Original Article

Mortality amongst COVID-19 Patients in Relation to their Vaccination Status

Balaji Selvaraju[1], Praveen Kumar M[2], Lawrence P[2]

Background : The second wave of COVID-19 occurred in March, 2021 in India causing large numbers of severe infections and also the vaccination drive was started during January, 2021. Previous studies proved that various factors were associated with mortality

Aims and Objectives : This study was conducted with the objective of estimating the prevalence of mortality and also the factors associated with it, especially in relation to the vaccination status

Materials and Methods : A cross-sectional study was conducted in a tertiary care hospital among the COVID-19 patients during the months of June and July 2021. A semi-structured questionnaire was used containing the basic details about the patient and the relevant clinical details. A universal sampling method was employed and those patients who were below the age of 18 years were excluded. Data analysis was done using SPSS 21.

Results : A total of 226 patients were included in the study. Most of the study subjects were in the age group of >45% (73.5%) and the majority were males. Nearly 42% of them had any one of the co-morbidities and only 11.5% of them were vaccinated against COVID-19. The prevalence of mortality was 21.2% and the factors associated were age, co-morbidity status, duration of hospital stay, disease severity and the vaccination status.

Conclusion : Vaccination against COVID-19 had less risk of mortality even though other factors could influence it. Hence further research is needed to explore other factors that might affect both morbidity and mortality.

[*J Indian Med Assoc* 2024; **122(5):** 24-7]

COVID-19 was declared a public health emergency by the World Health Organization because of its rapid spreading crossing the international border from Wuhan city of China to all other countries globally[1,2]. There occurs burden all over the world both in terms of health and wealth due to the ill effects of this disease causing significant mortality and morbidity[2,3,10]. Based on the WHO data the mortality rate during the pandemic varies from country to country ranging from 0.1% to 25%[4,5]. As of March, 2022, there are 446 million cases and 6 million deaths occurred reported all over the world[5].

In India, the second wave of COVID pandemic occurred in March, 2021 with large numbers in terms of severity at hospitals. Although there is no definitive treatment for COVID-19, steroids have been used based on the experience with influenza and SARS-CoV. But vaccination will be effective in not preventing but at least reducing the disease severity[11]. In India, vaccination drives are started from January, 2021 with

> **Editor's Comment :**
> - There are various risk factors which have been linked with mortality among COVID-19 patients.
> - Effective vaccination against COVID-19 could help in not only preventing the emergence of disease among high risk individuals but also helps in reducing the mortality among the population affected by COVID-19.

initial priority given to the health care and frontline workers which was later extended towards the elderly population and people aged above 45 years. COVID vaccination was provided for all people 18 years of age and above also as of June 2021[5-8]. Significant immunity was observed in both previously infected and naive subjects which varies from 92% in documented infection, 92% in severe disease, and 87 % in case of hospitalized patients[13-17]. Previous studies showed that numerous factors[9] were associated with mortality in COVID-19. We conducted this study to find the association between the vaccination status and mortality amongst the COVID patients and also the other factors of mortality.

MATERIALS AND METHODS

A cross-sectional study was conducted in a Medical College and Hospital situated in Tamil Nadu, South India. The study populations were all the patients with RT-PCR proven COVID-19 infection and admitted to

the Hospital. Those patients who were in the age group less than 18 years were excluded from the study since the vaccination was not approved for that age group. The study duration was between June, 2021 and July, 2021.Ethical approval was obtained from the institutional ethical committee and informed consent was obtained from the study participants

A semi-structured questionnaire containing the basic patient details, co-morbidity status, vaccination status and the severity of the disease was used. The severity of the disease was assessed using the guidelines given by the Ministry of health and family welfare for the management of COVID patients[12]. Universal sampling method was employed based upon which all those patients' admitted during June and July months of 2021 were taken. Based on the exclusion criteria, a total of 227 patients were included in the study.

Data were collected and entered in the MS-Excel and analyzed using the SPSS software version 21. Descriptive statistics were used to determine the frequencies of the study variables and to construct pie charts and bar charts. Association between the various factors especially vaccination status and mortality was analyzed by Chi-square test of proportion.

RESULTS

The study included 226 patients admitted during the two months in the tertiary care hospital which contains all the patients with all forms of mild, moderate, and severe COVID infection. The patient basic details and clinical details in which more than two-thirds of the study subjects were above the age of 45 years (Table 1). The majority (58.8%) were males and 93 participants (41.2%) had any one of the co-morbidities. With regards to the number of days of hospital stay, more than four-fifth of the study subjects were under hospital admission less than 7 days.

The vaccination status of the subjects in which only 26 participants had been vaccinated which contributes

only 11.5% of the total study population (Fig 1). The severity of the COVID infection in which the majority (42%) had the moderate form of the disease and only 24.4% had a severe form of the disease (Fig 2).

The study subjects with the age more than 45 years had higher mortality when compared to those aged less than 45 years (Table 2). Also those who have had any of the co-morbidity and those who had severe forms of disease had higher risk of mortality. The study subjects with hospital stay of less than 7 days and those who were vaccinated were at less risk of death when compared to the others. The above findings were found to be statistically significant at P value less than 0.05. There was no gender association found with the mortality status of the study subjects.

DISCUSSION

The results of our study showed that the overall mortality of the admitted patients during the study period was 21.2 % which is nearly equal to a similar study conducted in New Delhi by Muthukrishnan J, *et al*[13] which was depicted as 28.4 % of patients died. Also in the present study, those who were belonged to mild and moderate forms of disease never died. This clearly explains that only severe forms of the COVID infection were associated with mortality as shown in Table 2. These findings were consistent with the various other studies which explained the similar findings[15-19].
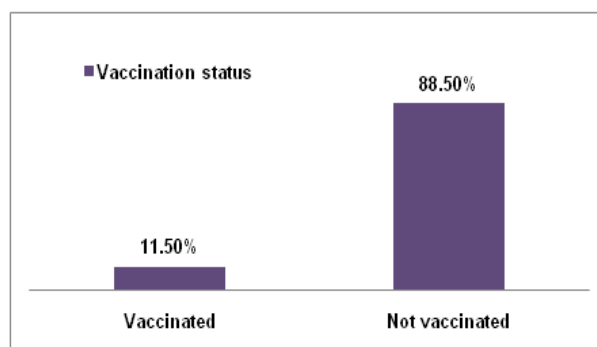

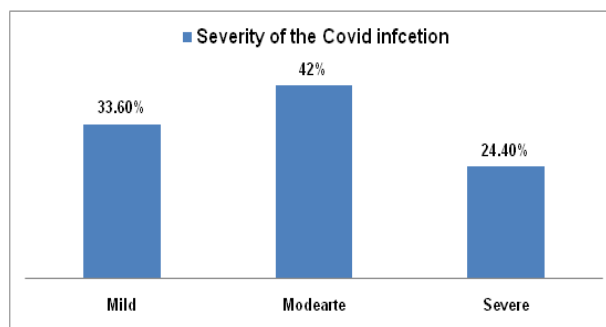Fig 1 — Vaccination status of study subjects (N-226)

Fig 2 — Severity of COVID infection of the study subjects (N-226)

Table 1 — *Basic characteristics of study subjects (N-226)*			
Characteristics		Frequency	Percentage
Age	<20 years	12	5.3%
	20-45	48	21.2%
	46-60	77	34%
	>60 years	89	39.5%
Gender	Male	133	58.8%
	Female	93	41.2%
Co-morbidities	Yes	93	41.2%
	No	133	58.8%
No of Hospital stays	<7 days	193	85.4%
	>7 days	33	14.6%

In the present study, we identified there is an increased risk of mortality with increasing age and also the presence of morbidity in the patients affected by COVID-19. These findings were supported by a study conducted in a similar setting by Rastad, *et al*[19] which showed that the presence of diabetes had more risk of developing death. But in our study, we considered only the presence of co-morbidity as a factor that was significant.

Previous studies conducted during trials and the real world data depicted that there is less possibility of having the severe forms of the disease and thus low mortality among those who are vaccinated against the COVID-19[20-22]. Our study showed less mortality rate among those who were under hospital stay of less than 7 days. The vaccine effectiveness of the AstraZeneca (ChAdOx1 nCoV-19) vaccine has shown to be as 80% in terms of the Hospitalization[23]. COVISHIELD vaccine has been proved to be effective in preventing the infection by 80-94%[24]. The current study finding of risk of hospitalization is also supported by a study done by Carrillo-Vega MF, *et al*[25].

In the present study, the vaccinated individuals though a very small proportion might fall into the severe forms of the disease but they never end their life. This clearly explains the importance of vaccination helps in reducing the severity of the disease and thereby reducing mortality. There are many limitations in the current study. One of them is that we didn't take into account the number of doses of vaccination and the type of vaccines since the effectiveness differs based upon these facts. Also, the study was done during the initial days immediately after the vaccination drive comes into action and hence many of the population would not be vaccinated. And since it was performed in a hospital the findings cannot be externally validated to the general population.

CONCLUSION

Thus the findings of the study imply that vaccination is as effective in reducing mortality and also the factors such as increasing age, presence of co-morbidity, severity duration of hospital stay should be considered while predicting mortality among the COVID-19 infected patients

Source of Fund : Nil
Conflicts of Interest : Nil

Table 2 — *Association between the study variables and mortality status (N-226)*					
Characteristics	Dead (N- 48)	Live (N-178)	Total N-226	Chi-square value	P value
Age :					
<45 years	2 (3.3%)	58 (96.7%)	60	15.6565	<0.05*
>45 years	46 (27.7%)	120 (72.3%)	166		
Gender :					
Female	22 (23.6%)	71 (76.4%)	93	0.552	0.458
Male	26(19.5%)	107 (80.5%)	133		
Co-morbidity status :					
Yes	34(25.5%)	99 (74.5%)	133	3.614	0.5792
No	14 (15%)	79 (85%)	93		
Severity of disease :					
Moderate& below	0 (0%)	171 (100%)	171	191.3	<0.05**
Severe	48 (87.2%)	7 (12.8%)	55		
No of hospital stay :					
<7 days	29 (15%)	164(85%)	193	30.501	<0.05*
>7 days	19(57.5%)	14(42.5%)	33		
Vaccination status :					
Not Vaccinated	48(64.8%)	26(35.2%)	74	7.923	<0.05**
Vaccinated	0(0%)	152(100%)	152		
*significant at p value <0.05 (Chi square test) **Significant at p value <0.05 (Likelihood ratio)					

REFERENCES

1 Chen J, Qi T, Liu L, Ling Y — Clinical progression of patients with COVID-19 in Shanghai, China. *Journal of Infection* 2020; **80:** 1-6 doi: 10.1016/j.jinf.2020.03.004

2 Chen N, Zhou M, Dong X — Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study 2020; **395:** 507-13. doi: 10.1016/S0140-6736(20)30211-7.

3 Wu F, Zhao S, Yu B — A new coronavirus associated with human respiratory disease in China 2020; **579:** 265-9. doi-10.1038/s41586-020-2008-3

4 Lippi G, Sanchis-Gomar F, Henry BM — Coronavirus disease 2019 (COVID-19): the portrait of a perfect storm, 2020; **8:** 497. doi: 10.21037/atm.2020.03.157.

5 Mohapatra PR, Mishra B — Regulatory approval of COVID-19 vaccine for restricted use in clinical trial mode, 2021; **21:** 599-600. doi- 10.1016/S1473-3099(21)00045-1

6 Estimating mortality from COVID-19. https://www.who.int/news-room/commentaries/detail/estimating-mortality-from-covid-19 Accessed 23 March 2022.

7 Kashte S, Gulbake A, El-Amin — COVID-19 vaccines: rapid development, implications, challenges and future prospects. Human cell, 2021; **34(3):** 711-33. doi- 10.1007/s13577-021-00512-4

8 Bhuyan A — India begins COVID-19 vaccination amid trial allegations, 2021; **397(10271):** 264. doi: 10.1016/S0140-6736(21)00145-8.

9 Acharya KP, Ghimire TR, Subramanya SH — Access to and equitable distribution of COVID-19 vaccine in low-income countries. npj Vaccines, 2021; **6(1):** 1-3. doi- 10.1038/s41541-021-00323-6.

10 Bhosale S, Kulkarni AP — Is a problem shared, a problem halved? Not always! The novel coronavirus COVID-19 outbreak, 2020; **24(2):** 88. doi: 10.5005/jp-journals-10071-23365

11 Dixit SB, Zirpe KG, Kulkarni AP — Current approaches to COVID-19: therapy and prevention, 2020; **24(9):** 838. doi: 10.5005/jp-journals-10071-23365.

12 Clinical Guidance For Management Of Adult Covid-19 Patients https://covid.aiims.edu/clinical-guidance-for-management-of-adult-covid-19-patients Accessed on March 23, 2022.

13 Muthukrishnan J, Vardhan V, Mangalesh S — Vaccination status and COVID-19 related mortality: A hospital based cross sectional study, 2021; **77:** 278-82. doi-10.1016/j.mjafi.2021.06.034

14 Rastad H, Karim H, Ejtahed H-S — Risk and predictors of in-hospital mortality from COVID-19 in patients with diabetes and cardiovascular disease, 2020; **12(1):** 57. doi- 10.1186/s13098-020-00565-9.

15 Estiri H, Strasser ZH, Klann JG — Predicting COVID-19 Mortality with ElectronicMedical Records, 2021; **4(1):** 15. doi: 10.1038/s41746-021-00383

16 Mehraeen E, Karimi A, Barzegary A — Predictors of mortality in patients with COVID-19ea systematic review, 2020; **40:** 101226. doi: 10.1016/j.eujim.2020.101226.

17 Eumann Mesas A, Cavero-Redondo, Aparecido Sarria Cabrera M — Predictors of In-Hospital COVID-19 Mortality: A Comprehensive Systematic Review and Meta-Analysis Exploring Differences by Age, Sex and Health Conditions, 2020; **15(11):** e0241742 doi: 10.1371/journal.pone.0241742.

18 Trecarichi EM, Mazzitelli M, Serapide F — Clinical characteristics and predictors of mortality associated with COVID-19 in elderly patients from a long-term care facility, 2020; **10(1):** doi: 10.1155/2022/5904332.

19 Polack FP, Thomas SJ, Kitchin N — Safety and efficacy of the BNT162b2 mRNA COVID-19 vaccine. **383(27):** 2603-2615. doi:10.1056/NEJMoa2034577

20 Dagan N, Barda N, Kepten E — BNT162b2 mRNA covid-19 vaccine in a nationwide mass vaccination setting, 2021; **384(15):** 1412-23. doi: 10.1056/NEJMoa2101765

21 Bhimraj A, Morgan RL, Shumaker AH, — Infectious diseases society of America guidelines on the treatment and management of patients with COVID-19. 2020. doi: 10.1093/cid/ciaa478.

22 Haas EJ, Angulo FJ, McLaughlin JM — Impact and effectiveness of mRNA BNT162b2 vaccine against SARS-CoV-2 infections and COVID-19 cases, hospitalisations, and deaths following a nationwide vaccination campaign in Israel: an observational study using national surveillance data, 2021; **397(10287):** 1819-29 doi: 10.1016/S0140-6736(21)00947-8.

23 Lopez Bernal J, Andrews N, Gower C — Effectiveness of the Pfizer-BioNTech and Oxford-AstraZeneca vaccines on covid- 19 related symptoms, hospital admissions, and mortality in older adults in England: test negative case-control study, 2021; **373:** n1088 doi: 10.1136/bmj.n1088

24 Hyams C, Marlow R, Maseko Z — Effectiveness of BNT162b2 and ChAdOx1nCoV-19 COVID-19 vaccination at preventing hospitalisations in people aged at least 80 years: a test negative, case-control study. **21(11):** 1539-48 doi: 10.1016/S1473-3099(21)00330-3

25 Carrillo-Vega MF, Salinas-Escudero G, García-Peña C — Early estimation of the risk factors for hospitalization and mortality by COVID-19 in Mexico 2020; **15(9):** e0238905. doi: 10.1371/journal.pone.0238905.