CLINICAL GUIDELINE	
Ventilated Neonate: Nursing Care of	
Scope (Staff):	Nursing and Medical Staff
Scope (Area):	NICU KEMH, NICU PCH, NETS WA

Child Safe Organisation Statement of Commitment

The Child and Adolescent Health Service (CAHS) commits to being a child safe organisation by meeting the National Child Safe Principles and National Child Safe Standards. This is a commitment to a strong culture supported by robust policies and procedures to ensure the safety and wellbeing of children at CAHS.

This document should be read in conjunction with this DISCLAIMER

Contents

Aim

This document is designed to provide guidance on the nursing care and management of the ventilated neonate including primary aspects of caring for a neonate on mechanical ventilation. This includes handling, positioning, observations, airway assessment, sound knowledge of equipment, documentation and the ability to respond to deterioration.

Key Points

- Intubation refers to the practice of insertion of an endotracheal tube (ETT) for the purpose of providing mechanical ventilation.
- Intubation is also required to relieve critical upper-airway obstruction and to provide a route for direct tracheal suctioning and as a means of delivering surfactant.
- Intubation of the COVID-19 positive neonate (Appendix 2)

Indications for Endotracheal Intubation

Endotracheal intubation is required for mechanical ventilation. This is required when there are issues with oxygenation, ventilation or the presence of apnoeas.

- Extreme prematurity and prolonged ventilation
- Respiratory support where there is cardiovascular compromise or instability.
- The need for an ETT change due to inadequate ventilation
- Pre or post-operative respiratory support

The Draeger VN500 is used at PCH and the Fabian is used at KEMH for conventional ventilation. Please refer to the Ventilation: Conventional, High Frequency Jet Ventilation and the High Frequency Oscillation Ventilation Guideline for modes of ventilation.

Complications

- Unplanned extubation
- Barotrauma/BPD
- PIE
- Pneumothorax
- Ventilator Acquired Pneumonia/Infection
- Obstruction
- Stenosis
- Retinopathy of prematurity
- Pressure injury
- Oral aversion
- Trauma
- Chronic Lung Disease

Nursing Requirements

Nursing staff require orientation to the neonatal ICU with supported clinical shifts, caring for a neonate on mechanical ventilation. The staff member is then provided ongoing support to ensure there are working within their scope of practice.

Ventilator

- Receive Clinical Handover following ISOBAR format.
- Document ventilator settings at the beginning of your shift in red. Take note of ETT size, position and integrity of taping.
- Check emergency equipment including suction and neopuff
    - Familiarise self with resus trolley contents and location. Ensure you are familiar with equipment required in an emergency situation
    - Check your neopuff is working with setting appropriate for your patient.
        - PEEP should be set the same as your patients current PEEP setting on the ventilator
        - PIP should be 30 for term and 25 for preterm infants.
- Ventilators should be plugged into Uninterrupted Power Supply (UPS) at all times.
- Ventilator circuits should be kept tangle free for occupational health and safety and to assist with easy access in the event of an emergency.
- Ventilator circuits and closed suction units are changed as required and as tolerated, or when no longer used. Ventilators should be stripped, cleaned and set up with new circuits, 6-8hrs post extubation.
- Mechanical ventilation should be utilising humidified gases to avoid trauma to the airway. Humidification chambers should be set at 37 degrees. There should be some misting in the ETT with minimal rainout. If rain out is excessive, consider adjusting humidification levels or insulating the inspiratory limb of the circuit.

ETT Securement

- ETT is to be secured immediately after intubation to prevent dislodgement, review the Intubation Guideline for how to adequately secure an ETT.
- A chest x-ray is always performed after intubation to verify the position of the ETT and review the lung fields.
- Hourly inspection of endotracheal tube taping (Neobar® or brown tape) to ensure it remains securely attached to baby's face and endotracheal tube
- **Re-strapping should be performed as an urgent procedure if the securing method is noted to be compromised/loose.**
    - **NOTE: The re-strap does not need to coincide with care times. This is a two person procedure, one of which MUST be a neonatal trained nurse. Inform the shift coordinator and medical team when an ETT restrap is required.**

Monitor Alarm Limits and Settings

- Continually monitor and record hourly HR, RR, SaO2 and ETCO2 (where applicable)

- Adjust ventilator alarms if necessary with changes in ventilator settings.
- Alarms must be switched on at all times.

Heart Rate	100-200 for ventilated infants and infants on CPAP
TcPO2	50-90 mmHg
TcPCO2	30-60 mmHg
TCM – temperature	44ºC – may be ↓ to 42ºC if infant is <27/40 & Consultant requests TCM/fragile skin
TCM – site time	Usually 4 hrs – may be ↓ 2hrs if <27/40 and <2 wks old/fragile skin
SaO_2	Infant <37wks 90–96%, Infant >37wks 93-98% Infant in room air: Upper limit SaO2 100%
Blood Pressure	Generally aim for Mean B/P of 35 - 50 mmHg. Depending on gestation

Handling and Positioning

- **Repositioning of a ventilated infant is a two person procedure**. Review ETT position and integrity of ETT securement prior to moving the infant. Prioritise retaping of the ETT if the integrity of the taping is compromised.
- Minimal handlings is to be observed to conserve energy for growth and development
- Handling the neonate for nappy changes, mouth care and repositioning is to be conducted 4-6 hourly, clustering cares as able. Ensure a neutral thermal environment to promote optimal temperature control.
- Plan and coordinate care to coincide with other procedures e.g. blood sampling, kangaroo care.
- Document changes in positioning on the observation chart.
- Ventilated patients should be nursed on a pressure mattress or sheepskin to assist with pressure area care.
- Continuously assess the infant's level of comfort and alert the medical staff if sedation is required.

Documentation

- At the commencement of each shift and/or after intubation, document ventilator settings and take note of ETT size, position, integrity of taping and any measurable leak.
- If your patient has a Cuffed ETT, it should be documented and state if it is inflated. Refer to Cuffed ETT Management Guideline
- Your first set of ventilator observations should be written in red. Any changes to ventilation settings should also be documented in red. This is to serve as a point of reference for the baby's response to change of treatment

- Document ventilator observations hourly, taking note of any changes in measurements. Inspect and document ETT taping integrity and position of the ETT each hour.
- If an intubation or extubation occurs during your shift, complete MR493.
- Complete Neonatal Endotracheal Tube Nursing Check MR 489.03 each shift, if there are any changes made to the ETT taping, reintubation or change in skin integrity.

Airway Assessment

Airway management is an important first step in the care of all patients, as an obstructed airway ultimately leads to problems with oxygenation. Failure to manage a patient's airway successfully can result in severe adverse outcomes, including brain injury, myocardial injury, airway trauma, and death.

- Assess the infant's colour, perfusion, tone, activity, pain/comfort and general appearance after any intubation, at admission and at handover to give a point of reference if the infants condition changes.
- Observe synchrony, adequacy and symmetry of chest expansion
- Auscultate quality of breath sounds and note respiratory rate / effort each hour.
- Note and document if there is a significant leak around the endotracheal tube. Any leak may be significant if ventilation cannot be optimised

Ventilator Acquired Pneumonia (VAP)

Ventilated acquired Pneumonia is a nosocomial infection that is not present prior to the infant being intubated. It is a preventable infection and measures should be taken to decrease the infants risk of developing the infection. It most commonly develops 48 hours after ventilation therapy and can increase patients' length of stay and risk of morbidity.

The following measures can greatly reduce ventilator acquired infections.

Elevation of Bed Head	
All babies who are clinically able will have the head of the bed elevated as close to 15 - 30º as possible.	Bed elevation correlates with significantly less micro-aspiration of stomach contents therefore reducing the risk of aspiration associated pneumonia. Exceptions to this are noted in some neurological conditions and post shunt insertion. Check with the medical team
Oropharyngeal Suction	
Oropharyngeal Suctioning is to be done prior to ETT suctioning, ETT strapping, Infant cares and repositioning, extubation and re-intubation	Secretions that form in the sub-glottic area are rapidly colonised with pathogenic bacteria. Introduction of oropharyngeal suctioning before repositioning or suctioning of the ETT reduces the risk of aspirating pooled oropharyngeal or nasopharyngeal

	secretions.
ETT Suctioning	
ETT Suctioning should ONLY be done on an as need basis and the use of Normal Saline should be avoided if at all possible	The use of Normal Saline when suctioning does not thin or assist in the mobilisation of mucous. It can adversely affect arterial and global tissue oxygenation and can dislodge bacterial colonies If saline is to be used during suctioning and/or flushing of the inline suction set, it should be as single, once only use of saline vials and syringes.
Hand Hygiene	
Strict hand hygiene must be performed before and after handling respiratory equipment.	
Aseptic Technique and Respiratory Secretions	
Staff are to wear gloves and follow standard precautions when handling ventilator condensate, respiratory and/or oral secretions.	
Neotech Little Suckers	
Neo-tech Little suckers, used for oral and nasal suctioning in the ventilated patient should be changed every 24 hours as per product recommendations. Each patient should have the Neo-tech little suckers labelled with their name and date and time of first use.	

Endotracheal Suctioning

ETT suction is performed to maintain a patent airway and optimize oxygenation and ventilation through the removal of airway secretions, whilst providing uninterrupted ventilation.

ETT suction is also required when obtaining an aspirate for MC&S:

- All intubated and ventilated infants should have a routine aspirate sent each Monday.
- All intubated infants who have a septic screen and all infants who are re-intubated.

In unstable infants and all infants on HFO/Jet Ventilation, perform the procedure with an assistant.

Adhere to VAP guidelines when attending to ETT Suction.

ETT suction is an aseptic technique, gloves are to be worn. Routine suction should be avoided. The need for suction should be based on the following clinical assessment:

- Visible or audible secretions in the chest or endotracheal tube.
- Interpretation of clinical changes: decrease in SaO2, bradycardia, altered air entry, chest wall movement, decrease in tidal volume, coarse or decreased breath sounds. Deterioration in blood gas values

Equipment

- Neopuff® with appropriate size mask (checked at commencement of shift)
- Ballards closed-system suctioning device
- Sodium Chloride 0.9% 10mL – for flushing of catheter post suction.
- 3mL leur slip syringe
- Functioning wall suction (checked at commencement of shift) settings:
  - 50-80 mmHg - infant < 1000 grams.
  - 80-100 mmHg – infant > 1000 grams

Observations

Auscultate with stethoscope before and after ETT suction to evaluate the necessity and effectiveness of the procedure.

Monitor vital signs before, during and after the procedure. Monitor End Tidal CO_2 or Transcutaneous Monitoring.

Procedure

For one person procedure, the operator must stand on the side of the ventilator to be able to adjust ventilator settings quickly if necessary. Where an assistant is present, the assistant is to stand by the ventilator with the operator on the opposite side.

Steps	**Additional Information**
1. Position the infant appropriately to perform the procedure safely	Turning of the infant's head from side to side during suction can occlude the jugular vein causing increased intracranial pressure; therefore this practice should be avoided
2. Routine use of saline should be avoided, however if secretions are thick and tenacious, 0.1-0.2mls Normal Saline can be instilled as lavage prior to suction.	Access port is to be cleaned with 2% Chlorhexidine/ Alcohol swab prior to use. Saline ampule and syringe are to be discarded after use.
3. Consider turning off continuous milk feed prior to procedure	Assist in the prevention of aspiration of milk
4. Perform hand hygiene and don gloves	

Steps	Additional Information
5. Perform oropharyngeal suction prior to ETT suction	Consider hand hygiene and change of gloves at this point
6. Increase FiO2 by 5-10% prior to suctioning (if appropriate).	
7. Open the Ballard suction valve, measure depth required	Level ETT is cut at + 5cm Correct measurement prevents deep suctioning which causes mucosal damage
8. Insert catheter to the predetermined length, apply suction and while supporting the endotracheal tube withdraw the catheter	This should not take longer than 10 seconds to minimise the risk of cerebral and pulmonary vasoconstriction.
9. Observe the secretions through the secretion viewing window	
10. Auscultate the chest; assess the need for further passes of the catheter	
11. On completion of suction, apply suction whilst instilling 2mls Normal Saline through the access port to flush the catheter.	
12. Close Ballard suction valve.	
13. Discard gloves and perform hand hygiene	
14. Recommence continuous milk feed	
15. Document procedure	Appearance and quantity of mucous obtained, and change in observations during or after procedure.

Recognising and Responding to Deterioration

Ventilator competent nursing staff should have a comprehensive knowledge about the possible complications of mechanical ventilation in order to minimise risk, prevent problems and provide immediate intervention when necessary.

Recognising and Responding to Clinical Deterioration Clinical Guideline

There are multiple reasons for a patient to deteriorate while on mechanical ventilation. The **DOPE** acronym is recommended in the literature as best practice for recognising and responding to deterioration in the ventilated neonate. Refer to Appendix 1: DOPE

Related CAHS internal policies, procedures and guidelines
Cuffed ETT Management
End Tidal CO_2
Extubation: Planned and Unplanned
High Frequency Jet Ventilation
High Frequency Oscillation Ventilation
Intubation
Needle Aspiration of the Chest
Pneumothorax
Transcutaneous Monitoring
Transillumination of the Chest

References and related external legislation, policies, and guidelines

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Appendix 1: DOPE

Displacement, Obstruction, Pneumothorax, Equipment

D: Displacement

A high index of suspicion for unplanned or accidental extubation is required when caring for ventilated patients. Unplanned or accidental extubations can present in the following ways:

- Sudden clinical deterioration with decrease in heart rate and oxygen saturation.
- Loss of chest wall movement with ventilation.
- Increase in leak noted by ventilator.
- Loss of end tidal CO2 detection.
- Loss of air entry sounds on auscultation.
- Audible cry.
- Absent or ↓ breath sounds
- Gasping
- ↓ Perfusion
- Cyanosis
- Bradycardia
- Hypoxemia
- Agitation / restlessness
- Abdominal distension
- ↓ SaO2

Management

- Check ETT for displacement or dislodgement
- Attach CO2 detector eg pediacap to verify
- Check ETT position – cm at the lips
- Press urgent assist bell to alert medical team to promptly attend and manage the patient, commence airway support.
- If dislodgement/extubation is suspected, refer to Extubation: Planned and Unplanned
- Complete CIMS form: mandatory
- Update parents and clearly document event in progress notes.

O: Obstruction

The ETT may be in the correct position but obstructed. This could be internal e.g. secretions, blood, an incompletely withdrawn suction catheter or surfactant. A kink in the tube, compression from a fixation device or a displaced ETT at the carina of the trachea can also present as obstruction.

Suspicion of an obstructed ETT includes:

- Increased WOB.
- Air entry reduced or absent.
- Increasing ventilatory requirements.
- Fluctuation in vital signs falling saturation levels and bradycardia.
- Loss of end tidal CO2 wave form and reading if complete obstruction or a sudden significant rise in etCO2 reading if partial blockage (Note: there may be other causes for a sudden rise in etCO2 e.g. a pneumothorax).

Management

- Attempt ETT suctioning
- Check for kink in ventilator tubing
- Inform medical staff.
- Consider removal of ETT

P: Pneumothorax

A Pneumothorax results from the over distension and subsequent rupture of an alveolus. Air then travels up the vascular sheath into the mediastinum and into the pleural cavity.

Clinical Presentation:

- Sudden deterioration in the infant's clinical state
- Marked respiratory distress
- Decreased air entry on the affected side.
- Cyanosis/fall in the oxygen saturations.
- Tracheal deviation to the contralateral side of the pneumothorax.

Management

- Transillumination of the chest with an intense beam of light is a useful method of making the diagnosis in an emergency.
- Confirmation by X-ray only if the infant is stable. If the infant is unstable, immediate draining of air is imperative. Refer to Needle Aspiration of the Chest

E: Equipment

Equipment malfunction can cause significant complications and sudden deterioration. These can include but aren't limited to:

- Mechanical failure of ventilator
- Gas supply failure
- Electrical failure
- Kinked tubing
- User error

Clinical Presentation:

- Sudden signs of deterioration include: ↓ HR, ↑ PaCO2, ↓ BP, ↓SaO2, ↓ PaO2 and cyanosis
- Signs of slow deterioration include: ↓ PaO2, ↓↑ BP, ↑ PaCO2 , ↓ SaO2

Management

- Disconnect from the ventilator and bag/neopuff manually
- Call for help
- Check for ventilator malfunction, interruption to gas supply
- Check other equipment, lines, tubing etc

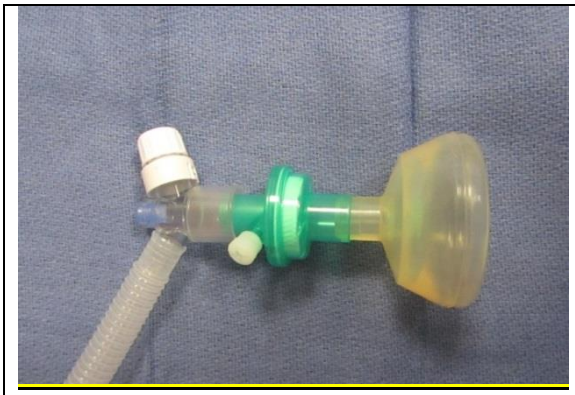
Appendix 2: Respiratory Care of the Neonate with COVID 19

Key Points

- All babies requiring respiratory support should be nursed in an incubator.
- Inline TracMac® should be used for surfactant administration.
- **Aerosol generating procedures include intubation, extubation, oral and open ended ETT suction, emergency chest needling, CPAP, CPR.**
- All staff should be mindful that a patient on respiratory support will generate aerosols.
- The baby should be nursed in an incubator in a negative pressure isolation room if available.
- Staff must be wearing appropriate PPE consistent with contact and airborne precautions.

Viral Filter Placement

- Place filter in the expiratory limb
- To be replaced 24hrly or if wet

	Neopuff and bag and mask
	Fabian Ventilator

	Sensormedics
	Drager
	Babylog ventilator