

A REVIEW OF CORONAVIRUS 2019 (COVID-19), A LIFE THREATING DISEASE ALL OVER THE WORLD

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Abstract – An outbreak of a new virus novel coronavirus (COVID-19 or 2019-CoV) infection has modeled significant extortions to the economy and international health. This virus affects the lower respiratory tract and manifests as pneumonia in humans. Despite rigorous global containment and quarantine efforts, the incidence of COVID-19 continues to rise, with 752,747 laboratory-confirmed cases and over 36,226 deaths worldwide. In the absence of any vaccine for this virus, there is an urgent need to find alternative methods to control the spread of disease. Here we have directed an online for all options for treating this coronavirus infection as well as some RNA virus infection. Further, we have also found that general treatments, coronavirus-specific treatments, and antiviral treatments should be useful in fighting COVID-19. We suggest some nutritional elements that can protect us from the infection of this virus. Also, we can use convalescent plasma to COVID-19 patients if it is available. In conclusion, we suggest some potential interventions to control the emerging COVID-19 if the infection is uncontrollable.

KEYWORDS: Coronavirus, COVID-19, SARS, MERS.

INTRODUCTION

Coronaviruses (CoVs) belongs to the subfamily of Orthocoronavirinae, in the family of Coronaviridae, and the order of Nidovirales. There are four types of coronavirus: alpha-coronavirus, beta-coronavirus, gamma-coronavirus, and delta-coronavirus¹. Primarily, Coronaviruses cause enzootic infections in birds and mammals. In the last decades, they have shown their capability of infecting humans². Recently, a novel flu-like coronavirus (SARS-CoV-2), related to the MERS and SARS that outbreak in 2012 and 2002, respectively, was found at the end of 2019 in Wuhan (Hubei Province, People's Republic of China)^{3,4}. This coronavirus had >95% homology with bat coronavirus and > 70% similarity with SARS-CoV³. Compared with SARS and MERS, this virus is highly infective and transmissible despite low mortality rate⁵. Human-to-human transmission of this virus is also confirmed⁶. It is

important to note that, even though the number of new cases is condensing in China, it is exponentially increasing worldwide in other countries like Italy, Spain, America, South Korea, and Iran. Bangladesh had reported only 51 cases till 31/3/2020. Five of the patients have already died. At the date of 30/3/2020 around 858,669 cases of coronavirus disease 2019 (COVID-19) and 42,151 deaths have been reported all over the world. Fortunately, children have been infrequently affected with no deaths. The future course of this virus is unknown. This article will give a bird's eye view of this new virus.

GENETIC STRUCTURE AND PATHOGENIC MECHANISM OF SARS-COV-2

Coronavirus is a virus that encircled single-stranded positive-sense RNA viruses with a diameter of 60 nm to 140 nm, which containing spike-like projections on



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its surface that give it a crown-like presence under the electron microscope. For this reason, its name is coronavirus⁷. COVID-19 possessed a typical genome structure that belongs to the cluster of beta-coronaviruses. It is more than 82% identical to SARS-CoV^{4,8}. SARS-CoV-2 uses angiotensin-converting enzyme 2 (ACE2) as a receptor-like SARS-CoV⁹. Generally, this type of Coronavirus identifies the target cell's corresponding receptor through the S protein on its surface and enters into the cell for causing the infection⁸. Wrapp et al showed, through a structural model analysis that SARS-CoV-2 binds with ACE2 with the affinity above 10 folds higher than SARS-CoV¹⁰. COVID-19 is high in occurrence, and the population is generally susceptible to SARS-CoV-2, which spread rapidly from a single Wuhan city to the entire country within 3 days⁸. Infection of this virus occurs not only through large droplets formed from coughing and sneezing by symptomatic patients, but also from asymptomatic people¹¹. These droplets can spread 1-2 m and can remain attached on surfaces. In favorable atmospheric conditions, the virus can remain viable on surfaces for days, but it can be destroyed in less than one minute by common disinfectants like hydrogen peroxide, sodium hypochlorite, and so on¹². Other human infection is acquired either by inhalation of these droplets or touching the surfaces contaminated by them. The virus is also present in the stool of the patients and can contaminate the water supply via aerosolization³. So, we should take proper initiatives to control the spread of the disease.

CONDITION OF COVID-19 ALL OVER THE WORLD

COVID-19 total cases

China first got the COVID-19 infection and reached a number of total cases of 81518 up to March 31, 2020. However, the USA has shown the highest number of infection (164665), followed by Italy in

the second position (101739). Iran and the UK are also showing a high number of infection cases, 44605 and 22141, consecutively (Figure 1).

Death rate in different country

Among all infected countries, the death rate in Italy is the highest (11.75%). While Bangladesh is showing a death rate of 9.8%, with a total infection cases number of 51. This virus is showing a 1.98% death rate in the USA (Figure 2).

Clinical characteristics of SARS-COV-2 infection

Like SARS, COVID-19 produces an acute viral infection in humans within 3.0 days incubation period¹³. The presenting features of COVID-19 are prominent in adults. The clinical features of this virus are varied, ranging from an asymptomatic state to acute respiratory distress syndrome; however, sometimes a multi-organ dysfunction is also found³. The most common clinical indications of this virus infection are fever (87.9%), cough (67.7%), fatigue (38.1%), whereas diarrhea (3.7%), and rarely vomiting (5.0%)¹⁴. Often patients also face sore throat, headache, fatigue, headache, myalgia, and breathlessness³. Most of the patients had some degree of dyspnea at presentation because the time from onset of symptoms to the development of acute respiratory distress syndrome (ARDS) was only 9 days¹⁵. Moreover, severe patients are prone to a variety of difficulties, including acute respiratory distress syndrome, acute heart injury, and secondary infection¹⁶. There are already some pieces of evidence that COVID-19 also can cause damage to other tissues and organs instead of the lung. In a study, researchers reported that among 214 COVID-19 patients, 78 (36.4%) had neurological manifestations¹⁷. Additionally, there are already some indications of ocular surface infection in patients with COVID-19 and SARS-CoV-2¹⁸. Some COVID-19 patients have an arrhythmia, acute

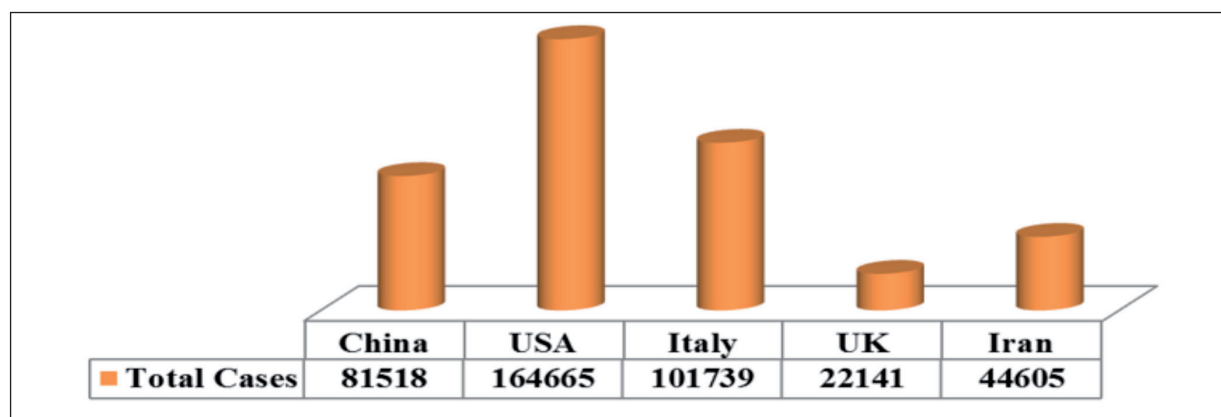


Fig. 1. COVID-19 total cases up to 31st March 2020.

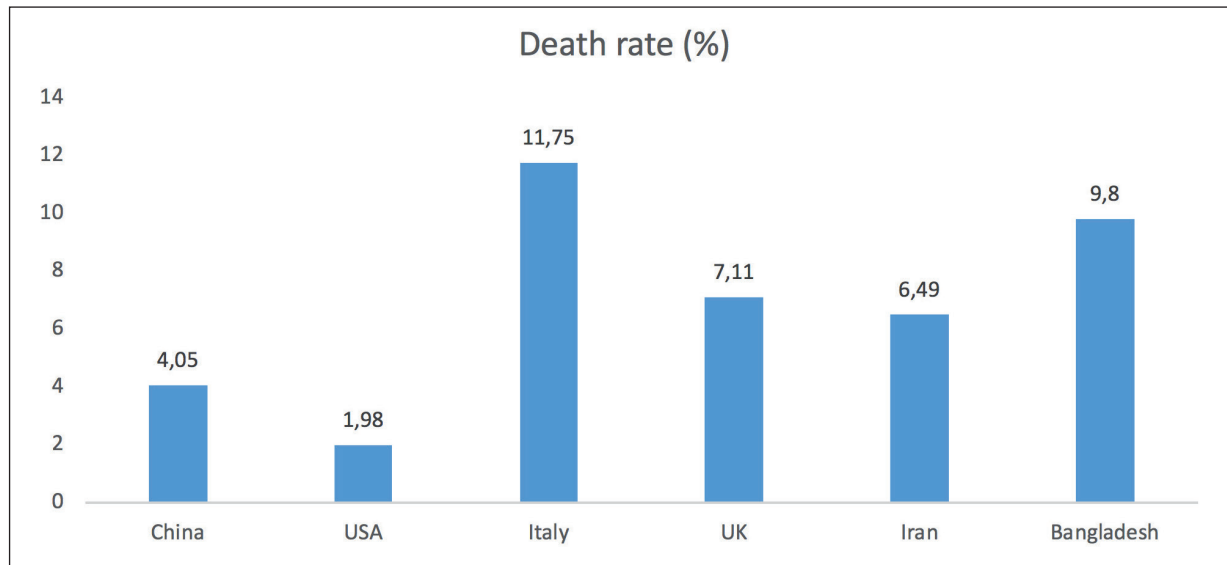


Fig. 2. COVID-19 death rate up to 31st March 2020.

heart injury, impaired renal function, and abnormal liver function (50.7%)⁸. A case report of the pathological manifestations of a patient with pneumonia showed modest microvesicular steatosis in liver tissue¹⁹. Generally, the radiographical features of coronavirus were similar to community-acquired pneumonia caused by other organisms²⁰. A recent study showed that most of the patients (90%) had bilateral chest CT findings. The sensitivity of chest CT suggests COVID-19 was 97%¹⁸. Combining clinical symptoms and laboratory tests with chest CT imaging features could facilitate the early diagnosis of COVID-19 pneumonia. Laboratory examination revealed that 82.1% of patients were lymphopenia, 36.2% of patients were thrombocytopenia. Most patients had normal leukocytes, but leukopenia observed in 33.7% of patients⁸. Most of the COVID-19 patients confirmed dominant levels of C-reactive protein, creatinine kinase, and lactate dehydrogenase. The minority of patients showed higher transaminase, abnormal myocardial enzyme spectrum, or elevated serum creatinine⁸. Additionally, higher levels of IL-6 and IL-10 and lower levels of CD4+T and CD8+T were present in COVID-19 patients²¹.

POTENTIAL TREATMENT OF SARS-COV-2

Antiviral Western medicine treatment

At present, the treatments of patients with SARS-CoV-2 infection are mainly symptomatic. Recently it is reported that Remdesivir, an antiviral drug, can be used as a promising agent against a wide array of RNA viruses. Holshue et al obtained good results for the first time by using Remdesivir against COVID-19²². Meanwhile, scientists also found that Chloroquine has an

immune-modulating activity on COVID-19 patients, and can effectively inhibit this virus *in vitro*⁸. Clinical trials also showed that *Chloroquine* proved to be effective in the treatment of COVID-19 patients²³. *Arbidol*, a small indole derivative molecule, was found to block viral fusion against influenza A, B, and hepatitis C viruses²⁴ and also confirmed having an antiviral effect on SARS-CoV in cell experiment²⁵, so it might be a choice for COVID-19 patients. Apart from the above, neuraminidase inhibitors, remdesivir, lopinavir/ritonavir, nucleoside analogs, and peptide EK1 could also be the choices of antiviral drugs against COVID-19²⁶. Baricitinib has been suggested as a potential treatment because it might decrease the process of both virus invasion and inflammation⁷.

Chinese medicine treatment

Chinese medicine has also been used for treatment of SARS-CoV-2 infection. Several traditional medicine prescriptions were also published by local governments and medicinal institutions. The Novel Coronavirus Pneumonia Diagnosis and Treatment Plan suggested clearing lung and detoxification decoction in the clinical Treatment⁸. CAS found that Shuanghuanglian oral liquid can inhibit SARS-CoV-2. Previous studies have proved that chlorogenic acid, baicalin, and forsythin in Shuanghuanglian oral liquid have definite inhibitory effects on a variety of viruses and bacteria²⁷. These components played a therapeutic role by reducing the inflammatory response of the body²⁸. Lianhuaqingwen capsule has been proven to have a wide-spectrum effect on a series of influenza viruses, including H7N9, and could regulate the immune response of the virus²⁹.



Immunoenhancement therapy

Synthetic recombinant interferon α has proven to be an effective treatment in clinical trials for SARS³⁰. Interferon is an effective inhibitor for MERS-CoV replication³¹. These findings suggested that we can use interferon for the treatment of COVID-19. Moreover, Thymosin alpha-1 (Ta1) can be a booster for an immune system for SARS patients, effectively controlling the spread of disease³². Immunoglobulin, Intravenous, and Ta1 may also be considered as therapeutics for COVID-19.

Convalescent plasma therapy

When there are no specific drugs and sufficient vaccines, convalescent plasma therapy could be an effective way to assuage the course of disease for severely infected patients³³. Convalescent plasma therapy is more effective than severe doses of hormonal shock in patients with severe SARS, reducing mortality, and shortening hospital stay³⁴. From the perspective of immunology, most of the patients recovered from COVID-19 would produce specific antibodies against the SARS-CoV-2 in their blood and serum. We can use those antibodies to prevent reinfection. At the same time, antibodies can limit the reproduction of the virus in the acute phase of infection and help to clear the virus, which is favorable to the rapid recovery of the disease.

Auxiliary blood purification treatment

According to the latest study, the kidney could be the main target to attack for novel coronavirus. Most of the severe patients who are positive with novel coronavirus might suffer from a cytokine storm. Immune damage can occur not only by the imbalance of pro-inflammatory, but also by anti-inflammatory factors. Therefore, blood purification technology could be used for removing inflammatory factors, eliminating cytokine storm, correcting electrolyte imbalance, and maintaining acid-base balance³⁵.

Nutritional interventions

As no treatment is available for this virus, there is an urgent need to find alternative methods to control the spread of disease. Some vitamins can protect us from this virus by improving our immune system. Vitamin A could be a promising option for the treatment of this novel coronavirus and the prevention of lung infection. Vitamin A and retinoids can inhibit measles replication, which is an up-regulating ele-

ment of the innate immune response in uninfected bystander cells, making them refractory to productive infection during subsequent rounds of viral replication³⁶. Vitamin B plays an essential role in body immune function as well. A shortage of B vitamins may weaken the immune response of the host. So, it should be supplemented to the virus-infected patients for enhancing their immune system⁴. Vitamin C also enhances immune functions and protectors against disease caused by coronavirus. Several researchers recommended that vitamin C might hold the susceptibility to the disease of the lower respiratory tract under certain conditions³⁷. Since COVID-19 is reported to cause the infection in the lower respiratory tract, vitamin C could be one of the efficient choices for its treatment. Vitamin D also stimulates the maturation of immune cells, so we can use vitamin D for stimulating our immune system⁴. Therefore, vitamin D could work as another therapeutic option for the treatment of this novel virus. Studies found that long-chain PUFAs, are important mediators of inflammation and adaptive immune responses³⁸. Therefore, Omega-3, including protectin D1, which served as a novel antiviral drug, could be considered for one of the potential interventions of this novel virus, COVID-19. Additionally, the combination of pyridoxine and zinc at low concentrations can inhibit the replication of SARS-coronavirus (SARS-CoV)³⁹.

CRISPR Cas technique

CRISPR based genome editing could be used for the treatment of this coronavirus, but this technique can only edit or target DNA⁴⁰. Whether RNA-targeting CRISPR systems design is possible, it will be possible to treat this virus. In an outstanding new resource for the scientific community published in Nature Biotechnology, researchers in the lab at the New York Genome Center and New York University have developed a new kind of CRISPR screen technology to target RNA. They characterized the CRISPR enzyme called Cas13 that can target RNA instead of DNA⁴¹.

PRACTICE POINTS FROM A BANGLADESHI PERSPECTIVE

At the time of writing this article, the risk of coronavirus in Bangladesh is very low, but that may change in the next few days. Therefore, the following is recommended:

1. Healthcare providers should take the travel history of all patients with respiratory symptoms and any international travel in the past 1 month as well as contact with sick people who have traveled internationally.

2. They should set up a system of triage of those patients having respiratory illness in the Outpatient Department and give them a simple surgical mask to wear. They should also use surgical masks themselves while examining such types of patients and practice hand hygiene frequently.
3. If suspected cases are found, then they should be referred to the government-designated center (IEDCR) for isolation and testing (Mohakhali, Dhaka 1212). Commercial kits for testing are not so much available in Bangladesh.
4. Patients admitted with acute respiratory distress syndrome and severe pneumonia should be evaluated for travel history and placed under contact and droplet isolation. Regular decontamination of surfaces should be done. They should be tested for SARS-CoV-2.
5. All clinical employees should keep themselves updated about recent developments, including the global spread of SARS-CoV-2.
6. Every people should stop scattering myths and false information about the disease and try to allay the panic and anxiety of the public.

CONCLUSIONS

This new virus outbreak has challenged the medical, economic, and public health infrastructure not only in China but in the whole world. Time will tell how the virus will impact our lives in Bangladesh, a highly populated country. Therefore, apart from curbing this outbreak, efforts should be made to devise comprehensive measures to prevent future outbreaks of SARS-COV-2. In Bangladesh, the death rate of SARS-COV-2 is higher, closer to Italy, but here the virus did not spread so much. The government is taking some actions for controlling this virus infection, but it is not possible to control this virus only by the government or Health ministry. Both government and people should work jointly to control this virus.

CONFLICT OF INTEREST:

The authors declare no conflict of interest

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