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 BCPAP 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 BCPAP pressure (e.g.,1 cm of depth produces 1 cm of H_2O pressure)

BCPAP is typically maintained between 5-10 cm of H_2O pressure

INITIATING BCPAP

1. All infants born < 28 weeks (i.e. infants 22 through 27 6/7 weeks) should be automatically started on BCPAP + 6 cm H_2O in the delivery room.
2. All infants born 28 to 29 weeks gestation should be automatically placed on BCPAP at ≥ 5 cm H_2O starting in the delivery room or as soon as possible.
3. Any infant ≤ 34 weeks postmenstrual age (PMA) who requires noninvasive respiratory support outside of the delivery room should be started on BCPAP at ≥ 5 cm H_2O.
4. Any infant >34 weeks PMA who requires noninvasive respiratory support may be assessed to see if they might be an appropriate candidate for BCPAP at ≥ 5 cm H_2O as an initial modality or for support after extubation based on their clinical presentation, underlying diagnosis and postnatal age.

WEANING FROM BCPAP

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

1. Currently on BCPAP at 5 cm H_2O with FiO_2 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 ≥ 90%
6. Not currently being treated for sepsis
7. Tolerates at least 15 minutes off BCPAP during care times

Once all of these criteria are met, infants should be weaned off of BCPAP 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.

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 four days have elapsed AND all stability criteria are met.[1]

OTHER BCPAP CONSIDERATIONS

1. BCPAP 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. In order to optimize FRC, there should be minimal interruptions to BCPAP (e.g., less than 20 seconds) other than when alternating between mask and prongs.
4. If infant with RDS in the first 48 hours of life exceeds BCPAP 6 cm H_2O and $Fi0_2$ > 0.4, surfactant should be considered (in and out). [2]
5. Consider the need for deep suctioning (both nose and mouth) when trouble shooting issues with BCPAP such as concern for obstruction or poor bubbling.
6. To help reduce the risk of pressure injury, RT may alternate approximately every six hours between mask and prongs.
7. A protective barrier dressing should be applied routinely to all babies on BCPAP. 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®
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. 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 H_2O and $FiO_2 \leq 0.30$ and either of the following:

1. Greater than or equal to 34 weeks PMA AND feeding cues

OR

2. Greater than 35 weeks PMA 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 $FiO_2 \leq 0.30$. 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 GA who has signs of respiratory distress, as evidenced by:
    a. Retractions
    b. Grunting
    c. Nasal flaring
    d. Tachypnea
    e. Hypoxemia - requiring sustained FiO_2 >0.25 to maintain SpO2 ≥ 94%
2. Consider change or escalation in therapy if:
    a. FiO_2 requirement of ≥ 0.50 for ≥ 1 hour to maintain SpO2 ≥ 94%
    b. CO_2 levels >65 mm Hg in blood gas analysis
3. Consider extubation to BCPAP in infants >34 weeks GA with BPD requiring high pressures with low FiO2.

REFERENCES

1. Clements J, Christensen PM, Meyer M. A randomised trial comparing weaning from CPAP alone with weaning using heated humidified high flow nasal cannula in very preterm infants: the CHiPS study. Arch Dis Child Fetal Neonatal Ed. 2022;108(1):63-8. Epub 20220718. doi: 10.1136/archdischild-2021-323636. PubMed PMID: 35851035; PubMed Central PMCID: PMCPMC9763181.

2. Haq MI, Datta V, Bandyopadhyay T, Nangia S, Anand P, Murukesan VM. Higher (40%) versus lower (30%) FiO(2) threshold for surfactant administration in preterm neonates between 26 and 32 weeks of gestational age: a non-inferiority randomized controlled trial. Eur J Pediatr. 2025;184(12):793. Epub 20251125. doi: 10.1007/s00431-025-06628-1. PubMed PMID: 41288797.

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