## Assisted Ventilation Care of Infant

### Purpose
To provide guidelines for infants in the Neonatal Nursery requiring assisted ventilation.

### Policy Statement
Assisted ventilation has been defined as the movement of gas into and out of the lung by an external source connected directly to the patient (Goldsmith & Karotkin, 2003). The external source may be a resuscitation bag, a continuous distending pressure device, T-piece resuscitator, or a mechanical ventilator. Patient interfaces include face mask, laryngeal mask airway, endotracheal tube (ETT), nasal prongs, and tracheostomy. Assisted ventilation is a measure for supporting pulmonary function until the infant can breathe adequately without help.

1. Initiation and discontinuation of assisted ventilation requires an order unless done as part of resuscitation in the delivery room. In the delivery room, the individual assuming the “lead” for the resuscitation makes this decision in concert with other team members.

2. Assisted ventilation and patient interfaces often cause infant distress. Provide comfort measures such as skin to skin, swaddling, nesting position, non-nutritive sucking, and reduction of environmental stimuli to calm the infant. Sedation may be required in some situations if comfort measures are ineffective.

3. Have resuscitation equipment available at the bedside: appropriate size mask, oxygen tubing, blended oxygen source, suction setup, stethoscope, and T-piece resuscitator. If a T-piece system is not available a flow or self inflating bagger must be available.

### Applicability
All Covenant Health Intermediate Care Nursery staff.

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**Approved by:**

- **Gail Cameron**
  Senior Director, Operations, Maternal, Neonatal & Child Health Programs

- **Dr. Sharif Shaik**
  Medical Director, Neonatology, MCH

- **Dr. P. Byrne**
  Medical Director, Neonatology, GNH

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**Policy Group:**
Respiratory
Principles

NON-INVASIVE ASSISTED VENTILATION

Heated High Flow Nasal Cannula (HHFNC)

This form of support uses flow rates that exceed patient inspiratory flow rates at various minute volumes. These higher flow rates purge end expiratory gas from the nasopharyngeal dead space to both oxygenate and decrease re-breathing exhaled carbon dioxide. These devices have been designed to warm and humidify gas, providing optimal conditioning of breathing gas to minimize complications. This may be achieved by administering blended gas via nasal cannula with flow of 500mL to 8L per minute. Flow rates are used to meet requirements dependent on infant’s peak inspiratory flow rates. HHFNC can be delivered utilizing either the Vapotherm or Junior Optiflow systems. If using the optiflow system, the prongs should not fill the nares and a clear gap should be visible around each prong.

Continuous Positive Airway Pressure (CPAP)

CPAP refers to positive pressure applied to the airways of a spontaneously breathing baby throughout the respiratory cycle. The basic goal is to provide low-pressure distension of the lungs and prevent collapse of the alveoli and terminal airways during expiration. The typical conditions CPAP is used for are respiratory distress syndrome, and apnea of prematurity. Other uses include decreased functional residual capacity, atelectasis, congestive heart failure, right-to-left cardiac or intrapulmonary shunting, ventilation-perfusion mismatch, alveolar edema, increased airway resistance, and chest wall and airway instability. Continuous flow CPAP devices (ventilators) provide a constant flow of air while variable flow CPAP devices (flow drivers) use flow changes to generate CPAP level. CPAP flow driver design allows redirection of gas during infant exhalation which minimizes resistance and work of breathing. Some flow drivers are able to provide two levels of CPAP one low (background) and one higher (rate). Timing of the higher CPAP may be unrelated to the patient’s respiratory cycle or a trigger device may be used to initiate the higher CPAP when the patient breathes.

1. The patient interfaces used to deliver CPAP include short nasal prongs, nasal mask, and nasopharyngeal (NP) tube. NP tube CPAP is used only in exceptional circumstances.

2. Total flow on nasal prong CPAP should not exceed 6-8 L/min for continuous flow CPAP devices as excessive flow will increase irritation of the nares. It will also contribute to abdominal distension.

3. Gas flow with CPAP causes accelerated drying of upper airway secretions. Dried secretions may lead to airway obstruction.

- Gases in the CPAP system are warmed and humidified. The temperature of the in-line heater will be maintained between 37-40°C. The Respiratory Therapist records temperatures every 2 hours.
- Frequency of suctioning for infants with CPAP will be determined individually.
- When a NP tube is used it should be suctioned every 2-3 hours and the tube changed every 48 hours and prn.
- When the NP tube is changed if possible the tube should be inserted in the opposite nare.

4. Nasopharyngeal tubes are changed every 48 and PRN as required. Nasal prongs and masks are cleaned PRN and changed as required.

5. Minimize interruptions of CPAP for procedures and assessments. Interruptions may cause airway destabilization. Additionally, circuit disconnects greater than a few (3) minutes may cause overheating of the line. When the circuit needs to be disconnected for a longer period, place on a test lung or have the humidifier turned off.

6. Infants on CPAP are fed by gavage and CPAP is maintained during the feeding. Infants on long-term CPAP for apnea and bradycardia may have the CPAP discontinued while nipple feeding AFTER CONSULTATION WITH THE Neonatologist/Designate and with an order.

7. Remove excess gastric air with a nasal / oral gastric tube every 1-3 hours & PRN to decompress the abdomen and improve feeding tolerance. The intention is to aspirate excess air and NOT to aspirate gastric contents. The gastric tube used in conjunction with infant flow driver CPAP is inserted orally whenever possible.

8. CPAP may cause necrosis to the nares and nasal septum by tension and/or pressure. Therefore:

- Ensure correct size, placement and positioning of prongs or tube and other stabilizing equipment. Infant flow driver “hats” must be fitted correctly.
- Use a thick foam dressing (i.e. Biatain®) under prong ties to cushion ties against face. If the nasal area has damaged skin, a soft silicone dressing is applied.
- Infant flow driver prongs and nasal masks will be alternated every 12 hours and assessed every 4 hours to prevent pressure ulcers.
- Skin integrity is to be checked once per 8 hour shift and more frequently according to the Skin Injury Prevention Guideline.

9. Continuous flow CPAP level is ordered by the Neonatologist/Designate and adjusted by the respiratory therapist.

INVASIVE VENTILATION

General Safety and Care

With any ventilator alarm condition AND sudden deterioration in patient condition or isolated, sudden deterioration in patient condition, (bradycardia, cyanosis, or marked increase in respiratory effort).

1. Quickly scan for obvious problems e.g. kinked ETT, ventilator tubing disconnection and resolve if identified.
2. Initiate manual breaths for 10 sec if the ventilator rate is 20 breaths/min or less. Call Respiratory if not yet at the bedside.
3. Disconnect and start manual ventilation if measures not successful or ventilator indicates inoperable malfunction. Call for assistance. Use the emergency call bell.
4. If the patient’s condition remains unchanged despite these measures, notify the Neonatologist/Designate immediately. If the patient is stable - heart rate 80 or greater-, wait for an airway / breathing assessment to check for a malpositioned endotracheal tube by an individual certified to intubate in the NICU. **If the infant is unstable**- heart rate < 80, the ETT may be removed to begin bag and mask ventilation. Whenever possible, this decision should be made in consultation between two registered personnel (RN, RRT).

5. Do not disrupt ventilation during care giving (e.g. positioning, weighing) since disconnections may cause atelectasis.
6. Frequency of blood gas monitoring varies with acuity of disease, presence of non-invasive monitoring and ease of blood sampling. However, episodes of clinical deterioration should be evaluated.
7. Keep saturations within appropriate COD profile. High and low alarms are set as per the appropriate COD profile or as ordered by Neonatologist/Designate. Do not make large or abrupt alterations in FiO2 to prevent rapid increases or decreases in oxygenation. Refer to oxygen administration policy & procedure, [http://www.compassionnet.ca/Policies/Oxygen_Delivery.pdf](http://www.compassionnet.ca/Policies/Oxygen_Delivery.pdf)

8. End tidal CO2 monitoring is standard practice for all ventilated patients. Every invasively ventilated patient should have an end tidal in place. This will facilitate trending and weaning of ventilation support.

10. Milk feeds must be administered via an enteral feeding tube.
11. Monitor urine output and hydration status of the infant.
12. Resuscitation equipment is set up with usual pressures and oxygen concentrations required by the patient.
13. RRT must be present during patient repositioning.
14. Notify RRT if ETT tapes are loose and/or lifting away from skin.

**AIRWAY CARE**

1. Secretion Removal by Suctioning – Suctioning of the ETT or tracheotomy is performed to maintain a patent airway and to minimize the development of atelectasis in the lungs in a manner that minimizes the deleterious effects of the procedure. If the patient is receiving continuous inhaled medications, the medication is not discontinued during suctioning.
2. Length to Suction – The airway is suctioned so that the suction catheter does **NOT** extend beyond the end of the device (determined by markings on airway and in line suction catheter).
3. Catheter Size – If in line suction is not available sizing is determine by size of ETT wherein a #8 French catheter is used for all ETT sizes except a 2.5 ETT or cuffed #3 ETT when a #6 French catheter is used.
4. Suction – The negative pressure generated for suctioning is the minimum amount needed to remove the secretions and should not exceed 80-110 mmHg for in-line suction systems and 60-80 mmHg for nasopharyngeal suction.
5. Adequate humidification of the airway is the most effective strategy to prevent accumulation of thick secretions and plugging. If thick secretions are an issue, consult a respiratory therapist to optimize humidification. If there is a need to stimulate a patient cough for those unable to cough effectively with suctioning alone, instillation may be warranted. Efficacy of saline instillation for thinning mucus has not been proven. Routine saline instillation is not recommended and its use is limited to elicitation of a cough.

6. Suction Frequency – The frequency of suctioning is established individually for each patient at the minimum events to maintain a patent airway as the procedure is extremely stressful and can result in atelectasis.

7. In-line suction catheters are used for endotracheal suctioning to prevent interruption of ventilation, loss of pressure, and to minimize the risk of infection. Because lung compliance decreases and airway pressure decreases during suctioning, some patients may not tolerate suctioning without increased respiratory support. A respiratory therapist should be present during suctioning to manipulate the ventilator for those patients that have a demonstrated intolerance of suctioning. If that is not possible because of an emergent need to suction, the ventilator manual breath control is used after suctioning to increase respiratory support as needed.

### PREVENTION OF INADVERTENT INSTILLATION /VENTILATOR ACQUIRED PNEUMONIA

1. Elevate the head of the bed of the incubator or the radiant warmer as high as the device will allow up to 30°. Change in infant position and elevation of head of bed should be recorded with each assessment.

2. Position ventilator tubing down the length of the patient to prevent inadvertent instillation of condensation. Do not allow the ventilator tubing to rest directly on the infant’s skin.

3. Prevent inadvertent instillation of accumulated condensation from the ventilator circuit into the patient airway. Drain condensation away from the patient into the trap or humidifier. If excessive water has accumulated in the breathing circuit, disconnect the circuit and drain condensation into a towel without allowing the tubing to touch the towel. Hand hygiene is performed before and after this procedure and gloves are worn.

4. Request help for position changes so that the ventilator is not disconnected and no condensation is instilled during the position change.

### VENTILATOR PARAMETER CHANGES

1. Ventilator parameter changes are made by the RRT according to specific or progressive orders written on the patient order record by a Neonatologist/Designate. If progressive orders are not available, the charge nurse, bedside nurse, and RRT should collaborate to make changes and to determine when the Neonatologist/Designate should be consulted.

2. The care team will make plans for progressive ventilator parameter changes on morning rounds when possible. These plans are written on the patient care order record.

3. Progressive orders are enacted by the RRT after discussion with the patient’s nurse.
ENDOTRACHEAL INTUBATION

1. Indications for endotracheal intubation and are found in the NICU Specialized Clinical Competency for Endotracheal Intubation.
2. In the ideal NICU situation, a respiratory therapist, a nurse and whoever is intubating are present during the procedure.
3. The nurse in charge is notified.
4. Each qualified individual is limited to a maximum of two 30 sec attempts at endotracheal intubation unless:
   - Equipment malfunction prevented a successful intubation.
   - There is no other individual available and the patient is not able to maintain adequate gas exchange with manual ventilation by mask or LMA.
5. To minimize complications and maximize tolerance of the procedure:
   - Pre-intubation medications are given before all intubations unless it is an emergency.
   - The patient’s ventilation is assisted as required with oxygen and/or assisted ventilation before the procedure.

ENDOTRACHEAL TUBE TAPING

1. The depth of an ETT placement is not adjusted without an order.
2. Two people should complete the procedure. Respiratory therapists usually tape the endotracheal tube. The nurse assigned to the patient should be aware of the procedure.
3. A person certified to intubate must be immediately available. For patients assessed to have a “critical airway”, that individual must be present in the unit.
4. Thin hydrocolloid dressing is placed on the skin underneath the securing tape.

AIRWAY STABILITY

To maintain and protect this artificial airway:

1. Ensure the securing tapes are adherent to the face.
2. Use tube supports to minimize traction of the ventilator circuit on ETT and skin tissues. Do not allow tubing to rest directly on infant’s skin.
3. Document ETT insertion depth in Kardex and respiratory flowsheet to minimize ETT misplacement.
4. Extension, flexion, and lateral movement of the infant’s head with respect to the body will alter the position of the ETT within the trachea. This may result in a right mainstem placement or movement of the ETT out of the trachea. The infant must be handled and positioned to minimize head movement and to keep head and neck in a neutral position.
5. Use mittens on patient’s hands if necessary to prevent grasping and pulling of the ETT.
6. Use developmental care based positioning techniques to settle baby so infant does not demonstrated agitated movements that might result in tube dislodgement. Restrain patient only after obtaining an order to do so.
EXTUBATION

Patients are weaned from ventilator support as soon as possible since the incidence of complications increases as ventilation time increases. There are no clinically useful tests to determine readiness and/or potential success of adequate ventilation after assistance is removed. Patients are usually weaned to low oxygen levels and low ventilator settings to evaluate readiness. Because they may not tolerate removal of assistance, personnel and equipment should be available to intervene as necessary. The Synactive Theory of Development proposes that modification of the environment to support the infant’s subsystems will assist in the achievement of successful extubation. Therefore, the timing of extubation and the environmental conditions are evaluated and modified to best support the infant.

1. There should be a written order for extubation. Plans for post-extubation respiratory support are also be made and an order written as necessary. If the patient is fed, an order to hold feeds one hour before extubation is written.
2. The time of extubation is based on the infant’s state, and parent desire for holding.
3. The environment is modified to minimize environmental stresses such as noise and bright lighting and to provide motor support for the infant.
4. An individual qualified to intubate should be immediately available.
5. Notify respiratory therapy so that a therapist is present and appropriate respiratory equipment is available for respiratory support post-extubation. Respiratory therapist presence is not required when the patient is extubated as part of withdrawal of extraordinary medical care.
6. Establish need for follow-up CXR and blood gasses. Obtain order for resumption of feeds as needed.

Related Documents
Continuous Positive Airway Pressure (2002)

References
F&P Optiflow Junior Nasal Cannula Fitting Guide: www.fphcare.com

Revisions
October 2003
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