Review Article

Emergence of SARS-CoV-2: A Review

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Abstract

Background: A novel corona virus infection spread in the city of Wuhan, Hubei province, China from the Hunan seafood wholesale market, which also sold wild animals, in December 2019. The genome sequence and symptoms of infection of this virus is mostly similar to the SARS-CoV which broke out in 2002. As a result this novel corona virus has been named as SARS-CoV-2 by WHO. WHO named the disease as COVID-19 as it took the form of a pandemic.

Mode of Transmission: Person to person transmission is thought to occur among close contacts mainly via respiratory droplets, aerosol and airborne when an infected person coughs or sneezes.

Receptor Specificity: SARS-CoV-2 uses ACE-2 receptors to infect airway epithelial alveolar type-II pneumocyte.

Conclusion: Patients of COVID-19 and SARS have similar pattern of inflammatory damage. It causes rapid transmission so countries around the world should intensify attention to the disease surveillance system.

Keywords: SARS-CoV, SARS-CoV-2, ACE-2, COVID-19

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Introduction

SARS-CoV-2 is of the corona virus family, *Coronaviridae* and of the order *Nidovirales.* The family consists of two subfamilies Coronavirinae and Torovirinae. The members of the family Coronavirinae are subdivide into four genera:

A. Alpha-coronavirus: Human coronavirus, HCoV-229E and HCoV-NL63.

B. Beta-coronavirus: HCoV-OC43, Severe Acute Respiratory Syndrome human corona virus (SARS-HCoV), HCoV-HKUI and Middle Eastern Respiratory Syndrome corona virus (MERS-CoV).

C. Gamma-coronavirus: viruses of whales and birds.

D. Delta-coronavirus: Viruses isolated from pigs and birds.[1]

SARS-CoV-2 as well as SARS-CoV and MERS-CoV, which are highly pathogenic, belong to the genera Beta-coronavirus. SARS-CoV-2 is an enveloped and positive-sense single strand RNA(+ss) virus.[2] A novel human infecting Beta-coronavirus has been named SARS-CoV-2 as its phylogenetic analysis reveals that it identifies 88% with at derived SARS like coronavirus collected in eastern China in 2018. It is genetically distinct from SARS-CoV (with about 79% similarity) and MERS-CoV.[3] As of 13 July 2020; more than 12.9 million cases have been reported across 188 countries and territories, resulting in more than 571,000 deaths. More than 7 million people have recovered.[4]

Transmission

SARS-CoV-2 was transmitted from animal to human. Although human to human transmission may have occurred earlier.[6] Infection among

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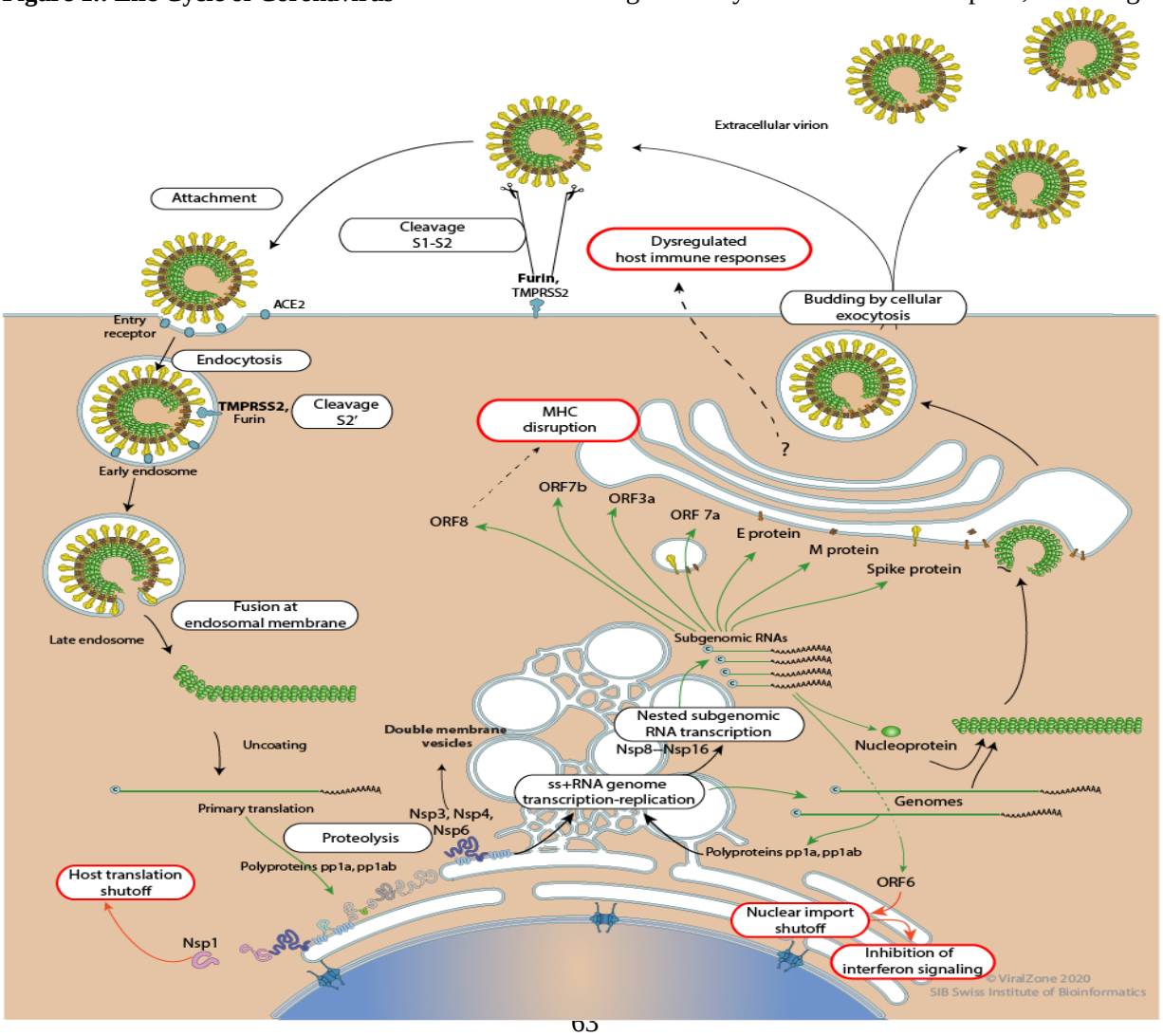
family members and medical workers have confirmed the person to person transmission.[7] Person to person is thought to occur among close contacts mainly via respiratory droplets when an infected person coughs or sneezes.

Fomites may be a large source of transmission.[2] Coronavirus can spread in the following ways: Coughing and sneezing without covering the mouth can disperse droplets into the air, touching or shaking hands or making physical contact with a person who has the virus can pass the virus between individuals, making contact with a surface or object that has the virus and the touching eyes or mouth.

Figure 1.: Life Cycle of Coronavirus[5]



Risk Factors

People have the highest risk of developing complications due to COVID-19

A. People aged 65 years or more.
B. Pregnant women.
C. People with chronic co-morbidities such as obesity, cardiovascular, cerebrovascular diseases and diabetes.[8,9]
D. Severe manifestation may be associated with co-infection of bacteria and fungi.[10]

Pathogenesis and Immune Response

Like most other members of the coronavirus family, beta-coronavirus exhibit high species specificity, but subtle genetic changes can significantly alter their tissue tropism, host range

and pathogenicity. The envelop spike(s) protein receptor binding domain of SARS-CoV-2 use host receptor angiotensin-converting enzyme-2 (ACE-2) to enter the cells.[3,11] ACE2 is an enzyme attached to the cell membranes of cells in the lungs, heart, arteries, CNS, kidney, and intestines.[12,13] Receptor recognition is not the only determinant of species specificity. Immediately after binding to their receptor, SARS-CoV-2 enters host cells where they encounter the innate immune response. To successfully infect the host SARS-CoV-2 has to inhibit or evade host immune signaling.

The host immune system responds to the viral infection with mediating inflammation and cellular antiviral activities, which is critical to inhibit viral replication and dissemination. However, pathogenesis takes place due to excessive immune response along with lytic effects of the virus on the host cell. Studies have shown that, on the onset of the illness the symptoms of severe pneumonia, with fever and dry cough are common. [10,14] In some cases patients rapidly developed Acute Respiratory Distress Syndrome (ARDS) and septic shock, which eventually proceeded into multiple organ failures of which about 10% patients died.[10] ARDS progression and extensive lung damage in COVID-19 are further indications that ACE-2 might be a route of entry for the SARS-CoV-2 as ACE-2 is known abundantly present on ciliated cells of the air way epithelium and alveolar type-II cells (pneumocyte that synthesize pulmonary surfactant) inhumans.[12]

Clinical Manifestations

Cold or flu-like symptoms usually start to form in 2-4 days after the infection and are typically mild. However, symptoms vary person to person. It can become fatal in some cases. The most common symptoms include fever, dry cough, fatigue and myalgia[9,14,15], fatigue, shortness of breath, and loss of smell and taste.[16-19] Less common symptoms include headache, dizziness, abdominal pain, diarrhea, nausea and vomiting.[8,13] While the majority of cases result in mild symptoms, some progress to acute respiratory distress syndrome (ARDS) possibly precipitated by cytokine storm[20], multi-organ failure, septic shock, and blood clots.[21-23]

In contrast to SARS and MERS, very few COVID-19 patients show prominent upper respiratory tract signs and symptoms such as rhinorrhoea, sneezing, or sore throat, suggesting, the virus might have greater preference for infecting the lower respiratory tract.[14]

Laboratory Findings

Laboratory abnormalities found in COVID-19 patients are lymphopenia[8-10], prolong prothrombin time and elevated lactate dehydrogenase.[9] ICU admitted patients have more laboratory abnormalities than non-ICU patients.[9,14] Some patients had elevated alanine and aspartate aminotransferase, creatine kinase, creatinine and C-reactive protein.[8,9,14,24] Clinical laboratory findings of elevated IL-2, IL-7, IL-6, granulocyte-macrophage colony-stimulating factor (GM-CSF), interferon-γ inducible protein 10 (IP-10), monocyte chemoattractant protein 1 (MCP-1), macrophage inflammatory protein 1-α (MIP-1α), and tumour necrosis factor-α (TNF-α) indicative of Cytokine Release Syndrome (CRS) suggest an underlying immunopathology.[14]Laboratory diagnosis of COVID-19 is done also by checking the level of ferretin and Ddimer. The standard method of diagnosis is by real-time reverse transcription polymerase chain reaction (rRT-PCR) from a nasopharyngeal swab.[25] oropharyngeal swab. Chest X-ray important role in diagnosis and Chest CT imaging may also be helpful for diagnosis in individuals where there is a high suspicion of infection based on symptoms and risk factors.[26,27]

Treatment

There is no specific treatment for COVID-19 until now. [29] Isolation and supportive care including oxygen therapy, fluid management' antipyretics (Paracetamol) and antibiotics treatment for secondary bacterial infection is recommended.[29] Antiviral drugs Remdesivir,

Favipiravir should be started in moderate to severe cases (viremic stage). It is strongly recommend that each individual should be on DVT Prophylaxis (LMWH 40mg SC daily or Heparin 5000 units SC BD) until there is any contraindication. There is post discharge 4-6 weeks of oral anticoagulation (Rivaroxaban 10mg daily) or prophylactic LMWH also suggested. Systemic steroids should be avoided in early viremic phase and in mild COVID cases given potential harm. Steroids can be considered in severe/critical COVID cases requiring oxygen or ventilatory support (RECOVERY Trial), refractory septic shock, severe ARDS and evident cytokine storm (in addition to Tocilizumab). Methyl prednisone 1-2mg/kg BD or oral Dexamethasone 10mg BD for 5-7 days.[30-33]

Conclusion

About 80% COVID-19 patients remain asymptomatic or have minimum symptoms. Approximately 14% become moderate to severely ill who need to be hospitalized, among them 5% cases need ICU support with very poor outcome. Therefore, early recognition, isolation and immediate management are of particular importance.

Conflict of Interests: The author declares no conflict of interest.

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