

Epidemiology of Covid-19 Viral Infection

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Abstract

Background: Coronavirus is one of the major pathogens which target primarily the human respiratory system. Covid-19 was firstly identified by The Chinese Center for Disease Control and Prevention as novel coronavirus from the throat swab sample of an infected patient on January 07, 2020. Since it has grown to over 18 countries, the WHO has declared the outbreak as a worldwide public health crisis of significance. At the conference of 30 January 2020 under the International Health Regulations four nations reported a human-to-human outbreak.

Aim: The purpose of this review is to examine the literature on the epidemiology, clinical symptoms and mode of transmission of COVID-19.

Conclusion: As COVID-19 continues to spread, it is important for communities to take action to prevent further transmission, reduce the impact of the outbreak, and support control measures. Trying to combat the current outbreak requires rigorous steps to reduce transmission from person to person of the COVID-19 infection.

Keywords: Epidemiology of Covid-19; Coronavirus; Covid-19; Pandemic

Introduction

A new type of coronavirus (COVID-19), which originated in Wuhan, China is now out breaking worldwide and has now spread to 140 other nations, including Japan, Korea and Italy [1]. Coronavirus is one of the major pathogens which target primarily the human respiratory system [2]. Covid-19 was firstly identified by The Chinese Center for Disease Control and Prevention as novel coronavirus from the throat swab sample of an infected patient on January 07, 2020 [3]. Then, in January 2020, the WHO declared the disease a public health emergency of international concern and on 12 February 2020 formally named the disease caused by the novel CoV2 as coronavirus disease 2019 (COVID-19) [4]. Since it has grown to over 18 countries, the WHO has declared the outbreak as a worldwide public health crisis of significance. At the conference of 30 January 2020 under the International Health Regulations four nations reported a human-to-human outbreak [1].

Coronaviruses are members of the subfamily Coronavirinae in the family Coronaviridae, order Nidovirales. Members of this subfamily were genetically classified into four major genera: Alphacoronavirus, Betacoronavirus, Gammacoronavirus, and Deltacoronavirus [5]. Coronavirus is a genus of viruses which are capable of inducing severe conditions including mild flu-like symptoms such as: Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) [6]. Covid-19 is a β Coronavirus of sub-genus Botulinum belongs to coronaviridae group and is the third known zoonotic coronavirus [5]. SARS-CoV-2 is suspected to have arisen in bats despite a surprising (89 - 96%) genomic homology for bat coronaviruses. SARS and MERS-CoV-2 are responsible of the two respiratory viral epidemics of the past two decades [7].

The purpose of this review is to examine the literature on the epidemiology, clinical symptoms and mode of transmission of COVID-19.

Mode of transmission

Transmission from person to person happens mainly by direct contact, or by droplets released by an infected person through coughing or sneezing. The WHO estimated the replication number for COVID-19 on 11 February 2020 to be approximately between 2.24 and 3.58 [8]. In respiratory tract specimens, RNA of the virus can be detected 1 - 2 days before the onset of symptoms and can survive for up to eight days in moderate cases and longer periods in more severe cases, peaking in the second week of diagnosis [9]. Nasopharyngeal swabs have recorded sustained viral RNA shedding in adult patients up to 63 days and in feces more than a month after infection in pediatric patients [10]. Recent data suggests that, in laboratory models [11], SARS CoV-2 was observed in air samples for up to 3h. Gou., *et al.* observed that the air samples at several different ward locations were positive [12]. Another more critical point for infection is intrauterine or transplacental infection from infected pregnant women to their fetuses. An observational study of 38 pregnant women with COVID-19 found no evidence of intrauterine transmission of SARS CoV-2 from mothers to their fetuses [13].

Signs and symptoms

Covid-19 induces respiratory infection with a highly complex clinical pattern depending upon conditions of the host and organism. Clinical severity of COVID-19 was defined in 5 groups as asymptomatic, mild, moderate, severe, and critical. Asymptomatic infection is of special concern to the population as a cause of disease. In fact, asymptomatic infants and kids may play a significant role in the transmission from human to human [14]. According to Tian., *et al.* the prevalence of asymptomatic infection was 5 percent, while it was nearly 18 percent in Diamond Princess Cruise Ship at Tokyo Bay, Japan [15,16].

Mild disease presents as self-limited respiratory symptoms characteristic of a viral pneumonia, including fever, cough, dyspnea, sore throat, anosmia and dysgeusia. Less common symptoms include headache, hemoptysis, nausea, vomiting, and diarrhea. Severe symptoms include florid pneumonia which may progress to acute respiratory distress syndrome (ARDS) along with cardiogenic or distributive shock [17]. Despite aggressive supportive measures like mechanical ventilation, mortality rates associated with severe COVID-19 are high (8 - 25%) [18]. Individuals who are most prone to serious and critical illness are those of old age or have chronic comorbidities such as cardiovascular disease, chronic obstructive pulmonary disease, and hypertension [19]. In a meta-analysis that analyzed 46,248 patients from eight trials, hypertension, diabetes mellitus, coronary disorders and respiratory diseases were the most common comorbidities. The observation of this analysis was the more likely occurrence of such comorbidities in serious patients [20].

Patients diagnosed with COVID-19 showed higher numbers of leukocytes, irregular respiratory findings and raised levels of pro-inflammatory cytokines in the plasma. The laboratory experiments revealed leucopenia of 2.91×10^9 cells/L counts of leukocytes, 70.0 percent of which were neutrophils. In addition, a blood C-reactive protein value of 16.16 mg/L was observed that is above the normal range (0 - 10 mg/L). High erythrocyte sedimentation rate and D-dimer were also observed [20].

The table below shows symptoms of covid-19 infection [21].

Symptom	Range
Fever	83–99%
Cough	59–82%
Loss of appetite	40–84%
Fatigue	44–70%
Shortness of breath	31–40%
Coughing up sputum	28–33%
Muscle aches and pains	11–35%

Epidemiology

An epidemic curve of infection is a statistical chart used in epidemiology to visualize the onset of the coronavirus outbreak. There are three phases in an epidemic curve: increasing, plateau and declining phases.

The first cases of COVID-19 infections were reported in December 2019 [22]. Five patients with acute respiratory distress syndrome were hospitalized from 18 December 2019 to 29 December 2019, of which one patient died [23]. By 2 January 2020, 41 patients had been reported as having a confirmed COVID-19 infection in the laboratory. Nearly half of these patients suffered from underlying conditions, especially cardiovascular disorders, hypertension and diabetes [24]. In fact, only those patients who were seriously ill were examined, so there were possibly plenty other patients who had been infected.

A total of 571 cases of COVID-19 infections were recorded in 25 provinces of China as of 22 January 2020 [25]. The information of the first 17 deaths was announced by China's National Health Commission before 22 January 2020. On 25 January 2020 a total of 1975 cases of COVID-19 infection and 56 deaths in mainland China were confirmed [26]. Another 24th January 2020 survey reported 5502 infections with COVID-19 in China [27,28].

On 24 March 2020, a single day reported 943 new cases and 29 deaths. The European area (Italy, Spain, Germany, the United Kingdom, Norway, etc.) accounted for a total of 195,511 positive cases, of which 24,087 were reported only in 1 day. The numbers peaked in 1 day with up to 10,189 confirmed cases and 1447 deaths [29].

The first case of COVID-19 human-to-human transmission was recorded in the US on 30 January 2020 until 5 April 2020, and the cumulative number of COVID-19 infected cases in the US amounted to 311,635 exceeding Italy (124,632) and China (81,669) infected cases. Of these 288,356 cases are active and 8454 are death cases whereas 14825 cases have been recovered as rest. Confirmed cases of 65 deaths were reported in the Southeast Asia region in 1990. A total of 27,215 people were affected in the Eastern Mediterranean region, and 1877 died as a result of this epidemic. There were 49,444 confirmed cases and 565 deaths registered in the Americas, with 12,428 new cases and 100 deaths recorded in a day. Finally, 1305 confirmed cases and 26 deaths were recorded in the African region [29].

On 5 April 2020, Italy's total number of infected cases reached 124,632, of which 20,996 have recovered and 88,274 are active, of these 15,362 deaths [30]. A total of 3374 cases of corona virus have been registered in India so far. There are 77 recorded cases of COVID-19 deaths in India till April 2020 [31]. 1056159 COVID-19 confirmed cases worldwide, including 57,206 confirmed death cases, were reported by the WHO at 5 April 2020. COVID-19 has spread across the globe to 208 countries so far [32].

As of 15 July 2020, over 13.2 million cases have been diagnosed globally with more than 578,000 fatalities. In the 14 days to 15 July, more than 2.8 million cases were reported [33]. In Saudi Arabia, on 3 June, the total number of confirmed cases surpassed 90,000 with a recovery rate of 74% with 68,159 recoveries [34]. As of 16 July, there were 243,238 confirmed cases in the Country, the largest among the Arab Gulf States, with 187,622 reported cases and 2,370 deaths [35].

Preventive measures

Controlling the current outbreak requires extensive measures to reduce the transmission of COVID-19 from person to person. Significant focus and resources should be paid to preventing or reducing transmission of vulnerable populations including infants, health care providers and elderly people [36]. The public utilities and hospitals should include regular washing of hands with decontaminating reagents. Physical contact with wet and contaminated objects should be considered in the treatment of the virus, in particular agents such as fecal and urine samples which could potentially serve as an alternative transmission route [37]. Epidemiological improvements in COVID-19 infection should be controlled taking into account possible transmission pathways and sub-clinical diseases, as well as the evolution, development and dissemination of virus among humans and possible intermediate animals and reservoirs [38].

Clinicians advise their patients to wear non-medical masks when social/physical distancing is not feasible in public spaces. It is in accordance with World Health Organization (WHO) and US CDC guidelines. The WHO recommends mask wearing as part of a comprehensive approach to reducing transmission of SARS-CoV-2 in settings where widespread transmission and social distance is difficult (e.g. in public settings, in congregated living settings, on public transportation) [39].

A decreased probability of transmission is expected to cause physical distancing separately. In a meta-analysis of observational studies evaluating the association between physical distance and transmission of SARS-CoV-2, SARS-CoV and coronavirus respiratory syndrome (MERS-CoV) in the Middle East, proximity and risk of infection is closely linked, and the infection rate was higher with contact within three feet (one meter) compared with contact beyond that distance (12.8 versus 2.6%) [40].

There are global curfews, quarantines and similar restrictions described as home-stay orders, shelter-in-place orders, shutdowns or lock-downs related to the COVID-19 pandemic and established to prevent COVID-19 [41]. In Saudi Arabia, on 27 February 2020 there was a declaration of a temporary suspension of entry for Muslims wishing to make a pilgrimage to the Great Mosque of Mecca or a visit to the Prophet's Mosque in Madinah [42]. On 5 March, more precautionary actions were taken with respect to the protection of Islamic holy sites, including the partial daily closing of the Great Mosque for sterilization purposes [43]. The Saudi government declared that all travel inside and outside the Qatif Region would be temporarily suspended on 8 March, while citizens of the area would be permitted to enter the city. The Ministry of the Interior has reported that all persons with verified cases in the country are from Qatif. On 6 April, it was declared that 24-hour curfews will take place in the cities of Riyadh, Dammam, Tabuk, Dhahran and Hofuf and the governorates of Jeddah, Ta'if, Khobar and Qatif, with movement limited to necessary transport from 6 a.m. Then by 3 p.m. Saudi Arabia re-imposed curfew and restrictions in Jeddah from 6 to 20 June on 5 June [44, 45].

Conclusion

Trying to combat the current outbreak requires rigorous steps to reduce transmission from person to person of the COVID-19 infection. Special attention and effort should be put in place to protect or reduce transmission in vulnerable populations, including infants, health care providers and the elderly. Each day, we learn new information about the current COVID-19 pandemic. Since the outbreak is not over yet, the updates should be closely monitored to monitor the disease and the risk factors as well as the modalities of therapy.

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