

# THE LANCET

## Supplementary appendix

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## Supplementary Appendix

### **Long-term consequences of discharged COVID-19 patients: a cohort study of six-month after symptom onset.**

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## **Methods Supplement**

### **Diagnosis of acute kidney injury (AKI)**

In our study, AKI was identified and classified on the basis of the highest serum creatinine (sCr) level according to the Improving Global Outcomes (KDIGO) guideline.<sup>1</sup> Patients with an increase in sCr to  $\geq 1.5$  times lowest value during hospitalization was defined as AKI at acute phase.

Estimated glomerular filtration rate (eGFR) are calculated based on Chronic Kidney Disease-Epidemiology Collaboration equation (CKD-EPI)<sup>2</sup>.

### **Diagnosis of diabetes mellitus**

The diagnosis of diabetes mellitus in our study are based on the glycated hemoglobin A1C (HbA1C) with a threshold of  $\geq 6.5\%$ .<sup>3</sup>

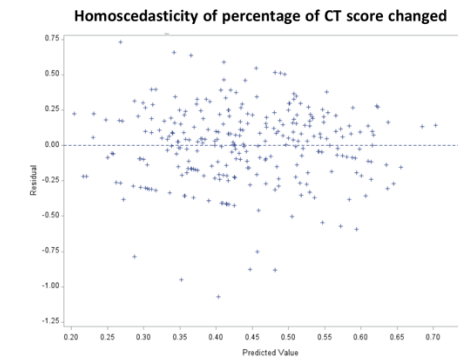
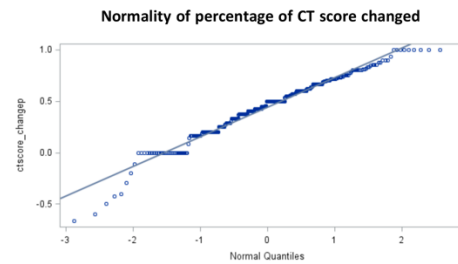
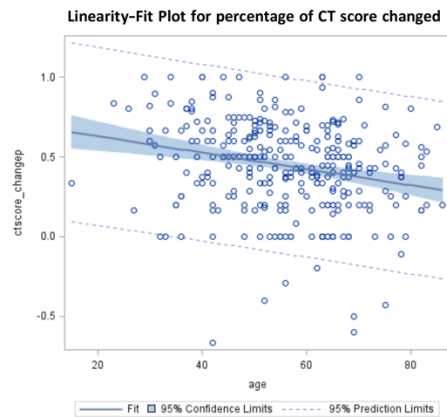
### **Diagnosis of deep venous thrombosis of lower limbs**

Deep venous thrombosis (DVT) is defined as “the formation of a blood clot within a deep vein”. The diagnosis of DVT of lower limbs in our study are performed by duplex ultrasound imaging.<sup>4</sup>

1. Kidney disease: Improving global outcomes (KDIGO) acute kidney injury work group. KDIGO clinical practice guideline for acute kidney injury. *Kidney International Supplements* 2012, 2:138
2. Levey AS, Stevens LA, Schmid CH, et al. A new equation to estimate glomerular filtration rate. *Ann Intern Med* 2009; **150**(9): 604-12.
3. American Diabetes A. Standards of medical care in diabetes--2010. *Diabetes Care* 2010; 33 Suppl 1: S11-61.
4. Olaf M, Cooney R. Deep Venous Thrombosis. *Emerg Med Clin North Am* 2017; 35(4): 743-70.

## Testing for assumption of linear regression

Assumptions of linear regression were tested when exploring association of disease severity with continuous outcome including quality of life, distance walked in 6 min, percentage of predicted value of distance walked in 6 min, volume of lung lesions/consolidation/GGO, volume ratio of lung lesion/GGO to total lung, CT score, percentage of CT score changed from acute phase to follow-up. The key assumption checked included linear relationship (age and outcome), normality, no or little multicollinearity, no auto-correlation, and homoscedasticity. No obvious violation of assumptions was observed. Below are the results for checking assumption of linear regression analyses for percentage of CT score changed from acute phase to follow-up.



**Multicollinearity of percentage of CT score changed**

Parameter Estimates							
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr >  t	Variance Inflation
Intercept	Intercept	1	0.52707	0.12877	4.09	<.0001	0
age	age	1	-0.00391	0.00143	-2.73	0.0067	1.37681
gender	gender	1	-0.07255	0.03565	-2.04	0.0428	1.19525
smoking_f	smoking_f	1	-0.01213	0.03884	-0.31	0.7551	1.10509
education_c	education_c	1	0.04321	0.03809	1.13	0.2576	1.27334
comorbidity	comorbidity	1	-0.01574	0.03602	-0.44	0.6625	1.23696
scale_g	scale_g	1	0.09888	0.02714	3.64	0.0003	1.51812
corti	corti	1	-0.04437	0.04390	-1.01	0.3130	1.62550
antiviral	antiviral	1	0.00559	0.03290	0.17	0.8651	1.03570
globulin	globulin	1	0.00852	0.04300	0.20	0.8432	1.48579

**Auto-correlation of percentage of CT score changed**

The REG Procedure  
Model: MODEL1  
Dependent Variable: ctscore\_change ctscore\_change

Durbin-Watson D	1.959
Number of Observations	288
1st Order Autocorrelation	0.020

## Symptom Questionnaire

1. Do you have any obvious discomfort since you were discharged from hospital?


If yes, please specify \_\_\_\_\_

2. How would you comment your current health status?

- Same as prior to COVID-19
- Often feel fatigue, and easier to get tired after activity now than prior to COVID-19
- Better health condition than prior to COVID-19

3. Have you experienced any of the following pain symptoms that appeared post COVID-19 and are persistent?

- No  Headache  Myalgia  Chest pain  Joint pain (if yes, please fill in the table below)
- Any other if yes, please specify \_\_\_\_\_

	Hand	Foot	Wrist	Ankle	Jaw	Elbow	Shoulder	Neck	Hip	Knee
Tenderness										
Swollen										
Numerical pain scale (0-10)										
0										10
No pain										Intolerable pain

4. Do you have any of the following symptoms that are newly onset post COVID-19 and persistent?

- No  sore throat  difficult to swallow

5. Do you have any of the following symptoms that are newly onset post COVID-19 and persistent?

- No  low grade fever (37.3-38.0°C)  palpitations  dizziness  nasal congestion  skin rash

6. Are you more prone to suffer from the following symptoms after discharge?

- No  Diarrhea  Nausea  Vomiting

7. How do you feel about your sense of smell compared with the status prior to COVID-19?

- Same as before  Worse than before  Better than before  Total loss

8. How do you feel about your sense of taste compared with the status prior to COVID-19?

- Same as before  Worse than before  Better than before  Total loss

9. How do you feel about your appetite compared with the status prior to COVID-19?

Same as before  Worse than before  Better than before

10. What do you think about your sleeping compared with the status prior to COVID-19?

Same as before  Worse than before  Better than before

11. How do you feel about your muscle strength compared with the status prior to COVID-19?

Same as before  Worse than before  Better than before

12. Have you experienced hair loss now compared with the status prior to COVID-19?

No hair loss before or after COVID-19

Hair loss is same as before

Lose more hair than before

Lose less hair than before

**Table S1. Characteristics of patients who died after discharge from hospital**

No.	Age, years	Sex	Comorbidity	Highest seven category scale during hospitalization	Cause of death
1	59	Man	Diabetes, hypertension, chronic kidney disease	6	Renal failure
2	87	Man	Coronary artery disease, diabetes, hypertension, cerebral infarction, hemiplegic paralysis	6	Renal failure
3	57	Man	Coronary artery disease, diabetes, hypertension, cerebral infarction	6	Pressure sore, skin infection
4	69	Man	Cerebral infarction, paralysis	5	Exacerbation of underlying disease
5	86	Man	Chronic obstructive pulmonary disease, hypertension, anemia	5	Exacerbation of chronic obstructive pulmonary disease
6	84	Woman	Hypertension	5	Exacerbation of underlying disease
7	68	Man	Diabetes, hypertension, renal dysfunction	4	Renal failure
8	90	Woman	Hypertension, coronary disease, bladder cancer	4	Bladder cancer metastasis
9	77	Man	Alzheimer's disease	4	Exacerbation of underlying disease
10	78	Man	Cerebral infarction, hemiplegic paralysis, lung cancer	4	Brain metastases of lung cancer
11	69	Woman	Hypertension, cerebral infarction, vascular dementia	4	Exacerbation of underlying disease
12	85	Woman	Hypertension	4	Gastric cancer
13	78	Man	Hypertension, diabetes, cerebral infarction, chronic kidney disease	4	Pressure sore, skin infection



<b>No.</b>	<b>Age, years</b>	<b>Sex</b>	<b>Comorbidity</b>	<b>Highest seven category scale during hospitalization</b>	<b>Cause of death</b>
14	90	Woman	Hypertension, cerebral infarction, Alzheimer's disease	4	Exacerbation of underlying disease
15	83	Man	Esophageal carcinoma, cerebral infarction	4	Esophageal carcinoma
16	86	Woman	Coronary artery disease, chronic heart failure, atrial fibrillation	4	Exacerbation of Heart failure
17	55	Man	Hepatitis C	4	Cerebral hemorrhage
18	80	Man	Coronary artery disease, diabetes, Chronic obstructive pulmonary disease, atrial fibrillation	4	Heart and respiratory failure
19	85	Woman	Cerebral infarction	4	Heart and respiratory failure
20	79	Man	Epiglottis tumor	4	Epiglottis tumor
21	73	Man	Diabetes, chronic kidney disease, decompensated cirrhosis	4	Decompensated cirrhosis
22	81	Woman	Cerebral infarction, paralysis	4	Exacerbation of underlying disease
23	57	Man	Lung cancer	4	Brain metastases of lung cancer
24	94	Woman	Epicophosis, ablepsia	4	Exacerbation of underlying disease
25	82	Man	Cerebral infarction, hemiplegic paralysis, Parkinson's disease	4	Exacerbation of underlying disease
26	94	Woman	Hypertension, coronary artery disease	4	Exacerbation of underlying disease
27	65	Man	Cerebral infarction, vascular dementia	4	Exacerbation of underlying disease
28	69	Woman	Diabetes, hypertension, cerebral infarction	4	Exacerbation of underlying disease

<b>No.</b>	<b>Age, years</b>	<b>Sex</b>	<b>Comorbidity</b>	<b>Highest seven category scale during hospitalization</b>	<b>Cause of death</b>
29	64	Woman	Stroke, cerebral infarction, hypertension	4	Exacerbation of underlying disease
30	70	Woman	Mental disease	3	Exacerbation of underlying disease
31	52	Man	Diabetes, chronic kidney disease	3	Renal failure
32	70	Man	gastric cancer	3	Multiple metastases of gastric cancer
33	73	Woman	Diabetes, cerebral infarction	3	Apastia

**Table S2. Symptoms, exercise capacity and health-related quality of life at follow-up according to sex**

<b>Characteristics</b>	<b>Men (N=897)</b>	<b>Women (N=836)</b>	<b>P value</b>
<b>Symptoms</b>			
Any one of the following symptom	621/856 (73%)	644/799 (81%)	0.0046
Fatigue/Muscle weakness	509/856 (59%)	529/799 (66%)	0.048
Sleep difficulties	212/856 (25%)	225/799 (28%)	0.25
Hair loss	176/856 (21%)	183/799 (23%)	0.75
Smell disorder	89/856 (10%)	87/799 (11%)	0.26
Palpitations	70/856 (8%)	84/799 (11%)	0.54
Joint pain	76/856 (9%)	78/799 (10%)	0.67
Lack of appetite	69/856 (8%)	69/799 (9%)	0.44
Taste disorder	58/856 (7%)	62/799 (8%)	0.38
Dizziness	48/856 (6%)	53/799 (7%)	0.59
Diarrhea or vomiting	39/856 (5%)	41/799 (5%)	0.85
Chest pain	38/856 (4%)	37/799 (5%)	0.25
Sore throat or difficult to swallow	31/856 (4%)	38/799 (5%)	0.49
Skin rash	22/856 (3%)	25/799 (3%)	0.55
Myalgia	22/856 (3%)	17/799 (2%)	0.033
Headache	11/856 (1%)	22/799 (3%)	0.23
Low grade fever	0/856 (0%)	2/799 (0%)	0.0046
<b>mMRC score</b>			0.07
0	626/824 (76%)	570/791 (72%)	
≥1	198/824 (24%)	221/791 (28%)	
<b>EQ-5D-5L questionnaire*</b>			
Mobility-Problems with walking around	46/830 (6%)	67/792 (8%)	0.06
Personal care-Problems with washing or dishing	5/830 (1%)	6/792 (1%)	0.021
Usual activity-Problems with usual activity	9/824 (1%)	16/787 (2%)	0.70
Pain/Discomfort-With pain or discomfort	195/828 (24%)	236/788 (30%)	0.13

Anxiety/depression-With anxiety or depression	149/829 (18%)	218/788 (28%)	0.0036
<b>Quality of life †</b>	80.0 (75.0-90.0)	80.0 (70.0-90.0)	0.034
<b>Distance walked in 6 min, meters</b>	495.0 (439.0-540.0)	490.0 (443.0-535.0)	0.34
Percentage of predicted value, %‡	84.9 (73.8-96.5)	91.2 (79.1-105.0)	<0.0001
Less than LLN §	221/868 (25%)	171/824 (21%)	<0.0001
<b>eGFR&lt;90 mL/min per 1.73 m<sup>2</sup></b>	288/725 (40%)	199/668 (30%)	<0.0001

\* More detailed results of EQ-5D-5L questionnaire were listed in Table S3.

† Quality of life was assessed using the EuroQol visual analog scale, ranging from 0 (worst imaginable health) to 100 (best imaginable health).

‡ Predicted values were calculated according to the method of Enright and Sherrill (Am J Respir Crit Care Med 1998; 158: 1384-1387).

§ The lower limit of the normal range was calculated by subtracting 153 m from the predicted value for men or by subtracting 139 m for women.

HFNC = high-flow nasal cannula for oxygen therapy; NIV = non-invasive ventilation; IMV = invasive mechanical ventilation; IQR = interquartile range; mMRC = modified British medical research council; EQ-5D-5L = EuroQol 5-Dimension Questionnaire 5-level version; LLN = lower limit of the normal range; eGFR = estimated glomerular filtration rate

**Table S3. Health-related quality of life at follow-up according to severity scale**

	<b>Total (N=1733)</b>	<b>Scale 3 Not requiring supplemental oxygen (N=439)</b>	<b>Scale 4 Requiring supplemental oxygen (N=1172)</b>	<b>Scale 5-6 Requiring HFNC, NIV or IMV (N=122)</b>
<b>Mobility</b>				
No problems with walking around	1509/1622 (93%)	401/426 (94%)	1012/1084 (93%)	96/112 (86%)
Slight problems with walking around	105/1622 (6%)	22/426 (5%)	69/1084 (6%)	14/112 (13%)
Moderate problems with walking around	6/1622 (0%)	2/426 (0%)	2/1084 (0%)	2/112 (2%)
Severe problems with walking around	2/1622 (0%)	1/426 (0%)	1/1084 (0%)	0/112 (0%)
Unable to walk around	0/1622 (0%)	0/426 (0%)	0/1084 (0%)	0/112 (0%)
<b>Personal care</b>				
No problems with washing or dressing	1611/1622 (99%)	426/426 (100%)	1074/1084 (99%)	111/112 (99%)
Slight problems with washing or dressing	10/1622 (1%)	0/426 (0%)	9/1084 (1%)	1/112 (1%)
Moderate problems with washing or dressing	1/1622 (0%)	0/426 (0%)	1/1084 (0%)	0/112 (0%)
Severe problems with washing or dressing	0/1622 (0%)	0/426 (0%)	0/1084 (0%)	0/112 (0%)
Unable to wash or dress	0/1622 (0%)	0/426 (0%)	0/1084 (0%)	0/112 (0%)
<b>Usual activities(e.g. work, study, housework, family or leisure activities )</b>				
No problems with usual activities	1586/1611 (98%)	420/425 (99%)	1061/1076 (99%)	105/110 (95%)
Slight problems with usual activities	21/1611 (1%)	5/425 (1%)	12/1076 (1%)	4/110 (4%)
Moderate problems with usual activities	3/1611 (0%)	0/425 (0%)	3/1076 (0%)	0/110 (0%)
Severe problems with usual activities	1/1611 (0%)	0/425 (0%)	0/1076 (0%)	1/110 (1%)
Unable to do usual activities	0/1611 (0%)	0/425 (0%)	0/1076 (0%)	0/110 (0%)
<b>Pain/discomfort</b>				
No pain/discomfort	1185/1616 (73%)	311/422 (74%)	808/1082 (75%)	66/112 (59%)
Slight pain/discomfort	371/1616 (23%)	95/422 (23%)	234/1082 (22%)	42/112 (38%)
Moderate pain/discomfort	53/1616 (3%)	14/422 (3%)	35/1082 (3%)	4/112 (4%)

	<b>Total (N=1733)</b>	<b>Scale 3 Not requiring supplemental oxygen (N=439)</b>	<b>Scale 4 Requiring supplemental oxygen (N=1172)</b>	<b>Scale 5-6 Requiring HFNC, NIV or IMV (N=122)</b>
Severe pain/discomfort	7/1616 (0%)	2/422 (0%)	5/1082 (0%)	0/112 (0%)
Extreme pain/discomfort	0/1616 (0%)	0/422 (0%)	0/1082 (0%)	0/112 (0%)
<b>Anxiety/depression</b>				
No anxiety/depression	1250/1617 (77%)	327/425 (77%)	848/1081 (78%)	75/111 (68%)
Slight anxiety/depression	307/1617 (19%)	82/425 (19%)	194/1081 (18%)	31/111 (28%)
Moderate anxiety/depression	48/1617 (3%)	13/425 (3%)	31/1081 (3%)	4/111 (4%)
Severe anxiety/depression	12/1617 (1%)	3/425 (1%)	8/1081 (1%)	1/111 (1%)
Extreme anxiety/depression	0/1617 (0%)	0/425 (0%)	0/1081 (0%)	0/111 (0%)

HFNC = high-flow nasal cannula for oxygen therapy, NIV = non-invasive ventilation, IMV = invasive mechanical ventilation.

**Table S4. Lung function at follow-up for men and women according to severity scale**

Characteristics	Seven-category scale			OR (95% CI)	
	Scale 3 Not requiring supplemental oxygen	Scale 4 Requiring supplemental oxygen	Scale 5-6 Requiring HFNC, NIV or IMV	Scale 4 vs 3	Scale 5-6 vs 3
<b>Men</b>					
Number of patients	52	91	62		
FEV1 (% of predicted) <80%	4 (8%)	4 (4%)	7 (11%)	0.49 (0.09-2.75)	1.69 (0.21-13.58)
FVC (% of predicted) <80%	3 (6%)	1 (1%)	6 (10%)	0.19 (0.01-2.76)	2.23 (0.16-31.89)
FEV1/FVC <70%	5 (10%)	5 (5%)	0 (0%)	0.71 (0.12-4.18)	NA
TLC (% of predicted) <80%,	6/51 (12%)	13/87 (15%)	21/60 (35%)	1.30 (0.36-4.67)	3.90 (0.85-17.88)
FRC (% of predicted) <80%,	3/51 (6%)	4/87 (5%)	11/59 (19%)	0.72 (0.14-3.77)	2.29 (0.36-14.63)
RV (% of predicted) <80%,	11/51 (22%)	22/87 (25%)	31/60 (52%)	0.97 (0.33-2.88)	2.55 (0.69-9.46)
DLCO (% of predicted) <80%‡	7/51 (14%)	27/87 (31%)	26/60 (43%)	3.20 (1.10-9.33)*	4.12 (1.13-14.98)*
<b>Women</b>					
Number of patients	37	81	26		
FEV1 (% of predicted) <80%	3 (8%)	0 (0%)	4 (15%)	NA	NA
FVC (% of predicted) <80%	0 (0%)	0 (0%)	4 (15%)	NA	NA
FEV1/FVC <70%	2 (5%)	8 (10%)	2 (8%)	1.29 (0.23-7.25)	0.95 (0.08-10.64)
TLC (% of predicted) <80%,	3/32 (9%)	4/78 (5%)	9 (35%)	0.39 (0.07-2.07)	2.21 (0.35-14.21)
FRC (% of predicted) <80%,	2/32 (6%)	2/78 (3%)	5/25 (20%)	0.34 (0.04-2.69)	13.91 (1.17-165.10)*
RV (% of predicted) <80%,	5/32 (16%)	6/77 (8%)	12 (46%)	0.37 (0.09-1.51)	4.53 (0.88-23.30)
DLCO (% of predicted) <80%	11/32 (34%)	21/78 (27%)	22 (85%)	0.95 (0.35-2.54)	15.01 (2.54-88.86)*

\*  $P < 0.05$ .

†  $P < 0.001$ .

‡ Carbon monoxide diffusion capacity was not corrected for hemoglobin.

OR = odds ratio; HFNC = high-flow nasal cannula for oxygen therapy; NIV = non-invasive ventilation; IMV = invasive mechanical ventilation; FEV<sub>1</sub> = forced expiratory volume in one second; FVC = forced vital capacity; NA=not applicable; TLC = total lung capacity; FRC = functional residual capacity; RV = residual volume; DLCO = diffusion capacity for carbon monoxide.



**Table S5. Chest CT at follow-up for men and women according to severity scale**

Characteristics	Seven-category scale			OR or $\beta$ (95% CI)	
	Scale 3 Not requiring supplemental oxygen	Scale 4 Requiring supplemental oxygen	Scale 5-6 Requiring HFNC, NIV or IMV	Scale 4 vs 3	Scale 5-6 vs 3
<b>Men</b>					
Number of patients	56	83	63		
At least one abnormal CT pattern	31 (55%)	49 (59%)	35/61 (57%)	0.83 (0.38-1.81)	0.89 (0.33-2.43)
GGO	23 (41%)	45 (54%)	28/61 (46%)	1.39 (0.64-3.03)	1.24 (0.46-3.34)
Irregular lines	8 (14%)	14 (17%)	16/61 (26%)	0.96 (0.33-2.76)	1.26 (0.35-4.56)
Consolidation	0 (0%)	2 (2%)	0/61 (0%)	NA	NA
Interlobular septal thickening	1 (2%)	0 (0%)	0/61 (0%)	NA	NA
Subpleural line	5 (9%)	2 (2%)	2/61 (3%)	NA	NA
Reticular pattern	0 (0%)	0 (0%)	0 (0%)	NA	NA
Volume of lung lesions, cm <sup>3</sup>	1.7 (0.7-5.6)	3.5 (1.1-19.0)	18.8 (2.9-51.4)	17.97 (-2.29-38.23)	28.38 (1.85-54.91)*
Volume of consolidation, cm <sup>3</sup>	0.2 (0.0-0.4)	0.3 (0.1-1.5)	0.5 (0.2-3.8)	0.92 (-0.92-2.76)	2.20 (-0.20-4.61)
Volume of GGO, cm <sup>3</sup>	1.5 (0.6-4.6)	3.0 (1.0-18.3)	17.9 (2.5-48.5)	17.05 (-2.00-36.09)	26.18 (1.23-51.12)*
Volume ratio of lung lesion to total lung, %	0.0 (0.0-0.1)	0.1 (0.0-0.4)	0.4 (0.1-1.0)	0.42 (-0.19-1.03)	0.83 (0.03-1.63)*
Volume ratio of consolidation to total lung, %	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.1)	NA	NA
Volume ratio of GGO to total lung, %	0.0 (0.0-0.1)	0.1 (0.0-0.3)	0.3 (0.1-0.9)	0.37 (-0.16-0.89)	0.71 (0.02-1.40)*
CT-score	3.0 (2.0-4.0)	4.0 (3.0-5.0)	5.0 (4.0-5.0)	0.64 (0.08-1.21)*	1.12 (0.38-1.86)*
<b>Women</b>					
Number of patients	39	80	32		
At least one abnormal CT pattern	18 (46%)	38/78 (49%)	15/31 (48%)	1.02 (0.44-2.38)	0.58 (0.16-2.05)
GGO	16 (41%)	33/78 (42%)	13/31 (42%)	1.01 (0.43-2.35)	0.60 (0.17-2.12)
Irregular lines	2 (5%)	10/78 (13%)	6/31 (19%)	4.66 (0.52-41.43)	4.49 (0.33-60.56)

Characteristics	Seven-category scale			OR or $\beta$ (95% CI)	
	Scale 3 Not requiring supplemental oxygen	Scale 4 Requiring supplemental oxygen	Scale 5-6 Requiring HFNC, NIV or IMV	Scale 4 vs 3	Scale 5-6 vs 3
Consolidation	0 (0%)	2/78 (3%)	0/31 (0%)	NA	NA
Interlobular septal thickening	0 (0%)	2/78 (3%)	0/31 (0%)	NA	NA
Subpleural line	1 (3%)	3/78 (4%)	2/31 (6%)	NA	NA
Reticular pattern	0 (0%)	1/78 (1%)	1/31 (3%)	NA	NA
Volume of lung lesions, cm <sup>3</sup>	1.3 (0.6-7.7)	2.5 (0.6-9.1)	53.6 (19.6-101.6)	-3.26 (-40.20-33.69)	46.00 (-5.81-97.82)
Volume of consolidation, cm <sup>3</sup>	0.2 (0.1-0.5)	0.2 (0.1-0.7)	3.3 (1.0-10.3)	-0.67 (-4.99-3.65)	4.42 (-1.63-10.48)
Volume of GGO, cm <sup>3</sup>	1.2 (0.5-7.5)	2.4 (0.6-8.6)	44.5 (18.6-91.9)	-2.59 (-35.50-30.35)	41.58 (-4.61-87.77)
Volume ratio of lung lesion to total lung, %	0.0 (0.0-0.2)	0.1 (0.0-0.2)	1.6 (0.6-3.4)	-0.50 (-3.32-2.32)	2.42 (-1.53-6.37)
Volume ratio of consolidation to total lung, %	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.1 (0.0-0.3)	NA	NA
Volume ratio of GGO to total lung, %	0.0 (0.0-0.2)	0.1 (0.0-0.2)	1.2 (0.5-3.0)	-0.46 (-2.92-2.00)	2.10 (-1.35-5.55)
CT-score	4.0 (2.0-5.0)	4.0 (2.0-5.0)	5.0 (5.0-6.5)	-0.02 (-0.95-0.92)	1.55 (0.24-2.86)*

\*  $P < 0.05$ .

†  $P < 0.001$ .

For all continuous variables which are displayed as median (IQR) (volume variables of chest CT and CT score), the values listed are  $\beta$  (95% CI).

For all categorical variables which are displayed as n (%) or n/N (%), the values are OR (95% CI).

OR = odds ratio; HFNC = high-flow nasal cannula for oxygen therapy; NIV = non-invasive ventilation; IMV = invasive mechanical ventilation;

GGO = ground glass opacity; NA=not applicable.

**Table S6. Comparison of chest CT scans during hospitalization and at follow-up according to severity scale**

Characteristic	Scale 3 Not requiring supplemental oxygen (N=95)		Scale 4 Requiring supplemental oxygen (N=163)		Scale 5-6 Requiring HFNC, NIV or IMV (N=95)	
	Hospitalization	Follow-up	Hospitalization	Follow-up	Hospitalization	Follow-up
	GGO	59/89 (66%)	39 (41%)	113/153 (74%)	78/161 (48%)	79/88 (90%)
Consolidation	11/89 (12%)	0 (0%)	39/153 (25%)	4/161 (2%)	26/88 (30%)	0/92 (0%)
Interlobular septal thickening	0/89 (0%)	1 (1%)	1/153 (1%)	2/161 (1%)	0/88 (0%)	0/92 (0%)
Subpleural line	1/89 (1%)	6 (6%)	5/153 (3%)	5/161 (3%)	3/88 (3%)	4/92 (4%)
Irregular lines	19/89 (21%)	10 (11%)	45/153 (29%)	24/161 (15%)	36/88 (41%)	22/92 (24%)
Crazy-paving pattern	0/89 (0%)	0 (0%)	4/153 (3%)	0/161 (0%)	2/88 (2%)	0 (0%)
Reticular pattern	3/89 (3%)	0 (0%)	3/153 (2%)	1/161 (1%)	10/88 (11%)	1/92 (1%)
Volume of lung lesions, cm <sup>3</sup>	50.4 (7.1-146.3)	1.6 (0.6-5.6)	209.8 (70.4-378.6)	3.3 (0.8-12.4)	673.9 (384.2-1041.7)	29.1 (4.6-77.3)
Volume of consolidation, cm <sup>3</sup>	3.1 (0.5-13.5)	0.2 (0.1-0.4)	16.1 (3.8-55.7)	0.3 (0.1-1.0)	49.0 (21.1-104.4)	1.6 (0.2-4.4)
Volume of GGO, cm <sup>3</sup>	43.8 (6.5-129.7)	1.4 (0.6-4.7)	179.0 (55.1-340.7)	2.9 (0.7-10.0)	591.4 (332.0-938.2)	26.3 (4.3-73.3)
Volume ratio of lung lesion to total lung, %	1.1 (0.2-4.9)	0.0 (0.0-0.1)	5.8 (1.8-11.2)	0.1 (0.0-0.3)	21.2 (10.7-41.5)	0.7 (0.1-2.2)
Volume ratio of consolidation to total lung, %	0.1 (0.0-0.4)	0.0 (0.0-0.0)	0.4 (0.1-1.7)	0.0 (0.0-0.0)	1.5 (0.6-3.3)	0.0 (0.0-0.1)
Volume ratio of GGO to total lung, %	1.0 (0.1-3.8)	0.0 (0.0-0.1)	4.7 (1.4-9.7)	0.1 (0.0-0.2)	19.0 (7.8-35.5)	0.6 (0.1-1.9)
CT-score	5.0 (4.0-6.0)	3.0 (2.0-5.0)	7.0 (5.0-10.0)	4.0 (3.0-5.0)	11.5 (8.0-15.0)	5.0 (4.0-6.0)

HFNC = high-flow nasal cannula for oxygen therapy, NIV = non-invasive ventilation, IMV = invasive mechanical ventilation, GGO = ground glass opacity, IQR = interquartile range, CT = computer tomography.

**Table S7. Ultrasound findings of abdomen and deep vein of lower limbs at follow-up according to severity scale**

	<b>Scale 3 Not requiring supplemental oxygen (N=100)</b>	<b>Scale 4 Requiring supplemental oxygen (N=185)</b>	<b>Scale 5-6 Requiring HFNC, NIV or IMV (N=105)</b>
<b>Deep venous thrombosis of lower limbs</b>	0/100 (0%)	0/185 (0%)	0/105 (0%)
<b>Kidney</b>			
Abnormal morphology -no. (%)	0/40 (0%)	0/113 (0%)	0/28 (0%)
Nonuniform echo-no. (%)	0/40 (0%)	0/113 (0%)	0/28 (0%)
Left kidney size (cm <sup>3</sup> )*	139.8 (126.2-164.1)	150.4 (119.4-178.9)	148.4 (132.2-184.4)
Right kidney size (cm <sup>3</sup> )*	137.0 (112.2-161.8)	139.6 (104.4-168.4)	130.8 (104.4-171.5)
Left kidney segmental artery RI	0.6 (0.6-0.6)	0.6 (0.6-0.6)	0.6 (0.6-0.6)
Right kidney segmental artery RI	0.6 (0.5-0.6)	0.6 (0.6-0.7)	0.6 (0.6-0.7)
<b>Spleen</b>			
Nonuniform echo-no. (%)	0/100 (0%)	0/185 (0%)	0/105 (0%)
Thickness (cm)	3.3 (2.9-3.6)	3.1 (2.7-3.4)	3.3 (2.9-3.6)
Length (cm)	9.8 (8.6-10.9)	9.6 (8.7-10.7)	9.8 (9.0-11.3)
<b>Liver</b>			
Abnormal morphology-no. (%)	0/100 (0%)	0/185 (0%)	0/105 (0%)
Nonuniform echo-no. (%)	0/100 (0%)	0/185 (0%)	0/105 (0%)
<b>Pancreas</b>			
Abnormal morphology-no. (%)	0/100 (0%)	0/185 (0%)	0/105 (0%)
Nonuniform echo-no. (%)	0/100 (0%)	0/185 (0%)	0/105 (0%)

\* Kidney volume was calculated by ellipsoid formula: height \* transverse width \* thickness \*  $\pi/6$ . HFNC = high-flow nasal cannula for oxygen therapy, NIV = non-invasive ventilation, IMV = invasive mechanical ventilation, RI = resistance index, cm = centimeter.

Figure S1. Chest CT features of a severe COVID-19 patient at different timepoints post illness onset

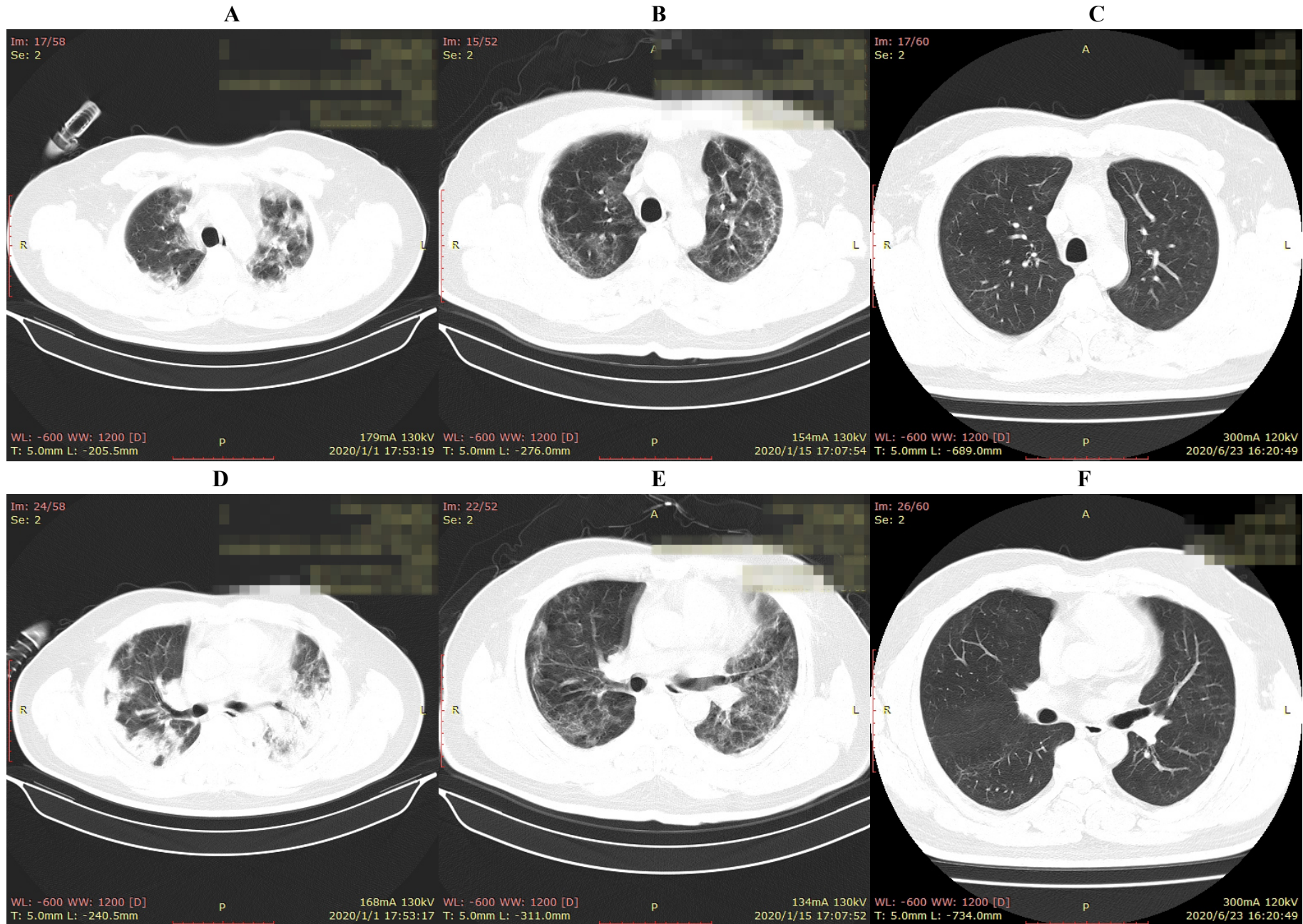


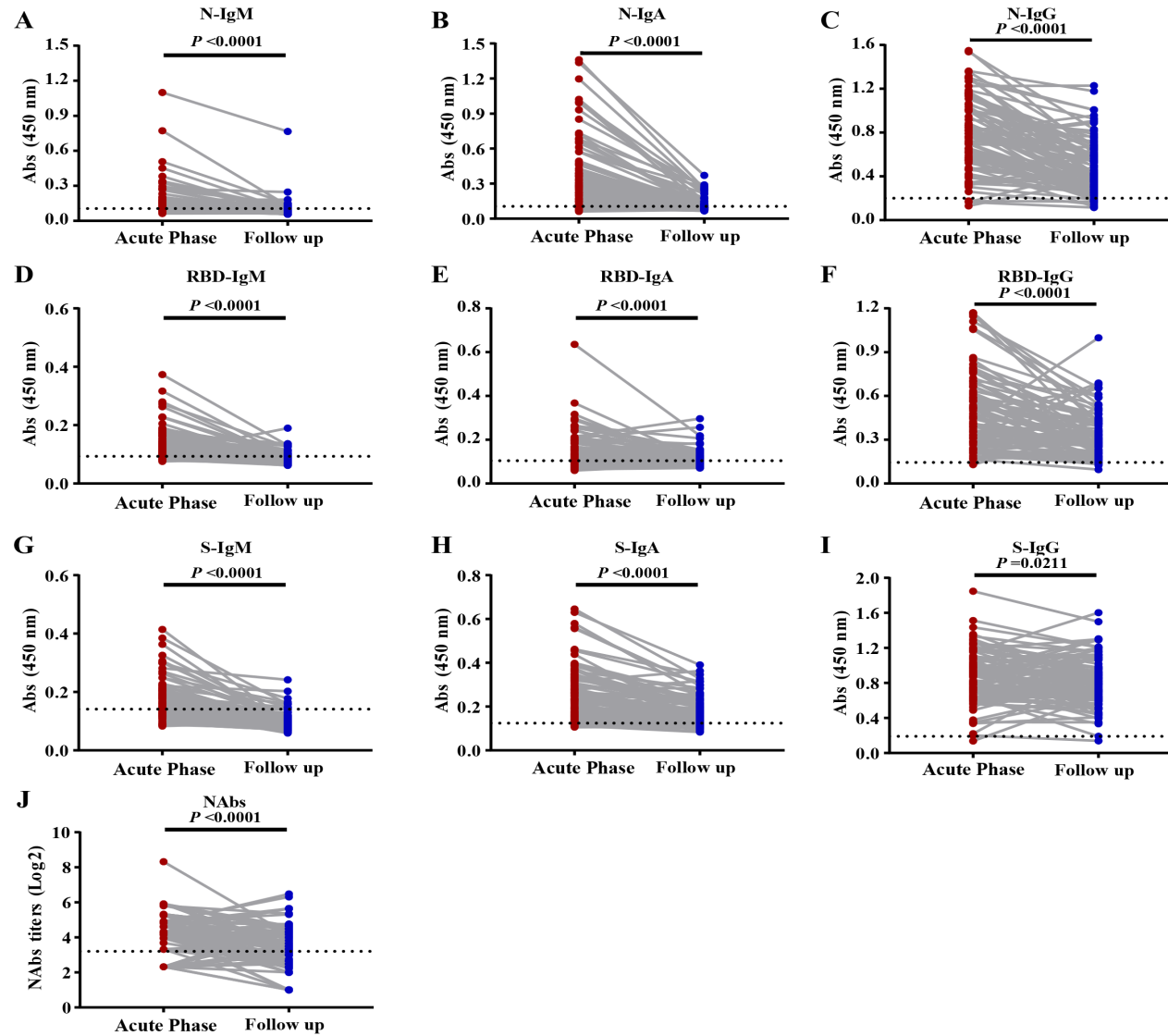
Figure S1 shows the dynamic changes of chest CT images of a 41-year old COVID-19 patient at different time-points after illness. He admitted to hospital on December 29, 2019 after 9 days of illness onset. During hospitalization, he received non-invasive mechanical ventilation due to respiratory failure, and discharged from Jin Yin-tan Hospital.

A, D: His first chest CT image on the third day after admission presented that bilateral consolidation was found.

B, E: The last CT before discharge on January 15, 2020 showed that consolidation was obviously absorbed, subpleural line and ground glass opacity were observed.

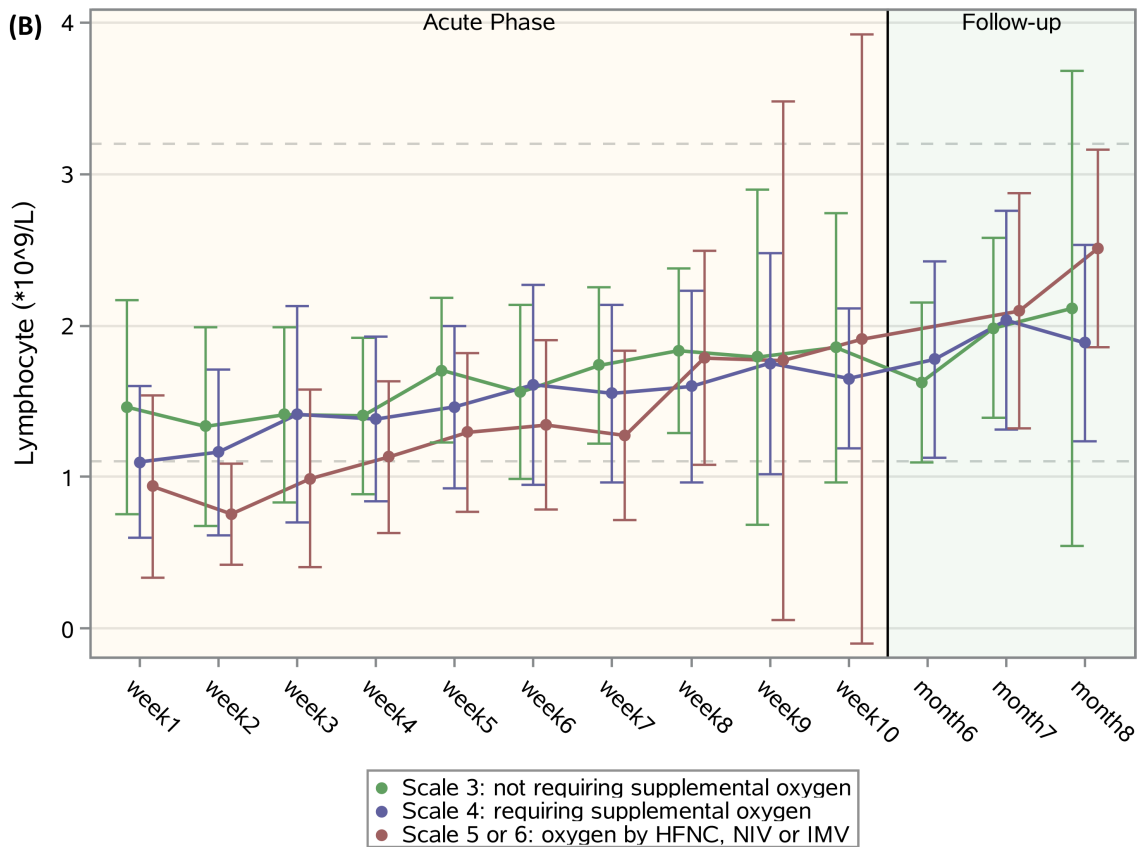
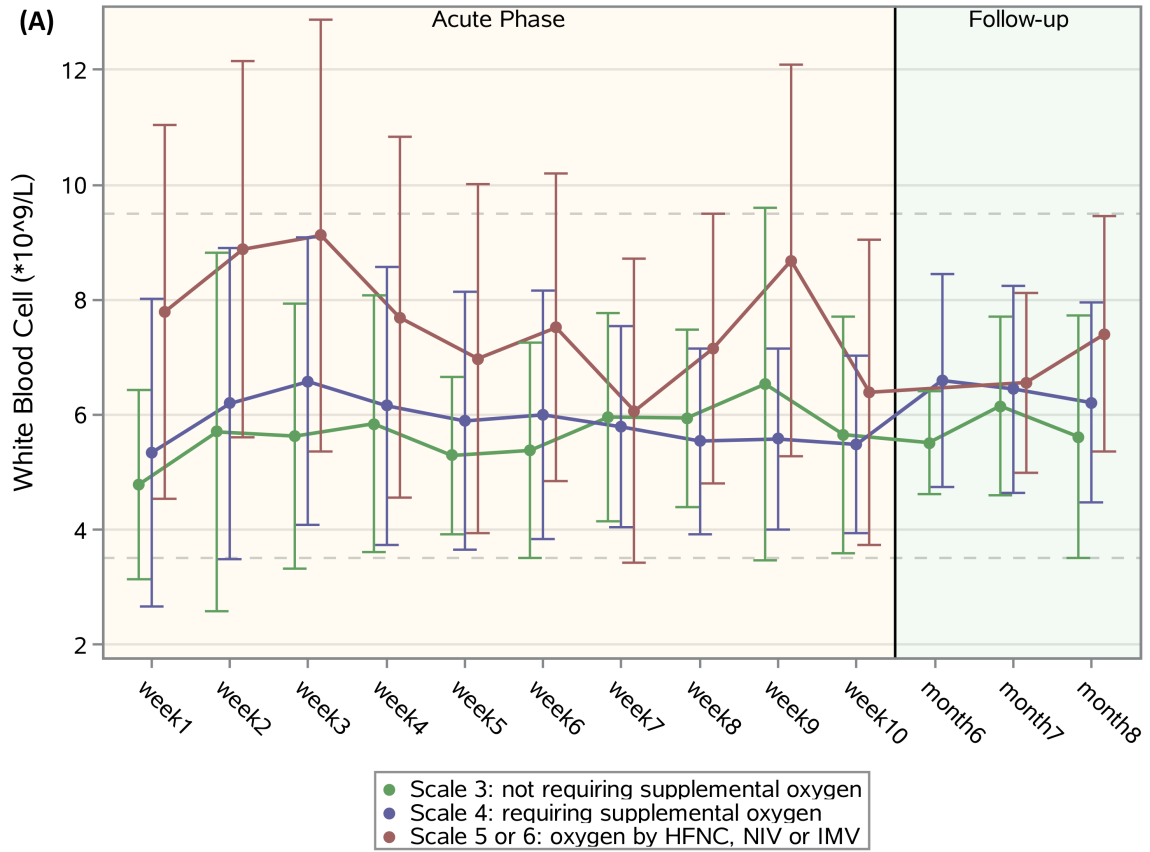
C, F: At this visit of follow-up on June 23,2020, nearly no residual abnormal pattern in chest image was observed.

Figure S2. Dynamic changes of N-IgM (A), N-IgA (B), N-IgG (C), RBD-IgM(D), RBD-IgA (E), RBD-IgG (F), S-IgM (G), S-IgA (H), S-IgG (I) and NAbs (J) levels at acute phase and follow-up

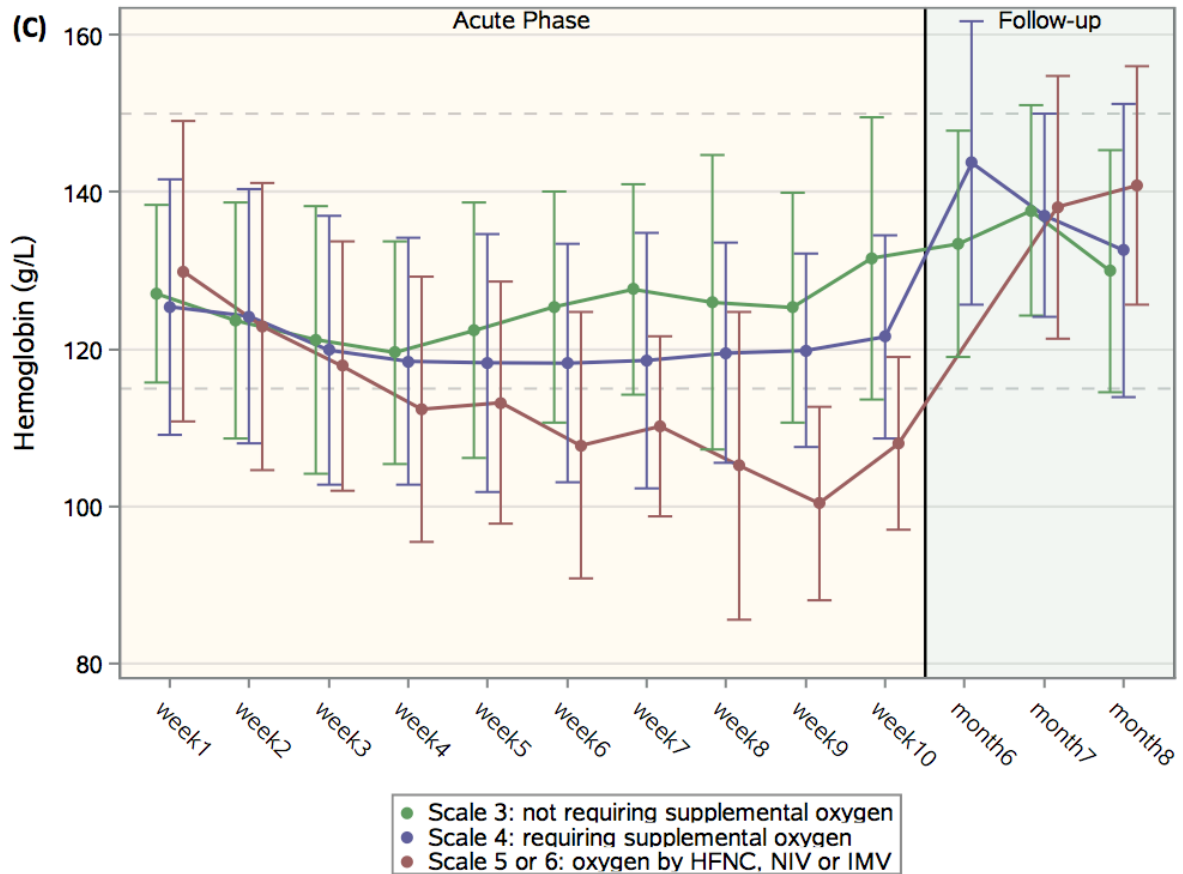


Plasma samples at acute phase were collected during hospitalization with a median duration of 23 (IQR 20, 26) days from illness onset.

**Figure S3. Dynamic changes in laboratory markers from illness onset to follow-up**



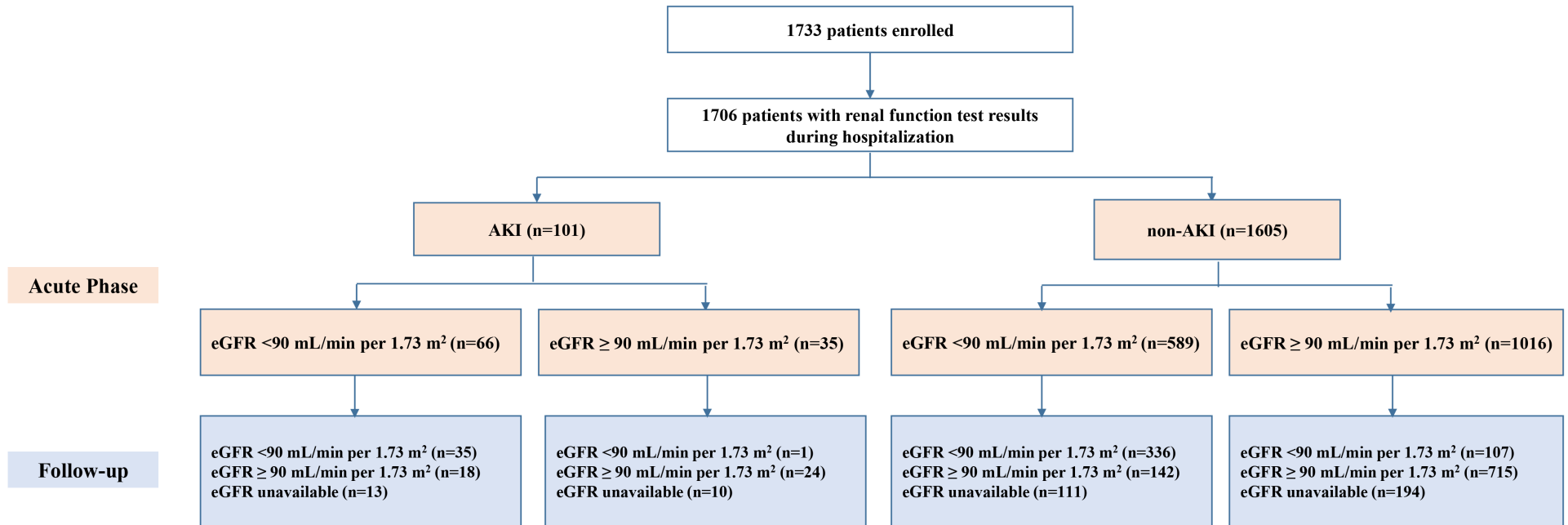




Mean and standard deviation are shown in the figure for dynamic changes of white blood cell count (A), lymphocyte count (B), and hemoglobin level (C) from illness onset to follow-up

The dashed horizontal lines indicate the normal reference values of laboratory markers.

**Figure S4. Distribution of kidney function at acute phase and follow-up**



If eGFR levels during hospitalization were all higher than 90 mL/min per 1.73 m<sup>2</sup> at acute phase, the participant was classified into the group as eGFR ≥ 90 mL/min per 1.73 m<sup>2</sup>. Otherwise, the participant was categorized into the group as eGFR < 90 mL/min per 1.73 m<sup>2</sup>.

eGFR=estimated glomerular filtration rate; AKI = acute kidney injury.