Clinical characteristics and outcomes of older patients with coronavirus disease 2019 (COVID-19) in Wuhan, China (2019): a single-centered, retrospective study

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Declaration of interests

We declare no competing interests.

Abstract

Background: In December 2019, the coronavirus disease 2019 (COVID-19) emerged in Wuhan city and spread rapidly throughout China and the world. In this study, we aimed to describe the clinical course and outcomes of older patients with COVID-19.

Methods: This is a retrospective investigation of hospitalized older patients with confirmed COVID-19 at Zhongnan Hospital of Wuhan University from January 1, 2020, to February 10, 2020.

Results: In total, 203 patients were diagnosed with COVID-19, with a median age of 54 years (interquartile range, 41-68; range, 20-91 years). Men accounted for 108 (53.2%) of the cases, and 55 patients (27.1%) were >65 years of age. Among patients who were 65 years and older, the mortality rate was 34.5% (19/55), which was significantly higher than that of younger patients at 4.7% (7/148). Common symptoms of older patients with COVID-19 included fever (94.5%; n=52), dry cough (69.1%; n=38), and chest distress (63.6%; n=35). Compared with young patients, older patients had more laboratory abnormalities and comorbidities. Through a multivariate analysis of the causes of death in older patients, we found that males, comorbidities, time from disease onset to hospitalization, abnormal kidney function, and elevated procalcitonin levels were all significantly associated with death.

Conclusions: In the recent outbreak of COVID-19, our local hospital in Wuhan found that patients aged 65 and older had greater initial comorbidities, more severe symptoms, and were more likely to experience multi-organ involvement and death, as compared with younger patients.

Keywords: COVID-19, SARS-CoV-2, coronavirus, Wuhan, older patients, clinical characteristics

Introduction

In December 2019, a group of patients in Wuhan, China, were diagnosed with pneumonia of an unknown origin. The causative agent was discovered to be a novel coronavirus, known as 2019-nCoV [1]. Full-genome sequencing and phylogenic analysis indicated that 2019-nCoV is a distinct clade from the betacoronaviruses associated with human severe acute respiratory syndrome (SARS) and the Middle East respiratory syndrome (MERS) [2]. The virus was subsequently renamed SARS-CoV-2, due to its similarity to the coronavirus responsible for severe acute respiratory syndrome (SARS-CoV).

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pneumonia is a newly recognized illness that initially spread from Wuhan (Hubei province) to other regions of China, before rapidly spreading around the world [3-6]. The World Health Organization (WHO) declared coronavirus disease 2019 (COVID-19) as a public health emergency of international concern on March 11, 2020.

The clinical spectrum of COVID-19 ranges from mild to critical cases. Previous studies have focused on general epidemiological findings, clinical presentations, and clinical outcomes of patients of COVID-19 [7-11]. However, the specific information about older patients remains unknown.

While several drugs and vaccines are under investigation, there are no effective therapies or vaccines currently available for COVID-19. The objectives of this clinical case study were to: (1) describe the clinical characteristics of 203 discharged patients with COVID-19, (2) compare the clinical characteristics of older and young patients, and (3) assess the relevant factors that may affect the prognosis of patients with COVID-19. The findings from this study will improve the awareness of COVID-19 pneumonia and may help enhance patient care in the future.

Methods

Study design and participants

This case series was approved by the Institutional Ethics Board of Zhongnan Hospital of Wuhan University (No. 2020011). Patients with confirmed COVID-19, who were admitted to Zhongnan Hospital of Wuhan University from January 1, 2020, to February 10, 2020, were enrolled in this study. All patients provided oral consent to be included in the study. Zhongnan Hospital, which is located in Wuhan (Hubei Province), is situated in the endemic area of COVID-19. It is a major teaching hospital and was responsible for the treatment of COVID-19, as assigned by the People's Republic of China. All patients with COVID-19 enrolled in this study were diagnosed according to World Health Organization interim guidance [12]. The clinical outcomes, including discharges, mortality, and length of hospital stay, were monitored up to February 20, 2020, which was the final follow-up date.

Data collection

The medical records of patients were analyzed by the research team of the Department of Infectious Disease at Zhongnan Hospital of Wuhan University. Epidemiological, clinical, laboratory, and radiological characteristics, along with treatment and outcome data, were obtained from electronic medical records. The data were reviewed by a trained team of physicians. The information recorded for this study included exposure history, demographic data, medical history, underlying comorbidities, symptoms, signs, laboratory findings, chest computed tomographic (CT) scans, and treatment measures (e.g., antiviral therapy, respiratory support, and corticosteroid therapy). The date of disease onset was defined as the day when the symptoms were noticed by the patient, those symptoms were as fever, cough, chest tightness, dyspnea, muscle pain et al. Symptoms, signs, laboratory values, chest CT scan, and treatment measures during the hospital stay were collected. The severity of

COVID-19 was defined according to the diagnostic and treatment guidelines for SARS-CoV-2 issued by the Chinese National Health Committee version 3-6. Severe COVID-19 was designated as having one of the following criteria: (a) respiratory distress with respiratory frequency ≥30/min; (b) pulse oximeter oxygen saturation ≤93% at rest; and (c) oxygenation index (artery partial pressure of oxygen/inspired oxygen fraction, PaO_2/ FiO_2) ≤300 mm Hg.

Acute respiratory distress syndrome (ARDS) was defined according to the Berlin definition [13]. Cardiac injury was defined by serum levels of cardiac biomarkers, such as troponin I, rising above the 99th percentile upper reference limit or the presence of new electrocardiography and echocardiography abnormalities. Acute kidney injury was identified according to the "Kidney Disease: Improving Global Outcomes" definition. The duration from disease onset to hospital admission, dyspnea, ARDS, intensive care unit (ICU) admission, and discharge were also recorded.

Laboratory confirmation and treatment

Sputum and throat swab specimens were collected from all patients upon admission and tested by real-time polymerase chain reaction (RT-PCR) for SARS-CoV-2 RNA within 3 h. Laboratory confirmation of the virus was performed [10]. Virus detection was repeated every 24-72 h.

Laboratory tests were conducted upon admission, including a complete blood count (CBC), serum biochemistry, and identification of other respiratory pathogens, such as influenza A virus (H1N1, H3N2, and H7N9), influenza B virus, parainfluenza virus, respiratory syncytial virus, and adenovirus. Most patients received antiviral treatment with arbidol (200 mg twice daily), interferon-alpha inhalation (50 μg twice daily), or lopinavir and ritonavir (400 mg twice daily and 100 mg twice daily, respectively). Patients received treatment with corticosteroids (40-80 mg/day) and gamma globulin (10- 20 g/day) for 3-5

days, or when their resting respiratory rate was >30 per min, oxygen saturation was <93% without oxygen, or multiple pulmonary lobes showed more than 50% progression of disease within 48 h of imaging. Patients also received treatment with probiotics in most cases. Quinolones and second-generation beta-lactams (oral and intravenous) were administered if fever lasted longer than seven days or C-reactive protein levels were >20 mg/L (normal range 0-10 mg/L). Patients suspected of having SARS-CoV-2 were discharged from hospital once the results of two RT-PCR tests, taken 24 h apart, were negative for SARS-CoV-2.

Statistical analysis

Categorical variables were described as frequency rates and percentages, and continuous variables were described using mean, median, and interquartile range (IQR) values. Means for continuous variables were compared using independent group *t*-tests when the data were normally distributed. In other instances, the Mann-Whitney test was used. Data (non-normal distribution) from repeated measures were compared using the generalized linear mixed model. Proportions for categorical variables were compared using the χ^2 test, although the Fisher exact test was used when the data were limited. All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) version 16.0 software (SPSS Inc., Chicago, IL USA). For unadjusted comparisons, a two-sided α of less than 0.05 was considered statistically significant. The analyses have not been adjusted for multiple comparisons and, given the potential for type I error, the findings should be interpreted as exploratory and descriptive.

Univariate and stepwise multivariate logistic regression models were used to analyze all variables as potential predictors for the death of older patients. All variables with a *p*-value of less than 0.10 in the univariate logistic regression models were included in the

multivariate logistic regression model. Odds ratios (OR) and 95% confidence intervals (CI) were calculated for each covariate.

Results

Demographic and clinical characteristics

The demographic and clinical characteristics are shown in **Table 1**. A total of 203 patients were diagnosed with COVID-19, with a median age of 54 years (interquartile range, 41-68; range, 20-91 years). Males accounted for 108 (53.2%) of the cases, and 55 patients (27.1%) were >65 years of age. Of the 55 patients who were >65 years of age, the average age was 74 years, with a range of 65 to 91 years. Compared to patients who were less than 65 years of age, the older group had more chronic comorbidities, especially hypertension, chronic obstructive pulmonary disease (COPD), diabetes, cardiovascular disease, cerebrovascular disease, and malignant tumors (all $P<0.05$). The common symptoms of older patients with COVID-19 included fever (94.5%; n=52), dry cough (69.1%; n=38), and chest distress (63.6%; n=35). In addition, older patients displayed higher rates of chest tightness, shortness of breath, and dyspnea when admitted to our hospital. Approximately 87.3% of older patients admitted to the hospital were severely or critically ill, which was significantly higher that of younger patients (39.9%).

Laboratory and radiologic findings upon hospital admission

Table 2 shows the laboratory and radiologic findings of the patients upon admission to the hospital. Of 203 patients who underwent chest CT upon admission, 172 (84.7%) patients showed bilateral lung involvement on chest radiographs (**Table 2**). Typical chest CT findings of infected patients during admission included bilateral or multiple lobular or subsegmental areas of consolidation or bilateral ground-glass opacity (**Figure 1**). Twenty-one patients

(10.3%) had pleural effusion (**Figure 2**). On average, a five-day follow-up CT scan revealed progression in 48 patients (23.6%). Compared with patients less than 65 years of age, the proportion of older patients who underwent CT imaging upon admission showed double lung disease, combined pleural effusion, and higher rates of CT re-examination (all $P<0.05$).

Treatment and clinical outcomes

Various therapies, including oxygen therapy, mechanical ventilation, expectorant, antiviral treatment, and corticosteroid therapy were initiated in 60.6%, 19.2%, 32.5%, 62.9%, and 52.7% of patients, respectively. The percentages of older patients using oxygen therapy, mechanical ventilation, and expectorant were significantly higher than those of the younger patients (**Table 3**). Of the 203 patients, the mortality rate was 12.8% with 26 deaths. The other patients improved and were discharged from the hospital. The mortality of older patients was significantly higher than that of younger patients (34.5% vs. 4.7%, $P<0.001$). The primary cause of death was ARDS or ARDS with multiple organ damage (**Table 3**).

Multivariate analysis of factors associated with the death of older patients

Nine significant factors in the univariate analysis were put into the multivariate analysis to identify independent factors associated with the death of older patients (Table 4). Men, those with multiple comorbid health conditions, dyspnea, elevated creatinine, aspartate aminotransferase, and procalcitonin had a much higher risk of death.

Discussion

Human coronavirus is one of the primary pathogens of respiratory infections worldwide. The two highly pathogenic viruses, SARS-CoV and MERS-CoV, cause severe respiratory syndrome in humans and have had global impacts in the past decades. In addition, four other

human coronaviruses have been shown to induce mild upper respiratory disease, including HCoV-OC43, HCoV-229E, HCoV-NL63, HCoV-HKU1. In December 2019, a novel type of coronavirus was identified as the cause of several cases of idiopathic pneumonia in Wuhan, China [1]. On February 11, 2020, the International Virus Classification Commission (ICTV) named the virus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). A national large sample epidemiological survey including 72,314 COVID-19 cases showed that the proportion of cases in older patients (>60 years of age) was 44.1% in Wuhan, 35.1% in Hubei (including Wuhan), and 31.2% across China (including Hubei).

Of the 203 confirmed patients in this study, 55 (27.1%) were older than 65 years of age. The main clinical manifestations included fever, dry cough, chest tightness, shortness of breath, and muscle/joint soreness, which are consistent with the clinical manifestations reported in the previous literature [13]. Although abdominal pain, diarrhea, and dizziness are uncommon COVID-19 symptoms, the patients with these symptoms often do not display fevers during the early stages of infection. It was previously reported that the virus might be detected in stool samples, which is consistent with the symptoms of abdominal pain and diarrhea in patients. Hence, the viral infection may impact the digestive tract, yet additional studies are needed to determine if gastrointestinal transmission is possible.

This study found that the proportion of older patients with chest tightness, shortness of breath, dyspnea, and abdominal pain was significantly higher than that of younger patients during hospital admission. As these symptoms may be associated with poorer prognoses, physicians should monitor older patients for these symptoms. Our hospital previously reported that high infection rates of medical staff and hospitalized patients [10]. These older patients often have chronic and comorbid conditions that can negatively affect overall outcomes. The incubation period before fever may permit greater spread of the virus. Therefore, during epidemics involving new respiratory diseases, physicians should take

precautions to minimize exposure, increase the utility of medical imaging, and viral nucleic acid diagnostics, in order to improve early diagnosis and prevent disease.

The mortality of SARS-CoV has been reported as more than 10%, while MERS-CoV has been reported to be higher than 35% [15]. In the current study, there were 26 deaths out of 203 patients, suggesting that the total mortality was 12.8%, which resembles that of a previous study [9]. The remaining patients improved and were discharged from the hospital. However, the mortality rate of older patients was significantly higher, at 34.5% (19/55). This rate was significantly higher than that of young people and previously reported patients with COVID-19, but lower than the mortality rate of 61.5% (32/52) in ICU patients reported by Xiaobo Yangasp et al. [11]. This is consistent with previous studies reporting that older patients have poorer prognostic factors and are more likely to experience critical disease [7, 11], suggesting that older patients should seek early screening and early diagnosis to reduce the mortality rates associated with COVID-19.

Studies on ICU patients with COVID-19 suggest that the older [8, 11], male patients, and complications are all risk factors for death and disease severity associated with COVID-19. The proportion of cardiovascular disease, cerebrovascular disease, COPD, and tumors in older patients was significantly higher than those of younger patients, which is consistent with studies mentioned above and indicates that comorbidities may be factors in the high mortality rates of older patients.

The proportion of older patients with severe and critical illness was also significantly higher than that of younger patients, and the time from disease onset to the admission of older patients was longer than that of younger patients. Previous studies have suggested that patients with aggravations often have an exacerbation in within one week of disease onset, including dyspnea [7, 10]. Hence, monitoring and supportive treatments should be strengthened around this time.

Similar to previous studies, important laboratory findings overall included low lymphocyte counts and albumin, elevated erythrocyte sedimentation, LDH, D-dimer, IL-6, and CRP with predominantly bilateral lung disease on CT scan [14]. As compared with younger patients, older patients had higher percentages with elevated white blood cells and procalcitonin, lower lymphocyte counts, higher percentages of liver and kidney dysfunction, higher LDH, and higher fasting blood glucose. The proportion with elevated D-dimer, ESR, CRP, and IL-6 all increased significantly, as compared with younger patients. In addition, older patients may be more prone to bacterial infections, liver and kidney dysfunction, and changes in blood glucose and coagulation levels.

Until now, no specific treatments have been recommended for COVID-19 infection, except for meticulous supportive care. The treatments currently available include symptomatic comprehensive supportive therapies, such as oxygen therapy, expectorants, prevention and treatment of infections, antivirals, and immune regulators. This study found that the proportion of older patients requiring oxygen therapy, expectoration, mechanical ventilation, or transfers to the ICU was significantly higher than that of younger patients, similar to previous studies. As older patients are more likely to have comorbidities and reduced lung function, these may be negative factors that can affect the severity of COVID-19.

A recent clinical study of severe COVID-19 patients in Wuhan showed that 84 (41.8%) of 201 patients developed ARDS, and that 44 (52.4%) of those 84 patients who developed ARDS died [16]. Our study shows similar results with 18 (69.2%) of 26 deaths being associated with ARDS or ARDS with multiple organ damage, suggesting that ARDS is the leading cause of death in critically ill patients. In the past, MERS and SARS studies also mentioned that hormone therapy might reduce the inflammatory immune response [17], yet treatment with hormones in patients with COVID-19 is still controversial. In this study,

52.7% of patients used hormones, but the effect of hormones on the prognosis of patients with COVID-19 still needs to be further explored.

Further multivariate analysis of the influencing factors of death in older patients with COVID-19 pneumonia shows that males and those with any complications, elevated creatinine, and elevated procalcitonin levels were associated with death. Another interesting finding is that the time between onset and hospitalization of the older patients who died was significantly shorter than patients who survived, which was also true in the multivariate analysis. Previous studies [10, 11] reported that the time from symptoms to dyspnea and ICU transfer were between 7 days and 9 days, respectively. It has been speculated that patients with shorter symptom duration may have a more rapid progression of the disease. The exact reason needs to be further explored by further studies with larger patient populations. The effects of gender on the progression of the disease have not been consistently reported. This study suggests being a is an unfavorable factor in older patients, but the effects of gender reported in patients from different ICUs have not been consistent.

Limitations

This study has several limitations. First, due to the concentrated outbreak of a large number of patients in the early stage of the pandemic, some personal histories were incomplete. This study did not include smoking history, which may also be an important risk factor for infection and death in older patients. Respiratory tract specimens were used for diagnosis using RT-PCR. Due to the shortage of reagents, most early studies did not use dynamic virologic examination as an observation index for clinical prognosis evaluation. In this study, virologic quantification was used as an index to assess disease progression. In addition, our institution was only the specified hospital for severe patients during the early outbreak, which could have resulted in some selection bias.

Conclusions

In short, this single-center retrospective study suggests that older patients, who are more likely to present with chronic comorbidities, have a high mortality rate of 34.5%. Through a multivariate analysis of the causes of death in older patients, we found that males, comorbidities, time from disease onset to hospitalization, abnormal kidney function, and elevated procalcitonin levels were all significantly associated with death.

Author Contributions: TieLong Chen, Zhe Dai, Pingzheng Mo, and Xinyu Li had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. TieLong Chen, Zhe Dai, Pingzheng Mo, and Xinyu Li contributed equally and share first authorship. Yongxi Zhang, Liping Deng, and Yong Xiong contributed equally to this article. Concept and design: Shicheng Gao, Ke Liang, Yongxi Zhang, Yong Xiong, and Liping Deng. Acquisition, analysis, or interpretation of data: TieLong Chen, Pingzheng Mo, Zhiyong Ma, and Shihui Song. Drafting of the manuscript: Liping Deng, Zhe Dai, and Xinyu Li. Critical revision of the manuscript for important intellectual content: Zhe Dai, Liping Deng, and Yong Xiong. Statistical analysis: Tielong Chen, Xinyu Li, Xiaoping Chen, and Mingqi Luo. Supervision: Liping Deng and Yong Xiong.

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Table 1. Baseline characteristics of older patients with COVID-19.

	No. (%)				**Age ≥ 65 y** No. (%)		
	Total (n=203)	**Age<65 (n=148)**	**Age ≥65y (n=55)**	*P*	**Died (n=19)**	**Survived (n=36)**	*P*
Age, median (IQR), years	54 (20-91)	46 (20-64)	74 (65-91)	0.00	77	72	0.02
Male	108 (53.2)	74 (50.0）	34 (61.8)	0.13	16 (84.2)	18 (50.0)	0.01
Presence of Comorbidities	88 (43.3)	51 (34.5)	37 (67.3)	0.00	18 (94.7)	17 (47.2)	0.00
Hypertension	43 (21.2)	22 (14.9)	21 (38.2)	0.00	9 (47.3)	12 (33.3)	0.31
Diabetes	16 (7.9)	4 (2.7)	12 (21.8)	0.00	5 (26.3)	7 (19.4)	0.73
Cardiovascular disease	16 (7.9)	5 (3.4)	11 (20.0)	0.00	6 (31.6)	5 (13.9)	0.12
Cerebrovascular disease	9 (4.4)	1 (0.7)	8	0.0	3	5 (13.9)	1.0

			(14.5)	0	(15.8)		
Malignancy	7 (3.4)	2 (1.4)	5 (9.1)	0.02	1 (5.3)	4 (11.1)	0.47
Chronic liver disease	8 (3.9)	6 (4.1)	2 (3.6)	1.0	1 (5.3)	1 (2.8)	1.0
Chronic renal disease	8 (3.9)	5 (3.4)	3 (5.5)	0.45	2 (10.5)	1 (2.8)	0.27
COPD	8 (3.9)	1 (0.7)	7 (12.7)	0.00	1 (5.3)	6 (16.7)	0.40
Tuberculosis	4 (2.0)	3 (2.0)	1 (1.8)	1.0	1 (5.3)	0	0.35
HIV	2 (0.1)	2 (1.4)	0 (2.0)	1.0			
Symptoms and signs							
Fever	181 (89.2)	129 (87.2)	52 (94.5)	0.13	17 (89.5)	35 (97.2)	0.27
Maximum Temp (℃)	38.5 (37.4-40.7)	38.5 (37.4-40.2)	38.5 (37.4-40.7)	0.80	38.7 (38.1-40.7)	38.6 (37.4-39.2)	0.86
Dry Cough	122 (60.1)	84 (56.8)	38 (69.1)	1.11	15 (78.9)	21 (58.3)	0.13

Chest distress	72 (35.5)	37 (25.0)	35 (63.6)	0.00	17 (89.5)	18 (50.0)	0.01
Fatigue	16 (7.9)	11 (7.4)	5 (9.1)	0.77	2 (10.5)	3 (8.3)	1.0
Shortness of breath	59 (29.1)	27 (18.2)	32 (58.2)	0.00	17 (89.5)	15 (41.7)	0.02
Myalgia or arthralgia	54 (26.6)	43 (29.1)	11 (20.0)	0.22	2 (10.5)	9 (25.0)	0.30
Anorexia	6 (3.0)	1 (0.7)	5 (9.1)	0.01	0	5 (13.9)	0.15
Headache	10 (4.9)	7 (4.7)	3 (5.5)	1.0	0	3 (8.3)	0.54
Diarrhea	10 (4.9)	7 (4.7)	3 (5.5)	1.0	1 (5.3)	3 (8.3)	1.0
Abdominal pain	4 (2.0)	1 (0.7)	3 (5.5)	0.06	0	2 (5.6)	0.54
Nausea	3 (1.5)	2 (1.4)	1 (1.8)	1.0	0	1 (2.8)	1.0
Vomiting	3 (1.5)	2 (1.4)	1 (1.8)	1.0	0	1 (2.8)	1.0
Chest pain	4 (2.0)	3 (2.0)	1 (1.8)	1.0	0	1 (2.8)	1.0
Dizziness	4 (2.0)	3 (2.0)	1 (1.8)	1.0	0	1 (2.8)	1.0
Dyspnea	3 (1.5)	2 (1.4)	1 (1.8)	1.0	1 (5.3)	0	0.35

Time from illness onset to first hospital admission (days)	5.8 (1-20)	5.5 (1-20)	7.1 (1-15)	0.05	5.2 (1-9)	8.0 (1-15)	0.00
Severity assessment at admission				0.00			0.04
Stable	96 (47.3)	89 (60.1)	7 (12.7)	0.00	0	7 (19.4)	0.08
Serious	73 (36.0)	49 (33.1)	24 (43.6)	0.17	3 (15.8)	21 (58.3)	0.01
Critical	34 (16.7)	10 (6.8)	24 (43.6)	0.00	16 (84.2)	8 (22.2)	0.00
Length of stay, median (days)	11 (1-45)	10 (1-38)	12 (1-45)	0.07	12.3 (2-42)	12.3 (1-45)	0.07

IQR, interquartile range; COPD, chronic obstructive pulmonary disease; HIV, human immunodeficiency virus; No., number; Temp, temperature.

Table 2. Laboratory and radiological findings of patients with COVID-19.

	Normal range	Median (IQR)			*P* value	Age ≥65y No. (%)		*P*
		Total (n=203)	Age <65 y (n=148)	Age ≥ 65y (n=55)		Died (n=19)	Survived (n=36)	
Blood routine								
White blood cell count, $\times10^9$/L	3.5-9.5	5.17 (0.8-25.7)	4.8 (1-17)	6.1 (2-25.7)	0.02	7.1 (3-25)	5.6 (2-14)	0.29
<4×10^9/L, No. (%)		79 (38.9)	59 (39.9)	20 (36.4)	0.65	5 (26.3)	15 (41.7)	0.38
>10×10^9/L, No. (%)		14 (6.9)	4 (2.7)	10 (18.2)	0.00	4 (26.1)	6 (16.7)	0.72
Neutrophil count, $\times10^9$/L	1.8-6.3	3.7 (0-21)	3.3 (0-16)	4.7 (1-21)	0.01	5.5 (2-21)	4.3 (1-13)	0.31
Lymphocyte count, $\times10^9$/L	1.1-3.2	0.98 (0-6.0)	1.0 (0-20.0)	0.89 (0-6.0)	0.31	1.0 (0-6)	0.8 (0-2)	0.61
<1.0×10^9/L, No. (%)		117 (57.6)	72 (48.6)	45 (81.8)	0.00	15 (78.9)	30 (83.3)	0.69
Platelet count, $\times10^9$/L	125-350	170 (2-530)	178 (2-530)	162 (22-414)	0.16	130 (47-227)	180 (22-414)	0.02
<100×10^9/L, No. (%)		22 (10.8)	13 (8.8)	9 (16.4)	0.12	5 (26.3)	4 (11.1)	0.25
Blood biochemistry								
Alanine aminotransferase, U/L	9-50	33.9 (5-279)	29.5 (5-200)	41.3 (8-279)	0.06	44 (13-91)	40 (8-279)	0.67

>50U/L, No. (%)		30 (14.8)	17 (11.5)	13 (23.6)	0.03	6 (31.6)	7 (19.4)	0.31
Aspartate aminotransferase, U/L	15-40	42.8 (6-209)	34.5 (16-159)	63.1 (18-209)	0.00	78 (18-168)	55 (20-209)	0.08
>40U/L, No. (%)		69 (34)	37 (25.0)	32 (58.2)	0.00	14 (73.7)	18 (50.0)	0.09
Albumin, g/L	40-55	37.2 (18-72)	39 (18-72)	33.3 (25-43)	0.00	33 (25-40)	33 (26-43)	0.76
<40g/L, No. (%)		131 (64.5)	83 (56.1)	48 (87.3)	0.00	17 (89.5)	31 (86.1)	1.0
Globulin, g/L	20-30	29.5 (18-86)	29 (18-86)	30 (20-48)	0.48	29 (20-43)	30 (23-48)	0.37
>30g/L, No. (%)		68 (33.5)	44 (29.7)	24 (43.6)	0.06	10 (52.6)	14 (38.9)	0.33
Creatinine, μmol/L	64-104	87 (37-1066)	82 (38-1066)	104.2 (37-787)	0.24	134 (63-787)	89 (37-685)	0.27
>104μmol/L, No. (%)		25 (12.3)	13 (8.8)	12 (21.8)	0.01	8 (42.1)	4 (11.1)	0.02
Lactate dehydrogenase, U/L	125-243	304 (99-849)	268 (99-849)	395 (153-775)	0.00	478 (153-775)	356 (189-604)	0.03
>243U/L, No. (%)		87 (42.9)	52 (35.1)	35 (63.6)	0.00	13 (68.4)	22 (61.1)	0.59
Creatine kinase, U/L	<171	168.1 (13-3051)	178 (25-3051)	141.2 (13-972)	0.40	213 (34-972)	106 (13-258)	0.15
>171U/L, No. (%)		29 (14.3)	21 (14.2)	8 (14.5)	0.95	3 (15.8)	5 (13.9)	1.0
FBS, mmol/L	3.9-6.1	6.0 (4-20)	6.5 (4-20)	7.5 (4-20)	0.21	8.6 (5-20)	6.9 (4-14)	0.10
>7mmol/L, No. (%)		22 (10.8)	3 (2.0)	19 (34.5)	0.00	6 (31.6)	13 (36.1)	0.73

Coagulation function								
D-dimer, ng/mL	0-500	1367.5 (1-105063)	1372 (1-1050630	1354 (108-18825)	0.99	1512 (124-15162)	1264 (108-18825)	0.8
>500 ng/mL, No. (%)		26 (12.8)	7 (4.7)	19 (34.5)	0.00	8 (42.1)	11 (30.6)	0.39
Infection-related biomarkers								
ESR, mm/h	0-15	32.5 (2-140)	28 (2-140)	45 (9-96)	0.00	45 (9-96)	44 (11-94)	0.91
>15 mm/h, No. (%)		82 (40.4)	47 (31.8)	35 (63.6)	0.00	12 (63.2)	23 (63.9)	0.96
C-reactive protein, mg/L	0-10	51.9 (0-293)	41 (0-293)	85.3 (2-284)	0.00	143 (12-284)	58 (2-151)	0.01
>10 mg/L, No. (%)		110 (54.2)	79 (53.4)	31 (56.4)	0.71	11 (57.9)	20 (55.6)	0.87
Interleukin-6, pg/mL	0-7	1.4 (0-200)	1.4 (0-200)	1.4 (0-200)	0.44	155 (35-448)	57 (5-286)	0.10
>7 pg/mL, No. (%)		44 (21.7)	22 (14.9)	22 (40)	0.00	6 (31.6)	16 (44.4)	0.35
Procalcitonin, ng/mL	<0.05	1.4 (0-200)	1.72 (0-200)	0.48 (0-8)	0.44	1.24 (0-8)	0.09 (0-1)	0.07
>1.0 ng/mL, No. (%)		7 (3.4)	2 (1.4)	5 (9.1)	0.02	4 (21.1)	1 (2.8)	0.04
Co-infected respiratory pathogens	na.							
Parainfluenza virus, No. (%)	na.	4 (2.0)	2 (3.4)	2 (3.6)	0.30	1 (5.3)	1 (2.8)	1.0
Syncytial virus, No. (%)	na.	3 (1.5)	2 (3.4)	1 (1.8)	1.0	1 (5.3)	0	0.35
Adenovirus, No. (%)	na.	3 (1.5)	2 (3.4)	1 (1.8)	1.0	0	1 (2.8)	1.0

Mycoplasma, No. (%)	na.	2 (1.0)	2 (3.4)	0	0.07	0	0	/
Influenza virus A, No. (%)	na.	2 (1.0)	1 (3.4)	1 (1.8)	0.47	0	1 (2.8)	1.0
Influenza virus B, No. (%)	na.	3 (1.5)	3 (3.4)	0	0.56	0	0	/
Chest CT or X-ray findings No. (%)								
Bilateral distribution	na.	172 (84.7)	118 (79.7)	54 (98.2)	0.00	19 (100)	35 (97.2)	1.0
Pleural effusion	na.	21 (10.3)	8 (5.4)	13 (23.6)	0.00	4 (21.1)	9 (25.0)	1.0
CT progress (mean interval 5 days)	na.	48 (23.6)	28 (18.9)	20 (36.4)	0.01	8 (42.1)	12 (33.3)	0.52

IQR, interquartile range; erythrocyte sedimentation rate, ESR; na., not available; No., number.

Table 3. Treatment and outcome of patients with COVID-19

	No. (%)				Age ≥ 65 y No. (%)		
	Total (n=203)	**Age < 65 y (n=148)**	**Age ≥ 65 y (n=55)**	***P***	**Died (n=19)**	**Survived (n=36)**	***P***
Oxygen inhalation	123 (60.6)	74 (50)	49 (89.1)	0.00	19 (100)	30 (83.3)	0.08
Mechanical ventilation	39 (19.2)	15 (10.1)	24 (43.6)	0.00	13 (68.4)	11 (30.6)	0.01
Expectorant	66 (32.5)	36 (24.3)	30 (54.5)	0.00	11 (57.9)	19 (52.8)	0.71
Corticosteroid	107 (52.7)	73 (49.3)	34 (61.8)	0.11	14 (73.7)	20 (55.6)	0.25
Antiviral treatment							
Arbidol	47 (23.2)	40 (27.0)	7 (12.7)	0.04	0	7 (19.4)	0.08
Lopinavir and ritonavir	36 (16.1)	26 (15.5)	10 (18.2)	0.64	4 (21.1)	6 (16.7)	0.72
Interferon inhalation	48 (23.6)	33 (22.3)	15 (27.3)	0.46	6 (31.6)	9 (25.0)	0.60
Immune enhancer							
Thymalfasin	16 (7.9)	11 (7.4)	5 (9.1)	0.70	1 (5.3)	4 (11.1)	0.65
Immunoglobulin	11 (5.4)	6 (4.1)	5 (9.1)	0.17	0	5 (13.9)	0.15
Death	26 (12.8)	7 (4.7)	19 (34.5)	0.00	/	/	/

Cause of death				
ARDS	7	1	6	/
ARDS with MOD	11	2	9	/
Sepsis/Shock	2	2	0	/
Heart failure	1	0	1	/
Myocardial infarction	3	1	2	/
Tumor	2	1	1	/
Intestinal bleeding	1	1	0	/

ARDS: acute respiratory distress syndrome; MOD: multiple organ damage.

Table 4. Multivariate analysis of 19 deaths in 55 older patients

	B	SE	Wals	*P*	OR (95% CI)
Male	2.63	1.17	5.08	0.02	13.8 (1.41-136.1)
Any comorbidities	2.78	1.08	6.62	0.01	16.1 (1.9-133.8)
Breath shortness	2.56	1.01	6.41	0.01	12.9 (1.8-94.4)
Time from illness onset to first hospital admission	-0.42	0.17	6.46	0.01	0.66 (0.47-0.91)
Blood tests					
AST >40 U/L	0.71	0.66	1.18	0.28	2.04 (0.56-7.38)
Cr >105 μmol/L	1.57	0.73	4.7	0.03	4.82 (1.16-16.96)
Lactate dehydrogenase (U/L)	0.04	0.01	2.37	0.12	1.02 (0.99-1.03)
C-reactive protein >10 mg/L	0.01	0.01	1.07	0.30	1.01 (0.98-1.04)
Procalcitonin >1.0 ng/mL	2.23	1.16	3.71	0.05	9.33 (0.96-90.63)

OR, odds ratio; CI, confidence interval.

Figure Legends:

Figure 1:

Fig 1a and Fig 1b January 21th 48 year old female, doctor , routine lung CT examination showed normal presentation,

Fig 1c and Fig 1d: February 5th patient has a fever after a day of fatigue, with body temperature of 38 degrees, urgent examination of throat swabs and positive SARS-CoV-2 test, CT examination showed a few patchy shadows of the right upper lung;

Fig 1e and Fig 1f: February 6th admitted to the hospital, still have fever, February 12th patient complained chest tightness and shortness of breath, review of CT showed, exudative lesions in both lungs increased significantly compared with the previous, patient was transferred to ICU, tracheal intubation the next day, is still under treatment in the ICU.

Figure 2:

Fig.2 Male, 66 years old, admitted to hospital on January 15th because of "regular dialysis 9 years, chest tightness, wheezing for 1 week"; the patient has 20 years of hypertension; cerebral infarction in 2005; started regular hemodialysis in 2010; Renal tuberculosis was found in the year 2014. 2020-01-17 Chest X-ray: bilateral lung infection, significantly enlarged heart with cardiac insufficiency (pulmonary edema); 2020-01-19 chest CT: bilateral lung infection (viral pneumonia?), Bilateral pleural effusion, enlarged heart shadow, a small amount of pericardial effusion, and widening of the pulmonary artery trunk; aortic and coronary atherosclerosis; mitral valve calcification; double renal nodules, and further examination is recommended. 1-23 Pharyngeal swabs were positive for nucleic acid diagnosis of SARS-CoV-2 pneumonia, transferred to the intensive care unit, and died at 1-24. The cause of death was considered severe pneumonia with cardiac insufficiency and sepsis.

Figure 1

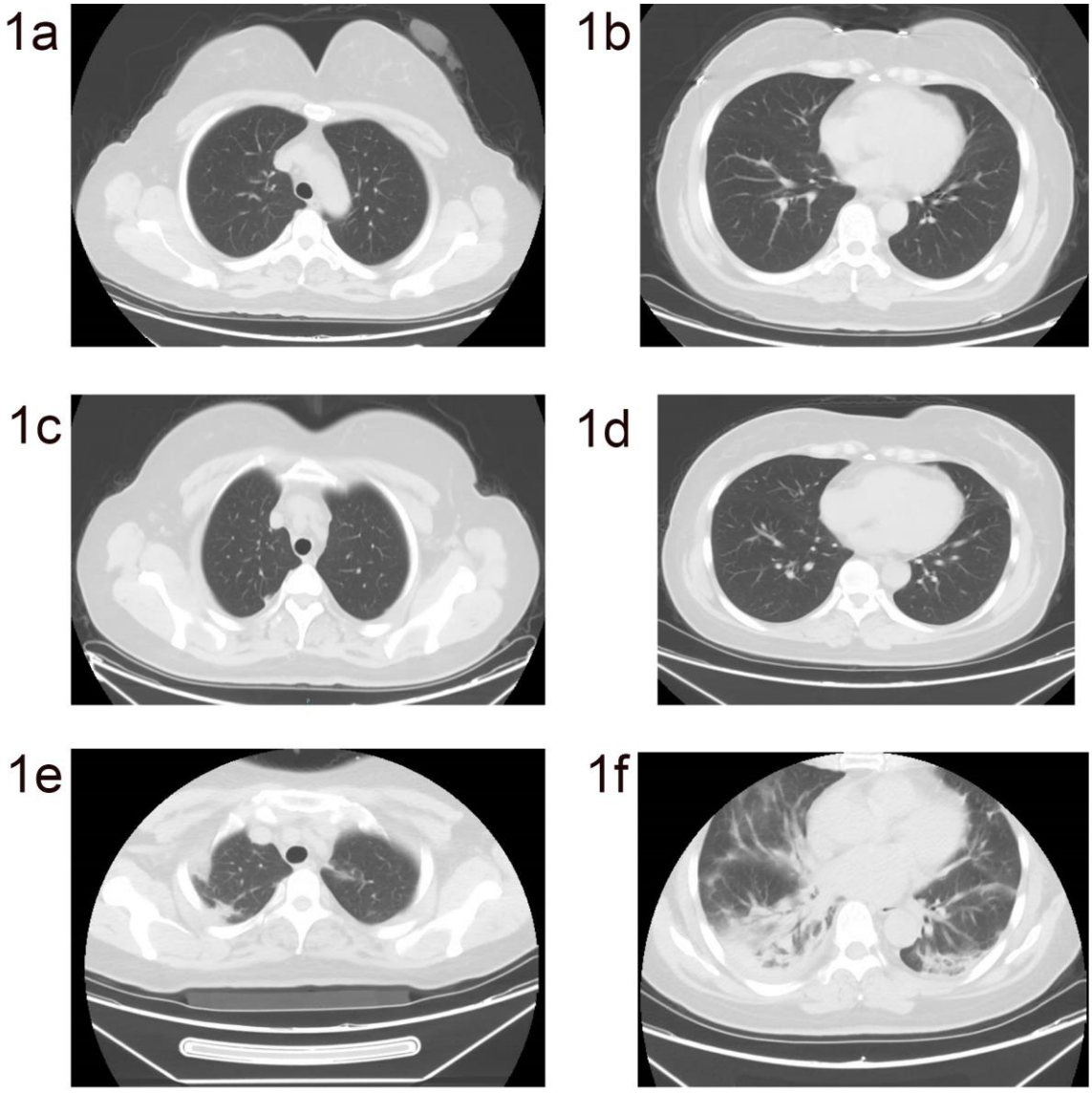

Figure 2