Epidemiological and clinical characteristics of COVID-19 patients in Nanjing

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Abstract

Background: Since December 2019, the outbreak of COVID-19 has spread quickly and thumped many countries and regions. The epidemic of central China was under the spotlight and attracted much more attentions. However, there are few reports describing COVID-19 patients in the regions outside of Wuhan, which are undergoing the change from sporadic imported cases to community-acquired transmission.

Methods: The electronic medical records of 74 laboratory-confirmed patients of COVID-19 were retrospectively reviewed and analyzed. Their epidemiological, demographic, clinical and radiological characteristics were systematically summarized. The difference between severe patients and non-severe patients were also analyzed statistically.

Results: The 74 COVID-19 patients were composed of 4 (5.4%) mild patients, 56 (75.7%) common patients, 13 (17.6%) severe patients and 1 (1.4%) critical patient. 43 were male, and 31 were female, with the average age 48.1±17.5. No significant difference of susceptibility was observed between genders, and almost people with all age were susceptible to SARS-CoV-2 infection. Before Jan 26, only imported sporadic cases were observed. However, from that day onward, family cluster infection cases increased dramatically, up to 70.3% (52/74), which were mainly from 15 family. The incubation period spanned from 0 to 19 days, with the median 5, and 81.4% had symptom onset within 7 days. At admission, 31.1% of patients had underlying diseases and the most common underlying diseases were hypertension (13.5%) and diabetes (5.4%). The most common symptoms were fever (90.5%), cough (75.7%), fatigue (36.5%) and chest distress (32.4%). 36.5% and 16.2% of patients had leukopenia and lymphocytopenia. 43.2% of patients had increased C reactive protein (CRP), and 40.5% had higher erythrocyte sedimentation rate (ESR) and 21.6% had higher calcitonin. 74.3% of patients had obvious lesions in both lung lobes and 56.8% of lesions manifested as ground glass opacity. Compared with non-severe group, the severe/critical group were significantly older and had more underlying diseases. After treatment, all patients improved and were discharged. No medical professional infection and death case were reported.

Conclusion: The epidemic of COVID-19 in Nanjing were mainly caused by family cluster infection.

The entire prevalence and illness were much milder than those of Wuhan. The disease of COVID-19 could be controlled and cured.

Background

Emergence of 2019 novel coronavirus disease (COVID-19) has caused a large global outbreak, which is a major issue for public health [1]. COVID-19 is highly contagious, which could spread from person to person via airborne transmission and close contact [2]. The causative pathogen, SARS-CoV-2, is the seventh member of coronavirus family with human-infecting capability [3]. Genome analysis revealed that SARS-Cov-2 was more closely related to two SARS-like coronaviruses originated from bat, instead of SARS-CoV and MERS-CoV [4]. In addition, SARS-CoV-2 is still in the continuing evolution process and many mutations and deletions were found in its genome [5]. The newly emerged L-subtype displayed more pathogenesis and transmission capacity [6], which might change the epidemiological features of COVID-19.

Since the first cases of COVID-19 was reported in Wuhan, China has quickly launched the first-order response to block the infection source. Therefore, based on severity of illness and transmission pattern, the epidemic area in China could be divided into three cycles, including the epicenter Wuhan city, Hubei province (excluding Wuhan) and China (excluding Hubei) [7]. Nanjing is located southeast China, belonging to the third cycle, which is one of the most prosperous cities of Yangtze River Delta. To date, there was no report about clinical characteristics of COVID-19 patients in Nanjing. Our hospital, the second hospital of Nanjing, is the unique designed hospital for diagnosis and treatment of COVID-19 patients in Nanjing district. In this retrospective study, we for the first time summarized the epidemical, demographic, clinical and radiological characteristics of patients associated with COVID-19 in Nanjing.

Methods

We retrospectively reviewed and analyzed the electronic medical records of 74 patients with COVID-19 that fulfilled the case definitions for “confirmed cases” by Chinese Center for Disease Control and Prevention, who were admitted in our hospital from the afternoon of Jan 19 to the night of Feb 7, 2020. All those patients were test positive for SARS-COV-2 in their throat swab specimens by

quantitative reverse transcription polymerase chain reaction.

Based on severity of illness, all cases were divided into four types: mild, common, severe and critical. The mild patients had minor clinical symptoms and no lesions on chest CT image. The common patients had obvious symptoms like fever and cough, and lesions on chest CT image. The severe patients reached one of the following criteria. (a) respiratory distress, RR ≥ 30 times/min; (b) oxygen saturation ≤ 93% under quiescent condition; (c) arterial partial oxygen pressure (PaO_2)/oxygen absorption concentration (FiO_2) ≤ 300 mmHg. The critical type had either respiratory failure, or shock or multiple organ failure. In addition, asymptomatic patients were admitted to the hospital without any discomfort, but their respiratory tract specimens were positive for virus nucleic acid test. The dates of laboratory confirmation for asymptomatic patients was counted as their onset dates.

The t-test was used for the quantitative data conforming to the normal distribution, and the rank-sum test was used for the data not conforming to the normal distribution. The qualitative data were obtained by quadrature table chi-square test, calibration chi-square test or Fisher's exact probability test.

Results

Demographic and epidemical features of COVID-19 patients

From Jan 19 to Feb 7, our hospital enrolled 133 patients in total. Among them, 59 suspected cases were medically excluded. 74 patients were diagnosed as COVID-19 and admitted to our hospital. According to the diagnostic classification of COVID-19 patients (Methods), 74 patients were composed of 4 (5.4%) mild patients, 56 (75.7%) common patients, 13 (17.6%) severe patients and 1 (1.4%) critical patient. Of those 74 patients, 43 were male, and 31 were female. No significant difference of susceptibility was observed between males and females. The age ranged from 10 to 97, with the average 48.1±17.5. Only one 10-year old child was enrolled. Patients of 46-65 years old were dominant, accounting for 44.6%, followed by patients of 18-45 with 43.2% (Fig. 1A). Almost people with all age were susceptible to SARS-CoV-2 infection. It is worthy to note that the age of the severe/critical group was 64.1±18.2, and the age of the non-severe group (mild and common) was 44.3±15.2. The former was significantly older than the latter ($p<0.05$).

Epidemiological investigation showed that 32 (43.2%) patients had been to Hubei province before symptom onset, 15 (20.3%) had close contact with personnel with Hubei traveling history, 23 (31.1%) contacted closely with local patients without traveling history, and the remaining 4 patients had no clear memory about infection source (Fig. 1B). Among the 70 patients with explicit infection routes, the incubation period spanned from 0 to 19 days, with the median 5 (3, 7), and 81.4% (57/70) had symptom onset within 7 days. For the severe/critical group and the non-severe group, the median incubation period was 7 (5, 8) days and 4 (2, 6) days, respectively, suggesting that the severe/critical patients had significantly longer incubation period ($p<0.05$).

Remarkably, Jan 26 was the watershed of epidemic situation, before which only imported sporadic cases were observed. However, from that day onward, family cluster infection cases increased dramatically, up to 70.3% (52/74), which were mainly from 15 family. The biggest infection case involved in 10 family members.

Clinical symptoms of COVID-19 patients

Among the 74 patients, only 23 (31.1%) had underlying diseases. Of them, 10 patients had more than one underlying diseases. The most common underlying diseases were hypertension (13.5%, 10/74) and diabetes (5.4%, 4/74). 35.7% (5/14) of severe/critical patients and 8.3% (5/60) of non-severe patients had underlying diseases, which indicated that underlying diseases significantly aggravated the illness ($p<0.05$)

At admission, the most common symptoms for 74 patients of COVID-19 were fever (90.5%), cough (75.7%), fatigue (36.5%) and chest distress (32.4%) (Fig. 2A). 7 (9.5%) patients had no fever. 39 (52.7%) patients had body temperature between 38.1℃and 39℃, followed by 25 (33.8%) with 37.3-38℃ (Fig. 2B), suggesting that low to medium fever was dominant for COVID-19 patients. Fatigue, chest tightness and shortness of breath were respectively observed in 64.3% (9/14), 71.4% (10/14) and 57.1% (8/14) of the severe/critical patients, which were significantly higher than those in the non-severe patients with 30.0% (18/60), 23.3% (14/60) and 6.7% (4/60), respectively ($p<0.05$).

Laboratory examination result of COVID-19 patients

Regular laboratory examination found a few abnormal indicators among those patients. Firstly, 27

(36.5%) and 12 (16.2%) patients had leukopenia and lymphocytopenia, respectively. $CD3^+$ and $CD4^+$ T lymphocytes decreased in 23% (17/74) and 32.4% (24/74) of patients, respectively. For $CD8^+$ T cells, 23% (17/74) of patients decreased, but 5.4% (4/74) increased. Secondly, 32 (43.2%) patients had increased C reactive protein (CRP), 30 (40.5%) had higher erythrocyte sedimentation rate (ESR) and 16 (21.6%) had higher calcitonin (Fig. 2C). All patients had normal platelet count except one patient with thrombocytopenia. It was intriguing that all patients had normal level of IL-6. Compared with the non-severe patients, higher proportion of severe/critical patients had lymphocytopenia, increased CRP and ESR ($p<0.05$). Thirdly, analysis of hepatorenal function and myocardial enzymes indicated some abnormalities of enzyme spectrum. 27 (36.5%), 11 (14.9%) and 9 (12.2%) patients had increased level of LDH, ALT and AST, respectively. Also, 6 (8.1%) and 7 (9.5%) patients had higher level of total bilirubin and creatine phosphokinase, respectively. Furthermore, 32 (43.2%) of patients had higher myoglobin. However, decrease of serum potassium and serum sodium was observed in 17 (23%) and 10 (13.5%) patients (Fig. 2D). Troponin, urea nitrogen and creatinine were within normal range for all patients. At last, fibrinolysis test showed that part of patients had higher level of D-dimer (6.8%, 5/74), longer prothrombin time (16.2%, 12/74), prolonged prothrombin activity (12.2%, 9/74), and increased fibrinogen (17.6%, 13/74) (Fig. 2E).

Interestingly, respiratory pathogen detection revealed that 10 patients (13.5%) had co-infected with influenza virus type A or B.

Radiological findings of patients with COVID-19

Of the 74 patients, chest CT showed that 55 (74.3%) had obvious lesions in both lung lobes and 15 (20.3%) had lesion only within single lung lobe. It’s worthy to note that 4 (5.4%) patients had no apparent lesions in the lung. Among all the radiological manifestation, ground glass opacity accounted for 56.8%, followed by patchy opacity (36.5%), interstitial change (6.8%) and consolidation change (6.8%) (Fig. 2F).

Treatment and outcome

All the COVID-19 patients accepted the anti-virus treatment plan recommended by the National

Health Commission, which is composed of Lopinavir/Ritonavir (400/100 mg, po, BID), Arbidol (0.2 g, po, TID), and aerosol inhalation of IFN-α (5 million units, BID). For severe patients, extra measures were taken, including oxygen inhalation and methylprednisolone via intravenous drip (40 mg, QD) for 5 days. By the end of March 8, all patients improved reached the discharge standards of the National Health Commission, and were discharged to the isolation points for continuing medical observation. No death case was reported.

Discussion

On Jan 30, 2020, the outbreak of COVID-19 has been declared as global public health emergency by World Health Organization (WHO), which has raised major concern of many countries. However, because of the economical and geographical differences, epidemiological features may vary in different regions. Early infected patients lived in Wuhan city or had travel history to Wuhan. Most of the patients were severe and fatality was relatively high. Huang et al. reported the clinical features of the earliest 41 patients in Wuhan. 73% of the patients were men and 32% had underlying diseases. Especially, most patients had exposing history to Huanan seafood market [8]. Similarly, another report also mentioned that 49% of 99 patients in Wuhan had been to the Huanan seafood market. In a single-center case series involving in 138 patients in Wuhan, Wang et al. reported that 26% of patients were severe and admitted to ICU and finally 4.3% died. In addition, hospital-associated transmission was suspected to occur for 40 health professionals [9]. 400 km away from Wuhan, Nanjing had sporadic imported cases before Jan 26. After that, cluster of infection was outstanding. 70.3% of patients were mainly from 15 family. The median incubation period was 5 days and the longest one was 19 days. The crux of the matter was just the latency window. Many patients travelled back to Nanjing before Jan 24, at the night of which Jiangsu province launched first-order response. Coincidently, Jan 24 was Spring Festival, the most important holiday for all Chinese. The asymptomatic patients did not feel uncomfortable during celebrating the new year together with their relatives in Nanjing. Unfortunately, at that moment, it was not realized that asymptomatic patients or carriers were also infective [2, 10, 11]. That’s how family cluster infection occurred in Nanjing.

The main clinical symptoms of 74 patients in Nanjing were fever (90.5%), cough (75.7%), fatigue

(36.5%), and chest distress (32.4%), which were consistent with other reports [12, 13]. Compared with patients in Wuhan [14], the illness of Nanjing patients was much milder. By coincidence ,17.6% (13/74) of our patients were severe, which was the same to that of COVID-19 patients in Beijing district (17.6%, 46/262) [15]. Compared with the non-severe patients, the severe patients were older (64.1±18.2 vs 44.3±15.2) and had significantly more fatigue, chest tightness and shortness of breath. Also, the severe patients had more complicated comorbidities and longer incubation periods. One plausible scenario was weaker immune surveillance of elder patients granted virus more time to replicate. Once prepared well, the destruction of virus was more serious.

In the laboratory examination, some patients had leukopenia and lymphocytopenia, increased CRP and ESR, electrolyte disturbance, as well as increased level of LDH, ALT and AST, which suggested that the virus infection may induce cytokine storm *in vivo*. Also, those abnormal changes were significantly more distributed in patients with severe illness, indicating that they were indicators of disease progression. In addition, SARS-CoV-2 infection lead to abnormity of fibrinolytic indicators, such as increased D-dimer, longer prothrombin time and prolonged prothrombin activity, which reminds us to keep an eye on the occurrence of thrombotic diseases. Based on “Diagnosis and treatment of pneumonia associated with SARS-CoV-2 infection (Trial 5)”, 10% of COVID-19 patients were complicated with elevated levels of serum creatinine. However, serum creatinine of all the 74 patients in Nanjing was in the normal range. So were interleukin-6 and troponin. This may be due to the small sample size of our study or the regional difference. $CD4^+$ and $CD8^+$ T lymphocytes play crucial roles in the processes of antibody production, antigen activation, immune regulation and direct killing of virus [16, 17]. In this study, we found that the absolute values of all $CD3^+$, $CD4^+$ and $CD8^+$ T lymphocytes decreased to some extent in each group, suggesting that the coronavirus infection affected the cellular immunity and humoral immunity of the patients.

Conclusions

We for the first time summarized the epidemical, demographic, clinical and radiological characteristics of 74 patients associated with COVID-19 in Nanjing, southeast China, describing the change from imported sporadic cases to family cluster infection. The symptoms of COVID-19 patients

in Nanjing were much milder. Through elaborate treatment, all patients improved and were discharged.

Declarations

Ethics approval and consent to participate

Ethical approval for this study was reviewed by Institutional Review Board of the Second Hospital of Nanjing ((2020-LS-ky003)). Written consent from study participants was exempted since we used medical records reviewing without personal information.

Consent to publication

All authors have read and approved the manuscript.

Availability of data and materials

Data relating to this study are contained and presented in this document. Other materials are available from the corresponding authors on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

WC and CMH wrote the draft. LLH summarized all the clinical data. MC conducted statistical analysis. YCZ provided laboratory data. HXW, YC, ZLH, YZ, YSZ, YL and CC provided epidemiological and clinical data. HMZ and WXW analyzed the qPCR data. XZ and YXY conceived the study and approved the manuscript.

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Figures

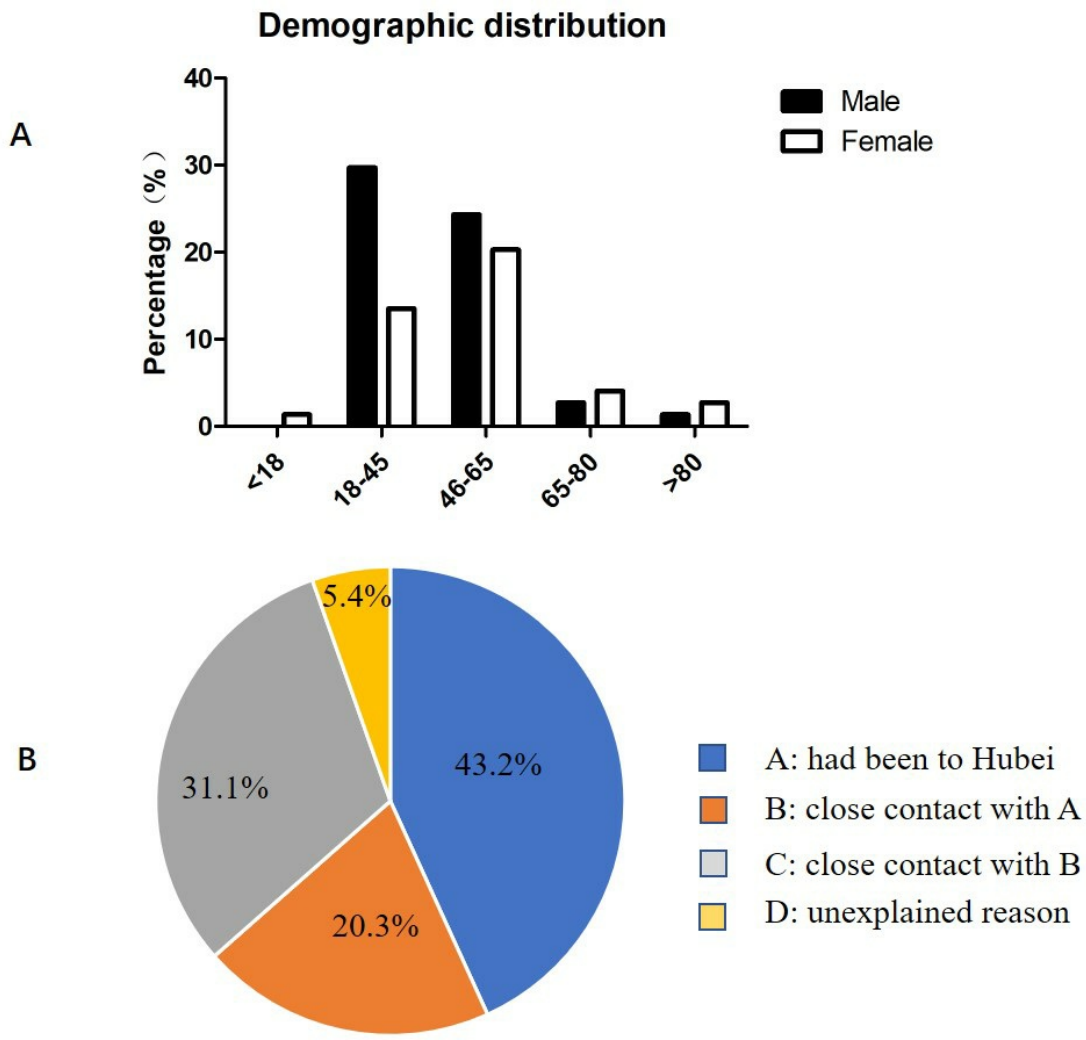

Figure 1

The demographical and epidemiological characteristics of COVID-19 patients in Nanjing.

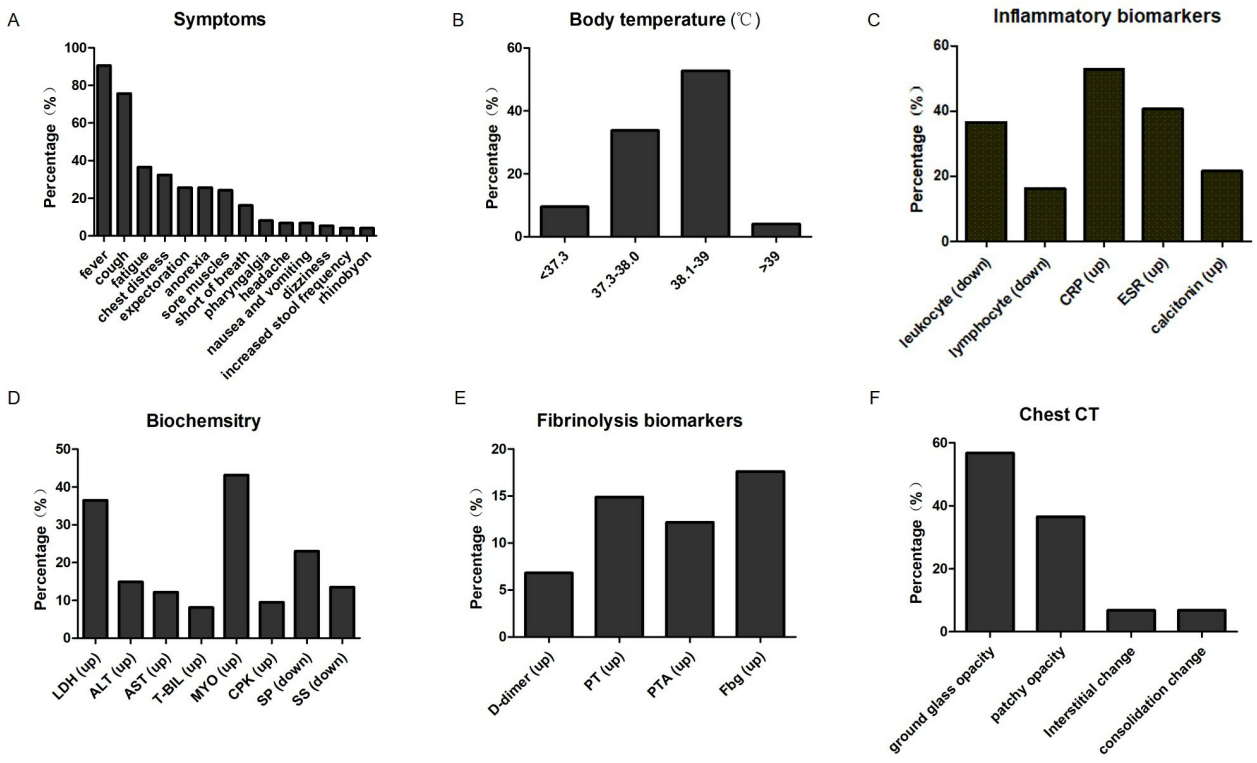

Figure 2

Clinical symptoms and laboratory examination of COVID-19 patients at admission. (A) main clinical symptoms. (B) body temperature. (C) abnormal inflammatory biomarkers. CRP: C reactive protein, ESR: erythrocyte sedimentation rate. (D) abnormal biochemistry indicators. LDH: lactate dehydrogenase, ALT: alanine aminotransferase, AST: aspartate aminotransferase, T-BIL: total bilirubin, MYO: myohemoglobin, CPK: creatine phosphokinase, SP: serum potassium, SS: serum sodium. (E): abnormal fibrinolysis biomarkers. PT: prothrombin time, PTA: prothrombin activity, Fbg: fibrinogen. (F) chest CT.

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