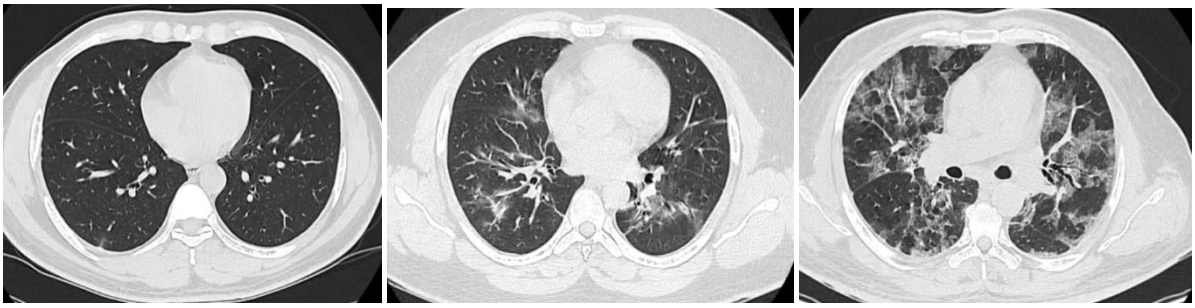


FIGURE – C

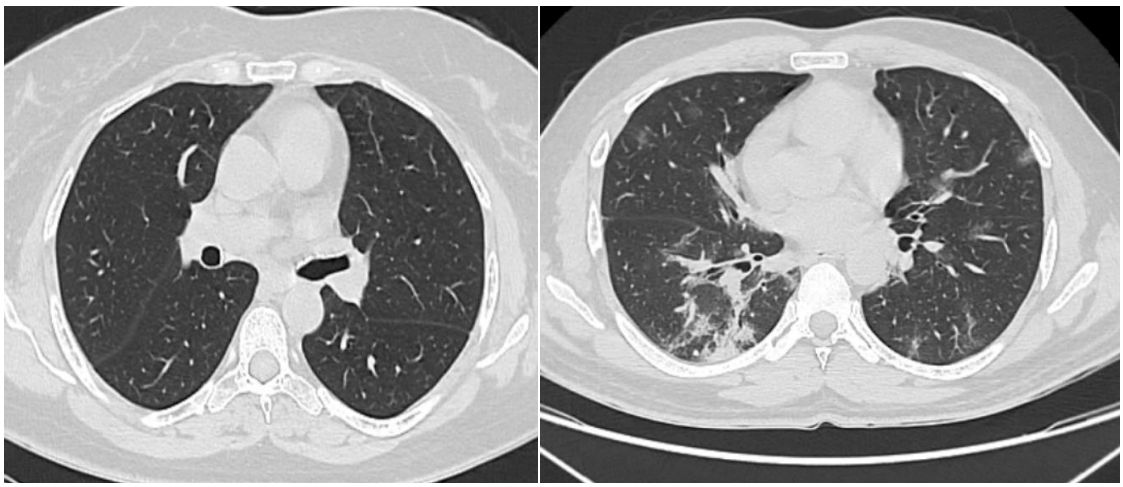


LEGENDS:



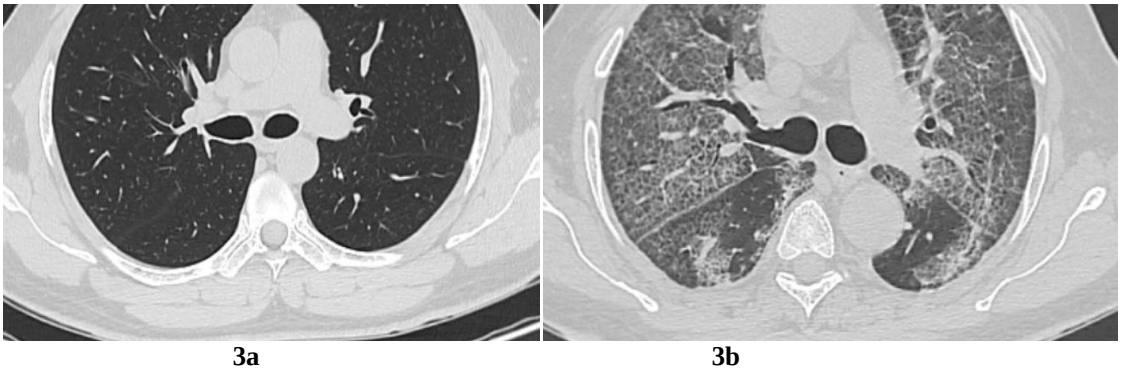
1a **1b** **1c**

Fig.1: HRCT axial images of Non-vaccinated cases showing mild (Fig.1a.), moderate(Fig.1b.) and severe(Fig.1c.) disease. All the three cases were RT-PCR proven positive and breathlessness was the presenting complaint in the later two cases.



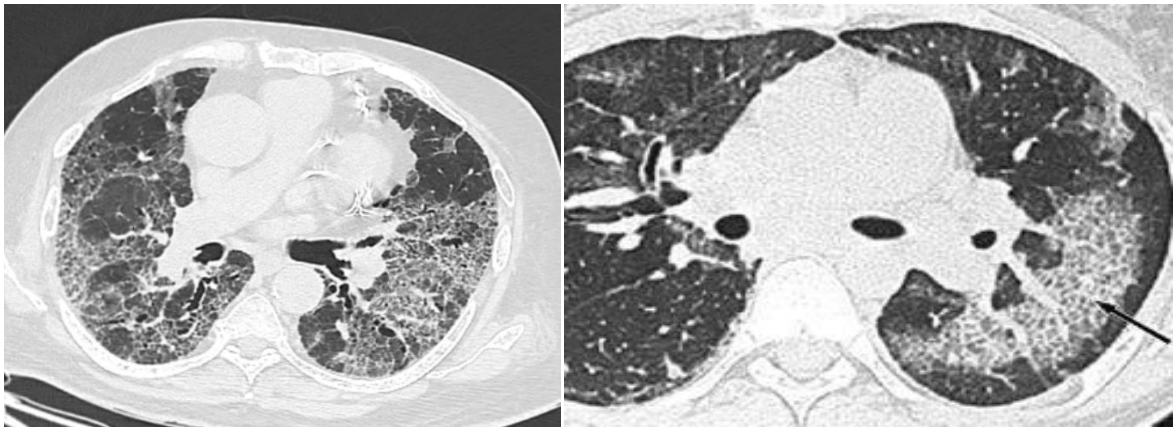
2a **2b**

Fig.2: HRCT axial images of first dose vaccinated cases showing normal lungs(Fig.2a.) in the first patient who was RT-PCR proven positive. The second image (Fig.2b.) shows ground glass opacities with adjacent consolidation in a patient who was RAT proven positive.



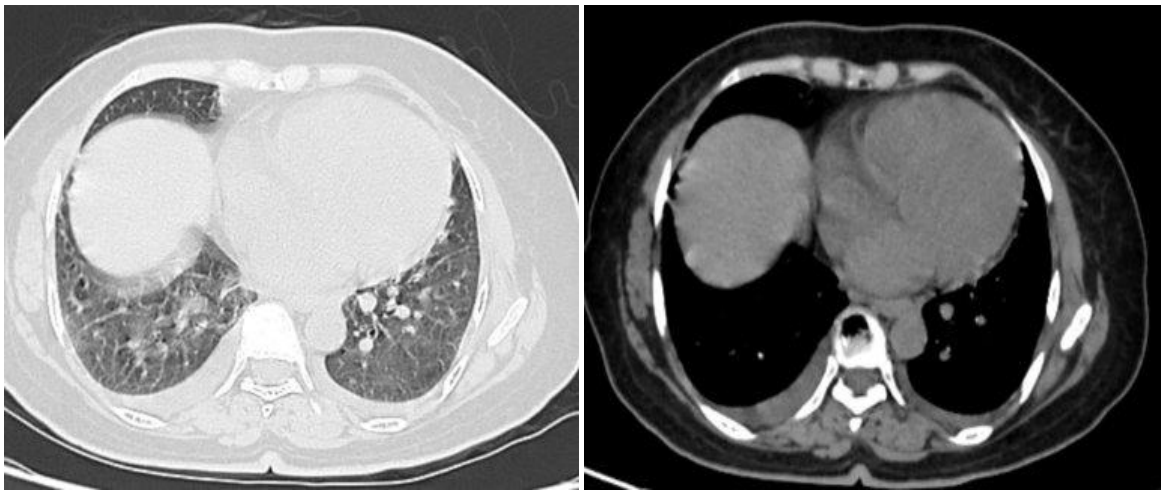
3a **3b**

Fig.3: HRCT axial images two cases of second dose vaccinated RT-PCR proven positive cases showing normal lungs (Fig.3a.), and the other case in which patient had breathlessness and showed ground glass opacities with interstitial septal thickening(Fig.3b.) – the pattern of crazy-paving.



4a **4b**

Fig.4: HRCT axial images of a first dose vaccinated and a known case of idiopathic pulmonary fibrosis(Fig.4a.) and developed covid infection(Fig.4b.).



5 a **5b**

Fig.5: HRCT axial images in lung window (Fig.5a.) and mediastinal window (Fig.5b.) showed mild disease with ground glass opacities associated with pleural effusion bilaterally (right>left) in a RAT proven positive case.

V. Discussion:

The results obtained showed us the imaging findings in covid pneumonia (Fig.1)(5). It showed a decrease in the positivity and the severity of the disease on imaging and in clinical presentation of the patient in vaccinated group. The percentage of population becoming diseased significantly reduced comparing the non-vaccinated(Fig.1), first dose vaccinated(Fig.2), second dose vaccinated (Fig.3)patients in our study(5). Some of the patients showed atypical findings such as pleural effusion (Fig.5)(6). Also, the percentage of severely diseased patients were considerably less in our study. The imaging findings included bilateral lung involvement, ground glass opacities, also the severity of the disease and percentage of lung involvement. The clinical manifestations, laboratory findings, imaging findings; the knowledge of these specialties is important for all the clinicians for proper diagnosis and management. As the laboratory findings only helped the clinicians in detecting the disease; the imaging modality plays a major role in not only detecting the disease, but also grading it, assessing the complications, sequelae changes, prognosis in some of the patients(1).

VI. Conclusion:

This study done at our institute described the most common imaging findings in patients of covid-19 etiology(5). Also, the importance of HRCT in the spectrum of covid-19 pneumonia(1). The importance of grading the disease and charactering the severity with the aid of HRCT(3). The efficacy(7) of vaccination, 2 complete doses in particular which led to the above discussed results (not considering the long-term

complications of vaccination)(8). Current recommendations suggest the use of 2 dose vaccinations even if virus variants are present in a country(5). Two dose vaccinations could be important in patients to prevent severe lung disease(5). The other important measures such as face mask, physical distance practices, avoiding crowing and social gatherings are need to be continued and practiced.

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