



Review Article

Origin, Symptoms, Transmission and Preclusions of COVID-19

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ABSTRACT

A novel coronavirus commonly known as COVID-19 has resulted in an ongoing outbreak of viral pneumonia. This pandemic started from Wuhan City, China and has spread throughout most parts of the world (210 countries). COVID-19 is a large sized, enveloped, positive stranded RNA virus. Out of the four known genera, alpha and beta corona viruses are the most commonly recognized viruses infecting human beings. COVID-19 is a new virus that is highly contagious. It spreads through infected persons in its prodromal stage which suggest its transmission is not likely through air. COVID-19 can affect people of all age groups and mostly results in the death of people with weak immune systems. Its most common reported symptoms are fever, fatigue, dry cough, lymphopenia, raised levels of lactate de-hydrogenase and, bilateral patchy shadows or ground glass opacity in the lungs (opacities may be mild damage of one lobe or all five lobes). This virus has the potential to affect pregnant women, however, its prevalence was not noticed in new-borns. Time to recovery is generally two weeks. To reduce the spread of COVID-19, observing hygienic practices like frequent hand washing, social distancing and drinking warm water and chloroquine phosphate are some of the measures to mitigate the effect of coronavirus.

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Authors' Contribution

RY conceived the idea and wrote the manuscript. SC did proofreading and editing of the manuscript.

Key words

COVID-19, Pandemic, Aerosolization, Lymphopenia, Chloroquine phosphate

INTRODUCTION

Coronaviruses are a group of pathogens (RNA viruses) that can cause serious infection in a variety of animals as well as human beings (de Wilde *et al.*, 2017). The strain under discussion was identified as a zoonotic coronavirus, which was comparable to SARS and MERS coronaviruses and is commonly referred as COVID-19 (Liu *et al.*, 2020). These coronaviruses are comparatively enormous in size, enveloped, positive single stranded RNA viruses that can be categorized into four major genera: Alpha (α), beta (β), gamma (γ), and Delta (δ). Of these, α and β coronaviruses are well-known to infect humans ((de Wilde *et al.*, 2017; Paules *et al.*, 2020). According to a study by Huang *et al.* (2020) a beta (β) coronavirus outbreak resulted in pneumonia in Wuhan, City of China. The most widely acknowledged source of origin for COVID-19 is a seafood wholesale market in Wuhan where both wild and

wet animals were traded (Zhu *et al.*, 2020). Genetic analysis that was carried out early in the outbreak of novel corona virus (COVID-19) in China has shown that the virus has similarities to severe acute respiratory syndrome coronavirus (SARS-CoV) and also a close genetic resemblance with the coronavirus responsible for COVID-19 infections, which was sequestered from bats Lu *et al.*, 2020). COVID-19 is able to produce acute respiratory disease (Xu *et al.*, 2020). The global impact of COVID-19 has been profound, presenting pandemic level respiratory threats in a severity that has been not seen since the 1918 H1N1 influenza pandemic of 2009 (Ferguson *et al.*, 2020). Both viruses are mostly pathogens and hazardous for both humans and animal health and can cause various enteric and respiratory diseases (Holmes, 2001; Weiss *et al.*, 2005; de Wilde *et al.*, 2017). The disease caused by COVID-19 can be very severe and life threatening with a fatality rate of 2% (Xu *et al.*, 2020).

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SOCIO-ECONOMIC EFFECT OF CORONAVIRUSES

Along with COVID-19, the spread of zoonotic coronaviruses such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) in human beings is responsible for both economic and social impacts. Presently, due to limited knowledge about

these coronaviruses, scientists, and researcher are still unsuccessful in controlling such pandemic outbreaks and treating infections (de Wilde *et al.*, 2017). According to the 77th report of the World Health Organization 90% of the world's students (1.5 billion children and young) are affected by nationwide school closures (WHO, 2020). All sort of businesses including trading, and import and export is also being affected across the globe. In developing countries like Pakistan, people who work on a daily-wage basis are suffering the most. Some economists are estimating that severe lockdowns in developing countries will create conditions that will mean prolonged periods of economic recovery. However, due to global lockdowns, certain decrease in transport and other polluting activities showed a positive impact on the environment, for example a three-fold reduction in Particulate matter (Both PM_{2.5} and PM₁₀) and emission of various gases like SO₂, CO, O₃ and NO₂ has been recorded in three cities of China (Xu *et al.*, 2020).

TRANSMISSION OF CORONAVIRUSES

The novel coronavirus COVID-19 first appeared in November, 2019 in Wuhan city, China and resulted in an ongoing outburst of viral pneumonia across the world (Dong *et al.*, 2020; Lai *et al.*, 2020; Zhou *et al.*, 2020). However, according to Liu *et al.* (2020) the alarmingly transmissible primary atypical (viral) pneumonia pandemic appeared first in December 2019. The virus has proven to have a very high transmission rate, now recorded in 210 countries (Lipsitch *et al.*, 2020; WHO, 2020). The COVID-19 outbreak was first recorded as 1,975 confirmed cases in China on 25th January since its first appearance on 12th December 2019 (Wu *et al.*, 2020a). The rate of its spread was noted to be high and 33, 738 definite cases were reported on 8 February 2020, with 811 deaths in China during this period (Liu *et al.*, 2020). The confirmed cases reached to 66, 580 and almost 1524 deaths by February 15, 2020 (Xu *et al.*, 2020). By February 17, 2020, the outbreak had spread to all provinces of China as well as 27 other countries, and there were 70, 000 confirmed cases as reported by WHO (2020). Moreover, the number of COVID-19 cases surpassed 300,000 globally as reported on March 23, 2020 (WHO, 2020). The number of infected COVID-19 reached 1,210,956 with 67,594 deaths on April 6, 2020 (WHO, 2020). The rate of its broadcast progressed steadily to cover 210 countries and 1,852,584 confirmed cases reported with 114, 214 deaths on April 13, 2020 (Worldmeter, 2020). The virus is highly contagious and person-to-person transmission has been demonstrated in numerous studies (Bai *et al.*, 2020; Li *et al.*, 2020; Liu *et al.*, 2020).

et al., 2020).

Zoonotic transmission of coronaviruses like SARS via bat, Himalayan palm civets and raccoon dogs has been reported by Graham and Baric (2010). Another coronavirus, MERS, causes a respiratory illness (asymptomatic to mild to fatal) that transmits through dromedary camels to man. Person to person transmission of MERS was also reported by Killerby *et al.* (2020). However, the transmission of COVID-19 occurs both directly and indirectly via infected persons or through contaminated surfaces and the use of contaminated stethoscope and thermometers (WHO, 2020). Various literature studies have reported that the highly transmittable COVID-19 can spread through contact from asymptomatic people or carriers or when an infected person in the viral incubation stage come into contact with healthy people (Chan *et al.*, 2020; Liu *et al.*, 2020; Qu *et al.*, 2020). COVID-19 transmission is possible through the mouth, nose, and eyes via inhalation of tiny aerosol droplets. However, the prevalence of the spread of COVID-19 by asymptomatic healthy subjects shows that airborne spread is not a major concern as confirmed by Ong *et al.* (2020), who analyzed 75,465 COVID-19 cases in China and concluded that the vast majority of COVID-19 cases were not from airborne particles. However as Qu *et al.* (2020) reported, COVID-19 can survive in the air for longer periods so its transmission via air is still possible. The experimental study from Van Doremalen *et al.* (2020), has shown that COVID-19 is transmitted via aerosol and fomite as it can survive in air for an hour and on surfaces for days (Asadi *et al.*, 2020; van Doremalen *et al.*, 2020). The deposition of COVID-19 aerosols on protective kits and floor surfaces and their re-suspension has been reported as a potential transmission pathway (Liu *et al.*, 2020) and Hisao *et al.* (2020) reported that the size of aerosol particles is critical in causing respiratory infection. Hindson (2020), also reported the possibility of transmission through the faeces of an infected person, as COVID-19 has been reported in stool samples. Aerosolization is therefore possible in a lavatory whenever, the washroom of an infected persons is used.

Higher temperatures and humidity levels have a role in controlling the spread of corona viruses. Both factors are responsible for significant reduction in the transmission of corona viruses like SARS, influenza and now this new coronavirus (COVID-19). A degree Celsius increase in temperature and humidity was found effective to reduce the transmission, so, summer and rainy seasons may contribute in control of transmission of the virus (Wang *et al.*, 2020). Whereas, controversial studies showed that COVID-19 transmission is irrespective to seasons or temperature and humidity (Haque and Rahman, 2020; Wu *et al.*, 2020b).

In the prodromal stage of infection, an infected person produces a huge number of viruses in the upper respiratory tract. This stage is critical for transmission and it spreads rapidly, especially in those who remained more mobile, going on with their routine activities. In this way, its transmission is very different as compared to SARS-CoV, which did not spread readily during the prodromal period particularly when the infected persons were slightly ill, rather, transmission of SARS-CoV has been reported as high when infected persons were severely ill. This varied transmission feature of SARS-CoV makes it easier to control outbreaks as compared to the current outbreak of COVID-19 (Peiris *et al.*, 2004).

SYMPTOMS OF COVID-19

The commonly reported symptoms of COVID-19 include fever, fatigue, dry cough, lymphopenia, myalgia, dyspnea, anorexia, persistent or prolonged prothrombin time, and raised lactate dehydrogenase levels. While, headache, dizziness, abdominal pain, nausea, diarrhea and vomiting were recorded as less common symptoms. Moreover, the presence of bilateral patchy shadows or ground glass opacity in the lungs were also noticed (Wang *et al.*, 2020). Bernheim *et al.* (2020) reported the presence of ground glass opacities from one lobe to five lobes in the lungs. Severity in this disease may result in death due to considerable alveolar damage and progressive respiratory failure. Huang *et al.* (2020) also reported severe complications such as acute respiratory distress syndrome (ARDS), RNAemia, and acute cardiac injury leading to death. Moreover, an elevated plasma levels of interleukin-II (IL-II), interleukin-VII (IL-VII), interleukin-X (IL-X), granulocyte-colony stimulating factor (GCSF), interferon gamma-induced protein (IP10), monocyte chemoattractant protein-1 (MCP1), macrophage inflammatory proteins (MIP1A), and tumor necrosis factor- α (TNF α) have been related to COVID-19. It was also reported that symptoms of respiratory illness due to COVID-19 are very similar to SARS.

DIAGNOSIS OF COVID-19 BY COMPUTED TOMOGRAPHY

Xu *et al.* (2020) studied the findings of chest computed tomography (CT) scans in COVID-19 patients over time. A CT scan was performed on the patients at: early (0-2 days), intermediate (3-5 days), and late (6-12 days) intervals. The bilateral and peripheral ground-glass and consolidative pulmonary opacities were selected as hallmarks of COVID-19 infection. It was seen that almost

56% of early patients were found with a normal CT scan. While the severity was enhanced to 76% and 88% in intermediate and late patients respectively. According to Shi *et al.* (2020) COVID-19 pneumonia reveals on chest CT imaging abnormalities, even in asymptomatic patients, and was rapidly evaluated from focal unilateral to diffuse bilateral ground-glass opacities which proceeded or co-existed with consolidations within 1–3 weeks. However, relating evaluation of imaging features with both clinical and laboratory outcomes could help for the early diagnosis of COVID-19 pneumonia (Shi *et al.*, 2020). Similarly, Pan *et al.* (2020) did a study with 21 patients and only four patients were not with chest CT abnormalities at the initial evaluation stage. It was noticed in most patients (18 out of 21), the over-all CT scored higher within ten days after the onset of symptoms, and then gradually lessened (Pan *et al.*, 2020). However, in another study, both chest CT and RT-PCR assay performed within first 3 days of infection with 51 patients, showed the sensitivity of CT for COVID-19 infection was 98% as compared to RT-PCR sensitivity of 71% ($p < .001$) (Fang *et al.*, 2020). Moreover, it was also noticed that asymptomatic carriers were found normal according to chest CT scans. According to another study, a boy of ten years old that was an asymptomatic carrier had chest abnormalities that appeared on CT (Chan *et al.*, 2020).

PREGNANCY AND COVID-19

A very limited data is available to evaluate the clinical characteristics of COVID-19 in pregnant women. Chen *et al.* (2020) reported that the clinical features of COVID-19 pneumonia in nine pregnant women were the same as in non-pregnant adult patients that were suffering from the same disease. It was noticed in this small group of cases that there was presently no signs of intra-uterine infection in women who developed COVID-19 pneumonia in late pregnancy.

TREATMENT OF COVID-19

COVID-19 is spreading rapidly, and scientists are endeavoring to discover drugs for its efficacious treatment in China. Most COVID-19 patients received antiviral (oseltamivir, 90%) and glucocorticoid treatment (45%) (Wang *et al.*, 2020). Chloroquine phosphate, a drug that was used for the treatment of malaria, has presented remarkable efficacy and found to be very safe against COVID-19 related pneumonia as proven in multicenter clinical trials conducted in China (Gao *et al.*, 2020). Moreover, experimental evidence showed that convalescent plasma (CP) therapy has aptitude to treat COVID-19 and a dose of

200 mL significantly improved the neutralizing antibodies (Duan et al., 2020), which may help to develop a vaccine against COVID-19 in the near future. Similarly, to control wide spread community transmission, mitigation activities must be undertaken. In mitigation activities there is the need to avoid communal assemblies, continue school closure, and promote remote working environments. Moreover, surveillance of the health of carriers by telephone or online health consultation, and provision of essential life support such as oxygen supplies, mechanical ventilators and extracorporeal membrane oxygenation (ECMO) equipment is essential. Serological tests must be developed which can estimate current and previous infections in general populations (Heymann and Shindo, 2020). Similarly, if we want to control COVID-19 epidemics, then quarantine, better hygienic implementations, and social distancing is recommended for all cases and is considered of prime importance (Dalton et al., 2020; Hellewell et al., 2020; Lau et al., 2020). Hand washing, drinking warm water, use of vitamin C, use of masks, sanitizers, and social distancing are all recommended to stop transmission of COVID-19. Proper room ventilation, open spaces, appropriate use and disinfection of toilet can all impact the ability to control aerosol transmission of this COVID-19 (Hsiao et al., 2020; Liu et al., 2020).

CONCLUSION

It is concluded that COVID-19 is a highly transmittable virus and its person to person spread via direct and indirect sources is rapid. It covered the whole world in barely 5 months from its discovery in December of 2019 and still its rate of infection is growing on a daily basis. While COVID-19 can survive in the air and aerosolization can be a possible way of its transmission, the life-time of the virus in the air is short as compared to floor surfaces making it a less likely transmission path, however, re-suspension from floor surface is still possible, re-emphasising the need for meticulous sanitising efforts in viral hotspots and treatment centres.

Statement of conflict of interest

The authors have declared no conflict of interest.

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