



## EFFECT OF PRIOR COVID VACCINATION ON LUNG INVOLVEMENT IN COVID PATIENTS

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**ABSTRACT** **INTRODUCTION:** COVID-19 is diagnosed based on microbiological tests like RTPCR and Rapid Antigen Tests (RAT), but radiological imaging also plays an important role in diagnosing and severity assessment of the disease. The extent of lung involvement and consequently the severity of the COVID can be assessed by the CT Severity Scoring.

**MATERIAL & METHODS:** This was a retrospective study done at a tertiary care centre in Uttarakhand to compare lung involvement and radiological features in COVID vaccinated and unvaccinated groups. CTSI score of CT chest of the patients was done.

**RESULTS & DISCUSSION:** Out of 50 subjects, 32 were never vaccinated, 9 were vaccinated with a single dose and 9 subjects had been vaccinated by 2 doses. CTSI Scoring of each CT scan was done. Average CTSI score was 11.7, overall. CTSI score for non-vaccinated was 15.28, CTSI score for vaccinated was 5.39. CTSI score for single dose COVID vaccinated subjects was 7.22, while CTSI score of subjects who got both shots of vaccine was 3.56.

**CONCLUSION:** In vaccinated individuals, the disease is restricted to the lower lobes. COVID patients who got both shots of COVID vaccine were less prone for lung damage, and hence had milder disease compared to non-vaccinated patients of COVID-19.

**KEYWORDS :** Vaccination, COVID-19, HRCT, Lung involvement

#### Introduction:

Wuhan Municipal Health Commission, China, reported a cluster of cases of pneumonia in Wuhan, Hubei Province on 31st December 2019. A novel coronavirus was eventually identified. On 11th March 2020 WHO made the assessment that COVID-19 can be characterized as a pandemic [1]. COVID-19 is diagnosed based on microbiological tests like RTPCR and Rapid Antigen Tests (RAT), but radiological imaging also plays an important role in diagnosing and severity assessment of the disease. On the basis of a literature study in the present pandemic, typical imaging findings are those that are often seen and are more specific for COVID-19 pneumonia[2]. Peripheral bilateral ground glass opacities (GGO) with or without consolidation or crazy paving pattern, reverse halo sign or other organizing pneumonia (OP) related findings, and multifocal GGO with or without consolidation or intralobular thickening (crazy paving pattern) are seen. However, some imaging findings in this viral pneumonia were less specific for COVID-19 pneumonia or were not widely reported; these findings were classified as indeterminate or atypical findings. Diffuse GGO with no definite distribution, isolated or segmental consolidation with no GGO, distinct tiny nodules (centrilobular, "tree in bud"), lung cavitation, and smooth interlobular septal thickening with pleural effusion are among the findings[3][4]. The extent of lung involvement and consequently the severity of the COVID can be assessed by the CT Severity Scoring (CTSS)[5].

India started its vaccination drive from 16 January 2021, first in healthcare workers followed by vaccination of people aged more than 60 years. By April, India was administering 3-4 million doses a day[6,7]. It was speculated that the vaccines reduce the severity of COVID-19 [8] Later research proved that prior COVID vaccination leads to decrease in mortality and hospital admissions of infected patients[9]. This study was done to find out whether prior vaccination decreases the extent of lung involvement as seen through CT scan of chest.

#### Material & Methods:

This was a retrospective study done at H.N.B. Base hospital, Srinagar, Uttarakhand tertiary care centre. Patients with COVID RAT or RTPCR positive who underwent high resolution computed tomography (HRCT) of chest from March 2021 to August 2021 were included in the study. 50 such patients were found, during this period, whose vaccination status was known. CT Images of the chest were obtained on a siemens, 16 slice multidetector CT Unit and slice section of 5 mm. This study was conducted to compare lung involvement and radiological features in vaccinated and unvaccinated groups.

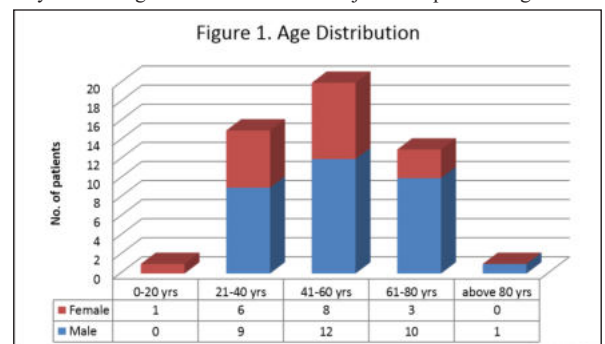
Images of all patients were reviewed independently by 2 experienced pulmonologists, blinded to the patients' names and clinical or other laboratory findings. Each observer viewed CTSI per patient separately. In all cases, CT severity scoring was calculated per each of the 5 lobes considering the extent of anatomic involvement, as follows [5]

- 0-No involvement
- 1- <□5% involvement
- 2- 5-25% involvement
- 3- 26-50% involvement
- 4- 51-75% involvement; and
- 5- >□75% involvement

The resulting CTSI score was the sum of each individual lobar score (0 to 25).

#### Results:

A total of 50 patients were included in the study. 32 (64%) were male participants while 18 (36%) were female. Mean age of subjects was 49 years. Youngest subject was of 17 years while most elderly subject was 86 years old. Age wise distribution of subjects is depicted in figure 1.



Out of 50 subjects, 32 were never vaccinated, 9 were vaccinated with a single dose and 9 subjects had been vaccinated by 2 doses. CTSI Scoring of each CT scan was done. Average CTSI score was 11.7, overall. CTSI score for non-vaccinated was 15.28, CTSI score for vaccinated (either single or double dose) was 5.39. CTSI score for single dose vaccinated subjects was 7.22, while CTSI score of subjects who got both shots of vaccine was 3.56.

Lobe involvement in both vaccinated and non-vaccinated individuals

is depicted in Table 1

Lobes involved	RUL	RML	RLL	LUL	LLL	Total
Non-vaccinated	27 (84.37%)	29 (90.62%)	30 (93.75%)	26 (81.25%)	30 (93.75%)	32
Vaccinated	6 (33.33%)	7 (38.89%)	12 (66.67%)	8 (44.44%)	12 (66.67%)	18

Table 1. Lobe involved in vaccinated and non vaccinated subjects

Major CT findings of the subjects are shown in Table 2

Major CT Findings	Non-vaccinated	Vaccinated	Total
GGO	18 (56.25%)	9 (50%)	27 (54%)
Consolidation	6 (18.75%)	1 (5.56%)	7 (14%)
Cystic lesions	4 (12.5%)	0	4 (8%)
Septal thickening	2 (6.25%)	2	4 (8%)
Air trapping	1 (3.12%)	0	1 (2%)
Crazy paving	1 (3.12%)	0	1 (2%)
Pleural effusion	0	1 (5.56%)	1 (2%)
Normal findings	0	5 (27.78%)	5 (10%)
Total	32 (100%)	18 (100%)	50 (100%)

Table 2. Major CT findings in COVID vaccinated and non-vaccinated subjects

Some CT scan findings of vaccinated and non vaccinated subjects are shown in Figures 2.

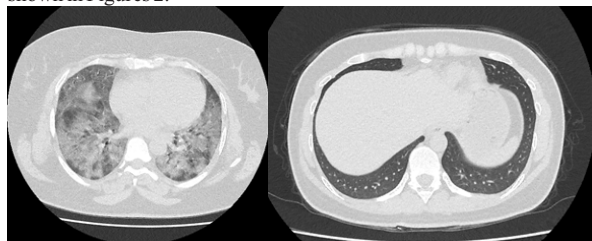
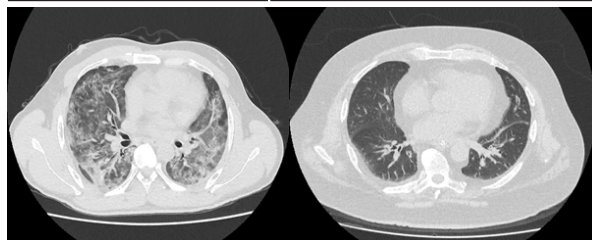


Figure 2a) Extensive GGO in a 47 year old non-vaccinated female patient

2b) Basal segments unaffected in a 22 year old female patient who got both doses of COVID vaccine



2c) Septal thickening, extensive GGOs in a 36 year old non-vaccinated male patient

2d) septal thickening, few nodular lesions in a 65 year old vaccinated male patient

**Discussion:**

Out of the 50 patients, the youngest subject was of 17 years old. This may be due to the fact that younger children were mostly asymptomatic and were hence not brought to the hospital for screening. Only 18 individuals were vaccinated, moreover only 9 individuals got both shots of the COVID vaccine. This is probably due to early initiation of this study when only healthcare workers and individuals above 60 years were getting vaccinated.

As evident, CTSI score for non-vaccinated was 15.28, which is much higher than the normal average CTSI score of 11.7. CTSI score for vaccinated (either single or double dose) was 5.39. Hence, this finding clearly demonstrates that the severity of radiological lesions is much more in non vaccinated individuals than in the vaccinated group. Furthermore, CTSI score for single dose vaccinated subjects was 7.22, while CTSI score of subjects who got both shots of vaccine was 3.56. Thus, number of shots of vaccine plays a role in radiological severity of the disease. Individuals who got both shots of COVID vaccine were less prone for lung damage. Since, CTSI score closely relates to clinical severity and disease outcome of the patient[10,11], hence, prior COVID-19 vaccination definitely decreases clinical severity and improves prognosis in COVID-19 patients.

bilaterally-[2,12,13], but in non-vaccinated individuals the proportion of patients having upper and middle lobe involvement was much higher than those who were vaccinated. Even lower lobe involvement was considerably less in the vaccinated individuals. Hence, in vaccinated individuals, the disease is restricted to the lower lobes and further progression is slowed down.

Atypical findings were seen in both vaccinated and non-vaccinated individuals. Ground glass opacification (GGO) were the most common CT chest findings in both vaccinated (50% cases) and non-vaccinated (56.25% cases) subjects. Atypical findings were found in quite a number of subjects as the study was done during the second wave of the coronavirus epidemic in India, and it was found that atypical radiographic features were more common in second wave of the epidemic[14]

**Conclusion:**

Proportion of patients having upper and middle lobe involvement was much higher than those who were vaccinated. In vaccinated individuals, the disease is restricted to the lower lobes. Individuals who got both shots of COVID vaccine were less prone for lung damage. Since, CTSI score closely relates to clinical severity and disease outcome of the patient, hence, prior COVID-19 vaccination definitely decreases clinical severity and improves prognosis in COVID-19 patients.

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