



CLINICAL PRACTICE GUIDELINE

Guideline coverage includes NICU KEMH, NICU PMH and NETS WA

Intubation

This document should be read in conjunction with the [Disclaimer](#)

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Securing an Oral Endotracheal Tube

Securing a Nasal Endotracheal Tube

Non-emergent intubation refers to the process of inserting an endotracheal tube (ETT) for provision of mechanical ventilation and administration of surfactant, under optimal conditions in a patient without the immediate requirement for resuscitation. Indications for non-emergent intubation in the newborn include extreme prematurity, surfactant deficiency, apnoea, hypoventilation, and respiratory failure and surgery.

Key Points

- ETT intubation is at least a two-person procedure and can be performed by staff deemed competent in this procedure.
- Pre-medication should be considered in all non-emergent intubations.
- Pre-diluted syringes of medications are available in SCN3 for immediate use:
 - **IV Fentanyl Dose = 4micrograms/kg administered slowly over 3 mins.** (presentation 20micrograms/2mls).
 - **IV Suxamethonium Dose = 2 mg/kg administered 30 secs** (presentation 10mg/2mls)
- IV Atropine may be used at the discretion of the senior doctor
Dose = 20 microgram/kg (presentation 100 micrograms/1ml)
- The order of administration is:



- IV Morphine 100-200 microgram/kg bolus remains an alternative opioid agent with provision of adequate time to produce analgesic effect of 10 mins.
- Naloxone (Opioid Antagonist) should be readily available in the rare event of chest wall rigidity, Dose = 100 microgram/kg
- Haemodynamic monitoring and stability are paramount, If a prolonged period of hypoxia or bradycardia occurs during an attempt at intubation, the procedure should be stopped and the infant stabilised. One team member should be allocated to alert the operator of the baby's condition. Patient positioning and condition, equipment selection and operator factors should be addressed prior to any further attempt.
- The use of a Videolaryngoscope is encouraged by staff trained in its use. This is to facilitate teaching and augment proof of placement of the ETT.

Equipment

- Appropriate Endotracheal Tube (see [Table 1](#)), and one size above and below.
- Laryngoscope - size zero is appropriate for the majority of term and preterm infants. Size 00 may be used at the very extremes of prematurity; a size 1 may be considered for macrosomic infants >4.5 kg.
- Suction
- Set ventilation, mask and T-piece, back-up bag-mask
- Pedi-Cap™ CO₂ detector and/or End Tidal CO₂ detector for ventilation circuit
- Stethoscope
- Securing device Neobar® or Leucoplast and Hydrocolloid tape (Comfeel) x 2
- Skin preparation wipe
- If nasal device: Black silk tie, Cotton buds

- Optional adjuncts:
 - Magill forceps
 - The use of an introducer/stylet is discouraged for infants not thought to have an airway abnormality because of concerns of an increased risk of trauma. If an introducer is used ensure the tip does not protrude beyond the end of the ETT and that the introducer can be removed easily prior to intubating the baby. Care should be taken when removing the introducer after successful intubation to ensure the ETT is not inadvertently dislodged.

Note: If using a NeoBar® Tube Holder to secure an oral ETT select the appropriate size colour coordinated with the measuring strip provided.

ETT Size & Depth Guide

Reference to gestational age or weight based formulary may guide to ETT insertion depth, together with vocal cord guide (marked on ETT) and position on chest x-ray. In extremely preterm infants where a 2.0 mm ETT is used it may be desirable to change to a 2.5mm when possible due to undesirable high impedance to ventilation and frequency of tube occlusion.

Oral ETT depth = Weight (kg) + 6cm

Nasal ETT depth= 1.5 x Weight (kg) +6cm

Table 1: Tracheal Tube Guide

Corrected Gestation (Weeks)	Actual Weight (Kg)	ETT Depth at Lip (cm)	ETT Size (mm)
23-24	<0.6	5.5- 6.0	2.0- 2.5
25-26	0.7-0.8	6.0	2.5
27-29	0.9-1.0	6.5	
30-32	1.1-1.4	7.0	2.5- 3.0
33-34	1.5-1.8	7.5	
35-37	1.9-2.4	8.0	3.5
38-40	2.5-3.1	8.5	
41-43	3.2-4.2	9.0	

Procedure

- **Patient preparation:** Ensure infant is supine, well positioned, comfortable and in as optimal physiological condition as possible before attempting intubation. Cardiorespiratory monitoring in situ, intravenous access secure and functioning.
- **Team preparation:** verbal confirmation of 'walk through' the procedure including location of key equipment, role allocation and plan in the event of for unsuccessful attempt.
 - **Equipment preparation:** Check all equipment is present and in working order
 - **Premedication** to be administered when ready to proceed.
- **Procedure:** Laryngoscope in left hand, gently open mouth and insert laryngoscope, watch the blade advance over surface of the tongue to identify the epiglottis. Once identified angle the handle of the blade to 30-45 degrees and continue to advance until the tip sits in the vallecular.
- Lift up and forwards with laryngoscope until cords come into view.
- If adequate visualisation is not achieved within 30-40 secs remove laryngoscope gently, provide IPPV and reassess patient positioning and condition, equipment selection and operator factors. Substitution with a more senior experienced operator should occur after no more than two attempts or if initial attempt was associated with patient instability.
- Hold tube lightly between index finger and thumb of right hand and introduce at 90° from the right side of the mouth.
- When tube at cords rotate anticlockwise and advance until cord markers at appropriate level.
- Maintain tube position with right hand while withdrawing laryngoscope blade.
- **Proof of Placement:** Visualisation of ETT placement through the vocal cords, with secondary confirmation from observer if videolaryngoscope used, placement of Pedi-Cap™ with initiation of IPPV observing for chest movement, vital signs and Pedi-Cap™ colour change. Auscultate to confirm bilateral equal air entry.
- Check depth of tube insertion at the lips (Table 1 or weight (kg) + 6cm) and adjust as necessary.
- Secure tube in place ([Appendix 1](#))
- Attach End Tidal CO₂ monitor when placing on ventilation and obtain chest x-ray
- Document procedure on the MR 493 Neonatal Intubation/Extubation record including use of premedication, ETT size and depth of insertion, confirmation of tube placement, patient stability and any adverse events.

Common Pitfalls

Laryngoscope tip impinges on cords. - potential for trauma	Use size 0 blade “Look see” technique with blade tip in vallecular
“Tyre levering of laryngoscope” - damage to upper alveolar margin - small mouth increases difficulty of intubation	Appropriate use of laryngoscope, Take a firm grip on laryngoscope Stand up and stand back Don't bend knees Aim to move the handle towards the wall rather than ceiling
Placing ET tube in “viewing channel” - difficult tube insertion	Appropriate use of laryngoscope, laryngoscope blade should be angled to the left side of mouth creating more room on the right side of the mouth for ETT insertion
Clumsy handling of ET tube - makes insertion more difficult	Tube should be placed from right side at 90° to laryngoscope. Hold lightly between finger and thumb so can easily be rotated anteriorly.
ET tube dropped in bed and reused. - Sepsis risk	Should be avoided

Insertion of a Nasal ETT

1. **Patient and team preparation** as above
2. **Procedure:** A size 6 suction catheter is passed through the ETT and initially passed via the nasal passage into the pharynx ensuring patency for the ETT and correct passage inferiorly. This should occur prior to administration of muscle relaxation in the event of difficult passage necessitating transition to an oral ETT.
3. Moisten the end of the ETT using sterile lubricant or sterile water, if necessary, to ease the passage of the tube reducing the mucosal trauma.
4. Position the infant supine in the neutral position. Gently tilt the infant's head into a sniffing position.
5. Feed the ETT along the suction catheter into the nostril to a depth of only 1-1.5 cm.
6. Visualise the suction catheter in the pharynx using the laryngoscope.
7. Advance the ETT along the floor of the nose into the pharynx and once visualised withdraw the suction catheter.
8. Using the Magill's forceps position the ETT in the trachea with reference to the vocal cord marker and reference guide depth= (1.5 x Weight (kg) +6cm)
9. **Proof of placement** and documentation as above
10. Secure ETT as per [Appendix](#)

Educational Notes

Use of premedication in non-emergent intubation

In 2010, the American Academy of Pediatrics (AAP) recommended premedications for all intubations in neonates, except in the emergent intubation during resuscitation¹. The use of premedication has been shown to provide conditions to support rapid and safe intubation without adverse effects (including reduction in the number of attempts and procedural duration); reduce pain and discomfort associated and minimise potential for related airway trauma and adverse physiological responses of bradycardia, systemic hypertension, intracranial hypertension and hypoxia^{1,2}.

There is significant variation in clinical practice worldwide regarding the use, selection and combination of medications regarding analgesic, vagolytic and muscle-relaxants for non-emergent intubations³⁻⁵. Ideal pharmacological properties include a rapid onset and offset action, with short duration of effect and clearance⁶.

The AAP recommends fentanyl as the preferred agent for analgesia during intubation¹. Fentanyl is a rapid acting analgesic reaching desired effect within 2-5 mins, and short duration of action⁶. Infants of lower gestational age and weight may exhibit reduced hepatic clearance. Adverse events reported include apnoea, hypotension, CNS depression and chest wall rigidity up to 10%, the latter largely correlating with dosage and rate of administration, and may be negated by use of a muscle relaxant and reversed by administration of naloxone^{1,2,6}.

There is emerging data for the efficacy of remifentanyl as a new and more rapid acting alternative to fentanyl^{1,7-13}. However, stability of the drug impacts of the suitability to supply in ready-for-use pre-filled syringes.

Intravenous Morphine remains an alternative analgesic agent with provision of adequate time to onset of action (5 mins) and time to produce analgesic effect of 10-15 mins^{1,14}. Interpatient variation in the pharmacokinetics of morphine in neonates can lead to risk of high prolonged effect and CNS depression, with a mean half-life up to 9.6 +/- 3.0 hours in term and preterm babies^{2,6,15}.

Atropine remains the most commonly used vagolytic agent used in NICUs in Australia^{6,16} preferred by the AAP compared to glycopyrrolate given rapid onset action and shorter duration¹. However, lack of evidence base regarding the use of atropine in paediatric anaesthesia has received recent attention¹⁷, but no current randomised controlled trials comparing specific vagolytic agents or placebo effect in term or preterm infants exist to date in the published literature. Atropine blocks the vagal response of bradycardia that placement of a laryngoscope and ETT may induce and minimizes oral secretions improving visibility of the vocal cords. Onset of action is within 2 minutes and half-life > 4 hours. Caution should be used in patients with sepsis or history of SVT due to risk of tachycardia or arrhythmia. Atropine should be administered prior to a muscle relaxant.

Inclusion of a neuromuscular blocking agent has been shown to improve both intubating conditions, shorten procedural duration and affords more haemodynamic stability in preterm infants^{1,2,6,18}. Suxamethonium acts as a depolarizing agent with rapid onset of action of 30 seconds and short duration of action of 3-6 minutes. Contraindications to succinylcholine include significant hyperkalaemia, a family history of malignant hyperthermia and suspicion of muscular dystrophy or suggestion of upper airway obstruction that may prevent intubation.

Acknowledgement of a paucity of evidence concerning potential neurotoxic effects of opioid analgesics, sedatives, and anaesthetics on the developing brain and long term developmental outcomes is advised.

Endotracheal Tube selection and depth guides

Gestational age based guidelines for ETT depth insertion at the mid-tracheal position are utilised by the European, New Zealand, Australian, and UK resuscitation councils as standard (Table 1)^{19,20}. Care should be employed regarding accuracy in infants at extremes of lower gestational age or growth restriction²¹. A randomised trial comparing use of weight formula (weight (kg) plus 6cm) vs vocal cord guide on the ETT demonstrated equivocal results²².

Nasal vs. Oral Endotracheal Intubation

Nasotracheal intubation may be considered by experienced practitioners, but in the Majority of patients orotracheal intubation is recommended as a first line. Failed attempts at nasotracheal intubation should be followed by orotracheal intubation. Nasal intubation has been associated with higher incidence of moderate to severe voice abnormality (58%) in infants less than 25weeks gestation²³ and other laryngeal pathologies in preterm infants up to 29 weeks gestation²⁴.

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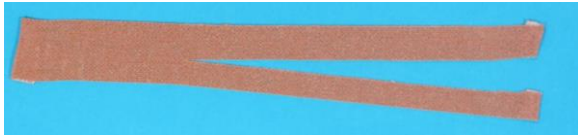
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Document owner:	Neonatal Directorate Management Committee		
Author / Reviewer:	Neonatal Directorate Management Committee		
Date first issued:	June 2006		
Last reviewed:	12 th October 2017	Next review date:	12 th October 2020
Endorsed by:	Neonatal Directorate Management Committee	Date endorsed:	28 th November 2017
Standards Applicable:	NSQHS Standards: 1  Governance		
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Appendix

Tapes Required



A) Trouser leg - 2 required



B) Anchor tape – 1 required



C) Hydrocolloid tape x2



Nasal ETT requires black silk suture

Alternatively, a Neobar® Tube holder can be used to secure an oral ETT.

Securing an Oral ETT Using Tape

- Step 1:** Place hydrocolloid tape (Comfeel) to both cheeks from the edge of the mouth ([Figure 1](#)).
- Step 2:** Place the oral ETT to one corner of the mouth.
- Step 3:** Place anchor tape "B strap" from the side of the ETT on the cheek and extend up the ETT ([Figure 2](#)).
- Step 4:** Place the first trouser leg tape with the non-split end on the cheek from the corner of the mouth where the ETT is. Place the upper leg across the top of the lip ([Figure 3](#)) and then the lower leg is wrapped around the ETT in a spiral fashion.
- Step 5:** Place the second trouser leg tape on the opposite cheek from the corner of the mouth. The lower leg is placed across the lower lip and the upper leg is then wrapped around the ETT in a spiral fashion ([Figure 4](#)).



Figure 1
Hydrocolloid Tape
Placement



Figure 2
Anchor tape



Figure 3
Trouser leg tape



Figure 4

Second Trouser leg tape

Strapping of an Oral ETT Using NeoBar®

1. Ensure skin is clean and dry, apply skin preparation and allow to dry.
2. Apply heat to tabs of the NeoBar® to facilitate adhesion.
3. NeoBar® should never come into contact with the infant's lips i.e. should be 5 mm from the lips and centred at the corners of the mouth.
4. Place ET tube **underneath** the stabilising platform to minimize trauma to the palate.
5. Place tabs anterior to the ears along the maxilla, hold in place for 60 seconds to ensure adhesion.
6. Wrap leucoplast tape once around the ETT, then once around the platform to secure.

Strapping of a Nasal Endotracheal Tubes

- Step 1:** Place hydrocolloid tape (Comfeel) to both cheeks from the edge of the nose (Figure 1).
- Step 2:** Tie a double knot with a black silk suture around the base of the ETT at the depth it is to be secured, taking care not to occlude the tube. Hold both ends of the black silk across the cheeks (Figure 2).
- Step 3:** Place the anchor tape from the forehead, down the bridge of the nose and extend up the ETT (Figure 3).
- Step 4:** Place the first trouser leg tape with the non-split end to the cheek that is on the same side as the nostril with the ETT. Place the lower leg across the top of the lip, to the other cheek securing the knot in the tie and ensuring the black silk is covered (Figure 4). The upper leg is then wrapped around the ETT in a spiral fashion.
- Step 5:** Place the second trouser leg tape on the opposite cheek (Figure 5). The upper leg is taken across the bridge of the nose to the other cheek. The lower leg is taken under the ETT and is wrapped around the tube in a spiral fashion. The other nostril should not be occluded by any tape or silk tie



Figure 1
Hydrocolloid Tape Placement



Figure 2
Double knot with silk



Figure 3
Anchor Tape



Figure 4
First Trouser leg tape



Figure 5
Second Trouser leg tape