International Journal of Innovative Research in Science and Engineering
Volume 7, Issue 09, 2021
www.ijirse.com
ISSN: 2454-9665

# A CASE STUDY OF BREAK THOROUGH INFECTION BY SARS-COV-2 VIRUS- CAUSES, SYMPTOMS, TREATMENT METHODS

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**ABSTRACT**

*People may get infected with covid-19 virus after two doses vaccination, is called Break through Infection (BTI). The percentage of people getting breakthrough infection is very less. The various causes and treatment methods for the infection is discussed in this study. Health care workers who have completed two doses of vaccination in a Medical college and Hospital in Chennai are tested for Covid-19 Infection using RT-PCR test, Rapid Antigen test and CT scan. Out of 227 health care workers, BTI occurs in 21 peoples in which 16 peoples having symptomatic symptoms and 5 peoples having asymptomatic symptoms. 30% People who have completed vaccination may get affected again by Covid-19 virus and patients with asymptomatic symptoms will spread the disease more.*

***Keywords:*** *Break through Infection (BTI), Covid-19, Vaccination, Symptomatic, Asymptomatic*

## 1. INTRODUCTION

In India now there are two types of vaccination are given as protection against Covid-19. Namely Covishield and Covaxin. Covishield vaccine formulated by oxford university in association with astrazeneca. Covaxin vaccine formulated by Bharat Biotech in association with Indian council of Medical research (ICMR).The different scientists gives different percentage of efficiency level for the two vaccines. The study shows a person after taking first dose is safe by 60% and after taking second dose is safe by 80-90%. In some cases a person getting infected even after two doses of vaccination. The infection of this kind is called Break through Infection, this may happen because of poor immune system of the person. In Persons getting infected with BTI , symptoms vary from person to person. In most cases the symptoms are mild and asymptomatic.Covid-19 cases, deaths occur only in small percentage of fully vaccinated peoples (4).The correct diagnostic methods should be used and also keeping in mind the clinical symptoms so that asymptomatic cases which occur mostly in pregnant woman might not be missed (6).

As per results the based on various studies the person who has vaccinated two times has very high immunity levels after 15 days from the date of second dose. The possible causes for Break through infection are

a) Losing high levels of Immunity due to lack of food taken over a period after two doses of vaccination , mental and physical stress.
b) Getting in close contact with infected person without protective mask, proper sanitization during the period when the person immunity level is very low.

Case study done on a patient with break through infection, the hemoglobin value was reduced considerably from 15.3 grams per decilitre to 11.2 grams per decilitre after BTI. Eventhough Immunity levels are boosted by vaccination, Mutations in virus beats the immunity boosters and infect the Public (1). Break through infection occurs mainly because of above two reasons.

## 2. DIAGNOSISTIC METHODS OF COVID-19

Testing plays an important role in determining rise or fall in Covid-19 cases. It is also necessary to test the fully vaccinated people to determine the number of Breakthrough Infections (3). The existing diagnostic methods for Covid-19 virus were developed during first wave of infectious disease (7). These methods can be immediately used for the forthcoming variants of virus enabling detection of virus in affected people easier. The various diagnostic methods their merits and demerits are discussed below.

### 2.1. RT PCR Test

Reverse transcription polymerase chain reaction test (RT PCR Test) is used mainly for diagnosis of Covid-19. Reverse Transcription is used for converting RNA to DNA.PCR Process amplifies the small element of DNA into thousand times and makes the DNA suitable for analysis. Suitable chemicals are used for testing samples.RNA converted to DNA , Since SARS-CoV-2 contains only RNA.RT PCR test has many advantages like high throughput over other methods. In this method samples collected from peoples by nasopharyngeal swab and by throat swabs by using suction catheter.

The results shows accuracy of detection of Viral RNA is less when only nasal and throat swabs are used for diagnosis, since they contain only very less viral RNA. Sputum contains more Viral RNA and mostly suited for detection of Virus. Collecting the respiratory tract sample from best anatomic site that contain high percentage of Viral RNA is very important for accurate diagnosis (8). Sensitivity of clinical samples by RT-PCR in different areas is shown in Table 1.

**Table 1**: Sensitivity of Clinical samples by RT-PCR

| Region | Sensitivity |
|---|---|
| Nasal swab | 63% |
| Pharyngeal swab | 32% |
| Sputum | 75% |
| Bronchoalveolar lavage | 95% |

RT-PCR is a standard diagnostic method for Covid-19.But the main drawback of the test is it takes a long time period up to 24 hours to give the result.

### 2.2. Rapid Antigen Test

A rapid antigen test is a diagnostic test used for detecting the presence of antigen.RAT is one of the technique used for the detection of SARS-CoV-2. Rapid antigen tests are used to detect protein. Rapid antigen tests are

very fast i.e less time consuming and low cost compared to other methods. Rapid antigen test visual results can be seen with a naked eye. The main advantage of rapid antigen test over antibody test is that it gives time for immune system to produce antibodies once the infection occurs.

### 2.3. Role of CT Scan

Due to the false negative results of about 10 to 30 % in RT-PCR tests, CT Scans are employed as a diagnostic tool for Covid-19(5).A computerized tomography (CT) scan employs medical imaging technology to get clear images of different parts of body noninvasively for diagnosis purposes. Non contrast MDCT (Multi detect CT) of chest done in 3mm thickness. The human lungs consists of five lobes ,three in right lung Right upper lobe(RUL),Right middle lobe (RML), and Right lower lobe (RLL). In the left lung there are two lobes the Left Upper lobe (LUL), and the Left lower lobe (LLL). CT severity score was put for 25(twenty five) based on percentage of area involvement in each of the five lobes. In HRCT Multislice helical CT study CT severity score was put for 40 (Forty).The inflammation in lungs will reaches its highest level after 10 days of infection. The CT Scan image of infected people shows ground glass opacities in lungs. The table 2 shows CT score and findings from it.

**Table 2**: Percentage of Lobe Involvement vs CT Findings

| Score | % of Lobe Involvement | CT Findings |
|---|---|---|
| 1 | Area of Lobe Involvement < 5 % | Normal or non infectious abnormalities |
| 2 | 5 to 25 % | Consists of abnormalities with infections other than Covid-19 |
| 3 | 25 to 50 % | Covid-19 presence confirmed |
| 4 | 50 to 75% | Suspicious for Covid-19 |
| 5 | >75 % | Typical Covid-19 |

CT scan visualizes the presence or absence of Bronchial thickening, Air space consolidation, nodules, cavities, and fibrosis. Lymph node enlargements, Pleural thickening are visualized using CT scan. Fluid collection also identified using CT scan. The abnormality of Bony cage and superficial soft tissues of the chest wall are also shown by CT scan.

### 2.4. Blood Tests

CRP (C Reactive Protein) a blood test used to detect the presence of inflammation in human body. When a foreign body (pathogens) enters human body, it overproduces cytokines and results in inflammation in lungs. CRP levels in blood increases with increase in inflammation. The test is also conducted in patients with autoimmune disorders. CRP normal value in blood should be less than 10mg/dL and anything over 10mg/dL is considered abnormal. SARS-CoV-2 causes inflammation in the lungs, hence measuring the CRP value used to detect the presence of covid-19 virus in the human body.

## 3. METHODS

The people working in Hospital environment and in direct or close physical contact with patients are named Health care workers (HCWs). Health care workers working in Covid care centres are more likely to be affected by Infection (2). In our Medical college and Hospital ,there are 227 health care workers (including doctors, nurses and others) for whom the two doses of vaccination was completed by 31st March 2021.

We have collected complete data of vaccination and the people infected with Covid after vaccination by RT PCR test , Rapid antigen test and by CT scan, their level of symptoms and the treatment they have undergone. Break through infection is one which occurs after second dose of vaccination. The data was collected upto 31st May 2021.

## 4. SYMPTOMS AND TREATMENT OF BTI

The symptoms of BTI are almost same as Covid-19 patients who have not done their vaccination and the only thing that differs is symptoms are very mild and asymptomatic. The symptoms are

- Throat infection and cough
- Loss of smell and Taste
- Fever ( 3 to 4 days)
- Difficulty in breathing

Treatment for BTI include taking antibiotics like azithromycin, doxycycline, clarithromycin, ceftriaxone, erythromycin, amoxicillin, benzylpenicillin, amoxicillin-clavulanic acid ,gentamicin, piperacillin, ceftazidime, cefepime, vancomycin and Ivermectin. In addition Paracematols are used for reducing fever and for pain relief. The immunity level of affected person improved by the intake of Vitamin C, Zinc, Vitamin B complex and Phosphoric acid. Apart from taking medicines and Vitamins it is very important to take protein rich foods like egg and meat. Hospitalization is very rarely required for people with BIT.

## 5. RESULTS & DISCUSSION

Health care workers 227 in total for whom second dose of vaccination was completed are tested for Covid-19 infection. Breakthrough Covid-19 infection occur in 21 peoples. Out of 21 people infected, 16 peoples having symptomatic symptoms and 5 peoples having asymptomatic symptoms and two persons need hospitalization. The people with infection have very mild symptoms like fever and cough. RT-PCR tests give 30 % false negative results and CT Scan is required for confirming the infection.BIT After complete vaccination is a big concern and about 10 to 30% have BIT after two doses of vaccination. The figure 1 visualizes BIT affected peoples with symptomatic and asymptomatic symptoms.

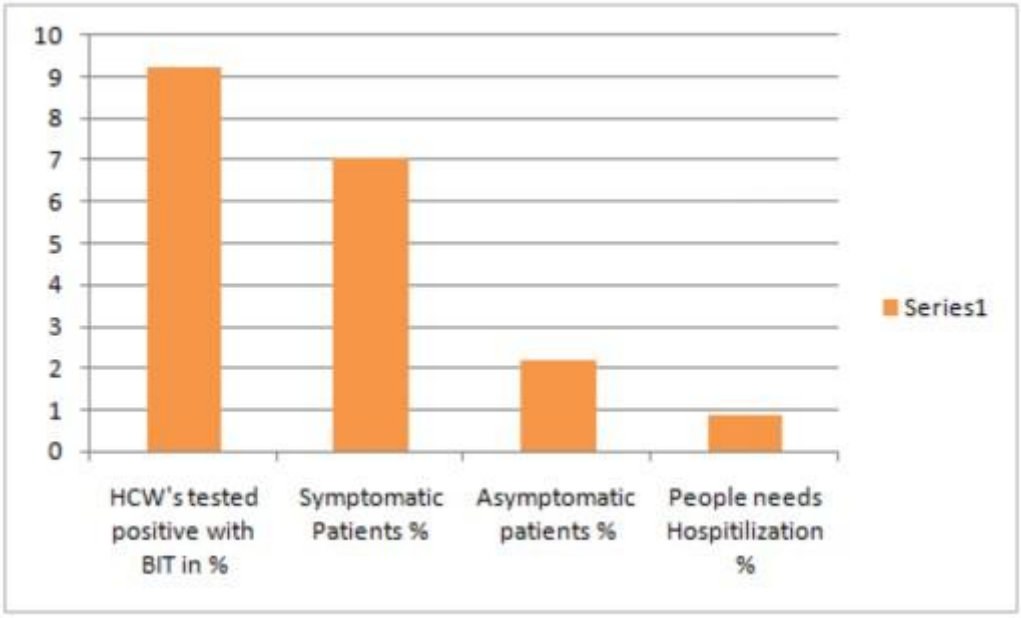


**Figure 1**: BIT People with different symptoms

## 6. CONCLUSION

Asymptomatic patients have higher chance of spreading the disease compared to symptomatic patients. Even though the vaccination gives protection against the deadly virus, it is not hundred percent. Maximum of Thirty percent people are getting infected with BIT. Hence the people who have completed the two doses of vaccination still need to be careful against the virus by wearing masks and by maintaining social distancing. Further research needed to eliminate or reduce the BIT.

## REFERENCES

[1] Ezhi Hacisulevman, Caryn Hale, Yuhki Saito, Nathalie E, Marissa Bergh, Erin G Conlon., et al. Vaccine Breakthrough Infections with SARS-CoV-2 Variants, The New England Journal of Medicine. 384, 2021. DOI: 10. 1056/NEJMoa2105000

[2] Claire L.Gordon, Jason A.Trubiano, Natasha E.Holmes, Kyra YL.Chua, JeffFeldman, GregYoung., et al. Staff to staff transmission as a driver of healthcare worker infections with Covid-19, Infection, Disease and Health., 2021. doi.org/10.1101/2020.12.25.20248824

[3] David R Holtgrave, Sten H Vermund, Leana S Wen , Potential Benefits of Expanded Covid-19 Surveillance in the US , JAMA, 2021. doi:10. 1001/jama.2021.11211.

[4] COVID-19 Vaccine Breakthrough Infections Reported to CDC — United States ,Morbidity and Mortality Weekly Report(MMWR),Centers for Disease control and Prevention.. 70 ( 21 ), 2021

[5] Buddhisha Udugama, Pranav Kadhiresan, Hannah N Kozlowski, Ayden Malekjahani, Matthew Osbome, Vanessa., et al. Diagnosing COVID-19: The Disease and Tools for Detection ,American Chemical Society . 2020. doi: 10.1021/acsnano.0c02624

ISSN: 2454-9665

[6]Banu Uygun-Can and Bilge Acar-Bolat. Clinical Properties and Diagnostic Methods of COVID-19 Infection in Pregnancies: Meta-Analysis, BioMed Research International. 2020. doi.org/10.1155/2020/1708267

[7] Olivier Vandenberg, Delphine Martiny,Oliver Rochas, Alex van Belkum and Zisis Kozlakidis. Considerations for diagnostic COVID-19 tests, Nature Reviews Microbiology . 19, 171-183, 2021. Doi.org/10. 1038/s41579-020-00461-z.

[8] Yi wei tang, Jonathan E Schmitz, David H Persing and Charles W Stratton. Laboratory Diagnosis of Covid-19: current issues and challenges, Journal of Clinical Microbiology. 2020. doi:10.1128/JCM.00512-20.

[9] Saadet Alpdagtas, Elif Ilhan, Ebru Uysal, Mustafa Sengor, Gem Bulent Ustundag and Oguzhan Gunduz. Evaluation of current diagnostic methods for COVID-19, APL Bio Engineering. 2020. https://doi.org/10.1063/5.0021554