NURSING DEPARTMENT
CRITICAL CARE POLICY MANUAL
MECHANICAL VENTILATION: INITIATION & MAINTENANCE

I. PROCEDURE:

To provide mechanical support of ventilation.

II. SKILL LEVEL: Anesthetist, Anesthesiologist, M.D., Respiratory Therapy (Critical Care Registered Nurse to Assist)

III. POLICY:

A. A physician order is required to initiate mechanical ventilator support.

B. Physicians or nurse will not adjust ventilator settings, except in emergency situations and when Respiratory Care personnel are not immediately available. In such situations, the physician or nurses (at the request of the physician) may make such changes and inform Respiratory personnel immediately.

C. The head of the bed will remain elevated at a minimum of 30 degrees.

D. Mouth care will be performed every 2 hours with CHG mouth care BID.

E. Hand hygiene.
IV. **EQUIPMENT:**
- Mechanical Ventilator with breathing circuit (volume ventilators are used most frequently)
- Oxygen tubing with adaptor and flow meter.
- Oxygen and air sources (pressurized at 50 pounds per square inch) (psi)
- BVM (bag/valve/mask) or “ambu bag”
- Stethoscope
- Suction apparatus and suction catheters
- Endotracheal tube holder
- Crash cart or airway toolbox

V. **PROCEDURE & *POINTS OF EMPHASIS:***

A. If not previously done, intubate patient.

*Ventilation is accomplished through positive pressure and, therefore, cuffed tube is required.*

B. Selection of ventilator, type, mode, and settings may be done jointly by physician and Respiratory Therapist. Consideration needs to be given to the patient’s diagnosis, and the expected length of time patient will require assisted ventilation.

*Most frequently used in critical care setting is positive-pressure volume-cycle ventilator. This allows a more accurate delivery of specified tidal volume with inspiration ending when a preset volume is delivered.*

**Note:** The more frequently used modes are:
- Assist control (AC): a preset total volume is delivered with each cycle set at a rate, but the patient may initiate breaths beyond that rate and receive the set tidal volume with each inspiration.

- Intermittent mandatory ventilation (IMV): is the same as AC except that the inspirations initiated by the patient deliver a tidal volume determined by his own inspiration effort; is used as a weaning mode.

- Synchronized intermittent mandatory ventilation (SIMV): is same as IMV except that ventilator breaths are synchronized with the patient’s own inspiration effort and the ventilator breath is inhibited; is used as a weaning mode.
• Continuous positive airway pressure (CPAP): a continuous pressure of approximately 5-15 cm H₂O is applied to keep the alveoli expanded, the tidal volume and respiratory rate are set by the patient; is used as weaning mode or in combination with IMV.

• Pressure support ventilation: patient initiates each breath and the ventilator augments each breath with set amount of positive pressure; patient determines rate and total volume but machine can augment volume; used in patient having difficulty with standard weaning methods.

• Positive end-expiratory pressure (PEEP): used to supplement other modes such as CMV, AC, and IMV; allows low FIO2 by maintaining low positive pressure in lungs (5-20 cm H₂O pressure); may cause hemodynamic compromise. Ventilator settings to be given by the physician, if the physician is not available set ventilator at: Tidal volume 6m/kg per body weight. A/C 14 FO₂ 100 until physician can be contacted.

C. Ready crash cart and intubation equipment.

D. Continue to administer O₂.
*This is to prevent hypoxia.

E. Obtain order for sedation and administer if necessary.
*To facilitate visualization of pharynx and vocal cords.

F. Remove Headboard
Flatten Head of Bed
Remove Pillow, Dentures
Explain procedure again and reassure patient.
Patient is intubated by anesthetist or M.D.
Bag patient until connected to ventilator.
Suction via endotube.
*Use sterile technique.

G. Secure endotube with endotracheal tube holder.

H. Recheck ventilator settings.
I. Determine tube position by feeling over tube top for warm exhalations, listen for air movement, observe chest expansion and auscultate for bilateral breath sounds. Obtain stat CXR.
*If tube is misplaced, patient’s abdomen will distend, or patient may belch. If breath sounds are only heard on the right side, then the tube is probably in the right bronchus. If patient is coughing and fighting, the tube is probably resting on the carina.

J. Check vital signs and monitor.
*Intubation causes transient cardiac arrhythmias. A change in intrathoracic pressures will change the patient’s vital signs and decrease cardiac output.

K. All ventilator settings are ordered by the Physician and initiated by the Respiratory Therapist.

L. The Respiratory Therapist will check all functions and alarms and make sure they are functioning.
*Alarms are never turned off. They are used to warn caregivers of high or low pressures in the system caused by multiple factors, such as a disconnect or a mucous plug.

M. Connect patient to the ventilator and initiate mechanical ventilation.
*Check all connections and make sure they are secure.

N. Stay with the patient until calm and stable.
*Patient’s anxiety, acute at first, can increase his O₂ consumption and create hypoxia.

O. Elevate head of bed 30 degrees or greater unless contraindicated.
*To facilitate lung expansion and to prevent ventilator acquired pneumonia.

VI. DOCUMENTATION:
Patient Progress Record

VII. MAINTENANCE OF PATIENT ON MECHANICAL VENTILATOR:
PROCEDURE AND *POINTS OF EMPHASIS:

A. Perform routine assessment of patient by checking breath sounds, respiratory rate; measuring while on ventilator the tidal volume and vital capacity, negative inspiratory pressure and effective or static compliance.
*These parameters may be measured by the respiratory therapist, but the nurse caring for the patient needs to be aware of these readings and any changes from baseline.
B. Provide thorough tracheobronchial hygiene, turn patient every two hours.
*These measures help prevent atelectasis.*

C. Provide good, routine mouth care. Change bite block or oropharyngeal airway daily.
*Helps ensure patient comfort and lessens chance of iatrogenic infection.*

D. Suction airway as needed following sterile technique.
*Regular suctioning lessens risk of infection and atelectasis.*

E. Auscultate chest carefully and regularly (at least every 2 hours) to determine need for suctioning, displacement of tube, or development of subcutaneous emphysema and pneumothorax.
*The last two complications are more likely to occur if trauma has occurred to airway or visceral pleura that allows leak with the positive pressure ventilation. Clearly, the patient on PEEP is at higher risk for development of this condition.*

F. The tachypneic patient who is developing hypocapnia can have the PCO$_2$ raised by adding additional tubing to the ventilator set-up, or being given medication to lower the respiratory rate.
*Suppression of respiratory drive will reduce the exhalation of CO$_2$. The addition of tubing between the inspiratory arm of the ventilating circuit and the patient’s airway causes the patient to rebreathe part of his expired CO$_2$."

G. The patient may overdrive the ventilator when tachypneic, leading to fatigue and reduced oxygen consumption; or “buck” the respirator because of restlessness or agitation secondary to fear, or other reasons. Drugs to suppress the respiratory drive and frequent reassurance and explanations need to be given to patient. Also, check for all possible causes of patient’s agitation, i.e., improper tube placement, kinking of tube, pneumothorax...
*Medication can be given to the patient in either of these instances, allowing the ventilator to deliver the oxygen and preventing fatigue and other complications from occurring. Narcotics suppress respiration and relieve anxiety. Neuromuscular blocking agents paralyze the respiratory muscles but do nothing for the patient’s anxiety. They may increase it since the patient may be aware of the paralysis, and will need much reassurance about this being temporary. Both groups of drugs can also have effects on the cardiovascular system. Medications include for ventilator management are anti-anxiety and anesthetic agents.*

H. Provide patient means of communicating, e.g., small writing surface or list of commonly used phrases and needs.
*This is probably the most difficult aspect of intubation for the patient and family.*
I. Maintain strict aseptic technique when working with ventilator tubing or providing pulmonary hygiene.
*The artificially ventilated patient is a compromised host and is at risk for development of an iatrogenic infection.*

J. Evaluate the ventilator regularly for proper function:
*This will be done routinely by the respiratory therapist.*

1. Check settings to make sure they are correct.
   *Ideal temperature is 30-35 degrees Centigrade.*

2. Drain condensed water from all tubes regularly.
   *Never allow water to drain back into humidifier reservoir, always drain it in the direction of the air flow, i.e., disconnect tube and drain it into a container.*

K. If the pressure alarm is activated, troubleshoot for cause and correct situation. If situation is not corrected immediately, manually ventilate patient with 100% oxygen. If situation cannot be corrected, replace ventilator as soon as possible while maintaining manual ventilation.
*Potential causes of high pressure limit alarm.*
1. Fluid or kink in tubing.
2. Mucous plug or increased secretions in airway requiring suction.
3. Restlessness, agitation requiring sedation.
4. Pneumothorax
5. Bronchospasm
6. External source of tube compression, e.g., patient biting tube. Potential causes or low pressure limit alarm:
   a. Airway disconnection from ventilation.
   b. Cuff leak with air loss.
   c. Disconnection of tubing.

L. Provide reassurance for patient, always explain what you are going to do beforehand, e.g., suctioning airway or disconnecting tubing. Remind patient that this is a temporary measure and provide encouragement for any signs of improvement.
*Patient will be very sensitive to changes and frightened if not prepared beforehand for airway suction. Begin to prepare patient at the beginning for eventual weaning and extubation.*

VIII. DOCUMENTATION:

Electronic Medical Records