

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



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SUMMARY	To provide clinicians a guideline on the appropriate use, set up, application, feeding requirements and nursing considerations for neonates on nasal Continuous Positive Airway Pressure support in Newborn Care Centre.
Key Words	CPAP, respiratory support, Bubble CPAP, interface, mask, prong, neonate

**Continuous Positive Airway Pressure (CPAP)
Therapy (Neonate)**

RHW CLIN119

Contents

1 BACKGROUND	3
2 RESPONSIBILITIES	3
2.1 Staff (medical, midwifery, Nursing, Allied health)	3
3 PROCEDURE	3
3.1 Indications ^{4, 9, 10, 11}	3
3.2 Equipment	4
3.3 Clinical Practice	4
3.3.1 Setting up CPAP (Picture 1 and 2).....	4
3.3.2 Commencing CPAP.....	5
3.3.3. Nursing Care	7
3.3.4. Ceasing CPAP.....	8
3.4 Documentation	8
3.5 Education Notes	8
3.6 Abbreviations.....	11
3.7 Related Policies/procedures	11
3.8 References	11
4 ABORIGINAL HEALTH IMPACT STATEMENT DOCUMENTATION	12
5 CULTURAL SUPPORT	12
6 NATIONAL STANDARDS	12
7 REVISION AND APPROVAL HISTORY.....	13
Appendix 1 Guide to Discontinuing CPAP.....	14

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

**Continuous Positive Airway Pressure (CPAP)
Therapy (Neonate)**

RHW CLIN119

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1 BACKGROUND

Continuous Positive Airway Pressure (CPAP) is a form of respiratory support utilised in Newborn Care Centre. It provides inspiratory and expiratory pressure above atmospheric pressure during the respiratory cycle of spontaneously breathing neonates. CPAP has become a pillar of treatment for respiratory distress in neonates. The management of CPAP on neonates requires close monitoring and observation from both the medical and nursing teams.

2 RESPONSIBILITIES

2.1 Staff (medical, midwifery, Nursing, Allied health)

- 1.1.1 Medical – to identify neonates that require CPAP, provide appropriate settings based on clinical condition, respond to a deteriorating neonate, assess appropriateness for intragastric feeding, provide settings for weaning and identify neonates that no longer require CPAP.
- 1.1.2 Nursing – to commence a neonate on CPAP, appropriate set up and application of CPAP, manage the neonate appropriately whilst receiving CPAP, recognise and respond to a deteriorating neonate, administer intragastric feeding, wean CPAP as per medical team and cease CPAP when no longer required.

3 PROCEDURE

3.1 Indications 4, 9, 10, 11

- Initial therapy for respiratory distress
- Ongoing therapy for respiratory distress
- Weaning therapy for respiratory distress
- Post-extubation
- Treatment of apnoeas
- Obstructive airways

NOTE:

Bubble CPAP is the preferred method of CPAP delivery in NCC. CPAP is not recommended for neonates with gastroschisis, omphalocele, congenital diaphragmatic hernia and complex/severe nasal trauma or deformities. Liaise with medical and surgical teams before commencing CPAP therapy in these neonates.

**Continuous Positive Airway Pressure (CPAP)
Therapy (Neonate)**

RHW CLIN119

3.2 Equipment

- Fisher & Paykel (F&P) 950 humidifier on intravenous (IV) pole
- F&P 950 neonatal bubble CPAP dual heated circuit
- Oxygen tubing
- Bottle of Water for Irrigation
- 1L bag of Water for Irrigation
- Blender with 2 x flow meters
- Oxygen analyser
- Flexitrunk nasal CPAP interface (snorkel) – appropriate length for neonate (70mm, 100mm)
- F&P nasal mask or prongs – appropriate size for neonate
- Canberra CPAP hat OR F&P CPAP hat – appropriate size for neonate
- Chin strap if required.

NOTE:

All babies on CPAP should have a neopuff at the bedside set up appropriately. The Positive End Expiratory Pressure (PEEP) should be set to match CPAP pressures.

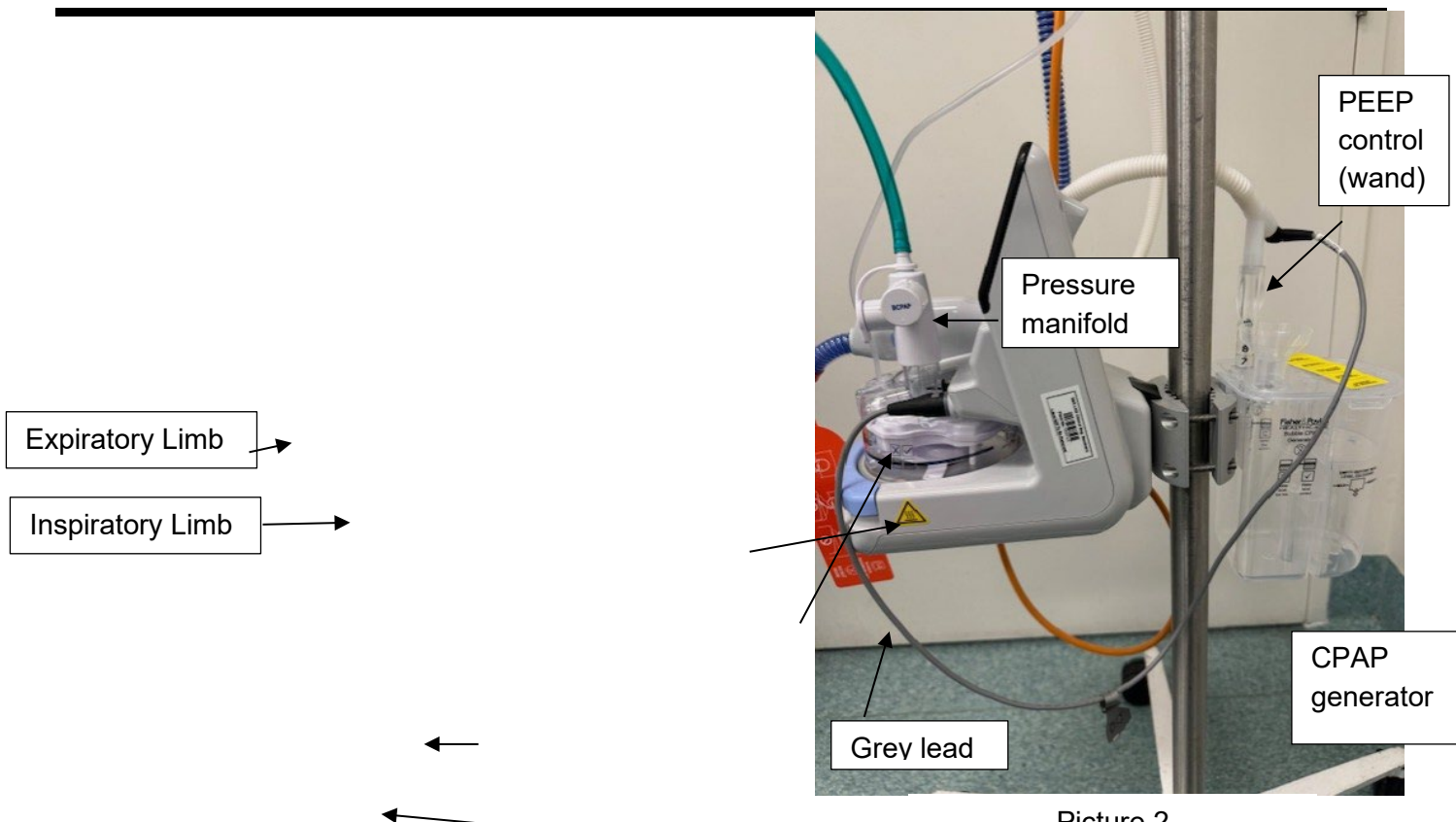
3.3 Clinical Practice

3.3.1 Setting up CPAP (Picture 1 and 2)

- Collect equipment.
- Ensure the air and oxygen blender is attached to the wall gases at bedspace.
- Slide humidifier chamber into humidifier base and CPAP generator onto alternate side.
- Set appropriate PEEP by sliding the wand to the correct number.
- Place the expiratory limb into the wand.
- Slide the inspiratory limb into the humidifier base. The inspiratory and expiratory limb should be closed off at the top with a yellow connector piece.
- Place the pressure manifold onto the humidifier chamber.
- Plug grey lead on humidifier base into back of expiratory (white) tubing.
- Plug humidifier base into power and ensure it is turned on.
- Ensure bag of water is spiked (if using immediately) and that the CPAP generator is filled to the mark with water for irrigation.
- Connect oxygen tubing to pressure manifold and the other end to the flow meter on the blender and turn on flow as prescribed by medical team.
 - At this point, if the circuit remains sealed, there should be a good bubble in the CPAP generator.
- Calibrate oxygen analyser and place into circuit.

**Continuous Positive Airway Pressure (CPAP)
Therapy (Neonate)**

RHW CLIN119



Picture 2

3.3.2 Commencing CPAP

- Measure head circumference and choose appropriate size Canberra or F&P hat pack from CPAP trolley.
- Place hat on neonate, ensuring that the hat sits over the ears, around the back of the head and just above the eyebrows (Picture 3,4).
 - Hats should fit comfortably over the neonate's head without leaving pressure marks or excessive gaping.



Picture 3 – Canberra hat



Picture 4 – F&P hat

- Place the 'Attach to Hat' velcro attachment to the centre of the Canberra hat (this will be the red side of the attachment).

**Continuous Positive Airway Pressure (CPAP)
Therapy (Neonate)**

RHW CLIN119

- Select the correct size mask (Picture 5) or prongs (Picture 6) using the measurement device that comes inside the flexitrunk nasal CPAP interface.
 - The mask should provide an adequate seal over the nose/nostrils without causing pressure sores or excessive leak. Ensure the mask is not pressed up against the nostrils causing an obstruction.
 - The prongs should fill the nares without stretching the skin but sit external to the nostril. The nose should not blanch when prongs are in position.



Picture 5



Picture 6

- Select appropriate size snorkel and attach to the inspiratory and expiratory limb of the CPAP circuit and then attach mask/prongs to end of snorkel.
- Attach CPAP to hat and use the straps to secure, ensuring the snorkel is midline and that bubbling is heard (Picture 7 & 8).
 - Ensure straps are away from eyes and are firm but not tight
 - Additional foam may be required under the snorkel to achieve an adequate seal and alleviate pressure on bridge of nose



Picture 7



Picture 8

NOTE:

If the neonate is not bubbling well or continues to open their mouth, therefore breaking the seal, a chin strap can be used to secure mouth closed.

**Continuous Positive Airway Pressure (CPAP)
Therapy (Neonate)**

RHW CLIN119

- Document respiratory timed process (Non-Invasive Ventilation – Bubble CPAP) on eRIC. Ensure to document CPAP pressure (PEEP), flow and FiO₂, prongs/mask and humidifier base temperature.

3.3.3. Nursing Care

- Feeding and gastric drainage
 - Ensure neonate has an OGT insitu for feeding and venting.
 - A NGT should not be used as it prevents a good seal and can cause significant pressure injuries when used with nasal prongs.
- Pain management
 - Ensure non-pharmacological pain interventions, such as non-nutritive sucking, Immuno-supportive oral care (ISOC), dummy, comfort holding/kangaroo care and nesting/neonate positioning, are used for neonates requiring CPAP support.
- Skin care
 - Attend to CPAP cares four to six hourly depending on the neonate. CPAP cares include:
 - Remove the snorkel, mask/prongs, chin strap (if used) and hat from neonate.
 - Assess the head, face and skin for any pressure injuries.
 - Clean the head, face, ears and mouth with sterile water and cotton wool (do not routinely clean eyes unless sticky)
 - Clean the mask/ prongs with sterile water and cotton wool.
 - Change from prongs to mask or vice versa.
 - All neonates should be given prongs to allow for a pressure break from their nasal bridge.
 - Ensure the measurement device is used for sizing prongs and masks, as babies grow, sizes will need to be upgraded to prevent pressure injuries.
 - Prevent tug or drag from the weight of tubing through positioning of the neonate and by supporting inspiratory and expiratory tubing using clips on tubing and securing to linen.
- Cares and weighing
 - Ask a second RN or medical officer to hold the CPAP to the neonate's face while performing cares/weights
 - Any time CPAP is required to be removed from the neonate, ensure this is a brief period and the neonate remains stable throughout
 - Ensure weights are a bare weight measurement (i.e. remove CPAP from head/face) **IF** neonate is clinically stable/tolerates time off CPAP
 - Encourage parents/carers to be actively involved during cares.
 - Parents can also participate by providing positive touch and containment during handling.
 - CPAP cares should be performed based on individual neonate requirement

NOTE:

If a parent is attending to the face cleaning, the nurse is always responsible for the respiratory support and the CPAP should never be held by a parent/carer.

**Continuous Positive Airway Pressure (CPAP)
Therapy (Neonate)**

RHW CLIN119

- Monitoring and documentation
 - Ensure all neonates on CPAP have continuous cardiorespiratory and saturation monitoring insitu
 - Attend to blood gases PRN or as directed by the medical team
- Infection control
 - Change the CPAP snorkel and hat every 14 days, or earlier if required.
 - Change the CPAP circuit every 14 days
 - Ensure the CPAP circuit remains at the bedside for 24 hours once the therapy is ceased in case the neonate requires recommencement. After that, discard the circuit and clean the pole/ humidifier base
 - Use a F&P blender transition kit to transition a neonate from CPAP to Humidified High Flow Nasal Cannula (HHFNC) therapy. This can be used with the neonate's current CPAP circuit. Ensure the pressure manifold is changed.
 - Clean the prongs and masks with sterile water and gauze/cotton wool and keep clean in a yellow specimen jar.

3.3.4. Ceasing CPAP

- Neonates until 31⁺⁶ weeks corrected gestational age (CGA) to remain on CPAP, unless the medical team decides otherwise.
- Neonates who are CGA $\geq 32^{+0}$ weeks can be weaned from CPAP to HHFNC or trialled off respiratory support completely if the neonate has been:
 - in room air (FiO₂ 0.21)
 - on a PEEP of 5cm H₂O
 - no significant changes to work of breathing (WOB)
- If neonates fail weaning/trialling off, CPAP may be recommenced as per medical team.
- Late preterm/term neonates with transient respiratory distress at birth to continue CPAP until WOB improves.
 - Consider risk of air leak in neonates with Transient Tachypnoea of the Newborn (TTN) as TTN can resolve within a few hours. These neonates should be monitored closely and wean CPAP appropriately.
- See Appendix 1 for further guidance.

3.4 Documentation

- eRIC

3.5 Education Notes

- CPAP maintains positive pressure in the airway and thereby increases functional residual capacity. CPAP does this by stabilising airspaces so that they do not collapse during expiration.

**Continuous Positive Airway Pressure (CPAP)
Therapy (Neonate)**

RHW CLIN119

- CPAP can be used with inhaled nitric oxide (iNO) if required. It is the responsibility of the medical team to prescribe the dosage and the nursing team to set up and commence. Refer to inhaled Nitric Oxide CBR for further guidance.
- Proposed mechanisms of CPAP therapy include:
 - Increase transpulmonary pressure
 - Increase functional residual capacity
 - Prevent alveolar collapse
 - Decrease intrapulmonary shunting
 - Increase lung compliance
 - Conserve surfactant
 - Increase airway diameter
 - Splint the airway
 - Splint the diaphragm
 - Stimulate lung growth
- There are four important components to consider before commencing a neonate on CPAP. They include pressure, gas flow, gas humidity and CPAP device.
 - CPAP Pressure
 - Normal physiologic PEEP is 2-3 cm H₂O. CPAP of 5-8 cm H₂O recruits more alveoli for gas exchange and increases the functional residual capacity
 - CPAP pressure needs to be individualised for each neonate and it may vary for each clinical scenario
 - Commence CPAP of 6-8 cm H₂O for any preterm neonate with acute RDS, however, as the lung compliance improves, PEEP may be weaned down
 - The medical team is responsible for determining the appropriate PEEP
 - CPAP gas flow
 - A flow of 6 to 8 L/min provides adequate pressure and prevent carbon dioxide re-breathing.

Flow (L/min)	Probe setting (cm H ₂ O)							
	3	4	5	6	7	8	9	10
4	3.1	4.1	5.1	6.1	7.1	8.1	9.1	10
5	3.2	4.2	5.3	6.3	7.3	8.3	9.2	10.1
6	3.4	4.4	5.4	6.4	7.4	8.4	9.3	10.2
7	3.6	4.6	5.6	6.6	7.6	8.5	9.5	10.4
8	3.8	4.8	5.8	6.8	7.8	8.7	9.6	10.5
9	4	5	6	7	7.9	8.9	9.8	10.6
10	4.3	5.3	6.2	7.2	8.1	9	9.9	10.8
11	4.6	5.6	6.5	7.4	8.4	9.2	10.1	10.9
12	4.9	5.8	6.8	7.7	8.5	9.4	10.2	11.1
13	5.2	6.1	7	7.9	8.8	9.6	10.4	11.3
14	5.5	6.4	7.3	8.2	9	9.8	10.6	11.4
15	5.8	6.7	7.5	8.4	9.2	10	10.8	11.6

Table 1: Mean CPAP values generated by F&P bubble CPAP at the set gas flow and probe level using F&P interface with a tight seal

**Continuous Positive Airway Pressure (CPAP)
Therapy (Neonate)**

RHW CLIN119

- The medical team is responsible for prescribing the flow.
- CPAP humidity
 - During normal inspiration, the human airway conditions inspired gases with heat and humidity to body temperature (100% Relative Humidity with 44 mg/L of Absolute Humidity). The lungs rely on these conditions to maintain the physiological balance of heat and moisture necessary for optimised airway defence and gas exchange while maintaining neonatal comfort
 - When delivering respiratory support to neonates, aim is to deliver gas (air/oxygen) at the nose at or near body temperature with optimal humidity (100% Relative Humidity at 37°C). Optimal humidity prevents airway cooling, which is a primary cause of pain and discomfort, airway drying and water loss, which will lead to thickened secretions and airway inflammation and constriction
 - An adequate water level is required to maintain inspired gas humidity. All F&P humidifiers have auto-feed system for the water chambers. Condensation will cause water to accumulate in tubing. This needs to be removed to prevent water from reaching the neonate
- CPAP delivery systems have four components ^{1, 3, 8}
 - Circuit to run the gas
 - Patient interface that connects the circuit to the neonate
 - CPAP generator
 - Hats and straps to secure interface
- CPAP devices can be divided into constant flow and variable flow devices and in NCC the following devices are used: Bubble CPAP, Drager ventilator CPAP and Maquet Servo-n CPAP, however, bubble CPAP is our main form
- Bubble CPAP is a constant flow CPAP generated by placing the expiratory limb of the breathing circuit under water which generates pressure and provide oscillations.
 - The expiratory limb of the breathing circuit is placed under water. This generates pressure and provides oscillations (almost like High frequency at 15-30 Hz)
 - The "bubbles" are generated as the gas flows into the water
 - Consistent, gentle bubbling is adequate (vigorous bubbling is not always necessary). Some neonates with mild respiratory distress may tolerate intermittent bubbling.
 - The amplitude created by the oscillations by vigorous bubbling is only 10% of the amplitude noticed on high frequency.
 - In a short-term cross-over trial, vigorous high amplitude bubbling compared with slow bubbling was not associated with any significant differences in respiratory rate, oxygen saturation or transcutaneous carbon dioxide levels
 - If no bubbling, search for leak/s in the system (such as an open mouth). Once that is ruled out, generally increasing the gas flow will increase the bubbling.
 - Bubble CPAP rarely needs more than 8 L/min flow.

**Continuous Positive Airway Pressure (CPAP)
Therapy (Neonate)**

RHW CLIN119

3.6 Abbreviations

CPAP	Continuous Positive Airway Pressure	F&P	Fisher and Paykel
PEEP	Positive End Expiratory Pressure	OGT	Orogastric Tube
ISOC	Immuno-supportive oral care	RDS	Respiratory Distress Syndrome
HHFNC	Humidified High Flow Nasal Cannula	CGA	Corrected Gestational Age
WOB	Work of Breathing	TTN	Transient tachypnoea of the newborn
iNO	Inhaled Nitric Oxide		

3.7 Related Policies/procedures

- RHW NCC Nursing CBR- [NAVA Nursing Management for Non-Invasive Mode](#)
- RHW NCC Nursing CBR- Humidified High Flow Nasal Cannula Therapy in Newborn Care Centre
- RHW NCC Medical CBR – Inhaled Nitric Oxide (iNO)
- RHW NCC Nursing CBR- [Intragastric Tube Insertion and Maintenance](#)
- RHW NCC Nursing CBR- [Immuno-Supportive Oral Care \(ISOC\)](#)

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**Continuous Positive Airway Pressure (CPAP)
Therapy (Neonate)**

RHW CLIN119

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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 3 Preventing and Controlling Infections
- Standard 5 Comprehensive Care

**Continuous Positive Airway Pressure (CPAP)
Therapy (Neonate)**

RHW CLIN119

- Standard 6 Communicating for Safety
- Standard 8 Recognising and Responding to Acute Deterioration

7 REVISION AND APPROVAL HISTORY

Date	Revision No.	Author and Approval
24/09/2013	Primary	Srinivas Bolisetty (Lead Clinician), Joanne Sheils (CNE), Eszter Jozsa (CNE)
17/4/2018	2	RHW NCC LOPS Committee
18/09/2024	3	E. Deibe (ACNE/CNS), S Bolisetty (Medical Co-Director)
12.2.25	3	BRGC

Continuous Positive Airway Pressure (CPAP)
Therapy (Neonate)

RHW CLIN119

Appendix 1 Guide to Discontinuing CPAP

