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Low rate of positive bronchoscopy for suspected foreign body aspiration in infants☆

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ABSTRACT

Objectives: To describe our institution's low rate of positive bronchoscopy in infants suspected of inhaling a foreign body.
Study Design: Retrospective chart review.
Methods: A retrospective review was performed of patients at a tertiary children's hospital with suspected inhalation of a foreign body. Charts were reviewed for demographic information, radiologic findings, operative reports, and respiratory viral panels were reviewed.
Results: Sixteen pediatric patients under 12 months of age were identified from 2008 to 2016 with a diagnosis of possible airway foreign body inhalation who underwent emergent bronchoscopy. Of these patients, only one was positive for a foreign body present in the airway. The remaining 15 children were found to have a negative direct laryngoscopy and bronchoscopy evaluation for a foreign body. Of these fifteen patients, 14 were found to have structural airway abnormalities and 7 tested positive for a respiratory viral infection.
Conclusions: Our institution has a low rate of positive bronchoscopy for highly suspected foreign body inhalation in a group of patients less than 12 months of age. Patients presenting with respiratory distress, stridor, or other airway symptoms were often found to have an underlying airway abnormality or viral infection, which coupled with an unclear history, would increase the suspicion for an airway foreign body and subsequent decision to perform bronchoscopy. In stable patients, diagnostic evaluation for an underlying respiratory infection should be performed in these cases.
Level of Evidence: Case Series.

1. Introduction

Aspiration of foreign bodies in the pediatric population is a serious condition that frequently leads to further illness and sometimes death. In 2008 alone, foreign body aspiration (FBA) accounted for more than 17,000 emergency department visits and 220 deaths in children under the age of 14 in the United States [1]. Presentation and diagnosis within 24 h of aspiration occurs in only 50–75% of cases and delays in diagnosis can lead to respiratory complications ranging from life-threatening airway obstruction to chronic wheezing, cough, or recurrent pneumonia [2]. The patient history, physical exam, and imaging are involved in the workup of foreign body aspiration, however, endoscopy is often needed to confirm the diagnosis. Thus, bronchoscopy is considered the gold standard for foreign body evaluation and practitioners are trained to have a low threshold to evaluate these patients using this procedure [3]. Although both diagnostic and therapeutic, complication including loss of airway control, damaged dentition or gingiva, bleeding, pneumothorax, and failure to recognize pathogens are possible [4].

An extensive amount of research has been completed on the epidemiology, work-up and management of foreign body aspiration in the pediatric population. The likelihood of foreign body aspiration is mostly dependent on 3 tiers of clinical suspicion: a witnessed aspiration event, a positive physical exam for findings including coughing, reduced airflow, and new onset wheezing, and lastly radiologic factors including identification of the foreign body, hyperinflation and unilateral atelectasis [5,6]. In a review of 431 pediatric patients undergoing bronchoscopy for suspected foreign body aspiration, a witnessed

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aspiration event had a positive rate of 87% for foreign body on bronchoscopy [5]. In children without a witnessed aspiration event there is a lot more variability that is dependent on multiple other factors including age, presenting symptoms, and duration of symptoms. A review of 115 pediatric patients undergoing bronchoscopy for suspected FBA showed that an abnormal physical examination was found in 73% of the children with FBA, but was also abnormal in 50% of children without a FBA [6]. In the absence of a witnessed aspiration event and in the absence of a foreign body visualized on imaging, there is not a single presenting symptom or radiologic factor that is specific for FBA.

Children are at risk for complications following foreign body aspiration such as pneumonia and death [7,8]. Although these children are at increased risk of foreign body complications due to decreased ability to protect the airway and decreased airway size, the developmental milestones achieved between a 4 year old and a 4 month old are very different. The Denver Developmental Screening Test is used by pediatricians as a screening tool for motor, cognitive, and personal development. Between the ages of 0–6 months children are typically dependent on a caregiver due to the inability to ambulate and support themselves. Thus, the risk of exploring a foreign body with their mouth is reliant on the presentation of a foreign body. It isn't until the age of 8–12 months that children begin to move independently and it isn't until 12 months that they have fully developed the pincer grasp in which the thumb and forefinger are used to pick up items [9]. Thus, the milestones thought to put a child at risk for foreign body aspiration are not developed until about one year of age. The purpose of this study is to review the incidence of positive bronchoscopy in patients under 12 months being evaluated for aspiration of foreign body after presenting to the emergency department in respiratory distress.

2. Materials and methods

This study was performed at Nationwide Children's Hospital, a tertiary care pediatric medical center in Columbus, Ohio. This study was approved by the Institutional Review Board at Nationwide Children's Hospital. An electronic search was used to create a database between the years of 2008 and 2016. Patients under the age of 12 months who underwent direct laryngoscopy and bronchoscopy (DLB) within 24 h of presenting to the emergency room were included in this study. Chart review was then used to collect data such as age, gender, length of hospitalization, time from ED presentation to DLB, chest x-ray findings, DLB findings, and respiratory viral panel results.

A second database was created to collect the total number of DLBs within 24 h of presentation to the ED for all ages. Charts were reviewed to determine the total number of positive bronchoscopies when evaluated for foreign body aspiration. With this information, the chi-squared test was used to determine the significance of our variables with $P < 0.05$ considered statistically significant.

3. Results

We found that 16 patients under the age of 12 months underwent direct laryngoscopy and bronchoscopy (DLB) within 24 h of presenting to the emergency department to rule out foreign body aspiration (Table 1). In this subset the average age was 8.6 weeks old with an equal ratio of males to females. The average time from ED admission to direct laryngoscopy and bronchoscopy was 13.7 h and the average length of hospital stay was 6.8 days. Of the 16 patients, only one patient was positive for a foreign body in the airway. This patient was 2 months old with a history positive for witnessed oral ingestion of an earring that was dropped into the child's stroller. The patient presented to the ED in respiratory distress and foreign body was confirmed by chest x-ray (Image 1). Therapeutic DLB found the earring in the esophagus, which had penetrated the esophageal mucosa causing posterior tracheal wall compression. The remaining 15 patients had negative DLBs and required further workup.

Table 1
Demographic Information of the 16 patients under the age of 12 months who underwent DLB within 24 h of presenting the ED.

	Age	Gender	Time between ED arrival and DLB	Length of Hospitalization
1	4 weeks	M	1 h	11 days
2	3 weeks	F	1 h	29 days
3	3 months	F	23.5 h	7 days
4	4 months	F	4 h	4 days
5	5 weeks	M	22 h	8 days
6	3 months	M	8 h	4 days
7	4 months	M	23 h	13 days
8	7 weeks	M	2 h	6 h
9	2 months	F	20 h	5 days
10	5 weeks	F	23 h	2 days
11	4 months	M	16 h	7 days
12	5 weeks	F	23 h	3 days
13	2 months	F	18 h	6 days
14	5 weeks	F	11 h	4 days
15[a]	2 months	M	2 h	36 h
16	2 months	M	23 h	4 days

[a] Positive finding on DLB for foreign body aspiration.

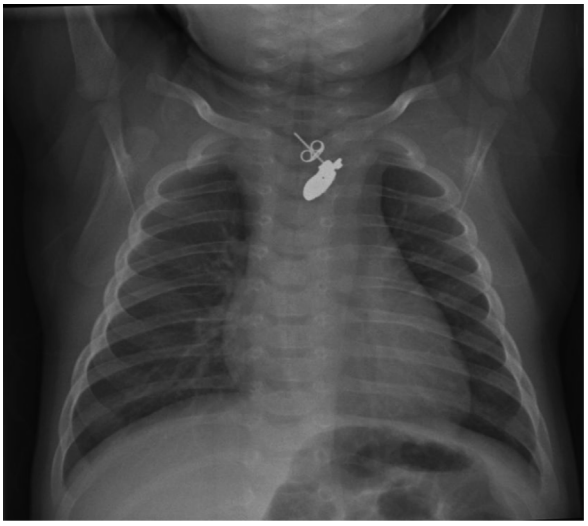

Image 1. Chest x-ray of ingested earring that penetrated the esophageal mucosa causing tracheal wall compression.

Of the 15 patients with negative evaluations using DLB, 14 patients were found to have a structural airway abnormalities such as subglottic narrowing, tracheomalacia, and findings of chronic bronchitis with associated airway edema. 7 of the patients were found to have a respiratory virus such as adenovirus, rhinovirus, or parainfluenza. Prior to DLB, a chest x-ray was completed in eight of the fifteen patients. 3 patients, upon direct laryngoscopy and bronchoscopy, were found to have neck masses by direct visualization with endoscopy or by the preceding physical exam under sedation (Table 2). All three cases were confirmed with neck ultrasonography.

Patient 2 (Table 2) presented to the emergency department as a level 1 trauma with hemoptysis. History by the caregivers stated the infant was left alone for approximately 5 min and when they returned the baby was continuously drooling blood. Physical exam in the emergency department found a posterior pharyngeal laceration concerning for a traumatic foreign body aspiration. Direct laryngoscopy and bronchoscopy was negative for foreign body aspiration, however, showed avulsion to the left tonsil as well as a large pyriform sinus laceration of the right esophageal inlet. Skeletal survey was positive for fracture of a unilateral medial tibial metaphysis. Given the extent of injuries the patient was admitted to the hospital for multiple weeks,