

Clinical Guideline: Nursing Management of a Baby on NCPAP, BiPAP and SiPAP

version 5.0

Authors:

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For use in: EOE Neonatal Units

Guidance specific to the care of neonatal patients

Used by: For use in neonatal units in the East of England


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1. Scope

For use in neonatal units in the East of England.

2. Purpose

To inform registered practitioners of the safe preparation and evidence-based care of a baby requiring Nasal Continuous Positive Airway Pressure (NCPAP).

3. Background

There are increasing numbers of low birthweight and premature infants surviving with conditions such as chronic lung disease or bronchopulmonary dysplasia due to complications of assisted mechanical ventilation and other factors. NCPAP has been used as an alternative respiratory treatment to mechanical ventilation to prevent and manage lung disease in preterm infants for almost over half a century.¹ Non-invasive respiratory support is now recognised as the preferred option in the management of the preterm infant in most circumstances.¹¹

Many infants admitted to the neonatal unit will require respiratory support. NCPAP reduces the need for ventilation by increasing inspiratory and expiratory pressure reducing airway resistance.² The majority of babies are preferential nose breathers, which facilitates the use of NCPAP.

The anatomy of premature infants places them at a much higher risk for respiratory complications. Their chest wall is very compliant and they are unable to generate enough volume to maintain their own functional residual capacity (FRC) independently, placing them at risk for extrathoracic airway collapse because of the increase in negative pressure. The premature infant's alveoli are unable to remain open and tend to collapse with diaphragmatic distention, increasing atelectasis, and decreasing tidal volumes.³

4. NCPAP

The physiological goal of NCPAP is to improve gas exchange in the baby. Many infants who are experiencing respiratory distress tend to have asynchronous breathing, creating a see-saw motion between their chest and their abdomen. When NCPAP is applied, it decreases the compliance of the chest wall and allows for synchronous breathing, resulting in decreased effort of breathing, improved gas exchange and improved cardiac function. NCPAP increases the FRC by exceeding the closing capacity of the lungs, which stabilizes and prevents the collapse of alveoli. It also provides a splint to the chest wall and airway, resulting in increased lung volumes, recruitment of atelectatic alveoli, and prevention of further atelectasis. With the correct amount of NCPAP, the exchange of carbon dioxide and oxygen occurs optimally at the cellular level.³

a) Benefits of NCPAP

Respiratory:

- Decreases the incidence of long-term lung complications such as chronic lung disease
- Avoids the trauma, inflammatory response and volu/barotrauma associated with mechanical ventilation¹¹
- Decreases alveolar oedema
- Increases tidal volume
- Decreases airway resistance and therefore both work of breathing and oxygen demand
- Increases lung recruitment and helps prevent atelectasis
- Decreases V/Q mismatching improving gas exchange
- Supports the work of breathing without mandatory breaths allowing the infant a more 'normal' breathing pattern
- Decreases the incidence of pneumothorax

Development/growth:

- Facilitates skin to skin contact
- Allows for oral stimulation and non-nutritive sucking, improves neurocognitive outcomes when compared with mechanical ventilation
- Maintains functional reserve capacity and reduces upper/lower airway resistance improving tolerance of caregiving and handling
- Improves growth.

Financial:

- Fewer hospital days and decreased hospital costs ⁴

b) Types

There are many different varieties of NCPAP, each having advantages and disadvantages.

NCPAP

Nasal Continuous Positive Airway Pressure (NCPAP) is the application of positive pressure to the airway of the spontaneously breathing infant through the respiratory cycle.⁷ In practice, NCPAP consists of a controlled flow of humidified medical air and or oxygen gases (measured in cm H₂O) through a flow driver to circulate the gas through a NCPAP circuit to the larynx or nose. To gain a lower or higher pressure, the flow of gas can be altered.

NCPAP and apnoea

NCPAP with added advantage of apnoea monitoring, via a sensor attached to abdomen. The apnoea alarm is triggered when no breaths detected within set timeout period.

BIPAP (Triggered)

BIPAP is often used to provide additional support in patients failing on NCPAP as a rescue prior to, or instead of intubation by providing two alternating background positive pressure levels, a set respiratory rate and provide a higher mean airway pressure (MAP). This leads to changes in the infants functional residual capacity (FRC) allowing for tiny breathes from the small change in pressure.⁸

The possible benefits for this mode include helping to prevent atelectasis and stimulate spontaneous breathes compared to NCPAP. The set respiratory rate is not synchronised with the infants breathing.

SiPAP

SiPAP provides synchronised respiratory support in the same way as BiPAP, however synchronises with the babies own respiratory efforts.

Bubble CPAP

Bubble NCPAP is created as humidified air flows at the rate of 6-10 L/min from the gas source passes the nasal prongs to the expiratory limb, and into the water. The amount of NCPAP that is administered is determined by the depth of the expiratory tubing: 1 cm is equivalent to 1 cm H₂O pressure. It appears to generate oscillations in the premature infant's chest, which mimic the vibrations of the high-frequency oscillator.⁴ It can also be modified and made mobile, allowing it to be placed on the neonate in the delivery room, thereby optimizing its use. It is unique in that it has no audible alarms, so greater vigilance is needed to ensure that there is a proper connection, position, pressure delivery and respiratory support. However, the produced PEEP is not able to be measured.

c) Indications for NCPAP

Following delivery and resuscitation, consider NCPAP as the initial method of breathing support after delivery in spontaneously breathing preterm/term infants.⁵

- Significant signs of respiratory distress: increased work of breathing through tachypnoea, expiratory grunting, intercostal recession, sternal recession and nasal flaring, cyanosis/increased oxygen requirements (i.e. FiO₂ >30% or 1lt/min on nasal cannula oxygen), deteriorating blood gases (i.e. pH <7.25 with evidence of CO₂ retention).⁶
- Apnoea and bradycardia of prematurity
- Atelectasis shown on x-ray
- Pulmonary oedema
- Non-Invasive support prior to intubation¹
- Post extubation support
- Transient Tachypnoea of the Newborn (TTN)
- Chronic Lung Disease (CLD)
- Respiratory Distress Syndrome (RDS)
- Tracheo-malacia or other abnormality of the lower airways.

d) Contra-indications

- Known pneumothorax
- Facial and nasal abnormalities e.g., bilateral choanal atresia, cleft palate, tracheoesophageal atresia/fistula
- Diaphragmatic hernia.
- Unrepaired gastroschisis.⁶
- Larger babies often do not tolerate application of NCPAP devices well, resulting in restlessness and labile oxygen requirement
- Persistent apnoeas – Poor respiratory drive

e) Complications

- Abdominal distension increasing risk of feed intolerance.⁶
- False pressure readings due to: an obstruction of nasal prongs, poor fixation, kinking, blockage from mucous plugging or increased resistance created by turbulent air flow through the prongs, artificially maintaining air pressure.
- Inadequate gas flow causing fluctuating baseline pressures, resulting in increased respiratory effort by the infant.
- Excessive flow preventing incomplete exhalation inadvertently increasing PEEP levels resulting in over-distension and increased work of breathing.
- Nasal irritation, septal distortion, pressure necrosis, nasal mucosal damage secondary to inadequate humidification or poor fixation of nasal prongs.⁶
- Skin irritation of the head and neck from improperly secured bonnets.
- Lung over-distension causing air leak syndromes i.e., pneumothorax.
- Equipment failure including tubing blockages, alarm failures, incorrect calibration.
- Leakage due to incorrect mask or prong size used; resulting in inadequate ventilation and increased oxygen requirement.

5. Equipment

- NCPAP machine with cables, NCPAP tubing and humidifier chamber that are clean and well maintained.
- Bag/Bottle of sterile water.
- Correctly sized hat using head circumference and manufacturers sizing tool.
- Correctly sized prongs/mask/fixings/straps using manufacturers sizing tool.
- Monitoring equipment to detect heart-rate, saturations, respirations and blood pressure.
- Observation chart.
- Gastric tube, skin protection and fixings.

6. Process

Prior to Commencing CPAP⁷

Consideration should be given to NCPAP as a primary mode of respiratory support for transfer between delivery and NICU.² The decision to commence NCPAP must be medically led from delivery onwards.

1. Infants should be nursed in a safe environment. There should be access to suction, oxygen and resuscitation equipment at the bedside, that is regularly checked with each shift.
2. Inform parents of the need to commence NCPAP and signpost to information and document.
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4. Attach/open sterile bag of water for humidification unit and turn on, ensuring it is warmed prior to attaching to the infant. Humidification is delivered to the infant at 37°C.
5. Measure head circumference to determine correct hat/head gear size, using manufacturers sizing tool as per manufacturer's guidance.
6. As per manufacturers guidance, use the sizing tool included within the NCPAP tubing, to measure the nares for correct prong/mask size:-
 - Prongs should fill the nares completely without stretching the skin.
 - Use the **biggest** possible size to ensure optimum seal and closest septum gap to maintain comfort and skin integrity.
 - It may be necessary to choose a smaller nares size to accommodate septum gap.
 - To confirm size place the prongs or mask in/on the infants' nostrils (briefly), prior to attaching to the nasal tubing.
7. Apply Hat/head gear on the baby.
8. Attach the prongs/mask to the generator prior to attaching to the baby.
9. Apply skin protection or a pressure reducing dressing on cheeks and nasal bridge.
10. Attach NCPAP to the baby, using appropriate fixings as per manufacturer's instructions avoiding excessive pressure on the nose, cheeks and base of neck.
11. Masks should be placed evenly on the nose to create a tight seal to deliver the set pressures. The eyes should be clearly visible without any of the mask touching them.⁹
12. Check NCPAP sounds can be heard in the lungs by auscultation with a stethoscope.
13. Following medical direction, increase flow to achieve required pressures within manufacturer's guidelines.
14. Measure and pass an orogastric tube (OGT); record size, length and position of gastric tube in accordance with unit guideline.

15. Place an open syringe onto the end of the OGT and leave open to the air to allow release of excess air in the stomach.

Ongoing Care⁷

1. Record observations of heart rate, respirations, saturations, FIO₂, humidity, pressures and flow hourly.
2. Report deviations to medical staff so a blood gas can be considered and document in notes.
3. In accordance with blood gases, overall condition and medical decision, appropriately adjust NCPAP respiratory support.
4. Visually check position of CPAP hourly to detect dislodgement
5. Monitor blood pressure as clinical condition dictates. At least 4 hourly for an ITU baby and at least 12 hourly for a HDU baby.¹⁰
6. Aspirate OGT 4-6hrly or more frequently if clinically indicated.
7. Assess and score skin condition as per unit guidelines.
8. Check nasal septum, nares, bridge of nose, cheeks and forehead hourly to reduce the risk of septal damage. Ensure that there is no unnecessary pressure from tubing.
9. The ears should be inspected 2-4 hourly to ensure they are not creased or folded.
10. Alternate between mask and prongs every 6 hours as a minimum to alleviate damage; unless the infant cannot tolerate this. Some infants may tolerate one interface better than the other. This needs to be documented in the care plan and handed over.
11. Remove headgear/hats once per shift to inspect head for skin integrity and pressure areas.
12. The use of mask or prongs should be documented hourly on the observation chart
13. Monitor for excess condensation/ water build up in CPAP tubing and empty regularly
14. Check air entry/seal with position changes/cares or with any increases in oxygen requirements or respiration rates
15. Observe for secretions and need for oral/nasal suctioning.
16. Give mouth care as needed in line with the mouth care assessment tool and document in the patient notes
17. Assess pain score as per network guidelines and act accordingly. Document actions taken.
18. Follow developmental care guidelines to ensure correct positioning of the neonate with positional aides to reduce any stress that the NCPAP might create. Document using Comfort scale and act accordingly.
19. NCPAP hats sizing must be checked weekly and hat/ size changed accordingly.

20. NCPAP tubing must be changed every 7 days or in line with hospital infection control guidelines and clearly documented within the notes

21. Any NCPAP equipment not in use must be decontaminated and tubing discarded.

7. Family Centred Care

Maintain a family centred approach to care that incorporates psychological, spiritual and social support.⁶

Keep parents educated and informed of progress on NCPAP, through verbal and written information, which is documented in the patient record. Involve parents in the decision making of their baby, encouraging any questions.

If baby is settled, encourage opportunities and support parents to provide care for their infant including routine cares, containment holding, kangaroo care and/or cuddles.

8. Audit

Audit will be in line with East of England Benchmarking group activity and consequent action planning using infant's charts and care plans to assess quality outcomes and guideline adherence. Poor scores may necessitate more frequent audits to ensure progress is being made.

9. References

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East of England Neonatal Benchmarking Group

Benchmark: Nasal Continuous Positive Airway Pressure

Score relates to practice in (unit):	
Scored by:	Date scored:
<p>Statement: Nasal continuous positive airway pressure (NCPAP) is a well established and effective respiratory support used in newborn infants with mild respiratory distress syndrome, apnoea or after extubation NCPAP has a number of physiological benefits, including:</p> <ul style="list-style-type: none"> ● airway stabilisation ● stabilised diaphragm and chest wall ● increased lung volumes ● reduced obstructive apnoea ● decreased airway resistance ● decreased respiratory effort <p>NCPAP reduces the need for/length of ventilation and the failure of extubation following ventilation in neonates with respiratory distress syndrome which potentially reduces the incidence of Chronic Lung Disease</p>	
<p>Standards: Careful observation will decrease the chances of trauma related to NCPAP therapy Regular ongoing assessments are instrumental in the success or failure of the infant on CPAP</p>	
<p>Patient Group: Any infant cared for in a neonatal unit that requires respiratory support from NCPAP</p>	
<p>Definition: An application of continuous positive pressure throughout the respiratory cycle which can be delivered using prongs or mask</p>	
<p>Indicators/Information that highlight concerns which may Trigger the need for benchmark activity: An increasing trend in nasal trauma.</p>	
<p>Criteria for scoring: A maximum of 6 infants nursed on CPAP will be assessed visually and their documentation reviewed within a four week period.</p>	

Key Factors		Individual scores	Possible total
F1	There is an evidence-based guideline to support clinical practice.		3
F2	Aspects of care		11
F3	Staff education		4

F4	Parent/carer education and involvement		2
	Overall Score		20

Factor 1: There is an evidence-based guideline to support clinical practice

Evidence based practice guidelines ensure that care delivered to the infant is of the highest standard.

Clinical guidelines are systematically developed statements to assist practitioner and patient decisions about appropriate healthcare for specific circumstances, statements about different aspects of the patients' condition and the care to be given.

Factor 2: Aspects of Care

In order to minimise the risk of potential damage caused by the CPAP interface, each time the system is set up it should be measured correctly and set up to not cause any pressure on the nares or septum.

Factor 3: Staff Education

The ongoing care of the infant on NCPAP is primarily the responsibility of the registered nurse, who will ensure its safe and effective delivery. They should also be able to troubleshoot any problems and prevent complications.

Factor 4: Parent/Caregiver Education and Involvement

Parents are educated about the role of CPAP for their neonate and they are supported in providing care for them.

Benchmarking Score Sheet: NCPAP

Key factors & criteria	Notes 1	Notes 2	Notes 3	Notes 4	Notes 5	Notes 6
<p>1. There is an evidence-based guideline to support clinical practice</p> <p>a) The guideline is evidence-based and referenced</p> <p>b) The guideline is reviewed regularly according to trust policy.</p> <p>c) The guideline is supported and used by the multidisciplinary team.</p>						

2. Patient Care

There is either documented/observed/discussed with staff evidence that:

- a) Selection of hat/headgear and prong/mask is according to manufacturer's instructions and is regularly measured whilst the system is in use to allow for growth changes and these measurements are documented according to the plan of care.
- b) The patient interface is checked for efficacy of seal, with the mask/prongs are correctly positioned for optimal delivery and the target pressure is delivered.
- c) The hat is placed so that the front is just over the eyebrows, the back extends to the base of the neck and the ears are completely covered. The lateral straps provide equal gentle tension according to manufacturer's instructions.
- d) Inspections of the nares/bridge of nose/cheeks and forehead to identify early signs of pressure and findings documented.
- e) Removal of the patient interface for detailed inspection and relief of pressure on the nares as well as cleaning of the nasal area.
- f) The infant should be positioned in such a way as to not add tension onto the patient interface (e.g. lateral supported position) with the use of positioning aids
- g) An orogastric tube is in situ to permit venting of gas from the stomach and aspirate 4 hourly.
- h) There is a regular assessment of respiratory effort that is recorded on the patient chart.
- i) Nasopharyngeal suction is administered as required to maintain a clear airway and reduce the work of breathing.
- j) The humidifier is set to deliver 37°C to maximise the water saturation of the gas.
- k) The circuit is changed every 7 days or according to manufacturer's guidelines or trust policy.

<p>3. Staff education</p> <p>a) Evidence based educational resources on the use of NCPAP available for staff.</p> <p>b) Staff are instructed in use of equipment.</p> <p>c) Staff are competent in the use of NCPAP with an awareness of potential adverse effects and the actions needed to avert them.</p> <p>d) Manufacturers trouble shooting information about CPAP equipment is available on the unit for staff to access as required.</p>						
<p>4. Parents (either documented or through discussion with parents).</p> <p>a) There is evidence that parents have been signposted to information on NCPAP.</p> <p>b) Parents are supported to provide care for their infant whilst being cared for on CPAP.</p>						

Statements to justify scores/local action plans:

What is CPAP?

CPAP stands for Continuous Positive Airway Pressure. It is a special type of breathing support that is used to help your baby's breathing.

What does CPAP look like?

- Your baby will have small prongs or a mask on their nose which is attached to tubes.
- This is attached to a soft hat or straps to keep it in place.
- The tubes are attached to a machine which will be situated beside your baby.



Why does my baby need CPAP?

CPAP is used when babies need a little help with their own breathing due to:

- Prematurity (their lungs are not fully developed yet)
- They were born with fluid in their lungs.
- They have an infection or other breathing problem.

How does CPAP work?

CPAP works by providing gentle pressure (sometimes with added oxygen) to help keep your babies airways and lungs open. This helps to reduce the effort needed to breath, improves oxygen levels in the blood and gives the lungs time to rest and grow stronger.

Is CPAP safe for my baby?

CPAP is a safe and effective way to treat babies with breathing difficulties, however, it can occasionally cause complications.

Potential complications of CPAP are:

- Abdominal distention. (Air in stomach which can be caused by the flow of the CPAP machine).
- Injury to the nose or skin from the prongs/mask
- Pneumothorax – air leak into the lining of the lungs.

What to expect?

- **Constant monitoring** -Medical staff will continuously check your baby's heart rate, blood oxygen levels, temperature, and skin.
- **Nasal care**-Your baby's nose will be carefully monitored for any pressure points or skin damage.
- **Positioning**-Your baby may benefit from being positioned on their stomach (prone), which can help with breathing.
- **Feeding**-An orogastric tube which is inserted through the mouth, down the throat to the stomach may be in place to release any gas that builds up in the stomach.
- **Comfort and Bonding** Skin-to-skin contact is encouraged with CPAP and can promote neurocognitive development.

How can you support your baby?

Once your baby is settled on CPAP, you will be able to: -

- Cuddle him/ her, Ask the nurses about kangaroo care and skin to skin.
- Assist with their cares and nappy changes.
- Express breast milk if your baby cannot feed directly yet, this helps with growth and recovery.
- Talk, sing and gently touch your baby, they know your voice.



Don't be afraid to ask questions, remember you play an essential role in your babies' journey through NICU.

Remember, CPAP is a safe and effect way to help babies' breath. Most babies do very well and go on to breathe normally on their own.

Further Information

For more information see the Bliss Baby Charity website at:

www.bliss.org.uk

Bliss helpline telephone number: 0808 801 0322 Or

e-mail: hello@bliss.org.uk

Information For Parents

CPAP

Neonatal Unit





East of England Neonatal ODN
(Hosted by Cambridge University Hospitals)

East of England Neonatal Benchmarking Group

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Exceptional Circumstances Form

Form to be completed in the **exceptional** circumstances that the Trust is not able to follow ODN approved guidelines.

Details of person completing the form:	
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Surname:	Telephone contact number:
Title of document to be excepted from:	
Rationale why Trust is unable to adhere to the document:	

Signature of speciality Clinical Lead:	Signature of Trust Nursing / Medical Director:
Date:	Date:
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