

Clinical Procedure: Endotracheal Intubation

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

Used by: Medical Staff and Neonatal Nurse Practitioners

Key Words: Indications, Airway, Positioning, Equipment, Sedation,

Date of Ratification: December 2018

Review due: December 2021 (or earlier in light of new evidence)

Registration No: NEO-ODN-2018-16

Approved by:

Clinical Oversight group	13th December 2018
Clinical Lead Mark Dyke	

Ratified by Eastern Board:

Date of Meeting	13th December 2018
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Audit Standards:

1. The intubation is fully documented in the infant's record
2. An x-ray is obtained after insertion to confirm the correct positioning of the tube.
3. ETT position should be changed if necessary following CXR and the change recorded
4. Sedation is given for non-urgent intubation according to Eastern guideline
5. The skin is protected with a colloid dressing before adherent fixation devices are applied

Clinical Procedure Part One: Endotracheal Intubation

1. Goal

To provide a secure airway

Indications^{1 2}

- To provide prolonged mechanical respiratory support
- Route for surfactant administration
- Prior to general anaesthesia
- To relieve upper airway obstruction
- To allow the removal of meconium from the trachea
- To permit administration of endotracheal adrenaline at resuscitation
- To allow bronchopulmonary lavage
- Prior to transfer if required

Complications³

- Oesophageal intubation/perforation
- Tracheal perforation
- Laryngeal oedema
- Palatal grooves (from long term oral intubation)
- Subglottic stenosis (from long term intubation >3-4weeks)
- Infection

2. Intubation Route⁴

- **Select the oro-tracheal route for all emergency intubations**
- **Reserve nasal intubation for elective procedures after stabilisation with an oral tube (see part two of this guideline).**

2.1 Visualisation of the Larynx

This is the most important part of intubation

- Avoid hyper-extending or rotating the neck
- Assistance may be required to maintain the proper position of the infant
- Where available consider the use of videolaryngoscopes for teaching

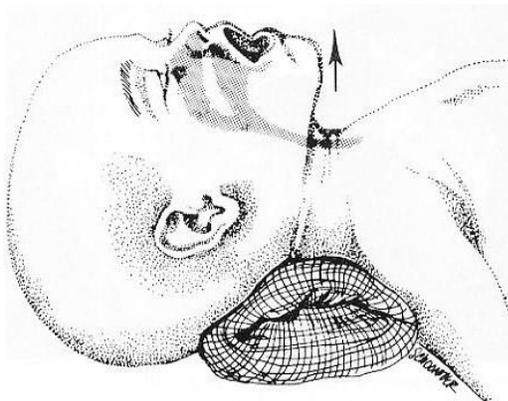


Figure 1. Neutral position for intubation - neck is not hyper-extended³

2.2 Number of Attempts

- To minimise hypoxia, each attempt should be limited to **30 seconds** unless SaO₂ is at a satisfactory level.
- After each unsuccessful attempt, stabilise the infant with mask ventilation.
- Depending on the condition of the infant after two attempts assistance should be sought from more experienced staff.
- Take care to maintain the sterility of the ETT during the intubation process as far as possible.

2.3 Airway Management

The airway should be managed with mask ventilation, providing adequate chest movement is achieved which improves the saturation and heart rate levels. In this situation the equipment required for intubation can be prepared in a calm non-urgent manner.

2.4 Sedation

Use depending on the infant's condition and the urgency of the intubation having first secured the airway with mask ventilation (see sedation for intubation guideline)

2.5 Cricoid Pressure

Cricoid pressure can be applied either by assistant or by little finger of the hand holding the laryngoscope and this may aid visualisation of the cords but this pressure should not be excessive

3. Procedure

3.1 Equipment

- Trolley or clear surface for equipment
- Endotracheal tubes with internal diameters of 2.5-4.0
- Laryngoscope handle & extra set of batteries
- Laryngoscope blade - size 1 or 0 (straight blades allow for optimal visualisation)
- Suction tubing and suction catheter attached to a suitable suction device
- Fixation device
- Colloid dressing
- Skin protectant if used
- Scissors
- Infant resuscitator providing accurate inspiratory pressure control and PEEP or NLS recommended bag with pressure relief valve and reservoir & mask
- Stethoscope
- Guedel airway (in case needed to manage the airway prior to intubation)
- Optional sterile stylet*

***Caution** should be taken when using an introducer or stylet. It is an option to use a stylet to provide rigidity to the tube but care must be taken to ensure:

- That the stylet tip does not protrude beyond the end of the ETT
- That the stylet cannot advance during intubation^{5,6,7}.

If the endotracheal tube is kept away from any heat source then it usually maintains its rigidity.

3.2 Suggested tube size and length ⁸

The tube used depends on the size of the infant's airway. The following tables give a potential guide to the size and the length to which the tube needs to be inserted but infants vary and it may be that an infant of <1kg may need a size 3.0 ETT.

Tube size:

25 weeks	<1kg	2.5 ETT
30 weeks	1-2kg	3.0 ETT
35 weeks	2-3kg	3.5 ETT

Oral intubation length: 6 + weight (kg)

Weight + 6	Distance from lips to tip of ETT
1kg + 6	7cm
2kg + 6	8cm
3kg + 6	9cm

Further research into optimal endotracheal tube placement has found there to be a non linear relationship between weight and gestation and therefore urge caution when using the "7-8-9 Rule"⁹. Below is a table with the recommended endotracheal position according to weight and gestation;

ETT length at lips (cm)	Corrected Gestation (weeks)	Actual weight (KG)
5.5	23-24	0.5-0.6
6.0	25-26	0.7-0.8
6.5	27-29	0.9-1.0
7.0	30-32	1.1-1.4
7.5	33-34	1.5-1.8
8.0	35-37	1.9-2.4
8.5	38-40	2.5-3.1
9.0	41-43	3.2-4.2

Please note: The above are for guidance only.

3.3 Preparation

1. Wash hands
2. Clean trolley
3. Prepare equipment including:
 - Suction set to 10Kpa¹⁰ (max.) or 76mmHg
 - Infant resuscitator set to appropriate pressure settings, depending on gestation, size and age of infant
 - OR prepare NLS recommended self-inflating bag & mask system.
4. Ensure that all nesting bedding is removed and that the infant is lying on a flat, firm surface.

5. Position the infant in a supine position with the head in the midline, with the neck slightly extended. A roll under the infant's shoulders may help maintain slight extension.
6. Monitor the infant's heart rate and oxygen saturation throughout the procedure.
7. Ensure that there is adequate heat output from the incubator or overhead heater so that the infant temperature is maintained.

3.4 Intubation

1. Stand behind the head of the infant and elevate the bed to a comfortable operating position.
2. Empty the stomach by aspirating the gastric tube and leave end of the tube open to air for the procedure.
3. Suction the oropharynx gently if needed.
4. Ventilate the infant with a mask and ensure that the infant is well saturated.
5. Open the laryngoscope blade and hold in the left hand. If held in the right hand the closed part of the blade may block the view of the glottis.
6. Stabilise the infant's head with the right hand, open the mouth and depress the tongue forward with the back of the index finger. Avoid using the blade to open the mouth.
7. Insert the laryngoscope blade, sliding over the tongue until the tip of the blade is resting on the base of the tongue in front of the epiglottis.

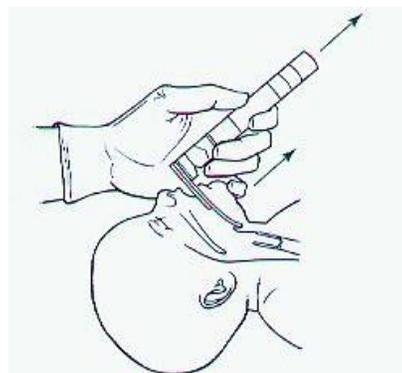
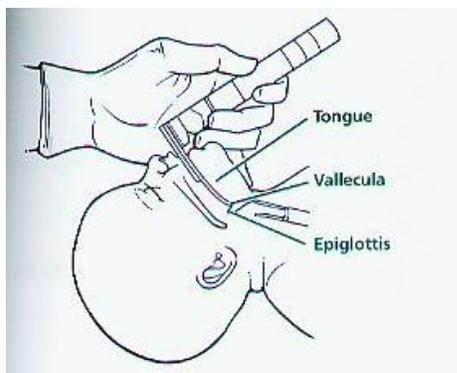


Figure 2 & 3: Identify landmarks, lift the laryngoscope blade to expose opening of larynx¹¹

8. Lift the blade vertically to open the mouth and simultaneously tip the blade slightly to elevate the epiglottis and visualize the glottis.



Figure 4: Visualizing the cord¹¹

9. Do not use the maxilla as a fulcrum for the laryngoscope blade.
10. Suction as necessary.
11. Apply gentle cricoid pressure or have an assistant do this to help to bring the glottis into view.
12. An assistant will place the endotracheal tube in your right hand. The tube should be passed into the right hand side of the mouth, outside the blade maintaining visualisation.
13. Once the trachea and vocal cords are visualised, insert the endotracheal tube through the vocal cords about 2cm into the trachea. Avoid pushing the tube against any obstruction.

Be careful not to advance the ETT too far beyond the cords. The edge of the black marking on the tube should be visible ¹². However, this is not always an accurate guide to placement.

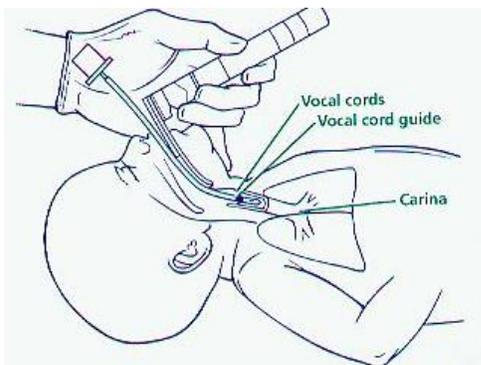


Figure 5. Inserting the tube to the correct depth¹⁰

14. If the tube appears to be too large or does not pass easily try decreasing the angle of the neck extension.
15. Holding the ET tube firmly at the lips, attach to the bagging system (via CO₂ detector if applicable) and check for position of the tube by giving IPPV and auscultating both sides of the chest, and observing for good chest wall movement.

Adequate placement is indicated by:

- Bilateral breath sounds
- Equal breath sounds
- Rise in the chest wall with inspiratory breath
- Rising heart rate and saturation

- Air entry over the stomach is less than over the chest
 - Presence of exhaled carbon dioxide as determined by CO₂ detector or capnography²
 - There is no gastric distension (late sign).
- If there is any doubt about the position of the tube look again with direct laryngoscopy.

16. Once the position has been ascertained ensure that the tube is held at the level of the lips whilst being formally fixed in place.

17. To secure the endotracheal tube:

- Apply skin protectant to each cheek (if used)
- Place a strip of colloid dressing to each cheek
- Use a tube holder to ensure that the tube is held securely at the correct depth.

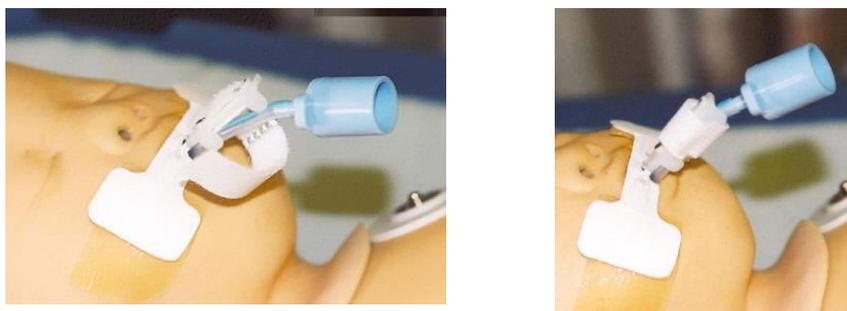


Figure 7 & 8: Apply tube fixing to the colloid dressing & wrap Velcro around tube

18. Confirm position of ETT with chest x-ray. Ensure that when the chest x-ray is taken that the head is in the midline position. The ETT tip should lie above the carina at T1-2.

4. Documentation

Record the procedure in the infant's notes. The entry in the medical notes must include:

- Date and time
- Indication for intubation
- Procedure undertaken
- Size and length of the endotracheal tube
- How many attempts
- How well the procedure was tolerated by the infant
- Confirmation of the endotracheal tube position on x-ray. Include any alterations made to the tube length following the x-ray.
- Signature, printed name and designation.

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Clinical Procedure: Part Two Nasotracheal intubation

1. Goal

To provide a secure longer term airway

Unless there is an anatomical reason, which precludes oral intubation, reserve the nasal intubation for elective procedures after stabilisation with an oral endotracheal tube.

Indications^{1,2}

- For long term intubation in the very sick/preterm infant
- Anatomy precludes oral intubation
- Prior to general anaesthetic for oral surgery

Complications³

- Trauma to the nares and nasal septum
- Increased nasal infections leading to potential damage to developing eustachian tubes and sinuses.

(Plus complications as documented in part one)

If the intubation is non-urgent intubation adequate sedation and pain relief will lead to shorter time to intubation^{4,5} (see "Sedation for Intubation" guideline).

2. Equipment

Equipment is the same as endotracheal intubation except for the addition of a pair of Magill's forceps (large and small)

3. Preparation

Preparation is the same for endotracheal intubation (see "Part One" Guideline)

4. Nasal Intubation

1. Stand behind the head of the infant and elevate the bed to a comfortable operating position.
2. Empty the stomach by aspirating the gastric tube and leave the end of the tube open to air for the procedure.
3. Suction the oropharynx gently if needed.
4. Ventilate the infant with a mask and ensure that he/she is well saturated.
5. If the infant already has an oral tube in situ position this to the far left of the mouth to allow continued ventilation during the nasal intubation. Release the fixation but keep the position secure.
6. Lubricate the new endotracheal tube.

7. Raise the hub of the tube so that the front points down to the floor of the nose, push the tube gently along the floor of the nose with the tip down and the bevel up, this will help avoid the turbinates and the cribiform plate¹. Advance the ET tube until it is visible in the pharynx.
8. If there are problems passing the tube through the nose due to prematurity or problems with anatomy - pass a gastric tube first via the nose into the oropharynx, then cut off the distal end of the gastric tube. Pass the endotracheal tube over the gastric tube and into to nose, using the nasogastric tube to gently guide the ET tube through the nose and into the oropharynx. Once the ETT is in place remove the nasogastric tube.
9. Gently open the infant's mouth and insert the laryngoscope blade over the tongue holding the laryngoscope with the left hand and visualize the oropharynx and larynx being careful not to hyper-extend the neck.
10. Advance the laryngoscope blade and lift the blade vertically in the direction of the handle, elevating the glottis to visualise the vocal cords. (see "Endotracheal Intubation" guideline for landmarks).
11. Perform suction if necessary keeping the laryngoscope in place.
12. The ET tube should be at the back of the pharynx, align the tip with the centre of the tracheal opening with the Magill's forceps held in the right hand. Move the infant's head if necessary.
13. Once the tip of the tube appears to be in line with the glottis and there is an oral tube in place the assistant can remove it carefully.
14. Apply gentle cricoid pressure.
15. The ETT is then passed through the vocal cords into the trachea using the Magill's forceps. Use the small pair of Magill's in the very preterm infant.
16. Be careful not to advance the ETT too far beyond the cords. The edge of the black marking on the tube should be visible⁷. This is not always an accurate guide to placement.
17. Attach the ETT to the infant resuscitator or bagging system (via CO₂ monitor is applicable) and confirm the position of the ETT by giving IPPV and auscultating both sides of the chest, and observing for good chest wall movement. Adequate placement is indicated by:
 - Bilateral breath sounds
 - Equal breath sounds
 - Slight rise in the chest wall with inspiratory breath
 - Rising heart rate and saturation
 - Air entry sounds are less over the stomach than the chest
 - Presence of exhaled carbon dioxide as determined by CO₂ detector or capnography⁸
 - There is no gastric distension (late sign).

If there is any doubt about the position of the tube check with direct laryngoscopy.

18.To secure the endotracheal tube, place a strip of colloid dressing to each cheek.

19.Use a fixing device to secure the tube in place (Figures 1 & 2).



Figure 1 & 2: Apply fixing to colloid dressing & wrap Velcro around the tube

21. Confirm position of ETT with chest x-ray. Ensure that when the chest x-ray is taken that the head is in the midline position. The ETT should lie above carina at T1-2.

5. Documentation

Record the procedure in the infant's notes and complete the procedures record at the front of the notes (as in endotracheal guideline).

The entry in the medical notes must also include:

- Nasal intubation
- The nostril used for intubation

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