Epidemiology and Clinical Characteristics of COVID-19

Xiaoyi Huang, MM1#; Fengxiang Wei, PhD2#; Liang Hu, MM2; Lijuan Wen, MM2; Ken Chen, MM1*

1School of Nursing, Guangdong Pharmaceutical University, 283 Jianghai Avenue, Haizhu District, Guangzhou, China
2Shenzhen Longgang District Maternity & Child Healthcare Hospital of Shenzhen City, Shenzhen 518172, China

Abstract
Since December 2019, there has been an outbreak of a novel coronavirus (COVID-19) infection in Wuhan, China. Meanwhile, the outbreak also drew attention and concern from the World Health Organization (WHO). COVID-19 is another human infectious disease caused by coronavirus. The transmission of COVID-19 is potent and the infection rate is fast. Since there is no specific drug for COVID-19, the treatment is mainly symptomatic supportive therapy. In addition, it should be pointed out that patients with severe illness need more aggressive treatment and meticulous care. Recently, accurate RNA detection has been decisive for the diagnosis of COVID-19. The development of highly sensitive RT-PCR has facilitated epidemiological studies that provide insight into the prevalence, seasonality, clinical manifestations and course of COVID-19 infection. In this review, we summarize the epidemiology and characteristics of COVID-19.

Keywords: COVID-19 virus, Epidemiology, Review


Introduction
In early December 2019, an outbreak of unexplained pneumonia occurred in Wuhan, Hubei Province.1,2 Since the outbreak of the new coronavirus pneumonia, with the rapid spread in the country and even the world, the number of infected cases has grown exponentially. The rapid spread of COVID-19 has attracted worldwide attention, and the World Health Organization (WHO)1, 3 has identified it as a public health emergency of international concern. The incubation period for this disease is generally 1−14 days.4 The disease usually begins with simple respiratory symptoms described as fever and cough for 2−3 days. Human challenge studies confirmed that COVID-19 causes upper respiratory disease and immune responses. Recent developments in RT-PCR for COVID-19 detection have given rise to a greater understanding of the clinical characteristics and molecular epidemiology of COVID-19.5 Since most of the patients with the earliest onset had been exposed to the south China seafood market in Wuhan, it was widely believed that COVID-19 originated from wild animals sold in the market. Shi et al6 reported that the natural host of COVID-19 might be bats; the team found that the full genome sequence of the COVID-19 obtained from the confirmed patient was 96% similar to the bat coronavirus, and it was also demonstrated that COVID-19 acts on the receptor angiotensin-converting enzyme 2 through the same cells as severe acute respiratory syndrome coronavirus (SARS-CoV). However, the relevant research on COVID-19 is not complete yet. In this review, we review the epidemiology and clinical characteristics of COVID-19.

Virus Forms and Structure
The coronavirus is a single-stranded RNA virus with a diameter of 80−120 nm. It consists of four types, namely α-CoV, β-CoV, δ-CoV and γ-CoV.7 Bats are the most important natural hosts. About 35% of the viruses they carry are coronaviruses, from which at least a dozen different coronaviruses have been identified so far.8 The COVID-19 was a novel class coronavirus with a circular or elliptic shape and a diameter of 60-140 nm.7,9 The typical coronavirus particle structure was observed under electron microscopy. Current studies have shown a 96.3% homology with the bat SARS-like coronavirus (BatCoV RaTG13), suggesting that bats may be the natural host for COVID-19.

Epidemiological and Clinical Characteristics

Methods of Detection
Seropositive studies provide key insight into the epidemiology of COVID-19, but there are limitations including the limited ability to determine the time of infection. This makes it difficult to identify and count mild and asymptomatic infections.10

Seroepidemiology
Previous studies have shown that viral RNA can be found in the plasma or serum of patients with SARS-
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COVID-19 in Adults
At the same time, current studies suggest that the population is generally susceptible to COVID-19, and the severity of the disease is positively correlated with age and underlying diseases (hypertension, diabetes, cardiovascular disease, etc.) This is similar to what happened with SARS and MERS. Huang et al. reported the first 41 cases of COVID-19 diagnosed in Wuhan, among which 27 cases (66%) had a history of exposure to the seafood market in southern China, and one case had familial clustering. This report first mentioned that COVID-19 may have human-to-human transmission characteristics. Subsequently, Chen et al. observed 99 patients with COVID-19 in the same hospital, and found that elderly men with close contacts and underlying diseases were more likely to be infected, which could rapidly progress to severe respiratory diseases such as acute respiratory distress syndrome (ARDS) and even become life-threatening.

COVID-19 in Children
A number of studies have focused on pediatric populations. As children’s immune function is not mature, they are susceptible to respiratory system infections, and their symptoms are more diversified, so the formation of antibodies and cross-immunity and other problems is easy to be missed. With the spread of the epidemic, the number of children gradually increased. The infection affected premature infants and infants, and now there are severe cases of children. At present, most of the confirmed cases of children are declared to be cluster disease, i.e. “second-generation” infection, and no clear reports of children as the source of adult infection have been found. Beijing, Guangdong and other places have seen a number of cases of children infected with the new coronavirus, especially on January 26, 2020, when a 9-month-old infant in Beijing was infected through close family contact. The transmission route in children is similar to adults, mainly by contact and respiratory droplets. Finding that most of the infected children have aggregation, aerosol transmission may also play a significant role in transmission. Careful monitoring of the developmental stages of mothers who become pregnant due to COVID-19 infection is needed, as adverse maternal and child outcomes of COVID-19 pregnancies persist, and public health system surveillance of the impact on infants and children is critical.

Seasonality
Although outbreaks and familial sexual transmission cases have been described, little is known about the seasonality of COVID-19. The scientists report that the new coronavirus is most likely to become a seasonal respiratory disease based on its current infectivity and lethality. McGraw, a professor of infectious diseases at Penn state university, believes that COVID-19 is more seasonal. It becomes more active in winter, when it enters people’s bodies by droplets, and it spreads faster in cold and dry air. Normal seasonal viruses usually cannot withstand high temperatures, so once summer arrives, the virus has basically zero infectivity when taken. On the other hand, infectious disease expert Amesh Adalja disagrees with McGraw, arguing that the evidence suggests it is not seasonal because we have not seen the time of spring and summer, and although its symptoms are somewhat similar to seasonal flu that does not mean that it is really a seasonal virus. Admittedly, the seasons can affect it, but they do not necessarily make it disappear. As we all know, our country is in the northern hemisphere; spring temperatures are mild, which helps spread virus. However, there have also been confirmed cases across the ocean in the southern hemisphere, suggesting that the virus is resistant. However, as the seasons change, it is possible that the epidemic situation in China may weaken and the crisis in the countries of the southern hemisphere may intensify, although we do not know yet. Therefore, it is too early to say whether the new coronavirus is seasonal. We do not know much about it, there is no data to carry out a comprehensive analysis, and everything should be rigorous.

Clinical Characteristics
COVID-19 is usually associated with respiratory disease. The most common symptoms associated with COVID-19 infection are fever, stuffy nose, and cough; However, the
Table 1. Summary of Clinical Characteristics of Patients Infected with COVID-19

<table>
<thead>
<tr>
<th>Author</th>
<th>Study Location</th>
<th>Age Range</th>
<th>Median Age (y)</th>
<th>No. Patients</th>
<th>Fever (%)</th>
<th>Rhinorrhea (%)</th>
<th>Cough (%)</th>
<th>Fatigue (%)</th>
<th>Headache (%)</th>
<th>Diarrhea (%)</th>
<th>Chest Tightness (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhao et al, 2020</td>
<td>Guangxi, China</td>
<td>11−68</td>
<td>45</td>
<td>28</td>
<td>18 (64)</td>
<td>2 (7)</td>
<td>12 (43)</td>
<td>7 (25)</td>
<td>4 (14)</td>
<td>NA</td>
<td>3 (11)</td>
</tr>
<tr>
<td>Yu et al, 2020</td>
<td>Guangzhou, China</td>
<td>33−62</td>
<td>50</td>
<td>91</td>
<td>70 (77)</td>
<td>NA</td>
<td>57 (63)</td>
<td>19 (21)</td>
<td>11 (12)</td>
<td>5 (5)</td>
<td>5 (5)</td>
</tr>
<tr>
<td>Chen et al, 2020</td>
<td>Wuhan, China</td>
<td>26−79</td>
<td>56</td>
<td>29</td>
<td>28 (97)</td>
<td>NA</td>
<td>21 (72)</td>
<td>12 (41)</td>
<td>2 (7)</td>
<td>4 (14)</td>
<td>17 (59)</td>
</tr>
<tr>
<td>Liu et al, 2020</td>
<td>Shenzhen, China</td>
<td>10−72</td>
<td>63</td>
<td>12</td>
<td>10 (83)</td>
<td>NA</td>
<td>11 (92)</td>
<td>NA</td>
<td>0 (0)</td>
<td>2 (17)</td>
<td>NA</td>
</tr>
<tr>
<td>Tian et al, 2020</td>
<td>Beijing, China</td>
<td>1−94</td>
<td>48</td>
<td>262</td>
<td>215 (82)</td>
<td>NA</td>
<td>120 (46)</td>
<td>69 (26)</td>
<td>17 (6)</td>
<td>NA</td>
<td>18 (7)</td>
</tr>
<tr>
<td>Wang et al, 2020</td>
<td>Wuhan, China</td>
<td>42−68</td>
<td>56</td>
<td>138</td>
<td>136 (99)</td>
<td>NA</td>
<td>82 (59)</td>
<td>96 (70)</td>
<td>9 (7)</td>
<td>14 (10)</td>
<td>43 (31)</td>
</tr>
<tr>
<td>Liu et al, 2020</td>
<td>Wuhan, China</td>
<td>43−66</td>
<td>55</td>
<td>109</td>
<td>90 (83)</td>
<td>NA</td>
<td>67 (61)</td>
<td>62 (57)</td>
<td>NA</td>
<td>12 (11)</td>
<td>NA</td>
</tr>
<tr>
<td>Xu et al, 2020</td>
<td>Zhejiang, China</td>
<td>32−52</td>
<td>41</td>
<td>62</td>
<td>48 (77)</td>
<td>NA</td>
<td>50 (81)</td>
<td>32 (52)</td>
<td>21 (34)</td>
<td>3 (5)</td>
<td>NA</td>
</tr>
<tr>
<td>Chen et al, 2020</td>
<td>Wuhan, China</td>
<td>21−82</td>
<td>56</td>
<td>99</td>
<td>82 (83)</td>
<td>4 (4)</td>
<td>81 (82)</td>
<td>NA</td>
<td>8 (8)</td>
<td>2 (2)</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Yang et al, 2020</td>
<td>Wuhan, China</td>
<td>NA</td>
<td>60</td>
<td>52</td>
<td>51 (98)</td>
<td>3 (6)</td>
<td>40 (77)</td>
<td>NA</td>
<td>3 (6)</td>
<td>NA</td>
<td>1 (2)</td>
</tr>
</tbody>
</table>

virus has been associated with pneumonia.14 Symptoms of clinical characteristics in patients infected with COVID-19 are frequently reported (Table 1).

Currently, it is believed that people are generally susceptible to COVID-19, including pregnant women and children. Most studies suggest that older middle-aged people are more predisposed to COVID-19 (median age of onset is about 55 years).24 Adults with COVID-19 infection most commonly manifest fever, cough and fatigue, which in some patients can be accompanied by runny nose, headache and other symptoms. Additional symptoms such as diarrhea are less common. Respiratory viruses can interact with each other and some bacteria may affect susceptibility to acute respiratory diseases, especially in patients with underlying immune deficiencies or chronic respiratory diseases, such as chronic obstructive pulmonary disease or cystic fibrosis.

In conclusions, the recent COVID-19 outbreak has been deemed a global health emergency. Internationally, the number of confirmed reports continue to rise.25 At present, China has listed COVID-19 as a class b infectious disease stipulated by the law on prevention and treatment of infectious diseases, and adopted an infectious disease prevention. The basic strategy for controlling the epidemic is early detection, early isolation, early diagnosis and early treatment. COVID-19 cases are insidious and transmissible in the incubation period, and multiple clusters have been reported in China. The causal role of COVID-19 in these cases is therefore uncertain and larger studies are needed in the future to describe the prevalence, clinical characteristics and course of the disease.26

Authors’ Contribution
All authors contributed significantly to both the study and the manuscript. XH contributed to the data collection, data analysis and wrote the draft of the manuscript. LH and LW prepared this manuscript for publication. FW and KC took responsibility for the integrity of the data analysis, and KC reviewed the manuscript. All authors read and approved the final manuscript.

Conflict of Interest Disclosures
The authors declare that they have no competing interests.

Ethical Statement
The study was conducted as per the ethical principles of the Helsinki Declaration.

Funding Sources
This work was supported by Longgang Science and Technology Development Foundation (LGKCYS20190000791) and Shenzhen Longgang Science and technology innovation Commission (LGKCZSYS2018000010).

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