

## CASE REPORT

## Airway

# Unusual foreign body aspiration in a 4-year-old patient

Florian Merkle MD, BA<sup>1</sup>  | Travis D. Olives MD, MPH, MEd<sup>1,2,3</sup> | Svatava Merkle MD<sup>4</sup> | Adam Rieves MD, MACM<sup>1,3</sup>

<sup>1</sup>Department of Emergency Medicine, Hennepin County Medical Center, Minneapolis, Minnesota, USA

<sup>2</sup>Minnesota Poison Control System, Minneapolis, Minnesota, USA

<sup>3</sup>Department of Emergency Medicine, University of Minnesota, Minneapolis, Minnesota, USA

<sup>4</sup>Department of Hematology and Oncology, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio, USA

**Correspondence**

Travis D. Olives, Minnesota Poison Control System, Minneapolis, MN, USA.  
Email: [oliv0070@umn.edu](mailto:oliv0070@umn.edu)

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**Abstract**

We present a case of a 4-year-old male child presenting with sudden onset of respiratory distress after aspirating a thumbtack. Prompt diagnostic evaluation with x-ray confirmed the presence of a radiodense foreign body at the level of the epiglottis, and the full size of the object was not clear on imaging. Visualization and retrieval of the object using video laryngoscopy resulted in a favorable outcome. This case underscores the unique anatomy of pediatric airways as well as the importance of timely recognition and intervention in cases of foreign body aspiration in pediatric patients to prevent respiratory compromise and ensure optimal clinical outcomes.

## 1 | INTRODUCTION

Foreign body aspiration (FBA) is a medical emergency occurring when an inhaled object becomes lodged in the airway, resulting in varying degrees of obstruction. FBA is a common cause of morbidity and mortality in children, particularly in those under the age of 3 years. The incidence of FBA has declined over time, but morbidity and mortality remain high.<sup>1</sup> In the United States, choking episodes account for over 15,000 emergency department (ED) visits and over 150 deaths annually among children under 14 years of age; however, some estimate that death from FBA may be as high as 3500 children per year in the United States alone.<sup>2-5</sup> Incidence is highest in children aged 1-3 years, with males affected more frequently than females. Com-

monly aspirated objects include nuts, seeds, popcorn, small toys, and batteries.<sup>2,6,7</sup> FBA is particularly hazardous in infants and children due to anatomical narrowing of the airway in the subglottic area, leading to significantly decreased airflow and variable obstruction including ball valve physiology.<sup>7</sup> Recent studies suggest that in contrast to prior beliefs, the pediatric larynx is not conical with the narrowest part being the cricoid ring. Rather, the narrowest part appears to be at the vocal cords or just below.<sup>8,9</sup>

Clinical manifestations of FBA may include coughing, choking, wheezing, and inability to control secretions and respiratory distress.<sup>10</sup>

Imaging studies such as chest and lateral neck radiographs may be helpful to diagnose FBA, but direct visualization with laryngoscopy or bronchoscopy may be necessary to confirm and remove the foreign body (FB). Emergent retrieval is essential in pediatric FBA patients presenting with respiratory distress. We present an unusual case of

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thumbtack aspiration in a 4-year-old child with obstruction just below the vocal cords, and the steps taken to emergently remove it.

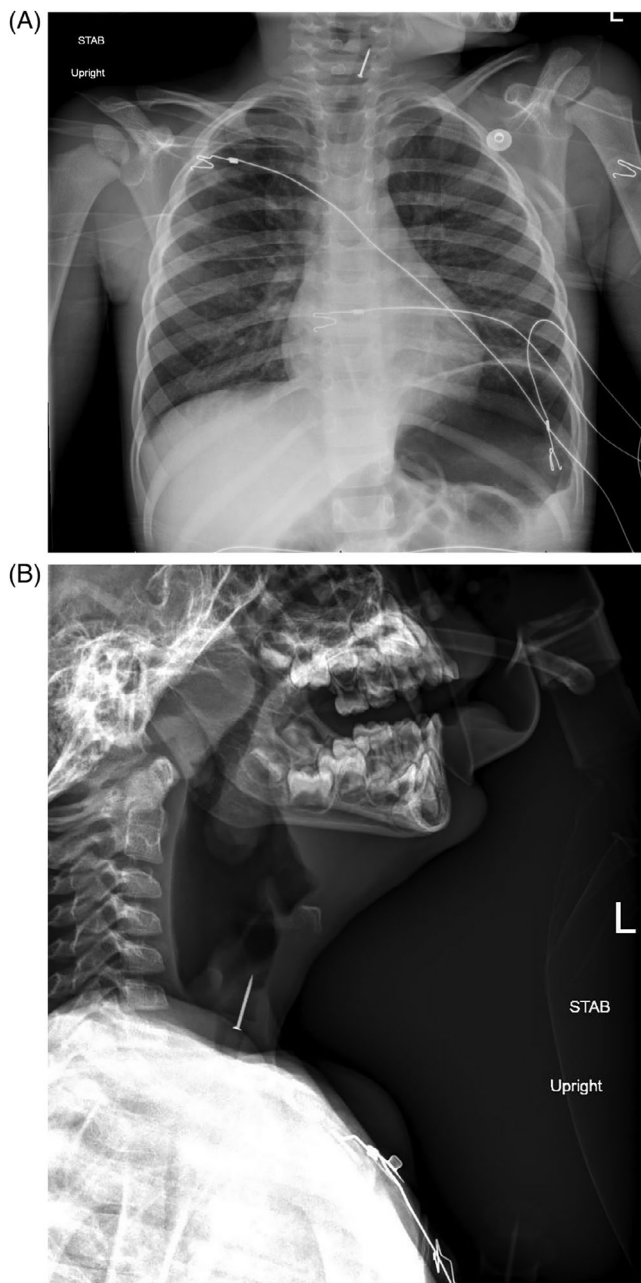
## 2 | CASE REPORT

A 4-year-old male child presented via emergency medical services (EMS) to a Level I ED after aspirating a thumbtack. EMS found the patient in respiratory distress but able to state that he “swallowed” a thumbtack. Initial prehospital presentation was significant for a heart rate of 148, respiratory rate of 50 breaths per minute with accessory muscle use and retractions. Peripheral oxygenation was measured at 85% on room air, he was alert and oriented but crying, had audible stridor, and was unable to control his secretions. He was placed on 15 L/min of oxygen via pediatric nonrebreather mask and transported emergently to our hospital. Oxygen saturation remained at 100% throughout transport, but medics reported that he appeared to be fatiguing, with a noted decrease in respiratory rate and mental status.

Upon arrival to the pediatric resuscitation bay, continuous cardiac monitoring, SpO<sub>2</sub>, ETCO<sub>2</sub>, and intermittent blood pressure monitoring were initiated. Initial vitals showed a blood pressure of 128/72 mmHg, heart rate of 144 beats per minute, respiratory rate of 26 breaths per minute, SpO<sub>2</sub> 100% on 15 L/min oxygen, and ETCO<sub>2</sub> of 35 mmHg. Primary survey was significant for tachypnea and subcostal and intercostal retractions. He was sitting in a tripod position with a Glasgow Coma Scale of 15, following commands and interacting appropriately, nodding and shaking his head in response to questions. The patient’s oropharynx was gently examined, but an FB was not appreciated.

Flush rate oxygenation via application of a pediatric nonrebreather mask (>40 L/min O<sub>2</sub> by fully opening a standard oxygen flowmeter) was initiated in preparation for potential intubation, and ENT was paged emergently to the bedside. Anterior posterior chest and lateral neck radiographs were obtained and demonstrated a metallic FB at the level of the vocal cords, with a faint outline in the shape of a pushpin just below the level of the cords (see Figure 1a,b).

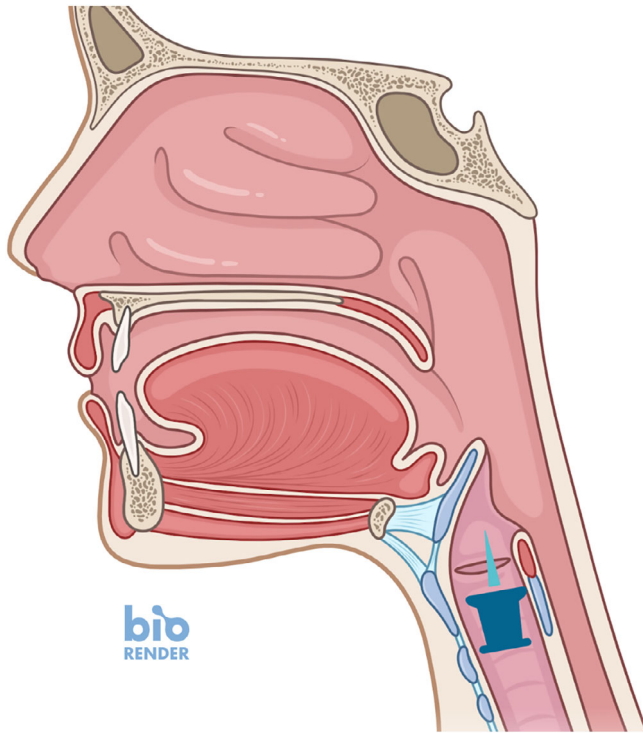
Given impending complete airway obstruction, rapid sequence intubation (RSI) followed by direct/video laryngoscopy and retrieval of the pushpin from above were planned. A second faculty-resident team positioned themselves at the patient’s right side, prepped to perform a surgical airway should laryngoscopy fail. Immediately available for the intubation were a Storz video laryngoscope with a MAC 3 blade; sizes 5.0, 4.5, and 3.5 endotracheal tubes (ETT); and pediatric and neonatal bougies. Pediatric and adult McGill forceps and nasal dressing forceps were immediately available for FB retrieval. The patient began to tire and became less interactive; ETCO<sub>2</sub> rose from 30 to 50 s. Position was optimized and, recognizing impending respiratory failure, a timeout was called and 40 mg of succinylcholine followed by 6 mg of etomidate was bolused intravenously to facilitate RSI. Bag valve mask ventilation was considered, but intentionally avoided following RSI medications due to the abnormal physiology associated with the FB’s subglottic location (Figure 2), out of concern that assisted (positive pressure)



**FIGURE 1** (A and B) Radiograph of the chest and neck; Anterior Posterior and radiograph of the neck lateral with metallic foreign body at the level of the vocal cords.

ventilation might further lodge the FB within the trachea, causing or furthering complete airway obstruction.

Laryngoscopy was performed utilizing both direct and video-assisted components. The pushpin was visualized with the pinpointing cranially through the vocal cords and the body of the pushpin lodged beneath, completely obstructing the view of the proximal trachea. An initial attempt to grasp the tip of the pushpin with the pediatric McGill forceps was unsuccessful, as the patient’s superior incisors or the laryngoscope blade inhibited successful advancement of the instrument. It was exchanged for a nasal dressing forceps. Despite difficulty angling



**FIGURE 2** Anatomic position of the pushpin in the airway. Created with BioRender.com.

the instrument adequately anteriorly to grasp the pin, a slight downward pressure over the anterior trachea allowed the operator to briefly grasp the pushpin at its tip. Control of the thumbtack was lost, but quickly regained, and the operator successfully removed it with gentle traction. The patient was subsequently endotracheally intubated in an uncomplicated fashion with a 5.0 cuffed ETT over a pediatric bougie.

The patient's SpO<sub>2</sub> remained at 100% throughout airway interventions, and first documented ETCO<sub>2</sub> following intubation was 48 mmHg.

Postintubation chest radiograph demonstrated successful removal of the FB, with ETT in appropriate position. A venous blood gas showed a pH of 7.40, pCO<sub>2</sub> of 35 mmHg, and bicarbonate of 21 mmol/L. Lactate was 1.7 mmol/L. His remaining ED course was uneventful and he was transferred to the PICU. Corticosteroids were administered at the recommendation of ENT and no further interventions were performed. He was extubated the next day and discharged home.

### 3 | DISCUSSION

Orotracheal FB removal is a high-risk procedure, particularly in children. Most case reports of FB removal in children originate from pediatric anesthesiology and otolaryngology literature. Over two-thirds of documented foreign bodies are lodged beyond the vocal cords and removal commonly performed in the operating room (OR) with rigid bronchoscopy.<sup>10-12</sup> Many cases present without acute respiratory distress, often in a delayed fashion.<sup>13</sup> However, some may precipitate rapidly progressive respiratory failure not amenable to safe

transfer to the OR. Emergency physicians—in general at least as experienced in managing acute airways as other specialties—should be prepared to manage airway emergencies.<sup>14,15</sup>

To date, there is no single procedure that has proven superiority for the “can't intubate, can't oxygenate” situation in patients under 8 years old.<sup>16-18</sup> In preparation for intubation, the option of intubating past the FB with a bougie was discussed. This option was rejected due to local experience with a previous case, which led to further impaction of the FB within the trachea. Transtracheal needle ventilation (TTNV) was also considered, however given the lack of evidence of this technique in the ED setting for emergent pediatric airways, this was deferred. Literature review revealed only two case reports where TTNV was successfully used in a patient <8 years old.<sup>16</sup> TTNV is a well-described procedure in the OR, mainly for elective surgical cases but lacks evidence in acute airway management.<sup>16,17</sup>

We thus opted for a surgical airway as a backup to RSI with FB removal and orotracheal intubation. A novel technique for surgical tracheostomy in small children has recently been described by Simpson et al. A suture is used to stabilize the trachea and prevent losing the distal end in case of accidental transection.<sup>17</sup> Surgical tracheostomy has been performed successfully in children as young as 1 year.<sup>19</sup> We felt comfortable that we would be able to perform a surgical airway in this patient. Regardless of approach, pre-oxygenation is essential to delay the onset of oxygen desaturation. The patient presented with a nonrebreather mask at 15 L O<sub>2</sub>/min placed by paramedics. Once in our care, this was increased to flush rate (>40 L/min O<sub>2</sub>).<sup>20</sup> Although apneic oxygenation could reasonably have been used during the procedure, the acute deterioration in respiratory status forced the care team to move rapidly to address the airway, and it was not implemented in the moment. Similarly, while the use of sedation in tandem with topicalizing is well supported by evidence for bronchoscopic FB removal in patients with an intact respiratory drive,<sup>20,21</sup> FB retrieval under ketamine sedation and topicalization with nebulized local anesthetic was considered but deferred given impending respiratory failure. Our goal of using sedative and paralytic was to obtain maximal compliance in a patient with rapidly declining respiratory status.

The OR is the preferred setting for FB removal whenever possible, and most case reports originate from anesthesia and ENT literature, often describing retrieval with a rigid bronchoscope. While the benefits of an operating theater—access to broadly ranging instruments, anesthesia support, and additional airway devices—are beneficial, our ED has extensive access to many of these benefits, coupled with the experience of EM physicians in managing acute airways.<sup>14,15</sup>

### 4 | SUMMARY

Pediatric FB removal, particularly in the setting of respiratory distress, is a rare but high-risk procedure. It is reasonable to attempt retrieval of foreign bodies presenting at or above the level of the vocal cords with an orotracheal approach. Given the risk of acute complete obstruction, a surgical airway should be considered if a direct orotracheal approach fails. Attempting to intubate past a FB carries the risk of converting to

complete obstruction. Every FBA is different and there may be scenarios when alternate maneuvers may be preferred, such as advancing an FB into a main bronchus. It seems both reasonable and within the scope of our practice to attempt ED-based removal of aspirated foreign bodies in pediatric patients in extremis and unstable for transport to the OR. This case demonstrates the value of a carefully considered plan to retrieve pediatric foreign bodies in an emergency setting.

## ORCID

Florian Merkle MD, BA  <https://orcid.org/0009-0001-0292-5766>

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