

	Policies and Procedures  Title: <b>SUCTIONING – PEDIATRIC/NEONATE PATIENTS <u>VENTILATED</u> (CONVENTIONAL AND HIGH FREQUENCY) VIA ARTIFICIAL AIRWAYS</b>  <b>RNSP: Advanced RN Intervention</b>  I.D. Number: <b>1056</b>
Authorization:  [X] SHR Nursing Practice Committee	Source: Nursing Date Revised: March 2017 Date Effective: March 2006 Scope: <b>Royal University Hospital  Saskatoon City Hospital  St. Paul’s Hospital</b>

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**DEFINITIONS:**

**Pediatric Patients:** those under 17 years of age

**ROLES:**

**Registered Nurses (RNs):** RNs identified by their manager in targeted practice settings will be certified in the RN Specialty Practice (Advanced RN Intervention): Suctioning - Pediatric/Neonate Patients Ventilated (conventional and high frequency) via Artificial Airways

**Graduate Nurses (GNs):** GNs who have been identified by their manager in targeted practice settings will be certified in the RN Specialty Practice (Advanced RN Intervention): Suctioning - Pediatric/Neonate Patients Ventilated (conventional and high frequency) Via Artificial Airways. The GN may only suction pediatric/neonate ventilated patients under the direct supervision of a certified RN.

**1. PURPOSE**

- 1.1 To safely maintain airway patency by removing pulmonary secretions or foreign matter from the endotracheal tube (ETT) or tracheostomy tube of a patient as a component of bronchial hygiene and mechanical ventilation. This decreases the risks of hypoxemia and potential for infection. It also enables collection of tracheal aspirate for diagnostic purposes.

**2. POLICY**

- 2.1 Routine suctioning should be avoided. Suction based on patient cues (see 3.1) Exception: patient with depressed cough reflex /neuromuscular block may need scheduled suction intervals to ensure airway patency.
- 2.2 Suction depth should be measured prior to suctioning and most suction passes should not exceed this depth. This distance (in cm) is documented in Patient Care Plan.

2.3 Suctioning may utilize closed or open technique.

2.3.1 **Open technique** – patient disconnected from ventilation device and suctioned with regular suction catheter.

2.3.2 **Closed technique** – utilizes an in-line suction catheter with patient remaining attached to mechanical ventilation. This technique is recommended all for patients, especially those with high oxygen requirements or increased levels of Positive Expiratory End Pressure (PEEP). Closed technique reduces de-recruitment of alveoli and subsequent atelectasis. It also minimizes aerosolization of contaminated secretions and may prevent nosocomial infections.

**Note:** *NICU/PICU – Closed suctioning is standard of care for endotracheal tube suctioning, with the exception of emergency situations where the artificial airway (ETT or tracheostomy tube) is obstructed and closed technique with an in-line suction has not relieved obstruction. Open suctioning may also be used when a specimen for C&S is required.*

2.4 Collection of Specimens for C&S: use a sterile open-suction technique or a new in-line suction catheter.

2.5 The RN or GN certified in this RNSP will have first completed the following learning modules/activities prior to performing suctioning on ventilated patients

- Complete the required learning module and quiz (teaching and learning methods may vary e.g. classroom and/or self-study using paper module or on line)
- Complete a skills checklist with a certified RN during simulation or during first access, to ensure safety checks are followed appropriately.
- Provide documentation of learning module quiz and skills checklist to educator/supervisor

2.6 The RN certified in this RNSP, the Registered Respiratory Therapist (RRT), and their students (with direct supervision) may perform suctioning of the ventilated pediatric patient who has an endotracheal tube or tracheostomy tube as necessary.

### 3. PROCEDURE

3.1 Assess the patient's need for suctioning by observing for

- increase RR and work at breathing
- decreased SpO<sub>2</sub> and/or increases in ETCO<sub>2</sub>.
- increased heart rate or cyanosis
- restlessness or agitation
- coarse breath sounds, crackles, noisy breathing
- auscultating changes in air entry
- coughing
- visible secretions in airway
- increased peak pressures during volume-controlled ventilation or decreased tidal volume during pressure-controlled ventilation
- changes in monitored flow or pressure graphics on ventilator

3.2 Instillation with 0.9% saline should not be done routinely as it has adverse effect on oxygenation and may promote infection.

3.2.1 Instillation prior to suctioning should be reserved for tenacious secretions.

3.2.2 Instillation of anything other than normal saline requires a physician or RN(NP) order.

Recommended saline instillation volumes:	Neonate	0.3 – 1 ml
	Infant	1 – 1.5 ml
	Child	1.5 – 2 ml
	Adolescent	2 – 3 mls

**Note:** *Instillation solutions must be kept sterile.*

3.3 Ensure that the following equipment is at the bedside and in good working order:

- oxygen flow meter
- manual resuscitation bag with reservoir and face mask of appropriate size
- suction regulator
- suction catheters of appropriate size [usually 2 times the Inner diameter of the ETT or trach gives the approximate suction catheter size in French e.g. 4.0ID = 8Fr catheter]  
Appropriate sized catheter (see Appendix A):
  - Neonates 5 – 8 Fr.
  - Pediatrics 8 – 12 Fr.
  - Adolescents 12 – 14 Fr.

**Note:** *Catheter should be no more than 2/3 of lumen of tube to prevent hypoxemia and atelectasis. However, if secretions are very thick and copious, use larger suction catheter to minimize number of suction passes and ensure secretions cleared<sup>5</sup>.*

- suction canister and connecting tubing
- 0.9% saline for instillation
- Mask with attached visor and sterile gloves, for open suction
- Mask with attached visor and clean gloves for closed suction
- mouth care supplies
- stethoscope
- monitoring equipment (if possible)- HR & SpO<sub>2</sub>

**Note:** *If Airborne Precautions are required, an appropriate fitting N95 respirator as well as full face shield would be required*

3.4 Perform hand hygiene.

3.5 Explain procedure to patient if appropriate, incorporating development care practices (see Appendix B).

3.6 Position patient with head of bed elevated 30 °supine and head midline, unless contraindicated.

**Note:** *Elevation of head of bed to 30° is recommended for all intubated pediatric patients in supine or side-lying positions.*

3.7 **Closed Suctioning (In-line) Procedure**

**Note:** *For C&S specimens, use new In-line suction catheter or open suction technique.*

**Note:** *Tracheostomy specific In-line suction catheters may be utilized with tracheostomy tubes.*

- 3.7.1 Perform hand hygiene and don PPE for closed suctioning. Ensure wall suction at appropriate setting.
  - 3.7.1.1 Pediatrics 120 mmHg, (may increase wall suction to 180 mmHg for very thick secretions)
  - 3.7.1.2 Neonate 100 mmHg.
- 3.7.2 Monitor patient for dysrhythmias, changes in heart rate, or SpO<sub>2</sub> while suctioning.
- 3.7.3 Preoxygenate patient if required by increasing F<sub>1</sub>O<sub>2</sub> on ventilator for at least 1 minute
  - 3.7.3.1 **PICU:** for very unstable patients, use the 100% oxygen key on the ventilator.  
**NICU:** Preoxygenate by increasing F<sub>1</sub>O<sub>2</sub> 0.1 to 0.2 above baseline.
- Note:** RRT to adjust ventilator settings as ordered for lung recruitment maneuvers (LMRs) prior to suctioning.
- 3.7.4 Determine correct color or number for suction depth (See Appendix C).
- 3.7.5 Unlock in-line suction.
  - 3.7.5.1 Instill, if required, via Instillation/Irrigation port.
- 3.7.6 Stabilize the catheter and endotracheal or tracheostomy tube with non-dominant hand.
- 3.7.7 Without suction, advance catheter to premeasured depth within the plastic sheath.
- 3.7.8 Depress the control valve to apply continuous suction. Maintain suction withdrawing the suction catheter fully, while stabilizing ETT or tracheostomy tube to prevent dislodgement. Duration of suction should not exceed 5 seconds. Monitor patient's tolerance continually.
- 3.7.9 When suction complete, ensure catheter tip fully retracted from ETT or tracheostomy tube
- 3.7.10 Check viewing port for secretions and assess patient. If further suctioning is required, repeat procedure from 3.8.6 – 3.8.8. Allow the patient to rest and reoxygenate between suction passes.
- 3.7.11 Clean the catheter of debris by flushing sterile 0.9% saline via the irrigation port while simultaneously applying suction. Close suction control valve.
- 3.7.12 Note: Catheter changed when debris cannot be cleared with flushing as above.
- 3.7.13 Return ventilator to baseline parameters, decreasing FiO<sub>2</sub> according to SpO<sub>2</sub> and clinical status.
- 3.7.14 Cap the irrigation port. Discard any unused normal saline. Disconnect suctioning from in-line suction catheter and re-cap in-line catheter end. Provide mouth care per unit policy.
- 3.7.15 Auscultate chest to determine the effectiveness of suctioning, ensure patient stability, comfort, and safety.

**Note:** *If Lung Recruitment Measures (LRM's) have been implemented, RRT to return ventilator settings to pre-suction baseline as ordered<sup>9</sup>.*

- 3.7.16 Document on appropriate record
- amount, color, and consistency of secretions
  - patient's tolerance of procedure, vital sign changes
  - actions taken if problems encountered during suctioning
  - air entry and adventitious breath sounds
  - if specimen sent.
- 3.7.17 Change suction catheter
- **PICU:** When visible debris cannot be cleared with irrigation or any problems with catheter function
  - **NICU:** q weekly as indicated in Patient Care Plan

### 3.8 Open Tracheal Suctioning Procedure

- 3.8.1 Perform hand hygiene and don PPE for open suctioning.
- 3.8.2 Set up sterile 0.9% saline for instillation and for flushing of catheter between catheter passes.  
Open suction catheter package maintaining the sterility of catheter. Attach catheter end to connection tubing from the suction apparatus. Adjust wall suction. Recommended pressures should not exceed 80 – 120 mmHg for pediatrics and 80 - 100 mmHg for neonates. Cleanse hands and put on sterile gloves.
- 3.8.3 Hyperoxygenate: Disconnect the patient from the ventilator ensuring ventilator connections are kept clean. Pre-oxygenate patient by ventilating for 3-5 breaths using a manual resuscitation bag and 100% oxygen.  
**NICU:** Hyperventilate at rate 10-20% above baseline.
- Note:** *Hyperoxygenation provides an oxygen reserve in the alveoli, reducing the risks of hypoxemia and bradycardia.*
- 3.8.4 With sterile gloved hand, advance catheter to pre-measured depth without applying suction. Utilizing measured depth ensures suction catheter does not extend beyond end of endotracheal tube or tracheostomy tube and cause trauma. (See Appendix C for how to measure suction depth).
- Note:** *In specific circumstances, such as suspected endotracheal tube obstruction, catheter may be advanced 0.5 cm. beyond pre-measured depth to remove secretions adhered to distal end of endotracheal tube.*
- 3.8.5 Apply intermittent suction while slowly withdrawing the catheter, rotating catheter between the finger and thumb. Continuous suction may be warranted with thick, copious secretions or meconium aspiration.
- Note:** *Duration of **intermittent** suction should not exceed 10 seconds in pediatric patients or 5 seconds in neonate. Duration of **continuous** suction should not exceed 5 seconds in neonate or pediatric patient<sup>2</sup>.*
- 3.8.6 Reoxygenate with the manual resuscitation bag for a minimum of 3-5 breaths at age appropriate rate or until SpO<sub>2</sub> returns to baseline for 30 seconds.

**NICU:** manually ventilate at rate 10-20% higher than ventilation parameters with FiO<sub>2</sub> to keep oxygen saturation within ordered parameters between suction passes.

**Note:** A drop in PaO<sub>2</sub> occurs during suctioning and with disconnection from the ventilator. Hyperoxygenation and hyperventilation before and after suctioning minimizes this drop.

3.8.7 If further suctioning is required, repeat procedure from 3.7.6 – 3.7.8. Allow the patient to rest and reoxygenate as necessary.

3.8.8 Clear the catheter and connecting tubing with sterile normal saline as needed before reinserting catheter and at the end of procedure.

3.8.9 Reconnect patient to ventilator when suctioning completed.

3.8.10 The mouth/nose may be suctioned with the same catheter used for tracheal suctioning, provided the mouth/nose are suctioned last.

**Note:** The mouth/nose are considered contaminated with normal bacterial flora. Oral/nasal suctioning should **never** precede tracheal suctioning if the same catheter is used.

3.8.11 Auscultate the chest to determine the effectiveness of suctioning and ensure patient comfort, stability and safety.

3.8.12 Document on appropriate record

- amount, color, and consistency of secretions
- patient's tolerance of procedure, vital sign changes
- actions taken if problems encountered during suctioning
- air entry and adventitious breath sounds
- specimen(s) obtained and sent

### 3.9 Suctioning Patients Receiving High Frequency Ventilation : Oscillating (HFOV) or Jet (HFJV)

3.9.1 Cues for suctioning are primarily based on visualization of secretions in endotracheal tube, changes in vital signs, decrease in chest vibrations (decreased chest wiggle factor). A change in air entry intensity may also indicate need for suction.

3.9.1.1 **With HFOV**, frequency of suctioning should be minimized, based on decreased chest wiggle factor (usually no more than every 12 to 24 hours).

3.9.1.2 **With HFJV**, decrease in Servo pressure may indicate need for suction.

**Note:** RRT should be present when patients receiving HFOV or HFJV are suctioned as ventilators put in "Standby" modes and may require adjustments following suctioning procedure, such as increased MAP (mean airway pressures) to re-open collapsed alveoli.

3.9.2 Pre-oxygenation and instillation should be based on patient needs as per 3.1 and 3.2. Suctioning is done utilizing pre-measured suction depth (see Appendix C).

3.9.2.1 **HFOV**

- In-line suction (closed suction technique) should always be utilized. Ventilator disconnects should be avoided to prevent DE recruitment of alveoli.
- Stop oscillations while maintaining Mean Airway Pressure per RRT during suction passes. HFOV turned back on by pressing the “Reset” button between suction passes to restart ventilator to oxygenate patient.
- Follow In-line suction procedures per 3.8. However, suction should be applied both during insertion and withdrawal of suction catheter, unless ordered otherwise. Withdrawal of catheter should be in a slow, rotating manner (5 to 10 seconds) to minimize effects of negative pressures caused by suctioning.

3.9.2.2 **HFJV**

- In-line suction (closed suction technique) should always be utilized. Ventilator disconnects should be avoided to prevent derecruitment of alveoli.
- HFJV with nitric oxide. The jet MUST be put into Standby when suctioning to minimize bolus amount of nitric oxide that can occur.

3.10 **Use of Neopuff**

- 3.10.1 Ensure Neopuff in working order and pressures set as ordered, usually same as ventilation pressures. Oxygen set per patient requirements.
- 3.10.2 Closed suctioning procedure-follow as per 3.7 with Neopuff attached to ventilation port on inline suction catheter
- 3.10.3 Open suctioning procedure-follow as per 3.8 with Neopuff attached to ETT or tracheostomy tube instead manual ventilation unit.

4. **REFERENCES**

AARC Clinical Practice Guidelines (2010). Endotracheal Suctioning of mechanically ventilated patients with artificial airway 2010. *Respiratory Care*, 55(6). Pp758-764.

Choong, K., Chartrkaw, P., Forndova, H., and Cox, P. (2003). Comparison of loss of lung volume with open versus in-line catheter endotracheal suction. *Pediatric Critical Care Medicine* 4(1) 69 – 73.

Curley, M. A., and Thompson, J. E. (2001). Chapter 8: Oxygenation and Ventilation (pp 233 – 322). In *Critical Care Nursing of Infants and Children (2<sup>nd</sup> Edition)*. M. A. Curley and P. A. Moloney-Harmon editors. Philadelphia: Saunders

Hahn, M. (2010). 10 Considerations for Endotracheal tube Suctioning. Retrieved 22 Nov 2016 from: [rtmagazine.com/2010/10-consideration-for-endotracheatube-sucitonin/](http://rtmagazine.com/2010/10-consideration-for-endotracheatube-sucitonin/)

Jackson, M. R. (2005) High frequency ventilation. *Journal for Respiratory Care Practitioners*. On line at: <http://www.rtmagazine.com/Articles.ASP?articleid=R0505F05>

Maggorie, SM, Lellouche, F., Pigeot, J., Taille, S., Deye, N., Bouchard, L. (2003). Prevention of endotracheal suction induced alveolar derecruitment in acute lung injury. *American Journal of Respiratory Critical Care*, 157 (9), 1215-24.

Morrow, B.M. & Argent, A.C. (2008). A comprehensive review of pediatric endotracheal suctioning: effect, indications and clinical practice. *Pediatric Critical Care Medicine*, 9 (5). Pp 465-477.

Ridling, D. A., Martin, L. D., and Bratton, S. L. (2003). Endotracheal Suctioning with or without instillation or isotonic sodium chloride in critically ill children. *American Journal of Critical Care* 12(3), 212 – 219.

Singh, N. C., Kissoon, N, Frewen, T., & Tiffin N. (1991). Physiological responses to endotracheal and oral suctioning in pediatric patients: the influence of endotracheal tube sizes and suction pressures. *Clinical Intensive Care*, 2 (6), 345-50.

Suctioning Ventilated Neonates. Policy #1021 (2005). Neonatal Intensive Care Unit Policy and Procedure Manual. SHR, Saskatoon

Wright, J. (1996) Closed-Suctioning Procedure in Neonates. *Neonatal Network*, Vol 15, No. 6, 87-90.

Wrightson, D. D. (1999) Suctioning Smarter: Answers to Eight Common Questions about Endotracheal Suctioning in Neonates. *Neonatal Network*, 18 (1), 51-55.



**Appendix A**

**Endotracheal/Tracheostomy Tube and Suction Catheter Chart**

Endotracheal/Tracheostomy Tube (inner diameter in mm)	Suction Catheter Size (French)	In-Line Suction Catheter (French)
2.5	5	6
3.0	6	6 or 8*
3.5	6	8*
4.0	8	8*
4.5	8	10
5.0	10	10
5.5	10	10
6.0	12	12
6.5	12	12
7.0	14	14*
8.0	14	14*

\*These sizes available as In-line suction catheters for Tracheostomy tubes

**Appendix B**

**Developmental Care Practices**

Suctioning can be a frightening and anxiety producing procedure for all children. Developmental Care Principles to incorporate during this procedure include:

- Timing procedure to infant’s sleep/wake cycle whenever possible. For older children, always tell them what you will be doing before start of procedure, and ways they can help you during procedure. For example, tell them that suctioning will make them cough but that you will let them rest following.
- Provision of containment and support of the infant during the procedure by using positioning, flexion, and swaddling. For older children, a second health care provider should be present to help ensure patient does not grab at endotracheal tube or move head excessively.
- Tailoring the pace of the procedure to respond to the infant’s cues and allowing the infant to reorganize to a calm state.
- Provision of a 20 to 30 minutes rest post-procedure to recover before the next activity, for example, feeding is especially important in infants. Whenever possible, suctioning should be done before feeds to minimize risk of vomiting.
- Chest physiotherapy and/or positional changes should be done prior to suctioning if possible, as these therapies may loosen secretions.

## Appendix C

### Measured Suction Depth

All routine suction passes should be to pre-measured depth to minimize risk of trauma to delicate tracheal tissues. Repeated suctioning past end of endotracheal or tracheostomy tube can result in bronchial perforation, hemorrhage, histological changes, and airway inflammation and tracheal stenosis. Suction catheter should not pass beyond distal end of endotracheal or tracheostomy tube on a regular basis. **Suction Catheters should never be inserted until resistance felt, as this causes trauma to carina.**

#### Endotracheal Tube

- Suction depth can be measured by noting cm markings on endotracheal tube visible at teeth or gums, then adding length of endotracheal tube and adapter beyond this. This measurement should not need adjustment with tube depth adjustments as entire tube moves up or down. This measure will, however, need adjustment if endotracheal tube is cut.
- For In-line suction catheters size 6, 8, 10 French – measure as above or add 5 cm to last visible cm. marking on tube for approximate suction depth

#### Tracheostomy Tube

- Use length of tracheostomy tube indicated on box plus measured distance of Tracheostomy above stoma (add length of adapter if used). Length of obturator may also be used to calculate suction depth but will be slightly longer than tracheostomy tube.
- Suction Depth measurement should be posted at bedside of all pediatric patients and documented on patient care plan. Suction catheter should only be inserted to this depth on regular basis. Utilize cm. markings on catheter, bedside measuring tape, or color-coded bars on in-line catheter to determine suction depth.