

Coronavirus: An Era of Pandemic

Surbhi Singh¹, Rini Abraham^{2*}

¹Student, Department of Biotechnology, Jyoti Nivas College Autonomous, Bangalore, India

²Assistant Professor, Department of Biotechnology, Jyoti Nivas College Autonomous, Bangalore, India

Abstract: Objective: People around the globe have been experiencing the outbreak of SARS-CoV-2, which has forced us to live in the 'Era of Pandemic'. The rapid spread of coronavirus has impacted us in ways beyond our imagination. The sector which has been most affected and cannot be compromised is, health. The virus has taken people of all age groups, even children under its grasp. Although no proper medication is known to cure the COVID-19, but the vaccines currently developed seem to be effective and safe. The paper is not restricted to one particular subject but covers all the areas related to the virus. Starting from its history, pathogenesis, symptoms and diagnostic techniques, new mutations, treatment till vaccination. It majorly outlines the present condition in India, impact of the virus and coping methods adopted. Method: Data was collected from authentic sources of World Health Organization, published journals and news sources.

Keywords: SARS-CoV-2, COVID-19, India, Treatment, Vaccination.

1. Introduction

Over the past few months, people all over the world have faced the toughest and most fearsome days of their lives. Being part of a pandemic, being locked up in your houses, the only way of communication being mobile phones & internet, without meeting anyone as you fear that you might get infected by the deadliest virus of all times – 'THE CORONA VIRUS' and suffer from the COVID-19 disease.

Since the influenza pandemic of 1918 and the Second World War (1939-1945), the world had not seen a global outbreak in recent memory like the COVID-19 pandemic [1]. The spread of the 2019 novel coronavirus (2019-nCoV) or severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has threatened the world and pushed us into 'The Era of Pandemic' [2]. Despite the advancement in technology, science, and medicine, the modern world is impotent in finding the solution for an invisible yet destructive problem, the coronavirus. The situation of COVID-19 is getting worse day by day and the world is unable to get the situation under control. The virus has caused havoc and destruction and has taken the lives of millions of people all over the world, irrespective of their social differences, like being rich or poor, the country being developed or under-developed, educated or uneducated. It has impacted our lives on all facets but most importantly, our health. It contains emerging and re-emerging pathogenic characteristics and is capable of mutation at a faster rate which has been a

major health concern lately. SARS-COV-2 is known to cause the 'COVID-19' disease, wherein, 'CO' stands for corona, 'VI' for the virus, and 'D' for disease. The name "Coronavirus" was recognized by the International Committee on the Taxonomy of Viruses (ICTV) and was first mentioned in the year 1968 [3].

The situation of pandemic arose from the rapid spread of the virus from person to person by inhalation or transmission of water droplets, either by sneezing or coughing. The infection originated in 2019 in Wuhan, China, and was spread to other countries by advanced modes of transportation. People were affected in a huge number all over the world and the death toll increasing many folds each day. Anyone with COVID-like symptoms is quarantined and their samples are collected (from nose or throat) immediately for diagnosis. RT-PCR (Reverse Transcription- Polymerase Chain Reaction) is the technique used for the diagnosis.

The second wave of COVID-19 infection in India is more infectious compared to the first wave due to new mutants being discovered and the death toll increasing many folds. Scientists and researchers have observed new symptoms like conjunctivitis or pink eye, dry mouth, unusual fatigue along with post- COVID symptoms in the recovered patients like black fungal, kidney damage, heart diseases [4, 5]. This study focuses on the history of the virus, its classification, global status, present scenario, diagnosis & possible treatments, and sheds light on the current vaccines being used & their effects in India. It also highlights the effects of the second wave of COVID infection among the people and its impact on India. The objective of this review paper is to study the "Novel Corona Virus" and its impact which led to the pandemic and affecting not just an area, state, or country but the whole World. The motive of this review paper is to make the world aware of the COVID-19 situation in India and to spread awareness about the symptoms, medication, preventive measures, and highlights the facts about the vaccination methodology followed in India.

2. Literature Review

Since the 1800s, pathogenic outbreaks and their interaction with humans and animals are suspected to be a result of cross-species transmission, which poses threat to human well-being and physical security. One reason for this rapid spread and outbreaks can be globalization and advancement in human

*Corresponding author: riniabr@gmail.com

activities, due to which the transmission of pathogens across borders has increased. Few examples are hemorrhagic fever

host. The fatality rate of cases was approximately 36%. In May 2015, the largest outbreak of the virus outside its endemic

Table 1
Comparison between SARS-CoV, MERS-CoV & SARS-CoV-2

S.no.	Virus Type	Originated in (Year/Country)	No. Of countries affected	Period of Spread	Confirmed cases	Death cases	% of death rate
1	SARS-CoV	2002, China	32	Nov. 2002 to Aug. 2003	8422	916	10.87%
2	MERS-CoV	2012, Saudi Arabia	27	Apr. 2012 to Dec. 2019	2496	868	34.77%
3	SARS-CoV-2	2019, China	170+	Dec. 2019 to now	162M	3.37 M	2.08%

viruses (Lassa, Ebola) in West Africa, influenza (avian influenza A H7N9, pandemic H1N1) in China [6]. Coronavirus disease (COVID-19) is an infectious disease caused by SARS-CoV-2 causing pneumonia-like symptoms. The virus primarily causes an acute febrile illness which later proceeds to acute respiratory distress syndrome (ARDS) [7]. On 30th January 2020, WHO declared the COVID-19 epidemic as a public health emergency of international concern and SARS-CoV-2 as a pandemic on 11th March 2020. The origin of infection is believed to be zoonotic and is transmitted to humans by an unknown intermediate and people exposed to street seafood in Wuhan reported the first cases of the infection. The infection is transmitted via inhalation or direct contact with the infected person through droplets. The incubation period is around 2-14 days, and the classic symptoms are cold, cough, fever, sore throat, breathlessness, etc. It majorly affects the elderly, older than 50 years, having cardiac & respiratory disorders, and children but is known to affect all age groups [6, 8].

3. History

The novel coronavirus was first identified in the 1960s [9]. There have been frequent occurrences of different strains of the virus since 2001 causing various diseases. Over 5 new strains of human associated with both upper and lower respiratory tract diseases, and group II coronaviruses, HKU1, are newly identifies groups [7]. The 2019-nCoV was first discovered in 1960 and was known to cause the common cold. The infections were believed to be self-resolving. In Canada, in a study conducted in 2001, more than 500 patients depicted flu-like symptoms. When virologically analysed by polymerase chain reaction, around 3.6% of patients were positive for the HCoV-NL63 strain. The first outbreak of the coronavirus was in 2002-2003 in Guangdong province, China which also spread to other countries and caused Severe Acute Respiratory Syndrome (SARS) with mortality rates over 1000. It originated in bats and was transmitted to humans via palm civets as hosts [6]. A state of emergency was declared by the World Health Organization (WHO) and the Centres for Disease Control and Prevention (CDC). In another outbreak in 2012 in Jeddah, Saudi Arabia, the coronavirus continued to spread to other countries in Asia, Africa, Europe & America. Most cases occurred in Middle Eastern Countries, including the Gulf countries like Saudi Arabia, Qatar, UAE, Iraq, Jordan, Syria, Lebanon, Palestine, Egypt. This strain of Coronavirus was called Middle East respiratory syndrome coronavirus (MERS-CoV) [9]. It also originated in bats and is transmitted by dromedary camels as the

region began [10]. Since, SARS-CoV in 2002 and MERS-CoV in 2012, the emergence of SARS-CoV-2 in 2019 marked as the third introduction of an extremely pathogenic and large-scale epidemic coronavirus affecting the human population all over the world. SARS-CoV-2 or COVID-19 was first reported in December 2019 in Wuhan, Hubei province of China, and has been spreading since at a massive rate, a new strain of coronavirus that was isolated from a Huanan Seafood Market in China [11].

Hence, we can conclude from the above data that although the 2019-nCov has affected a huge population all over the world and is transmitted rapidly, the fatality rate of MERS-CoV (34.77%) is comparatively higher than SARS-CoV (10.87%) and SARS-CoV-2 (2.08%).

4. Classification and Structure of the Virus

Coronaviruses belong to the subfamily Coronavirinae and order Nidovirales, enveloped, positive-sense, single-stranded RNA viruses [8]. SARS-COV-2 belongs to the β -coronavirus genus and subgenus Sarbecovirus. SARS-COV-2 Wuhan-Hu-1 was the first coronavirus isolated from Wuhan, China, whose genome was sequenced. The virus has a genome size of 29.9 KB with 11 open reading frames (ORFs) [12]. The genome of SARS-COV-2 is said to be 82% identical to SARS-CoV, 96% to bat-CoV-RaTG13, and 86.9% to bat-SL-CoVZC45. Hence, it is said to have originated from a horseshoe bat due to similarity in their genome compared to SARS-CoV. SARS-CoV-2 can be destroyed by the use of 75% ethanol, p-acetic acid, and other disinfectants containing chlorine as it is said to be sensitive to heat and UV rays [13]. Corona viruses are divided into 4 genera, α -coronavirus, β -coronavirus, γ -coronavirus and δ -coronavirus (Fig 1).

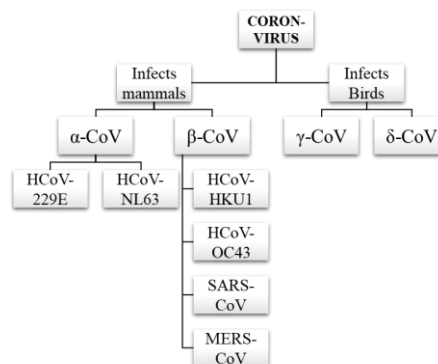


Fig. 1. Classification of Corona Virus [8]

SARS-CoV-2 belongs to β -coronavirus, is an enveloped non-segmented positive-sense RNA virus, and can be distinguished by the crown-like spikes protruding out of their surface have an extremely long genome and special mechanism of replication. The virions are spherical with 125nm diameter as observed from cryo-electron tomography and cryo-electron microscope. Nucleocapsids are helically symmetrical and are enveloped inside the virion which is uncommon in positive-sense RNA. The virus is composed of four primary structural proteins i.e., the spike (S), membrane (M), envelope (E), and nucleocapsid (N), all code inside the 3' end of the viral genome as seen in Fig 2. Membrane protein (25-30 kDa) is the most abundant protein in the virion. It is a major component in maintaining its shape. The signal sequence of N-terminals to reach ER is controlled by S protein (150 kDa). E protein (8-12 kDa) is present in small amounts and allows the installation and publishing of the virus. It is also necessary for pathogenesis. N protein is a single protein in the nucleocapsid and consists of two separate domains, an N-terminal Domain (NTD) and C-terminal domain (CTD), capable of binding to the RNA with multiple modes of each domain. Hemagglutinin-Esterase (HE), a special accessory protein is a subset of β -coronaviruses. It helps in enhancing the entry of S protein-mediated cells and the spread of infection through the mucosa. It is also responsible for genome maintenance and viral replication. The S protein and the SARS-CoV-2 N protein are the two most immunogenic and predominantly expressed proteins during infections [14].

1) Pathogenesis

The first step of viral infection is recognition and binding to the receptors on host cells, followed by cell membrane fusion. SARS-CoV is primarily known to infect the lung epithelial cells and can reach macrophages and dendritic cells but only to an abortive infection. Thus, human-to-human transmission occurs by binding the receptor-binding domain of the SARS-CoV spike protein to angiotensin-converting enzyme 2 (ACE2) receptors. The receptor-binding domain sequence of SARS-CoV-2 is similar to SARS-CoV. Hence, the virus enters the host via the ACE2 receptor.

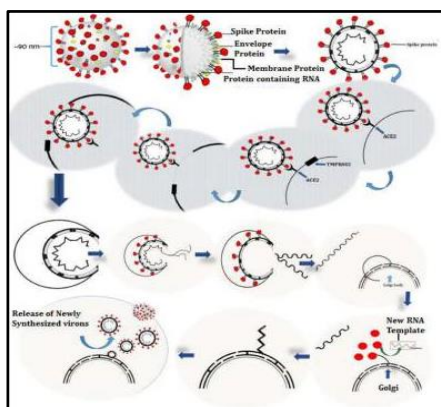


Fig. 2. Schematic representation of the genesis and transmission of SARS-CoV-2 in humans [6].

The SARS-CoV-2 has 4 structural proteins and an RNA strand. The spike or S proteins play a role in establishing contact

with human cells and help in the recognition of the ACE2 receptor, especially in respiratory cells. After the virion is bound to ACE2, another protein TMPRSS2, present on the exterior wall, cleaves the membrane, allowing entry by opening the spike protein. The RNA of the virion is released and translated to proteins, produces more RNA strands. One strand enters the Golgi bodies where membrane and envelope proteins are produced, evolving new virion. One virion particle is capable of producing hundred new ones, each having ability to infect new cells [6, 14]. The pathway of SARS-COV-2 infection in humans is represented in Fig 2.

An abundance of ACE2 protein is found on lung alveolar epithelial cells and enterocytes of the small intestine help to explain the routes of infection and disease manifestation. Nonetheless, infection of macrophages, dendritic cells, lung epithelial cells is imperative for pro-inflammatory cytokines activation which causes the disease. Clinical examination reveals a reduced count of peripheral lymphocyte and lymphocytopenia. Most importantly, ACE2 takes part in the Renin-angiotensin System (RAS), which regulates blood pressure. Therefore, the attack of SARS-CoV-2 on ACE2 receptors in endothelial cells results in coagulation, hypotension, cardiac injury, kidney dysfunction, and secondary infections [6].

2) Symptoms and diagnosis

According to reports, human-to-human transmission of SARS-CoV-2 occurs when the individual is at incubation stage or is showing symptoms whereas it can also spread from individuals who do not show any symptoms, who are asymptomatic but is contagious, they are also known as super spreaders. The virus remains airborne for a long time. Hence, can be transmitted via contact with infected surfaces, such as skin, and by touching infected objects mediated through eyes, nose, or mouth. SARS-COV-2 is reported to survive on contaminated metal surfaces and sterile sponges for several hours. The route of transmission can be through faecal matter or airborne dust. SARS-COV-2 is reported to be present in stool samples for up to 4 days. In other studies, coronaviruses are reported to be present in water, sewage and these viruses can cause infection for 3 days to 3 weeks. Earlier reports suggest that transmission of infectious diseases can be due to the presence of microorganisms in airborne particulate matter. Hence, countries suffering from air pollution may influence the rate of transmission [6]. A small study conducted by Chen *et al.* (2020), on COVID-19 positive pregnant women, observed that all the pregnant mothers underwent a caesarean delivery in the study hence, remains unclear whether the viral transmission is possible through vaginal birth as there is no evidence of transmission of the infection from mother to the child, the uncertainty persists as pregnant women are more prone to respiratory pathogenic and pneumonia-like infections [15].

The signs of COVID-19 appear at an incubation period of 2-14 days, with an average of 5.2 days. The time of onset is commonly marked by fever or chills, dry cough, cold, breathlessness (dyspnoea), fatigue, headache, muscle pain, sore throat, running nose, anosmia (loss of smell), and ageusia (loss of taste). Symptoms like diarrhoea, nausea may occur in a few

patients 1-2 days before infection. Difficulty in breathing (hypoxia) and acute respiratory distress syndrome (ARDS) are observed in patients, 5 days and 8 days after onset of infection respectively. In severe conditions, the patient may experience abdominal distress and pneumonia, depending on their immune and health status may also experience other functional failures. The severity of COVID-19 symptoms ranges from mild to critical; Mild (mild symptoms to mild pneumonia in 81%), severe shortness of breath (dyspnoea), hypoxia and 50% lung involvement in 14%) and critical (multi-organ failure, respiratory failure, or shock in 5%). The period starting from onset of infection to death is about 6 to 41 days with an average of 14 days. The length of time depends on various factors such as age and health and tends to be shorter for patients with comorbidities (10.5% for cardiovascular diseases, 7.3% for diabetes & 6% for respiratory disorders and cancer) and those aged above 70 years. According to U.S Epidemiological data, the case fatality rate was highest in the age group of ≥ 85 years (10%–27%), 65–84 years (3%–11%), 55–64 years (1%–3%), and < 55 years ($< 1\%$) [6, 14].

Diagnosis plays an important role here, where the world is suffering from a pandemic and the cases are increasing at a rapid rate all over the globe. An efficient and faster diagnostic technique will help in the early detection of the infection and help in reducing the transmission. The preferred method of diagnosis for human Co-V currently in use is RT-PCR (Reverse Transcription-Polymerase Chain Reaction). Multiplex RT-PCR assays are capable of detecting all four HCoV's and can even be used for new ones. RT-PCR techniques are widely used for COVID-19 testing as the results are efficient, but the only drawback is that it takes 2-3 days for the generation of the results [14]. WHO has also supplied rapid antigen detection tests for COVID-19 surveillance, another method for COVID-19 diagnosis. Rapid antigen tests are generally used for the diagnosis of respiratory disorders. In the case of SARS-CoV-2, the test looks for proteins produced by the virus. They are also said to be used as an alternative for PCR tests or NAAT (Nucleic acid amplification tests) which detect the viral RNA. The turnaround time of these tests is short, around 10-30 minutes compared to 2 days for PCR [16]. The National Health Commission of the People's Republic of China in their 6th version of the Diagnosis and Treatment Program, defined diagnosis based on radiological features of viral pneumonia as one of the criteria for COVID-19 diagnosis. As there is no scientifically proven treatment for SARS-COV-2, Chest computer tomography (CT) can be used for accurate diagnosis. Chest CT scan indicates pneumonia in patients along with other abnormal features such as RNAemia, acute cardiac injury, ground-glass opacity, and ARDS, which have been reported as a cause of death in infected patients. However, the usage of CT scans for the diagnosis of COVID-19 is controversial. As the infected patients suffer from gastrointestinal symptoms among which diarrhoea is prominent, therefore, faecal and urine samples of the infected patients should also be tested to avoid another route of transmission. Early diagnosis and treatment lead to high recovery rates if not might lead to the death of the patient. Innovation by PathShodh Health care, a start-up

incubated at the Society for Innovation and the Indian Institute of Science has developed a semi-quantitative electrochemical ELISA test for COVID-19 IgM and IgG antibodies. This novel technology can detect COVID-19 antibodies at a nanomolar concentration [17].

5. Second Wave

An exponential rise in COVID-19 cases was observed from February 2021 onwards in India. As the rise in COVID cases was observed for the second time, it was identified as the 'second wave'. The reason for the outbreak is unknown, however, it is believed that the new strains of the virus including the UK virus, South Africa Virus, and the double mutant could be the reason for the sudden rise in COVID cases in India. The new strains of the coronavirus such as double mutant B.1.617.2, first identified in India which carries two mutations i.e., E484Q & L452R, are said to be of major concern by Public Health England. People belonging to the age group of 18-45 are also susceptible, it can also infect children [18, 19, 20].

The second wave of COVID-19 infection has not just brought new mutant strains or increased death tolls, also new symptoms in COVID patients. Symptoms such as Gastrointestinal tract infections (loss of hunger, vomiting, abdominal pain, loose stools), hearing loss, extreme weakness and lethargy, conjunctivitis or pink eye (itching, redness, watery eyes), dry mouth, sudden headache which does not subside with painkillers, skin rashes have been identified in the infected patients during the second wave. Additional symptoms include breathing difficulty, chest pain, pale skin, loss of speech and movement. It is advised to seek medical care immediately if the above symptoms are observed [21]. A new condition called 'Happy Hypoxia' has been reported commonly in youngsters, wherein the patient has low oxygen saturation but does not develop any symptoms due to high immunity. The tolerance is seen up to oxygen saturation of 81 whereas generally symptoms develop at saturation of 90. This leads to severe lung damage as the symptoms develop later than usual, hence the fatality rate is more among the youngsters [22].

Apart from new COVID-19 symptoms, Post-COVID symptoms have been reported in many recovered patients, the most prominent among them is the black fungus infection. Black fungus infection is also known as mucormycosis is caused by a class of molds called mucormycetes. It is an invasive infection caused by the inhalation of fungal spores present in the air. The spores enter through the nose and cause infection at the site. The infection grows from nose to eyes and eventually reaches the brain which is believed to be fatal. The symptoms include sudden blindness, face paralysis, blackish nasal discharge, throbbing headache, swelling in the upper jaw, loosening of teeth, and fever. The symptoms are commonly observed in COVID patients suffering from diabetes or having a weak immune system due to steroidal therapy. The fungus can also infect a person with a normal immune system; however, it is known to be asymptomatic. Liposomal amphotericin B injections are prescribed to the patients infected by mucormycosis. Surgical intervention is also required to stop the infection from spreading, which includes endoscopy through

the nasal cavity to remove infected tissue or removal of eyes or jawbones. Indian Council of Medical Research (ICMR) has issued an advisory for screening and diagnosis of the fungal infection. Other symptoms include kidney damage, heart attack, poor immunity, chronic weakness, brain fog, headaches, myalgia (pain in muscles), lingering cough, diabetes, myocarditis (inflammation in the heart), arrhythmias (irregular heartbeat), a psychological and neurological disorder [5, 21].

6. Treatment and Vaccination

1) Medication and preventive measures

SARS-CoV-2 genome contains specific genes which encode for structural (S, M, E & N), non-structural proteins (Nsp1-16), and accessory proteins (HE). The S-protein interacts with the

COVID-infected patients [14]. A few of them are listed in table 2.

Other drugs which are currently used are Human immunoglobulin, Azithromycin, Arbidol (umifenovir), Oseltamivir, Darunavir-cobicistat combination, Recombinant human interferon $\alpha 2\beta$, Combinations of Oseltamivir, favipiravir, and chloroquine, Thalidomide, Bromhexine hydrochloride, Pirfenidon, and many more.

Most studies suggest that SARS-CoV-2 like other viruses (MERS-CoV and HCoV-229E), tends to survive on different non-living materials for many hours. Thus, to avoid infection from contaminated surfaces, suspended biocidal agents are used. 75% ethanol, 2% glutardialdehyde, 0.8% formaldehyde, 0.21% sodium hypochlorite have shown optimistic results

Table 2
List of potential drugs currently being applied for the treatment of COVID-19

Potential drug	Mechanism	Administration	References
Hydroxychloroquine (HCQ)/ Chloroquine	It is safe and effective against COVID-19. Used in the treatment of malaria, HIV, viral infections as they inhibit viral replication cycles. Also, reduce viral transmission.	Oral	[24, 25, 26]
Ivermectin (avermectins)	Inhibits viral replication FDA approved as an anti-parasitic agent	Oral	[27, 28]
Lopinavir/ ritonavir	Has a protease inhibiting property Cleaves HIV-1 protease, used in HIV treatment Inhibits 3CL ^{pro} , an enzyme in SARS-COV-2 replication	Oral	[29, 6]
Remdesivir	Blocks replication of coronavirus Approved by FDA	Intravenous infusion	[14]
Vitamin C	Antioxidant Reduces oxidative stress Improves vasopressor synthesis and immune cell function	Oral	[14]
Angiotensin-converting enzyme inhibitors and Angiotensin 2 receptor blockers	Rebalancing Renin-Angiotensin-Aldosterone System (RAAS)	Oral	[14]

human ACE-2 receptor and plays a role in viral infection and disease transmission. Other accessory proteins such as ORF3a, ORF6, ORF7a ORF8, and ORF10 genes help in assembling of virus and causing infection. Apart from ACE-2, Papain-like protease (PLPro), 3-chymotrypsin-like protease (3CLPro), RNA-dependent RNA polymerase (RdRp), helicase, exoribonuclease, and 2'-O-methyltransferase are some of the vital therapeutic targets which can be used for anti-viral drug development [23].

Till today, there are no specific antiviral treatments proven for treating COVID-19. Although the usage of the vaccines produced is still controversial. Several vaccines and anti-viral drugs are under different stages of clinical trials to discover a potential treatment for the SARS-COV-2 infection. As there is no particular therapy approved, presently, supportive treatments are used. Treatments given are based on the treatments for influenza, flu, or other respiratory, according to the Centers for Disease Control and Prevention (CDC) which is called supportive care. These treatments are given for symptoms like cold, cough, fever, and shortness of breath. Medication like acetaminophen (Tylenol) is given to patients to reduce fever, anti-viral drugs like Oseltamivir or Tamiflu, to suppress viral replication. Ventilation through masks or injection of the tube through the windpipe is also in practice in case of pneumonia. There are more than 70 potential drugs and their combinations that can be used for the treatment of

within 1 minute of exposure. These disinfectants are effective in the inactivation of viral infections [14]. Since there are no drugs or vaccines approved by the FDA yet for the treatment and prevention of COVID-19. Thus, prevention is the only way to subside the infection. WHO has issued guidelines to be followed by every country and individual to tame the present situation. The preventive measures to be followed are listed below.

- Properly washing of hands with an antiseptic soap or handwash for about 20 minutes under running tap water before food, before and after touching any contaminated surface or sneezing, coughing. In the absence of soap and water, alcohol-based gel or sanitizer is advised. Avoid frequent touching of the face with unclean hands.
- Frequent cleaning of contaminated surfaces with disinfectants is advised to avoid any kind of infection.
- Strictly following the social distancing (minimizing physical contact between people) norms and guidelines issued. Maintaining a 6ft. distance at all times with the other person. Avoiding crowded areas or crowding in any area, unnecessary travel, handshakes, or any other kind of physical contact.
- Maintaining respiratory hygiene. Cover the face while sneezing or coughing with a tissue or handkerchief and

proper disposal of it. Washing of hands and elbows after sneezing/ coughing.

- Wearing protective materials such as face masks to prevent the spread of infection. All the citizens are encouraged to wear face masks to reduce the rate of transmission. Front line workers, healthcare workers, doctors are strictly advised to wear Personal Protective Equipment (PPE) while attending a COVID-positive patient.
- Rapid testing is necessary for early diagnosis and treatment. Self-isolation is advised for individuals awaiting their COVID test results, also for the ones who have traveled to a COVID-19 hotspot area. Quarantine is a process to isolate oneself from others to avoid the spread of infection. It is advised to the individuals belonging to the older age group and also to the ones who tested positive for the disease. Lastly, contact tracing is done to know the others who are at risk and have been in contact with the infected individual.

Apart from the above-mentioned measures, movement restriction, specific hours curfews, quarantine measures, following standard safety, workplace measures, facility closures, and lockdown protocols are other workable COVID-19 mitigation methods [1].

2) Vaccination

A vaccine can be defined as a kind of medicine that helps the immune system to fight disease and induces the production of antibodies to fight a pathogen that the body has not encountered before [30]. Vaccines are made by either killing or weakening of pathogen till it does not cause any disease. Hence, it gives a fake stimulation to make the immune system believe that it has been attacked by a pathogen so that when a real pathogen attacks, our immune system is prepared to fight against it. Unlike other medicines, vaccines prevent the diseases rather than treating or curing them [31].

and are a hub for half a dozen major manufacturing companies. The vaccine drive launched by India, in early January, is considered the world's largest inoculation effort [32]. The following data represents vaccination doses given till 20th May 2021 in different countries (Graph 1). So far around 186M people have been vaccinated in India. In the first phase of Vaccination, healthcare and frontline workers were prioritized. The Vaccines Produced in India which are currently in use are Covaxin and Covishield. The Sputnik V jabs are also being administered to the citizens.

Covaxin- It is manufactured by Bharat Biotech and being a homegrown government-backed vaccine, has an efficiency rate of 81% from its phase 3 trial data. The manufacturers claim it to be a 'Milestone' in vaccine discovery. It is a vaccine made by a killed coronavirus which makes it safe for injection. It is a type of inactivated vaccine. A sample of coronavirus, isolated by India's National Institute of Virology was used by the vaccine's manufacturer. Two doses are administered at an interval of four weeks. It is stored at a temperature of 2oC to 8oC. There were many controversies around Covaxin and its approval as the vaccine was given a green light despite being on a trial stage. Later, the manufacturer and the drug regulator claimed that it was safe to use and provides a vigorous immune response.

Covishield- An Oxford-AstraZeneca vaccine made from the weakening of adenovirus (common cold virus) isolated from chimpanzees whose shape was altered to look like coronavirus and is harmless. It was manufactured by the world's largest vaccine manufacturer, Serum Institute of India. When injected, alarms the immune system and stimulates antibody production. Two doses of the jab are given at about 4-12 weeks apart. It is stored at a temperature same as domestic refrigerators. The first dose of the vaccine is 70% effective and the effectiveness reaches 90% with the second dose. The data recorded during the international clinical trial suggests that the overall effect depends on the time gap between the doses. Longer the gap, the higher the effectiveness. There are claims by All India Drug Action Network that the approval was rushed as the "Bridging Studies" of the vaccine on Indians was not completed.

Sputnik V- developed by Dr. Reddy's Lab and Gamaleya National Centre in Russia. It works similar to the Oxford-AstraZeneca vaccine wherein a cold-type virus is made harmless and acts as a carrier to deliver a fragment of the coronavirus in the body. Unlike other vaccines, the first and second doses are slightly different and are given 21 days apart. Both target different "spikes" of the virus, it is believed that two different formulas boost the immunity for the long term compared to using the same version twice. It is claimed to be safe and 92% effective as seen in the last stage of the clinical trial [32].

2-deoxy-D-glucose (2-DG), an oral anti-COVID-19 drug developed by DRDO (Defence Research and Development Organisation) has been given a green signal for emergency use by the Drugs Controller General of India (DCGI). The drug helps in faster recovery and reduces supplemental oxygen dependency as shown in results during the clinical trials [34]. Other vaccines are at different stages of clinical trials such as

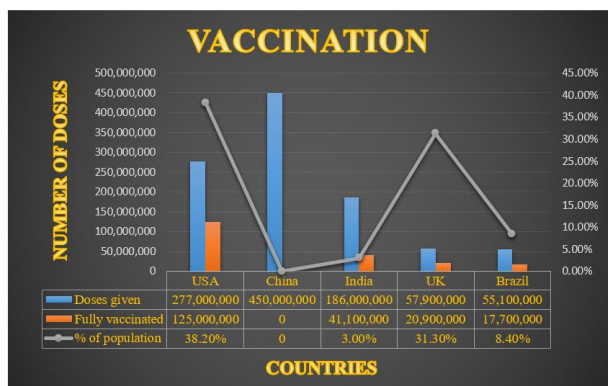


Fig. 3. Graph 1:- Graphical representation of vaccination doses given in Top 5 Country till 20th May 2021 [33]

In the present COVID situation, many vaccines have been produced and many more are at different stages of a clinical trial. India, known as the vaccine powerhouse, has been producing and supplying vaccines to neighbouring countries and other nations. 60% of the world's vaccines are made in India

ZyCov-Di developed by Ahmedabad-based ZyduS-Cadila, nasal vaccine by Bharat BioTech, HGCO19 is India's first mRNA vaccine, another vaccine developed by Serum Institute of India and American vaccine development company Novavax [32].

7. Present Scenario

COVID-19 is spreading rapidly, and its varied impacts can be observed worldwide. The COVID-19 has affected over 220 countries and territories all over the globe. As of 5th April 2021, the total cases of coronavirus worldwide were 132,242,572 (around 132 M) out of which 106,456,839 (nearly 106 M) were recovered with 2,869,888 (approx. 2.8 M) reported deaths. The countries with the highest number of COVID-19 cases were USA #1 with 31 M, Brazil #2 with 12.9 M, India #3; 12.6 M, France #4; 4.8 M, and Russia #5 with approximately 4.5 M cases reported represented in graph 2. The reported cases of India have multiplied many times since the hit of the second wave of infection. In a span of about a month, the total reported cases of COVID-19 have doubled in number, it has increased from 12.6 M on 5th April 2021 to 24,965,463 (approx. 25M) confirmed cases on 20th May 2021 [35].

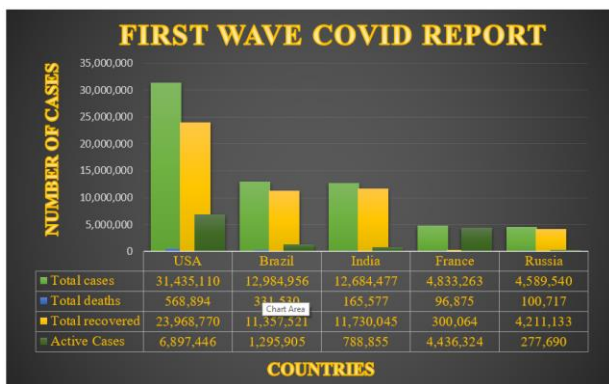


Fig. 4. Graph 2. Graphical representation of reported COVID-19 Cases and Deaths in Top 5 Country on 5th April 2021 [35]

The cases worldwide have reached 165,877165 (approx. 166M) among which 146,590,280 (146.5M) patients have recovered and 3,445,455 (nearly 3.5M) total deaths have incurred [35]. Therefore, from graphs 2 and 3, the impact of the second wave of COVID-19 can be observed from the drastic change in numbers in a period of just 1 month. Studies and research is being conducted on hijacking the mechanism of



Fig. 5. Graph 3:- Graphical representation of reported COVID-19 Cases and Deaths in Top 5 Country on 20th May 2021 [35]

Indian SARS-COV-2 isolates based on structural and functional characteristics of protein variants. Among 12 Indian SARS-COV-2 isolates around 41 protein mutations were identified from 30 different sites by analyzing genome variants across the 460 genome sequences from each geographical site in India [23]. India, on 5th April 2021, was the 3rd among others having the highest number of reported COVID-19 cases and now has become the 2nd country reporting the highest number of COVID cases. The state-wise increase in COVID-19 cases on 5th April 2021 and 20th April 2021 are represented below in graph 4.

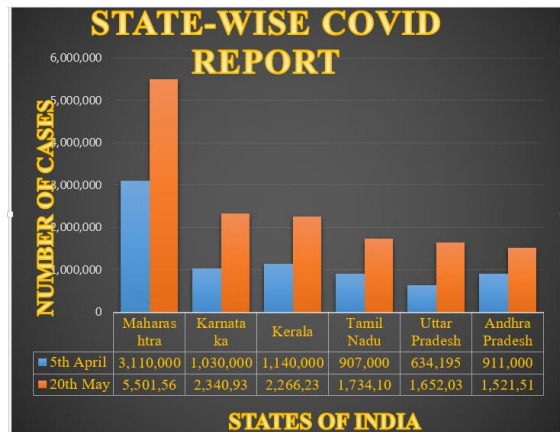


Fig. 6. Graph 4:- Graphical representation of COVID-19 Cases reported in Top 6 states in India on 5th April and 20th May 2021 [36].

The GOI launched various apps such as the 'Aarogya Setu' mobile application and 'CoWIN' portal (www.cowin.gov.in) to keep the citizens updated and informed about the COVID situation in the country, state-wise cases, facts and figures, safety and prevention measures, and also information on the vaccine, nearest vaccination centres and allows users to register for vaccination.

8. Conclusion

Since December 2019, SARS-CoV-2 has posed an ongoing threat to humanity. This viral strain infects host cells through ACE2 to cause COVID-19, and causes damage to the myocardium, although the precise mechanisms are still uncertain and patients already suffering from diabetes, cardiovascular disease, ARDS and low immunity deserve particular attention. WHO has declared this infection as a pandemic and a disease of global concern? Faecal screening of patients with COVID-19 is a promising challenge to understand transmission especially in underdeveloped nations where faecal decomposition takes place in open areas. The outer part of SARS-CoV-2 is formed from lipids which will be disrupted by surfactant or handwashing. Natural resources like plants and other materials with antiviral characteristics are promising candidates for screening as lead molecules for drug design and the development of treatment for COVID-19. These existing natural resources will save time and be cost-effective within the current scenario of a world health emergency and a lack of treatment modalities.

Despite, the manufacturing of vaccines and the use of different drugs for treatment, limitations still exist. The doubt arises that the vaccines produced might not be efficient towards the new variants or mutants of the virus. The treatments used currently are not 100% effective; it is based on the trial-and-error method. Although there are new vaccines produced, there is still a doubt whether these vaccines and new treatment methods can control the pandemic. With the cases increasing every day and with the occurrence of new mutations now and then, it seems difficult to cope with current diagnostic and treatment methodologies. A well-developed vaccine plan is required to develop, test, and manufacture vaccines within weeks. Shortly, researchers and scientists might discover a new technique for curing the global pandemic and a new method to tame this virus.

9. Author's Contribution

Surbhi Singh reviewed the whole content, collected details and drafted the manuscript. Dr. Rini Abraham conceptualized the article and supervised the data.

10. Conflict of Interest

No

Acknowledgment

We are grateful to the opportunity and cooperation from our institution Jyoti Nivas College Autonomous, Bangalore. We express our sincere thanks to the Faculty members of Department of Biotechnology, Jyoti Nivas College Autonomous for their support and well wishes. We also acknowledge the authors of articles reviewed for their impact on our ideas.

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