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This Week's Citation Classic

Northway W H, Jr., Rosan R C & Porter D Y. Pulmonary disease following respirator therapy of hyaline-membrane disease: bronchopulmonary dysplasia. *N. Engl. J. Med.* 276:357-68, 1967.
[Depts. Radiol., Pediat., and Pathol., Stanford Univ. Sch. Med., Stanford, CA]

Clinical, radiologic, and pathologic data are reported from a series of 32 newborn infants with severe respiratory distress syndrome (RDS), who were treated for 24 hours or more with warm, humidified 80-100 percent oxygen via an intermittent positive pressure respirator. Examples of acute, subacute, and chronic pulmonary disease, not previously described, are documented, and an idealized picture of a new syndrome termed bronchopulmonary dysplasia (BPD) is presented. [The SCI® indicates that this paper has been cited over 380 times since 1967.]

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"Shortly after arriving at Stanford University Medical Center in 1964, I was asked to review a series of chest radiographs of an infant with severe respiratory distress syndrome (RDS). This infant was being treated with a then new therapy of artificial ventilation and high concentrations of supplemental oxygen and was having a prolonged and difficult course in the hospital. These chest radiographs showed an unusual progression of changes in the lungs from the initial picture of RDS to one resembling chronic obstructive pulmonary disease after one month of age. This was unusual because prior to this time infants with RDS either died by three or four days of age or were well by seven days of age. In order to determine what was occurring to infants receiving this therapy, I reviewed their records, radiographs, and pathology.

"This review was laborious since many of these infants were hospitalized for months and the concentration and duration of supplemental oxygen and duration of artificial ventilation and endotracheal intubation had to be thoroughly documented. At the outset these three variables and the severity of the initial underlying lung disease seemed most likely to be the factors associated with the development of the chronic lung disease. With completion of the review, it was evident that 13 of the 32 infants treated had developed a lung disease which had not previously been described.

"The data in this study also indicated that the appearance of the disease was most strongly associated with the prolonged use of 80-100 percent oxygen. I was, therefore, tempted to call the entity 'pulmonary oxygen toxicity in the newborn,' but after discussions with Rosan, who had reviewed the lung pathology, we decided to name it 'bronchopulmonary dysplasia' (BPD). This name accurately described our interpretation of the pathology without attributing an etiology.

"The report of this study faced a mixed reception at first from neonatologists, probably for two reasons. The first was that no physician wants to believe that a therapy he is employing may produce a problem such as chronic lung disease. The second reason was related to the fact that the study had been done by a young pediatric radiologist and not an experienced neonatologist.

"I believe this publication has been highly cited because it was the first to describe a new syndrome of acute, subacute, and chronic lung disease in the newborn infant with severe RDS. This syndrome was rapidly recognized as occurring throughout the world when newborn infants with respiratory difficulty were artificially ventilated with supplemental oxygen. Following recognition and acceptance of the BPD syndrome and its iatrogenic etiology, significant improvements in the technique of artificial ventilation occurred as well as changes in the use of supplemental oxygen in the newborn infant. These changes have resulted in improved survival of infants with severe RDS, but the problem of the development of BPD in these infants persists. The most recent review of BPD is 'Workshop on Bronchopulmonary Dysplasia' published in *Journal of Pediatrics.*"[1]

1. Workshop on bronchopulmonary dysplasia. *J. Pediatrics* 95(5-Pt. 2):815-920, 1979.