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Original Article

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Correlation of Clinical Severity, Radiological Features, Vaccination Status and Outcome of Hospitalized Covid 19 Patients in a Tertiary Care Hospital

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ABSTRACT

Introduction: Corona virus is a family single stranded RNA virus. Covid 19 the disease spectrum varies from asymptomatic infections to severe disease requiring mechanical ventilation. Chest X-ray and computed tomography are primary imaging tests for diagnosis, follow up and complications in this pandemic era. This study was intended to correlate the clinical severity, radiological features, and vaccination status with the outcome of hospitalized COVID 19 patients. **Materials And Methods**: This retrospective study included 757 admitted covid-19 patients in a dedicated tertiary care hospital. The patient's data concerning medical history, vaccination history, laboratory findings, radiological features, severity and outcome were extracted from medical records for subsequent evaluation, interpretation and correlation. **Results**: A total of 757 patients included in the study, the mean agewas52 years with male preponderance. Majority of them had mild disease (52.8%), moderate and severe disease were (31%) and (13.5%) respectively. In this study 74.5% of people were vaccinated and 25.5% unvaccinated. To assess the severity of the disease chest X-rays were done. In that 32.5% were normal, 66.05% had consolidation. Bilateral involvement was seen in 45.18%.it was observed that involvement of left lung was more than the right. Upper zone involvement was associated with severe disease (67.6%).When compared with vaccination status patients, unvaccinated had more severe disease correlating with chest X-ray features in severity. **Conclusion**: This present study emphasizes the importance of covid vaccination; patients who didn't receive vaccination had more severe disease and was evidenced by involvement of the lung showing severity of radiological features in chest X-ray.

Keywords: *Covid 19, Vaccination, Radiological features, Clinical severity, Chest X-Ray.*

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INTRODUCTION

The novel coronavirus disease 2019, a viral infection caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV2), emerged in Wuhan city of China towards the end of 2019.[1] Over the next few months, the virus spread all across the world and with the emergence of new variants, it posed a huge threat to global public health. Despite unprecedented movement restrictions, social distancing measures, and stay-at-home orders enacted in many countries, the COVID-19 pandemic has caused devastating morbidity and mortality.

Corona virus related respiratory illness usually manifests clinically as pneumonia with predominant imaging findings of an atypical or organizing pneumonia. Typical CXR findings of COVID-19 include bilateral peripheral and basal multifocal airspace opacities (ground-glass opacity (GGO) and consolidation). Plain radiography is very helpful for COVID 19 disease assessment and follow up.

While the CT is more sensitive and sensitive when compared to the chest X ray, however it requires time-consuming decontamination procedures to prevent the risk of cross-infection hence is not suitable for assessment of severity of the disease which requires repeated imaging. Chest Xray therefore plays an important role in identification and detection of abnormal lung changes, plays a key role in evaluating the potential complications, disease severity and progression.

Multiple studies have shown the efficacy of vaccine in preventing disease , even though it confers limited protection against the infection , it can substantially mitigate future attack rates and hospitalisations and reduce severity of the disease .The risk of infection is much lower among vaccinated individuals and vaccination reduces the severity of illness . The purpose of this study is to correlate the disease severity, vaccination status with the outcome of covid 19 infection with radiological features in chest X-ray.

MATERIALS AND METHODS

This was a retrospective observational study conducted among patients admitted under General Medicine department between December 2021 to February 2022 at a tertiary care hospital in Bangalore, Karnataka, India. Approval and clearance were obtained from the institutional ethics committee.

The study included patients aged ≥ 18 years of either sex, diagnosed with COVID-19 infection by RT-PCR technique and willing to give informed consent. The study excluded patients <18 years and those not willing to provide signed informed consent prior to the study.

Case record form with follow-up chart was used to record the demographic data, and duration and clinical features of the disease. Clinical severity, radiological features, Vaccination status and outcome were assessed in the patient.

All the selected participants were followed up until discharge or death. Patients were divided into 4 groups (Asymptomatic, mild, moderate, severe) based on clinical severity using SpO2 and respiratory rate on admission. The severity and the vaccination status were corelated with the radiological presentation. The outcome of infection was then corelated to the radiological presentation.

STATISTICAL ANALYSIS

SPSS (Statistical Package for Social Sciences) version 20. (IBM SPASS statistics [IBM corp. released 2011] was used to perform the statistical analysis

- Data was entered in the excel spread sheet.
- Descriptive statistics of the explanatory and outcome variables were calculated by mean, standard deviation for quantitative variables, frequency and proportions for qualitative variables.
- Inferential statistics like
    - Chi-square test was applied to associate the inflammatory markers with severity and outcome.
- The level of significance is set at 0.05.

RESULTS

Demographics

The study included 752 patients admitted to Bowring and Lady Curzon Hospital, Bangalore under General Medicine department who were diagnosed positive for SARS-COV-2 infection.

Table 1: AGE AND SEX DISTRIBUTION

AGE GROUP	NUMBER OF PATIENTS	PERCENT
13 TO 30	120	15.9
31 TO 40	74	9.8
41 TO 50	107	14.2
51 TO 60	149	19.8
61 TO 70	150	19.9
>70	152	20.2
TOTAL	**752**	

There were 752 patients with male preponderance.
The mean age of all patients was 52years.

Table 2: AGE GROUP DISTRIBUTION

GENDER	FREQUENCY	PERCENT
MALE	456	60.6
FEMALE	296	39.4

CLINICAL SEVERITY

752 patients were categorized into 4 Groups based on clinical severity -
AYMPTOMATIC – 2.7 %
MILD INFECTION – 52.8 %
MODERATE INFECTION – 31 %
SEVERE INFECTION – 13.5 %

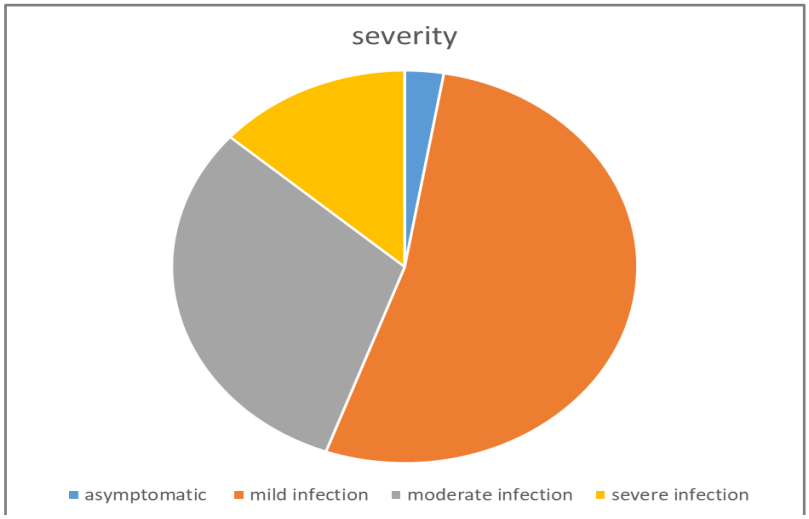

Figure 1: CLINICAL SEVERITY

Table 3: VACCINATION STATUS

	FULLY VACCINATED	PARTIALLY VACINATED	UNVACCINATED
ASYMPTOMATIC	13	5	2
MILD INFECTION	262	64	74
MODERATE INFECTION	118	37	80
SEVERE INFECTION	39	26	37
TOTAL	**432**	**132**	**193**

57.4 % of the patients were fully vaccinated against COVID – 19, among whom 60.6 % developed mild infection, 27.3 % developed moderate infection and 9.02 % developed severe infection.

17.6 % of the patients were partially vaccinated, among whom 48.5 % developed mild infection, 28 % developed moderate infection and 19.7 % of the patients developed severe infection.

25.7 % of the patients in the study were unvaccinated, among whom 38.3 % developed mild infection, 41.4 % developed moderate infection and 19.1 % of the patients developed severe infection.

ASSOCIATION OF CLINICAL SEVERITY AND LUNG INVOLVEMENT IN XRAY

Mild disease was seen in 86.2%, they had Normal Xray. In the remaining 12.8% left lung involvement seen more compared to right lung involvement then followed by bilateral lung involvement.

Moderate disease had bilateral lung involvement of 53.9%, right lung involvement and left 19.2% and 8.8% respectively. Severe disease 27.9% had bilateral involvement, 10.3% left and 1.8% right lung respectively.

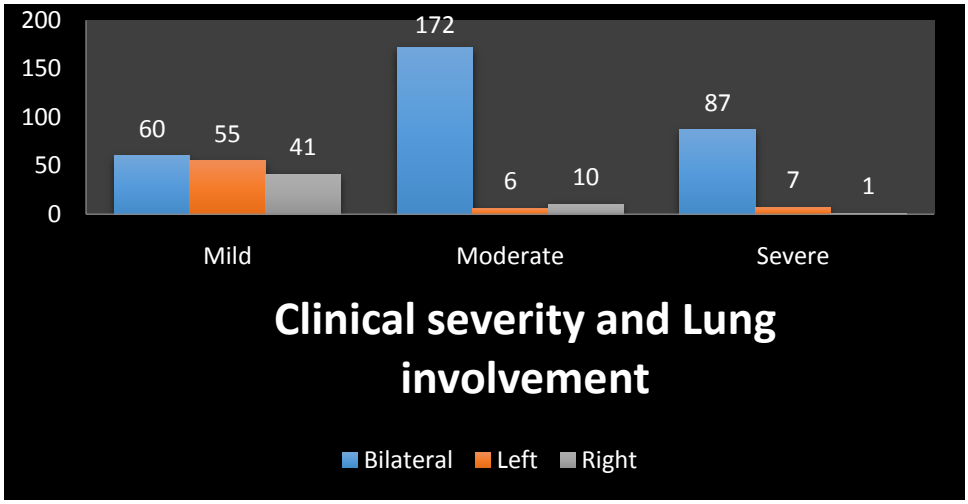

Figure 2: ASSOCIATION OF CLINICAL SEVERITY AND LUNG INVOLVEMENT IN XRAY

ASSOCIATION OF VACCINATION STATUS AND RADIOLOGICAL PRESENTATION

- In Fully vaccinated 41.5% bilateral lung involvement, 37.3% had normal Xray and left lung 11.4% and right 9.8% respectively.
- In unvaccinated 58.6% had bilateral lung involvement, 29.6% had normal Xray.
- In partially vaccinated 52% had bilateral lung involvement, 32.5% had normal Xray.

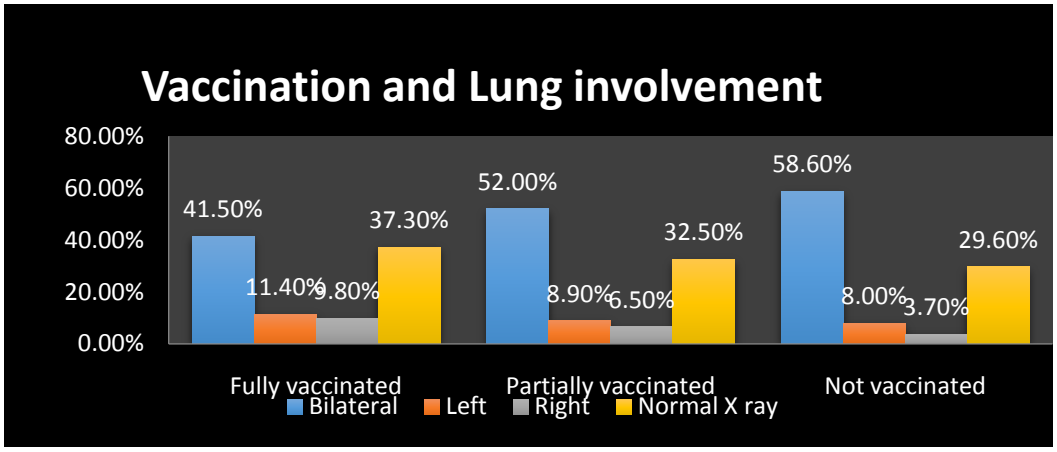

Figure 3: ASSOCIATION OF VACCINATION STATUS AND RADIOLOGICAL PRESENTATION

ASSOCIATION OF VACCINATION STATUS AND INVOLVEMENT OF LUNG ZONES

- In fully vaccinated upper zone 12.7%, middle zone 46.6% and lower zone 62.7% were involved
- In unvaccinated upper zone 18.5%, middle zone 61.7% and lower zone 71.6% were involved
- In partially vaccinated upper zone 17.1%, middle zone 55.3% and lower zone 61.5% were involved.

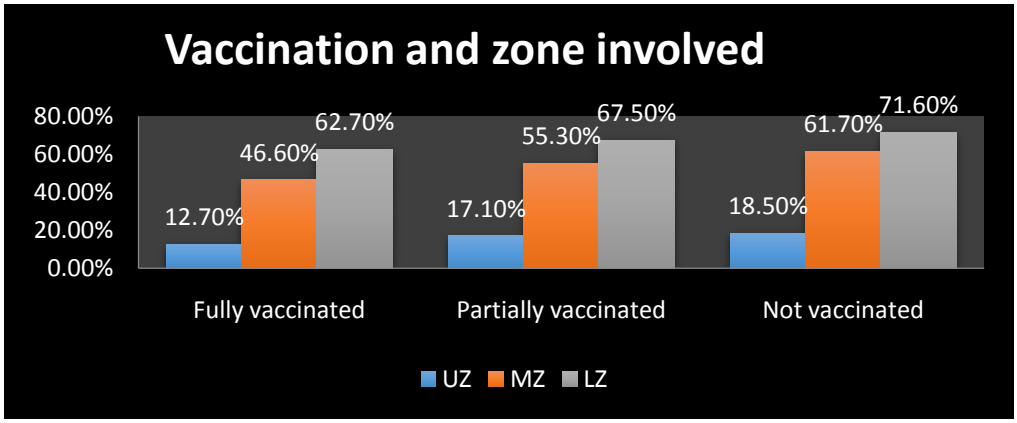

Figure 4:ASSOCIATION OF VACCINATION STATUS AND INVOLVEMENT OF LUNG ZONES

ASSOCIATION OF OUTCOME WITH RADIOLOGICAL FEATURES

- In a total of 100 patients with upper zone involvement mortality was 53%, middle zone involvement had 20.68% and lower zone 18.6%.
- Discharge rate was more in lower zone>middle zone and upper zone 61.4%, 46.7% and 8.1% respectively.

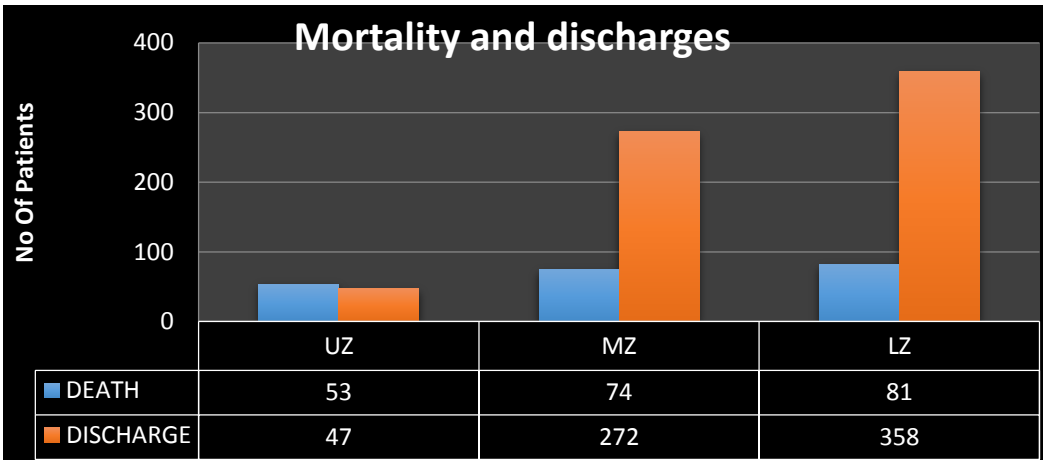

Figure 5: ASSOCIATION OF OUTCOME WITH RADIOLOGICAL FEATURES

DISCUSSION

COVID 19 outbreaks have caused significant global morbidity and mortality and also have had significant effect on the economic and social well being of individuals and the population as a whole. In this study we studied the proportion of the population who were vaccinated and assessed the vaccination status, classified the disease as Asymptomatic, mild, moderate and severe and studied the radiological presentation of the disease on Chest X rays.

We found that more than half the patients in the study were fully vaccinated and the incidence of severe infection was significantly lower in the fully vaccinated group when compared to the unvaccinated and the partially vaccinated group. The incidence of mild infection was greater in the fully vaccinated group as compared to the partially vaccinated and unvaccinated group.

As the age increased, more patients had bilateral involvement in the unvaccinated group . 86.2 % patients with mild disease had normal X-rays, in the remaining left lung was found to be involved most of the time. In moderate disease bilateral lung involvement was found to be more common as was with severe disease.

In Unvaccinated patients the incidence of bilateral lung involvement was found to be higher when compared to the partially vaccinated and completely vaccinated patients, the percentages being 58.6 %, 52%, and 41.5% respectively.

Upper zone involvement was seen more commonly with unvaccinated group as compared to the partially and fully vaccinated group incidence being 18.5 %,17.1 % and 12.7 % respectively. Upper zone involvement was associated with higher mortality.

Hence through this study we understand that the severity of the COVID 19 disease is much more severe in the unvaccinated individuals and that the severity of the disease can be assessed adequately by chest X -rays.

Multiple studies have shown that the vaccinated patients exhibited fewer radiological findings of COVID 19 pneumonia. The need for ventilatory support and frequency of ICU admission were significantly lower in the vaccinated group as compared to the unvaccinated group.

Chest X-rays are a cost-effective and convenient tool to assess the severity of COVID-19 disease, even though CT has higher sensitivity and specificity in the diagnosis of COVID 19 the cumbersome processes of maintaining sterility and the higher cost limit its use for assessing disease severity when compared to the Xray.

A study conducted by Yasin et al showed that the most common features in COVID 19 cases were consolidation, followed by reticular interstitial thickening and ground glass opacities. They used the total severity score for classifying the severity of the disease and used in at multiple junctures of the study and found the lowest score was found at baseline and the highest score was found in the 4rth follow up chest X – ray. The study concluded that chest X-rays are a good monitor of COVID-19 chest manifestations and its scoring systems provides an accurate method to predict the disease severity.

A study conducted by Andrea Borghesi et al concluded that the Brixia score which is a dedicated chest radiography scoring system was much higher in the unvaccinated group than in the vaccinated group and that the percentage of chest radiographs without lung abnormalities was higher in the vaccinated group than in the unvaccinated group.

A multicentre study conducted by Lee et al concluded that patients with breakthrough COVID 19 infections had significantly higher proportion of CT scans without pneumonia compared with unvaccinated patients. Vaccinated patients with breakthrough infections had a lower likelihood of requiring supplemental oxygen and intensive care unit admission.

Another study conducted by Adam S Lauring et al concluded that vaccinated patients admitted to the hospital with COVID – 19 infections had significantly lower disease severity than the unvaccinated patients for all variants. Severity was assessed according to a using a modified version of the WHO clinical progression scale.

CONCLUSION

The clinical severity and radiological features correlating such that vaccinated patients had less severe disease than unvaccinated. Chest x rays are important screening tool in assessing severity and follow up of the patients.This present study emphasizes the importance of vaccination.

Conflicts of Interest: Nil

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