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Case Report

Pen cap aspiration in children: A case series with diverse retrieval techniques

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Abstract

Introduction: Pen cap aspiration, though seemingly benign in origin, poses significant airway risks in children. Its smooth surface and cylindrical shape make removal technically demanding; delays in diagnosis and inappropriate manipulation may lead to complications.

Aim: To highlight the diverse retrieval strategies for pen cap aspiration in children, emphasizing individualized management and the importance of multidisciplinary collaboration.

Case study: Case 1, a 7-year-old boy, aspirated a mechanical pencil cap that lodged in the left main bronchus and was removed via rigid bronchoscopy using optical grasping forceps. In Case 2, a 7-year-old girl developed extensive subcutaneous emphysema after aspirating a pen cap. Rigid bronchoscopy failed to extract the object safely, and an emergency tracheal incision was performed for successful removal. In Case 3, an 8-year-old boy with concurrent COVID-19 infection aspirated a pen cap that was successfully retrieved using flexible bronchoscopy-guided cryotherapy, minimizing aerosol exposure and procedure time.

Results and discussion: The choice of removal technique depends on the foreign body's characteristics, airway anatomy, and clinical stability. Rigid bronchoscopy remains the gold standard; however, open surgical or cryotherapy-assisted approaches may be warranted in select cases. Cryotherapy is effective for smooth or slippery objects, offering a safe, rapid, and minimally traumatic retrieval option.

Conclusions: Pen cap aspiration in children presents a diverse range of clinical scenarios that require tailored management. Awareness of various retrieval methods, including rigid bronchoscopy, tracheal access, and cryotherapy, improves safety and outcomes in paediatric airway foreign body cases.

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1. INTRODUCTION

Foreign body aspiration (FBA) is a life-threatening condition that can occur at any age with children, especially toddlers and pre-schoolers, being the most vulnerable. It is the fourth most common cause of death in this age group.[1] When taking a history is difficult, especially without a witness, maintaining a high index of suspicion is crucial. Thorough physical examination and appropriate investigations are essential for a quick assessment and decision regarding bronchoscopy.

Among aspirated objects, pen caps represent a unique challenge because of their smooth surface, cylindrical shape, and potential to completely occlude the airway. The management strategy depends on the object's size, location, and the child's clinical status.

2. AIM

The aim of this case series is to describe the different presentations of pen cap foreign body airway in children and to highlight various challenges encountered during foreign body removal. Individualised treatment strategies are essential to minimise morbidity and mortality.

3. CASE STUDY

CASE 1

A 7-year-old boy reported choking on a plastic mechanical pencil cap at school. After the incident, he showed no signs of stridor or other obstructed airway symptoms. His vital signs were stable and lung examinations were unremarkable. Chest X-ray (CXR) revealed no lung collapse, hyperinflated lungs or radio-opaque foreign body (FB). During rigid bronchoscopy, the pencil cap was visualised snugly lodged in the left main bronchus and was successfully removed using optical grasping forceps (Figure 1). The pencil cap appeared to fit tightly within the bronchial lumen, yet the patient remained asymptomatic, possibly due to partial airflow around the cap. Post-procedure, the patient was well and discharged home without complications.

CASE 2

A 7-year-old girl aspirated the rear cap of a pen, leading to an immediate, transient cyanotic episode. She later noticed bilateral neck swelling. Clinical examination revealed extensive subcutaneous emphysema over the neck and upper chest. CXR showed subcutaneous emphysema over neck and upper chest, with consolidation in the right upper lobe and patchy opacities of the right lung (Figure 2). These findings

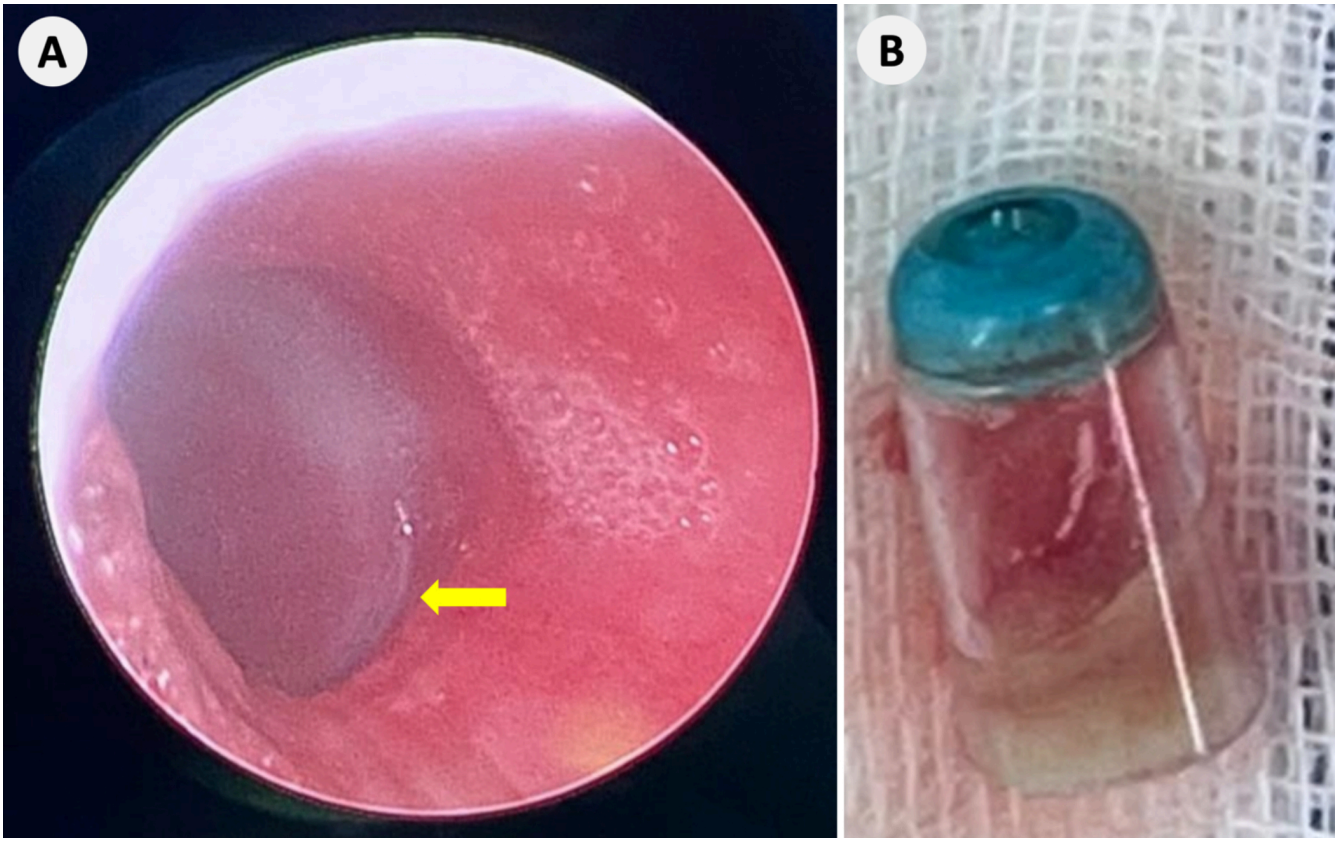

Figure 1. (A) Bronchoscopic view of mechanical pencil cap in the left main bronchus, marked with an arrow. (B) Mechanical pencil cap successfully removed using optical grasping forceps.

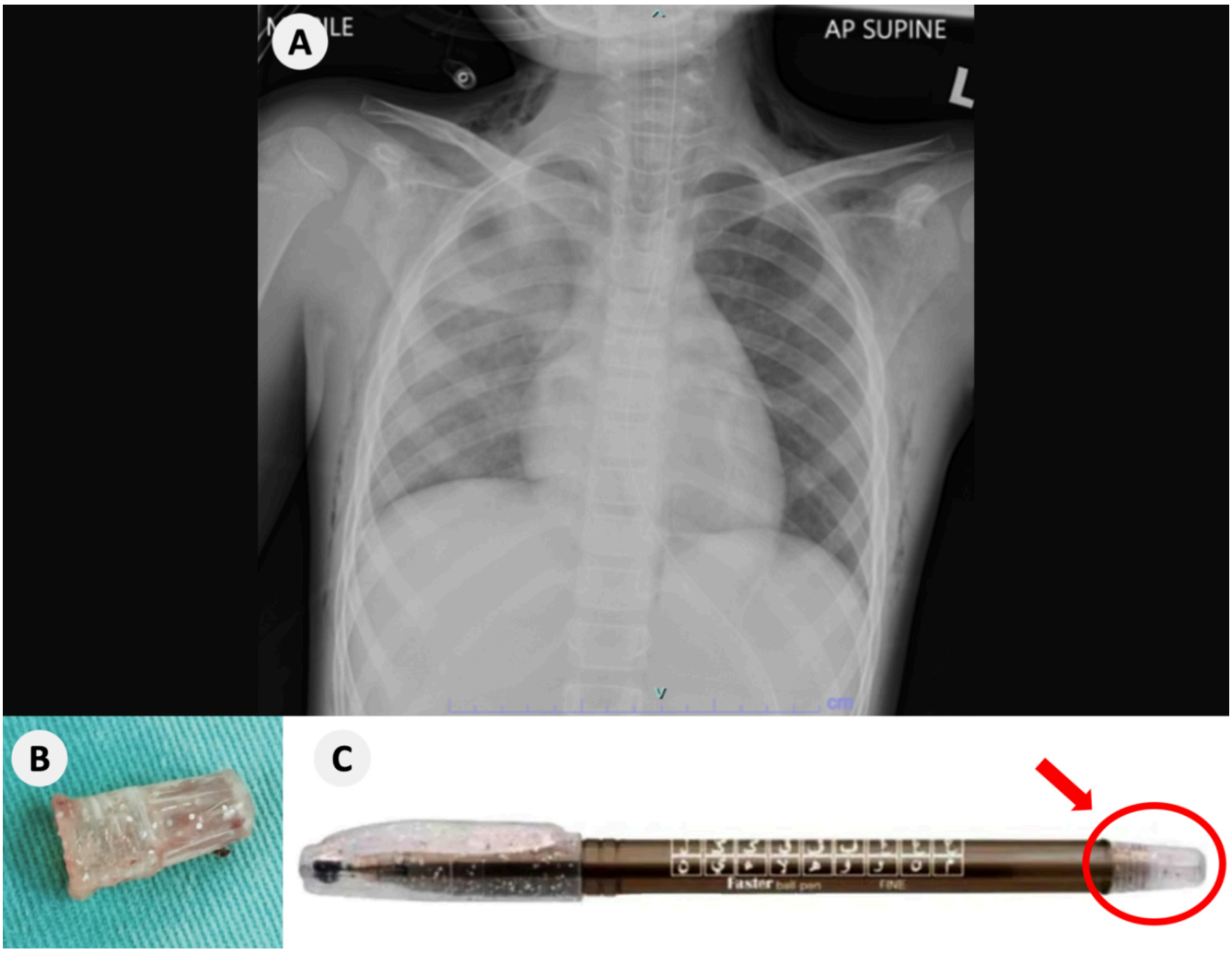

Figure 2. (A) CXR showing subcutaneous emphysema at cervical regions and bilateral lateral chest walls, as well as right upper lobe consolidation and right lung patchy consolidations. (B) Rear tip of pen cap retrieved via tracheostomy opening. (C) The aspirated pen cap, as described by the parents.

are suggestive of right-sided airway obstruction with post-obstructive inflammatory changes secondary to a retained foreign body. The subcutaneous emphysema was likely due to mucosal injury and air leakage from trachea caused by FB impaction. During an emergency rigid bronchoscopy, the FB was found in the right main bronchus. However, we encountered difficulty removing it endoscopically. The relatively large size of the FB compared to the glottic opening caused it to become stuck in the subglottic region. A tracheal incision was performed at the second and third tracheal rings, allowing retrieval through the tracheostomy opening. The trachea and neck wound were closed primarily. Postoperatively, the patient was monitored in the high-dependency ward. The subcutaneous emphysema resolved, and she was discharged home. During subsequent follow-up, the neck wound had healed well, and the patient had no airway issues.

CASE 3

An 8-year-old boy presented to the Emergency Department with fever, cough, and rapid breathing for two days. Three days prior, he had ingested a pen cap and experienced brief episodes of cyanosis and coughing that resolved spontaneously. On examination, he was tachypnoeic with an oxygen saturation of 93% on room air, which later improved to 100% with supplemental oxygen. Lung auscultation revealed reduced air entry over the left mid and lower zones, with no additional rhonchi or crepitations. Meanwhile, CXR showed left lung atelectasis. Due to a positive COVID-19 rapid antigen test, we opted for flexible bronchoscopy performed by our respiratory team to minimise aerosol generation. The pen cap was seen in the distal left main bronchus and was successfully retrieved using flexible bronchoscopy-guided cryotherapy under general anaesthesia (Figure 3).

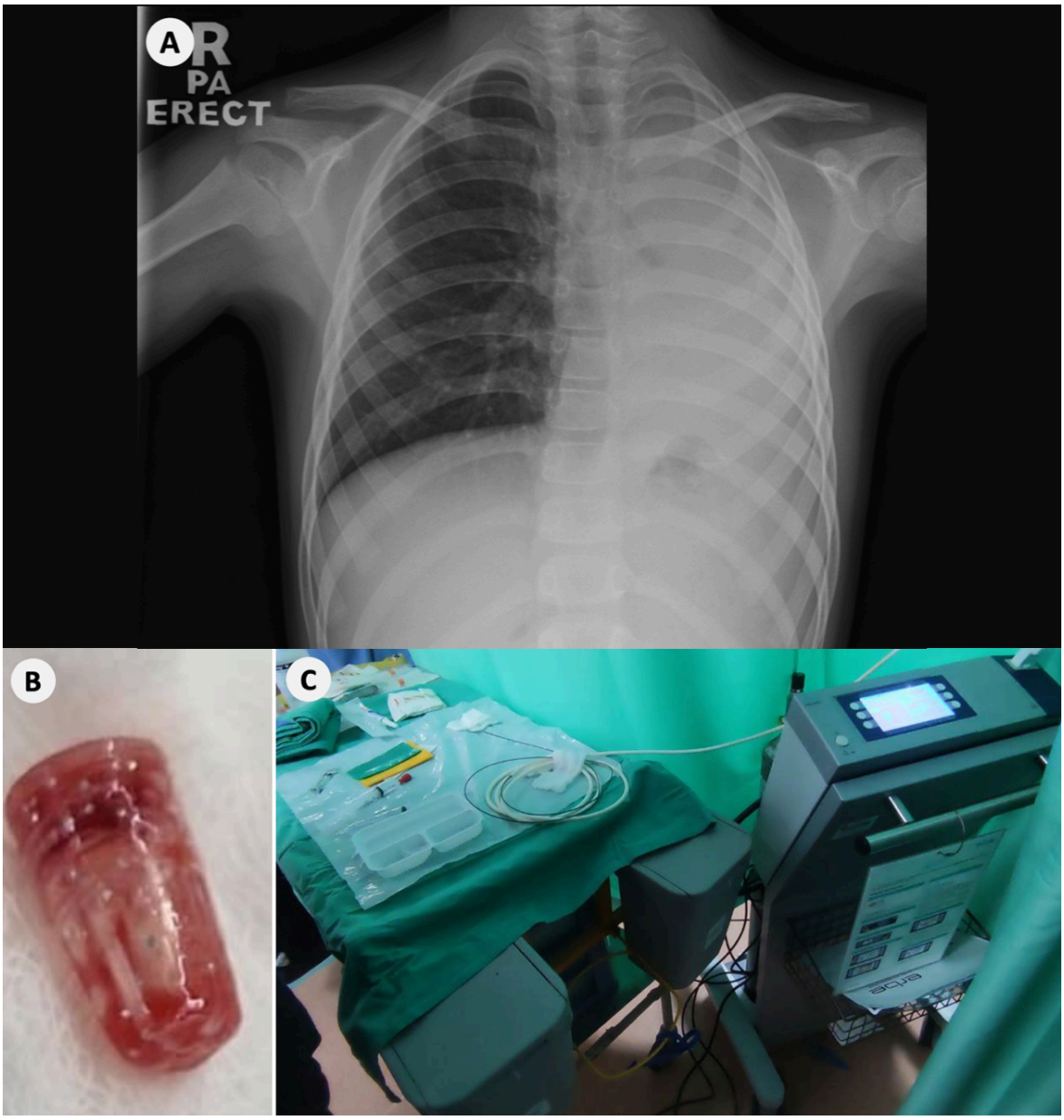

Figure 3. (A) CXR showed left hemithorax white-out with abrupt tapering of left main bronchus, heart shifted to the left and hyper-expansion of right lung. (B) Pen cap retrieved from the left main bronchus. (C) Cryotherapy machine used during the procedure.

Table 1. Summary of cases.

Case	Age/Sex	Foreign body	Location	Symptoms	Imaging findings	Retrieval method	Outcome
1	7/M	Mechanical pencil cap	Left main bronchus	Asymptomatic	Normal CXR	Rigid bronchoscopy with optical grasping forceps	Uneventful recovery
2	7/F	Pen cap (rear tip)	Right main bronchus	Cyanosis, neck swelling, subcutaneous emphysema	Subcutaneous emphysema, right upper lobe consolidation, patchy opacities right lung	Tracheostomy assisted FB retrieval	Resolved subcutaneous emphysema, full recovery without complications
3	8/M	Pen cap	Distal left main bronchus	Fever, cough, tachypnoea	Left lung atelectasis	Flexible bronchoscopy with cryotherapy	Resolution of atelectasis, COVID-19 recovery

Postoperatively, serial CXRs demonstrated improvement in the lung atelectasis. He was discharged with outpatient follow-up for his Covid-19 recovery.

4. RESULTS AND DISCUSSION

In the year 2000, around 30 per 100,000 children were reported to have foreign body aspiration (FBA). From that figure, 160 resulted in death.[2] Symptoms and physical findings of airway foreign body (FB) vary depending on the size, type, and location of the FB, as well as the duration of aspiration and the age of the patient.[3] A patient can be either asymptomatic or have symptoms such as coughing, choking cyanosis, shortness of breath, noisy breathing, or recurrent or unresolved lung infections.[4] A study by Na'ara et al. found that initial lung auscultation of infants or younger children with airway FB revealed rhonchi, which later progressed to reduced breath sounds. In contrast, older children most frequently exhibited decreased breath sounds first, followed by wheezing.[5]

Rigid bronchoscopy is the gold standard for the initial diagnostic and therapeutic treatment of FBA. However, other options, such as flexible fibreoptic bronchoscopy, are helpful when smaller FBs dislodge further into the bronchial tree. Various tools can be used to remove the FB during rigid or flexible bronchoscopy, such as grasping forceps, baskets, nets, snares, Fogarty balloons, and cryoprobes. If these transoral endoscopic approaches fail, open surgery such as tracheostomy or thoracotomy may be necessary.[6]

As the pen cap is a cylindrical or conical object with a smooth and slippery surface, removal can be difficult, especially when the closed tip is pointing upwards.[7]

Our Case 1 was successfully managed using rigid bronchoscopy and optical grasping forceps, as we were able to easily grasp the open end of the pen cap. The size of the pen cap in this case was smaller than the glottic opening, which allowed easy endoscopic removal. The scenario was different in Case 2. The pen cap was relatively larger, and its conical shape allowed it to enter the lower airway easily. However, its upper part, being larger than the glottic opening, caused it to become stuck below the glottic region. Forceful removal attempts could result in injury to the trachea and vocal cords, potentially leading to upper airway obstruction from oedematous mucosa or blood clots. To prevent this, we opted for an open approach in Case 2 to facilitate FB removal. This technique has been similarly described by Wang et al. and Singh et al.[8,9]

In Case 3, we collaborated with our respiratory team. In our opinion, removing the lower airway FB using flexible bronchoscopy-guided cryotherapy was the best approach to minimise aerosol exposure in an active COVID-19 patient. Our team was on standby for rigid bronchoscopy or emergency tracheostomy in case of failed removal by flexible bronchoscopy. Cryotherapy relies on the principle of cryoadhesion, in which rapid cooling of the probe tip to approximately –80 °C (using CO_2 or N_2O) causes the target surface to freeze and stick, enabling controlled removal.[10] Thus, once the cryoprobe touched the pen cap, it quickly cooled, froze and adhered to the pen cap, which was then easily extracted from the left main bronchus. One of the advantages of cryotherapy is that the procedure is simple and convenient with a shorter operation time, thereby reducing the risks associated with prolonged anaesthesia, sedation and direct aerosol exposure. However, due to the narrow and soft airway in children, extra care should be taken to avoid contact with the mucosa as mucosal damage can cause bleeding and airway oedema, which later can precipitate granulation tissue formation or airway stenosis.[10]

5. CONCLUSION

(1) Rigid bronchoscopy remains the gold standard for foreign body airway removal in children.
(2) Flexible bronchoscopy and cryotherapy serve as valuable adjuncts in selected cases.
(3) When endoscopic removal fails, early consideration of open surgical approaches, such as tracheostomy or thoracotomy, is crucial.
(4) A multidisciplinary collaboration enhances safety and optimises outcomes in complex paediatric airway foreign body management.

Informed consent
Informed/verbal consent obtained from the carer/parent.

Ethics approval
None declared. No ethical approval is required from the institution as this is a case report.

Conflicts of interest
There are no conflicts of interest in declaring that area relevant to the content of this article.

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Author Contributions
Study design: ACMA, AA, SSAH, MNO, HBI
Data collection: ACMA, HBI, MNAB
Manuscript preparation: ACMA, AA, SSAH, MNO
Literature search: ACMA

References
1 Tsang JE, Sun J, Ooi GC, Tsang KW. Endobronchial Foreign Body Presenting as Exacerbation of Asthma. *Case*

Rep Emerg Med. 2017:1–5. https://doi.org/10.1155/2017/6863083.

2 Gómez-Ramos JJ, Marín-Medina A, Castillo-Cobian AA, Felipe-Diego OG. Successful Management Foreign Body Aspiration Associated with Severe Respiratory Distress and Subcutaneous Emphysema: Case Report and Literature Review. *Medicina (Mex).* 2022;58(3):396. https://doi.org/10.3390/medicina58030396.

3 Liu B, Ding F, An Y, et al. Occult foreign body aspirations in pediatric patients: 20-years of experience. *BMC Pulm Med.* 2020;20(1):320. https://doi.org/10.1186/s12890-020-01356-8.

4 D'Addio E, Palma PL, Di Sessa A, Guarino S, Marzuillo P, Apicella A. Foreign Body Aspiration in Children – Diagnostic Clues through a Clinical Case. *Pediatr Rep.* 2022;14(1):81–85. https://doi.org/10.3390/pediatric14010012.

5 Na'ara S, Vainer I, Amit M, Gordin A. Foreign Body Aspiration in Infants and Older Children: A Comparative Study. *Ear Nose Throat J.* 2020;99(1):47–51. https://doi.org/10.1177/0145561319839900.

6 Sarkar A, Murthy V. Foreign body aspiration: A review of current strategies for management. *Shanghai Chest.* 2021;5:25–25. https://doi.org/10.21037/shc-20-38.

7 Seifarth FG, Triana J, Knight CG. Aspiration of a perforated pen cap: Complete tracheal obstruction without radiologic evidence. *Ann Pediatr Surg.* 2012;8(1):22–24. https://doi.org/10.1097/01.XPS.0000409957.09525.b9.

8 Wang H-cheng, Chen Y-chao, Pan H-guang, Li L, Teng Y-shu. Tracheostomy-Assisted Foreign Body Removal: Insights From a Case Series and Literature Review. *Ear Nose Throat J.* 2023:01455613231201015. https://doi.org/10.1177/01455613231201015.

9 Singh JK, Vasudevan V, Bharadwaj N, Narasimhan KL. Role of tracheostomy in the management of foreign body airway obstruction in children. *Singapore Med J.* 2009;50(9):871–874.

10 Zhang L, Yin Y, Zhang J, Zhang H. Removal of foreign bodies in children's airways using flexible bronchoscopic CO_2 cryotherapy: Flexible Bronchoscopic CO_2 Cryotherapy for Children. *Pediatr Pulmonol.* 2016;51(9):943–949. https://doi.org/10.1002/ppul.23361.