

Mechanical Ventilation

Mechanical ventilation

Involves the use of a machine to move air into a patient's lungs.

Mechanical ventilations use either positive or negative pressure to ventilate patients.

Indications:

- Acute respiratory failure due to ARDS, pneumonia, COPD, pulmonary embolism, heart failure, trauma, tumors, or drug overdose.
- Respiratory center depression due to stroke, brain injury, or trauma.
- Neuromuscular disturbance caused by neuromuscular diseases, such as Gullain-Barre syndrom, multiple sclerosis, myasthenia gravis; trauma including spinal cord injury.

Positive Pressure Ventilators:

Exerts pressure on the airway, which causes inspiration while increasing tidal volume (V_t). A high-frequency ventilator uses high respiratory rates and low V_t to maintain alveolar ventilation.

The inspiratory cycles of these ventilators may be adjusted for volume, pressure, or time.

- A volume-cycled ventilator, the type used most commonly, delivers preset volume of air each time, regardless of the amount of lung resistance.

Negative pressure ventilators:

Work by creating pressure, which pulls thorax outward and allows air to flow into the lungs.

They're used primarily to treat patients with slowly progressing neuromuscular disorders.

Examples:

- Iron lung.
- Cuirass (chest shell).
- Body wrap.

Nursing consideration:

- . Provide emotional support to the patient to reduce anxiety and promote successful treatment. Even if the patient is unresponsive, continue to explain all procedures and treatments.
- . Make sure the ventilator alarms are ON at all times to alert you to potentially hazardous conditions and changes in patient's status. If an alarm sounds and the problem can't be easily identified, disconnect the patient from ventilator and use a handheld resuscitation bag to ventilate him.
- . Assess cardiopulmonary status frequently (every 2 to 4 hours or more often if indicated)

- . Assess vital signs and auscultate breath sounds
- . Monitor pulse oximetry or ET co2 levels.
- . Monitor intake and output for fluid balance.
- . Be alert to ventilator complications :
 - 1.Decreased cardiac output (especially with PEEP).
 - 2.Barotrauma.
 - 3.Pneumothorax.
 - 4.Atelectasis
 - 5.Oxygen toxicity.
 - 6.Stress ulcers.
 - 7.Ventilator – associated pneumonia (VAP).

- . Unless contraindicated, turn the patient from side to side every 1-2 hr to aid lung expansion and removal of secretions.
- . Perform active or passive range of motion exercises for all extremities to reduce the hazards of immobility.
- . Place the call bell within the patient's reach and establish method of communication (such as communication board) because intubation and mechanical ventilation impair the patient's ability to speak.
- . Administer a sedative or neuromuscular blocking agent(as ordered), to relax the patient or eliminate spontaneous breathing efforts that interfere with ventilator's action.

Weaning:

The patient's body quickly comes to depend on artificial ventilation and must gradually return to spontaneous breathing.

Successful weaning depends on:

- Strong spontaneous respiratory effort.
- Stable CVS.
- Sufficient respiratory muscle strength and LOC.

Weaning methods:

.In **intermittent mandatory ventilation (IMV)**, the number of breaths produced by the ventilator is gradually reduced; allowing the patient to breathe independently. Decreasing the number of breaths allows the patient to gradually increase his respiratory muscle strength.

. **Pressure support ventilation (PSV)** may be used or as an adjunct to IMV. In this procedure, a set burst of pressure is applied during inspiration with the patient's normal breathing pattern, allowing the patient to build respiratory muscle strength.

. **Spontaneous breathing trials** : Are the next step in weaning. In this procedure, a T-piece is attached to the end of the ET tube or the tracheostomy tube.

The ventilator is then disconnected and the patient is allowed to breathe on his own through the ET or tracheostomy tube.

The amount time spent off the ventilator is initially short, 1 to 2 minutes, then gradually increased as the patient can tolerate it.

Nursing considerations:

- . Continue observing for respiratory distress, fatigue, hypoxia or cardiac arrhythmias.**
- . Schedule weaning to comfortably and realistically fit into the patient's daily regimen, avoiding weaning during times of meals, baths, or lengthy therapeutic procedures.**
- . Document the length of weaning trial and the patient's toleration of the procedure.**
- . After the patient is successfully weaned and extubated, place him on the appropriate oxygen therapy.**

Oxygen Therapy:

Normal O₂ in blood = 20 ml/100 ml blood

(Each gram Hb contain 1.34 ml O₂)

This means tissue oxygenation depends on adequate delivery of O₂ to the Hb and an adequate circulation of oxygenated blood.

FiO₂ (Inspired O₂ concentration)

Various types of devices are used to deliver oxygen therapy, regardless of the type, always assess the patient closely and check the results of pulse oximetry or arterial blood gas analysis 20 to 30 min. after adjusting flow rate.

Delivery devices:

- . Nasal Cannula (1 to 6 L/min.), 24 to 44% FiO₂.
- . Simple Face Mask (6 to 10 L/min.), 40 to 60% FiO₂.
- . Partial Rebreathing Mask (6 to 10 L/min), 35 to 60%.
- . Non Rebreathing Mask with Reservoir bag (6 to 10 L/min), 60 to 100% FiO₂

Provides the highest FiO₂ without using sealed facemask.

The reservoir bag provides store of O₂ from which the patient inspires during peak inspiratory flow rate and the one way valve prevents expired air from filling the reservoir bag.

Fixed Performance Mask: “Venturi Mask” (4 to 10 L/min), Provides 28% FiO₂.

Used in patients with COPD where they have elevated CO₂ levels and the “hypoxia” becomes their main stimulation to breathe.

In COPD patients if they require FiO₂ > 60%, we have to go for intubation and ventilation.

Non Invasive Ventilatory Support: NIV—Bilevel mask ventilation

-Continuous positive airway pressure (CPAP)

Supplies positive airway pressure throughout all phases of spontaneous ventilation, it is applied via (tight fitting mask) used for: weaning from ventilation, chronic airway collapse and pulmonary edema)

-Biphasic Positive Airway Pressure (BiPAP)

Used in respiratory failure type II alternating between high and low pressure at fixed frequency to increase air flow through inspiration.









Good luck in your exams