

Pulmonary interstitial emphysema in a preterm infant following non-invasive ventilation

This is a case report of a premature infant developing pulmonary interstitial emphysema after non-invasive ventilation managed at a district general hospital.

NA was the second of twins born at 29⁺² weeks' gestation with a birth weight of 1385g to a 33-year-old caucasian with no significant medical history. Conception was unassisted, pregnancy uncomplicated, labour spontaneous and delivery vaginal. Membranes ruptured at 28⁺⁵ weeks when two doses of antenatal steroids were given. There was no history of maternal pyrexia or group B Streptococcus. NA was born in a good condition but developed chest recessions and grunting soon after birth. Initial chest radiograph (**FIGURE 1**) was suggestive of hyaline membrane disease (HMD) and nasal continuous positive airway pressure (CPAP) in air was commenced. The other twin, a girl weighing 1210g, also required nasal CPAP.

NA's clinical condition worsened whilst on CPAP at 20 hours of age with tachypnoea, increasing oxygen requirements (up to 46%) and desaturations. He was switched to bi-level positive airway pressure (BiPAP) with some resultant improvement and reduction in his oxygen requirements. However, at 30 hours of age, his condition again deteriorated when he was intubated and given his first dose of surfactant (Curosurf 240mg). Chest radiograph (**FIGURE 2**) immediately after intubation showed multiple, non-confluent, cystic radiolucencies along with hyperinflation in the left lung field suggestive of pulmonary interstitial emphysema (PIE).

There was no evidence of pneumothorax or pneumomediastinum. Ventilator settings were adjusted with a reduction in peak inspiratory pressure (PIP) from 20 to 16cmH₂O, increase in rate from 40 to 60 per minute and reduction in inspiratory time to 0.3 seconds. Sedation with morphine was also commenced.

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Further management, following advice from a tertiary neonatal unit, included a strategy of low pressure ventilation (with a view to wean off ventilation as soon as possible), a second dose of surfactant and nursing in the left lateral position. The option of high frequency ventilation (HFOV) was to be considered in the event of further deterioration.

A repeat chest radiograph (**FIGURE 3**) the following day (12 hours later) showed a worsening in the left lung field and progression of cystic changes in the right lung. However, over the next three days, NA showed clinical improvement and was weaned off to BiPAP. Twenty-four hours later he was extubated to self ventilate in air. The final chest radiograph (**FIGURE 4**) showed signs of resolution. The remaining neonatal period was uneventful and he was discharged home on day 47 at gestational age 36⁺¹ weeks.

Discussion

PIE is caused by air trapped within the peri-vascular sheaths of the lung due to an air leak after alveolar rupture following over-distension. Reduction in alveolar ventilation and ventilation-perfusion mismatch results in hypoxia and hypercarbia. It can be lobar in distribution but may involve both lungs and be associated with pneumothorax or pneumomediastinum¹.

Incidence of PIE has an inverse relationship to birth weight and is now reduced with newer strategies of ventilation and the use of surfactant².

PIE is recognised to occur mainly after positive pressure ventilation with high PIP, presumably through barotrauma. Few cases of PIE after exclusive use of CPAP have been reported so far³⁻⁵. The PIP used in CPAP, though lower than conventional mechanical ventilation (CMV), may still result in a significant air leak in immature lungs with HMD.

Keywords

pulmonary interstitial emphysema; continuous positive airway pressure

Key points

Kapadia J, Dogra H, Saravanan K. Pulmonary interstitial emphysema in a preterm infant following non-invasive ventilation. *Infant* 2009; 5(5): 160-61.

1. Air leaks can occur in preterm infants following non-invasive ventilation.
2. Conventional interventions before referral to a tertiary centre can result in a successful outcome.

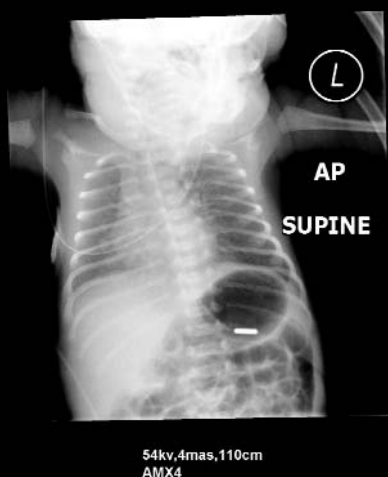


FIGURE 1



FIGURE 3

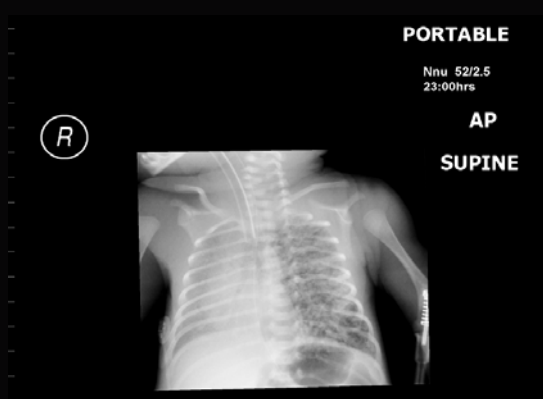


FIGURE 2

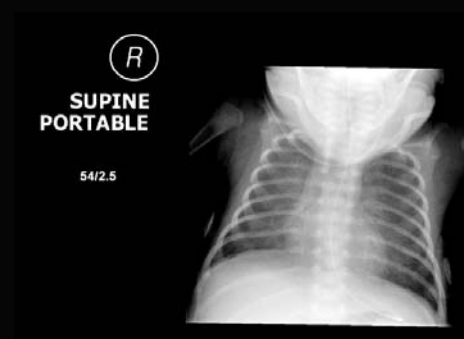


FIGURE 4

This case demonstrates that PIE is important to consider in an infant with worsening respiratory distress on CPAP as subsequent management will require careful titration of adequate oxygenation with minimum ventilatory pressures to limit further air leak. Studies have described various methods of treating PIE secondary to CMV such as positioning the infant with the affected side down and selective intubation of the bronchus on the uninvolved side in unilateral PIE, to the use of HFOV and Heliox with inhaled nitric oxide⁶.

Our conservative management in a level II unit using previously described strategies resulted in a good outcome.

Consent has been obtained from baby NA's parents before submitting this report.

References

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**The Scottish Neonatal Nurses Group annual
conference on 30th October 2009 has been cancelled.
It will be rescheduled in the Spring.**