*Review Article*

# COVID-19 Pandemic: Epidemiology, diagnosis, and treatment knowledge

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**Abstract**

There is a new health crisis threatening the world with which shows its presence by the end of 2019 called as novel coronavirus (2019-nCoV) or the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) .Coronavirus diseases (COVID-19) is an infectious disease caused by a newly discovered coronavirus. Since its first occurrence in the Wuhan city of China, it spread like forest fire across all over all countries and cause illness and death of humans within very short span of time. The COVID-19 viruses spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes or even shakes hands and remain in close contact with the society. Respiratory infections like common cold and later it leads to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) observe in this disease. As per reports, this new virus and disease first was seen in Wuhan, China, in December, 2019. Currently there is no targeted therapeutics and effective treatment options to treat this novel disease, though countries like Britain, USA claim for clinical trial for this novel virus using vaccine. To cure the Coronavirus diseases (COVID-19) a lot of research is going on, but still it is in the primary stage. Based on the published article, we are hereby trying to summarize the epidemiology, life cycle, diagnosis, treatment and prevention of knowledge surrounding COVID-19.

***Keywords:*** Coronavirus diseases (COVID-19); Middle East respiratory syndrome; severe acute respiratory syndrome; SARS-CoV-2

## Introduction

In recent times all over world is facing a big challenge against a virus, called Corona Virus. WHO officially named the disease novel COVID-19. International Committee on Taxonomy of Viruses (ICTV) named the virus Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2).It is assumed emergence of a novel and highly pathogenic coronavirus (SARS-CoV- 2) first seen in Wuhan city, Hubei province of China and but its rapid spread from country to country within a few months of time and has posed a serious global public health emergency (Liu et al., 2020; Wang at al., 2020). Patients infected by SARS-CoV- 2 shows a range of symptoms including dry cough, fever, headache, dyspnea and pneumonia with estimated mortality rate in the range of 3–5%6–8. Since the initial outbreak in December of 2019 of this myth burster SARS-CoV-2 has spread throughout China and to all other countries 2020-CoV-2 and declared as pandemic.

Structurally the novel Coronaviruses has a positive sense RNA with diameter ranging from 60 nm to 140 nm and have spike like projections on its surface which make it structure crown like when we observe in an electron microscope; hence the name coronavirus (Richman et al., 2016). This new class of virus is divided into four types: α-coronavirus (α-COV), β-coronavirus (β-COV), δ-coronavirus (δ-COV) and γ - coronavirus (γ-COV) (Chan et al., 2013). Phylogenetic analysis on the coronavirus genomes has revealed that SARS-CoV-2 is a new member of the beta coronavirus genus, which includes SARS-CoV, MERS-CoV, bat SARS-related coronaviruses (SARSr-CoV), as well as others identified in humans and diverse animal species (Zhu et al., 2019; Wu et al., 2020). Bat coronavirus RaTG13 appears to be the closest relative of the SARS-CoV-2 sharing over 93.1% sequence identity in the spike (S) gene. SARS-CoV and other SARSr-CoVs however are rather distinct are rather distinct with less than 80% sequence identity (Xinhua 2020). In humans, coronaviruses cause respiratory tract infections

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like common cold (which has other possible causes, predominantly rhinoviruses) and symptoms like SARS, MERS, and COVID-19.

**Life cycle of corona virus**

Corona virus infection begins when the viral spike (S) glycoprotein attaches to its complementary host cell receptor and after attachment, a protease of the host cell cleaves and activates the receptor-attached spike protein. The process of cleavage and activation allows the virus to enter the host cell by endocytosis or direct fusion with the host membrane (Simmons, 2020). Coronavirus RNA genome has a 5′ methylated cap and a 3′ polyadenylated tail, so on entry into the host cell, the virus particle is uncoated, and its genome enters the cell cytoplasm and translation occurs 10 and forms a long polyprotein which cleave the polyprotein into multiple non-structural proteins.

**Replication**

During replication process a number of the non-structural proteins like RNA-dependent RNA polymerase (RdRp) coalesce to form a multi-protein replicase-transcriptase complex (RTC) which is involved in the replication and transcription of RNA from an RNA strand. The other non-structural proteins in the complex assist in the replication and transcription process. The exoribonuclease non-structural protein, for instance, provides extra fidelity to replication by providing a proofreading function which the RNA-dependent RNA polymerase lacks (Fehr et al., 2015; Sexton et al., 2016). Important property of this complex is to replicate the viral genome. RNA-dependent RNA polymerase responsible for the synthesis of negative-sense genomic RNA from the positive-sense genomic RNA in host cell, which is followed by the replication of positive-sense genomic RNA from the negative-sense genomic RNA.

**Release to host cell**

The replicated positive-sense genomic RNA which are formed from the negative-sense genomic RNA becomes the genome of the progeny viruses and form mRNAs which are translated by the host's ribosome into the structural proteins and a number of accessory proteins. RNA translation occurs inside the endoplasmic reticulum. The structural proteins like S, E, and M present in virus move along the secretory pathway into the Golgi intermediate compartment where the M proteins send signals to most protein-protein interactions required for assembly of viruses following its binding to the nucleocapsid. Progeny viruses are then released from the host cell by exocytosis through secretary vesicles (Fehr and Perlman, 2015; Masters, 2020).

**Transmission**

The interaction of the coronavirus spike protein with its complement host cell receptor is central in determining the tissue tropism, infectivity, and species range of the virus (Cui et al., 2019; Li et al., 2015) . The SARS coronavirus, for example, infects human cells by attaching to the angiotensin-converting enzyme-2 (ACE2) receptor (Wertheim, 2013).

In December 2019, a pneumonia outbreak was reported in Wuhan, China. On 31 December 2019, the outbreak was traced to a novel strain of coronavirus (WHO World Health Organization). Coronavirus disease (COVID-19) Technical Guidance (2020) which was given the interim name 2019-nCoV by the World Health Organization (WHO) (Li-sheng et al., 2019) later renamed SARS-CoV-2 by the International Committee on Taxonomy of Viruses. Some researchers have suggested the Wuhan Seafood Wholesale Market may not be the original source of viral transmission to humans (Cohen, 2020). The virus has a 96% similarity to a bat coronavirus, so it is widely suspected to originate from bats as well (Hui et al., 2020; Wang et al. 2020). The pandemic has resulted in travel restrictions and nationwide lockdowns in several countries.

In the month of December 2019 the people of in Wuhan, China, observed with 'pneumonia of unknown cause which may be due to when they comes in contact to a seafood market. So the Chinese Centre for Disease Control and Prevention (CDC) and local CDCs organised come forward to study this outbreak cause and they found the symptoms cause due to a novel virus which has an incubation period of five days and showing symptoms like dry cough and fever. This leads to inform to 31 December 2019 to the local World Health Organisation (WHO) Country Office. The WHO estimates globally COVID-19 has a mortality rate of 3.4%. COVID-19 reached all over world and all countries are affected with this novel virus. In India first COVID patient was detected in the month of January 2020. On March 11 the WHO declared the COVID-19 outbreak a pandemic. Scientists detected SARS-CoV-2 in the samples of stool, gastrointestinal tract, saliva and urine. Based on bioinformatics evidence indicated that digestive tract might be a potential route of SARS-CoV-2 infection (Xiao et al., 2020). Consistently, SARS-CoV-2 RNA was also detected in" gastrointestinal tissues from COVID-19 patients (Xia et al., 2020) Moreover, SARS-CoV-2 was detected in the tears and conjunctival secretions of covid-19 patients (Chen et al., 2020). Researcher conducted a study in pregnant women with COVID-19 had for the first time to study the possibility of intrauterine vertical transmission between mothers (Rothe et al., 2020), however, available data on pregnant women infected with SARS-CoV-2 were inadequate and hence further studies and research is going on to required to verify the potential vertical transmission of SARS-CoV-2 in pregnant women.

**Symptoms**

The main way the disease spreads is through respiratory

droplets expelled by someone who is coughing. The risk of catching COVID-19 from someone with no symptoms at all is very low. However, many people with COVID-19 experience only mild symptoms. This is particularly true at the early stages of the disease. It is therefore possible to catch COVID-19 from someone who has, for example, just a mild cough and does not feel ill.

**Pathogenesis**

In novel COVID-19, People can catch COVID-19 from others who have the virus. The disease can spread from person to person through small droplets from the nose or mouth which are spread when a person with COVID-19 coughs or exhales by symptomatic patients but can also occurs from asymptomatic people and before onset of symptoms (Zou et al., 2020; Kampf et al., 2020). These droplets land on objects and surfaces around the person. Other people then catch COVID-19 by touching these objects or surfaces, then touching their eyes, nose or mouth. People can also catch COVID-19 if they breathe in droplets from a person with COVID-19 who coughs out or exhales droplets. This is why it is important to stay more than 1 meter (3 feet) away from a person who is sick. The virus can remain viable on surfaces for days in favourable atmospheric conditions but are destroyed in less than a minute by common disinfectants like sodium hypochlorite, hydrogen peroxide etc (Holshue et al., 2020). Infection is acquired either by inhalation of these droplets or touching surfaces contaminated by them or then touching the nose, mouth and eyes. The virus is also present in the stool and contamination of the water supply and subsequent transmission via aerosolization/ feco oral route is also hypothesized.

**Possible treatments of SARS-COV-2**

Patients infected with COVID-19 virus shows mild to moderate respiratory illness. But old age people and patients suffering with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer develop serious illness. So the best way to prevent and slow down transmission of this virus is to educate and proper information to patients by washing hands or using an alcohol based rub frequently and not touching your face frequently and by coughing into a flexed elbow.

Though there are no specific vaccines or treatments for COVID-19, however, in some countries doctors are using combinations of medicine for treating patients suffering from COVID-19 and based on outcome of results there are many ongoing clinical trials evaluating potential treatments.

***Antiviral medicine treatment***

At present, the treatments of patients with SARS-CoV-2 infection not known, still doctors are using Remdesivir an antiviral drug for treatment. Holshue et al. (2020) for the first time reported that treatment of a patient with COVID-19 used Remdesivir which is neuraminidase inhibitors and achieved good results for treatment of patient's suffering with COVID-19 (Wang et al., 2020). So in some countries clinical trials is undergoing on this drug. Meanwhile, also found that chloroquine has an immune-modulating activity and could effectively inhibit in this virus in vitro (Gao et al., 2020). Clinical controlled trials have shown that Chloroquine was proved to be effective in the treatment of patients with COVID-19 (Boriskin et al., 2008). Arbidol, a small Indole derivative molecule, was found to block viral fusion against influenza A and B viruses and hepatitis C viruses (Khamitov et al., 2008) and confirmed to have antiviral effect on SARS-CoV in cell experiment (Lu, 2020), so that it might be a choice for COVID-19 treatment. A study conducted on drug Arbidol showed that Arbidol had better therapeutic effect and could significantly reduce the incidence of severe cases. Besides other drugs like Lopinavir/Ritonavir, nucleoside analogues also the choices of antiviral drugs for COVID-19 treatment.

***Chinese medicine treatment***

Though as per report novel COVID-19 first originates from Wuhan city, China, number of medicinal treatments like clearing lung and drugs like Shuanghuanglian oral liquid could inhibit SARS-CoV-2 symptoms. In some previous research article, it was mentioned that baicalin, chlorogenic acid and forsythin in Shuanghuanglian oral liquid have certain inhibitory effects on a variety of viruses and bacteria (Li, 2002). The mechanism might be that these components played a therapeutic role by effectively reducing the inflammatory response of the body caused by viruses and bacteria (Chen et al., 2002). *Lianhua Qingwen capsule which is also a* traditional Chinese medicine has been proven to have a wide-spectrum effect on a series of influenza viruses, including H7N9, and could regulate the immune response of the virus, reducing the level of inflammatory factors in the early stage of infection (Ding, 2017).

***Immunoenhancement therapy***

It is a treatment method in which immune cells are taken out from the patient's body which are cultured and processed to activate them until their resistance to cancer is strengthened and then the cells are put back in the body. The cells, antibodies, and organs of the immune system work to protect and defend the body against not only tumor cells but also bacteria. Interferon was found to be an effective inhibitor of MERS-CoV replication (Mustafa et al., 2018). Those findings suggested that interferon could be used in the treatment of COVID-19. Intravenous immunoglobulin might be the safest immunomodulator for long-term use in

all ages, and could help to inhibit the production of pro inflammatory cytokines and increase the production of anti-inflammatory mediators (Gilardin et al., 2015). Thymosin alpha-1 (Ta1) which is responsible for restoring immune function can be an immune booster for SARS patients, effectively controlling the spread of disease COVID-19 (Kumar et al., 2017).

***Convalescent plasma therapy***

The convalescent plasma therapy use antibodies from the blood of a recovered Covid-19 patient to treat patients who are affected by the virus. In this therapy patients who are recovered from COVID-19, there antibodies are collected and then ingested into somebody under treatment where they will begin targeting and fighting the novel coronavirus in the second patient (Mair-Jenkins et al., 2015; Soo et al., 2004). Still the convalescent plasma therapy is a preventive measure and but not a treatment for the Covid-19 disease. The therapy can also used to immunise those at a high risk of contracting the virus, such as health workers, families of patients and other high-risk contacts. This therapy's concept is simple and is based on the premise that the blood of a patient who has recovered from Covid-19 contains antibodies with the specific ability of fighting novel coronavirus.

A study conducted by Hung and colleagues showed that for patients with pandemic H1N1 influenza virus infection in 2009, the relative risk of death was significantly lower in patients treated with convalescent plasma (Hung et al., 2011). The patients recovered from COVID-19 would produce specific antibodies against the SARS-CoV-2, and their serum could be used to prevent re infection in plasma therapy as per initial study for treating COVID-19 patients where antibodies can reduce the virus reproduction in the acute phase of infection and help clear the virus, which is conducive to the rapid recovery of the disease (GR, 1996). Generally, effect of corona virus during the first week of most viral infections, and it should be more effective to give recovery plasma early in the disease (Cheng et al., 2005).

Still then convalescent plasma therapy has some serious complications like, when as the blood transfusion takes place, there are risks that an inadvertent infection might get transferred to the patient. The therapy might fail for some patients and can result in an enhanced form of the infection and may end up suppressing the body's natural immune response, leaving a Covid-19 patient vulnerable to subsequent re-infection.

***Auxiliary blood purification treatment***

Blood purification technology plays an important role in the treatment of severe COVID-19 patients, and can be used in the treatment of severe COVID-19 and its complications. In the treatment of severe COVID-19 patients, the choice of blood purification technology should be based on the path physiological changes of the patients, take the clinical treatment objectives as the core, take into account the advantages and disadvantages of various treatment techniques, and choose the best treatment scheme for the patients at the right time (Zarbock et al., 2016). Blood purification technology could be used to remove inflammatory factors, eliminate cytokine storm, correct electrolyte imbalance, and maintain acid-base balance, to control patient's capacity load in an effective manner (Lim et al., 2015).

Since at this time there are no approved treatments for COVID-19, so prevention is crucial and by this we can reduce chances of being infected or spreading COVID-19 by taking some simple precautions like;

(a). Regularly and thoroughly clean our hands with an alcohol based hand rub or wash them with soap and water.

(b). Maintain at least 1 metre (3 feet) distance between yourself and anyone who is coughing or sneezing.

© Avoid touching eyes, nose and mouth.

(d). Stay home if someone feel unwell and if we have a fever, cough and difficulty in breathing, seek medical attention and call in advance.

(e). Self-isolate by staying at home if we begin to feel unwell, even with mild symptoms such as headache, low grade fever (37.3 C or above) and slight runny nose, until we recover. This will also help to prevent possible spread of COVID-19 and other viruses.

**Role of India**

Amid this entire crisis, India has been playing an important role. India's role could be considered at both the domestic level – the steps taken to tackle the crisis at home and the diplomatic level- India's assistance to other countries, especially in the Indian Ocean Region (IOR), amid the pandemic. India has emerged as a major supplier of medicines to different countries worldwide in the fight against COVID-19. Though treatment to cure COVID-19 still unknown, so Self-isolate by staying at home if you begin to feel unwell, even with mild symptoms such as headache, low grade fever (37.3°C or above) and slight runny nose, until you recover is the ultimate goal to cure and spread the diseases.

**Conclusion**

This new virus outbreak has challenged the economic, medical and public health infrastructure of China and to some extent, of other countries especially, its neighbours. Time alone will tell how the virus will impact our lives here in India. More so, future outbreaks of viruses and pathogens of zoonotic origin are likely to continue. Therefore, apart from curbing this outbreak, efforts should be made to devise comprehensive measures to prevent future outbreaks of zoonotic origin.

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**Conflicts of Interests**

The authors declare no conflicts of Interest

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