Journal of Medical and Scientific Research

JMSR
www.jmsronline.com

Meena MS et al. J Med Sci Res. 2023; 11(4):290-295
http://dx.doi.org/10.17727/JMSR.2023/11-54

ORIGINAL RESEARCH OPEN ACCESS

COVID-19 vaccination and its influence on the disease severity among the COVID patients in a tertiary care hospital – A cross sectional study

Selva Meena M[1], Sangumani J[2], Brahadeesh M[3,*], Anbuvel Natrajan[2], Jeshwin John[2] and Joseph Wilfred Jeyaseelan D[1]

[1]Department of Community Medicine, Government Medical College, Virudhunagar – 626002, Tamil Nadu, India
[2]Department of General Medicine, Government Medical College, Virudhunagar – 626002, Tamil Nadu, India
[3]Department of Pharmacology, Government Medical College, Virudhunagar – 626002, Tamil Nadu, India

Abstract

Introduction: COVID-19 disease was a global health emergency from March 2020 till May 2023 with no effective drug to date. COVID-19 vaccines with other precautious measures like hand washing, disinfection, social distancing etc. were the only ways to decrease the burden of the disease worldwide. The study aimed to determine the association between COVID-19 vaccination and disease severity among COVID-19 patients admitted to a Government Medical College hospital.

Methods: This cross sectional study included 983 COVID-19 patients admitted to a tertiary care hospital from March 2021 to December 2021. Secondary data were collected from the case sheets and vaccination details were collected from the patients over the phone and through COWIN App. Chi-square test and binary logistic regression were done and the p value and odds ratio were estimated.

Results: 92.9% of study participants were unvaccinated, 2.7% were fully vaccinated, and 4.3% were partially vaccinated. Among fully vaccinated 11.1% had breathlessness, 0% ICU admission, 3.7% died, 20% had COVID pneumonia findings in CT lung, 9% had low lymphocyte levels which were statistically significantly lower than in partially vaccinated (39.5%, 41.9%, 7%, 18.6%, 59.3%, 65.1%, 76.9% respectively) and unvaccinated (31.1%, 27.7%, 2%, 4.6%, 48.2%, 45.2%, 68.4% respectively).

Conclusion: Two doses of vaccines provided significant protection from severe forms of the disease. Partially vaccinated were affected more, which may be due to insufficient immunity gained and their careless attitude post-vaccination with decreased shielding behaviour. The present study shows that partial vaccination is not protective against the progression of COVID-19 disease severity. More focus should be made on full vaccination of the community and educating the public about complete vaccination and emphasis on preventive measures even after vaccination must be made to reduce the burden of COVID-19 in the community.

Keywords: COVID-19; COWIN App; vaccination; coronavirus disease

Introduction

"Coronavirus disease 2019" (abbreviated "COVID-19") is an emerging respiratory disease that is caused by a novel beta coronavirus and was reported first in December 2019, in Wuhan, China. The disease is highly infectious, and its main clinical symptoms include fever, dry cough, fatigue, myalgia and dyspnea. WHO was informed about pneumonia-like infection of unknown cause, which was identified as COVID-19 and has spread over 213 countries and territories around the world. In India 43,024,440 total cases of COVID-19 were confirmed with 521,159 deaths. In Tamil Nadu

***Corresponding author:** Dr. Brahadeesh M, Associate Professor, Department of Pharmacology, Government Medical College, Virudhunagar – 626002, Tamil Nadu, India. Email: brahadeesh186@gmail.com

Received 4 July 2023; *Revised* 2 September 2023; *Accepted* 8 September 2023; *Published* 19 September 2023

Citation: Meena MS, Sangumani J, Brahadeesh M, Natrajan A, John J, Jeyaseelan DJW. COVID-19 vaccination and its influence on the disease severity among the COVID patients in a tertiary care hospital – A cross sectional study. J Med Sci Res. 2023; 11(4):290-295. DOI: http://dx.doi.org/10.17727/JMSR.2023/11-54

total confirmed cases were 34,52,790 and deaths were 38,025 [1]. COVID-19 has rapidly affected our day to day life and business. The income losses translate directly into a decrease in spending and the well-being of every individual, particularly for those who work on the basis of a daily wage. It mainly affects the physical and mental health of individuals. COVID -19 also affected the education of school children as they were not able to attend face to face classes. They also find it difficult to attend the online classes as they were new to this system and their physical activity has also decreased dramatically. Due to the lockdown, most of the people got stuck in their houses and many of them reported having severe depression.

To date there has been no effective drug to reduce the spread of covid-19, ideally, the COVID-19 vaccine would be the most effective way to decrease the severity of the disease, decrease the acquisition of infection, and decrease the transmission. Two vaccines were granted for emergency use by the central drugs standard control organizations in India, Covishield [AstraZeneca's vaccine manufactured by serum institute of India] and Covaxin [manufactured by Bharat Biotech Limited]. In India, 220,67,76,793 vaccine doses have been administered and in Tamil Nadu 10,30,69,900 vaccine doses have been administered [1].

It has been found from previous studies that vaccination decreased the following probabilities- acquisition of COVID infection, hospitalization, ICU admission and death [2, 3]. But there is no such study on vaccination done in our study area so the present study is done to estimate the association between COVID vaccination and disease severity among patients hospitalized for COVID-19.

The study aimed to determine the association between COVID vaccination and disease severity among COVID patients admitted in a Government Medical College hospital.

Methodology

This study was a cross sectional study done to estimate the efficacy of the COVID vaccine among vaccinated COVID patients compared to non-vaccinated COVID patients admitted to a Government Medical College hospital in terms of disease severity. The Government Medical College hospital selected is a tertiary care hospital with a dedicated COVID wing, with its catchment area extended to several villages surrounding it and backed with a vision to offer the best in patient care and equipped with technologically advanced healthcare facilities. All COVID patients belonging to all age groups and admitted to Government Medical College hospital from March 2021 to December 2021 were included in the study. COVID's second wave was started in March 2021 in the study area and vaccination for the general public was started after March 1st (people >60 years and 45 – 60 years with co-morbidities were the first beneficiaries, both were started with vaccination at the same time). The study duration was three months from January 2022 to March 2022. During those three months' secondary data were collected from the case sheets and vaccination details were collected by contacting the patients over the phone and through COWIN App. Patients whose case sheets were incomplete; whose mobile phone numbers were not entered in the case sheets and whose mobiles were switched off or not reachable or who did not pick up the call even after three attempts done at an interval of three days were excluded from the study. Out of 1,770 COVID-positive patients admitted to our hospital from March 2021 to December 2021 after applying exclusion criteria, we arrived at a final sample size of 983 COVID patients. But however, after June 2021 and before May 2021 cases of different degrees of severity (among our study participants cases with severe pneumonia - 28.3%, mild pneumonia – 38.8% with no pneumonia - 32.2%) were admitted to our hospital because there were few cases in the district and there was no COVID care centre in that period, thus reducing the Berkisonian and selection bias.

The operational definition for COVID-positive

A person with laboratory confirmation of COVID-19 infection (RT-PCR positive for SARSCOV-2), irrespective of clinical signs and symptoms.

COVID death: COVID-positive patients whose primary cause of death is due to COVID pneumonia.

Uncomplicated illness: Patients with uncomplicated upper respiratory tract viral infection, may have non-specific symptoms such as fever, cough, sore throat, nasal congestion, malaise, headache. The elderly and immunosuppressed may present with atypical symptoms.

Mild pneumonia: Patient with pneumonia and no signs of severe pneumonia. Child with non-severe pneumonia has cough or difficulty in breathing/ fast breathing: (fast breathing - in breaths/min) <2 months, ≥60; 2–11 months, ≥50; 1–5 years, ≥40 and no signs of severe pneumonia.

Severe pneumonia

Adolescent or adult: fever or suspected respiratory infection, plus one of the following; respiratory rate >30

breaths/min, severe respiratory distress, SpO_2 <90% on room air.

Child with cough or difficulty in breathing, plus at least one of the following: central cyanosis or SpO_2 <90%; severe respiratory distress (eg. grunting, chest in drawing); signs of pneumonia with any of the following danger signs: inability to breastfeed or drink, lethargy or unconsciousness, or convulsions. Other signs of pneumonia may be present: chest in drawing, fast breathing (in breaths/min): <2 months ≥60; 2–11 months ≥50; 1–5 years ≥40. The diagnosis is clinical; chest imaging can exclude complications.

Patients who were referred to other hospitals were called over the phone to know about their outcome (death or discharge).

Factors like symptomatic-status, oxygen requirement, ICU admission, abnormal lab parameters and CT findings and death were used to determine the disease severity. They are dependent factors in the study and vaccination status (unvaccinated, partially vaccinated and fully vaccinated) is the independent factor in the study. If a COVID vaccine dose is given in less than 14 days before the onset of illness, that dose is not considered because after vaccination it takes some time for the immune system to get activated and to produce antibodies as per UK surveillance data and the incubation period for COVID disease is also 14 days.

Data collection was done using the semi-structured predesigned questionnaire validated by expert review and pilot study was used. It includes questions regarding the patient's basic details like name, age, gender, address; Symptoms and date of onset of the first symptom; patient's O_2 requirement; comorbidity; vaccination history like vaccination status, date of vaccination, number of doses and type of vaccination; C-reactive protein; lymphocyte count; glycaemic control, CT lung findings; date of admission; date of discharge; outcome (death or discharge) and outcome date. When the patients were contacted by phone details of the study were explained to the patients and verbal informed consent was obtained. The protection of the privacy of the research participants and confidentiality of research data was ensured. Ethical clearance was obtained through institutional ethical clearance.

Data were entered in Microsoft excel and analysis was done using SPSS v.21. Descriptive statistics were done to find out frequencies, percentages, mean and standard deviation. Chi-square test was done to find out the association between two categorical variables, Fisher exact test is used when more than 25% of cells had value less than 5 and binary logistic regression was done to predict the various disease severity factors associated with vaccination and to estimate the odds ratio. ANOVA test was used to find out the difference in mean (mean duration of hospital stay and mean duration from onset of symptom till outcome) between groups. P value<0.05 was considered to be statistically significant.

Results

Out of 983 study population, the majority (60%) were females and 40% were males. Table 1 depicting the age and sex distribution of the study population shows that 16–30 years were the most common age group affected followed by 46-60 years, then 31–45 years, then greater than 60 years and then by less than 15 years. 60% of COVID patients were females. Cough was the most common symptom and diabetes mellitus was the most common co-morbidity in our study participants.

Table 1: Age and gender distribution of COVID patients (n=984).

Age in years	*Male*	*Female*	*Total n (%)*
<15	6	6	12 (1.2%)
16-30	45	350	395 (40.1%)
31-45	112	80	192 (19.5%)
46-60	125	100	225 (22.8%)
>61	108	51	159 (16.1%)
Total	396 (40.2%)	587 (59.7%)	983 (100%)

Out of a total of 983 participants, 92.9% (913) were unvaccinated, only 7% (70) were vaccinated. 2.7% (27) of our study subjects were fully vaccinated and 4.3% (43) were partially vaccinated among vaccinated, 77.1% (54) took Covishield which was more compared to those who took Covaxin which was 22.8% (16).

Table 2 portrays the association between vaccination and various factors determining the disease severity. It was found that among fully vaccinated 11.1% of them had breathlessness, 25.9% required O_2 support, no one were in ICU, 85.2% were symptomatic and only 3.7% died this was comparatively lower than in unvaccinated (31.1%, 27.7%, 2%, 70.6%, 4.6% respectively) and partially vaccinated (39.5%, 41.9%, 7%, 81.4%, 18.6% respectively).But statistically significant differences between groups were found only for factors like breathlessness, ICU admission and death and not for other factors. Partially vaccinated were at 5.2 times more risk and unvaccinated were at 3.6 times more risk in developing breathlessness compared to fully vaccinated. Partially vaccinated were at 5.9 times more risk and unvaccinated were at 1.5 times more risk of death compared to fully vaccinated.

Table 2: Association between Vaccination status and disease severity among study population (n= 983).

Vaccination status	*Breathlessness*	*O2*	*ICU*	*Symptomics*	*Death*
	P value - 0.039 Chi-sq-6.468*	*P value - 0.127 Chi-sq-4.130*	*P value - 0.04**	*P value - 0.08 Chi-sq-4.876*	*P value - 0.001* Chi-sq-16.498*
Unvaccinated (913)	284 (31.1%) OR – 3.612	253 (27.7%) OR – 1.095	18 (2%)	645 (70.6%) OR – 0.419	42 (4.6%) OR – 1.524
Partially vaccinated (43)	17(39.5%) OR- 5.231	18 (41.9%) OR – 2.057	3 (7%)	35 (81.4%) OR – 0.761	8 (18.6%) OR – 5.943
Fully vaccinateda (27)	3 (11.1%)	7 (25.9%)	0	23 (85.2%)	1 (3.7%)
Total (983)	304 (30.9%)	278 (28.3%)	21 (2.1%)	703 (71.5%)	51 (5.2%)

Abbreviations: *Statistically significant; [a]reference category taken in binary logistic regression; OR- odds ratio calculated using binary logistic regression.

Table 3 shows the association between vaccination and lab parameters. It was found that in the fully vaccinated group only 20% of the COVID patients had COVID pneumonia findings in their CT lungs, 37.5% of them had lower lymphocytes count, and in 54.5% of them, CRP was elevated which were low compared to unvaccinated patients with 48.2% of them with COVID pneumonia CT lung findings, 45.2% of them with lower lymphocytes count, 68.4% with abnormal CRP values. In partially vaccinated group 59.3% of them were with COVID pneumonia CT lung findings, 65.1% of them were with lower lymphocytes count, and 76.9% were with abnormal CRP values. Differences between the groups were statistically significant for CT lung and lymphocyte count. Unvaccinated were at 3.7 times more risk of developing abnormal CT lung findings compared to fully vaccinated and partially vaccinated were at 5.8 times higher risk compared to fully vaccinated. Partially vaccinated were also at 3 times higher risk of getting elevated lymphocyte count compared to fully vaccinated.

Table 3: Association between Vaccination status and Lab parameters among study population.

Vaccination status	*CT lung*		*p-value*	*Odds ratio*
	Normal	*Abnormal*		
Unvaccinated	299 (51.8%)	278 (48.2%)	0.022*	3.719
Partially vaccinated	11 (40.7%)	16 (59.3%)		5.818
Fully vaccinated[a]	16 (80%)	4 (20%)		
Total	326 (52.2%)	298 (47.8%)		
Vaccination Status	*Lymphocytes*		*p value*	
	Normal	*Abnormal*		
Unvaccinated	474 (54.8%)	394 (45.2%)	0.027*	1.573
Partially vaccinated	15 (34.9%)	28 (65.1%)		3.111
Fully vaccinated[a]	15 (62.5%)	9 (37.5%)		
Total	504 (54.1%)	428 (45.9%)		
Vaccination Status	*CRP*		*p value*	
	Normal	*Abnormal*		
Unvaccinated	172 (31.6%)	373 (68.4%)	0.244	1.802
Partially vaccinated	6 (23.1%)	20 (76.9%)		2.778
Fully vaccinated[a]	10 (45.5%)	12 (54.5%)		
Total	188 (31.7%)	405 (68.3%)		

Abbreviations: *Statistically significant; [a] reference category taken in binary logistic regression unadjusted odds ratio calculated using binary logistic regression.

It was found that proportion of patients with breathlessness (24.1%), O_2 requirement (29.6%), symptomatic (81.5%) and death (9.3%) were comparatively low among those vaccinated with Covishield compared to those vaccinated with Covaxin (43.8%, 56.2%, 0, 87.5%, 25% respectively). However, none of these differences between groups was found to be statistically significant. ICU admission was high among patients vaccinated with Covishield (5.6%) compared to those vaccinated with Covaxin (0%) but this was also not statistically significant.

Among study participants mean duration of hospital stay in fully vaccinated (4.26 days) was low compared to unvaccinated (6.04 days) and partially vaccinated (5.09 days). The mean duration from onset of symptoms to outcome in fully vaccinated (7.73 days) was also low compared to unvaccinated (10.45 days) and partially vaccinated (9.83 days). But no statistically significant difference was seen between groups for both the parameters.

Discussion

We evaluated the association between COVID-19 vaccination and disease severity among COVID patients admitted to the Government Medical College hospital. 92.9% of the study participants were unvaccinated, 7.1% were vaccinated, 2.7% has received two doses, and 4.3% were partially vaccinated. Among the vaccinated people, 77.1% received Covishield, and 22.9% received Covaxin. Among people who were fully vaccinated 11.1% had breathlessness, 25.9% required O_2, 85.2% were symptomatic, 0% ICU admission and 3.7% died. In partially vaccinated 39.5% had breathlessness, 41.9% required O_2, 7% were admitted in ICU, 81.4% symptomatic, 18.6% dead. The laboratory finding shows that 20% of fully vaccinated had COVID pneumonia in CT lung, 9% had low lymphocyte level and 54.5% had increased CRP level. In partially vaccinated, 59.3% of people had COVID pneumonia in CT findings, 65.1% had low lymphocyte levels and 76.9% with increased CRP levels. Among people who have fully vaccinated duration of hospital stay was 4 days. In partially vaccinated it was 5 days.

Here the probability of ICU admission/breathlessness, and death were statistically significantly lower among fully vaccinated patients compared to partially vaccinated and unvaccinated patients. In fully vaccinated, the proportion of patients with abnormal CT lung findings and lymphocyte counts were significantly lower than partially and unvaccinated. Our study reported that 85.2% had symptoms after getting two doses of vaccine but there was no significant association between vaccination and disease severity. Our study was similar to another study done by Beatty where 80% patient had symptoms after getting fully vaccinated [4, 5], but it is different from the study done by Paulkoudi et al where only 67% of vaccinated had symptoms which is comparatively lower than our study [6]. Our study reported that in partially vaccinated 81.4% were symptomatic which was comparatively higher than other study done by Bernal et al where a significant reduction in symptomatic COVID-19 was found even if they were partially vaccinated [7]. Another study done by Brongna et al reported partial vaccination had not shown to be protective which was similar to our study [8]. In fully vaccinated, only 20% had COVID pneumonia in CT findings, and they were in a milder form. Our study was similar to the other study done by Brongna et al they also reported fully vaccinated affected with mild form COVID pneumonia [8].

Our study reported 0% ICU admission and 3.7% death after getting two doses of vaccine and there was a statistically significant association of vaccination status with the above parameters which was similar to other study done by Bernal et al [7] and Malli et al in those studies also there was a significant decrease in ICU admission and death among fully vaccinated [9]. In our study, 11.1% of fully vaccinated had breathlessness which was lower than the other study done by Colaneri et al where fully vaccinated had significant worsening of the breathlessness [10]. In a study done by Das et al among fully vaccinated 41.8% required O_2 which was comparatively higher than our study where only 25.9% required O_2, but it was not significant in their study as ours. They also reported that in partially vaccinated only 35% required O_2 which was lower than our study reported where 41.9% required O_2 [10, 11]. Our study reported that the length of hospital stay was lower in fully vaccinated compared to partially vaccinated and unvaccinated which was similar to other study done by Bahl et al [12].

Limitations: It is done in a tertiary care hospital where only severe cases might have been admitted. But however, after June 2021 and before May 2021 cases of different degrees of severity were admitted to our hospital because there were few cases in the district and there was no COVID care centre in that period, thus reducing the Berkisonian and selection bias.

Conclusion

Our results showed that in comparison with fully vaccinated patients, partially vaccinated were affected more, even more than unvaccinated due to their attitude changes post-vaccination, carelessness and decreased shielding behaviour that could be influencing. Hence two dose of vaccination is important to protect ourselves

from COVID-19. More focus should be made on full vaccination of the community and educating the public that partial vaccination may not give them full immunity against the disease and emphasis on preventive measures even after vaccination must be made to reduce the burden of COVID-19 in the community.

Conflicts of interest

Authors declare no conflicts of interest.

Reference

[1] Dadax Limited daily COVID-19 census Worldometer homepage. Accessed on 31 March 2022 from: https://www.worldometers.info/coronavirus

[2] Government of India. Daily COVID-19 census. Ministry of Health and Family Welfare. Accessed on 31 March 2022 from: https://www.mohfw.gov.in

[3] Bhattacharya A, Ranjan P, Ghosh T, Agarwal H, Seth S, et al. Evaluation of the dose-effect association between the number of doses and duration since the last dose of COVID-19 vaccine, and its efficacy in preventing the disease and reducing disease severity: A single centre, cross-sectional analytical study from India. Clin Res Rev. 2021; 15:102238.

[4] Selvaraj P, Muthu S, Jeyaraman N, Prajwal GS, Jeyaraman M. Incidence and severity of SARS-CoV-2 virus post COVID-19 vaccination: A cross-sectional study in India. Clin Epidemiol Global Health. 2022; 14:100983.

[5] Beatty AL, Peyser ND, Butcher XE, Cocohoba JM, Lin F, et al. Analysis of COVID-19 vaccine type and adverse effects following vaccination. JAMA. 2021; 4:e2140364-e2140364.

[6] Kuodi P, Gorelik Y, Zayyad H, Wertheim O, Wiegler KB, et al. Association between BNT162b2 vaccination and reported incidence of post-COVID-19 symptoms: cross-sectional study 2020-21, Israel. NPJ Vaccines. 2022; 7:101.

[7] Bernal JL, Andrews N, Gower C, Robertson C, Stowe J, et al. 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. BMJ. 2021; 373:n1088.

[8] Brogna B, Bignardi E, Brogna C, Capasso C, Gagliardi G, et al. COVID-19 pneumonia in vaccinated population: a six clinical and radiological case series. Medicina. 2021; 57:891.

[9] Malli F, Lampropoulos IC, Papagiannis D, Papathanasiou IV, Daniil Z, et al. Association of SARS-CoV-2 vaccinations with SARS-CoV-2 infections, ICU admissions and deaths in Greece. Vaccines. 2022; 10:337.

[10] Colaneri M, De Filippo M, Licari A, Marseglia A, Maiocchi L, et al. COVID vaccination and asthma exacerbation: might there be a link? Int J Infect Dis. 2021; 112:243–246.

[11] Das S, Tumpa NI, Khan AA, Hoque MM, Hoque ME, et al. Relation of vaccination with severity, oxygen requirement and outcome of COVID-19 infection in Chattogram, Bangladesh. medRxiv. 2021; 2021-06.

[12] Bahl A, Johnson S, Maine G, Garcia MH, Nimmagadda S, et al. Vaccination reduces need for emergency care in breakthrough COVID-19 infections: A multicenter cohort study. Lancet Reg Health Am. 2021; 4:100065.