

The Impact of Bronchopulmonary Dysplasia on Childhood Outcomes



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KEYWORDS

- Bronchopulmonary dysplasia • Chronic lung disease • Prematurity • Development • Outcomes

KEY POINTS

- As mortality rates after extremely premature birth decrease, rates of survival with bronchopulmonary dysplasia (BPD) are increasing.
- BPD is associated with adverse health outcomes throughout early childhood and until school age; these include rehospitalizations, respiratory symptoms, and poor lung function.
- Preterm-born children with BPD have worse developmental outcomes in early childhood than both preterm-born and full-term peers. At school age, they often have lower intelligence quotient and worse performance on tests of academic achievement.
- Many interventions to decrease BPD and the sequelae of BPD have been studied; few to date have been proven to decrease both BPD and later disability.

INTRODUCTION

Worldwide, 5% to 18% of infants are born early (before 37 weeks) and, despite a slight decline in recent years, 10% of infants born in the United States each year are premature.^{1,2} Modern practices have led to improved survival to discharge for preterm infants throughout the world, with the most significant improvements among the smallest and most immature infants. Mortality and both the incidence and severity of morbidities of prematurity increase with decreasing gestational age.³ Lung diseases, namely respiratory distress syndrome (RDS) and bronchopulmonary dysplasia (BPD), remain leading causes of mortality among premature infants. Although

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historically BPD was caused by a combination of barotrauma and oxygen toxicity, BPD in modern neonatology refers primarily to an arrest of lung development that is unique to the most extremely prematurely born children.⁴ Although the optimal definition of BPD is under debate, it is most commonly defined as a need for supplemental oxygen at 36 weeks postmenstrual age (PMA) (Fig. 1).⁵ The literature suggests that mortality from BPD and RDS in the United States has fallen in recent years, from 83 deaths per 1000 live births 22 to 28 6/7 weeks in 2000 to 2003 to 68 per 1000 live births in 2008 to 2011 ($P = .002$).⁶ However, this also corresponds with significantly increasing rates of BPD among the same immature infants, from 32% in 1993 to 47% in 2012 (Fig. 2).³ This trend reflects, at least in part, improved survival of the most extremely premature infants.³ This article explores what is currently known about the effects of survival with BPD on respiratory and developmental outcomes during early and middle childhood. The article then discusses the impact of efforts to reduce BPD on these outcomes. Lastly, the article briefly presents an agenda for future research to improve the outcomes of infants and children in this high-risk population.

THE IMPACT OF BRONCHOPULMONARY DYSPLASIA ON MEDICAL OUTCOMES IN EARLY CHILDHOOD

In the early years, after discharge from the hospital, BPD is associated with increased hospital readmissions as well as increased utilization of medical resources.^{7–9} Smith and colleagues⁷ demonstrated that among infants born less than 33 weeks and discharged from 6 level 3 neonatal intensive care units in Northern California, 49% of those with BPD and 23% of those without BPD were rehospitalized in the first year of life. In addition, children with BPD had significantly more and longer rehospitalizations.⁷ The inverse is also true. Extremely preterm infants who were rehospitalized between initial discharge and 18 to 22 months were more likely to have BPD, were more likely to have received postnatal steroids for prevention or treatment of BPD, and had a longer average duration of mechanical ventilation and supplemental oxygen exposure while in the hospital.¹⁰ Furthermore, infants who were rehospitalized were more likely to have been discharged on supplemental oxygen or diuretics.¹⁰ Importantly, excess hospitalizations among infants with BPD are not exclusively due to

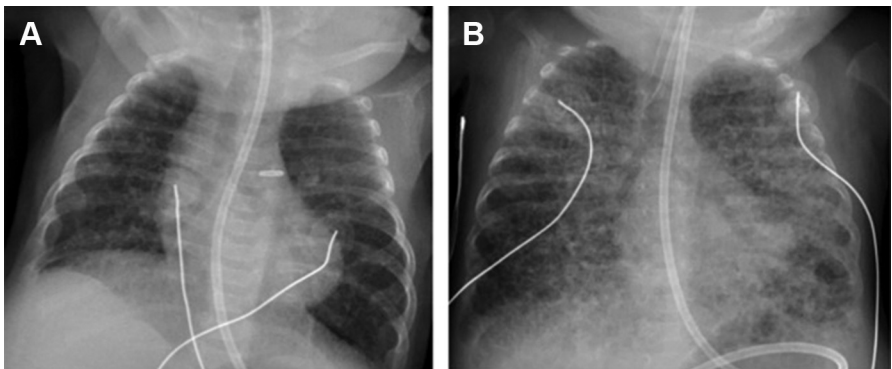


Fig. 1. Chest radiographs of infants born at 23 weeks gestation (A) and 26 weeks gestation (B), both obtained at 36 weeks PMA. Infant A remained on noninvasive positive pressure ventilation and less than 30% FiO_2 , whereas infant B remained intubated with 40% to 50% FiO_2 . Therefore, both met criteria for severe BPD. (Data from Jobe AH, Bancalari E. Bronchopulmonary dysplasia. *Am J Respir Crit Care Med* 2001;163(7):1723–9.)

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