European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 9, Issue 3, Winter 2022

ORIGINAL RESEARCH

A CROSS SECTIONAL STUDY TO FIND THE MAGNITUDE AND FACTORS ASSOCIATED WITH BREAK THROUGH INFECTION AND RE-INFECTION OF COVID- 19 IN ADULT POPULATIONBEING VACCINATED AT A MEDICAL COLLEGE OF PATNA, BIHAR

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ABSTRACT:

Introduction: Possibility of breakthrough infection to Covid-19 variants which may cross vaccine induced immunityas immunity acquired from natural COVID-19 infection or vaccines is not absolute and reinfections postnatural COVID-19 infections, as well as vaccine breakthrough infections, are not uncommon. Furthermore, lack of data is available on breakthrough infection as well as reinfection in India especially in Bihar. Thus, the present study is undertaken to find out magnitude of breakthrough infection and re-infection of COVID 19 and to find out factors associated with breakthrough infection and re-infection.

Materials and Method: The present telephone based cross sectional study was carried over a period of 3 months among400 subjects of age group ≥18yrs vaccinated with both doses of COVID Vaccine. A predesigned; semi-structured, pre-tested questionnaire was designed for elucidating the information about demographic details, vaccination, infection and serology. Data analysis was carried out using SPSS version 16. Chi square test was used to analyze association. P value of <0.05 considered significant.

Results: Regarding patients who suffered from Covid breakthrough infection after vaccination were 40 patients and patients who suffered from reinfection, total was 8 patients, among them 1 positive patient was out of 137 who were in age group of 18-25 years, 4 out of 59were in 26-44 years, 0 out of 17 were in 45-59 years and 3 out of 187were ≥60 years age group. P-value was significant with p=0.037 (as p>0.05). Regarding vaccine intake, among 400 subjects, 134 subjects were suffering were vaccinated with Covaxin, out of which 17 acquired covid breakthrough infection; those who were given Covishield, out of 242, 22 acquired covid breakthrough infection and among 24 subjects who were not knowing about type of vaccination given 1 acquired covid breakthrough infection. P-value was not significant among all those parameters.

Conclusion: The study identifies the possibility of breakthrough infections among vaccinated peoples and ensures the impact of vaccination in limiting disease severity. However, prior vaccination provided substantial protection against symptomatic re-infection and severe disease. The findings suggest that COVID-19 preventive measures should be continued even among vaccinated individuals. Breakthrough infection in India after complete dose of vaccination should be major area of research.

Keywords: COVID-19; Pandemic; Prevention

INTRODUCTION:

The novel coronavirus (COVID-19) is an infectious disease caused by severe acute respiratory syndrome corona virus-2 (SARS Cov-2)[1] and it has been declared as a global pandemic by the World Health Organization (WHO) on March 11, 2020.[2] it has caused enormous physical, mental, social as well as economic challenges. No treatment, therapy and any medicine is approved till date, however Covid appropriate behavior and vaccine has shown optimal protection.[3] Vaccines are effective in decreasing risk of getting infection by 70-90%, also shield from severe infection. Due to large number of mutations, there is emergence of new strains and variants. Possibility of breakthrough infection to Covid-19 variants which may cross vaccine induced immunity[4] as immunity acquired from natural COVID-19 infection or vaccines is not absolute and reinfections postnatural COVID-19 infections, as well as vaccine breakthrough infections, are not uncommon.[5]

An epidemiological definition was used for reinfection which defines any person who tested positive for SARS-CoV-2 on 2 separate occasions by either molecular testing (reverse transcription–polymerase chain reaction test, cartridge-based nucleic acid amplification test) or a rapid antigen test, at least 90 days apart.[6]By the CDC's definition, a breakthrough infection is a COVID case that occurs in someone who is fully vaccinated, meaning 14 or more days after completing the recommended doses of an authorized vaccine.[7]In addition to the risk of group transmission of an infectious disease, attention must be given to the treatment of the original comorbidities of the individual while treating pneumonia, especially in older patients with serious comorbid conditions and polypharmacy. Not only capable of causing pneumonia, COVID-19 may also cause damage to other organs such as the heart, the liver, and the kidneys, as well as to organ systems such as the blood and the immune system. Patients die of multiple organ failure, shock, acute respiratory distress syndrome, heart failure, arrhythmias, and renal failure.[1,8]

Furthermore, lack of data is available on breakthrough infection as well as reinfection in India especially in Bihar. Thus, the present study is undertaken to find out magnitude of breakthrough infection and re-infection of COVID 19 and to find out factors associated with breakthrough infection and re-infection.

MATERIALS AND METHOD:

The present telephone based cross sectional study was carried over a period of 3 months at IGIMS, Patna. The study population comprised of people of age group ≥18yrs vaccinated with both doses of COVID Vaccine at IGIMS, Patna who were enrolled using simple random sampling. A telephone based cross-sectional study was carried out on people of age group ≥18years of both sexes who received both doses of covid-19 vaccine at least 1 month before

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starting study. Institutional ethics committee approval was taken (letter no. 28/IEC/IGIMS/2021) before commencement of the study. Informed consent was taken from study participants.

A predesigned, semi-structured, pre-tested questionnaire was designed for elucidating the information about demographic details, vaccination, infection and serology. Data analysis was carried out using SPSS version 16. Categorical data is presented as proportion and for continuous data mean and standard deviation was calculated. Chi square test was used to analyze association. P value of <0.05 considered significant.

RESULTS:

Among 400 study participants, 137 were in age group of 18-25 years, 59 were in 26-44years age group, 17 were in 45-59 age group and 187 were of or above 60 years (figure 1). Distribution according to gender showed that 63.50% were male and 36.50% were female (figure 2). Figure 3 shows distribution of study subject according to comorbidity which was Present in 31.30% of subjects. Among the study subjects, 33.3% were vaccinated by Covaxin vaccine, 60.5 % by Covishield and 6% were not aware of the name of vaccine with which they were vaccinated (figure 4).

Figure 1: Distribution of study subject according to Age

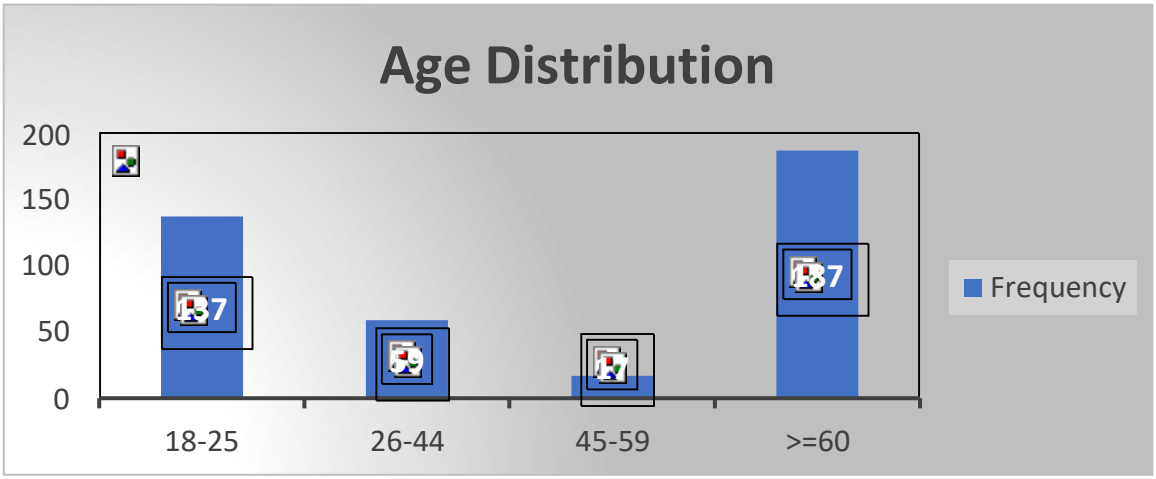

Figure 2: Distribution of study subject according to Gender

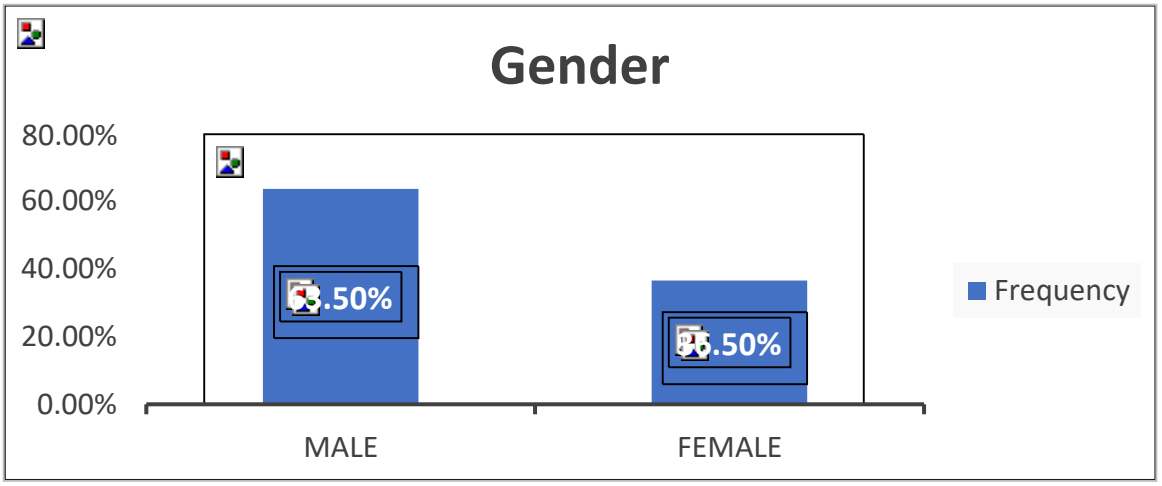

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Figure 3: Distribution of study subject according to comorbidity

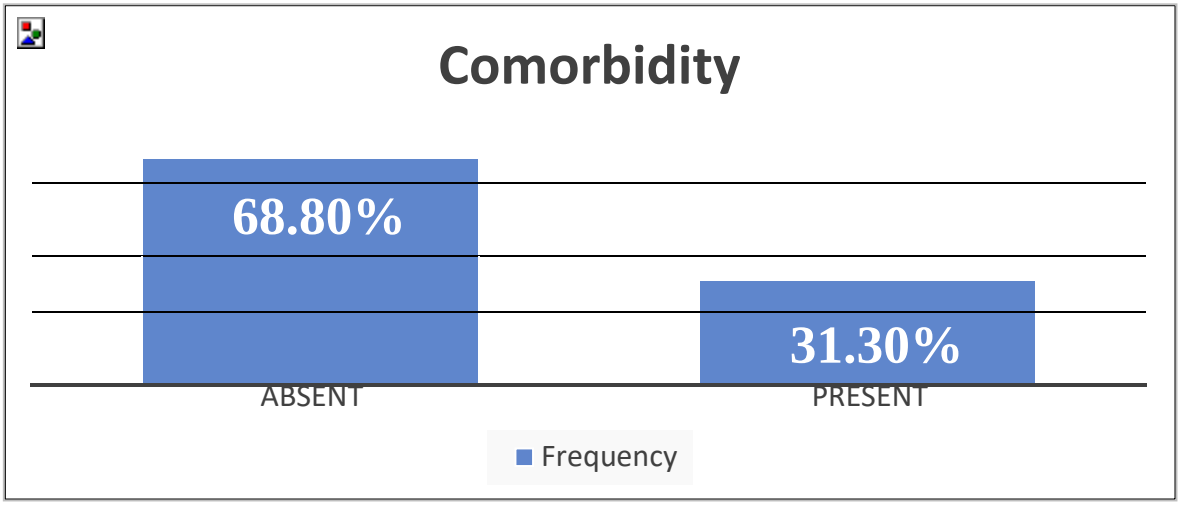

Figure 4: Distribution of study subject according to Vaccine Taken

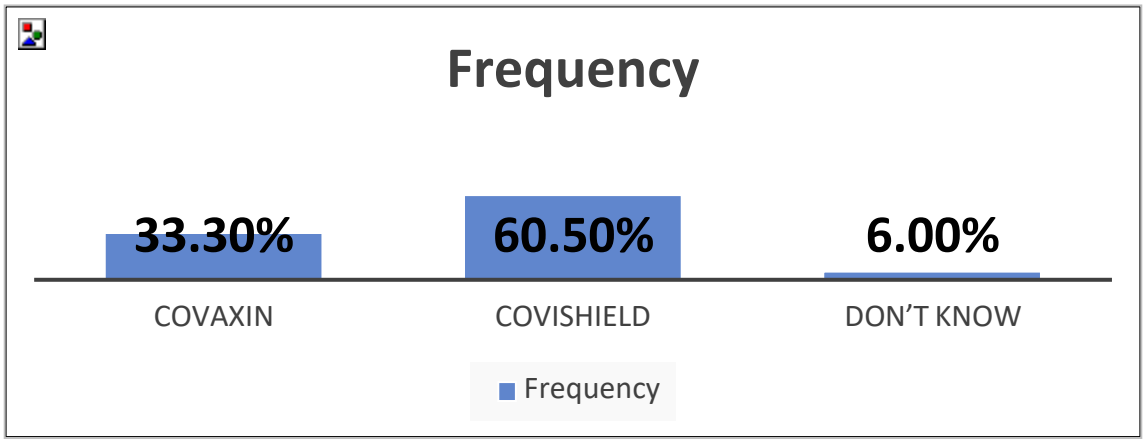

Table 1 shows association between demographic variables and Breakthrough infection. Regarding patients who suffered from Covid breakthrough infection, 16 positive patients were in age group of 18-25 years, 10 were in 26-44 years, 2 were in 45-59 years and 12 were ≥60 year's age group. Among 400 subjects, 254 were male, out of which 28 male patients acquired covid infection after being fully vaccinated and among 146 female subjects who enrolled for the study, 12 acquired covid breakthrough infection. Regarding presence of comorbidity, among 400 subjects, 125 subjects were suffering from two or more diseases or medical conditions simultaneously, out of which 8 acquired covid breakthrough infection while subjects with no other comorbidities, 32 out of 275 acquired covid breakthrough infection.

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Regarding vaccine intake, among 400 subjects, 134 subjects were suffering were vaccinated with Covaxin, out of which 17 acquired covid breakthrough infection; those who were given Covishield, out of 242, 22 acquired covid breakthrough infection and among 24 subjects who were not knowing about type of vaccination given 1 acquired covid breakthrough infection. P-value was not significant among all those parameters.

Table 1: Association between demographic variables and Breakthrough infection

Demographic Variables	Breakthrough infection		Chi-square	P value
	Positive	Negative		
Age Group (Years)			6.31	0.097
18-25	16	121		
26-44	10	49		
45-59	2	15		
≥60	12	175		
Gender				
Male	28	226	0.81	0.368
Female	12	134		
Comorbidity				
Present	8	117	2.618	0.10
Absent	32	243		
Vaccine Taken				
Covaxin	17	117	2.20	0.332
Covishield	22	220		
Don’t know	1	23		

Table.2. Association between demographic variables and reinfection

Demographic Variables	Reinfection		Chi-sq	P value
	Positive	Negative		
Age Group (Yrs)				
18-25	1	136	8.50*	**0.037**
26-44	4	55		
45-59	0	17		
≥60	3	184		
Gender				
Male	5	249	0.004	0.953
Female	3	143		
Comorbidity				
Present	2	123	0.148	0.700
Absent	6	269		
Vaccine Taken				
Covaxin	3	131	0.534	0.766
Covishield	5	237		
Don't know	0	24		

Table 2 shows association between demographic variables and reinfection. Regarding patients who suffered from reinfection, 1 positive patient out of 137 were in age group of 18-25 years, 4 out of 59 were in 26-44 years, and none out of 17 were in 45-59 years and 3 out of 187were ≥60 year's age group. P-value was significant with p=0.037 (as p>0.05).Among 400 subjects, 254 were male, out of which 5male patients acquired covid reinfection after being fully vaccinated and among 146 female subjects who enrolled for the study, 3 acquired covid reinfection. Regarding presence of comorbidity, among 400 subjects, 125 subjects were suffering from two or more diseases or medical conditions simultaneously, out of which 2acquired covid reinfection while subjects with no other comorbidities, 6out of 275 acquired covid reinfection. Regarding vaccine intake, among 400 subjects, 134 subjects were suffering were vaccinated with Covaxin, out of which 3acquired covid reinfection; those who were given Covishield, out of 242, 5acquired covid reinfection and among 24 subjects who were not knowing about name of vaccination given none of themacquired covid reinfection. P-Value was not significant among all those parameters.

DISCUSSION:

The vaccination campaign for COVID19 in India was started on January 16, 2021 using two vaccines; Covishield (manufactured by Astra Zeneca). At present (May 1, 2021) about 268 million people in India have been fully vaccinated. The recipients of vaccines include health care workers, front line workers & people with more than 45 years of age with morbidities (like diabetes, coronary artery disease etc.). From May 1st onwards vaccination is open to all individuals (>18 y of age) in India.[2]

In the present study, regarding patients who suffered from Covid breakthrough infection after vaccination were 40 patients, among them 16 positive patients were in age group of 18-25 years, 10 were in 26-44 years, 2 were in 45-59 years and 12 were ≥60 year's age group. Regarding patients who suffered from reinfection, total was 8 patients, among them 1 positive patient was out of 137 who were in age group of 18-25 years, 4 out of 59were in 26-44 years, 0 out of 17 were in 45-59 years and 3 out of 187were ≥60 years age group. P-value

was significant with p=0.037 (as p>0.05). That reveals prior vaccination provided substantial protection against symptomatic re-infection and severe disease. Regarding vaccine intake in the present study, among 400 subjects, 134 subjects were suffering were vaccinated with Covaxin, out of which 17 acquired covid breakthrough infection; those who were given Covishield, out of 242, 22 acquired covid breakthrough infection and among 24 subjects who were not knowing about type of vaccination given 1 acquired covid breakthrough infection. P-value was not significant among all those parameters. Similarly, Murugesan M et al[9] reported that the protective efficacy of prior infection against symptomatic infection was 86.0% (95% CI 76.7%–91.6%). Vaccination combined with prior infection provided 91.1% (95% CI 84.1%–94.9%) efficacy. In the absence of prior infection, vaccine efficacy against symptomatic infection during the second wave was 31.8% (95% CI 23.5%– 39.1%). Reinfection with SARS-CoV-2 is not frequent yet the incidence rate of it is increasing globally owing to the slow emergence of drift variants that pose a perpetual threat to vaccination strategies and have a greater propensity for disease reoccurrence. Long-term protection against SARS-CoV-2 reinfection relies on the induction of the innate as well as the adaptive immune response endowed with immune memory.[10]

Moreover, in a survey among health care workers regarding preventive practices in the COVID-19 pandemic conducted by Agarwal A et al,[11] it was found that suboptimal compliance in preventive practices like handling PPE, distancing in cafeteria/duty rooms and hand hygiene is not uncommon in HCWs. Certain barriers are identified which should be addressed to ensure adequate safety of HCWs against COVID-19 to prevent breakthrough infection and re-infection.

Furthermore, Stouten V et al[12] revealed factors associated with an increased risk of a breakthrough infection were younger age, female sex, non-healthcare workers, vaccination with adenoviral-vector-based vaccines, a higher background virus level and being tested frequently for COVID-19. Having had a prior COVID-19 infection before vaccination and having received a booster vaccine were associated with a lower risk of a breakthrough infection which is also found by the present study. Among those with a breakthrough infection, having had a prior COVID-19 infection also lowered the odds of experiencing symptoms. Thus, a multitude of factors including the selection pressure, the waning immunity against SARS-CoV-2 over the first year after infection possibly favors evolution of more infectious immune escape variants, amplifying the risk of reinfection. Additionally, the correlates of immune protection, the novel SARS-CoV-2 variants of concern (VOC), and the durability of the adaptive and mucosal immunity remain major challenges for the development of therapeutic and prophylactic interventions.[10] the vaccines should be available for everyone who could benefit from them to contribute to the control of the pandemic. The world needs to come to terms that no country is safe until every country is safe.[13]

CONCLUSION:

The study identifies the possibility of breakthrough infections among vaccinated peoples and ensures the impact of vaccination in limiting disease severity. The findings suggest that COVID-19 preventive measures should be continued even among vaccinated individuals. Breakthrough infection in India after complete dose of vaccination should be major area of research.

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