

Clinical Features and Short-term Outcomes of 18 Patients with Corona Virus Disease 2019 in Intensive Care Unit

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Jianlei Cao^{1#}, MD, PhD; Xiaoyong Hu^{1#}, MD, PhD; Wenlin Cheng¹, MD, PhD; Lei Yu², MD, PhD; Wen-Jun Tu^{3‡}, MD, PhD; Qiang Liu^{3‡}, PhD

1. Department of Cardiology, Zhongnan Hospital, Wuhan University, Wuhan, China

2. Department of Infectious Diseases, The Fourth Affiliated Hospital of Harbin Medical University, Harbin, China

3. Institute of Radiation Medicine, China Academy of Medical Science & Peking Union Medical College, Tianjin, China

‡Corresponding author:

Wen-jun Tu; Email: tuwenjun@irm-cams.ac.cn; Tel/fax: 86-022-81682291

Address: No.238, Baiti Road, Tianjin, 300192, P.R. China

Or

Qiang Liu; E-mail: liuqiang@irm-cams.ac.cn; Tel/Fax: +86-022-81682291

Address: No.238, Baiti Road, Tianjin, 300192, P.R. China

Contributed equally to this work

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Take-home message

The COVID-19 patients admitted to the ICU are more likely suffered from comorbidities and complications of hospitalization. The effective treatment application in the ICU can improve patient prognosis.

To the editor,

In December, 2019, a series of pneumonia cases of unknown cause emerged in Wuhan, Hubei, China [1] and further a novel coronavirus was separated from lower respiratory tract samples, which was further named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) [2]. The SARS-CoV-2 disease officially had a name of Corona Virus Disease 2019(COVID-19) on 11 February, 2020. In this study, we examine which treatments are being used and assess clinical and laboratory features and short-term outcomes of patients with COVID-19 in intensive care unit.

This retrospective case series involved 102 adult patients with COVID-19 admitted to Wuhan University Zhongnan Hospital in Wuhan, China, between January 3 and February 1, 2020. All those patients were with laboratory-confirmed SARS-CoV-2 infection [3]. Epidemiological, clinical, radiological characteristics, underlying diseases, laboratory tests at admission and during hospitalization, treatment, complications and outcomes data were collected [3-4]. Patients outcomes (discharge or death) and admitted to ICU (yes or no) were followed up at discharge until Feb 15, 2020. The study was approved by Zhongnan Hospital Ethics Committee and oral consent was obtained from patients or relatives.

Demographic details of the included 102 patients are shown in supplementary table I. All patients were treated in isolation. Seventeen patients died (discharge mortality, 16.7%; 95% confidence interval [CI], 9.4%-23.9%) and eighteen patients were admitted to the ICU; thus, the rate was 17.6% (95% CI, 10.2%-25.0%). The reasons for admission included severe

patients require mechanical ventilation(N=6), breathing rate increases/oxygen saturation < 90%/cannot cooperate with noninvasive ventilator(N=7), and combined shock and/or organ failure(N=5). The timeline of SARS-CoV-2 onset in ICU patients is shown in the figure 1. Those ICU patients were older (66[54-76] vs. 31[35-62]) and more likely exposure to source of transmission (66.7% vs. 40.2%) when compared those non-ICU patients. Health care workers were less likely admitted to the ICU (0% vs. 28.2%). ICU patients more likely suffered from comorbidities (Any [100.0% vs. 34.5%]; hypertension [55.5% vs. 21.4%]; and chronic liver disease [11.1% vs. 0%]). Those patients needed more time to confirm the laboratory-diagnosis (12[7-19] vs. 8[4-11]). They also needed longer hospital stays (15[8-21] vs. 10[7-14]) and more medical expenses (62 556[48 938-160 629] vs. 12 808[8 166-27 691] CNY). Supplementary table I.

As shown in the supplementary table I, the treatment in ICU included antiviral therapy (100.0%), antibiotic treatment (100.0%), glucocorticoid therapy (61.1%), oxygen inhalation (61.1%), noninvasive ventilation (11.1%), invasive mechanical ventilation (38.9%), extracorporeal membrane oxygenation (16.7%) and CRRT (22.2%). Furthermore, there were no significant difference of drugs treatment, oxygen inhalation and noninvasive ventilation between ICU group and non-ICU group ($P>0.05$ all). ICU patients received more treatment of invasive mechanical ventilation (38.9% vs. 4.8%), extracorporeal membrane oxygenation (16.7% vs. 0%) and CRRT (22.2% vs. 2.4%). They also more likely suffered from hospital complications (ARDS [44.4% vs. 14.3%]; acute infection [38.9% vs. 11.9%]; acute cardiac injury [33.3% vs. 10.7%]; arrhythmia [38.9% vs. 13.1%]; acute kidney injury [44.4% vs. 14.3%] and acute liver injury [66.7% vs. 26.2%]). ICU patients had a higher mortality rate than non-ICU patients (33.3% vs. 13.1%), but this difference was not significant ($P=0.081$).

Our results suggest that ICU patients suffer more comorbidities and complications of hospitalization and receive more aggressive treatment, and can result in a similar mortality

when compared to non-ICU patients. We found that 17.6% of the patients required admission to the ICU and 16.7% died. A previous study included 138 patients with COVID-19 showed that 26% of patients required admission to the ICU and 4.3% died [3]. Another study reported that 23% of COVID-19 required admission to the ICU and 11.0% died [4]. It should be noted that most patients in those two studies were still hospitalized at the time of manuscript submission [3-4]. Our hospital is one of the major tertiary teaching hospitals and is responsible for the treating critically ill patients with COVID-19. Thus, our cohort might represent the more severe COVID-19 and the rates of death and ICU admission are overestimated. A recent large-sample and multicenter study showed that only 5.00% of the included COVID-19 patients were admitted to ICU and 1.36% succumbed [5].

DECLARATIONS

Author Contributions: Drs Cao and Hu contributed equally as the co-author. Drs Tu and Liu contributed equally as senior authors. Drs Cao and Tu 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.

Concept and design: Cao, Hu, Cheng, Yu, Tu, Liu

Acquisition, analysis, or interpretation of data: Cao, Hu, Cheng, Yu, Tu, Liu

Drafting of the manuscript: Cao, Hu, Tu, Liu

Critical revision of the manuscript for important intellectual content: Cheng, Yu.

Statistical analysis: Cao, Tu.

Administrative, technical, or material support: Cao, Hu, Cheng, Tu, Liu

Supervision: Cao, Hu, Cheng

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Conflict of Interest Disclosures: None reported.

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Data Availability Data available can be obtained from the corresponding author.

A Consent for publication Not applicable.

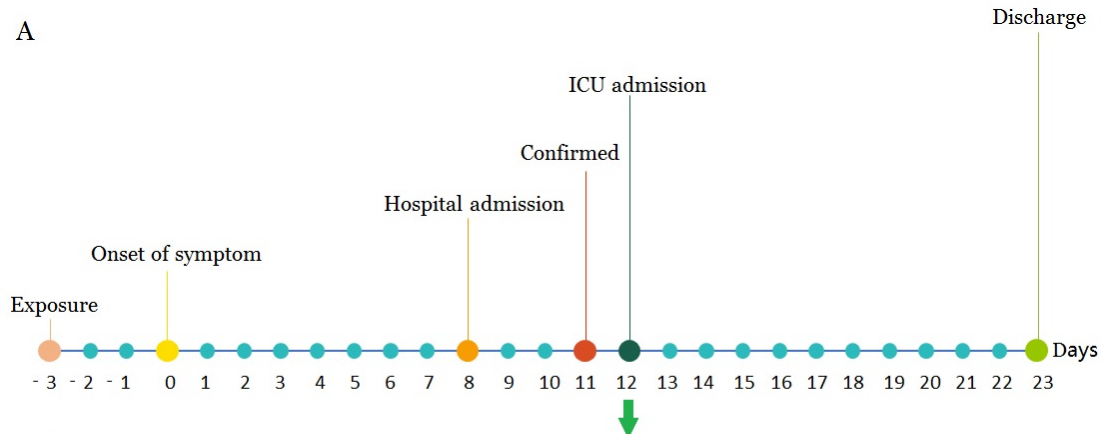
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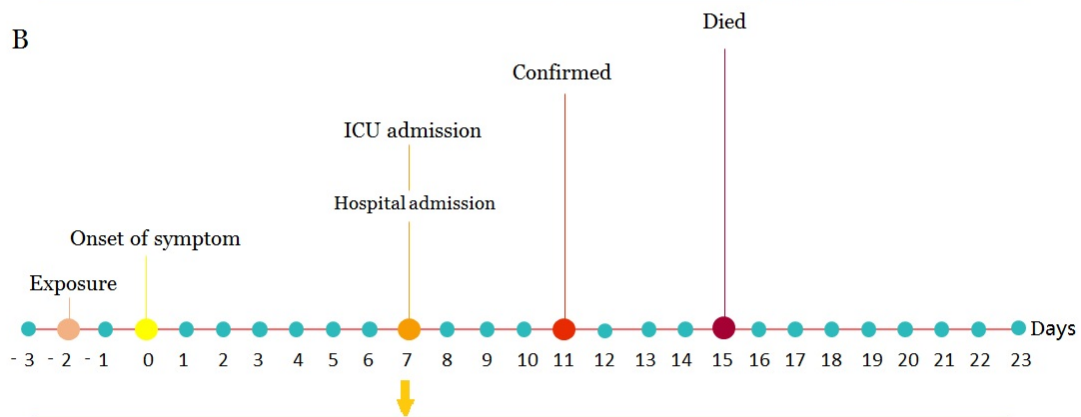
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Figure 1. The timeline of SARS-CoV-2 onset in ICU patients. (A) The timeline of SARS-CoV-2 onset in ICU survivors(N=12); (B) The timeline of SARS-CoV-2 onset in ICU non-survivors(N=6). The results were presented as number (%). The onset of symptom was defined as day 0. The points represent the median value. ICU, Intensive Care Unit; SARS-CoV-2, Severe Acute Respiratory Syndrome Coronavirus 2; MV, Mechanical ventilation; NV, Noninvasive ventilation; IMV, Invasive mechanical ventilation; EMCO, Extracorporeal membrane oxygenation; OI, Oxygen inhalation; ACI, Acute cardiac injury; AKI, Acute kidney injury; ALI, Acute liver injury



Reasons for admission	Treatments	Complications
Severe patients require MV, 3(25.0)	Antiviral, 12(100.0)	Shock, 1(8.3)
Breathing rate increases	Antibiotic, 12(100.0)	ARDS, 2(16.7)
oxygen saturation < 90%	Glucocorticoid, 6(50.0)	Acute infection, 1(8.3)
cannot NV, 6(50.0)	OI, 5(41.7)	ACI, 2(16.7)
Shock and/or organ failure, 3(25.0)	NV, 2(16.7)	Arrhythmia, 3(25.0)
	IMV, 2(16.7)	AKI, 3(25.0)
	EMCO, 2(16.7)	ALI, 7(58.3)
	CRRT, 2(16.7)	Lymphopenia, 9(75.0)



Reasons for admission	Treatments	Complications
Severe patients require MV, 3(50.0)	Antiviral, 6(100.0)	Shock, 3(50.0)
Breathing rate increases	Antibiotic, 6(100.0)	ARDS, 6(100.0)
oxygen saturation < 90%	Glucocorticoid, 5(83.3)	Acute infection, 6(100.0)
cannot NV, 1(16.7)	OI, 6(100.0)	ACI, 4(66.7)
Shock and/or organ failure, 2(33.3)	NV, 0(0.0)	Arrhythmia, 4(66.7)
	IMV, 5(83.3)	AKI, 5(83.3)
	EMCO, 1(16.7)	ALI, 5(83.3)
	CRRT, 2(33.3)	Lymphopenia, 6(100.0)

Supplementary Table I: Baseline characteristics, complications and outcome of COVID-19 patients admitted to ICU or not ‡

	ALL	ICU	Non-ICU	P
N	102	18	84	
Age, years	54(37-67)	66(54-76)	31(35-62)	0.003
Sex-female	49(48.0)	6(33.3)	43(51.2)	0.169
BMI, kg/m ²	24.4(21.8-26.0)	24.6(23.7-27.6)	24.2(21.3-25.9)	0.242
Exposure to source of transmission within 14 days	47(46.1)	12(66.7)	35(40.2)	0.040
Familial cluster	10(9.8)	1(5.6)	9(10.7)	0.817
Infection				
Health care Workers	24(23.5)	0(0)	24(28.2)	0.022
Hospitalized patients and/or outpatients in past 14 days	10(9.8)	8(44.4)	2(2.4)	<0.001
Signs and symptoms				
Fever	83(81.4)	16(88.9)	67(80.0)	0.569
Fatigue	56(54.9)	10(55.6)	46(54.8)	0.951
Dry cough	50(49.0)	11(61.1)	39(46.4)	0.258
Muscle ache	35(34.3)	7(38.9)	28(33.3)	0.652
Diarrhea	11(10.8)	4(22.2)	7(8.3)	0.192
More than one sign or symptom	92(90.2)	17(94.4)	75(89.3)	0.817
Comorbidities				
Any	47(46.1)	18(100.0)	29(34.5)	<0.001
Hypertension	28(27.5)	10(55.5)	18(21.4)	0.008
Diabetes	11(10.8)	4(22.2)	7(8.3)	0.192
Cerebrovascular disease	6(5.9)	3(16.7)	3(3.6)	0.112
Cardiovascular disease	5(4.9)	2(11.1)	3(3.6)	0.457
Respiratory diseases	10(9.8)	3(16.7)	7(8.3)	0.521
Malignancy	4(3.9)	0(0)	4(4.8)	0.783
Chronic kidney disease	4(3.9)	1(5.6)	3(3.6)	0.783
Chronic liver disease	2(2.0)	2(11.1)	0(0)	0.032
Incubation period, days(n=47)	3(2-6)	2(2-6)	3(2-6)	0.182
Onset of symptom to, days				
Hospital admission	6(3-7)	8(3-10)	6(3-7)	0.087
Confirmed Diagnosis	8(5-14)	12(7-19)	8(4-11)	0.010
Length of hospitalized, days	11(7-15)	15(8-21)	10(7-14)	0.018
Cost of hospitalization, CNY	18138(8436-42450)	62556(48938-160629)	12808(8166-27691)	<0.001
Treatments				
Antiviral therapy	100(98.0)	18(100.0)	82(97.6)	0.783

Antibiotic treatment	101(99.0)	18(100.0)	83(98.8)	0.394
Glucocorticoid therapy	51(50.0)	11(61.1)	40(47.6)	0.299
Intravenous immunoglobulin therapy	11(10.8)	0(0.0)	11(13.1)	0.228
Chinese medicine treatment	3(2.9)	0(0.0)	3(3.6)	0.964
Oxygen inhalation	76(74.5)	11(61.1)	56(66.7)	0.860
Noninvasive ventilation	5(4.9)	2(11.1)	3(3.6)	0.457
Invasive mechanical ventilation	14(13.7)	7(38.9)	4(4.8)	<0.001
Extracorporeal membrane oxygenation	3(2.9)	3(16.7)	0(0)	0.002
CRRT	6(5.9)	4(22.2)	2(2.4)	0.007
Complications				
Shock	10(9.8)	4(22.2)	6(7.1)	0.130
ARDS	20(19.6)	8(44.4)	12(14.3)	0.009
Acute infection	17(16.7)	7(38.9)	10(11.9)	0.015
Acute cardiac injury	15(14.7)	6(33.3)	9(10.7)	0.036
Arrhythmia	18(17.6)	7(38.9)	11(13.1)	0.024
Acute kidney injury	20(19.6)	8(44.4)	12(14.3)	0.009
Acute liver injury	34(33.3)	12(66.7)	22(26.2)	0.002
Lymphopenia	78(76.5)	15(83.3)	63(76.8)	0.773
Outcomes at discharge				
Discharge	85(83.3)	12(66.7)	73(86.9)	0.081
Died	17(16.7)	6(33.3)	11(13.1)	0.081
MODS	10(58.8)	2(33.3)	8(72.7)	0.288
ARDS	1(5.9)	1(16.7)	0(0)	0.751
Cardiac arrest	4(23.5)	2(33.3)	2(18.2)	0.916
Respiratory Failure	2(11.8)	1(16.7)	1(9.1)	0.746

* The results were presented as median (IQR) for continuous variables and number (%) for categorical variables. The different characteristics between death and survival groups were tested by Mann-Whitney U test (continuous variables) or Chi-square test (categorical variables). A two-sided α of less than 0.05 was considered statistically significant.

MODS, multiple organ dysfunction syndrome; CRRT, continuous renal replacement therapy; ARDS, Acute respiratory distress syndrome; ICU, Intensive Care Unit; BMI, body mass index; CNY, China Yuan