**Supporting Information**

**Supplemental Table 1. Statistical characteristics of time-related variables in 146 critically ill patients with COVID-19**

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| --- | --- | --- | --- | --- |
|  | **All patients(n=146)** | **Death(n=119)** | **Improvement(n=27)** | ***P* value**# |
| Onset of symptom to hospital admission days | 10 (7～15) | 10 (7～15) | 14 (8～20) | 0.274 |
| Onset of symptom to ICU admission days | 14 (10～19) | 14 (10～19) | 14 (9～20) | 0.927 |
| Time from hospital admission to ICU admission days | 2 (0～4) | 2(0～5) | 0(0～3) | 0.006 |
| Time from ICU admission to death days |  | 7 (3～12) |  |  |
| Time from ICU admission to Condition improved days |  |  | 9 (7～20) |  |
| Data are presented median (interquartile range), unless otherwise stated. COVID-19: the coronavirus disease 2019; ICU: intensive care unit; #: P values indicate differences between death and improvement, P<0.05 was considered statistically significant. |

**Supplemental Table 2.** **Clinical****symptoms** **and****sign****s of** **146 critically ill patients with** **COVID-19**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All patients(n=146)** | **Death(n=119)** | **Improvement(n=27)** | ***P* value** # |
| **Clinical****symptoms** |  |  |  |  |
| Fever | 127(88.8) | 105(89.7) | 22(84.6) | 0.684 |
| Cough | 110(76.9) | 90(76.9) | 20(76.9) | >0.99 |
| Expectoration | 57(40.1) | 48(41.4) | 9(34.6) | 0.525 |
| Dyspnoea | 112(78.3) | 97(82.9) | 15(57.7) | 0.005 |
| Chest pain | 5(3.5) | 4(3.4) | 1(3.8) | >0.99 |
| Diarrhea | 32(22.5) | 29(25) | 3(11.5) | 0.138 |
| Nausea | 9(6.3) | 7(6.0) | 2(7.7) | >0.99 |
| Vomiting | 7(4.9) | 5(4.3) | 2(7.7) | 0.827 |
| Poor appetite | 65(45.8) | 53(45.7) | 12(46.2) | 0.966 |
| Headache | 8(5.6) | 8(6.9) | 0(0) | 0.364 |
| Fatigue | 69(48.6) | 59(50.9) | 10(38.5) | 0.253 |
| **Clinical****sign****s** |  |  |  |  |
| Temperature on admission ℃ | 36.8(36.5～37.8) | 36.8(36.5～37.8) | 36.7(36.5～37.5) | 0.616 |
| Highest temperature ℃ | 38.5(38.0～39.0) | 38.5(38.0～39.0) | 38.5(38.0～39.0) | 0.888 |
| Systolic blood pressure mmHg | 134.0 (120.0～146.0) | 134.0(120.0～146.0) | 132.5(120.0～145.0) | 0.722 |
| Diastolic blood pressure mmHg | 80.0(73.0～87.0) | 80.0(71.0～87.0) | 80.0(77.0～91.0) | 0.219 |
| Pulse bpm | 92 (81～106) | 92(80～105) | 92(81～108) | 0.859 |
| Respiratory rate | 23.5 (20.0～31.0) | 24.5(20.0～31.5) | 21.5(20.0～28.0) | 0.221 |
| Percutaneous oxygen saturation % | 94.0(85.0～98.0) | 92.0(84.0～97.0) | 96.5(93.0～99.0) | 0.003 |
| Data are presented as n (%) or median (interquartile range), unless otherwise stated. COVID-19: the coronavirus disease 2019; bpm: beats per minute; #: P values indicate differences between death and improvement, P<0.05 was considered statistically significant. |

**Supplemental Table 3.** **The plasma osmolality of 146 critically ill patients with COVID-19**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All** | **Death** | **Improvement** | ***P* value** # |
| **All patients** | 296.47( 290.31～305.26) |  298.32( 290.50～ 308.37) | 293.23( 289.74～ 296.82) | 0.026 |
| **Patients with diabetes** | 303.86( 296.00～ 319.15) | 308.97( 297.11～ 324.33) | 296.20( 292.86～ 296.67) | 0.013 |
| **Patients without diabetes** |  293.16( 288.93～ 300.76) |  293.60( 288.93～ 300.90) |  292.34( 287.89～ 296.82) | 0.283 |
| Data are presented as median (interquartile range), unless otherwise stated. COVID-19: the coronavirus disease 2019; bpm: beats per minute; #: P values indicate differences between death and improvement, P<0.05 was considered statistically significant. |

**Supplemental Table 4. Risk factors associated with in-ICU death**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Univariable OR (95%CI)** | **P value**# | **MultivariableOR (95% CI)** | ***P* value**# |
| Age<65 years(vs>= 65 years) | 0.32(0.14- 0.76) | 0.010 | 0.23( 0.05- 0.99) | 0.049 |
| Gender, Male (vs Female) | 1.64(0.71- 3.81) | 0.249 | 0.79( 0.21- 2.89) | 0.717 |
| Fever, No (vs Yes) | 0.63(0.19- 2.13) | 0.456 |  |  |
| Dyspnea, No (vs Yes) | 0.28(0.11- 0.70) | 0.007 | 0.49( 0.12- 2.01) | 0.322 |
| Random blood glucose mmol·L-1 <=7.8(vs >7.8) | 0.61(0.26- 1.43) | 0.255 | 0.41( 0.11- 1.45) | 0.166 |
| Plasma osmolality mOsm·kg.H2O-1 | 1.03(1.00 1.07) | 0.055  |  |  |
| Life Support+, No (vs Yes) | 0.30(0.07- 1.35) | 0.115 |  |  |
| Highest temperature§ ℃  | 0.86(0.43- 1.71) | 0.664 |  |  |
| Percutaneous oxygen saturation§ % | 0.90(0.83- 0.98) | 0.010 |  |  |
| White-cell count§ ×109·L-1 | 1.03(0.95- 1.12) | 0.441 |  |  |
| Lymphocyte count§, ×109·L-1 | 0.25(0.10- 0.63) | 0.003 | 0.85( 0.18- 4.09) | 0.835 |
| Alanine transaminase§ U·L-1¶ | 1.00(0.99- 1.00) | 0.459 |  |  |
| Creatine kinase§ U·L-1¶ | 1.00(1.00- 1.00) | 0.114 |  |  |
| Total bilirubin§ μmol·L-1 | 1.04(0.99- 1.10) | 0.149 |  |  |
| Albumin§ g·L-1 | 0.91(0.83- 1.00) | 0.059 |  |  |
| eGFR§ mL·min-1 | 0.97(0.95- 0.99) | <0.001 | 0.99( 0.97- 1.02) | 0.523 |
| D-dimer§ mg·L-1 | 1.10(1.03- 1.17) | 0.003 | 1.10( 1.01- 1.20) | 0.032 |
| C-reactive protein§ mg·L-1 | 1.02(1.01- 1.03) | <0.001 | 1.01( 1.00- 1.03) | 0.024 |
| Prothrombin time§ s | 1.49(1.12- 1.99) | 0.006 | 1.06( 0.73- 1.54) | 0.763 |
| Potassium§ mmol·L-1 | 0.83(0.48- 1.44) | 0.516 |  |  |
| Sodium§ mmol·L-1 | 1.07(0.99- 1.15) | 0.081 | 0.99( 0.86- 1.14) | 0.915 |
| Interleukin- 6§ pg·mL-1 | 1.02(1.01- 1.04) | 0.004 | 1.01( 1.00- 1.03) | 0.032 |
| Serum ferritin§ μg·L-1 | 1.00(1.00- 1.00) | 0.041 |  |  |
| Data are presented as OR (95% CI), unless otherwise stated. #: P values indicate differences between death and improvement, P<0.05 was considered statistically significant; ¶: SI conversion factors, to convert alanine transferase to μkat/L, multiply by 0.0167; creatine kinase to μkat/L, multiply by 0.0167; +: Life Support includes extracorporeal membrane oxygenation and replacement therapy; §: Per 1 unit increase. |

**Supplemental Table 5. Reference Range of Laboratory Findings**

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| --- | --- | --- |
|  | **Reference Range** | **Units** |
| White-cell count  | 3.50~9.50 | \*109·L-1 |
| Neutrophil count  | 1.80~6.30 | \*109·L-1 |
| Lymphocyte count  | 1.10~3.20 | \*109·L-1 |
| Monocyte count  | 0.10~0.60 | \*109·L-1 |
| Eosinophil count  | 0.02~0.52 | \*109·L-1 |
| Erythrocyte count  | 4.30~5.80 | \*109·L-1 |
| Haemoglobin level  | 130.0~175.0 | g·L-1 |
| Platelet count  | 125.0~130.0 | \*109·L-1 |
| Alanine transaminase | ≤41 | U·L-1 |
| Aspartate aminotransferase  | ≤40 | U·L-1 |
| Lactic dehydrogenase  | 135~225 | U·L-1 |
| Creatine kinase  | <190 | U·L-1 |
| Total bilirubin | ≤26 | μmol·L-1 |
| Albumin g·L-1 | 35.0~52.0 | g·L-1 |
| eGFR | >90 | mL·min-1/1.73m2 |
| Actual bicarbonate | 22.0~29.0 | mmol·L-1 |
| Uric Acid  | 202.3~416.5 | μmol·L-1 |
| Total Cholesterol  | <5.18 | mmol·L-1 |
| Triglyceride | <1.70 | mmol·L-1 |
| Glycosylated hemoglobin  | 4.0~6.0 | mmol·L-1 |
| Calcium  | 2.20~2.55 | mmol·L-1 |
| Prothrombin time | 11.5~14.5 | s |
| D-dimer  | <0.5 | ug/mL |
| C-reactive protein  | <1 Low risk of cardiovascular disease1~3 Medium risk of cardiovascular disease>3 high risk of cardiovascular disease>10 Suggesting the possibility of infection and inflammation | mg·L-1 |
| Erythrocyte sedimentation rate | 0-15 | mm·H-1 |
| Procalcitonin | 0.02~0.05 | ng·mL-1 |
| Serum ferritin | 10.6~28.3 | μg·L-1 |
| Brain natriuretic peptide | <89.3 | pg·mL-1 |
| Cardiac troponin I  | ≤34.2 | μg·mL-1 |
| Interleukin-1β | <5 | pg·mL-1 |
| Interleukin-2R  | 223~710 | U·mL-1 |
| Interleukin- 6  | <7.0 | pg·mL-1 |
| Interleukin- 8  | <62 | pg·mL-1 |
| Interleukin- 10 | <9.1 | pg·mL-1 |
| Tumor Necrosis Factor-α | <8.1 | pg·mL-1 |

**Supplemental Table 6. correlation among osmolarity and the inflammatory markers**

|  |  |  |
| --- | --- | --- |
|  | ***r*\*** | ***P*#** |
| Lymphocyte count ×109·L-1 | -0.1831 | 0.0309 |
| Lactic dehydrogenase U·L-1¶ | 0.3439 | <.0001 |
| Total bilirubin μmol·L-1 | 0.4017 | <.0001 |
| D-dimer mg·L-1 | 0.2226 | 0.0089 |
| C-reactive protein mg·L-1 | 0.0768 | 0.3760 |
| Serum ferritin μg·L-1 | 0.1143 | 0.2575 |
| Interleukin-1β pg·mL-1 | 0.0664 | 0.4747 |
| Interleukin-2R U·mL-1 | 0.0008 | 0.9933 |
| Interleukin- 6 pg·mL-1 | 0.3398 | 0.0002 |
| Interleukin- 8 pg·mL-1 | 0.2450 | 0.0080 |
| Interleukin- 10 pg·mL-1 | 0.0739 | 0.4284 |
| Tumor Necrosis Factor-α pg·mL-1 | 0.4065 | <.0001 |
| \*: r values represent the pearson correlation coefficient, indicate the correlation degree among osmolarity and the inflammatory markers.#: P values indicate correlation between osmolarity and the inflammatory markers., P<0.05 was considered statistically significant; |