

Clinical Guideline: Suction

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For use in: EoE Neonatal Units
Guidance specific to the care of neonatal patients.

Used by: Healthcare professionals giving direct care to neonatal patients.

Key Words: suction, endotracheal, nasopharyngeal, oropharyngeal, tracheostomy, HFOV, surfactant

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1. Scope

For use in neonatal units in the East of England Neonatal ODN

2. Aim

Airway suction is necessary to remove secretions and prevent obstruction¹. Serious complications may result from the procedure. We aim to achieve a balance by helping without harming².

3. Indications for endotracheal suctioning^{3,4,5}

- Coarse breath sounds on chest auscultation
- Lack of breath sounds on chest auscultation
- Reduced chest movement
- Increased work of breathing
- Apnoea
- Bradycardia
- Increasing end tidal CO₂
- Audible or visible secretions
- Increasing airway pressures
- Decreasing minute or tidal volume
- Deteriorating oxygen saturation levels or blood gases
- Removal of thick meconium particulate under direct vision⁴³

The need for suction should be based on assessment of the infant's clinical status³⁵. To help with this clinical decision making, the oxygen saturation, inspired oxygen concentration trend, blood gases, chest movement and tidal volume (Vt) can be assessed, as well as taking into consideration the amount and type of secretions removed during suction performed in the past 12 hours.

3.1 Complications of suctioning

Atelectasis³⁸
Hypoxia^{6,7,8}
Bradycardia⁹
Blood pressure changes¹⁰
Airway trauma eg necrotising tracheobronchitis¹¹
Pneumothorax (after closed circuit suction)^{5,12,13}
Raised intracranial pressure^{14,15,16}
Nosocomial infection⁴
Discomfort^{17,18}
Tube dislodgement □
Risk of CoNS colonisation⁴³

3.1.2 Competency

Oro/nasopharyngeal suction should only be performed by registered nurses, nursery nurses & assistant practitioners who have been deemed competent to do so, following local competencies. Staff yet to attain competence should be under the direct supervision of a nurse already competent in suction Endotracheal (ET) suction must only be performed by a QIS (Qualified in Speciality) neonatal nurse, or by a non-QIS

registered nurse undergoing QIS training under the direct supervision of a QIS neonatal nurse.

3.2 Precautions

3.2.1 Saline Lavage

Occasional use of saline when secretions are thick is acceptable even though there is no proven benefit⁴⁵. Saline lavage may nonetheless be necessary when secretions are very thick or when pulmonary haemorrhage has occluded the ET tube, but should only be performed under medical instruction^{20,21}.

0.25ml (<2kg baby)

0.5ml (>2kg baby)

should be sufficient to loosen secretions^{6,19,34}.

Always use a plastic saline ampoule.

3.2.2 Pre-oxygenation

Although there appears to be evidence suggesting that pre-oxygenation can significantly reduce hypoxemia related to ET suction, this procedure has in fact been found to have long-term adverse effects on the infant. These include retinopathy of prematurity, parenchymal lung damage and oxygen free radical damage and therefore should not be common practice^{22,36}.

3.2.3 Catheter size & length

The suction catheter should not totally occlude the airway^{23,26}. The recommendation for size of catheter is one of not more than half the inside diameter of the endotracheal tube (OD:ID of 2:1)^{23,24,36}. The catheter should be inserted to a pre-determined length and should not be advanced beyond the ET tube tip^{31,36}.

ET Tube size	Catheter size
2.5	5FG
3.0 – 3.5	6-7FG
4.0 – 4.5	8FG

3.2.4 Closed versus open suction technique

Closed suction technique is proven to have less impact on the oxygen requirements during and after suctioning but there is no evidence to suggest that this is superior to open ended suctioning²⁵ and therefore if your unit has a choice then a clinical judgement needs to be made as to which technique you use.

3.2.5 Duration and timing of suction

When suction is necessary as part of clustered care, it should ideally be performed at the end of the care episode, allowing the infant adequate time to recover before other routine procedures are carried out. As it commonly takes between 30 minutes⁹ and 1 hour⁷ to recover from endotracheal suctioning, minimal handling should be observed for this length of time following ET suction².

3.2.6 ANTT

Aseptic Non-Touch Technique should be used for all suction procedures⁴²
As well as PPE.

3.2.7 Surfactant administration via ETT & suction

If pulmonary secretions are prominent prior to surfactant administration, suctioning prior to dosing may lessen the probability of mucus plugs obstructing the endotracheal tube following surfactant administration. If possible, suction should be avoided for at least one hour after surfactant administration, with the exception of life-threatening circumstances.³⁷

3.2.8 Assessment of need

For all types of suction, an assessment of need should be undertaken:

- Have the physiological parameters changed?
- Is the chest moving?
- Has the tidal volume or minute volume decreased?
- What was the result of the most recent blood gas?
- Auscultate the chest – are the breath sounds noisy, is air entry equal?
- Has the oxygen requirement increased?
- What were the secretions like on the last suction event?
- When was the last suction performed?
- Has the infant recently been handled?

If the parents are present, explain the reason for suctioning and the procedure.

4. Closed Suction of Endotracheal Tubes

4.1 Setting up the closed suction

1. Select the correct size of catheter, if the catheter is too large for the tube it will occlude the airway and lead to hypoxia. As a rough guide, the French size of the catheter should be approximately twice the diameter of the ETT. Eg A 6Fr catheter is correct for a size 2.5, 3.0 or 3.5mm ETT.
2. Select the correct size Y-adapter for the ETT. The Y-adapter stays on the ETT and replaces ETT connector e.g. the blue connection on a Portex tube.
3. Connect the catheter to the Y-adapter.
4. Take out the ETT connector and attach the larger port to the ventilator tubing.
5. Attach the daily change sticker across the bottom of the thumb control valve, and then lock the thumb valve by rotating the white button on the suction valve. **The catheter should be changed every 24 hours.**

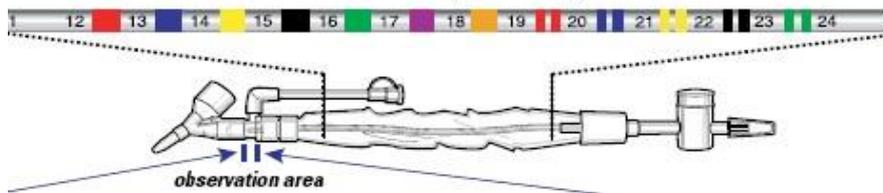


Figure 1: Measuring the depth of the catheter

4.2 Procedure

1. Closed suction should be a two person procedure to ensure that the ETT is held throughout and that the infant is supported.
2. Wash hands & apply non-sterile gloves ^{41,42}.
3. Ensure the suction tubing is connected to the closed suction unit.
4. Check that the wall suction is working by depressing the white button. Add 10% to the normal settings for wall suction e.g. 10kpa +10% = 11kpa or 60mmHg + 10% = 66mmHg^{23,25}.
5. Support the Y-connector and ETT throughout the procedure. It may be easier to have the second person to do this, then they can also be supporting the infant with a quiet hand on the head or by containment.
6. Check the number on the ETT closest to the ETT adapter then add 5cm to that figure. This will give the depth to which the suction catheter needs to be passed e.g. ETT at 9cm + 5 = 14. The colour that is in front of the calculated number should be the correct depth that the catheter is passed to. This calculation should be added to the cot card and the ITU chart to ensure that a clear record is made.

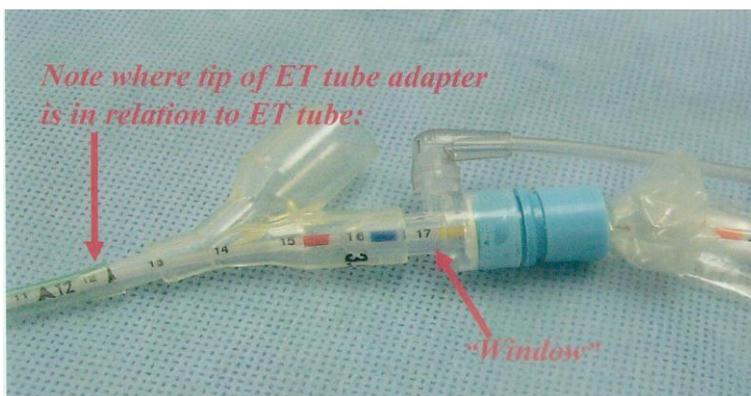


Figure 2: Checking the depth of the catheter

Figure 3: Documenting the calculation

To Determine Suction Depth		EXAMPLE!
<i>(Observe in area directly across from lavage port connector)</i>		
Number on ET tube nearest endotracheal tube adapter tip	12	cm
Add 5.0 cm to suction at ET Tube Tip	+ 5	cm
Add 5.5 cm to suction .5 cm <u>past ET Tube Tip</u>		
Equals suction depth:	Total	17 cm

7. Push the catheter forward and advance it into the airway. Do not let go of the catheter but lighten the grip to allow the plastic sleeve to slide back over the catheter. The catheter is gripped by PEEP seal allowing the catheter to advance whilst the sleeve remains out of the way.
8. Slowly advance the catheter until you see the coloured strip in the cleaning port. This position will ensure that the tip of the catheter is near the end of the ETT.
9. Apply suction. Wait for 2 seconds, if the infant tolerates it, and then withdraw the catheter **slowly** back. Because the infant remains ventilated throughout the procedure the actual suction can take up to 8 seconds. If the infant does not tolerate then the procedure should be stopped and the suction catheter withdrawn.
10. Withdraw the catheter until the black tip is within the cleaning chamber. It is also important to fully withdraw the catheter, as leaving it inside the ETT may restrict ventilation. In addition it poses the risk of inadvertently cutting the suction catheter when cutting the ETT, which could result in the cut end of the catheter lodging in the patient's airway. (As per Patient Safety Alert, July 2014)³⁹
11. With the black tip inside the cleaning chamber apply suction, the ETT in a position parallel to the cot and at the same time instil 0.5-1.0ml saline via the administration port. Secretions should be seen in the clear tubing in front of the suction valve. Use as little saline as is needed to clear the catheter, repeat if necessary until all secretions are removed from the catheter. This **MUST** be performed after every suction event.
12. Replace the cap over the administration port and and turn off the wall suction when finished.
13. If saline lavage is indicated (see 3.2.1), advance the catheter tip to the infant's lips with the ETT tilting downwards, instil the saline and suction as above.

5. Endotracheal Suction (Open)

5.1 Equipment

- Stethoscope
- Gloves either clean or sterile.^{40,41,42}
- Appropriate sized suction catheters
- Suction bottle connected to suction apparatus – pressures set 60-80mmHg (8-10kpa)^{5,23} and suction connecting tube
- Pre-cut tape measure for suction catheter measurement
- Saline, syringe and filter needle if required
- Rubbish bag

- Sterile water (to rinse suction tubes after the procedure)
- Documentation

5.2 Preparation

1. Wash hands
2. Prepare equipment
3. Using a filter needle draw up saline into syringe if required (see 3.2.1), taking care not to touch key parts, and replace syringe back into paper packet
4. Attach suction catheter to suction tubing, leaving catheter in the protective packaging to prevent contamination
5. Check the vacuum pressure ensuring that the maximum negative pressure does not exceed 60-80mmHg (8-10kpa)⁵
6. Determine length of endotracheal tube (including any dead space and length of the blue ETT hub). This is the length you will need to pass the suction catheter to ensure that the catheter reaches the end of the ETT tip^{27,28,29}. This can be achieved by observing the markings of the suction catheter or by measuring the catheter against a pre-cut tape measure which may be stuck to the inside of the incubator. The catheter should remain within its packaging to ensure sterility is maintained.

Emergency suction

For emergency suction of the ETT, step 7 of the preparation procedure may not be achievable. It may be necessary to increase the inspired oxygen concentration in response to desaturation, but in some cases (such as blocked ETT) waiting until the oxygen saturation is >90% is not practical. Suction in this situation should be performed to prevent further desaturation or bradycardia.

7. Auscultate the chest prior to suctioning to have baseline information on which to compare post suctioning auscultation
8. Position the head in the mid-line if possible to reduce changes to cerebral blood flow.
9. Where possible organize another person/parent to help with the procedure to allow the infant to be contained during the suctioning as it has been shown to aid recovery.

5.3 Procedure

1. Wash hands and apply gloves⁴².
2. If preferred, put two gloves onto the dominant hand. Double gloving means that the top glove can be removed to contain the catheter after the suctioning is

- complete.
3. If only using 1 pair of gloves then ensure that the suction catheter is placed directly into your rubbish bag after use
 4. Withdraw suction catheter from protective packaging and hold in the sterile double gloved hand.
 5. Silence ventilator alarm with other hand.
 6. Detach ETT from ventilation tubing with non-dominant hand
 7. Steady the ET tube with the non-dominant hand and insert the suction catheter down the ETT to the pre-determined length with the gloved hand. The catheter should not advance beyond the end of the ETT^{11,31}, as doing so can cause damage to the carina.
 8. Apply suction
 9. Withdraw catheter, whilst applying suction. It should take no longer than 4 - 5 seconds to completely withdraw catheter.
 10. Re-attach ventilation tubing to the ETT.
 11. Assess tolerance of the procedure by observing oxygen saturation, colour, heart rate and activity.
 12. Adjust the FiO₂ to stabilise the oxygen saturations of the baby and reset to baseline requirements when the baby reaches pre-suction apex and oxygen saturation levels
 13. Auscultate the chest and repeat suction as necessary
 14. If further suction is needed, repeat the procedure from step 3 using a new suction catheter each time. Usually 1-2 attempts are sufficient to clear ET secretions
 15. Routine use of saline isn't recommended (see section 3.2.1), but if there are indications, (such as thick secretions or blood from pulmonary haemorrhage occluding the tube), for using saline, instil this into the ETT prior to Step 2 above. Reconnect the ventilator for a minimum of 5 breaths to ensure that the saline has thoroughly moistened the ETT.
 16. Observe and document colour, quantity and type of secretions in the suction catheter.
 17. Continue containment if the infant has not tolerated the procedure well.

5.4 Following the Procedure

1. Remove the glove from the dominant hand by inverting it over the used catheter
2. Dispose of waste in clinical waste bin
3. Use water to clean through suction tubing and turn suction off
4. Wash hands
5. Document the procedure, including amount, type and colour of secretions. If fresh blood is obtained, report to medical staff immediately. Tolerance and effectiveness of the suctioning should also be documented.

5.5 Collecting a Specimen

Additional equipment needed

Mucus trap
Ampoule of sterile water/saline

Procedure

- If a specimen is required, a mucus trap should be attached between the suction tubing and the suction catheter.
- ET suction should then be performed in the same way as detailed in the guideline.
- Following suction the sterile water should be suctioned through the catheter into the mucus trap before it is sealed.

6. Additional Information

6.1 HFOV and suctioning

The procedure for ET suction is exactly the same for infants receiving HFOV or conventional ventilation.

After instilling the saline, it may be necessary to oscillate for a few seconds, as there is no great pressure shift to get the saline into the ETT.

In some situations the mean airway pressure may need to be briefly increased by 1-2cm to re-recruit alveoli and stabilise ventilation, but care must be taken to reduce back to initial settings within a specific time frame (discuss on ward round with consultant) to avoid any over-distension of already damaged lungs.

7. Oropharyngeal or nasopharyngeal suction

7.1 Preparation

1. Wash hands
2. Prepare equipment needed for nasopharyngeal suction. Catheter size will vary based on baby's size and gestation (typically 6Fr – 10Fr, though a Yankauer may be needed for thick meconium).
3. Attach suction catheter to suction tubing, leaving catheter in the protective packaging to prevent contamination
4. Check the vacuum pressure ensuring that the maximum negative pressure does not exceed 60-80mmHg (8-10kpa)⁵.
5. Observe pre-suctioning saturation, apex beat and blood pressure (if monitored) and ensure the infant is well oxygenated prior to procedure without "pre-oxygenating"
6. Where possible organize another person/parent to help with the procedure to allow the infant to be contained during the suctioning as it has been shown to aid recovery.

7.2 Procedure

7.3 Nasal suction

1. Wash Hands and apply gloves
2. Measure the catheter from the mouth to the suprasternal notch to estimate the length required for insertion³⁰
3. It may be necessary to lubricate the tip of the catheter in some saline/water to prevent trauma to the lining of the nose.
4. Introduce the catheter gently into the nostril and ease it to the back of the pharynx to the predetermined length.
5. Apply suction and gently withdraw the catheter not taking more than 10 seconds. Suction should not be applied whilst inserting the catheter as this causes mucosal irritation or damage and can potentially lead to hypoxia.

7.4 Oral suction

1. Wash hands and apply gloves

2. Measure the catheter from the mouth to the suprasternal notch to estimate the length required for insertion
3. Gently insert the catheter into the mouth in an upward and backward direction, if the infant has a gag reflex he/she may cough
4. Apply suction and gently withdraw the catheter not taking more than 10 seconds. Suction should not be applied whilst inserting the catheter as this causes mucosal irritation, damage and can potentially lead to hypoxia.

8. Tracheostomy suction

1. The suction equipment should be pre-set at 60-80 mmHg (or 8-10kpa)⁵ to minimise the risk of trauma and atelectasis.
2. Measure the depth to which the suction tube needs to be passed against an identical tracheostomy tube³³. Suction catheter diameter should be less than half the size of the tracheostomy tube to reduce the potential for hypoxia. As a guide, practitioners should double the size of the tracheostomy tube to obtain the appropriate size catheter. Eg. Size 4.0 tracheostomy tube = size 8fg suction catheter³⁸.
3. Wash hands, dry and apply alcohol hand rub to reduce the risk of infection
4. Open the suction catheter and attach to the tubing, leaving the rest of the catheter in the packet to keep the catheter as clean as possible
5. Put on two non-sterile gloves on your dominant hand to minimise the risk of infection. The gloves should be non-powdered to prevent the introduction of powder into the airway^{40,41,42}.
6. Saline instillation is not recommended and pre-suction saline nebulisers are preferred to loosen secretions^{32,33}. (see 3.2.1)
7. Insert the catheter into the tracheostomy tube. **DO NOT** pass catheter beyond end of tracheostomy tube (check the length by measuring against another tube).
8. To minimise irritation of the mucous membranes apply suction to the side port only as the catheter is gently removed. Do not rotate the catheter as it is withdrawn³².
9. Any pass of the suction catheter should not take longer **than** 10 seconds³².
10. Reassess the infant to determine whether further suctioning is necessary, ensuring infant has recovery time between each pass. Use a new sterile catheter on each occasion.
11. Observe for recovery of oxygenation, heart rate, respiration - altering FiO₂ if

necessary.

12. Disconnect and dispose of the catheter. Clear the suction tubing with water. Attach a new catheter ready for the next use.
13. Record the suctioning event on the ITU chart, indicating the amount, colour and consistency. Secretions are likely to be blood stained in the first 24 hours.

9. Signs that suctioning has been effective

- Reduced work of breathing
- Reduced respiratory rate in the unventilated infant
- Increased oxygen saturation
- Chest movement improves
- Mv/Vt improves
- Apnoea & bradycardia events lessen
- Visible evidence of secretion removal
- Absence of audible/visible secretions in the upper airway
- Improving blood gases

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Monitoring compliance with and effectiveness of the Guideline

Individual units should periodically monitor that the standards set out in this guideline are being met, by review of case notes and charts and an observational audit of infants cared for on the neonatal unit.

This can be achieved through annual benchmarking activity and consequent action planning. Poor scores may necessitate more frequent audits to ensure progress is being made.

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