

Airway Disease and Management in Bronchopulmonary Dysplasia



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KEYWORDS

- Subglottic stenosis • Tracheomalacia • Bronchomalacia • Tracheotomy
- Failure to extubate • Bronchopulmonary dysplasia

KEY POINTS

- Early use of continuous positive airway pressure significantly reduces the incidence of extubation failure.
- Early use of continuous positive airway pressure significantly shortens the duration of mechanical ventilation.
- Prolonged intubation in neonates may be tolerated for months, but, if there is no realistic prospect of extubation, tracheotomy should be considered once the infant weighs more than 1500 g.
- The ideal size of an endotracheal tube is the smallest tube that permits adequate ventilation of an infant.
- In an infant who is difficult to intubate, tracheotomy should be considered early if the reason for intubation difficulty is not correctable.

INTRODUCTION

Over the previous 2 decades, increased survival rates of preterm infants have paralleled improvements in prenatal, obstetric, and neonatal care. However, significant morbidity and mortality among extremely preterm infants (ie, gestational age between

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22 and 28 weeks) remain high and have reached a plateau. Bronchopulmonary dysplasia (BPD) is the most common cause of pulmonary morbidity in this patient population. Moderate to severe BPD occurs in 41% of all extremely preterm infants, with an incidence ranging from 85% to 23% in those born at 22 and 28 weeks' gestation respectively. Almost all (93%) of these infants develop respiratory distress and 62% require either conventional or high-frequency ventilation.¹ The strategies for the discontinuation of mechanical ventilation include nasal continuous positive airway pressure (NCPAP) and high-flow nasal cannula (HFNC).

The incidence of extubation failure in preterm infants remains significant, because it ranges from 25% to 30%.^{2,3} This problem is more evident among the most premature infants, those with lower gestational age, and those with residual lung disease who require supplemental oxygen at the time of extubation.

Although prolonged intubation has permitted the survival of increasingly premature infants with increasingly premature lungs, it has also brought about a concurrent marked increase in the incidence of tracheotomy-dependent children with acquired subglottic stenosis (SGS), which in turn has precipitated the development of surgical techniques to manage this disease.^{4,5}

Airway disease in premature infants may therefore present as an inability to extubate or an inability to wean off noninvasive positive pressure support. Although management generally consists of tracheotomy placement and potentially positive pressure support, in selected cases, airway reconstructive surgery may prevent the need for tracheotomy. If tracheotomy is required, the intent is that eventually the infant will be weaned off positive pressure support and ultimately be decannulated; however, in some case, airway reconstructive surgery is required to achieve decannulation.

This article presents an overview of the neonatal pulmonary and airway problems that are frequently encountered when managing infants with BPD and briefly describes the management of these problems.

RESPIRATORY SUPPORT OF CHILDREN WITH BRONCHOPULMONARY DYSPLASIA

NCPAP has become an effective option for noninvasive respiratory support and is widely used to facilitate weaning from mechanical ventilation and preventing the recurrence of respiratory failure in preterm infants.^{6,7}

A randomized controlled trial of 2 NCPAP levels after extubation in preterm infants found that extubation failure with residual lung disease was less common in infants with an NCPAP range of 7 to 9 cm H₂O compared with 4 to 6 cm H₂O.⁸ The mechanism by which a larger distending airway pressure decreases the rate of extubation failure is yet to be determined. Alternative settings, such as unsynchronized nasal intermittent positive pressure ventilation (NIPPV), were superior to NCPAP in achieving successful extubation.^{9,10}

WEANING FROM NASAL CONTINUOUS POSITIVE AIRWAY PRESSURE

Methods of weaning from NCPAP vary among centers and providers. A randomized controlled trial tested the outcomes of 3 different approaches to weaning. The study compared (1) the discontinuation of CPAP with the view to staying off, (2) cycled on and off CPAP with incremental time off, and (3) cycled on and off CPAP but during off periods infants were supported with 2-mm nasal cannula at a flow of 0.5 L/min. The first approach significantly shortened CPAP weaning time, CPAP duration, oxygen duration, and admission time. Bi-level CPAP was compared with NCPAP as an approach to achieve faster weaning from positive pressure ventilation and oxygen

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