The rate and pattern of bronchopulmonary dysplasia in Kuwait

Mazen Al-Essa, FRCP, MRCPCH (UK), DCH; Sitratallah O. Maiyegun, MRCPCH (UK)

*From the Department of Pediatrics, Kuwait University, and
Department of Neonatology, Maternity Hospital, Kuwait*

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Bronchopulmonary dysplasia (BPD) was first described in 1967 by Northway et al.¹ There are various definitions of BPD, but all describe a constellation of clinical, radiological and pathological characteristics.²⁻⁴ BPD usually follows ventilation and oxygen treatment for respiratory distress in preterm infants, and is caused by a variety of lung diseases, including hyaline membrane disease and congenital pneumonias.²⁻⁵ The definition of BPD is based on the requirement for oxygen or ventilatory support at 28 days of age.^{2,6} However, many neonatologists nowadays adopt a definition of chronic lung disease based on oxygen and ventilator dependence with or without radiological changes in the lungs at 36 weeks postconception.^{7,8} Moreover, in most neonatal units, treatment of the disease starts as early as 14 to 21 days of age to facilitate early extubation as the pathological changes of BPD are recognized as early as 14 to 72 hours of age, regardless of definition.^{7,9-12} A number of risk factors have been addressed in a variety of clinical studies. Prematurity and mechanical ventilation are widely accepted as risk factors.¹³⁻¹⁶

The neonatal unit of Maternity Hospital is the largest in Kuwait, but common neonatal diseases, including BPD, have not been characterized. Therefore, this study assessed the rate and pattern of BPD in our institution.

Methods

Data were collected retrospectively on all newborn infants less than or equal to 1500 grams body weight who were admitted to the neonatal intensive care unit of Maternity Hospital in Kuwait and received mechanical ventilation during the period between January and December 1999. Exclusion criteria were major congenital anomalies and death in the first two weeks of life. We used two definitions of BPD: a requirement for oxygen or assisted

ventilation at 28 days of chronological age, and a requirement for oxygen or ventilation at 36 weeks of postconceptional age.⁸ The data were collected from the patients' hospital charts. The information included, in addition to

the demographics, risk factors such as maternal diabetes, pregnancy-induced hypertension, antepartum hemorrhage and use of prenatal steroids. Infant-related risk factors included Apgar scores, mode and duration of ventilation, use of surfactant, associated pulmonary morbidity such as pneumonia, pulmonary hemorrhage, air leak and pulmonary hypoplasia. The use of intotropes, a daily fluid requirement, the highest fraction of inspired oxygen (FiO₂), and finally the number of packed cells transfusions were collected. Infants were given a blood transfusion when the hematocrit was below 30% to 35%, depending on the postconceptional age. The practice in the unit is to use a short course of early postnatal dexamethasone to facilitate extubation. The timing of postnatal steroids was at the discretion of the attending neonatologist. Therefore, the use of dexamethasone was divided into three courses: 14, 21 and 42 days.^{10,12}

The data were analyzed by comparing infants with and without BPD according to the two definitions and by use and non-use of postnatal corticosteroids (dexamethasone). Statistical analysis was done using SPSS version 11.0 (Statistical Package for Social Sciences Inc. Chicago, Ill.) Student's t-test was used to compare continuous variables and the chi-square test was used for categorical variables. The differences were considered significant at a value less than 0.05 (2-sided). Logistic regression analysis was used to define the independent predictors of the disease according to the various definitions used.

Results

During the period of study, 162 newborn infants of less than 1500 grams body weight were admitted to the neonatal unit at Maternity Hospital, including 118 Kuwaiti infants, 83 male infants and 79 females. The mean birth weight was 1175.6±242.5 grams and the mean gestational age was 30.6±2.6 weeks. Thirty of 88 (34%) ventilated infants required oxygen or assisted ventilation at 28 days of age, 23 (26%) required oxygen or assisted ventilation at 36 weeks of postconceptional age, while 37 infants (42%) required postnatal corticosteroid treatment at different ages.

Statistically significant risk factors for BPD in infants who required oxygen or assisted ventilation at 28 days of age were use of surfactant, Kuwaiti nationality, lower birth weight, lower gestational age, hypotension at birth, patent ductus arteriosus, greater duration of ventilation,

*Correspondence to:
Mazen Al-Essa, FRCP, MRCPCH
Department of Pediatrics
Faculty of Medicine
Kuwait University
P.O. Box 24923
Safat 13110
Kuwait
E-mail: mazen@hsc.kuniv.edu.kw*

greater number of blood transfusions, and greater number of surfactant doses. Statistically significant risk factors for BPD in infants who required oxygen or assisted ventilation at 36 weeks of postconceptional age were use of surfactant, Kuwaiti nationality, lower mean birth weight, lower mean gestational age, hypotension at birth, patent ductus arteriosus, greater duration of ventilation, greater number of blood transfusions, greater number of surfactant doses, high FiO_2 , greater number of courses of dexamethasone, and 42 days of dexamethasone. Risk factors for postnatal corticosteroids were non-Kuwaiti nationality, lower birth weight, lower gestational age, hypotension at birth, patent ductus arteriosus, longer duration of ventilation, greater number of blood transfusions, greater number of surfactant doses. Logistic regression analysis showed only long duration of ventilation to be independently associated with the BPD ($P<0.016$) at 28 days and among those who required postnatal corticosteroids ($P<0.027$), while a longer course of dexamethasone was a marginal predictor of BPD at 36 weeks postconceptional age.

Discussion

Our study is the first of its kind in Kuwait that reports the incidence of BPD among newborn infants. Despite the study being retrospective, the rate is comparable to other neonatal units around the world.^{8,9} We adopted the recent approach of the early management of BPD at 14 to 21 days of life to facilitate early extubation and discharge of preterm infants.¹⁰ With the two definitions of BPD used in the analysis, prolonged duration of ventilation was shown to be a significant risk factor, as reported earlier. However, after logistic regression analysis, it was only a predictor at 28 days of life. Longer duration of dexamethasone use was a marginal predictor for BPD at 36 weeks postconceptional age. This is consistent with other studies.^{5,8}

Among the other risk factors, hypotension at birth was significantly associated with the disease. The explanation for this could be that hypotension can indicate infection and pneumonia and hence congenital pneumonia tends to predispose to BPD.⁶ Other risk factors such as multiple blood transfusions, number of doses of surfactant and the highest FiO_2 were also contributory, as reported previously.^{5,8}

The rate of BPD at 28 days of life was more than that at 36 weeks postconceptional age for obvious reasons. This could be attributed to early intervention in the first few days of life and the increased growth of the infants, including growth of the lungs over time. Infants with more risk factors tended to fulfill the criteria for BPD more than those with fewer risk factors. Infants with BPD at 36 weeks postconceptional age required the longest course of dexamethasone and also received more than one course of steroid. This gives an indication of the severity of the BPD at 36 weeks postconceptional age. These babies also have mean birth weights and gestational ages less than their counterparts at 28 days of life. We did not find an association of BPD with other important risk factors like high distending ventilation pressure and degree of respiratory distress syndrome at birth.^{5,7}

Fluid overload in the first few days of life in the form of high fluid intake or increased pulmonary blood flow secondary to patent ductus arteriosus, with consequent heart failure, has the tendency to predispose to the development of BPD.^{8,9,13-15} The effect of patent ductus arteriosus was not apparent at 36 weeks postconceptional age. Infants who had BPD at 28 days of life persisted with BPD at 36 weeks postconceptional age. Lower birth weight or younger gestational age, as in other preterm diseases, are important risk factors that were buried in the logistic regression analysis. The improved outcome and survival might be due to recent advances in the management of respiratory distress in infants, such as gentle ventilation with better modes of support and the prompt use of surfactant.^{4-7,9-10}

In conclusion, BPD remains one of the important diseases in the newborn population in Kuwait. Long duration of ventilation with consequent barotrauma remains the major risk factor associated with the disease. Because of a limited capacity for admitting infants to the unit, the maternity unit has adopted the use of early and shortest possible duration of treatment with steroids to facilitate early extubation. However, we exercise great caution in initiating steroid therapy because of the long-term effects of steroids. It is also imperative to have adequate follow-ups because of the documented neurodevelopmental outcome in steroid-exposed infants.⁷⁻⁹ A larger prospective study is needed to investigate other possible risk factors for the development of BPD, such as air leak syndrome and congenital pneumonia and for better management of our newborn population.

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