Well-planned rather than rushed extraction of airway foreign body in 532 g preterm neonate

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**ABSTRACT**

A case is presented of an extremely low birth weight (ELBW) and growth restricted preterm twin girl with a birth weight of 532 grams who underwent an airway foreign body extraction via rigid bronchoscopy. The patient was intubated in the delivery room and required administration of surfactant via an access catheter. A chest radiograph on the 5th day of life (DOL) demonstrated a foreign body in the left main bronchus and it was concluded that it had been present for at least 4 days. The foreign body, identified as a 2.8 cm tip of the surfactant catheter accidentally cut upon trimming of the endotracheal tube, was successfully extracted on DOL 6. This case demonstrates the lowest reported weight where such a procedure has been successfully performed without complications. We present a discussion on the optimal timing of foreign body extractions, stressing the importance of pre-operative medical management in improving outcomes.

**Introduction**

The adequate management of foreign bodies in the pediatric airway is a topic of debate and provides a delicate challenge for the clinician, especially when dealing with cases involving preterm neonates [1–5]. Most causes are iatrogenic in nature and require attention not only be directed towards the extremely small anatomical conditions, but also an immature respiratory system demanding a high level of anesthetic care [6].

The case below sheds light on some of the considerations that were made at Karolinska University Hospital (KUH) when successfully extracting a foreign body in an extremely low birthweight (ELBW) preterm neonate.

**Case presentation**

In 2010, a woman presented with a twin pregnancy and a suspected twin-to-twin transfusion syndrome (TTTS) at 16 weeks of gestational age (GA). Therapeutic amniocenteses were performed three times and, due to the increased risk of preterm delivery, a course of antenatal betamethasone was administered early at 26 weeks GA. Due to decreased blood flow (class 3a) to the donor twin, the decision was made to perform a Cesarean section at 27 + 1 weeks GA. The donor twin was born weighing 532 grams with Apgar scores of 6, 7, and 10 at 1, 5 and 10 min respectively. She was ventilated manually and intubated at 3 min of age. Surfactant was administered via a 5 French (Fr) closed suction system catheter, which was introduced through the endotracheal tube (ETT). In accordance with local practices, the catheter was maintained for at least 6 h to avoid suctioning into the ETT during the first hours after surfactant administration. The ETT was thereafter cut to length and a new closed suction system replaced the previous one.

The patient was admitted to the neonatal intensive care unit (NICU) and kept on High Frequency Oscillatory Ventilation with low pressures, requiring less than 30% fraction of inspired oxygen (FiO\textsubscript{2}) to maintain an adequate level of oxygen saturation. Echocardiography on the 1\textsuperscript{st} day of life (DOL) demonstrated a Patent Ductus Arteriosus (PDA) with a significant left-to-right shunt which was closed using a single dose of administered Ibuprofen (Pedex\textsuperscript{®}).
Initial chest radiographs (CXR) were clear with good aeration of both lungs and indicated no signs of Respiratory Distress Syndrome (RDS). However, on DOL 5, the CXR demonstrated hypo-inflation of the left lung and a foreign body reminiscent of a catheter in the left main bronchus (Figure 1). It was upon further review noted that the foreign body could also be seen on previous scans and that it had not been detected due to the human factor. The findings were considered to represent the tip of the surfactant catheter, which was deemed to have been accidentally cut during the process of trimming the ETT. Evaluation using a fiber-optic laryngoscope (Olympus, 2.2 mm diameter without a working canal) through the ETT confirmed the diagnosis and the decision was made for removal by rigid bronchoscopy. As a preparatory measure, the patient was given hydrocortisone 2.5 mg/kg and a platelet transfusion, due to thrombocytopenia with a platelet count of 35 × 10^9/L.

Extraction of the foreign body was performed on DOL 6 in an open incubator, with the patient positioned with an extended neck and shoulders slightly elevated. Sevoflurane and Fentanyl were administered to induce anesthesia followed by Atracurium for muscle relaxation. Once apnea was achieved, the patient was ventilated to full oxygen saturation (100%), extubated, and a standard Karl Storz® ventilating bronchoscope (size 2.5, 18.5 cm length and 4.0 mm outer diameter, OD) was introduced orally. The foreign body, identified as a 2.8 cm long tip of a surfactant catheter with a diameter of 1.6 mm, was visualized with a 0° semirigid telescope (30.6 cm length, 1.3 mm OD and attached camera) inserted into the bronchoscope. It was thereafter grasped using an alligator forceps (35.0 cm length, 1 mm sheath diameter) and extracted through the bronchoscope. The bronchoscope was thereafter removed, and the patient reintubated nasally. Oxygen saturation was maintained throughout the procedure at an acceptable level by ventilating through the bronchoscope.

The patient was monitored in the NICU for an additional day, which corresponded to DOL 7, prior to being transferred to the NICU of her local hospital. The patient did not exhibit any symptoms related to the foreign body prior to the extraction and tolerated the procedure well. There were no signs of procedure-related complications during the following days and there are to date no reports of complications that can be traced back to the foreign object or the extraction. As an outcome of this case, the established routine of fully retracting the surfactant catheter before cutting the ETT to length was further defined.

**Discussion**

The successful extraction of an accidentally cut catheter tip from the airway of a 532 gram ELBW preterm neonate may be considered as the joint-lowest reported weight to have undergone such a procedure and the lowest with a successful outcome and no further
described complications [4]. One should, however, in cases similar to this not solely focus on the weight of the child when considering the risks of airway foreign body removal. Although our patient may have been severely growth restricted, the degree of maturity for age and weight were important factors allowing the patient to successfully tolerate the procedure.

The patient was mechanically ventilated through the bronchoscope during the procedure. Maintaining spontaneous breathing was not deemed possible and although comfortable from the surgeons’ point of view, jet ventilation at KUH is only considered for children weighing above 30 kg due to the increased risk of barotraumatic injury.

The catheter tip was present for some time without giving rise to alarming symptoms and it was not until DOL 5 that a CXR showed signs of hypo-inflation, warranting further investigation. This is not surprising, as the small size and material composition of the foreign body made it chemically and biologically inactive. The present case thus demonstrates that unless such an object obstructs the main airflow through the trachea, it can be present in the airway for some time without giving rise to alarming symptoms or interfere with pulmonary function. Computed tomography (CT) is the primary imaging used when suspecting airway foreign bodies in the pediatric population and may have better revealed the object, however it is not routinely used in premature infants as it requires patient transport and exposes neonates to unnecessary radiation (even though the latter is significantly reduced when using airway foreign body protocols).

Conforming to our experiences with larger children, where extraction is successfully delayed until pulmonary function is medically optimized, we believe that a similar strategy may (with the good judgment of the clinician) be practiced even in very small infants. A foreign body extraction from the airways of a premature neonate presents particular concerns due to the extremely small anatomical conditions and an immature cardio-respiratory system. These challenges were in our case successfully managed as the intervention was adequately planned and implemented without rush or hurry. Pre-operative administration of corticosteroids, antibiotics, bronchodilators as well as other adjuncts may be used to improve pulmonary function before removing the foreign body and decrease the risk of complications, such as pneumothorax or hypoxic cardiac arrest.

Whilst it is widely agreed that foreign bodies should always be extracted as soon as possible, a hasty decision to so – often in vain anticipation of a sudden and marked improvement in pulmonary function – should be avoided to increase the safety of the procedure.

**Conclusion**

It is possible to successfully extract a foreign body from the main bronchus of a preterm neonate with a weight as low as 532 g. Pursuant to strategies usually employed in older children and adults, the clinical stability – and in particular the respiratory function – of a preterm neonate with an airway foreign body should always first be optimized in order to improve the prospects of a successful surgical extraction.

**Acknowledgments**

Ramez Rawhani, M.D. (University of South Alabama Children’s and Women’s Hospital) for language review.

**Informed consent statement**

Written informed consent has been obtained from the patient.

**Disclosure statement**

No potential conflict of interest was reported by the author(s).

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