How I Do It  
Anterior Laryngofissure Approach to an Airway Foreign Body After Migration Into the Paraglottic Space

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INTRODUCTION

Airway foreign bodies (FBs) are often removed with endoscopic techniques. Although the vast majority of FBs can be removed endoscopically, this is not possible in all situations. With FBs that are either located beyond the reach of endoscopy or in the presence of significant granulation tissue, endoscopic removal may not be possible secondary to exceedingly high risk. Often in these situations, an open surgical procedure in the form of a tracheotomy or a limited thoracotomy with bronchotomy is advocated to successfully retrieve the FB. An FB aspiration to the larynx with subsequent paraglottic migration, however, is a rare occurrence and can be successfully managed, as described in the following case, with an anterior laryngofissure approach and assistance from intraoperative ultrasound guidance.

A 16-year-old male presented to The Children’s Hospital emergency department with hoarseness, biphasic stridor, and increasing respiratory distress. Six weeks prior to presentation, the patient was involved in a motor vehicle collision, in which he was ejected from the vehicle. He was intubated on arrival to an outside hospital emergency department after the incident. The patient sustained injuries including abdominal trauma and facial trauma with dislodgement of the left lower central incisor tooth. A computed tomography (CT) study of the face revealed multiple broken teeth including an avulsed inferior left central incisor with bony fragments in the oral cavity (Fig. 1). The patient endorsed intact dentition prior to the accident. Both the dental and otolaryngology services at the outside hospital were consulted for tooth fracture and lip laceration, respectively. A review of the outside hospital records did not reveal specific documentation that the debris in the oral cavity seen on CT was removed, nor any further investigation performed. The imaging obtained at initial presentation included a chest x-ray, CT of the cervical spine, and maxillofacial CT. None of these studies showed an FB. He was extubated uneventfully on hospital day 2.

The patient was discharged on hospital day 6 in satisfactory condition after treatment of his injuries. He continued with an uneventful recovery for the next 5 weeks. One week prior to presentation, however, he began developing odynophagia and dyspnea. On the day of admission, he had an acute worsening of symptoms. On presentation in the emergency department, he was found to have biphasic stridor and posturing in the sniffing position. CT imaging demonstrated a 7-mm calcified structure within the right endolaryngeal soft tissues (Fig. 2). An abscess measuring 3.4 × 1.5 × 2.3 cm surrounded the FB. The CT findings were significant for leftward displacement and compression of the adjacent airway.

SURGICAL MANAGEMENT

In anticipation of imminent respiratory distress, the otolaryngology team brought the patient immediately to the operating room. In conjunction with the anesthesia team, an awake flexible fiberoptic nasolaryngoscopy was performed. Vocal cord mobility and dynamic airway status was found to be intact and the airway was deemed safe to secure by intubation. After the airway was secured, a microlaryngoscopy, bronchoscopy, and esophagoscopy were then performed with exploration of the right hypopharynx and right subglottis. The procedure revealed bulging of the right subglottis and granulation tissue. Dissection into the submucosa of the medial wall of the right piriform sinus did not reveal an FB or abscess.

Based on these findings, an FB was suspected within the right paraglottic space, which could not be safely retrieved via an endoscopic approach. The decision was then made to transport the patient intubated to the pediatric intensive care unit (PICU). An
alternative strategy was discussed for an open approach to the laryngeal mucosa and underlying soft tissue to allow drainage of the abscess cavity and retrieval of the FB. Ultrasound performed at the bedside in the PICU, in consultation with the ultrasound radiologist, verified the presence of the FB in the paraglottic soft tissues, and the decision was made to pursue an anterior laryngofissure approach for optimal access to the area. A lateral window approach had been considered; however, there were concerns for limited access, especially to the inferior extent of the abscess, inadequate size for FB removal, and increased risk to laryngeal nerves.

The following day, the patient was taken back to the operating room and underwent anterior laryngofissure to adequately explore the paraglottic region. The laryngofissure commenced by raising subplatysmal flaps with dissection through the strap musculature to expose the laryngeal framework and the proximal trachea. A laryngofissure was then made through the thyroid cartilage to the first tracheal ring and included the anterior commissure. For optimal visualization of the larynx, a separate tracheotomy incision was created to place the endotracheal tube. Examination of the endolaryngeal and tracheal lumen through the anterior laryngofissure at this location revealed granulation tissue and purulent drainage from the right subglottic mucosa. Blunt dissection into the right paraglottic space revealed an abscess cavity with associated purulence. A small portion of the lateral cricoid cartilage was removed to obtain adequate access to the cavity and allow complete drainage. The FB was not apparent on exploration of this cavity, and therefore intraoperative ultrasound was performed with the assistance of the consulting radiologist to assist in localization of the embedded object.

Interpretation of the ultrasound suggested an echogenic mass in a region superior and posterior to the cricoid, just inferior to the thyroid cartilage. Extensive dissection with the continued aid of ultrasound guidance ultimately revealed an FB with histologic appearance consistent with a bone fragment (Fig. 3). Re-examination of the neck with ultrasound demonstrated an empty cavity where the mass had been previously located, thus confirming FB removal. A formal tracheotomy was made given the significant degree of dissection within the airway. Flexible laryngoscopy at 48 hours after surgery revealed an extremely swollen supraglottis and immobile arytenoids. The patient was discharged home with the tracheostomy in place and with a prescription for pantoprazole, 30 mg twice daily, on hospital day 12.

He underwent direct laryngoscopy at 2 weeks and 2 months postoperatively, which were significant for edema and predominate right glottic granulomas. By 3.5 months following FB removal, rigid endoscopy findings were significant for resolution of laryngeal granulomas and improved edema (Fig. 4A) and a posterior right true vocal fold deficiency (Fig. 4B). Given the extensive inflammation and infection involving this area, significant dissection was required to extract the lodged FB. The subsequent healing process with associated inflammation.

Fig. 1. Non-contrast computed tomography of the face after motor vehicle accident demonstrating bony fragments in oral cavity and absence of left lower central incisor. L, left; P, posterior.

Fig. 2. Contrast-enhanced computed tomography of the neck acquired at presentation demonstrating bony fragment in the right paraglottic space.

Fig. 3. Permanent cross-section of extracted foreign body (hematoxylin and eosin, original 2x). Image demonstrates cancellous woven bone with hypocellular marrow and dilated medullary sinuses. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]
scarring likely contributed to this deficiency. The patient was noted to have subtle hoarseness and a lower pitched voice postoperatively. His airway at 3.5 months postoperatively was deemed stable, and he underwent uneventful decannulation.

DISCUSSION

Airway FBs have been extensively studied and occur predominately in the pediatric population. Although most FBs negotiate the upper aerodigestive tract to settle within the tracheobronchial tree, FB aspiration to the larynx is relatively rare, with fewer than 4% of FBs being found in the larynx. Endoscopy has been the mainstay of management for FB aspiration since the pioneering work of Chevalier Jackson in the early 1900s. Despite widespread use of endoscopic techniques for FB removal, consideration of open surgical techniques for extraction is required when endoscopic techniques are unsuccessful. Reports of techniques described for airway FB removal include tracheotomy, limited thoracotomy, and bronchotomy. However, a review of the literature does not reveal a description of a laryngofissure approach to FB retrieval.

A key point regarding the initial evaluation at the outside hospital was the management of the debris seen on maxillofacial CT. In the above case, a careful evaluation of the patient accounting for the debris was required. Indeed, the patient who presents with dental trauma and missing teeth requires ruling out retained FB. Given that the patient was immediately intubated in the field, he was at increased risk for airway FB. Specifically in this case, careful debridement of debris in the oral cavity and a full airway endoscopy to ensure all debris was removed could have prevented subsequent patient morbidity.

The initial procedure was expected to yield retrieval of the FB as the object was clearly visualized on CT. Thorough examination with bronchoscopy, esophagoscopy, and endoscopic dissection, however, did not reveal the object. Use of intraoperative imaging such as image intensifiers for retrieval of airway foreign bodies has been described. After exposure with an anterior laryngofissure approach, however, the successful extraction of the FB from the submucosal location in the paraglottic space was made with the assistance of intraoperative ultrasound guided dissection performed in consultation with a radiologist. Although a laryngofissure was chosen in this case, other potential options, such as a lateral window approach with consideration for ultrasound guided assistance, may be appropriate for a smaller FB but would depend on the specific clinical scenario.

CONCLUSION

Thorough debridement of upper aerodigestive tract FBs observed on imaging studies is imperative to prevent subsequent morbidity of a retained FB. With unsuccessful attempts to endoscopically retrieve an FB of the upper aerodigestive tract, an open approach should be considered that offers sufficient access for retrieval but minimizes morbidity. Once sufficient access has been obtained, with suspicion that the FB has migrated into the submucosa, intraoperative imaging technologies, such as ultrasound, can help guide dissection to successfully localize and retrieve objects that migrated into the submucosa.

BIBLIOGRAPHY