CONTINUOUS MECHANICAL VENTILATION

Purpose: To provide general guidelines concerning the application of mechanical ventilation.

Goals: Primary Clinical Objectives

1. To reverse hypoxemia through increasing alveolar ventilation, increasing lung volume, decreasing O2 consumption, or other measures.
2. To reverse acute respiratory acidosis (not necessarily through achieving a normal arterial PCO2).
3. To relieve respiratory distress while the primary disease process reverses or improves.
4. To prevent or reverse atelectasis.
5. To reverse ventilatory muscle fatigue.
6. To permit sedation and/or neuromuscular blockade as in certain ICU procedures and in certain disease states.
7. To decrease systemic or myocardial oxygen consumption when the work of breathing or other muscular activity impairs systemic O2 delivery or produces an overload of the compromised heart.
8. In certain circumstances to lower elevated intracranial pressure.
9. To stabilize the chest wall in the circumstance of loss of thoracic integrity such as flail chest.

Location of Care:

Continuous mechanical ventilation will only be provided in a critical care unit or in the emergency department. Mechanical ventilation may accompany patients to diagnostic procedure units when accompanied by the respiratory therapist. Continuous mechanical ventilation shall not be provided in any other settings unless it is as a temporary measure while an ICU or ER bed is being made available, and only if a medical staff member remains with the patient until the patient is relocated.

Hazards/Complications:

Improperly set or improperly monitored parameters may lead to;

1. Barotrauma including subcutaneous emphysema, pneumomediastinum, pneumopericardium, pneumoperitoneum, and pneumothorax.
2. Oxygen toxicity.
3. Cardiovascular complications, hemodynamic compromise.
4. Patient-ventilator asynchrony which in turn may increase work of breathing.

Noncardiopulmonary complications may include;

1. Psychological distress due to impaired sleep quality, pain, fear, inability to communicate, and the use of medications.
2. Renal dysfunction as a result of decreased circulating blood volume in response to positive ventilation pressures.
3. Gastrointestinal consequences including gut distension from air swallowing, vomiting, mucosal ulceration.
4. Increased intrathoracic pressures can elevate jugular venous and intracranial pressures, and thereby reduce cerebral perfusion pressure.
Other complications not cause-effect related from mechanical ventilation include;

1. Pulmonary infection
2. Failure to detect a malfunctioning mechanical ventilator as a direct result of improperly set or non-functioning alarm systems.

Personnel: Respiratory Care Technicians I and II and Respiratory Therapists I and II are solely responsible for maintaining and monitoring mechanical ventilation as directed by physician order or physician order protocols. Other personnel, and physicians not trained in mechanical ventilation, should not manipulate ventilator parameters. Nursing staff in the intensive care units will be provided training in order to make FIO2 adjustments and remove the patient from the ventilator in emergency situations.

Criteria for physician’s orders:

These control parameters will be delivered as ordered by the physician either through specific orders or pre-approved protocols. The respiratory therapist will monitor and titrate other parameter adjuncts such as flow characteristics and inspiratory and expiratory cycling mechanisms to best serve patient-ventilator synchrony.

1. Written order for mechanical ventilation.
2. Parameter settings:
   a. Mode.
   b. Concentration of oxygen to be delivered.
   c. Frequency of breaths per minute.
   d. Tidal volume or inspiratory pressure.
   e. Pressure support.
   f. Positive end expiratory pressure.
   g. Inspiratory time for pressure control modes.
   h. Pause time.

Procedure:

1. A ventilator pre-use check is performed prior to use. See ventilator specific policies or operator manual for guidelines.
2. Attach all circuit components including circuit, inspiratory and expiratory filters, and HME or heated humidity system.
3. Set ventilator parameters as obtained from the physician order or according to appropriate ventilator protocol orders.
4. Check and monitor the following after initiation:
   a. Breath sounds
   b. Respiratory rate/pattern
   c. Cardiac rhythm/rate
   d. Blood pressure
   e. Overall appearance of patient
   f. Artificial airway placement and securement
5. Alarm systems on the ventilator must be incorporated and activated for safe operation at all times. Refer to procedure "Guidelines for Establishing and Maintaining Alarm Settings".
6. Ventilator management is continued as per protocol and/or on-going physician assessment and his/her orders.
7. For the purpose of assuring proper operation of the ventilator per parameters as ordered by the physician, to verify that appropriate alarms are activated, and to evaluate the patient’s response to mechanical ventilation, a patient-ventilator systems check shall be performed at least Q4 hours and:
a. Upon initiation of the ventilator and re-initiation after interruptions in ventilation (i.e. transport to a special procedure, T-tube trial, bronchoscopy).
b. Prior to obtaining a blood gas sample.
c. Following any change in ventilator settings.
d. As soon as possible after an acute deterioration of the patient’s condition.
e. Anytime that ventilator performance is questionable.
f. **NOTE:** Q2 hour vent checks will be maintained when correcting Vt for compressible circuit volume.

A patient-ventilator systems check shall include:

a. Documentation of all ventilator settings and assurance of compliance with physician orders.
b. Documentation of appropriately set alarms.
c. Documentation of spontaneous patient parameters and patient monitors (i.e. pulse oximetry, ETCO2, hemodynamics, lung mechanics, blood gas results).
d. Drainage of condensate from the ventilator tubing.
e. Checking humidification/temperature of patient system.
f. Assessment of patency of artificial airway and need for suctioning.

8. Documentation of the following shall be done at least once per 8 hour shift in conjunction with assessment of the patient on mechanical ventilation:

a. Current diagnosis relating to reason requiring mechanical ventilation.
b. Chest X-ray findings.
c. Type and size of artificial airway, placement as seen on chest X-ray.
d. Security of tube holder, whether tube holder was changed, and cm marking at which tube is secured.
e. Airway cuff pressure maintained at $\leq 25 \text{ cmH2O}$ or “minimal leak” technique to maintain seal.
f. Analysis of FiO2 if ventilator is not equipped with continuous FiO2 analyzer.
g. Pulse ox probe site change.
h. Documentation of current treatments and verification of physician orders.

9. A brief narrative assessment of clinical observations indicative of the patient’s response to mechanical ventilation and/or therapy shall be documented at least twice per 8 hour shift or with any patient therapy or clinical intervention. This assessment can include, but is not limited to:

- breath sounds, heart rate, therapy toleration
- spontaneous rate, volume, pattern, chest motion
- patient’s level of consciousness
- secretions
- patient-ventilator synchrony
- current ventilator strategy or decision made per protocols.

**NOTE:** Any assessment of a patient respiratory event or deterioration of respiratory status (i.e. decrease in SpO2 or increased WOB during ventilator weaning) shall be communicated to the patient’s attending nurse and physician. It is the primary responsibility of the Respiratory Therapist to insure that such information is communicated to the physician and that follow up action, as directed by the physician, is taken.
10. All ventilator and treatment orders should be updated and reviewed every 7 days or as needed. Notification stickers are placed on the front of the chart or the physician is contacted as needed.

Infection Control: All patient circuit items are single patient use. Some internal ventilator components that are exposed to patient exhalation are re-usable and are processed between patients. Ventilator specific procedures are described in the Infection Control policy section.

References:

2. Medical Records documentation guidelines.
3. Infection Control Committee
4. AARC Clinical Practice Guidelines

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