Post Vaccination Covid Infection in Health Care Workers at a Tertiary Care Centre: A Retrospective Cohort Study

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ABSTRACT

Introduction: SARS-CoV-2 (severe acute respiratory syndrome corona virus -2) infection is an ongoing global pandemic. An efficacious vaccine is considered essential to prevent further morbidity and mortality. Vaccination programs started during December 2020 in several countries and prioritized healthcare workers (HCWs). In India vaccination campaign coincided with second surge of COVID cases with daily number of approximately 10,000 new cases in Mumbai. Aim: It aimed to assess the prevalence of COVID-19 infection in vaccinated HCWs and study disease severity post vaccination. The authors share their experience regarding COVID-19 AZD1222 (Covishield) vaccine at tertiary health care centre

Material and methods: This was a retrospective observational study. Out of 441 HCWs, 40 HCWs were infected post vaccination during February till March 2021. Data was obtained by telephonic survey and hospital records. Details of time period of first and second vaccination doses and infection, disease severity statistically analyzed.

Results: Prevalence of SARS-CoV-2 cases was 10.1% of vaccinated HCWs. Most of infection cases occurred within two weeks of first vaccine dose. Disease severity was mild in 92.5% cases, moderate in 7.5% cases. There was no severe case and mortality.

Conclusion: HCWs are at highest risk of exposure and are also likely source of infection of their family members. Vaccination in HCWs on priority is essential. Infection can occur even after single dose of vaccine. It is important to distinguish symptoms of side effects of vaccine from COVID infection. Disease severity is milder post vaccination. Vaccination coverage globally and Infection control practices like wearing mask, social distancing, appropriate PPE, hand sanitization will help in combating the pandemic.

Keywords: Post vaccination, Healthcare Workers, COVID-19 Infection, Prevalence, Disease Severity

INTRODUCTION

Corona virus disease 2019 (COVID-19) was declared as pandemic by WHO (World Health Organization) on March 10, 2020. It has caused more than 1 million deaths in the first 6 months of the pandemic and huge economic and social upheaval internationally. Several countries have seen a two-wave pattern of COVID cases. India is witnessing unprecedented spike in COVID-19 cases again since March 2021. An efficacious vaccine is essential to prevent further morbidity and mortality.[1] Various forms of vaccines such as inactivated (PiCoVacc), live attenuated (CDX-CoV), viral vector (Sputnik V), protein subunit (Novavax) and nucleic acid (DNA (Zydus Cadila), RNA (Pfizer, Moderna) are in various stages of development.[2] Covishield vaccine, is a Viral Vector based Technology. Covaxin vaccine, is a whole-Virion Inactivated Corona Virus Vaccine.[3]

National COVID-19 Vaccination programs started in January 2020 and prioritized healthcare workers (HCWs).[4] Two vaccines that have been granted emergency use authorization by the Central Drugs Standard Control Organization (CDSCO) in India are Covishield (AstraZeneca's vaccine manufactured by Serum Institute of India) and Covaxin (manufactured by Bharat Biotech Limited).[2] India is in a prime position to both benefit from the world's vaccine need and provide for its own citizens.[5] In this article, the authors share their experience in Covishield vaccinated HCW.

The vaccination campaign coincided with second surge of COVID with daily number of approx 10000 cases in Mumbai.

Aims

1. To study the prevalence of COVID-19 infection in post vaccinated HCWs
2. To study post vaccination disease severity in HCWs.
3. To study rate of infection after first and second dose of vaccination.

MATERIAL AND METHODS

This was a retrospective cross sectional cohort study from tertiary hospital, with 200 beds for COVID patients. India launched vaccination campaign on early January 2021. Out of total 441 healthcare workers at this tertiary hospital, 393 had received Covishield vaccine. Symptomatic HCWs were tested for COVID 19, and asymptomatic testing was done to HCWs for workplace exposure, out of state travel and as per request. SARS-CoV-2 cases in HCWs were detected by

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real time reverse transcriptase polymerase chain reaction (rRTPCR) and rapid antigen test (RAT). We included infected HCW till 31st March 2021 and had received atleast one dose of vaccine. A telephonic survey was done to collect data about dates of vaccination of first and second dose, Date of positive report, symptoms, severity and hospitalization. Odds ratio was calculated to find association between vaccination and decrease in infection rate.

RESULT

As of 31st March 2021, out of total 441 HCWs those receiving either single or double doses of vaccine was 393 (Case Population) while 48 were non vaccinated (Control Population) (Table 1). Of these 313 had taken both doses and 80 had taken single dose (Table 2).

Total HCWs infected with COVID-19 was 52. Out of 52 infected, 40 HCW had taken atleast one dose of vaccine and 12 HCW had not taken single dose of vaccine. Full dose of vaccination was completed by 22 while 18 had taken single dose (Table 2, Chart2). The vaccinated HCWs were 0.34 times less likely to develop COVID infection. Conversely, non vaccinated HCWs were at 2.94 times higher risk of contracting COVID infection as compared to the vaccinated HCWs. Odds Ratio = 0.34 and Confidence Interval = 0.16 - 0.70. Significant difference in infection rates was seen in vaccinated and non vaccinated population p- value= 0.0048 (Table1). Prevalence of infected HCWs was 10.1% (40/393) of vaccinated HCWs. Case rate in HCW who received single dose was 22.5% (18/80) and in those getting both doses was 7.02% (22/313) (Table 2).

Infections detected after 14 days from initial dose were

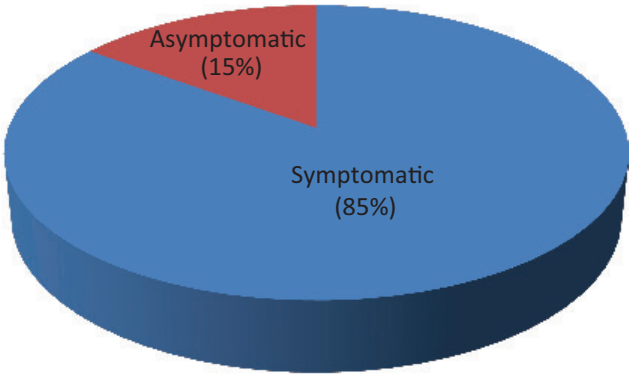

Figure-1: Post vaccination COVID 19 disease presentation

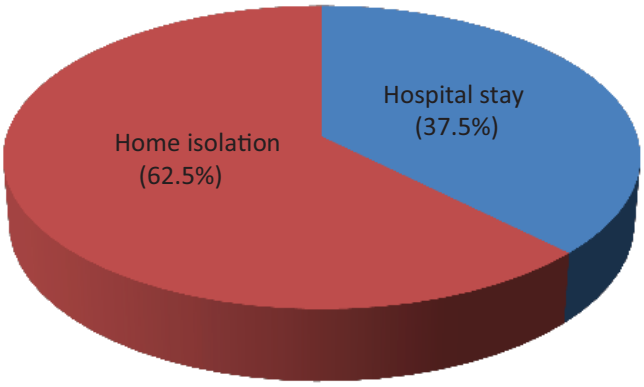

Figure-2: Hospitalization Vs Home quarantine statistics

	HCWs	Total positive cases	Percentage (%)
Vaccinated (cases)	393 (89.1%)	40	10.1
Non vaccinated (control)	48 (10.9%)	12	25
Total	441	52	
P Value		p- value= 0.0048	

Table-1: Vaccinated (cases) and non vaccinated (control) group infectivity rate statistics

Vaccine dose	Total HCW receiving	Positive cases after	Percentage (%) of infected HCW after
1st dose	80 (20.3%)	18	22.5
2nd dose	313 (79.7%)	22	7.02
Total	393	40	

Table 2: Percentage (%) of infected HCW after 1ST and 2nd dose of vaccination

Category	Total HCWs	Total vaccinated COVID positive HCWs	Days Between Dose of Vaccine and Positive Test	
			<14 Days	>14 Days
Doctors	96	8	5	3
Nursing staff	201	14	9	5
Laboratory staff	17	4	3	1
Radiographers	8	4	2	2
Hospital attendant	40	4	3	1
Helper	28	1	0	1
Dresser	32	3	3	0
Hospital Peon	15	1	1	0
Dialysis Technician	4	1	1	0
Total	441	40	27 (67.5%)	13 (32.5%)

Table-3: HCWs Characteristics Stratified by Vaccination-to-Diagnosis Timing

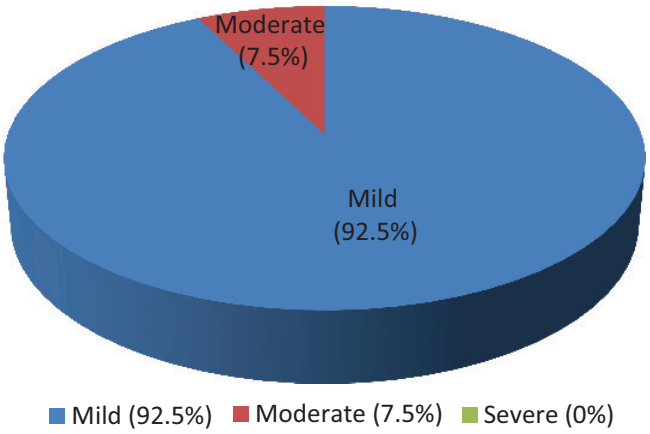

Figure-3: Post vaccination disease severity status

less (32.5%, 13/40) as compared to cases within 14 days (67.5%, 27/40). Percentage was higher in Radiographers (50%), Dialysis Technician (25%), Laboratory staff (23.5%), doctors (8.3%), as compared to other HCWs. Categories of HCWs and time period of infection post vaccination is enlisted (Table 3).

Symptomatic cases were 34 (85%) and asymptomatic were 6 (15%). Conjunctivitis, diarrhea, sore throat, anosmia, and headache were common at presentation as compared to body ache, fever. Asymptomatic cases were only (Chart 1).

OPD basis treatment and home isolation was advised in 25 cases (62.5%) and 15 cases (37.5%) required hospitalization (Chart 2).All moderate cases and few mild cases were admitted. Disease severity was mild in 37 cases (92.5%), moderate in 3 cases (7.5%). There was no severe case and no mortality (Chart 3).

DISCUSSION

COVID pandemic has caused high morbidity, mortality and global economic recession. SARS-CoV-2 is different from other known viruses due to multiple mutations on the sites of nonstructural proteins (NSP) 2 and 3, and the varying nature of virulence between different persons.[2] Multiple waves of transmission during infectious disease epidemics represent a major public health challenge.[6] Several studies emphasized that newer SARS-CoV2 variants have increased infectivity, modest decrease in neutralizing activity, and may impact vaccine effectiveness via escape from vaccine-induced immunity, specifically by mutations in the spike protein.[7]

Efficacious vaccine is an ultimate conclusive solution to combat the pandemic. Vaccine development is an extensive process with high chances of failure and even involves numerous challenges and safety issues to get accepted and approved.[2] Currently, hundreds of COVID-19 candidate vaccine projects have been registered in the US clinical trial database (clinicaltrials.gov).[8,9] According to different targets and technologies, vaccines can be divided into the following categories: inactivated vaccines, recombinant spike protein vaccines, viral vector vaccines, RNA vaccines, live attenuated vaccines and virus-like particle vaccines, etc.[10,11]

India witnessed explosion of COVID cases in March. India's huge immunization drive began on 16 January 2021. Covishield is version of the Oxford University-AstraZeneca vaccine that was found to have an average efficacy of 70.4% in a peer reviewed study. Covishield is an Indian version made by the world's largest vaccines manufacturer, the Serum Institute of India. Covaxin is India's first home produced vaccine against covid-19. It was developed by Bharat Biotech in collaboration with the Indian Council of Medical Research and the National Institute of Virology.[5] Meanwhile, India is donating 800 000 doses of Covishield to be divided between Bangladesh, Bhutan, Myanmar, Nepal, the Philippines, and Seychelles as a goodwill gesture, with Afghanistan, Sri Lanka, and Mauritius also in line for donations.[12] India's biotech companies are also expected to produce 300 million doses of Russia's Sputnik V vaccine. Sputnik V also cleared Indian safety trials in mid-January.[13] India is in a prime position to both benefit from the world's vaccine need and provide for its own citizens.[5]

Similar to studies done by Polack FP et al, Lumley SF etal, Marck Thompson etal, we found greater reductions in new positive cases after two vaccine doses compared with one dose.[14,15,16] Bouton et al study had prevalence of 1.3% (96/7,109) infected HCWs who received at least one dose and 0.3% (17/5,913) HCWs given both doses.[17] Amit S et al study showed 0.54% infection prevalence in vaccinated HCWs.[18] Thompson et al study had prevalence of 5.2% (205/3,950).[16]

High prevalence in our study as compared to other studies can be explained on basis of multiple parameters. This study includes HCW as compared to other studies which include general population. Also most of the HCW in this study are frontline HCWs working in COVID wards. The study site has 200 beds of COVID patients. The time period of study coincided with the second surge of Pandemic. Study was conducted in initial months of post vaccination campaign. Most of the HCWs of this hospital travel by public transport system, community acquired infection being a possibility.

Asymptomatic cases were detected because of Contract tracing. Also HCWs had an easy accessibility for testing as compared to General public. In most of the cases active or passive surveillance were conducted. Cases of Nosocomial outbreak incidence was reported in surgery OT. High prevalence in Radiographers can be explained because of transmission from asymptomatic patients as imaging being a prerequisite for admission. High prevalence in Laboratory staff can be because of increased risk during oropharyngeal swab collection, sample processing in RTPCR lab.

ICMR chief Balram Bhargava said only 2 to 4 in 10,000 breakthrough infections (COVID infections post inoculation) have been seen in India so far, which was negligible. Likewise, 10,03,02,745 people received Covishield first dose and of these 17,145 (0.02%) got breakthrough infection. Out of 1,57,32,754 who got the second dose of Covishield, 5,014 reported breakthrough infection.[19]

The post-vaccination breakthrough infection rate in India for COVID-19 is not more than 0.04 percent, as per the data shared by the Indian Council of Medical Research (ICMR) on April 21. The contraction of virus after being inoculated

with a single or both doses of the vaccine is referred to as post-vaccination breakthrough infection, ICMR Director-General Dr Balram Bhargava explained. According to Union Health Secretary Rajesh Bhushan, Indian government's prioritized approach in the immunization drive has yielded success as around 87 percent of health workers and 79 percent of frontline workers have received their first dose of COVID-19 vaccines. The two groups are considered to be at the maximum risk of contracting the infection.[20]

Adequate immune response takes 2-3 weeks after completion of entire vaccination schedule. Most of cases occurred in first two weeks after vaccination. Prevalence of infection in HCW could have been higher in absence of vaccination. An efficacious COVID-19 vaccine could reduce the likelihood of infection of an individual, severity of disease in an individual, or degree of transmission within a population.[3] Infections of SARS-CoV-2 fell by 65% after a first dose of the Oxford-AstraZeneca or Pfizer-BioNTech vaccines, preliminary results from a large UK surveillance study indicate. Reductions increased to 70% after a second dose of the Pfizer vaccine, data from the UK Covid-19 Infection Survey show.[21]

This is not an efficacy study. In this article, the authors share their experience in COVID-19 AZD1222 Covishield vaccinated HCW and infected in early weeks post vaccination. Lessons learnt from experience of infected HCWS post- vaccination infection in early weeks should alert the general population. Vaccine should not undermine the importance of infection control measures like social distancing, hand sanitization and mask etc.

Limitations

Comparison in other studies in which other vaccines were used. Sample size was smaller in our study. Sample population was general population in many studies. Prevalence of infection rate, strain of virus, status of herd immunity varies in different parts of world and hence in studies.

CONCLUSION

HCWs being at highest risk of exposure are being vaccinated on priority. However infection can occur in first few weeks of vaccination. Hence adequate infection control practices are mandatory. In Pandemic period, laboratory testing for COVID should be done to differentiate symptoms of side effects of vaccine and those caused by COVID infection in vaccinated population. If subsequent waves of this novel virus transmission occur, vaccination will decrease mortality and diseases severity.

Simultaneous large scale vaccine coverage and education about infection control practices especially social distancing and wearing mask in the weeks following first dose is essential.

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