Interfacility Protocol

<table>
<thead>
<tr>
<th>Protocol Title:</th>
<th>Mechanical Ventilator Monitoring &amp; Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Adoption Date:</td>
<td>05/2009</td>
</tr>
<tr>
<td>Past Protocol Updates</td>
<td>05/2009, 12/2013, 03/2015</td>
</tr>
<tr>
<td>Date of Most Recent Update:</td>
<td>01/2019</td>
</tr>
<tr>
<td>Medical Director</td>
<td>Cory Vaudt M.D.</td>
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Purpose:

- Outline the management of ventilatory support with the Hamilton T-1 transport ventilator.

- Advanced transport ventilators provide improved patient ventilation over bag-valve mask ventilation. The use of a ventilator allows for a more consistent minute volume than bag-mask ventilation. Controlled ventilation reduces the risks commonly associated with other forms of ventilation. The use of a transport ventilator will optimize care of critical patients and reduce inadequate ventilation and oxygenation.

- When an ancillary staff member (Nurse, Respiratory Therapist, etc..), accompanies the transport, the Paramedic and the accompanying staff will work collaboratively in providing patient care. If the patient’s condition deteriorates during transport and the accompanying staff is not a Specialty Transport Team Member (Blank Neonate or Pediatric RN, or Life Flight personnel), the Paramedic may assume full responsibility in conjunction with their Medical Director for care that exceeds the accompanying staffs scope of practice and/or is not addressed by the transferring physician’s medical orders. The accompanying personnel shall then, as appropriate, initiate contact with the transferring physician for appropriate intervention orders and when possible notify the receiving facility of the change in patient’s status.
Indications:

- Patients requiring continuous ventilatory assistance.

AT SENDING FACILITY:

1. If patient is already on ventilator:
   a. Ensure that the endotracheal tube is patent, intact, properly positioned, and is adequately secured in place. EtC02 waveform must be used to confirm ETT placement, along with two other means of confirmation.
   b. Place patient on continuous pulse oximetry and capnography if not already done.
   c. Review ventilator settings with sending physician; consider capabilities of transport ventilator when doing so.
   d. Perform circuit check, ensure that the transport ventilator is functioning properly with the same settings as the sending facility is using, and ensure ventilator is ready to be attached to the endotracheal tube.
   e. Detach the endotracheal tube from hospital ventilator and attach transport ventilator to endotracheal tube.
   f. Verify breath sounds and chest rise remain present bilaterally and there are no significant changes in vital signs. Monitor EtCO2 waveform.

2. If patient is not on ventilator:
   a. Ensure that the endotracheal tube is patent, intact, properly positioned, and is adequately secured in place. EtC02 waveform must be used to confirm ETT placement, along with two other means of confirmation.
   b. Place patient on continuous pulse oximetry and capnography if not already done.
   c. Perform circuit check, ensure that the transport ventilator is functioning properly, and set settings as follows for patients >10 kg:
      i. Mode:
         1. ACVM
         2. Volume Control
      ii. Rate: Adults: 10-14; Child: 16-20
      iii. Tidal Volume: 6-8 ml/kg using patients ideal body weight
      iv. PEEP: 5 cmH20
      v. FiO2: Adjust to maintain oxygen saturations >90%
   d. Detach the endotracheal tube from bag-valve and attach transport ventilator to endotracheal tube.
   e. Verify breath sounds and chest rise remain present bilaterally and there are no significant changes in vital signs. Monitor EtCO2 waveform.
**DURING TRANSPORT:**
- Continuously monitor airway, breath sounds, chest rise, vital signs, oxygen saturation, capnography and ventilator function.
  - Maintain ETCO2 between 30-45 mmhg, adjust rate to maintain this
  - Maintain oxygen saturations above 90%, adjust FiO2 as needed
    - If low SpO2 persists and FiO2 is 100% consider adjusting PEEP to no more than 10 mmH20.
- In the event of mechanical failure which cannot readily be corrected, detach endotracheal tube from ventilator and perform manual ventilation with bag-valve device.
  - Consider DOPE: Displacement, Obstruction, Pneumothorax, & Equipment malfunction
    - Low Peak Pressures –
      - Consider pulmonary embolism, circuit leak, cuff leak, extubation, inadequate volume or patient overbreathing the ventilator
    - High Peak Pressures – Airway Resistance Issue or Compliance Issue
      - Sedation Level – Refer to continued sedation protocol
      - Consider kinked tubing - Unkink
      - Bronchoconstriction - Bronchodilators
      - Mucous Plug - Suction
      - ARDS/ALI – PEEP
      - Auto PEEP – Bronchodilators
      - Abdominal Pressures – Gastric Tube
      - Pneumothorax – Needle Decompression
      - CHF – Refer to CHF Protocol
  - Consider using PEEP valve on bag-valve mask if patient was requiring PEEP on ventilator

**AFTER TRANSPORT:**
- Record type and model of transport ventilator used, ventilator settings employed, and the oxygen saturation and capnography measurements obtained during transport, as well as any changes in patient condition, modifications in ventilator settings and unusual incidents occurring enroute on the PCR.

**Special Considerations**
- **Alarm settings:**
  - High Pressure Limit: 10-15 cm H2O over PIP
  - Low Pressure Limit: 5-10 cm H2O less than PIP
  - Low Minute Volume: 10-20% less than VE
  - Apnea: 20 Seconds
  - High PEEP: This is automatic on T-1, otherwise: 5-10 cm H2O over set PEEP
  - High Rate Alarm 10-20 Bpm over normal awake breath rate

- If you are not familiar with the type of transport ventilator being used or do not feel comfortable with the ventilator settings prescribed by the sending physician, do not attempt transport. If needed contact Shift Supervisor, Assistant Chief, or other Administrative Staff member for further instructions.

**Tracheostomy Tubes**
- In patients being ventilated via tracheostomy tubes rather than endotracheal tubes, exercise special care in detachment and attachment of ventilator circuits to avoid dislodgment of cannulas.
- Thick secretions are typically present in patients being ventilated via tracheostomy tubes and may require that saline solution and sterile suctioning technique be used.

**Pediatric Patients**
- **Do NOT** use a volume-cycled transport ventilator for an infant or small child who requires a pressure-cycled ventilator unless specifically prescribed by the physician.
- Un-cuffed ET Tubes are used in ventilating infants and small children, increasing the risk of dislodgement during transport.

**RESOURCES:**

If needed, a Unity Point Respiratory Therapist can be contacted by using the following numbers:
Adult CCU Therapist: 515-333-7007
PICU Therapist: 515-333-7005
Appendix A

Ideal Body Weight Chart

<table>
<thead>
<tr>
<th>Height (feet)</th>
<th>MALE IBW (kg)</th>
<th>Tidal Volume</th>
<th>FEMALE IBW (kg)</th>
<th>Tidal Volume</th>
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</thead>
<tbody>
<tr>
<td>5' 0&quot;</td>
<td>50</td>
<td>300</td>
<td>45.5</td>
<td>273</td>
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<tr>
<td>5' 1&quot;</td>
<td>52.3</td>
<td>313.8</td>
<td>47.8</td>
<td>286.8</td>
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<tr>
<td>5' 2&quot;</td>
<td>54.6</td>
<td>327.6</td>
<td>50.1</td>
<td>300.6</td>
</tr>
<tr>
<td>5' 3&quot;</td>
<td>56.9</td>
<td>341.4</td>
<td>52.4</td>
<td>314.4</td>
</tr>
<tr>
<td>5' 4&quot;</td>
<td>59.2</td>
<td>355.2</td>
<td>54.7</td>
<td>328.2</td>
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<tr>
<td>5' 5&quot;</td>
<td>61.5</td>
<td>369</td>
<td>57</td>
<td>342</td>
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<tr>
<td>5' 6&quot;</td>
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<td>382.8</td>
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<td>66.2</td>
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<td>73.1</td>
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<td>479.4</td>
<td>75.4</td>
<td>452.4</td>
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<td>493.2</td>
<td>77.7</td>
<td>466.2</td>
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<td>89.2</td>
<td>535.2</td>
</tr>
</tbody>
</table>

Appendix B

Riker Sedation-Agitation Scale (SAS)

Score Term Descriptor

7 Dangerous Pulling at ET tube, trying to remove catheters, climbing over bedrail, Agitation striking at staff, thrashing side-to-side
<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Very Agitated</td>
<td>Requiring restraint and frequent verbal reminding of limits, biting ETT</td>
</tr>
<tr>
<td>5 Agitated</td>
<td>Anxious or physically agitated, calms to verbal instructions</td>
</tr>
<tr>
<td>4 Calm and Cooperative</td>
<td>Calm, easily arousable, follows commands</td>
</tr>
<tr>
<td>3 Sedated</td>
<td>Difficult to arouse but awakens to verbal stimuli or gentle shaking, follows simple commands but drifts off again</td>
</tr>
<tr>
<td>2 Very Sedated</td>
<td>Arouses to physical stimuli but does not communicate or follow commands, may move spontaneously</td>
</tr>
<tr>
<td>1 Unarousable</td>
<td>Minimal or no response to noxious stimuli, does not communicate or follow commands</td>
</tr>
</tbody>
</table>

**Guidelines for SAS Assessment**

1. Agitated patients are scored by their most severe degree of agitation as described
2. If patient is awake or awakens easily to voice (“awaken” means responds with voice or head shaking to a question or follows commands), that’s a SAS 4 (same as calm and appropriate – might even be napping).
3. If more stimuli such as shaking is required but patient eventually does awaken, that’s SAS 3.
4. If patient arouses to stronger physical stimuli (may be noxious) but never awakens to the point of responding yes/no or following commands, that’s a SAS 2.
5. Little or no response to noxious physical stimuli represents a SAS 1.

This helps separate sedated patients into those you can eventually wake up (SAS 3), those you can't awaken but can arouse (SAS 2), and those you can’t arouse (SAS 1).

4. Validating the Sedation-Agitation Scale with the bispectral index and visual analog scale in adult ICU patients after cardiac surgery. Intensive Care Med 2001; 27:853-858.