

Policy: Nasal Continuous Positive Airway Pressure (CPAP)**Introduction to Nasal CPAP**

1) Purpose:

To provide a summary background of Bubble Continuous Positive Airway Pressure (bCPAP), its indications, contraindications, adverse effects, and sample order set

2) Background:

The respiratory distress syndrome of premature infants is a direct result of their anatomical features. Their chest wall is overly compliant, they have low muscle mass with low tone, and their lungs are less elastic with a higher recoil. Preterm infants are unable to generate enough tidal volume (V_t) to maintain their own functional residual capacity (FRC). This predisposes them to airway and alveolar collapse. Full-term infants who have respiratory compromise due to delayed transition (excess fluids in the lungs), meconium aspiration or pneumonia, will have similar pathophysiology with less V_t and similar inability to maintain their FRC.

Bubble Continuous Positive Airway Pressure (bCPAP) is a non-invasive respiratory intervention that is a valid alternative to endotracheal intubation and mechanical ventilation. CPAP is proven to be an efficient tool for initial resuscitation of distressed infants in the delivery room, as a maintenance therapy for infants with respiratory distress syndrome, and a supportive tool for apnea of prematurity.

Early introduction of bCPAP in the management of infants with respiratory distress improves gas exchange and lead to better oxygenation and wash of carbon dioxide therefore decreasing and preventing barotrauma, volutrauma and oxytrauma associated with mechanical ventilation. Infants on bCPAP are usually not exposed to sedation or muscle relaxants, therefore they do not suffer from the fluid imbalance and edema seen after prolonged paralysis.

Bubble CPAP depends on a constant flow of air within a sealed respiratory circuit that is set up between the source of air/gas mixture and the infant's lungs. In bCPAP circuits, an almost constant pressure will be created within the circuit and the infant's lungs, splinting the airway and distending the alveoli preventing them from collapsing after each breath. The vibrations generated within the circuit when the bubbles exit the water surface create a low frequency, low amplitude waves that resemble the vibrations generated by a high-frequency ventilator. These waves help dislodge thick secretions that obstruct small airways therefore **recruit more alveoli** and improve functional residual capacity.

Bubble CPAP is compared to ventilator-derived CPAP in multiple studies. Infants who received bCPAP have lower respiratory rates and minute volumes, increased functional residual capacity (FRC), and a lower fractional concentration of inspired

oxygen (FiO_2). Infants breathe more comfortably even with a partial pressure carbon dioxide (PCO_2) level of 60

3) Indications for the use of CPAP:

CPAP is used to avoid endotracheal intubation or as a transient post-extubation measure in infants experiencing respiratory distress, such as tachypnea, nasal flaring, grunting, retractions, cyanosis, increased oxygen requirements, and apnea with bradycardia. Common indications for bubble CPAP include:

1. Pulmonary diseases with diminished functional residual capacity (FRC):
 - a. Respiratory Distress Syndrome (RDS)
 - b. Delayed transitioning or transient tachypnea of newborn (TTN)
 - c. Meconium aspiration syndrome (MAS)
 - d. Pneumonia/pneumonitis
2. Airway closure disease:
 - a. Tracheomalacia
 - b. Bronchopulmonary Dysplasia (BPD)
 - c. Bronchiolitis
3. Apnea of prematurity
4. Partial paralysis of diaphragm
5. Respiratory support after extubation

4) Contraindications for the use of CPAP:

There are no contraindications to using non-invasive respiratory intervention. However, it is up to the clinician to decide whether sick infants would respond to bCPAP or consider more invasive options for the initial management or upgrade of intervention of these infants. In such conditions, the following parameters may be used as a threshold to upgrade from bCPAP to more invasive interventions:

- $\text{FiO}_2 > 50\%$ for more than 4 hours
- $\text{PaCO}_2 > 75$ mmHg for more than 4 hours
- Respiratory Acidosis: $\text{pH} < 7.25$ (ABG) or < 7.20 (CBG) for more than 4 hours
- Significant distress with severe desaturations, persistent bradycardia or frequent apneas

Absolute contraindications for nasal CPAP:

- Bilateral Choanal Atresia
- Severe bilateral Choanal Stenosis
- Other nasal or nasopharyngeal anomalies that may interfere with air penetration from nose to trachea

Relative contraindications for nasal CPAP:

- Severely eroded nasal septum (until it heals)
- Severely swollen vocal cords and upper airway

5) Adverse effects of nasal CPAP:

- Nasal septal erosion
- Nasal mucosal irritation, bleeding and subsequent transient obstruction
- Swallowing excess air can lead to gastric distention and dilated bowel loops

References:

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http://www.vtoxford.org/meetings/AMQC/Handouts2014/LearningFair/NorthShore_DoesRoutineUseofChinstraps.pdf
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- 6) American Association for Respiratory Care (AARC). AARC clinical practice guideline. Application of continuous positive airway pressure to neonates via nasal prongs or nasopharyngeal tube. March 22, 2005, www.guideline.gov

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