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Short Survey

Novel Coronavirus (COVID-19): A New Emerging Pandemic Threat

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Abstract

Coronavirus disease 2019 (COVID-19), with high-transmission power, is spreading rapidly, and researchers are endeavoring to discover eligible medications for its efficacious prevention and treatment globally. According to the World Health Organization (WHO) reports, several multicenter clinical trials are launched to determine effective treatment protocols against COVID-19-associated pneumonia. In this article, we aimed to discuss some critical issues concerning novel coronavirus.

Introduction

Recently, outbreak of novel coronavirus (SARS-CoV-2) infection as highly pathologic, wide-spread virus in human has been emerged as a serious public health and global concern with high rate of both morbidity and mortality.[1] In fact, the current coronavirus outbreak is the third epidemic viral infection caused by novel coronavirus in the 21st century. Given that the risk of this virus outbreak depends on its characteristics such as how well it could be spread between people, the severity of related illness, the reliable medical tools for diagnosis as well as available vaccine or medications for control of virus dangerous impacts, the World Health Organization (WHO) has declared the potential public health threat carried by novel coronavirus (NCOV) is extremely high, resulting in death upon the person-to-person spreading worldwide.[2] On February 11, 2020, the WHO announced an official name for this disease, COVID-19.[3-5] At this time, some people are categorized as vulnerable groups with an increased risk of infection including older people (≥aged 65), patients with immunodeficiency or liver and kidney failure, as well as healthcare staff caring for COVID-19 patients, and other individuals who closely are in contact with these patients in clinical settings.[6] According to the recent estimations, the coronavirus will possibly peak by the end of February. It is also worth to note that huge transmission power and high spreading capacity of the COVID-19 results in a considerable limitation in some important political and other strategic plans.

What is the coronavirus?

Coronaviruses (CoVs), causing zoonotic infectious diseases, belong to Nidovirales order, Coronaviridae large family and Coronavirinae subfamily. CoVs are enveloped viruses with the largest single-stranded RNA and genome size of 26-32 kb in length.[7,8] Preliminarily, CoVs are able to infect mammals and birds by causing various lethal diseases. Notably, following some genetic mutation, this virus has potential to lead infection in respiratory system from upper respiratory tract by resembling simple cold symptoms to lower respiratory tract such as bronchitis and pneumonia as well as severe acute respiratory syndrome (SARS), both of which are implicated in human CoVs (hCoVs) and can predominant the importance of new corona virus.[3,9]

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Structural characteristics of Coronavirus

The structure of 2019 novel coronavirus is a mutation form. The genome of virus encodes four important structural proteins, which play important role in producing intracellular particles; including:

1. Spike (S) glycoprotein, 2. Membrane (M) protein, 3. Envelope (E) protein, and 4. Hemagglutinin-Esterases (HEs).[8,10,11] In case of replication, S protein promotes the viral and host/uninfected cell fusion to facilitate viral related substances entry into the host cells.[12-14] In addition, S protein is located at the cell membrane and plays a crucial role in cell to cell attachment. The large S glycoproteins are used by the virus to gain entry to human cells and it has been proposed that these giant-form cells serve as a strategy to permit wide spreading of the virus between cells and subsequently subvert the virus-destroying antibodies.[15-18] After that, they most likely attach to angiotensin converting enzyme 2 receptor on the cell membrane allowing the virus entry.[19] However, the exact mechanism is not fully known yet. M protein abundantly is detectable particularly for viral envelope formation and could interact with other coronavirus structural proteins.[20] This protein also could confirm the nucleocapsid stability and subsequently promotes viral assembly and encapsulates the genetic materials known as the rival envelope.[21,22] The smallest protein of coronavirus is related to the E protein with 76–109 amino acids between 8.4-12 kDa in size which extremely expresses inside the infected cells and involves in virion envelope.[23] Notably, recombinant or novel version of CoVs have no E protein that significantly alters the viral concentration and maturation.[23] Another protein known as N protein, is a non-structural protein that plays an impressive role, relating to the RNA genome and replication process and primarily is able to bind to the genome of virus to form a N protein-RNA complex named nucleocapsid.[24,25] In fact, N protein is necessary for completing virion formation. HEs are considered as a family of envelope glycoproteins that reversibly mediate attachment to O-acetylated sialic acids**.** Apparently, HEs are found in influenza C, toro-, and coronaviruses following the recent lateral gene transfer events.[26] According to the previous study it has been reported that coronavirus related HE forms a crystal structure in combination with its receptor (Figure 1).

Source of virus and illness severity

Despite intense efforts, the exact source of the disease is still unclear. However, the severe respiratory disorder was reported in Wuhan, China for the first time. In this regard, the recent epidemiological studies have suggested that the virus outbreak most likely was associated with a seafood market. In other words, the severity of the coronavirus is presumably derived from a genetic mutation and identified new RNA strain. According to the recent phylogenetic, analysis of the comprehensive viral genome including 29 903 nucleotides revealed the highly similarity to SARS-like coronaviruses (89.1%) found in bats in china which highlighted the ability of viral transferring from animal to human by causing severe respiratory disorders.[28] Based on the epidemiologic estimation, COVID-19 mortality rate is approximately 2%. However, what raises the concerns about the disease is high rate of the transmission from the infected persons and human to human transmission has accounted main leading cause of fast virus spread. Comparing with coronaviruses related to both SARS identified in 2003, and middle east respiratory syndrome

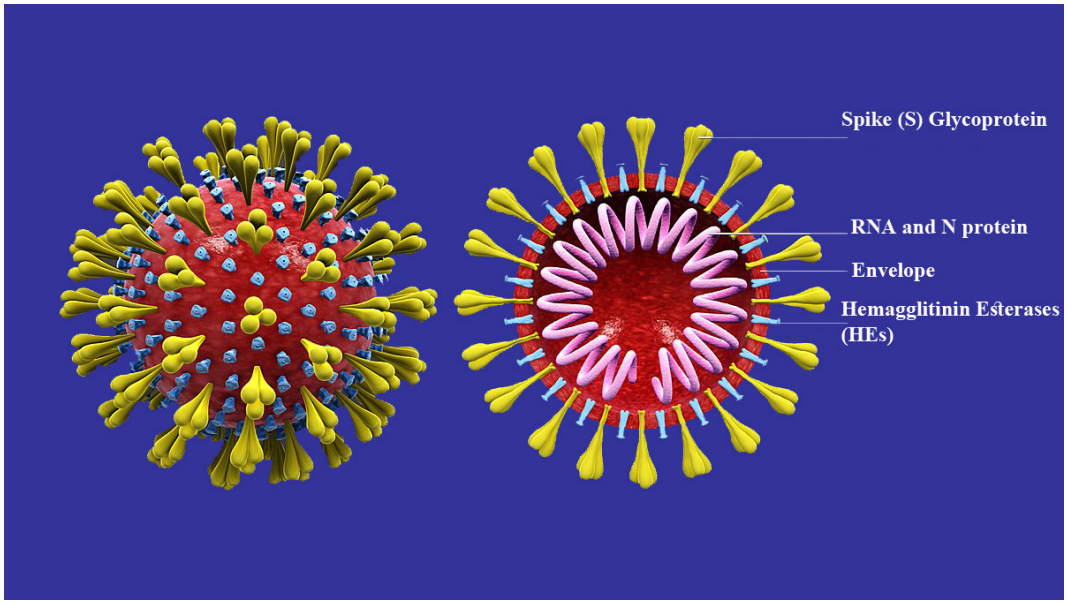

Figure 1. The structural characteristics of Coronavirus.[27]

(MERS) identified in 2012, which have been known to cause severe illness, the complete clinical representation regarding COVID-19 is not fully understood. Meanwhile, reported illnesses have been ranged from mild to severe, which finally promote mortality due to severe pneumonia.[8,29] Depending on incubation period of NCOV, flu-like symptoms including fever, dry cough, and shortness of the breath (dyspnea) could appear from 2 to 14 days after exposure.[30] Moreover, some admitted patients may need mechanical ventilation and intubation because of acute respiratory distress syndrome development.[31] Although the respiratory system is the target organ of 2019-nCoV, some gastrointestinal symptoms (e.g, nausea, vomiting and diarrhea) as well as asymptomatic infections also could be reported in some cases which are relatively uncommon.[32,33] It is not documented evidence, but upon the COVID-19 infections the liver organ also could be affected. In fact, following CBC test some serum hepatic enzymes were elevated in infected patients. According to the Master of Public Health (MPH) course of Shahid Beheshti University of Medical Sciences, some common symptoms of COVID-19 have been brought in Table 1.

COVID-19 related fatalities in China, the United States and Iran

The virus that is responsible for the 2019–2020 coronavirus outbreak (SARS-CoV-2), originated from Wuhan, China.[3] Outbreak acceleration of the virus which caused about 75 000 people infection and more than 2000 death globally, extended the economic irreparable damages in china. In this regard, 80 WHO associated clinical trials designed to assess possible treatments by setting required standards.[34-36] On the other hand, new cases have been identified in a growing number of other locations, including the United States. As of the 10th Feb, 2020, it has been estimated that the number of Persons Under Investigation (PUI) in the United States is about 398 patients.[37] The prevalence rate of COVID-19 in Iran is also growing since past few weeks; and the first confirmed death of two elderly patients from the COVID-19 virus in the Middle East located in Qom city. Based on the recent reports, several new cases also identified in other northern and central cities of Iran.

Preventing Coronavirus wide-spread

According to a recent report, this type of coronavirus can remain infectious on all inanimate surfaces for up to nine days. While some biocidal agents such as benzalkonium chloride and chlorhexidine digluconate have not shown more considerable antiseptic effects, 62%-71% ethanol as well as 0.1% sodium hypochlorite (NaClO), which significantly reduce viral infectivity by 1 min exposure, will be helpful for early containment of further spreading.[38]

Clinical manifestations and paraclinical findings

Despite the high similarity between flu and COVID-19 symptoms, it is requisite to develop high sensitivity and specificity laboratory diagnostic kits with enough rapid and accurate detection, as well as exclusive tests for COVID-19 strain to determine exact positive specimens.[39] At the first step, a simple complete blood count (CBC) test is requested to determine white blood cell count. As a result, in patients with COVID-19, leukopenia, leukocytosis, and lymphopenia have been appeared in CBC profile with D-dimer high levels, but the lymphopenia is the most

Table 1. Comparison between COVID-19 and Flu-like diseases symptoms

Symptoms	Coronavirus	Influenza	Cold
Speed of onset	Rarely	Suddenly	Rarely
Fever	Common (99%), lower than 40 °C	Common (99%), more than 40°C	Common (99%), lower than 40°C
Tremor	Mild, rarely	Common, severe	Moderate, rarely
Headache	Rarely (7%)	More common	Rarely
Cough	Common (60%), dry	Common (60%), wet	Rarely, dry
Sore throat	Rarely (20%)	Common	Common
Myalgia	Relatively rare (35%)	More common	Rarely
Fatigue feeling	Moderately common (70%)	Severely common	Rarely, weak
Rhinorrhea (runny nose)	Very rare	Rare	Very common
Nasal congestion	Moderately common	Rare	More common
Anorexia	Relatively common (40%)	Common	Relatively common
Abdominal cramp	Rarely (3%)	Rarely	Highly rare
Sneezing	Severely rare	Severely rare	Severely common
Vomiting & Nausea	Rarely (≥10%)	Relatively common (25%)	Severely rare
Diarrhea	Rarely (10%)	Relatively common (25%)	-
Impacts of predisposing factor	Completely effective	Completely effective	Not so effective

common. According to the Center for Disease Control and Prevention (CDC) in china, the COVID-19 related laboratory test kits mainly depend on nucleic acid based real time RT-PCR technique. One of the disadvantages of the current test assumed to be falsely negative results due to laboratory error or indefinable viral material in the specimen. However, following the positive findings of X-ray, computed tomography (CT) imaging or RT-PCR tests in all patients, the suspicious positive cases for presumed COVID-19 pneumonia are isolated for ongoing proceedings.[40-45] In coronavirus-infected patients, we expected to see a parenchymal abnormality in lung tissue along with a range of focal unilateral to diffuse bilateral patchy infiltrations and ground-glass opacification, as well as probable diffuse pulmonary small nodular in both chest X ray and CT scan.[46] A typical chest X-ray and CT pattern of novel coronavirus-infected pneumonia has been depicted in Figure 2. Figure 2A represents a typical ground-glass view related to an X-ray image of a suspected patient who referred to the Imam-Reza hospital, Tabriz. Figure 2B, also shows the ground-glass shadow in different sections of computed tomography in lung tissue.

Histopathological changes

Some histopathological changes of COVID-19 pneumonia in infected patients are consisted: edema, proteinaceous exudates in alveolar spaces with granules, mononuclear inflammatory cells, multinucleated giant cells, Intra-alveolar fibrin, multi focal hyperplasia of pneumocytes, and abundant macrophages that infiltrate airspaces.[48]

Promising treatment for COVID-19

Given that 2019-NCOV belongs to Beta-coronaviruses, no effective vaccine has been developed in this area so far. However, several antiviral drugs such as ribavirin, interferon, lopinavir-ritonavir and some corticosteroids might be effective for COVID-19. To find an effective approach for drug discovery, recent study conducted by Wang et al revealed that some drugs including nitazoxanide, nafamostat, chloroquine as well as two broad-spectrum antiviral agents, remdesivir and favipiravir, were used in in vitro designed experiment on isolate 2019-NCOV.[49] In line with this finding, chloroquine phosphate, as an old antimalarial drug, is also shown to have obvious efficacy against respiratory complications of this disease in clinical setting which is recommended to be listed in guideline of treatment for pneumonia caused by COVID-19.[50] The results showed that chloroquine and remdesivir are significantly effective against 2019-NCOV infection; suggesting that this combination could have more efficacy in patients suffering from novel coronavirus complications. Moreover, some WHO cohort studies recommended pharmacotherapy protocols based on chloroquine and some anti-HIV drugs for probable virus control (Table 2).

Conclusion

Given the importance of COVID-19 in public health, and since it is becoming a serious international problem, increasing awareness about the symptoms of the virus and preventive strategies among people can be helpful for timely diseases control.

Table 2. The list of some recommended drugs for COVID-19 treatment

Drug	Dosage	Group
Chloroquine phosphate/ hydroxychloroquine sulfate	Tab 500 mg/400 mg single dose	Anti-malaria
Ribavirin	Cap 1200 mg, BD (twice a day), At least for 5 days	Anti-viral
Lopinavir/ritonavir	Tab 100/400, BD, At least for 5 days	Anti-viral
Oseltamivir	Cap 75 mg, BD, at least for 5 days	Anti-viral

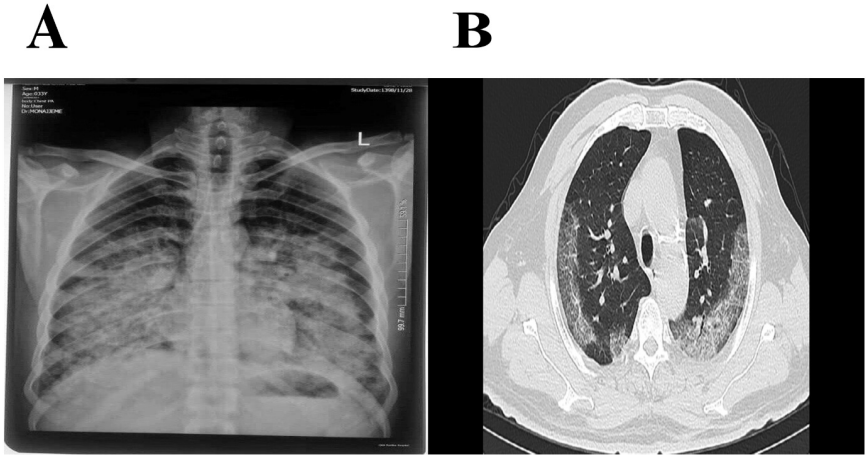

Figure 2. Representative images of X-ray and CT scan findings related to the COVID-19.

Authors' contributions
AR conceived and designed the topic. AA interpreted the X-ray image and edited the final manuscript. SHK wrote the manuscript.

Conflict of interest
The authors declare there is no conflict of interest.

Ethical Approval
Not applicable.

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