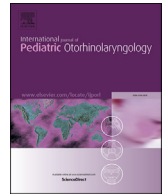




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Review Article

Treatment of bronchial foreign body aspiration with extracorporeal life support in a child: A case report and literature review

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ABSTRACT

We present a case in which extracorporeal life support treatment of a 6-year-old girl asphyxiated by aspiration of an elliptic plastic ball is described. The attempts for extraction of the foreign body by conventional bronchoscopy under critically ill conditions had failed. Thus, a skin incision was made in the midline, and an emergency open-chest cardiopulmonary bypass (CPB) with aortic, superior vena cava and inferior vena cava cannulation was performed for circulatory support. Following tracheal extubation, a video-assisted rigid bronchoscope was inserted to clear the airway and remove the foreign body. The CPB lasted for 68 min, and the endotracheal tube was pulled out 6 h after the surgery. On the 10th day, the patient was discharged and followed up for 3 months when no neurological symptoms or other complications were documented. The removal of the aspirated bronchial foreign body under extracorporeal life support has been rarely reported. Here, we review the indication, cannulation method, support mode, surgical procedure, and patient outcome in the 8 papers retrieved from the PubMed database and compare their clinical characteristics with those of our case to justify the safe and effective use of CPB for critically ill patients with bronchial foreign body aspiration.

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1. Introduction

Bronchial foreign body aspiration is very dangerous for children, sometimes it can even lead to suffocation or death [1–3]. The foreign body may be brought in by trauma or inhaled during cave-in, drowning, feeding, game, and so on, and is generally extracted by using laryngoscopy, bronchoscopy, or rigid bronchoscopy. Some intractable cases may require the application of surgical methods, such as tracheotomy or open-chest procedure, and the implementation of special life support techniques (cardiopulmonary bypass [CPB]/extracorporeal membrane oxygenator [ECMO]) is necessary for some cases of acute/severe respiratory failure, instable hemodynamics, or hypoxic intolerance, so as to facilitate foreign body extraction [4,5]. Here, we report a critical emergency case of a patient with an aspirated bronchial foreign body treated with the aid of CPB. A review of the clinical features of eight other cases has also been done. Moreover, the effects of CPB are compared with those of ECMO, and the indication, cannulation method, and surgical procedure are also summarized to provide guidance for the treatment of critically ill patients with bronchial foreign body aspiration.

2. Case presentation

A 6-year-old girl (weighing 25 kg) aspirated an elliptic plastic ball, 1×0.8 cm in size, leading to immediate dyspnea, restlessness, and cyanosis. Five hours later, she was admitted to our institution in a comatose state. A chest radiograph was ordered revealing shifting of trachea to the right and right lung atelectasis. The auscultation indicated weak breath sounds in the right lung and a heart rate of 172 beats per minute. With blood oxygen saturation dropping to 40–50%, the patient experienced metabolic acidosis, hypoxemia, and hypercapnia. Since the consultations with the departments of otorhinolaryngology, cardiovascular surgery, thoracic surgery, and anesthesiology indicated that the one-lung ventilation resulting from right main bronchus obstruction could not meet the surgical demand, and the round ball was likely to further slide to cause surgical difficulties, emergency surgery with extracorporeal life support was instituted on the basis of the child's vital signs and with consideration to the fact that the foreign body might not be safely extracted without the assistance of CPB.

The patient was placed in the supine position and was given general anesthesia via intravenous route. The depth of anesthesia was controlled at an appropriate level to reduce surgical stress and bronchospasm. The high airway pressure reached 38–40 cm H₂O following foreign body obstruction, thus high-frequency ventilation was also initiated with a large tidal volume to maintain the child's oxygenation. Then, median sternotomy was performed, followed by aortic, superior vena cava, and inferior vena cava cannulation for parallel circulation. After tracheal extubation, a video-assisted rigid bronchoscope was inserted and detected a great quantity of endotracheal purulent secretion which was subsequently suctioned to identify a foreign body located in the right main bronchus, surrounded by some white intrabronchial mucus, they contributed to the difficulty in ventilation and maintenance of inadequate oxygenation. Then, the foreign body with a size of approximately 1×0.8 cm was clamped and taken out, intra-bronchial mucus drainage carefully to avoid the occurrence of postoperative bronchopneumonia, then the tracheal re-intubation was performed after lung dilation (see Fig. 1).

The CPB lasted for 68 min, and the endotracheal tube was pulled out 6 h after surgery. The patient presented no neurologic complications or other symptoms related to a respiratory injury. Consequently, she was transported from the intensive care unit to the general ward on the 2nd day and discharged on the 10th day.

During a 3-month follow-up, no sequelae were observed.

3. Literature review

Eight papers, published between 1980 and 2014, discussing foreign body extraction assisted by CPB/ECMO were retrieved from PubMed database by the key words “aspirated bronchial foreign body”, “bronchial foreign body”, “CPB”, and “ECMO”. One case with endotracheal foreign body brought by neck trauma and seven cases with aspirated bronchial foreign body were included in the search results, as shown in Table 1.

3.1. General information

There were 6 males and 2 females with an age range from 14 months to 52 years (mean age, 18.87 ± 16.92 years). In one of the cases, an endotracheal foreign body was brought in by neck trauma, while in the other seven cases a bronchial foreign body had been aspirated and was located in the right main bronchus (1), the left main bronchus (2), or in both (4). Further, three cases were complicated by a cardiac arrest, hypothermia, and lung cancer, respectively.

3.2. Surgical procedures

Five cases were supported by ECMO: two of veno-venous ECMO (VV-ECMO), and 3 of arterio-venous ECMO (AV-ECMO)), and three cases were aided by CPB. Right atrium-right femoral arterial cannulation, femoral arteriovenous cannulation, and right internal jugular bicaval cannulation were performed in 1, 5, and 2 of the cases, respectively. Open-chest surgery, rigid bronchoscopy, and bronchoscopy were conducted in 1, 4, and 3 cases to remove the

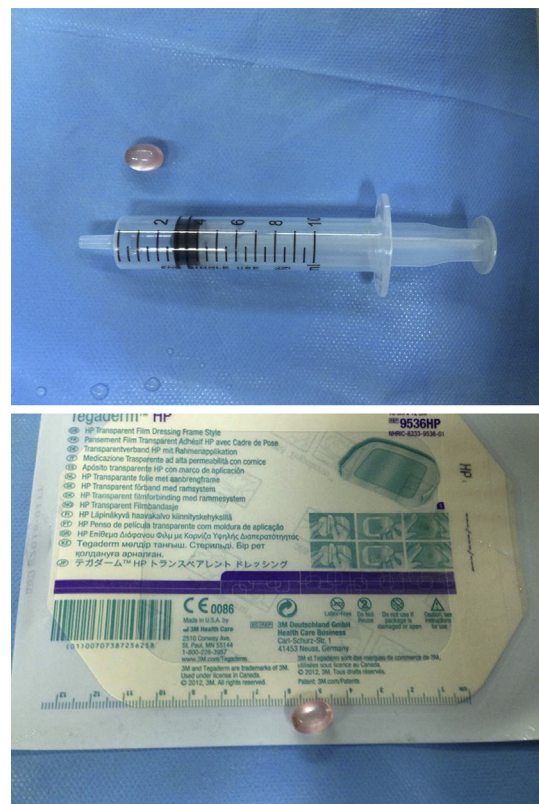


Fig. 1. Picture of the foreign body extracted: elliptic plastic ball, 1×0.8 cm in size.

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