

Table S1 Univariate analysis of the risk factors for non-invasive ventilation failure

| Variable  | Total (n=101)   | NIV outcome        |                 | $\chi^2/t/Z$ value | <i>P</i> value     |
|---|-----------------|--------------------|-----------------|--------------------|--------------------|
|   |                 | NIV failure (n=50) | success (n=51)  |                    |                    |
| Gender,n(%)                                       |                 |                    |                 |                    |                    |
| Male  | 57(56.44)       | 33(57.89)          | 24(42.11)       | 3.684              | <sup>a</sup> 0.055 |
| Female  | 44(43.56)       | 17(38.64)          | 27(61.36)       |                    |                    |
| Age(years)  | 61.91±18.43     | 62.78±18.64        | 61.06±18.36     | 0.467              | <sup>b</sup> 0.641 |
| Wight(kg)   | 57.38±10.94     | 58.52±11.31        | 56.27±10.55     | 1.034              | <sup>b</sup> 0.304 |
| Height(cm)  | 161.53±8.14     | 163.92±7.76        | 159.20±7.89     | 3.033              | <sup>b</sup> 0.003 |
| BMI(kg/m <sup>2</sup> )                           | 21.92±3.58      | 21.67±3.44         | 22.17±3.73      | 0.709              | <sup>b</sup> 0.480 |
| IBW(kg)   | 56.44±6.15      | 58.21±5.92         | 54.71±5.92      | 2.972              | <sup>b</sup> 0.004 |
| APACH II score at ICU admission                   | 21.06±6.25      | 21.70±5.90         | 20.43±6.57      | 1.020              | <sup>b</sup> 0.310 |
| Interval between admission of hospital and ICU(d) | 1.00(0.00,6.50) | 1.00(0.00,6.00)    | 1.00(0.00,9.00) | 0.257              | <sup>c</sup> 0.797 |
| Duration of NIV (d)                               | 4.00(2.00,6.00) | 4.00(2.00,6.00)    | 4.00(3.00,6.00) | 0.038              | <sup>c</sup> 0.970 |
| Morbidity, n (%)                                  |                 |                    |                 |                    |                    |

|                          |              |              |              |       |   |       |
|--------------------------|--------------|--------------|--------------|-------|---|-------|
| Hypertension             |              |              |              |       |   |       |
| Without                  | 65(64.36)    | 32(49.23)    | 33(50.77)    | 0.005 | a | 0.941 |
| With                     | 36(35.64)    | 18(50.00)    | 18(50.00)    |       |   |       |
| CHD                      |              |              |              |       |   |       |
| Without                  | 92(91.09)    | 44(47.83)    | 48(52.17)    | 1.164 | a | 0.281 |
| With                     | 9(8.91)      | 6(66.67)     | 3(33.33)     |       |   |       |
| COPD                     |              |              |              |       |   |       |
| Without                  | 90(89.11)    | 46(51.11)    | 44(48.89)    | 0.853 | a | 0.356 |
| With                     | 11(10.89)    | 4(36.36)     | 7(63.64)     |       |   |       |
| Immunosuppressive agents |              |              |              |       |   |       |
| Without                  | 100(99.01)   | 49(49.00)    | 51(51.00)    | 1.030 | a | 0.310 |
| With                     | 1(0.99)      | 1(100.00)    | 0(0.00)      |       |   |       |
| HR-D1(bpm)               | 110.99±23.96 | 115.82±22.19 | 106.25±24.90 | 2.037 | b | 0.044 |
| HR-MAX (bpm)             | 117.50±23.36 | 124.26±20.66 | 110.86±24.13 | 2.995 | b | 0.003 |
| MAP-D1(mmHg)             | 96.28±18.10  | 96.61±18.55  | 95.95±17.83  | 0.184 | b | 0.854 |
| MAP-MIN (mmHg)           | 81.90±15.47  | 80.49±18.64  | 83.29±11.59  | 0.911 | b | 0.365 |

|                          |                      |                     |                      |       |              |       |
|--------------------------|----------------------|---------------------|----------------------|-------|--------------|-------|
| MAP-MAX(mmHg)            | 103.60±15.89         | 103.79±16.20        | 103.41±15.74         | 0.118 | <sup>b</sup> | 0.906 |
| RR-D1(bpm)               | 26.00(21.50,33.00)   | 26.00(22.00,33.25)  | 25.00(21.00,31.00)   | 1.419 | <sup>c</sup> | 0.156 |
| RR-MIN(bpm)              | 20.00(18.50,23.00)   | 21.00(19.00,25.00)  | 20.00(17.00,21.00)   | 2.993 | <sup>c</sup> | 0.003 |
| RR-MAX(bpm)              | 29.00(25.00,34.50)   | 30.00(26.00,38.00)  | 27.00(23.00,33.00)   | 2.122 | <sup>c</sup> | 0.034 |
| T-D1(°C)                 | 37.22±0.81           | 37.32±0.97          | 37.12±0.61           | 1.242 | <sup>b</sup> | 0.217 |
| T-MIN(°C)                | 36.72±0.51           | 36.74±0.62          | 36.71±0.38           | 0.236 | <sup>b</sup> | 0.814 |
| T-MAX(°C)                | 37.72±0.90           | 37.94±1.07          | 37.50±0.63           | 2.494 | <sup>b</sup> | 0.014 |
| SPO <sub>2</sub> -D1(%)  | 96.00(86.50,99.00)   | 95.00(85.50,98.00)  | 97.00(90.00,100.00)  | 1.398 | <sup>c</sup> | 0.162 |
| SPO <sub>2</sub> -MIN(%) | 93.00(86.00,96.00)   | 91.00(84.00,93.25)  | 94.00(90.00,98.00)   | 2.787 | <sup>c</sup> | 0.005 |
| SPO <sub>2</sub> _MAX    | 100.00(96.00,100.00) | 98.50(96.00,100.00) | 100.00(98.00,100.00) | 2.405 | <sup>c</sup> | 0.016 |
| PH-D1                    | 7.42(7.33,7.48)      | 7.42(7.30,7.48)     | 7.42(7.37,7.47)      | 0.479 | <sup>c</sup> | 0.632 |
| PH_MIN                   | 7.38(7.29,7.45)      | 7.35(7.27,7.45)     | 7.40(7.33,7.45)      | 1.319 | <sup>c</sup> | 0.187 |
| PH-MAX                   | 7.48(7.43,7.53)      | 7.49(7.40,7.53)     | 7.48(7.44,7.52)      | 0.418 | <sup>c</sup> | 0.676 |
| PaCO <sub>2</sub> -D1    | 33.00(26.50,46.00)   | 32.50(24.00,43.50)  | 35.00(30.00,47.00)   | 1.356 | <sup>c</sup> | 0.175 |
| PaCO <sub>2</sub> -MIN   | 31.00(25.50,38.00)   | 29.50(24.00,37.25)  | 32.00(27.00,39.00)   | 1.414 | <sup>c</sup> | 0.157 |
| PaCO <sub>2</sub> -MAX   | 40.00(34.00,57.00)   | 37.00(32.00,58.25)  | 41.00(36.00,52.00)   | 1.444 | <sup>c</sup> | 0.149 |

|  |                           |                           |                           |       |              |       |
|--|---------------------------|---------------------------|---------------------------|-------|--------------|-------|
| HCO <sub>3</sub> <sup>-</sup> -D1            | 23.55±9.24                | 22.52±9.60                | 24.55±8.86                | 1.104 | <sup>b</sup> | 0.272 |
| HCO3_MIN                                     | 22.37±8.93                | 21.30±9.10                | 23.43±8.72                | 1.203 | <sup>b</sup> | 0.232 |
| HCO <sub>3</sub> <sup>-</sup> -MAX           | 29.74±10.64               | 27.90±10.84               | 31.54±10.22               | 1.738 | <sup>b</sup> | 0.085 |
| FiO <sub>2</sub> _D1                         | 50.00(40.00,80.00)        | 50.00(40.00,80.00)        | 45.00(40.00,80.00)        | 0.628 | <sup>c</sup> | 0.530 |
| FiO <sub>2</sub> _MAX                        | 55.00(40.00,95.00)        | 60.00(43.75,100.00)       | 50.00(40.00,80.00)        | 1.562 | <sup>c</sup> | 0.118 |
| Total input volume (ml) -D1                  | 1497.00(874.50,2776.00)   | 1686.00(895.00,3290.50)   | 1330.00(665.00,2610.00)   | 2.245 | <sup>c</sup> | 0.025 |
| Total input volume-MAX(ml)                   | 3080.00(2375.00,4124.50)  | 3333.50(2578.75,4497.25)  | 2762.00(2267.00,3652.00)  | 1.345 | <sup>c</sup> | 0.179 |
| Cumulative input volume during NIV(ml)       | 8213.00(4306.00,11955.00) | 9238.00(5666.25,12426.00) | 6995.00(4002.00,11318.00) | 1.015 | <sup>c</sup> | 0.310 |
| Intravenous input volume-D1(ml)              | 1225.00(682.50,2468.50)   | 1242.00(745.00,2906.25)   | 1100.00(652.00,2048.00)   | 2.174 | <sup>c</sup> | 0.030 |
| Intravenous input volume-MAX(ml)             | 2161.00(1437.50,3640.50)  | 2571.00(1689.25,3899.00)  | 1890.00(1117.00,2750.00)  | 1.854 | <sup>c</sup> | 0.064 |
| Cumulative intravenous volume during NIV(ml) | 5420.00(2970.00,9013.50)  | 6664.50(3433.25,9402.00)  | 3890.00(2739.00,8008.00)  | 0.391 | <sup>c</sup> | 0.696 |
| Total output volume-D1 (ml)                  | 1280.00(660.00,2262.50)   | 1350.00(775.00,1925.00)   | 1200.00(600.00,2570.00)   | 1.063 | <sup>c</sup> | 0.288 |
| Total output volume-MIN(ml)                  | 1100.00(500.00,1700.00)   | 1025.00(452.50,1470.00)   | 1200.00(600.00,1900.00)   | 0.425 | <sup>c</sup> | 0.671 |
| Total output volume-MAX(ml)                  | 2815.00(2025.00,3970.00)  | 2775.00(2087.50,3902.50)  | 2850.00(1900.00,4180.00)  |       |              |       |

|                               |                           |                           |                           |       |              |       |
|-------------------------------|---------------------------|---------------------------|---------------------------|-------|--------------|-------|
| Cumulative output volume (ml) | 6760.00(3965.00,11115.00) | 6300.00(3742.50,10765.00) | 6850.00(4000.00,13250.00) | 0.696 | <sup>c</sup> | 0.486 |
| Urinary volume-D1(ml)         | 900.00(485.00,1425.00)    | 1000.00(452.50,1412.50)   | 850.00(500.00,1700.00)    | 0.224 | <sup>c</sup> | 0.823 |
| Urinary volume (ml) -MIN      | 700.00(300.00,1100.00)    | 610.00(242.50,1100.00)    | 730.00(400.00,1200.00)    | 1.040 | <sup>c</sup> | 0.298 |
| Urinary volume-MAX (ml)       | 2000.00(1315.00,2800.00)  | 2000.00(1075.00,2657.50)  | 2000.00(1400.00,3150.00)  | 1.077 | <sup>c</sup> | 0.282 |
| ALT-D1(U/L)                   | 28.00(16.99,61.08)        | 37.32(17.43,94.45)        | 22.39(16.31,51.34)        | 1.583 | <sup>c</sup> | 0.114 |
| ALT-MAX                       | 31.52(20.68,111.33)       | 50.94(20.71,195.08)       | 27.60(19.39,57.20)        | 2.000 | <sup>c</sup> | 0.045 |
| AST-D1(U/L)                   | 44.92(31.12,106.45)       | 56.96(37.20,161.97)       | 40.80(25.69,68.00)        | 2.364 | <sup>c</sup> | 0.018 |
| AST-MAX(U/L)                  | 54.94(35.74,181.28)       | 65.00(42.43,274.61)       | 44.90(30.41,81.10)        | 2.731 | <sup>c</sup> | 0.006 |
| Cr-D1(μmmol/L)                | 82.81(58.59,177.24)       | 85.35(63.69,173.47)       | 82.81(53.71,181.10)       | 0.734 | <sup>c</sup> | 0.463 |
| Cr-MAX (μmol/L)               | 91.84(62.29,194.43)       | 101.48(68.33,233.57)      | 83.00(58.01,194.00)       | 1.209 | <sup>c</sup> | 0.227 |
| TB-D1(mmol/L)                 | 15.85(10.28,35.94)        | 18.60(11.40,52.55)        | 14.70(8.51,22.40)         | 2.092 | <sup>c</sup> | 0.036 |
| TB-MAX (mmol/L)               | 20.35(11.84,43.83)        | 24.85(14.85,64.84)        | 17.40(10.50,28.58)        | 2.326 | <sup>c</sup> | 0.020 |
| ALB-D1(g/L)                   | 32.20±6.09                | 30.84±6.19                | 33.52±5.75                | 2.255 | <sup>b</sup> | 0.026 |
| ALB-MIN(g/L)                  | 29.32±5.11                | 27.96±5.06                | 30.65±4.84                | 2.727 | <sup>b</sup> | 0.008 |
| PA-D1(mg/L)                   | 126.74±69.78              | 117.71±74.55              | 135.59±64.27              | 1.292 | <sup>b</sup> | 0.200 |
| PA-MIN(mg/L)                  | 102.24±64.36              | 89.71±67.27               | 114.52±59.48              | 1.964 | <sup>b</sup> | 0.052 |

|                                |                          |                           |                          |       |   |       |
|--------------------------------|--------------------------|---------------------------|--------------------------|-------|---|-------|
| TRO-D1(ng/ml)                  | 0.03(0.02,0.10)          | 0.02(0.01,0.10)           | 0.04(0.02,0.10)          | 1.423 | c | 0.155 |
| TOR-MAX (ng/ml)                | 0.04(0.02,0.15)          | 0.04(0.01,0.14)           | 0.05(0.03,0.16)          | 1.396 | c | 0.163 |
| BNP-D1(pg/ml)                  | 2422.00(518.23,9800.00)  | 1922.00(461.00,10649.00)  | 2717.00(665.45,10253.50) | 0.635 | c | 0.525 |
| BNP_MAX(pg/ml)                 | 3426.00(870.25,13910.75) | 3084.50(1071.50,15969.00) | 3932.50(777.23,10253.50) | 0.228 | c | 0.819 |
| Na-D1(mmol/L)                  | 139.50±6.20              | 139.65±5.78               | 139.36±6.65              | 0.230 | b | 0.819 |
| Na-MIN(mmol/L)                 | 137.64±4.73              | 137.96±4.66               | 137.32±4.82              | 0.682 | b | 0.497 |
| Na-MAX(mmol/L)                 | 142.49±5.99              | 143.28±6.27               | 141.71±5.66              | 1.322 | b | 0.189 |
| K-D1(mmol/L)                   | 4.17±0.86                | 4.13±0.96                 | 4.21±0.76                | 0.496 | b | 0.621 |
| K-MIN(mmol/L)                  | 3.86±0.75                | 3.90±0.88                 | 3.81±0.60                | 0.580 | b | 0.564 |
| K-MAX(mmol/L)                  | 4.61±0.83                | 4.66±0.95                 | 4.56±0.69                | 0.635 | b | 0.527 |
| LAC-D1(mmol/L)                 | 2.10(1.00,3.55)          | 2.50(1.05,4.30)           | 2.00(0.93,2.88)          | 1.704 | c | 0.088 |
| LAC-MAX(mmol/L)                | 2.50(1.50,3.55)          | 2.60(1.80,4.30)           | 2.15(1.23,2.98)          | 2.068 | c | 0.039 |
| WBC (×10 <sup>9</sup> /L) -D1  | 11.07(7.76,15.35)        | 11.91(8.39,16.17)         | 9.42(7.72,13.57)         | 1.644 | c | 0.100 |
| WBC (×10 <sup>9</sup> /L) -MIN | 8.77(6.27,12.46)         | 9.69(5.97,14.25)          | 8.13(6.47,11.50)         | 1.372 | c | 0.170 |
| WBC (×10 <sup>9</sup> /L) -MAX | 12.85(8.97,18.79)        | 14.53(10.16,24.96)        | 10.82(8.50,15.44)        | 2.656 | c | 0.008 |
| HB-D1 (g/L)                    | 114.09±32.94             | 113.02±34.83              | 115.14±31.30             | 0.322 | b | 0.748 |

|  |                       |                      |                       |       |              |        |
|--|-----------------------|----------------------|-----------------------|-------|--------------|--------|
| HB-MIN (g/L)   | 103.15±31.99          | 103.44±34.02         | 102.86±30.20          | 0.090 | <sup>b</sup> | 0.929  |
| OI-D1 (mmHg)   | 170.00(116.78,261.25) | 144.75(91.88,215.38) | 188.00(137.50,288.75) | 2.619 | <sup>c</sup> | 0.009  |
| OI-MIN (mmHg)  | 148.89(97.50,175.00)  | 119.06(78.75,163.13) | 162.22(128.00,210.00) | 3.424 | <sup>c</sup> | <0.001 |
| Number of patients not using NE-D1, n(%)               | 92(91.09)             | 43(46.74)            | 49(53.26)             |       | <sup>a</sup> | 0.075  |
| Number of patients using NE-D1, n(%)                   | 9(8.91)               | 7(7.78)              | 2(22.22)              | 3.159 |              |        |
| Number of patients not using NE during NIV, n(%)       | 84(83.17)             | 36(42.86)            | 48(57.14)             | 8.823 | <sup>a</sup> | 0.003  |
| Number of patients using NE during NIV, n(%)           | 17(16.83)             | 14(82.35)            | 3(17.65)              |       |              |        |
| Number of patients not using dopamine-D1, n(%)         | 100(99.01)            | 50(50.00)            | 50(50.00)             | 0.990 | <sup>a</sup> | 0.320  |
| Number of patients using dopamine-D1, n(%)             | 1(0.99)               | 0(0.00)              | 1(100.00)             |       |              |        |
| Number of patients not using dopamine during NIV, n(%) | 100(99.01)            | 50(50.00)            | 50(50.00)             | 0.990 | <sup>a</sup> | 0.320  |
| Number of patients using dopamine during NIV, n(%)     | 1(0.99)               | 0(0.00)              | 1(100.00)             |       |              |        |

| Number of patients with different liquid balance |           |           |           |       |              |       |
|--|-----------|-----------|-----------|-------|--------------|-------|
| Infusion balance-D1, n(%)                        |           |           |           |       |              |       |
| Negative   | 36(35.64) | 17(47.22) | 19(52.78) | 0.117 | <sup>a</sup> | 0.733 |
| Positive   | 65(64.36) | 33(50.77) | 32(49.23) |       |              |       |
| Infusion balance-during NIV, n(%)                |           |           |           |       |              |       |
| Negative   | 36(35.64) | 12(33.33) | 24(66.67) | 5.852 | <sup>a</sup> | 0.016 |
| Positive   | 65(64.36) | 38(58.46) | 27(41.54) |       |              |       |

Data were presented as mean  $\pm$ SD, or median (interquartile range), or number (percentage); Statistical analysis were completed by a Pearson Chi square test (a), Group T test (b), or by Mann-Whitney U test.

BMI body mass index; IBW ideal body wight; CHD,coronary heart disease; COPD,chronic obstructiv pulmonary disease; HR, heart rate; bpm,beat per minute; D1, the value at the first day of ICU admission; MAX, the maximal value during NIV treatmen; MIN, the minimal value during NIV treatment; RR, respiratory rate (breath per minute, bpm), T, temperature; ALT, alanine aminotransferase; AST, aspartate aminotransferase; Cr, serum creatinine; TB, total bilirubin; ALB, albumin; PA, prealbumin; TRO, troponin; BNP, brain natriuretic peptide; Na, sodium ion; K, potassium ion; LAC, serum lactic acid; WBC, peripheral white blood cell count; HB, hemoglobin; OI, oxygenation index; NE, norepinephrine. NIV, non-invasive mechanical ventilation.