

	Department:  <b>Respiratory Services</b>	Date Originated: <b>September 2009</b>  Date Reviewed/Revised: <b>April 2011</b>
<b>Clinical Guideline</b>	Topic: <u>Critical Care</u> – Asthma Management - Guidelines for Ventilation (Respiratory Therapy)  Number: B-00-12-12034	Related Links:  <a href="#">B-00-12-12047</a> <a href="#">B-00-12-12045</a>

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#### **APPLICABLE SITES:**

St. Paul's Hospital  
 Mount Saint Joseph Hospital (except where noted)

### **Mode of Ventilation**

#### **Invasive Ventilation:**

- Use protective lung strategy with Vt 6-8 mL/kg (ideal body weight) and pPlat less than 30cmH<sub>2</sub>O<sup>1, 4, 6</sup>
- No conclusive studies recommending volume control vs. pressure control<sup>4</sup>
- Volume control may be preferred because there is less variation in minute volume & therefore potentially more control when administering permissive hypoventilation

#### **Noninvasive Ventilation (NPPV, BiPAP):**

- NPPV/BiPAP is probably not recommended in the setting of acute, severe asthma<sup>3, 4, 11, 15</sup>

### **Minimizing Dynamic Hyperinflation**

#### **Sedation & Analgesia:**

- Patients with acute, severe asthma that require mechanical ventilation should be heavily sedated – this promotes patient-ventilator synchrony and facilitates strategies to limit gas trapping<sup>1, 8</sup>
- May also decrease CO<sub>2</sub> production & therefore decrease ventilation requirements<sup>1</sup>

#### **Neuro Muscular Blockade:**

- Although NMB will promote patient-ventilator synchrony, decrease risk of barotraumas, and decrease CO<sub>2</sub> production, prolonged use (especially with steroid administration) can cause prolonged paralysis and/or myopathy<sup>1, 6, 8</sup>
- Recommended for limited, short-term use only when absolutely necessary<sup>1, 6</sup>

### **Maximize Bronchodilator Therapy:**

- Standard inhaled therapy – salbutamol administered regularly & PRN, ipratropium bromide administered regularly
- May be delivered by MDI (as effective as nebulizer therapy)<sup>11,12</sup>

### **Permissive Hypercapnia / Controlled Hypoventilation:**

- Consider targeting arterial pH around 7.15 (regardless of pCO<sub>2</sub>)
- Decrease minute volume by decreasing RR (most benefit) and/or decreasing Vt (less benefit)<sup>1, 8, 11</sup>

### **Manipulating I:E Ratio:**

- Increasing expiratory time by decreasing insp time (increasing insp flow in volume control or decreasing insp time directly in pressure control)
- Magnitude of effect decreases as minute volume decreases – minimal effect generally seen when minute volume < 10 L/min because of the low end exp flow rates<sup>1, 9</sup>
- Consider changing flow waveform from decelerating to square to decrease insp time

### **Relieving Expiratory Resistance:**

- Maintain bronchial hygiene – suction PRN
- Large bore ETT<sup>1</sup> (this is only a consideration on initial intubation. Do NOT change ETT to insert larger bore ETT, as there is more morbidity associated with this)

### **Measurement / Assessment of AutoPEEP**

- Precise measurement of autoPEEP limited when:
  - Patient is triggering ventilator
  - Patient is actively exhaling
  - When gas is trapped behind collapsed airways not in communication with the rest of the tracheal-bronchial tree and ETT/ventilator circuit<sup>1, 8</sup>

### **Application of External PEEP – Recommendation for Sedated and/or Paralyzed Patients**

- Set ventilator/external PEEP less than or equal to 5cmH<sub>2</sub>O - this may improve gas flow out of the lungs by increasing the pressure gradient between the alveoli and mouth/ETT <sup>1, 4, 11</sup>
- Monitor patient closely for signs of trying to trigger inspiration / patient-ventilator dysynchrony

### **Other Therapies to Consider in Severe Asthma**

If patient shows no improvement or continues to deteriorate despite optimizing more conventional proven therapies, the following may be considered – these require a specific order from the attending physician:

#### **Heliox (\*only available at SPH): [B-00-12-12047](#)**

- Less dense gas – may promote higher flows through airways, thereby decreasing, peak airway pressure, gas trapping, and dynamic hyperinflation <sup>13</sup>
- May only improve pulmonary function (decreased dyspnea, improved gas exchange, decrease pulsus paradoxus) in patients with the most severe air flow obstruction, but probably does not change/improve outcome <sup>1, 6, 7</sup>
- Use with AVEA ventilator (80:20 heliox mixture only) – flows and volumes automatically compensated
- Benefits of heliox decrease as FiO<sub>2</sub> requirements increase – discontinue therapy if FiO<sub>2</sub> greater than or equal to 50% (heliox provides no additional therapeutic benefit at 50:50 ratio or less) <sup>13</sup>
- Limited supply – need to ensure there are enough gas tanks available in ICU & Stores when instituting therapy
- Will go through approx 1 heliox tank / 6 hours (depends on FiO<sub>2</sub> and minute volume)

Note – do **not** use ventilators other than the AVEA with Heliox – not only will flow and volume measurements be affected, but microprocessor failures may result from alterations in gas density (as is the case with the PB840).

#### **Isoflurane (\*only available at SPH):**

- Inhaled anesthetic agent with potent bronchodilation properties (achievable in sub-anesthetic concentrations) <sup>11</sup>
- Requires specific equipment to deliver therapy (S900C or anesthetic gas machine) – exhaled gases must be scavenged

#### **Extracorporeal Life Support (\*only available at SPH):**

- For the treatment of acute, severe, reversible respiratory failure secondary to refractory asthma resulting in life-threatening hypotension and/or barotraumas (secondary to severe, dynamic hyperinflation), severe hypercapnic acidosis<sup>5, 14</sup>
- Consider when other strategies have failed / are failing
- Supportive measure only ("*bridge to recovery of lung function*") – decreases mechanical ventilation requirements (and therefore reduces dynamic hyperinflation by allowing further decreases in minute ventilation) until bronchospasm resolves<sup>14</sup>
- Only reviewed in case reports and small case series

### **Manual Exhalation:**

- Manual compression of chest/thorax in an attempt to decrease dynamic hyperinflation should **NOT** be used<sup>11</sup>
- In very severe dynamic hyperinflation resulting in significant hemodynamic compromise, passive exhalation may have some benefits (removing mechanical ventilation in patient who has no inspiratory effort for up to 60 seconds, allowing patient to passively exhale)

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