# Guideline framework for CPAP

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<td>Related documents</td>
<td>References</td>
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<td></td>
<td>Ho.T and Mok.J (2003) Condensate clearance from CPAP circuit: an examination of two methods of draining condensate from the inspiratory tubing,</td>
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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. |

### 1.0 Aim of Guideline Framework

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

### 2.0 Scope of Guideline Framework

The guideline applies to all babies receiving CPAP within South Central.

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<th>North Network</th>
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<tr>
<td>Milton Keynes General Hospital, NHS Foundation Trust</td>
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<tr>
<td>Oxford University Hospitals NHS Trust, both John Radcliffe Hospital site &amp; Horton site.</td>
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<td>Buckinghamshire Healthcare NHS Trust, Stoke Mandeville site.</td>
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<td>Royal Berkshire NHS Foundation Hospital</td>
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<td>Heatherwood &amp; Wexham Park Hospitals NHS Foundation Trust</td>
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<th>South Network</th>
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<tr>
<td>Dorset County Hospital NHS Foundation Trust</td>
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<td>Hampshire Hospitals NHS Foundation Trust, Basingstoke site &amp; Winchester site</td>
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<td>Poole Hospitals NHS Foundation Trust</td>
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<td>University Hospital Southampton NHS Foundation Trust</td>
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<td>Salisbury NHS Foundation Trust</td>
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<td>Portsmouth Hospitals NHS Trust</td>
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<td>Western Sussex Hospitals NHS Trust, St Richard’s site.</td>
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3.0 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.
4.0 Practice Guidelines

4.1 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.

4.2 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 (In some types of humidifier this will achieved by setting the temperature to 40°C - 3°C or 39°C - 2°C)
- When the option is available on the humidifier, set to humidify in ventilation mode.
- When cycling on and off CPAP the manufacturer have no research findings to identify whether the humidifier and gas flow should be left on. Some neonatal units have chosen to leave the humidifier on with the gas flow turned down but not off, as there is a belief that allowing the system to cool down with static air inside it will encourage the growth of organisms which could then be passed to the baby when the CPAP is placed back on the baby again. The manufacturers recommend that local infection control policies are followed until specific research findings are available.

4.3 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.
4.4 Positioning

- It is very common that babies’ noses become squashed and pushed upwards whilst receiving CPAP, correct positioning can reduce this. 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 should be used to maintain comfort and correct positioning.
- Do not use gauze or dental rolls between the cheek and the CPAP straps.

4.5 Tubing

- Expiratory tubing should always be outside of an incubator, or at the point furthest away from the baby if nursed in a cot.
- Silencer filters should be fitted at the end of expiratory tubing. They do not reduce the noise level for the baby, but act as bacterial filters and are recommended for use by the manufacturers.
- Silencers filters should be changed according to manufacturers guidelines, however if they become filled with condensation before this time they should be changed. 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 most neonatal unit 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.

4.6 Nasal Prongs

- Bi-lateral nasal prongs have been found to give the most effective CPAP so should be used as first preference.
- 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 anyway 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 5.0 NASAL CARE POLICY FOR MORE INFORMATION**
4.7 Masks

- Nasal prongs are used in preference to masks, however masks are more commonly used where there is nasal trauma or the smallest prongs do not fit, usually in the extremely low birth weight infant.
- Use the sizing guide provided by the manufacturer to correctly gauge the size of mask needed. As masks come only in sizes extra small and extra large, be aware that with the majority of infants >1.5kgs it will not be possible to fit a mask effectively.
- 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.

4.8 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,
  - apnoeas, bradycardias 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, ie pneumothorax or need for intubation and ventilation.

4.9 Weaning off CPAP

- Where available weaning from CPAP should be according to local written weaning protocol.
- 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, headbox 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.

<table>
<thead>
<tr>
<th>Signs baby may be ready to try time off CPAP, or have CPAP pressure weaned</th>
<th>Signs baby is not ready to try time off CPAP or have pressure weaned</th>
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<tbody>
<tr>
<td>Having infrequent or no desaturations</td>
<td>Having frequent or profound desats</td>
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<tr>
<td>Having infrequent or no bradycardias</td>
<td>Having frequent or profound bradycardias</td>
</tr>
<tr>
<td>Effort of breathing minimal</td>
<td>Baby persistently tachyapnoeic</td>
</tr>
<tr>
<td>Blood gas stable</td>
<td>Recession apparent when breathing observed</td>
</tr>
<tr>
<td>Oxygen requirement stable and less than 30%</td>
<td>Oxygen requirement greater than 30% and/or rising.</td>
</tr>
<tr>
<td>Baby has tolerated brief times off CPAP, ie when weighed or during cares.</td>
<td>Baby does not tolerate brief time off CPAP when weighed or having cares done.</td>
</tr>
<tr>
<td>Baby copes well with handling</td>
<td>Baby does not cope with handling well.</td>
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If you are uncertain whether a baby is coping with their regime consult with the medical team or nurse in charge.

4.10 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.
- 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.
- 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 the baby’s oxygen requirement rises significantly (especially above 40%) inform the medical staff and the nurse in charge as this may be indicative of a more serious problem.
**CPAP** can be a painful 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.

**4.11 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.

**4.12 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
  - A blood pressure should be taken at least 24 hourly.
- Any agreed changes in CPAP pressure should be documented.

**5.0 Care of the Nose and Face.**  
See the care of the nose and face policy below.
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 infant’s 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 intubation and CPAP or ventilation. Inform tissue viability nurse and plastic surgeons. Complete an incident form. **Document any changes in care.**