SECTION 7: CARE OF THE CHILD WITH A RESPIRATORY CONDITION

7.2 Oxygen Therapy

7.2.4 Bubble CPAP (Continuous Positive Airway Pressure) for Infants

Aim

To deliver continuous positive airway pressure to spontaneously breathing infants via nasal cannula.

Key points

- Bubble CPAP is a medically ordered mode of respiratory support. It should only be initiated by medical staff with knowledge and experience of its use, following consultation with Respiratory Medicine or PICU staff.
- When Bubble CPAP is used for respiratory support on a medical ward a Respiratory Medicine Department Consultant should be involved in the care.
- Any deterioration or significant changes in patient condition must be reported immediately to the medical team.
- The flow and Positive End Expiratory Pressure (PEEP) must be medically ordered and documented in the medical record. Any alteration to FiO_2, flow and pressure is a medical decision and must be documented in the patient's medical record.
- The Fisher & Paykel Bubble CPAP system can be used to deliver continuous positive airway pressure with air or oxygen via nasal cannula.
- The care described throughout this document is to be read in conjunction with / supplemental to PNPM 7.2.1 Oxygen Administration and PNPM 3.1.1 General Observations, including Respiratory Assessment.

Indications

- Infants requiring respiratory support with respiratory disease whose condition is stable enough not to require care in PICU.
- Infants with lower respiratory tract conditions requiring additional respiratory support eg. chronic lung disease.
- Infants with upper airway obstruction.

Contraindications

- Infants who are acutely unwell and deteriorating unless PICU is consulted and the infant is assessed regarding the need for admission to PICU.

- Not generally used outside PICU for infants previously well with an acute respiratory condition. (PICU/Respiratory Team must be involved in management if the infant is acutely unwell).

Nursing Considerations

1. Assign the infant to a room with good visibility, ability to hear monitor alarms and easy access to resuscitation equipment.
2. The nurse caring for an infant on Bubble CPAP must be able to demonstrate a sound knowledge in respiratory assessment and experience in emergency care.
3. Nursing allocation should be based on patient acuity.
4. Oral feeds are usually withheld for infants requiring bubble CPAP. Liaise with dietitian for oro/nasogastric feeding regime unless otherwise directed by medical staff.

Equipment

Fisher & Paykel's Bubble CPAP System which includes:

- MR 290 humidifier chamber
- Pressure manifold
- Single heated circuit includes blue inspiratory limb and white expiratory limb
- CPAP Generator with funnel

Air/oxygen blender with high flow oxygen meter

High flow oxygen meter at the wall (**FOR USE IN AN EMERGENCY**)

Two-way oxygen adaptor

Green oxygen tubing

Tape measure

Appropriate size CPAP Cap System (includes Velcro. chip strap and toggle)

Hudson Infant Nasal CPAP Cannula pack in appropriate size (Keep a spare set at the bedside in case of blockage)

MR 850 humidifier base with: - Temperature probe and heater wire adaptor

Water for irrigation 1 x 1L bag and 1 x 500mL bottle

IV pole and two C clamps (to attach MR 850 Humidifier and CPAP generator)

Additional equipment

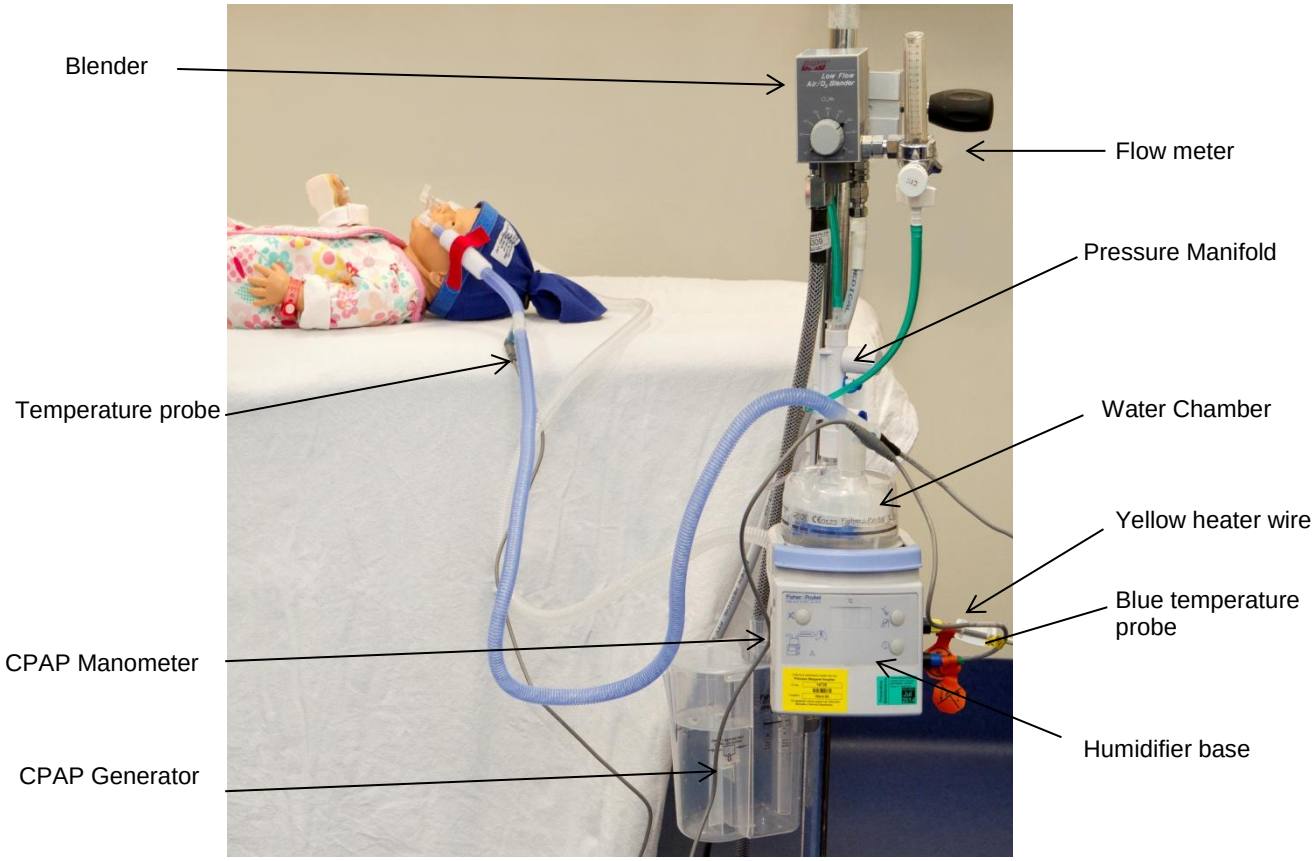
Thin Comfeel® / hole punch (If required)

Critic Barrier Wipe

PEEP valve for Laerdal bag (If indicated)

BUBBLE CPAP SET UP

(Note: The humidifier chamber must be positioned *below* the level of the patient)



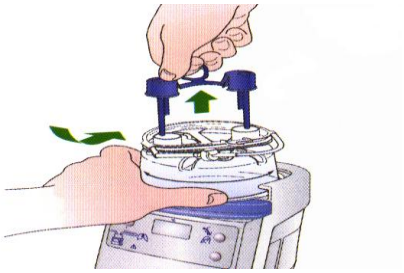
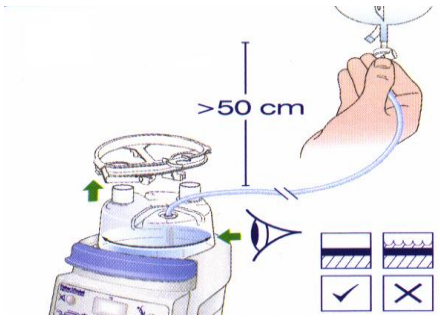
Hudson RCL Infant Nasal CPAP Cannula

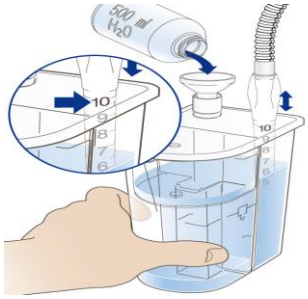
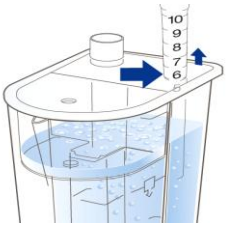
Size	Weight
Size 3	2000-3000 grams
Size 4 & 5	> 3000 grams

This is a guideline only and cannula size should be determined based on size of cannula required to form a seal in nostrils. Smaller sized cannulas are available.

CPAP Cap System

Size	Head circumference
Medium	30-35 cm
Large	35-40 cm
XL	40-45 cm
XXL	45-50 cm

Procedure	Additional Information
Assemble required equipment.	**Note:** Bubble CPAP circuit and HHF RT329 circuit are not interchangeable.
Where possible, avoid setting up CPAP near air vents or in a draft.	Cold air on the circuit will increase condensation.[1]
Add two-way oxygen connector to wall before connecting oxygen hose. Connect air and oxygen hoses to wall gas supply.	This allows O_2 high flow meter to be available for emergency use. Connect hoses simultaneously to decrease noise made by gas disconnect alarm.
Ensure humidifier chamber is positioned **lower** than the patient.	This allows any condensation to collect in the tubing away from the patient.
Fit water chamber to the humidifier and remove blue caps.	
Hang sterile water bag and connect to water chamber. Ensure bag is positioned at least 50cm above the humidifier chamber.	
Connect the pressure manifold to the chamber. Connect the elbow of the blue inspiratory circuit to the chamber.	

Procedure	Additional Information
Connect one end of the yellow heater wire adaptor plug into the yellow socket on the side of the humidifier and the other into the blue circuit elbow.	
Fill CPAP generator to the line with 500mL water for irrigation via funnel provided. Connect the clear expiratory circuit to CPAP manometer.	Do not overfill. 
Attach C clamp to pole below humidifier. Place CPAP generator onto C clamp.	
Adjust CPAP manometer to required pressure (cm H_2O) as per medical order.	

Procedure	Additional Information
Determine the required cannula size. Select appropriate sized cannula.	Cannula size should be determined based on size of cannula required to form a seal at nostrils.[2] • Too small - seal will not be formed and risk of damage to nasal septum and mucosa • Too large – can cause nasal blanching, erosion and necrosis [3]
Apply Velcro to the 'patient' ends of both the blue inspiratory and clear expiratory circuit tubing and attach cannula. Attach cap to expiratory port on cannula.	
Set the blender dial to the required oxygen percentage. Set the flow rate as per medical order.	Adequate flow ensures constant bubbling and is usually set between 6-8 litres/minute.[4]
Occlude the cannula. Confirm that there is bubbling in CPAP generator.	With supply of air and oxygen, bubbles should be seen and heard in CPAP generator. This is a test for leaks in the system.[1] If no bubbling is observed, check for leak in system.
Turn the humidifier on and set to *invasive mode.* 	This is the default setting and is recommended for bubble CPAP to provide optimal humidification - 37°C, 44mg/L H_2O. Temperature readout on humidifier will fluctuate 35-40°C to ensure optimum humidity is delivered to the patient. Refer to MR850 operations guide for alarm information.[1]
Measure the infants head circumference with the tape measure to determine correct cap size. Measure the circumference from nape of neck, across the ears to middle of forehead.	Should be a snug fit: ▪ Too loose, cannula will move damaging the nasal mucosa and lead to pressure loss. ▪ Too tight, may lead to head moulding and pressure points.[4]

Procedure	Additional Information
Apply cap Place along nape of neck, over ears (ensure stitching sits over tip of left ear) and across the middle of the forehead. Overlap should be approx 2cms. Gather top and apply toggle.	 
With the cannula curving down into infant's nares, insert the cannula. Ensure cannula forms a downward arch.	This prevents distortion of the nares and compression of the septum which can lead to skin breakdown or necrosis.[3] 
Secure blue inspiratory and clear expiratory circuit tubing to cap with Velcro straps. Monitor for continuous bubbling in the CPAP generator and system. If necessary reposition cannula or apply a hydrocolloid dressing eg. *Comfeel*® around the nares to maintain a seal and bubbling:[3] Cut and customise the dressing to fit infant - punch a hole ½ size smaller than the nasal prong size. Application of skin protection barrier wipe prior to the dressing can aid adhesion and the need for frequent reapplication, reducing the risk of skin excoriation. For CPAP dependent infants this is a two person procedure: one to maintain position of the prongs while the other applies the dressing.	An open mouth can be a significant source of pressure leaking. Gently close mouth, use a chin strap as necessary.[3, 5] Offer dummy if parents permit. **Note:** Chin strap not to be used as a dummy strap. The backing plastic can be used as a template.  
Cycling off CPAP: Remove nasal Comfeel during episodes of cycling off CPAP or when humidified high flow (HHF) or PBF nasal prongs in situ.	Prevents increased work of breathing and CO_2 retention and allows the infant to inspire air as well as oxygen delivered by PBF or HHF.[4]

Procedure	Additional Information
Circuit Checks **Tubing Position:** • When infant is side lying, position blue inspiratory circuit uppermost. • Check the tubing and nasal cannula for presence of condensation at least hourly and empty excess as necessary.	This helps prevent condensation from entering the nasal cannula. Increased condensation can impede the flow of air through the system.[3]
• Drain any excess condensation in tubing down towards humidifier chamber. • Empty excess condensation in cannula via the cap on the cannula.	Condensation in the tubing/nasal cannula may lead to aspiration.[6]
Nasal Cannula • **Check** nasal cannula are not blocked at least **hourly**. • Replace the nasal cannula if blocked with secretions.	A blockage in the tubing may manifest as: • An increase in respiratory effort • Respiratory distress • A fall in SpO_2 levels[3]
• Provide gentle nasal suctioning if required. • **Check** nasal cannula position to ensure no pressure is placed on nasal septum at least **hourly**. • Change Comfeel® at least every 24 hours and observe skin for pressure and excoriation.	To maintain patent nares and airway.[7] Consider critic barrier wipe prior to application of Comfeel® to protect skin.
Hat • Release hat for several minutes at least every 4 hours and check for pressure areas and excoriation. • Document hat changes on MR824.4 chart.	To minimise deformities of the head and pressure areas occurring.[4]
Humidity: • Check water level in humidifier chamber hourly and replace water bag as necessary. • Check water level in CPAP generator hourly - fill to line as required.	Flotation device will prevent overfilling.[8] Empty overflow container as necessary.

Procedure	Additional Information
OBSERVATIONS/ DOCUMENTATION **Patient observation** • Continuous pulse-oximetry • Document hourly vital signs and respiratory assessment on the CEWT chart.	Oxygen saturation parameters will be recorded in patient record by the medical team and documented on the front page of the CEWT chart.
• Observe chest for symmetrical movement.	There is a risk of pneumothorax with CPAP therapy.[5]
• Observe infant for abdominal distension and vomiting. • Consider the need for a NGT or OGT for gastric decompression and continuous feeds.	Distended abdomen results in increased pressure on the diaphragm which may result in a compromised respiratory state.[3]
Circuit Checks Record hourly or prn on the long term ventilation chart MR824.4: • Check the system for bubbling. • Check and record CPAP setting. • Oxygen setting on blender dial. • Oxygen/Air Flow rate. • Humidifier temperature	Inadequate humidification can lead to nasal mucosal damage and increased viscosity of airway secretions.[9]
CLEANING Change the circuit according to manufacturer's instruction, or sooner if it is:- • visibly soiled • mechanically malfunctioning • damaged [6]	F&P Bubble CPAP System circuit and Hudson nasal cannula are disposable. Breathing circuits used at PMH are intended for 7 days use as per manufacturers recommendation.[10]
CPAP Cap System Single patient use.	Dispose when CPAP no longer required.
Non Disposable Parts: **Temperature probe (blue)** Send to HSSD for decontamination. **Heater wire (yellow)** Wipe over heater wire cable with mild detergent.	

Related policies, procedures and guidelines.
PNPM 7.2.1 Oxygen Administration.
PNPM 3.1.9 Children's Early Warning Tool
PNPM 3.1.1 General Observations, including Respiratory Assessment.

Resources.
Therapy Overview Brochure Fisher & Paykel. Nurturing Life. Infant Respiratory Care Continuum.
Instructions for Use Fisher & Paykel M850 Respiratory Humidifier

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8. Kubicka Z, Limauro J & Darnall A. Heated humidified high-flow nasal cannula therapy: Yet another way to deliver continuous positive airway pressure? [In vitro]. Pediatrics 2008. Available from: http://pediatrics.aappublications.org/content/121/1/82.full.pdf. Accessed: 24 April 2014
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