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Original Research Article

A comparative study of second (delta) wave and third (omicron) wave of Covid -19 based on positivity rates at a sub-district hospital in Goa

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ABSTRACT

Introduction: The covid-19 outbreak was due to a virus which emerged in china at the end of December 2019, and was widespread in more than 200 countries worldwide. In India, the virus was introduced first by travelers returning home from various countries followed by local transmission. The SARS-CoV-2 variants B.1.1.7 (Alpha), B.1.617.2 (Delta), and B.1.1.529 (Omicron) caused rapid increase of infections worldwide.
Materials and Methods: A retrospective study was carried out in a sub district hospital of south Goa during second covid wave of delta variant and third covid wave of omicron variant. Throat and nasopharngeal swabs were collected in flu OPD and sent to covid lab for RTPCR by truenat and rapid antigen tests. The positivity rates were calculated and data was used to find out various differences observed in both the waves.
Results: The peak positivity rate was 61% in mid april during delta wave and 66% in mid January during omicron wave. Signs and symptoms of fever, shortness of breadth/difficult in breathing, sore throat, cough and fatigue were seen along with minor symptoms such as malaise, headache, loss of sense of smell and taste, nausea/vomiting and diarrhea. Males were more affected than females. Rate of infection were less in immunised individuals. Adults and youth were affected more in number as compared to elderly and children. In both the waves, travellers going outside state showed low positivity.
Conclusion: Covid variants confirmed to pose an important health burden to the society on account of its pulmonary etiology and communicable character. The study climaxes the burden of the pandemic on states and thus the significance of following COVID-19 protocols for the fear of contracting this transmission.

1. Introduction

The covid-19 outbreak was due to a virus which emerged in china at the end of December 2019, and was widespread in more than 200 countries worldwide.[1] In India, the virus was introduced first by travelers returning home from various countries followed by local transmission.[2]

According to the Centers for Disease Control and Prevention (CDC), the variant responsible for increased transmissibility, severe disease course, reduced effectiveness of treatments and many other alarming factors is designated as the VOC (Variant of Concern).[3] The SARS-CoV-2 variants B.1.1.7 (Alpha), B.1.617.2 (Delta), and B.1.1.529 (Omicron) caused rapid increase of infections worldwide. The Delta variant of concern of SARS-CoV-2 got spread globally causing large outbreaks and resurgences of COVID-19 cases.[4]Retrospective investigation revealed that Delta was first detected in India in mid-September 2020; it subsequently became the variant primarily responsible for a wave of transmission and mortality in India in early-mid 2021, replacing Alpha and Kappa in the process.[5] Omicron variant was a newer heavily

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mutated SARS-CoV-2 variant known as B.1.1.529, and was designated as a VOC by the World Health Organization on November 26, 2021.[2]

The central and state government took several measures and formulated several wartime protocols to prevent the transmission. The outbreak was inextricably linked to the economy of the nation, as it dramatically impeded industrial sectors and businesses in the affected regions.[6] Mass vaccination of the population was the only key strategy to manage the Coronavirus Disease 2019 (COVID-19) pandemic.[7]

2. Materials and Methods

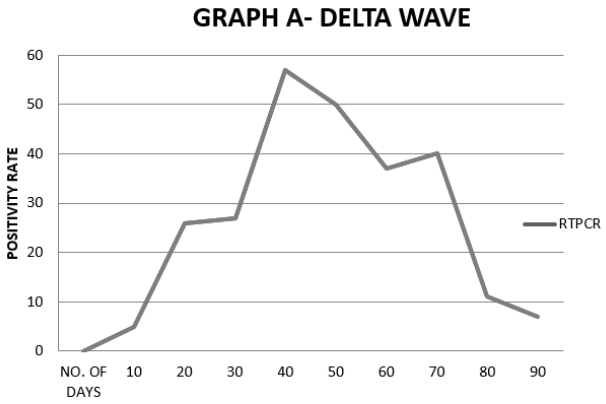
A retrospective study was carried out in a sub district hospital of south Goa during second covid wave of delta variant and third covid wave of omicron variant. Throat and nasopharngeal swabs were collected in the flu OPD and sent to covid lab for RTPCR and rapid antigen testing. Samples were tested by truenat kits on 4 molbio truenat analysers and 8 extractors and rapid antigen testing was done by SD biosensor kits. 1 truenat analyser processed 4 samples at a time and gave results in 1 and a half hours including time for extraction in truenat extractors which processed 2 samples at a time.

Second delta covid wave lasted for 3 months from 15^{th} march 2021 to 15^{th} June 2021. Third omicron wave lasted for 1 and half months from 25^{th} December and 10^{th}February 2022. The day wise positivity rate was calculated for RTPCR and antigen testing. Our present study is on the comparison of the delta and omicron waves based on positivity rates and sample load, duration and factors predisposing the occurrence of the wave, age and gender distribution, travel history, clinical manifestations and immunisation.

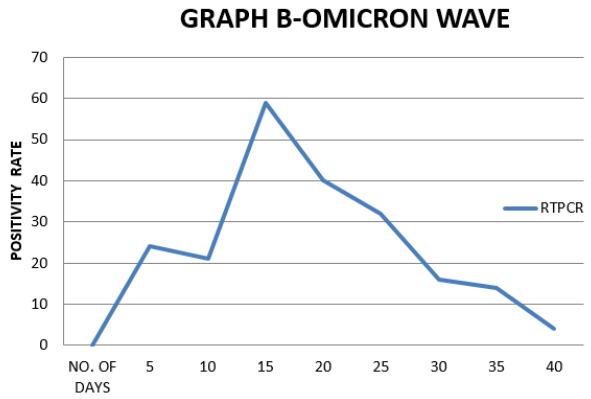
3. Results

During second wave a total of 7929 samples were tested by RTPCR with 2614 (33 %) positives and 11824 by rapid antigen testing with a total of 3327 (28%) samples being positive. The peak positivity rate was 61% in mid April 2021. During third wave a total of 3540 sample were tested by RTPCR with a total of 965 (27%) being positive and 7563 by rapid antigen tests with 1235 (16%) positives. The peak positivity rate was 66% in mid January 2022. Omicron wave lasted half the duration of the delta wave. A) Graph 1 Graph depicting the delta wave. B) Graph 2 depicting the omicron wave.

In delta wave, males were more affected than females. Adult (25-60 years) population was the most affected.ie about 43%, followed by elderly (60 years and above) 35% and young patients (9-25 years) 20% whereas only about 2% were paediatric population. Also in omicron wave, males were more affected than females. 40% of the patients



Graph 1: Graph A- Delta wave



Graph 2: Graph B-Omicron wave

affected were young followed by adult age group (35%) and elderly (20%). About 5 % affected were paediatric patients with double the positivity compared to delta wave. In both the waves, travellers going outside state showed low positivity of 3% and 5% in delta and omicron waves respectively.

4. Discussion

India is one of the worst affected countries during the COVID-19 pandemic. We carried out comparative analyses of the COVID-19 situation in the sub –district hospital of Goa, India for the second and third waves.

Goa is India's smallest state by area and the fourth-least populous. In the first 23 days of May 2021, Covid-19 killed 1,058 people in Goa. It had taken the first wave 10 months to breach this milestone. By 23 May, Goa reported 146,460 cases. Manipur, with a million people more, had less than a third of Goa's deaths. Goa's fatality rate was highest in India and its test positivity rate (TPR) ie. the percentage of all corona virus tests that are positive, had consistently been among India's top three. At the beginning of March 2021, there was a surge in daily cases marking the onset of

the second wave.[8] Reports indicate that Delta has increased transmissibility,[9] rates of hospitalization,[10] and immune evasion[11] compared to Alpha (Pango lineage B.1.1.7),[12] the variant previously dominant in many countries.

An analysis done in second wave decoded the spatial pattern of the concentration and spread of the infection from March to May 2021. During May (peak time), the spatial pattern indicated the same concentration of very high case fatality ratio (greater than 2.045) surrounding the Mumbai urban, and interestingly Goa had also come under this category. In May, the HH (high-high) clusters of CFR clearly indicated two pivots of the infection i.e. Mumbai urban-Pune-Nasik-Kolhapur region (comprising Goa). The LH (Low-High outlier) cluster in Goa state indicated some high confirmed cases surrounding it.[13]

The number of people infected in a region from single person is estimated as R_0. R_0 is the rate at which new infections stem from a single case.[14] $R_0 < 1$ indicates the reduction of cases, whereas $R_0 > 1$ suggests that the number of cases are increasing. The global R_0 value for covid-19 is estimated to range between 3 and 5, which is twice as fast as SARS (Severe Acute Respiratory Syndrome).[15] This is the reason why the sample load was very high in both the waves due to the contagious nature of the disease putting burden on the healthcare system. This increased the turn over time of the tests delaying the reports and treatment. Asymptomatic individuals with positive viral load but lack of symptoms further increased the spread. Data in India had reported 28% asymptomatic people which was alarming.[16]

The peak positivity rate in both the waves was more than 60%. The testing rate was higher in delta wave due to severity of the disease compared to omicron though it was highly contagious but mild in comparison. In delta wave, patients presented with moderate to severe infection with fever, shortness of breath / difficulty in breathing, sore throat, cough and fatigue. Other minor symptoms were malaise, headache, loss of sense of smell and taste, nausea/vomiting and diarrhoea. As a result of lung involvement, mortality and morbidity was high and majority of patients required hospital admission, CT scan investigations, oxygen therapy, antiviral drugs and symptomatic management.

World Health Organization identified the variant B.1.1.529 as a variant of concern, naming it Omicron, based on evidence that Omicron contains numerous mutations that may influence its behavior.[3] At the start of omicron wave, state's recovery rate had fallen to 87.9%.[17] Infection rates were four times higher in the Omicron variant than in the wild type and twice as high in the Delta variant. These findings indicate that spike sequence influences infectivity, with the Omicron variant displaying more effective ACE2-mediated infection than the wild type or other variant strains.[18] Omicron wave lasted half the duration of the delta wave due to shorter incubation period of the variant. The median incubation period was 3.1 days.[19] Running nose, sneezing, sore throat, headache and fatigue i.e. cold like symptoms were chief clinical presentations. Hence, as a result of mild infection mortality rate was less and most patients were managed by home isolation and symptomatic treatment. A study found that the Omicron variant had a higher affinity for human angiotensin-converting enzyme 2 (ACE2) than the Delta variant due to a significant number of mutations in the SARS-CoV-2 receptor-binding domain (RBD), indicating a higher potential for transmission. The heavy mutation in the spike protein of the Omicron variant is related to increased infectivity and antibody evasion.[20]

Males were more affected in both the waves. It should be noted that during the first wave mostly the urban centers were affected whereas during the second wave rural population.[21] Delta wave affected the elderly more as compared to the omicron wave where young adults were affected the most. Upper airways represent the entry site for respiratory infections including SARS-CoV-2.[22] Upper airway size decreases with increasing age in both men and women and that men have greater upper airway collapsibility than women. This key-point explans the difference in the prevalence of covid infection by gender.[23] Children were slightly more affected in omicron wave with mild infection of throat or cold like symptoms; as it does not involve lungs due to lack of angiotensin receptors in children. Angiotensin converting enzyme-2 (ACE2) has been found to be the SARS-CoV-2 cell entry receptor while TMPRSS2, a cellular transmembrane serine protease, is employed by the virus for S protein priming.[24] Liu et al. analyzed the clinical characteristics of elderly patients with COVID-19 to dissect differences between elderly and younger patients. The most common symptoms in both groups were fever, cough and sputum; concomitant less common symptoms were runny nose, headache, diarrhea.[25]

The infectivity rate was higher in omicron wave but with very less morbidity and mortality most probably due to higher immunisation coverage in the area. The morbidity and mortality rate was higher in delta wave as the majority of population was unimmunised as the vaccine was introduced in January 2021 i.e. just 2 months before the second wave. Only a total of 22.6% of the population was fully vaccinated.[26] Multiple studies have assessed COVID-19 vaccine effectiveness (VE) against SARS-CoV-2 infection and severe COVID-19 outcomes in second wave.[7] 92% of Goa covid deaths had not taken single dose of vaccine.[26]Goa State Immunisation department had reported that 75.25 per cent of the 2,724 Covid-19 patients in the second wave and 53 per cent of the 91 patients who succumbed during the ongoing third wave in Goa had not taken even a single dose of vaccine.[27] The Omicron variant of SARS-CoV-2 was identified from the COVID-19 vaccinated patients, suggesting the new variant's immune invasion and demanded updated vaccines.[28]

Both the waves were followed by either cultural festivals or social gatherings due to wedding or new year celebrations where the covid protocols were violated by overcrowding or covid inappropriate behaviour like not wearing mask and not following the hand hygiene. It should also be noted that the total number of cases is higher in the second and third wave compared to the first due to various factors. Of these, the following may be the most important: (i) easing of restrictions with the opening of eateries and road-side vendors, the opening of places of worship, religious gatherings and marriages, etc, (ii) complacency in the population and reluctance to maintain personal protection; and (iii) emergence of new mutant strains which are more virulent.[29]

To protect against the deadly virus, the government of India had undertaken necessary and strict measures, including establishing health check posts between the national borders to test whether people entering the country have the virus.[6] Travellers preparing for the travel in outside countries for work showed lesser rate of infection; most probably due strict adherence to the covid protocols as they could not afford missing the international flights due to high fees or the fear of loosing their job. This also highlighted the importance of covid appropriate behaviour to avoid infection.

4.1. Study area

The hospital where this study was conducted is located in Mormugao taluka near the city of Vasco Da Gama in South Goa near the coast. It has a harbour/seaport and an airport as well as a railway station. Thus making it the entry point for the novel viruses and newer diseases via people landing in the city via ships and flights from outside states or countries. The first covid case in the state of Goa was in the Mormugao taluka in Mangoor hills in the month of march 2020. The patient was tested in the covid lab of this sub district hospital and was the first patient who turned out to be positive on RTPCR in Goa.

5. Conclusion

The delta variant was seen to take a greater toll on the health of the people due to lung involvement and lesser immunisation coverage during the wave. Due to the contagious nature of both waves, covid testing was over and above the capacity of the labs to handle the sample load delaying the reports and hence the treatment. This study has highlighted the burden of pandemic in the state and thus the importance of following covid protocols by the population to prevent this infection.

Meanwhile, the previous recommendations to tackle the COVID-19 pandemic need to be maintained worldwide along with the newly improvised directions such as genome sequencing of all the samples, maintaining social distance, hand hygiene, wearing mask, vaccination and isolating the newer variant positive patients. New COVID-19 variants discovered recently remind us that the epidemic is far from ended and that covid appropriate behavior must be continued.

6. Source of Funding

None.

7. Conflicts of Interest

None.

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