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Risk Factors for Severity and Mortality in Adult Patients Confirmed with COVID-19 in Sierra Leone: A Retrospective Study

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Abstract

Background: The coronavirus disease 2019 (COVID-19) is a highly infectious respiratory disease. There is no recommended antiviral treatment approved for COVID-19 in Sierra Leone, and supportive care and protection of vital organ function are performed for the patients. This study summarized the clinical characteristics, drug treatments, and risk factors for the severity and prognosis of COVID-19 in Sierra Leone to provide evidence for the treatment of COVID-19.

Methods: Data of 180 adult COVID-19 patients from the 34th Military Hospital in Freetown Sierra Leone between March 31, 2020 and August 11, 2020 were retrospectively collected. Patients with severe and critically ill are classified in the severe group, while patients that presented asymptomatic, mild, and moderate disease were grouped in the non-severe group. The clinical and laboratory information was retrospectively collected to assess the risk factors and treatment strategies for severe COVID-19. Demographic information, travel history, clinical symptoms and signs, laboratory detection results, chest examination findings, therapeutics, and clinical outcomes were collected from each case file. Multivariate logistic analysis was adopted to identify the risk factors for deaths. Additionally, the clinical efficacy of dexamethasone treatment was investigated.

Results: Seventy-six (42.22%) cases were confirmed with severe COVID-19, while 104 patients (57.78%) were divided into the non-severe group. Fever (56.67%, 102/180) and cough (50.00%, 90/180) were the common symptoms of COVID-19. The death rate was 18.89% (34/180), and severe pneumonia (44.12%, 15/34) and septic shock (23.53%, 8/34) represented the leading reasons for deaths. The older age population, a combination of hypertension and diabetes, the presence of pneumonia, and high levels of inflammatory markers were significantly associated with severity of COVID-19 development ($P < 0.05$ for all). Altered level of consciousness [odds ratio (OR) = 56.574, 95% confidence interval (CI) 5.645–566.940, $P = 0.001$], high levels of neutrophils (OR = 1.341, 95%CI 1.109–1.621, $P = 0.002$) and C-reactive protein (CRP) (OR = 1.014, 95%CI 1.003–1.025, $P = 0.016$) might be indicators for COVID-19 deaths. Dexamethasone treatment could reduce mortality [30.36% (17/56) *vs.* 50.00% (10/20)] among severe COVID-19 cases, but the results were not statistically significant ($P > 0.05$).

Conclusions: The development and prognosis of COVID-19 may be significantly correlated with consciousness status, and the levels of neutrophils and CRP.

Keywords: COVID-19; Clinical type; Dexamethasone; Risk factor

Introduction

The World Health Organization (WHO) declared that the coronavirus disease 2019 (COVID-19) reached a worldwide pandemic on March 11, 2020.[1] The pandemic was caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which belongs to the genus *Betacoronavirus* and subgenus *Sarbecovirus* (lineage B).[2] COVID-19 is a highly infectious respiratory disease, which is transmitted through droplets, respiratory secretions, and direct contact in humans.[3,4] Even worse, the virus could be isolated from the blood and fecal swabs, revealing its other transmittal means.[5] Fever and cough are the common symptoms at the early stages of onset.[6] With the aggressive disease progression, acute respiratory distress syndrome, respiratory failure, and multiple organ failure are frequently observed, leading to death.[7] The reported death rate of severe and critical COVID-19 is up to 15% to 18%.[8]

Until now, there is no recommended antiviral treatment approved for COVID-19 in Sierra Leone, and supportive care and protection of vital organ function are performed for the patients.[9,10] The low dose of systemic corticosteroids and antivirals and atomization inhalation of interferon are encouraged

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in clinical management for patients in critical conditions.[11] Several drugs have been reported in COVID-19 treatment, including chloroquine, remdesivir, favipiravir, lopinavir/ritonavir, convalescent plasma, and mesenchymal stem cell therapy.[12,13] However, these drugs could not be applied for routine treatment of COVID-19 based on the current clinical findings.[13]

Sierra Leone, an African country, was heavily affected by the Ebola virus during the 2014 to 2016 outbreak. With the assistance of the Chinese People's Liberation Army, the Tropical Infectious Diseases Prevention and Control Center (IDPC), was constructed at the 34th Military Hospital and handed over to the Sierra Leone military. Since the opening of the center in July 2018, the center is jointly staffed by local experts and members of the Chinese Military Medical Expert Group in the prevention and treatment of infectious diseases based on China-Sierra Leone collaboration. IDPC is designated as an essential COVID-19 testing and treatment unit for mainly severe cases in Sierra Leone since the COVID-19 outbreak. In this retrospective study, we investigated the risk factors for severity and death among COVID-19 cases treated at IDPC of the 34th Military Hospital in Sierra Leone. In addition, we discussed the clinical efficacy of dexamethasone treatment.

Methods

Ethics approval

This study was approved by the Ethics Committee of Sierra Leone (No. 20200712-SLESRC-003) and also has been carried out in accordance with the World Medical Association Declaration of Helsinki. Informed consent was obtained from all patients/ participants or their legal representatives.

Study population

A total of 180 COVID-19 patients were recruited from the Tropical Infectious Diseases Prevention and Control Center of the 34th Military Hospital in Sierra Leone in collaboration with the Chinese Military Medical Expert Group between March 31, 2020 and August 11, 2020. The clinical and laboratory information was retrospectively collected to assess the risk factors and treatment strategies for severe COVID-19. Demographic information, travel history, clinical symptoms and signs, laboratory detection results, chest examination findings, therapeutics, and clinical outcomes were collected from each case file.

The eligible patients were confirmed to be infected by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) based on nasopharyngeal swabs, and met the diagnostic criteria of COVID-19 issued by the WHO.[14] The severity of COVID-19 was estimated according to the Guidelines issued by the National Health Committee of China[15] and WHO.[14] Patients with severe and critically ill are classified in the severe group, while patients that presented asymptomatic, mild, and moderate disease were grouped in the non-severe group. In addition, due to the limited medical conditions, the sudden symptoms were confirmed based on the patients' clinical presentation and doctors' experiments.

Nucleic acid testing

The laboratory diagnosis of SARS-CoV-2 was achieved using a real-time reverse transcription-polymerase chain reaction (RT-PCR). In brief, total RNA samples were obtained from the nasopharyngeal swabs using an automated extraction instrument (KingFisher Flex, ThernoFisher Scientific, MA, USA) or Trizol reagent (Sigma-Aldrich, St. Louis, MO, USA) by manual extraction. Then, PCR reaction was performed by a one-step real-time PCR kit (VR-11-120) for the detection of SARS-CoV-2 ORF1ab/N (Shanghai Huirui Biotechnology, Shanghai, China). The amplification was carried out in the RT-PCR detection system (CFX96 Bio-Rad, CA, USA) according to the instructions in the manufacturer's manual.

Hematologic analysis

The hematologic analysis was performed for all the patients on admission using automated analyzer devices like TEK5020 and TEK6030 (Tecom Science Corporation, Jiangxi, China). The detected hematologic indexes included white blood cell (WBC) with counts of lymphocytes, monocyte, neutrophils, hemoglobin (HGB), platelet count (PLT). The biochemical indices included serum albumin (ALB), total protein (TP), alanine aminotransferase (ALT), aspartate aminotransferase (AST), total bilirubin (TB), direct bilirubin (DB), blood glucose, blood urea nitrogen (BUN), creatinine (CRE), uric acid (UA), and lactate dehydrogenase (LDH). D-dimer was assessed using quantitative detection kits (Hightop Biotech Co., Ltd. Qingdao, China), while C-reactive protein (CRP) and procalcitonin (PCT) were detected by quantitative detection kits using immunofluorescence chromatographic method (Sichuan Xincheng Biological Co., Ltd. Chengdu, China).

Statistical analysis

All the calculations were achieved using SPSS version 18.0 software (SPSS Inc., Chicago, IL, USA). The distributions of continuous data were estimated using Kolmogorov-Smirnov test. Normally distributed continuous variables were presented as means ± standard deviation and non-normally distributed continuous variables as medians (interquartile ranges; IQR). Categorical variables were summarized as numbers (percentages). Continuous variables were compared by the Student's t test or the Mann-Whitney U test, and categorical variables by the chisquare test or Fisher exact test. Multivariate logistic regression model performed by "Forward: LR" method was employed to identify the risk factors for disease severity and death of COVID-19 patients, and the variables with P values less than 0.01 would be entered into the analysis. All the tests were two-tailed, and P values less than 0.05 indicated the results' statistical significance.

Results

Baseline characteristics of the study subjects

A total of 180 COVID-19 patients were retrospectively included in our study. Based on disease severity, 104 patients (57.78%) were divided into the non-severe group, while 76 patients (42.22%) were divided into the severe group. On discharge, 34 patients died (7 patients in the non-severe group, 27 patients in the severe group), and the death rate was 18.89%.

The average age of the enrolled patients was 52 ± 16years. There were 42 (23.33%) females and 138 (76.67%) males. The epidemiological link of 78 cases (43.33%) was identified in a confirmed community transmission area. The most common comorbidities were hypertension (57, 31.67%), and combined hypertension and diabetes (18, 10.00%). In addition, there were

Table 1: The baseline and demographic of the study subjects

Features	Total	Survival		*P* values
		Survivors ($n=146$)	Non-survivors ($n=34$)	
Mean age (years, means ± SD)	52 ± 16	50 ± 16	62 ± 14	<0.001
Gender [male, *n* (%)]	138 (76.67)	111 (76.03)	27 (79.41)	0.674
History of epidemiology [yes, *n* (%)]	78 (43.33)	75 (51.37)	3 (8.82)	<0.001
Co-morbidity [*n* (%)]				
Hypertension	57 (31.67)	46 (31.51)	11 (32.35)	0.924
Diabetes	7 (3.89)	6 (4.11)	1 (2.94)	0.502
Hypertension+diabetes	18 (10.00)	13 (8.9)	5 (14.71)	0.310
AIDS	8 (4.44)	4 (2.74)	4 (11.76)	0.021
Pregnancy	2 (1.11)	2 (1.37)	0 (0)	1.000
Others	4 (2.22)	3 (2.05)	1 (2.94)	0.752
Clinical types [*n* (%)]				<0.001
Asymptomatic	22 (12.22)	22 (15.07)	0 (0)	
Mild	54 (30.00)	52 (35.62)	2 (5.88)	
Moderate	28 (15.56)	23 (15.75)	5 (14.71)	
Severe	41 (22.78)	32 (21.92)	9 (26.47)	
Critical	35 (19.44)	17 (11.64)	18 (52.94)	
Length of hospital stay [days, median (IQR)]	13 (9)	14 (7)	2 (5)	<0.001

SD: standard deviation; AIDS: Acquired immunodeficiency syndrome; IQR: interquartile range.

2 (1.11%) pregnant women in our study. On admission, 22 cases (12.22%) were asymptomatic; 54 cases (30.00%) were diagnosed with the mild disease; and 28 cases (15.56%) exhibited moderate disease. Severe and critical diseases were confirmed in 41 (22.78%) and 35 (19.44%) cases, respectively. The median hospital stay time was 13 days. The detailed information was recorded in Table 1.

The most common symptoms were fever (56.67%), cough (50.00%), dyspnea (39.44%), fatigue (37.22%), headache (11.67%), altered level of consciousness (10.56%), anorexia (10.56%), etc. According to chest examination, 7 (3.89%) cases had unilateral pneumonia; 79 cases (43.89%) had bilateral pneumonia; 27 (15.00%) cases showed multiple patch-like shadows (early stage); 45 (25.00%) cases showed ground-glass opacity in both lungs (intermediate stage); and 7 (3.89%) cases exhibited lung consolidation (late stage) [Table 2].

During hospitalization, 105 (58.33%) patients received azithromycin (500 mg/day); 100 (55.56%) patients were treated with ceftriaxone (2 g/day); 37 (20.56%) received hydroxychloroquine (1000 mg/day); 62 (34.44%) patients received dexamethasone (20 mg/day in decreasing dose); 39 (21.67%) cases were treated with enoxaparin (40 mg/day); 49 (27.22%) patients received paracetamol; 116 (64.44%) patients received vitamin C; and 116 (64.44%) were treated with multivitamins (immunoboost) [Table 2].

The major reasons for deaths of COVID-19 patients were severe pneumonia (44.12%), septic shock (23.53%), stroke (14.71%), brain herniation (5.88%) (due to the lack of brain computed tomography, brain herniation was diagnosed according to the patients' clinical presentation and doctors' experiments), renal failure (5.88%), and diabetic ketosis or hyperosmotic decompensation (5.88%) [Figure 1A].

On admission, all the patients received routine laboratory examinations. Their median temperature was 36.50°C, SpO_2 was 96.00% (IQR, 8.00%), systolic blood pressure (SBP) was 133.99 ± 24.70mmHg, diastolic blood pressure (DBP) was 82.52 ± 15.84mmHg, heart rate (HR) was 92.27 ± 17.51beats/min, and respiratory rate (RR) was 24.00 (IQR, 8.00) breaths/min. The routine laboratory parameters are shown in Table 3.

The comparisons of baseline and laboratory parameters between survivors and non-survivors

Compared to the survivors, the non-survivors were more likely to exhibit older ages ($P < 0.001$) and have no history of foreign travel ($P < 0.001$). Moreover, most of the non-survivors had either critical (52.94%) or severe illness (26.47%) at presentation, only 2 (5.88%) were confirmed with mild illness, and no asymptomatic cases were observed in the non-survivor group at presentation. The occurrences of dyspnea and altered level of consciousness were significantly higher among non-survivors than in survivors ($P = 0.004$ and $P < 0.001$). The treatment strategies showed a slight difference between survivors and non-survivors. Ceftriaxone and dexamethasone treatments were more frequently administered to non-survivors, while Vitamin C and multivitamins (immunoboost) treatments were rarely used in non-survivors ($P < 0.05$ for all). The survivors had prolonged hospital stay time [14 (IQR, 7) days *vs*. 2 (IQR, 5) days] [Table 1 and Table 2].

The non-survivors showed significantly low levels of SpO_2, high levels of HR, and RR ($P < 0.05$ for all). Routine blood examinations demonstrated that compared to survivors, the non-survivors were more likely to exhibit high levels of WBC, monocyte, neutrophils, AST, TB, glucose, BUN, CRE, UA, CRP, and D-dimer, as well as low lymphocytes and ALB levels ($P < 0.05$ for all) [Table 3].

The comparison of clinical manifestations between severe and non-severe groups

As shown in Figure 1B, the death rates were significantly higher in severe and critical groups. We compared the baseline characteristics between severe and non-severe groups. Analysis results demonstrated that the cases in the severe group exhibited

Table 2: The clinical characteristics of the study subjects

Features	Total	Survival		*P* values
		Survivors ($n=146$)	Non-survivors ($n=34$)	
Fever	102 (56.67)	82 (56.16)	20 (58.82)	0.512
Cough	90 (50)	77 (52.74)	13 (38.24)	0.214
Sore throat	4 (2.22)	4 (2.74)	0 (0)	1.000
Dyspnea	71 (39.44)	51 (34.93)	20 (58.82)	0.004
Fatigue	67 (37.22)	52 (35.62)	15 (44.12)	0.234
Myalgia	17 (9.44)	14 (9.59)	3 (8.82)	0.970
Nasal stuffiness	7 (3.89)	7 (4.79)	0 (0)	0.418
Running nose	3 (1.67)	3 (2.05)	0 (0)	1.000
Sneezing	2 (1.11)	2 (1.37)	0 (0)	1.000
Smell disturbances	6 (3.33)	6 (4.11)	0 (0)	0.502
Taste disturbances	2 (1.11)	2 (1.37)	0 (0)	1.000
Headache	21 (11.67)	18 (12.33)	3 (8.82)	0.639
Diarrhea	3 (1.67)	2 (1.37)	1 (2.94)	0.485
Anorexia	19 (10.56)	15 (10.27)	4 (11.76)	0.712
Alteration in the level of consciousness	19 (10.56)	4 (2.74)	15 (44.12)	<0.001
Chest pain	8 (4.44)	8 (5.48)	0 (0)	0.350
Sputum	6 (3.33)	6 (4.11)	0 (0)	0.502
Chest examination				0.284
Normal	94 (52.22)	76 (52.05)	18 (52.94)	
Unilateral pneumonia	7 (3.89)	5 (3.42)	2 (5.88)	
Bilateral pneumonia				
Early stage	27 (15.00)	21 (14.38)	6 (17.65)	
Middle stage	45 (25.00)	40 (27.40)	5 (14.71)	
Late stage	7 (3.89)	4 (2.74)	3 (8.82)	
Azithromycin	105 (58.33)	89 (60.96)	16 (47.06)	0.139
Ceftriaxone	100 (55.56)	72 (49.32)	28 (82.35)	<0.001
Hydroxychloroquine	37 (20.56)	31 (21.23)	6 (17.65)	0.641
Dexamethasone	62 (34.44)	44 (30.14)	18 (52.94)	0.012
Enoxaparin	39 (21.67)	30 (20.55)	9 (26.47)	0.450
PCM	49 (27.22)	44 (30.14)	5 (14.71)	0.069
Vit C	116 (64.44)	108 (73.97)	8 (23.53)	<0.001
Multivitamins	116 (64.44)	108 (73.97)	8 (23.53)	<0.001

Data are presented as number (%).
PCM: Paracetamol; Vit C: Vitamin C.

older age ($P<0.001$), and had no history of an epidemiology link in a setting with community transmission ($P<0.001$). Moreover, the severe group was more likely to have the combined hypertension and diabetes ($P=0.001$), fever ($P=0.001$), cough ($P<0.001$), dyspnea ($P<0.001$), fatigue ($P<0.001$), alteration in the level of consciousness ($P=0.003$), and sputum ($P=0.013$). In addition, 82.89% of cases in the severe group showed pneumonia, which was significantly higher than that of the non-severe group ($P<0.001$). Azithromycin, ceftriaxone, hydroxychloroquine, dexamethasone, and prophylactic dose of enoxaparin were frequently used for the treatment of severe illness ($P<0.05$ for all). The death rate was significantly higher in the severe group than in the non-severe group (35.53% vs. 6.73%) ($P<0.001$). Furthermore, septic shock and septic shock were the primary reasons for death among severe cases, while stroke and brain herniation represented the leading reasons for deaths in the non-severe group [Table 4].

The patients with severe COVID-19 exhibited significantly low SpO_2 and high levels of HR and RR ($P<0.05$ for all). Severe COVID-19 patients frequently had high levels of WBC, monocyte, neutrophils, PLT, ALT, AST, blood glucose, CRE, UA, LDH, CRP, and D-dimer, and low levels of lymphocytes, HGB, and ALB ($P<0.05$ for all) [Table 5].

Risk factors for prognosis of COVID-19 patients

Multivariate logistic regression model was performed to identify the risk factors for deaths in COVID-19 patients. Alteration in the level of consciousness [odds ratio (OR) = 56.574, 95% confidence interval (CI) 5.645–566.940, $P=0.001$), high neutrophils (OR = 1.341 95%CI 1.109–1.621, $P=0.002$), and high CRP (OR = 1.014, 95%CI 1.003–1.025, $P=0.016$) were independently correlated with death caused by COVID-19 [Table 6].

Dexamethasone treatment for COVID-19

During hospitalization, we found that dexamethasone could significantly improve the clinical outcomes of COVID-19. As shown in Figure 2A, the daily administration dose of dexamethasone was significantly lower in survivors than that in non-survivors ($P<0.001$). Moreover, the daily dose of dexamethasone did not show significant differences between

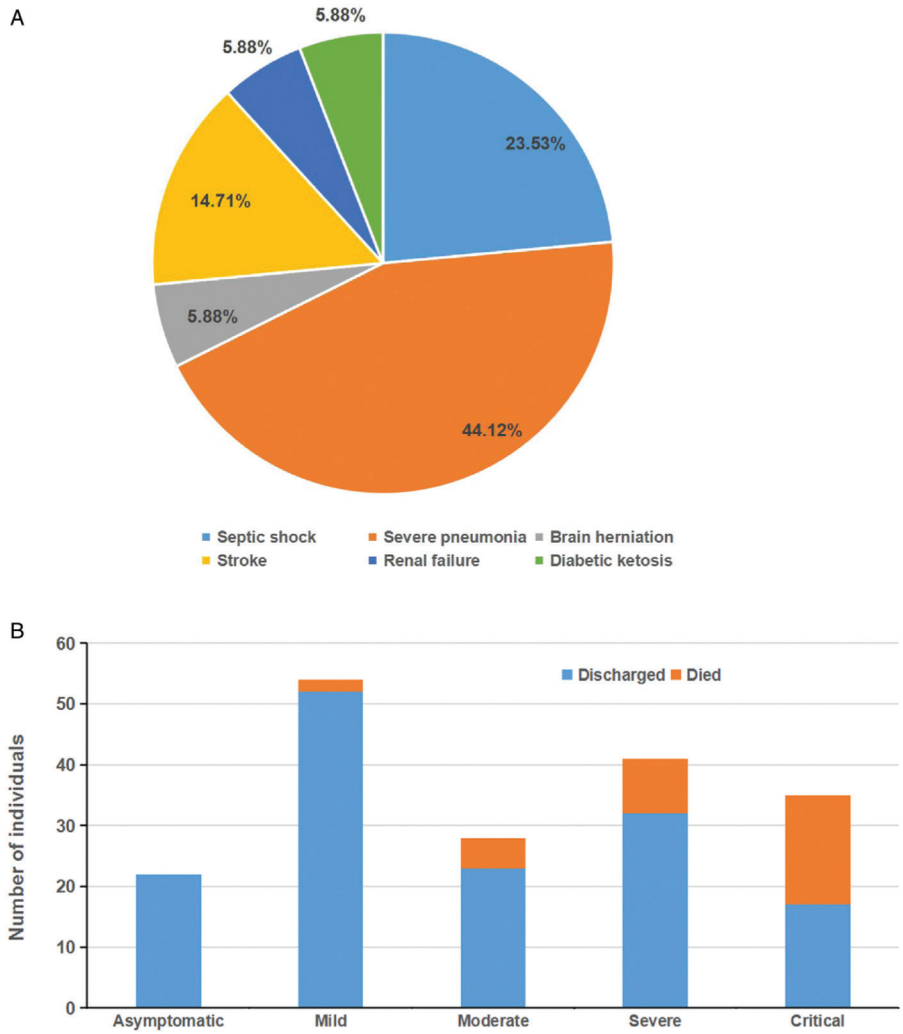

Figure 1: The prognostic data of patients with COVID-19. (A) Causes of death among the patients confirmed with COVID-19. (B) The clinical types and outcomes of the included patients. COVID-19: Coronavirus disease 2019.

non-severe and severe groups ($P > 0.05$) [Figure 2B]. Among the patients with severe stage, dexamethasone treatment could reduce the death rate 30.36% (17/56) vs. 50.00% (10/20), but the results were insignificant ($P > 0.05$) [Figure 2C].

Discussion

COVID-19 is a severe respiratory infection, without effective treatments. Although various studies have reported the clinical presentation of COVID-19 in different regions,[16–19] little is known about the spread of COVID-19 in Sierra Leone, due to the disease heterogeneity. This study summarized the clinical characteristics, medications, and clinical outcomes of 180 COVID-19 patients in the 34th Military Hospital in Sierra Leone.

Among the included patients, fever and cough were the main clinical symptoms. The death rate was 18.89%; severe pneumonia and septic shock represented the leading causes of death. Multivariate analysis found that consciousness status, and the levels of CRP and neutrophils were independently associated with death of COVID-19. A meta-analysis of 1,994 hospitalized patients with COVID-19 analyzed from 10 articles showed the death rate of COVID-19 was 5%.[20] As IDPC was selected as a referral center for moderate risk factors, nearly half of the included patients were developed to severe and critical conditions that contributed to the high mortality. According to reports, the mortality rate of COVID-19 cases requiring intensive care was as high as 40%.[21] Timely treatment at early stages might be an effective way to improve the prognosis of COVID-19.

Generally, the immunity of COVID-19 patients with severe and critical illness were significantly dysregulated, which was characterized by lack of antigen-presenting cells, varying number, function of T cells, and the activation of negative immune regulation.[22,23] Our laboratory findings were consistent with this view. The non-survivors and severe cases exhibited significantly higher levels of white cells, neutrophils, and low levels of lymphocytes and monocyte, revealing the aggressive inflammatory conditions and poor immune response. Therefore, for cases confirmed with COVID-19, especially cases under critical conditions, host immune surveillance was very necessary.

Clinical-stage is an important factor for the survival of COVID-19 patients. Our study found that the death rates of asymptomatic, mild, moderate, severe, and critical cases were 0, 3.70%, 17.86%, 21.95%, and 51.43%, respectively. The mortality rate of severe and critical patients was much higher

Table 3: The laboratory parameters of the study subjects at admission

Parameters	Total	Survival		*P* values
		Survivors (*n*=146)	Non-survivors (*n*=34)	
Routine examinations				
Temperature (°C)	36.50 (0.40)	36.50 (0.40)	36.45 (0.60)	0.498
SpO2 (%)	96.00 (8.00)	96.00 (7.00)	88.50 (13.25)	<0.001
SBP (mmHg)	133.99±24.70	135.58±23.53	127.18±28.58	0.285
DBP (mmHg)	82.52±15.84	84.01±14.38	76.15±20.02	0.085
HR (beats/min)	92.27±17.51	89.24±16.23	105.29±17.06	<0.001
RR (breaths/min)	24.00 (8.00)	22.00 (6.00)	27.00 (6.00)	<0.001
Blood routine examinations				
WBC ($\times10^9$/L)	7.80 (6.00)	7.10 (5.60)	13.35 (8.75)	<0.001
Lymphocytes ($\times10^9$/L)	1.80 (1.22)	1.90 (1.30)	1.60 (0.645)	0.002
Monocyte ($\times10^9$/L)	0.42 (0.40)	0.40 (0.30)	0.92 (0.75)	<0.001
Neutrophils ($\times10^9$/L)	4.60 (6.15)	4.30 (5.00)	9.80 (9.625)	<0.001
HGB (g/L)	142.00 (34.50)	142.00 (33.00)	118.50 (73.50)	0.058
PLT ($\times$ 10^9/L)	174.00 (132.00)	170.00 (131.00)	193.50 (141.00)	0.592
ALB (g/L)	42.28±7.86	42.81±7.69	38.93±8.26	0.031
ALT (U/L)	34.05 (33.125)	33.60 (30.25)	35.25 (53.05)	0.333
AST (U/L)	29.80 (14.80)	29.60 (12.90)	40.20 (27.75)	0.016
TB (μmol/L)	14.25 (7.375)	13.70 (6.825)	16.85 (12.125)	0.023
Blood glucose (mmol/l)	6.30 (2.625)	6.20 (2.05)	9.20 (6.80)	0.009
BUN (mmol/l)	4.80 (4.90)	4.40 (3.35)	15.25 (19.50)	<0.001
CRE (ml/min)	100.00 (40.00)	97.00 (30.00)	150.50 (180.25)	<0.001
UA (μmol/L)	366.20 (177.40)	360.70 (155.80)	498.60 (344.58)	0.005
LDH (U/L)	341.25±220.86	323.01±218.48	447.63±212.86	0.071
CRP (mg/L)	43.38 (103.70)	38.62 (82.28)	134.05 (119.16)	<0.001
D-dimer (mg/L)	2.13 (6.52)	1.49 (5.29)	11.88 (10.50)	<0.001

Continuous variables in normal distribution are shown as means±standard deviations, while the continuous variables in abnormal distributions are expressed by median with IQR (interquartile range). SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HR: Heart rate; RR: Respiratory rate; WBC: White blood cell; HGB: Hemoglobin; PLT: Platelet count; ALB: Blood albumin; TP: Total protein; ALT: Alanine aminotransferase; AST: Aspartate aminotransferase; TB: Total bilirubin; BUN: Blood urea nitrogen; CRE: Creatinine clearance; UA: Uric acid; LDH: Lactic dehydrogenase; CRP: C-reaction protein.

Table 4: The comparisons of baseline clinical characteristics between severe and non-severe patients

Features	Clinical types		*P* values
	Non-severe (*n*=104)	Severe (*n*=76)	
Baseline and demographic			
Mean age (years, mean±SD)	46±16	60±14	<0.001
Gender [*n* (%)]			0.924
Female	24 (23.08)	18 (23.68)	
Male	80 (76.92)	58 (76.32)	
History of epidemiology [*n* (%)]			<0.001
No	41 (39.42)	61 (80.26)	
Yes	63 (60.58)	15 (19.74)	
Co-morbidity [*n* (%)]			
Hypertension	27 (25.96)	30 (39.47)	0.054
Diabetes	4 (3.85)	3 (3.95)	1.000
Hypertension+diabetes	4 (3.85)	14 (18.42)	0.001
AIDS	2 (1.92)	6 (7.89)	0.120
Pregnancy	2 (1.92)	0 (0)	0.509
Others	2 (1.92)	2 (2.63)	1.000
On admission [*n* (%)]			
Fever	49 (47.12)	53 (69.74)	0.001
Cough	37 (35.58)	53 (69.74)	<0.001
Sore throat	2 (1.92)	2 (2.63)	1.000
Dyspnea	10 (9.62)	61 (80.26)	<0.001

(*continued*)

Table 4
(continued).

Features	Clinical types		*P* values
	Non-severe ($n=104$)	Severe ($n=76$)	
Fatigue	24 (23.08)	43 (56.58)	<0.001
Myalgia	9 (8.65)	8 (10.53)	0.629
Nasal stuffiness	7 (6.73)	0 (0)	0.055
Running nose	3 (2.88)	0 (0)	0.366
Sneezing	2 (1.92)	0 (0)	0.509
Smell disturbances	5 (4.81)	1 (1.32)	0.385
Taste disturbances	2 (1.92)	0 (0)	0.509
Headache	16 (15.38)	5 (6.58)	0.079
Diarrhea	2 (1.92)	1 (1.32)	1.000
Anorexia	7 (6.73)	12 (15.79)	0.043
Alteration in the level of consciousness	5 (4.81)	14 (18.42)	0.003
Chest pain	4 (3.85)	4 (5.26)	0.958
Sputum	0 (0)	6 (7.89)	0.013
Chest examination			<0.001
Normal	81 (77.88)	13 (17.11)	
Unilateral pneumonia	6 (5.77)	1 (1.32)	
Bilateral pneumonia			
Early stage	15 (14.42)	12 (15.79)	
Middle stage	2 (1.92)	43 (56.58)	
Late stage	0 (0)	7 (9.21)	
Treatments [*n* (%)]			
Azithromycin	43 (41.35)	62 (81.58)	<0.001
Ceftriaxone	30 (28.85)	70 (92.11)	<0.001
Hydroxychloroquine	12 (11.54)	25 (32.89)	<0.001
Dexamethasone	7 (6.73)	56 (73.68)	<0.001
Enoxaparin	9 (8.65)	30 (39.47)	<0.001
PCM	30 (28.85)	19 (25)	0.567
Vit C	70 (67.31)	46 (60.53)	0.348
Multivitamins	70 (67.31)	46 (60.53)	0.348
On discharge			
Length of hospital stay [days, median (IQR)]	14 (6)	13 (14)	0.460
Outcomes [*n* (%)]			<0.001
Discharged	97 (93.27)	49 (64.47)	
Died	7 (6.73)	27 (35.53)	
Reasons for death [*n* (%)]			<0.001
Septic shock	0 (0)	8 (10.53)	
Severe pneumonia	0 (0)	15 (19.74)	
Brain herniation	2 (1.92)	0 (0)	
Stroke	4 (3.85)	1 (1.32)	
Renal failure	0 (0)	2 (2.63)	
Diabetic ketosis	1 (0.96)	1 (1.32)	

SD: standard deviations; AIDS: Acquired immunodeficiency syndrome; PCM: Paracetamol; IQR: interquartile range.

than in non-severe cases. Respiratory failure and septic shock were the major causes of death in severe cases.

Until now, there are no recommended antiviral drugs for the clinical treatment of COVID-19.[24,25] In the current analysis, we found that dexamethasone treatment could reduce the fatality rate of severe COVID-19 cases, but the results were insignificant. A preliminary report including hospitalized patients with COVID-19 showed that dexamethasone treatment could reduce the mortality among the patients who received oxygen, but the efficacy was not obvious among those with respiratory support.[26] Dexamethasone might improve the respiratory infection syndromes secondary to COVID-19, thus prolonging ventilator-free days.[27] Well-designed randomized controlled trials with a large sample size are required to explore the long-term therapeutic efficacy of dexamethasone among African patients with SARS-CoV-2.

The death rate of the severe cases included in this study was 35.53%. That is because the source of the cases in this study was from IDPC, a critical care institution designated by the Sierra Leone government, which admitted more than half of the severe cases in Sierra Leone. The COVID-19 epidemic in Sierra Leone is not accounted for so serious. According to the WHO website as of October 29, 2021, the number of COVID-19 confirmed cases in Sierra Leone is 6397, with 121 deaths (mortality rate 1.89%),

Table 5: The comparison of laboratory parameters between severe and non-severe patients at admission

Parameters	Clinical types		*P* values
	Non-severe ($n=104$)	Severe ($n=76$)	
Routine examinations			
Temperature (°C)	36.50 (0.50)	36.40 (0.40)	0.041
SpO_2 (%)	98.00 (3.00)	88.00 (10.00)	<0.001
SBP (mmHg)	132.07 ± 20.02	136.63 ± 29.89	0.222
DBP (mmHg)	84.44 ± 14.2	79.89 ± 17.59	0.057
HR (beats/min)	86.12 ± 14.13	100.7 ± 18.26	<0.001
RR (breaths/min)	20.50 (4.00)	28.00 (4.00)	<0.001
Blood routine examinations			
WBC ($\times 10^9$/L)	6.20 (3.45)	11.50 (5.20)	<0.001
Lymphocytes ($\times 10^9$/L)	2.15 (1.00)	1.50 (1.03)	0.001
Monocyte ($\times 10^9$/L)	0.30 (0.28)	0.60 (0.55)	<0.001
Neutrophils ($\times 10^9$/L)	3.15 (2.50)	8.80 (4.65)	<0.001
HGB (g/L)	145 (27)	129 (41)	0.007
PLT ($\times 10^9$/L)	155 (116)	209 (159)	<0.001
ALB (g/L)	44.18 ± 7.55	39.52 ± 7.52	<0.001
ALT (U/L)	31.50 (24.00)	41.20 (54.13)	<0.001
AST (U/L)	27.00 (13.13)	35.90 (18.55)	<0.001
TB (μmol/L)	14.20 (6.80)	14.25 (7.70)	0.241
Blood glucose (mmol/L)	5.90 (1.10)	7.80 (6.40)	<0.001
BUN (mmol/L)	3.90 (2.30)	7.00 (6.475)	<0.001
CRE (ml/min)	95.50 (26.00)	117.00 (69.00)	<0.001
UA (μmol/L)	342.90 (131.40)	413.90 (189.175)	<0.001
LDH (U/L)	240.26 ± 132.28	452.58 ± 245.71	<0.001
CRP (mg/L)	10.00 (57.74)	87.85 (113.95)	<0.001
D-dimer (mg/L)	0.35 (1.82)	6.78 (12.05)	<0.001

Continuous variables are shown as mean ± standard deviations or median (interquartile range) depending on whether they are normally distributed.
SpO_2: oxygen saturation; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HR: Heart rate; RR: Respiratory rate; WBC: White blood cell; HGB: Hemoglobin; PLT: Platelet count; ALB: Blood albumin; ALT: Alanine aminotransferase; AST: Aspartate aminotransferase; TB: Total bilirubin; BUN: Blood urea nitrogen; CRE: Creatinine clearance; UA: Uric acid; LDH: Lactic dehydrogenase; CRP: C-reaction protein.

which ranked 181 out of 233 countries and regions in the world.[28] As a country severely affected by the Ebola epidemic from 2014 to 2015, Sierra Leone has greatly improved its investment in public health, and the awareness of people on infectious disease prevention and control is improved. So at the beginning of the COVID-19 epidemic, the National COVID-19 Emergency Reaction Center was founded quickly. With the assistance of countries around the world, Sierra Leone has been fully prepared in terms of personnel, technology and medical supplies, and the surveillance for suspicious cases was enhanced as well. When the first case was confirmed, he was quickly admitted to the IDPC ward. Subsequently, the severe cases were actively rescued, and the mild cases were effectively isolated. There is no intensive care unit with good facilities, but mortality is not so high in Sierra Lenon, which is partly due to the Chinese aid experts in our research group working together with local colleagues to actively rescue patients. This approach is a positive example for the prevention and control of COVID-19 and other novel outbreaks in underdeveloped countries, as well as a positive contribution to the global fight against COVID-19.

Limitations

There were several limitations in the current study. First, due to the limited detection conditions, some laboratory factors, such as LDH and CRP, were not estimated initially but were added later, which affected the statistical results to a certain extent. Second, some of these patients' test results and clinical details were incomplete, which reduced the statistical power of multivariate analysis. Nonetheless, the study has provided insight into the clinical characteristics and risk factors of severe COVID-19 disease and its mortality in a typical African setting.

Table 6: Multivariate analysis for the clinical outcomes of the patients confirmed with COVID-19

Variables	*B*	S.E.	Wals	OR	95%CI	*P* values
Alteration in the level of consciousness	4.036	1.176	11.778	56.574	5.645–566.940	0.001
Neutrophils	0.293	0.097	9.200	1.341	1.109–1.621	0.002
BUN	0.009	0.011	0.744	1.010	0.988–1.031	0.389
CRP	0.014	0.006	5.857	1.014	1.003–1.025	0.016

BUN: Blood urea nitrogen; CRP: C-reaction protein; S.E.: Standard error; OR: Odds ratio; CI: Confidence interval.

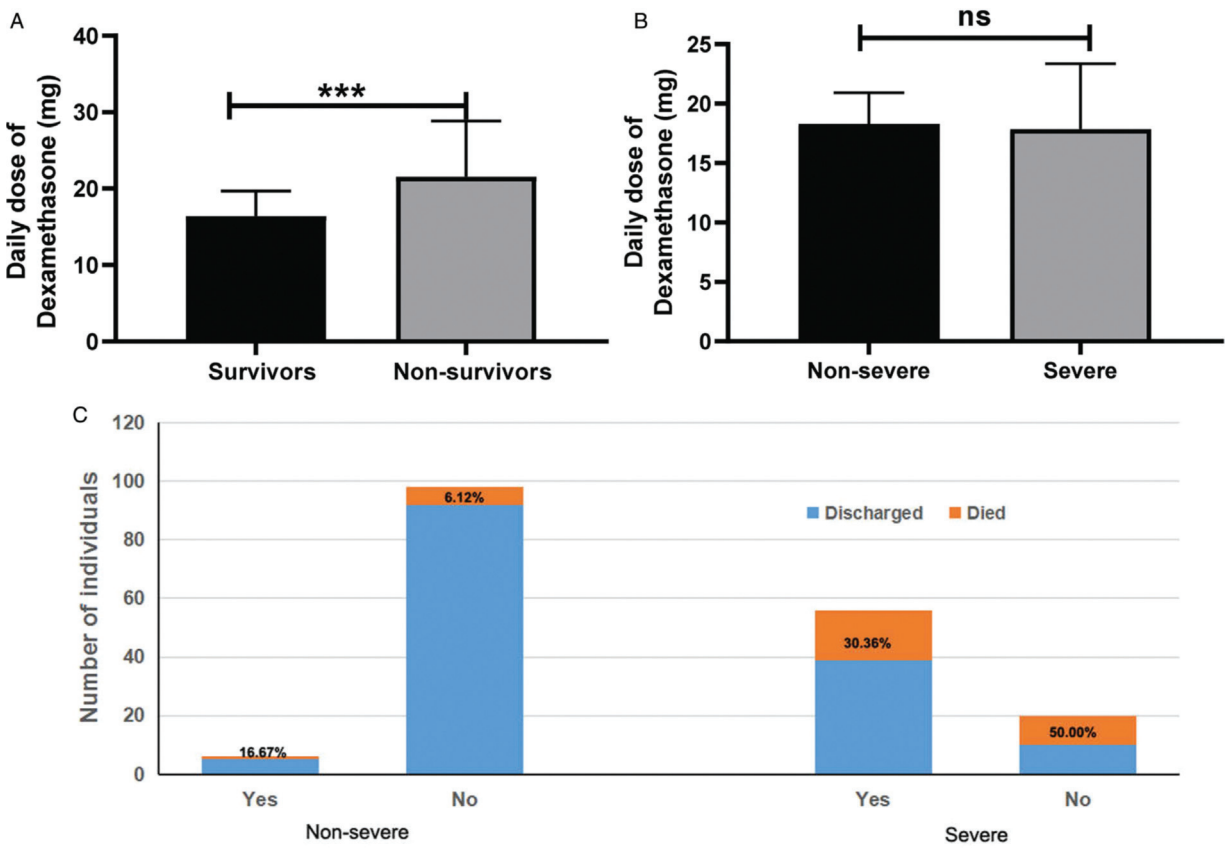

Figure 2: Dexamethasone treatment for COVID-19 patients. (A) The comparison of Dexamethasone daily dose between the survivors and non-survivors. ***$P < 0.001$; ns: not significant. (B) The comparison of Dexamethasone application between the non-severe group and severe group. ns: not significant. (C) The influences of Dexamethasone treatment on clinical outcomes of the patients confirmed with COVID-19 based on their clinical types. Yes: Dexamethasone treatment; no: without Dexamethasone treatment. COVID-19: Coronavirus disease 2019.

Conclusion

In conclusion, the mortality rate of severe COVID-19 patients is as high as 35.53% in our study which was administrated in 34th Military Hospital in Sierra Leone between March 31, 2020 and August 11, 2020. Older age, hypertension and diabetes, fever, alteration in the level of consciousness, and high levels of inflammatory markers are closely related to the severity of COVID-19. Moreover, the alteration in the level of consciousness and high levels of neutrophils and CRP may increase the death risk in patients with COVID-19. Dexamethasone treatment may improve the survival of severe COVID-19 patients, but the clinical effect requires further verification.

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Author Contributions

Bo Tu, Biao Xu, and Weiwei Chen designed, drafted the manuscript. Marta Lado, Reginald Cole, Fang Chu, Susan Hastings-Spaine, and Mohamed Boie Jalloh contributed to the acquisition and analysis of the data. Junjie Zheng, Sulaiman Lakoh, and Stephen Sevalie conceived the manuscript and substantively revised it. All authors revised and approved the final manuscript.

Conflicts of Interest

None.

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