

Supplemental digital content 1. Institutional weaning protocol

Institutional weaning protocol part 1 of 2

| Assessment the readiness to wean | Failure of Spontaneous breathing trial |
|---|--|
| Adequate cough | Agitation and anxiety |
| Absence of excessive tracheobronchial secretions | |
| Resolution of disease acute phase for which the subject required invasive mechanical ventilation | Diaphoresis, cyanosis, evidence of increased breathing effort (activation of accessory respiratory muscles), dyspnea |
| Mean arterial pressure >65 mm Hg; heart rate ≤ 140 beats/min | Systolic blood pressure >190 mm Hg; Mean arterial pressure <60 mmHg; heart rate >140 beats/min |
| arterial oxygen saturation $\geq 90\%$ (or $\text{PaO}_2/\text{FiO}_2 \geq 150$ mm Hg) with $\text{FiO}_2 \leq 0.4$). PEEP ≤ 10 cm H ₂ O. | $\text{PaO}_2 \leq 50$ -60 mm Hg (or arterial oxygen saturation $<90\%$) on $\text{FiO}_2 \geq 0.5$. |
| Respiratory rate <35 breaths/min; Tidal volume >5 ml/kg of predicted body weight; Respiratory rate on tidal volume ratio <105 | Respiratory rate ≥ 35 breaths/min; Respiratory rate on tidal volume ratio >105 breaths/(min*l) |

breaths/(min*1)

Absence of respiratory acidosis

pH <7.32 or a decrease in pH \geq 0.07 units; PaCO₂ >50 mm Hg or an increase in PaCO₂ >8 mm Hg.

Adequate mentation with or without sedation

Cardiac arrhythmias or electrocardiographic signs of ischemia

Criteria for prophylactic non-invasive ventilation applied for up to 48 hours after extubation

Difficult weaning, as defined by initial weaning failure requiring up to three spontaneous breathing trial or as long as 7 days from the first weaning attempt to achieve successful weaning.

Prolonged weaning, as defined by initial weaning failure requiring at least three weaning attempts or require more than 7 days of weaning after the first spontaneous breathing trial.

Cardiac failure, as defined by patients with a NYHA class III (i.e., inability to do the ordinary daily activity) or IV (i.e., presence of symptoms at rest) before the ICU admission.

Upper airways stridor at extubation not requiring immediate re-intubation.

PaO₂/FiO₂, arterial oxygen tension on inspired oxygen fraction ratio; PEEP, positive end-expiratory pressure; PaO₂, arterial oxygen tension; FiO₂, inspired oxygen fraction; PaCO₂, arterial carbon dioxide tension; ICU, intensive care unit.

Institutional weaning protocol part 2 of 2

Post-extubation failure criteria

Respiratory rate >25 breaths/min over at least 2 hours.

Heart rate >140 beats/min or sustained increase or decrease >20%.

Clinical signs of respiratory muscle fatigue (activation of accessory respiratory muscles).

SaO₂ <90%; PaO₂/FiO₂ <250 with FiO₂ ≥0.5.

PaCO₂ >45 mm Hg or ≥ 20% from pre-extubation; pH <7.35.

Criteria for non-invasive ventilation

Non-invasive CPAP: dyspnea and PaO₂/FiO₂ <200 mm Hg.

Non-invasive ventilation: dyspnea with 7.30 >pH <7.35 and 45 mm Hg <PaCO₂ <50 mm Hg.

Criteria for reintubation

Cardiac or respiratory arrest.

Inability to protect airway; coma or psychomotor agitation not controlled by continuous intravenous sedative infusion.

Unmanageable secretions or uncontrolled vomiting.

Life threatening arrhythmias or electrocardiographic signs of ischemia.

Hemodynamic instability (mean arterial pressure <60 mm Hg despite fluids and or low dosage

vasopressors administration).

Intolerance to all interfaces for non-invasive ventilation.

Two of the following: dyspnea, $\text{PaO}_2/\text{FiO}_2 < 200$ mm Hg, and respiratory acidosis ($\text{pH} < 7.30$ and $\text{PaCO}_2 > 50$ mm Hg).

SaO_2 , arterial oxygen saturation, $\text{PaO}_2/\text{FiO}_2$, arterial oxygen tension on inspired oxygen fraction ratio; FiO_2 , inspired oxygen

fraction; PEEP, positive end-expiratory pressure; PaCO_2 , arterial carbon dioxide tension; CPAP, continuous positive end-expiratory pressure.

Supplemental digital content 2. Intra-observer reliability.

| Variable | Pearson Correlation | Bias | 95% CI | Lower limit of agreement | 95% CI | Upper limit of agreement | 95% CI | ICC | 95% CI |
|------------------------------------|---------------------|-------|---------------|--------------------------|---------------|--------------------------|-------------|------|-------------|
| <i>Assessor 1</i> | | | | | | | | | |
| Inspiratory Velocity-Time integral | 0.95 | -0.04 | -0.11 – 0.04 | -0.51 | -0.64 – -0.38 | 0.44 | 0.31 – 0.57 | 0.97 | 0.95 – 0.98 |
| Inspiratory Peak Velocity | 0.97 | -0.06 | -0.14 – 0.02 | 0.54 | -0.67 – -0.40 | 0.41 | 0.28 – 0.55 | 0.98 | 0.97 – 0.99 |
| Inspiratory Mean Velocity | 0.91 | -0.10 | -0.18 – -0.03 | -0.55 | -0.68 – -0.42 | 0.35 | 0.22 – 0.47 | 0.94 | 0.90 – 0.96 |
| Inspiratory Acceleration | 0.84 | -0.53 | -1.30 – 0.25 | -5.26 | -6.59 – -3.93 | 4.21 | 2.88 – 5.54 | 0.91 | 0.86 – 0.94 |
| Expiratory Peak Velocity | 0.93 | 0.01 | -0.10 – 0.11 | -0.61 | -0.78 – -0.44 | 0.62 | 0.45 – 0.79 | 0.96 | 0.94 – 0.98 |
| Expiratory Mean Velocity | 0.83 | -0.08 | -0.15 – -0.01 | -0.49 | -0.61 – 0.38 | 0.33 | 0.22 – 0.45 | 0.86 | 0.78 – 0.91 |
| Expiratory acceleration | 0.84 | -0.28 | -1.26 – 0.70 | -6.28 | -7.97 – -4.60 | 5.73 | 4.04 – 7.42 | 0.92 | 0.87 – 0.95 |
| <i>Assessor 2</i> | | | | | | | | | |
| Inspiratory Velocity-Time integral | 0.91 | 0.01 | -0.09 – 0.10 | -0.58 | -0.74 – -0.41 | 0.59 | 0.42 – 0.75 | 0.95 | 0.92 – 0.97 |
| Inspiratory Peak Velocity | 0.95 | 0.03 | -0.08 – 0.14 | -0.62 | -0.80 – -0.43 | 0.68 | 0.49 – 0.86 | 0.97 | 0.96 – 0.98 |
| Inspiratory Mean Velocity | 0.91 | 0.02 | -0.06 – 0.10 | -0.48 | -0.62 – -0.34 | 0.52 | 0.38 – 0.66 | 0.95 | 0.92 – 0.97 |
| Inspiratory Acceleration | 0.78 | -0.46 | -1.37 – 0.45 | -6.03 | -7.59 – -4.46 | 5.11 | 3.54 – 6.67 | 0.87 | 0.80 – 0.92 |

| | | | | | | | | | |
|--------------------------|------|-------|--------------|-------|---------------|------|-------------|------|-------------|
| Expiratory Peak Velocity | 0.97 | -0.02 | -0.09 – 0.06 | -0.46 | -0.59 – -0.34 | 0.43 | 0.31 – 0.56 | 0.98 | 0.98 – 0.99 |
| Expiratory Mean Velocity | 0.88 | 0.08 | 0.01 – 0.15 | -0.35 | -0.47 – -0.23 | 0.51 | 0.39 – 0.63 | 0.91 | 0.85 – 0.94 |
| Expiratory acceleration | 0.83 | 0.33 | -0.73 – 1.39 | -6.15 | -8.0 – 4.33 | 6.81 | 5.00 – 8.63 | 0.91 | 0.86 – 0.94 |

CI, confidence interval; ICC intraclass correlation coefficient.

Supplemental digital content 3. Inter-observer reliability.

| Variable | Pearson Correlation | Bias | 95% CI | Lower limit of agreement | 95% CI | Upper limit of agreement | 95% CI | ICC | 95% CI |
|------------------------------------|---------------------|-------|---------------|--------------------------|---------------|--------------------------|-------------|------|-------------|
| <i>Assessor 1 – Assessor 2</i> | | | | | | | | | |
| Inspiratory Velocity-Time integral | 0.92 | -0.05 | -0.11 – 0.01 | -0.58 | -0.69 – -0.48 | 0.48 | 0.38 – 0.58 | 0.96 | 0.94 – 0.97 |
| Inspiratory Peak Velocity | 0.95 | -0.10 | -0.17 – -0.03 | -0.75 | -0.87 – -0.62 | 0.54 | 0.42 – 0.67 | 0.97 | 0.95 – 0.98 |
| Inspiratory Mean Velocity | 0.90 | -0.07 | -0.12 – -0.01 | -0.54 | -0.63 – -0.44 | 0.40 | 0.31 – 0.50 | 0.94 | 0.91 – 0.96 |
| Inspiratory Acceleration | 0.90 | -0.08 | -0.51 – 0.35 | -3.86 | -4.59 – -3.12 | 3.70 | 2.96 – 4.43 | 0.95 | 0.92 – 0.97 |
| Expiratory Peak Velocity | 0.93 | -0.15 | -0.23 – -0.08 | -0.79 | -0.92 – -0.67 | 0.49 | 0.36 – 0.61 | 0.95 | 0.93 – 0.97 |
| Expiratory Mean Velocity | 0.77 | -0.08 | -0.13 – -0.02 | -0.57 | -0.66 – -0.47 | 0.41 | 0.31 – 0.50 | 0.85 | 0.76 – 0.91 |
| Expiratory acceleration | 0.80 | -0.08 | -0.51 – 0.35 | -3.86 | -4.59 – -3.12 | 3.70 | 2.96 – 4.43 | 0.89 | 0.83 – 0.93 |

CI, confidence interval; ICC intraclass correlation coefficient.