Case Report

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A Successful Airway Resuscitation of Life-threatening Subglottic Foreign body in an infant: A case report

Running title: Airway resuscitation of subglottic airway foreign body

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Abstract

Airway foreign body removal is challenging. It is a time-limited and life-saving procedure. We report a successful case of life-saving by pushing a foreign body further into the distal airway to block one lung and save the other lung.

A 12-month-old boy presented in the emergency department with choking. Upon arrival, his mental status was alert. However, respiratory failure rapidly progressed and arrest occurred. We tried to push the foreign body distal by pushing the endotracheal tube as deep as possible and inserting stylet further. With this procedure, the patient was successfully resuscitated and bronchoscopic foreign body removal was performed. The patient was discharged without respiratory or neurologic sequelae.

We reported this successful life-threatening subglottic airway foreign body removal case in an infant.
Capsule Summary

What is already known

Airway obstruction due to foreign body mainly occurs in children under 3 years of age and is the leading cause of non-disease related death in children under 12 months of age. Rapid removal is crucial, and a widely endorsed approach for this is utilizing a rigid bronchoscope.

What is new in the current study

Respiratory failure due to a foreign body requires a life-saving 'bridge' until definite removal. After inserting the endotracheal tube deeper, an additional technique involved using a stylet to push the foreign body, resulting in successful migration into the right main bronchus. This case illustrates a life-saving intervention.
Introduction
Airway obstruction due to foreign body (FB) mainly occurs in children under 3 years of age and is the leading cause of non-disease related death in children under 12 months of age [1-3]. Children’s airways are smaller in diameter than adults and have greater risk of respiratory failure, in situations with FB aspiration. Therefore, rapid removal is very important and widely recommended treatment is a rigid bronchoscope [4]. However, in the case of life-threatening cases accompanied by respiratory failure at the emergency department (ED), initial procedures for life-saving are critical.

In this case report, we reviewed an infant who visited the ED with respiratory failure due to subglottic FB aspiration.

Case report
A 12-month-old, Caucasian boy presented in the ED with choking. According to his mother’s statement, he was eating bread and got caught in his throat. He was born to nonconsanguineous, healthy parents, had a normal perinatal period, and was developmentally age-appropriate. His estimated body weight was 10 kilograms.

On examination, his mental status was alert, and response was appropriate. Initial heart rate (HR), respiratory rate and body temperature were 175/min, 40/min, and 36.6 °C, respectively. His peripheral oxygen saturation was checked as 100%, but inspiratory chest wall retraction was observed. Crying was possible, but the voice was gradually decreasing. No FB was found in the oral cavity, we attempted 3 cycles of 5 chest thrusts and 5 back blows. However, nothing was ejected. Chest X-ray [figure 1] showed a 2 centimeter (cm) sized, radio-opaque, oval shaped FB at the carina. A team for rigid-bronchoscope was activated. Since respiratory distress was worsened, endotracheal intubation was initiated. During attempting intubation, his HR suddenly decreased to 40/min. We recognized him as arrest, and started chest compression. We used a 4.0 Fr, cuffed endotracheal tube (ET). Return of spontaneous circulation (ROSC) was obtained within 2 minutes of compression, but the ambu-bag was stiff because of high airway resistance.
Then we attempted to push the FB by inserting the ET as deep as possible. However, airway resistance was not resolved. We marked on the stylet the length that can protrude 2cm more from the ET with the same size as intubated tube. Then we pushed the stylet into the patient’s ET to the marked length. Right after this procedure, bagging was carried out smoothly, and cyanosis disappeared. In 5 minutes, he opened his eyes and showed signs of regaining consciousness. Figure 1-2 showed the FB migrated into the proximal right bronchus.

The FB removal was performed using rigid bronchoscope. 2.5cm sized stone was blocking the right bronchus [figure 3], and removed. The post-operative X-ray was shown as figure 4. The patient was discharged without any sequelae on the 3rd day of hospitalization.

**Discussions**

We report a case of subglottic FB aspiration in an infant which develop respiratory failure and arrest. Even after endotracheal intubation, respiratory arrest could be repeated. FB aspiration can be a life-threatening event, especially at young age, and can have irreversible results if golden time is missed. According to a study by Yutaka I et al. 2022[5], the rate of progression to vegetative state or death was differed greatly if more than 6 minutes elapse form airway obstruction to removal. If it takes more than 10 minutes, the rate of progressing Cerebral performance category (CPC) 4 or 5 reached 70 percent. There is lack of references to the time taken from recognition of FB aspiration to a rigid bronchoscope. In this case, during the daytime on weekdays, and it took about 45 minutes from call to execution. The operating time took 15 minutes additionally. According to Wojciech Korlacki et al. [6], in 27 children who underwent bronchoscopy for FB aspiration, operating time ranged from 5 to 90 minutes, with a mean of 24 minutes.

There are educational and review literatures that intubation past the obstruction or forcing the blockage into one of the mainstem bronchi can be attempted [7,8]. The two major factors of this success is as follows; First, we decided to attempt one lung ventilation right after we recognize the ventilation was not effective after endotracheal intubation. Second, when we found that one-lung ventilation wasn't achieved even with the E-tube fully inserted, we got a new ET of the same size and
pre-marked the stylet for deeper insertion, guiding adequate placement of FB, with lack of real-time fluoroscopy in typical emergency and resuscitation rooms.

There is no evidence to support the effectiveness of this approach in the setting of complete subglottic airway obstruction from a FB [8]. Also, it was difficult to find descriptions of the expected complications. The decision should be considered carefully about the type of FB. Organic materials can absorb fluid and swell, oils from nuts cause localized inflammation, and sharp objects can pierce the airway [9]. The method's appropriateness varies with the FB nature; sharp items pose an increased risk of airway rupture, while soft materials like food might need deeper tube insertion than initially thought. Detailed history taking to determine the nature of the FB is crucial. However, paradoxically, as in this case, the possibility of it being different from the initial statement should also be considered.

**Conclusions**

We here report a successful case of life-saving by forcing a foreign body further into the right mainstem of bronchus. This procedure could lead to safe bronchoscopic removal and discharge without sequelae.
Ethics statement
This study has been approved by the Institutional Review Board (IRB), and the IRB number is as follows; AJOUIRB-EXP-2022-042. The informed consent for this case report is waived due to its focus on a case that has already been diagnosed and treated, involving the analysis of existing medical records without the use of personal identifiers or sensitive information.

Disclosure
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REFERENCES


Fig. 1. Initial chest X-ray after arriving at the emergency department.

A radio-opaque foreign body placed at the patient’s carina (yellow arrow).
Fig. 2. Chest X-ray after intubation and pushing the foreign body with a stylet.

The foreign body placed at the proximal right bronchus (yellow arrow).
Fig. 3. Bronchoscopic image obtained while performing rigid bronchoscope.

A stone blocks the inlet of the right bronchus.
Fig. 4. Chest X-ray performed after foreign body removal.