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Case report

Acute pulmonary haemorrhage in an infant during induction of general anaesthesia

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Summary

Pulmonary haemorrhage is a rare, life-threatening complication of anaesthesia. This report describes the anaesthetic management of an infant who developed laryngospasm and pulmonary haemorrhage during general anaesthesia. The infant was subsequently found to have prior exposure to a fungus, *Stachybotrys chartarum*, which produces mycotoxins that may have produced capillary fragility in the infant's rapidly growing lungs.

Keywords: anaesthesia; laryngospasm; pulmonary haemorrhage; *Stachybotrys chartarum*

Introduction

Acute pulmonary haemorrhage is rare in infants and children. The most common aetiologies include cardiac or vascular malformations, infectious processes, milk protein allergy, immune vasculitides, and trauma. However, 37 cases of pulmonary haemorrhage and haemosiderosis have occurred in infants in Cleveland, Ohio, USA, since January 1993 (1,2).

A case control study of the first 10 infants revealed that these infants were exposed to high levels of a fungus, *Stachybotrys chartarum* (taxonomically, *Stachybotrys chartarum* is the preferred name for *Stachybotrys atra*), which is found in water damaged homes (3). Spores of this fungus contain mycotoxins (4), which are potent inhibitors of protein synthesis, hypothesized to cause capillary fragility in young, rapidly growing lungs.

We describe a case in which one infant developed an acute pulmonary haemorrhage during mask induction of anaesthesia. The infant was subsequently found to have been exposed to *S. chartarum*. The anaesthesiology literature contains a previous case report of pulmonary haemorrhage in an infant during induction of anaesthesia, however, the authors were uncertain of the aetiology of the event (5).

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Case report

An apparently healthy 5.5 kg, 7-week-old African American boy was admitted to ambulatory surgery for bilateral inguinal herniorraphy. His birth history, past medical history, growth, development, and physical examination were unremarkable. He received no preinduction sedation or medications. A

general anaesthetic with supplemental caudal block was planned.

Anaesthesia was induced by mask with oxygen, 70% nitrous oxide, and halothane. During induction, a brief laryngospasm occurred with oxygen desaturation. He was treated with 100% oxygen, positive airway pressure by mask, and intramuscular succinylcholine 20 mg. Oxygen saturation improved and direct laryngoscopy revealed blood in the laryngeal inlet. A 3.5-mm tracheal tube was inserted without difficulty. A small amount of blood was suctioned and positive pressure ventilation was started. Breath sounds were equal and bilateral, and oxygen saturation increased to 100%. An intravenous line was inserted and a caudal block was performed with 6 ml of 0.125% bupivacaine with 1:300 000 epinephrine.

Anaesthesia was maintained with 0.8% to 1.5% isoflurane in oxygen and intravenous atracurium 3 mg. During surgery, the endtidal CO_2 remained between 5.8 and 7.1 kPa (45–55 mmHg) despite multiple adjustments of respiratory rate, peak inspiratory pressure, and positive endexpiratory pressure during ventilation with a paediatric circle circuit. Oxygen saturation was 100% throughout. Following surgery, muscle relaxation was reversed with intravenous atropine 0.1 mg and neostigmine 0.25 mg, however, extubation was delayed because of persistent difficulty with ventilation.

A limited fibreoptic bronchoscopy revealed frank, copious blood in the trachea and main bronchii. A portable AP chest X-ray showed bilateral diffuse infiltrates of the lung fields. An arterial line was inserted and arterial blood was sampled: pH was 7.27, pO_2 was 48 kPa (375 mmHg), pCO_2 was 7.8 kPa (60 mmHg), and bicarbonate was 27 $mmol \cdot l^{-1}$.

The patient remained intubated and sedated, and was transferred to paediatric intensive care for mechanical ventilation and supportive care. A haemoglobin of 7.7 $g \cdot dl^{-1}$ was treated with a blood transfusion. He was weaned and extubated within 24 h of admission.

Subsequently, urinalysis, a respiratory antigen panel, G6PD screening, and titres of milk precipitans were within normal limits. The health department inspected the patient's home and found a long-standing water leak in a crawl space with water-saturated wood and black, slimy mould growing on it. Bulk samples grew almost exclusively *S. chartarum*, with a mean of 3.65×10^8 $CFU \cdot g^{-1}$. Air particulates collected by semiaggressive sampling of the infant's bedroom grew a mean of 6.29×10^4 $CFU \cdot m^{-3}$ of *S. chartarum*, which greatly exceeds levels found in homes of infants without pulmonary haemosiderosis (3). Two months following the haemorrhage, a follow-up bronchoalveolar lavage revealed haemosiderin-laden macrophages. The final diagnosis was pulmonary haemorrhage and haemosiderosis of infancy, associated with exposure to *S. chartarum.* Discharged from the hospital to a new home environment, he has demonstrated no evidence of overt pulmonary haemorrhage over the subsequent 24 months.

Discussion

S. chartarum spores contain several classes of mycotoxins, notably the trichothecene saratoxins G and H which are very potent protein synthesis inhibitors (4). It is likely that inhalation of airborne mycotoxins produced capillary fragility in this infant's rapidly growing lungs.

Brief laryngospasms are not unusual complications of mask induction in children but frank pulmonary haemorrhage subsequent to a mild laryngospasm is unusual. We believe that the capillary fragility induced by *S. chartarum* set the stage for this complication.

Anaesthesiologists should be aware that *S. chartarum* may predispose children to pulmonary haemorrhage during induction of anaesthesia. This case illustrates that a population at risk are infants with pulmonary haemosiderosis due to exposure to *S. chartarum*. These infants are often asymptomatic until the first episode of haemorrhage, and are more likely to be males from low income neighbourhoods (2).

Although endemic to the Cleveland area, exposure to this fungus can occur in other regions of the country and world. Physicians in 30 states have reported 138 cases of unexplained pulmonary haemorrhage in infants during the last 5 years (Etzel and Dearborn, unpublished observation). Therefore, anaesthesiologists from any region should consider this diagnosis in an infant with unexplained pulmonary bleeding.

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