Clinical findings of 35 cases with novel coronavirus pneumonia outside of Wuhan

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Research

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Abstract

Objective: We sought to investigate the clinical characteristics of patients with novel coronavirus pneumonia in Xiamen, which is a city in Fujian Province, China.

Methods: From January 20, 2020, to March 4, 2020, the clinical characteristics of all patients confirmed with novel coronavirus pneumonia admitted to the First Affiliated Hospital of Xiamen University, which was the only designated hospital for cases of novel coronavirus pneumonia in Xiamen, were analyzed.

Results: A total of 35 cases of novel coronavirus pneumonia were confirmed. Patients were divided into the general-ward admission group and the intensive-care-unit (ICU) admission group. The most commonly observed symptoms were fever (80%), cough (51%), expectoration (28%), and fatigue (23%). Compared with patients in the general-ward group, patients in the ICU group had a higher maximum body temperature, a longer duration of fever after admission, and more symptoms of systemic pain. Considering the laboratory findings, patients in the ICU group exhibited lower peripheral blood lymphocyte ratios and lymphocyte counts but higher C-reactive protein and lactate dehydrogenase levels. All patients were discharged without death, and no patients required invasive ventilation, continuous renal replacement therapy, or extracorporeal membrane oxygenation.

Conclusion: Relative to patients with novel coronavirus pneumonia in Wuhan, the cases in Xiamen were less severe.

Introduction

Since December 30, 2019, reports of cases of pneumonia of an unknown cause began to appear from Wuhan, and the causative pathogen was confirmed to be a novel coronavirus by nucleic acid sequencing technology. This disease was thereafter officially named coronavirus disease 2019 (COVID-19) by the World Health Organization. Many studies to date have been conducted on the epidemiological and clinical characteristics of COVID-19 [1–3]. Among these, the epidemiological, clinical characteristics, laboratory findings, and prognosis of COVID-19 in Wuhan for the first time were published by Huang et al [2]. Later, there was another study conducted by Wang et al. that compared the clinical characteristics of patients with severe and nonsevere COVID-19 in Wuhan [3]. However, fewer reports on COVID-19 patients outside Wuhan exist. Thus, the present retrospective analysis was performed involving 35 patients confirmed to have COVID-19 in Xiamen, with the purpose of providing an insight into the diagnosis and treatment of COVID-19 outside of Wuhan, China.

Materials And Methods

Research object

We conducted a retrospective study of all COVID-19 cases confirmed in the First Affiliated Hospital of Xiamen University, the only designated COVID-19 hospital in Xiamen. This research project was approved

by the medical ethics committee of the First Affiliated Hospital of Xiamen University and written informed consent was waived.

Research methods

1. Data collection

This study was a case series. We collected the clinical data of 35 patients admitted to the First Affiliated Hospital of Xiamen University from January 20, 2020, to March 4, 2020, confirmed to have COVID-19 by nucleic acid testing through a review of their electronic medical records. The collected information included demographic characteristics such as age, sex, body mass index, smoking history, history of basic diseases, epidemiology, symptoms characteristics on admission, routine blood examination, C-reactive protein (CRP), calcitonin (PCT), D-dimer and biochemical examination, which was observed before or 24 hours after admission. The lowest lymphocyte count recorded during blood routine examination and biochemical examination were observed from 5–7 days after admission. We also collected the information of novel coronavirus nucleic acid detection results generated from nasal swabbing, lung computed tomography (CT) imaging findings within 48 hours before or after admission, treatments and outcomes. If any missing data in the electronic medical records were noted, the researchers communicated directly with the patient or their family to supplement the information.

2. Clinical diagnosis and classification standard

Initially, patients were diagnosed according to the Novel Coronavirus Pneumonia Diagnosis and Treatment Scheme (Third Edition) formulated by the general office of the national health committee [4]. Along with the continuous renewal of the selected diagnosis and treatment plan, admission diagnosis and classification of cases were updated in a standardized fashion. Finally, all cases were classified according to the Novel Coronavirus Pneumonia Diagnosis and Treatment Scheme (Seventh Edition) [5]. Patients with the mild type showed mild clinical symptoms and no evidence of pneumonia on imaging. Those with the common type presented with fever, respiratory tract, and other symptoms, and pneumonia could be seen during imaging. A diagnosis of the severe type involved any of the following criteria: (1) respiratory distress, with a respiratory frequency of 30 times/min or greater; (2) at rest, oxygen saturation was 93% or less; and (3) arterial partial oxygen pressure (PaO_2)/oxygen absorption concentration (FiO_2) of 300 mmHg or less. If pulmonary imaging showed that the lesions progressed to affect greater than 50% of the lungs within 24–48 hours, the patients were managed as severe cases. Finally, patients with the critical type showed any one of the following conditions: (1) respiratory failure, requiring mechanical ventilation; (2) shock; and (3) other organ failure requiring intensive care unit (ICU) care.

3. Nucleic acid detection

Reverse-transcription polymerase chain reaction (RT-PCR) was adopted as the nucleic acid detection method. The detection kit was provided by Shanghai Zeno Company (Shanghai municipality), Shanghai Zhijiang Company (Shanghai municipality), and Jiangsu Shuo Shi Company (Jiangsu province). The

results revealed that the cutoff (Ct) value was 40 points; thus, a Ct value of less than 37 points represented a positive result of the nucleic acid test, a Ct value of greater than 40 points represented a negative result of the nucleic acid test, and a Ct value of between 37 and 40 points necessitated retesting.

4. Disisolation and discharge standards

For hospital discharge, the following four conditions were required to be met: (1) the body temperature returned to and remained normal for more than three days, (2) respiratory symptoms improved significantly, (3) pulmonary imaging showed significant improvements in acute exudative lesions, and (4) nucleic acid testing of respiratory tract specimens such as sputum and nasopharyngeal swabs was negative two consecutive times (with sampling conducted at least 24 hours apart).

Statistical analysis

The SPSS 25.0 statistical software program (IBM Corp., Armonk, NY, USA) was adopted, and enumeration data were represented by the number of cases (percentage), while Fischer's exact test was used for the comparison between groups. Normality testing was conducted for the enumeration data, and the data conforming to the normal distribution arrangement were expressed as means ± standard deviations. Those that did not conform to normal distribution were instead represented by medians (interquartile ranges). The rank-sum test was used for inter-group comparison. A p-value of less than 0.05 was considered to be statistically significant.

Results

Demographic characteristics and epidemiology

As of March 4, 2020, Xiamen reported a total of 35 COVID-19 patients, including 2 cases of the mild type, 26 cases of the common type, 5 cases of the severe type, and 2 cases of critical type divided into the general ward admission group and the ICU admission group. Of note, the study population included one pregnant woman and no children or juvenile cases. Twenty-two (63%) patients had a history of travel or residence in Wuhan within the last two weeks. A total of 22 (63%) cases involved familial clustering, including eight families. There were no nosocomial infections or cases in medical staff. Table 1 presents additional information.

Table 1

Demographic characteristics and symptom characteristics of COVID-19 patients

	All of the patients (n = 35)	General ward patient (n = 28)	Patients in the ICU (n = 7)	p-value
Demographic characteristics				
Age (years)	54 (38–67)	52 (40–66)	64 (36–71)	0.70
Gender	..	..	..	0.59
Male	21 (60)	17 (61)	4 (57)	..
Female	14 (40)	11 (39)	3 (43)	..
BMI $(kg/m)^2$	24.86 ± 3.31	24.54 ± 2.53	26.17 ± 5.54	0.47
Smoking history	2 (6)	2 (7)	0 (0)	0.64
Number of cases that had been to Wuhan within two weeks prior	22 (63)	17 (61)	5 (71)	0.48
Familial cluster of cases	22 (63)	16 (57)	6 (86)	0.17
Any underlying disease	17 (48)	12 (43)	5 (71)	0.18
hypertension	7 (20)	4 (14)	3 (43)	0.13
diabetes	7 (20)	6 (21)	1 (14)	0.57
Coronary heart disease (CHD)	3 (9)	2 (7)	1 (14)	0.50
Cardiocerebrovascular disease	1 (3)	1 (4)	0 (0)	0.80
History of the tumor	2 (6)	0 (0)	2 (29)	0.04
Other (e.g., atrial fibrillation, valvular heart disease)	2 (6)	1 (4)	1 (14)	0.37
Characteristics of symptoms				
Fever	28 (80)	21 (75)	7 (100)	0.18
Maximum temperature range	..	..	..	0.04
37.1 °C–37.9 °C	9 (26)	8 (29)	1 (14)	..
38.0 °C–38.9 °C	15 (43)	12 (43)	3 (43)	..
≥ 39.0 °C	4 (11)	1 (4)	3 (43)	..

COVID-19: coronavirus disease 2019; BMI: body mass index.

	All of the patients (n = 35)	General ward patient (n = 28)	Patients in the ICU (n = 7)	p-value
Time for fever reduction after admission (days)	1.50 (0–4)	0 (0–2.50)	4 (2–8)	0.03
Chills	8 (23)	5 (18)	3 (43)	0.18
Cough	18 (51)	12 (43)	6 (86)	0.05
Expectoration	10 (28)	6 (21)	4 (57)	0.08
Difficulty with breathing	3 (9)	1 (4)	2 (29)	0.10
Time from onset to dyspnea (days)	3.33 ± 2.51	..	..	..
Fatigue	8 (23)	5 (18)	3 (43)	0.18
Stuffy/runny nose	4 (11)	2 (7)	2 (29)	0.17
Systemic pain	2 (6)	0 (0)	2 (29)	0.04
Sore throat	7 (20)	6 (21)	1 (14)	0.57
Diarrhea	7 (20)	5 (18)	2 (29)	0.43
Headache	5 (14)	4 (14)	1 (14)	0.74
Length of onset of symptom to admission (days)	2 (1–4)	2 (1–3)	1 (1–4)	0.79
Time for transfer to the ICU after admission (days)	2 (2–6)	..	2 (2–6)	..
COVID-19: coronavirus disease 2019; BMI: body mass index.				

Clinical Manifestations

Among the 35 patients, the most common symptoms recorded were fever (80%), cough (51%), sputum (28%), and fatigue (23%). Initially, there were only three (9%) patients with dyspnea at admission, but other five patients with dyspnea in a later stage were transferred to the ICU for treatment. As compared with patients in the general-ward group, patients in the ICU group had a higher maximum body temperature, a longer antipyretic time after admission, and a greater frequency of systemic pain symptoms (Table 1).

Laboratory Examination And Pulmonary Ct Imaging Findings

As compared with patients in the general-ward group, the neutrophil ratio and neutrophil count were higher in the ICU group per blood routine examination conducted within 24 hours before or after admission. Conversely, as compared with patients in the general-ward group, the blood neutrophil ratio was higher and the lymphocyte ratio and lymphocyte count were lower in the ICU group during blood routine examination conducted five to seven days after admission. Patients in the ICU group also had higher CRP and D-dimer levels within 24 hours before or after admission, and the former remained higher in the ICU group at five to seven days after admission. Considering biochemical findings, glutamate transaminase and lactate dehydrogenase were higher in the ICU group than in the general-ward group within 24 hours before or after admission. Further biochemical examination at five to seven days after admission indicated that the lactate dehydrogenase level was still higher in the ICU group. Finally, the main manifestations among pulmonary CT imaging features were bilateral pulmonary multiple lesions (86%), subpleural distribution (97%), and ground-glass shadow (71%), with no statistically significant differences noted between the two groups. Tables 2 and 3 present additional specific information.

Table 2

Laboratory examination within 24 hours before and after admission, pulmonary CT findings, and novel coronavirus nucleic acid test results of COVID-19 patients

	All of the patients (n = 35)	General ward patients (n = 28)	Patients in the ICU (n = 7)	p-values	Normal range
Blood routine, CRP, D-dimer, biochemical results					
White blood cell count (× 10^9 L)	4.37 (3.44–6.00)	4.22 (3.26–5.96)	5.17 (4.29–9.71)	0.06	3.5–9.5 × 10^9/L
Neutrophil ratio	64.00 ± 12.74	61.92 ± 12.37	71.41 ± 12.04	0.04	50–70%
Lymphocyte ratio	25.11 ± 11.11	26.49 ± 11.36	20.17 ± 9.25	0.12	20–50%
Neutrophil count (× 10^9/L)	3.01 (2.05–3.86)	2.91 (1.83–3.75)	3.69 (3.09–7.20)	0.03	1.8–6.3 × 10^9/L
Lymphocyte count (× 10^9/L)	1.18 (0.65–1.48)	1.19 (0.68–1.45)	1.07 (0.61–1.72)	1.00	1.1–3.2 × 10^9/L
Hemoglobin (G/L)	137 (126–149)	138 (126–149)	133 (120–170)	0.83	130–175G/L
Platelet count (× 10^9/L)	153 (125–179)	153 (126–178)	144 (121–187)	0.43	125–350 × 10^9/L
C-reactive protein (mg/L)	11.95 (5.00–26.10)	9.20 (4.77–20.65)	64.60 (9.56–112.00)	0.03	0–7 mg/L
Procalcitonin (ng/mL)	0.05 (0.05–0.07)	0.05 (0.05–0.05)	0.12 (0.05–0.20)	0.06	0–0.1 ng/mL
D-dimer (mg/L)	0.22 (0.16–0.40)	0.20 (0.14–0.29)	0.35 (0.26–0.57)	0.02	0–0.5 mg/L
Creatine kinase (U/L)	86 (60–152)	83 (58–150)	138 (75–246)	0.26	38–174 U/L
Creatine kinase isoenzyme (U/L)	10.97 ± 6.38	9.84 ± 5.54	15.00 ± 7.98	0.06	0.1–24 U/L

COVID-19: coronavirus disease 2019; CT: computed tomography.

	All of the patients (n = 35)	General ward patients (n = 28)	Patients in the ICU (n = 7)	p-values	Normal range
Albumin (g/L)	35.63 ± 4.40	35.80 ± 4.16	35.00 ± 5.48	0.63	40–55 g/L
Aminotransferase (U/L)	22 (17–32)	21 (17–29)	25 (16–72)	0.36	9–50 U/L
Transaminase (U/L)	23 (20–32)	23 (20–29)	33 (23–50)	0.01	15–40 U/L
Urea (mmol/L)	3.89 ± 1.51	3.83 ± 1.56	4.09 ± 1.40	0.56	2.9–8.2 mmol/L
Creatinine (mmol/L)	79.00 ± 18.45	79.40 ± 17.99	77.57 ± 21.49	0.85	62–115 mmol/L
Lactate dehydrogenase (U/L)	160 (142–204)	151 (139–180)	248 (162–273)	0.002	91–180 U/L
CT image characteristics of lung					
Bilateral pulmonary multiple lesions	30 (86)	23 (82)	7 (100%)	0.30	..
Subpleural distribution	34 (97)	27 (96)	7 (100%)	0.80	..
Ground-glass shadow	25 (71)	18 (64)	7 (100%)	0.07	..
Nucleic acid test results					
Time of the first negative result of nucleic acid detection after treatment (days)	9.80 ± 2.87	9.89 ± 2.85	9.43 ± 3.16	0.71	..
One nucleic acid test was needed to confirm the number of cases	26(74)	22 (79)	4 (57)	0.24	..
Two nucleic acid tests were needed to confirm the number of cases	6(17)	5 (18)	1 (14)	0.66	..
Three or more nucleic acid tests were needed to confirm the number of cases	3(9)	1 (4)	2 (29)	0.10	..

COVID-19: coronavirus disease 2019; CT: computed tomography.

Table 3
Laboratory examination of COVID-19 patients five to seven days after admission

	All of the patients (n = 35)	General ward patients (n = 28)	Patients in the ICU (n = 7)	p-values	Normal
White blood cell count (× 10^9/L)	5.40 ± 1.77	5.30 ± 1.60	5.80 ± 2.46	0.51	3.5–9.5 × 10^9/L
Neutrophil ratio	64.23 ± 10.44	61.85 ± 8.26	73.76 ± 13.34	0.005	50–70%
Lymphocyte ratio	23.69 ± 8.31	25.75 ± 6.37	15.46 ± 10.46	0.002	20–50%
Neutrophil count (× 10^9/L)	3.24 (2.56–4.40)	3.19 (2.54–4.34)	3.62 (2.56–8.39)	0.34	1.8–6.3 × 10^9/L
Lymphocyte count (× 10^9/L)	1.24 ± 0.49	1.33 ± 0.46	0.88 ± 0.49	0.03	1.1–3.2 × 10^9/L
Hemoglobin (G/L)	136 ± 16	135 ± 16	133 ± 16	0.77	130–175G/L
Platelet count (× 10^9/L)	219 ± 71	219 ± 70	218 ± 82	0.97	125–350 × 10^9/L
C-reactive protein (mg/L)	8.97 (4.71–24.00)	7.71 (4.58–18.15)	38.57 (8.30–84.60)	0.02	0–7 mg/L
Procalcitonin (ng/ml)	0.05 (0.05–0.05)	0.05 (0.05–0.05)	0.05 (0.05–0.11)	0.20	0–0.1 ng/mL
Creatine kinase (U/L)	45 (30–99)	44 (29–94)	50 (30–99)	0.70	38–174 U/L
Creatine kinase isoenzyme (U/L)	6 (5–11)	6 (5–10)	8 (1–16)	0.95	0.1–24 U/L
Albumin (g/L)	32 ± 4	32 ± 4	31 ± 3	0.42	40–55 g/L
Aminotransferase (U/L)	28 (20–38)	25 (20–36)	36 (31–49)	0.12	9–50 U/L
Transaminase (U/L)	24 (19–32)	24 (19–30)	27 (22–53)	0.16	15–40 U/L
Urea (mmol/L)	3.85 (2.92–4.68)	3.82 (2.67–4.65)	3.85 (3.17–5.20)	0.50	2.9–8.2 mmol/L
Creatinine (mmol/L)	78 ± 16	77 ± 16	80 ± 17	0.71	62–115 mmol/L

COVID-19: coronavirus disease 2019.

	All of the patients (n = 35)	General ward patients (n = 28)	Patients in the ICU (n = 7)	p-values	Normal
Lactate dehydrogenase (U/L)	172 ± 47	160 ± 39	218 ± 50	0.002	91–180 U/L
COVID-19: coronavirus disease 2019.					

Nucleic Acid Test Results

The 35 patients with COVID-19 were sent to the Xiamen Center for Disease Control and Prevention for novel coronavirus nucleic acid testing using nasal swabs. The number of cases requiring three or more nucleic acid tests to confirm the diagnosis was three (9%), while one case required six nucleic acid tests. The novel coronavirus nucleic acid test results were re-examined five to seven days after each patient who was confirmed positive was treated. There was no statistical difference between the two groups regarding the time of the first negative result during nucleic acid testing after treatment. Table 2 provides additional specific information.

Clinical Treatment And Prognosis

Concerning drug therapies, 15 (43%) patients received methylprednisolone (mostly 40–80 mg/day, 3–7 days), 24 (69%) patients received antibacterial drugs (mainly respiratory quinolone, ceftriaxone, and cefotaxime), 24 (69%) patients received gamma globulin, and 27 (77%) patients were treated by the thymalfasin. All patients were treated using an anti–COVID-19 drug recommended in the national diagnosis and treatment scheme. There was no statistically significant comparison made in terms of use patterns between the two groups considering all of the drugs mentioned above. In terms of respiratory support, none of the patients required invasive ventilator-assisted ventilation, continuous renal replacement therapy (CRRT), or extracorporeal membrane oxygenation (ECMO). Conversely, there was a statistically significant difference between the two groups for high-flow nasal oxygen and noninvasive ventilator-assisted ventilation requirements: no patients in the general wards were treated with high-flow nasal oxygen and noninvasive ventilator-assisted ventilation. By March 4, all patients have been discharged from the hospital without death. Table 4 provides additional specific information.

Table 4
Treatment status of COVID-19 patients

	All of the patients (n = 35)	General ward patient (n = 28)	Patients in the ICU (n = 7)	p-values
Gamma globulin (number of cases)	24 (69)	17 (61)	7 (100)	0.05
thymalfasin (number of cases)	27 (77)	22 (79)	5 (71)	0.52
Anti–novel coronavirus (examples)	35 (100)	28 (100)	7 (100)	1.00
Methylprednisolone (number of cases)	15 (43)	10 (36)	5 (71)	0.10
Antimicrobial agents (number of cases)	24 (69)	17 (61)	7 (100)	0.05
Nasal catheter for oxygen (number of cases)	24 (69)	17 (61)	7 (100)	0.05
High-flow nasal oxygen (number of cases)	4 (11)	0 (0)	4 (57)	0.001
Noninvasive ventilator-assisted ventilation (number of cases)	2(6)	0 (0)	2 (29)	0.04
Number of discharged patients (number of cases)	35(100)	28 (100)	7 (100)	1.00
COVID-19: coronavirus disease 2019.				
Tables				

Discussion

Human coronavirus is one of the pathogens that causes respiratory tract infection. Before the discovery of the novel coronavirus that caused this outbreak, six other coronaviruses were known to infect humans: HCoV-229E, HCoV-OC43, HCoV-NL63, HCoV-HKU1, SARS-CoV, and MERS-CoV. Respiratory diseases caused by four types of coronavirus, HCoV-229E, HCoV-OC43, HCoV-NL63, and HCoV-HKU1, are generally mild, while both SARS-CoV and MERS-CoV are highly infectious and pathogenic and have caused epidemics or outbreaks [6–8]. The present novel coronavirus has the typical characteristics of the coronavirus family and belongs to the beta - coronavirus, which is the closest genome-wide relative of the SARS-like coronavirus strain RaTG13 carried by bats, with a homology of 96% [9]. At present, the COVID-19 epidemic in China has been significantly mitigated under strict and active prevention and control measures [10]. By March 4, 2020, all COVID-19 patients admitted to the hospital Xiamen had been discharged. The following includes an analysis of the clinical characteristics of these patients.

The cases in Xiamen involved eight family clusters, which clearly indicates that coronavirus presents the capacity for human-to-human transmission, consistent with previous reports [9]. Further study must focus

on the spread of the virus, such as its propagation mode and transmission by different types of specimens (e.g., upper and lower respiratory tract, saliva, feces, and urine).

According to the case data reported in this paper, by comparing the characteristics of previously reported cases in Wuhan [1–3], we found that the severity of cases in Xiamen was less than that in Wuhan, which is mainly reflected by that the proportions of patients with the severe and critical disease types were lower and the proportion of patients requiring organ support technology was lower. Huang et al. [2] reported 41 cases of Wuhan COVID-19 patients, including 13 (32%) who required ICU care, 2 (5%) who received invasive ventilator-assisted ventilation, 2 (5%) who underwent ECMO, and 6 (15%) who died. Separately, Wang et al. [3] provided details of 138 cases of Wuhan COVID-19 patients, with 36 cases (26%) requiring ICU care, 17 cases (12%) receiving invasive ventilator-assisted ventilation, 4 cases (3%) using ECMO, and 6 cases (4.3%) who died. In our study, a total of 35 COVID-19 patients were admitted and discharged from the hospital in Xiamen, among which seven (20%) cases required ICU care. There were no patients requiring invasive ventilator-assisted ventilation, CRRT, or ECMO. Also, there were no deaths, no nosocomial infections, or infections of medical staff. Importantly, our study offers a more complete picture of the long-term outcomes relative to the two aforementioned studies. These cases reported from Wuhan were during the earlier stage of the outbreak of COVID-19, so the pathogenicity and infectivity of the virus were not fully recognized. In addition, the number of COVID-19 patients diagnosed in Wuhan was too high to achieve early and timely treatment. However, before the first confirmed case of COVID 19 appeared in Xiamen, the Xiamen municipal government had already attached great importance to its management and adopted all-out efforts to prevent and control the spread of the disease. The government also preemptively established a designated hospital for the treatment of novel coronavirus. From January 15, 2020, onward, 21 outpatient clinics for fever were set up. Wang et al. [3] also reported in their study that the duration of hospitalization from symptom onset to hospital admission among their Wuhan cases was seven (4–8) days, while the duration among the Xiamen cases was two (1–4) days, without no nosocomial infections, infections of the medical staff infection, or deaths. The above facts suggest that the Xiamen municipal government achieved the eight goals of early and concentrated mitigation [9]—that is, early detection, early report, early diagnosis, and early isolation as well as centralizing patients, centralizing experts, centralizing resources, and centralizing treatment while also directing the concentration of severe patients to the best comprehensive medical institutions, thus improving the rates of hospitalization and cure and reducing the infection and mortality rates. In the literature, the global mortality of MERS-CoV cases is about 34.4% [11], and the mortality of the next generation of disease is expected to be 20.4% [12], suggesting that, with the spread of transmission, novel coronavirus also shows the potential that its infectivity and pathogenicity would be gradually weakened.

When compared with patients in the general-ward group, the patients in the ICU group had higher maximum body temperatures and longer fevers after admission, suggesting that if the patients experienced repeated high fevers without alleviation, such were manifestations of severe disease. During the laboratory examination, we found that many patients had low blood lymphocyte ratios and lymphocyte counts at the time of admission, but there was no significant difference observed in either regard between the general-ward group and the ICU group. However, by five to seven days after

admission, the blood lymphocyte ratios and lymphocyte counts of the ICU group were still low, while the general-ward group's results normalized, resulting in a significant difference between the general-ward group and the ICU group. Thus, we can draw a conclusion that persistent low or gradual decline in the level of lymphocytes suggests a poor prognosis. Meanwhile, relative to patients in the general-ward group, patients in the ICU group had higher CRP and lactate dehydrogenase levels, suggesting that the above indicators may also be clinical warning indicators of severe disease, which is consistent with China's novel coronavirus pneumonia diagnosis and treatment scheme (seventh edition) [5].

Lung CT findings included mainly bilateral multiple lesions (86%), subpleural distribution (97%), and ground-glass shadow (71%), which were consistent with details in previous reports [1–3].Novel coronavirus nucleic acid testing showed three cases (6%) requiring three or more nucleic acid tests before being ruled positive, and one case required six nucleic acid tests before being ruled positive. Thus, if the patient has an epidemiological history, respiratory symptoms, and typical pulmonary CT imaging changes such as multiple subpleural distributions of ground-glass shadow, even if the novel coronavirus nucleic acid test was negative twice, it was believed to still be necessary to continue nucleic acid testing to reduce the rate of missed diagnosis. In addition, we found that one patient still had a positive nucleic acid report after 14 nucleic acid tests, but the day after nasal irrigation, the nucleic acid test results from the nasal swab turned negative; at the same time, the patient had no symptoms, and the lung lesions had been completely absorbed for five days. Considering the possible reasons for this, when a patient has a nasal scab or sinus inflammation, it can result in the continuous presence of localized viral nucleic acids; however, in such a case, there is no virus activity in the body. At this time, nucleic acid detection should be performed on alternate days after nasal cleansing.

Treatment is mainly based on the novel coronavirus pneumonia diagnosis and treatment scheme developed by the national health board. However, up to now, there has been no effective medicine available for novel coronavirus, which is mainly treated by strengthening supportive treatment, the timely provision of effective oxygen therapy, and maintenance of a stable internal environment.

Our study has several limitations. First, we included only 35 cases—and fewer patients in the ICU group in particular—so we need to be cautious about the indicators used for clinical early warning purposes. Second, we listed some abnormal clinical manifestations and gave some possible explanations, but, due to the small sample size, the real reasons for these manifestations need to be further studied. Third, we used data from a single city outside Wuhan. More data collected from other cities outside Wuhan may be needed to evaluate the real differences between the cases in Wuhan and those outside Wuhan.

Conclusion

Our research suggests the severity of COVID-19 in Xiamen was less severe than that in Wuhan. However, in view of the disease's strong infectivity and pathogenicity, we still need to take active and strict control measures.

Abbreviations

ICU: intensive-care-unit; COVID-19: coronavirus disease 2019; CRP: C-reactive protein; PCT: calcitonin; CT: computed tomography; RT-PCR: Reverse-transcription polymerase chain reaction; Ct: cutoff; CRRT: continuous renal replacement therapy; ECMO: extracorporeal membrane oxygenation; SARS-CoV: Severe acute respiratory syndrome coronavirus; MERS-COV: Middle East respiratory syndrome coronavirus; HCoV-229E: human coronavirus-229E; HCoV-OC43: human coronavirus- OC43; HCoV-NL63: human coronavirus- NL63; HCoV-HKU1: human coronavirus- HKU1.

Declarations

Ethics approval and consent to participate

This research project was approved by the medical ethics committee of the First Affiliated Hospital of Xiamen University and written informed consent was waived.

Consent for publication

Not applicable

Availability of data and material

The dataset used and/or analyzed during the current study will be available from the corresponding author on a reasonable request after the final result is published in a journal.

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Competing interests

All authors declare no conflict of interest here.

Authors' contributions

WZX and WDH designed the study and revised the manuscript, they should be regarded as co-corresponding author. LW and LYH participated in the design of the study and data collection and drafted the manuscript, they should be regarded as co-first author. YXY, SYH and LF participated in data collection and analysis and helped to draft the manuscript. All authors read and approved the final manuscript.

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