Endotracheal suction

Introduction:
Maintenance of a patent airway is one of the primary goals when nursing a baby with an endotracheal tube (ETT). Essential to this is the effective and safe suction of the ETT. Practices amongst units are often based on ritual and routine rather than sound evidence (Pritchard 2001, McCormack 2003, Spence 2003). Adverse effects such as hypoxaemia, pneumothorax, increased cerebral blood flow, pain and discomfort have all been associated with ETT suction (Pritchard 2001, Celik 2006).

Background:
An ETT bypasses the upper airway mechanisms that warm, humidify and filter the gas passing into the lower respiratory tract. In addition the ETT is a foreign body and over time will produce additional secretions. This increase in secretions can lead to atelectasis, blockage of the ETT and adversely affect gas exchange (Turner 2000, Celik 2006).

Suction of the ETT should not be considered a routine procedure. Assessment of the infant’s respiratory disease and clinical condition should be made to determine the need for suction. Clinical signs indicating the need for suction can include: oxygen desaturation, bradycardia, audible crackles on auscultation (McCormack 2003), obvious secretions in the tube and decreased chest movement. The infant may also become agitated and restless. The volume tracing on the Dräger 8000 and Stephanie CE0482 can be used to assist the decision to suction as a slow return to baseline on expiration may be suggestive of increased secretions – see below.
**Depth of suction:**
Shallow suction is when the suction catheter is not passed beyond the end of the ETT (Spence 2003). Shallow suction is considered to be best practice and as such is the preferred method used in RPA Newborn Care. The alternative method known as deep suction, is when the suction catheter is passed beyond the tip of the ETT to the carina where resistance is met and/or the infant coughs (Ahn 2003, Spence 2003). Deep suction is reported to cause mucosal damage, possible tracheal/bronchial perforation and haemorrhage and is not routinely practised in our nursery.

Most infants with respiratory distress syndrome do not require suction of the endotracheal tube during the first 24-48 hours.

**Saline instillation:**
There is no evidence to support the practice of routine saline instillation during suction. Saline instillation can be associated with adverse effects such as a fall in oxygen saturation, increased intracranial pressure, increased arterial blood pressure and nosocomial infection (Akgul 2006). If an infant’s secretions are tenacious and dry ensure optimal humidification of the airways and assess infant hydration. Saline may be needed to obtain enough tracheal aspirate for a CLICK test.

**Pre-oxygenation:**
In the absence of good evidence, pre-oxygenation is not routinely recommended (Pritchard 2001). Long term adverse effects have been reported as a result of this procedure, these include major issues such as chronic lung disease, retinopathy of prematurity and peri-ventricular leukomalacia (Pritchard 2001). Each infant’s response and/or need for increased oxygen should be assessed during the procedure and documented in the infant’s progress notes (MR 45) and the Neonatal Intensive Care Chart (I/D 630727). If required, FiO$_2$ should be increased using small increments until the infant recovers and then weaned according to SpO$_2$%.
Suction port:
The ventilator circuit is not routinely disconnected during suction of the ETT. This is especially important when the infant is receiving HFO and / or nitric oxide. Disconnection will cause a fall in functional residual capacity, lung recruitment and possible atelectasis therefore ensure suction port is inserted prior to administration of surfactant. The Neo-LINK™ (VIASYS) or Ballard TRACH CARE® (Kimberley-Clark) systems are used to maintain PEEP during suction of the ETT. The latter system is preferred for unstable infants on high frequency oscillation and / or nitric oxide therapy.

Size of Suction Catheter:
Recommendations from VIASYS regarding use of the Neo-LINK™ closed suctioning adaptor are as follows:

<table>
<thead>
<tr>
<th>ETT Size</th>
<th>Maximum Catheter size</th>
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<tbody>
<tr>
<td>2.5mm</td>
<td>6 French</td>
</tr>
<tr>
<td>3.0mm</td>
<td>6 French</td>
</tr>
<tr>
<td>3.5mm</td>
<td>6 French</td>
</tr>
<tr>
<td>4.0mm</td>
<td>8 French</td>
</tr>
</tbody>
</table>

The suction catheter should not occlude greater than two thirds the diameter of the ETT, this is thought to assist with maintenance of PEEP during the suction procedure.

Comfort measures:
ETT suction is recognised as one of the most frequent, painful and uncomfortable procedures infants are exposed to in the neonatal intensive care setting (Ward-Larson 2004). Pain can impair the infants ability to heal and can have long term implications for their development (Blauer 1998). Research has shown containment and/or use of sucrose may reduce pain and the associated adverse effects experienced by neonates during ETT suctioning (Ward-Larson 2004) – see RPA Newborn Care Pain Protocol http://www.sswahs.nsw.gov.au/tnpa/neonatal/ It may be helpful to use a small sheet to swaddle the infant whilst the second registered nurse (RN) assists with opening/closing the suction port.
**Suction Procedure:**
For the infant on high frequency oscillation do **not** suction immediately before a chest x-ray. Chest x-rays are used to assess lung recruitment and there may be a transient loss of lung recruitment immediately after suction. Plan your suction at least one hour before routine x-ray. Suction prior to insertion of surfactant.

Suction should be an aseptic procedure and should be attended by two RNs or a RN and physiotherapist. The second clinician is required to assist with maintenance of the non touch technique and provide comfort to the infant. ETT suction should only be performed by clinicians following adequate instruction.

**Goal:** To maintain airway patency, minimise infant discomfort and maintain adequate oxygenation.

**Equipment:**
1. Suction and tubing: negative pressure should not exceed -100mmHg (-13KpA) when occluded.
2. Neopuff® with same PIP & PEEP / FiO₂ currently delivered to infant and appropriate sized mask
3. Neo-LINK™ (VIASYS) or Ballard TRACH CARE® (Kimberley-Clark) systems if first suction / 24 hour change
4. Sterifield®
5. Indoplas® suction catheters: size 6Fg for ETT 2.5 – 3.5 mm, size 8Fg is generally used for particularly tenacious secretions, ETT ≥ 4.0mm and oral suction.
6. Sterile gloves
7. Galipot with sterile water for irrigation

**Procedure:**
1. Clean procedure trolley with a neutral detergent eg. Lemex
2. Assemble all equipment – as above
3. Both clinicians to wash hands – 1st clinician to don sterile glove on dominant (clean) hand
4. Prior to suction depth of catheter insertion should be estimated
5. Attach suction catheter to suction tubing. The hand (usually the left) holding the suction tubing is now considered unclean and should not touch suction catheter during the procedure.

6. Assess level of comfort prior to, during and following the procedure and document need for nurse initiated medication - sucrose on the Medication Chart (MR 70), Neonatal Intensive Care Chart (I/D 630727) and infant progress notes (MR 45) and evaluate efficacy of same.


8. The infant’s colour, activity, heart rate, respiratory effort and SpO2% / transcutaneous oxygen (PaO2 mmHg) and CO2 are noted before, during and following the procedure.

9. Suction is applied as the catheter is withdrawn and the procedure should take no longer than 10 seconds. The suction catheter is to be used only twice, if a third pass is needed the catheter should be changed.

10. Both RNs should assess the infant’s response to suction. The infant should be allowed to recover from any adverse effects before a second pass. If necessary, the infant may require a small increase in FiO₂. Assess the need for repeat suction.

11. Following suction of the ETT, suction the mouth, oropharynx and nares if required.

12. Auscultate the chest and evaluate efficacy of procedure.

13. Clear the suction tubing with water for irrigation from the galipot and turn off suction and Neopuff®

14. Ensure the infant has recovered from the procedure and is comfortable.

15. Wash hands.

16. Document procedure in the progress notes (MR 45) and Neonatal Intensive Care Chart (I/D 630727), noting infant response, management (need for
additional oxygen / sucrose) and the type and quantity of secretions returned – see rear of Neonatal Intensive Care Chart (I/D 630727) for guidance.

Outcome:
Patency of the airway is maintained and infant is comfortable with no adverse effects.

Use of the Ballard TRACH CARE® Closed Suction System

The benefits of a closed suction system are reported to reduce the frequency of endotracheal suction, ventilator acquired pneumonia and decrease days of ventilation and severity of chronic lung disease (Cordero 2000). In RPA newborn care the Ballard TRACH CARE® is primarily used for unstable infants receiving HFO and / or nitric oxide.

While the decision to suction and the procedure is similar when using the Ballard TRACH CARE® - there are a few additional issues for the registered nurse to be aware of. These include:

1. The procedure is still routinely performed by two RNs, as it remains an uncomfortable procedure. The 2nd RN should provide comfort measures to the infant before, during and following the procedure - as outlined above.

2. After each suction pass and at end procedure - it is essential to withdraw the suction catheter so the black mark is visible within the dome. Catheters left within the ETT will increase airway resistance and affect gas break the integrity of the circuit. Catheters withdrawn too far will break the seal and cause the circuit to lose pressure.

3. To reduce the potential risk of nosocomial infection, the system is changed every 24 hours. Stickers are provided to document date /time of system change.
**Before use / attaching of the TRACH CARE® Closed Suction System:**

Two RNs are needed for this procedure

Ensure the Neopuff® with same PIP & PEEP / FiO₂ currently delivered to infant is available with an appropriate sized mask

Note size and position of the ETT

Remove the blue ETT connector and quickly attach the appropriate ETT suction adaptor from the Ballard TRACH CARE® packet. The size of each adaptor is labelled – *see below*

Insert dome of suction catheter into the smaller port (ETT size labelled here).

The larger port then attaches to the ventilator circuit.

Auscultate chest, confirming position of ETT tube and ventilator settings

*Catheter size guide:*

<table>
<thead>
<tr>
<th>Colour</th>
<th>Catheter size</th>
<th>ETT Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange</td>
<td>5FR</td>
<td>2.0mm &amp; 2.5mm</td>
</tr>
<tr>
<td>Blue</td>
<td>6FR</td>
<td>2.5mm, 3.0mm*, 3.5mm*</td>
</tr>
<tr>
<td>Pink</td>
<td>8FR</td>
<td>3.0mm*, 3.5mm*, 4.0mm</td>
</tr>
</tbody>
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In line suction set up

1. Match the ETT size to the suction port.

2. Remove the blue ETT connector and add the suction port.

3. Connect the inline suction to the suction port with the black ETT size written on it.

4. The ventilator goes in the other port.
In line suctioning procedure

5. Measure from the lips/nares to the Y part of the suction port + then add the cm @ nares/lips

6. Turn on suction at the wall & connect to blue nozzle. Twist the white button on the side 180 degrees.

7. Advance the catheter down the ETT to the pre-measured length

8. Stabilise the ETT with one hand. With the other hand apply suction by pressing in the white button and withdrawing the catheter at the same time

**DO NOT ADVANCE THE CATHETER BEYOND THE MEASUREMENT**
The black tip is very hard and may induce bradycardia if it hits the carina.

****Danger****

**When the suction bag inflates there is NO ventilation going to the baby & the ventilator will display Apnoea & 100% leak**

**Maintain airway, call for help, 2nd person to check equipment**

**The black tip needs to be inside the inner dome (see picture below) and not inside the bag**
In line suction change

• Change the in line suction every 24hrs at the junction shown in the picture.

• There are 3 sizes;
  Peach- Size 5Fr
  Blue- Size 6Fr
  Pink- Size 8 Fr

• Remember to put the blue cap back on the blue nozzle after suctioning is complete

References


