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AN INSIGHT INTO THE COVID-19: A CORONAVIRUS INFECTION IN HUMANS

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ABSTRACT

There is a new public health crises caused by a 2019 novel coronavirus (2019-nCoV) or the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), the coronavirus disease 2019 (COVID-19) has spread throughout China and received worldwide attention. The COVID-19 has been diagnosed as the cause of an outbreak of severe pneumonia or respiratory illness in Wuhan, Hubei Province, China beginning in month of December 2019. As per report of World Health Organization till 01 May 2020, this epidemic had spread to 212 countries or territories with 3,614,702 confirmed cases, including 2,50,220 deaths. On 30 January 2020, World Health Organization officially declared the COVID-19 epidemic as a public health emergency of international concern. The clinical symptoms of COVID-19 patients include mild to moderate respiratory illness and a small population of patients appeared gastrointestinal infection symptoms. The elderly and people with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease and cancer are susceptible to infection and prone to serious outcomes, which may be associated with acute respiratory distress syndrome (ARDS). At present, there are no specific vaccines or drugs for the treatment of COVID-19. However, there are many ongoing clinical trials evaluating potential treatments and several potent candidates of antivirals and repurposed drugs are under urgent investigation. In this review, we summarized the origin, spread, latest research progress, diagnosis methods, pathogenesis, symptoms and clinical characteristics of COVID-19 and also discussed the currently available treatment and scientific advancements to combat the novel corona virus.

KEYWORDS: COVID-19, SARS-CoV-2, Novel Corona Virus, Pandemic, 2019-nCOV.

INTRODUCTION

The coronavirus belongs to the Coronaviridae family in the Nidovirales order of viruses that may cause illness in animals or humans. Corona represents crown-like spikes on the outer surface of the body of the virus; thus, it was named as a coronavirus. Coronaviruses are minute in size (65–135 nm in diameter) and contain a single-stranded RNA as a nucleic material, size ranging from 26 to 32 kbs in length (Figure 1). The coronaviruses family is divided into alpha (α), beta (β), gamma (γ) and delta (δ) subgroups.[1]

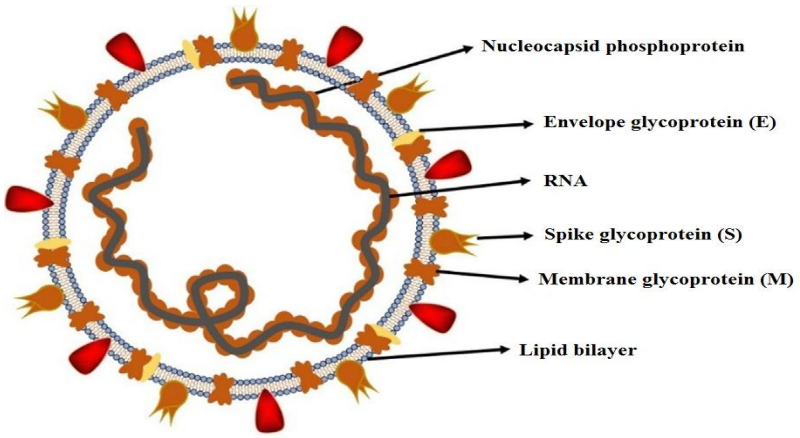

Figure 1: Structure of Coronavirus.

These viruses are common in animals especially in bat and camel, but very few cases have been known to affect humans. These viruses were thought to infect only animals until the world witnessed a severe acute respiratory syndrome (SARS) outbreak caused by SARS-CoV, 2002 in Guangdong, China.[2] Only a decade later, another pathogenic coronavirus, known as Middle East respiratory syndrome coronavirus (MERS-CoV) caused an endemic in Middle Eastern countries.[3] The most recently discovered coronavirus, 2019 novel coronavirus causes coronavirus disease COVID-19. This virus was reported to be a member of the b group of coronaviruses. The Chinese researchers named this novel virus as Wuhan coronavirus or 2019 novel coronavirus (2019-nCoV). The International Committee on Taxonomy of Viruses (ICTV) named the virus as SARS-CoV-2 and the disease as COVID-19.[4,5]

Origin and Spread of COVID-19

In the beginning of December 2019, adults in Wuhan, a capital city of Hubei province and also a major transportation hub of China started presenting to local hospitals with severe pneumonia or respiratory illness of unknown cause. On 29 December 2019, the first 4 cases

of severe pneumonia or respiratory illness reported in china, all linked to the Huanan seafood wholesale market in Southern China and were identified by local hospitals using a surveillance mechanism for "pneumonia of unknown aetiology" that was established in the wake of the 2003 severe acute respiratory syndrome (SARS) outbreak with the aim of allowing timely identification of novel pathogens such as 2019-nCoV.[6,7] On 31 December 2019, China notified the outbreak to the World Health Organization and on 1st January the Huanan sea food market was closed. On January 7, officials announced they had identified a new virus as a coronavirus that had >95% homology with the bat coronavirus and > 70% similarity with the SARS-CoV. Environmental samples from the Huanan sea food market also tested positive for virus, signifying that the virus originated from there. In a short time period the number of cases started increasing exponentially, some of which did not have exposure to the live animal market, suggestive of the fact that human-to-human transmission of disease was occurring.[8,9] The disease can spread from person to person through small droplets from the mouth or nose which are spread when a person with SARS-CoV-2 infection coughs or exhales. These droplets land on surfaces or objects around the infected person. Other people then catch SARS-CoV-2 by touching these surfaces or objects, then touching their mouth, nose or eyes without washing their hands. People can also catch COVID-19 if they breathe in droplets from a person with COVID-19 who coughs out or exhales the droplets. On 11 January 2020, China announced its first death from the virus, a 61-year-old man who had purchased goods from the seafood market. By 23 January 2020, the 11 million population of Wuhan was placed under lock down with restrictions of entry and exit from the region. Soon this lock down was extended to many other cities of Hubei province. On 30 January 2020, the WHO declared coronavirus a global emergency as the death toll in China jumped to 170, with 7,711 cases reported in the country, where the virus had spread to all 31 provinces.[9] Cases of COVID-19 in countries outside China were reported in those with no history of travel to China suggesting that local human-to-human transmission was occurring in these countries. Airports in different countries including India, America put in screening mechanisms to detect symptomatic or COVID-19 suspected people returning from China and placed them in isolation and testing them for COVID-19 infection. Soon it was understood that the infection could be transmitted from asymptomatic people and also before onset of symptoms. Therefore, countries including India who evacuated their citizens from Wuhan through special flights or had travellers returning from China, placed all people symptomatic or otherwise in isolation for 14 days and tested them for the virus periodically.[10] In recent months, infections have been identified in other Chinese cities and in more than a two

hundred countries around the world. As per report of World Health Organization till 01 May 2020, this epidemic had spread to 212 countries or territories with 3,614,702 confirmed cases, including 2,50,220 deaths.[11]

Pathogenesis and Symptoms of COVID-19

The most common symptoms of COVID-19 are similar as earlier beta-corona virus symptoms such like fever, tiredness, dry cough and dyspnea. However, COVID-19 showed some unique clinical features that include the targeting of the lower airway as evident by upper respiratory tract symptoms like nasal congestion, runny nose, sore throat or diarrhea. These symptoms are usually mild and begin gradually. Some people become infected by COVID-19 but don't develop any symptoms and don't feel unwell. As a report about 80% people recover from the disease without needing special treatment. While around 1 out of every 6 people who get COVID-19 infection becomes seriously ill and develops difficulty breathing and fever. Older people and those with underlying medical problems like high blood pressure, cancer, heart problems or diabetes, are more likely to develop serious illness. People with fever, cough and difficulty breathing should seek medical attention.[12] These symptoms may appear 2-14 days after exposure, based on the incubation period of MERS-CoV-2 viruse. The incubation Period can vary greatly among patients. The World Health Organization reported an incubation period for COVID-19 between 2 and 10 days. While China National Health Commission (NHC) had initially estimated an incubation period for MERS-CoV-2 viruse infection from 10 to 14 days.[13] A Chinese study published in the New England Journal of Medicine on 30 January 2020,[7] has found the incubation period to be 5.2 days on average, but it varies greatly among patients. Understanding the incubation period is very important for health authorities and research teams as it allows them to introduce more effective quarantine systems for people suspected of carrying the MERS-CoV-2 virus, as a way of controlling and hopefully preventing the spread of the viral infection. The period from the onset of COVID-19 symptoms to death ranged from 2 to 41 days with a median of 19 days.[14] This period is dependent on the age of the patient and status of the patient's immune system. It was shorter among patients above 70 years old compared with those under the age of 70.[14] Clinical features revealed by a chest CT scan presented as pneumonia, however, there were abnormal features such as Anaemia, acute respiratory distress syndrome, acute cardiac injury and incidence of grand-glass opacities that led to death.[10] In some cases, the multiple peripheral ground-glass opacities were observed in sub-pleural regions of both lungs

that likely induced both systemic and localized immune response that led to increased inflammation.[15]

Protective Measures Against COVID-19

There is currently no approved vaccine or treatment available to prevent coronavirus disease 2019 (COVID-19). So the best way to prevent illness is to avoid being exposed to MERS-CoV-2 virus. People can catch COVID-19 from others who have the MERS-CoV-2 virus infection. The disease can spread from infected person to others through small droplets which are spread when a person with COVID-19 coughs or exhales. These droplets land on objects and surfaces around the MERS-CoV-2 infected person. Other people then catch MERS-CoV-2 virus infection by touching these objects or surfaces and then touching their eyes, nose or mouth. So to reduce the frequency of spreading of MERS-CoV-2 virus, clean and disinfect frequently touched surfaces daily. This includes doorknobs, books, pens, light switches, countertops, handles, desks, phones, keyboards, bags, tables and sinks. People can also catch COVID-19 if they breathe in droplets from a person with COVID-19 infection who coughs out or exhales droplets.[12] Everyone should wash their hands often with soap and water for at least 20 sec especially after you have been in a public place, a meeting or after blowing your nose, coughing, or sneezing. If soap and water are not readily available, use a hand sanitizer that contains at least 60% *iso*-propyl alcohol or ethyl alcohol. Then cover all surfaces of your hands and rub them together until they feel dry. Some recent studies have suggested that some people does not show symptoms of COVID-19 but may be spread the MERS-CoV-2 virus to other people. So remember that some people without symptoms may be able to spread MERS-CoV-2 virus.[16]

Current Diagnostic Strategies

As the world is struggling to contain the COVID-19 outbreak, healthcare infrastructure, availability of testing equipments and testing capacity has emerged as major issues. Diagnostic testing for COVID-19 is critical to tracking the virus, understanding pathogenesis, informing case management, epidemiology, disease symptoms and to suppressing transmission. Adequate testing capacity for identification of SARS-CoV-2 infection is lacking worldwide, preventing people from accessing care. It also means the community is dependent on models and estimates to get an accurate picture of the COVID-19 outbreak and its evolution, even though this information is critical to inform public health measures that could stop or suppress disease transmission in the public. On 11-12 February 2020, WHO

organized a forum to identify research gaps and priorities for COVID-19, in collaboration with the GloPID-R.[17] One of the eight immediate research needs agreed upon as part of the forum was to mobilize research on rapid point of care diagnostics for use at the community level. This was early recognition of the urgent need for access to accurate and standardized diagnostics for SARS-CoV-2 infection, which can be deployed in decentralized settings.[18] An R and D Roadmap for COVID-19 was published in March 2020 by WHO.[19] Different countries have implemented different testing strategies, reflecting the availability of diagnostic equipments, methods and reagents and the needs of their individual health systems. Many *in-house* and commercial assays that detect the SARS-CoV-2 virus have been developed by researchers or are currently under development. Countries that have no testing capacity or have national testing laboratories with limited experience on SARS-CoV-2 virus testing are encouraged to send the first five positives and the first ten negative SARS-CoV-2 samples to WHO reference laboratories providing confirmatory testing for COVID-19. WHO is continually updating technical guidance for COVID-19, including recommendations on laboratory testing.[20]

Treatment Options for COVID-19

Since at this time, there are no specific antiviral vaccines or therapies approved by the U.S. Food and Drug Administration (FDA) for SARS-CoV-2 virus infection. Several therapeutically active agents are being used under clinical trial and compassionate use protocols based on *in vitro* activity against SARS-CoV-2 or related viruses and on limited clinical experience. While some researchers claimed that some western, traditional or home remedies may provide comfort and alleviate symptoms of COVID-19, but there is no evidence that current medicine can prevent or cure the disease. Several properties of this virus make its prevention difficult such as, long incubation period, non-specific features of the disease, transmission from asymptomatic people or viral infectivity even before onset of symptoms in the incubation period, tropism for mucosal surfaces such as the conjunctiva, prolonged duration of the illness and transmission even after clinical recovery. Treatment is essentially supportive and only symptomatic. The usual principles to control the COVID-19 are maintaining hydration and nutrition and controlling fever and cough. Routine use of antibiotics and some antivirals such as oseltamivir should be avoided in confirmed cases. In hypoxic patients, provision of oxygen through nasal prongs, face mask, high flow nasal cannula or non-invasive ventilation is indicated.[21] Antiviral drugs such as ribavirin, lopinavir, ritonavir have been used based on the experience with SARS and MERS.[22] The

role of corticosteroids is unproven; while current international consensus and WHO advocate against their use, Chinese guidelines do recommend short term therapy with low-to-moderate dose corticosteroids in COVID-19 ARDS.[23] Also, Chinese researcher Zhou *et al.* reported that short term moderate-dose of corticosteroid (160 mg/day) with immunoglobulin (20 g/day) significantly reduced lung injury, normalized lymphocyte counts, body temperature, C-reactive protein levels and oxygenation index in ten COVID-19 patients. On the other hand, while studying 416 COVID-19 patients, Shang *et al.* reported that corticosteroid therapy and gamma globulin administration increased mortality and appeared to be useful only in patients with lower lymphocyte counts.[24] Another report showed that the broad-spectrum antiviral remdesivir and chloroquine are highly effective in the control of 2019-nCoV infection *in vitro*. These antiviral compounds have been used in human patients with a safety track record. Thus, these therapeutic agents can be considered to treat COVID-19 infection.[25] According to Jian-ya *et al*. treatment of 51 COVID-19 patients with traditional Chinese medicine, interferon, Lopinavir, Ritonavir and short-term (3 to 5 days) corticosteroids was successful and resulted in recovery and discharge of 50 patients.[24] Several other combinations, such as combining the antiviral or antibiotics with traditional Chinese medicines were also evaluated against SARS-CoV- 2 induced infection in humans and mice.[26] Furthermore, there are a number of other compounds that are in development and research teams all over the world are working to investigate the key features, pathogenesis and treatment options of COVID-19.

CONCLUSION

This review shows a holistic picture of the current research in response to the outbreak of COVID-19. The novel corona virus originated from the Hunan seafood market at Wuhan, China in Dec 2019 and rapidly spread up to 207 countries or territories with 1210956 confirmed cases, including 67594 deaths as on 05 April 2020. Until now, no promising clinical treatments or prevention strategies have been developed against human corona viruses. However, the researchers are working to develop efficient therapeutic strategies to cope with the novel corona viruses. Beside the development of most efficient treatment, a strategy to rapidly diagnose SARS-CoV-2 in suspected patient is also required because the signs and symptoms of SARS-CoV-2 induced COVID-19 are a bit similar to influenza and seasonal allergies so a person suffering from influenza or seasonal allergy may also exhibit temperature which can be detected by thermo-scanners, hence the person will become suspected. Therefore, an accurate and rapid diagnostic kit, laboratory method or meter for

detection of SARS-CoV-2 in suspected patients is required. Epidemiological changes in SARS-CoV-2 infection should be monitored taking into account possible routes of transmission and subclinical infections, in addition to the adaptation, evolution and virus spread among humans and possible intermediate animals and reservoirs. The therapeutic strategies used by Chinese, should also be followed by other countries because at present Chinese doctors or researchers have efficiently controlled the outbreak in china and limited the mortality rate to less than 2% only. We also recommend that the scholarly community conduct further research to provide valid and reliable ways to manage or control this kind of public health emergency in both the short-term and long-term.

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Nil.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

ABBREVIATIONS

COVID-19: Coronavirus induced disease 19; **SARS-CoV:** Severe acute respiratory syndrome coronavirus; **FDA:** Food and Drug Administration; **SARS:** Severe acute respiratory syndrome; **MERS:** Middle East respiratory syndrome; **WHO:** World Health Organization.

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