

# First cured patient with 2019 novel coronavirus in Changsha, China, a case report

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## Case report

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# Abstract

**Background:** In December, 2019, the novel coronavirus (2019-nCoV) firstly occurred in Wuhan, Hubei Province, China. It spreads rapidly and many cases are identified in multiple countries, which pose a great threat to people's health. Here we report the first cured patient with 2019-nCoV infection in Changsha, China, and the symptoms, diagnosis, treatment and management of this patient are all described in the present study.

**Case presentation:** A 57 year old woman developed cough and fever after returning from Wuhan to Changsha on January 9, 2020. She was tested positive for 2019-nCoV infection, which was supported by Chest CT. Lopinavir and ritonavir tablets and interferon alfa-2b injection were used for treatment. A small dose of glucocorticoids were used in a short period to control the immune response in bilateral lung and this patient avoided the occurrence of cytokine storms. The clinical condition of this patient improved and negative result was obtained for 2019-nCoV assay on January 25, 2020. This patient was recovered and discharged on January 30, 2020.

**Conclusions:** At present, many reports about 2019-nCoV infection focused on the epidemiological and clinical characteristics of this disease. This case described the symptoms, diagnosis, treatment and management of a cured patient with 2019-nCoV infection, which may provide information for the treatment of 2019-nCoV infection.

## Background

Infection with 2019-nCoV can lead to severe respiratory diseases. At the beginning of December, 2019, a cluster of PATIENTS WITH 2019-NCOV INFECTION WERE REPORTED IN China.[1, 2] [3] Previous report about 2019-nCoV indicates that human-to-human transmission of 2019-nCoV is occurring[4]. As of February 11, 2020, a total of 40235 cases and 40528 cases had been detected in China and around the world, respectively.[5] Epidemiological clinical features were reported in several studies.[4, 6, 7] The first case of 2019-nCoV infection in the United States were reported on January 20, 2020 and the clinical condition of this patient appeared to be improved following treatment with intravenous remdesivir.[8] Here we describe the symptoms, diagnosis, treatment and management of the first cured patient with 2019-nCoV infection in Changsha, China.

## Case Presentation

On January 16, 2020, a 57 year old woman came to Emergency Department of the First Hospital of Changsha City, China. After 10 minutes, She was taken into the examination room and evaluated by the emergency physician. According to the chief complaint of this patient, she developed cough and fever with general weakness and muscle aches after returning from Wuhan to Changsha 7 days ago. Given her symptoms and recent travel history, she decided to see a health care provider. The patient has a history of hypertension, carotid plaque, hypothyroidism, and chronic gastritis without the habit of smoking or

drinking. The physical examination indicated a body temperature of 38.0°C, blood pressure: 143/76 mmHg, pulse: 78 beats per minute, respiratory rate: 13 breaths per minute, and oxygen saturation: 96%. She had congestion in throat and thick breath sounds in the lungs. Considering abnormal breath sounds in lung, we performed examination of chest CT, which revealed pneumonia in both side of the lung (Fig. 1A). Both of nucleic acid amplification test (NAAT) for influenza A and B were negative. Given the patient's travel history and CT finding, the Hunan province and Chinese Center for Disease Control and Prevention (CCDC) were immediately notified. CCDC staff required us to test the patient for 2019-nCoV even though the patient reported that she had never been to the Huanan seafood market and reported no known contact with ill persons in the past one month. Specimens were collected following CCDC guidance. After specimen collection, she was admitted to the isolation ward of the First Hospital of Changsha City. On admission, the patient reported persistent dry cough, fatigue, headache, sore throat and chest pain for a week. On physical examination, the patient was found to have congestion in throat without other remarkable finding.

On hospital days 2 - 4 (illness days 8 - 10), the patient's vital signs remained largely stable. She reported cough and sore throat were worse than before, accompanied by chest pain and a small amount of sputum. Intermittent fevers and sore throat were still reported (Table 2). Supportive treatment was performed in this stage and methylprednisolone sodium succinate 40mg QD intravenously guttae was given to inhibit inflammation in lung. During this period, we found that the patient developed melena in the morning so that we should be aware of the possibility of upper gastrointestinal bleeding. Patients were treated with pantoprazole for acid suppression. Ambroxol (30mg BID intravenously guttae) and limonene and pinene enteric soft capsules (0.3g TID peros) were used to expel sputum. Laboratory results on hospital days 1 - 3 (illness days 7 - 9) reflected leukopenia, neutropenia, lymphopenia and reduced hematocrit. Additionally, elevated levels of lactate dehydrogenase and C-reactive protein were found (Table 1).

On hospital day 4 (illness day 10), re-examination of lung CT shows progress in lung inflammation (Fig. 1B). The usage for methylprednisolone sodium succinate changed to 40mg Q12H intravenously guttae and human immunoglobulin (PH4) 5g BID was added via intravenously guttae to inhibit inflammation in lung. Given the clinical presentation, treatment with piperacillin sodium and tazobactam sodium (4.5g Q8H intravenously guttae) and moxifloxacin hydrochloride and sodium chloride injection (0.4g QD intravenously guttae) was initiated.

On hospital day 5 (illness day 11), the CCDC confirmed that the oropharyngeal swabs of this patient tested positive for 2019-nCoV by real-time reverse transcriptase-polymerase chain reaction (rRT-PCR) assay. According to the suggestion of *The Diagnosis and Treatment of Pneumonitis with 2019-nCoV Infection* (DTPI) published by National Health Commission of the PRC, lopinavir and ritonavir tablets (2 pills BID peros), which were used for HIV infection in the past, as well as interferon alfa-2b injection (5 million IU add into 2ml of sterile water, inhalation BID) were given into the treatment for this patient. On hospital day 8 (illness day 14), the temperature of this patient dropped to 36.4°C. Moreover, her appetite improved and she was asymptomatic apart from fatigue and chest pain. CT scans showed that the

patchy lesions in bilateral lung are absorbed compared to the CT image obtained previously (Fig. 1C). Methylprednisolone sodium succinate was discontinued. On hospital day 9 (illness day 15), blood pressure of this patient dropped to 85/55mmHg. Therefore, Shenmai injection 50mg QD intravenously guttae was used and the patient's blood pressure rose to 113/70mmHg. On hospital day 10 (illness day 16), negative result was obtained for 2019-nCoV assay. This patient reported that she stopped cough and fever with clinical condition improved. Lopinavir and ritonavir tablets were discontinued on hospital day 10 (illness day 16). Interferon alfa-2b injection and antibiotics were discontinued on hospital day 11 (illness day 17). On hospital day 14 (illness day 20), this patient retested negative for 2019-nCoV by rRT-PCR assay and was discharged on January 30, 2020 (hospital day 15, illness day 21).

## Methods

### Diagnosis process

According to DTPI, this case was diagnosed based on epidemiological history and clinical manifestations:

1. Epidemiological history (Comply with any one of the following):

- (1) Travel history or residence history in Wuhan, China within 14 days before the onset of illness;
- (2) Been exposed to patients with fever or respiratory symptoms from Wuhan city within 14 days before the onset of illness;
- (3) Aggregative onset or epidemiological association with new coronavirus infection.

2. Clinical manifestations (Comply with any two of the following):

- (1) Fever ( $>37.3^{\circ}\text{C}$ );
- (2) With imaging characteristics of pneumonia;
- (3) The total number of white blood cells is normal or decreased, or the lymphocyte count is decreased in the early stage of onset.

3. Laboratory testing

- (1). Testing positive for 2019-nCoV via rRT-PCR;
- (2). The results of sequencing using respiratory specimens or blood specimens are highly homologous with 2019-nCoV.

### Laboratory testing

The laboratory test assays of 2019-nCoV were conducted according to the WHO recommendation.[9] Laboratory identification of 2019-nCoV was performed in three different institutions: The First Hospital of Changsha City, Hunan CDC and CCDC. Upper and lower respiratory tract specimens were obtained from this patient for three times (hospital day 3, 8 and 13). RNA was obtained and further tested by rRT-PCR through the same method described in previous study [2]. Other respiratory viruses (influenza A virus, influenza B virus, respiratory syncytial virus and) parainfluenza virus were also tested in this study. In addition, this patient were given chest x-rays and chest CT.

## Result

CT imaging showed multiple patchy shadows and cord-like ground-glass opacity (GGO) under the pleura and bilateral lung (hospital day 1, illness day 7, Fig. 1A). Furthermore, a second chest CT indicated that the texture of the trachea and blood vessels in both lungs became thicker. GGO increased and the original GGO was consolidated (hospital day 4, illness day 10, Fig. 1B). The oropharyngeal swabs were obtained from this patient on hospital day 3, 8 and 13. Positive result for 2019-nCoV was indicated on hospital day 5. On hospital day 8 (illness day 14), 3 days after treatment using lopinavir and ritonavir tablets combined with interferon alfa-2b injection, a third chest CT indicated that the patchy lesions in bilateral lung were absorbed compared to the CT imaging obtained on hospital day 4, and the fiber shadow was increased (Fig. 1C). On hospital day 10 (illness day 16), the 2019-nCoV infection of this case was checked by rRT-PCR assay and negative result was obtained. On hospital day 15 (illness day 21), a fourth CT showed that the consolidation images of bilateral lung were further absorbed than before. The fiber strands were reduced and GGO increased slightly (Fig. 1D). The 2019-nCoV infection of this case was rechecked and negative result was obtained.

## Discussion And Conclusions

The number of infections of 2019-nCoV is increasing and and so is the death toll.[10, 11] At present, the full spectrum and transmission dynamics are not fully understood by us. In this report, we described a cured case of 2019-nCoV in Changsha, China. Treatment using lopinavir and ritonavir tablets combined with interferon alfa-2b injection obtained good curative effect, while we need to be careful about the side effects of lopinavir and ritonavir tablets on blood pressure, etc. During the progress of the patient's disease, a small dose of glucocorticoids were used to control the immune response and the patient avoided the occurrence of cytokine storms, thereby reducing the risk of complications such as acute respiratory distress syndrome (ARDS) in patients. During the Severe Acute Respiratory Syndrome (SARS) period in 2003, usage of high doses glucocorticoids caused a series of sequelae in survivors such as osteonecrosis of the femoral head and glucose metabolism disorders. In view of this lesson, we gave a small dose (40–80 mg/day) of glucocorticoid therapy in a short period (5 days) and adjusted the dose and time of medication according to the dynamic changes of the patient's chest CT imaging, which achieved good results.

The case in this study reported that she returned from Wuhan to Changsha without visiting Huanan seafood market. Previous study revealed the evidence about 2019-nCoV indicating person-to-person transmission.[12] Up to February 4, 2020, no secondary cases of 2019-nCoV related to this patient have been confirmed. What we have know about the clinical spectrum of 2019-nCoV infection is very limited at present. According to several reports, many complications related to 2019-nCoV have been reported.[2, 6, 13] In this study, this patient initially manifested fever and cough with eukopenia, neutropenia and lymphopenia. The report about first case of 2019-nCoV in the United States indicated no sign of pneumonia on chest X-Ray on illness day 4, which indicated that this disease may have a latency period. The nonspecific signs of 2019-nCoV infection may be clinically different from some other infectious diseases. Currently, it has been implemented in many hospitals in China to use lopinavir and ritonavir tablets combined with interferon alfa-2b injection. In this report, this patient achieved good results by using the medicine above-mentioned, while more study are needed to confirm the effect of this therapeutic schedule. Now a multicenter randomized controlled trial of treatment 2019-nCoV using lopinavir and ritonavir tablets is underway in China.

In the present study, this case indicates the need to confirm the full spectrum, and pathogenesis related to 2019-nCoV infection. More information about this disease is still needed for clinical management. We should make every possible effort to control this infectious disease.

## Abbreviations

2019-nCoV

The novel coronavirus

GGO

Ground-glass opacity

CCDC

Chinese Center for Disease Control and Prevention

NAAT

Nucleic acid amplification test

rRT-PCR

real-time reverse transcriptase-polymerase chain reaction

DTPI

The Diagnosis and Treatment of Pneumonitis with 2019-nCoV Infection

ARDS

Acute respiratory distress syndrome

SARS

Severe Acute Respiratory Syndrome

## Declarations

### Ethics approval and consent to participate

This study was approved by the Second Xiangya Hospital of Central South University Committee for Clinical Research and all methods were in accordance with the Declaration of Helsinki. All participants provided written consent form to participate in this study. All methods were performed in accordance with the relevant guidelines and regulations.

### **Consent for publication**

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

### **Availability of data and materials**

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

### **Competing interests**

The authors declare no competing interests.

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### **Author contributions**

Jian Zhou, Di-xuan Jiang, Zi-qin Cao and Wan-chun Wang conceived and designed the study, and critically revised the manuscript. Jian Zhou, Wanchun Wang and Zhi-guo Zhou carried out the experiments and drafted the manuscript. Kang Huang, Fang Zheng and Yuan-lin Xie contributed to the revision of the manuscript. All authors read and approved the final manuscript.

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## Table

Table 1. Clinical Laboratory Results.

Measure	Reference range	16	17	18	19	20	21	22	23	24	26	29	30
White-cell count (10 <sup>9</sup> /L)	4-10	2.45*	2.29*	2.2*	6.15	8.56	9.73	9.33	4.82	4.3	4.21	6.88	6.12
Red-cell count (10 <sup>12</sup> /L)	3.5-5.5	3.96	3.8	4.4	3.96	4.11	4.1	4.18	3.99	4.07	4.1	3.43*	3.6
Absolute neutrophil count (10 <sup>9</sup> /L)	2-7	1.75*	1.44*	1.45*	5.34	7.97 <sup>#</sup>	9.21 <sup>#</sup>	8.59 <sup>#</sup>	4.08	2.92	2.32	4.7	3.86
Absolute lymphocyte count (10 <sup>9</sup> /L)	0.8-4	0.6*	0.73*	0.69*	0.62*	0.45*	0.32*	0.43*	0.49*	0.92*	1.39*	1.48*	1.6*
Platelet count (10 <sup>9</sup> /L)	100-300	145	139	181	203	231	290	326 <sup>#</sup>	326 <sup>#</sup>	358 <sup>#</sup>	342 <sup>#</sup>	325 <sup>#</sup>	358 <sup>#</sup>
Hemoglobin (g/L)	110-160	110	106*	122	108*	114	113	114	110	111	111	94*	100*
Hematocrit (%)	37-54	34.4*	32.8*	38.1	34.1*	35.1*	35.1*	35.8*	34*	35.1*	35.6*	30.1*	31.4*
Potassium (mmol/L)	3.5-5.5	4.09	-	3.71	3.7	3.3*	4.06	3.69	3.77	4.12	3.72	4.08	4.12
Sodium (mmol/L)	133-149	134.4	-	135.2	134	136.3	134.7	139.5	137.7	134.2	135.8	135.8	135.6
Chloride (mmol/L)	95-110	99.8	-	101.9	101	101.6	102.3	101.9	103.2	100	102.1	102.5	103.8
Calcium (mmol/L)	1.05-1.35	-	-	1.19	1.21	1.19	1.18	1.21	1.22	1.19	1.2	1.25	1.2
Alanine aminotransferase (U/L)	0-42	16.2	20.6	23.88	21.84	21.31	18.94	26.12	21.81	16.74	22.37	19.54	19.18
Aspartate aminotransferase (U/L)	0-37	35.6	43.4 <sup>#</sup>	37.4 <sup>#</sup>	27.47	22.7	19.44	17.51	16.3	11.27	15.91	14.04	18.88
Total bilirubin (μmol/L)	3.4-20.5	5.2	4.6	5.94	5.3	6.23	7.83	13.41	13.54	10.98	5.32	5.43	5.03
Total protein (g/L)	60-83	58.9*	58.5*	63.17	56*	59.3*	67.79	64.42	58.2*	58.51*	57.99*	55.43*	62.03
Albumin (g/L)	35-55	35.4	35.8	37.6	33.51*	33.38*	34.56*	32.88*	28.08*	28.73*	34.33*	31.67*	34.79*
Blood urea nitrogen	2.86-8.2	2.5*	2.47*	3.85	4.32	4.61	5.99	13.29 <sup>#</sup>	10.29 <sup>#</sup>	8.05	6.63	5.45	4.21
Creatinine (μmol/L)	19.8-87.1	63.8	65.6	49.85	52.44	51.73	55.2	98.25 <sup>#</sup>	77.66	82.63	52.08	48.85	57.25
Uric acid (μmol/L)	149-430	247	196	236.6	206.6	192.9	196	343.6	188.8	125.4*	88.1*	135.2*	116.7*
Creatine kinase (U/L)	10-190	160.3	-	149.2	96.7	60	43	19.2	16.6	14.7	19.1	26	34.1
Creatine kinase-MB (U/L)	0-24	35.2 <sup>#</sup>	17.2	19.4	18.2	17.8	28.6 <sup>#</sup>	6.9	12.8	5.4	3.9	5.4	4.7
Lactate dehydrogenase (U/L)	80-245	306 <sup>#</sup>	282 <sup>#</sup>	286.3 <sup>#</sup>	275.9 <sup>#</sup>	280.1 <sup>#</sup>	266.4 <sup>#</sup>	218.9	176.8	150.8	128.6	139.9	168.5
Venous lactate (mg/L)	120-160	-	-	-	-	705.2 <sup>#</sup>	295.8 <sup>#</sup>	831.3 <sup>#</sup>	902.3 <sup>#</sup>	812 <sup>#</sup>	838.4 <sup>#</sup>	880.1 <sup>#</sup>	803.7 <sup>#</sup>
C-reactive protein (mg/L)	0-8	19.7 <sup>#</sup>	18.8 <sup>#</sup>	17.05 <sup>#</sup>	16.07 <sup>#</sup>	55.42 <sup>#</sup>	43.19 <sup>#</sup>	22.71 <sup>#</sup>	12.61 <sup>#</sup>	6.49	3.72	-	10.37 <sup>#</sup>
Partial pressure of carbon dioxide (mmHg)	35-45	31.8*	-	24.8*	28.1*	36.1	27.5*	39.4	38.7	43.1	38.8	33.5*	27.1*
Partial pressure of oxygen (mmHg)	80-100	78.8*	-	119.2 <sup>#</sup>	116.8 <sup>#</sup>	56.8*	78.2*	77.2*	61.9*	97.9	74.6*	89.5	102.5 <sup>#</sup>
Blood oxygen saturation (%)	91.9-99.9	96.6	-	98.6	98.6	92	96.5	96.4	93.3	97.7	95.8	97.6	98.2
Carbon dioxide (mmol/L)	24-32	-	-	18.6*	21.9*	28.6	21.1*	31.5	29.3	31.5	29.2	27.5	22.2*
Procalcitonin (ng/ml)	0-0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

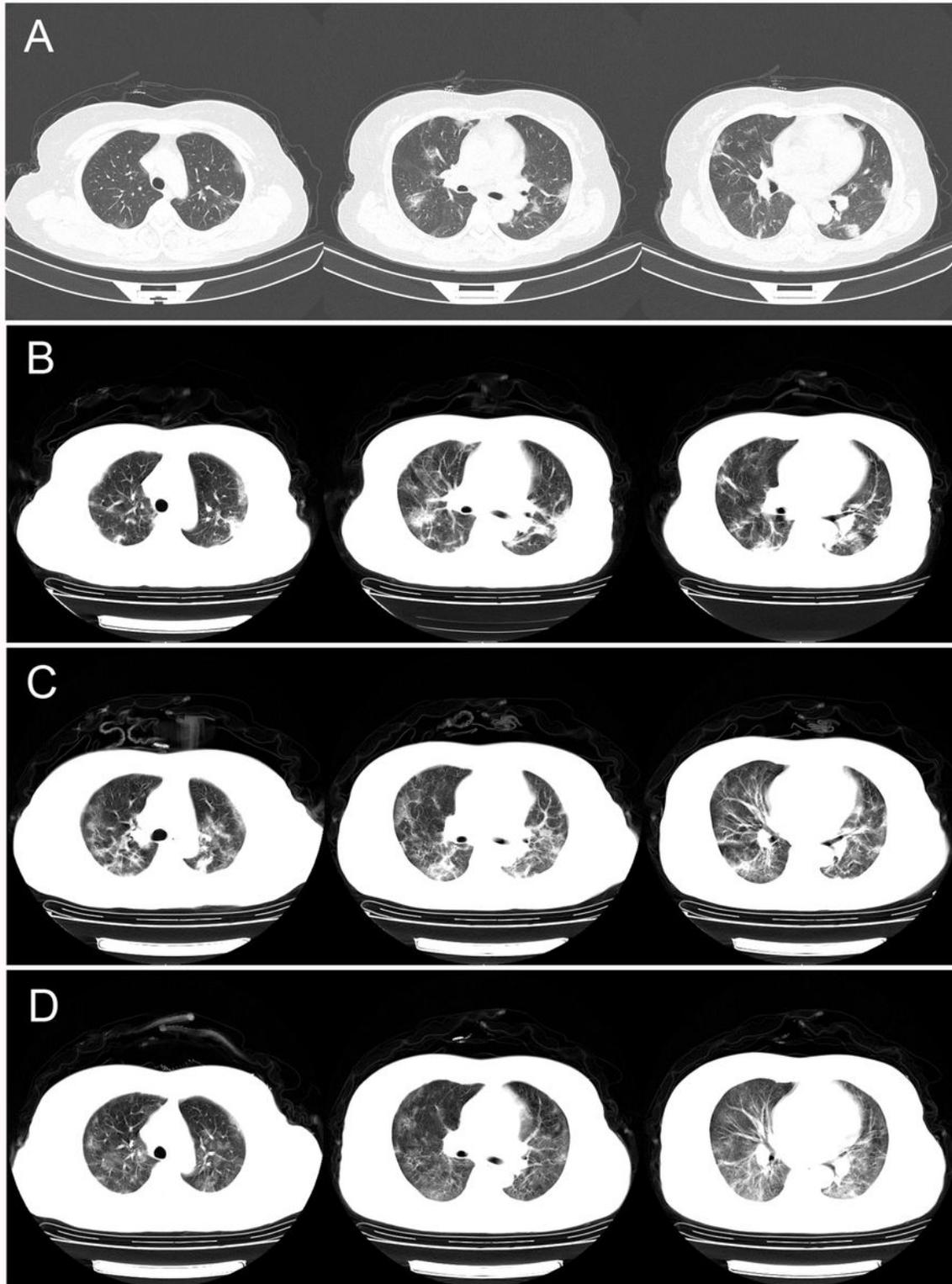
\* The value in the patient was below normal.

# The value in the patient was above normal.

Table 2. Body Temperatures and symptoms from January 9 to January 30, 2020.

Date	Jan 9	Jan 10-Jan 15	Jan 16	Jan 17	Jan 18	Jan 19	Jan 20	Jan 21	Jan 22	Jan 23	Jan 24	Jan 26	Jan 28	Jan 30
Illness day	Travel from	Home	7	8	9	10	11	12	13	14	15	17	19	21
Hospital day	Wuhan, China		1	2	3	4	5	6	7	8	9	11	13	15
Fever (°C)	Subjective fever	Subjective fever	38	38	37	37.8	37	36.5	36.4	36.4	36.5	36.5	36.6	36.4
Cough	√	√	√	√	√	√	√							
Shortness of breath							√	√	√	√				
Chest distress							√	√						
Fatigue	√	√					√	√	√	√	√	√		
Headache	√	√	√	√										
Sore throat	√	√	√	√	√	√	√							
Chest pain	√	√	√	√	√	√	√	√	√					
Diarrhea	√		√	√										

# Figures



**Figure 1**

Chest CT of this patient. (1A) Chest CT was obtained on Jan 16, 2020 (hospital day 1, illness day 7). Multiple patchy shadows and cord-like ground-glass opacity (GGO) under the pleura and bilateral lung were observed. (1B) Chest CT was obtained on Jan 19, 2020 (hospital day 4, illness day 10). The texture

of the trachea and blood vessels in both lungs became thicker. GGO increased and the original GGO was consolidated. (1C) Chest CT was obtained on Jan 23, 2020 (hospital day 8, illness day 14). The patchy lesions in both lungs were absorbed and the fiber shadow was increased. (1D) Chest CT was obtained on Jan 30, 2020 (hospital day 15, illness day 21). The consolidation of bilateral lung were further absorbed. The fiber strands were reduced and GGO was slightly increased.

## Supplementary Files

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