

Original articles

Esophageal and tracheobronchial foreign bodies in infants and children

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Abstract. In an effort to improve the diagnosis and management of children with aspiration or ingestion of foreign bodies we reviewed 100 consecutive cases of esophageal (49) or tracheobronchial (51) foreign bodies occurring over a 6-year period. While the incidence of positive physical findings in the esophageal group was low, the combination of plain and contrast radiography was positive in 96% (47/49). Of the patients with tracheobronchial foreign body, 78% (40/51) had lateralizing signs on physical examination and 80% (41/51) had abnormal inspiratory/expiratory radiographs. Disimpaction of esophageal foreign bodies was carried out using a combination of techniques with 100% success and no complications. All cases of tracheobronchial foreign bodies were managed with the rigid bronchoscope with 98% success (50/51) using a variety of instruments. Complications secondary to the foreign body itself rather than its management were seen in 9 patients, and were often due to a delay in diagnosis. A careful history and physical examination along with appropriate radiographic studies will result in a correct diagnosis in virtually all cases of esophageal and tracheobronchial foreign bodies. A liberal indication for endoscopy using an approach tailored to the particular case will almost always be successful.

Key words: Foreign bodies — Esophagoscopy — Bronchoscopy

Introduction

Foreign bodies of the esophagus and tracheobronchial tree are frequently encountered in the pedi-

atric age group. Reports from the National Safety Council estimate that approximately 600 children die each year from complications related to the aspiration or ingestion of foreign bodies. Under the age of 4 years it is one of the top four causes of accidental death, with a rate approaching 2 per 100,000 children [9], an incidence which has not changed significantly in the last 20 years.

Over the years, a number of instruments and techniques for foreign body extraction have been described. The most significant advance in the safe and successful treatment of esophageal and tracheobronchial foreign bodies, however, has been the development in the 1970s of the Hopkins rod-lens optical system along with fiberoptic illumination [5]. The incorporation of these two advances into the rigid endoscope has resulted in our heavy reliance on this instrument for most foreign body extractions. In order to assess our results with this approach, we have reviewed our experience with 100 consecutive patients with esophageal or tracheobronchial foreign bodies over the 6-year period from November 1979 to September 1985.

Materials and methods

One hundred consecutive patients with foreign bodies of the esophagus or airway treated at the University of Michigan, Mott Children's Hospital, over the 6-year period November 1979–September 1985 were reviewed. There were 49 cases of esophageal impaction and 51 patients with tracheobronchial aspiration. The presenting clinical history, diagnostic evaluation, methods of treatment, and outcome were analyzed in all cases. Initial evaluation of all patients was carried out by senior surgical house staff under the direction of an attending pediatric surgeon. Foley catheter removal of esophageal foreign bodies was performed under fluoroscopy; all endoscopies were performed in the operating room with general anesthesia.

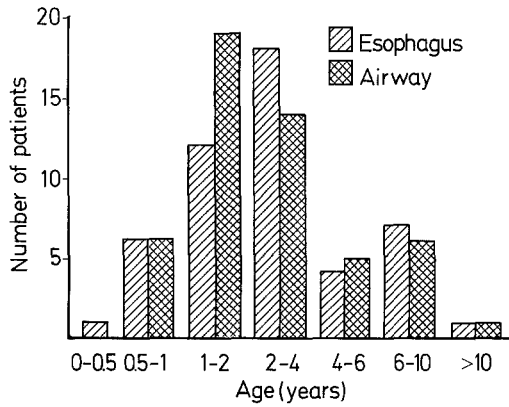


Fig. 1. Age distribution of patients with esophageal and tracheobronchial foreign bodies

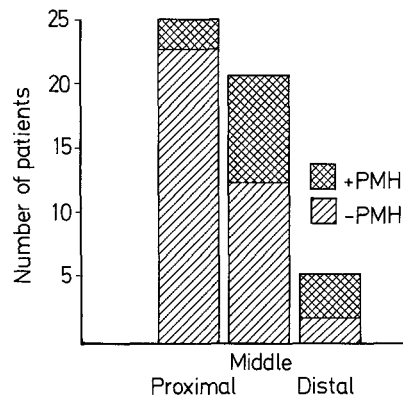


Fig. 2. Location of foreign bodies in the esophagus. PMH = past medical history

Results

Esophageal foreign bodies

Ninety-eight percent of the children were under 10 years of age and 75% were under 4 years of age (Fig. 1). The peak incidence occurred between the ages of 2 and 4.

Thirteen patients (26.5%) with esophageal foreign bodies had a past medical history of predisposing conditions. These were prior esophageal surgery in 10 (7 were treated for esophageal atresia, 2 had undergone a fundoplication, and 1 had multiple recurrent esophageal strictures following caustic ingestion). Three patients had some degree of mental impairment and a history of previous foreign body ingestion.

The distribution of foreign objects found in the esophagus is depicted in Fig. 2. As listed in Table 1, coins constituted the most frequently encountered object impacted in the esophagus. The remainder of the list reflects the great variety of items young children will place in their mouths.

Most cases of esophageal foreign body were associated with a witnessed episode of foreign body ingestion, and thus the time before obtain-

ing appropriate evaluation was generally short. Twenty-nine patients (59.2%) received definitive therapy within the first 24 h following ingestion. In only 8 cases (16.3%) was treatment delayed beyond a week, and in 75% of these patients the wait was attributed to delay in seeking medical attention rather than a delay caused by medical personnel. In the group of patients with a past history of esophageal surgery or documented dysmotility, 4 of 13 (31%) had a delay in treatment of 1 week or more, nearly twice the rate for the series as a whole.

Symptoms and signs associated with esophageal foreign bodies are listed in Table 2. All patients without signs or symptoms had episodes of foreign body ingestion witnessed by another family member, which prompted their visit for medical evaluation. Findings referable to the respiratory tract were found in 3 patients (6.1%), presumably caused by compression of the airway by a large, proximally located foreign body.

Standard chest roentgenograms were performed in 46 cases (93.9%) with a radiopaque object demonstrated in 38 (82.6%) (Fig. 3). Twelve patients underwent an esophageal contrast study,

Table 1. The variety of foreign objects impacted in the esophagus and tracheobronchial tree

Esophagus			Tracheobronchial Tree		
Coins	26	(53.1%)	Food	37	(72.6%)
Food	7	(14.3%)	Peanut	18	(35.3%)
Plastic toy parts	5	(10.2%)	Carrot	6	(11.8%)
Pins, tacks	3	(6.2%)	Popcorn	5	(9.8%)
Endotracheal tubes	2	(4.1%)	Other food	8	(15.7%)
Key ring/chain	2	(4.1%)	Toy parts	6	(11.8%)
Button, hair clip, marble, glass	1 each	(2.0%)	Pins	4	(7.8%)
			Pen parts	3	(5.9%)
			Wood	1	(1.9%)
Total	49	(100%)			
				51	(100%)

Table 2. Clinical findings in foreign body impaction

Esophageal		Tracheobronchial	
History			
Emesis	20 (40.8%)	Cough	34 (66.7%)
Dysphagia	16 (32.7%)	Wheezing	26 (51.0%)
Odynophagia	7 (14.3%)	Dyspnea	15 (29.4%)
Choking	7 (14.3%)	Fever	11 (21.6%)
Cough	6 (12.2%)	Cyanosis	5 (9.8%)
Drooling	4 (8.2%)	Emesis	3 (5.9%)
Gagging	4 (8.2%)	Pain	3 (5.9%)
Foreign body sensation	3 (6.1%)	Pneumonia	3 (5.9%)
None	7 (14.3%)	None	3 (5.9%)
Physical findings			
Drooling	4 (8.2%)	Decreased breath sounds	26 (51%)
Gagging	3 (6.1%)	Wheezing	23 (45.1%)
Respiratory symptoms	3 (6.1%)	Dyspnea	9 (17.6%)
Emesis	2 (4.1%)	Fever	5 (9.8%)
None	39 (79.6%)	Rhonchi	5 (9.8%)
		Cough	3 (5.9%)
		None	4 (7.8%)
		Lateralizing signs	40 (78.4%)

which revealed evidence of the foreign body in 10 (Fig. 4). Included in these 12 were the 3 patients who did not at first have a plain chest film as well as all of those with initially normal chest X-rays. Thus, the overall accuracy of radiologic diagnosis for esophageal foreign bodies was 96%, representing 47 of 49 patients. The 2 remaining patients had documented pre-existing esophageal problems in addition to a presenting history strongly suggestive of impacted foreign material.

Removal of the foreign body by the Foley catheter technique was attempted in 23 patients (46.9%), all of whom had impacted coins or other smooth objects. This was successful in 13 (56.5%).

The average duration of impaction in the group in which this method was successful was 6.7 h. However, in those cases where Foley catheter extraction was not successful the average duration of impaction was 5.2 days, even after 1 patient with a greater than 6-month delay is excluded. All successful Foley catheter extractions were performed within the first 24 h, and for this early treatment group the success rate was 76.5%. Patients with failed Foley dislodgement and all those in whom this method was not attempted were treated under general anesthesia using a direct laryngoscope (7) or rigid esophagoscope (27).

In all cases the offending object was success-

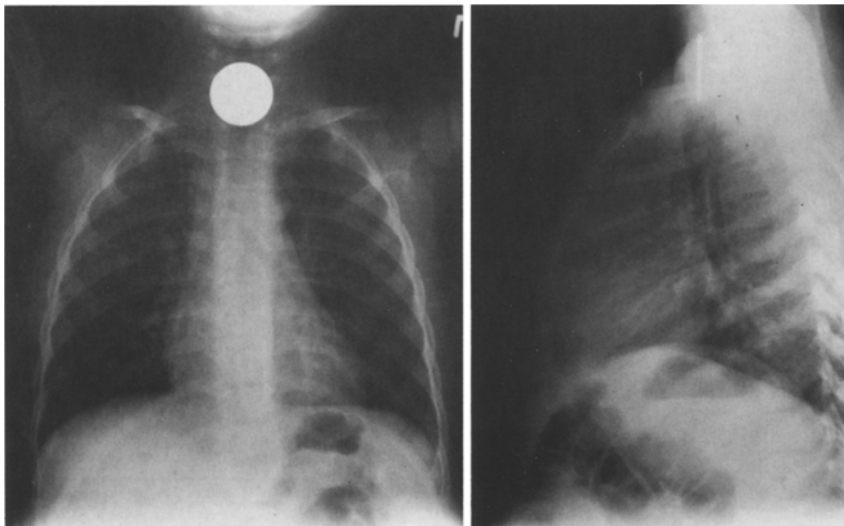


Fig. 3. Radiopaque foreign body (coin) in the proximal esophagus

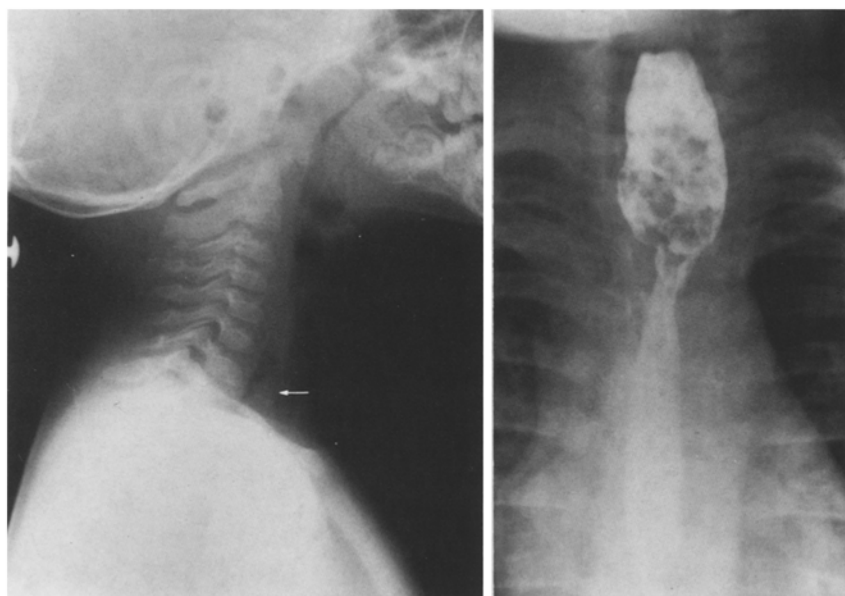


Fig. 4. Radiolucent foreign body (food) in the esophagus (*left*) *Arrow* shows air in esophagus above food bolus (*right*) Esophagogram readily demonstrates foreign body

fully disimpacted without complication. Forty-one objects were retrieved (83.7%) while 8 (16.3%) were advanced into the stomach and later passed without incident. No patient required laparotomy or thoracotomy.

All patients treated using the Foley technique were discharged home from the emergency area immediately. The remainder, who were treated with rigid endoscopy, were observed briefly in the hospital with an average stay of 1.5 days.

Tracheobronchial foreign bodies

The age distribution of patients with tracheobronchial aspiration of a foreign body is also seen in Fig. 1. Seventy-five percent of patients were 4 years of age or younger, with 98% presenting in the 1st decade of life. The peak incidence is slightly lower than that for the esophageal foreign body group, falling into the 1–2-year age group. In contrast to the esophageal foreign body group, no patient with foreign body aspiration had a predictive or predisposing history. The spectrum of offending objects and their distribution in the tracheobronchial tree is represented in Table 1 and Fig. 5 respectively. Peanuts constituted the largest single group (35.3%) and were particularly troublesome due to the accompanying inflammatory reaction and their hygroscopic characteristics, which cause them to become soft and thus require piecemeal removal. In 24 cases (47.1%) of foreign body aspiration, treatment was carried out within 24 h, while in 14 cases (27.5%) treatment was delayed for 7 or more days. Ten pa-

tients in the latter group were evaluated by medical personnel during the initial week following aspiration and were treated for presumed respiratory tract infections or bronchospasm.

The signs and symptoms at presentation are listed in Table 2. It was unusual for a patient to have no complaint or negative physical findings. In 40 cases (78.4%) the physical findings, typically wheezing or decreased breath sounds, were localized to one hemithorax or lobar region. This finding alone should alert the examiner to suspect foreign body aspiration in this young age group.

When tracheobronchial foreign body aspiration is suspected we routinely obtain inspiratory/expiratory chest roentgenograms, or bilateral decubitus views in patients not old enough to cooperate. The chest X-ray was abnormal in 41 cases (80.4%) with visualization of a radiopaque foreign

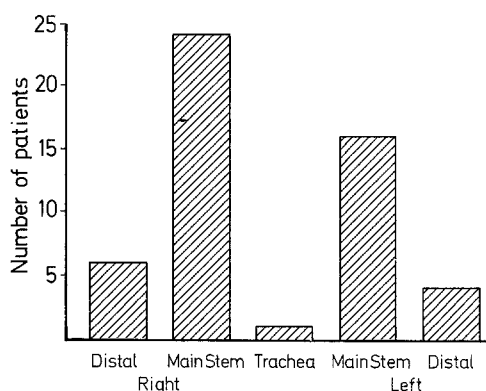


Fig. 5. Distribution of foreign bodies in the tracheobronchial tree

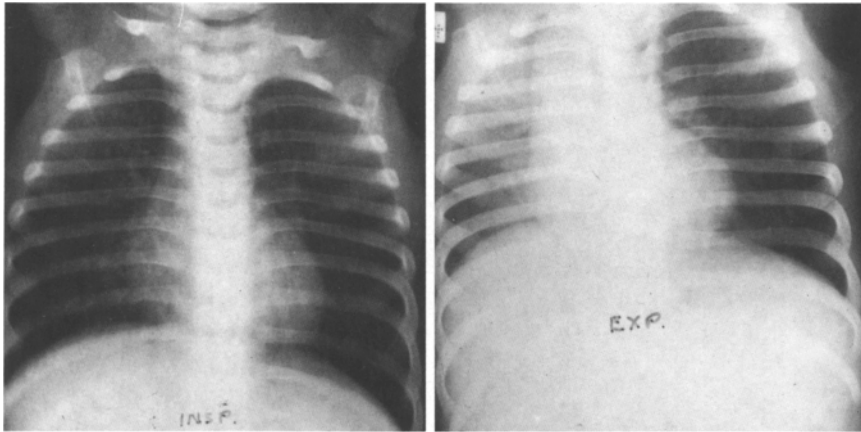


Fig. 6. Inspiratory/expiratory chest X-ray demonstrating air trapping on the *left side* during expiration

body in only 5 (9.8%). Air trapping (Fig. 6) was the most common radiologic finding (54.9%) followed by an abnormal density (17.6%). Of the 10 patients with normal radiographic studies, all had an abnormal physical finding and 9 had a witnessed episode of aspiration.

All 51 patients with demonstrated or suspected tracheobronchial foreign bodies underwent rigid bronchoscopy under general anesthesia, with successful retrieval in 50 cases (98%). In the remaining case a straight pin had migrated beyond the reach of the instruments and required removal via thoracotomy. The pin was extruded manually through the lung parenchyma and removed without the need for bronchotomy; the patient recovered uneventfully. One or more of various grasping forceps were employed to remove the foreign body in 45 patients (88.2%). The Fogarty catheter technique [8, 14] was used in 8 selected cases (15.7%) while a suction device was used in 11 (21.6%). Twelve cases (23.5%) required a combination of instruments, emphasizing the ingenuity often needed in achieving successful removal.

Complications occurred in 9 patients. There were 4 requiring treatment for uncomplicated pneumonia, 3 of whom had evidence of pneumonia preoperatively or had a long duration of foreign body impaction. One patient had a foreign body undiagnosed for 18 months and experienced recurrent pneumonias leading to bronchiectasis, and eventually required lobectomy after referral to our institution. Four other patients developed transient episodes of wheezing, isolated temperature elevation, or cough postoperatively which could be related to instrumentation or anesthesia. Two were managed as outpatients; the remainder were hospitalized, with an average stay of 2.1 days.

Discussion

Impaction of foreign objects in the esophagus and airway is predominantly a problem of the pediatric age group [3, 4, 6, 7, 10, 11, 15]. There are a number of factors that predispose infants and children to foreign body aspiration or impaction. Children frequently place an assortment of objects in their mouths in the process of exploring their environment or as an imitation of adult behavior. A number of food items are difficult for a child under age 5 to chew and can become lodged in an abnormal or normal esophagus. Children may be allowed to walk about and play while eating, putting them at risk for tracheobronchial aspiration. Prevention is the most important goal.

As seen in this series and others [3, 4, 7, 10], a history of underlying illness or esophageal abnormality may often be encountered in patients with esophageal impactions. The distribution of foreign objects in the esophagus in our entire series was notably affected by this subgroup of patients (Fig. 2). In the subset with no significant prior history, two-thirds of the foreign objects impacted in the proximal esophagus, a finding similar to that reported in earlier series [4].

We found that prolonged delays prior to treatment of esophageal foreign bodies did not adversely affect the outcome, as our overall complication rate was extremely low. It is important to note, however, that 4 of 8 patients who had delayed management had undergone prior esophageal surgery and almost certainly had abnormal esophageal motility resulting in some baseline swallowing difficulty. In these patients, symptoms related to an impacted foreign body could be easily overlooked due to the fact that the associated symptoms were very similar to the patient's typical

state. Instructing families of such patients to be alert for even subtle changes in complaints or behavior related to swallowing and feeding may result in earlier diagnosis and treatment in this group.

Given the frequency of symptoms and signs found in cases of tracheobronchial foreign body aspiration, it was surprising to find that 27.5% of patients had a delay in treatment of 7 days or more. Such delay in diagnosis of foreign body aspiration is not uncommon, especially when the episode itself is unwitnessed, as documented by a number of authors [1, 6, 12, 15]. It is significant that 71% of these patients had been seen at a medical facility during the initial week postaspiration and were misdiagnosed. While the episode of aspiration may be unrecognized and asymptomatic in a small percentage of cases, and standard inspiratory X-rays alone may be normal in up to 40% of cases [6, 10], we found in our series that the combination of history, physical examination, and appropriate inspiratory and expiratory radiographs could be diagnostic in 100% of cases. The finding of lateralizing signs in 78.4% of patients on physical examination emphasizes the need to initiate a vigorous search for possible foreign body aspiration whenever such signs are found in this age group.

The technique of using a Foley catheter to dislodge an esophageal foreign object was initially described in the late 1960s [2, 13] and its success has been emphasized in recent reviews [3, 4, 10]. Our experience with the Foley catheter technique for removal of esophageal foreign objects, essentially coins, was not as successful as that reported by others. We found that the duration of impaction affected the success of this method, with a 76.5% success rate for a duration less than 24 h but no success for delays greater than 24 h. We also found that this technique was less effective in removing objects in the upper cervical esophagus. Due to the greater diameter of the esophagus at that level, the Foley balloon was often not able to distend it and dislodge the foreign body. Our rate of success for objects in this location was 50% compared to a 75% rate for midesophageal objects. In this group of patients, we therefore recommend initial management by direct laryngoscopy under sedation, an approach we found highly successful.

At our institution rigid endoscopy remains the mainstay for treatment of all tracheobronchial and most esophageal foreign bodies. While flexible endoscopy is gaining increased popularity, the currently available rigid systems offer an increased margin of patient safety, particularly in airway management, and superior visibility. The

role of both types of instrumentation in the management of tracheobronchial foreign bodies is well summarized by Wood and Gauderer [16].

In summary, the basic principle of a careful history and physical examination along with a few appropriate radiologic studies is very effective in reaching a correct diagnosis. In cases of esophageal foreign body, the Foley catheter technique should be employed routinely in cases presenting within 24 h of impaction with the exception of high cervical objects, which can be better managed by direct laryngoscopy. Based on our experience, we recommend a liberal use of esophagoscopy in treating patients with impactions present longer than 24 h. In the bronchoscopic management of tracheobronchial foreign bodies, we have found that adaptability in the choice of instruments to each specific case is the key to a safe and successful outcome.

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