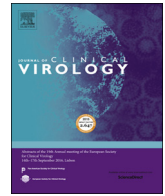




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Epidemiological characteristics and clinical features of 32 critical and 67 noncritical cases of COVID-19 in Chengdu

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ABSTRACT

Background: In December 2019, Wuhan, China, experienced an outbreak of coronavirus (COVID-19). The number of cases has increased rapidly, but information on the clinical characteristics remains limited.

Objectives: This paper describes the epidemiological and clinical characteristics of COVID-19. Early detection and identification of critically ill patients is necessary to facilitate scientific classification and treatment.

Study design: This study included a retrospective, single-center case series of 99 consecutively hospitalized patients with confirmed COVID-19 at Chengdu Public Health Clinical Medical Center in Chengdu, China, from January 16 to February 20, 2020. The final date of follow-up was February 23, 2020.

We collected and analyzed epidemiological, demographic, clinical, laboratory, radiological, and treatment data. We compared outcomes of critically ill patients and noncritically ill patients.

Results: Of the 99 hospitalized patients with COVID-19, the median age was 49 years (minimum, 3 months; maximum, 87 years) and 51 (52 %) were men; 42 (42 %) had traveled to or lived in Wuhan and 48 (49 %) had come into close contact with patients with new coronavirus pneumonia; 41 (41 %) patients had underlying disease. Common symptoms included fever (85 [86 %]), dry cough (84 [85 %]), and fatigue (72 [73 %]).

We analyzed the clinical characteristics of patients. We expressed the measurement data as mean \pm standard deviation. We collected data for age (49.39 \pm 18.45 years), number of hospital days (12.32 \pm 6.70 days), and laboratory indicators.

We compared critically ill and noncritically ill patients: p-values for age, C-reactive protein, high-sensitivity troponin T, prothrombin time, fibrin degradation products, D-Dimer, and CD4+ count were $p < 0.001$; and p-values for hospital days, white blood cell, neutrophil, lymphocyte, creatine kinase isoenzyme, myoglobin, N-terminal brain natriuretic peptide, and CD8+ count were $p < 0.05$.

Conclusions: We collected data from a single-center case series of 32 hospitalized patients who were critically ill with confirmed COVID-19 in Chengdu, China, and compared data with 67 noncritically ill patients. Elderly patients had chronic underlying diseases, notably cardiovascular disease. Higher C-reactive protein levels, higher levels of myocardial damage, and higher brain natriuretic peptide levels; lower white blood cells, neutrophils, and lymphocytes; and lower CD4 and CD8 counts could be used for early detection and identification of critically ill patients, and dynamic Data observation was more important than at a single moment.

1. Background

Since the end of December 2019, a new type of coronavirus pneumonia appeared in Wuhan City. The World Health Organization named this new coronavirus pneumonia COVID-19 [1]. This virus spread to other parts of the country as well as to other countries and regions around the world.

The number of patients has increased rapidly, but information on

the clinical characteristics of these critically ill patients remains limited. Case data on COVID-19 from other cities is even more scarce than in Wuhan.

2. Objectives

In the face of emerging outbreaks of infectious diseases, it is extremely important to fully understand the spread, epidemiology,

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clinical characteristics, progression, and prognosis of the disease. By identifying the clinical characteristics of critical cases, we can detect and identify critically ill patients earlier. Early identification and prediction of critical illness is critical to ensure early and immediate focus on the most critically ill cases, reasonable allocation of time, and use of high-quality resources.

3. Study design

We collected data for a total of 99 COVID-19 cases from Chengdu Public Health Clinical Medical Center from January 16, 2020, to February 20, 2020. According to disease development and condition, we divided the cases into two groups: critically ill patients and non-critically ill patients. We separated the noncritically ill patients and the critically ill patients in the general ward and in the intensive care unit (ICU) equipped with negative pressure.

We performed a retrospective study on the 99 patients and collected clinical data, including general information, epidemiological history, medical history, symptoms, signs, imaging examinations, and laboratory examinations. We summarized the epidemiological characteristics and clinical characteristics of patients, evaluated chest imaging characteristics, and examined prognosis of disease progression.

Diagnostic criteria met the guidelines for diagnosis and treatment of COVID-19 (trial version 5) [2]. We confirmed all cases according to nucleic acid real time-polymerase chain reaction (RT-PCR) tests. Most of the patients had lived in Wuhan or came into close contact with patients who had COVID-19.

Critical cases met any of the following criteria: (1) Increased breathing rate (≥ 30 beats/min), difficulty breathing or cyanosis of the lips; (2) upon inhalation, oxygen saturation was $\leq 93\%$; (3) arterial blood oxygen partial pressure (PaO₂)/oxygen concentration (FiO₂) was ≤ 300 mmHg (1 mmHg = 0.133 kPa); (4) pulmonary imaging showed multilobular lesions or lesion progression within 50 h of $> 50\%$; or (5) other clinical conditions requiring hospitalization. Severe critical cases met one of the following conditions: (1) respiratory failure occurred, requiring mechanical ventilation; (2) shock occurred; or (3) ICU monitoring and treatment were required for combined organ failure.

We processed data using SPSS 20.0 statistical software. We expressed measurement data as mean \pm standard deviation ($x \pm s$) and used a *t*-test. We expressed count data as rate (%), and used a χ^2 test. *P*-values < 0.05 indicated that the difference was statistically significant.

4. Results

Of the 99 patients with COVID-19, 42 patients (42 %) traveled to or lived in Wuhan and 48 patients (49 %) had come into close contact with patients who had COVID-19. An additional nine cases (9 %) had no clear epidemiological history. We detected and confirmed all cases using real-time RT-PCR. The study included 51 men and 48 women. Of the total, 41 (41 %) patients had underlying disease, of which heart disease (21 %), including hypertension or coronary heart disease, was the most common, followed by diabetes (6 %). The other 58 (59 %) patients did not have underlying disease. We determined that 32 (32 %) patients met the criteria for critically ill cases, and the remaining 67 patients (68 %) were noncritically ill cases.

Patients demonstrated clinical manifestations of fever (85 [86 %] patients), cough (84 [85 %] patients), fatigue (72 [73 %] patients), shortness of breath (35 [35 %] patients), muscle ache and headache (12 [12 %] patients), other respiratory symptoms (5 [5 %] patients), and gastrointestinal symptoms (2 [2 %] patients). According to imaging examinations, 79 (80 %) patients had interstitial pneumonia; 15 (15 %) patients developed acute respiratory distress syndrome; and, among these patients, 3 (3 %) patients worsened in a short period of time and died of multiple organ failure. We analyzed the clinical characteristics of patients (see Table 1). We recorded some of the laboratory

Table 1
Clinical characteristics of 99 patients at admission.

	N	MIN	MAX	MEAN	SD
AGE (years)	99	0.25	87.00	49.40	18.45
HOSPITAL DAY (day)	99	5.00	50.00	23.82	11.18
WBC (10 ⁹ /l)	99	2.29	15.44	6.21	2.64
NEU (10 ⁹ /l)	99	1.21	14.49	4.31	2.46
LYM (10 ⁹ /l)	99	.22	8.60	1.81	1.26
CRP (mg/l)	99	.80	174.17	24.79	35.49
ALT (u/l)	92	7.00	208.00	35.16	36.09
AST (u/l)	92	7.00	502.00	34.59	52.44
CKMB (ng/mL)	96	.30	42.00	5.42	6.57
MYO (ng/mL)	88	21.00	1299.00	53.10	139.19
TNTHSST (pg/mL)	88	3.00	174.20	12.28	24.13
NT-proBNP (pg/mL)	84	5.00	17324.00	430.72	1965.34
PT (s)	94	11.50	17.40	13.10	.80
FDP (ug/mL)	94	1.40	35.50	4.03	5.53
D-Dimer (ug/mL)	94	.23	17.70	1.41	2.51
CD4 (cells/ul)	89	38.00	2699.00	471.65	355.85
CD8 (cells/ul)	89	35.00	1422.00	306.24	238.28

Note: WBC, white blood cells; NEU, neutrophil; LYM, lymphocyte; CRP, C-reactive protein; CKMB, creatine kinase isoenzyme; MYO, myoglobin; TNTHSST, high-sensitivity troponin T; NT-proBNP, N-terminal brain natriuretic peptide; PT, prothrombin time; FDP, fibrin degradation products; CD4, CD4+ count; CD8, CD8+ count.

indicators, including blood routine, myocardial injury indicators and heart function, immunity, coagulation indicators, and liver and kidney function. We expressed the measurement data as mean \pm standard deviation.

To analyze the clinical characteristics of critically ill patients, we compared laboratory data for critically ill and noncritically ill patients (see Table 2). We calculated the mean and standard deviation of the measurement data for these two groups, and compared whether these indicators were statistically different between the two groups according to the *p*-value.

5. Discussion

- We asked all patients for details about their epidemiological history. We identified that 42 patients lived in or had been to Wuhan, and 49 patients had close contact with patients with confirmed COVID-19. The other eight cases had no clear epidemiological history. We found no statistical difference (χ^2 , 0.184, > 0.05) in the epidemiological history of critically ill patients and noncritically ill patients. The patients admitted in the early stage had a history of touring or living in Wuhan (first-generation patients), and the patients admitted in the later stage usually had close contact with patients with confirmed COVID-19 (second-generation patients). The first generation of patients was highly distributed and related to contacts in Wuhan, but the second generation of patients showed a high degree of family clustering [3]. This may indicate that respiratory droplets and close contact are the primary routes of transmission. This finding also showed that benefits of reducing the flow of people and large gatherings as well as staying at home and self-isolation have begun to take effect on reducing transmission [4].
- The study included 48 female patients and 51 male patients, including 19 male and 13 female critically ill patients. There was no statistically significant difference between the two groups (*p*-value 0.293 > 0.05).
- The mean age of critically ill patients was 63.8 years, whereas that of noncritically ill patients was 42.5 years [5]. This difference (*p*-value 0.000 < 0.001) was extremely significant and statistically significant. With an increase in age, the probability of occurrence of basic diseases also increased significantly. Of all patients, 41 cases had significant chronic disease. Among the critically ill patients, 17 cases had heart-related disease, 3 cases had type 2 diabetes, and 1

Table 2
Comparison of laboratory indicators between critically ill and noncritically ill patients.

	CONDITION	N	MEAN	SD	p-value
AGE	Critical	32	63.81	16.51	0.000
	Noncritical	67	42.51	15.11	
HOSPITAL DAY	Critical	32	35.97	8.99	0.000
	Noncritical	67	18.02	6.480	
WBC*	Critical	32	7.00	3.09	0.040
	Noncritical	67	5.83	2.33	
NEU*	Critical	32	5.42	2.84	0.002
	Noncritical	67	3.78	2.08	
LYM*	Critical	32	2.19	1.44	0.039
	Noncritical	67	1.64	1.12	
CRP*	Critical	32	49.63	48.11	0.000
	Noncritical	67	12.93	18.48	
ALT*	Critical	30	42.37	48.88	0.184
	Noncritical	62	31.68	27.75	
AST*	Critical	30	51.23	88.67	0.033
	Noncritical	62	26.53	12.73	
CKMB*	Critical	31	3.55	5.34	0.053
	Noncritical	65	6.32	6.94	
MYO*	Critical	31	97.50	229.10	0.026
	Noncritical	57	28.96	17.22	
TNTHSST*	Critical	31	24.80	37.77	0.000
	Noncritical	57	5.47	2.58	
NT-proBNP*	Critical	30	1085.55	3217.11	0.022
	ordinary	54	66.92	90.85	
PT*	Critical	32	13.49	.96	0.001
	Noncritical	62	12.91	.63	
FDP*	Critical	32	6.72	8.36	0.001
	Noncritical	62	2.65	2.33	
D-Dimer	Critical	32	2.65	3.93	0.000
	Noncritical	62	.78	.76	
CD4*	Critical	26	273.92	185.21	0.001
	Noncritical	63	553.25	377.81	
CD8*	Critical	26	202.31	144.31	0.007
	Noncritical	63	349.13	256.50	

patient had bronchitis. Among noncritically ill patients, 5 cases had hepatitis, 4 had heart disease, and 3 had diabetes. Among these patients, 49 patients did not have significant chronic disease and were classified as noncritically ill patients [6]. We found significant statistical differences between the two groups (χ^2 , $0.000 < 0.001$). Elderly patients with significant cardiovascular disease were prone to develop critical illness and had extremely high mortality rates [7].

4 In addition to lung disease and acute respiratory distress syndrome in critically ill patients, the blood system, myocardium, and immunity showed significant damage. In terms of white blood cells, neutrophils, lymphocytes, c-reactive protein, CKMB, MYO, TNTHSST, NT-ProBNP, PT, FDP, D-Dimer, CD4, and CD8, we observed a very significant difference between critically ill and noncritically ill patients [8]: p-values for CRP, TNTHSST, PT, FDP, D-Dimer, and CD4 were $p < 0.001$ and p-values for WBC, NEU, LYM, CKMB, MYO, NT-proBNP, and CD8 were $p < 0.05$.

In critically ill patients who had worsening of the disease, we observed progressively decreased blood leukocytes, neutrophils, lymphocytes, CD4, and CD8, and increased myocardial damage, cardiac function indexes, and coagulation indexes. In cases of the virus that were detected early, we observed relatively less damage to the liver and kidneys [9]. The death cases progressed rapidly to acute respiratory distress syndrome, septic shock, difficult-to-correct metabolic acidosis, and coagulopathy and multiple organ failure. In general, the severity of disease for most patients could be determined according to these clinical characteristics 1 week after admission, and patients could be identified as improving or dying 2–3 weeks after admission [10]. C-reactive protein > 49.6 mg/l, MYO > 97.5 ng/mL, TNTHSST > 24.8 pg/mL, NT-proBNP > 1085.5 pg/mL, PT > 14.5 s, FDP > 6.7

ug/mL, D-Dimer > 2.6 ug/mL, CD4 < 274 cells/ul, and CD8 < 202 cells/ul were relatively dangerous and demonstrated a manifestation of critical illness. This finding was similar to cases reported from the hospital in Wuhan [11].

5 The average length of hospital stay for all patients was 24 days, with a minimum of 5 days and a maximum of 50 days. The average length of hospital stay for critically ill patients was 36 days, and for noncritically ill patients was 18 days. We identified significant statistical differences between the two groups (p -value $0.000, < 0.001$).

6 This retrospective study has some obvious shortcomings. For example, in many laboratory inspections, we could not completely collect data according to the admission stage. At these stages, such as when the patient was newly admitted, when the condition changed, when the patient improved, or when they died, we could distinguish the progress of each patient's condition. Therefore, some indicators lacked a certain degree of comparability. In addition, although this was a retrospective study, because of large differences in enrollment time, some patients have not yet been discharged, and their outcome and prognosis will still change.

In summary, we collected data on cases of critically ill patients of COVID-19 and compared them with noncritically ill patients. We found that the elderly exhibited chronic underlying diseases, especially cardiovascular disease, higher C-reactive protein levels, and higher myocardium. Damage levels; higher brain natriuretic peptide levels; lower white blood cells, neutrophils, and lymphocytes; and lower CD4 and CD8 counts could enable early detection and identification of critically ill patients. Dynamic observation was important and facilitated concentration of superior resources to improve patient prognosis [12]. Although there were 32 critically ill patients, we immediately transferred them to the ICU to ensure a good prognosis for the most critically ill patients.

CRedit authorship contribution statement

Yongli Zheng: Conceptualization, Writing - review & editing, Writing - original draft, Formal analysis, Methodology, Software. **Hong Xu:** Project administration. **Ming Yang:** Resources. **Yilan Zeng:** Supervision. **Hong Chen:** Resources. **Ru Liu:** Resources. **Na Zhang:** Resources. **Dan Wang:** Data curation.

Declaration of Competing Interest

We declare that we have no financial and personal relationships with other people or organizations that can inappropriately influence our work, there is no professional or other personal interest of any nature or kind in any product, service and/or company that could be construed as influencing the position presented in, or the review of, the manuscript entitled, "Epidemiological Characteristics and Clinical Features of 32 Critical and 67 Noncritical Cases of COVID-19 in Chengdu".

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