

# STICU/BICU Mechanical Ventilation Guidelines

I. **Initial ventilator settings:**

- a. Mode: Volume control (VC)
- b. Tidal Volume: 6 ml/kg predicted body weight (PBW)
- c. Rate: individualize based on pH & PaCO<sub>2</sub>.

II. **Ventilator management:**

a. **Ventilation:**

- i. Document plateau pressure every 4 hours and following ventilator changes
- ii. Goal plateau pressure is <30 cm H<sub>2</sub>O
- iii. Decrease tidal volume to 4 ml/kg PBW as needed to keep plateau pressure <30 cm H<sub>2</sub>O
- iv. Increase rate as needed up to 35 breaths/min to maintain pH>7.2 (do not allow PaCO<sub>2</sub> to drop below 30-35). Monitor for breath stacking.

b. **Oxygenation:**

- i. Goal PaO<sub>2</sub> is 60-80 mm Hg. Goal oxygen saturation is >90%
- ii. Increase peep/FiO<sub>2</sub> as needed using the following table:

FiO <sub>2</sub>	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	5	5	8	8	10	10	10	12	14	14	14	16	18	18-24

c. **Airway Pressure Release Ventilation (APRV):**

- i. Consider changing ventilator mode to APRV when patients are requiring an increase in PEEP, have a plateau pressure > 30 cm H<sub>2</sub>O, and are breathing spontaneously.
- ii. Prior to changing modes, determine the patient's mean airway pressure. The initial P high setting should be high enough to increase mean airway approximately 2-3 cm H<sub>2</sub>O higher than the previous mean airway pressure.
- iii. Settings should be individualized based on each patient's clinical status.  
Common initial settings are:
  - 1. P high 20-30 cm H<sub>2</sub>O (try to avoid pressures > 30 cm H<sub>2</sub>O)
  - 2. P low 0-5 cm H<sub>2</sub>O (adjust based on the measured peep with goal of 3-5 cm H<sub>2</sub>O).
  - 3. T high: 3-5 seconds
  - 4. T low: 0.5-1 seconds

d. **Pressure Regulated Volume Control (PRVC):**

- i. Consider changing to PRVC when patients are requiring increase in PEEP, have a plateau pressures are > 30 cm H<sub>2</sub>O, and are not or minimally breathing spontaneously.
- ii. Do NOT use PRVC/SIMV.
- iii. Some patients may require sedation to tolerate the application of PRVC.

- III. Refractory hypoxemia (PaO<sub>2</sub>:FiO<sub>2</sub> ratio <150) and/or plateau pressure >30-35 cm H<sub>2</sub>O on 4 ml/kg PBW in VC or PRVC** (Evaluate and treat causes of hypoxemia and elevated plateau pressure as indicated by clinical condition. These include pneumonia, atelectasis, pulmonary edema, pneumothorax, pleural effusions, and abdominal compartment syndrome)
- a. Initiate continuous sedation with fentanyl and/or propofol. Midazolam may be substituted in hypotensive patients.
  - b. If PaO<sub>2</sub>:FiO<sub>2</sub> ratio <120 or plateau pressure remains above 30-35 cm H<sub>2</sub>O while sedated, initiate neuromuscular blockade (NMB) using either cisatracurium or atracurium x 24-48h. Attempt to stop NMB by 48h. Continuous infusion of fentanyl and propofol required. Midazolam may be substituted in hypotensive patients.
  - c. Consider changing I:E to 1:1 or 2:1
  - d. If PaO<sub>2</sub>: FiO<sub>2</sub> ratio remains < 150, place patients without contraindications in prone position.
    - i. Patients should be turned to the supine position as needed for procedures and then returned to the prone position.
    - ii. When the PaO<sub>2</sub>:FiO<sub>2</sub> ratio remains >150 with FiO<sub>2</sub> ≤60 and PEEP ≤10, attempt to place patient in supine position. If PaO<sub>2</sub>:FiO<sub>2</sub> ratio drops below 150, return to prone position.
    - iii. Ongoing paralysis is not required in prone position. Spontaneous awakening trials should still be performed.
    - iv. Attempts should be made to turn patients every 2 hours and provide routine skin care.
    - v. Contraindications to prone positioning:
      1. Absolute:
        - a. Spinal instability
        - b. Open abdomen
      2. Relative:
        - a. Recent thoracic or abdominal surgery
        - b. Hemodynamic instability
        - c. Cardiac abnormalities (eg, pacemaker)

References:

1. Beitler JR, Shaefi S, Montesi SB, et al. Prone positioning reduces mortality from acute respiratory distress syndrome in the low tidal volume era: a meta-analysis. *Intensive Care Med* 2014; 40:332-341.
2. Guerin C, Reigner J, Richard JC, et al. Prone positioning in severe acute respiratory distress syndrome. *N Engl J Med* 2013;368:2159-2168
3. Higher vs lower positive end-expiratory pressures in patients with the acute respiratory distress syndrome. The National Heart, Lung, and Blood Institute ARDS Clinical Trials Network. *N Engl J Med* 2004;351:327-36.
4. Papain L, Forel JM, Gacouin A, et al. Neuromuscular blockers in early acute respiratory distress syndrome. *N Engl J Med* 2010;363:1107-16.
5. Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome. The Acute Respiratory Distress Syndrome Network. *N Engl J Med* 2000; 342:1301