

Inter-Facility Transfer Portable Ventilator Procedure

Policy Number: **XXX**

Effective Date: **XXXXXXXXXX**

Revision Date: **XXXXXX**

I. Purpose

Ventilators are used to provide respiratory support for patients who are unable to effectively breathe on their own. There are many commercial ventilators on the market. Most of the ventilators used in the pre-hospital settings are fairly simple to use. Most if not all have built-in safety features, which prevent over inflating the lungs causing barotrauma. Paramedics must complete an EMS Division approved training course prior to use.

II. Indication

Continuation of ventilator controlled respirations on chronic ventilator dependent patients during inter-facility transfers.

III. Contraindication

1. Hemodynamically unstable patient
2. Intubated patient WITH a known pneumothorax WITHOUT a chest tube.
3. Patient without adequate sedation/analgesia.

IV. Adverse Effects/Complications

1. Increased intra-thoracic pressure
2. Decrease venous return to the heart and decrease cardiac output (hypotension, tachycardia)
3. Increased V/Q ratio (ventilation/perfusion ratio)
4. Decrease blood flow to the kidney with resultant fluid retention (edema)
5. Air trapping and intrinsic PEEP (auto PEEP)
6. Barotrauma
7. Nosocomial infections of the lungs and sinuses
8. Respiratory alkalosis
9. Agitation and increased respiratory distress
10. Increased work of breathing

V. General Ventilator settings for transport ventilators:

For the most part, there are a few settings that are common/standard to all ventilators:

1. **FIO₂** (Percent of inspired oxygen (room air is 21%): **21% - 100%**. Titrate to maintain pulse ox between 92% - 94%
2. **Tidal Volume: 6 - 8 ml/kg** (ideal body weight)

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3. **Select Mode:** CPAP, Intermittent mandatory ventilation (IMV), Synchronized Intermittent mandatory ventilation (SIMV)
 - a. To manage work of breathing, use assist/control mode. If patient is paralyzed and sedated, there is no difference between assist control AC and SIMV

4. **Respiratory rate: Set between 10 – 16 breaths/minute.** Selection varies on ventilators to accommodate a range of patient ages and conditions.

NOTE: On some ventilators, inspiratory flow rate (usually 40 – 60 L/second) is determined by tidal volume, respiratory rate, and in the inspiratory: expiratory (I:E) ratio. (The I:E ratio is generally 1:2 to allow for complete exhalation and prevent air trapping). On other ventilators, flow rate is independently set, which allows adjustment of air-flow to the flow wave pattern that is most comfortable for the patient. If the patient is having difficulty with spontaneous breathing, increasing the flow rate may be indicated. However, a higher flow rate means a shorter inspiratory time and usually a higher respiratory pressure secondary to increased resistance, with a lower flow rate requiring a longer inspiratory time with a decreased inspiratory pressure. The paramedic should always consult with medical control before changing the flow rate on any ventilator device.

5. **Adjust the peak flow rate or inspiratory time** to accommodate the patients inspiratory flow demand and to allow for sufficient expiratory time and avoidance of auto-PEEP
6. **Adjust the sensitivity to -1cm H₂O**
7. **Pressure support:** Usually set at **10 cm H₂O**
8. **PEEP (Positive End Expiratory Pressure): Usual setting is 5 cm H₂O**
9. **End Tidal CO₂:** ET_{CO}₂ less than 35 mmHg=Hyperventilation/Hypocapnia
ET_{CO}₂ greater than 45mmHg=Hypoventilation/Hypercapnia
10. **Plateau Pressure:** Less than 30cm H₂O

VI. Procedure:

Patient is already on Ventilator

1. As part of your initial patient assessment inquire if patient has any spontaneous respiratory effort or is 100% dependent on the ventilator
2. Make note of patient's vital signs before any change over occurs. This includes the pulse ox.
3. Assess the ET tube or Tracheal tube placement to assure they are properly secured

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4. Acquire the patient's current ventilator settings from the nurse or RT caring for the patient. Try to match these settings on the transport ventilator to be used (do this before patient is switched to transport ventilator).
 - a. If unable to match the settings and there is a significant discrepancy, contact the sending physician for assistance.
5. Patient should already be on cardiac monitor and pulse ox prior to switching ventilators.
6. Ensure adequate analgesia and sedation. Continued analgesia and sedation methods during transport must be within the paramedic scope of practice.
7. IV access shall be established prior to transport.
8. Have an Ambu-Bag and suction available for unexpected emergencies
9. Switch patient over to the transport ventilator and end tidal CO₂ monitor and observe for any distress. It may take a minute or so for the patient to become accustomed to the new ventilator. If necessary, ventilate with an Ambu-Bag for several minutes.
10. Closely monitor pulse ox, capnography, signs of labored respirations, and chest rise for any signs of hypoxia/distress. Remove patient from ventilator and assist respirations with an Ambu-Bag if there are ANY concerns or problems with ventilation after patient was switched to transport ventilator.
11. Once patient has been switched to the transport ventilator and is tolerating this well, then move patient over to the EMS stretcher for transport.
12. The patient shall remain on continuous waveform capnography for the entirety of the transport.
13. If alarm on ventilator sounds, immediately check patient. Reasons for alarm:
 - a. Low Battery/power source: sounds when electrical supply to the ventilator is inadequate or the gas inlet pressure is low. It is corrected by restoring the proper power supply.
 - b. Low-pressure alarm:
 - i. Leak or disconnection (reconnect or tighten connections)
 - ii. Cuffed tube may be leaking
 - iii. Check O₂ supply
 - c. High-pressure alarm:
 - i. Ventilator uses too much pressure to deliver the tidal volume

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- 1) Bronchospasm's
 - 2) Secretions in airway that increased the resistance/pressure in airway (suction airway)
 - 3) Kinks in ET tube (unkink tube)
 - 4) Biting on ET tube
 - 5) Coughing
 - 6) Gagging
 - 7) Breathing asynchronously or bucking the vent
 - 8) Alveolar over distention
 - 9) Improper ventilator settings (High or low tidal volumes, excessive rate causing stacking and auto PEEP) (Consult medical control for change)
 - 10) Water in the ventilator tubing (disconnect the tubing, empty water, reconnect tubing)
 - 11) Pneumothorax (notify hospital to set up for this if you are in route)
 - 12) Patient anxiety (contact medical control for sedation order)
- d. If unable to identify the cause of the ventilator alarm and/or patient's condition deteriorates, disconnect from ventilator and assist respirations via the Ambu-Bag.
 - e. Contact Base Hospital, if needed, for assistance while transporting.
14. During transport vital signs should be repeated every 5 minutes with reassessment of vent settings, capnography, pulse ox, as well as assessing patient for lung sounds, chest rise and fall, condensation in the tube, etc.
 15. Upon arrival at the care facility, follow above steps when transferring from EMS stretcher to care facility stretcher. Report any problems to the accepting staff.
 16. Document vent settings used, vital signs, pulse ox, any changes in the patient's condition during transport.
 17. Contact medical control during any of the above steps for assistance as needed.
 18. All instances where a Mechanical Ventilator is used shall be reviewed for QI purposes.