

# A comparative study on COVID-19 disease severity and outcome among patients admitted before and after vaccination at tertiary care hospital

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## ABSTRACT

**Background:** Coronavirus disease 2019 (COVID-19) is a novel infectious disease caused by SARS CoV-2 that emerged in Wuhan, China, and has rapidly spread worldwide. The mortality rate of critically ill COVID-19 patients is high. The objective of the study was to assess the COVID-19 disease severity and outcome among COVID-19 positive patients admitted before and after vaccination. **Methodology:** A prospective observational study conducted among all patients aged more than 18 years were included in the study. The patients who were positive before vaccination and received at least one dose of vaccine and positive after receiving two doses of vaccination included in the study. Disease severity was assessed in terms of high-resolution computed tomography (HRCT) score, intensive care unit (ICU) admission, SpO<sub>2</sub> maintained, oxygen, plasma exchange, steroids received and on mechanical ventilation, and outcome was assessed on prognosis and stabilized/discharged to home. **Results:** A total of 172 were participated in the study with 101 (58.7%) males and 71 (41.3) females, respectively. Amongst them, 92 were affected before vaccination and 80 were affected before vaccination. The patients admitted in the ICU were 56 (32.6%) and 116 (67.4%) were not admitted in the ICU; among the patient admitted in ICU 42 (45.7%) before vaccination, and 14 (17.5%) were after vaccination, and difference was statistically significant with *P*-value <0.001. SPO<sub>2</sub>, steroids given, plasma exchange, oxygen >10 litres given and mechanical ventilation were positively associated with the vaccine received and disease severity with *P*-value <0.05. **Conclusion:** The severe COVID-19 had the worst outcome in the unvaccinated patients in terms of severity. Most partially vaccinated patients got infected before developing immunity; receiving at least one vaccination dose significantly reduced illness severity.

**Keywords:** Covid-19, observational study, outcome, severity, vaccination

## Introduction

Despite unprecedented movement restrictions, social distancing measures, and home stay orders, COVID-19 pandemic has caused devastating morbidity and mortality. Yet, the disease burden is seen more or less in both vaccinated and unvaccinated individuals.<sup>[1]</sup>

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Received: 17-11-2022

Revised: 27-04-2023

Accepted: 29-05-2023

Published: 21-12-2023

Vaccination has been started in all the age groups (18+). This compels an urgent need to understand the potential impact of vaccination in affected individuals on COVID-19 transmission and disease outcome.<sup>[2]</sup> Disease course has differed among young, elderly people with comorbidities/vaccinated and unvaccinated ones. It would help in creating awareness to patients regarding benefits of vaccination.<sup>[3]</sup> It also helps in encouraging patients of ESIC in taking vaccination. It will help patients in modification of treatment and outcome, especially post vaccination. The vaccine's effectiveness in preventing hospitalization after the second dose

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**How to cite this article:** Mood N, Darivemula SB, Shrivani S, Kavyasri K, Kiran JR. A comparative study on COVID-19 disease severity and outcome among patients admitted before and after vaccination at tertiary care hospital. J Family Med Prim Care 2023;12:3115-8.

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**DOI:**  
10.4103/jfmprc.jfmprc\_2238\_22

was 87% in a case-control trial. Prospective cohort research<sup>[4]</sup> has shown that COVID-19-immunized cases have a shorter duration of illness, and a decreased risk of infection disease outcome in post vaccinated patients can be studied. Primary care is first contact care and crucial part of the primary health care system which extends to public health promotion, disease prevention and safeguarding of good health and well-being in communities and at home.<sup>[5]</sup> There are not more studies regarding covid profile and outcome, especially post vaccinated patients.

Thus, the study was planned with the objective to assess COVID-19 disease severity and outcome among COVID-19 positive patients admitted in a tertiary care centre before and after vaccination.

## Methodology

### Study design and setting

A prospective observational study was done from July to August 2022 (two months) among all the patients aged more than 18 years at the ESIC Medical College, Sanath Nagar Hyderabad.

### Inclusion criteria

The patients who were positive before vaccination and received at least one dose of vaccine and positive after receiving two doses of vaccination included in the study.

### Exclusion criteria

Patients with aged less than 18 years and having known cases of lung pathology and not willing to provide informed consent excluded from the study.

### Sample size

The convenient sampling was taken during the study period. The informed consent was obtained before participate in the study.

### Ethical clearance

The study was approved by Institution ethics committee vide reference No: 799/U/IEC/ESICMC/S0123/09/2021.

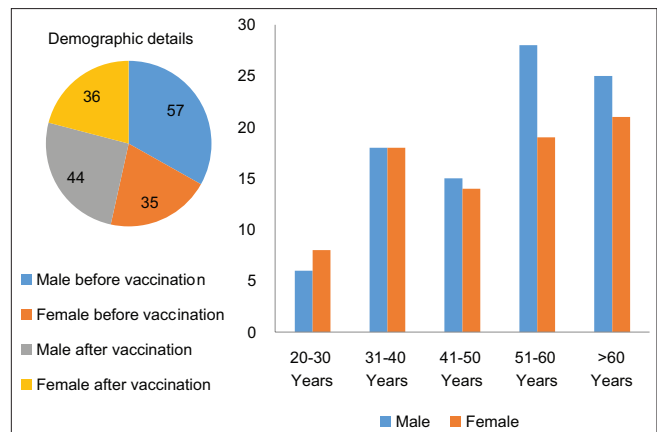
### Data collection and analysis

Disease severity was assessed in terms of HRCT score, intensive care unit (ICU) admission, SpO<sub>2</sub> maintained, oxygen, plasma exchange, steroids received and on mechanical ventilation, and outcome was assessed on prognosis and stabilized/discharged to home. Demographic details and other disease-related data were entered in Microsoft excel 2010, analysis was done in SPSS 21.0 software, categorical values were represented in frequency and proportion and Chi-square test was used to see the association between the groups between different variables.

## Results

### Sociodemographic details

A total of 172 were participated in the study shown in Figure 1 with 101 (58.7%) males and 71 (41.3) females, respectively.



**Figure 1:** Socio-demographic details of the participants

Among them, 104 (60.4%) received covaxin, 64 received one dose, 40 received two doses and 68 (39.6%) received covishield, 32 received at least one dose of vaccine and 36 received both the doses. Amongst them, 92 were affected before vaccination and 80 were affected before vaccination. There is no gender difference in the COVID-19 disease affecting before and after vaccination, and it is not statistically significant. More than half, 91 (54.0%), of them affected with COVID-19 belong to the above 50 years of the age group, and there is no variation in the age wise distribution among before and after vaccination.

### Disease severity and their association before and after vaccination

The patients admitted in the ICU [Table 1] were 56 (32.6%) and not admitted were 116 (67.4%); among them, 42 (45.7%) were admitted before and 14 (17.5%) after vaccination, and the difference was statistically significant with *P*-value <0.001. Among 92 admitted before vaccination, more than half of the 53 (57.6%) were not maintained the SpO<sub>2</sub> levels and 29 (36.2%) were not maintained SpO<sub>2</sub> levels among 80 patients, and it is statistically significant with *P*-value <0.005. Out of them, 35 (20.3%) before and 12 (6.9%) after vaccination were required more than 10 litres of oxygen, and it is statistically significant with *P*-value <0.002. Majority, 67 (72.8%) before vaccination and 12 (15.0%) after vaccination, of them were given steroids, and it is statistically significant with *P*-value <0.0001. Almost half of the patients were given plasma exchange in both the groups before and after vaccination, and it is not statistically significant with *P* value 0.95. A total of 75 (43.7%) required mechanical ventilation; among those 51 (55.4%) before and 24 (42.5%) required after vaccination, and it is statistically significant with *P*-value <0.0007. A total of 38 (20.3%) were had poor prognosis; among those, 26 (28.2%) were before and 9 (11.2%) were after vaccination, and overall prognosis was good before and after vaccination.

### Disease outcome and their association before and after vaccination

Finally, the outcome assessment of the patient from the COVID-19 were 27 (29.3%) before vaccination and 11 (13.8%)

**Table 1: Distribution of the participants with their socio-demographic and disease severity and outcome**

Variable	Before vaccination (%)	After vaccination (%)	Total (%)	Chi-square and P
COVID positive	92 (53.5)	80 (46.5)	172 (100)	-
Gender				
• Male	57 (61.9)	44 (55.0)	101 (58.8)	0.854
• Female	35 (38.1)	36 (45.0)	71 (41.2)	0.355
Age in years				
• 20–30	6 (6.5)	8 (10.0)	14 (8.1)	1.56
• 31–40	18 (19.6)	18 (22.5)	36 (21.0)	0.815
• 41–50	15 (16.3)	14 (17.5)	29 (16.9)	
• 51–60	28 (30.4)	19 (23.8)	47 (27.3)	
• >60	25 (27.2)	21 (26.2)	46 (26.7)	
HRCT severity score				
• Mild (1–7)	0	0	0	25.43
• Moderate (8–15)	28	40	39	<0.0001*
• Severe ≥16	9	11	49	
• Not done	55	29	84	
Admitted				
• In ICU	1. 42 (45.7)	2. 14 (17.5)	3. 56 (32.6)	4. 15.44
• Non-ICU	50 (54.3)	66 (82.5)	116 (67.4)	<0.001*
SpO <sub>2</sub>				
• Maintained	39 (42.4)	51 (63.8)	90 (52.3)	7.82
• Not maintained	53 (57.6)	29 (36.2)	82 (47.7)	<0.005*
Oxygen received				
• <10 litres	22 (12.8)	35 (2.9)	57 (33.1)	13.38
• >10 litres	35 (20.3)	12 (6.9)	47 (27.3)	<0.002*
Steroids	67 (72.8)	12 (15.0)	79 (45.9)	57.61
• Given	25 (27.2)	68 (85.0)	83 (54.1)	<0.0001
• Not given				
Plasma exchange				
• Given	51 (55.4)	44 (55.0)	95 (55.2)	0.003
• Not given	41 (44.6)	36 (45.0)	77 (44.8)	0.95
Mechanical ventilation				
• Required	51 (55.4)	24 (42.5)	75 (43.7)	11.25
• Not required	41 (44.6)	56 (57.5)	97 (56.3)	0.0007*
Prognosis				
• Good	66 (71.8)	71 (88.8)	137 (79.7)	7.63
• Poor	26 (28.2)	9 (11.2)	38 (20.3)	0.005*
Outcome				
• Stabilized	65 (70.7)	69 (86.2)	134 (77.9)	6.04
• Expired	27 (29.3)	11 (13.8)	38 (22.1)	0.012*

\*P&lt;0.05 is considered as significant

after vaccination were expired in our study. The overall outcomes of the patients in terms of the stabilized and recovered, 134 (77.9%) from the disease in the study groups, were good in both before and after vaccination, and it is statistically significant with *P* value 0.012.

## Discussion

In this study, we examined 172; out of them, 104 (60.4%) received covaxin and 68 (39.6%) received covishield. Despite the fact that the majority of the vaccinated group was partially immunized, being a minority in the whole cohort is comprehensible, as several studies demonstrated vaccine efficacy between 80% and 91% after the first dose.<sup>[6-9]</sup> The reported features of vaccine breakthrough COVID19 cases after mRNA and/or adenovirus vector-based vaccines were also quite similar to the features found in our study; among cases hospitalized for COVID-19, fully vaccinated ones were older and more likely to have underlying

medical conditions or to be immunosuppressed compared with unvaccinated cases.<sup>[10-13]</sup>

The present study found that after the vaccination the severity of the disease in terms of HRCT score was less; a similar study done by Thathai A *et al.*<sup>[14]</sup> in Rajasthan was observed that after single dose 42.86% had mild infection, 24.49% had moderate and 32.65% had severe infection, while after both doses, 80.39% had mild infection, 7.84% had moderate and just 11.6% had severe infection. Most clinical trials on post-vaccination COVID-19 looked at disease severity in terms of symptomatic or asymptomatic presentation, the number of hospitalizations, ICU admissions, MV or death events,<sup>[15,16]</sup> concluding that vaccinated patients had a lower severity (depending on the study design). The present study shows that most patients admitted in the ICU were not vaccinated, and this statement was comparable with the study done by Bajpai J *et al.*<sup>[17]</sup> Most patients with COVID-19 admitted to the ICU in our study were non-vaccinated. Most partially

vaccinated patients got infected before developing immunity, and a small percentage of completely vaccinated patients were likely non-responders.

### Strengths and limitations

Our study setting was a tertiary care facility, and it was the first to acknowledge in assessing disease severity and outcome before and after COVID vaccination. The limitations of the study were observational, and individual-level confounders that were not adjusted for might affect mortality risk, including baseline health status, underlying conditions, health care utilization and socioeconomic status.

### Conclusion

In our study, the majority of COVID-19 patients with HRCT score more than 16, those with SpO<sub>2</sub> levels not maintained, received oxygen more than 10 litres. The patients admitted in ICU were not immunized; most of the partially immunized patients got infected before immunity could develop, and small percentage of fully immunized patients probably were non-responders. Receiving at least one dose of immunization significantly decreases severity of the disease across all ordinal severity categories. Furthermore, at least one dose of immunization is significantly associated with lower 30 day all-cause mortality.

### Acknowledgement

I would like to thank all the participants who were involved in the study and all the authors for their work.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

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