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Archives of Gerontology and Geriatrics 91 (2020) 104185

Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger

Clinical characteristics of 312 hospitalized older patients with COVID-19 in Wuhan, China

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ARTICLE INFO

Keywords:
Clinical characteristics
Older patients
COVID-19
Severity
Risk factors
Outcomes

ABSTRACT

Objectives: Much of the previous research on COVID-19 was based on all population. But substantial numbers of severe episodes occur in older patients. There is a lack of data about COVID-19 in older adults. The aims of this study were to analyze the clinical characteristics of older adult patients with COVID-19.

Methods: Retrospective study of older patients hospitalized with COVID-19 from February 1 st to March 31 st, 2020 was conducted in the Sino-French New City Branch of Tongjing Hospital in Wuhan, China. According to the degree of severity of COVID-19 during hospitalization, 312 older patients were divided into non-severe and severe cases.

Results: the mean age of the patients was 69.2 ± 7.3 years, and 47.4 % of patients had exposure history. 77.2 % of patients had a co-morbidity, with hypertension being the most common (57.1 %), followed by diabetes (38.8 %) and cardiovascular disease (29.8 %). Multivariable regression showed increasing odds of severe COVID-19 associated with age(OR 1.59, 95 %CI 1.13 − 2.08), SOFA score(OR 5.89, 95 %CI 3.48 − 7.96), APACHEII score (OR 3.13, 95 %CI 1.85 − 5.62), platelet count < 125 × 10^9/L(OR 2.36, 95 %CI 1.03 − 4.14), D-dimer (OR 4.37, 95 %CI 2.58 − 7.16), creatinine > 133 μmol/L(OR 1.85, 95 %CI 1.12 − 3.04), interleukin-6(OR 4.32, 95 %CI 2.07 − 7.13), and lung consolidation(OR 1.94, 95 %CI 1.45 − 4.27) on admission. The most common complication was acute respiratory distress syndrome (35.6 %), followed by acute cardiac injury (33.0 %) and coagulation disorders (30.8 %). 91.7 % of patients were prescribed antiviral therapy, followed by immune globulin (52.9 %) and systemic glucocorticoids (43.6 %). 21.8 % of patients received invasive ventilation, 1.92 % for extracorporeal membrane oxygenation. The overall mortality was 6.73 %, and mortality of severe patients was 17.1 %, which was higher than non-severe patients (0.962 %).

Conclusions: Older patients with COVID-19 had much more co-morbidity, complications and mortality. More attention should be paid to older patients with COVID-19.

1. Introduction

In December 2019, some pneumonia cases of unknown origin were identified in Wuhan, the capital city of Hubei province (Huang, Wang et al., 2020; Huang, Wei, Hu, Wen, & Chen, 2020). The pathogen has been identified as a novel enveloped RNA betacoronavirus that has been named as acute respiratory syndrome coronavirus 2(SARS-Cov-2), which has a phylogenetic similarity to SARS-Cov (Coronaviridae Study Group of the International Committee on Taxonomy of Viruses, 2020; Lu et al., 2020; Zhu et al., 2020). The World Health Organization named the disease caused by SARS-Cov-2 as coronavirus disease 2019(COVID-19), and declared it a public health emergency of international concern (World Health Organization, https://www.who.int). Although the population is generally susceptible to SARS-CoV-2, most of the patients who need to be admitted to hospital are older (Wu & McGoogan, 2020). And most of deaths are among the elderly (Servello & Ettorre, 2020). Moreover, older age is a potential risk factor for mortality of adult inpatients (Zhou et al., 2020). Although some case series have been published, no previous studies focused on older patients exclusively (Huang, Wang et al., 2020; Fu et al., 2020; Novel Coronavirus Pneumonia Emergency Response Epidemiology Team, 2020; Huang, Wei et al., 2020). The estimation of risk factors for severe cases are therefore not very robust. Additionally, details of the clinical course of older patients with COVID-19 have not yet been well

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https://doi.org/10.1016/j.archger.2020.104185
Received 5 June 2020; Received in revised form 20 June 2020; Accepted 28 June 2020
Available online 15 July 2020

described.

Here, we present details of all older patients admitted to the designated hospital in Wuhan—the Sino-French New City Branch of Tongjing Hospital—with laboratory-confirmed COVID-19. We aim to describe clinical, laboratory, and radiological characteristics, treatment, and outcomes of them, and to compare the clinical features between non-severe and severe patients. We hope our finding will call doctors' attention to older patients with COVID-19.

2. Materials and methods

2.1. Design

We performed a retrospective analysis of hospital admissions for COVID-19 from February 1 st to March 31 st admitted to the Sino-French New City Branch of Tongjing Hospital, one of 53 designated hospitals for COVID-19. The study was approved by the institutional review board of the hospital. Due to the retrospective nature of the study, informed consent was waived.

We included all patients not younger than 65 years old, the data cutoff for the study was March 31 st, 2020. COVID-19 was diagnosed on basis of the WHO interim guidance (Metlay et al., 2019). A confirmed case of COVID-19 was defined as a positive result on high-throughput sequencing or real-time reverse-transcriptase-polymerase-chain-reaction (RT-PCR) assay of nasal and pharyngeal swab specimens. Only laboratory-confirmed cases were included in the analysis.

Enrolled patients were allocated to two groups according to severity of COVID-19 during hospitalization. And we defined the degree of severity of COVID-19 (non-severe vs. severe) using the American Thoracic Society guidelines for community-acquired pneumonia (Metlay et al., 2019).

2.2. Data collection

We extracted the recent exposure history, clinical symptoms or signs, and laboratory findings on admission from electronic medical records. Radiological assessments included chest radiography or computer tomography (CT), and all laboratory testing was performed according to the clinical care needs of the patient. We determined the presence of a radiological abnormality on basis of the documentation or description in medical charts. Laboratory assessments consisted of a complete blood count, blood chemical analysis, coagulation testing, assessment of liver and renal function, and measures of electrolytes, procalcitonin, lactate dehydrogenase, hypersensitive troponin I, creatine kinase, serum ferritin and interleukin-6. All the above data of enrolled patients were recorded with standardized data collection forms.

2.3. Definitions

Acute respiratory distress syndrome and shock were defined according to the interim guidance of WHO for novel coronavirus (World Health Organization, https://www.who.int/docs/default-source/coronaviruse/clinical-management-of-novel-cov.pdf). Hypoxaemia was defined as arterial oxygen tension (PaO_2) over inspiratory oxygen fraction (FiO_2) of less than 300 mmHg (Sanz, Gimeno, & Lloret, 2011). Acute kidney injury was identified and classified on the basis of the highest serum creatinine level or urine output criteria according to the kidney disease improving global outcomes classification (Kidney disease: improving global outcomes (KDIGO) acute kidney injury work group, https://kdigo.org/wp-content/uploads/2016/10/KDIGO-2012-AKI-Guideline-English.pdf). Acute cardiac injury was diagnosed if serum levels of cardiac biomarkers (eg, troponin I) were above the 99th percentile upper reference limit, or new abnormalities were shown in electrocardiography and echocardiography (Shi et al., 2020). Coagulation disorders was defined as a 3-second extension of prothrombin time or a 5-second extension of activated partial thromboplastin time (Jain & Acharya, 2018). Nosocomial infection was diagnosed if the patients had clinical symptoms or signs of nosocomial pneumonia or bacteraemia, and was combined with a positive culture of a new pathogen from a lower respiratory tract specimen (including the sputum, transtracheal aspirates, or bronchoalveolar lavage fluid, or from blood samples taken ≥ 48 h after admission) (Garner, Jarvis, Emori, Horan, & Hughes, 1988).

2.4. Statistics

Continuous variables were expressed as mean ± SD. Categorical variables were expressed as absolute values and percentages. Paired student's t-test, chi-square, ANOVA and Fisher's exact tests were used to compare values of variables between groups. Bonferroni test was used for correction of multiple testing errors of results from ANOVA. Pearson's chi-square test or Fisher's exact test were used to assess the association between each of the discrete variables and severe COVID-19. Factors associated with severe COVID-19 in the univariate analysis ($p < 0.10$) were then included in multivariable regression model. Stepwise selection method for logistic regression model was used to identify the independent risk factors. Statistical tests were considered significant if $P < 0.05$. All statistical analyses were performed in SPSS (V.22.0, IBM, Chicago, USA).

3. Results

312 older inpatients (≥65 years old) were analyzed in the study, and 105 patients were severe cases. The mean age was 69.2 ± 7.3 years, and most patients were male. The mean time from illness onset to hospital admission was 10.4 ± 5.3 days. 148 (47.4 %) patients had exposure history. Comorbidities were present in 241 (77.2 %) patients, with hypertension being the most common, followed by diabetes and cardiovascular disease. The most common symptoms on admission were fever and cough, followed by dyspnea, fatigue and sputum. The mean SOFA and APACHEII score were 3.1 ± 2.2 and 14.3 ± 5.2 separately. The demographics and baseline characteristics of patients on admission were showed in Table 1.

The white blood cell count, d-dimer, transaminase, bilirubin and creatinine were significantly higher in severe cases than non-severe cases. But the lymphocyte count and platelet count were significantly lower. From the perspective of inflammation indicators, procalcitonin, serum ferritin and interleukin-6 were much higher in severe cases. As for radiological findings, consolidation and bilateral pulmonary infiltration were found in 88.7 % and 71.4 % of severe patients, which were significantly higher than non-severe patients. The laboratory and radiographic findings of patients on admission were showed in Table 2.

Further regression analysis suggested that age(OR 1.59, 95 %CI 1.13 − 2.08), SOFA score(OR 5.89, 95 %CI 3.48 − 7.96), APACHEII score(OR 3.13, 95 %CI 1.85 − 5.62), platelet count < 125×10^9/L(OR 2.36, 95 %CI 1.03 − 4.14), d-dimer(OR 4.37, 95 %CI 2.58 − 7.16), creatinine > 133 μmol/L(OR 1.85, 95 %CI 1.12 − 3.04), interleukin-6(OR 4.32, 95 %CI 2.07 − 7.13), and lung consolidation(OR 1.94, 95 %CI 1.45 − 4.27) on admission were independent risk factors for severe COVID-19 (Table 3).

The most common complication was acute respiratory distress syndrome (35.6 %), followed by acute cardiac injury (33.0 %) and coagulation disorders (30.8 %). 91.7 % of patients were prescribed antiviral therapy, followed by immune globulin (52.9 %) and systemic glucocorticoids (43.6 %). 21.8 % of patients received invasive ventilation, 1.92 % for extracorporeal membrane oxygenation. The overall mortality was 6.73 %, and mortality of severe patients was 17.1 %, which was higher than non-severe patients (0.962 %). The complications, treatments and outcomes of patients were showed in Table 4.

Table 1
Demographics and baseline characteristics of older patients with COVID-19 on admission.

Characteristics	All patients (n = 312)	Non-severe (n = 207)	Severe (n = 105)	p value
Age, years	69.2 ± 7.3	67.1 ± 5.4	71.3 ± 4.6	0.023
Sex(Male/Female)	187/125	120/85	67/40	0.529
Exposure history, n(%)	148(47.4)	77(37.2)	71(67.6)	0.039
Medication history of ACEI	97(31.1)	60(29.0)	37(35.2)	0.053
Current smoker, n(%)	32(10.3)	18(8.70)	14(13.3)	0.367
Co-morbidity, n(%)	241(77.2)	146(70.5)	95(90.5)	0.028
Hypertension, n(%)	178(57.1)	91(44.0)	87(82.9)	0.017
Diabetes, n(%)	121(38.8)	72(34.8)	49(46.7)	0.045
Cardiovascular disease, n(%)	93(29.8)	47(22.7)	46(43.8)	0.025
Chronic lung disease, n(%)	27(8.65)	16(7.73)	11(10.5)	0.035
Cerebrovascular disease, n(%)	20(6.41)	11(5.31)	9(8.57)	0.617
Chronic liver disease, n(%)	11(3.53)	7(3.38)	4(3.81)	0.801
Chronic kidney disease, n(%)	10(3.21)	6(2.90)	4(3.81)	0.549
Tumour, n(%)	12(3.85)	7(3.38)	5(4.71)	0.587
Fever(temperature > 37°C), n(%)	252(80.8)	170(82.1)	82(78.1)	0.125
Respiratory rate > 24 breaths per min, n(%)	101(32.4)	51(24.6)	50(47.6)	0.037
Pulse ≥ 125 beats per min, n(%)	13(4.17)	4(1.93)	9(8.82)	0.012
Systolic pressure, mmHg	120.3 ± 30.3	135.4 ± 27.6	112.5 ± 35.7	0.031
Headache, n(%)	28(8.97)	17(8.21)	11(10.5)	0.419
Cough, n(%)	239(76.6)	155(74.9)	84(80.0)	0.603
Sputum, n(%)	67(21.5)	42(20.3)	25(23.8)	0.568
Nausea or vomiting, n(%)	22(7.05)	13(6.28)	9(8.57)	0.246
Diarrhoea, n(%)	25(8.01)	17(8.21)	8(7.62)	0.086
Myalgia, n(%)	18(5.77)	10(4.83)	8(7.62)	0.063
Fatigue, n(%)	83(26.6)	40(19.3)	43(41.0)	0.015
Dyspnea, n(%)	167(53.5)	84(40.6)	83(79.0)	0.021
Chills, n(%)	33(10.6)	11(5.31)	22(21.0)	0.013
Time from illness onset to hospital admission, days	10.4 ± 5.3	10.1 ± 6.7	10.6 ± 5.1	0.521
IADL	0.85 ± 0.23	0.96 ± 0.12	0.81 ± 0.21	0.531
SOFA score	3.1 ± 2.2	2.5 ± 2.3	4.3 ± 2.5	0.003
APACHEII score	14.3 ± 5.2	12.1 ± 5.6	16.3 ± 4.3	0.002

Abbreviations: ACEI, Anti-angiotensin-Converting Enzyme Inhibitor; IADL, Instrumental Activities of Daily Living; SOFA, Sequential Organ Failure Assessment; APACHE, Acute Physiologic and Chronic Health Evaluation.

4. Discussion

To our knowledge, this retrospective study was the first case series focusing on hospitalized older patients (≥65 years) with COVID-19 exclusively. By March 31 st 2020, 312 patients were recruited in the Sino-French New City Branch of Tongjing Hospital, which was designated to treat COVID-19 patients in Wuhan, China. This study compared clinical characteristics between non-severe and severe COVID-19 cases among older patients, and identified several risk factors for severe cases.

Table 2
Laboratory and radiographic findings of older patients with COVID-19 on admission.

	All patients (n = 312)	Non-severe (n = 207)	Severe (n = 105)	p value
White blood cell count, $\times 10^9$/L	7.5 ± 4.3	6.8 ± 3.9	12.1 ± 4.5	0.031
Neutrophil count, $\times 10^9$/L	6.1 ± 3.6	5.7 ± 3.5	10.3 ± 5.1	0.039
Lymphocyte count, $\times 10^9$/L	1.1 ± 0.4	1.9 ± 0.6	0.8 ± 0.4	0.012
< 1.1, n(%)	191(61.2)	109(52.7)	82(78.1)	0.029
Haemoglobin, g/L	120.3 ± 28.4	124.5 ± 32.1	119.4 ± 25.7	0.387
Platelet count, $\times 10^9$/L	205.3 ± 85.6	233.7 ± 92.6	157.4 ± 95.3	0.002
< 125, n(%)	64(20.5)	10(4.83)	54(51.4)	0.001
Prothrombin time, s	13.5 ± 4.9	12.7 ± 5.4	14.8 ± 4.5	0.010
Activated partial thromboplastin time, s	35.4 ± 6.3	33.9 ± 5.6	38.7 ± 7.8	0.028
D-dimer, mg/L	0.7 ± 0.6	0.5 ± 0.3	4.8 ± 2.1	0.018
Alanine transaminase, U/L	40.5 ± 20.5	31.6 ± 18.9	48.2 ± 20.1	0.009
Aspartate transaminase, U/L	45.2 ± 30.6	40.6 ± 22.7	50.3 ± 29.8	0.005
Total bilirubin, mmol/L	18.7 ± 10.5	13.7 ± 9.9	21.2 ± 9.6	0.035
Creatinine, μmol/L	64.7 ± 46.7	52.4 ± 40.2	91.3 ± 41.3	0.003
> 133, n(%)	21(6.73)	4(1.93)	17(16.2)	0.016
Potassium, mmol/L	4.0 ± 1.1	3.9 ± 0.8	4.2 ± 1.0	0.535
Sodium, mmol/L	141.1 ± 9.2	143.0 ± 8.3	139.8 ± 7.9	0.457
Creatine kinase, U/L	85.6 ± 46.7	82.3 ± 38.7	101.2 ± 32.1	0.612
Lactate dehydrogenase, U/L	200.2 ± 61.2	150.4 ± 58.4	220.1 ± 42.1	0.652
Hypersensitive troponin I, pg/mL	8.6 ± 4.3	7.5 ± 5.4	15.3 ± 3.6	0.025
Procalcitonin, ng/mL	0.25 ± 0.12	0.16 ± 0.11	0.33 ± 0.20	0.013
Serum ferritin, μg/L	702.3 ± 200.4	665.4 ± 86.5	1203.1 ± 126.7	0.027
Interleukin-6, pg/mL	7.8 ± 4.6	6.9 ± 3.8	18.7 ± 4.5	0.001
Ground-glass opacity, n(%)	251(80.4)	170(82.1)	81(77.1)	0.052
Consolidation, n(%)	163(52.2)	70(43.5)	93(88.6)	0.005
Bilateral pulmonary infiltration, n(%)	231(74.0)	156(50.0)	75(71.4)	0.042

Table 3
The risk factors associated with severe COVID-19 in older patients.

Risk factors	B	SE	Wald	p value	OR	95 %CI
Age	0.075	0.047	10.264	0.0102	1.59	1.13 − 2.08
SOFA score	0.094	0.057	24.167	< 0.0001	5.89	3.48 − 7.96
APACHEII score	1.003	0.364	3.785	0.0018	3.13	1.85 − 5.62
Platelet count < 125 × 10^9/L	0.138	0.049	4.682	0.0128	2.36	1.03 − 4.14
D-dimer	0.036	0.497	6.148	0.0024	4.37	2.58 − 7.16
Creatinine > 133 μmol/L	0.017	0.218	2.194	0.0137	1.85	1.12 − 3.04
Interleukin-6	0.245	0.416	7.378	0.0016	4.32	2.07 − 7.13
Consolidation	0.339	0.675	3.569	0.0262	1.94	1.45 − 4.27

Abbreviations: SOFA, Sequential Organ Failure Assessment; APACHE, Acute Physiologic and Chronic Health Evaluation.

Older patients had more previous medical history, so there were more comorbidities (King & Green, 2018). Hypertension and diabetes were common among Chinese elderly (Guan et al., 2020). Cardiovascular disease had a high comorbidity rate, which may be related to the characteristics of the SARS-Cov-2 (Duarte, Furtado, Sousa, & Carvalho, 2020). Angiotensin-converting enzyme 2 (ACE2) was also highly expressed in myocardium, which was the main target of SARS-CoV-2 attack (Hamming et al., 2004). The main clinical manifestations included fever, cough, dyspnea, fatigue, which were inconsistent with the clinical manifestations reported in the previous literature (Feng et al., 2020). This meant that older patients had their own characteristics. The proportion of older patients with dyspnea was higher than previous studies, which may be related to poor compensation of respiratory function in the elderly (Feng et al., 2020). The elderly were inherently susceptible to fatigue (Tartarisco et al., 2012). Coupled with the effects of hypoxia, the proportion of older patients with fatigue was also higher than the overall population. Like other studies, the rate of older patients with nausea, vomiting or diarrhea was not high (Feng et al., 2020). Therefore, part of the gastrointestinal symptoms encountered in the clinic may be side effects of drug treatment. SOFA and APACHEII score were tools that reflected the severity of the illness, with good sensitivity and specificity (Gupta, Karnik, & Agrawal, 2017; Qiao, Lu, Li, Shen, & Xu, 2012). The scores of elderly COVID-19 patients was significantly higher than other diseases, especially in severe cases. In addition, severe cases were significantly different from non-severe cases in terms of age, comorbidities, and symptoms.

Similar to previous studies among patients of all ages, important laboratory findings in older patients included low lymphocyte and platelet counts, elevated coagulation time, d-dimer, transaminase, bilirubin and creatinine (Fu et al., 2020). As compared with overall population, older patients had higher percentages with above abnormalities, and the severe cases had much higher percentages. SARS-CoV-2 can attack cardiomyocytes trough binding to ACE2 receptors on Cardiomyocyte membrane (Hamming et al., 2004). So the hypersensitive troponin I was high. And severe cases were higher than non-severe. Essentially, COVID-19 was an infectious disease caused by a virus, so it could cause an inflammatory response (Jia, 2016). The procalcitonin, serum ferritin and interleukin-6 would rise. The more severe the COVID-19, the higher the degree of increase. The lung was the most severe organ involved in COVID-19. The most findings of lung CT were ground-glass opacity, bilateral pulmonary infiltration and consolidation, which were similar to previous studies (Bao, Liu, Zhang, Li, & Liu, 2020). Similarly, severe cases were much worse from non-severe cases in terms of laboratory and radiographic abnormalities.

This study identified several risk factors for severe COVID-19 cases among older patients. In general, older age, higher SOFA and APACHEIIscore, platelet count < 125 × 10^9/L, creatinine > 133 μmol/L, higher interleukin-6 and d-dimer, and lung consolidation on admission were associated with higher odds of severe COVID-19. There may be overlapping indicators between these factors. For example, platelet count < 125 × 10^9/L and creatinine > 133 μmol/L were items of SOFA and APACHEIIscore, which meant coagulation and kidney dysfunction (Qiao et al., 2012). Previous studies in macaques inoculated with SARS-CoV found that older macaques had stronger host innate response to virus infection, with increase in expression of genes associated with inflammation (Smits et al., 2010). The age-dependent defects in T-cell an B-cell function and the excess production of type 2 cytokines could lead to a deficiency in control of viral replication and more prolonged proinflammatory responses, potentially leading to severe cases (Opal, Girard, & Ely, 2005). Currently, there was no scale specifically for COVID-19. SOFA and APACHEIIscore were commonly used in intensive care unite, which reflected the state and degree of multi-organ dysfunction. The higher the score, the more serious the illness. High levels of d-dimer had a reported association with pneumonia severity in emergency department, which also applied to older COVID-19 patients.

Like the SARS and MERS, the most common complication was acute respiratory distress syndrome, owing to direct injury of SARS-CoV-2 and secondary injury of inflammation (Rabaan et al., 2020). Injury of vascular endothelium and hematopoietic function by viral toxins and

Table 4
Complications, treatments and outcomes of older patients with COVID-19.

	All patients (n = 312)	Non-severe (n = 207)	Severe (n = 105)	p value
Complications				
Acute respiratory distress syndrome, n(%)	111(35.6)	18(8.70)	93(88.6)	0.041
Shock, n(%)	76(24.4)	10(4.83)	66(62.9)	0.027
Acute kidney injury, n(%)	50(16.0)	7(3.38)	43(41.0)	0.004
Acute cardiac injury, n(%)	103(33.0)	37(17.9)	66(62.9)	0.038
Coagulation disorders, n(%)	96(30.8)	66(31.9)	30(28.6)	0.645
Nosocomial infection, n(%)	18(5.77)	4(1.93)	14(13.3)	0.009
Treatments				
Antiviral therapy, n(%)	286(91.7)	186(89.9)	100(95.2)	0.426
Antibacterial therapy, n(%)	87(27.9)	16(15.2)	71(67.6)	0.031
Systemic glucocorticoids, n(%)	136(43.6)	68(32.9)	68(64.8)	0.046
Immune globulin, n(%)	165(52.9)	70(33.8)	95(90.5)	0.035
High-flow nasal cannula, n(%)	94(30.1)	83(40.1)	11(10.5)	0.029
Noninvasive ventilation, n(%)	22(7.05)	2(0.966)	20(19.0)	< 0.001
Invasive ventilation, n(%)	68(21.8)	0	68(64.8)	< 0.001
Extracorporeal membrane oxygenation, n(%)	6(1.92)	0	6(5.71)	< 0.001
Continuous renal replacement therapy, n(%)	24(7.69)	0	24(22.9)	< 0.001
Outcomes				0.010
Discharge, n(%)	245(78.5)	193(93.2)	52(49.5)	
Hospitalization, n(%)	46(14.7)	11(5.31)	35(33.3)	
Death, n(%)	21(6.73)	3(0.962)	18(17.1)	

inflammatory factors caused coagulation disorders (Jain & Acharya, 2018). So far, there were no effective antiviral drugs for SARS-CoV-2. But Chines doctors often prescribed antiviral drugs empirically or according to the consensus of Chinese experts. Immune globulin and systemic glucocorticoids were also suggested by consensus of Chinese experts. As with the treatment of hypoxemia caused by other causes, the methods of oxygen therapy included high-flow nasal cannula, non-invasive ventilation, Invasive ventilation, and extracorporeal membrane oxygenation. The more severe the condition, the greater the intensity of support required. But patients' resilience were ignored in the treatment in China (Chen, 2020). The overall mortality was 6.73 % for older patients, which was higher than previous studies. One of the main reasons was the poor compensatory function of multiple organs in the elderly. But mortality was similar to another Chinese study (Niu et al., 2020).

There are some limitations in the present study. First, it was a single-center study. The hospital for treating patients with COVID-19 was designated by government. And admitted patients were also designated by the government. So there must be some selective bias. Second, as of March 31 st, there were still some patients in hospital. Their prognosis can not be determined. Hence, more future studies need to be carried out to further clarify these issues.

In summary, Older patients with COVID-19 had much more comorbidity, complications and mortality. Age, SOFA score, APACHEII score, platelet count < 125 × 109/L, d-dimer, creatinine > 133 μmol/L, interleukin-6, and lung consolidation on admission were independent risk factors for severe cases among older patients with COVID-19. For clinical practice, more attention should be paid to older patients with COVID-19.

Declarations of Fundings

There was no founding supporting the article.

CRediT authorship contribution statement

Tao Li: Conceptualization, Writing - original draft. **Lei Lu:** Methodology, Software. **Weishuo Zhang:** Methodology, Software. **Yu Tao:** Data curation, Formal analysis. **Liuming Wang:** Investigation, Data curation, Formal analysis. **Jing Bao:** Investigation, Data curation, Formal analysis. **Bao Liu:** Investigation, Data curation, Formal analysis. **Jun Duan:** Project administration, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors would like to thank all the people that participated in this study and all Wuhan people that isolated themselves at home.

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