Respiratory Mechanisms of Support

Nasal Cannula

Hi Flow Nasal Cannula

CPAP
- Continuous positive airway pressure
- Works like PEEP, but patient must be breathing spontaneously

BIPAP
- Like CPAP, but also uses PIP

Mechanical Ventilation:

<table>
<thead>
<tr>
<th>Volume vs. Pressure</th>
<th>Volume Control</th>
<th>Pressure Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle</td>
<td>Volume</td>
<td>Time or Flow</td>
</tr>
<tr>
<td>Trigger</td>
<td>Child and machine</td>
<td>Child and machine</td>
</tr>
<tr>
<td>Limit</td>
<td>Flow</td>
<td>Pressure</td>
</tr>
<tr>
<td>Tidal Volume</td>
<td>Constant</td>
<td>Variable</td>
</tr>
<tr>
<td>Peak Pressure</td>
<td>Variable</td>
<td>Constant</td>
</tr>
<tr>
<td>Advantages</td>
<td>Constant Tidal Volume</td>
<td>Avoids excessive PIP</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>Risk of barotrauma</td>
<td>Variable tidal volume risks atelectasis</td>
</tr>
</tbody>
</table>

HFOV (high frequency oscillatory ventilation)
- Uses constant mean airway pressure
- MAP affects oxygenation
- Amplitude (Delta P) affects ventilation (CO2 removal)
- Hertz (1 Hz=60 bpm)
- Best for patients with very poor lung compliance and high airway resistance

PEEP (positive end expiratory pressure)
- Recruits alveolar space at the end of expiration

RATE
- Breaths per minute, effects CO2 removal, higher rate=more CO2 removal

PIP (peak inspiratory pressure)
- Amount of pressure required to force air into the lungs

Tidal Volume
- Volume of air inhaled and exhaled with each breath.
- Usually 5-10ml/kg

Inhaled Nitric Oxide (iNO)
- Pulmonary vasodilator
- Check Methemoglobin for toxicity
- Usually 5-20 +ppm

ABG Interpretations
Respiratory Acidosis: ▲ pCO2 ▼pH
*impaired ventilation (example – pneumothorax, mucus plug, pneumonia)
  Treatment: assisted ventilation, position, suction
Respiratory Alkalosis: ▼pCO2 ▲pH
*exaggerated ventilation (example – crying, fever)
   Treatment: reduce ventilation with dead space, decrease rate

Metabolic acidosis: ▼HCO3 ▼pH (ex. – hypoxia, hypotension, diarrhea, TPN, diamox)
   Treatment: improve oxygenation, correct hypotension, bicarb therapy, check Cl in TPN

Metabolic alkalosis: ▲HCO3 ▲pH (ex. – overzealous bicarb therapy, excessive vomiting, diuretics)
   Treatment: electrolyte management, adjust diuretics

These are typical reference ranges, although various analysers and laboratories may employ different ranges.

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Range</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.35 - 7.45</td>
<td>The pH or H⁺ indicates if a patient is acidemic (pH &lt; 7.35; H⁺ &gt;45) or alkalemic (pH &gt; 7.45; H⁺ &lt; 35).</td>
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<tr>
<td>PO₂</td>
<td>80-100 mmHg</td>
<td>A low O₂ indicates that the patient is not respiring properly, and is hypoxemic.</td>
</tr>
<tr>
<td>PCO₂</td>
<td>35-45 mmHg</td>
<td>The carbon dioxide and partial pressure (PCO₂) indicates a respiratory problem: for a constant metabolic rate, the PCO₂ is determined entirely by ventilation. A high PCO₂ (respiratory acidosis) indicates underventilation, a low PCO₂ (respiratory alkalosis) hyper- or overventilation. PCO₂ levels can also become abnormal when the respiratory system is working to compensate for a metabolic issue so as to normalize the blood pH.</td>
</tr>
<tr>
<td>HCO₃⁻</td>
<td>22–26 mmol/l</td>
<td>The HCO₃⁻ ion indicates whether a metabolic problem is present (such as ketoacidosis). A low HCO₃⁻ indicates metabolic acidosis, a high HCO₃⁻ indicates metabolic alkalosis. HCO₃⁻ levels can also become abnormal when the kidneys are working to compensate for a respiratory issue so as to normalize the blood pH.</td>
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<tr>
<td>Base excess</td>
<td>-3 to +3 mmol/l</td>
<td>The base excess is used for the assessment of the metabolic component of acid-base disorders, and indicates whether the patient has metabolic acidosis or metabolic alkalosis. A negative base excess indicates that the patient has metabolic acidosis (primary or secondary to respiratory alkalosis). A positive base excess indicates that the patient has metabolic alkalosis (primary or secondary to respiratory acidosis).</td>
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</tbody>
</table>

Respiratory Support
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