Original Article

Breakthrough Coronavirus Disease Infection after Vaccination among Type 2 Diabetes Mellitus Patients in a Tertiary Care Hospital in India

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Abstract

Aim: Globally, pandemic coronavirus 2019 has gained attention for its rapid and exponential diffusion. In India, coronavirus disease (COVID-19) vaccination has become available to all adults, yet the disease continues to spread. The current study aimed to determine the breakthrough of the COVID-19 infection after vaccination among type 2 diabetes mellitus (T2DM) patients in a tertiary care hospital.

Materials and Methods: The retrospective, observational study was conducted among post-vaccinated T2DM patients infected with COVID-19 from May 2021 to October 2021. The specific vaccination details for COVID-19, along with vaccination date, 1st or 2nd dose, symptoms, onset of symptoms after vaccinations (in days), and severity of infection were recorded accordingly.

Results: Out of 3243 vaccinated patients, 36 were reported to be infected with COVID-19, post any dose of vaccine (Covaxin = 14; CoviShield = 22). The second dose was completed in 24 (66.66%) patients. Symptomatic COVID infection was observed in 97.2% (*n* = 35) and 2.77% (*n* = 1) showed asymptomatic infection. Infection occurred any time after 14 days of post-vaccination was observed in 23 patients, of which 16 patients (5 Covaxin and 11 CoviShield) were vaccinated completely and considered to have a breakthrough infection of COVID-19. Mild-to-moderate infection was observed in 25 (39.44%) patients and was home quarantined and 11 (30.5%) patients had severe to critical illness and required hospitalization.

Conclusion: The current study finding highlighted that the symptomatic breakthrough infections are observed in T2DM patients. Further research on breakthrough infections in Indian population is required to obtain the larger data set to work with it.

Key words: Coronavirus disease-19, Vaccination, Breakthrough infection

INTRODUCTION

Worldwide, the coronavirus disease (COVID-19) pandemic alert is a major challenge confronted and many efforts have been initiated to prevent and control the infection. In recent times, many efficient vaccines have been discovered[1-4] and showed significant protection against the infection. In India, the vaccination campaign starts from January 2021 and used CoviShield (AstraZeneca) and Covaxin (Bharat

Biotech). Till now, 4,136,000 individuals have been fully vaccinated. From May 1 onwards, vaccination is open to all individuals (>18 years of age) in India to all general public. Perhaps, the real-life studies revel the major challenges among the general population.

Even though COVID-19 vaccines are effective and are being used to control/halt the spread of the pandemic, no vaccine is completely effective in preventing the illness. Even people who are fully vaccinated may get sick, and some may even be hospitalized or die as a result of COVID-19. Perhaps, evidences suggested that vaccination may lessen the severity of the illness, thus lower the risk of infection, hospitalization, and mortality in vaccinated individuals when compared to their counterparts. The vaccine breakthrough infection is defined as COVID

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infection in the collected specimen from the individual greater than 14 days after the completion of recommended dose of an authorized COVID-19 vaccine.[5]

The findings of the recent study[6] and a Phase 3 clinical trial[3,7,8] highlighted the robust vaccine efficiencies which are greater than 85% in preventing the severe COVID disease. Perhaps, the unusual emerging evidences show the breakthrough COVID-19 infections among fully vaccinated persons.[9] A recent study conducted among the health care workers report symptomatic breakthrough infections.[10] Similarly, another breakthrough infection study was reported recently.[11] Thus, the current study focused to determine the breakthrough of COVID-19 infection after vaccination among type 2 diabetes mellitus (T2DM) patients in a tertiary care hospital.

MATERIALS AND METHODS

The present retrospective, observational study was conducted among T2DM patients infected with COVID-19 after vaccination in a tertiary care hospital. In the present study, we carefully examined and reviewed the patients who were registered for the regular check-up for diabetes for COVID infection after vaccination between May 2021 and October 2021. The study subjects were recruited base on inclusion and exclusion criteria, T2DM patients with COVID-19 infection after 1st or 2nd dose of vaccination who were mentally oriented, persons of both the genders aged between 18 and 80 years and took treatment for COVID-19, and T2DM patients with or without pre-existing comorbid conditions were included in the study. Those individuals who were on alternative treatment for COVID-19 and other serious illness, pregnant women, and COVID-19 infection before COVID vaccination were excluded from the study. The specific vaccination details for COVID-19, along with vaccination date, 1st or 2nd dose, symptoms, onset of symptoms after vaccinations (in days), and severity of infection were recorded accordingly. Telephonic interview was conducted with the affected individuals to obtain the relevant data. The clinical and demographic characteristics such as age, gender, and pre-existing conditions such as dyslipidemia, cardiovascular disease, hypertension, and thyroid were recorded, respectively. Descriptive statistics were used.

RESULTS

A total of 10,805 patients stepped in to the hospital during the study period, fairly 3243 (30%) patients were vaccinated either partially or completely. Of 3243 patients who were vaccinated (partially or completely), 36 (1.11%) patients were reported to be infected with COVID after vaccination. Majority of the study participants were male (58.33%). The mean age of the study participants was 60.22 ± 8.56 years, and the age ranged between 40 and 75 years. In the present study, 38.88% of the individuals were under the age group of 60–70 years. Clinical data and demographic characteristics are summarized in Table 1.

The study participants were vaccinated with either Covaxin ($n = 14$) or CoviShield ($n = 22$). Of 36 patients, 12 (33.33%) have received partial vaccination (1st dose) and 24 (66.66%) received complete course of vaccination (2nd dose) at the time of COVID-19 infection. The symptomatic COVID-19 was observed in 97.22% of the study participants, whereas 2.7% ($n = 1$) of the patients did not experience any symptoms (admitted to hospital for a non-COVID-19-related diagnosis but with an incidental positive polymerase chain reaction test). COVID infection was observed in 12 individuals after the first dose (Covaxin $n = 5$; CoviShield $n = 7$), whereas 24 participants had tested positive after the second dose (Covaxin $n = 9$; CoviShield $n = 15$) of vaccine. The symptomatic COVID infection occurred in 13 (36.11%) individuals less than 14 days after the vaccination of which majority ($n = 8$) of the individuals completed 2st dose of vaccination. Likewise, 63.66% ($n = 23$) of the post-vaccinated individuals showed infection any time after 14 days (mean days 31.5 days) which includes both 1st ($n = 7$) and 2nd ($n = 16$) dose of vaccination. Thus, these 16 patients (5 Covaxin and 11 CoviShield) considered to have a breakthrough infection of COVID-19. Mild-to-moderate infection was observed in 25 (39.44%) patients and was home quarantined and 11 (30.5%) patients had severe to critical illness and required hospitalization.

The pre-existing comorbidities apart from diabetes such as cardiac problem ($n = 8$), hypertension ($n = 26$), dyslipidemia ($n = 21$), and thyroid (n =7) were observed in the study population. The common symptoms and signs during the onset of infection include fever, cough, breathlessness, sputum, body pain, and few have experienced loss of smell and taste. The symptoms lasted for about 4–10 days.

DISCUSSION

The breakthrough infection can be recognized as the variant of COVID which detour vaccine-induced immunity,[12] which is an area need to be explored in near future. In addition, special concern has to be given to the asymptomatic COVID-infected patients who might likely to spread the viral infection. New variants of COVID-19 pose a clinical concern. Two areas of concern relate to

Table 1: Demographic characteristics of Post Vaccinated and COVID 19 infected T2DM patients.

Variables				N (%) n= 36		
Age	40 - 50			8 (22.22%)		
	50 - 60			10 (27.77%)		
	60 - 70			14 (38.88%)		
	70 - 80			4 (11.11%)		
Gender	Male			21 (58.33%)		
	Female			15 (41.66%)		
Type of Vaccine	Covaxin			14 (38.88%)		
	Covishield			22 (61.11%)		
No of dose	1st	Covaxin		5 (41.66%)		12 (33.33%)
		Covishield		7 (58.33%)		
	2nd	Covaxin		9 (37.5%)		24 (66.66%)
		Covishield		15 (62.5%)		
COVID -19 incidence (no of days Post vaccination)	≤ 14 days	Covaxin	1st dose	2 (33.3%)	6 (46.15%)	13 (36.11%)
			2nd Dose	4 (66.66%)		
		Covishield	1st dose	3 (42.85%)	7 (53.15%)	
			2nd Dose	4 (57.14%)		
	≥ 14 days	Covaxin	1st dose	3 (37.5%)	8 (34.78%)	23 (63.66%)
			2nd Dose	5 (62.56%)		
		Covishield	1st dose	4 (26.6%)	15 (65.21%)	
			2nd Dose	11 (73.33%)		
Severity of COVID-19 infection	Home quarantine	Covaxin		10 (40%)		25 (69.44%)
		Covishield		15 (60%)		
	Hospitalization	Covaxin		4 (36.33%)		11 (30.5%)
		Covishield		7 (63.63%)		
Co morbid conditions	Hypertension			26 (72.22%)		
	Dyslipidemia			21 (25.33%)		
	Cardiac problem			8 (22.22%)		
	Thyroid			7 (19.44%)		
	Others (Heart, Liver, kidney problem/ wheezing/ migraine)			14(38.8%)		
Presence of Symptoms	Symptomatic			35 (97.22%)		
	Asymptomatic			1 (2.77%)		
Common symptoms & signs during onset of infection	Fever			30 (93.75%)		
	Cough			29 (90.62%)		
	Breathlessness			25 (78.12%)		
	Sputum			26 (81.25%)		
	Body pain			28 (87.5%)		

the ability of variants to evade vaccine-induced immunity and cause asymptomatic infection (and thereby promote viral spread) or illness. Both consequences are important, both need to be considered independently, and both are largely unknown. Recent statement from Indian Council of Medical Research (ICMR) states that 2–4/10,000 got infected with COVID-19 after vaccinations in India.[13] Further a recent ICMR study also highlighted that the breakthrough cases were infected with the variants and only 9.8% of the infected individuals required hospitalization[14] and 0.4% fatality, thus vaccination reduces hospitalization.

In a recent study conducted among the skilled nurses, 22 were infected with COVID-19 after receiving their vaccination. Further, the infection was detected any time after 14 days of second dose of vaccine and two-third of the breakthrough infection were asymptomatic.[15] Further reports highlight the mild or asymptomatic[10] and symptomatic breakthrough infection among the health care.[16] Another study highlighted that more than a quarter of completely vaccinated individuals were hospitalized due to COVID-19 infection and some were severely or critically ill.[11] A study conducted by Jain *et al.*,[17] discussed various

causes for COVID-19 infection and mortality following COVID-19 vaccination.

Thus, the critical aspect of pandemic management is preventing vaccine failures due to variants. It is important to be aware of the mechanisms by which variants may escape vaccine-induced immunity and cause asymptomatic infection (which can lead to viral spreading) or illness, which has to be focused independently. In the meantime, the public health measures such as mandatory wearing of mask and hand wash techniques remain essential to control outbreaks.

Although the incidence of COVID-19 illness remains low in completely vaccinated patients, we observed that a number of patients were also experienced severe illness and were hospitalized due to COVID-19, this might be due to other factors such as emerging variants of COVID, individual's immune response against the vaccine, decreased effectiveness of vaccine, pre-existing comorbid conditions, and the use of immune suppressants. Although the vaccines are extremely effective against the COVID-19 infection, there exists a rare breakthrough infection which carries an infectious potential and poses a greater challenge in the vulnerable population.

The sample size is the major limitation of the present study, even though we have extensive documentation details of vaccinated individuals, the number of reported cases was relatively less. The comorbid conditions which also determined the severity of the COVID infection should also be considered with larger study population.[18] The current study does not focused on the immunological aspects such as COVID specific T-cell responses. Further asymptomatic individuals would create a greater impact on the study finding. Hence, the findings do not allow to derive the conclusion. Despite these limitations, the current study findings provide data on COVID-19 infection after vaccination among Indian population.

CONCLUSION

The prevalence of breakthrough infection in individuals completed the full dose of vaccination, would be the prime research area in the near future. In nutshell, even though the vaccination provides a widespread protection against COVID infection globally, further research is required in this line to detect the alleviating factor associated with the inadequate vaccine response in individuals with breakthrough infection.

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