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*Case reports*

# Severe pulmonary interstitial emphysema of the right lung treated by selective intubation of the left main bronchus

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**Abstract.** As an alternative to surgical treatment, we have selectively intubated the left main bronchus in children with severe pulmonary interstitial emphysema (PIE) of the right lung. Within 12 – 24 h the unilateral hyperinflation disappeared. We propose that when conservative treatment of unilateral PIE fails, contralateral SBI should be be tried before surgical intervention, leading to loss of functioning tissue, is undertaken.

**Key words:** Interstitial emphysema – pneumothorax and pulmonary

Pneumothorax and pulmonary interstitial emphysema (PIE) are the major acute pulmonary complications of mechanical ventilation in the treatment of Respiratory Distress Syndrome. Pneumothorax and interstitial emphysema develop in 15% – 50% (mean 30%) of infants who are mechanically ventilated for Respiratory Distress Syndrome [5]. In many cases pulmonary interstitial emphysema leads to pneumothorax or pneumomediastinum. In rare cases this condition may lead to hyperexpansion of one lung. Surgical resection of lung tissue [2], pleurotomy [3] and selective intubation [1] have been recommended for treatment.

So far only selective bronchial intubation (SBI) of the right main bronchus has been reported. We treated four cases of severe PIE of the right lung with SBI of the left main bronchus. One case is reported in detail.

## Case report

A 1300-g, 31-week gestational age, male infant was born by elective Caesarean section delivery because of severe maternal toxaemia; apgarscores were 8 and 9 at 1 and 5 min respectively. Severe respiratory distress syndrome, requiring mechanical ventilation, developed during the first 24 h. The maximal inspiratory pressure had to be raised to 36 cm $H_2O$, to reach eucapnea. On the third day PIE was noted in both lungs on the chest radiograph, predominantly of the right lung. The pressure was reduced and the respiratory rate increased from 40 to 60/min. The clinical condition gradually improved, but on day 7, clinical signs of a PDA were noted. Conservative management was not successful and on day 9 the ductus arteriosus was surgically ligated. On the day following surgery a pneumothorax occured on the right side, which was drained. A chylothorax was noted 7 days after ligation. This condition was treated by repeated taps, over an 11-day period. Attempts to wean the child off the ventilator failed. The chest radiograph showed extensive PIE of the right lung, with a mediastinal shift

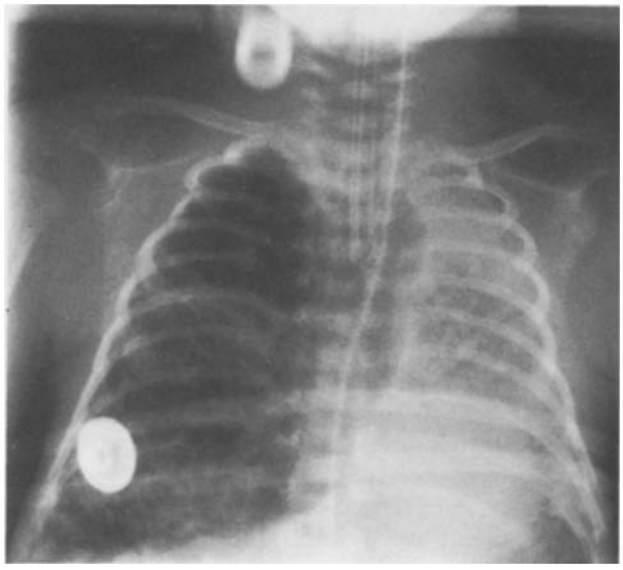

**Fig. 1.** Day 25. Pulmonary interstitial emphysema and marked hyperinflation of the right lung

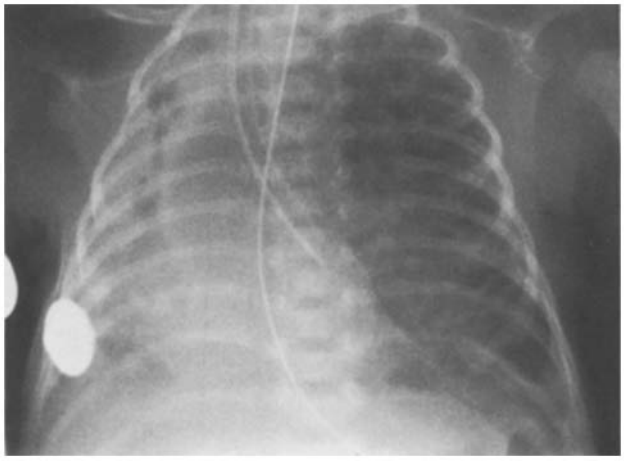

**Fig. 2.** Day 28. Collapse of the right lung, after 24 h of selective intubation of the left main bronchus

to the left (Fig. 1). Only after resolution of the chylothorax on day 27 could selective intubation of the left main bronchus be performed. Over a period of 24 h, gradual loss of aeration of the right lung and reexpansion of the left lung were seen (Fig. 2). Initially a marked increase of oxygen requirement was seen, but this resolved within 24 h. Selective intubation was maintained for 7 days. The tube dislodged twice and entered the right main bronchus, causing acute detoriation of the condition of the child. Thereafter, however, the child could be weaned from the ventilator over a period of 6 days. He was placed in an oxygen hood with 45% oxygen and then very slowly adapted to room air, because of a mild broncho-pulmonary dysplasia.

## Discussion

In an attempt to reduce hyperaeration of the right lung due to PIE, and to reexpand the compressed left lung, four patients were treated with SBI, as an alternative to surgery. The outcome was successful in three of these cases, and no residual changes of PIE were seen on the chest radiograph following extubation.

Although SBI of the right main bronchus is known to be easier, all four infants could be intubated into the left main bronchus. Nasotracheal reintubation with a longer, smaller diameter (2.5 instead of 3 mm) tube was performed; when the tube was located in the trachea, the head of the child was turned to the extreme right and the long end of the bevel of the tube was positioned towards the main left bronchus. The tube was then advanced gently 0.5 – 1 cm beyond the carina.

Several complications may occur with SBI. Firstly the tube should not be advanced too far down the main bronchus, because of the risk of injury to the respiratory epithelium and occlusion of the upper bronchus. A chest radiograph should be performed immediately after the procedure to confirm the position of the tube. A life threatening complication is the occurrence of a tension pneumothorax of the ventilated lung. For this reason minimal ventilatory settings should be used to achieve satisfactory blood gases. Furthermore, a sudden fall in arterial oxygen tension can occur probably due to venous admixture in the bypassed lung, although in one study [1] a xenon ventilation scan confirmed that there was very little ventilation of the hyperexpanded lung before SBI.

Accidental dislodgement of the tube can occur when left main stem intubation is used. The tube is likely to enter the right main bronchus causing acute detoriation. We saw this complication in two of our four cases. With very careful fixation of both the child and the tube we were able to prevent further dislodgement. The clinician should be familiar with these complications, and the infant sould be examined frequently, when this treatment is used.

Selective left bronchial intubation was followed by a collapse of the right lung, with reexpansion of the compressed left lung, within 12 – 24 h. It was maintained for between 5 and 7 days and the children were weaned, ventilating one lung.

Although the cause of PIE is still unknown, there seems to be a correlation with the use of high peak inspiratory pressures. Three of our four patients also had to be ventilated with high peak inspiratory pressures to achieve satisfactory blood gases. The ventilatory rate was 40/min in all cases. In the near future we may be able to prevent PIE or progression of mild PIE by the use of high frequency oscillation [4].

When conservative management of severe unilateral PIE fails, the treatment of first choice should be intubation of the contralateral main bronchus, as a preferable alternative to surgery.

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