

# LONG—TERM VENTILATORY SUPPORT IN AN INFANT WITH BRONCHO—PULMONARY DYSPLASIA · A CASE REPORT

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## SUMMARY

*Long-term ventilatory support of a child with bronchopulmonary dysplasia is described. Dedicated nursing care and emotional support of child and family were two important factors in the management of the child in intensive care, and in the weaning of the child from the ventilator.*

## INTRODUCTION

Bronchopulmonary dysplasia is a chronic lung disease seen in infants who have had intensive therapy for respiratory difficulties soon after birth.<sup>1,2,3</sup> It is characterized by hypoxia, hypercarbia and oxygen dependence, with associated chest roentgenograms showing hyperexpansion, focal hypertranslucency and focal opacification. Severe bronchopulmonary dysplasia has a high mortality,<sup>4</sup> because of difficulties in maintaining the child on the ventilator and in the

weaning process. Clinical parameters in identifying the ability of the child with severe bronchopulmonary dysplasia to tolerate the weaning from the respirator have been described.<sup>5</sup> The use of steroids has also been attempted.<sup>6</sup> This case illustrates the problems encountered in the care of the child with severe bronchopulmonary dysplasia and the dedicated nursing and emotional support that finally helped the successful weaning.

## Case Report

A two-and-a-half-month old infant was admitted into the Intensive Care Unit, University Hospital, in severe respiratory distress.

He had been delivered by an elective caesarean section at 38 weeks for a transverse lie. At birth, he was 36 weeks by assessment, birth weight was 2.4 kg and Apgar score was 6/8 at one minute. He developed hyaline membrane disease at five hours of life, which became severe at 30 hours, requiring 80% oxygen to maintain colour. A chest roentgenogram showed finely granular opacification in both lung fields.

He was admitted into the intensive care for ventilatory support and controlled oxygen therapy. Duration of ventilation was six days, peak positive inspiratory pressures ranged from 46 cm H<sub>2</sub>O, to 30 cm H<sub>2</sub>O, inspired oxygen concentration from 60% to 40%. After extubation, he was discharged back to the general pediatric ward. He was noted to be oxygen-dependent and persistently tachypnoeic. Serial chest roentgenograms (Fig. 1) showed patchy

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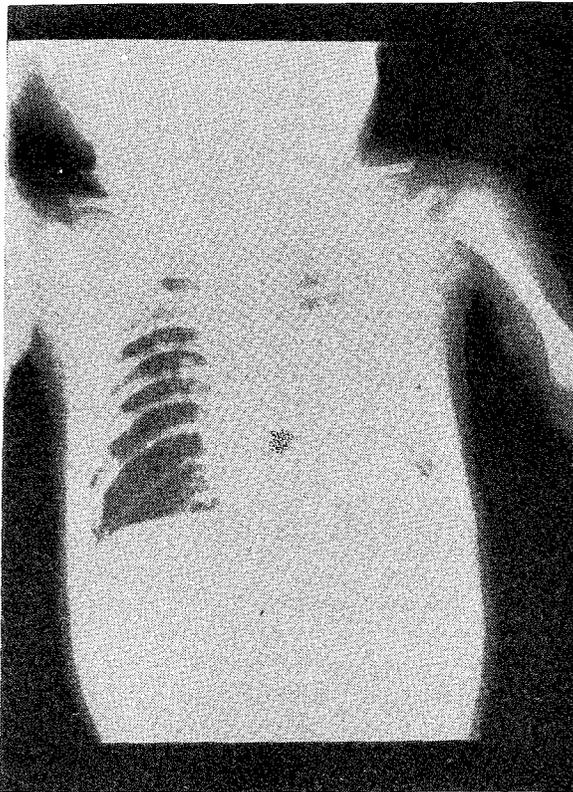


Fig. 1 A chest roentgenogram showing patchy opacification and areas of hyperinflation.

opacification with a possible diagnosis of bronchopulmonary dysplasia. He developed repeated pseudomonas pneumonia requiring antibiotic therapy. He was digitalized for heart failure. His general condition deteriorated with the development of hypoxia, hypercarbia and generalized convulsions, which precipitated the second admission into the intensive care unit.

On admission into the intensive care, he was severely dyspnoeic, cyanosed and drowsy with marked subcostal and intercostal recession. Respiratory rate was 60, pulse 200, blood pressure 60/20. He was immediately resuscitated with the institution of ventilatory support,<sup>7</sup> inotropic support (low-dose dopamine infusion)<sup>8,9</sup> and continuous intravenous sedation with althesin.<sup>10,11</sup> Arterial blood gas estimation with the child on the respiratory, with a ventilatory rate of 30, peak inspiratory positive pressure of 40 cm H<sub>2</sub>O, fractional

inspired oxygen concentration of 0.7 was satisfactory: PaO<sub>2</sub> 66 mm Hg, PaCO<sub>2</sub> 47 mm Hg and pH 7.4. His condition improved. Circulatory support was withdrawn after 24 hours. Central sedation was stopped after 48 hours. After two weeks on IMV<sup>12</sup> (Intermittent Mandatory Ventilation) CPAP<sup>13,14</sup> (continuous positive airway pressure) breathing was commenced. A trial of extubation after 24 hours of CPAP was unsuccessful. A second attempt at extubation a week later was also unsuccessful. Bronchoscopy revealed mild tracheomalacia and bilateral bronchomalacia.

The clinical impression was that the child required prolonged ventilatory support for severe bronchopulmonary dysplasia.<sup>12</sup>

### Weaning off the Respirator

The fractional inspired oxygen concentration was again reduced to 0.3 by the 20th day. IMV was slowly reduced. By the 50th day, the child was weaned off the respirator and could be placed in a head box. He was extubated on the 55th day. This third trial of extubation was unsuccessful and he had to be reintubated and restarted on IMV.

From the third month onwards, CPAP was alternated with IMV, by the nursing staff, as part of the nursing care plan. On the 137th day, a trial of extubation was again unsuccessful. On the 156th day, the child extubated himself. He was observed closely for respiratory distress. Supplemental oxygen was supplied via a head box. Salbutamol inhalation via a nebulizer was commenced at the onset of respiratory distress associated with the presence of rhonchis on auscultation of the chest, with effective response.<sup>15,16</sup>

He was discharged to the general ward after two weeks of intensive nursing, physiotherapy and bronchodilator therapy. He was discharged home after another two weeks. He had stayed in hospital for eight months.

Follow-up reports show that he is not dependent on oxygen in the home, and that he is developing well, although slower than his peers. A chest

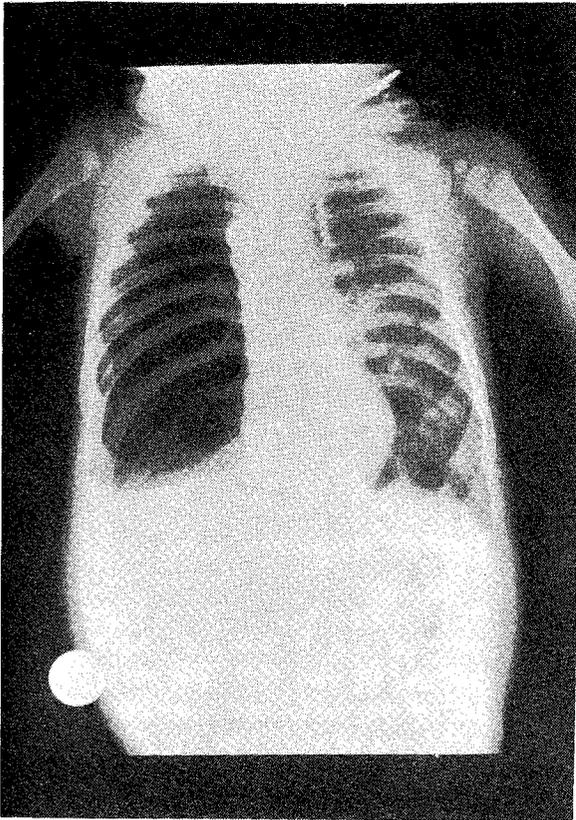


Fig. 2 Chest roentgenogram showing hyperinflation.

roentgenogram (Fig. 2) still shows evidence of hyperinflation.

## DISCUSSION

Severe bronchopulmonary dysplasia carries a high mortality during the first year of life.<sup>4</sup> The infant is ventilator-dependent and frequently dies slowly after several months of severe cardiopulmonary failure with hypoxaemia and CO<sub>2</sub> retention, resistant to ventilation and oxygenation.<sup>17</sup> Infants not so severely affected may survive with a gradual improvement in pulmonary function and may eventually be weaned off the respiratory. Supportive treatment advocated for the ventilator-dependent child includes digitalization and diuretics, methylxanthine bronchodilators,<sup>15</sup> fluid-restriction,<sup>18</sup> nutritional supplementation,<sup>5,19</sup> ligation of patent ductus arteriosus,<sup>20,21</sup> and oxygen supplementation.

Two techniques of weaning are generally employed. In one technique, IMV is gradually reduced over weeks or months. In another, daily periods of spontaneous unassisted ventilation of gradually increasing duration is employed. In a recent study, Morray<sup>5</sup> attempted to identify the clinical parameters which would signify the ability of the child to tolerate a reduction in the level of respiratory support. A turning point was identified between six and ten months of age, associated with the ability to tolerate reduction in IMV. Before this turning point, there was persistent elevation in PCO<sub>2</sub> and respiratory rate, consistent with respiratory failure.

In the case of the patient, attention in the intensive care was given to make the child as comfortable as possible. The nurses were encouraged to play with the child. The family was taught to participate in the nursing care. Particular attention was paid to the child's nutrition, regular clinical chemistry investigation, bronchopulmonary toilet and changes of endotracheal tube as the child grew or when the endotracheal tube slipped out. Chest roentgenograms were taken weekly or when necessary.

With the establishment of good family and nursing support for the child, the staff in the intensive care felt that a pattern of weaning could be established by the nursing staff. When the child was asleep, on an IMV mode, this was changed to CPAP mode and the duration of CPAP was the duration the nursing staff felt comfortable with. As the child grew, the weaning process was extended to taking the child off the respiratory, and going for walks in the intensive care. The intensive care staff felt that in this way, every available minute was successfully utilized in the rehabilitation of this child. The result was that this child with severe bronchopulmonary dysplasia could be weaned off the respiratory, be looked after efficiently by a confident nursing staff and be discharged home.

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