The Initial Developments to Contain SARS-CoV-2 Spread and the Viability of the Virus on Different Surfaces and Environments

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ABSTRACT
This review article examines the initial incidences stemming from the emergence of the COVID-19 disease caused by the SARS-CoV-2 virus. The various developments and concepts of COVID-19 disease and the SARS-CoV-2 virus have also been covered. Financial and administrative issues prevented the Tokyo 2020 Olympics from occurring as planned due to the outbreak. As of May 28, 2020, before the Olympic schedule (July 24–August 9, 2020), 5.7 million people had contracted the virus, leading to 355,000 deaths globally. The virus spread, causing deaths that led to the suspension of international travel. The article also discusses SARS-CoV-2 testing, treatment, and vaccine development. The initial phase-wise development and final preparation of vaccines and drugs by companies and research organizations have been mentioned. Experts recommended following well-known 3Cs protocols (avoiding closed spaces and crowded places and contacts) and using a three-layer surgical mask to stop the spread of the virus. In the Dharavi slum (Mumbai, India), no new infections were reported during the second and most damaging Delta wave due to generation of herd immunity among slum dwellers. During the initial Wuhan outbreak, up to 75% of people in the slums developed antibodies from natural infection, which helped prevent further surges. Recently published “Health Index Theory,” which claims that states with better health infrastructure had more infections than those with poor infrastructure, explained why the normalized caseload (per million) varied in different Indian states. Kerala, a state with advanced healthcare infrastructure, reported a higher caseload than Uttar Pradesh, a state with poor health facilities, according to India’s health index. The main text of the article discusses the virus's ability to survive in different environments and methods for sanitization to help control virus transmission. The cited reference provides additional details. Transmission occurs among humans, between humans and pets, and among pets living together. There was no outbreak due to reverse zoonotic transmission.

Keywords: Delta and Omicron variants, hybrid immunity, SARS-CoV-2 viability, vaccine-generated immunity.

1. Introduction
The SARS-CoV-2 virus originated in Wuhan (China) in December 2019 and caused COVID-19 disease. It quickly spread around the world, becoming a pandemic. Initially, physicians identified the disease with pneumonia-like symptoms in a cluster of people that spread globally [1], [2]. Since its emergence, the virus has been continuously mutating and surging over and over again in the form of variants, causing COVID-19 pandemic waves and posing a big challenge to the economy and health infrastructure worldwide. The study [3] found that the Delta sublineage AY.29 with mutations C5239T and T5514C took over in Japan after the first four waves of the Alpha variant (original Wuhan). The new and circulating variants of the virus...
during the Tokyo 2020 Olympics and Paralympic Games were investigated and identified on a regular basis. The Tokyo 2020 Olympics and Paralympic games started on July 23 and August 24, 2021, respectively, without spectators. The possibility of emerging new variants during the games was high due to the arrival of foreign participants and the movement of athletes and staff. Among the total Japanese Delta variants, the sublineage AY.29 was the major lineage, accounting for 95.1%. The lineage became predominant in June 2021. In terms of monthly trends, AY.29 accounted for 95.4%, 97.6%, and 90.8% of the total reported sequences in July, August, and September, respectively in 2021. During the games, the number of Delta variants imported from abroad remained very low or negligible during the Delta surge (fifth wave), which hit Japan. The rise in daily new infections of the Delta variant was due to the mutation occurring in Japan and not because of foreign athletes and staff. The Alpha variant gave way to the more contagious Delta variant just before the games (first week of July 2021). The returning participants introduced 29 strains from Japan into other countries. As of January 10, 2022, 118 samples were identified in 20 countries [4]. The US had 50 samples, with 10 distinct introductions. The UK had 13 distinct strains introduced in 18 samples. Other countries were Canada, Germany, South Korea, Hong Kong, Thailand, and the Philippines, with multiple introductions. Out of the 20 countries included in the above category, the majority of European and North American nations achieved vaccination rates exceeding 50%, carried out genomic sequencing surveillance, and thus successfully contained the spread of the virus. In Japan mutating strains have wreaked havoc. During the sixth original Omicron wave that struck the country at the beginning of 2022, the daily death count recorded at its peak exceeded 200 on several days in the last week of February 2022. However, on several other days, it remained below 200, still a high toll. Furthermore, during the BA.5 Omicron surge (seventh wave), the number of daily mortalities related to SARS-CoV-2 infection exceeded 300 on several days in the last week of August and first week of September 2022, when the BA.5 subvariant ran rampant in Japan [5]. All Omicron variants were less fatal than their earlier variants, but health experts cautioned against underestimating the disease. The fatality rate of Omicron variants was 0.13%, significantly higher than that of seasonal influenza, which was in the range 0.006% to 0.09% of total infections. The huge spurt in Japan was due to the highly transmissible Omicron subvariant (BA.5) that caused the 7th wave in July–September 2022. As of July 14, the cumulative caseload had reached 10 million since the pandemic began in Japan. In just about two months, the number of cases increased by another 10 million. The emergence of XBB.1.5 contributed partially to the eighth wave that hit Japan in winter 2022 (last week of October 2022), but the previously prevailing BA.5 variant was primarily responsible for the surge. At the peak of the seventh wave, the daily 7-day average caseload reached more than 180,000 infections. Over the next three months, Japan added 10 million more cases to the cumulative caseload, bringing the total to 30 million by the first week of January 2023. As the eighth wave subsided, herd immunity developed, causing the infections to decrease. A survey by the health ministry in March 2023 revealed that the percentage of people in Japan with IgG antibodies against the SARS-CoV-2 virus increased to 42.3% from 26.5% in November 2022 [6]. From the economic perspective, the Union Health Ministry of India released reports [7], [8] showing that India’s unprecedentedly strong COVID-19 vaccination drive saved at least 3.4 million lives. Apart from saving lives, the strong vaccination campaign benefited the country economically by preventing a loss of 18.3 billion US dollars. After deducting the cost of the vaccination campaign, a net profit of 15.42 billion US dollars was estimated. On January 16, 2021, India began the vaccination campaign, and within a year, 90% of the country’s eligible population had received partial vaccination. As of December 2, 2022, India had administered over 2 billion doses, accounting for first, second, and booster shots. India became one of the countries that undertook the largest and most successful vaccination drive against COVID-19 globally, as India is the home of about 17% of the world’s population. The lifetime earnings of the people who survived or remained unaffected by COVID-19 due to vaccination were estimated to be 21.5 billion US dollars. The development and production of vaccines in India, COVAXIN and Covishield, helped the country to fight against the SARS-CoV-2 virus. The vaccination not only prevented a large number of people from infection but also reduced the burden on health infrastructure and hospitals. The IMF (International Monetary Fund) estimated that India spent around 280 billion US dollars during COVID-19 through direct and indirect funding, which benefited the country’s economy and people’s livelihood.

Elsewhere in US, the researchers studied the challenges of implementing mandatory vaccine laws. According to the research that covered nine US cities, indoor vaccine mandates at the city level were ineffective during the pandemic [9]. The effectiveness of the imposed mandates in these cities was examined. No significant impacts were found on COVID-19 vaccine uptake, cases, or deaths. The vaccine mandates were implemented to ban unvaccinated individuals from going to bars, restaurants, or places where food or drinks were served. Unlike Canada and European countries, the study found no evidence of changes happened in people’s behavior towards vaccination in US cities. The mandates in US cities did not yield the desired results. Instead, there were negative consequences. In New York city, over 90% of restaurants faced customer- and staff-related issues, such as losing customers over asking for vaccine mandates, the study reported. Three-quarters of the restaurants reported staffing problems. Some customers followed a different route of driving to the suburbs or the next town to avoid the mandates. Such a loophole was the reason for not achieving the objectives of the mandates. The study examined the trend of COVID-19 cases and vaccination status in nine cities (New York, Boston, New Orleans, Chicago, Los Angeles, Philadelphia, San Francisco, Seattle, and Washington, DC) that implemented the mandates. The mandates were implemented for the period August 2021–March 2022. The data were compared with those from cities without vaccine mandates. There was no noticeable deviation or benefit resulting
from the mandates. Looking at the nationwide vaccination coverage over time, at the start of the mandates, about 60% and 53% of the US population received at least one-dose and two-dose regimens, respectively. As of February 21, 2023, the percentage of the population who completed at least one- and two-dose vaccinations increased to 80% and 70%, respectively, while only 16% received the updated bivalent booster shot. The overall US vaccination data showed that the vaccination policy may have worked at the national level, but at the local level, it was not apparent.

The level of protection or immunity derived from past infections has been studied. Recent articles [10], [11] have reviewed literature documenting the reduction in the risk of novel coronavirus infection among individuals with a prior SARS-CoV-2 infection as compared to those who had no COVID-19 history. The articles covered data published from the disease's onset until September 31, 2022. A reinfection is defined as a positive RT-PCR or RAT reported more than 90 days after a previous COVID-19 infection. If the reinfection leads to the onset of the symptoms, it is a symptomatic reinfection. Likewise, a reinfection is considered severe if it causes severe illness leading to hospitalization or death. Researchers analyzed the data from 65 studies from 19 countries. The overall (mean) estimated protection against re-infection was above 82% for the original Wuhan, pre-Delta, and Delta variants. The protection was substantially reduced to just 45.3% against BA.1 (the first dominant Omicron variant) reinfection. Nevertheless, the protection against severe illness from Omicron reinfection remained high. The other Omicron subvariants, BA.4 and BA.5, had a significantly higher immune escaping rate, which led to the reinfection. Protection from past infections decreased over time. All the studies reported a strong level of protection comparable to that of a two-dose regimen of mRNA vaccines. The studies showed that, in general, the protection against severe illness was high (>78%) against all SARS-CoV-2 variants. The original Wuhan had the lowest, at 78.1%. The protection lasted up to one year. The researchers have worked out the effectiveness of the mRNA bivalent vaccine in recently published articles [12], [13]. The bivalent vaccine targeted Omicron BA.1 and the original Wuhan strain to prevent the infection. The study focused on the Netherlands population from September 26 to December 19, 2022, during the Omicron wave. The adult participants had past infections, most likely caused by the BA.1 subvariant of Omicron. The participants had one or two monovalent booster doses already after their primary COVID-19 vaccination. The sample size consisted of 32,542 participants who met the above criteria. The bivalent original Omicron BA.1 targeting vaccine was 31% effective against Omicron infection in people aged 18 to 59 and 14% effective in people aged 60 to 85. Researchers reported that Omicron infection provided a higher level of protection than bivalent vaccination among those without prior infection. As a booster dose, the bivalent vaccine increased protection against COVID-19 hospitalizations. Therefore, the aforementioned study found a limited additional benefit of bivalent vaccination in preventing SARS-CoV-2 infection. The vaccine effectiveness (VE) of the updated bivalent mRNA vaccine was estimated [14] against symptomatic infections caused by the Omicron BA.5 and XBB subvariants. The study period was between December 1, 2022, and January 13, 2023. The updated bivalent mRNA booster vaccine has provided additional protection against symptomatic XBB and XBB.1.5 infections in the recipients who had already received 2 to 4 monovalent vaccine doses for at least three months. The bivalent booster vaccines have mRNA that codes for the spike (S) gene of two different strains of SARS-CoV-2, the ancestral strain and the Omicron BA.4 and BA.5 sublineages.

2. Method

Velumani et al. [15] described the methodology for conducting the serosurvey and data analysis. The Thyrocare Laboratories, which had the facilities for testing IgG antibodies, were used to conduct the tests. The study was supported by the Canadian Institutes of Health Research and the University of Toronto, Canada. A total of 448,518 people were approached for antibody testing in the period June 2020–December 2020. The SARS-CoV-2 infection caseload and mortality numbers were taken from the dashboard www.covid19india.org [16]. Antibody testing was a paid survey, as described in Section 3.3 (self-referred), so it only covered the healthy population. The seropositivity data provided in the above section did not represent a uniform random urban population. References [17]–[20] contain the method used to determine the SARS-CoV-2 viability measurements as given in Section 3.5.

3. Results and Discussion

3.1. COVID-19 Research to Contain the Pandemic: Early Incidences, Advances, and Developments

Various developments and concepts of COVID-19 diseases and the SARS-CoV-2 virus have been published [21]–[42]. Shervani et al. [21] described the financial losses and additional administrative problems arising from the COVID-19 outbreak, which prevented the Tokyo 2020 Olympics from proceeding as planned. Japan lost 6.0 billion US dollars due to a delay in the Tokyo 2020 Olympics. Because of the virus spread, travelling outside the countries was stopped. As of May 28, 2020, 5.7 million people were infected, and 355,000 deaths were reported worldwide. SARS-CoV-2 virus testing, treatment, and vaccine development were also discussed in the above article. Shervani et al. [22] described the initial phase-wise development and preparation of SARS-CoV-2 vaccines undertaken by companies and research centers. The vaccines include Sputnik V, mRNA-based vaccine from Pfizer-BioNTech, and Oxford University-AstraZeneca. Other companies were Novavax Inc., Moderna Therapeutics, Chinese SinoVac, and CanSino Biologics Inc., which also carried out vaccine research to make the products safe and effective. The article [23] demonstrated the use of a supercomputer (SC) to select SARS-CoV-2 drugs and suggested protocols to contain the spread of the virus. The world's fastest SC, “Fugaku,” developed in Japan, was used. The computer simulation method selected the 30 most potentially effective drugs against the virus out
of 2,128 possible ones. Clinical trials of these drugs were undertaken all over the world. SC suggested important, widely known 3Cs protocols (avoid closed spaces and crowded places and contacts) to stop the virus spread. The article also elucidated the use and benefit of a three-layer surgical mask.

3.2. Establishing the Concept of Herd (Mass) Immunity (Herd Immunity at Work)

The possibility of the herd immunity concept against SARS-CoV-2 was established [24]–[28] first by studying the spread dynamics in Dharavi and Cuffe Parade slums (Mumbai, India). The results of the first and second serological surveys conducted in aforementioned slums were analyzed. No caseload (no infection) was reported in the Dharavi slum during the second and most damaging Delta wave, which was attained due to the generation of herd immunity (57%) among the slum dwellers. The antibody prevalence in the nearby Cuffe Parade slums was the highest, at 75%. The proportion of seroprevalence among Dharavi slum residents might have peaked at 75%, but it gradually declined when the survey occurred. In just 2.4 square kilometers, one million residents of the Dharavi slum live in closely packed, high-density population clusters, making virus transmission easy and fast that have infected a large population during the first original Wuhan wave. The generation of immunity among large population (higher IgG antibodies prevalence) against the virus, which stopped the subsequent second Delta wave and made the Dharavi slums a COVID-19-free zone.

3.3. Seroprevalence in Indian Cities and the Dynamics of the Spread

Self-referred serological surveys in 12 major Indian cities (Mumbai, Chennai, Pune, Coimbatore, Surat, Visakhapatnam, Kolkata, Nagpur, Delhi, Ahmedabad, Jaipur, and Bangalore) revealed [29]–[30] that overall, 31% of India’s major cities developed SARS-CoV-2 antibodies during the period July–December 2020. The antibodies built up due to the first original Wuhan wave that hit the country, peaking in September 2020. Gender- and age-wise analysis of the seropositivity was also conducted. The impact of seropositivity on the monthly caseload was also analyzed in the mentioned articles for the first and second waves that affected the cities.

3.4. “Health Index Theory” and Susceptibility to the Virus

The novel coronavirus (SARS-CoV-2) caseload varied in different states of India. In second wave, Kerala had the highest number of cases, accounting for 48% of India’s total infections as of February 12, 2021. The “Health Index Theory”, established first in the above two articles [31]–[32], has explained the high susceptibility of Kerala’s population. Individuals living in Kerala are more susceptible and less immune to the virus than in other Indian states. Kerala has the highest score on the health index, at 76.55 and 74.01 for the years 2015–2016 and 2017–2018, respectively, among all the states, while Uttar Pradesh has the lowest at 33.69 for 2015–16 and 28.61 for 2017–18 [33]. However, better health facilities in Kerala kept the fatality rate (CFR) at the lowest in India. Kerala’s improved health infrastructure has raised the life expectancy at the highest (75.2 years) among all the Indian states, while Uttar Pradesh has the lowest at 65.0 years. The overall India’s average is 69.0 years [34]. Kerala had the highest number of active cases among all Indian states. Kerala alone accounted for 45% of India’s total active cases, followed by Maharashtra (26%) [35]. Fig. 1 shows the pie diagrams comparing the proportion of Kerala’s population to the Indian population. The state of Kerala has just 2.7% of the India’s population while the caseload share of Kerala was 48% of the total India’s caseload. The data verified the aforementioned health index theory.

3.5. SARS-CoV-2 Viability in Different Environments

Viable aerosols spreading the COVID-19 virus (SARS-CoV-2) from an infected individual or surface are infectious and capable of causing both symptomatic and asymptomatic infections. The transmission of the virus via air occurs by inhaling suspended aerosol particles loaded with the virus. Therefore, methods must be established to determine the viability of the virus and to disinfect air, various surfaces, and foodstuffs. We have described the stability of the virus under different conditions and environments and suggested sanitization methods [36]. The pattern of virus transmission on a bus, hospital, and cruise ship was also discussed to uncover the disease’s epidemiology. Various studies have shown human to human airborne transmission and the possibility of contracting viruses through contaminated surfaces. Table I shows the viability or stability of the virus in different environments and surfaces.

3.6. Transmission of the Virus (SARS-CoV-2) from Humans to Pets and Vice Versa

We assessed [37] the reverse-zoonotic transmission (humans to pets) and the zoonotic transmission (pets to humans). Animal to animal transmission between co-housed pets, such as cats, dogs, and ferrets was also reported. The COVID-19 infection in minks, ducks, pigs, and chickens, as well as the ectoparasites of domestic pets like cat fleas, was also explored. Cats and ferrets are highly susceptible to SARS-CoV-2, dogs are susceptible to a lower
degree, and chickens, pigs, and ducks are not susceptible. The genetic analysis of a virus isolated from pets and their owners confirmed the reversal of zoonotic transmission in dogs and cats. The clinical symptoms in dogs and cats were nearly nonexistent. Pets do not show any evidence of zoonotic transmission outbreaks, but we cannot rule out the possibility. In a mink farm, transmission of the COVID-19 infection occurred from humans to minks and from minks to humans (zoonotic). The concern remained that mink becoming possible intermediate hosts of the virus that could lead to more threatening mutations in the virus. We must not abandon the pets, as there is no evidence of virus transmission from household pets to humans. To prevent virus transmission from infected households to pets and pets to pet, we must quarantine and isolate pets using the same methods as humans. Leaving pets roaming in the community will increase the risk of virus transmission. Because the source of the virus is still unknown, pet and animal management is critical to halting current and future pandemics.

3.7. Breakthrough Infections (BTI) Among the General Population and Healthcare Workers (HCWs) in India

Researchers have studied BTI among healthcare workers, HCWs [38] and the general population [39]. Various hospitals in India (PGIMER (Postgraduate Institute of Medical Education and Research, Chandigarh), (Medanta Park, Narayana, and Civil Hospital) (Gurugram), Apollo Hospital, Maulana Azad, Max, and Fortis) reported vaccine-related BTI among their HCWs. During the Delta variant spurt, the BTI were 6.0%–25.0% higher due to higher viral load the HCWs were exposed than reported during the original Wuhan wave (1.6%–2.6%). Due to the vaccination, the severity of the infection was mild, as the hospitalization rate and oxygen requirements remained low. BTI did not cause mortality among HCWs. Additionally, BTI did not result in any reported death among HCWs. In August, September, and October 2021, the general population of Gurugram city reported a monthly BTI rate of 26%, 41%, and 76%, respectively. This increased the monthly caseload to 167, 150, and 206 cases, respectively. However, the BTI could not cause the surge. Higher vaccination rate and previous infection, as seropositivity of 78.3% was recorded in the city in September 2021, stopped the surge. The severity and spread dynamics of the Omicron spurt in India were studied [40]-[42]. The Omicron surge was the least severe due to the hybrid immunity (vaccination and previous infection) compared to the previous two waves that hit India. Hospitalization, oxygen requirement, and ICU admissions remained low during the Omicron wave compared to the Delta and original Wuhan surges.

4. Conclusion

Globally, as of May 28, 2020, there were 355,000 reported deaths and 5.7 million confirmed COVID-19 cases. The Tokyo Olympics 2020 (July 24–August 9, 2020) had to be rescheduled due to the suspension of international travel. Japan lost 6.0 billion US dollars due to a delay in the Tokyo 2020 Olympics. Several vaccines were developed to contain the pandemic, including Sputnik V, Pfizer-BioNTech (mRNA-based), and Oxford University—AstraZeneca. In addition to Novavax Inc., Moderna Therapeutics, Chinese SinoVac, and CanSino Biologics Inc., which also carried out vaccine research, were the other companies that developed safe and effective vaccines. The COVID-19 drugs were picked by using the world’s fastest supercomputer (SC), “Fugaku,” developed in Japan. The SC also suggested famous 3Cs protocols avoiding closed spaces, crowded places, and contacts. According to the analysis of SARS-CoV-2 IgG antibodies in Dharavi and Cuffe Parade slums (Mumbai, India), 75% seropositivity was the threshold to stop the second Delta wave and the waves after. The slums became a COVID-19-free zone. As of February 12, 2021, Kerala had the highest number of cases, accounting for 48% of India’s total infections. Among all the Indian states, the highest infection rate in Kerala has been explained by the newly established “Health Index Theory.” The theory suggests that people living in better health infrastructure environments are at higher risk. Owners can transmit the virus to their pets. In a mink farm, transmission of the COVID-19 infection occurred from humans to minks and from minks to humans (zoonotic). However, no outbreak was reported due to animals’ susceptibility to the virus. The virus (SARS-CoV-2) remained viable in aerosols for 3 hours. After 4 hours, no viable virus remained on the copper surface. After 24 hours, no viable virus was detected on the cardboard. At 4 °C, the virus remained viable for up to 14 days. Viability was not measurement after 14 days. It was sensitive to heat and was inactivated in 5 minutes at 70 °C. On tissue or printing paper, it was not contagious after 3 hours. After 2 days, no viable virus was detected on the treated wood and cloths. The virus was viable on the

### TABLE I: Viability of SARS-CoV-2 in Different Environments and Surfaces

<table>
<thead>
<tr>
<th>Medium/Surface</th>
<th>Viability duration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerosols</td>
<td>3 hours</td>
<td>After 4 hours no viability detected</td>
</tr>
<tr>
<td>Copper surface</td>
<td>4 hours</td>
<td>After 4 hours no viability detected</td>
</tr>
<tr>
<td>Cardboard surface</td>
<td>24 hours</td>
<td>After 24 hours no viability detected</td>
</tr>
<tr>
<td>Virus transport medium (VTM)/4 °C</td>
<td>14 days</td>
<td>After 14 days viability was not measured (may be stable longer)</td>
</tr>
<tr>
<td>Virus transport medium (VTM)/70 °C</td>
<td>5 minutes</td>
<td>Inactivated in 5 minutes</td>
</tr>
<tr>
<td>Printing and tissue papers</td>
<td>3 hours</td>
<td>After 3 hours no infectious virus was found</td>
</tr>
<tr>
<td>Treated wood and clothes</td>
<td>2 days</td>
<td>After 2 days no viable virus was detected</td>
</tr>
<tr>
<td>Glass surface and banknote</td>
<td>4 days</td>
<td>No viable virus was detected on day 4</td>
</tr>
<tr>
<td>Stainless steel and plastic</td>
<td>7 days</td>
<td>On day 7 no viable virus was detected</td>
</tr>
<tr>
<td>Outer layer of the surgical mask</td>
<td>7 days</td>
<td>Live virus remained detectable up to day 7</td>
</tr>
</tbody>
</table>
outdoor surface of the surgical mask for 7 days. Indian hospitals reported vaccine-related BTI cases among HCWs. Due to the higher viral load the HCWs exposed during the Delta surge, the BTI ranged from 6.0% to 25.0%, higher than the 1.6% to 2.6% reported during the original Wuhan wave. The vaccination reduced hospitalization and oxygen requirement, and there were no reported fatality among BTI HCWs. Due to the hybrid immunity (vaccination and previous infection), the Omicron surge was less severe than the two previous waves that affected the Indian population. Hospitalization, oxygen requirement, and ICU admissions were lower during the Omicron wave compared to the Delta and Wuhan waves reported in India.

5. STATEMENTS

No experiments on animals or humans were conducted in the laboratory. The author, Zameer Shervani (ZS), Ph.D., is the Director General of the Food & Energy Security Research & Product Center located in Sendai, Japan. The article copyright belongs to the corresponding author (ZS). Coauthors contributed online. Authors have qualifications: Intazam Khan MD; Deepali Bhardwaj MBBS, MD, DVDL, M.Phil.; Venkata Phani Sai Reddy Vuyyuru MBBS; Adil Ahmed Khan MBBS; Parangimalai Diwaker Madan Kumar BDS, MDS; Aisha Mahmood MBBS.

CONFLICT OF INTEREST

The authors declare that they do not have any conflict of interest.

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