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(REVIEW ARTICLE)

A review of recent progress and control measures of severe coronavirus disease (COVID-19) outbreak

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Abstract

The emergence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) disease (COVID-19) in China at the end of 2019 has caused a large global outbreak. Therefore, the present study was aimed to reviews the current status of COVID-19 and the progress management measures worldwide. The symptoms are usually fever, cough, sore throat, breathlessness, fatigue, malaise among others. The disease is mild in most people; in some it may progress to pneumonia, acute respiratory distress syndrome (ARDS) and multi organ dysfunction. Several drugs such as chloroquine, arbidol, remdesivir, and favipiravir are currently undergoing clinical studies to test their efficacy and safety in the treatment of COVID-19, some promising results have been achieved thus far. The virus spreads faster than its two ancestors the SARS-CoV-2 and Middle East respiratory syndrome coronavirus (MERS-CoV), but has lower fatality. The case fatality rate is estimated to range from 2 to 3%. SARS-CoV-2 showed a superior plasma membrane fusion capacity by its spike(S) protein. The global pandemic has made an impact on the overpopulated developing country Bangladesh. The Government of the People's Republic of Bangladesh is trying hard to control this pandemic. Extensive measures to reduce person-to-person transmission of COVID-19 are required to control the current outbreak. The global impact of this new epidemic is yet uncertain. This article reviews the pandemic, present symptoms, role of immunity, clinical manifestations, diagnosis, and controlling methods of severe COVID-19 and puts forward some ideas, aiming to provide some recommendations for the diagnosis and recovery from severe COVID-19.

Keywords: SARS-CoV-2; Symptoms; Pandemic; Immunity; Diagnosis; Management

1. Introduction

Coronavirus is one of the major pathogens that primarily targets the human respiratory system. Previous outbreaks of corona viruses (CoVs) include the SARS-CoV and the MERS-CoV which have been previously characterized as agents that are a great public health threat. Since the emergence of the 2019 novel coronavirus (2019-nCoV) infection in Wuhan, China, in December 2019 [1], it has rapidly spread across China and many other countries [2-7]. On 11 February 2020, the International Committee on Taxonomy of Viruses (ICTV) named this virus SARS-CoV-2 [8]. On the same day, the WHO named the disease caused by SARS-CoV-2 as COVID-19 [9]. Currently, COVID-19 has become a public health emergency of international concern, and the WHO has upgraded its threat status to the "highest" level and declared as pandemic. So far, 2019-nCoV has affected more than 51,05,881 patients in 216 countries/regions and has become a major global health concern on 23 May 2020, the World Health Organization (WHO) announced a new name for the

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epidemic disease caused by 2019-nCoV: COVID-19 [10]. In late December 2019, a cluster of patients was admitted to hospitals with an initial diagnosis of pneumonia of an unknown etiology. These patients were epidemiologically linked to a seafood and wet animal wholesale market in Wuhan, Hubei Province, China [1,11]. The chronology of COVID-19 infections is as follows and the first cases were reported in December 2019 [12]. From December 18, 2019 through December 29, 2019, five patients were hospitalized with acute respiratory distress syndrome and one of these patients died [13]. By January 2, 2020, 41 admitted hospital patients had been identified as having laboratory-confirmed COVID-19 infection, less than half of these patients had underlying diseases, including diabetes, hypertension, and cardiovascular disease [14]. Although early studies reported a link between a single local fish and wild animal market and most cases of infection, indicating possible animal-to-human transmission, studies have increasingly demonstrated human-to-human transmission of SARS-CoV-2 through droplets or direct contact [10,15,16]. In addition to the high transmission efficiency of SARS-CoV-2, the advancement and convenience of global travel could further enhance its worldwide spread [17]. On 30th January 2020, the WHO declared the COVID-19 outbreak as the sixth public health emergency of international concern. Therefore, health workers, governments and the public need to co-operate globally to prevent its spread [18]. The novel corona virus that has so far spread from China to almost all countries around the World does not seem to be as ''deadly as other corona viruses including SARS and MERS' briefed by the Head of the WHO in their daily press note [9]. However, despite the lower case fatality rate, covid-19 has so far resulted in more deaths than SARS and MERS combined [19]. Till 23/05/2020 around 51,05,881 confirmed cases of COVID-19 and 3,33,446 deaths have been reported [20]. But the future course of this virus is still unknown.

Due to the unique work nature of the intensive care unit (ICU), COVID-19 poses an immense challenge to medical staff in the ICU, as not only does it require an increase in manpower and materials but there is also a risk of infection [21]. The present article reviews the pandemic, transmission factors, pathogenesis, diagnosis, and medication methods of severe COVID-19, aiming to suggest some indication for the diagnosis and recovery of devastating COVID-19.

2. Findings and discussion

2.1. Epidemiology and pathogenesis

All ages are susceptible for COVID-19. Infection is transmitted through large droplets generated during coughing and sneezing by symptomatic patients but can also occur from asymptomatic people and before onset of symptoms [22]. Eight Studies have shown higher viral loads in the nasal cavity as compared to the throat with no difference in viral burden between symptomatic and asymptomatic people [2]. Patients can be infectious for as long as the symptoms last and even on clinical recovery. Some people may act as super spreaders; a UK citizen who attended a conference in Singapore infected 11 other people while staying in a resort in the French Alps and upon return to the UK [23]. These infected droplets can spread 1–2 m and deposit on surfaces. The virus can remain viable on surfaces for days in favorable atmospheric conditions but are destroyed in less than a minute by common disinfectants like sodium hypochlorite and hydrogen peroxide [24]. Infection is acquired either by inhalation of these droplets or touching surfaces contaminated by them or then touching the nose, mouth and eyes.

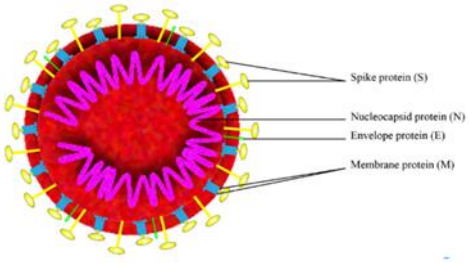

Figure 1 Schematic of the overall structure of SARS-CoV-2 (Internet).

2.2. Symptoms

The symptoms of COVID-19 infection appear after an incubation period of approximately 5.2 days [2]. The period from the onset of COVID-19 symptoms to death ranged from 6 to 41 days with a median of 14 days [25]. This period is dependent on the age of the patient and status of the patient's immune system. It was shorter among patients > 70-years old compared with those under the age of 70 years [26]. The most common symptoms at onset of COVID-19 are illness, fever, cough, and fatigue, while other symptoms include sputum production, headache, haemoptysis, diarrhoea, dyspnoea, and lymphopenia [13,14, 25,26]. Clinical features revealed by a chest CT scan presented as pneumonia, however, there were abnormal features such as RNAaemia, acute respiratory distress syndrome, acute cardiac injury,

and incidence of grand-glass opacities that led to death [15]. However, COVID-19 showed some unique clinical features that include the targeting of the lower airway as evident by upper respiratory tract symptoms (Figure 2) like rhinorrhoea, sneezing, and sore throat [27,28]**.** The incubation period of COVID-19 infection is approximately 5.2 days [29]. There are general similarities in the symptoms between COVID-19 and previous beta coronavirus.

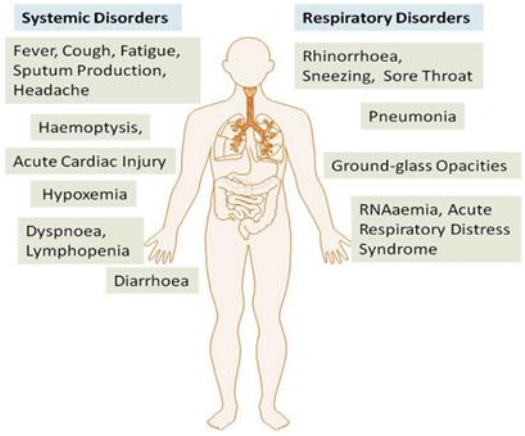

Figure 2 The systemic and respiratory disorders caused by COVID-19 infection [27].

2.3. Phylogenetic analysis

SARSCoV-2 was found to be a positive-sense, single-stranded RNA virus belonging to the genus βcoronavirus [30]. Phylogenetic analysis revealed that SARS-CoV-2 is closely related to two bat-derived SARS-like corona viruses, namely bat-SL-CoVZC45 and batSL-CoVZXC21, but it is more distant from SARS-CoV and MERS-CoV [30,31, 33]. Chen et al. [32] applied an RNA-based meta genomic next generation sequencing approach to identify a human coronavirus from two pneumonia cases during the Wuhan outbreak in 2019 which entire genome was 29881 bp in length. Phylogenetic analysis indicates that SARS-CoV-2 is similar to the coronavirus circulating in Rhinolophus, with 98.7% nucleotide similarity to the partial RNA-dependent RNA polymerase (RdRp) gene of the bat coronavirus strain BtCoV/4991 and 87.9% nucleotide similarity to bat coronavirus strain bat-SL-CoVZC45 and bat-SL-CoVZXC21. Evolutionary analysis based on ORF1a/1b, S and N genes suggests that SARS-CoV-2 is more likely a novel coronavirus that was independently introduced from animals to humans [32].

2.4. Evaluation of COVID-19

Most countries are utilizing some type of clinical and epidemiologic information to determine who should have testing performed. In the laboratory, amplification of the genetic material extracted from the saliva or mucus sample is through a RT-PCR, which involves the synthesis of a double-stranded DNA molecule from an RNA mold. In patients with confirmed COVID-19 diagnosis, the laboratory evaluation should be repeated to evaluate for viral clearance prior to being released from observation. In critical patients, D-dimer value is increased, blood lymphocytes decreased persistently, and laboratory alterations of multi-organ imbalance are found [32].

Person-to-person transmission has been demonstrated, but, to our knowledge, transmission of the novel coronavirus that causes COVID-19 from an asymptomatic carrier with normal chest CT findings has not been reported. All patients underwent chest CT imaging. Real-time RT-PCR tests for COVID-19 nucleic acid were performed using nasopharyngeal swabs (Novel Coronavirus PCR Fluorescence Diagnostic Kit, BioGerm Medical Biotechnology). The sequence of events suggests that the coronavirus may have been transmitted by the asymptomatic carrier. The incubation period for patient 1 was 19 days, which is long but within the reported range of 0 to 24 days. The mechanism by which asymptomatic carriers could acquire and transmit the coronavirus that causes COVID-19 requires further study [2].

ACE2 is a membrane-bound aminopeptidase that cleaves angiotensin I and angiotensin II into the angiotensin-(1–9) and angiotensin-(1–7) peptides. Several studies support the existence of a cardiovascular-protective ACE2–angiotensin-(1–7)–Mas receptor axis [34]. ACE2 is over expressed in heart failure, arterial hypertension and diabetes mellitus [35]. Moreover, ACE2 has been identified as a functional receptor for the entry of coronaviruses generally, and SARS-CoV-2 specifically, into host cells [36]. Given that most of the severe forms of COVID-19 have occurred in elderly patients with cardiovascular comorbidities, ACE2 levels can be increased by the use of renin–angiotensin–aldosterone system inhibitors [37]. We wish to clarify that different RAAS inhibitors have different effects on ACE2 levels [38,39],

administration of ACE inhibitors increased cardiac Ace2 mRNA levels but had no effect on ACE2 activity in experimental models [40,41]. For these reasons, chronic treatment with ACE inhibitors has no reason to influence the course of SARS-CoV-2 infection (Figure 3). When SARS-CoV-2 infects the healthy tissue or cells in a human or animal body, it immediately expressing the surface receptors ACE2 and TMPRSS2. Altogether, these processes lead to clearance of the virus and minimal lung damage, resulting in recovery. G-CSF, granulocyte colony-stimulating factor; TNF, tumor necrosis factor [42].

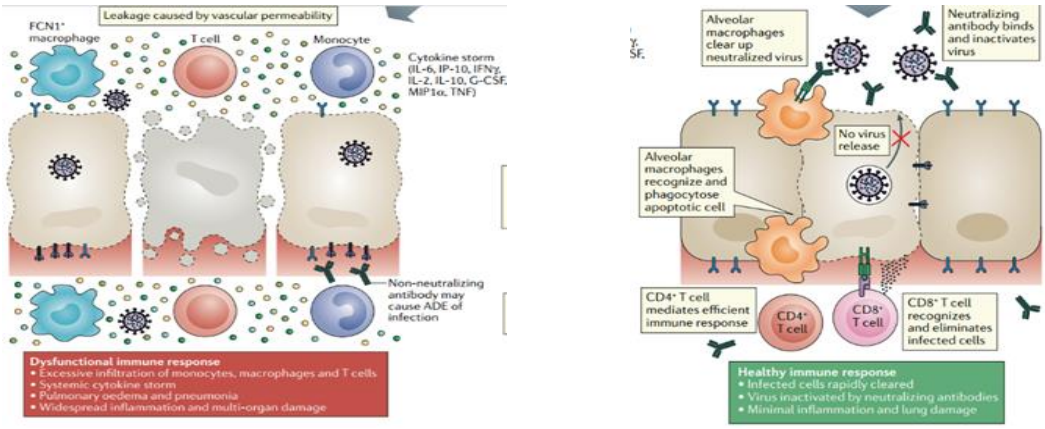

Figure 3 Chronology of events during SARS-CoV-2 infection [42].

ACE2 is an enzyme within the RAS that is expressed on the cell surface of type 2 alveolar epithelial cells in the lungs, as well as on cells in many other tissues. Binding of the spike protein to ACE2, along with proteolytic cleavage of ACE2 by TMPRSS2, facilitates entry of the virus into cells, viral replication and cell-to-cell transmission. South et al., [43] hypothesize that the suppression of ACE2 occurs as a consequence of increased internalization and shedding of ACE2 from the cell surface into less biologically active peptides. Although ACE inhibitors and ARBs do not directly affect ACE2 activity, studies in experimental animal models showing that these agents can upregulate the expression and activity of ACE2 in heart and kidney tissue [43,44] have prompted concerns of patients receiving these drugs to SARS-CoV-2 infection and COVID-19 severity (Figure 4).

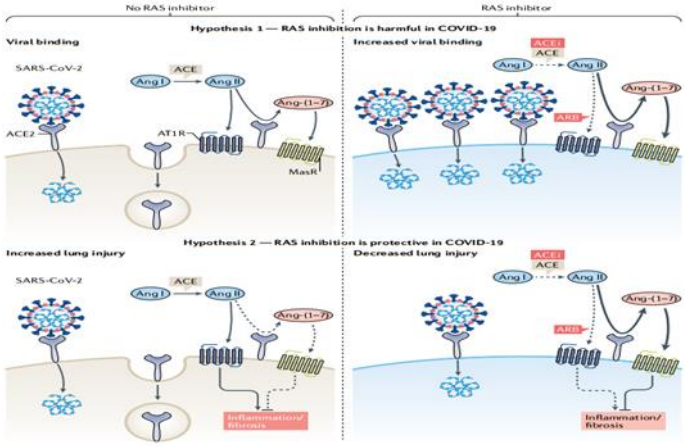

Figure 4 Possible effects of renin–angiotensin system inhibition on CoVID-19 [43,44].

2.5. Characterization of spike glycoprotein of SARS-CoV-2 on virus entry

CoVs infect human and animals and cause varieties of diseases, including respiratory, enteric, renal, and neurological diseases. The intermediate host or whether there is an intermediate host remains to be determined. CoV uses its spike glycoprotein (S), a main target for neutralization antibody, to bind its receptor, and mediate membrane fusion and virus entry. Most of the CoVs, including SARS-CoV and MERS-CoV use C-domain to bind their receptors. While S proteins of SARS-CoV-2 share about 76% and 97% of amino acid identities with SARS-CoV and RaTG13, respectively. Depending on virus strains and cell types, CoV S proteins may be cleaved by one or several host proteases, including furin, trypsin, cathepsins, TMPRSS-2, TMPRSS-4, or human airway trypsin-like protease (HAT). Availability of these proteases on

target cells largely determines whether CoVs enter cells through plasma membrane or endocytosis that could promote virus entry of SARSCoV-2 remains elusive [70]. Clinically, the immune responses induced by SARS-CoV-2 infection are two phased. During the incubation and no severe stages. For the development of an endogenous protective immune response at the incubation and non-severe stages, the host should be in good general health and an appropriate genetic background (e.g. HLA) that elicits specific antiviral immunity. Therefore, good general health may not be advantageous for patients who have advanced to the severe stage: once severe lung damage occurs, efforts should be made to suppress inflammation and to manage the symptoms. Alarmingly, after discharge from hospital, some patients remain/ return viral positive and others even relapse. This indicates that a virus eliminating immune response to SARS-CoV-2 may be difficult to induce at least in some patients and vaccines may not work in these individuals. Those recovered from the non-severe stage should be monitored for the virus together with T/B cell responses [44]. The cytokine release syndrome (CRS) seems to affect patients with severe conditions. Since lymphocytopenia is often seen in severe COVID-19 patients, the CRS caused by SARS-CoV-2 virus has to be mediated by leukocytes other than T cells. It is important to mention that various studies have shown that in animal models with bleomycin-induced lung injury, vitamin B3 is highly effective in preventing lung tissue damage. It might be a wise approach to supply this food supplement to the COVID-19 patients [45]. The expression of T cell exhaustion markers (PD1 and TIM3) was assessed in peripheral blood cells from 14 patients with COVID-19 and 3 controls. CD8+ T cells from patients in intensive care units (ICUs) showed increased expression of PD1 compared with patients not in ICUs and healthy controls. [46]. Sajuthi et al. [47] analyze nasal airway epithelial transcriptomes from a large cohort of healthy and asthmatic subjects to distinguish relative contributions of host immune networks to coronavirus susceptibility. They use network co-expression analyses and transcriptomics on muco ciliary cultures to show that genes implicated in SARS-CoV-2 infectivity. TMPRSS2 and ACE2, are significantly influenced by type 2 cytokine-driven inflammation and interferon signaling, respectively which are aggravated in patients with asthma, might increase susceptibility to severe COVID-19 [47].

2.6. Laboratory abnormalities in patients with COVID-2019 infection

The clinical characteristic of COVID-19 have been broadly defined, an outline of the most representative laboratory abnormalities found in patients with COVID-2019 infection is still lacking to the best of our knowledge [48].

Table 1 Laboratory abnormalities in patients with unfavorable progression of COVID-19

Characteristics
Increased white blood cell count
Increased neutrophil count
Increased lactate dehydrogenase (LDH)
Increased alanine aminotransferase (ALT)
Increased aspartate aminotransferase (AST)
Increased total bilirubin
Increased creatinine
Increased cardiac troponin
Increased D-dimer
Increased prothrombin time (PT)
Increased procalcitonin
Increased C-reactive protein (CRP)
Decreased lymphocyte count
Decreased albumin

2.7. Discovering drugs to treat COVID-19

Scientists are endeavoring to find drugs to treat this disease. Research thus far has revealed more than 30 agents including Western medicines, natural products, and traditional Chinese medicines that may have potential efficacy against COVID-19. Some of these agents have been quickly tested in clinical studies and demonstrated preliminary

efficacy against COVID-19. IFN-α, lopinavir/ritonavir, chloroquine phosphate, ribavirin, and arbidol have been included in the latest version of the guidelines for the prevention and treatment of COVID-19 [49]. Chloroquine phosphate and arbidol are included in the sixth edition of the guidelines based on the preliminary outcomes of clinical studies [50]. A recent report suggested that the combination of hydroxychloroquine and azithromycin (HY/AZ) may have a favorable effect on the clinical outcomes and viral loads of infected patients. In March 2020, in the midst of the COVID-19 pandemic, reports that chloroquine (CQ) can inhibit the growth of SARS-CoV-2 [51]. A Chinese study has demonstrated that HCQS is more potent than CQ in inhibiting SARS-CoV-2 in vitro [52].

2.8. Different patients care during COVID-19 pandemic

Patients with cancer had worse outcomes from SARS-CoV-2 than other individuals without cancer. The main management strategies for patients with cancer in this COVID-19 pandemic include clear communication and education about hand hygiene, infection control measures, high-risk exposure, and the signs and symptoms of the COVID-19. Telemedicine may be used to support patients during an infectious pandemic to minimize visits and risk of exposure. More research is needed to further understand SARS-CoV-2 virology and epidemiology in the cancer population [53].

COVID-19 has significant implications for the cardiovascular care of patients. Based on currently observed disease patterns, cardiovascular (CV) specialists will be actively engaged in the care of patients with COVID-19. CVD may predispose to COVID-19 infection directly have an elevated risk of adverse outcomes; and infection itself is associated with cardiovascular complications [1-3]. Therapeutics for COVID-19 have the potential for adverse CV effects and clinicians delivering CV care are at risk of developing the illness or become vectors for the infection [54]. Due to the unique characteristics of dental procedures, the standard protective measures in daily clinical work are not effective enough to prevent the spread of COVID-19. Dentists should take strict personal protection measures and avoid or minimize operations that can produce droplets or aerosols. The use of saliva ejectors with low or high volume can reduce the production of droplets and aerosols. Therefore, extra-oral dental radiographies, such as panoramic radiography and cone beam CT, are appropriate alternatives during the outbreak of COVID-19 [55]. Fang et al., [56] hypothesize that diabetes and hypertension treatment with ACE2-stimulating drugs increases the risk of developing severe and fatal COVID-19. They suggest that patients with cardiac diseases, hypertension, or diabetes, who are treated with ACE2- infected by severe COVID-19, should be monitored, such as ACE inhibitors or ARBs [57]. There is no evidence to suggest that antihypertensive calcium channel blockers increased ACE2 expression or activity, therefore these could be a suitable alternative treatment in these patients [56]. Intrauterine transmission is one of the most serious complications of viral diseases occurring during pregnancy. This lack of maternal-fetal transmission of SARS-CoV-2 is consistent with past experiences with other coronavirus infections SARS and MERS occurring in pregnant women [58]. Term neonates born to COVID-19 mothers are usually asymptomatic. PPE, CPAP continuous positive airway pressure, HFNC high flow nasal cannula, PAPR powered air purifying respirator [59]. Hyperglycemia and a diagnosis of T2DM are independent predictors of mortality and morbidity in patients with SARS. For COVID-19, a cytokine storm has been implicated in the multi-organ failure in patients with severe disease [4]. Metabolic inflammation will also compromise the immune system, reducing the body's ability to tackle the infection, impairing the healing process and prolonging the recovery [60].

ARDS and robust cytokine storm are the hallmark of severe COVID-19 cases. Liao et al., [61] found that the depletion of tissue resident alveolar macrophages and the accumulation of monocyte derived inflammatory macrophages associate with disease severity. Inflammatory macrophages adopted interferon-signaling and monocyte-recruiting chemokine programmed that may drive the myeloid cell compartment, such as IL-6 inhibitors, to treat COVID-19-associated inflammation [61].

2.9. Controlling and management of COVID-19

2.9.1. TaibUVID therapy

El Sayed et al., [62] introduce TaibUVID therapy as a novel evidence-based medicinal nutritional treatment for eradicating COVID-19 pandemic. TaibUVID stands for anti-COVID-19 treatment as a novel evidence-based approach (using natural products) for treating COVID-19 patients in Saudi Arabia. They used a single TaibUVID dose includes: 1 small spoonful (tea spoonful) of Nigella sativa oil (or 2 gram nigella sativa seeds) mixed with 1 gram of grinded Anthemis hyalina mixed with 1 large spoonful of natural honey. They suggested the mixture to chew in the mouth and swallowed orally for both COVID-19 contacts and patients. Moreover, the report suggested that the TaibUVID and TaibUVID Plus are promising evidence-based approach to rescue lives, decrease fatalities and put a rapid end to COVID-19 pandemic. Anthemis hyalina was reported to suppress the replication of coronaviruses by 100% while Citrus sinensis was reported to suppress the replication of coronaviruses by less than 90% [63].

El Sayed et al., [62] proposed Nigella sativa decoction vapor. The vapor is given to patients through a face mask in case of breathing difficulty. They also suggest the Anthemis hyalina and clove oil decoction vapor inhalation in case of breathing difficulty. Moreover, some expert Doctors and patients suggested a cocktail vapor. They are used to mixes a suitable amount of zinger, lemon, cumin, bay leaf and clove followed by boiling in 500-1000ml water for 10-15min and inhale the vapor directly 5-7 time in a day.

2.9.2. Infection control measures in ophthalmology

A three level hierarchy of control of COVID-19 measures was adopted. First, for administrative control, in order to lower patient attendance, text messages with an enquiry phone number were sent to patients to reschedule appointments or arrange drug refill. To minimize cross-infection of COVID-19, a triage system was set up to identify patients with fever, respiratory symptoms, acute conjunctivitis or recent travel to outbreak areas for at least 14 days. Second, for environmental control, to reduce droplet transmission of COVID-19, installation of protective shields on slit lamps, frequent disinfection of equipment, and provision of eye protection to staff were implemented. Third, universal masking, hand hygiene, and appropriate use of personal protective equipment (PPE) were promoted. In COVID-19, ophthalmologists should work closely with local infection control teams to implement infection control measures [64].

2.9.3. Nutritional management

The lack of nutritional procedures could, in turn, prolong patients' recovery and increase further infectious complications. The two sides of the same coin are the following: nutritional support to the COVID-19 patients and meals supply to the healthcare professionals in wards. Nutritional support is considering a basic treatment and part of the multi-disciplinary management for symptomatic SARS-CoV-2 affected patients. Patients should avoid the potential spreading of SARS-CoV-2 through the canteen and to pay particular care to the nutritional status of the isolated and fragile COVID-19 patients [65]. Proper nutrition and hydration are vital. So, patients should eat a variety of fresh and unprocessed foods every day to get the vitamins, minerals, dietary fibre, protein and antioxidants your body needs.

Eat fresh and unprocessed foods every day

Eat fruits, vegetables, legumes, nuts and whole grains, and foods from animal sources. Daily, eat: 2 cups of fruit, 2.5 cups of vegetables, 180 g of grains, and 160 g of meat and beans. For snacks, choose raw vegetables and fresh fruit rather than foods that are high in sugar, fat or salt. Vegetables and fruits should not overcook as this can lead to the loss of important vitamins. When using canned or dried vegetables and fruit, choose varieties without added salt or sugar.

Drink enough water every day

Water is essential for life. It transports nutrients and compounds in blood, regulates your body temperature, gets rid of waste, and lubricates and cushions joints. Drink 8–10 cups of water every day. Water is the best choice, but you can also consume other drinks, fruits and vegetables that contain water, for example lemon juice, tea and coffee. But be careful not to consume too much caffeine, and avoid sweetened fruit juices, syrups, fruit juice concentrates, fizzy and still drinks as they all contain sugar.

Eat moderate amounts of fat and oil

Consume unsaturated fats rather than saturated fats. Choose white meat (e.g. poultry) and fish, which are generally low in fat, rather than red meat. Avoid processed meats because they are high in fat and salt. Where possible, opt for low-fat or reduced-fat versions of milk and dairy products. Avoid industrially produced Trans fats. These are often found in processed food, fast food, snack food, fried food, frozen pizza, pies, cookies, margarines and spreads.

Eat less salt and sugar

When cooking and preparing food, limit the amount of salt and high-sodium condiments. Limit your daily salt intake to less than 5 g, and use iodized salt. Avoid foods that are high in salt and sugar. Limit your intake of soft drinks or sodas and other drinks that are high in sugar. Choose fresh fruits instead of sweet snacks such as cookies, cakes and chocolate.

2.9.4. The effect of travel restrictions

A global meta population disease transmission model to project the impact of travel limitations on the national and international spread of the epidemic. The model is calibrated based on internationally reported cases, indicate that sustained 90% travel restrictions and modestly affect the epidemic trajectory unless combined with a 50% or higher reduction of transmission in the community. The analysis of the COVID-19 outbreak and the modeling assessment of the effects of travel limitations could be instrumental to national and international agencies for public health response

planning. Moving forward we expect that travel restrictions to COVID-19 affected areas will have modest effects, and that transmission-reduction interventions will provide the greatest benefit to mitigate the COVID-19 epidemic [66].

2.9.5. The socio-economic implications

Coronavirus has also sparked fears of an impending economic crisis and recession. Social distancing, self-isolation and travel restrictions forced a decrease in the workforce across all economic sectors and caused many jobs to be lost. At the beginning of COVOD-19, different countries food sector has seen a great demand due to panic-buying and stockpiling of food products that increased the foods and ingredients prize immediately. COVID-19 has impacted communities, businesses and organizations globally, inadvertently affecting the financial markets and the global economy. Estimates indicate that COVID-19 could cost the world more than $10 trillion. For each percentage point reduction in the global economy, more than 10 million people are plunged into poverty worldwide. Since the pandemic has perpetuated an economic crisis, unemployment rates will rise substantially. This requires measures to provide companies with financial lifelines, such as the interest-free loans are being provided by some governments, as well as those that reduce the costs falling upon businesses [67-69].

2.9.6. Antibody testing and vaccine against SARS-CoV-2

Codagenix and Novavax, Inc. announced to develop a live-attenuated vaccine against SARS-CoV-2 for human testing. Moderna, has been launched in animal experiments and clinical batch production. SARS-CoV-2 DNA vaccines are under development. Inovio Pharmaceuticals developed a DNA vaccine candidate termed INO-4800. Houston-based Greffex Inc. has completed the construction of SARS-CoV-2 adenovirus vector vaccine. Tonix Pharmaceuticals announced research to develop a potential SARS-CoV-2 vaccine based on Horsepox Virus. Recombinant protein from the Urbani strain of SARS-CoV was administered to mice and hamsters. The mRNA based vaccine prepared by the US National Institute of Allergy and Infectious Diseases against SARS-CoV-2 is under phase 1 trial. INO-4800- DNA based vaccine will be soon available for human testing. Chinese CDC and Prevention working on the development of an inactivated virus vaccine. Soon mRNA based vaccine's sample will be available. GeoVax-BravoVax is working to develop a Modified Vaccina Ankara (MVA) based vaccine. While Clover Biopharmaceuticals is developing a recombinant 2019-nCoV S protein subunit-trimer based vaccine [70-72]. An online newspaper on behalf of an USA news agencies reported that China is applying Covid-19 vaccine on Chinese peoples, though the trialing procedure is not complete yet.

3. COVID-19 and its impact on Bangladesh

The global pandemic has also made an impact on the overpopulated developing country Bangladesh. In Bangladesh, the Institute of Epidemiology, Disease Control and Research (IEDCR) has reported the first 3 cases of coronavirus on 8 March 2020. As the coronavirus outbreak quickly surges, Bangladesh is adopting non-therapeutic preventive measures, which include travel bans, remote office activities, country lockdown, and most importantly, social distancing. Social distancing is difficult in many areas of the country, and with the minimal resources, the country has, it would be extremely challenging to implement the mitigation measures. As pandemic just spread in Bangladesh, the end of this pandemic is uncertain. In this situation, recovery from disease is the main concern rather than considering the economic impact. Overall, the current economic situation may seriously undermine the livelihood of the underprivileged cohort of the population. In the post-Covid-19 era, there shall be a boost in demand for certain types of products and services. These include health equipment such as masks, gloves, ventilators, etc. and the services of medical scientists including doctors, microbiologists, chemists, pharmacists, and auxiliary health staff such as technicians and nurses. Lack of access to basic healthcare, knowledge of hygiene and social safety net has always been a challenge for this cohort and the pandemic is likely to increase these challenges, exponentially. In general, in Bangladesh, almost 80 percent of the population still seek their first line of care from informal healthcare providers such as traditional healers or pharmacy owners. For that reason, during a pandemic situation, general people are facing tremendous suffering to get proper and adequate medical support due to a lack of strong primary healthcare delivery infrastructure. Improvised and timely measures taken with proper coordination may help the country to fight the lethal virus. Bangladesh-based generic pharmaceuticals manufacturer Beximco is the first company in the world to introduce a generic of the drug, under the brand name Bemsivir, to treat the viral disease. As the world grapples with a rising number of coronavirus cases and deaths with a vaccine still far off, researchers are now betting on Convalescent Plasma Therapy (CPT) for saving lives of COVID-19 patients. The Government of Bangladesh is trying hard to control this pandemic. Nevertheless, the government will not be able to mitigate the situation alone; individual efforts from the citizens, direct involvement of the nation's public health experts, and international help are urgently needed [73,74].

4. Future directions to control the COVID-19

Extensive measures to reduce person-to-person transmission of COVID-19 are required to control the current outbreak. Special attention and efforts to protect or reduce transmission should be applied in susceptible populations including children, health care providers, and elderly people. A guideline was published for the medical staff, who are interested in the 2019-nCoV [26]. The early death cases of COVID-19 outbreak occurred primarily in elderly people, possibly due to a weak immune system that permits faster progression of viral infection [2,75]. Physical contact with wet and contaminated objects should be considered in dealing with the virus, especially agents such as faecal and urine samples that can potentially serve as an alternative route of transmission [28,30] China and other countries including the US have implemented major prevention and control measures including travel screenings to control further spread of the virus [76]. A new study found that many people develop anti-viral T cells due to being infected with different strains of the virus and the T cell become resistant [76]. Scientists also claim that people who have symptoms of the mild coronavirus may develop T cells and antibodies that will protect them from future infections [46].

The pandemic of COVID-19 has clearly entered a new stage with rapid spread in countries outside China and all members of society must understand and practice measures for self-protection and for prevention of transmission of infection to others. STAG-IH makes the following recommendations. First, countries need to rapidly and robustly increase their preparedness, readiness, and response actions based on their national risk assessment. Second, all countries should consider a combination of response measures such as public awareness, promotion of personal protective hygiene, preparation of health systems for a surge of severely ill patients, stronger infection prevention and control in health facilities, nursing homes, and long-term care facilities, and postponement or cancellation of largescale public gatherings. Third, countries with no or a few first cases of COVID-19 should consider active surveillance for timely case finding; isolate, test, and trace every contact in containment; practice social distancing; and ready their health-care systems and populations for spread of infection. Fourth, lower-income and middle-income countries that request support from WHO should be fully supported technically and financially [77].

5. Conclusion

The outbreak of COVID-19 has become a clinical threat to the general population and healthcare workers worldwide. However, knowledge about this novel virus remains limited. The effective option of antiviral therapy and vaccination are currently under evaluation and development. What we can do now is aggressively implement infection control measures to prevent the spread of SARS-CoV-2 via human-to-human transmission. Public health authorities should keep monitoring the situation, as the more we learn about this novel virus and its associated outbreaks, the better we can response.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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