

Continuous Positive Airway Ventilation (CPAP) Neonatal - Summary

Reference no.: NIC RC 03

Introduction

Continuous positive airway pressure (CPAP) is the most widely used respiratory support for preterm infants. It is used both as a primary mode, immediately after birth, and after extubation from mechanical ventilation [1].

Although the exact physiological mechanism by which CPAP supports breathing is not known, it possibly helps by

- Improving lung compliance and reduction in airway resistance
- Improving ventilation/perfusion ratio and reducing oxygen requirement
- Keeping upper airways open and reducing the risk of obstructive apnoea
- Conserving surfactant in the alveoli, preventing alveolar collapse, and improving alveolar recruitment

Modes of CPAP

CPAP is used via a pressure interface at the nose – nasal CPAP. Other interfaces such as nasopharyngeal (via a cut endotracheal (ET) tube) or ETCPAP are not used routinely and should only be considered in exceptional circumstances such as facial or upper airway abnormalities. Although several systems and modes are available for delivering CPAP, the 2019 European consensus guideline [4] states that the system delivering the CPAP is of little importance. The interface should be a short binasal prong or mask with a starting pressure of about 6-8 cm of H₂O [2].

CPAP is most widely used in its simplest form. The machine is set to deliver a constant peak end expiratory pressure (PEEP) that provides a continuous distending pressure to the airway. In routine use, PEEP is set at 6-8 cm of H₂O in extremely and very preterm infants. Nasal CPAP is the recommended primary respiratory support for preterm infant and early routine use of nasal CPAP without or following surfactant administration is recommended for preterm infants with respiratory distress syndrome [3]. Spontaneously breathing preterm infants should be stabilised with CPAP of at least 6 cm of H₂O via a mask or nasal prong. CPAP is also recommended for post- extubation respiratory support for preterm infants.

Biphasic or Bi-level CPAP (BiPAP) is used as an enhance mode of non-invasive respiratory support. PEEP is set as usual and an additional high pressure (up to 2-3 cm of H₂O higher than the PEEP) is set with an inspiratory time (usually 0.3) and respiratory rate (usually 60 breaths per minute). The respiratory rate is gradually reduced to wean the extra pressure support before changing to CPAP. These breaths can be synchronised with the infant's breathing efforts. This modality, may reduce the incidence of extubation failure and the need for reintubation within 48 hours to one week more effectively than CPAP although it has no effect on chronic lung disease or mortality [4].

2. Aim and Purpose

To ensure a standardised approach to infants requiring CPAP

3. Definitions, Keywords

CPAP: Continuous positive airway pressure

PEEP: Peak end expiratory pressure

RDS: Respiratory distress syndrome

4. Main body of Guidelines

Indications for use

1. Primary respiratory support in preterm infants: at birth, in spontaneously breathing preterm infants with RDS
2. Apnoea of prematurity
3. Post-extubation respiratory support in preterm infants
4. Airway abnormalities where an infant is susceptible to airway collapse such as tracheomalacia

CPAP is indicated in infants who have RDS or other respiratory disease requiring more than 40% inspired oxygen to maintain their oxygen saturations within the appropriate limits.

CPAP is also used to support ventilation (i.e. carbon dioxide exchange) and should be used in infants with rising carbon dioxide levels (such as a $p\text{CO}_2 > 7$ kPa).

CPAP is also used to support work of breathing, particularly in preterm infants who have respiratory distress (such as intercostal and subcostal recessions and recurrent episodes of apnoea, bradycardia, or desaturations).

CPAP should be started with PEEP of at least 6-8 cm of H₂O. Higher PEEP may be safe even in extremely preterm babies. The recent ÉCLAT trial showed that extubation of extremely preterm infants to CPAP with 10 cm of H₂O PEEP significantly reduced extubation failure compared with extubation to PEEP of 7 cm of H₂O without increasing rates of adverse effects [5].

Cautions

1. CPAP is not suitable for use in infants with established respiratory failure – such infants require mechanical ventilation.
2. CPAP is not the preferred modality when the RDS is severe and requires surfactant therapy – such infants should be intubated, given endotracheal surfactant.
3. CPAP should be used with caution in larger, more mature infants who appear to “fight” the CPAP. Such infants may be more comfortable breathing spontaneously in higher levels of inspired oxygen (such as up to 60-70% ambient oxygen) or should be intubated and mechanically ventilated.
4. CPAP should be used with caution in infants with abdominal distention particularly with suspected necrotising enterocolitis.
5. Infants with unstable respiratory drive and severe cardio-vascular instability such as due to sepsis should be electively intubated and ventilated.

Contraindication

1. Oesophageal atresia and/or tracheo-oesophageal fistula
2. Gastro-intestinal perforation
3. Diaphragmatic hernia