



HEALTH HOLDING

HAFER ALBATIN HEALTH
CLUSTER
MATERNITY AND
CHILDREN HOSPITAL

Department:	Pediatric Intensive Care Unit (PICU)		
Document:	Departmental Policy and Procedure		
Title:	Pediatric Patient on Mechanical Ventilator		
Applies To:	All PICU Staff, Respiratory Therapists and Biomedical Engineers		
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1. PURPOSE:

- 1.1 To improve pulmonary gas exchange.
- 1.2 To relief of respiratory distress (by relieving upper and lower airway obstruction reducing oxygen consumption and relieving respiratory failure).
- 1.3 To manage pulmonary mechanisms (by normalizing and maintaining the distribution of lung volume and providing pulmonary toilet).
- 1.4 To provide airway protection.
- 1.5 To provide general cardiopulmonary support.
- 1.6 To prevent complications of ventilator – associated pneumonia (VAP).

2. DEFINITONS:

- 2.1 **Mechanical ventilation** – is also called positive pressure ventilation. Following an inspiratory trigger, a predetermined mixture of air (i.e. oxygen and other gases) is forced into the central airways and then flows into the alveoli. As the lungs inflate, the intra alveolar pressure increases. A termination signal eventually causes the ventilator to stop forcing air into the central airway pressure decreases. Expiration follows passively, with air flowing from the higher-pressure alveoli to the lower pressure central airways.
- 2.2 **Mechanical ventilator** is a machine that helps a patient breath (ventilate) when they are having surgery or cannot breathe on their own due to a critical illness. The patient is connected to the ventilator with a hollow tube (artificial Airway) that goes in their mouth or nose and down into their main airway or trachea.
- 2.3 **Ventilator-associated Pneumonia (VAP)** is defined as pneumonia in a patient intubated and ventilated at the time of or within 48 hours before the onset of the event.

3. POLICY:

- 3.1 All nurses working in PICU must be a Basic Life Support (BLS) and Pediatric Advance Life Support (PALS) certified provider and competent in knowledge and skills in carrying out care of patient on mechanical ventilation.
- 3.2 Ventilator parameters must be written by the Physician.
- 3.3 Patient on mechanical ventilator should be connected to continuous cardiac and pulse oximetry monitoring with a set of alarm parameters 'turned on' and on maximum volume prompt alarm.
- 3.4 Blood gas levels must be monitored routinely or per doctor's order and evaluated to set appropriate ventilator setting and parameters.
- 3.5 Airway clearance and bronchial hygiene must be carried out in rendering proper care to mechanically ventilated patients at all times.
- 3.6 Patient on mechanical ventilator should be checked for signs of pneumothorax, airway patency and blood gas analysis.
- 3.7 Standard precaution must be carried out throughout the procedure.
- 3.8 Mechanical ventilator must be updated for Periodic Preventive Maintenance (PPM) by biomedical technician every 6 months.

- 3.9 Ventilator machine must be prepared and maintained by Respiratory therapist (if available in the unit) for functioning before use.

4. PROCEDURE:

- 4.1 Explain the procedure to the patient/ guardian.
- 4.2 Perform hand hygiene before and after contact with the patient, the ventilator and handling equipment.
- 4.3 If the patient needs sedation, it should be ordered by the physician before starting the procedure
- 4.4 Make sure that the Respiratory Therapist has checked the mechanical ventilator for functioning. Adjust the ventilator setting by RT before connecting PT, Ensure that the ventilator for functioning. Ensure that the ventilator alarms are turned 'on' at all times to alert on potentially hazardous conditions and changes in the patient's status.
- 4.5 Check ventilator settings and modes during endorsement and initially while receiving the patient.
- 4.6 Compare current ventilator settings with prescribed in the Physician order. Familiarize with ventilator alarms and the actions to take when an alarm sounds.
- 4.7 Ventilator alarms must be set at maximum level at all times.
- 4.8 Place patient on continuous cardio-respiratory monitoring to ensure hemodynamic stability.
- 4.9 Locate suction equipment. Check the availability of bag valve mask for every patient with an artificial airway connected to an oxygen source.
- 4.10 Elevate the head of the bed at 35° – 45°. Positioning the patient upright to prevent ventilator associated pneumonia (VAP) and aspiration. Turn from side to side every 1 to 2 hours to aid lung expansion, removal of secretions and to prevent skin breakdown.
- 4.11 Connect the patient's airway to the ventilator tubing. Make sure the endotracheal tube or tracheostomy tube and connections are secured properly to prevent dislodgement. Auscultate for equal bilateral air entry and watch for tube dislodgement.
- 4.11.1 Assess the patient for adequate chest movement & rate of respiration.
- 4.11.2 Note peak airway pressure and positive end airway (PEEP). Adjust gas flow if necessary.
- 4.11.3 Assess frequently for changes in respiratory status. If any change is noted, notify the physician.
- 4.11.4 Ensure adequate ventilation at all times, monitor and troubleshoot alarm conditions. However, if it cannot be corrected immediately, remove the patient from the mechanical ventilator and manually ventilate with an ambubag.
- 4.11.5 Measure delivered tidal volume and analyze oxygen concentration every 4 hours or more frequently if indicated
- 4.12 Assess for need of suctioning every 2 hours and prn. Do suction as needed, after providing Chest Physiotherapy (CPT) and prior to feeding from endotracheal tube or tracheostomy tube to prevent occlusion with secretions and stimulate cough reflex
- 4.12.4 Hyper oxygenate the patient before and after suctioning. Limit the suction time to 10 seconds and pressure to the lowest level needed to remove the secretions.
- 4.12.3 Routine instillation of normal saline should not be necessary if the humidification is adequate
- 4.13 Provide humidification:
- 4.13.1 Heated humidifier:
- 4.13.1.1 Always wash hands before filling and after emptying fluid from ventilator circuitry.
- 4.13.1.2 Check water level in the humidification reservoir and fill acceptable amount of volume with sterile water.
- 4.13.1.3 Replenish reservoirs between scheduled changes by emptying residual fluid before refilling.
- 4.13.1.4 Drain condensation from ventilator circuit periodically and when repositioning patient into a separate receptacle not into the humidifier. Take care not to allow the condensate drain towards the patient.

- 4.13.2 Heat and moisture exchanger (HME) contains a hygroscopic paper surface that absorbs the moisture in expired air. Upon inspiration the air passes over the hygroscopic paper surface and warms the air that passes into the airway.
 - 4.13.2.1 Change daily or as needed if the filter appears to be excessively moist or blocked, never wet HME prior to use. Single use item, disposes properly after use.
 - 4.13.2.2 Place HME close to the patient, where the humidity is greatest. If you put it further away, the humidity in the expired gas will just 'rain out' and precipitate itself on the surfaces of the ventilator tubing, where it pools, bubbling uselessly and triggering alarms. All HME has standard airway and ventilation circuit connectors. Only one end hooks into T-pieces and ventilator circuit tubing.
 - 4.13.2.3 Close the standard Luer – lock port for connecting an EtCO₂ sampling tube when not in use.
- 4.14 Consider utilizing EtCO₂ monitoring for additional trending of ventilation therapy as ordered by physician.
- 4.15 Provide oral hygiene. Ventilated patients must have comprehensive oral hygiene regimen be implemented which pose them at risk for ventilator associated pneumonia.
- 4.16 Assess skin integrity every 2 hours. Inspect and pay attention to bony prominences, areas of nose and mouth in contact with ETT. Rotate placement from side to side of the mouth. Turn patient from side to side every 2 hours or more frequently as possible. Assess lips and tongue for pressure ulcers and provide oral care
- 4.17 Obtain blood gases every 6 hours or as ordered to monitor gas exchange and oxygenation status.
- 4.18 Assess breath sounds and airway patency every 4 hours. Observe for the development of complications associated with mechanical ventilation. These complications include barotrauma, pneumothorax, atelectasis, oxygen toxicity, stress ulcer and ventilator – associated pneumonia.
- 4.19 Administer a sedative or neuromuscular blocking agent, as ordered, to relax the patient or eliminate spontaneous efforts that can interfere with ventilator's action.
- 4.20 Perform passive range of motion exercises of all extremities. This may improve circulation.
- 4.21 Make sure that the respiratory therapist has change ventilator circuit, humidifier every (7) days or when circuit is visibly soiled or malfunctioning. The components of the circuitry are:
 - 4.21.1 Fluid Reservoir Bag
 - 4.21.2 Administration Tubing Set
 - 4.21.3 Water Chamber
 - 4.21.4 Corrugated Tubing
 - 4.21.5 Temperature Probe
 - 4.21.6 Ambubag
 - 4.21.7 Disposable Filters (Change Every 24 Hours and PRN).
 - 4.21.8 Heating Element
- 4.22 Label fluid reservoir bag and the circuitry with date, time and signature when placed and changed.
- 4.23 Care to patient on High frequency oscillation (HFO) ventilation.
 - 4.23.1 Provide adequate information to family the sight of the patient being 'oscillated'.
 - 4.23.2 Observe for vibration pattern (the chest wiggle factor) constitutes the most reliable clinical measure which may reveal early evidence of changing lung disease or adverse effects.
 - 4.23.2.1 If chest wiggle diminishes or vibration mainly on the neck, the ET tube might have slipped down or become obstructed.
 - 4.23.2.2 One sided chest wiggling or asymmetry may indicate a pneumothorax.
 - 4.23.3 Listen to the intensity or sound the piston makes
 - 4.23.4 Obtain frequent blood gas monitoring as ordered to monitor effectiveness of high frequency oscillation ventilation (HFOV).
 - 4.23.5 Suction with the used of in-line close suction catheter must be used and usually not necessary for the first 24 hour unless clinically indicated such as:

- 4.23.5.1 Diminished chest wall movement (chest wobble).
- 4.23.5.2 Elevated CO₂ or worsening oxygenation suggesting airway or ET tube obstruction.
- 4.23.5.3 Visible/ audible secretions in the airway.
- 4.23.6 Press the stop button briefly while quickly inserting and withdrawing suction catheter (PEEP is maintained). Disconnection is discouraged as it can cause alveolar collapse and loss of lung volume.
- 4.23.7 Press start after suctioning.
- 4.23.8 Draw back the catheter all the way on completion when using a closed system.
- 4.23.9 Position the patient with at least two nurses, one should assist with ET tube and ventilator tubing's while the other will position the patient for protection. Repositioning as necessary, otherwise patient is under minimal handling.
- 4.23.10 Provide humidified gas to prevent necrotizing trachea-bronchitis.
- 4.24 Watch out for signs of pulmonary infection.
 - 4.24.1 Aspirate tracheal secretion into a sterile container and send to microbiology for culture and sensitivity testing.
 - 4.24.2 Monitor for systemic signs of pulmonary infection (increased heart rate, increased temperature and increased WBC count).
- 4.25 Evaluate need for sedation or muscle relaxants to decrease anxiety and to relax the patient to prevent competing with the ventilator.
- 4.26 Monitor nutritional status patients with endotracheal tubes are to be tube fed or parenterally nourished.
- 4.27 Monitor gastro intestinal function. Mechanically ventilated patients are at risk for development of stress ulcers. Do gastric aspiration. Ventilation may lead to increased gas flow to stomach.
- 4.28 Monitor and record intake and output in the patient's flow chart. Obtain accurate daily weight
- 4.29 Document in the patient's flow chart:
 - 4.29.1 Type of ventilator used.
 - 4.29.2 Ventilator settings.
 - 4.29.3 Time mechanical ventilator started.
 - 4.29.4 Any problem encountered and action taken.
 - 4.29.5 Size and depth of the tube (lip line level).
- 4.30 Implement and document entries in bundle for Pediatric/ Neonatal ventilator bundle form. Bundle protocol aimed to effectively decrease the rates of VAP.
- 4.31 Document the patient condition, all treatment given, nursing care rendered, response to procedure, tolerance and response to ventilator and sedation support.

5. MATERIALS AND EQUIPMENT:

- 5.1 Endotracheal or Tracheostomy Tubes
- 5.2 Artificial Airway
- 5.3 Mechanical Ventilator
- 5.4 Laryngoscope Handles and Blades
- 5.5 Ventilation Circuit
- 5.6 Humidifier
- 5.7 Suction Equipment
- 5.8 Oral Care Supplies

6. RESPONSIBILITIES:

- 6.1 Physician
- 6.2 Nurses
- 6.3 Respiratory Therapist
- 6.4 Biomedical Engineers



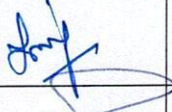



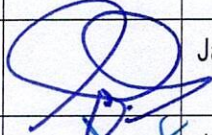
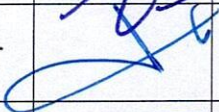

7. APPENDICES:

N/A

8. REFERENCES:

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- 8.2 Accessed from <http://www.uptodate.com/contents/overview-of-mechanical-ventilation>.
- 8.3 Kingdom of Saudi Arabia, Ministry of Health Baish General Hospital, 2018.
- 8.4 Kingdom of Saudi Arabia, Ministry of Health , Qatiffah cluster ,PICU protocol in Qatifah central Hospital, 2024

9. APPROVALS:

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