


RESEARCH ARTICLE

Clinical characteristics of moderate COVID-19 patients aggravation in Wuhan Stadium Cabin Hospital: A 571 cases of retrospective cohort study

Lei Shu^{1,2}  | Xiaoyan Wang³ | Mingquan Li⁴ | Xiaolin Chen¹ | Ningfei Ji⁵ | Lei Shi¹ | Mingjing Wu¹ | Kaili Deng¹ | Jing Wei¹ | Xueli Wang¹ | Yang Cao¹ | Jiaxin Yan¹ | Ganzhu Feng⁶

¹Department of Respiratory Medicine, Sir Run Run Hospital, Nanjing Medical University, Nanjing, Jiangsu, China

²Department of Respiratory Medicine, The Second Clinical Medical School of Nanjing Medical University, Nanjing, Jiangsu, China

³Department of Geriatric Cardiology, The First Affiliated Hospital of Nanjing Medical University, Nanjing, Jiangsu, China

⁴Department of Neurology, Taikang Xianlin Drum Tower Hospital, Medical School of Nanjing University, Nanjing, Jiangsu, China

⁵Department of Respiratory and Critical Care Medicine, The First Affiliated Hospital of Nanjing Medical University, Nanjing, Jiangsu, China

⁶Department of Respiratory Medicine, The Second Affiliated Hospital of Nanjing Medical University, Nanjing, Jiangsu, China

Correspondence

Ganzhu Feng, No.109 Longmian Rd, Jiangning, Nanjing, 211166 Jiangsu, China.
Email: zhu1635253@163.com

Funding information

Key Research and Development Project of Jiangsu Province, Grant/Award Number: BE2020616; National Natural Science Foundation of China, Grant/Award Number: 81670013

Abstract

To report the clinical characteristics and potential risk factors of patients with coronavirus disease 2019 (COVID-19) in Wuhan Stadium Cabin Hospital in Hubei Province. A total of 571 patients of COVID-19 treated in the Wuhan Stadium Cabin Hospital were selected for analysis, univariable and multivariable logistic regression methods were used to explore the risk factors associated with disease aggravation. The main clinical symptoms of moderate COVID-19 were fever, cough and dyspnea, hypertension, diabetes, and coronary heart diseases were the main comorbidities both in transferred and stable patients. Twenty-six patients (4.55%) of mild and moderate patients had disease aggravation, and most of which occurred between 36 and 48 hours after admission. Multiple regression analysis showed increasing odds of disease aggravation associated with former smoker history, diabetes, dyspnea, consolidation, and interstitial abnormalities of computed tomography scanning, lymphopenia and elevated of C-reactive protein, the time points of transferred patients mainly between 36 and 48 hours (65.38%), and the average hospital stay for stable patients was 15 days. It could help clinicians to identify patients with poor prognosis at an early stage, and provide early warning role for timely intervention.

KEYWORDS

clinical characteristics, coronavirus disease-19 (COVID-19), logistic regression, pneumonia

1 | INTRODUCTION

Since December of 2019, a series of coronavirus pneumonia (coronavirus disease 2019 [COVID-19]) break out in Wuhan City, Hubei Province and other parts of China. Recently it has been identified as a type of beta coronavirus.^{1,2} Up to 24 March 2020, total 81 773 cases have been confirmed in China, including 67 801 cases in Hubei

Province, 50 006 cases in Wuhan City, accumulative 60 323 cured cases in Hubei Province (43 214 cases in Wuhan), and cumulative 3160 deaths in Hubei Province (2524 cases in Wuhan). Other countries include 59 138 cases in Italy, 31 573 cases in the United States, 28 572 cases in Spain, 24 774 cases in Germany, 23 049 cases in Iran, 15 821 cases in France and so on. Considering the highly prevalence and infection, COVID-19 has been classified as a Class B

infectious disease according to the Law of the People's Republic of China on the prevention and control of infectious diseases and managed as Class A infectious disease.³ At the same time, The World Health Organization (WHO) has recently declared COVID-19 as a public health emergency of international concern,⁴ which indicating this COVID-19 poses a huge threat to global health.

To solve the problem of difficult hospitalization of the patients, By the end of February, the Chinese government totally opened 14 Cabin Hospitals to treat patients confirmed with mild or moderate of COVID-19. With the effective intervention measures and isolation plans formulated by the government in an efficient manner, most patients received timely diagnosis and treatment.

Since the outbreak of COVID-19, lots of basic, clinical and epidemiological studies have been reported successively,⁵⁻⁸ and the severity of some cases of COVID-19 mimicked that of severe acute respiratory syndrome coronavirus (SARS-CoV),^{6,9} however, there is no special study on the clinical characteristics of patients and potential risk factors for disease aggravation in Cabin hospital. As a centralized admission hospital for treating COVID-19, we have treated 571 patients were diagnosed of COVID-19. This study intends to summarize and analyze the clinical characteristics of the above-mentioned patients, and explore the risk factors for disease aggravation, and hope to help clinicians to identify patients with poor prognosis at an early stage, and provide early warning function for timely intervention.

2 | METHODS

2.1 | Study design and participants

This was single-center, retrospective cohort study, and the general information, epidemiological history, incidence, clinical manifestations, laboratory parameters, imaging examinations and treatment of patients confirmed COVID-19 pneumonia were admitted in Wuhan Stadium Cabin Hospital, the study was approved by the Ethics Committee of Wuhan Stadium Cabin Hospital, and the written informed consent was waived because of the retrospective nature of the study and belongs to emergency medical service.

The diagnosis of COVID-19 is based on the WHO interim guidance¹⁰ and new coronavirus pneumonia diagnosis and treatment program (6th ed.) (in Chinese),¹¹ only laboratory-confirmed positive cases were included in this analysis through Real-time fluorescence quantitative polymerase chain reaction assay of pharyngeal swab specimens.⁵

2.2 | Diagnostic criteria

2.2.1 | Epidemiological history

- (1) Travel history or residence history of Wuhan and surrounding areas or other communities with case reports within 14 days before the onset of illness;

- (2) History of contact with new coronavirus infected persons (positive nucleic acid test) within 14 days before onset;
- (3) Have been exposed to patients with fever or respiratory symptoms from Wuhan and surrounding areas, or from communities with case reports;
- (4) Cluster of diseases.

2.2.2 | Clinical manifestations

- (1) Fever and /or respiratory symptoms;
- (2) Imaging characteristics of pneumonia: multiple small patchy shadows and interstitial changes in the early stage, subsequently developed into bilateral ground-glass opacity, infiltrates in both lungs. In severe cases, pulmonary consolidation may occur with little pleural effusion;
- (3) Total number of white blood cells in the early stage of disease was normal or decreased, and the lymphocyte count was decreased.

2.3 | Clinical classifications

According to the guideline of New coronavirus pneumonia diagnosis and treatment program, the confirmed patients were divided into the following types: (1) Mild: the clinical symptoms were light, and there was no sign of pneumonia on imaging; (2) moderate: with fever, respiratory tract and other symptoms, imaging suggests pneumonia; (3) severe: coincide with any of the following: (a) respiratory distress, respiration rate (RR) ≥ 30 times /min; (b) the oxygen saturation $\leq 93\%$ in the resting state; (c) $\text{PaO}_2/\text{FiO}_2 \leq 300$ mm Hg (1mm Hg = 0.133 kPa); (4) Critically ill: coincide with any of the following: (a) respiratory failure occurs and mechanical ventilation is required; (b) shock; (c) the patient develops other organ failure and needs ICU monitoring and treatment. The mild and moderate types were collected as subjects in our study.

2.4 | Real-time reverse transcription polymerase chain reaction assay for novel coronavirus

Reverse transcription polymerase chain reaction assays were performed in accordance with the protocol established by the WHO.¹² Throat swab samples were collected for extracting 2019-nCoV (novel coronavirus) RNA from patients suspected of having 2019 nCoV infection. After collection, the throat swabs were placed in to a collection tube with 150 μL of virus preservation solution, and total RNA was extracted within 2 hours using the respiratory sample RNA isolation kit (Zhongzhi, Wuhan, China). The nucleic acid testing was performed by a third institution recognized by Chinese Center for Disease Control and Prevention, and details regarding laboratory confirmation processes are provided in the Supplementary Appendix (Table S1).

2.5 | Statistical analysis

Continuous variables with normal distribution were expressed as mean \pm standard deviation; non-normal continuous variables were reported as median (interquartile range [IQR]). For *P* value, the Mann-Whitney *U* test were used for analyzing the normally distributed continuous variables, and the Kruskal-Wallis test for non-normally distributed data. The categorical variables were presented as percentage and analyzed by the χ^2 test or the Wilcoxon rank-sum test. All statistical analyses were performed with Stata version 14.2 for Mac (StataCorp, College Station, TX), and *P* value less than .05 was considered statistically significant. Multiple logistic regression models were used to identify factors that influenced outcomes and presented as odds ratios (ORs) and 95% confidence intervals (CIs). The differences in baseline characteristics among nonanemic and anemic patients entered into the multivariate regression. Results were reported follow that all associations as ORs in logistic regression models, with their corresponding 95% CIs.

3 | RESULTS

In our study, 571 cases confirmed with COVID-19 in Wuhan Stadium Cabin Hospital were involved (Figure 1), all of these cases had no epidemic history of contacting with seafood market of South China directly. Among them, 293 were females (51.56%), 278 were males (48.70%), the median age is 50 years (IQR, 38.0-59.0), 26 patients (4.55%) were transferred to a designated specialized hospital for further treatment within 72 hours of admission due to the aggravation of the disease. The time points of transferred patients mainly between 36 and 48 hours (65.38%) (Figure 2). There were 14 cases (53.85%) of transferred patients with a history of smoking, and 122 cases (22.39%) in stable patients. Hypertension, diabetes, and coronary heart diseases were the main comorbidities both in

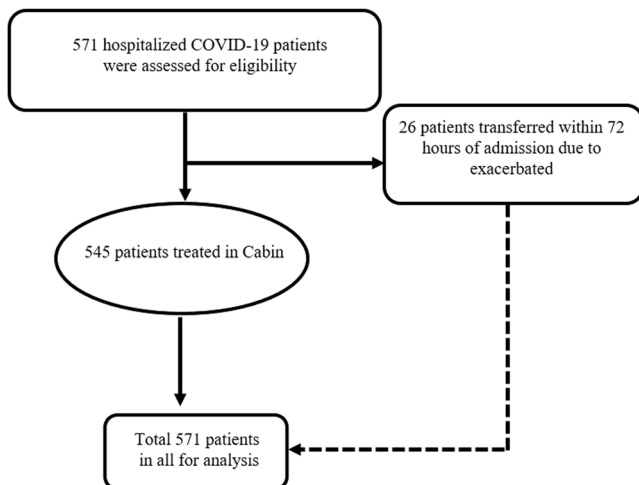


FIGURE 1 Flow diagram of clinical trial in the study. COVID-19, coronavirus disease 2019

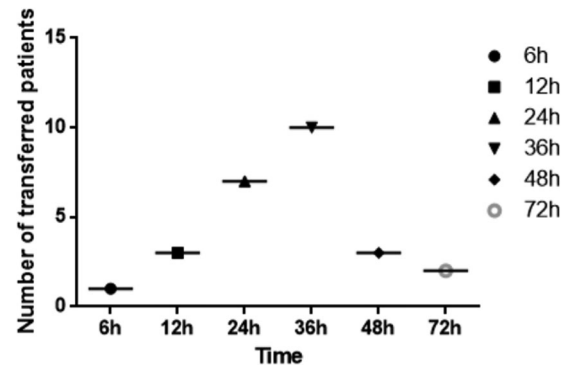


FIGURE 2 Number of transferred patients at different timepoints

transferred patients (26.92%, 15.38%, 15.38%) and in stable patients (9.51%, 2.38%, 1.65%). The main clinical symptoms were fever, cough, and dyspnea, which accounted for 15 (57.69%), 20 (76.90%), and 16 (61.54%) cases in transferred patients, and 284 (51.92%), 382 (70.09%), and 89 (16.27%) cases in stable patients. Computed tomography (CT) scanning showed consolidation and interstitial abnormalities were obviously seen in transferred patients (38.46%, 61.54%) than that in stable patients (5.32%, 8.25%) (Table 1). The other symptoms included fatigue, muscle aches, chest tightness, headache, diarrhea, etc. There was no significant difference between the transferred and stable patients.

Laboratory results showed the white blood cell count, neutrophils and lymphocytes were all lower in transferred patients than stable patients, whereas, lactate dehydrogenase (LDH) and C-reactive protein (CRP) were both in significantly higher in transferred patients than stable patients. No significant difference of the other laboratory results between in the two groups patients (Table 2).

In univariable analysis, odds of disease aggravation were higher with diabetes or coronary heart disease or hypertension (Table 1). Former smoker history, lymphopenia, LDH, and CRP were also associated with disease aggravation (Tables 1 and 2).

We included 571 patients with complete data for all variables (26 transferred patients and 545 stable patients) in the multivariable logistic regression model. We found that former smoker history, diabetes, dyspnea, consolidation, and interstitial abnormalities of CT scanning, lymphopenia, and elevated of CRP were associated with increased odds of disease aggravation (Table 3).

All patients were treated with a single antibiotic moxifloacin, antiviral therapy (oseltamivir/arbido), and traditional Chinese medicine (Lian hua qing wen capsule). Twenty-six patients (4.55%) were transferred to a designated specialized hospital for further treatment within 72 hours of admission due to the aggravation of the disease. In stable patients, 135 patients (24.77%) used intranasal oxygen inhalation, and no patient used intravenous drug and invasive ventilator.

Clinical outcomes of the transferred patients were unknown due to transferred to another hospital and lost connection, according to the discharge standard, up to 10 March, 545 cases (100%) of stable

TABLE 1 Clinical characteristics of 571 patients infected with COVID-19

Characteristics	Total patients (N = 571)	Transferred patients (N = 26)	Stable patients (N = 545)	P value
Age, y				
Median (IQR)	50.0 (38.0-59.0)	50.0 (31.0-60.25)	50.0 (38-58.5)	.711
Sex: 0.845				
Female	293/571 (51.30%)	12/26 (46.20%)	281/545 (51.60%)	
Male	278/571 (48.70%)	14/26 (53.80%)	264/545 (48.40%)	
Smoking history				
Former smoker	56/571 (9.80%)	10/26 (38.46%)	46/545 (8.44%)	.0001***
Current smoker	80/571 (14.0%)	4/26 (15.38%)	76/545 (13.94%)	.979
Comorbidities				
Hypertension	55/571 (9.63%)	7/26 (26.92%)	52/545 (9.51%)	.0234*
Diabetes	17/571 (2.98%)	4/26 (15.38%)	13/545 (2.38%)	.0007***
Coronary heart disease	12/571 (2.10%)	3/26 (15.38%)	9/545 (1.65%)	.002**
Chronic kidney disease	1/571 (0.18%)	0	1/545 (0.18%)	.976
Gout	2/571 (0.35%)	0	2/545 (0.37%)	.953
Signs and symptoms on admission				
Fever $\geq 37.3^{\circ}\text{C}$	299/571 (52.36%)	15/26 (57.69%)	284/545 (51.92%)	.856
Cough	402/571 (70.40%)	20/26 (76.9%)	382/545 (70.09%)	.757
Fatigue, muscle aches	95/571 (16.63%)	8/26 (30.77%)	77/545 (14.77%)	.077
Dyspnea	105/571 (18.39%)	16/26 (61.54%)	89/545 (16.27%)	<.0001***
Headache	55/571 (9.63%)	3/26 (11.54%)	52/545 (9.51%)	.945
Sore throat	28/571 (4.90%)	2/26 (7.69%)	26/545 (4.75%)	.797
Nasal congestion	17/571 (2.98%)	2/26 (7.69%)	15/545 (2.75%)	.351
Chest tightness	100/571 (17.51%)	5/26 (19.23%)	95/545 (17.37%)	.973
Diarrhea	51/571 (8.93%)	2/26 (7.69%)	49/545 (8.96%)	.975
Nausea or vomiting	21/571 (3.68%)	2/26 (7.69%)	19/545 (3.49%)	.538
Abnormalities on chest CT				
Ground-glass opacity	277/571 (48.51%)	8/26 (30.76%)	276/545 (50.64%)	.141
Normal density shadow	108/571 (18.91)	0	108/545 (19.82%)	.007**
Consolidation	39/571 (6.83%)	10/26 (38.46%)	29/545 (5.32%)	<.0001***
Nodular lesion	93/571 (16.29%)	6/26 (23.07%)	87/545 (15.96%)	.631
Interstitial abnormalities	61/571 (10.68%)	16/26 (61.54%)	45/545 (8.25%)	<.0001***
Treatments				
Antibiotic treatment	571/571 (100%)	26/26 (100%)	545/545 (100%)	
Antiviral treatment	571/571 (100%)	26/26 (100%)	545/545 (100%)	
Traditional Chinese medicine	571/571 (100%)	26/26 (100%)	545/545 (100%)	
Hormone therapy	26/571 (4.55%)	26/26 (100%)	0	<.0001***
Intranasal oxygen inhalation	38/571 (6.65%)	26/26 (100%)	135/545 (24.77%)	.0002***
Mechanical ventilation	Unknown	Unknown	0	
ECMO	Unknown	Unknown	0	
Clinical outcome				
Discharged	Unknown	Unknown	545/545 (100%)	
Remained in hospital	Unknown	Unknown	0	
Died	Unknown	Unknown	0	

Abbreviations: COPD, chronic obstructive pulmonary disease; COVID-19, coronavirus disease-19; CT, computed tomography; ECMO, extracorporeal membrane oxygenation; IQR, interquartile range.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

TABLE 2 Laboratory tests of 571 patients infected with COVID-19

Variables	Total patients (N = 571)	Transferred patients (N = 26)	Stable patients (N = 545)	P value
Blood routine (IQR)				
WBC count (x10 ⁹ /L)	5.55 (3.94, 8.11)	4.47 (3.44, 5.83)	5.65 (4.06, 8.13)	.007***
NEU count (x10 ⁹ /L)	4.17 (3.00, 5.87)	3.50 (2.55, 4.48)	4.21 (3.03, 5.95)	.030*
LYM count (x10 ⁹ /L)	0.72 (0.42, 1.10)	0.53 (0.41, 0.72)	0.74 (0.43, 1.13)	.004***
Hb, g/L	134.0 (125.0, 144.0)	142.0 (130.3, 145.0)	134.0 (125.0, 143.5)	.142
PLT count (x10 ⁹ /L)	256.0 (226.0, 289.0)	247.0 (224.8, 287.3)	256.0 (226.0, 289.0)	.637
Coagulation (IQR)				
PT, s	11.20 (10.40, 11.60)	11.20 (10.30, 11.53)	11.20 (10.42, 11.60)	.716
APTT, s	34.22 (29.78, 36.50)	31.69 (29.13, 34.79)	34.44 (29.78, 36.76)	.133
D-D, ng/mL	189.5 (144.5, 306.2)	198.0 (148.0, 271.0)	198.0 (148.0, 263.5)	.878
Mycardial enzymes (IQR)				
CK, IU/L	235.3 (178.2, 290.3)	234.6 (170.1, 264.6)	235.3 (178.2, 290.8)	.744
LDH, U/L	287.7 (210.5, 373.2)	432.7 (411.1, 496.6)	287.5 (205.0, 354.2)	<.0001**
CK-MB, U/L	19.23 (16.43, 22.45)	19.71 (18.05, 22.68)	19.22 (16.43, 22.45)	.345
Biochemical indicators (IQR)				
ALT, IU/L	34.56 (26.34, 42.34)	36.94 (30.01, 43.76)	34.56 (26.23, 42.34)	.345
AST, IU/L	32.12 (24.54, 36.12)	31.30 (24.35, 34.32)	32.12 (24.54, 36.43)	.530
ALB, g/L	44.57 (39.81, 48.32)	43.90 (38.76, 47.57)	44.57 (39.89, 48.32)	.2141
Cr, μmol/L	87.34 (76.45, 98.60)	88.00 (76.31, 98.63)	87.34 (76.45, 98.70)	.8198
BUN, mmol/L	6.54 (5.44, 7.45)	6.43 (5.42, 7.50)	6.54 (5.44, 7.45)	.7606
Indicators of inflammation (IQR)				
CRP, mg/L	39.32 (26.71, 67.32)	60.73 (42.41, 77.43)	38.33 (25.85, 67.23)	.002***
PCT, ng/mL	0.031(0.019, 0.043)	0.027 (0.019, 0.043)	0.031 (0.019, 0.043)	.5296

Abbreviations: ALB, Albumin; ALT, alanine aminotransferase; APTT, activated partial thromboplastin time; AST, aspartate aminotransferase; BUN, urea nitrogen; CK, creatine kinase; CK-MB, creatine kinase-MB; COVID-19, coronavirus disease-19; Cr, creatinine; CRP, C-reactive protein; D-D, DD dimers; Hb, hemoglobin; IQR, interquartile range; LDH, lactate dehydrogenase; LYM, lymphocytes; NEU, neutrophils; PCT, procalcitonin; PLT, platelets; PT, prothrombin time; WBC, white blood cells.

**P* < .05.

***P* < .01.

****P* < .001.

patients were discharged from the Cabin hospital, and no patient died. The average hospital stay for discharge patients was 15 days.

4 | DISCUSSION

This study was a single-center retrospective cohort study that reported the clinical characteristics of patients diagnosed with COVID-19 and potential risk factors for disease aggravation in Wuhan Stadium Cabin Hospital. With the epidemic development of COVID-19 pneumonia, the number of patients diagnosed as COVID-19 in Wuhan has increased sharply since January. To solve the problem of difficult hospitalization of the patients, By the end of February, the Chinese government totally opened 14 Cabin Hospitals to treat patients confirmed with mild or moderate of COVID-19. With the effective intervention measures and isolation plans formulated by the government in an efficient manner, most patients received timely diagnosis and treatment. Among the patients admitted to Wuhan Stadium Cabin Hospital, except for 26 patients who were

exacerbated and transferred to the designated special hospital for further treatment, the remaining 545 patients showed mild and common symptoms, and improved significantly after symptomatic treatment.

In our study, we identified several risk factors for disease aggravation in cabin hospital with COVID-19. Through univariable analysis, odds of disease aggravation were higher with diabetes or coronary heart disease or hypertension. Former smoker history, lymphopenia, LDH, and CRP were also associated with disease aggravation. In the multivariable logistic regression model, we found that former smoker history, diabetes, dyspnea, consolidation and interstitial abnormalities of CT scanning, lymphopenia and elevated of CRP were associated with increased odds of disease aggravation.

Earlier reports on SARS-CoV-2 and COVID-19 suggested that they were similar to SARS and Middle East respiratory syndrome (MERS) in the early years, with most patients presented with fever, dry cough, fatigue, and dyspnea,^{5,13,14} our study also found that fever dry cough and dyspnea accounted for 15 (57.69%), 20 (76.90%), and 16 (61.54%) cases in transferred patients, and 284 (51.92%), 382 (70.09%), and

TABLE 3 Risk factors associated with transferred hospital

Characteristics	Univariable analyses	Multiple variable regression	
	P value	OR, 95%CI	P value
Age, y, median (IQR)	.711		
Female	.845		
Male			
Former smoker	.0001	14.53 (3.18, 66.20)	.001**
Current smoker	.979		
Hypertension	.0234	0.75 (0.12, 4.59)	.755
Diabetes	.0007	22.64 (2.30, 223.022)	.0008*
Coronary heart disease	.002	6.75 (0.629, 72.61)	.115
Chronic kidney disease	.976		
Gout	.953		
Fever $\geq 37.3^{\circ}\text{C}$.856		
Cough	.757		
Fatigue, muscle aches	.077		
Dyspnea	<.0001	10.93 (2.95, 40.45)	<.0001*
Headache	.945		
Sore throat	.797		
Nasal congestion	.351		
Chest tightness	.973		
Diarrhea	.975		
Nausea or vomiting	.538		
Ground-glass opacity	.141		
No abnormal density shadow	.007		
Consolidation	<.0001	15.52 (2.86, 84.24)	.001**
Nodular lesion	.631		
Interstitial abnormalities	<.0001	13.40 (4.05, 44.31)	<.0001*
Antibiotic treatment			
Antiviral treatment			
Traditional Chinese medicine			
Lymphocyte counting		0.89 (0.81, 0.97)	.008**
Elevated LDH		5.01 (1.00, 25.35)	.05
CRP (>40 mg/L)	<.0001	5.03 (1.41, 19.16)	.013***
Hormone therapy	<.0001		
Intranasal oxygen inhalation			
Mechanical ventilation			
ECMO			
Discharged			
Remained in hospital			
Died			

Abbreviations: CI, confidence interval; CRP, C-reactive protein; ECMO, extracorporeal membrane oxygenation; IQR, interquartile range; LDH, lactate dehydrogenase; OR, odds ratio.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

89 (16.27%) cases in stable patients. However, in this study, the typical symptoms of upper respiratory tract infection, such as runny nose, sneezing, and sore throat are not common, which are different from the previously reported SARS and MERS related onset symptoms.^{13,14}

Older age has been reported as an important independent predictor of mortality not only in SARS and MERS,^{15,16} but also in COVID-19,¹⁷ however, in our study, age was not a risk factor for disease aggravation, this may be related to the majority of mild and moderate patients admitted to the cabin hospital.

Although smoking history was not an independent risk factor for disease exacerbations in previous studies, however, in our multivariate regression analysis, former smoker history was associated with disease aggravation, which may have an impact on breathing, and further research is needed to determine whether smoking is an independent risk factor for assessing of disease prognosis.

It is well known that diabetes is an independent risk factor for a variety of diseases, in previous studies, diabetes was considered as a risk factor for disease exacerbation of COVID-19,^{18,19} through our regression analysis, it was also found that patients with diabetes had higher rate of transferred, previous data suggested that ACE2 expression was increased in diabetes and treatment with ACE inhibitors and ARBs increased ACE2 expression, however, whether the specific mechanism of diabetes affecting prognosis of COVID-19 through the expression of ACE2 still need further study.

Our study has some limitations. First, due to the retrospective study design, not all laboratory tests were done in all patients, which might be underestimated in predicting disease condition. Second, the results and prognosis of 26 patients were unknown due to transferred to a designated specialized hospital for further treatment, last but not least, interpretation of our findings might be limited by the sample size. However, by including the number of cases in cabin hospital, we believe our study population is representative disease condition of mild and moderate of COVID-19.

In summary, we hope the potential risk factors of former smoker history, diabetes, dyspnea, consolidation and interstitial abnormalities of CT scanning, lymphopenia and elevated of CRP could help clinicians to identify patients with poor prognosis at an early stage, and provide early warning function for timely intervention.

ACKNOWLEDGMENTS

The authors thank the authors of the primary studies for their timely and helpful responses to our information requests. This work was supported by grant of National Natural Science Foundation of China (81670013) and Key Research and Development Project of Jiangsu Province (BE2020616).

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

AUTHOR CONTRIBUTIONS

LS, NJ, and GF conceived and designed the study, and take responsibility for the integrity of the data and the accuracy of the data analysis. XW, XC, and ML contributed to analysis the infection situation and

write the report. LS, MW, KD, JW, XW, YC, and JY assisted in data collection, extraction and evaluation the eligibility of the original data. LS and ML analyzed the data. LS and GF interpreted the data and contributed to the writing of the final version of the manuscript. All authors agreed with the results and conclusions of this article.

DATA AVAILABILITY STATEMENT

The data used to support the findings of this study are available from the corresponding author upon request.

ETHICS STATEMENT

This study was approved by the Institutional Review Board of Wuhan Stadium Cabin Hospital. All data were anonymized to comply with the provisions of personal data protection legislation. The written informed consent was waived because of the retrospective nature of the study and belongs to emergency medical service.

ORCID

Lei Shu  <https://orcid.org/0000-0003-0505-9506>

REFERENCES

- Zhou P, Yang XL, Wang XG, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature*. 2020.
- Xu X, Chen P, Wang J, et al. Evolution of the novel coronavirus from the ongoing Wuhan outbreak and modeling of its spike protein for risk of human transmission. *Sci China Life Sci*. 2020;63(3):457-460.
- Kanne JP, Chest CT. Findings in 2019 novel coronavirus (2019-nCoV) infections from Wuhan, China: key points for the radiologist. *Radiology*, 2020:200241.
- World Health Organization. Coronavirus disease (COVID-19) outbreak. 2020. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>
- Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020;395(10223):497-506.
- Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA*. 2020.
- Chan JF, Yuan S, Kok KH, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *Lancet*. 2020;395(10223):514-523.
- Chen Y, Liu Q, Guo D. Emerging coronaviruses: genome structure, replication, and pathogenesis. *J Med Virol*. 2020;92(4):418-423.
- Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet*. 2020;395(10223):507-13.
- WHO. Clinical management of severe acute respiratory infection when novel coronavirus (nCoV) infection is suspected: interim guidance. [https://www.who.int/internalpublications-detail/clinical-management-of-severe-acuterespiratoryinfection-when-novel-coronavirus-\(ncov\)-infection-is-suspected](https://www.who.int/internalpublications-detail/clinical-management-of-severe-acuterespiratoryinfection-when-novel-coronavirus-(ncov)-infection-is-suspected). Accessed 11 January 2020.
- National Health Commission of People's Republic of China. New coronavirus pneumonia diagnosis and treatment program (6th ed.) (in Chinese). <http://www.nhc.gov.cn/xcs/zhengcwj/202002/3b09b894ac9b4204a79db5b8912d4440.shtml>
- World Health Organization. Coronavirus disease (COVID-19) technical guidance: laboratory testing for 2019-nCoV in humans. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/laboratory-guidance>

13. Lee N, Hui D, Wu A, et al. A major outbreak of severe acute respiratory syndrome in Hong Kong. *N Engl J Med.* 2003;348(20):1986-1994.
14. Assiri A, Al-Tawfiq JA, Al-Rabeeh AA, et al. Epidemiological, demographic, and clinical characteristics of 47 cases of Middle East respiratory syndrome coronavirus disease from Saudi Arabia: a descriptive study. *Lancet Infect Dis.* 2013;13(9):752-761.
15. Choi KW, Chau TN, Tsang O, et al. Outcomes and prognostic factors in 267 patients with severe acute respiratory syndrome in Hong Kong. *Ann Intern Med.* 2003;139(9):715-723.
16. Hong KH, Choi JP, Hong SH, et al. Predictors of mortality in Middle East respiratory syndrome (MERS). *Thorax.* 2018;73(3):286-289.
17. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet.* 2020.
18. Zhang J, Dong X, Cao Y, et al. Clinical characteristics of 140 patients infected with SARS-CoV-2 in Wuhan, China. *Allergy.* 2020;75:1730-1741.
19. Wang YC, Luo H, Liu S, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. *Lancet Respir Med.* 2020.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Shu L, Wang X, Li M, et al. Clinical characteristics of moderate COVID-19 patients aggravation in Wuhan Stadium Cabin Hospital: A 571 cases of retrospective cohort study. *J Med Virol.* 2021;93:1133-1140. <https://doi.org/10.1002/jmv.26414>