



## GUIDELINE

### Intubation

<b>Scope (Staff):</b>	Nursing and Medical Staff
<b>Scope (Area):</b>	NICU KEMH, NICU PCH

#### Child Safe Organisation Statement of Commitment

CAHS commits to being a child safe organisation by applying the National Principles for Child Safe Organisations. This is a commitment to a strong culture supported by robust policies and procedures to reduce the likelihood of harm to children and young people.

This document should be read in conjunction with this [disclaimer](#)

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The following guideline outlines the process for neonatal intubations. If you are encountering a **Difficult Airway**, please refer to the [Difficult Airway \(Neonatal\) Guideline](#) for the Optimization checklist and Algorithm

## Aim

- To help clinical staff safely prepare for and perform endotracheal intubation through a standardized and structured approach.
- Promote good communication, teamwork and situational awareness.
- Reduce complications associated with intubation.

## Risk

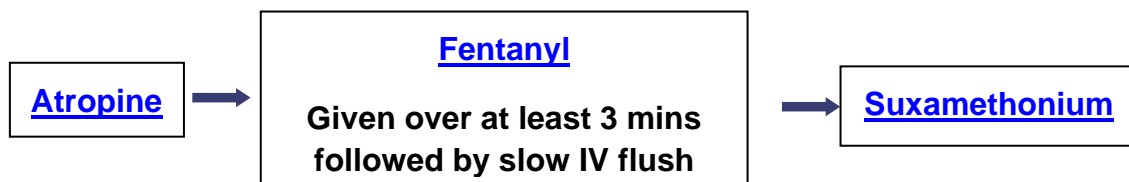
Endotracheal intubation is one of the highest risk procedures in newborns, with adverse events being common. Adverse tracheal intubation associated events can be categorized as non-severe or severe:

- Non-severe events can include desaturation, oesophageal intubation with immediate recognition and no cardiac compressions required, mainstem bronchus intubation, gum or dental trauma, vomiting without aspiration and pain or agitation.
- Severe events can include cardiac arrest, oesophageal intubation with delayed recognition, hypotension, laryngospasm, vomiting associated with aspiration, pneumothorax and/or pneumomediastinum and direct airway injury.
- Other risks also include ventilator-acquired pneumonia, which may be introduced during the procedure.

## Key Points

- Factors associated with intubation success and reduced adverse events are:
  - Provider experience<sup>1</sup>
  - Premedication (non-emergent intubations)<sup>2, 3</sup>
  - Video laryngoscope<sup>1, 3, 4</sup> (when inexperienced providers are being instructed by experienced staff)
  - Teamwork, communication and preparation.<sup>5</sup>
- In an emergency situation where there is difficulty ventilating or oxygenating the infant, the priority is to [Recognise and Respond to the Clinical Deterioration](#) and proceed directly to intubation.
  - A sterile towel must be utilised to maintain sterility of the equipment and appropriate PPE donned by the clinician performing the intubation.
  - The assignment of roles is to occur as the team arrive at the bedside.
- If unfamiliar with intubation and able to ventilate adequately via face mask, wait until more experienced help arrives.

- Nasotracheal intubation should be performed only under special circumstances and by experienced senior registrars or consultants.
- Consider using size 3.0mm cuffed ETT for surgical and cardiac infants as well as those with suspected or confirmed COVID-19 if the infant is > 35 weeks gestation > 2.7 Kg. This will avoid the need for reintubation in theatre by the anaesthetists, for whom cuffed ETT is the preferred option. 3.0mm Cuffed ETT could also be used if there is significant leak on 3.5 uncuffed ETT.
  - Refer to [Respiratory Management of the Neonate with Suspected or Confirmed COVID-19](#)
- Pre-diluted syringes of atropine, fentanyl and suxamethonium are available in for immediate use.
- The order of administration is:



- IV [Morphine](#) bolus remains an alternative opioid agent with provision of adequate time to produce analgesic effect of at least 10 mins.
- [Naloxone](#) (Opioid Antagonist) should be readily available in the rare event of chest wall rigidity.
- 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.
- The Team Leader should stand back and maintain situational awareness at all times and alert the intubator of the baby's condition.
- Patient positioning and condition, equipment selection and operator factors should be addressed prior to any further attempt.

## Ventilator-acquired Pneumonia (VAP) Prevention Strategies

- A sterile towel is to be used to place any open intubation equipment when not in use. This can be placed on the airway trolley or in the patient bedspace.
- All intubation equipment is to remain in its packaging until required.
- A new ETT should be used with each intubation attempt.
- No intubation equipment should be placed on the infant's bedding/sheet unless it is protected by its packaging.
- Equipment should be replaced if contaminated or comes in contact with the infants bedding.

- Gloves are to be worn when intubating or encountering oral/respiratory sections.
- Oropharyngeal suction is to be performed prior to intubation or reintubation.

## Equipment required for Intubation

1. Appropriate Endotracheal Tube (see [Table 1](#)), and one size above and below.
2. 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 marosomic infants >4.5 kg.
3. Suction
4. Set ventilation, mask and T-piece, back-up bag-mask
5. Pedi-Cap™ CO<sub>2</sub> detector and/or End Tidal CO<sub>2</sub> detector for ventilation circuit
6. Stethoscope
7. Surgical facemask (N95 only for suspected COVID-19)
8. Protective eyewear (goggles or face visor)
9. Securing device Neobar® or Leucoplast and Hydrocolloid tape (Comfeel) x 2
10. Skin preparation wipe
11. If nasal device: Black silk tie, Cotton buds
12. Optional adjuncts:
  - a. Magill forceps
  - b. 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)	Uncuffed ETT Size (mm)	Cuffed ETT size (mm)
23-24	<0.6	5.5- 6.0	2.0- 2.5	N/A
25-26	0.7-0.8	6.0	2.5	
27-29	0.9-1.0	6.5	2.5	
30-32	1.1-1.4	7.0	2.5- 3.0	3.0
33-34	1.5-1.8	7.5		
35-37	1.9-2.4	8.0	3.0 - 3.5	
38-40	2.5-3.1	8.5		
41-43	3.2-4.2	9.0		

## Procedure

Steps	Additional Information
<b>Patient Preparation</b>	
<input type="checkbox"/> Ensure infant is supine, well positioned, comfortable and in as optimal physiological condition as possible before attempting intubation. Ensure thermal care throughout.	
<input type="checkbox"/> Cardiorespiratory monitoring in situ, intravenous access secure and functioning.	ECG, SpO2 and NBP
<b>Team Preparation</b>	
<input type="checkbox"/> Assign roles to clinical staff NOTE: This is a full list, some roles may need to be combined when resources are limited.	Role allocations: <ul style="list-style-type: none"> <li>• Team Leader</li> <li>• Airway Lead (Intubator)</li> <li>• Airway assistant</li> <li>• Medication nurse</li> <li>• Circulatory nurse</li> <li>• Scribe</li> </ul>
<input type="checkbox"/> Check all equipment is present and in working order and place on sterile towel	

Steps	Additional Information
<input type="checkbox"/> Pre-procedural 'Time Out'. Nurse to read out 'Intubation Time Out' check list	Use laminated copy on intubation trolley or print from <a href="#">Appendix 2</a> .
Procedure	
1. Clinician performing the intubation to don appropriate PPE	Surgical face mask, protective eyewear and gloves. See also <a href="#">Respiratory Management of Neonates with Suspected or Confirmed COVID-19</a> for intubation process and checklists
2. <a href="#">Premedication</a> to be administered when ready to proceed	Airway Lead to instruct when this is to be given
3. Aspirate gastric contents	
4. Airway Lead to proceed with intubation	Refer to Appendix 4 for insertion of an Oral ETT Refer to Appendix 5 for insertion of a nasal ETT
Proof of Placement	
<ul style="list-style-type: none"> <li>• Visualisation of ETT placement through the vocal cords, with secondary confirmation from observer if videolaryngoscope used</li> <li>• Chest movement with IPPV</li> <li>• Pedi-Cap™ colour change</li> <li>• Misting of ETT</li> <li>• Increasing Heart rate and saturations</li> <li>• Auscultate to confirm bilateral equal air entry</li> </ul>	
1. Check depth of tube insertion at the lips (Table 1 or weight (kg) + 6cm) and/or vocal cord guide and adjust as necessary	
2. Secure tube in place ( <a href="#">Appendix 1</a> )	
3. Attach End Tidal CO <sub>2</sub> monitor when placing on ventilation and obtain chest x-ray	

Steps	Additional Information
4. Document procedure on the MR 493 Neonatal Intubation/Extubation record	Include <ul style="list-style-type: none"> <li>• use of premedication</li> <li>• ETT size and depth of insertion</li> <li>• confirmation of tube placement,</li> <li>• patient stability and any adverse events.</li> </ul>

## Common Pitfalls

Laryngoscope tip impinges on cords. <ul style="list-style-type: none"> <li>• potential for trauma</li> </ul>	Use size 0 blade “Look see” technique with blade tip in vallecular
“Tyre levering of laryngoscope” <ul style="list-style-type: none"> <li>• damage to upper alveolar margin</li> <li>• small mouth increases difficulty of intubation</li> </ul>	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” <ul style="list-style-type: none"> <li>• difficult tube insertion</li> </ul>	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 <ul style="list-style-type: none"> <li>• makes insertion more difficult</li> </ul>	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. <ul style="list-style-type: none"> <li>• Sepsis risk</li> </ul>	Should be avoided

## Related CAHS internal policies, procedures and guidelines

### Neonatology Clinical Guidelines

- [Nursing Care of the Ventilated Neonate](#)
- [Recognising and Responding to Clinical Deterioration](#)
- [Respiratory Management of Neonates with Suspected or Confirmed COVID-19](#)
- [Surfactant Therapy](#)



## References and related external legislation, policies, and guidelines

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Healthy kids, healthy communities

Compassion

Excellence

Collaboration

Accountability

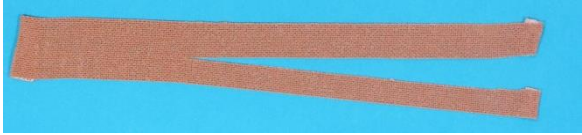



Equity

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## Appendix 1: Securing of Endotracheal Tube

### Tapes Required

<b>2 x Trouser Leg</b>	
<b>Anchor Tape</b>	
<b>2 x Comfeel Tape</b>	
<b>Black Silk Suture (NASAL only)</b>	

### Securing an Oral ETT Using Tape



Steps	Additional Information
<ul style="list-style-type: none"> <li>Place hydrocolloid tape (Comfeel) to both cheeks from the edge of the mouth</li> </ul>	
<ul style="list-style-type: none"> <li>Place the oral ETT to one corner of the mouth</li> </ul>	




Steps	Additional Information
<ul style="list-style-type: none"><li>Place anchor tape from the side of the ETT on the cheek and extend up the ETT</li></ul>	
<ul style="list-style-type: none"><li>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 and then the lower leg is wrapped around the ETT in a spiral fashion</li></ul>	
<ul style="list-style-type: none"><li>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</li></ul>	

## 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

Steps	Additional Information
<ol style="list-style-type: none"> <li>1. Place hydrocolloid tape (Comfeel) to both cheeks from the edge of the mouth</li> </ol>	
<ol style="list-style-type: none"> <li>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</li> </ol>	

Steps	Additional Information
<p>3. Place the anchor tape from the forehead, down the bridge of the nose and extend up the ETT</p>	
<p>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. The upper leg is then wrapped around the ETT in a spiral fashion.</p>	
<p>5. Place the second trouser leg tape on the opposite cheek. 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</p>	

## Appendix 2: NICU Intubation Timeout Checklist

Perform prior to administration of medications for intubation.

Team Leader/Airway Lead	Nursing
<input type="checkbox"/> Notify Consultant on-call	<input type="checkbox"/> IV access available and working
<input type="checkbox"/> Special equipment or meds	<input type="checkbox"/> Equipment <ul style="list-style-type: none"> <li>– ET tube (consider uncuffed vs cuffed)</li> <li>– Laryngoscope/blade</li> <li>– CO<sub>2</sub> detector</li> <li>– Sterile towel to place open equipment when not in use</li> <li>– Manometer + 3 way tap + 1ml syringe (for cuffed ETT)</li> <li>– Stethoscope</li> <li>– CMAC</li> </ul> <input type="checkbox"/> Suction ready <input type="checkbox"/> Stomach aspirated <input type="checkbox"/> Medications drawn up
<input type="checkbox"/> Premeds ordered	<input type="checkbox"/> Skin prep
<input type="checkbox"/> Neopuff set-up correctly	<input type="checkbox"/> Tape cut or neobar
<input type="checkbox"/> Video laryngoscope at bedside if needed	<input type="checkbox"/> Surfactant (if required)
<input type="checkbox"/> Parents notified before and after	<input type="checkbox"/> Ventilator calibrated and set-up
1. Is our checklist complete?	
2. Whom and why are we intubating?	
3. Are there specific concerns for this patient?	
– Difficult airway, at risk of IVH, hypotensive, poor cardiac function, ductal-dependent CHD, should not be bagged?	
4. If so what precautions should we take?	
5. We are using _____ medications and will tape at _____ cm at the gum line (see table 1; approx. weight + 6cm).	
6. Neopuff set to PIP of _____, a PEEP of _____ and an FiO <sub>2</sub> of ---_____.	
7. Please tell me if the heart rate is below _____, the oxygen saturations below _____ or if anyone has any concerns during the procedure.	

Adapted from Hatch LD et al. Interventions to Improve Patient Safety During Intubation in the Neonatal Intensive Care Unit. Pediatrics. 2016. 138(4)

## Appendix 3: 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 resuscitation<sup>6</sup>. 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.<sup>6, 7</sup>

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 intubations.<sup>8-10</sup> Ideal pharmacological properties include a rapid onset and offset action, with short duration of effect and clearance<sup>6</sup>.

The AAP recommends fentanyl as the preferred agent for analgesia during intubation.<sup>6</sup> Fentanyl is a rapid acting analgesic reaching desired effect within 2-5 mins, and short duration of action<sup>11</sup> 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.<sup>6, 7, 11</sup>

There is emerging data for the efficacy of remifentanyl as a new and more rapid acting alternative to fentanyl.<sup>6, 12-18</sup> 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.<sup>6, 19</sup> 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.<sup>7, 11, 20</sup>

Atropine remains the most commonly used vagolytic agent used NICUs in Australia<sup>11, 21</sup> preferred by the AAP compared to glycopyrolate given rapid onset action and shorter duration.<sup>6</sup> However, lack of evidence base regarding the use of atropine in paediatric anaesthesia has received recent attention<sup>22</sup>, 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.<sup>6, 7, 11, 23</sup> Suxamethonium acts a depolarizing agent with rapid onset of action of 30 seconds and short duration of action of 3-6 minutes. Contra-indications 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).<sup>24, 25</sup> Care should be employed regarding accuracy in infants at extremes of lower gestational age or growth restriction.<sup>26</sup> A randomised trial comparing use of weight formula (weight (kg) plus 6cm) vs vocal cord guide on the ETT demonstrated equivocal results.<sup>27</sup>

### **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 gestation<sup>28</sup> and other laryngeal pathologies in preterm infants up to 29 weeks gestation<sup>29</sup>.

## Appendix 4: Insertion of an Oral ETT

Steps	Additional Information
1. Laryngoscope in left hand, gently open mouth and insert laryngoscope, watch the blade advance over surface of the tongue to identify the epiglottis.	
2. Once identified angle the handle of the blade to 30-45 degrees and continue to advance until the tip sits in the vallecular.	
3. Lift up and forwards with laryngoscope until cords come into view.	
4. 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 <u>two attempts</u> or if initial attempt was associated with patient instability.
5. Hold tube lightly between index finger and thumb of right hand and introduce at 90° from the right side of the mouth.	
6. When tube at cords rotate anticlockwise and advance until cord markers at appropriate level.	
7. Maintain tube position with right hand while withdrawing laryngoscope blade.	

## Appendix 5: Insertion of a Nasal ETT

1. Patient and team preparation as above
2. 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=  $(1.5 \times \text{Weight (kg)} + 6\text{cm})$
- 9. Proof of placement and documentation as above**
10. Secure ETT as per [Appendix 1](#)