

Newborn Critical Care Center (NCCC) Clinical Guidelines

Bubble CPAP Guidelines

INTRODUCTION

Continuous positive airway pressure (CPAP) is a non-invasive technique of administering pressurized heated and humidified air and/or oxygen to the airways of a spontaneously breathing patient. The end expiratory pressure generated during CPAP deters alveolar collapse, increases end-expiratory lung volumes (EELV), and maintains functional residual capacity (FRC). CPAP is a respiratory therapy that is typically utilized in newborns with respiratory distress syndrome and other causes of pulmonary dysfunction that result in decreased FRC. CPAP is also sometimes used to treat apnea of prematurity and to assist in preventing small airway collapse.

EQUIPMENT

Bubble continuous positive airway pressure (BCPAP) is the adopted technique of administering CPAP in the NCCC. Care and maintenance of BCPAP, including ensuring appropriate bubbling, is the interdisciplinary responsibility of nursing, respiratory therapy and physicians. The components of the BCPAP system include:

- A heated and humidified gas source with flow rates between 8-10 L/min
- A nasal interface (nasal prongs or mask and FlexiTrunk™ interface) that connects the patient to the CPAP circuit and pressure generator
- An expiratory limb of corrugated respiratory tubing submerged into a bottle of 0.25% acetic acid
- A water seal canister in which the expiratory limb of the circuit is immersed to a depth in centimeters that equals the desired CPAP pressure (e.g., 1 cm of depth produces 1 cm of H₂O pressure)
- BCPAP is typically maintained between 5-8 cm of H₂O pressure

INITIATING BCPAP

1. All infants born < 30 weeks (i.e. infants 22 through 29 6/7 weeks) should be automatically placed on CPAP at ≥ 5 cm H₂O starting in the delivery room or as soon as possible.
(**Note:** ELBW guideline recommends starting at +6 for ELBW infants.)
 - a. Do not wean CPAP pressure below 5 cm H₂O or interrupt CPAP within the first 24 hours of therapy (other than alternating from mask to prongs.)
2. Infants < 34 weeks CGA who require noninvasive respiratory support should be started on CPAP at ≥ 5 cm H₂O.

Infants >34 weeks CGA who require noninvasive respiratory support should be assessed to see if they might be an appropriate candidate for bCPAP at ≥ 5 cm H₂O as an initial modality or for support after extubation.

WEANING FROM BCPAP

The first trial off of CPAP for infants with RDS born at <30 weeks GA (with a postmenstrual age of <34 weeks) should occur when the following clinical criteria are met:

1. Currently on bCPAP at 5 cm H₂O with FiO₂ 0.21 for at least 48 hours
2. A respiratory rate not greater than 60 bpm for more than two hours
3. Absence of significant retractions on physical exam
4. Less than or equal to 2 apneas with bradycardia or desaturations in the past 24 hours, all of which must be self-limiting
5. Maintains oxygen saturations \geq 90%
6. Not currently being treated for PDA or sepsis
7. Tolerates at least 15 minutes off CPAP during care times

Once all of these criteria are met, infants should be weaned off of CPAP to room air. The use of nasal cannula (either low flow or high flow) should not be used as a first line weaning device in this situation.

An infant will be deemed unsuccessful during a wean trial off positive pressure if any of the following criteria are met:

1. Respiratory rate greater than 60 bpm for more than 2 hours
2. Marked retractions on exam
3. More than 2 apnea events with bradycardia or desaturation in a 24 hour period OR any event requiring positive pressure ventilation (PPV)
4. Failure to maintain oxygen saturations above 90%

If an infant is unsuccessful based on any of the above criteria, the infant should be placed back on bCPAP. The infant should have another trial after a period of 1 week has elapsed AND all stability criteria are met.

OTHER BCPAP CONSIDERATIONS

1. CPAP device (Argyle™ nasal prongs or face mask) should be taken to all deliveries of infants < 30 weeks to provide positive pressure via Neopuff.
2. Ensure appropriate oxygen is administered to achieve target oxygen saturation ranges.
3. No interruption of CPAP should occur in the first 24 hours of life (other than alternating between mask and prongs.)
4. If infant with RDS in the first 48 hours life exceeds CPAP 6 cm H₂O and FiO₂ > 0.3, surfactant should be considered (in and out).
5. A protective barrier dressing should be applied routinely to all babies on CPAP. There should be a small space maintained between the columella (bottom portion of nasal septum) and the prongs.
 - Any patient <1000g will use Mepilex[®] and thin Duoderm[®] *if needed*
 - Any patient >1000g will use Mepilex[®]

6. Routine suctioning should NOT be performed if there is appropriate bubbling when auscultating the baby's chest, as the aim is to avoid trauma and nasal swelling which can result in upper airway obstruction.
7. To help reduce the risk of pressure injury, RT may alternate approximately every six hours between mask and prongs.
8. Routinely monitor for any signs of skin breakdown, including discoloration, scabbing, or indentations, particularly at the nasal septum. If any signs are noted, a plan of care should be made with nurse, respiratory therapist and medical team to determine extent of injury, as well as potential need for wound care and/or plastic surgery consult. Consider increasing frequency of alternating mask and nasal prongs to every three hours if signs of skin breakdown are present.
9. If receiving enteral feeds, monitor for signs of feeding intolerance due to gastric distention.
10. Monitor for signs of cardiovascular compromise secondary to increased intrathoracic pressure leading to impaired venous return.
11. Monitor for signs of respiratory distress or hypoxemia which may be suggestive of pneumothorax.

INDICATIONS FOR HIGH-FLOW NASAL CANNULA (HFNC)

Consider a transition from bCPAP to high-flow nasal cannula when it will benefit the developmental status of the infant. To be considered for this transition, the infant must be on bCPAP 5 cm H₂O and FiO₂ ≤ 0.30 and either of the following:

1. Greater than or equal to 34 weeks corrected gestational age AND feeding cues
- OR**
2. Greater than 35 weeks corrected gestational age without signs of feeding cues

The RT will transition infants who meet these criteria to 4 L/min high-flow nasal cannula. Some larger infants may need to start on higher liter flow (2L/kg). The respiratory therapist will wean the infant by 1 L/min of flow no faster than every 12 hours if the infant's work of breathing remains appropriate and FiO₂ ≤ 0.30. Once the infant reaches 2 L/min, the infant may start working on feeds PO.

INDICATIONS TO CONSIDER CPAP IN INFANTS ≥ 34 WEEKS GA

1. Consider placement of bCPAP on an infant who is ≥ 34 weeks gestational age who has signs of respiratory distress, as evidenced by:
 - a. Retractions
 - b. Grunting
 - c. Nasal flaring
 - d. Tachypnea
 - e. Hypoxemia - requiring sustained FiO₂ >0.25 to maintain SpO₂ ≥ 94%

Bubble CPAP may represent appropriate therapy in the delivery room and early in neonatal course for respiratory distress syndrome, transitional tachypnea of the newborn, persistent pulmonary hypertension of the newborn, and sepsis. In certain clinical scenarios, it may be

appropriate, at the discretion of the supervising physician, to begin CPAP at 5 cm H₂O and escalate up to 8 cm H₂O.

2. Consider change or escalation in therapy if:
 - a. FiO₂ requirement of ≥ 0.50 for ≥ 1 hour to maintain SpO₂ $\geq 94\%$
 - b. CO₂ levels >65 mm Hg in blood gas analysis
3. Consider extubation to bCPAP in infants >34 weeks GA with BPD and low FiO₂, high pressure requirement.