Review Article

Insights into the SARS-CoV2 Outbreak; the Great Global Challenge: A Mini Review

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Abstract

The emergence of COVID-19 outbreak caused by a novel coronavirus, was reported in Wuhan, Hubei, China in December 2019, and it spread rapidly across the world, resulting in the World Health Organization announcing a global health emergency on 30 January 2020. The first death caused by it in Iran was reported in February 2020 with aftermath outbreak across the country. The novel virus responsible for sever complications even death in all age groups, especially in older adults and people of any age who have serious underlying medical conditions. Researchers around the world are studying to identify the novel virus, SARS-CoV-2, with the aim of preventing its dissemination and to reduce its complications. Here, we discuss the available information regarding the SARS-CoV-2 Outbreak and disease caused as a mini-review.

Keywords: Covid-19, Outbreak, Coronaviruses

Please cite this article as: Pourhossein B, Dabbagh A, Fazeli M. Insights into the SARS-CoV-2 Outbreak; the Great Global Challenge: A Mini Review. J Cell Mol Anesth. 2020;5(1):23-6.

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Introduction

The emergence of COVID-19 outbreak caused by a novel coronavirus, was reported in Wuhan, Hubei, China in December 2019, and it spread rapidly across the world, resulting in the World Health Organization (1) announcing a global health emergency on 30 January 2020 (2). The first confirmed COVID-19 death in Iran was reported in February 2020 with a widespread outbreak during the next weeks across the country. Older adults and people of any age who have serious underlying medical conditions are at higher risk for developing severe complications from COVID-19 and even death (3). Researchers around the world are studying to identify the novel virus, Severe Acute Respiratory Syndrome coronavirus-2 (SARS-CoV2), with the aim of preventing its dissemination and to reduce its complications.

Origin of the coronaviruses

Coronaviruses are single-stranded, positive-sense RNA belonging to the family Coronaviridae. *Coronaviridae* along with *Arteriviridae*, *Roniviridae* and *Mesoniviridae* families, are in order *Nidovirales*; they all encode a set of subgenomic-nested mRNAs. Serologically, coronaviruses are divided into three serogroups, I and II (isolated from mammals) and serogroup III (isolated from birds). The prototype of group I is the human HcoV-229E virus; in addition, the group has the human HcoV-NL63 virus and several animal coronaviruses (4). The prototype of group II is murine hepatitis virus (MHV); this group also includes

human coronaviruses HcoV-OC43, HKU-1, SARS-CoV and several other animal coronaviruses (4).

The recent SARS-CoV2 (the cause of COVID-19 disease) like SARS-CoV and MERS-CoV belongs to the zoonotic coronaviruses of the genus Betacoronavirus. The virus has a genome of about 30 kb that encodes some structural and unstructured proteins (Figure 1) (5).

Four major structural proteins include the Spike (S), the Envelope (E), the Membrane (M) and the Nucleocapsid (N) protein needed to produce a structurally complete viral particle (6, 7). Their virions have a round shape of 100-160 nm in diameter. They have distinct "spikes" or "peplomers" on the surface that give them a crownlike appearance (8). The genome forms a helical nucleocapsid in conjunction with phosphoprotein (9). There are two different types of spikes in the virion envelope:

- S glycoproteins (formerly E2) found in all coronaviruses. S is a trimer and promote entry into cells. Neutralizing antibodies is also produced against S glycoprotein
- Glycoprotein HE (formerly E1) or hemagglutinin esterase is present only in some group II coronaviruses, in short spike form and with disulfide bond dimers. This protein mutates over several passages and is eliminated. Therefore, HE is not required for virus replication. HE glycoprotein of coronavirus is about 30% similar to the Influenza C Virus hemagglutinin. This glycoprotein is capable of binding to neuraminic acid and has acetyl esterase activity. Therefore. HE glycoprotein can facilitate virus release (9).

S protein mediates the attachment and entering the host cell, so understanding its structure and function is important. The S Protein is a highly glycosylated type 1 transmembrane protein. Glycoprotein S is comprised of three domains, including the ectodomain, transmembrane domain, and endodomain. The ectodomain is divided into two subunits S1 and S2; the function of S1 is to bind the host cell receptors. The sequence of S1 amino acid is more variable than S2 (10). S protein has been identified as the major protein responsible for inducing the host immune response and developing neutralizing antibodies against the virus. Therefore, this protein could be an attractive target for immunotherapy against SARS-CoV2.

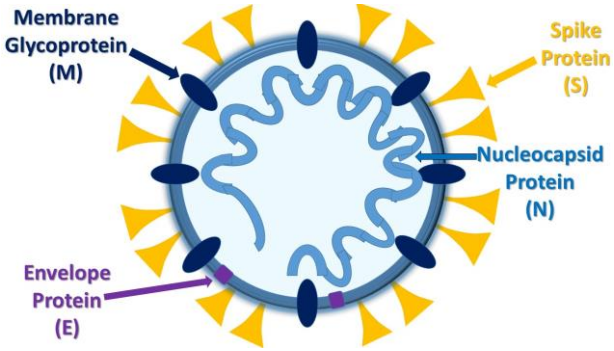

Figure 1. Schematic structure of SARS-CoV2 (11).

Clinical feature of the virus

Most coronaviruses naturally infect only one animal species or a few species close together. Before that, SARS-CoV was the only exception, because it can infect a wide range of mammals, including humans, primates, dogs, raccoons, cats, and rodents.

In humans, coronaviruses generally causes mild respiratory infections such as those observed in the common cold; however, some coronavirus infections in humans have recently led to lethal endemics, which include the SARS (originated from Southern China), MERS (Middle East Respiratory Syndrome, Saudi Arabia in 2012) and COVID-19 (5). While no case of SARS-CoV infection has been reported since 2004, MERS-CoV has been around since 2012 and has caused multiple sporadic outbreaks in different countries.

Coronaviruses are the second leading cause of common colds after rhinoviruses. However, some recent human coronaviruses infections including MERS-CoV cause more severe complications such as middle east respiratory syndrome (12) and SARS-CoV, the virus responsible for severe acute respiratory syndrome (13). Diarrhea is seen in patients with SARS-CoV infection; there is lymphopenia of TCD4 and TCD8 cells in this disease. The virus can also cause liver disorders such as hepatitis. Patients of covid-19 may experience flu like syndrome, fever, fatigue and Difficulty breathing (severe cases) (14, 15).

Discusion

Coronaviruses are often diagnosed in temperate climates between December and May and vary in

frequency from year to year. Virus peak activity often occurs every two to four years. The virus is also present in nosocomial respiratory infections in intensive care units in children and in elderly care centers (16). There was no human circulation of the virus prior to the outbreak of SARS in 2002-2003. Although animals were the main source of the SARS-CoV and SARS-CoV2, they have spread across the world from human to human (5).

Unlike the usually mild disease associated with other human coronaviruses, SARS-CoV, MERS-CoV and SARS-CoV2 viruses usually results in severe lower respiratory disease requiring hospitalization. Although SARS-CoV and SARS-CoV2 belong to the beta-coronavirus subgroup, their genome-level similarity is only 70%, and the novel virus shows significant genetic differences with agent of SARS (5).

WHO (World Health Organization), in its first emergency meeting estimated that the crude mortality ratio (the number of deaths reported by cases) of COVID-19 is around 4%. The virus infects people of all ages (17).

Various reports related to SARS-CoV suggest a protective role of both humoral and cell-mediated immune responses. One of overexpress protein in the virus is N protein. The protein has well immunogenicity and is one of the vaccine candidate (18). Different study have shown there are acceptable cell mediate immunity (CTL) against S and N proteins. (19). Another study showed there was similarity in antigenic epitopes for T and B cells between SARS-CoV and SARS-CoV2A (5).

Many efforts are being made to develop an effective covid-19 vaccine based on Replicating Viral Vector, Non Replicating Viral Vector, RNA, DNA, Inactivated and Live Attenuated Virus, and Protein Subunit platform, all of which are in the pre-clinical evaluation phase (20). However, there are not any approved antiviral drugs or vaccines to protect against COVID-19 disease yet for use in the human host. Considering the prevalence of this disease and its worldwide mortality, the design and development of an effective vaccine against the disease seems urgent.

Currently, the most effective way to protect against the novel coronavirus is by maintaining personal hygiene and the implementation of quarantine measures based on WHO recommendations

Conclusion

As highlighted Coronaviridae family conclude some viruses can cause lethal epidemic and pandemic in recent decade. Furthermore, scientist should change their revision about this family and study more about virology and pathogenesis of the viruses to create efficient vaccines and therapies.

Acknowledgment

None.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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