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Systematic Review on Novel / Corona Virus a Threat to Human Era

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Abstract: ***The highly infectious coronavirus disease 2019, COVID-19, is caused by the RNA virus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which was first identified in Wuhan, China in December 2019 and declared a pandemic by the World Health Organization (WHO) in March 2020.We will discuss the impact of COVID-19 on the pediatric and elderly populations, assess the evidence for the effectiveness of therapeutics options, progress in the development of vaccines, and current regional public health measures to control the pandemic.***

Keywords: Novel, Corona, Virus, Pandemic, COVID-19

1. Introduction

The highly infectious coronavirus disease 2019, COVID-19, is caused by the RNA virus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which was first identified in Wuhan, China in December 2019 and declared a pandemic by the World Health Organization (WHO) in March 2020. By the end of 2020 COVID-19 had reached all continents including Antarctica sparing just a few Pacific Island nations, and daily increases can be monitored via accessing the Johns Hopkins Coronavirus Resource site (Johns Hopkins University and Medicine, 2020). Consequently, the impact of the pandemic on healthcare is unprecedented stretching healthcare systems across the globe, as well as endangering healthcare professionals as one in seven has been infected (Nebehay S, 2020) The swift identification and sequencing of the SARS-CoV-2 genome initiated a global program to develop vaccines as well as to investigate potential therapeutic agents. In this review we update our current knowledge of the genome structure of SARS-CoV-2 including mutational changes and implications on infectivity, transmission, pathophysiology, and host immune responses. We will discuss the impact of COVID-19 on the pediatric and elderly populations assess the evidence for the effectiveness of therapeutics options, progress in the development of vaccines, and current regional public health measures to control the pandemic.

Only after around two months since the initial case report in Wuhan, the first one thousand infections were recorded. Within a short period of time, the infection rate had grown exponentially, and as of February 25, 2021, over one-hundred and thirteen million infections have been registered globally, with over two million deaths (~2.2% overall mortality to date, which has been reduced from the -5% mortality at the start of the outbreak) (Worldometer, 2020)(WHO, 2020). Therefore, the aim of this review is to provide a holistic, comprehensive overview, both in a retrospective and interim manner, of the relevant epidemiology, pathogenesis, management, potential therapies and vaccines, global efforts, disease burden, and preventive measures that have and can be implemented in the global pursuit of containing COVID-19.

2. Methods and Results

The state government has taken several actions to contain the spread and impact of COVID-19. In this blog, we look at the key measures taken by the Tamil Nadu government between January 19 and April 28, 2020.

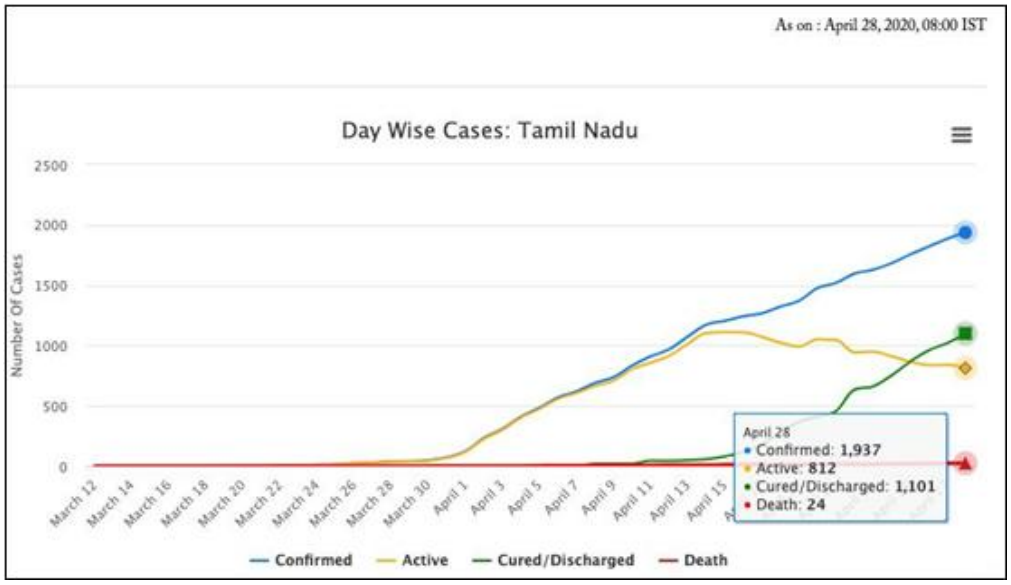

Figure 1: Day wise covid cases in Tamilnadu

Welfare Measures

The government announced financial assistance of a total of Rs 60 crore to various departments, such as, health; transport etc, to take precautionary measures to combat COVID-19.

The government announced the distribution of cash support of Rs 1,000 to all entitled family cardholders. Further, they were also eligible for free supply of essential commodities such as rice, dal, sugar, etc, during the month of April, through the Public Distribution System (PDS).

Lockdown in Tamilnadu

Some of the key measures undertaken during the lockdown period are:

a) Travel and movement

Amidst the lockdown, on March 25, the government notified that establishments providing essential goods and services, which were allowed to operate. These included establishments such as (i) police forces, (ii) treasury, (iii) public utilities, (iv) banks, (v) media, (vi) telecommunications, and (vii) shops dealing with food, groceries etc. Further, on March 28, the government permitted a few agriculture-related establishments to operate, such as, Mandis, fertiliser shops, and agencies involved in procurement of agriculture products.

An Expert Committee formed by the state government to formulate guidelines for phased exit from lockdown after April 20, recommended the extension of the lockdown till May 3. Certain select activities were, however, permitted to resume operations from April 20 onwards. These include (i) MNREGA works related to irrigation and water conservation, (ii) rural construction projects on irrigation, dam safety, hospital buildings, roads and bridges, and (iii) state and central government offices at one-third capacity.

In view of rising number of cases, on April 24, stringent curfew orders were passed in the districts of (i) Chengalpattu, (ii) Kancheepuram, and (iii) Thiruvallur. The curfew will be imposed between April 26 and April 29, from 6 am to 9 pm, and with more stringent restrictions than under the ongoing nation-wide lockdown, such as, (i) petrol bunks to operate only between 8 am and 12 noon, and (ii) supermarkets and shops to remain shut. Curfew orders were passed in 5 more districts.

Figure 2: Traffic Police personnel take part in a bike rally to spread awareness COVID-19

b) Welfare Measures

- On March 30, the government announced a cash assistance of Rs 1,500 per month to be credited into the bank accounts of differently-abled persons. It also announced that transgenders without ration cards, were eligible to receive 12kg of rice, 1kg of dal, and 1 litre of cooking oil, from fair price shops (FPS).
- Further, a cash assistance of Rs 1,000 was announced for (i) all ration card holders through FPS, (ii) registered auto drivers and construction workers, (iii) members of TN Cine Welfare Board, and (iv) match factory workers.
- Tamil Nadu Government released the District wise abstract of day to day information of Covid -19 positive cases.

Table 1

District wise abstract of COVID-19 positive cases* (25/01/2021)

Sl. No	District	Indigenous Cases		Imported Cases		Total cases till Date
		Till 24.01.2021	On 25.01.2021	Till 24.01.2021	On 25.01.2021	
1	Ariyalur	4655	1	20	0	4676
2	Chengalpattu	51252	38	5	0	51295
3	Chennai	230142	157	47	0	230346
4	Coimbatore	53970	56	51	0	54077
5	Cuddalore	24679	11	202	0	24892
6	Dharmapuri	6351	3	214	0	6568
7	Dindigul	11109	8	77	0	11194
8	Erode	14132	20	94	0	14246
9	Kallakurichi	10462	0	404	0	10866
10	Kancheepuram	29158	18	3	0	29179
11	Kanyakumari	16631	16	109	0	16756
12	Karur	5327	4	46	0	5377
13	Krishnagiri	7871	3	169	0	8043
14	Madurai	20766	11	158	0	20935
15	Nagapattinam	8306	5	88	0	8399
16	Namakkal	11437	20	105	0	11562
17	Nilgiris	8134	6	22	0	8162
18	Perambalur	2259	0	2	0	2261
19	Pudukottai	11493	4	33	0	11530
20	Ramanathapuram	6269	3	133	0	6405
21	Ranipet	16038	4	49	0	16091
22	Salem	31874	14	420	0	32308
23	Sivagangai	6571	6	68	0	6645
24	Tenkasi	8342	6	49	0	8397
25	Thanjavur	17597	5	22	0	17624
26	Theni	17007	1	45	0	17053
27	Thirupathur	7443	5	110	0	7558
28	Thiruvallur	43391	25	10	0	43426
29	Thiruvannamalai	18937	5	393	0	19335
30	Thiruvarur	11109	9	37	0	11155
31	Thoothukudi	15976	5	273	0	16254
32	Tirunelveli	15103	5	420	0	15528
33	Tiruppur	17722	34	11	0	17767
34	Trichy	14552	11	34	2	14599
35	Vellore	20277	6	380	0	20663
36	Villupuram	14979	11	174	0	15164
37	Virudhunagar	16437	1	104	0	16542
38	Airport Surveillance (International)	0	0	940	0	940
39	Airport Surveillance (Domestic)	0	0	1033	1	1034
40	Railway Surveillance	0	0	428	0	428
	Grand Total	**8,27,758**	**537**	**6,982**	**3**	**8,35,280**

Vaccines

1) Coveshield

Serum Institute of India (SII), Pune, has signed agreements with a few manufacturers such as Oxford-AstraZeneca, Codagenix, and Novavax. It is now producing at a large scale, the Oxford-AstraZeneca Adenovirus vector-based vaccine AZD1222 (which goes under the name "Covishield" in India), and it has stockpiled about 50 million doses (Voysey, M., *et al.*2021). The company will produce 100 million doses per month after January 2021. SII will ramp up its capacity further to produce 2 billion doses per year. Covishield is produced under the "at-risk manufacturing and stockpiling license" from the Drugs Controller General of India (DCGI), and the Indian Council for Medical Research (ICMR). The ICMR funded the clinical trials of the Covishield vaccine developed with the master stock from Oxford-AstraZeneca.

2) Covaxin

India's first domestic COVID-19 vaccine, CovaxinTM, developed and manufactured by Bharat Biotech International Limited, in collaboration with the National Institute of Virology of ICMR, is one of the two vaccines of the company, undergoing clinical trials, and is being stockpiled under an "at-risk manufacturing and stockpiling license".

Covaxin™ is an inactivated-virus vaccine, developed in Vero cells.The inactivated virus is combined with Alhydroxiquim-ll (Algel-IMDG), chemosorbed imidazoquinoline onto aluminum hydroxide gel, as an adjuvant to boost immune response and longer-lasting immunity. This technology is being used under a licensing agreement with Kansas-based ViroVax. The use of the Imidazoquinoline class of adjuvants (TLR7/8 agonists), shifts the T-cell response towards Th1, a T-Helper 1 phenotype (which is considered safer than Th2 responses against SARS-CoV-2) and reduces the risk of immunopathologically mediated enhanced disease (Ella, R., *et al.*2021)

3) Sputnik

Sputnik V could be another useful means of satisfying the need for mass vaccination, mainly in developing countries not only because it costs less than competitor vaccines, a part Vaxzevria, but also, and mainly, because it fits well with the needs of nations in which lack of adequate transport, storage and distribution facilities is a challenge compromising delivery of vaccine.

By now, Sputnik V has been approved in 70 different countries, mainly lower-middle-income nations with a high unmet need when it comes to access to vaccines but also two EU members, and has also come to the aid of several low and middle-income countries through the COVID-19 Vaccines Global Access (COVAX) agreement (Nogrady B, 2021). COVAX is a global multilateral initiative to develop, manufacture and deploy COVID-19 vaccines on a fair and equitable basis.

3. Discussion

Compared with previous naturally occurring SARS-CoV-2 variants, Omicron exhibits an unprecedented degree of neutralizing antibody escape. Indeed, the degree of neutralization resistance exhibited by Omicron is similar to that exhibited by PMS20, a designed neutralization resistant spike in which 20 naturally occurring and laboratory selected mutations were aggregated. The similarity in neutralization properties and distribution of changes on the spike protein surface between PMS20 and Omicron argues that a major selective pressure leading to the emergence of Omicron was imposed by neutralizing antibodies. Whether this selective pressure occurred in one or more immunocompromised individuals with persistent infection, or populations that have experienced high prevalence infection by waves of prior variants remains unclear.

Of particular concern, neutralizing antibody titers against Omicron were low, even below the limit of detection in a significant fraction of convalescent individuals, Ad26 vaccine recipients or 2 dose mRNA vaccine recipients, particularly following the waning that ensues following infection or vaccination. Nevertheless, individuals that had been previously infected with SARS CoV-2 and subsequently received mRNA vaccines, or those that have received three doses of mRNA vaccines had substantial neutralizing antibody titers against Omicron-1month after boosting. The ability of plasmas from these individuals to neutralize Omicron likely represents the combined effect of increased antibody levels following multiple exposures to antigen, as well as the effects of affinity maturation that can dramatically improve the neutralizing breadth of individual SARS-CoV-2 antibodies as well as polyclonal plasmas.

4. Conclusion

There is currently no specific COVID-19 responsive drug commercially available for the treatment of SARS-CoV-2 infection. Some medicines and therapies like antiviral/retroviral drugs and certain kinds of steroids are being used to reduce swelling and inflammation of the lungs and other parts of the body. There are many mutant strains that have been detected in India, but still, the Covaxin and Covishield work against them. To date, in India, the effectiveness of Covishield is much higher than Covaxin. In Covishield, only the S protein work as a single epitope, so the immunogenicity and antigenicity are more. Because Covaxincontains the entire SARS-CoV-2 virus in an inactivated form, the body generates antibodies against various epitopes. Several studies reported that there is reduced efficacy of both vaccines against the Delta variant (B.1.617.2). Finally, the present review covers detailed insights into the immunological and therapeutic efficacy of two widely administered vaccines in India, which will enrich the knowledge in the field of concern.

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