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Treatment of Persistent Tension Pneumothorax in a Neonate by Selective Bronchial Intubation

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Persistent tension pneumothorax is usually seen in patients who have bronchopleural fistulas following pneumonectomy,^{1,2} but has not, to our knowledge, been found in the newborn infant. The following case illustrates the value of selective bronchial intubation in the management of persistent tension pneumothorax in a neonate.

REPORT OF A CASE

A 42-week gestation, 2.5-kg female infant, was delivered by cesarean section because of intrauterine distress and bradycardia. The infant was meconium-stained and was resuscitated with endotracheal intubation at the time of delivery. After aspiration of meconium from the endotracheal tube, the trachea was extubated. On admission of the infant to the Newborn Intensive Care Unit (NICU) at 8 hours of age with an $F_{I_{O_2}}$ of 0.4, analysis of arterial blood revealed pH 7.26, $P_{a_{O_2}}$ 52 torr, and $P_{a_{CO_2}}$ 34 torr. In order to maintain a $P_{a_{O_2}}$ range of 50-70 torr, $F_{I_{O_2}}$ was increased to 0.9 during the next several hours. When the infant was 24 hours of age, a left-side pneumothorax was detected and a French #16 chest tube was inserted. Because of low $P_{a_{O_2}}$ (<50 torr), mechanical ventilation (Bourn's infant respirator) was begun. With a tidal volume of 15 ml, peak pressure of 30 cm H_2O , positive end-expiratory pressure (PEEP) of 5 cm H_2O , and $F_{I_{O_2}}$ 0.9, $P_{a_{O_2}}$ increased from 35 to 105 torr. Because of the

possibility of persistent fetal circulation, the infant was given tolazoline (1 mg/kg as a bolus, then 0.1 mg/kg/min continuous iv drip) for two hours. There was no apparent improvement of arterial blood gases following tolazoline administration. Roentgenogram of the chest at 48 hours of age showed persistent pneumothorax; therefore, a second chest tube was inserted. Both chest tubes were suctioned with 5 cm H_2O negative pressure. In spite of continuous air drainage from both chest tubes, left-sided tension pneumothorax was again apparent on roentgenograms of the chest (fig. 1).

In an attempt to improve $P_{a_{O_2}}$, intubation of the right bronchus and ventilation of the undamaged lung were performed. The endotracheal tube was advanced beyond the carina and the position of the tube was immediately confirmed roentgenographically. An increase of $P_{a_{O_2}}$ from 35 to 226 torr was seen within 30 minutes of this procedure. A repeat roentgenogram of the chest showed expansion of the right lung and normal position of the mediastinum (fig. 2). Mechanical ventilation of the right lung was maintained for four hours using a pressure of 30 cm H_2O , PEEP 5 cm H_2O , and $F_{I_{O_2}}$ 0.7. The endotracheal tube was withdrawn above the carina, and it was then possible to ventilate both lungs with low airway pressures. The $F_{I_{O_2}}$ was reduced to 0.5 in 20 hours and the trachea was extubated in 30 hours. Both chest tubes were removed two days later, and the infant was discharged at 10 days of age in good condition. A follow-up evaluation at the chronological age of 13 months indicated that the child was functioning at a 15-month level in both motor and mental developmental tests. Eye ground examination disclosed no abnormality.

DISCUSSION

The pneumothorax that occurred prior to the initiation of mechanical ventilation in this infant might have been related to meconium aspiration or resuscitative measures. It is known that meconium may partially obstruct the airway, leading to a ball-valve mechanism and alveolar rupture.³ However, the mechanism responsible for the persistent tension pneumothorax in this infant is not clear. Continuous air leakage from the left lung could have been aggravated by high positive airway pressures and PEEP,

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FIG. 1. Left-sided tension pneumothorax.

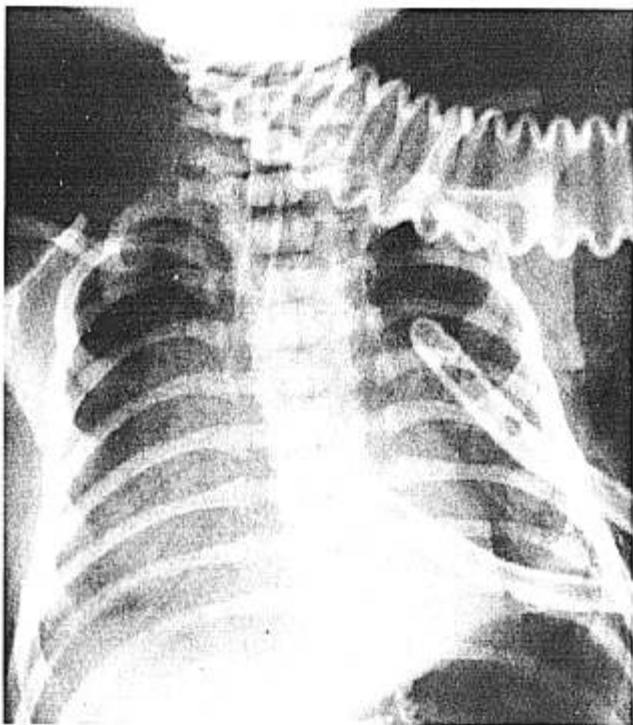


FIG. 2. Expansion of the right lung and normal position of the mediastinum.

non-uniform compliance of alveoli, subsequent to meconium aspiration, and/or partial collapse of the right lung. Since the infant did not need thoracotomy, the possibility of perforation of the lung, related to chest tube insertion⁴ or endotracheal catheter suctioning,⁵ can only be postulated.

Treatment of tension pneumothorax in newborn infants receiving mechanical ventilation includes insertion of chest tube for drainage and avoidance of excessive ventilatory pressure. However, this management may not be successful in the presence of severe pulmonary disease. Selective bronchial intubation and ventilation of the undamaged lung may have to be considered. Ventilation of the undamaged lung in our infant not only improved arterial oxygenation, but also facilitated the closure of the air leak from the damaged lung. Selective bronchial intubation has been reported to be beneficial in the treatment of localized interstitial emphysema in infants during mechanical ventilation.⁶ It has also been successfully applied, for a period of 23 days, in an adult patient who had bronchopleural fistula.⁷ This case suggests that selective bronchial intubation may be beneficial in the treatment of tension pneumothorax that does not respond to chest tube drainage.

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