Royal Hospital for Women (RHW)
NEONATAL BUSINESS RULE
COVER SHEET

Ref: T24/17502

NAME OF DOCUMENT	Extubation of a Neonate
TYPE OF DOCUMENT	Clinical Business Rule
DOCUMENT NUMBER	RHW CLIN022
DATE OF PUBLICATION	28 February 2025
RISK RATING	Low
REVIEW DATE	2030
FORMER REFERENCE(S)	Extubation
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SUMMARY	To guide clinicians in the timely and safe removal of an endotracheal tube (ETT) [extubation]
KEY WORDS	Extubation, Endotracheal tube, Resuscitation,

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This Clinical Business Rule (CBR) is developed to guide safe clinical practice at the Royal Hospital for Women (RHW). Individual patient circumstances may mean that practice diverges from this Clinical Business Rule. Using this document outside RHW or its reproduction in whole or part, is subject to acknowledgement that it is the property of RHW and is valid and applicable for use at the time of publication. RHW is not responsible for consequences that may develop from the use of this document outside RHW.

1 BACKGROUND

Critically ill neonates in the intensive care unit frequently require mechanical ventilation via an endotracheal tube (ETT), a procedure known as invasive ventilation. While this life-saving intervention is essential, it carries risks, including ventilator-induced lung injuries, ventilator-associated pneumonia, airway trauma, and potential neurodevelopmental consequences. Research indicates a strong correlation between prolonged ventilation and increased mortality and morbidity in this population, highlighting the importance of proactive planning and discussions regarding extubation readiness.

As a neonate's condition improves, the focus shifts towards removing the ETT and transitioning to non-invasive ventilation methods (e.g., continuous positive airway pressure [CPAP] or humidified high-flow nasal prongs [HHFNP]) or spontaneous breathing. This procedure is known as extubation, where careful planning is essential for patient safety.

2 RESPONSIBILITIES

1.1 Medical Staff- to identify neonates that are eligible for extubation, to prescribe pre-extubation orders if required, to prescribe non- invasive respiratory support if required, to be available within Newborn Care during the procedure, to respond to the deteriorating neonate, to provide appropriate escalation of care if required, to outline post- extubation investigations if required.
1.2 Nursing Staff- to ensure it is safe to perform the extubation and there is adequate help available, to fulfill pre- extubation medical orders as required, to perform the extubation, to apply non- invasive respiratory support if required, to monitor the neonate post extubation, to perform post extubation orders, to communicate with the parent/carers of the outcome.

3 PROCEDURE

3.1 Equipment

- Resuscitation trolley with intubation equipment
- Resuscitation equipment (Neopuff™ or self-inflating bag with mask)
- Oxygen blender
- Suction equipment
- Adhesive remover
- Scissors
- Gastric tube (appropriate size for the patient)
- Comfeel
- Adhesive tape
- Non-invasive respiratory support equipment e.g. NAVA, CPAP or HHFNP set-up
- Cardio-respiratory monitor and pulse oximetry

NOTE: Endotracheal extubation is a two-person procedure where at least one person is a senior nurse. The medical team must be aware that the extubation is occurring.

3.2 Clinical Practice

3.2.1 Planned extubation

1. Check with the medical consultant/fellow that the neonate is ready for extubation with consideration to:
   • Oxygen requirement
   • Ventilation pressure requirements
   • Neonate's ability to breathe spontaneously
   • Need for caffeine prior to extubation
   • Need to withhold feeds prior to extubation
2. Inform the neonate's parent/carers of the procedure (if present).
3. Check that resuscitation equipment (neopuff™ with face mask) and intubation trolley is prepared and ready for use before proceeding with extubation.
   - Prepare same size ETT, appropriately sized laryngoscope blade with handle, intubating stylet on trolley surface. Do not open the packets.
4. Determine need for respiratory support post extubation with medical staff.
   - Set up required respiratory support at bedside including correct hat, snorkel and mask/prong size for CPAP and prong size for HHFNP
5. Check that there are no other procedures planned for the time of extubation.
6. Inform medical staff that extubation is happening now.
   - Ensure that medical staff are within Newborn Care while the neonate is being extubated
7. Position the neonate supine with the head in the midline for the procedure.
8. Check cardio-respiratory monitoring and pulse oximetry is attached to neonate and functioning.
9. Suction the neonate's airway if required.
10. Allow the neonate to recover post-suctioning before continuing.
11. Aspirate the feeding tube and discard contents.
12. Use adhesive remover to loosen tapes or NeoBar® from the face, then remove gently remove the tapes from the skin.
    - The tapes can either be removed completely from the face and ETT or be removed from the face only
    - If a NeoBar has been used, apply adhesive remover to hydrocolloid pads to loosen from face. ETT and NeoBar can be removed in one motion
13. Remove the ETT from the airway (the gastric tube may or may not be removed during this process).
14. Apply the non-invasive respiratory support equipment including oxygen promptly if required post extubation.
15. If gastric tube was removed, re- insert new tube and secure with comfeel and adhesive tape.
16. Remove the ETT (with in- line suction attached) from the end of the flow sensor and discard in bin.
17. Place the test lung (kept on top of ventilator) back on to the end of the flow sensor.
18. Turn the ventilator onto 'standby' mode.
19. Turn off humidifier base.
20. Inform medical staff of the outcome of the procedure.
21. Inform parents (if present) on the outcome of the procedure.
22. Document the procedure in eRIC using the online form.
    - Discontinue ventilation and ETT tube on eRIC.

23. Consider nursing the neonate prone to maximise lung expansion until the next set of cares.
24. Observe the neonate for:
    - Increased work of breathing
    - Increased oxygen requirement
    - Apnoea's
    - Desaturations
    - Bradycardia
25. Consult with medical staff whether a blood gas is required and when to re-commence feeds.

NOTE:
The ventilator and circuit must be kept at the bedside for 24 hours post extubation.
After this time, discard the disposable components into the bin.
Send the expiratory block (Dräger ventilator only), flow sensor, housing and test lung to CSD for sterilisation.
The container for CSD components is kept in the utility room, complete the logbook stored on the bench top with the date and item to be sent.
Clean the ventilator with appropriate cleaning solution.
Ensure there are 2 ventilators set up and ready for use in NICU.

3.2.2 Unplanned extubation

1. Consider possible unplanned extubation when:
   • Presence of an audible cry
   • Increased leak on ventilator
   • Loss of synchrony of chest wall movement with ventilator
   • No air entry on auscultation
   • No end tidal CO2 detection
   • Sudden clinical deterioration – decrease in heart rate and oxygen saturation
2. Immediately call for assistance and ask for resuscitation trolley.
3. Provide immediate airway support.
   - Attach neopuff/ self- inflating bag to ETT and commence Intermittent Positive Pressure Ventilation (IPPV)
   - Consider using Pedicap to check for presence of carbon dioxide (CO_2)
   - Consider visual inspection with a laryngoscope
4. Remove the ETT tapes on the face with adhesive remover or cut the sides of the NeoBar® attached to the bar and hydrocolloid pads and pull out the ETT.
5. Re-intubate the neonate if required and secure ETT or apply appropriate respiratory support (if required).
6. Replace the neonate's gastric tube (if removed).
7. Confirm ETT location and position with a chest x-ray.
8. Position the neonate in a comfortable posture.
9. Inform and update parents of the event.
10. Document incident in eRIC, IMS+ and complete NCC KPI form.

3.2.3 Suspected blocked ETT

1. Consider blocked ETT when:
   - Increased work of breathing (WOB)
   - Air entry reduced or absent

- Increasing ventilatory requirements
- Fluctuation in vital signs (falling saturation levels and bradycardia)
- Loss of end tidal $C0_2$ wave form and reading if complete blockage (if in situ)
- Sudden significant rise in etC02 reading if partial blockage (there may be other causes for this such as pneumothorax)

2. Immediately call for assistance.
3. Provide immediate airway support
   - Suction ETT
   - Increase Fi02 as needed
   - Attach neopuff/ self- inflating bag to ETT and commence IPPV
4. Consider removal of ETT (as directed by medical team).
5. If ETT removed, place on to appropriate respiratory support as indicated by the medical team.
6. Position neonate in a comfortable position.
7. Inform and update parents of the event.
8. Document incident in eRIC.

3.3 Educational Notes

- Evidence suggests that earlier extubation in very preterm neonates may reduce the risk of chronic lung disease. This benefit may be offset by the risk of increased instability on non-invasive support and potential trauma of repeated intubations. Readiness for extubation of extreme preterms should be determined by a consultant with consideration of FiO2, age, ductus, caffeine prescription, pre-extubation gas and ability to spontaneously ventilate.[3,4]
- Extubation failure (defined as the need for reintubation in the first 2-7 days after extubation) has been reported as high as 10-80% in different populations of VLBW infants[5]. Despite advances in the mechanical ventilation of neonates, it is still a challenge to identify whether a neonate is ready for extubation. Meticulous serial evaluations of readiness for extubation are essential in weaning neonates from mechanical ventilation since prolonged mechanical ventilation is harmful, but early extubation may be associated with respiratory failure, reintubation, and sometimes tragic complications[6].
- Prediction of the extubation outcome is a complex process that depends on several parameters, such as sufficient neural signals and neuromuscular synapses, the functional capacity of respiratory muscles, and the primary pathology of the lung[6].

3.4 Abbreviations

ETT	Endotracheal Tube	CPAP	Continuous Positive Airway Pressure
HHFNP	Humidified High Flow Nasal Prongs	NAVA	Neurally Adjusted Ventilatory Support
CSD	Central Sterilising Department	IPPV	Intermittent Positive Pressure Ventilation
$C0_2$	Carbon Dioxide	IMS+	Incident Management System
KPI	Key Performance Indicator	WOB	Work of Breathing
etC02	End Tidal Carbon Dioxide	Fi02	Fraction of Inspired Oxygen

3.5 Related policies/procedures

- RHW NCC CBR- Humidified High Flow Nasal Cannula Therapy in Newborn Care Centre
- RHW NCC CBR- Neurally Adjusted Ventilatory Assist (NAVA) in Neonates using Maquet SERVO-n - Clinical Guidelines
- RHW NCC CBR- Intragastric Tube Insertion and Maintenance
- RHW NCC CBR- Drager Babylog VN 500 set up
- RHW NCC CBR- Deteriorating Neonate - Recognition and management inside Newborn Care Centre
- RHW NCC CBR- Maquet SERVO-n 'NAVA' ventilator- Set up
- RHW NCC CBR- Suction - Closed Tracheal Suction from an Endotrachael Tube

3.6 References

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4 ABORIGINAL HEALTH IMPACT STATEMENT DOCUMENTATION

- Considerations for culturally safe and appropriate care provision have been made in the development of this Business Rule and will be accounted for in its implementation.
- When clinical risks are identified for an Aboriginal and/or Torres Strait Islander woman or family, they may require additional supports. This may include Aboriginal health professionals such as Aboriginal liaison officers, health workers or other culturally specific services

5 CULTURAL SUPPORT

- For a Culturally and Linguistically Diverse CALD woman, notify the nominated cross-cultural health worker during Monday to Friday business hours
- If the woman is from a non-English speaking background, call the interpreter service: NSW Ministry of Health Policy Directive PD2017_044-Interpreters Standard Procedures for Working with Health Care Interpreters.

6 NATIONAL STANDARDS

- Standard 1 Clinical Governance
- Standard 5 Comprehensive Care
- Standard 6 Communicating for Safety
- Standard 8 Recognising and Responding to Acute Deterioration

7 REVISION AND APPROVAL HISTORY

Date	Revision No.	Author and Approval
15/12/2022 21/09/2023	1	KB Lindrea (CNC); Primary document approved NCC CBR Committee Endorsed by RHW SQC
04/04/2024 30.1.2025	2	KB Lindrea (CNC), R Jackson (NE) Endorsed by NCC CBR Committee
10/02/2025	2	RHW BRGC