Unexpected outcome (positive or negative) including adverse drug reactions

Tension pneumothorax at anaesthetic induction in an ex-premature infant with bronchopulmonary dysplasia

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Summary

ME, a 12-week-old premature infant with a history of complicated ventilatory support at birth, was referred to as a large tertiary centre for urgent retinal laser photocoagulation for retinopathy of prematurity. Following routine induction by a consultant paediatric anaesthetist, immediate ventilation difficulties were encountered, associated with a distended abdomen. Rapid assessment and escalation of the situation occurred, including assistance from several consultants. ME was diagnosed as having a pneumothorax. Rapid intervention, including needle decompression and insertion of a chest drain stabilised the patient. The procedure was cancelled, and the patient returned to intensive care. Over the next few days the patient gradually improved, and was gradually stepped down. The patient continued to improve, successfully overcoming the pneumothorax, pneumonia and insertion of a ventriculoperitoneal shunt, and eventually was discharged back to the referring hospital.

BACKGROUND

Bronchopulmonary dysplasia is a complication affecting the extremely premature, requiring early oxygen support. It develops into a chronic lung disease, increasing the risk of pneumonia, difficulties in ventilation and 'stiff' lungs.

Pneumothorax is a recognised complication of anaesthesia, requiring rapid assessment, diagnosis and management. Treated appropriately this complication can have minimal long-term impact, but delayed recognition or treatment can result in significant morbidity or mortality.

This case illustrates the interaction between the patient's underlying premorbid conditions and interventions and the possible complications. It also illustrates the need to constantly re-evaluate any new development in a patient's condition, and to evaluate the effect of the resultant interventions.

CASE PRESENTATION

We present a case illustrating the life-threatening complications of anaesthesia in ex-premature infants. ME, a 12-week-old female infant, attended the operating theatre for urgent retinal laser photocoagulation for retinopathy of prematurity.

ME was born by emergency caesarean section at 26 weeks gestation, after maternal spontaneous rupture of membranes and labour. She was intubated 4 min after delivery and remained invasively ventilated for 15 days, including high-frequency oscillation ventilation following pulmonary haemorrhage. Since then, she has required varying levels of non-invasive ventilation. Immediately prior to theatre, ME was not in respiratory distress and had modest oxygen requirements, via nasal cannulae. Enteral feeding was started on day 8 and full feed was established by day 25. In her first week of life she had also sustained a cerebral intraventricular haemorrhage with posthaemorrhagic hydrocephalus. She was transferred to a

tertiary centre for insertion of a Rickman CSF reservoir, on day 44 of life.

In theatre, prior to induction of anaesthesia for laser retinal photocoagulation, her nasogastric tube was aspirated and 120 mcg atropine was given intravenously. A gaseous induction of anaesthesia was performed by a consultant paediatric anaesthetist, with oxygen and sevoflurane. Facemask ventilation was performed before 2 mg atracurium was given intravenously. She was intubated uneventfully with a 3 mm endotracheal tube, length 11 cm at the lips. Immediate difficulty in ventilating the lungs was noted due to poor chest compliance. ME's oxygen saturations started to fall and her abdomen became progressively more distended. Air entry was noted to be poor in the right hemithorax but adequate in the left. Gastric decompression was attempted with the existing nasogastric (NG) tube (size 8 French), but was impossible. A second NG tube (size 8) was inserted and then replaced by a size 12 orogastric tube, neither of which was able to aspirate stomach contents. Diaphragmatic splinting by the distended abdomen made ventilation of the lungs almost impossible. A second paediatric consultant anaesthetist was now in attendance. By this point (10 min postinduction of anaesthesia) circulatory shock was evident with cool, mottled peripheries and very slow capillary refill.

Owing to the combination of inability to ventilate and a poor capnography trace, correct position of the endotracheal tube was now in doubt. ME was extubated and reintubated with another 3 mm endotracheal tube. There was no improvement. Bilateral tension pneumothoraces were considered as a diagnosis. Bilateral needle decompressions were performed with 22 gauge intravenous cannulae at the second intercostal space, midclavicular line. Minimal amounts of air were aspirated from the left hemithorax but large volumes of air were aspirated from

Figure 1 Insertion of chest drain.

the right. There was immediate resolution of the breathing and circulation problems. Ventilation was possible, oxygen saturations improved and circulatory shock improved rapidly. An intercostal drain was inserted into the right hemithorax and connected to an underwater seal.

The laser retinal photocoagulation procedure was cancelled and the patient was returned to neonatal intensive treatment unit, intubated. High-frequency oscillation ventilation was considered, but not required. The chest drain was removed after 4 days, following resolution of the pneumothorax. Since then ME has been successfully extubated, overcome pneumonia and has had a ventriculoperitoneal shunt inserted. She has been well enough to be transferred out to a district general hospital (figures 1 and 2).

Figure 2 Post drain insertion.

DISCUSSION

Bronchopulmonary dysplasia (BPD) is a form of chronic lung disease that develops in preterm neonates treated with oxygen and positive pressure ventilation. It involves a complex pathophysiology of interactions between various toxic factors which interfere with alveolar septation, resulting in simplification and reduced total surface area available for gas exchange.¹ Patients with BPD experience persistent respiratory signs including prolonged mechanical ventilation, oxygen therapy, recurrent respiratory infections and distress, reduced exercise tolerance and other problems beyond childhood.²

The condition predominantly affects the extremely premature survivors treated with ventilator and oxygen therapy for acute respiratory failure after birth, and can have significant morbidity for the patient. Infants born in the late canalicular or saccular stage of lung development (24–28 weeks gestation) are most at risk. Although surfactant therapy overcomes the biochemical and functional aspect of the premature lung, it does not treat the underlying immaturity.³ However, a postmortem study by De Paepe *et al*⁴ concluded that the premature lung in the ventilated preterm infant displayed angiogenesis nearly proportional to the growth of gas-exchange parenchyma, challenging the notion of growth arrest.

Thebaud and Abman⁵ concluded that the dysmorphic alveolar development in BPD may be attributable to the arrested and dysmorphic angiogenesis and decreased lung growth factor expression, but there are still large gaps in the understanding of lung development to be overcome, contributing to the associated morbidity in this patient group.

ME demonstrated a number of the adverse effects of prolonged mechanical ventilation and oxygenation in the extremely premature infant. Poor pulmonary compliance in association with abdominal distension necessitated high airway pressures for ventilation, putting the patient at high risk of a pneumothorax, which is likely to tension under positive pressure ventilation.

Learning points

- ▶ Bronchopulmonary dysplasia is an infrequently encountered condition. However, it can be present in many settings with signs and symptoms often encountered in chronic obstructive pulmonary disease patients.
- ▶ Rapid recognition and treatment of pneumothorax is essential to avoid a negative outcome.
- ▶ Involving a large multidisciplinary team is essential to optimise patient outcome and instigate appropriate treatment, especially in unusual circumstances.

Competing interests None.

Patient consent Obtained.

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