Pulmonary Hypertension and Vascular Abnormalities in Bronchopulmonary Dysplasia

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KEYWORDS

• Bronchopulmonary dysplasia • Pulmonary vascular disease
• Pulmonary hypertension • Echocardiogram • Inhaled nitric oxide

KEY POINTS

- Pulmonary vascular disease (PVD) and cardiovascular abnormalities are increasingly recognized components of bronchopulmonary dysplasia (BPD) and contribute significantly to morbidity and mortality.
- Complex interactions between antenatal and postnatal factors contribute to impair normal pulmonary vascular signaling pathways, leading to altered growth, structure, and function of the developing pulmonary circulation after preterm birth.
- The impairments of the developing pulmonary vasculature may result in prolonged oxygen requirements, exacerbated effects of anatomic shunt lesions, exercise intolerance, altered pulmonary blood flow distribution in response to acute respiratory infections, and ultimately pulmonary hypertension (PH).
- Several studies using echocardiograms to screen preterm infants have determined the incidence of PH in BPD to be 16% to 25%, but some cardiovascular abnormalities may be missed with echocardiograms and require cardiac catheterization.
- Further studies are needed to determine the risk factors, mechanisms of disease, and long-term outcomes, and to better define the clinical approach and treatment of PVD in BPD.

Funding sources: This work was supported in part by grants from the NHLBI HL085703 (P.M. Mourani and S.H. Abman), HL068702 (S.H. Abman), and U01 HL102235 (S.H. Abman).
Conflicts of interest: The authors have no significant conflicts of interest.
Disclosures: The authors do not have any relationships to disclose.
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Clin Perinatol 42 (2015) 839–855
http://dx.doi.org/10.1016/j.clp.2015.08.010 perinatology.theclinics.com
0095-5108/15/$ – see front matter

INTRODUCTION

Bronchopulmonary dysplasia (BPD) is a chronic lung disease that occurs in preterm infants who require mechanical ventilation and oxygen therapy for postnatal respiratory distress.[1] BPD is characterized by persistent pulmonary disease with a prolonged need for supplemental oxygen, recurrent respiratory exacerbations with frequent emergency department visits and hospitalizations,[2,3] exercise intolerance, and associated respiratory problems that can extend into adulthood.[4] Improved respiratory support strategies, antenatal steroids, surfactant therapy, and other advances in clinical care have decreased the risk for death and the development of BPD in larger preterm infants. These strategies have also increased the survival of infants born earlier in gestation who then have high risk to develop BPD. Thus, the incidence of BPD has remained fairly stable over the past decade.[5,6] BPD in this new era most often occurs in infants born at 24 to 28 weeks' postmenstrual age (PMA), weighing less than or equal to 1000 g, who have less severe acute respiratory symptoms and require less respiratory support than patients with BPD in the era when the disease was first described.[7,8]

Maternal, genetic, and environmental factors can lead to early injury of the developing lung that impairs angiogenesis and alveolarization, resulting in simplification of the distal lung airspace and clinical manifestations of BPD. The impairments of the developing pulmonary vasculature may result in significant pulmonary vascular disease (PVD) (**Fig. 1**). In its most severe form, PVD results in pulmonary hypertension (PH).[9–12] The impact of clinically apparent PH in the new BPD era suggests that morbidity[13–17] and late mortality are high, with up to 48% mortality 2 years after diagnosis of PH.[18]

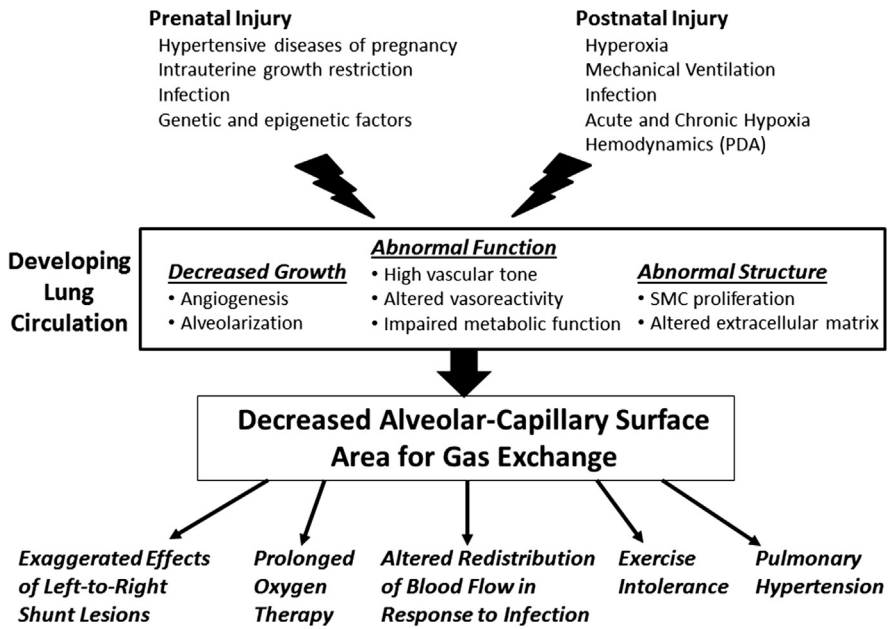

Fig. 1. The components contributing to PVD in BPD and the clinical manifestations that result. PDA, patent ductus arteriosus; SMC, smooth muscle cells.