ORIGINAL ARTICLE

Efficacy of COVID-19 Vaccines against Mortality among COVID-19 Cases of Indore, Central India

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Abstract

Background: Vaccines against severe acute respiratory syndrome coronavirus 2 (SARS-COV2) virus is being used since January 2021 in India. Current data shows that the vaccines are effective against coronavirus disease 2019 (COVID-19) related morbidity and mortality. Vaccine efficacy in fully vaccinated may decrease over time.

Materials and methods: Retrospective study was done to assess vaccine efficacy against COVID-19 pneumonia related deaths in a tertiary COVID-19 care hospital in Central India. The vaccine efficacy was assessed in the patients with respect to age, gender, and comorbidity and since they received 2nd dose of the vaccine, the study also investigated the waning effectiveness over time leading to mortality.

Results: Vaccine effectiveness against COVID-19 mortality did not peak in the early weeks post receiving the second dose (12.5% mortality in 1st month) but then it increased by the 5th month (7.4% mortality). After the 5th month, vaccine effectiveness decreased (11.9% mortality). Waning of vaccine effectiveness causing mortality was greater in the elderly ≥60 years (18.2%) than in patients <60 years (5.4%). Fully vaccinated males had higher mortality than females. A greater reduction in vaccine efficacy was observed in persons with comorbidities (14.1% mortality) than in noncomorbid (3.4% mortality). On comparing all patients with comorbidity, there was lower mortality in patients who received a full dose of vaccination (14.1%) than those who didn't (22.7%). Fully vaccinated elderly ≥60 years (18.2%) had lesser mortality than those who were not vaccinated (36.4%).

Conclusion: Waning of vaccine effectiveness and related death is seen against COVID-19 after the 5th-month post second dose of the COVID-19 vaccine. Greater mortality is noted in the elderly, males, and patients with comorbidities. Fully vaccinated elderly and patients with comorbidities had a lower mortality rate than those who were not vaccinated.

Keywords: Coronavirus disease 2019, Coronavirus disease 2019 mortality, Vaccine efficacy.

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Introduction

Currently, data from around the world, shows that the vaccines have good efficacy in providing short-term protection against SARS-CoV-2, which causes COVID-19, with respect to the severity of the disease and the clinical outcomes such as hospital admissions and death. But, the duration for which the person remains protected and, thus, the need for further doses is undetermined.[1–7]

In previous studies, it was found that vaccine effectiveness was significantly lower against the delta variant than with the alpha variant among individuals who had received two doses of the COVID-19 vaccine.[1,8] However, the definite reason for this reduced efficacy of vaccines, could not be ascertained. Whether it is a result of decreasing immunity or the presence of a new variant. Immunogenicity data shows that the waning of antibody titers is relatively fast after receiving two doses of vaccine, indicating it is a major factor for the decrease in vaccine efficacy over time.[1,9,10]

This study is aimed to assess the efficacy of vaccines in India COVISHIELD vaccine—recombinant subunit vaccine, and Covaxin inactivated whole virus-based vaccine) against mortality in COVID-19 pneumonia in adults post full (second dose) vaccination, in comorbid patients and in elderly over the age of 60 years in a tertiary COVID-19 care hospital of Central India.

Materials and Methods

This was a hospital record based retrospective study which was done after taking approval from the ethical and scientific committee.

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The study includes 176 hospitalized patients who were rapid antigen test (RAT) and reverse transcription polymerase chain reaction (RT-PCR) positive for COVID-19 between 1st December 2021 and 22nd February 2022. Data were obtained from patient records from a tertiary hospital in Indore, Central India. The study was done to assess the effectiveness of the COVID-19 vaccines available in India post second dose administration in adults with respect to age, gender, comorbidities, and in overtime since receiving the vaccine dose to investigate the waning of the vaccine efficacy leading to mortality due to COVID-19 pneumonia. Data management was done on a Microsoft Excel spreadsheet and significance was calculated using an appropriate analytical test (Chi-squared and Fisher's exact test) (Table 1).

Table 1: Comparison of mortality accounting various factors associated with COVID-19 vaccination

		Improved	*Deaths*	*Total*	*% Mortality*	*P (p-value)*
Duration interval from last vaccination	0–1 month	7	1	8	12.5%	0.553
	1–5 months	62	5	67	7.4%	
	>5 months	54	7	61	11.9%	
Comorbid cases	Fully vaccinated	67	11	78	14.1%	
	Not fully vaccinated	17	5	22	22.7%	
Cases of age >60 years	Fully vaccinated	36	8	44	18.2%	
	Not fully vaccinated	7	4	11	36.4%	
Fully vaccinated cases (gender)	Males	69	10	79	12.6%	0.148
	Females	54	3	57	5.2%	
Fully vaccinated cases (age)	<60 years	87	5	92	5.4%	**0.018**
	≥60 years	36	8	44	18.2%	
Fully vaccinated cases (comorbidity)	Present	67	11	78	14.1%	**0.037**
	Absent	56	2	58	3.4%	

Bold terms shows the results with significant *p*-value.

Results

Vaccine effectiveness against COVID-19 mortality did not peak in the early weeks post receiving the second dose (12.5% mortality in 1st month) but then it increased by the 5th month (7.4% mortality). After the 5th month, vaccine effectiveness decreased (11.9% mortality).

Waning of vaccine effectiveness causing mortality was greater and was statistically significant in the elderly ≥60 years (18.2%) than in patients <60 years (5.4%). Fully vaccinated males had higher mortality than females of 12.6 and 5.2% respectively. Among fully vaccinated cases, greater reduction in vaccine efficacy was observed and was statistically significant in persons with comorbidities (14.1% mortality) than in noncomorbid (3.4% mortality). On comparing all patients with comorbidity, there was lower mortality in patients who received a full dose of vaccination (14.1%) than those who didn't (22.7%). Fully vaccinated elderly ≥60 years (18.2%) had lesser mortality than those who were not vaccinated (36.4%).

Discussion

As a mass vaccination strategy is potentially the most effective way to end the pandemic, surveillance of vaccine efficacy becomes necessary. The performance of the new vaccines in an actual world setting often differs from that seen in trial conditions. The effectiveness data for vaccines is also required to guide future policy decisions.[11]

In this study, we observed a reduction in the vaccine efficacy against COVID-19–related mortality after 5th-month postvaccination with two doses of the vaccine. No significant reduction in the mortality of COVID-19 disease was seen in the early weeks after administration of the second dose (i.e., 12.5% mortality rate within 1 month of vaccination) but then the mortality decreased by 5th month to 7.4% (with maximum effectiveness seen in the 2nd- and 3rd-month postvaccination). After 5th-month postvaccination, a reduction in the vaccine efficacy was noted against mortality (11.9% mortality rate). Another study done by Andrews et al.[1] showed similar results where the vaccine effectiveness was highest in the early weeks post receiving the second dose and subsequent reduction of effectiveness by 20 weeks. After 20 weeks post second vaccination, vaccine efficacy decreased in preventing COVID-19 hospital admissions and mortality.[1] Waning leading to mortality was more in older adults, males, and in individuals with preexisting comorbidities. This is in concordance with a study done by Andrews et al.[1] which also shows that reduction in vaccine efficacy was more in persons 60 years of age or older and in persons having other medical conditions.[1] Additionally, in this study during the comparison of fully vaccinated group cases with those who were not fully vaccinated, we found that there was comparatively lower % mortality in patients who had a full dose of vaccination than those who didn't, with a mortality rate of 14.1 and 22.7%, respectively. While comparing mortality in all patients of age ≥60 years, there was a comparatively lower mortality rate in patients who had a full dose of vaccination than those who did not, with a mortality rate of 18.2 and 36.4%, respectively. On comparing all cases with comorbidities or with age ≥60 years, we found that there was comparatively higher mortality in cases who were not fully vaccinated. Limitations of our study included firstly, the unavailability of an Omicron variant specific testing facility. Secondly, since the facility is a tertiary care hospital, hospital bias with more percentage of moderate to severe cases was included in the study and finally, the sample size was small and the results are expected to be more statistically relevant in a bigger sample size. We also observed in our study that the average duration of hospital stay was more in unvaccinated patients (9.4 days), as compared to vaccinated patients (7 days).

Finally, we conclude that a reduction in vaccine efficacy is seen against COVID-19-related deaths after 5th-month postvaccination with two doses of the COVID-19 vaccine. Greater mortality is noted in the elderly, males, and patients with comorbidities. Fully vaccinated elderly and patients with comorbidities had lower mortality than those who were not.

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