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A cross-sectional comparison of epidemiological and clinical features of patients with coronavirus disease (COVID-19) in Wuhan and outside Wuhan, China

Ziying Lei\textsuperscript{a,b,2}, Huijuan Cao\textsuperscript{a,b,2}, Yusheng Jie\textsuperscript{a,b,2}, Zhanlian Huang\textsuperscript{a,b}, Xiaoyan Guo\textsuperscript{a,b}, Junfeng Chen\textsuperscript{a,b}, Liang Peng\textsuperscript{a,b}, Hong Cao\textsuperscript{a,b}, Xiaoling Dai\textsuperscript{a,b}, Jing Liu\textsuperscript{a,b}, Xuejun Li\textsuperscript{a,b}, Jianyun Zhu\textsuperscript{a,b}, Wenxiang Xu\textsuperscript{a,b}, Dabiao Chen\textsuperscript{a,b}, Zhiliang Gao\textsuperscript{a,b,1}, Jian-Rong He\textsuperscript{c,1,∗∗}, Bing-Liang Lin\textsuperscript{a,b,1,∗}

\textsuperscript{a} Department of Infectious Diseases, The Third Affiliated Hospital of Sun Yat-Sen University, Guangzhou, China
\textsuperscript{b} Guangdong Provincial Key Laboratory of Liver Diseases, The Third Affiliated Hospital of Sun Yat-sen University, Guangzhou, China
\textsuperscript{c} Nuffield Department of Women's and Reproductive Health, University of Oxford, UK

\textbf{ARTICLE INFO}

\textbf{ABSTRACT}

\textbf{Background:} Coronavirus disease 2019 (COVID-19) has spread outside the initial epicenter of Wuhan. We compared cases in Guangzhou and Wuhan to illustrate potential changes in pathogenicity and epidemiological characteristics as the epidemic has progressed.

\textbf{Methods:} We studied 20 patients admitted to the Third Affiliated Hospital of Sun Yat-Sen University in Guangzhou, China from January 22 to February 12, 2020. Data were extracted from medical records. These cases were compared with the 99 cases, previously published in Lancet, from Wuhan Jinyintan Hospital from January 1 to January 20, 2020.

\textbf{Results:} Guangzhou patients were younger and had better prognosis than Wuhan patients. The Wuhan patients were more likely to be admitted to the ICU (23\% vs 5\%) and had a higher mortality rate (11\% vs 0\%). Cases in Guangzhou tended to be more community clustered. Diarrhea and vomiting were more common among Guangzhou patients and SARS-CoV-2 RNA was found in feces. Fecal SARA-CoV-2 RNA remained positive when nasopharyngeal swabs turned negative in some patients.

\textbf{Conclusions:} This study indicates possible diminishing virulence of the virus in the process of transmission. Yet persistent positive RNA in feces after negative nasopharyngeal swabs suggests a possible prolonged transmission period that challenges current quarantine practices.

\section{1. Introduction}

Coronaviruses are enveloped non-segmented positive-sense RNA viruses belonging to the family Coronaviridae, with a genome ranging from 26 to 32 kilobases in length [1]. Among the several coronaviruses that are pathogenic to humans, most are associated with mild clinical symptoms, with two notable exceptions: severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV) [2,3], which have caused more than 10000 cumulative cases in the past two decades with mortality rates of 9.5\% and 34.4\% respectively [4–6]. In December 2019, a novel pneumonia, termed coronavirus disease 2019 (COVID-19), emerged in Wuhan, China and has been proven to be caused by a severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [7]. All the twenty-

\textbf{List of Abbreviations:} COVID-19, coronavirus disease 2019; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; CDC, Centre for Disease Control and Prevention; RNA, ribonucleic acid; ICU, intensive care unit; ESR, erythrocyte sedimentation rate; CRP, C-reaction protein; PCT, Procalcitonin; CT, computerized tomography

\textsuperscript{∗} Corresponding author. Department of Infectious Diseases, The Third Affiliated Hospital of Sun Yat-Sen University, 600 Tianhe Road, Guangzhou, China.
\textsuperscript{∗∗} Corresponding author.
\textbf{E-mail addresses:} jianrong.he@gtc.ox.ac.uk, bjyr0703@163.com (J.-R. He), linbingl@mail.sysu.edu.cn (B.-L. Lin).

\textsuperscript{1} Bing-Liang Lin, Jian-Rong He and Zhiliang Gao contributed equally to this work.

\textsuperscript{2} Ziying Lei, Huijuan Cao and Yusheng Jie contributed equally to this work.

https://doi.org/10.1016/j.tmaid.2020.101664
Received 7 March 2020; Received in revised form 4 April 2020; Accepted 5 April 2020
Available online 09 April 2020
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seven first cases reported by December 31, 2019 were closely related to exposure with the Huanan Seafood Market in Wuhan [8]. By analyzing the genome sequence of SARS-CoV-2, it was speculated that the pathogen originated in bat, the natural reservoir host, and then transmitted to humans via an uncertain wild animal intermediate host [9]. There is convincing evidence that the human-to-human transmission has occurred since the end of December 2019 or the early January 2020 [10]. To control the spread of COVID-19, the Wuhan authority has sealed off the entire city from outside contact since Jan 23, 2020. However, it’s estimated that five million people have left Wuhan before the “lockdown” and travelled throughout China [11]. By April 1, 2020, the disease has affected over 200 countries, with over 880,000 confirmed cases and 44220 deaths [12–18]. In China, substantial attention has focused mainly on Wuhan, whereas the detailed information regarding the disease outside Wuhan is rarely reported [19,20]. Furthermore, little is known about the changes in pathogenicity, clinical manifestations and mode of transmission of SARS-CoV-2 when the epidemic expanded beyond Wuhan.

Here, we summarized the epidemiologic and clinical characteristics of 20 laboratory-confirmed cases of COVID-19 in Guangdong who hospitalized in the 3rd affiliated hospital of Sun Yat-sen University from January 22 to February 18, 2020, and compared these cases with previous reported cases in Wuhan, aiming to provide information for understanding the changes in clinical manifestations and transmission model.

2. Methods

2.1. Study design and participants

The study was approved by the Third Affiliated Hospital of Sun Yat-Sen University Ethics Committee, and oral consent was obtained from patients. All confirmed patients with COVID-19 admitted to the Third Affiliated Hospital of Sun Yat-sen University from Jan 22 to Feb 12, 2020 were enrolled and followed-up until February 18, 2020. All patients with COVID-19 enrolled in this study were diagnosed according to the WHO interim guidance [21]. To compare the epidemiological and clinical characteristics between patients in Guangdong and Wuhan (epidemic area), we included previously published data on 99 cases admitted to the Third Affiliated Hospital of Sun Yat-Sen University from Jan 22 to Feb 12, 2020 [10]. To control the spread of COVID-19, the Wuhan authority has locked down over 200 countries, with over 880,000 confirmed cases and 44220 deaths [12–18]. In China, substantial attention has focused mainly on Wuhan, whereas the detailed information regarding the disease outside Wuhan is rarely reported [19,20]. Furthermore, little is known about the changes in pathogenicity, clinical manifestations and mode of transmission of SARS-CoV-2 when the epidemic expanded beyond Wuhan.

2.2. Data collection

The epidemiological characteristics (including recent exposure history), clinical symptoms and signs, radiologic and laboratory findings were extracted from electronic medical records. Radiologic assessments included chest X-ray or computed tomography (CT). Laboratory assessments consisted of complete blood count, blood chemistry, coagulation test, liver and renal function, electrolytes, C-reactive protein (CRP), procalcitonin (PCT), lactate dehydrogenase and creatine kinase. ARDS was defined according to the Berlin definition [23].

2.3. Laboratory confirmation of SARS-CoV-2 infection

The viral nucleic acid testing-based laboratory confirmation of SARS-CoV-2, performed by the hospital’s laboratory and the key laboratory of Guangdong Centre for Disease Control and Prevention (CDC), China, was determined by real-time RT-PCR according to the Chinese national CDC recommended protocol. Firstly, the nasopharyngeal swab was collected every 2 days during hospitalization. Then the RNA samples from the nasal swab specimens were extracted and subjected to the real-time RT-PCR test using SARS-CoV-2 specific primers and probes. Specifically, the primers for the open reading frame 1 ab (ORF1ab) are 5′-CCCTGGGTTTTTACACCTAA-3′ (Forward) and 5′-ACGATTGTGACATCGCTGA-3′ (Reverse); the corresponding probe is

| Table 1 | Baseline characteristics and epidemiology of patients with COVID-19 within and outside Wuhan. |
|---|---|
| Characteristics | Guangzhou#1 (N = 20) | Wuhan#2 (N = 99) | P values |
| Age, years, Mean (SD) | 43.2 (14.0) | 55.5 (13.1) | < 0.001 |
| Range | 25–64 | 21–82 | 40–49 | 2 (40.0%) | 22 (22.2%) | 0.002 |
| Sex | Female | 10 (50.0%) | 32 (32.3%) | Male | 10 (50.0%) | 67 (67.7%) |
| Chronic medical illness | Cardiovascular and cerebrovascular diseases | 7 (35.0%) | 50 (50.5%) | 0.229 |
| Digestive system disease | 3 (15.0%) | 11 (11.1%) | 0.703 |
| Endocrine system disease | 1 (5.0%) | 13 (13.1%) | 0.460 |
| Malignant tumor | 0 (0.0%) | 1 (1.0%) | 1.000 |
| Respiratory system disease | 1 (5.0%) | 1 (1.0%) | 0.309 |
| Admission to intensive care unit | 1 (5.0%) | 23 (23.2%) | 0.072 |
| Signs and symptoms | Fever | 16 (80.0%) | 82 (82.8%) | 0.752 |
| Cough | 11 (55.0%) | 81 (81.8%) | 0.017 |
| Shortness of breath | 2 (10.0%) | 31 (31.3%) | 0.052 |
| Myalgia | 7 (35.0%) | 11 (11.1%) | 0.013 |
| Sore throat | 4 (20.0%) | 5 (5.1%) | 0.043 |
| Diarrhea | 5 (25.0%) | 2 (2.0%) | 0.001 |
| Nausea and vomiting | 3 (15.0%) | 1 (1.0%) | 0.015 |
| More than one sign or symptom | 18 (90.0%) | 89 (89.9%) | 1.000 |
| Comorbid conditions | Fever, cough, and shortness of breath | 2 (10.0%) | 15 (15.2%) | 0.734 |
| Any | 3 (15.0%) | 33 (33.3%) | 0.118 |
| ARDS | 1 (5.0%) | 17 (17.2%) | 0.302 |
| Acute renal injury | 0 (0.0%) | 3 (3.0%) | 1.000 |
| Acute respiratory injury | 1 (5.0%) | 8 (8.1%) | 1.000 |
| Septic shock | 1 (5.0%) | 4 (4.0%) | 1.000 |
| Ventilator-associated pneumonia | 0 (0.0%) | 1 (1.0%) | 1.000 |

Data are n (%) unless specified otherwise. N is the total number of patients with available data. ARDS = acute respiratory distress syndrome. COVID-19 = coronavirus disease – 19. P values for comparing two groups were derived using Fisher’s exact test for categorized variables and t-test for continuous variables. 

#1 Admitted to the Third Affiliated Hospital of Sun Yat-Sen University in Guangzhou from January 22 to February 12, 2020, the last follow-up was on February 18, 2020.

#2 Diagnosed in Wuhan Jinyintan Hospital from January 1 to January 20, 2020. Wuhan patients were followed-up until January 25, 2020 [22].

#3 Only include the cases with long-term exposure to Huanan seafood market. NA, not available.

* Epidemic area refers to Wuhan and other epidemic areas in Hubei Province.
3′. The clearance of SARS-CoV-2 was defined as two consecutive negative results with qPCR detection at an interval of 24 h.

2.4. Statistical analysis

Continuous variables were expressed as mean (SD) or median (IQR) and compared with the *t*-test or Mann-Whitney *U* test; categorical variables were expressed as frequency (%) and compared by χ² test or Fisher’s exact test between the cases in Guangzhou and Wuhan. For laboratory indicators, we categorized the results into normal or abnormal (increased or decreased). We used SPSS (IBM, version 26.0) for all analyses.

2.5. Role of the funding source

Funding sources had no role in this study. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

3. Results

3.1. Demographics, baseline characteristics and clinical characteristics

All the COVID-2019 patients (N = 20) admitted in the Third Affiliated Hospital of Sun Yat-sen University were enrolled, including 10 males and 10 females. Patients in Guangzhou were younger than those in Wuhan (43.2 vs 55.5 years, *P* < 0.001). Among Guangzhou patients, 14 had a history of living or travelling in Wuhan, and 6 were local incident patients with a history of close contact with confirmed cases. 10 Guangzhou patients were from seven clusters, including five family clusters, one cruise ship cluster and one driving tour cluster to Wuhan, while only two shoppers were community clustered among Wuhan patients.

Patients in both cities mainly manifested fever, cough and myalgia. Cough (82% vs 55%, *P* = 0.017) and shortness of breath (31% vs 10%, *P* = 0.052) were more prevalent among patients in Wuhan, while patients in Guangzhou had a higher prevalence of diarrhea (2% vs 25%, *P* = 0.001) and vomiting (1% vs 15%, *P* = 0.015). Higher percentages of patients were admitted to the ICU (23% vs 5%, *P* = 0.072) and complications (33% vs 15%, *P* = 0.118), such as ARDS (17% vs 1%, *P* = 0.302) in Wuhan (Table 1).

3.2. Laboratory, imaging, and pathogenic characteristics of patients with COVID-19

Blood routine and biochemical data of the patients in Guangzhou were basically normal, and only 25% of the patients had a lymphocyte count of less than 1.0 × 10^9/L. The lymphocyte count, hemoglobin and albumin of patients in Wuhan were significantly lower, while inflammatory biomarkers, blood erythrocyte sedimentation rate (ESR), CRP and PCT were significantly higher than those in Guangzhou (all *P* values < 0.05). Chest CT scan indicated bilateral involvement in both cities. Based on Guangzhou data, the main manifestations were multiple patches (90%), ground-glass opacity (80%) and interstitial lesions (80%). Invasive lesions were presented in 55% of patients (Fig. 1).

Multiple mottling and ground-glass opacity were more common in Guangzhou patients (14% vs 60%, *P* < 0.001) (Table 2).

3.3. Treatment and prognosis of patients with COVID-19

In both cities, most patients were mainly treated with antibiotics or antiviral therapy, including Lopinavir and Ritonavir (Kaletra), arbidol, ribavirin and aerosol inhalation of interferon alpha, 13 (65%) patients were given combination antiviral therapy (data only available in Guangzhou patients) (Table 3). 27%–30% of patients were treated with immunoglobulin and 20% with thymosin alpha-1 (data only available in Guangzhou patients) to regulate immunity. 25% of patients in Guangzhou, compared to 19.2% in Wuhan, with severe pulmonary inflammation and decreased oxygenation index received short-term corticosteroids treatment, with methylprednisolone 1 mg/kg/day for 3 days. More patients in Wuhan needed oxygen treatment than those in Guangzhou (75% vs 40%, *P* = 0.001). By the last follow-up date, the patients in Guangzhou have a higher discharged rate and lower mortality rate than those in Wuhan (*P* = 0.005).

3.4. SARS-CoV-2 RNA in nasopharyngeal swabs and feces

Among Guangzhou patients, SARS-CoV-2 RNA in nasopharyngeal swabs disappeared at an average of 12 days (maximum, 22 days). SARS-CoV-2 RNA in feces turned negative in 4–16 days. In two cases, the fecal RNA did not turn negative until 5 and 6 days after negative nasopharyngeal swab.
4. Discussion

By comparing cases from the Third Affiliated Hospital of Sun Yat-Sen University in Guangzhou from January 22 to February 12, 2020 and Wuhan Jinyintan Hospital from January 22 to February 12, 2020, the last follow-up was on February 18, 2020. #1 Admitted to the Third Affiliated Hospital of Sun Yat-Sen University in Guangzhou from January 22 to February 12, 2020, the last follow-up was on February 18, 2020. #2 Diagnosed in Wuhan Jinyintan Hospital from January 1 to January 20, 2020, the last follow-up was on January 25, 2020. NA, not available.

Table 2
Comparison of Laboratory data and Outcome of Patients with COVID-19 Within and Outside Wuhan.

|                              | Guangzhou¹ (N = 20) | Wuhan² (N = 99) | P value |
|------------------------------|----------------------|-----------------|---------|
| Blood routine                |                      |                 |         |
| Leukocytes ( × 10^9/L, normal range 3.5-9.5) | 5.2 (1.6)           | 7.3 (3.6)       | 0.006   |
| Lymphocytes ( × 10^9/L, normal range 1.1-3.2) | 1.4 (0.7)           | 0.9 (0.5)       | 0.003   |
| Platelets ( × 10^5/L, normal range 125.0-350.0) | 205.0 (62.6)        | 213.5 (79.1)    | 0.652   |
| Hemoglobin (g/L, normal range 130.0-175.0) | 139.3 (15.3)        | 129.8 (14.8)    | 0.010   |
| Blood biochemistry           |                      |                 |         |
| Increased alanine            | 4 (20.0%)            | 28 (28.3%)      | 0.584   |
| aminotransferase             | 3 (15.0%)            | 35 (35.4%)      | 0.113   |
| Increased aspartate          | 1 (5.0%)             | 18 (18.2%)      | 0.192   |
| aminotransferase             | 1 (5.0%)             | 97 (98.0%)      | < 0.001 |
| Increased total bilirubin    | 1 (5.0%)             | 97 (98.0%)      | < 0.001 |
| Albumin (g/L)                | 44.8 (5.6)           | 31.6 (4.0)      | < 0.001 |
| Decreased                    | 1 (5.0%)             | 97 (98.0%)      | < 0.001 |
| Increased serum creatinine   | 1 (5.0%)             | 3 (3.0%)        | 0.526   |
| Increased creatine kinase    | 5 (25.0%)            | 13 (13.1%)      | 0.183   |
| Increased myoglobin          | 2/17 (11.8%)         | 15 (15.2%)      | 1.000   |
| Infection-related biomarkers |                      |                 |         |
| Erythrocyte sedimentation rate (mm/h, normal range 0-15) | 19.3 (13.2)        | 49.9 (23.4)    | < 0.001 |
| C-reaction protein (mg/L, normal range 0-6) | 25.0 (29.3)         | 51.4 (41.8)    | 0.002   |
| Procalcitonin (ng/mL, normal range 0-0.05) | 0.08 (0.09)         | 0.5 (1.1)      | < 0.001 |
| Chest X-ray and CT finding   |                      |                 |         |
| Unilateral pneumonia         | 2 (10.0%)            | 25 (25.3%)      | 0.239   |
| Bilateral pneumonia          | 18 (90.0%)           | 74 (74.7%)      | 0.239   |
| Multiple motting and ground-glass opacity | 12 (60.0%)         | 14 (14.1%)      | < 0.001 |
| Peripheral pneumonia         | 17 (85.0%)           | NA NA           |         |
| Intestinal lesions           | 16 (80.0%)           | NA NA           |         |
| Ground-glass opacity         | 16 (80.0%)           | NA NA           |         |
| Multiple patches             | 18 (90.0%)           | NA NA           |         |
| Multiple Infiltration         | 11 (55.0%)           | NA NA           |         |
| Nodule                       | 4 (20.0%)            | NA NA           |         |
| Lung consolidation           | 4 (20.0%)            | NA NA           |         |
| Pleural effusion             | 2 (10.0%)            | NA NA           |         |

Data are n (%) and mean (SD). N is the total number of patients with available data. COVID-19 = coronavirus disease; 2019 P values for comparing two groups were derived using Fisher's exact test for categorized variables and t-test for continuous variables. #1 Admitted to the Third Affiliated Hospital of Sun Yat-Sen University in Guangzhou from January 22 to February 12, 2020, the last follow-up was on February 18, 2020. #2 Diagnosed in Wuhan Jinyintan Hospital from January 1 to January 20, 2020, the last follow-up was on January 25, 2020. NA, not available.

Table 3
Treatment and prognosis of patients with COVID in Guangzhou and Wuhan.

|                              | Guangzhou¹ (N = 20) | Wuhan² (N = 99) | P value |
|------------------------------|----------------------|-----------------|---------|
| Treatment                    |                      |                 |         |
| Oxygen therapy               | 8 (40.0%)            | 75 (75.8%)      | 0.001   |
| Mechanical ventilation       | 2 (10.0%)            | 17 (17.2%)      | 0.738   |
| Non-invasive (ie, face mask) | 1 (5.0%)             | 13 (13.1%)      | 0.460   |
| Invasive                     | 1 (5.0%)             | 4 (4.0%)        | 1.000   |
| CRRT                         | 0 (0.0%)             | 9 (9.1%)        | 0.354   |
| ECMO                         | 0 (0.0%)             | 2 (3.0%)        | 1.000   |
| Antiviral therapy            | 16 (80.0%)           | 75 (76.0%)      | 0.781   |
| Kaletra*                     | 16 (80.0%)           | NA NA           |         |
| Arbidol                      | 13 (65.0%)           | NA NA           |         |
| Interferon alpha atomized inhalation | 5 (25.0%) | NA NA |
| Ribavirin                    | 1 (5.0%)             | NA NA           |         |
| Combination of two antiviral drugs | 9 (45.0%) | NA NA |
| Combination of three antiviral drugs | 4 (20.0%) | NA NA |
| Antibiotic therapy           | 17 (85.0%)           | 70 (70.7%)      | 0.271   |
| Glucocorticoids              | 4/25 (25.0%)         | 19 (19.2%)      | 0.350   |
| Intravenous immunoglobulin   | 6 (30.0%)            | 27 (27.3%)      | 0.789   |
| therapy                      |                      |                 |         |
| Thymosin alpha1              | 4 (3.0%)             | NA NA           |         |
| Chinese traditional medicine | 20 (100.0%)          | NA NA           |         |
| SARS-CoV-2 RNA positive at admission |      |                 |         |
| Nasopharyngeal swabs         | 20 (100.0%)          | 99 (100.0%)     | 1.000   |
| Feces (n/N, %)               | 4/7 (57.1%)          | NA NA           |         |
| Duration of SARS-CoV-2 RNA positive |          |                 |         |
| Nasopharyngeal swabs (N = 20) (days) | 12.0 (7.5, 15.5) | NA NA |
| Feces (N = 4 of 7) (range, days) | 4.0–16.0 | NA NA |
| Clinical outcome             |                      |                 |         |
| Outcome                      |                      |                 | 0.005   |
| Remained in hospital         | 6 (30.0%)            | 57 (57.6%)      |         |
| Discharged                   | 14 (70.0%)           | 31 (31.3%)      |         |
| Died                         | 0 (0.0%)             | 11 (11.1%)      |         |

Data are n (%) and mean (SD). N is the total number of patients with available data. COVID-19 = coronavirus disease-2019. SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2. CRRT = continuous renal replacement therapy. ECMO = extracorporeal membrane oxygenation. P values for comparing two groups were derived using Fisher's exact test for categorized variables and t-test for continuous variables. *Kaletra: Lopinavir and ritonavir.

By comparing cases from the Third Affiliated Hospital of Sun Yat-Sen University in Guangzhou from January 22 to February 12, 2020, the last follow-up was on February 18, 2020. #2 Diagnosed in Wuhan Jinyintan Hospital from January 1 to January 20, 2020, the last follow-up was on January 25, 2020. NA, not available.

hospitals could represent two stages of the epidemic, while treatment and follow-up time are the same, which may well reflect the changing clinical and epidemiological characteristics of the disease. The median ages of cases in Wuhan reported by Cao and Zhang were 49.0 and 55.5 years respectively [8,25], while patients in Guangzhou were relatively younger, with the median age of 43.2 years. There have been reports of cases in children, indicating all ages are susceptible [24]. Compared with patients in Guangzhou, patients in Wuhan were more severe, reflected by that Wuhan patients had a higher incidence of dyspnea and ARDS, higher levels of inflammatory biomarkers and worse prognosis. These differences could be due to age and pre-existing conditions [8,25,26]. However, in the present study, we did not observe an evident difference in underlying disease between Guangzhou
patients and Wuhan patients. We speculate that the differences may be related to that the diminishing pathogenicity of the virus after transmission of multiple generations [5, 27], however, further studies are required to confirm this hypothesis. Besides, patients in Guangzhou were more aware of the disease; thus, they visited the hospital at the earlier stage with less severe symptoms. Furthermore, given the experience in Wuhan, the health authorities in Guangzhou were well-prepared for the epidemic and were able to carry out comprehensive screening, early case identification and contact tracing and timely treatment.

In terms of clinical characteristics, we observed that the gastrointestinal symptoms such as diarrhea and vomiting were more prevalent in patients with later-onset in Guangzhou. Meanwhile, fecal RNA was positive in 4 out of 7 patients, indicating the possibility of gastrointestinal transmission. Xiao Fei also confirmed gastrointestinal infection by detecting SARS-CoV-2 in feces and gastrointestinal tissues [28]. These findings have important implications for patient triage and hospital risk zoning. Gastroenterologist outpatient medical staff could be at higher risk when encountering COVID patients, thus more aggressive PPE protection and proactive patient screening are necessary. In addition, sufficient education and protocols should be given to caregivers who could be exposed to the patients’ vomits and feces directly, and feces disposal should be managed properly to reduce environmental hazards. More importantly, we found that two patients’ fecal virus RNA turned negative 5 and 6 days later than the nasopharyngeal swab respectively, suggesting that transmission of virus is possibly prolonged, and fecal virus RNA may be an indispensable indicator for lifting quarantines. Given that some “recovered” cases being tested positive again a few days after discharge have been reported recently [29], our findings highlight the importance of fecal virus test for patient management and quarantines. The health authority may also have to re-consider quarantine strategy for possible extended case management time and burden when distributing health resources.

Our findings also suggest that the modes of transmission have changed considerably with the spread of the disease. A large fraction of early reported cases in Wuhan were linked to Huanan seafood markets, whereas none of cases in Guangzhou had a history of exposure to wildlife markets. Furthermore, 10 patients from Guangzhou were involved in seven cases of clustering. This finding suggests strong community transmission poses a great challenge to the entire prevention and control. It resonates with the concept that the transmissibility increases while virulence decreases as virus spread [30]. As indicated by Tang’s research, the L type of SARS-CoV-2 prevalent in the early stages of the outbreak in Wuhan, decreased after early January 2020, while the S type, which is less aggressive, has increased in relative frequency due to relatively weaker selective pressure [31]. Thus early detection and timely isolation is vital before a case becomes a cluster. It also raises the concern that the risk and benefit should be balanced in home quarantine for confirmed cases which could result in family case clusters.

At present, symptomatic, support treatment and airway maintenance are the main treatments, as there is no proven effective antiviral therapy. It is claimed that kaletra, remdesivir and chloroquine phosphate have antiviral effects from preliminary studies [32, 33], but the results of clinical trials are yet to be released. Patients in Guangzhou mainly use kaletra + arbidol, some with severe pulmonary inflammation added interferon atomized inhalation, which has also achieved good treatment effect. Nevertheless, further research with control groups would be helpful to differentiate whether the effect is caused by drugs or patients’ self-recovery of the disease.

Our study has limitations. First, the number of patients was small. Second, Wuhan cases are from published data, and more detailed information, such as the final prognosis of patients, could not be obtained.

In summary, our results suggest that the virulence of SARA-CoV-2 is possibly waning in the process of transmission and the clustering occurrence is becoming the primary model of transmission. In addition, our observation that fecal virus RNA turned negative later than the nasopharyngeal swab justifies that the concern of faecal-oral transmission and suggest that fecal virus RNA should be assessed before lifting quarantine.

Funding

This work was supported by the National Science and Technology Major Project, China [Bing-Liang Lin, 2018ZX10032204, Bing-Liang Lin, 2017ZX10023201003], Emergency special program for 2019-nCoV of Guangdong province science and technology project, China (GDSTP-ESP [Zhihong Gao, 2020B111105001] and Tackling of key scientific and emergency special program of Sun Yat-sen University, China [SYSU-TKSESP, Bing-Liang Lin]).

CRediT authorship contribution statement

Ziyiing Lei: Conceptualization, Investigation, Data curation, Formal analysis, Writing - original draft. Huijuan Cao: Formal analysis, Writing - original draft. Yusheng Jie: Investigation, Formal analysis. Zhanlian Huang: Investigation, Formal analysis. Xiaoyan Guo: Writing - original draft. Junfeng Chen: Investigation, Liang Peng: Resources. Hong Cao: Resources. Xiaoling Dai: Resources. Jing Liu: Formal analysis. Xuejun Li: Investigation, Jianyun Zhu: Investigation. Wenxiong Xu: Investigation. Dabiao Chen: Investigation. Zhihong Gao: Resources, Writing - review & editing, Funding acquisition, Supervision. Jian-Rong He: Conceptualization, Methodology, Data curation, Formal analysis, Writing - review & editing. Bing-Liang Lin: Conceptualization, Methodology, Data curation, Formal analysis, Writing - review & editing, Project administration, Funding acquisition.

Declaration of competing interest

The authors declare that they have no competing interests.

Acknowledgments

We thank all patients involved in the study. We thank Mr. Jonathan Hsu and Mrs. Xulan Fu for proofreading this manuscript. Jian-Rong He was supported by China Scholarship Council-University of Oxford Joint Reference.

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