

Clinical Characteristics of 107 Patients with COVID-19 in Ningbo, China: Single Center Experience Outside Hubei

Boming Wu

Hwa Mei Hospital, University of Chinese Academy of Sciences

Junjie Li

Shanghai Jiao Tong University Medical School Affiliated Ruijin Hospital

Hongping Xuan

Hwa Mei Hospital, University of Chinese Academy of Sciences

Nanhong Zheng

Hwa Mei hospital, University of Chinese Academy of Sciences

Honghua Ye

Hwa Mei Hospital, University of Chinese Academy of Sciences

Yaoren Hu

Hwa Mei Hospital, University of Chinese Academy of Sciences

Tong'en Chen

Chinese Academy of Medical Sciences & Peking Union Medical College Hospital of Skin Diseases and Institute of Dermatology

Hao Ying

Hwa Mei Hospital, University of Chinese Academy of Sciences

Lingyan Fan

Hwa Mei Hospital, University of Chinese Academy of Sciences

Qing Xie

Shanghai Jiao Tong University Medical School Affiliated Ruijin Hospital

Zike Sheng (✉ shengz12@fudan.edu.cn)

Shanghai Jiao Tong University Medical School Affiliated Ruijin Hospital <https://orcid.org/0000-0001-6803-6729>

Yin Ying

Hwa Mei Hospital, University of Chinese Academy of Sciences

Research

Keywords: severe acute respiratory syndrome coronavirus 2, coronavirus disease 2019, clinical features, human-to-human, follow-up

DOI: <https://doi.org/10.21203/rs.3.rs-44830/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background Since December 2019, there has been an outbreak of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in Wuhan, China. Nowadays, it rapidly spread across the country and then worldwide. We aimed to investigate the clinical characteristics of patients with COVID-19.

Methods The patients with confirmed COVID-19 admitted between January 25 and February 10, 2020, were enrolled. Epidemiological, demographic, clinical, laboratory, radiological data, and antiviral therapies, were retrospectively collected and analyzed. The 90-day follow-up of these patients was also performed.

Results A total of 107 patients were included. The median age was 55.0 years (range from 18.0 to 85.0 years), and 72 (67.3%) were female. Ninety-three (86.9%) of the patients had a history of contacting with residents from Wuhan (n=31), or contacting with confirmed COVID-19 patients (n=62) within 2 weeks. Fifty-eight (54.2%) had a family cluster onset. Fever and cough were the most common symptoms. Only two patients had diarrhea. The most common underlying disease was hypertension. Lymphopenia was observed in 26 patients. Fifty-two patients with an elevated level of IL-6. On admission, bilateral patchy shadowing and ground-glass opacity were the typical radiological findings on chest computed tomography. Six patients had an intensive care unit (ICU) stay. Antiviral therapy was performed to all patients. 105 patients discharged with an improved condition, and no death was occurred during our 90-day follow-up for these patients.

Conclusions Patients with COVID-19 in our hospital had relatively mild symptoms, and good prognosis. This study also highlights the importance of human-to-human transmission in COVID-19.

Introduction

Since December 2019, a novel coronavirus, termed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has emerged in Wuhan city, Hubei province, China, and rapidly spread across the country and then worldwide. Due to its fast transmission, outbreak of SARS-CoV-2 has raised a global public health concern and attracted a wide attention.

SARS-CoV-2 could cause different clinical conditions, which named coronavirus disease 2019 (COVID-19) by the WHO. Among COVID-19, pneumonia is a common clinical manifestation, and can progress to severe acute respiratory syndrome, and even death. SARS-CoV-2 related pneumonia has been characterized, as well as the difference between the severe and non-severe cases [1–4]. Very recently, limited studies demonstrated the clinical characteristics of patients with COVID-19 [2, 3, 5–8]. Increasing evidence indicated the presence of person-to-person transmission of SARS-CoV-2. To date, although specific therapeutic drugs or vaccines for COVID-19 are not available, multi-center clinical trials to explore the efficacy and safety of antiviral agents are in progress.

However, with its globally continuously evolving and expansion, it is urgent to unravel more about SARS-CoV-2 and COVID-19. Moreover, to the best of our knowledge, nowadays, rare studies presented the follow-up of patients with COVID-19. The aims of this study are to describe the epidemiological and clinical features of 107 inpatients with laboratory-confirmed COVID-19 outside Wuhan, and the 90-day follow-up of these patients.

Patients And Methods

Patients

All hospitalized patients with laboratory-confirmed COVID-19, admitted to Hwa Mei Hospital from January 25 to February 10, were enrolled. Hwa Mei Hospital, located in Ningbo, Zhejiang province, is a tertiary teaching hospital and is designated for patients with COVID-19. This study was approved by the institutional ethics board of Hwa Mei Hospital, University of Chinese Academy of Sciences (PJ-NBEY -KY-2020-047-01). Oral consent was obtained from patients due to emerging infectious diseases.

Data Collection

The medical records of patients with COVID-19 were retrospectively reviewed by the attending physicians of our team. Clinical data, such as clinical manifestations, laboratory tests, imaging examinations, antiviral therapies, and epidemiological history, were extracted from the electronic records. The incubation period was defined as described previously [5]. The day of disease onset was defined as the time when the first symptom occurred. The time gap between disease onset and admission was noted. Patient with COVID-19 was confirmed when a positive result was recorded by real-time reverse-transcriptase polymerase-chain-reaction (RT-PCR) test for throat swab, or sputum specimens [2], and only these confirmed hospitalized patients were included for further analysis. The patients with COVID-19 were classified as non-severe (including uncomplicated illness and mild pneumonia) and severe according to the World Health Organization interim guidance [9]. Patients discharged when following criteria were met: a) body temperature normal for over 3 days, b) respiratory symptoms markedly improved, c) chest imaging suggesting inflammation alleviated remarkably, and d) ≥ 2 consecutively negative tests for respiratory sample for SARS-CoV-2 RNA with an interval over 24 h. The 90-day follow-up was carried out by the physicians communicating with the patients.

Statistical analysis

Categorical variables were recorded as frequencies rates and percentages, and continuous variables were noted by median, and interquartile range (IQR) values. SPSS (version 19.0) was used for analyzing the data.

Results

Clinical characteristics

A total of 107 patients with confirmed COVID-19 were enrolled. The demographic and clinical data are summarized in Table 1. Of the 107 patients, the median age was 55.0 years (range from 18.0 to 85.0 years, IQR, 39.0 to 64.0), and 72 (67.3%) were female. Ninety-three (86.9%) patients had a history of contacting with residents from Wuhan (n = 31), or contacting with patients with confirmed COVID-19 (n = 62) within 2 weeks. Fifty-eight (54.2%) of the 107 patients had a family cluster onset. Of the 107 patients, the median incubation period was 6 days (range from 1.0 to 17.0 days, IQR, 2.0 to 7.0), and the median duration between disease onset and admission were 6 days (range from 1 to 14 days, IQR, 4 to 9). No healthcare workers were infected by SARS-CoV-2 in this study, and all the cases were domestic.

Table 1
Characteristics of Patients with COVID-19

Characteristics	No.
Age, yrs	
Median (IQR)	55.0 (39.0–64.0)
Range No. (%)	
≤ 29	12.0 (11.2)
30–39	17.0 (15.9)
40–49	10.0 (9.3)
50–59	37.0 (34.6)
60–69	20.0 (18.7)
≥ 70	11.0 (10.3)
Sex No. (%)	
Female	72 (67.3)
Male	35 (32.7)
Epidemiology No. (%)	
Contacting with residents from Wuhan	31 (29.0)
Contacting with COVID-19 patients	62 (57.9)
Having a family cluster onset	58 (54.2)
Median incubation period (IQR), days	6.0 (2.0–7.0)
Median duration between disease onset and admission (IQR), days	6.0 (4.0–9.0)
Signs and symptoms No. (%)	
Fever	79 (73.8%)
Cough	44 (41.1%)
Expectoration	13 (12.2%)
Fatigue	7 (6.5%)
Sore throat	6 (5.6%)
Chills	2 (1.9)
Nasal congestion	2 (1.9)
Rhinorrhoea	2 (1.9)

Characteristics	No.
Dizziness	2 (1.9)
Headache	2 (1.9)
Shortness of breath	2 (1.9)
Chest tightness	2 (1.9)
Nausea	3 (2.8)
Diarrhoea	2 (1.9)
Poor appetite	1 (0.9)
Underlying disorders No. (%)	
Hypertension	23 (21.5)
Diabetes	12(11.2)
Chronic liver diseases	11 (10.3)
Chronic obstructive pulmonary disease	3 (2.8)
Coronary heart disease	2 (1.9)
Cancer	2 (1.9)
Chronic gastritis	1 (0.9)
Hyperlipidemia	1 (0.9)
Antivirus treatment No. (%)	
Lopinavir/ritonavir + interferon α -2b	48 (44.9)
Lopinavir/ritonavir + interferon α -2b + chloroquine	29 (27.1)
Lopinavir/ritonavir + interferon α -2b + arbidol	14 (13.1)
Lopinavir/ritonavir + interferon α -2b + chloroquine + ribavirin	1 (0.9)
Interferon α -2b + chloroquine	11 (10.3)
Interferon α -2b + arbidol	3 (2.8)
Interferon α -2b	1 (0.9)

There were four patients without symptoms had a positive throat swab for SARS-CoV-2 by RT-PCR. Among the 103 remaining patients, on admission the most common symptoms were fever (n = 79, 73.8%), cough (n = 44,41.1%), following by expectoration (n = 13, 12.2%) and fatigue (n = 7, 6.5%) (Table 1). Of the 79 patients with fever, most patients (n = 73, 92.4%) had a body temperature less than

39°C. Only one (0.9%), two (1.9%), and three (2.8%) patients presented with poor appetite, diarrhea, and nausea, respectively.

Forty (37.4%) patients were with underlying disease(s), and the most common were hypertension (n = 23, 21.5%), diabetes (n = 12, 11.2%), and chronic liver diseases (n = 11, 10.3%) (Table 1). Of the 23 patients with hypertension, 12 were taking angiotensin-converting enzyme inhibitor (ACEI). During hospitalization, 94 and 13 patients were classified into non-severe and severe subgroups, respectively. Among the 13 severe patients, 8 (8/13, 61.5%) had underlying disorders (hypertension, n = 4; hypertension plus chronic liver disease, n = 1; hypertension plus diabetes, n = 1; chronic liver disease, n = 1; chronic obstructive pulmonary disease, n = 1). Of 6 severe patients with hypertension, three were taking ACEI.

Laboratory And Radiologic Findings

When they admitted, blood cell counts and levels of C-reactive protein (CRP) were performed in all of patients. Lymphopenia and leukopenia occurred in 26 (24.3%) and 20 (18.7%) patients, respectively (Table 2). Increased levels of CRP were observed in 70 (65.4%) patients, while elevated levels of procalcitonin (PCT) were only noted in two patients (1.9%). Elevated levels of alanine aminotransferase (ALT) and lactate dehydrogenase (LDH) were seen in 10 (9.4%) and 30 (28.0%) patients, respectively.

Table 2
Laboratory and Radiological Findings of Patients with COVID-19

Findings	No. (%)
Laboratory findings	
Leucocytes (normal range 3.5–9.5, × 10 ⁹ /L)	
≥9.5	2 (1.9)
≤3.5	20 (18.7)
Lymphocytes (normal range 0.8-4.0, × 10 ⁹ /L)	
≥4.0	0
≤0.8	26 (24.3)
Hemoglobin (normal range 130–175, g/L)	
≥175	0
≤130	46 (42.3)
Platelets (normal range 125–350, × 10 ⁹ /L)	
≥350	4 (3.7)
≤125	11 (10.3)
C-reactive protein (normal range 0–6, mg/L)	
≥6	70 (65.4)
Procalcitonin (normal range 0.0–0.5, ng/mL)	
≥0.5	2 (1.9)
Erythrocyte sedimentation rate (normal range 0.0–15.0, mm/h)	
≥15	89 (94.7)
Interleukin-4 (normal range 0.0-2.8, pg/mL)	
≥2.8	17 (17.3)
Interleukin-6 (normal range 0.0-5.3, pg/mL)	
≥5.3	52 (53.1)
Interleukin-10 (normal range 0.0-4.9, pg/mL)	
≥4.9	27 (27.6)
Tumor necrosis factor-α (normal range 0.0-2.3, pg/mL)	
≥2.3	9 (9.2)

Findings	No. (%)
Alanine aminotransferase (normal range 15–40, IU/L)	
≥40	10 (9.4)
Lactate dehydrogenase (normal range 120–250, IU/L)	
≥250	30 (28.0)
Chest computed tomography scan	
Normal	9 (8.4)
Abnormal	98 (91.6)
Bilateral patchy shadowing	75 (70.1)
Ground-glass opacity	19 (17.8)
Lung consolidation	4 (3.7)

On admission, levels of erythrocyte sedimentation rate (ESR) were detected in 94 patients, and 89 (94.7%) had an abnormal result (≥ 15 mm/h). A total of 98 patients had a test of tumor necrosis factor- α , interleukin (IL)-4, IL-6, and IL-10, and 9 (9.2%), 17 (17.3%), 52 (53.1%), and 27 (27.6%) of them had an increased level, respectively.

On admission, all of the 107 patients underwent chest computed tomography (CT) scan. Nine (8.4%) patients were with normal CT findings, and 98 (91.6%) patients had abnormal findings (Table 2). The most common CT manifestation was bilateral patchy shadowing ($n = 75$, 70.1%) and ground-glass opacity ($n = 19$, 17.8%) (Fig. 1). The CT image of the remaining 4 (3.7%) patients shown lung consolidation.

Antivirus Treatment

Antivirus therapy was performed to all patients (Table 1). Of the 107 patients, 48 (44.9%) patients received lopinavir/ritonavir and interferon α -2b treatment. Twenty-nine (27.1%), fourteen (13.1%), and eleven (10.3%) patients received lopinavir/ritonavir and interferon α -2b plus chloroquine, lopinavir/ritonavir and interferon α -2b plus arbidol, and interferon α -2b plus chloroquine, respectively.

Clinical Outcomes

The median length of hospitalization was 14.0 days (IQR, 10.0 to 18.0, range from 2.0 to 31.0 days). Thirteen (12.1%) patients progressed to severe pneumonia, and 6 of them had an ICU stay due to the presence of organ dysfunction. However, 105 of the 107 patients discharged with an improved condition. The remaining two patients who transferred to another hospital still stayed in ICU (one underwent liver

transplant before infected by SARS-CoV-2, and another underwent lung transplant due to severe COVID-19). As of May 19, 2020, 90-day follow-up for the discharged 105 patients with confirmed COVID-19 was completed, and no death was occurred during our follow-up.

Discussion

This study firstly reported the 90-day follow-up of patients with COVID-19, and all the cases survived during our follow-up. The median duration between disease onset and admission were 6 days in this study, which was shorter than those cases reported from Wuhan [2, 3]. In addition, all of the patients received an antivirus treatment in this study. Actually, to explore the efficacy of antivirus agents for SARS-CoV-2, multi-center clinical studies are ongoing in China.

Severe cases accounted for 12.1% in this study. Similarly, Guan *et al.* reported severe illness occurred in 15.7% of the 1009 patients with COVID-19 [5]. Whereas, another two studies outside Wuhan demonstrated lower rates of severe cases in China [7, 8]. On the other hand, studies from Wuhan reported relative high rates of patients who had an ICU stay [1, 3]. No death happened in our study, while the mortality rate of COVID-19 ranged from 0 to 15% in previous studies [1, 2, 4–8]. These discrepancies may result from the various sample sizes, inclusion criteria, and different stages of the disease. Taken together, early detection and early intervention likely contributes to improve the prognosis of COVID-19.

Currently, the confirmed origin of SARS-CoV-2 is yet unknown. However, increasing evidence demonstrates it could spread effectively among human beings [8, 10, 11]. Most (86.9%) patients had a history of contacting with residents of Wuhan or the patients with COVID-19 in the present study, which is in agreement with previous studies [4, 5, 8]. Surprisingly, over 50% of the patients had a family cluster onset in this study. These results indicated that the importance of human-to-human transmission in SARS-CoV-2. The main transmission routes of SARS-CoV-2 are considered to be respiratory droplets and direct contact [5]. Gastrointestinal tract and urine are potential transmission routes of SARS-CoV-2, which needs to be confirmed. To date, with the threat of COVID-19 worldwide, effective measures to block the transmission routes are urgent.

A few patients were without any symptoms after being infected by SARS-CoV-2. However, fever (mainly mild to moderate) and cough were the most common symptoms of our patients with COVID-19 in this study, which was in agreement with recent studies [2, 3, 5, 6]. Gastrointestinal symptoms were not common in COVID-19. The most common underlying disease was hypertension in this study. These were in accordance with previous studies [1, 2, 5, 6, 12].

Approximately a quarter of the patients had a lymphopenia in this study, which was lower than those reported in recent studies [2, 5–8]. Different disease stages might result in this. Increased levels of inflammatory factors CRP and ESR were frequently occurred in the present study, while upregulated levels of PCT were uncommonly observed in patients with COVID-19. The level of LDH was increased in a relative high rate of patients in this study. These results were similar with recent publications [2, 5, 7].

As showing in this study, chest CT scan of patients with COVID-19 could be normal, lung consolidation, ground-glass opacity, and bilateral patchy shadowing, and the latter two were most common. These findings were consistent with published studies [1, 5, 13–15]. Different stages of COVID-19 may result in various radiological manifestations [16].

This study has limitations. First, respiratory samples were used to confirm the presence of COVID-19 by RT-PCR. Due to newly emerging of SARS-CoV-2, the false negative may be inevitably existed, which would influence the findings of the study. Second, no pediatric patients included in the present study, because Hwa Mei Hospital is an adult hospital, and pediatric patients with COVID-19 were designated to a children hospital. Third, cases were all from one hospital in this study.

Conclusions

In the present study, among the 107 domestic hospitalized patients with confirmed COVID-19 in Ningbo, China, most (89%) had a history of contacting with residents in Wuhan or patients with COVID-19. Further, more than half of patients had a family cluster. A 90-day follow-up of the discharged patients with COVID-19 revealed a satisfactory prognosis, which may be attributed to early detection and early intervention.

Abbreviations

COVID-19, coronavirus disease 2019; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; RT-PCR, real-time reverse-transcriptase polymerase-chain-reaction; IQR, interquartile range; ACEI, angiotensin-converting enzyme inhibitor; CRP, C-reactive protein; PCT, procalcitonin; ALT, alanine aminotransferase; LDH, lactate dehydrogenase; ESR, erythrocyte sedimentation rate; IL, interleukin; CT, computed tomography; ICU, intensive care unit.

Declarations

Statement of Ethics

This study was approved by the institutional ethics board of Hwa Mei Hospital, University of Chinese Academy of Sciences (PJ-NBEY -KY-2020-047-01).

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Conflict of Interest

None.

Funding

This study was supported by the funding from the National Natural Science Foundation of China (NO. 81703567 to J. Li, and NO. 81603166 to Z. Sheng), the 2019 Coronavirus (Covid-19) Platform Project of Hwa Mei Hospital, Chinese Academy of Sciences (2020 HMZD21 to L. Fan), and the Shanghai Municipal Key Clinical Specialty (Infectious disease, YW20190002 to Q. Xie). The funding bodies did not play a role of in the design of the study and collection, analysis, and interpretation of data and in writing the manuscript.

Acknowledgments

The authors thank all of the patients, the nurses, and the physicians.

Authors' contributions

BW, and HX, study design, and data collection and analysis;

JL, study design, data interpretation and analysis, and manuscript drafting;

NZ, data collection,

HOY, YH, and HAY, study design, manuscript revision;

TC, and LF, data interpretation and analysis;

QX, manuscript revision;

ZS, and YY, study conception and design, data interpretation and analysis, manuscript drafting and revision;

All authors approved the final submission.

References

1. Wang D, Hu B, Hu C, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA* 2020.
2. Wang Y, Li X, Ren L, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020;395(10223):497–506.
3. Zhang JJ, Dong X, Cao YY, et al. Clinical characteristics of 140 patients infected with SARS-CoV-2 in Wuhan, China. *Allergy* 2020.
4. Tian S, Hu N, Lou J, et al. Characteristics of COVID-19 infection in Beijing. *J Infect* 2020.
5. Guan WJ, Ni ZY, Hu Y, et al. Clinical Characteristics of Coronavirus Disease 2019 in China. *N Engl J Med* 2020.
6. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet*. 2020;395(10223):507–13.
7. Wu J, Liu J, Zhao X, et al. Clinical Characteristics of Imported Cases of COVID-19 in Jiangsu Province: A Multicenter Descriptive Study. *Clin Infect Dis* 2020.
8. Xu XW, Wu XX, Jiang XG, et al. Clinical findings in a group of patients infected with the 2019 novel coronavirus (SARS-Cov-2) outside of Wuhan, China: retrospective case series. *BMJ*. 2020;368:m606.
9. WHO. Clinical management of severe acute respiratory infection when novel coronavirus (nCoV) infection is suspected.
10. Phan LT, Nguyen TV, Luong QC, et al. Importation and Human-to-Human Transmission of a Novel Coronavirus in Vietnam. *N Engl J Med*. 2020;382(9):872–4.
11. Chan JF, Yuan S, Kok KH, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *Lancet*. 2020;395(10223):514–23.
12. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* 2020.
13. Yang W, Cao Q, Qin L, et al. Clinical characteristics and imaging manifestations of the 2019 novel coronavirus disease (COVID-19): A multi-center study in Wenzhou city, Zhejiang, China. *J Infect* 2020.
14. Zhao W, Zhong Z, Xie X, Yu Q, Liu J. Relation Between Chest CT Findings and Clinical Conditions of Coronavirus Disease (COVID-19) Pneumonia: A Multicenter Study. *AJR Am J Roentgenol* 2020: 1–6.
15. Xu YH, Dong JH, An WM, et al. Clinical and computed tomographic imaging features of novel coronavirus pneumonia caused by SARS-CoV-2. *J Infect* 2020.
16. Shi H, Han X, Jiang N, et al. Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study. *Lancet Infect Dis* 2020.

Figures

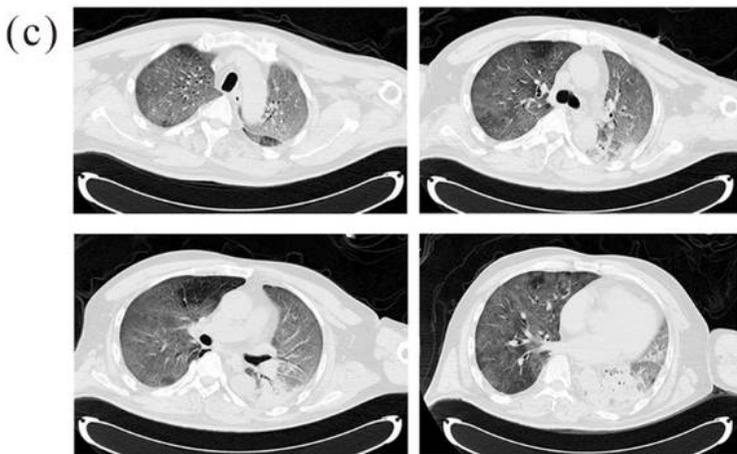
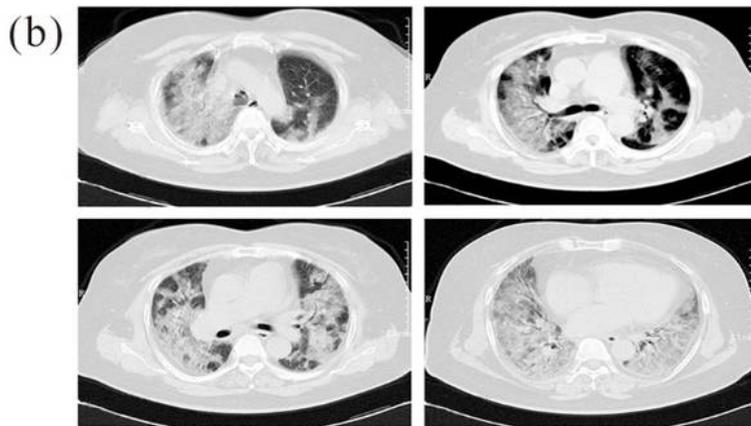


Figure 1

Transverse chest CT scans in patients with COVID-19 pneumonia. (a) two non-severe cases, a' and b', 55-year-old woman, day 7 after symptom onset; c' and d', 64-year-old woman, 6-day after symptom onset. bilateral, peripheral patchy shadowing was noted. (b) a severe case, 65-year-old woman, day 12 after symptom onset, predominant bilateral lung consolidation was noted. (c) a severe case, 63-year-old man,

day 7 after symptom onset, predominant bilateral ground-glass opacity with subsegmental lung consolidation was noted.