Operating Instructions for High Frequency Oscillatory Ventilation (HFOV)

Purpose
To provide guidelines for the initiation of therapy and troubleshooting for the Sensormedics 3100A High Frequency Oscillatory Ventilator.

Audience
Physicians, Nursing staff, and Licensed Respiratory Care Practitioners.

Scope
The Sensormedics 3100A Oscillatory Ventilator is indicated for ventilatory support and treatment of respiratory failure and barotrauma in neonates who weigh between .540 and 4.6 kilograms and who are between 24 and 43 weeks gestational age.

The Sensormedics 3100B Oscillatory Ventilator is approved for the treatment of acute respiratory failure in adults and children weighing >35kg.

Accountability
Licensed Respiratory Care Practitioners with understanding of age specific requirements of patient populations.

Special Training
Competency-Based training in the proper application and therapeutic use of High Frequency Oscillatory Ventilation.

Physician's Order
Physician orders must include the following:
- Mean Airway Pressure (MAP)
- Amplitude (Delta P)
- Hertz (Hz)
- FiO₂
- Inspiratory Time (I.T.)

Indications
Neonatal Respiratory Distress Syndrome
Persistent Pulmonary Hypertension
Meconium Aspiration Syndrome
Congenital Diaphragmatic Hernia
Neonatal Lung Hypoplasia
Neonatal Air Leak Syndrome
Adult and Pediatric Acute Respiratory Failure

Goals
Improve and maintain oxygenation
Eliminate CO₂ retention
Create less lung injury

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Adverse Effects

The adverse effects associated with high frequency oscillatory ventilation can be divided into three categories:

**Pulmonary Barotrauma:**
Lung over-distention
Bronchopulmonary dysplasia

Atelectasis
Pneumothorax
Pneumopericardium
Pneumomediastinum
Pneumoperitoneum
Pulmonary interstitial emphysema

**Cardiovascular Effects:**
Decreased venous return
Decreased cardiac output
Increased pulmonary vascular resistance
Intraventricular hemorrhage

**Removal of natural defense mechanisms with intubation:**
Contamination of ventilator circuits
Contamination through suctioning
Vocal cord paralysis, tracheal stenosis, Tracheomalacia, tracheal-esophageal fistula
Necrotizing Tracheobronchitis

Equipment

One Sensormedics 3100A or 3100B High Frequency Oscillator Ventilator
One high-output humidifier with temperature feedback circuit.
One disposable breathing circuit with heated wire.
One manual water-feed system.
One Oxygen/ Air Blender with 50 psi connections
One Oxygen line with 50 psi connection (to drive bias gas flow)
One Air line with 50 psi connection (to connect to the air cooling inlet)

Procedure

Refer to the appropriate equipment manual for assembly instructions.

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<td>1</td>
<td>Assemble the Sensormedic circuit as per diagram (Appendix I).</td>
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| 2    | • Connect oxygen line from the 50-psi outlet on the external Air/ Oxygen blender to inlet on the rear panel of the 3100A ventilator.  
• Attach external Air/ Oxygen blender lines to the appropriate 50-psi wall source. |

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• Attach air line from cooling inlet to an appropriate 50-psi wall source.

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| 3    | **Perform circuit calibration:**  
  • Insert stopper into the patient Y connection.  
  • Turn Bias gas flow to 20 LPM.  
  • Turn on the power.  
  • Adjust **Mean Pressure Limit** to max.  
  • Turn **Mean Pressure Adjust** to max.  
  • Depress and hold reset.  
  • Observe MAP display for a reading of 39-43 cm H₂O. Adjust bias gas flow slightly to achieve this pressure if necessary. Failure to achieve this MAP indicates a leak in the circuit. Refer to troubleshooting section. |

| 4    | **Initiating treatment:**  
  • Start oscillator  
  • Set Frequency (Hz) to desired rate.  
  • Check that **Inspiratory Time** (I.T.) is set at 33%, unless otherwise directed by physician.  
  • Adjust the Power knob to desired level.  
  • For preterm infants, decrease bias flow to a minimum of 10L/min or until desired MAP is achieved. Use adjust knob to lower MAP once bias flow is at 10L/min (term infants and pediatric patients may require bias flow of 20L/min to ensure adequate gas flow; in these patients use the adjust know to set MAP).  
  • Set pressure alarms 4 cm H₂O above and below the set MAP.  
  • Check inspired FiO₂ levels from the Air/ Oxygen blender on the side of the oscillator using a calibrated oxygen analyzer.  
  • Press start to begin HFOV once connected to the patient’s endotracheal tube.  
  • Adjust Piston Control to keep piston in a central position (**3100A only**)  
  • Turn humidifier on and set in the invasive humidification mode. |
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| 5    | **Troubleshooting during circuit calibration:**  
  - Check that the water trap is closed.  
  - Check that Bias Gas Flow is on 20 LPM. Increase Bias Flow slightly.  
  - Remove and check the limit, control, and dump cap/diaphragm valves. Replace valves if circuit still fails to calibrate.  
  - Replace circuit if it cannot be calibrated to 39-43 cm H₂O.  
  - If there has been a disconnection, push reset/power and hold until oscillations resume. |

**Patient Management during HFOV**

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| 1    | **Positioning:**  
  - The Oscillator should be placed at the head of the patient’s bed.  
  - The brakes should be on at all times.  
  - Use of an adult Bodai adapter allows for proper positioning and turning during patient therapy. |
| 2    | **Patient Repositioning:**  
  - Patients should be individually assessed for frequency of repositioning.  
  - When patient is stable, patients should be repositioned every 2-4 hours. Repositioning is to be done only at physician direction.  
  - A respiratory therapist will be present for all major repositioning of the infant (**ISCU only**)  
  - Avoid disconnection during repositioning.  
  **Caution:** Inadvertent disconnection from HFOV can cause alveolar collapse and loss of lung volume. |
| 3    | **Suctioning:**  
  In-line suction catheters will be used on patients during HFOV in order to maintain MAP.  
  **Suction is done on an as needed basis only, unless otherwise directed by the physician.** |
Assessment of Outcome

- Arterial, Venous and Capillary Blood Gas Values
- Pulse oximetry
- Chest x-rays (optimal lung inflation is 8.5 – 9 ribs)
- Sputum: Culture, amount, color, consistency

Infection Control

Follow procedures outlined in Healthcare Epidemiology Policies and Procedures #2.24; Respiratory Care Services.


Safety Precautions

Oxygen safety techniques as outlined in section 3.6 of this manual will be followed.

All alarms on ventilators will be activated at all times

References

Sensormedic High Frequency Oscillatory Ventilator Operating Manual.


