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An assessment tool for infants requiring nasal continuous positive airway pressure

Most neonatal intensive care units use nasal continuous positive airway pressure (nCPAP) to achieve non-invasive ventilation. Although offering decreased lung damage and reduced rates of bronchopulmonary dysplasia (BPD), there are potential complications of nCPAP, specifically trauma to the nares. This article discusses an assessment tool for the early detection of trauma and prevention of injury in neonates.

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Key points

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1. Nasal CPAP is an important means of oxygen supplementation but can cause trauma to the nares.
2. Healthcare providers should be aware of the potential complications of nCPAP.
3. Use of an assessment tool enables early detection of any trauma to the nares.
4. A comprehensive and up-to-date approach for caring for an infant receiving nCPAP via a mask and/or prongs is discussed.

A trend towards an increased use of nasal continuous positive airway pressure (nCPAP) has arisen from several studies that have provided evidence of decreased lung damage and reduced incidence of chronic lung disease in neonates[1,2]. Nasal CPAP is as an effective treatment modality for neonates with bronchopulmonary dysplasia (BPD) and respiratory disease[3].

Southmead neonatal intensive care unit (NICU) is a level 3 tertiary unit. From 1 January 2013 to 31 April 2014 there were 3,112 days of nCPAP, a total of 353 infants received nCPAP and 52 infants were transferred to other NICUs on nCPAP. On the unit, infants receive:

- nCPAP via the Dräger Babylog 8,000 ventilator
- bubble CPAP using the Fisher & Paykel Optiflow system
- SiPAP using the Viasys (now CareFusion Infant Flow) system.

External or internal complications of nCPAP can be relatively frequent and close surveillance for potential complications should be considered during nCPAP use. One study reports an overall internal or external complication rate of 13.2%, including tissue necrosis, intranasal ulceration, granulation, and vestibular stenosis[4]. Other implications from nasal trauma due to nCPAP include litigation and additional anxiety for the parents who are already involved in a stressful and complex situation[5]. Caregivers providing close observations, ie hourly assessment of the infant's nares, have a unique opportunity to identify and assess these possible complications. It is therefore of vital importance that bedside caregivers understand the nCPAP system they are using to prevent skin complications from the interfaces used.

Educational guidelines

Nurses caring for infants receiving nCPAP work through a competency plan. The Practice Development and Respiratory teams at Southmead Hospital devised a set of guidelines that include a CPAP competency and a CPAP care plan. In accordance with the Department of Health's Toolkit for High Quality Neonatal Services[6], staff undergo training to achieve these competencies.

This infant received 74 days of nCPAP before transferring onto nasal high flow therapy. Nasal trauma was avoided by the successful implementation of a score chart for early detection of tissue damage.

Each manufacturer provides a tool or template with directions for measuring the infant's nares and head to determine the appropriate size prongs, mask and hat. One major challenge is obtaining a good fitting hat and prongs/mask to maintain airway pressure. The following components need to be examined to ensure a good fit is present[5]:

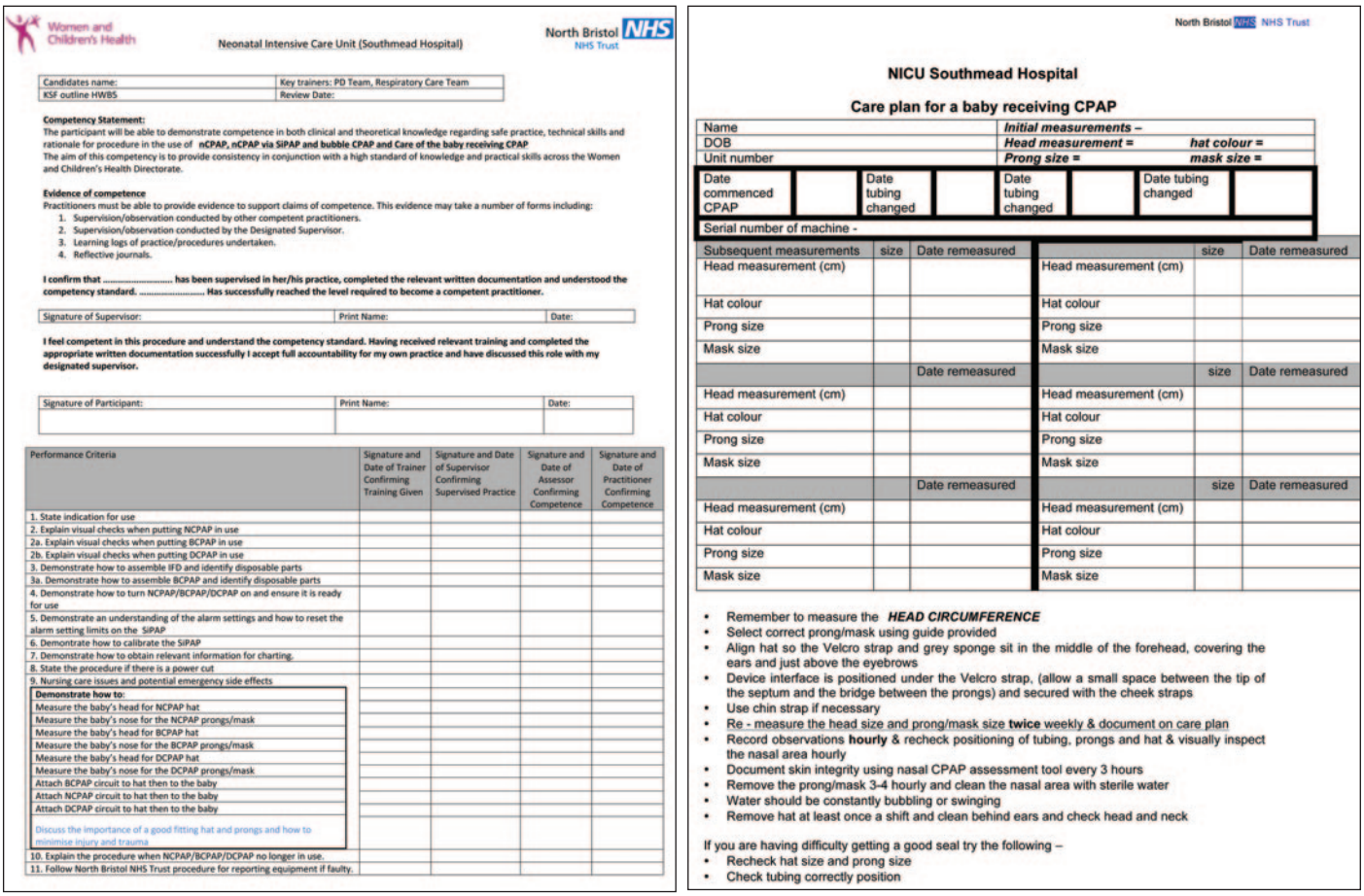
- Do the straps fit securely but not too tight?
- Is the mask pressing up against the nares and occluding them?
- Is the nasal interface component twisted because of tension on the tubing?
- Is there any blanching of the skin around the nares?

CPAP devices have the potential to cause nasal excoriation and scarring if inappropriately applied or infrequently monitored[7]. Nasal prongs will tend to cause nasal wall and septal breakdown whereas the masks tend to cause breakdown low on the septum at the base of the philtrum and high on the bridge of the nose[8]. As such, trauma related to nasal prongs tends to be maximum around the medial aspect of the nasal septum and the columella (the fleshy external end of the nasal septum), whereas trauma related to nasal masks is more often seen at the junction of the nasal septum and philtrum and at the glabella (the skin between the eyebrows and above the nose)[9]. As nasal masks and prongs can cause nasal trauma in differing distribution, the interface used is often alternated[10]. Prevention of skin breakdown in a neonate on nCPAP is paramount. If skin damage does occur, the caregiver needs to assess the degree of damage and try to relieve pressure at this point[11].

In some cases, surgical repair to nasal defects due to nCPAP trauma may be necessary and this is usually conducted when the infant is older and compliant. The surgery will involve using small local flaps of nasal tissue to repair the damage caused by a CPAP device.

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 the baby is wearing the correct size hat/mask/prong as per NICU guidelines and that all are correctly positioned Assess/discuss with senior nurse/registrar/consultant if a change in mask/prongs is needed or consider a change of device Document on NICU care 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 NICU care chart, in notes and complete AIMS form Doctor to refer to plastic surgeons and obtain medical imaging

FIGURE 1 A score chart for a baby receiving nCPAP.



Women and Children's Health

Neonatal Intensive Care Unit (Southmead Hospital)

North Bristol NHS Trust

Candidates name:	Key trainers: PD Team, Respiratory Care Team
KSF outline HWBS	Review Date:

Competency Statement:
The participant will be able to demonstrate competence in both clinical and theoretical knowledge regarding safe practice, technical skills and rationale for procedure in the use of **nCPAP, nCPAP via SiPAP and bubble CPAP and Care of the baby receiving CPAP**
The aim of this competency is to provide consistency in conjunction with a high standard of knowledge and practical skills across the Women and Children's Health Directorate.

Evidence of competence
Practitioners must be able to provide evidence to support claims of competence. This evidence may take a number of forms including:
1. Supervision/observation conducted by other competent practitioners.
2. Supervision/observation conducted by the Designated Supervisor.
3. Learning logs of practice/procedures undertaken.
4. Reflective journals.

I confirm that ..... has been supervised in her/his practice, completed the relevant written documentation and understood the competency standard. ..... Has successfully reached the level required to become a competent practitioner.

Signature of Supervisor:	Print Name:	Date:

I feel competent in this procedure and understand the competency standard. Having received relevant training and completed the appropriate written documentation successfully I accept full accountability for my own practice and have discussed this role with my designated supervisor.

Signature of Participant:	Print Name:	Date:

Performance Criteria	Signature and Date of Trainer Confirming Training Given	Signature and Date of Supervisor Confirming Supervised Practice	Signature and Date of Assessor Confirming Competence	Signature and Date of Practitioner Confirming Competence
1. State indication for use				
2. Explain visual checks when putting NCPAP in use				
2a. Explain visual checks when putting BCPAP in use				
2b. Explain visual checks when putting DCPAP in use				
3. Demonstrate how to assemble IFD and identify disposable parts				
3a. Demonstrate how to assemble BCPAP and identify disposable parts				
4. Demonstrate how to turn NCPAP/BCPAP/DCPAP on and ensure it is ready for use				
5. Demonstrate an understanding of the alarm settings and how to reset the alarm setting limits on the SiPAP				
6. Demontrate how to calibrate the SiPAP				
7. Demonstrate how to obtain relevant information for charting.				
8. State the procedure if there is a power cut				
9. Nursing care issues and potential emergency side effects				
Demonstrate how to:				
Measure the baby's head for NCPAP hat				
Measure the baby's nose for the NCPAP prongs/mask				
Measure the baby's head for BCPAP hat				
Measure the baby's nose for the BCPAP prongs/mask				
Measure the baby's head for DCPAP hat				
Measure the baby's nose for the DCPAP prongs/mask				
Attach BCPAP circuit to hat then to the baby				
Attach NCPAP circuit to hat then to the baby				
Attach DCPAP circuit to hat then to the baby				
Discuss the importance of a good fitting hat and prongs and how to minimise injury and trauma				
10. Explain the procedure when NCPAP/BCPAP/DCPAP no longer in use.				
11. Follow North Bristol NHS Trust procedure for reporting equipment if faulty.				

North Bristol NHS Trust

NICU Southmead Hospital

Care plan for a baby receiving CPAP

Name	*Initial measurements –*	
DOB	*Head measurement =*	*hat colour =*
Unit number	*Prong size =*	*mask size =*

Date commenced CPAP		Date tubing changed		Date tubing changed		Date tubing changed	

Serial number of machine -

Subsequent measurements	size	Date remeasured		size	Date remeasured
Head measurement (cm)			Head measurement (cm)		
Hat colour			Hat colour		
Prong size			Prong size		
Mask size			Mask size		
		Date remeasured		size	Date remeasured
Head measurement (cm)			Head measurement (cm)		
Hat colour			Hat colour		
Prong size			Prong size		
Mask size			Mask size		
		Date remeasured		size	Date remeasured
Head measurement (cm)			Head measurement (cm)		
Hat colour			Hat colour		
Prong size			Prong size		
Mask size			Mask size		

- Remember to measure the ***HEAD CIRCUMFERENCE***
- Select correct prong/mask using guide provided
- Align hat so the Velcro strap and grey sponge sit in the middle of the forehead, covering the ears and just above the eyebrows
- Device interface is positioned under the Velcro strap, (allow a small space between the tip of the septum and the bridge between the prongs) and secured with the cheek straps
- Use chin strap if necessary
- Re - measure the head size and prong/mask size **twice** weekly & document on care plan
- Record observations **hourly** & recheck positioning of tubing, prongs and hat & visually inspect the nasal area hourly
- Document skin integrity using nasal CPAP assessment tool every 3 hours
- Remove the prong/mask 3-4 hourly and clean the nasal area with sterile water
- Water should be constantly bubbling or swinging
- Remove hat at least once a shift and clean behind ears and check head and neck

If you are having difficulty getting a good seal try the following –
- Recheck hat size and prong size
- Check tubing correctly position

FIGURE 2 The CPAP competency (left) and care plans used at Southmead Hospital.

External complications from nCPAP, especially columellar necrosis, can be difficult to repair surgically and adverse cosmetic results may ensue.

An assessment tool

To try to prevent nasal scarring and excoriation the nCPAP score chart was introduced within Southmead NICU in 2008; this score chart has since been updated (**FIGURE 1**). Staff are encouraged to effectively use the nCPAP score chart. Six months after implementation an audit took place to permit quality improvement and help improve outcomes for patients[12]. The following areas were audited:

- documentation of nasal score on NICU chart – 100% completion and the nasal score corresponded with the actual condition of the babies' nares at that time.
- size of prongs/mask documented on NICU chart – 100% completion.

The audit revealed that the score chart had been implemented within this NICU successfully and that the nurses understood the need for the score chart, how to use it and why it was being used.

Using an instrument that predicts and ultimately prevents skin breakdown could help to[13-16]:

- alleviate pain, reduce an infant's discomfort and improve developmental outcomes
- decrease the risk of morbidity
- reduce re-intubation rates
- reduce sepsis
- decrease prolonged hospital stays in the NICU and the associated costs
- lessen complaints from parents and potential litigation costs.

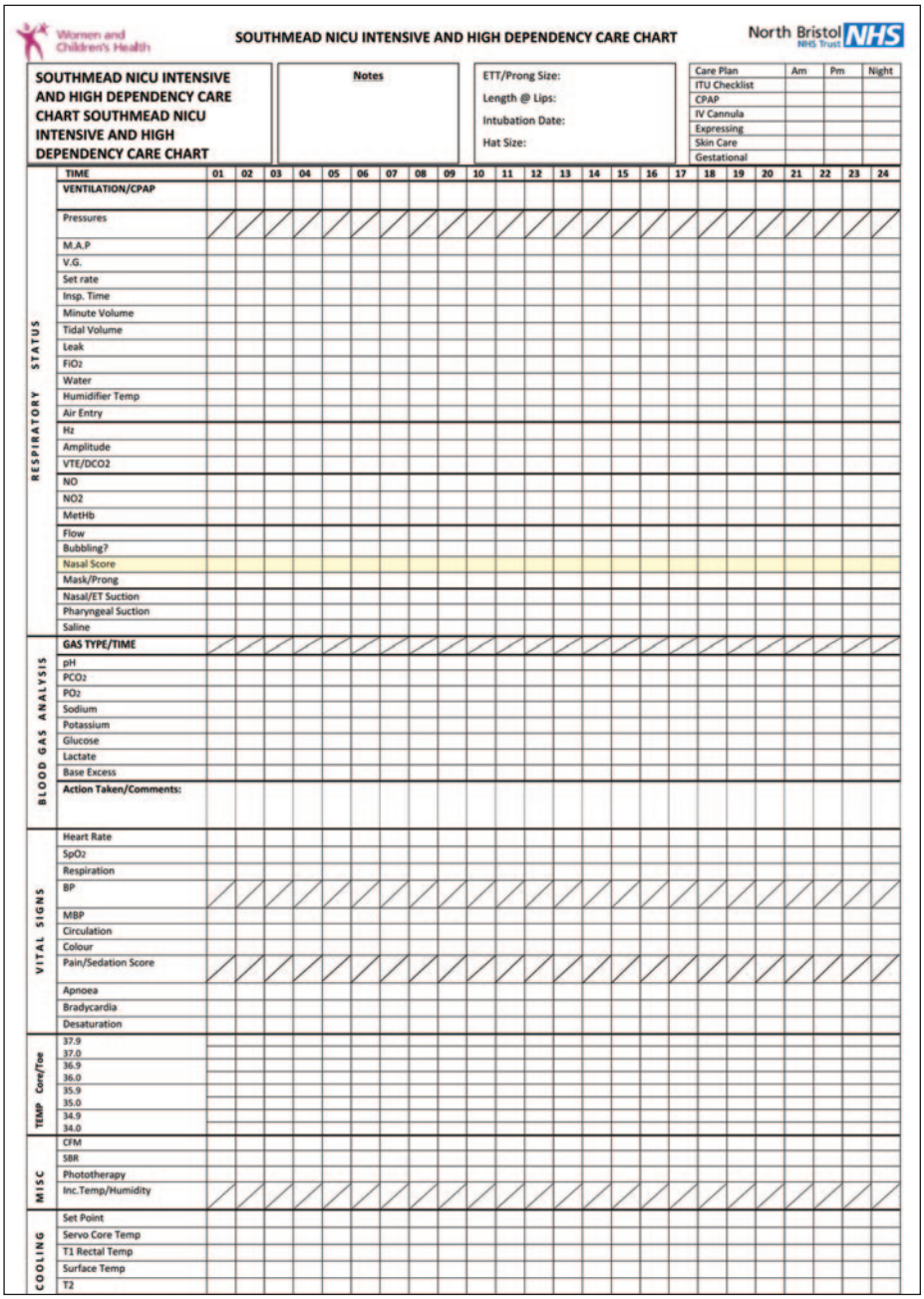


FIGURE 3 The nasal score is included in the unit's intensive and high dependency care chart.

Current practice

Specific CPAP care and competency plans (**FIGURE 2**) are now in use within Southmead NICU. The nasal score chart and CPAP care plan allow a systematic approach so that all aspects of the care an infant requires while on CPAP are not overlooked. The nasal score chart is integrated within the unit's NICU care chart (**FIGURE 3**). On an hourly basis, an infant's nares are assessed and scored and any evidence of skin breakdown is identified quickly and managed appropriately. **FIGURE 4** provides photographic examples of nasal scores 0, 1 and 2.

Close collaboration between NICU staff and the manufacturers of the ventilation equipment has enabled better working partnerships with enhanced feedback and organised study days.

Since the introduction of the nasal assessment tool, there has been a marked reduction in the number of nasal injuries and the extent of damage. In the past 12 months, just one infant received nasal trauma at score 2, as per the assessment tool. The nurse caring for the infant promptly identified the nasal injury, the attending consultant was notified, the injury was documented concisely in the infant's notes and the parents were informed. The nasal prongs were removed and the infant received nCPAP from a mask initially before commencing low flow oxygen therapy and later ambient oxygen via the incubator. The infant was referred to the plastic surgery team and, in accordance with North Bristol NHS Trust guidelines on reporting incidences, an accidents, incidents and near misses (AIMS) form was completed. This incident was investigated by the NICU risk management team. Unfortunately, the infant developed a *Staphylococcus aureus* infection a few days later and was re-intubated.

Nasal high flow therapy (nHF) is also now widely used within Southmead NICU and from 1 January 2013 to 31 April 2014, there were 666 days of nHF with a total of 106 infants receiving this mode of supplemental oxygen administration. Although nasal trauma is reduced in nHF when compared to nCPAP[17], an infant's nares still require vigilance while on nHF.

FIGURE 4 Representations of the nasal score chart. A) A nasal score of 0. The infant received two days of nCPAP and 22 days of nHF. B) A nasal score of 1. There is indentation from the nasal mask but no apparent skin damage. The infant received 34 days of nCPAP only. C) A nasal score of 2. Indentation on the cheeks and around the nose is seen in this infant who received 22 days of nCPAP and 19 days of nasal intermittent ventilation. There is redness over the top of the nose.

For this reason, the nasal score chart is used for all infants receiving nHF and accordingly, a nHF competency plan has been developed by the Practice Development team.

Since the introduction of this assessment tool, the nasal score forms part of the nurse-to-nurse handover process and it is felt that referral to the plastic surgery team has decreased (actual data are unavailable). Staff are more vigilant in the prompt assessment of an infant's nares and any necessary action.

Conclusion

The assessment tool is a simple staging system that, when used together with the nCPAP competency, nHF competency and nCPAP care plans, serves as a strategy for prevention and treatment to this iatrogenic cutaneous event.

Current practice at Southmead Hospital has improved awareness of the use of nCPAP and nHF and the safety issues that are involved when caring for infants receiving these therapies.

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