

A scoping review on epidemiology, etiology, transmission, clinical presentation, treatment and management of coronavirus disease (COVID-19)

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ABSTRACT: *Coronavirus (COVID-19) is a highly infectious disease which has posed serious threats to global health. This viral disease was discovered in late December 2019, in Wuhan, China. Infection rates due to the pandemic amounts to over 1 million globally while death rate is over 80,000. The United States, Italy and Spain are epicenters of the disease and have recorded more deaths due to the viral infection than other countries. Since the virus is spreading worldwide, on March 11, 2020, the WHO officially described the COVID-19 outbreak as a pandemic. The virus is transmitted when people interact with each other for some time in close proximity. Precisely, this review aims to provide the evidence of early findings on the etiology, transmission, symptoms, treatment and management of COVID-19. Studies have recorded Covid-19 infection in asymptomatic patients and in those with visible symptoms. Elderly people, pregnant women, people with underlining illness and compromised immune system are very susceptible to COVID-19 than other categories of people, however, reports of deaths of people without history of underlining illness has led to controversies. The diseased due to the virus should try to seek appropriate medical help and limit their exposure to other unaffected persons. Currently, there are no vaccines for the pandemic, but the FDA has recommended hydroxyl chloroquine as a therapy for COVID-19. The likelihood of transmission can be reduced by practising hygienic measures. Frequent disinfection and cleaning are advised for groups that are at risk of contracting the virus.*

KEYWORDS: Covid-19, pandemic, epicenter, virus, asymptomatic, immune system, vaccines, therapy

INTRODUCTION

Human coronaviruses (COVID-19) disease is an ongoing pandemic of coronavirus disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)[1], affecting the lower respiratory tract of patients with pneumonia of respiratory illness in Wuhan, Hubei Province, China beginning in December 2019[2]. This new virus seems to be very contagious and has quickly spread [3]. As On 31 January 2020, there were 213 deaths reported globally [4]. Confirmed cases were reported in the following 19 countries outside of China: Australia, Canada, Cambodia, France, Finland, Germany, India, Italy, Japan, Nepal, Malaysia, the Philippines, the Republic of Korea, Singapore, Sri Lanka, Thailand, the United States of America, United Arab Emirates and Vietnam[4]. In response to the outbreak,

epidemiological and etiological investigations by WHO confirmed that the outbreak of the coronavirus epidemic was associated with the Huanan South China Seafood Market place, but no specific animal association was identified [5]. Susceptibility seems to be associated with age, biological sex, and other health conditions [6]. COVID-19 has now been declared as a Public Health Emergency of International Concern by the WHO [7]. However, in the last twenty years, viral diseases continue to emerge and represent a serious issue to public health [8]. Human coronaviruses (COVID-19) have long been considered inconsequential pathogens found in animals and, rarely, can be transmitted from animals to humans and then spread person to person, causing the “common cold” in otherwise healthy people [9]. Coronaviruses have been described for more than 50 years; the coronavirus belonging to a family of viruses that are common in animals worldwide, but very few cases have been known to affect humans [10]. However, in the 21st century, 2 highly pathogenic HCoV—severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV)—emerged from animal reservoirs to cause global epidemics with alarming morbidity and mortality [11]. In general, coronaviruses cause widespread respiratory, gastrointestinal, and central nervous system diseases in humans and other animals, threatening human health and causing economic loss [12]. Coronaviruses are capable of adapting to new environments through mutation and recombination with relative ease and hence are programmed to alter host range and tissue tropism efficiently [13]. Therefore, health threats from coronaviruses are constant and long-term [14]. Understanding the virology of coronaviruses and controlling their spread have important implications for global health and economic stability [15]. This review aims to provide the evidence of early and recent findings on the etiology, transmission, symptoms, treatment and management of COVID-19. This may support government decision-making process on development of coherent strategies to handle this public health emergency at the community, national, and international levels. It can also lead to a better understanding and mechanism of developing a first-line therapy.

Epidemiology

Health authorities in Wuhan, the capital of Hubei province, China, reported a cluster of pneumonia cases of unknown cause on 31 December 2019 and an investigation was launched in early January 2020 [16]. The cases mostly had links to the Huanan Seafood Wholesale Market and so the virus is thought to have a zoonotic origin [17]. The virus that caused the outbreak is known as SARS-CoV-2, a newly discovered virus closely related to bat coronaviruses pangolin coronaviruses, [18] and SARS-CoV [19]. The earliest known person with symptoms was later discovered to have fallen ill on 1 December 2019 without any visible connections with the later wet market cluster [20,21]. Of the early cluster of cases reported in December 2019, two-thirds were found to have a link with the market [22,23]. On 13 March 2020, an unverified report from the *South China Morning Post* suggested that a case traced back to 17 November 2019, in a 55-year-old from Hubei province, may have been the first [24, 25].

On 26 February 2020, the WHO reported that, as new cases reportedly declined in China but suddenly increased in Italy, Iran, and South Korea, the number of new cases outside China had exceeded the number of new cases within China for the first time [26]. There may be substantial

underreporting of cases, particularly among those with milder symptoms [27, 28]. By 26 February, 2020, relatively few cases had been reported among youths 2.4% of cases worldwide. [29]. Government sources in Germany and the United Kingdom estimate that 60–70% of the population will need to become infected before effective herd immunity can be achieved [30, 31, 32].

Etiology

The Coronaviruses (CoVs) are the largest group of viruses belonging to the Nidovirales order, which includes Coronaviridae, Arteriviridae, Roniviridae and Mesoniviridae families [33]. The classification of Coronaviruses has been based on genomic organization, similarities in genomic sequence, antigenic properties of viral proteins, replication strategies, and structural characteristics of virions, pathogenic, cytopathogenic and physicochemical properties [34].

The Coronaviridae family is the largest one of the four families, by its genomic sizes of coronaviridae range from 26 to 32 kb [35]. Coronaviridae virus family subdivided into two subfamilies, coronavirinae and torovirinae [36]. It is now divided into four genera, Alpha coronavirus, Beta coronavirus, Gamma coronavirus and Delta coronavirus. They can be classified into four genera: *Alphacoronavirus*, *Betacoronavirus*, *Gammacoronavirus*, and *Deltacoronavirus*. Among them, alpha-and betacoronaviruses infect mammals, gammacoronaviruses infect avian species, and deltacoronaviruses infect both mammalian and avian species [37]. Representative alphacoronaviruses include human coronavirus NL63 (HCoV-NL63), porcine transmissible gastroenteritis coronavirus (TGEV), PEDV, and porcine respiratory coronavirus (PRCV). Representative betacoronaviruses include SARS-CoV, MERS-CoV, bat coronavirus HKU4, mouse hepatitis coronavirus (MHV), bovine coronavirus (BCoV), and human coronavirus OC43[38]. Representative gamma-and deltacoronaviruses include avian infectious bronchitis coronavirus (IBV) and porcine deltacoronavirus (PdCV), respectively. Coronaviruses are large, enveloped, positive-stranded RNA viruses. They have the largest genome among all RNA viruses, typically ranging from 27 to 32 kb. The genome is packed inside a helical capsid formed by the nucleocapsid protein (N) and further surrounded by an envelope. Associated with the viral envelope are at least three structural proteins: The membrane protein (M) and the envelope protein (E) are involved in virus assembly, whereas the spike protein (S) mediates virus entry into host cells. Some coronaviruses also encode an envelope-associated hemagglutinin-esterase protein (HE) [39].

Among these structural proteins, the spike forms large protrusions from the virus surface, giving coronaviruses the appearance of having crowns (hence their name; *corona* in Latin means crown). In addition to mediating virus entry, the spike is a critical determinant of viral host range and tissue tropism and a major inducer of host immune responses [40].

To date, seven human CoVs (HCoVs) — capable of infecting humans — have been identified. Some of HCoVs were identified in the mid-1960s, while others were only detected in the new millennium [41]. Common human CoVs: HCoV-OC43, and HCoV-HKU1 (betaCoVs of the A

lineage); HCoV-229E, and HCoV-NL63 (alphaCoVs). They can cause common colds and self-limiting upper respiratory infections in immunocompetent individuals. In immunocompromised subjects and the elderly, lower respiratory tract infections can occur [42].

Other human CoVs: SARS-CoV, SARS-CoV-2, and MERS-CoV (betaCoVs of the B and C lineage, respectively). These cause epidemics with variable clinical severity featuring respiratory and extra-respiratory manifestations. Concerning SARS-CoV, MERS-CoV, the mortality rates are up to 10% and 35%, respectively [43]. Thus, SARS-CoV-2 belongs to the betaCoVs category. It has round or elliptic and often pleomorphic form, and a diameter of approximately 60–140 nm. Like other CoVs, it is sensitive to ultraviolet rays and heat. Furthermore, these viruses can be effectively inactivated by lipid solvents including ether (75%), ethanol, chlorine-containing disinfectant, peroxyacetic acid and chloroform except for chlorhexidine [44].

Transmission

Some details about how the disease is spread are still being determined. [45]. Because the first cases of the CoVID-19 disease were linked to direct exposure to the Huanan Seafood Wholesale Market of Wuhan, the animal-to-human transmission was presumed as the main mechanism [46]. Nevertheless, subsequent cases were not associated with this exposure mechanism [46]. Therefore, it was concluded that the virus could also be transmitted from human-to-human, and symptomatic people are the most frequent source of COVID-19 spread. The disease is believed to spread during close contact and by small droplets produced when people cough, sneeze, or talk [47] with close contact being within 1 to 2 meters (3 to 6 feet) [48]. Studies have found that an uncovered coughing can lead to droplets travelling up to 4.5 metres (15 feet) to 8.2 metres (27 feet) [49]. The virus is most contagious when people are symptomatic; while spread may be possible before symptoms appear, this risk is low.[50]. The European Centre for Disease Prevention and Control (ECDC) states that while it is not entirely clear how easily the disease spreads, one person generally infects two to three others [51]. The virus survives for hours to days on surfaces [52]. Specifically, the virus was found to be detectable for up to three days on plastic and stainless steel, for one day on cardboard, and for up to four hours on copper. This, however, varies based on the humidity and temperature [53].

Further studies are needed to understand the mechanisms of transmission, the incubation times and the clinical course, and the duration of infectivity.

Clinical Presentation

Incubation period

These symptoms may appear 2-14 days after exposure (based on the incubation period of MERS-CoV viruses). with a median time of 4-5 days from exposure to symptoms onset [54]. One study reported that 97.5% of persons with COVID-19 who develop symptoms will do so within 11.5 days of SARS-CoV-2 infection [54].

Presentation

The signs and symptoms of COVID-19 present at illness onset vary, but over the course of the disease, most persons with COVID-19 will experience the following: Fever (83–99%), Cough (59–82%), Shortness of breath (31–40%), Fatigue (44–70%), Anorexia (40–84%), Sputum production (28–33%), Myalgias (11–35%) [55].

Atypical presentations have been described and older adults and persons with medical comorbidities may have delayed presentation of fever and respiratory symptoms [56]. Headache, confusion, rhinorrhea, sore throat, hemoptysis, vomiting, and diarrhea have been reported but are less common (<10%) [57]. Some persons with COVID-19 have experienced gastrointestinal symptoms such as diarrhea and nausea prior to developing fever and lower respiratory tract signs and symptoms. Anosmia or ageusia preceding the onset of respiratory symptoms has been anecdotally reported, but more information is needed to understand its role in identifying COVID-19 [58].

Asymptomatic and Pre-Symptomatic Infection

Several studies have documented SARS-CoV-2 infection in patients who never develop symptoms (asymptomatic) and in patients not yet symptomatic (pre-symptomatic) [59]. Since asymptomatic persons are not routinely tested, the prevalence of asymptomatic infection and detection of pre-symptomatic infection is not well understood [60]. Although transmission of SARS-CoV-2 from asymptomatic or pre-symptomatic persons has been reported risk of transmission is thought to be greatest when patients are symptomatic [61].

Clinical Course***Illness Severity***

The largest cohort of >44,000 persons with COVID-19 from China showed that illness severity can range from mild to critical [62].

- Mild to moderate (mild symptoms up to mild pneumonia): 81%
- Severe (dyspnea, hypoxia, or >50% lung involvement on imaging): 14%
- Critical (respiratory failure, shock, or multiorgan system dysfunction): 5%

Risk Factors for Severe Illness

Age is a strong risk factor for severe illness, complications, and death [63]. Among more than 44,000 confirmed cases of COVID-19 in China, the case fatality rate was highest among older persons: ≥80 years: 14.8%, 70–79 years: 8.0%, 60–69 years: 3.6%, 50–59 years: 1.3%, 40–49 years: 0.4%, <40 years: 0.2% [64]. Early U.S. epidemiologic data suggests that the case fatality was highest in persons aged ≥85 years (range 10%–27%), followed by 3%–11% for ages 65–84 years, 1%–3% for ages 55–64 years, and <1% for ages 0–54 years [65].

Patients with no reported underlying medical conditions had an overall case fatality of 0.9%, but case fatality was higher for patients with comorbidities: 10.5% for those with cardiovascular disease, 7.3% for diabetes, and approximately 6% each for chronic respiratory disease,

hypertension, and cancer [66]. Heart disease, hypertension, prior to stroke, diabetes, chronic lung disease, and chronic kidney disease have all been associated with increased illness severity and adverse outcomes [67].

Treatment / Management

There is no vaccines currently available for the treatment of COVID-19. The treatment is symptomatic, and oxygen therapy represents the major treatment intervention for patients with severe infection. Mechanical ventilation may be necessary in cases of respiratory failure refractory to oxygen therapy, whereas hemodynamic support is essential for managing septic shock [68].

On January 28, 2020, the WHO released a document summarizing WHO guidelines and scientific evidence derived from the treatment of previous epidemics from HCoVs. This document addresses measures for recognizing and sorting out patients with severe acute respiratory disease; strategies for infection prevention and control; early supportive therapy and monitoring; a guideline for laboratory diagnosis; management of respiratory failure and acute respiratory distress syndrome (ARDS); management of septic shock; prevention of complications; treatments; and considerations for pregnant patients [69].

Among these recommendations, we report the strategies for addressing respiratory failure, including protective mechanical ventilation and high-flow nasal oxygen (HFNO) or non-invasive ventilation (NIV).

Precautions: WHO recommends multiple steps to prevent the transmission and risk of Covid-19:

1. Regularly and thoroughly washing of hands with soap and water, and alcohol-based hand sanitiser.
2. Maintaining at least 1 & half metres (5 feet) distance between yourself and anyone who is coughing or sneezing.
3. Persistent coughing or sneezing persons should stay home or keep a social distance, not mixing in crowd.
4. Ensuring that you and people around you are following good respiratory hygiene which means covering of mouth and nose with a disposable tissue while sneezing.
5. staying at home when a person feels unwell with symptoms like fever, cough and difficulty in breathing. Avoidance of engagements in self-medication.
6. Staying informed on the latest developments about COVID-19 through official channels on TV and Radio, State Ministry of Health, NCDC and Federal Ministry of Health [69]

CONCLUSIONS AND FUTURE DIRECTIONS

Coronaviruses (CoVs) are a diverse family of viruses that interact at multiple levels with components of host cells taking the advantage of some of the cellular machineries for replication and proliferation. Various techniques are known about the molecular biology of CoVs but more information is needed. For example, many of the nonstructural and accessory proteins encoded by these viruses remain uncharacterized with no known function, and it will be important to identify mechanisms of actions for these proteins as well as defining their role in viral replication and

pathogenesis. Benda et al.'s (2021) extensive investigation into the long-term effects of COVID-19 encompasses a comprehensive review of various diagnostic technologies employed in the realm of COVID-19 testing. Their work delves into molecular tests, rapid antigen tests, and serology tests, underlining the critical importance of precise test result reporting and its integration within epidemiological studies. Furthermore, the researchers highlight the potential of utilizing saliva samples for testing, as well as the accessibility of at-home collection kits. This research constitutes a crucial resource for gaining insights into the ever-evolving landscape of COVID-19 diagnostics and its far-reaching implications for long-term patient care (Benda *et al.* 2021) [70].

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