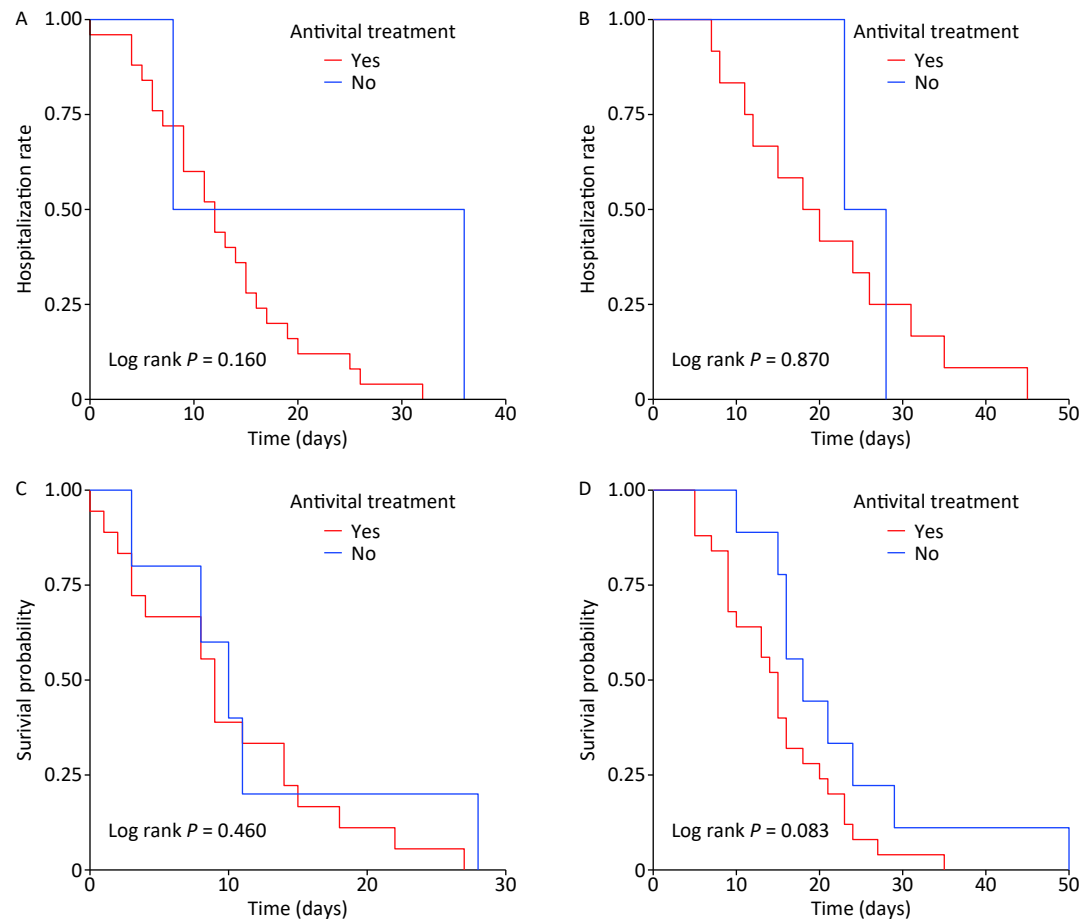
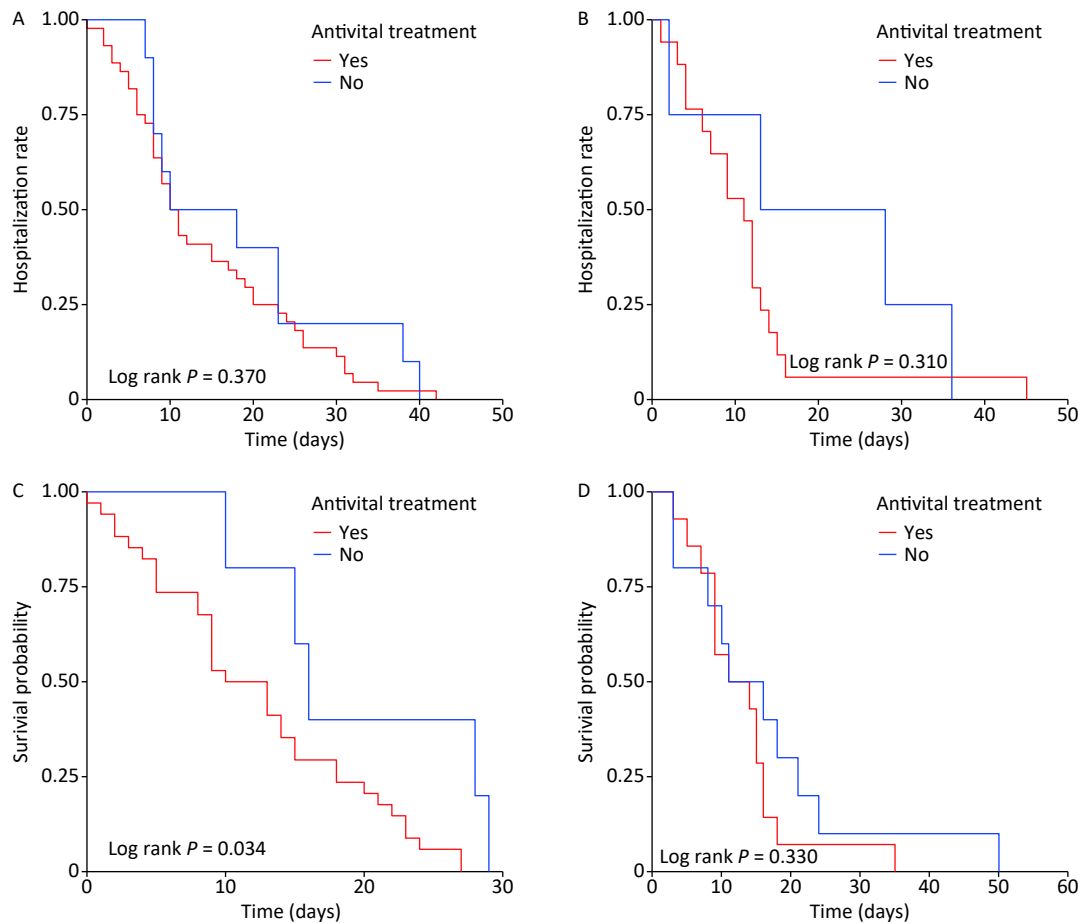
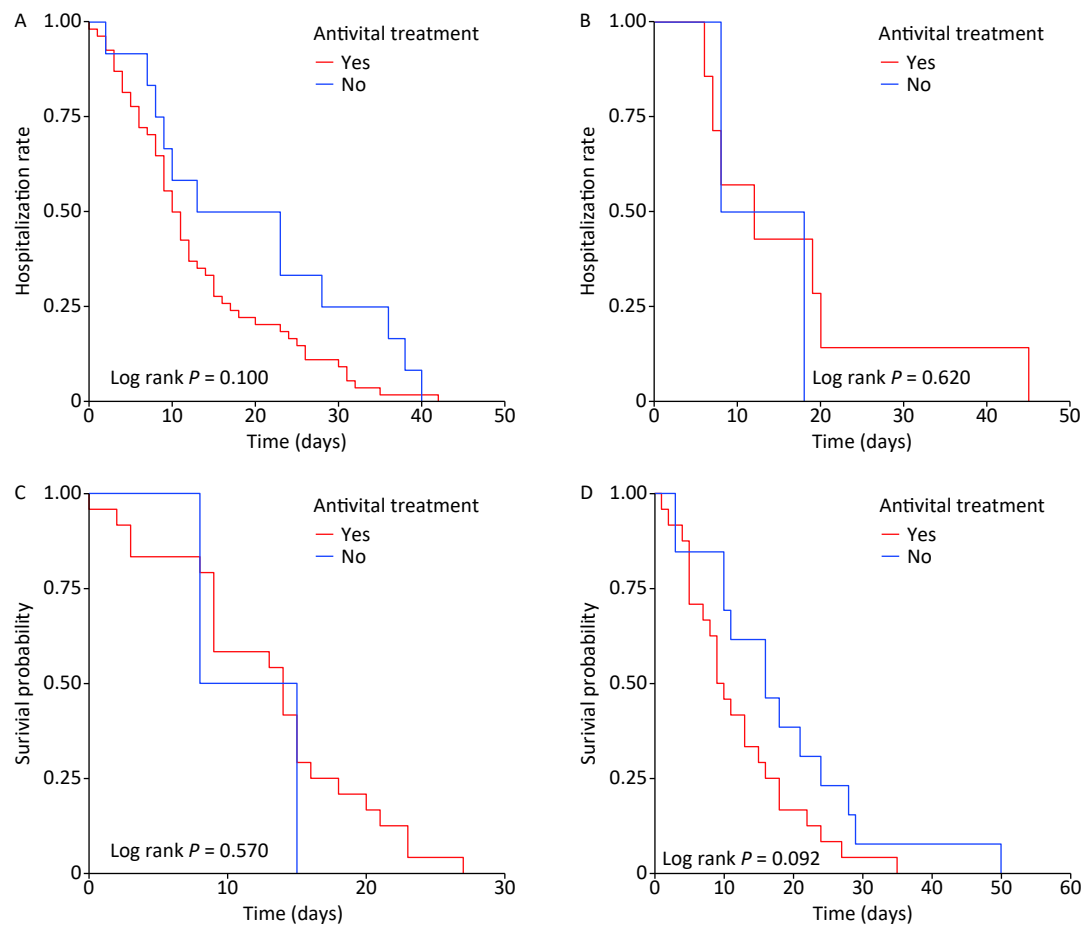




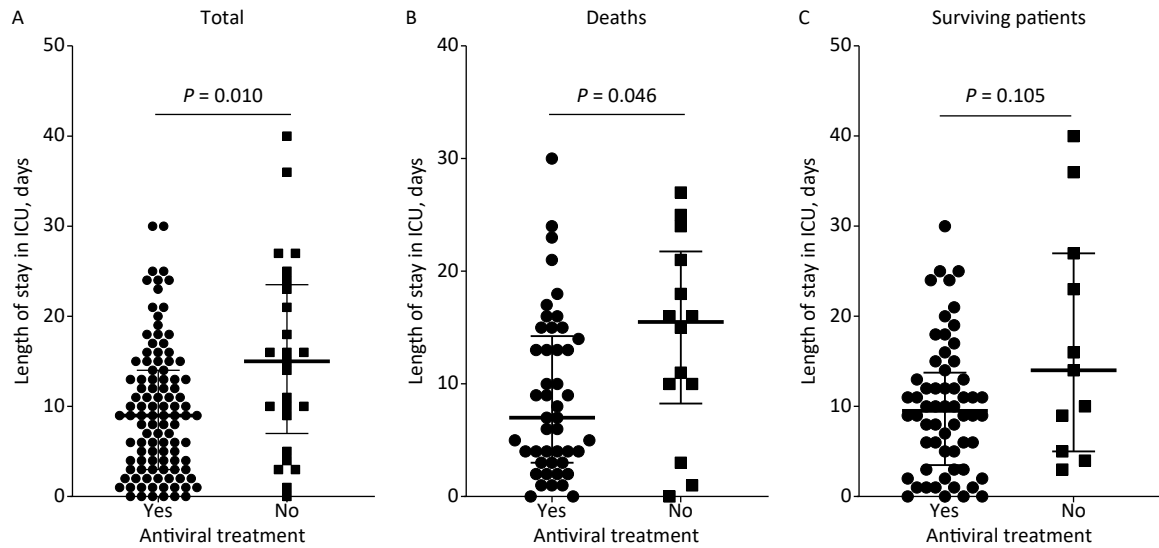
Supplementary Figure S1. Adjusted Kaplan-Meier curves of antiviral treatment stratified by duration of glucocorticoid therapy. (A) Kaplan-Meier curves of surviving patients stratified by duration of glucocorticoid therapy ≤ 4 days, (B) Kaplan-Meier curves of surviving patients stratified by duration of glucocorticoid therapy > 4 days, (C) Kaplan-Meier curves of deaths stratified by duration of glucocorticoid therapy ≤ 4 days, and (D) Kaplan-Meier curves of deaths stratified by duration of glucocorticoid therapy > 4 days.



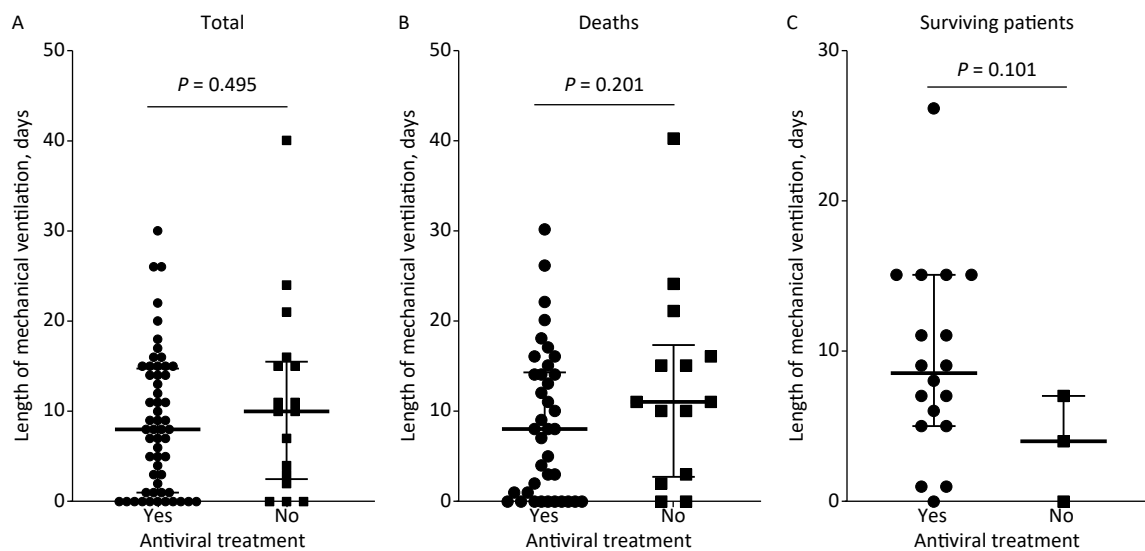
Supplementary Figure S2. Adjusted Kaplan-Meier curves of antiviral treatment stratified by high-flow oxygen therapy. (A) Kaplan-Meier curves of surviving patients without high-flow oxygen therapy, (B) Kaplan-Meier curves of surviving patients with high-flow oxygen therapy, (C) Kaplan-Meier curves of deaths without high-flow oxygen therapy, and (D) Kaplan-Meier curves of deaths with high-flow oxygen therapy.



Supplementary Figure S3. Adjusted Kaplan-Meier curves of antiviral treatment stratified by non-invasive ventilation. (A) Kaplan-Meier curves of surviving patients without non-invasive ventilation, (B) Kaplan-Meier curves of surviving patients with non-invasive ventilation, (C) Kaplan-Meier curves of deaths without non-invasive ventilation, and (D) Kaplan-Meier curves of deaths with non-invasive ventilation.



Supplementary Figure S4. Length of ICU stay by antiviral treatment in all patients (A), deaths (B), and surviving patients (C). ICU, intensive care unit.



Supplementary Figure S5. Length of mechanical ventilation by antiviral treatment in all patients (A), deaths (B), and surviving patients (C).

Supplementary Table S1. Vital signs and laboratory findings of severe COVID-19 patients at admission

Item	Total (<i>n</i> = 138)	Antiviral treatment		<i>P</i>
		Yes (<i>n</i> = 109)	No (<i>n</i> = 29)	
Vital signs				
Systolic blood pressure (mmHg; normal range 90–140)	130 (120–140)	130 (120–140)	130.5 (110.5–141.5)	0.720
Increased	1 (0.7)	1 (0.9)	0 (0.0)	0.670
Decreased	30 (21.7)	23 (21.1)	7 (24.1)	
Diastolic blood pressure (mmHg; normal range 60–90)	80 (70–85)	80 (72–84.75)	74.5 (64.25–86)	0.247
Increased	7 (5.1)	6 (5.5)	1 (3.4)	0.932
Decreased	11 (8.0)	9 (8.3)	2 (6.9)	
Heart rate (beats per minute; normal range 60–100)	90 (80–101)	90 (80–101)	88 (80–100)	0.635
Increased	35 (25.4)	30 (27.5)	5 (17.2)	0.258
Axillary temperature (°C; normal range 36.2–37.3)	36.8 (36.5–37.7)	36.8 (36.6–37.7)	37.0 (36.5–37.8)	0.885
Increased	50 (36.2)	36 (33.0)	14 (48.3)	0.129
Respiratory rate (breaths per minute; normal range 12–20)	23 (20–27)	23 (20–26)	23 (20–29.5)	0.318
21–29	62 (45.6)	49 (45.4)	13 (46.4)	0.165
≥ 30	23 (16.9)	16 (14.8)	7 (25.0)	
Oxygen saturation (%; normal range ≥ 94)	89 (84.75–95)	89.5 (85–94)	88.5 (83.25–95.75)	0.664
Decreased	100 (72.5)	80 (73.4)	20 (69.0)	0.635
Laboratory findings				
Leucocytes (10 ⁹ /L; normal range 3.5–9.5)	7.68 (5.20–11.05)	6.79 (4.75–10.90)	8.10 (6.79–11.25)	0.088
Increased	43 (31.4)	33 (30.6)	10 (34.5)	0.661
Decreased	11 (8.0)	9 (8.3)	2 (6.9)	
Neutrophils (10 ⁹ /L; normal range 1.8–6.3)	6.47 (3.86–9.89)	6.09 (3.44–9.93)	7.24 (5.36–9.99)	0.086
Increased	72 (52.6)	52 (48.1)	20 (69.0)	0.043
Lymphocytes (10 ⁹ /L; normal range 1.1–3.2)	0.58 (0.36–0.92)	0.58 (0.36–0.89)	0.63 (0.34–1.22)	0.477
< 1.0	111 (81.0)	90 (83.3)	21 (72.4)	0.183
≥ 1.0	26 (19.0)	18 (16.7)	8 (27.6)	
Erythrocyte (10 ¹² /L; normal range 4.3–5.8)	4.00 (3.65–4.49)	4.05 (3.66–4.51)	3.92 (3.43–4.39)	0.192
Decreased	92 (67.2)	71 (65.7)	21 (72.4)	0.453
Haemoglobin (g/L; normal range 130–175)	121 (108–131)	121 (108–134)	118 (105–126)	0.365
Decreased	101 (73.7)	77 (71.3)	24 (82.8)	0.209
Platelet count (10 ⁹ /L; normal range 125–350)	172.0 (118.0–237.5)	173.0 (127.0–240.3)	164.0 (98.5–212.5)	0.307
Decreased	35 (25.5)	26 (24.1)	9 (31.0)	0.341
Procalcitonin (ng/mL; normal range < 0.5)	0.28 (0.06–1.28)	0.28 (0.06–1.29)	0.46 (0.05–1.23)	0.786
Increased	59 (44.4)	46 (44.2)	13 (44.8)	0.954
IL-6 (pg/mL; normal range 0.0–7.0)	0 (0–5.77)	0 (0–0)	62.13 (2.43–86.22)	< 0.001
Increased	10 (23.8)	3 (9.4)	7 (70.0)	< 0.001
ESR (mm/h; normal range 0.0–15.0)	45 (26–63)	43 (23–55)	45 (35–75)	0.458
Increased	25 (86.2)	16 (88.9)	9 (81.8)	1.000
D-dimer (ng/mL; normal range 0.0–500.0)	1.90 (0.52–6.21)	1.11 (0.41–5.03)	71.15 (2.44–2197.00)	< 0.001
Increased	12 (9.9)	2 (2.2)	10 (35.7)	< 0.001

Continued

Item	Total (n = 138)	Antiviral treatment		P
		Yes (n = 109)	No (n = 29)	
Fibrinogen (mg/dL; normal range 238–498)	4.17 (3.01–5.43)	3.85 (2.86–5.01)	182.50 (4.15–453.50)	< 0.001
Increased	7 (5.6)	3 (3.0)	4 (15.4)	< 0.001
Decreased	106 (84.8)	92 (92.9)	14 (53.8)	
ALT (U/L; normal range 9.0–50.0)	33.95 (22.63–48.75)	35.00 (23.00–52.00)	30.00 (20.00–42.5.)	0.310
Increased	32 (23.5)	28 (26.2)	4 (13.8)	0.163
AST (U/L; normal range 15.0–40.0)	39.4 (28.40–59.443)	41.0 (28.6–59.9)	36.0 (5.9–10.2)	0.518
Increased	65 (47.8)	54 (50.5)	11 (37.9)	0.282
TBLI (μmol/L; normal range 5.0–21.0)	10.85 (7.48–16.65)	10.50 (7.50–16.51)	13.00 (7.44–18.30)	0.314
Increased	19 (14.0)	15 (14.0)	4 (13.8)	0.771
Albumin (g/L; normal range 40.0–55.0)	33.00 (29.43–36.00)	33.10 (29.80–36.20)	31.10 (27.80–33.05)	0.013
Decreased	125 (91.9)	97 (90.7)	28 (96.6)	0.516
Creatinine (μmol/L; normal range 64.0–104.0)	78.90 (57.73–105.30)	78.80 (58.80–105.40)	79.00 (46.70–101.75)	0.557
Increased	36 (26.5)	29 (27.1)	7 (24.1)	0.679
BUN (mmol/L; normal range 2.8–7.6)	6.66 (4.88–10.07)	6.60 (4.90–8.90)	7.35 (4.30–17.72)	0.508
Increased	51 (37.5)	37 (34.6)	14 (48.3)	0.290
hs-cTnI (pg/mL; normal range 0.0–26.2)	0.03 (0.01–0.29)	0.02 (0.01–0.10)	1.02 (0.01–131.10)	0.002
Increased	7 (6.2)	4 (4.7)	3 (11.1)	0.449
Blood glucose (mmol/L; normal range 3.9–6.1)	7.01 (5.89–10.17)	6.90 (5.89–10.40)	7.30 (5.87–10.17)	0.930
Increased	83 (68.6)	66 (69.5)	17 (65.4)	0.827
pH (normal range 7.35–7.45)	7.42 (7.36–7.46)	7.42 (7.36–7.46)	7.43 (7.31–7.46)	0.670
Increased	30 (28.3)	26 (28.6)	4 (26.7)	0.745
Decreased	24 (22.6)	20 (22.0)	4 (26.7)	
PaO ₂ (mmHg; normal range 80–100)	68.35 (46.75–81.73)	68.40 (47.00–81.60)	60.00 (40.00–96.00)	0.680
Decreased	76 (71.7)	65 (71.4)	11 (73.3)	0.954
PaCO ₂ (mmHg; normal range 35–45)	39.50 (33.70–48.05)	39.10 (33.70–47.70)	41.90 (33.60–57.00)	0.379
Increased	34 (32.4)	28 (31.1)	6 (40.0)	0.606
HCO ₃ ⁻ (mmol/L; normal range 21.4–27.3)	24.50 (18.70–29.25)	24.75 (20.90–29.18)	21.00 (16.50–30.10)	0.174
Increased	43 (41.0)	38 (42.2)	5 (33.3)	0.123
Decreased	30 (28.6)	22 (24.4)	8 (53.3)	
Lactate (mmol/L; normal range 0.5–1.6)	2.26 (1.50–3.10)	2.26 (1.50–3.15)	2.10 (1.36–3.08)	0.693
Increased	68 (68.7)	62 (69.7)	6 (60.0)	0.575

Note. Data are presented by number (%) or median (IQR). *P* values were calculated by Mann-Whitney test, χ^2 -test, or Fisher's exact test, as appropriate. ALT, alanine aminotransferase; AST, aspartate aminotransferase; BUN, blood urea nitrogen; COVID-19, coronavirus disease 2019; ESR, erythrocyte sedimentation rate; HCO₃⁻, bicarbonate concentration; IL-6, interleukin-6; IQR, interquartile range; hs-cTnI, high sensitivity troponin; PaO₂, partial pressure of oxygen in artery; PaCO₂, partial pressure of carbon dioxide in artery; pH, potential-of-hydrogen; TBLI, total bilirubin. Denominator used for calculating the percentage may not be the total number because of missing data.

Supplementary Table S2. Antiviral treatment in severe COVID-19 patients

Antiviral treatment	Total (n = 138)
Drugs and use	109 (79.0)
Ribavirin	50 (36.2)
Dose, median (range), g/d	0.8 (0.4–1.5)
Duration of therapy, median (range), d	5 (1–10)
Oseltamivir	45 (32.6)
Dose, mg/d	150
Duration of therapy, median (range), d	5 (2–13)
Abidor	23 (16.7)
Dose, median (range), g/d	0.4 (0.4–0.6)
Duration of therapy, median (range), d	6 (3–14)
Interferon	16 (11.6)
Dose, median (range), million IU/d	8 (6–10)
Duration of therapy, median (range), d	9 (1–15)
Lopinavir/ritonavir	7 (5.1)
Dose, mg/d	800
Duration of therapy, median (range), d	3 (2–8)
Therapy strategy	
Monotherapy	85 (61.6)
Combined therapy	24 (15.9)

Note. Data are presented by number (%) or median (range). COVID-19, coronavirus disease 2019; d, day(s).

Supplementary Table S3. Application of other treatments in severe COVID-19 patients

Treatments	Total (n = 138)	Antiviral treatment		P
		Yes (n = 109)	No (n = 29)	
Antibiotics	133 (96.4)	106 (97.2)	27 (93.1)	0.615
Glucocorticoids	98 (71.0)	80 (73.4)	18 (62.1)	0.232
Initial dose, median (IQR), mg/d	40 (40–80)	40 (40–80)	40 (40–60)	0.554
Duration of therapy, median (IQR), d	4 (2–9)	4 (2–9)	8 (3.75–15.25)	0.014
Vasoactive drugs	42 (30.4)	32 (29.4)	10 (34.5)	0.594
Duration of therapy, median (IQR), d	4 (0.75–9.25)	4 (0.25–7.75)	4.5 (0.75–11)	0.592
High-flow oxygen therapy	45 (32.6)	31 (28.4)	14 (48.3)	0.043
Non-invasive ventilation	46 (33.3)	31 (28.4)	15 (51.7)	0.018
Invasive mechanical ventilation	73 (52.9)	56 (51.4)	17 (58.6)	0.487
Prone position ventilation	12 (8.7)	9 (8.3)	3 (10.3)	1.000
CRRT	7 (5.1)	4 (3.7)	3 (10.3)	0.327
Duration of therapy, median (IQR), d	2 (0–8)	3 (1.25–7.75)	0 (0–0)	0.285

Note. Data are presented by number (%) or median (IQR). P values were calculated by χ^2 -test, Mann-Whitney test, or Fisher's exact test, as appropriate. COVID-19, coronavirus disease 2019; IQR, interquartile range; d, days.

Supplementary Table S4. Outcomes and complications of severe COVID-19 patients

Variables	Total (<i>n</i> = 138)	Antiviral treatment		<i>P</i>
		Yes (<i>n</i> = 109)	No (<i>n</i> = 29)	
Outcomes				
Death	63 (45.7)	48 (44.0)	15 (51.7)	0.460
Duration of hospitalization	11 (7.75–19.25)	11 (6.5–18.0)	16 (8.5–26.0)	0.339
ICU admission	131 (94.9)	106 (97.2)	25 (86.2)	0.053
Mechanical ventilation	73 (52.9)	56 (51.4)	17 (58.6)	0.487
Complications				
Respiratory failure	105 (76.1)	85 (78.0)	20 (69.0)	0.312
ARDS	70 (50.7)	59 (54.1)	11 (37.9)	0.121
Sepsis	48 (34.8)	44 (40.4)	4 (13.8)	0.008
Acute cardiac injury	38 (27.5)	30 (27.5)	8 (27.6)	0.995
Acute liver injury	36 (26.1)	29 (26.6)	7 (24.1)	0.788
Acute kidney injury	31 (22.5)	26 (23.9)	5 (17.2)	0.448
Septic shock	24 (17.4)	22 (20.2)	2 (6.9)	0.093
DIC	11 (8.0)	6 (5.5)	5 (17.2)	0.091
Arrhythmias	10 (7.2)	10 (9.2)	0 (0.0)	0.197
Gastrointestinal bleeding	7 (5.1)	6 (5.5)	1 (3.4)	1.000
Acute cerebrovascular disease	5 (3.6)	5 (4.6)	0 (0.0)	0.538

Note. Data are presented by number (%). *P* values were calculated by χ^2 -test or Fisher's exact test, as appropriate. ARDS, acute respiratory distress syndrome; COVID-19, coronavirus disease 2019; DIC, disseminated intravascular coagulation; ICU, intensive care unit.