# Neonatal Intubation

## Guideline Responsibilities and Authorisation

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| **Target Audience** | NICU medical and nursing staff |
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## Guideline Review History

| Version | Updated by | Date Updated | Summary of Changes |
|---|---|---|---|
| 1.0 | M Bailey-Wild | May 2021 | New Document |
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# Neonatal Intubation

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## 1 Overview

### 1.1 Purpose

Neonates in intensive care often require intubation and mechanical ventilation. Elective intubation refers to the practice of inserting and endotracheal tube (ETT) for the purpose of providing mechanical/invasive ventilation in a non-emergency setting. Indications include extreme prematurity, the need for endotracheal tube change, pre or post-operative ventilation support and respiratory failure.

### 1.2 Scope

Staff working in Waikato District Health Board NICU.

### 1.3 Patient / client group

This guideline is applicable to all elective neonatal intubations undertaken within Waikato DHB.

### 1.4 Exceptions / contraindications

Caution should be exercised in infants with congenital malformations of the head, neck and chest.

### 1.5 Definitions and acronyms

| | |
|---|---|
| **ETT** | Endotracheal tube |
| **CNS** | Clinical Nurse Specialist |
| **IV** | intravenous |
| **Medical staff** | Neonatal Nurse Practitioners, Clinical Nurse specialists, Registrars, Fellows, SMOs |
| **NNP** | Neonatal Nurse Practitioner |
| **SMO** | Senior Medical Officer |

## 2 Clinical management Guideline

### 2.1 Indications for consideration of intubation

- Extreme prematurity
- Escalating respiratory support requirements
- Elective ETT change (upsizing or oral to nasal tube)
- Pre- or post-operative respiratory support
- Respiratory failure

- Congenital anomalies such as gastroschisis, omphalocoele, congenital diaphragmatic hernia etc.
- SMO discretion

## 2.2 Role allocation

Role allocation ensures effective team work that allows for minimisation of human factors and improves patient outcomes. Roles should be allocated by the team leader, although this can be done in collaboration with the scribe or nursing lead to ensure the roles and skills/knowledge are appropriately aligned.

**Key roles**

- Leader
- Airway lead
- Airway support
- Medication 1
- Medication 2/Circulation support
- Scribe
- Scout

The Leader and co-lead/scribe should review the Intubation Checklist and discuss preparation and plans A-D (see Appendix B) **before** pre-medications are administered.

## 2.3 Competency required

Nurse Practitioners, Clinical Nurse Specialists, Registrars, Fellows and Senior Medical Officers competent at oral or nasal intubation or under supervision of senior practitioner.

It is the most experienced present practitioner's responsibility for the procedure in ELBW (<1000g, or < 28/40).

## 2.4 Equipment

- Cardiorespiratory monitoring (+/- QRS volume) and saturation monitoring functioning (pre-ductal when relevant)
- Neopuff checked, set to appropriate patient parameters with attached facemask of correct size
- Ventilator set up, checked and ready for patient use
- Functioning IV access
- Three endotracheal tubes (weight appropriate ± ½ size)

| Tube Size (internal diameter) | Weight (g) | Gestational Age |
|---|---|---|
| 2.5 | < 1000 | < 26 |
| 3.0 | 1000-2000 | 27 - 34 |
| 3.5 | 2000-3000 | 35 - 40 |
| 3.5 - 4.0 | > 3000 | > 38 |

- Two working laryngoscopes
- Laryngoscope blades of size appropriate ± next size
- Magills of appropriate size for nasal ETT
- Introducer for oral ETT
- Suction catheter attached to working suction unit
- Pedicap/colorimetric $CO_2$ detector
- Stethoscope
- Pre-cut ETT tapes
- Nasogastric tube
- Premedication as below

## 2.5 Premedication

In the setting of an elective intubation, premedications provide adequate analgesia, sedation and minimisation of the physiological effects of intubation. Intubation has been identified as a painful procedure and associated with physiologic side-effects including bradycardia, desaturation, increased blood pressure and increased intracranial pressure which may be associated with intraventricular haemorrhage. Premedication administered to newborns for elective intubation reduces the time and number of attempts needed to complete the intubation procedure and minimises the potential for intubation-related trauma. Whilst premedication provides overall improved physiological stability, in 30% of infants administered premedication, blood pressure dropped by 20%.

An evidenced-based, protocol for premedication prior to elective intubation in neonates is to administer a vagolytic, an analgesic and a muscle-relaxant medication.

In emergency situations, it may be appropriate to intubate without premedication.

Premedication should be administered in the **following order:**

| Medication | Dose | Administration |
|---|---|---|
| Atropine | 20 microgram/kg/dose | Slow IV push<br>IM if IV not available |
| Fentanyl | 4 microgram/kg/dose | Slow IV over 3-5 mins<br>IM if IV not available |
| Suxamethonium | 2 mg/kg/dose | Slow IV over 10-30 sec<br>IM if IV not available |

Second doses of suxamethonium may be required if effect wears off prior to successful intubation.

*N.B. in some situations, IV access may not be available or able to obtained in a timely fashion. In this instance, premedication can be administered intramuscularly.*

### 2.6 Procedure

- Ensure premedication is available and ready
- Equipment must be ready, especially the bag-mask circuit and laryngoscope. The infant will have no spontaneous respiratory effort once muscle relaxing agents (or Fentanyl) have been given.
- Position infant supine, aspirate NGT/OGT, maintain warmth
- The infant should have bag-mask ventilation during the administration of Fentanyl and Suxamethonium, or prior to this if respiratory effort is poor.
- Laryngoscopy should commence once spontaneous respiratory movements have ceased.
- Visualise vocal cords and pass ETT tube
  - For nasal intubation this should be assisted with Magills forceps **without** stylet
  - For oral intubation a stylet may be used to assist
- Confirm position with
  - Direct visualisation
  - Observe misting in ETT
  - Observe chest rise
  - Affix colorimetric device (Pedi-cap or similar) to confirm exhaled $CO_2$.
  - Auscultate bilaterally to ensure equal air entry
  - Length of insertion:
    - oral: 6cm + weight in kg
    - nasal: 7cm + weight in kg

- ANZCOR recommends use of the following table in ELBW

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

- Secure ETT as per Endotracheal Tube (ETT) Taping - Nasal and Oral in Newborn Intensive Care Unit (NICU) procedure
- Connect to pre-set up ventilator
- Chest X-ray to confirm position of ETT (midway between level of clavicles and carina). Nasogastric tube should be (re)placed *prior* to Chest X-ray.
- *If bradycardia occurs in the presence of hypoxaemia, a second dose of Atropine should not be given. The bradycardia is due to inadequate oxygenation and/or ventilation.*
- *If the intubation is unsuccessful, Suxamethonium can be re-administered but Atropine and Fentanyl should **not** be repeated.*
- *If intubation is unsuccessful, a laryngeal mask airway (LMA) may be considered until further help arrives.*

## 2.7 Potential complications

**DOPE**: A mnemonic that assists with troubleshooting when a ventilated infant unexpectedly deteriorates (Displacement or Dislodgement, Obstruction, Pneumothorax and Ventilator or Equipment failure).

- **D**isplacement of the ETT (into right main bronchus or out of trachea) or disconnected tubing: inspect all connections from the ETT back to the ventilator or Neopuff. Observations of neonate for alteration in vital signs (heart rate and $SpO_2$ deterioration), observe for equal, bilateral chest movement and auscultate for equal, bilateral air entry.
- **O**bstruction with mucus plug or with kinked ETT or respiratory tubing: auscultate chest for air entry, inspect tubing, and suction ETT.
- **P**neumothorax: observe neonate for equal chest movement on right and left, auscultate for equal, bilateral air entry, inform medical staff immediately and prepare neonate for transillumination of the chest/chest x-ray and potential thoracentesis and/or insertion of a chest drain.
- **E**quipment failure: Ensure there is a checked and functioning Neopuff ready with appropriate sized neonatal face mask.

### 2.8 After care

- ETT should be taped as per the Endotracheal Tube (ETT) Taping - Nasal and Oral in Newborn Intensive Care Unit (NICU) procedure
- Final position should be confirmed on Chest X-ray and procedure documented in clinical notes.
- Consider repeat gas in 30-60mins post procedure.
- Patient deterioration should be rapidly escalated to the medical team.

## 3 Patient information

Once a decision to perform intubation has been made, parents should be updated. In an emergency this may be following the intubation procedure. Caffeine Citrate (0591) should be part of the management plan for babies under 30 week's gestational age.

## 4 Audit

### 4.1 Indicators

- The threshold for intubation meets criteria 2.1
- Documented monitoring of saturations, oxygen requirement, ABG/Cap gas before, during and after procedure
- Monitor intubation incidents

## 5 Evidence base

### 5.1 Bibliography


- Trung. L, Kim. J.H, Kateria. A.C, Finer. N. N, Marc-Aurele. K, (March 2020) Haemodynamic Effects of Premedication for Neonatal Intubation: An Observational Study. Arch Dis Child Fetal Neonatal Ed, 105 (2): 123-127.
- Barrington, K. (2011), Premedication for endotracheal intubation in the newborn infant. *Paediatric Child Health* 16(3): 159-164.
- Schmölzer GM, Roehr CC. Techniques to ascertain correct endotracheal tube placement in neonates. Cochrane Database of Systematic Reviews 2014, Issue 9. Art. No.: CD010221. DOI: 10.1002/14651858.CD010221.pub2.
- ANZCOR Guideline 13.5: Tracheal Intubation and Ventilation of the Newborn Infant. (2016) https://www.nzrc.org.nz/assets/Guidelines/Neonatal-Resus/ANZCOR-Guideline-13.5-Aug16.pdf
- Yamada. N.K, Kamlin. C.O.F, Halamek. L.P, (2018) Optimal Human and System Performance During Neonatal Resuscitation, Seminars in Fetal and Neonatal Medicine, 23 306-311.

- Emergency Airway Management https://www.rch.org.au/clinicalguide/guideline_index/Emergency_airway_management/
- Newborn intensive Care guideline – intubation - premedication for intubation in neonate (2020) https://www.starship.org.nz/guidelines/intubation-premedication-for-intubation-in-neonate
- Newborn intensive Care guideline – Endotracheal tube management in NICU https://www.starship.org.nz/guidelines/endotracheal-tube-management-in-nicu/

### 5.2 Associated Waikato DHB Documents

- Atropine for neonates drug guideline (Ref. 6356)
- Fentanyl for neonates drug guideline (Ref. 2916)
- Suxamethonium for neonates drug guideline (Ref. 2968)
- Endotracheal Tube (ETT) Taping - Nasal and Oral in Newborn Intensive Care Unit (NICU) procedure (Ref. 2627)
- Endotracheal Suctioning in Newborn Intensive Care Unit (NICU) procedure (Ref. 5962)

## Appendix A – Intubation Checklist (adapted from Starship Newborn Services)

### Is this an EMERGENCY intubation?

- Call for help (Push red bell/call neonatal code blue and ask for resuscitation trolley/airway trolley
- Contact NICU Consultant on service/on call (Unless discussed previously)
- Consider need for other staff – do you need the Paediatric code blue team/additional airway expertise?

**Duty Anaesthetist**
**23322**

**ENT Registrar/SMO**
**via switch 777**

### High Risk Patient?

if ANY of the following present consider delaying intubation, if possible, until senior help is present

**Airway**

- History of known difficult airway
- Any of the following: small mouth, small jaw, large tongue, short neck, signs of airway obstruction, or swelling to the face or neck

**Clinical Status**

- Unstable haemodynamics

**Event Manager**

- ☐ Confirm/allocate roles: Event Manager, CCN/Senior Nurse, Intubator, Airway Assistant, Circulation nurse, Medication Nurses (combine roles where necessary)
- ☐ Mini-summary including Plan A and Plan B
- ☐ Confirm whether pre-intubation drugs will be needed
- ☐ "Does anyone have any concerns?"

**CCN/Senior Nurse**

- ☐ Organise Nursing team roles
- ☐ Liaise with Event Manager
- ☐ Documentation (with times) - to be reallocated if/when Event Manager

**Intubator**

- ☐ Confirm with airway assistant that all equipment is ready
- ☐ Inform Event Manager that ready to intubate
- ☐ Ask medication nurses to administer the intubation drugs (if using)
- ☐ Intubate
- ☐ Confirmation of correct ETT placement (see below)
- ☐ Secure ETT with airway assistant

**Airway Assistant**

- ☐ Assemble equipment
- ☐ Optimise patient position
- ☐ Neopuff at correct pressure for baby (default 20/5, adjusted for baby)
- ☐ Working suction and appropriately sized suction catheter
- ☐ Oxygen/air blended (target FiO2 to saturations)
- ☐ Aspirate NGT/OGT

**Medication Nurse**

(discuss required medications with Event Manager)

- ☐ NICU emergency medication sheet printed
- ☐ IV fluid for volume expansion
- ☐ Intubation medications
- ☐ Adrenaline (drawn up if high risk patient) + other resus medications

**Circulation Nurse**

- ☐ Monitoring attached
  *ECG*
  *NIBP (cycle q2min) or arterial line*
  *SpO2 (not on same limb as BP cuff)*

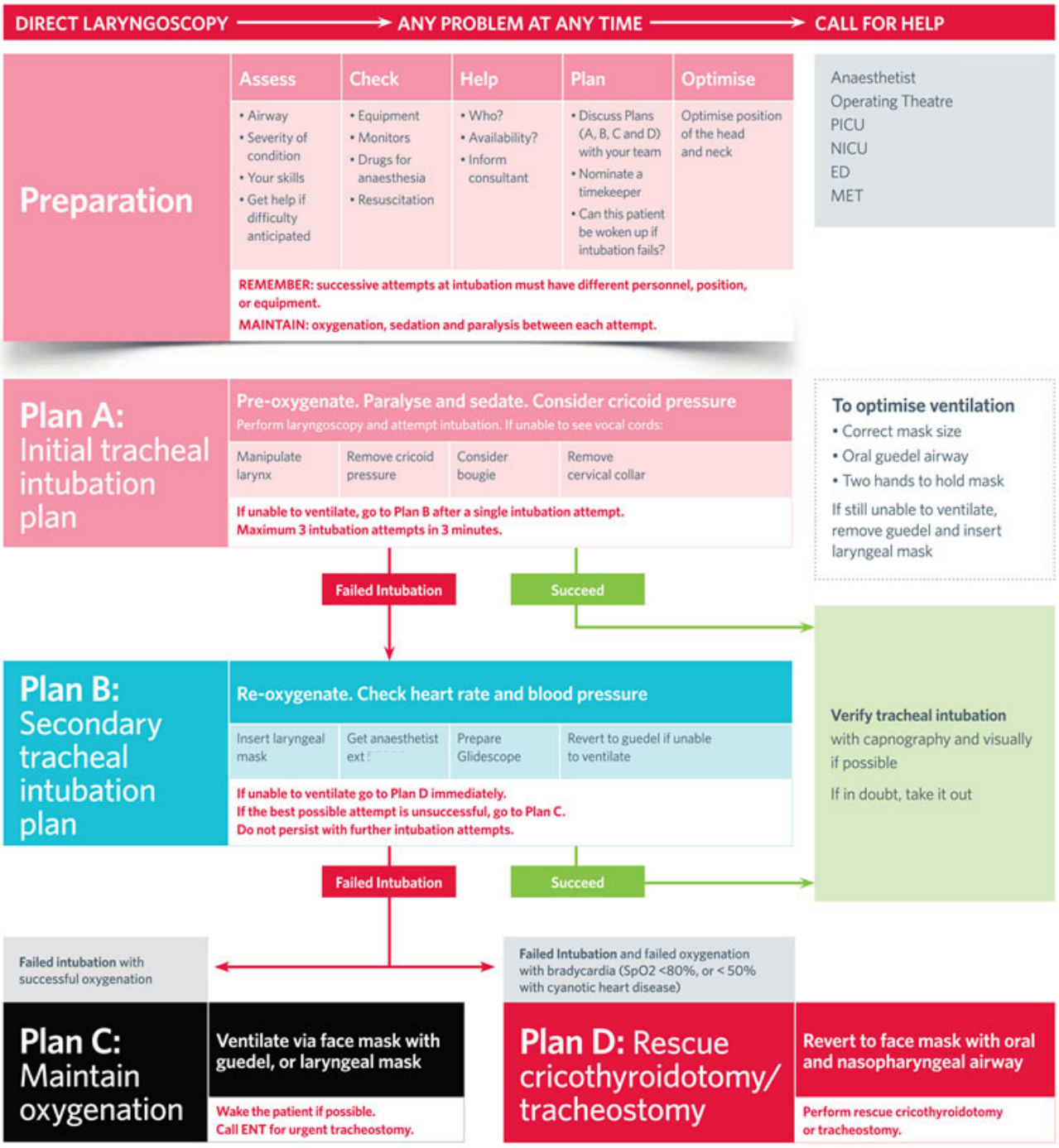
**Equipment**

- ☐ Facemask of correct size
- ☐ Three endotracheal tubes (weight appropriate ± ½ size)
- ☐ Two working laryngoscopes
- ☐ Laryngoscope blades of size appropriate ± next size
- ☐ Hydrocortisone cream for nasal intubation
- ☐ Magills of appropriate size for nasal ETT
- ☐ Introducer for oral ETT
- ☐ Pedicap/colorimetric CO2 detector
- ☐ Pre-cut ETT tapes

### Confirmation criteria

Pedicap/colorimetric CO2 detector
Increased HR if previously slow
Misting of ETT
Symmetrical air entry
Increased saturations

## Appendix B – Plan development for intubation (Royal Children's Hospital, Melbourne)



## Appendix C – NLS Algorithm