Guideline for the Administration of nasal CPAP in Victorian non-tertiary Level 2 nurseries

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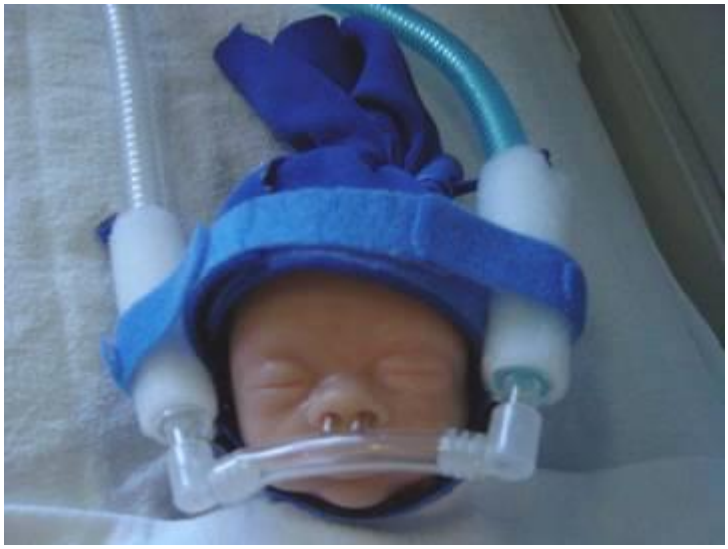

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INTRODUCTION

The purpose of this document is to provide guidelines for staff in non-tertiary Level 2 special care nurseries (SCNs), who undertake nasal continuous positive airway pressure (NCPAP) with the intention of reducing the need to transfer to a Level 3 NICU.

The background to the use of NCPAP outside a tertiary neonatal environment is presented in Appendix A.

Hospitals should have a clear policy on the use of NCPAP. This policy should reflect hospital executive support, clinician input and a commitment to provide the resources necessary for the safe and effective delivery of NCPAP.

Non-tertiary SCNs undertaking NCPAP should have clear links with a tertiary unit to facilitate access to ongoing medical and nursing collaboration.

For an individual baby the Consultant Paediatrician responsible for the baby is encouraged to access clinical advice and support directly from the duty NETS Consultant. It is stressed that this communication should be Consultant to Consultant. For babies who fall outside the recommended indications discussion with the duty NETS Consultant is mandatory.

The document does not aim to describe the total care associated with a sick baby receiving NCPAP, although it does include some discussion on aspects of care that are relevant to NCPAP (e.g. IV fluid therapy).

A statewide data collection will be established for all babies receiving NCPAP in non-tertiary SCNs. This will take 2 forms:

1. VicPIC will have a field added so SCNs can enter the number of babies receiving NCPAP.
2. A core set of clinical data will be collected, preferably via an online form, and managed either through the Australian and New Zealand Neonatal Network or by NETS.

Information from this dataset will be reported to PSAC (to be confirmed) and individual units.

The guidelines cover 3 main areas:

1. A clinical protocol that encompasses indications and contraindications, technique of administration, assessment of success/failure, weaning and discontinuation, complications, and monitoring requirements
2. Medical and Nursing resources
3. Equipment.

CLINICAL PROTOCOL

Indications for NCPAP in babies having continuing care in non-tertiary Level 2 SCNs

N.B. Babies with meconium aspiration syndrome, pneumonia, or with a history of a significant asphyxial insult often have, or are susceptible to, significant cardiorespiratory instability and are not suitable for ongoing support on NCPAP outside a NICU.

Babies with no other risk factor who have respiratory distress for > 6hrs duration should be prescribed antibiotics

The purpose of initiating NCPAP is to establish and maintain lung volume.

Babies should meet **all** the following criteria:

- Birth weight >1499g and gestation ≥32 weeks;

- Less than 24 hours old (the use of rescue NCPAP in a 2-3 day old baby with progressive respiratory failure is not infrequently followed by the need for rescue endotracheal intubation and aggressive mechanical ventilation)
- Have clinical signs of respiratory distress.
- Require FiO_2 of at least >0.25 to maintain a saturation between 91-95%.
- A chest radiograph consistent with mild respiratory distress syndrome or transient tachypnoea.

N.B. Babies on NCPAP requiring an ongoing FiO_2 of >0.40 must be ***discussed*** *w*ith the duty NETS Consultant.

Contraindications to NCPAP for ongoing management in non-tertiary Level 2 SCNs

- Birth weight ≤ 1500g
- Gestation <32 weeks
- More than 24 hours old at initiation of NCPAP
- Insufficient medical or nursing resources
- Persistent FiO_2 >0.40 (after commencing NCPAP)
- Persistent hypercarbia ($PaCO_2$ >60mmHg) with respiratory acidosis (pH<7.25)
- Apnoea (babies >1499g and ≥32 weeks gestation rarely have uncomplicated apnoea of prematurity as a reason to require NCPAP)
- Babies who remain dependant on NCPAP for >72 hours

NCPAP can be initiated in these babies, but early discussion with NETS to arrange transfer to a Level 3 NICU should occur.

Technique for administration of NCPAP in non-tertiary SCNs

The commonly used interfaces are:

- Various binasal prong techniques: these prongs are short, wide tubes that extend approximately ½-1cm into the nostrils.
- Nasal mask

Commonly used devices used to generate CPAP include:

- Bubble CPAP. This is the main mode of delivery of CPAP. Note this delivery mode does not have a disconnect alarm.
- A mechanical ventilator.

The recommended level for commencement of NCPAP is 7cm H_2O.

Specific details of nursing care required for these babies are outlined below.

The course of babies on NCPAP

Babies with respiratory distress on whom NCPAP is initiated are usually tachypnoeic, grunting and require mild to moderate inspired oxygen concentrations.

Signs of a positive response to NCPAP include:

- A reduction in the respiratory rate – typically by 10-20 breaths/min.
- Stabilisation or reduction in FiO_2. Babies who commence CPAP in FiO_2 >0.40 should show a clear reduction in oxygen requirements within 2 hours of commencement.

- Resolution of grunting.
- Reduction in the degree of sternal and intercostal recession.

Failure of NCPAP is indicated by one or more of the following:

- A sustained requirement for a FiO_2 >0.40 on CPAP of 7cm H_2O.
- Absolute rise in FiO_2 of 0.10 or greater over a time frame not exceeding 2 hours.
- Respiratory acidosis – pH<7.25 with a rising $PaCO_2$ >60mmHg on an arterial or capillary sample.
- Development of recurrent apnoea requiring stimulation.
- Development of spontaneous episodes of significant desaturation (<91% for >20secs).
- Increased recession and tachypnoea.
- Agitation not relieved by simple measures (comforting, repositioning).
- Development of a pneumothorax.

If any of the above signs of failure become evident, immediate consultation with the duty NETS Consultant is required to discuss further management and retrieval.

Nutrition

Babies who receive NCPAP for acute respiratory indications in the first 24 hours after birth are kept nil by mouth until their respiratory rate is <70 breaths/min, the FiO_2 is <0.25, and their work of breathing (as evidenced by grunting, intercostal recession) has improved significantly.

- Maintenance IV fluids are therefore required (60mL/kg/day 10% Glucose IV)
- Once the neonate is stable and improving, trophic feeds can be commenced cautiously (<15mL/kg/day). If risks for NEC exist (e.g. early compromise or severe growth restriction), discuss with the duty NETS Consultant
- If feeds cannot be commenced by 96 hours of age due to ongoing respiratory distress, parenteral nutrition will usually be required and the baby should be transferred to a tertiary centre.

Weaning

Once a baby's respiratory rate falls below 70 breaths/min, the FiO_2 is <0.25 and the baby is breathing with less effort, the CPAP should be reduced by 1cm H_2O every 2-4 hours until at 5cm H_2O. A trial off NCPAP is undertaken once the baby is stable for several hours on a CPAP of 5cm H_2O in a FiO_2<0.25 with a respiratory rate <70 breaths/min. It is common to see a mild increase in respiratory rate (10-20 breaths/min) as well as a small increase in inspired oxygen concentration (for example, FiO_2 0.25 to FiO_2 0.30) in the first hour after discontinuation of NCPAP. This weaning strategy is pragmatic rather than prescriptive.

Complications

- Pneumothorax
- Agitation
- Continued deterioration
- Nasal trauma (irritation, ulceration, distortion of the septum)

Monitoring

- Patient interface:
    - prongs in the nose
    - nasal airway clear
    - mouth closed
    - Observe for any signs of nasal trauma
    - Orogastric tube in situ
- CPAP system
    - Regular hourly inspection and assessment of the ventilator circuit and equipment
- Patient position
    - Neck slightly extended
- Continuous saturation monitoring. Target 91-95% regardless of gestation and postnatal age.
- Continuous cardiorespiratory monitoring
- 2-4 hourly blood pressure monitoring (non-invasive or invasive)
- Blood gas analysis as ordered.
    - Babies on NCPAP who have stabilised or improved whose FiO_2 is <0.40 do not require routine blood gas monitoring. There is no place for "4hrly" or "6 hrly blood gas" orders. Weaning should be managed on clinical grounds. See appendix C.
- Blood glucose monitoring

MEDICAL AND NURSING RESOURCES

Consultant Paediatricians involved in the administration of NCPAP should be:

- Experienced in the management of babies receiving NCPAP;
- Familiar with the indications and contraindications for NCPAP;
- Familiar with the expected course of babies supported on NCPAP; and
- Technically competent in the management of tension pneumothorax and in the procedure of endotracheal intubation and delivery of mechanical ventilation

A number of Level 2 nurseries do not have 24-hour on-site paediatric registrar coverage. While the acute collapse of a baby on NCPAP is uncommon, access to medical staff with appropriate skills to recognise and manage severe deterioration must be readily available. This response capability is similar to that required for a newly born baby who requires advanced resuscitation where severe depression at birth has not been anticipated.

The availability of appropriately trained nursing staff is critical. Not only do staff need to be available when NCPAP is initiated, but there needs to be a guaranteed availability for the predicted duration of NCPAP.

Education

- Regular participation in professional development activities is essential for medical and nursing staff. Such activities should include:
    - Principles of NCPAP
    - Specific medical and nursing management
    - Prong(s) care
    - Prevention, diagnosis and management of blocked prong(s)

  - Strapping and changing prong(s)
  - Understanding and problem solving in relation to equipment associated with delivery of NCPAP, and
  - Review of specific procedures in relation to complications (e.g. pneumothorax).
- A competency package will be developed by NETS Education to include these aspects of care.
- Level 3 experience. The relationship with a tertiary service should include opportunities for medical and nursing staff placements to enhance direct hands on experience.

EQUIPMENT

The equipment required, both specific and supportive, is similar to that used for stabilization prior to transfer of babies needing respiratory support. A complete list is provided in the Appendix B.

General issues

These guidelines are for the Level 2 nurseries to maintain care of babies on NCPAP:

- On a case-by-case basis, there must be agreement between senior medical/nursing staff that suitable resources are available for the predicted duration of the therapy.
- The default nurse to patient ratio should be 1:2. This may vary with the baby's acuity.
- Pathology/i-STAT and radiology services must be available, both in-hours and after-hours.
- Babies with respiratory distress commenced on NCPAP should have antibiotics prescribed.

Research and Quality

- Level 2 nurseries are encouraged to undertake audit and quality improvement activities in this area.
- Standardised data collection will be undertaken as described previously and reported to PSAC (to be confirmed) on at least an annual basis.

Disclaimer

These guidelines have been developed for use by medical and nursing personnel working in non-tertiary newborn special care nurseries throughout Victoria.

Whilst appreciable care has been taken in the preparation of this material, users of these guidelines should confirm the information contained within them is correct by way of independent sources. No responsibility is accepted for any inaccuracies or information perceived as misleading. The authors shall not be held responsible for any act or omission which may result in injury or death to any baby as a result of reliance on this material.

Feedback, comments and questions

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Neonatal Advisory Group

Newborn Emergency Transport Service

Neonatal Services Advisory Committee

Medical and Nursing staff of Victoria's non-tertiary SCNs

Appendix A

Background

CPAP is the application of positive pressure to the airways of spontaneously breathing patients throughout the respiratory cycle. Correctly applied NCPAP in babies with respiratory distress facilitates and sustains lung inflation. When applied to babies with respiratory distress NCPAP results in a reduced requirement for oxygen, and a reduction in the respiratory rate, work of breathing and other signs of respiratory distress.

In a randomised controlled trial in a group of Level 2 SCNs in New South Wales, NCPAP was found to reduce the need for up transfer (Buckmaster et al, Pediatrics 2007;120;509-518). NCPAP has been used in Level 2 Victorian nurseries for more than 10 years. Although there has been no systematic statewide data collection, individual units have informally reported their experience. Unpublished data from Barwon Health shows that over a 4 year period (2005-9) 92 babies received NCPAP (D. Fuller and N. Parekh, Neonatal Double Feature Meeting, Melbourne. May 2009). In 60 babies, NCPAP was commenced with the intent of avoiding up-transfer and in 53 of these it was successful. No serious complications were experienced in this cohort. An audit of babies transferred by NETS who were commenced on NCPAP in Victorian Level 2 nurseries, where the intent was to continue to manage the infant in the Level 2 nurseries, showed that 56% of the babies were subsequently ventilated (Hart-Davies E., Wheeler K.and Stewart M. A retrospective case note review of NETS referrals for babies initially managed on NCPAP. PSANZ Annual Congress, Hobart 2011). There were a range of underlying respiratory conditions, including respiratory distress syndrome, sepsis and meconium aspiration syndrome, and reasons for transfer included lack of resourcing, persistent hypercarbia or acidosis, apnoea, and increasing oxygen requirements. Although the number of infants studied was small, 2 of the 27 babies subsequently died, both from sepsis.

While it can be argued that many babies receiving NCPAP might be more appropriately classed as requiring high dependency rather than intensive care in terms of acuity, tertiary neonatal centres regard NCPAP as an intensive care practice and resource it accordingly. Currently 8 of the 20 public Level 2 nurseries in Victoria offer NCPAP as a treatment for babies with respiratory distress with a number of others well advanced in their plans to introduce NCPAP.

NCPAP is a relatively simple and effective therapy for respiratory distress syndrome; however, it is resource intensive, particularly in relation to the requirement for skilled medical and nursing care.

Appendix B

Equipment required for the administration of nasal continuous positive airway pressure (NCPAP) in non-tertiary Level 2 nurseries.

Thermal maintenance

- Resuscitaire with servo-controlled radiant heater

or

- Incubator

Mechanical ventilator system/Bubble CPAP system

- Continuous flow mechanical ventilator set in the CPAP mode with high and low pressure, loss of power and gas alarms or bubble CPAP system with air/oxygen blending capacity
- Humidifying chamber
- Sterile water (bottle or bag and feed set)
- Lightweight ventilator tubing or NCPAP tubing
- Temperature probe for the circuit
- Medical Air and oxygen outlets

Monitoring equipment

- Cardiorespiratory monitor
- Pulse oximeter
- Non-invasive blood pressure monitor
- Equipment for collecting blood gases
- Transilluminator for rapid clinical diagnosis of pneumothorax

Equipment to connect the ventilator tubing or CPAP circuit to the airway

- Binasal prongs or nasal mask and recommended fixation for same (e.g. the NCPAP cap or Fisher & Paykel infant bonnet), or
- Nasal CPAP mask
- Hydrocolloid dressing (e.g. Comfeel, extra-thin DuoDERM) [optional]
- Suction apparatus
- Fg 5 or 6 and 8 suction catheters
- T piece device/self inflating bag and face mask
- Intubation equipment

Equipment for gastric decompression

- Fg 8 orogastric tube
- Tape for securing
- Container to collect gastric drainage

- 10mL syringe

Resuscitation equipment

To be kept at the bedside at all times:

- Suction apparatus
- Suction catheters Fg 5, 6 and 8
- Intubation equipment
- Hand ventilation system and face mask (T piece device or self inflating bag)
- Thoracocentesis equipment: 21 gauge butterfly needle or 22 gauge cannula
  3 way stopcock
  10 or 20mL syringe
  alcohol swab
  sterile cotton swab
- Equipment for inserting an intercostal catheter (see Neonatal Handbook at www.netsvic.org.au/nets/handbook/index.cfm?doc_id=604 or NETS Ventilation Package)

Documentation

Observation chart with provision for recording vital signs and other parameters. In general, the following parameters should be recorded hourly (or more frequently):

1. FiO_2
2. CPAP pressure/measurement/setting/level
3. Gas flow rate
4. Water level in humidifying chamber
5. Humidifier and circuit temperature
6. Activity of bubbles in Bubble CPAP system

Appendix C
Monitoring Ventilation and Oxygenation

To assist with making decisions regarding need for nasal CPAP, intubation and oxygen requirements the following should be considered:

Ventilation = CO_2 clearance. Need blood gas.

1. Arterial sampling is the gold standard for pCO_2 measurement. However, repeated arterial stabs are unrealistic and arterial lines are rarely indicated outside an ICU.
2. A single arterial stab is useful if the result on a venous or capillary sample appears inconsistent with other parameters (oxygen requirements, clinical assessment) AND if confirmed would result in a significant management change (e.g. intubation and transfer).
3. Capillary pCO_2 has good agreement with arterial pCO_2 and is useful if in the 40-60mmHg range.
4. Venous pCO_2 is useful if in the 50-60mmHg range (which likely indicates that the baby's ventilation is at least adequate). However, it consistently overestimates arterial pCO_2 and a single high measure cannot be relied on.
5. Despite an increasing trend to tolerating respiratory acidosis and hypercarbia in selected circumstances, a pCO_2 >60mmHg in association with a pH <7.25 should be discussed with the duty NETS Consultant.

Oxygenation = Use pulse oximetry (right hand). Do not use blood gas to assess oxygenation.
Target range in all babies SpO_2 91-95%