

Omicron Breakthrough Infections in Fully Vaccinated Individuals during Omicron Wave in Kashmir, India and Current Regional Scenario

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Abstract

In this study we look at Omicron Breakthrough Infections in fully vaccinated patients during the officially declared omicron wave in our region. A large number of mutations have been identified in the Omicron variant which has been associated with increased transmissibility and immune evasion after natural infection and vaccination. All samples were taken from within the officially declared period of Omicron wave in our state of J&K India. Vaccination status and other demographic information of the patients was collected via a proforma filled at the time of sample collection. Samples were processed according to ICMR prescribed protocols. 124734 samples were tested with average positivity of 9.37% over a period of 2 months. 61.5% were males and most common age group was 30-40 years. Majority of covid positive patients were symptomatic (80.6%). It was observed that a major chunk of patients (85.18%) who were infected with Omicron were fully vaccinated with two doses of vaccine as per the vaccination program of our country. Omicron's vaccine-escape capability is near 14 times as high as that of the Delta variant. Our results call for the development of a new generation of vaccines and mAbs that will not be easily affected by viral mutations.

Keywords: Omicron breakthrough infections, COVID-19 vaccines, Omicron's S protein mutations, omicron wave Kashmir India.

Introduction: If entire mankind were to be asked the two bad years of their lives, then 2020 and 2021 will be the top selected options in the poll. The only reason behind is CoVID-19 who changed the way of lifestyle of almost everyone in one way or the other. CoVID-19 or Corona Virus Disease was first reported in DEC-2019 in Wuhan China. The causative organism of this disease was novel corona virus or SARS CoV-2. Since then, till date, this disease has claimed almost 5,453,463 lives worldwide. The novel corona virus kept on evolving with almost every quarter, a new variant was disclosed with delta variant being most fatal [1-4].

On 28 November 2021, a variant of corona B.1.1.529 has been designated Omicron. This has also been declared to be the variant of concern. Although knowledge available on Omicron is limited yet this variant has created significant panic worldwide. Several states have even re-initiated night curfews and CoVID-19 appropriate behavior is being enforced to ensure that the spread of the same can be curbed [5-7].

A large number of mutations have been identified in the Omicron variant, including multiple mutations in the receptor binding domain of the spike protein which have been associated with increased transmissibility and immune evasion after natural infection and vaccination.(8) Emerging laboratory data indicate significantly reduced neutralizing antibody response to Omicron compared to the original COVID-19 virus or the Delta variant in vaccinated individuals, although booster doses improved neutralizing activity.(9,10) Neutralizing antibody has been found to correlate with protection against reinfection and vaccine effectiveness against infection, therefore reduced vaccine effectiveness against Omicron is anticipated based on these early laboratory findings.(11-13) COVID-19 vaccines are highly effective against symptomatic disease and, more so, against severe disease and fatal outcomes with the original strain as well as the Alpha variant that predominated in early 2021.(14) Modest reductions in vaccine effectiveness against infection and mild disease have been observed with Beta and Delta variants, although effectiveness against severe disease has remained high for at least 6 months after primary immunization with two COVID-19 vaccine doses.(15) Waning of protection has been observed with time since vaccination, and

especially with the Delta variant which is able to at least partially evade natural and vaccine-induced immunity.(16) However, third (booster) dose provide a rapid and significant increase in protection against both mild and severe disease outcomes.(17) In this study we try to look at omicron breakthrough infections in fully vaccinated patients during the officially declared omicron wave in our region.

Material and method:

All samples were taken from within the officially declared period of Omicron wave in our state of Jammu and Kashmir India (January 2022-march 2022). Vaccination status and other demographic information of the patients was collected via a proforma filled at the time of sample collection. All the health care workers (HCW's) involved in sample collection and transport were trained appropriately and provided relevant SOP's. Before initiating sample collection, a full personal protective equipment (PPE) was worn. For initial diagnostic testing of SARS-CoV-2 infections, CDC recommends collecting and testing an upper respiratory specimen. Upper respiratory tract specimens, which include Nasopharyngeal (NP) swabs, oropharyngeal (OP) swabs, Nasal mid-turbinate (NMT) swabs, nasopharyngeal wash/aspirate, and saliva have all been used. All samples were taken according to CDC recommendations for taking covid sample. [18]. On receipt, the samples collected from different locations spread around the state were processed in the biosafety level III lab (BSL III), negative pressure room. A real-time RT-PCR assay in accordance with the manufacturer's instructions was used for the detection of ribonucleic acid (RNA) from SARS-CoV- 2 present in the NP swabs from patients suspected of COVID-19. RNA extraction and purification was done for all the specimen using the Invitrogen, PureLink Viral RNA/DNA Mini Kit by ThermoFisher scientific. Extracted and purified RNA was reverse transcribed to c DNA and subsequently amplified using the ABI 7500 Fast DX RT-PCR thermocycler. Meril COVID-19 One Step RT-PCR Kit was used which is a one step kit wherein the N- gene and ORF-1ab was used for detection of SARS-CoV-2 specific RNA.To ensure the integrity and verification of RT-PCR assay results, an internal control (IC) was analyzed for each patient

sample, also testing one replicate of the positive control and one replicate of the negative control in each batch. A cycle threshold value (Ct value) < 35 was defined as a positive test result, and a Ct value of ≥ 40 was defined as a negative test result. A Ct value of 35 to less than 40 was reported as Inconclusive, with a request to repeat sampling.

Results:

Total number of samples tested were 124734 with average positivity of 9.37% over a period of 2 months .61.5% were males and most common age group was 30 -40 years . Majority of covid positive patients were symptomatic (80.6%). In this study, it was observed that major chunk of patients (85.18%) who were infected with Omicron were fully vaccinated with two doses of vaccine as per the vaccination program of our country.(Table 1)

S no:	Parameters	Number	Percentage%
1.	Total number of tests done	124734	
	Total positives	11692	9.37%
	Total negative	113042	90.62%
2.	Gender (n=11692)		
	Male	7200	61.5%
	Female	4492	38.4%
3.	Age (n=11692)		
	0-10	769	6.57%
	10-20	1100	9.40%
	20-30	2590	22.1%
	30-40	3376	28.8%
	40-50	1789	15.3%
	50-60	1112	9.51%
>60	956	8.17%	
4.	Symptoms (n=11692)		
	Symptomatic	9430	80.65%
	Asymptomatic	2262	19.34%
6	Vaccination status of infected patients		
	Vaccinated	9960	85.18%
	Unvaccinated	1732	14.81%

Discussion:

In this study 80.6% patients were symptomatic with omicron infection. Also it was observed that majority (85.18%) of patients who were fully vaccinated still got the infection. This can be explained as a result of Vaccine Breakthrough infection. Essentially, the current COVID-19 vaccines in use mainly target the S protein.(19) The 32 amino acid changes, including three small deletions and one small insertion in the spike protein, in the Omicron variant give it antibody resistance.(20) also , these mutations may dramatically enhance the variant's ability to evade current vaccines.

In general, it is essentially impossible to accurately characterize the full impact of Omicron's S protein mutations on the current vaccines in the world's populations. First, different types of vaccines may lead to different immune responses from the same individual. Additionally, different individuals characterized by race, gender, age, and underlying medical conditions may produce different sets of antibodies from the same vaccine. Moreover, the reliability of statistical analysis over populations may be limited because of the inability to fully control various experimental conditions. Omicron is about 10 times more infectious than the original virus or about 2.8 times as infectious as the Delta

variant. Omicron's vaccine-escape capability is near 14 times as high as that of the Delta variant. Our results call for the development of a new generation of vaccines and mAbs that will not be easily affected by viral mutations.

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