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Case Report

Penetrating injuries to the oropharyngeal cavity in children-a challenge to the anesthetist

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Abstract: The penetration of foreign bodies into the oropharyngeal cavities in children is a relatively rare type of accident. However, difficulties associated with accessing the airway and assessing the trauma condition make the management of these cases a challenge to the anesthetists, surgeons, and emergency pediatric physicians. In addition, the foreign bodies in close proximity to critical blood vessels and nerves may lead to life-threatening conditions. The present article reports 3 pediatric patients from the emergency department with oropharyngeal penetrating injuries based on retrospective review. All three patients received successful tracheal intubation and removals of the foreign body. Trans-pharyngeal penetrating injuries were properly treated without secondary damage to adjacent vessels and nerves. The patients achieved good outcome with no obvious sequelae observed during and after hospitalization.

Keywords: Foreign body, penetrating injury, airway management, children

Introduction

Penetrating injuries to the oropharyngeal cavity in pediatric patients are relatively rare. The related complications including major vascular or nerve damage, airway obstructions and aspiration, may lead to severe morbidity and mortality [1]. Difficulties associated with accessing the airway and assessing the trauma condition make the management of these cases a challenge to both the anesthetists and surgeons [2]. In addition, the foreign bodies in close proximity to critical blood vessels and nerves may elicit secondary injuries during tracheal intubation, especially in children [3]. Therefore, penetration injuries with foreign bodies require particularly urgent but cautious treatment. Delay of intervention may cause edema, aspiration, or respiratory distress. Here we reported a series of 3 pediatric cases of penetrating injury to the oropharyngeal cavities to emphasize the importance of multidisciplinary trauma team approach in evaluation and treatments.

Case report 1

History and clinical examination

A 2-year-old girl was admitted to the emergency room with a wooden stick inserted into the bottom of her mouth, which occurred when she fell down with the stick in her mouth 7 hours ago. Since the injury, the patient showed no obvious coma, vomiting or dyspnea, with limited bleeding volume approximately less than 10 ml.

Physical examination and imaging

The patient's vital signs were normal, but she was anxious. Facial asymmetry, with swelling on the right side of the face and neck, was obvious. A 5-cm rough-surfaced wooden stick was identified outside her mouth (**Figure 1A**).

Computed tomography (CT) scan showed a hypo-dense foreign body penetrating in the bottom of the mouth that extended down to the deep side of the pharyngeal cavity and pterygoid muscle, where swelling, bleeding and gas were observed (**Figure 1B** and **1C**).

Operation

The patient's basic vital signs were monitored. The emergency tracheotomy instruments and the related medicine was prepared bedside. A large volume of sputum and secretion were suctioned. A dose of 0.3 mg/kg dexamethasone was administered and sevoflurane (8% in anesthesia induction and 3% in anesthesia mainte-

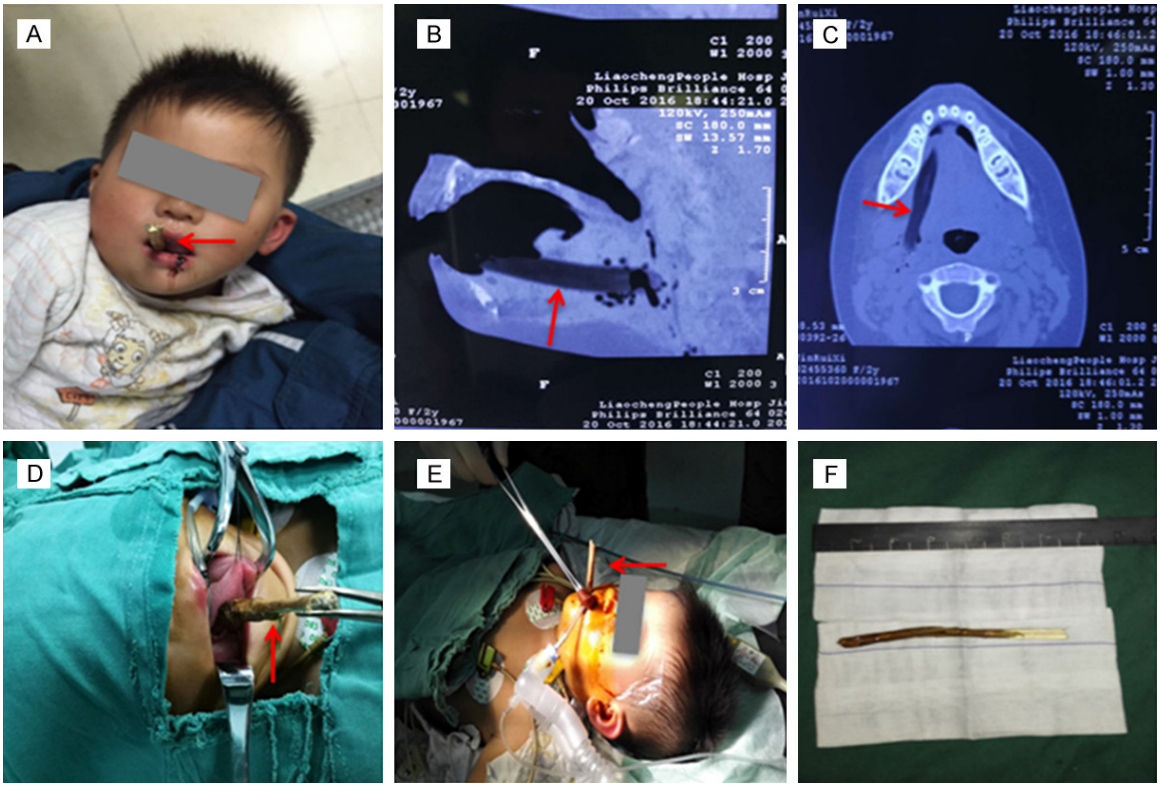

Figure 1. A. The wooden stick penetrated the floor of the mouth. B and C. Preoperative CT showing a hypo-dense foreign body penetrating into the pharyngeal cavity. D and E. Operative images after successful intubation. F. The wooden stick after it was removed.

nance) was inhaled. The laryngoscopy was placed from the left side of the mouth to expose the epiglottis. With stable vital signs and spontaneous respiration, endotracheal intubation was performed properly using direct laryngoscopy. Then 5 μg sufentanil and 1.5 mg cisatracurium were administered for general anesthesia (**Figure 1D** and **1E**).

After general anesthesia, the wooden stick was completely taken out of the mouth without damages to the carotid sheath (carotid artery, vein and the relative nerves). The stick was 13 cm long (**Figure 1F**).

Postoperative course

No hemorrhage, respiratory distress, or other complications were observed in the following 5 days. The patient was discharged on the day 5 postoperative.

Case report 2

History and clinical examination

A 5-year-old boy was admitted with glass debris penetrating the left mandibular angle into the pharyngeal cavity. The patient vomited once with stomach contents after the injury. The hemorrhage volume was approximate 100 ml.

Physical examination and imaging

A 1-cm wound with slightly swollen edges and obvious bleeding was seen on the left side of his lower jaw (**Figure 2A**). A 5-cm glass debris was exposed in the oral cavity with no obvious active bleeding. CT scan showed a foreign body penetrating from the left mandibular angle to the bottom of the mouth (**Figure 2B**). Three-dimensional CT analysis showed that the foreign body located closely adjacent to the internal carotid artery (**Figure 2C**).

Operation

After rapid intravenous induction and exposure of the epiglottis by direct laryngoscopy, we observed the glass debris in the pharyngeal cavity with one end exposed in the oral cavity. After the general anesthesia was performed, the 5-cm-long glass was completely removed from the submandibular area (**Figure 2D**).

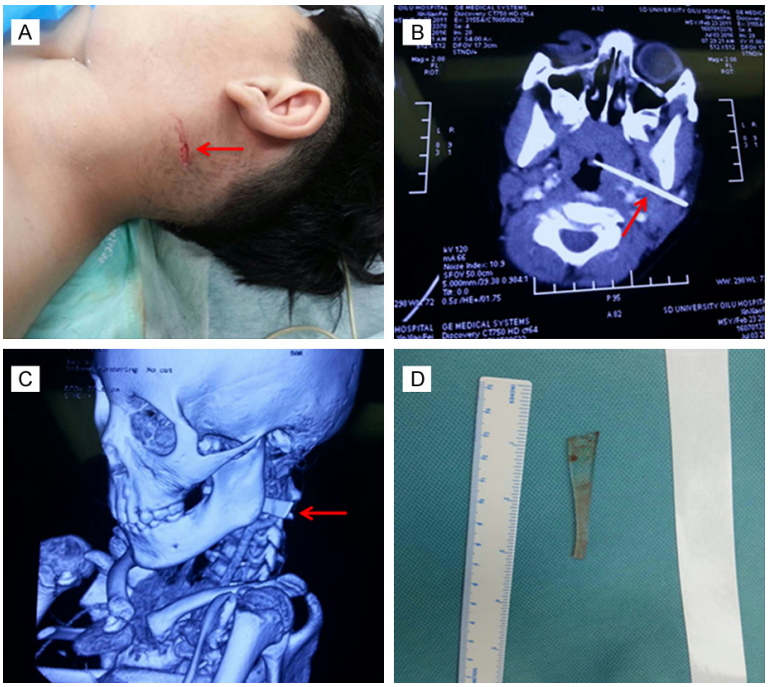

Figure 2. A. A wound on the left side of the mandibular angle. B. CT showing the linear hyper-dense foreign body to the pharyngeal cavity. C. Three-dimensional CT showing the foreign body located adjacent to the internal carotid artery. D. The glass debris after it was removed.

Postoperative course

The patient was observed in hospital for 6 days, with administering broad-spectrum antibiotics for 6 days. There were no hemorrhages or respiratory distresses observed at follow-up.

Case report 3

History and clinical examination

A 3-year-old girl fell prone while walking with a chopstick in her mouth, which pierced through the hard palate approximately 3 cm into her brain cavity (**Figure 3A**). She was admitted to the emergency department with nausea and vomiting of blood clots and stomach contents.

Physical examination and imaging

Physical examination revealed an oral foreign body piercing upward through the hard palate into the cranial cavity. CT scan showed that the foreign body penetrated from the oral cavity to the upper part of the sphenoid body. The results also showed fracture of the right maxillary palate, inferior turbinate and the upper part of the sphenoid bone with a small quantity of intracranial gas **Figure 3B** and **3C**).

Operation

After rapid intravenous induction, exposure of the object by direct laryngoscopy and successful tracheal intubation, the surgeons first cut off the outer part of the chopstick that was exposed outside of the mouth. Then, the remaining chopstick was successfully removed without secondary injuries to the brain or critical vessels (**Figure 3D**).

Postoperative course

The patient remained in the postoperative care unit for 3 days and received broad-spectrum antibiotics for 14 days. No severe complications such as cerebrospinal fluid fistula or nervous complications were observed at follow-up.

Discussion

Penetrating injuries into the oropharynx cavities are rare cases that often result from children falling with objects in their mouth [4]. The emergency care and management of these pediatric patients depends on the size of the foreign bodies, the location of the injuries and hemodynamic signs. A foreign body in the oropharyngeal cavity may lead to tongue immobilization, epiglottis exposing difficulties and limited submandibular motion, which make anesthesia and airway management particularly complex [5]. As revealed by CT, the foreign body may be located closely adjacent to the critical vessels and nerves. It is thus necessary to expedite general anesthesia to limit the patients' movement and avoid further injuries to the adjacent tissues and organs [6]. Airway management in oropharyngeal injuries is even more complicated in children than that in adults. The cricoid cartilage, instead of glottis vera, is the narrowest portion of the pediatric airway, and the mucosa of the cricoid area lacks a substantial submucosal layer [7]. Additionally, penetrating foreign bodies are relatively large in pediatric oropharyngeal cavities and thus considerably decrease the operating space within the oral cavity. Furthermore, the structural and physiological characteristics of

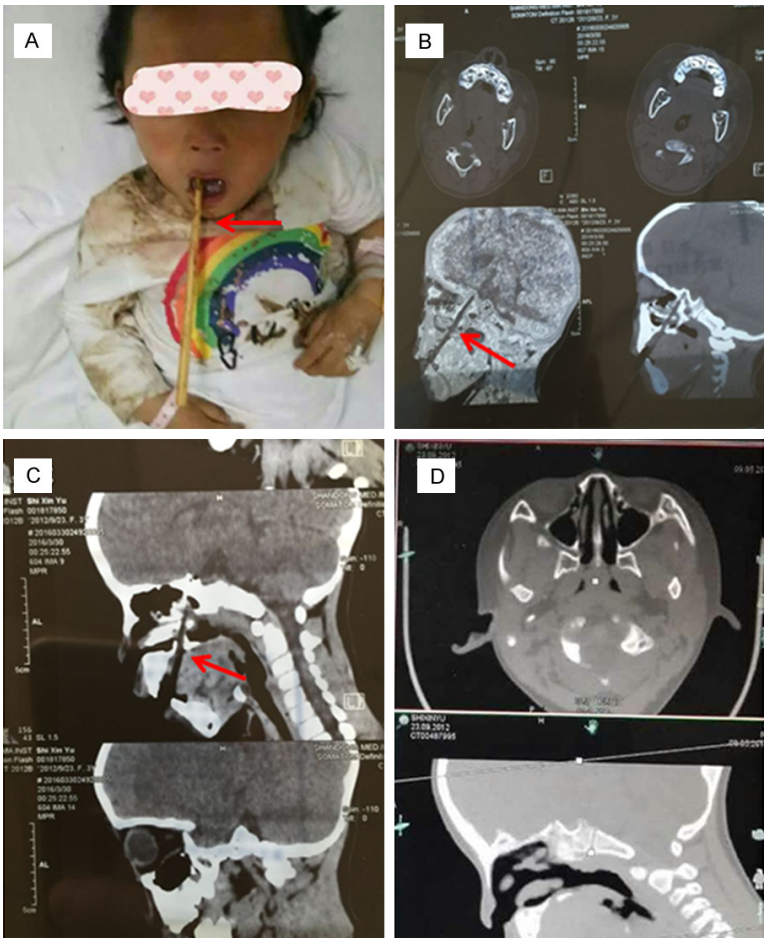

Figure 3. A. The oral foreign body piercing upward through the hard palate to cranial cavity. B and C. CT showing the presence of an object with low density penetrating from the oral cavity to the upper part of the sphenoid body. D. The postoperative brain CT image.

the pediatric airway predispose it to injury during intubation [8], and the hypersensitivity reaction of children to intubation facilitates airway spasm [9] in serious conditions.

Given the potentially difficulties, we considered all the possible alternatives for airway management, including anesthetic induction with autonomous respiration, rapid-sequence induction, fiberoptic incubation, and surgical tracheotomy [10].

In case 1, we choose anesthetic induction with autonomous respiration for airway management due to that it is the safest way for patients. We decided to protect the patient's airway by carefully performing tracheal intubation and maintaining the stability of the foreign bodies at all times with autonomous respiration. Thus, to maintain spontaneous respiration and to prevent cough and bronchospasm during tracheal intubation, the following measures should be taken: accurate assessment of the airway and degree of injuries, careful interpretation of image information, preparation of emergency equipment, and precise administration of anesthesia. After the confirmed success of tracheal intubation, further anesthesia should be given.

We also considered fiberoptic incubation of the trachea while awake; however, given the lack of patient compliance, difficulties in visualization due to vomitus, secretions, or blood in the oral airway, this approach has not been proven to be better than direct laryngoscopy in some cases [11].

In contrast, in case 2 and 3 described above, after carefully evaluation of the position of foreign bodies and the extent of glottic visualization, we choose rapid-sequence induction followed by direct laryngoscopy (DL) for airway management under pre-oxygenation and cervical stabilization [12]. If the above options fail or the adjacent artery is damaged, which may lead to hematoma or even apnea, in case of failure of intubations, emergency jet ventilation or tracheotomy were prepared [13]. The tracheotomy is not recommended due to the frequently occurring complications including bleeding, respiratory cardiac arrest, subcutaneous emphysema, acute pulmonary edema, and postoperative tracheal stenosis in pediatric patients [14]. However, with emergency measures to manage the airway, tracheotomy was considered as alternatives in these cases.

In these cases, tracheal intubation may increase the incidence of secondary damage to the blood vessels and nerves around the foreign body [15]. We attempted orotracheal incubation with an assistant holding the foreign bodies to prevent damages to the surround-

ings. It is important to develop a detailed ventilation strategy, to ensure adequate anesthesia induction and preparation, to organize an multidisciplinary team to acutely manage the difficult airway and to keep in mind possible injuries of vital organs such as the cerebellum, brainstem, or adjacent carotid artery. In addition, radial artery or internal jugular vein catheterization must be prepared to monitor perioperative hemodynamic changes. Finally, we also emphasize the importance of parents supervising their children carefully to prevent such emergency accidents.

In conclusion, we reported 3 cases of pediatric penetrating injuries of foreign bodies in to the orophanrygeal cavity to highlight the importance of a detailed ventilation strategies, induction preparations, and procedures for the acute management of difficult airways.

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Disclosure of conflict of interest

None.

Abbreviations

CT, Computed Tomography; DL, Direct Laryngoscopy.

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