

THAMES VALLEY & WESSEX NEONATAL OPERATIONAL DELIVERY NETWORK

Nursing care of CPAP/ BiPhasic CPAP

Approved by	Thames Valley & Wessex Neonatal ODN Lead Nurses and Practice Educators Group.
Date of publication	August 2018
Last Reviewed	Original version Jan 2007, Version 4 -updated Feb 2018.
Review date (Max 3 years)	Due Feb 2021.
Authors	Thames Valley OD Neonatal Network, Quality Care Group.
Distribution	Thames Valley and Wessex Neonatal Clinical Forums Thames Valley and Wessex Neonatal Network website Thames Valley and Wessex Neonatal Network e-bulletin
Related documents	<p>Alys (2001) Nasal prongs continuous positive airway pressure: a simple yet powerful tool, Pediatrics, 108, pp759-61</p> <p>Bamat et al (2016) Duration of continuous positive airway pressure in premature infants. <u>Seminars in fetal and neonatal medicine</u>. June; 21(3) pp189-95. Found at; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4902733/</p> <p>Bowe.L, Clarke, P (2005) Current use of nasal continuous positive airway pressure in neonates, Archives of Disease in Childhood, Fetal and Neonatal Ed, 2005, 90, f92-4</p> <p>Cahill.S (2012) Continuous Positive Airway Pressure (CPAP) Nursing Guidelines. NHS Forth Valley, version 1, pp1-12.</p> <p>Chandrasekaran. A et al (2017) Nasal masks or binasal prongs for delivering continuous positive airway pressure in preterm neonates-a randomised trial. <u>European Journal of Pediatrics</u>. March 176 (3) p379-86. Found at; https://www.ncbi.nlm.nih.gov/pubmed/28091776</p> <p>De Klerk.RK (2001) The use of continuous positive airway pressure in preterm infants, comments and experience from</p>

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Implications of race, equality & other diversity duties for this document	This guideline must be implemented fairly and without prejudice whether on the grounds of race, gender, sexual orientation or religion.

Nursing care of CPAP/ BiPhasic CPAP

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1.0 Aim of Guideline

To provide a framework to ensure that all infants receiving CPAP/ BiPhasic CPAP are optimally cared for.

2.0 Scope of Guidelines

The guideline applies to all babies receiving CPAP/ BiPhasic CPAP within Thames Valley and Wessex OD Neonatal Networks.

Thames Valley	
Buckinghamshire Healthcare NHS Trust	- Stoke Mandeville Hospital, Aylesbury
Frimley Health NHS Foundation Trust	- Wexham Park Hospital, Slough
Milton Keynes University Hospital NHS Foundation Trust	- Milton Keynes General Hospital
Oxford University Hospitals NHS Foundation Trust	- John Radcliffe Hospital, Oxford
Royal Berkshire NHS Foundation Trust	- Reading
Wessex	
Dorset County Hospital NHS Foundation Trust	- Dorset
Hampshire Hospitals NHS Foundation Trust	- Basingstoke
Hampshire Hospitals NHS Foundation Trust	- Winchester
Isle of Wight NHS Trust	- St Mary's Hospital
Poole Hospital NHS Foundation Trust	- Poole Hospital
Portsmouth Hospitals NHS Trust	- Queen Alexandra Hospital
Salisbury NHS Foundation Trust	- Salisbury
University Hospital Southampton NHS Foundation Trust	- Princess Anne Hospital
Western Sussex Hospitals NHS Foundation Trust	- St Richard's Hospital, Chichester

3.0 Guideline Summary

- Continuous heart rate, respiratory rate and oxygen saturation monitoring should be in place, with 6hrly blood pressure checks.
- Hourly observations should be performed and recorded for each infant. See list on p9
- Decision on CPAP pressures and gas flow should be made between the medical and nursing staff and documented in the care plan and notes.
- Weaning from CPAP should be according to local written weaning protocol which is based on the baby's condition. See guidance on p7.
- Staff should be vigilant for signs of pain and discomfort or distress and should seek to modify baby's environment and offer developmental care where appropriate.
- CPAP circuits should be humidified at all times. Humidification is delivered to the infant at 37°C
- Sterile water is used to fill humidification chambers.
- There is a risk that babies' noses become squashed and pushed upwards whilst receiving CPAP, correct positioning should be used to prevent this.
- Nasal prongs and Nasal mask should be used in rotation- being exchanged approximately every 6 hours.
- Ensure correct size and fit of hat- see p 4 for details.
- The area behind a baby's ears can become moist with dead skin collecting there under the CPAP hat, so should be checked and cleaned at least daily.
- Time and care should be taken to ensure that CPAP is secure, well-fitting and safe. See guidance on p10.
- It is considered best practice to rotate the use of nasal prongs and nasal mask for a baby receiving CPAP. This should be individualised for each baby, but usual practice is interchanging these 4-6hourly.
- There should be careful monitoring of skin integrity of the nares, as there is a high risk of damage to the external skin and/or internal membranes of the nose. Appropriate risk assessment / skin integrity score should be used- see p8
- Due to a risk of air building up in the baby's stomach, all baby's on CPAP should have an oro-or nasogastric tube in situ. The tube should be aspirated a minimum of every four hours to remove air, and more frequently if required.
- If the baby is stable parents/carers should be encouraged to have to cuddles and skin to skin care with their baby.

4.0 Guideline Framework

4.1 Background information:

Continuous Positive Airway Pressure (CPAP) has become a widely accepted means of respiratory support for term and preterm infants since it was first used by Gregory and associates in 1971 to bring about a significant decline in the mortality rates for neonatal respiratory distress syndrome (RDS). Physiological effects of CPAP in neonates include improved oxygenation, maintenance of lung volume, reduced upper airway resistance, regularisation of respiratory rate and a reduction in obstructive apnoea.

CPAP has been found to be beneficial in many neonatal contexts and conditions which is a major reason for its use and popularity in current practice. Listed uses include;

- Prevention of extubation failure.
- Apnoea of prematurity.
- Alternative to intubation and ventilation in RDS.
- Extremely preterm neonates.
- Infants with chronic lung disease.

In practice CPAP consists of a controlled flow of gas, (either air or an air and oxygen mixture) administered to the baby using a 'flow driver' to circulate humidified gas through a CPAP circuit to the larynx or nose. The 'level' of CPAP administered to a baby is measured as a pressure reading of cmH₂O. In order to raise or lower the pressure given to a baby the flow of gas in l/min can be increased or decreased.

When CPAP was first used it was given via an endotracheal tube, headbox or face chamber. As equipment and techniques have improved CPAP is now usually given by silicone nasal mask or soft moulded nasal prongs held in place by a specially designed hat. This method is often most well tolerated by an infant and allows access to the baby's head and mouth and easy movement of the baby.

Despite the many documented benefits of CPAP it is a form of respiratory support that has its complications and can be time consuming and tricky to administer effectively. For example, CPAP relies on maintaining constant pressure within the thorax, so the nasal prongs or mask distorting, the baby moving or simply the baby opening its mouth can cause sudden swings and loss of pressure.

Traumatic injuries to the nose are the most common complication of CPAP in neonates. Nasal prongs may rub and damage the internal aspects of the nasal septum whereas nasal masks are found to cause trauma or lacerations at the junction between the nasal septum and nasal philtrum. Both of these problems can be minimised by good nursing techniques. Other complications include a two to three fold increase in the risk of pneumothorax, gaseous distension of the stomach and difficulties identifying when a baby is 'failing' on CPAP and requires more intensive intervention.

These guidelines have been produced to direct nursing staff in their care of neonates receiving CPAP and are based on research findings and agreed current best practice. For accessibility, the guidelines have been collated under distinct subheadings, in the order that information is likely to be needed in practice. However, the reader is strongly advised to read the guidelines in full and to seek the advice and support of more senior or experienced colleagues in the practice setting.

4.2 Practice Guidelines

4.21 Prior to Commencing CPAP

- Infants should be nursed in a safe environment. There should be access to suction, oxygen and resuscitation equipment at the bedside. These should be checked at the beginning of each shift.
- CPAP drivers, circuits and humidifiers should be clean and well maintained.
- The CPAP driver and associated cables and tubing should be used in accordance with health and safety guidelines.
- The CPAP stand should have brakes on it and these must be used.

- The flow should be set to local guidelines, usually around 8Lpm and oxygen at the infants current requirement.
- PEEP (positive end expiratory pressure) should be set based on the infant's current condition and local guidelines, 'normal' initial PEEP is 5cm H2O.
- Alarms on the CPAP should be set according to the manufacturer's guidance. Guidance cards showing this should be readily available, along with equipment manual.

4.22 Humidification

- CPAP circuits should be humidified at all times.
- Ensure that the humidifier is on and warmed prior to connecting to an infant. Failure to do this may lead to a cold infant.
- Sterile water is used to fill humidification chambers.
- Don't overfill the humidification chamber, don't let it boil dry.
- Humidification is delivered to the infant at 37°C
- When the option is available on the humidifier, set to humidify in ventilation mode.

4.23 Hats

- There are a variety of sizes available, use the tape measure provided to guide you on correct hat size. The hat size should be measured where the hat will lie, ie from the base of the neck to the line of the forehead and NOT the head circumference. Be aware that it may be necessary to go up or down a hat size to ensure the best fit.
- The hat size should be reviewed weekly and documented.
- The hat should be positioned mid forehead, not so low that it infringes on the eyes, or so high that it is above the hairline, it should fit snugly over the ears.
- The open end of the bonnet should be tied off to ensure a snug and secure fit.
- The hat is single patient use only and should not be washed and reused.
- The hat should be changed when dirty or elasticity is lost.
- **See manufacturer manual for diagrams showing correct fitting of hat and CPAP unit.**

4.24 Positioning

- There is a risk that babies' noses become squashed and pushed upwards whilst receiving CPAP, correct positioning can prevent. Time and care should be taken to ensure that CPAP is secure, well-fitting and safe.
- Ideally, the CPAP driver should be at the foot end of the incubator or cot. If this is not feasible, ensure that the tubing is following the line of the body.
- The CPAP tubing coming away from the baby should be positioned so that it follows over the top of the head and down the line of the spine.
- CPAP should not be pulled so tight that it is pulling on the baby.
- Positioning the baby prone is known to have great benefits, especially for the preterm infant. Consideration must be given to the developmental needs of the baby and each should have individualised care to achieve this.
- Positioning aids can be used to maintain comfort and correct positioning.
- Do not use gauze or dental rolls between the cheek and the CPAP straps.

4.25 Tubing

- Expiratory tubing should always be outside of an incubator, or at the point furthest away from the baby if nursed in a cot.
- Silencers filters may be required- depending on the manufacturer brand of tubing being used. These are fitted at the end of expiratory tubing and do not reduce the noise level for the baby, but act as bacterial filters.
- Where required they should be changed according to manufacturer's guidelines. However if the silencer becomes filled with condensation before this time limit, it should be changed sooner, as

high levels of condensation in the filters will increase the resistance of gas flow through the filter, and cause the baby increased expiratory effort.

- CPAP circuits are for single patient use and should be changed as per manufacturer's guidelines and recommendation.
- Water vapour condenses and gathers in the CPAP tubing, this needs to be removed as soon as it is noticed, because it is very noisy for the baby when it swings in the tubing and can also move and blow into the baby's nose causing distress and affecting breathing.
- The current EME CPAP tubing used by many neonatal units in the UK has a number of slits in the expiratory tubing to allow excess pressure to be released without harming the baby. The slits run down the whole length of the expiratory tubing and are NOT an indicator of faulty or damaged tubing.

4.26 Nasal Prongs

- Use the sizing guide provided by the manufacturer to correctly gauge the size of prongs needed.
- Prongs should be positioned correctly so that they are square onto the nose, and not tipped at an angle. It should not be pressed hard against the nasal septum. This is to prevent damage to the lateral walls of the nostrils and the nasal septum.
- It is not acceptable practice to tightly tie or secure tapes in any way to restrict the movement of the prongs.
- Prongs should be kept clean, patent and free from any obstruction.
- The use of dressings is NOT recommended as a preventative measure to protect the skin. Correct fitting of the prongs/ careful observation of the nose and immediate response to any indicators of nasal damage should be employed instead. If skin protection is used, ensure that it is secure and that it cannot migrate into the nostrils or airway passages and block them. See point 4.33 on page 11 'Care of the nose and face', for more information.

4.27 Masks

- Research has found that CPAP with a mask as the interface is as effective as nasal prongs but causes less nasal trauma.
- It is considered best practice to rotate the use of nasal prongs and nasal mask for a baby receiving CPAP. This is done to vary the areas of high pressure on the internal and external surfaces of the baby's nares, in the belief that pressure damage to the skin or mucous membranes will be minimised. Individual judgement is required as to how often to disturb the baby and swap between the prongs and mask- but usual practice is between 4-6hourly.
- Sometimes it will be necessary to use only the prongs or mask. This is often because there is nasal trauma in a specific area that is avoided by one or other device, or sometimes even the smallest prongs do not fit the extremely low birth weight infant.
- Use the sizing guide provided by the manufacturer to correctly gauge the size of mask needed.
- Position correctly and securely to minimise gas leak, especially to the eyes. The eyes should be clearly visible without any of the mask touching them.
- Take extra care to ensure that the nose is not pulled upwards to minimise trauma to the base of the nasal septum, which is most at risk when using mask.
- For the majority of babies, skin protection is not needed or necessary, however, babies who are receiving prolonged mask CPAP may benefit from some protection – refer to nasal skin care policy.
- Observe for any indentation into the nose and base of septum (this can be cut by the mask and not be visible without careful examination), around the nose and the bridge of the nose.

4.28 Pressure and Flow

- Pressure varies greatly depending on the infant's condition. Initial PEEP is usually 4-6cm H₂O, however, effective CPAP can vary between 2-10cm H₂O.
- Pressure is achieved by altering the flow. Usual flow is between 4-14L/pm.
- Decision on pressures and flow should be made between the medical and nursing staff and documented in the care plan and notes.

- Indications for adjusting pressure are:
 - degree of RDS,
 - effort of breathing,
 - chest x-ray results,
 - oxygen requirement,
 - unsatisfactory blood gas,
 - apnoea, bradycardia and desaturation events.
- Medical staff should be informed of any change in the infant's condition and a blood gas should be considered.
- If you need to increase the pressure significantly, then inform the medical staff and nurse in charge, as this could be indicative of a more serious problem, i.e. pneumothorax or need for intubation and ventilation.

4.29 Weaning off CPAP

- Weaning from CPAP should be according to local written weaning protocol which is based on the baby's condition. At the current time there is NO clear evidence to suggest which is the best way to support a baby until they no longer require CPAP, however two methods are commonly used;
 - 1) It is possible to cycle the baby on and off CPAP over a number of days or weeks, so that time spent on CPAP reduces and the time spent off CPAP increases. Eventually the baby will be able to come off and not need to go back on again.
 - 2) It is also acceptable to leave the baby continually on CPAP, weaning the PEEP as the baby's condition indicates it is able to receive less support. When the CPAP support is at a low level, the CPAP is then removed and support discontinued.
- Whichever method is selected the same general principles of care apply;
 - document planned weaning regime
 - document how baby coped with regime
 - if a baby is having time off CPAP but still requires oxygen this can be given via low flow cannula, head box or incubator oxygen.
 - if baby does not manage planned time off, consider a shorter period off next time, or a longer time on CPAP between cycles, to allow the baby more time to recover.(consult with medical team)
 - if a baby is off CPAP and has a desaturation or bradycardia, this does not necessarily mean the baby has to go back onto CPAP. The occasional desaturation or bradycardia may be 'normal' for them. See the list below for guidance.

Signs baby may be ready to try time off CPAP, or have CPAP pressure weaned	Signs baby is <u>not</u> ready to try time off CPAP or have pressure weaned
Having infrequent or no desaturations	Having frequent or profound desats
Having infrequent or no bradycardias	Having frequent or profound bradycardias
Effort of breathing minimal	Baby persistently tachyapnoeic
Blood gas stable	Recession apparent when breathing observed
Oxygen requirement stable and less than 30%.	Oxygen requirement greater than 30% and/or rising.
Baby has tolerated brief times off CPAP, ie when weighed or during cares.	Baby does not tolerate brief time off CPAP when weighed or having cares done.
Baby copes well with handling	Baby does not cope with handling well.

If you are uncertain whether a baby is coping with their regime consult with the medical team or nurse in charge.

4.30 General Care

- Suction may be required, this should be available and individualised to the infants needs.
- Continuous heart rate, respiratory rate and oxygen saturation monitoring should be in place. There should be access to a blood gas machine.
- Being nursed on CPAP is known to reduce venous return. This does not usually cause clinical complications for a baby, but in order to monitor for any compromise in the baby, every baby on CPAP should have their blood pressure checked at least 6 hourly.
- An oro-gastric tube should be used in preference to a naso-gastric tube, to prevent distortion of the nostrils and ensure a good seal of the prongs/mask. This should be aspirated prior to feed to empty gas and reduce the risk of abdominal distension, although CPAP rarely causes a distended abdomen.
- If a baby is not being fed, the oro-gastric tube should be aspirated a minimum of every four hours, and more frequently if required. It is possible to leave the tube open or a syringe barrel on the end, but you may get stomach contents passed up through it.
- There should be careful monitoring of skin integrity of the nares, as there is a definite risk of damage to the external skin and/or internal membranes of the nose. Best practice for nose care is for the nose and surrounding area to be assessed and scored on an hourly basis, so that evidence of skin breakdown is identified quickly and managed appropriately. The score should be documented in a predetermined place, the ITU/HDU observation chart would be an appropriate place. See the example below;

Signs	Score	Action
Nares appear healthy	0	No action required
-Slight redness noted around nares. -Area appears painful to touch. -Some indentation noted.	1	-Ensure that the baby is wearing the correct size mask/prongs/ hat as per NICU guidelines and that all are correctly positioned. -Assess/discuss with senior nurses/ registrar/ consultant if a change in mask/ prongs is needed or consider a change of device. -Document on NICU chart and in notes.
Any of the following evident; -marked indentation. -painful to touch -tissue breakdown.	2	-Call senior nurse/ registrar/ consultant -Remove mask/ prongs immediately ensuring baby's breathing remains supported. -Decide on appropriate alternative respiratory support -Document on NIU care chart, in notes and complete AIMS form -Doctor to refer to plastic surgeons and obtain medical imaging

A score chart for baby a receiving nCPAP. Taken from Lamburne (2014)

- Ensure that the face is kept clean and free from secretions.
- Ensure the area behind a baby's ears is kept clean, as very preterm babies may be nursed with a CPAP hat on 24 hours a day for many weeks in a row.
- If transferring a baby on CPAP within a hospital or between hospitals refer to local transportation guidelines and policies.
- If there is a significant change in a baby's support requirement or respiratory status, inform the medical staff and the nurse in charge, as this may be indicative of a more serious problem.
- CPAP can be an uncomfortable and unpleasant experience for babies due to the loud noise levels, high gas flow through the mouth and nose, restricted head movements and obstructed faces. Staff

should be vigilant for signs of pain and discomfort or distress and should seek to modify baby's environment and offer developmental care where appropriate. For example, kangaroo care, nesting, non-nutritive sucking, containment holding or a cuddle.

4.31 Parents.

- Keep parents/carers informed about their baby's progress on CPAP
- Encourage and support parents/carers to interact with and care for their baby whilst on CPAP.
- If the baby is stable parents/carers should be allowed to cuddle and have Kangaroo care with their baby.

4.32 Documentation

- Use local CPAP care plan if available.
- One hourly observations should be performed and recorded for each infant. These include
 - heart rate
 - respiratory rate
 - oxygen saturations
 - flow of gas
 - PEEP
 - fiO₂
 - humidity temperature
 - baby's position
 - nose score- if used on unit
 - A blood pressure should be taken at least 24 hourly.
- 6 hourly blood pressure should be checked and recorded.
- Any agreed changes in CPAP pressure should be documented.

4.33 Care of the Nose and Face.

Skin Care Policy for Infants Nursed on CPAP

Every hour check visually:

- The generator should be positioned correctly.
- The nose should not be squashed or pushed upwards.
- The eyes should be clearly visible.
- Tapes should not be too tight and should certainly not cause indentation, pitting or ocular oedema.

At least four hourly check physically:

- The hat should be checked for tightness and correct fit regularly – it should not be too tight or too loose or rub against the infant's skin.
- Prongs/Mask should be removed from the nose to allow rest from the pressure on it, more often if the infant's condition dictates.
- The nose should be inspected for signs of redness, skin breakdown, bruising, indentation, altered shape and bleeding. Any alteration in appearance should be documented.
- Prongs/Mask should be checked to ensure that they are clean and patent prior to being replaced on the infant.
- The ears should be inspected to ensure that they are not creased or folded. They should also be inspected for signs of skin breakdown, redness, bruising, swelling, discharge or bleeding. Any alteration in appearance should be documented

Remember:

- Prongs/Mask should be removed by loosening of the tapes rather than pulling them straight off the infants face.
- Regular mouth care should be performed.

- Suctioning should NOT be routine but as dictated by the infant.
- It is important that documentation is completed when the nose is checked and any changes noted.

If there are changes to the nose or surrounding area:

1. Check that all of the above have been followed – that the hat/mask/prongs are the correct size and are clean and patent. That there is no error with the set-up of the CPAP. **Document and recheck in 1-2 hours depending on severity.**
2. Recheck – have there been any changes? Has it improved or deteriorated? **If improved, document and continue to recheck regularly, minimum of every four hours. If deteriorated, inform nurse in charge and medical staff, document.**
3. Try increasing time off to relieve pressure, consider facial oxygen if needed. Consider using Vapotherm if available or alternating mask and prongs. Consider a dressing or treatment to the affected area. **Document any changes in care.**
4. Consider elective intubation and ett CPAP /ventilation. Inform tissue viability nurse and plastic surgeons. Complete an incident form. **Document any changes in care.**

Version Control (add when final draft agreed and ready for ratification):

Version	Date	Details	Author(s)	Comments
4th	Feb 2018	Reviewed and updated.	Thames Valley and Wessex Neonatal ODN, Quality Care Group.	Katherine Reed- Chair.
				Approved by the Lead Nurses and Practice Educators Group
Review Date:	Feb 2021			