

# A review on global pandemic corona virus: Current status of diagnosis, treatment and prevention

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## ABSTRACT

Coronavirus or Covid-19 is a new kind of viral respiratory tract disease which was declared as a lethal pandemic for the world. COVID-19 affects different people in different ways. The most common symptoms include fever, sore throat and dry cough. But some patients are asymptomatic also

which somehow increases the risk for transmission. More than 210 countries are currently facing this disease and are fighting from COVID-19 but better approaches of diagnostics and medical facilities have helped some countries to recover at some extent. Some vaccines are under development for SARS-CoV-2 infection and once it will be approved and available for human use, it will help a lot in controlling this pandemic.

**Key Words:** COVID-19; SARS-CoV-2; Pandemic

## INTRODUCTION

In the month of December 2019, some cases of “pneumonia with unknown Etiology” were noticed in Huanan seafood market in Wuhan city of China. The major symptom associated with this unidentified pathogen is fever ( $\geq 38^{\circ}\text{C}$ ) with pneumonia. It can be diagnosed by less WBC count or less lymphocyte count, using different radiological imaging techniques and with no recovery in the health status of the patient even after treatment with antimicrobial therapy upto 4-5 days. Now, this unidentified human pathogen was recognized as novel coronavirus (2019-nCoV), which is nowadays acknowledged as SARS-CoV-2 causing the deadly viral sickness COVID-19 [1] and on March 11, 2020, the World Health Organization (WHO) confirmed that the COVID-19 disaster as a pandemic since the numbers of cases along with the causality were increasing rapidly not only in China but all around the world [2].

## GENOMIC ARRANGEMENT AND REPLICATION

The basic genomic arrangement of Corona virus consist of 4 structural proteins which are designated as envelope protein (E), spike glycoprotein (S), membrane protein (M) and Nucleoprotein (N) (Figure 1). There is one more protein reported that is present in a few varieties of coronavirus is haemagglutinin esterase (HE). The major function of this protein favors the entry of virus into the host cell along with its considerable role in causing infection to the natural host [3]. S proteins having a molecular weight of ~150 kDa are profoundly glycosylated [4]. These are present on the external surface and basically form homotrimers that gives the characteristic crown like symmetry (shape) to the virus; that's why named as Coronavirus [5].

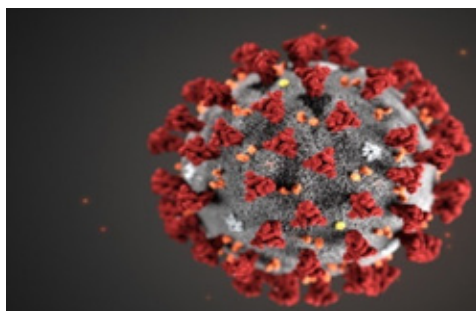


Figure 1) Structure of Coronavirus.

The studies from electron microscopy depicted that this virus has either spherical or pleomorphic shape. From the outer cover few club shaped projections emerged out and formed the spike proteins. The virus contains positive sense genomic m-RNA, having terminal cap at 5' position and a poly-adenylate tail at 3' end.

In coronavirus the genomic mRNA acts as an early RNA or template RNA to complete the infectious cycle. After replication and transcription process, this mRNA i.e. act as a genetic material, was packed into the virus progeny and finally get released using the apoptosis process [6]. After release, these mature viral particles have affinity with human epithelial cell; henceforth they bind with these cells and come inside the host cell by the endocytosis mechanism. After getting inside, the very first event of uncoating takes place, thus the viral RNA genome get released into the host cell. Now this viral RNA genome gets integrated with host genome and starts its replication process. After replication of viral genome, translation process begins that ultimately leading to the formation of structural and non-structural viral proteins. Finally, these structural and non-structural viral proteins get assembled along with the viral RNA genome into it and the mature viral structures get released into the environment [6].

In the present scenario, recent research on whole genome sequencing followed by phylogenetic analysis depicted that SARS-CoV-2 has close resemblance with  $\beta$ -coronavirus that was the member of sub-genus SARS-CoV that is the causative agent of SARS tragedy in the year 2002-2003[7]. Apart from the common sub-genus like SARS-CoV, MERS-CoV and SARS-CoV-2, four other new varieties of coronavirus viz. OC43, 229E, NL63 and HKU1 are capable of causing lethal human infection. In majority of cases, coronavirus causes mild to severe infections related to respiratory tract among almost all age groups [7].

## EPIDEMIOLOGY

The first case of this novel coronavirus (COVID-19) was found in Wuhan city of China and the major symptoms associated with this infection are early pneumonia followed by lung failure. The causative agent of this lethal infection has been identified as novel coronavirus, recently also known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It was observed that this SARS-CoV-2 was a zoonotic coronavirus just similar to the SARS-CoV, which was spread in year 2002. This coronavirus infection is rapidly spread in China and other countries initially in Thailand by a female tourist from Wuhan city of China [8]. Initially in Wuhan city, the infection spread in the seafood market and it was the starting of phase I of COVID-19.

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As per the recent data available on October 20, 2020; there are total 40,660,963 cases of coronavirus worldwide. 1,123, 180 deaths occurred and about 30,312, 361 patients were recovered from this deadly infection. As the number of infected cases, the maximum cases of this coronavirus were reported in USA followed by India, Brazil, Russia and Spain. In China the total number of infected cases was found to be 85,704. As a result in China, lockdown has been revoked in April, 2020 [9]. This coronavirus has spread drastic infection in India also having 7,597,063 infective cases and 115,236 deaths till October 20, 2020. Henceforth, India secured 2<sup>nd</sup> position after USA as far as the total number of infected cases was concerned.

### CLINICAL SYMPTOMS

As we already discussed earlier that the major symptoms associated with this coronavirus are respiratory disorders. The duration between exposure to an infection and the manifestation of the first symptoms is 2-14 days and symptoms persists upto 12-14 days after exposure. The time duration from the beginning of infection to death required approximately 6-41 days with an average of 14 days [10]. This time duration may vary from person to person because it mainly depends on the age and immunity power of an individual. It has been observed that the individuals having age more than 70 years are more prone to this infection in comparison to others. The most frequent indication of coronavirus infection is cough, fever, fatigue along with headache, sore throat, skin rashes, diarrhea and conjunctivitis, impaired taste and smell, Raynaud's phenomenon (discoloration of fingers or toes), and shortness of breath, difficulty in speaking, chest pain, bloody sputum and lymphocytopenia [10-13].

Moreover, in most of the cases with age more than 70 years, respiratory failure may occur because of blockage of alveoli [14]. In severe cases, heart failure and kidney damage may occur within a short duration of time [15,16]. The immunity power of coronavirus infected patients become impaired due to decrease in WBCs count, low level of lymphocytes in the blood along with extended thromboplastin duration with elevated C-reactive protein level [14-17]. Henceforth, it has become evident that the patients with impaired immune system become more prone to this infection. Recently, Centre for Disease Control and Prevention (CDC) has announced an emergency warning for COVID-19, for which instant and necessary medical facility will be needed immediately [18].

### TRANSMISSION

Viruses including, SARS-CoV and influenza can easily survive on different surfaces from hours to extended periods up-to months. The factors which influence the survival of these viruses includes; surface type, suspension medium, type of strain, temperature, and also the relative humidity [19]. Direct and indirect contact also plays a crucial role in the transmission of such lethal viral infections. Indirect contact transmission including contamination of inanimate surfaces is uncertain when compared with direct contact transmission of independent of surface contamination such as droplet or airborne routes [20-22].

The high correlation of case detected with airborne movement points out the high risk of transmission of the Corona virus across the globe [23,24].

### DIAGNOSIS

For the identification of a particular infection, disorder or damage, diagnosis based on its signs and symptoms plays an important factor. It has become a matter of great concern for the scientists whole around the world to control the spread of COVID-19, as this coronavirus is very progressive and lethal virus and till date there is no medicine or vaccine available for its treatment. As per the guidelines issued by WHO, the person detected positive for coronavirus infection must undergo quarantine immediately. After that medical treatment has been started instantly under the supervision of specialist doctor. After molecular identification the case was confirmed as positive for coronavirus because in the symptoms varies according to the immunity of the patient. Several possible treatment and certain medicines are given and the patient is in continuous observation under a medical team. Now, recently research is carry on for the development of potential vaccine for the successful treatment of coronavirus [25,26]. Henceforth, WHO and CDC has announced the safety guidelines for doctors, public, patients and old persons to prevent them from the infection as well as to prevent the spread the infection to others [27-29].

For the most sensitive diagnosis of SARS-CoV, MERS-CoV and SARS-CoV-2, proper collection as well as testing of samples (both upper and lower respiratory tract) are recommended [30]. However, safety precaution should be taken by the healthcare professionals during the sputum collection and bronchoalveolar lavage (BAL) through bronchoscopy and avoid the aerosol formation. Henceforth, the healthcare professionals should wear Personal Protective Equipment (PPE) as an essential precautionary measure. Well trained medical professionals are required for conducting bronchoscopy and it has been observed that at many places such trained staff is not available. Sample from upper respiratory tract can be collected more easily, so sample can be processed more easily without using extra resources. The detection of SARS-CoV and MERS-CoV can also be done by collecting the specimen from urine, blood and stool but more sensitivity was observed with respiratory specimens [30-32].

After the appearance of primary symptoms in patient, the sample must be collected from upper respiratory tract and is the most sensitive method for the detection of coronavirus infection. It has been found that RNA shedding dynamics helps in indicating the specimen source, severity of illness and other risk factors associated with MERS and SARS infections. After the commencement of first symptom among MERS-CoV, the RNA level has reached maximum in the first week in hospitalized patient and they did not needed the ventilator support. However, ventilator support was required for the critical patients in which the RNA levels in the specimen collected from lower respiratory tract has reached maximum within 2-3 weeks [33]. Similar RNA shedding pattern was observed with SARSCoV, where the RNA level was found to be maximum between 7-10 days in the specimen collected from upper respiratory tract and then it gradually decline. Whereas among the samples collected from lower respiratory tract has showed the maximum RNA level upto 3 weeks after the appearance of first symptom [34].

In certain infections like viral pneumonias, there is no production of purulent sputum. Henceforth, for the testing, specimen should be collected from nasopharyngeal swab. If the early infection is not detected in the nopharyngeal specimens, bronchoscopy is to be performed for the collection of specimen from deeper tissues.

Among the saliva specimens (self-collected), the result of 11 out of 12 COVID-19 patients become positive which advocating that it is a potentially safe and non-invasive method of diagnosis, examine and control of the SARS-CoV-2 infections [35]. However, the most sensitive and confirmed diagnosis along with the identification of SARS-CoV-2 can be performed by using Polymerase Chain Reaction (PCR) technique. The accuracy of the results obtained from PCR technique depends on several factors like sample type, quality and method used for the sample collection and the time at which the sample was collected and processed. It has been observed that about 67% sensitivity with the PCR results obtained, when the sample was collected and processed within a week of the appearance of symptoms. While the maximum sensitivity in PCR results noticed with the broncho-alveolar lavage samples and it was approx. 90% [36]. Now days there were few industries that developed ready to use kits for detection of novel SARS-CoV-2 virus and some of them also got approval and authentication from ICMR (Indian council of medical research). Such ready to use kits gave authenticated results, whether the patient is positive or negative for coronavirus [37,38]. Indian Institute of Technology (IIT), Delhi recently developed a probe free COVID-19 testing detection assay with 100% sensitivity and accuracy and it is also authentication from ICMR [39].

In addition to usual antigen detection tests exist for the diagnosis of COVID-19, other tests also available that detect the specific antibody in the patient that is infected with COVID-19. Although it has been observed from recent research that antibodies usually appeared in the second week after the appearance of first symptom. Moreover, the performance of these ready to use kits also vary with the time of sample collection and its further processing [40-42]. Henceforth, patients in whom antibody detection was performed, they generally advised to undergo repeat testing after 8-10 days [43].

Apart from these diagnosis methods, some qualitative tests like ELISA (Enzyme Linked Immuno Sorbant Assay) is available that detects the presence or absence of IgG/IgM antibody in sera of the COVID-19 infected patient. Such qualitative tests are normally safe but are less frequently used in routine diagnostic purposes [44].

Furthermore, quantitative antibody testing is a hope for developing plasma therapy. There is urgent need to develop more advanced and sensitive quantitative immunological tests that detects the antibody titers after coronavirus infection. Hence, there is no chance of re-infection from same type of SARS-CoV-2 Viruses.

### BIOSAFETY PRECAUTIONS

During the laboratory diagnosis of the specimen from coronavirus suspected patient, the guidelines issued by WHO should be strictly follow [45]. All the procedures like collection, storage, packaging, and transportation of the specimen should be performed as per the guidelines issued by WHO and health ministry. Because it has been found in certain studies that SARS-CoV-2 was also detected in some unusual types of specimens like saliva and conjunctival swabs [36–38,40], henceforth it has been strongly suggested that the collected specimen must be established as potentially infectious sample. For performing various sensitive experimentations like DNA isolation and amplification, RNA extraction and sequencing, BSL-2 laboratory facility must require. In addition, BSL-3 or BSL-2 facility is needed for carry out neutralization assays and virus culture [50]. Now, it has become evident that by following biosafety rules and personal protection seriously help us a lot in the prevention and control of emerging lethal diseases.

### TREATMENT AND CONTROL

As we all know that till date no medicine or vaccine available in the market for curing the lethal COVID-19 infection. Scientists in different countries try their level best to develop vaccine but it require some more time. In few countries trials has been done but the potential results are still awaited. Government of different countries around the world has announced the safety guidelines for the travelers, local public and medical staff not to travel without any specific reason. Travelers coming from affected countries must be isolated from the local public and undergo quarantine. Regular health check-ups of these patients are performed and they are also screened for SARS-CoV-2 so as to keep away from any further spread to healthy individuals [51-54].

### CONCLUSION

As per the guidelines of WHO, coronavirus get inactivated or killed on contaminated surfaces or non-living objects by treating them with some chemical agents like 70% isopropyl alcohol, 0.5% H<sub>2</sub>O<sub>2</sub> and 0.1% sodium hypochlorite solution for minimum 60 seconds of time duration.

### REFERENCES

- Li Q, Guan X, Wu P, et al. Early transmission dynamics in Wuhan, China, of Novel Corona virus infected pneumonia. *N Engl J Med*. 2020;382:1199-07.
- Thompson R. Pandemic potential of 2019-nCoV. *The Lancet. Infectious Diseases*. 2020;20(3):280.
- Lissenberg A, Vrolijk MM, van Vliet AL, et al. Luxury at a cost? Recombinant mouse hepatitis viruses expressing the accessory hemagglutinin esterase protein display reduced fitness in vitro. *J Virol*. 2005;79:15054-63.
- Fehr AR, Perlman S. Coronaviruses: An overview of their replication and pathogenesis. 2015;1282:1-23.
- Graham RL, Baric RS. Recombination, reservoirs, and the modular spike: Mechanisms of coronavirus crossspecies transmission. *J Virol*. 2010;84:3134-46.
- Rao K, Verma P, Kumar K, et al. Review on newly identified coronavirus and its genomic organization. *SSR Inst. Int J Life Sci*. 2020;6(2):2509-19.
- Chen Y, Liu Q, Guo D. Emerging coronaviruses: Genome structure, replication, and pathogenesis. *J Med Virol*. 2020;92:418-23.
- Sun J, He WT, Wang L, et al. COVID-19: Epidemiology, evolution, and cross-disciplinary perspectives. *Trends Mol Med*. 2020.
- World Health Organization. Coronavirus disease 2019 (COVID-19) situation report-103. 2020.
- Wang W, Tang J, Wei F. Updated understanding of the outbreak of 2019 novel corona virus (2019-nCoV) in Wuhan, China. *J Med Virol*. 2020; 92(4):441-47.
- Ren LL, Wang YM, Wu ZQ, et al. Identification of a novel coronavirus causing severe pneumonia in human: A descriptive study. *Chinese Med J*. 2020.
- Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020;395:497-06.
- Carlos WG, Dela Cruz CS, Cao B, et al. Novel wuhan (2019-nCoV) coronavirus, *Am J Respir Crit Care Med*. 2020;201:7-8.
- Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: A descriptive study. *Lancet*. 2020;395:507-13.
- Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA*. 2020.
- Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China *Lancet*. 2020;6736(20):30183-85.
- Guan Y. Isolation and characterization of viruses related to the SARS coronavirus from animals in southern China. *Science*. 2003;302:276-78.
- Centers for disease control and prevention. Symptoms of coronavirus.
- Otter JA, Donskey C, Yezli S, et al. Transmission of SARS and MERS coronaviruses and influenza virus in healthcare settings: The possible role of dry surface contamination. *J Hosp Infect*. 2016;92:235-50.
- Bridges CB, Kuehnert MJ, Hall CB, et al. Transmission of influenza: Implications for control in healthcare settings. *Clin Infect Dis*. 2003;37:1094e1101.
- Brankston G, Gitterman L, Hirji Z, et al. Transmission of influenza A in human beings. *Lancet Infect Dis*. 2007;7:257e265.
- Boone SA, Gerba CP. Significance of fomites in the spread of respiratory and enteric viral disease. *Appl Environ Microbiol*. 2007;73:1687e1696.
- Haider N. Passengers destinations from China: Low risk of novel coronavirus (2019-nCoV) transmission into Africa and South America'. *Epidemiol Infect*. 2020;148.
- Lee A. 'Wuhan novel coronavirus (COVID-19): Why global control is challenging?' *Public Health*. 2020;179:A1-A2.
- Gul MH, Htun ZM, Shaikat N, et al. Potential specific therapies in COVID-19. *Ther Adv Respir Dis*. 2020;14.
- Vellingiri B, Jayaramayya K, Iyer M, et al. COVID-19: A promising cure for the global panic. *Sci Total Environ*. 2020;725:138277.
- Centre for Disease Control and Prevention (CDC) 2020. 2019 novel coronavirus: Prevention & treatment.
- WHO 2020, Laboratory testing for coronavirus disease 2019 (COVID-19) in suspected human cases: Interim guidance, 2 March 2020. World Health Organization, 2020.
- WHOc. List of Blueprint priority diseases 2018.
- Cheng PK, Wong DA, Tong LK, et al. Viral shedding patterns of coronavirus in patients with probable severe acute respiratory syndrome. *Lancet*. 2004;363(9422):1699-700.
- Al-Abdely HM, Midgley CM, Alkhamis AM, et al. Middle East respiratory syndrome coronavirus infection dynamics and antibody responses among clinically diverse patients, Saudi Arabia. *Emerg Infect Dis*. 2019;25(4):753-66.
- Poissy J, Goffard A, Parmentier-Decrucq E, et al. Kinetics and pattern of viral excretion in biological specimens of two MERS-CoV cases. *J Clin Virol*. 2014;61(2):275-78.
- Al-Abdely HM, Midgley CM, Alkhamis AM, et al. Middle East respiratory syndrome coronavirus infection dynamics and antibody responses among clinically diverse patients, Saudi Arabia. *Emerg Infect Dis*. 2019;25(4):753-66.
- Cheng PK, Wong DA, Tong LK, et al. Viral shedding patterns of coronavirus in patients with probable severe acute respiratory syndrome. *Lancet*. 2004;363(9422):1699-700.
- To KK, Tsang OT, Chik-Yan Yip C, et al. Consistent detection of 2019 novel coronavirus in saliva. *Clin Infect Dis*. 2020.

36. Wang W, Xu Y, Gao R, et al. Detection of SARS-CoV-2 in different types of clinical specimens.
37. Guidelines for use of commercial kits for nasal/throat swab based diagnosis of COVID19 in India. 2020.
38. US food and drug administration. Emergency use authorizations. US food and drug administration; 2020.
39. ICMR approves the Probe-free COVID-19 detection assay developed at IIT Delhi. 2020.
40. Indian Council of Medical Research. guidance on rapid antibody kits for COVID-19. Indian Council of Medical Research; 2020.
41. Bruning AHL, Leeflang MMG, Vos JMBW, et al. Rapid tests for influenza, respiratory syncytial virus, and other respiratory viruses: A systematic review and meta-analysis. *Clin Infect Dis*. 2017;65(6):1026-32.
42. Zhao J, Yuan Q, Wang H, et al. Antibody responses to SARS-CoV-2 in patients of novel coronavirus disease 2019. *Clin Infect Dis*. 2020;ciaa344.
43. Ministry of Health and Family Welfare. Advisory to start rapid antibody based blood test for COVID-19.
44. Johns Hopkins University. Serology-based tests for COVID-19.
45. World Health Organization. Laboratory biosafety guidance related to coronavirus disease 2019 (COVID19).
46. To KK, Tsang OT, Yip CC, et al. Consistent detection of 2019 novel coronavirus in saliva. *Clin Infect Dis Off Publ Infect Dis Soc Am*. 2020.
47. To KK, Tsang OT, Leung WS, et al. Temporal profiles of viral load in posterior oropharyngeal saliva samples and serum antibody responses during infection by SARS-CoV-2: An observational cohort study. *Lancet Infect Dis*. 2020;20:565-74.
48. Chen JH, Yip CC, Poon RW, et al. Evaluating the use of posterior oropharyngeal saliva in a point-of-care assay for the detection of SARS-CoV-2. *Emerg Microbes Infect*. 2020;1-14.
49. Zhou Y, Zeng Y, Tong Y, et al. Ophthalmologic evidence against the interpersonal transmission of 2019 novel coronavirus through conjunctiva. *medRxiv*. 2020.
50. World Health Organization, Laboratory testing for 2019 novel coronavirus (2019-nCoV) in suspected human cases.
51. Cheng AC, Williamson DA. An outbreak of COVID-19 caused by a new coronavirus: what we know so far. *Medical J Aust*. 2020;9:393394.
52. Chen H, Guo J, Wang C, et al. Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: A retrospective review of medical records. *The Lancet*. 2020;395:809-15.
53. Kaplan EH. Containing 2019-nCoV (Wuhan) coronavirus. *Health Care Manag Science*. 2020.
54. Kampf G, Todt D, Pfaender S, et al. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. *J Hosp Infect*. 2020;104:246-51.