EPIDEMIOLOGICAL AND CLINICAL FINDINGS OF DISCHARGE PATIENTS INFECTED WITH THE 2019 NOVEL CORONAVIRUS (SARS-COV-2) IN CHANGCHUN, NORTHEAST CHINA: A RETROSPECTIVE COHORT STUDY

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ABSTRACT

Introduction*: Few previous studies have been well described the details of the clinical and virological course of illness among discharged patients. The study aims to study the epidemiological and clinical features of discharged patients with SARS-CoV-2 infection in Changchun, Northeast China.*

Materials and methods*: We included all discharged patients with SARS-CoV-2 infection from Changchun Infectious Hospital, China, as 9 March 2020. We extracted and collected on data of demographic characteristic, clinical features, chest computed tomography (CT) scan, laboratory result, and treatment from the electronic medical records. Exact epidemiological information was obtained from the investigation of patients or close contacts by investigators of at all levels of the Center for Disease Prevention and Control in Jilin Province.*

Results*: Of the 43 discharged patient retrospective studied, 38 were mild novel coronavirus pneumonia, only one with critical ill case and no health workers were infected. The median age was 41.0 years, and 25 were male. All cases were infected by person-to-person transmission and the median incubation period from exposure to illness onset was 8.0 days. 22 patients had comorbidities. The most common symptoms at illness onset were fever, cough, expectoration, myalgia or fatigue, chest tightness, nasal congestion or sneezing. Median duration of illness onset to hospital admission and discharged was 6.0 days and 22.0 days, the median duration of viral shedding after illness onset was 19.0 days (IQR: 14-22).*

Conclusion*: Patients were imported and cluster cases by person-to-person transmission and relatively mild in Changchun, China. Our findings further confirmed the prolonged viral shedding among patients.*

Keywords: *COVID-19, SARS-CoV-2, epidemiology, family cluster, viral shedding, therapeutics.*

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Introduction

In December 2019, an outbreak of pneumonia of unknown cause in Wuhan, China were later designated coronavirus disease 2019 (COVID-19) by WHO[(1)], that was caused by infected with a novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)[(2)]. As of 11 March 2020, WHO has characterized COVID-19 as a pandemic which have infected more than 118,000 cases in 114 countries and 4,291 people have lost their lives[(3)].

Epidemiological findings showed that initial patients of the outbreak had exposure history to a local seafood market and SARS-CoV-2 was isolated from these patients that would cause person-to-person transmission in hospital and family setting[(4-8)]. The gene sequence of SARS-CoV-2 is highly similar to that identified in bats[(9, 10)], and shared more than 79% its sequence with the coronavirus responsible for severe acute respiratory syndrome (SARS-CoV), but only 50% homology with middle east respiratory syndrome (MERS-CoV)[(10, 11)].

Although some several studies with patients being hospitalized patients have reported the epidemiology and clinical features of SARS-CoV-2 infection, mainly including upper respiratory tract illness, lower respiratory illness, acute respiratory distress syndrome (ARDS), shock and die[12-15]. But, about 29% of patients had no radiological abnormality on initial presentation[4] and 31-56% of patients were asymptomatic or mild cases[16, 17]. However, the epidemiological and clinical features of patients with SARS-CoV-2 infection in Northeast China have not been described and there are few previous studies have been performed among discharged patients for the details of the clinical and virological course of illness have not been well described.

Here, we collected data of all discharged patients with SARS-CoV-2 infection in Changchun, Northeast China for describing the epidemiology, clinical features, viral shedding and laboratory findings of patients with COVID-19.

Methods

Data sources and collection

The retrospective study focusing on the epidemiology, clinical features, viral shedding and laboratory findings of discharged patients in Changchun, Northeast China. Since Changchun Infectious Diseases Hospital was the major designated hospitals for receiving transferred patients with COVID-19 from other hospitals in Changchun, we included all 43 discharged patients with confirmed SARS-CoV-2 infection, as 9 March 2020. Patients with COVID-19 and the disease severity were confirmed according to the Chinse management guideline for COVID-19 (6.0)[18], including epidemiological history, clinical features and laboratory results, by Changchun Center for Disease Control and Prevention and its subordinate district centers for disease control and prevention (Changchun CDC), the Center for Disease Prevention and Control in Jilin Province and Chinese Center for Disease Control and Prevention (China CDC). Ethical approval was obtained by Jilin University School of Public Health (2020-03-11), and written informed consent was obtained from all cases.

We extracted and collected on data of demographic characteristic, clinical feature, chest computed tomography (CT) scan, laboratory result (including RNA detection results), and treatment from the electronic medical records of patients using the uniform data collection form.

Epidemiological information was extracted from the investigation of patients or close contacts by investigators of at all levels of the Center for Disease Prevention and Control in Jilin Province, including initial symptoms and exact date, exposure histories before illness onset, dates of close contact with confirmed or suspected patients and illness onset. The incubation period was defined as the time from the exact date of close contact with confirmed or suspected patients to the onset of illness. Cluster cases refers to the detection of 2 or more confirmed cases or asymptomatic infected persons within 14 days in a small area (such as a family, a construction site, a unit, etc.), and the possibility of person-to-person transmission caused by close contact, or the possibility of infection caused by joint exposure. All data were independently extracted by two researchers.

Laboratory confirmation and treatment

SARS-CoV-2 RNA was detected from sputum and throat-swab specimens of all patients using real time polymerase chain reaction (RT-PCR) methods on admission and confirmed by Changchun CDC and its subordinate district centers for disease control and prevention, the Center for Disease Prevention and Control in Jilin Province and China CDC. After clinical improvement, health institutions would obtain and re-test the throat swab specimens for SARS-CoV-2 detection apart 24 hours. Routine blood tests were performed on admission, including complete blood count, blood gas analysis, coagulation test, blood biochemistry, liver and renal function, electrolytes, myocardial enzymes, C-reactive protein, lactate dehydrogenase, creatine kinase. All patients underwent chest CT scans. The criteria for discharge were absence of fever for at least 3 days, substantial improvement in both lungs in chest CT, clinical remission of respiratory symptoms, and two throat-was specimens negative for SARS-CoV-2 RNA obtained at least 24 hours apart[19].

Statistical analysis

We summarized continuous and categorical variables using median with interquartile and the number of illness and its percentages. We separated patients into mild, severe or critical cases according to the Chinse management guideline for COVID-19 (6.0). We used Mann-Whitney U test, Chi-square test and Fisher's exact test comparing the differences between mild and severe or critical cases. All data and graph were analyzed and plotted by R 3.6.1 software, and $p \leq 0.05$ was considered to be statistically significant.

Results

Epidemiological and clinical characteristics

As 9 March 2020, we included all 43 discharged patients with confirmed SARS-CoV-2 infection in Changchun, China. On admission, most patients were mild (general), 5 were severe or critical, respectively. Of 43 patients, 36 patients were aged 16-64 years, 6 were 65 years or older and only one were aged 10 years (Table 1, Figure 1a).

The median age was 41.0 years (IQR 33.0-52.0) and most patients were male (58.1%) (Table 1, Figure 1b). No healthcare workers were infected. 7 patients had been to Wuhan before illness onset and 36 patients had been exposed to confirmed or suspected patients (Table 1, Figure 1d). Most patients were clustered cases (81.4%) with eight familiar clusters and one work place cluster (Table 1, Figure 1c, Figure 2). More severe or critical had been exposed to Wuhan and mild cases were more cluster cases and (all P<0.05) (Table 1). All patients have provided the detailed epidemiology history, including the accurate date of close encounter with confirmed or suspected SARS-Cov-2 infections. The median incubation period was 8.0 days (IQR 5.0-11.0), and 6 days (IQR 3.5-9.5) for severe or critical cases. Median clinical course and viral shedding after illness onset were 22.0 days (IQR 18.0-24.0) and 19.0 days (IQR 14-22), respectively (Table 1, Figure 3). There were no significantly differences in age, sex, occupation, smoking status, respiratory rate between mild and severe or critical cases (all P>0.05). The heart rate and mean arterial pressure of severe or critical cases were higher than mild cases (all P<0.05), but the partial pressure of carbon dioxide in artery of severe or critical cases was lower (P<0.05).

Comorbidities were present in more than half of patients (51.2%), with hypertension and diabetes being the most common comorbidities (Table 1). The most common symptoms at onset of illness were fever (76.7%), cough (81.4%), expectoration (72.1%), myalgia or fatigue (53.5%), chest tightness (46.5%), nasal congestion or sneezing (34.9%), respectively (Table 1). The median duration of fever was 6.0 days (IQR 3.0-9.0) and cough persisted for 10.0 days (IQR 7.0-16.0) (Table 1, Figure 3). There were no significantly differences in comorbidities between mild and severe or critical cases (P>0.05) (Table 1).

Laboratory and radiologic findings

On admission, 6 patients showed leucopenia, 4 neutropenia and 17 lymphopenia, respectively (Table 2). Most patients demonstrated increased levels of total bilirubin (95.3%), Glucose (60.5%), C-reactive protein (58.1%), followed by elevated of lactate dehydrogenase (34.9%), alanine aminotransferase (32.6%), aspartate and myoglobin (27.9%), respectively.

Characteristics	Total (n=43)	Mild (n=38)	Severe or critical (n=5)	*p* value
Age, median(IQR), y	41.0(33.0-52.0)	41.0(32.0-52.0)	46.0(31.0-64.0)	0.755
Age groups				
<16 y	1(2.3%)	1(2.6%)	0	0.885
16-44 y	23(53.5%)	21(55.3%)	2(40.0%)	
45-64 y	13(30.2%)	11(28.9%)	2(40.0%)	
≥65 y	6(14.0%)	5(13.2%)	1(20.0%)	
Sex				0.929
Female	18(41.9%)	16(42.1%)	2(40.0%)	
Male	25(58.1%)	22(57.9%)	3(60.0%)	
Occupation				0.410
Agricultural worker	2(4.7%)	1(2.6%)	1(20.0%)	
Employee	19(44.2%)	16(42.1%)	3(60.0%)	
Professional technical	6(14.0%)	6(15.8%)	1(20.0%)	
Retired	9(20.9%)	8(21.1%)	0	
Self-employed	3(7.0%)	3(7.9%)	0	
Unemployed	4(9.3%)	4(10.5%)	0	
Exposure history				0.024
Exposure to Wuhan	7(16.3%)	4(10.5%)	3(60.0%)	
Exposure to confirmed or suspected people	36(83.7%)	34(89.5%)	2(40.0%)	
Case detection mode				0.167
Fever clinic	23(53.5%)	16(42.1%)	4(80.0%)	
Active screen	20(46.5%)	22(57.9%)	1(20.0%)	
Cluster patients	35(81.4%)	33(86.8%)	2(40.0%)	0.011
Single case	8(18.6%)	5(13.2%)	3(60.0)	0.035
Family cluster	28(65.1%)	26(68.4%)	2(40.0)	
Working cluster	7(16.3%)	7(18.4%)	0	
Smoking status				0.762
Never	34(79.1%)	30(78.9%)	4(80.0%)	
Current	6(14.0%)	5(13.2%)	1(20.0%)	
Ever	3(7.0%)	3(7.9%)	0	
Comorbidities	22(51.2%)	19(50.0%)	3(60.0%)	0.674
Hypertension	7(16.3%)	6(15.8%)	1(20.0%)	0.811
Diabetes	5(11.6%)	4(10.5%)	1(20.0%)	0.534
Malignancy	3(7.0%)	2(5.3%)	1(20.0%)	0.224
Hypothyroidism	3(7.0%)	3(7.9%)	0	
Chronic obstructive pulmonary disease	2(4.7%)	2(5.3%)	0	
Coronary heart disease	2(4.7%)	2(5.3%)	0	
Bronchitis	2(4.7%)	2(5.3%)	0	
Neurodegenerative disease	2(4.7%)	2(5.3%)	0	
Asthma	1(2.3%)	1(2.6%)	0	
Heart rate, median(IQR), bpm	88(80-96)	86(80-94.2)	96(90.5-102)	0.044
Respiratory rate, median(IQR)	19(18.0-20.0)	18.5(18.0-20.0)	20(18.0-26.0)	0.405
Respiratory rate >24 breaths per min	3(7.0%)	2(5.3%)	1(20.0%)	0.224
Systolic blood pressure, median(IQR), mm Hg	123(110-137)	121(110-132)	142(121-158)	0.071
Mean arterial pressure, median(IQR), mm Hg	91(83-100)	90.5(83.3-96.9)	103.3(91.6-119.3)	0.049
Blood Gas Analysis				
PH	7.4(7.3-7.4)	7.37(7.33-7.41)	7.39(7.6-7.42)	0.286
Lactate, median(IQR), mmol/L	1.6(1.4-1.9)	1.61(1.45-1.98)	1.56(1.43-1.88)	0.605
PaO2, median(IQR), mm Hg	73.5(64.0-86.8)	76.0(66.4-87.5)	59.0(53.0-88.0)	0.155
PaO2:FIO2, median(IQR), mm Hg	345.0(293.0-397.0)	351.0(299.0-397.8)	250.0(250.0-250.0)	0.261
PaCO2, median(IQR), mm Hg	38.9(35.2-45.0)	39.6(36.0-45.4)	34.7(28.6-37.2)	0.030
Symptoms				
Fever	33(76.7%)	28(73.7%)	5(100.0%)	0.092
Highest temperature, °C				0.109
<37.3	10(23.3%)	10(26.3%)	0	
37.3-38	19(44.2%)	18(47.4%)	1(20.0%)	
38.1-39	10(23.3%)	7(18.4%)	3(60.0%)	
>39	4(9.3%)	3(7.9%)	1(20.0%)	
Cough	35(81.4%)	31(81.6%)	4(80.0%)	0.933
Expectoration	31(72.1%)	17(44.7%)	4(80.0%)	0.127
Myalgia or fatigue	23(53.5%)	17(44.7%)	4(80.0%)	0.080
Chest tightness	20(46.5%)	17(44.7%)	3(60.0%)	0.520
Nasal congestion or sneezing	15(34.9%)	15(50.0%)	0	0.138
Diarrhea	8(18.6%)	5(13.2%)	3(60.0%)	0.025
Nausea or vomiting	8(18.6%)	5(13.2%)	3(60.0%)	0.001
Headache	6(14.0%)	6(15.8%)	0	0.205
Abdominal pain	3(7.0%)	3(92.1%)	0	0.380
Sore throat	3(7.0%)	3(7.9%)	0	0.525
Incubation period, median(IQR), d	8.0(5.0-11.0)	8.5(4.8-12.0)	6.0(3.5-9.5)	0.326
Onset of illness to, median(IQR), d				
Fever	1.0(1.0-1.0)	1.0(1.0-1.0)	1.0(1.0-1.0)	0.613
Cough	1.0(1.0-1.0)	1.0(1.0-1.0)	1.0(1.0-1.0)	0.565
Hospital admission	6.0(2.0-8.0)	5.5(2.0-7.5)	7.0(6.0-8.5)	0.172
Discharge	22.0(18.0-24.0)	22.0(18.0-24.0)	19.0(18.0-26.5)	0.468
Duration of viral shedding after onset illness, median(IQR), d	19.0(14.0-22.0)	19.5(15.0-22.0)	14.5(14.0-22.0)	0.985
Hospitalization time, median(IQR), d	17.0(11.0-20.0)	17.0(11.0-20.0)	13.0(9.5-20.0)	0.495

Table 1: Baseline of demographic characteristic, clinical features of 43 discharged patients with SARS-Cov-2 infection in Changchun, China.

However, the increased of aspartate aminotransferase, blood urea nitrogen were less common. Severe or critical cases had more elevated levels of alanine aminotransferase, aspartate aminotransferase, C-reactive protein, lactate dehydro-

genase, myoglobin and glucose than mild cases (P<0.05). All patients present abnormalities on chest computed tomography on admission, and the typical findings on chest computed tomography were bilateral distribution of patchy shadows or ground-glass opacity (72.1%). 25 patients only showed ground-glass opacity, and 10 had reticular shadow, respectively (Table 2).

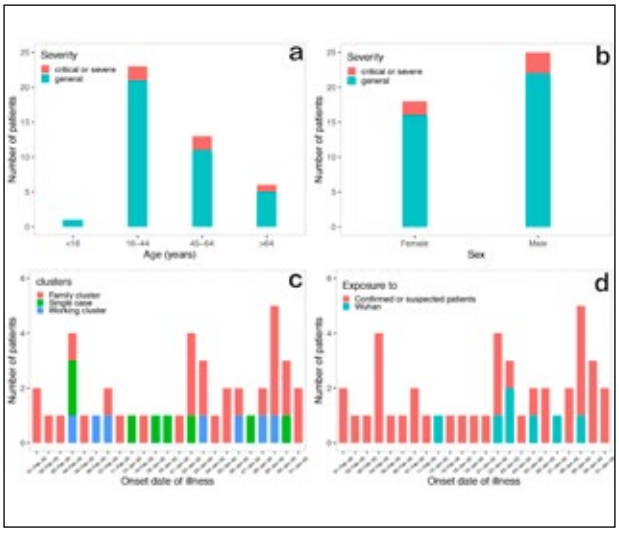

Fig. 1: Age, sex and onset date of patients with SARS-Cov-2 infections. (**a**: age distribution by severity of illness; **b**: sex distribution by severity of illness; **c**: illness onset date by clusters; **d**: illness onset data by exposure history).

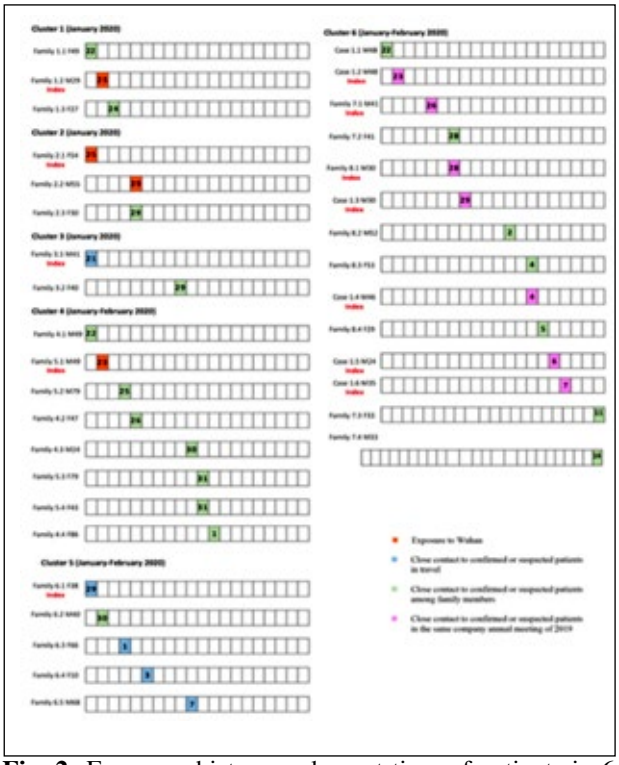

Fig. 2: Exposure history and onset time of patients in 6 clusters (35 cases). (Onset time of illness are in the boxes).

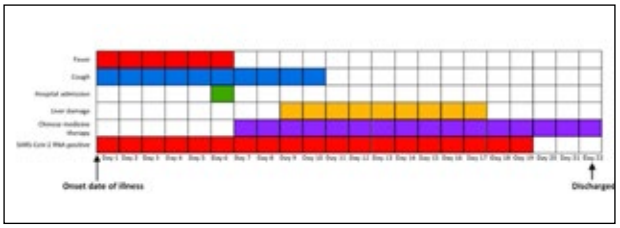

Fig. 3: Clinical course of patients with SARS-Cov-2 infections.

	Normal range	Total (n=43)	Mild (n=38)	Severe or critical (n=5)	*p* value
Laboratory results					
White blood cell count, ×10⁹/L	3.5-9.5	5.3(4.1-6.4)	5.4(3.7-6.6)	5.2(5.0-6.0)	0.983
<3.5		6(14.0%)	6(15.8%)	0	0.574
3.5-9.5		32(74.4%)	28(73.7%)	4(80.0%)	
>9.5		2(4.7%)	2(5.3%)	0	
Neutrophil count, ×10⁹/L	1.8-6.3	3.7(2.8-4.9)	3.6(2.7-5.0)	4.1(3.6-4.8)	0.476
<1.8		4(9.3%)	4(10.5%)	0	0.658
1.8-6.3		32(74.4%)	28(73.7%)	4(80.0%)	
>6.3		2(4.7%)	2(5.3%)	0	
Lymphocyte count, ×10⁹/L	1.1-3.2	1.1(0.8-1.6)	1.1(0.9-1.7)	0.9(0.6-1.3)	0.152
<1.0		17(39.5%)	13(34.2%)	4(80.0%)	0.100
≥1.0		20(46.5%)	19(50.0%)	1(20.0%)	
Monocyte count, ×10⁹/L	0.1-0.6	0.3(0.2-0.5)	0.3(0.2-0.5)	0.3(0.2-0.5)	0.873
Haemoglobin, g/L	115-175	144(130-157)	140.0(129.0-157.0)	151.5(138.5-157.0)	0.460
C-reactive protein, mg/L	0-6	10.9(2.5-33.4)	6.6(2.4-28.9)	71.5(10.6-84.3)	0.045
>6		25(58.1%)	20(52.6%)	5(100.0%)	0.049
Platelet count, ×10⁹/L	125-350	183(161-223)	194.0(165.0-228.0)	165.5(132.5-209.0)	0.333
<125		4(9.3%)	3(7.9%)	1(20.0%)	0.567
125-350		34(79.1%)	31(81.6%)	4(80.0%)	
≥350		1(2.3%)	1(2.6%)	0	
Prothrombin time, s	10-14	12.0(11.6-12.9)	12.0(11.6-12.9)	12.4(10.4-13.2)	0.735
Activated partial thromboplastin time, s	22.2-38	32.6(30.5-35.4)	32.7(30-35.4)	32.6(32.6-35.8)	0.651
Fibrinogen, g/dl	2-4	2.2(2.0-3.5)	2.2(2.0-3.3)	3.8(2.2-4.8)	0.133
Thrombin time, s	14-20	15.8(15.2-16.7)	15.7(15.2-16.7)	16.3(15.8-16.7)	0.323
Alanine aminotransferase, U/L	5-40	25.0(19.0-45.0)	24.0(19.0-43.5)	49.0(40.0-72.0)	0.011
<40		29(67.4%)	28(73.7%)	1(20.0%)	0.016
≥40		14(32.6%)	10(26.3)	4(80.0%)	
Aspartate aminotransferase, U/L	8-40	26.0(22.0-32.0)	25.0(21.8-30.0)	39.0(30.5-52.5)	0.008
<40		37(86.0%)	34(89.5%)	3(60.0%)	0.074
≥40		6(14.0%)	4(10.5%)	2(40.0%)	
Potassium, mmol/L	3.5-5.5	4.0(3.7-4.4)	4.0(3.7-4.4)	4.0(3.4-4.6)	0.832
Sodium, mmol/L	136-145	139.0(136.6-140.5)	139.2(136.9-140.5)	135.7(122.9-141.1)	0.188
Chloride, mmol/L	96-108	99.6(97.1-101.6)	99.8(98.1-101.7)	97.1(85.3-101.0)	0.197
Albumin, g/L	37-53	44.2(42.0-46.1)	44.5(42.2-46.1)	42.0(36.8-46.6)	0.382
Total bilirubin, mmol/L	1.7-2.1	7.9(6.7-10.4)	7.9(6.7-10.0)	9.2(6.5-14.9)	0.510
>2.1		41(95.3%)	37(97.4%)	4(80.0%)	0.083
Cholinesterase, U/L	5000-12000	7575(6084-9029)	7898.0(6306.0-9029.5)	5199.0(989.5-9254.0)	0.237
Creatine, μmol/L	45-104	69.2(62.1-77.3)	69.2(61.0-77.0)	79.1(66.5-84.8)	0.237
Creatine kinase, U/L	26-174	79(12-24)	75.0(58.0-116.5)	210.0(135.2-449.0)	0.008
≤185		36(83.7%)	34(89.5%)	2(40.0%)	0.032
>185		6(14.0%)	4(10.5%)	2(40.0%)	
Creatine kinase-MB, U/L	0-24	16(12-24)	15.5(11.8-21.8)	17.0(12.0-25.0)	0.840
Blood urea nitrogen, mmol/L	2.82-8.2	3.7(2.9-4.5)	3.8(2.9-4.6)	3.8(3.3-3.9)	0.851
<2.82		8(18.6%)	8(21.1%)	0	0.625
>8.2		1(2.3%)	0	3(60.0%)	
Lactate dehydrogenase, U/L	109-245	210(185-269)	205.5(178.8-257.2)	314(280.5-362.0)	<0.001
≤245		28(65.1%)	28(73.7%)	0	0.001
>245		15(34.9%)	10(26.3%)	5(100.0%)	
Myoglobin, ng/mL	0-85	69.7(20.3-118.6)	24.5(19.7-53.2)	200.4(60.4-420.5)	0.008
>85		12(27.9%)	9(23.7%)	3(60.0%)	0.031
Glucose, mmol/L	3.89-6.11	6.5(5.7-8.0)	6.5(5.7-8.0)	6.8(5.8-8.6)	0.918
>6.11		26(60.5%)	24(63.2%)	4(80.0%)	0.606
Cardiac troponin I, pg/mL	0-1.5	1.7(1.2-7.4)	1.6(1.2-5.0)	8.4(1.0-11.0)	0.497
CT imaging features	**NA**				
Bilateral distribution of patchy shadows or ground glass opacity		31(72.1%)	26(68.4%)	12(31.6%)	0.139
Patchy high density shadows		31(72.1%)	28(73.7%)	3(60.0%)	0.521
Ground-glass opacity		25(58.1%)	20(52.6%)	5(100.0%)	0.044
Reticular shadow		10(23.3%)	9(23.7%)	1(20.0%)	0.844

Table 2: Laboratory and CT findings at admission in discharged patients with SARS-Cov-2 infection in Changchun, China.

Severe or critical cases presented more prominent radiologic abnormalities on chest computed tomography than mild cases (P<0.05).

Treatment and complications

During hospitalization, liver function abnormal occurred in 19 patients, followed by metabolic acidosis (18.6%), hypoxemia (18.6%), respiratory failure (14.0%), leukopenia (14.0%), hypochloremia (14.0%), acute cardiac injury (11.6%), and electrolyte metabolism disorder (11.6%) (Table 3). Severe or critical cases showed significantly higher rates of respiratory failure and pleural effusion than mild cases (P<0.05). Only one patient had been transferred to intensive care unit for the development of organ dys-

function, especially severe respiratory failure. All 43 discharged patients received antiviral therapy, of which 40 patients received Lopinavir/ritonavir+Interferon alpha inhalation. 36 patients received anti-

	Total (n=43)	Mild (n=38)	Severe or critical (n=5)	*p* value
Complications				
Liver function abnormalities	19(44.2%)	17(44.7%)	2(40.0%)	0.841
Metabolic acidosis	8(18.6%)	8(21.1%)	0	0.138
Hypoxemia	8(18.6%)	8(21.1%)	0	0.255
Respiratory failure	6(14.0%)	2(5.3%)	4(80.0%)	<0.001
Leukopenia	6(14.0%)	5(13.2%)	1(20.0%)	0.678
Hypochloremia	6(14.0%)	4(10.5%)	2(40.0%)	0.074
Acute cardiac injury	5(11.6%)	3(7.9%)	2(40.0%)	0.035
Electrolyte metabolism disorder	5(11.6%)	4(10.5%)	1(20.0%)	0.534
Respiratory alkalosis	4(9.3%)	4(10.5%)	0	0.446
Hypokalemia	3(7.0%)	2(5.3%)	1(20.0%)	0.224
Hyponatremia	3(7.0%)	2(5.3%)	1(20.0%)	0.297
Pericardial effusion	2(4.7%)	1(2.6%)	1(20.0%)	0.083
Pleural effusion	2(4.7%)	0	2(40.0%)	0.002
Treatment				
Antiviral therapy	43(100.0%)	38(100.0%)	5(100.0%)	
Lopinavir/ritonavir+ Interferon alpha inhalation	40(93.0%)	35(92.1%)	5(100.0%)	0.515
Antibiotics	36(83.7%)	31(81.6%)	5(100.0%)	0.294
Moxifloxacin	30(69.8%)	26(68.4%)	4(80.0%)	0.596
Moxifloxacin+Xuebijing Injection	13(30.2%)	9(23.7%)	4(80.0%)	0.010
Corticosteroids	23(53.5%)	18(47.4%)	5(100.0%)	0.027
Anti-fibrosis (acetylcysteine Effervescent Tablets)	32(74.4%)	28(73.7%)	4(80.0%)	0.761
Oxygen supplementation	25(55.8%)	20(52.6%)	5(100.0%)	0.034
Traditional Chinese medicine therapy	42(97.7%)	37(97.4%)	5(100.0%)	-

Table 3: Complications and treatments in hospitalization of discharged patients with SARS-CoV-2 infection in Changchun, China.

biotic treatment (moxifloxacin, [30, 69.8%]), 23 were given corticosteroids and 25 were given oxygen supplementation. Meanwhile, 42 patients were treated with Chinese medicine therapy on the 7th day (IQR 4-10) after illness onset (Figure 3).

Moxifloxacin+Xuebijing, Corticosteroids and Oxygen supplementation were more given in severe or critical cases than mild patients (all P<0.05).

Discussion

So far, the number of SARS-CoV-2 infections have increased rapidly worldwide, compared with the new cases abroad, few local new cases occur in China and most of new cases have been imported from abroad. At the early stage of COVID-19 in cities of China, strict controlling of the transmission rate and local clusters had quickly prohibited the spread of it and prevented the outbreaks from imported cases. However, taking the results from previous studies into account[16, 17, 20], we think that about 30-50% of patients were asymptomatic or mild infection in a general population. The clinical features of confirmed SARS-CoV-2 patients were different may vary from region to region[11], the epidemiology and clinical characteristics of discharged patients are limited and no relative studies performed in Changchun, China. In our study, 43 admitted patients with confirmed SARS-CoV-2 infection have been discharged from hospital and no deaths have occurred in Changchun, China, as 9 March 2020.

Only 7 patients had exposure to Wuhan, 36 patients were the clustered cases. Our results provide the further evidence of person-to-person transmission, which is consistent with previous studies[4-8, 21]. The accurate mode of transmission is still under research, but previous studies suggested that the conventional routes of transmission of SARS-CoV consisted of the respiratory droplets and direct contact[4, 22]. However, recent reports suggested that fomite transmission might have play a role in the rapid transmission of SARS-CoV-2[4], researchers have directly detected the SARS-CoV-2 in saliva, respiratory tract and sputum, stool or urine specimens[4, 23]. No statistical difference was found on the SARS-CoV-2 infections between male and female in our study, which might due to small samples in the study, but several studies[14, 15, 24] found that men may be more prone to have higher severity and mortality independent of age and susceptibility.

The initial dominant symptoms of patients with COVID-19 in Jilin province were consistent with those in other areas of China. 76.7% of initial symptoms was fever that provide further evidence of absence of fever in patients with COVID-19 is more frequent than other SARS-CoV infections[22, 24]. 17 patients showed lymphopenia in our study and 4 in severe or critical cases, which might be an indicator of disease severity and prognosis of SARS-CoV-2 infections[24, 25]. SARS-CoV-2 might directly infect lymphocytes or indirectly damage lymphatic organs by the coronavirus receptor ACE2 resulting in lymphocyte death[25]. No patients die and only one patient was admitted to intensive care unit for the development of organ dysfunction. The median incubation period was 8.0 days, which was longer compared with results in the early outbreak phase of China (4-6.4 days) and global (5.6 days)[4, 6, 26, 27].

Backer JA[26] estimated that the mean incubation period to be 6.4 days (IQR 2.1-11.1) using the best-fit Weibull distribution in Mainland China, which was similar with our study. It is need to further research of the incubation distribution for directly estimating the proportion with long incubation periods. Median duration of viral shedding after COVID-19 onset was 19.0 days (IQR 14-22) in our study. Zhou F et al[19] found that the median duration of viral shedding was 20.0 days, which are similar with our study. The persisted SRAS-CoV-2 RNA shedding is the important factor for evaluating transmission risk of it, and guiding patients' isolation and treatment. The duration from illness onset to hospital admission of severe or critical patients was longer than mild patients (7 days vs. 5.5 days), but the median clinical course and hospitalization were shorter than those

patients (clinical course: 19 days vs. 22 days; hospitalization time: 17 days vs. 13 days). For severe or critical patients, all of these cases occurred during the Spring Festival Holiday that might have been delayed to hospital admission by atypical symptoms or even asymptomatic. The clinical features of second generation patients with symptoms for more than 10 days after illness onset were less severe than those of the primary infected patients from Wuhan, which was similar with the transmission of MERS-CoV[11]. Meanwhile, patients with symptoms of any upper respiratory tract were hospitalized at an early stage and active screen for patients with suspected infection under nation and government advocacy. Besides, moxifloxacin combined with xuebijing injection, corticosteroids and oxygen supplementation were given in severe or critical cases than the mild patients. That might shorten the hospitalization and clinical course of severe or critical patients.

All patients in our study received antiviral therapy, and treated with Chinese medicine therapy on the 7th day (IQR 4-10) after illness onset; but the types of drugs or therapy used varied between patients. Most of patients received lopinavir/ritonavir combined with interferon alpha inhalation therapy in our study. Previous studies reported that lopinavir/ritonavir treatment might be a beneficial part of treating SARS-CoV-2 infection[11]. However, in a randomized, controlled, open-label clinical trial (ChiCTR2000029308), Cao B et al[28] found that lopinavir/ritonavir treatment for adult inpatient with severe COVID-19 has no benefit beyond standard care. Previous studies found that delayed antiviral treatment was an independent risk factor for prolonged avian influenza A(H7N9) virus RNA shedding detection[19, 29], but Zhou F et al[19] showed that lopinavir/ritonavir treatment did not shorten the duration of SARS-CoV-2 shedding in adult inpatients. Therefore, future researches are needed to clarify the potential benefits of lopinavir/ritonavir treatment in patients with COVID-19. More than 34 patients received antibiotic therapy and more than 21 patients have been given corticosteroid and oxygen supplementation in Changchun, China. Besides, almost all patients had received the Traditional Chines Medicine treatment, and we assumed that might be the beneficial part of treating COVID-19. However, there are still unknown of the effective of those therapies, especially for the treatment of severe illness caused by SARS-CoV-2.

Given that all SARS-CoV-2 infections in Changchun, China were imported and clustered cases by person-to-person transmission, our findings provide worthy information for the better understanding of the clinical features of COVID-19 and support take of active preventive measures for preventing mass transmission around the world, including performing public educational campaigns on precautionary measures, banning gatherings, active investigation and screening, early detection, early isolation and early treatment, as the number of confirmed or suspected patients with SARS-CoV-2 continues to grow rapidly worldwide. Our study has several notable limitations. Firstly, only 43 discharged patients in Changchun, Jilin province were included. Some patients were continually being discharged from hospital in Jilin province after data were being collected, but we collected data on all discharged patients, as 9 March 2020 and it representative of SARS-CoV-2 infections in Changchun, China. Secondly, given that the retrospective study and the different conditions of patients, not all same laboratory variables were tested in all patients and exits some briefly or incomplete documentations. Thirdly, the SARS-CoV-2 RNA detection were all from sputum and throat-swab specimens, while the duration of SARS-CoV-2 RNA detection of fecal sample was longer than that of breath swab specimens in a recent study[23], that might limit the duration of virus shedding[30]. Even though, our patients were all imported and clustered cases that might be provide more clinical features of COVID-19 for better screen cases and preventing the spread of it around the world.

Conclusion

Patients were all imported and cluster cases by person-to-person transmission and relatively mild in Changchun, China. Our findings further confirmed the prolonged viral shedding among discharged patients, which provide valuable theoretical basis for virus detection, isolation intervention of infected patients, diagnosis and treatment of patients and improvement of prognosis. However, there are no effective strategy yet have been confirmed for treating patients with SARS-CoV-2 infection and it's urgent to strengthen the research and development of drugs and vaccines to against it.

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