Removal of esophageal foreign bodies:

A review for emergency physicians

Gregory P. Conners, MD, MPH, FAAP

Departments of Emergency Medicine and Pediatrics

University of Rochester School of Medicine and Dentistry

Golisano Children's Hospital at Strong

Rochester, NY
**Introduction**

You are working in the emergency department, and are faced with a pediatric patient with an esophageal foreign body. Perhaps it was a witnessed, recent ingestion of a common object, like a coin; this is the most common scenario.\(^1\) Perhaps an esophageal foreign body was discovered in the course of a work-up of drooling, a cough, fever, wheezing, or hematemesis. A metal detector may have been used to screen for a metal object in the esophagus. Most likely, the presence of the foreign body was discovered or confirmed by radiography, either with plain films alone, or possibly with a contrast study. You are now faced with management decisions.

Children with esophageal foreign bodies are at risk for a variety of health problems. Vomiting with secondary foreign body aspiration is often discussed but rarely if ever seen in general a child with a normal sensorium. Complete or near esophageal obstruction may lead, however, to pooling and potential aspiration of secretions or food, and is uncomfortable. Persistent esophageal foreign bodies, even relatively smooth ones, create esophageal inflammation.\(^2\) This, in turn, may lead to ulceration, fevers, pain, and, ultimately, scarring. Children may refuse or limit food intake, leading to weight loss or failure to thrive.\(^3\) Although some foreign bodies remain localized within the esophagus, even for years, others will migrate elsewhere.\(^2,^4\) Some will become localized within the mediastinum, and may lead to mediastinitis. This may cause unexplained fevers or compression of vital structures within the chest, leading to respiratory, nervous, or vascular complications.\(^5\) Migration to the bronchi or lung can lead to pneumonia and other pulmonary complications. The most fearsome, although rare, complication is migration to the aorta, with creation of an aortoesophageal fistula.\(^6\) These typically cause a small "sentinel" bleed, followed soon after by massive exsanguination, usually fatal. Finally, some foreign bodies may cause injury due to their size, shape, or composition, as noted below.

The goal of management of esophageal foreign bodies therefore should therefore be prevention of complications by removing the object from the esophagus (in some cases, allowing or causing its passage into the stomach), ideally in as cost-effective a manner as possible. Costs to be considered include those of a financial nature as well as the important but less-quantifiable costs of discomfort, anxiety, disruption of family life, and the like.

There are four typical approaches to management of esophageal foreign bodies. Endoscopic foreign body removal is the most commonly selected method. Withdrawal using a Foley (or other balloon) catheter or advancement into the stomach with a bougie (bougienage) are also well-described. Since some esophageal foreign bodies will pass into the stomach without an intervention, watchful waiting for spontaneous passage is another appropriate management
The four principal management strategies

Endoscopy (esophagoscopy) is the most commonly used method for removal of esophageal foreign bodies in children, at least in the United States. Endoscopic withdrawal of a foreign body using grasping forceps is generally the procedure of choice for removal of esophageal foreign bodies with any important associated degree of complication, as discussed below. Endoscopy for foreign body removal is well-described. A radiograph should be obtained just before the procedure, to confirm the continued presence of a radiopaque object. Either rigid or flexible endoscopy may be used. Gastroenterologists, general and pediatric surgeons, and otolaryngologists all report success. Although typically performed in an operating room under general anesthesia, endoscopic foreign body removal under sedation in the emergency department by experienced personnel can be effective and safe. No matter how it is done, endoscopy has several advantages. It allows the endoscopist the ability to closely examine the esophagus and detect important injuries, other pathology, or unsuspected additional foreign bodies. It is nearly 100% successful, and rarely if ever causes complications that could have been avoided by another removal method. The principal disadvantages of endoscopy are its invasiveness and its cost. Emergency department visit costs, operating and recovery room costs, surgeon and anesthesiologist costs, radiographs, and a brief hospital stay all add up to about US $3000, and at least one to two days’ worth of lives (patient and family) disrupted.

The Foley catheter method involves passage of the uninflated balloon end of a Foley catheter into the esophagus beyond a foreign body, inflation of the balloon, and gentle withdrawal of the object into the mouth, where it is removed or spat out by the patient. The procedure is typically performed with fluoroscopic guidance, with an unsedated patient placed prone on a table. A slightly head-down position may help to prevent aspiration of the foreign body. The balloon may be inflated with dilute contrast to enhance its fluoroscopic visibility. Occasionally, an object may be either specifically advanced into the stomach, or may inadvertently pass into the stomach; this is considered a successful removal. Various reports suggest that the success rate of the Foley catheter method is over 90%, and over 95% successful when its use is restricted to patients meeting strict criteria, as noted below. Important complications are unusual.
unsuccessful, endoscopy is recommended; use of multiple catheters simultaneously or performance of several removal attempts has been associated with complications and should probably be avoided.\textsuperscript{11}

**Bougienage** is the passage of a lubricated esophageal dilator through the esophagus into the stomach of a restrained, upright child, with the intent of advancing a foreign body into the stomach. It too may be performed under fluoroscopic guidance, but its safe and effective use in the Emergency Department with a simple post-procedure radiograph of the chest and upper abdomen has been described.\textsuperscript{13} When used in a well-selected population, as noted below, bougienage is nearly always successful; complications are unusual.\textsuperscript{9,10,13,14} If unsuccessful, endoscopic removal is usually performed.

**Spontaneous passage** of esophageal foreign bodies, often while a child is awaiting a removal procedure, has been described for many years.\textsuperscript{15} In recent years, specific selection of observation of a child to allow for spontaneous passage of a coin from the esophagus into the stomach as a management strategy has been adopted.\textsuperscript{16,17} Although a few children will spontaneously pass upper or middle esophageal coins, spontaneous passage is most likely when the coin is initially lodged in the lower esophagus.\textsuperscript{15,16,18} A specific observation period, such as 12-24 hours following ingestion, is most commonly used, after which a removal procedure is selected. Criteria for selecting an observation period, the most appropriate setting (ED, in-patient, home), and the utility of this method for managing children with non-coin esophageal foreign bodies have not been tested. When used in adults, glucagon enhances passage of some esophageal foreign bodies to the stomach; it has not, however, proved useful in children.\textsuperscript{19} Giving food or liquids to affected children may enhance the probability of passage into the stomach, but may also potentially delay or complicate a removal procedure; data are lacking.

### Issues when selecting strategies

There are several specific issues to be considered when determining how to best proceed with management of esophageal foreign bodies. These include a variety of patient and family issues, foreign body issues, local practice and resources, and cost-comparison issues.

**Patient and family issues:**

*Time within the esophagus:* The presence of esophageal mucosal inflammation at the site of foreign body impaction makes spontaneous passage into the stomach unlikely, and increases the risk of esophageal injury when removing foreign bodies. The risk of procedure failure, and
probably of complication, in the presence of inflammation is greater when using the Foley catheter or bougienage methods, given their less precise nature.\textsuperscript{11,20} Research on esophageal coins suggests that significant esophageal inflammation only rarely occurs in the first 24 hours after ingestion.\textsuperscript{21,22} Thus, children who ingested relatively smooth foreign bodies less than 24 hours ago are considered good candidates for any of the above-mentioned management methods. Many believe that the first 48-72 hours is still a safe period for Foley catheter removal, while bougienage is usually performed only within the first 24 hours after ingestion.\textsuperscript{11,13} Spontaneous passage is unlikely after the first 24 hours.\textsuperscript{16,18} Beyond the initial period, endoscopy is generally preferred as a removal method. When the timing of the foreign body ingestion is unknown (typically an unwitnessed ingestion), it is generally safest to assume that the foreign body has been there long enough to cause significant inflammation, and to proceed with endoscopic removal.

\textit{Stomach / lower GI tract abnormalities:} Although the primary aim of the Foley catheter method is to withdraw an esophageal foreign body into the esophagus, it is also considered successful when the foreign body is advanced into the stomach.\textsuperscript{11} This is, of course, the express purpose of bougienage and of watchful waiting for spontaneous passage. This is quite safe and acceptable for the large majority of children, who will go on to pass the object in their stool. Children with pre-existing gastric or lower gastrointestinal tract disorders, however, are at increased risk of a second complication, such as impaction, at the site of abnormality. In these children, expressly removing esophageal foreign bodies via endoscopy may prevent a more invasive removal procedure, such as surgery, later. When in doubt, these patients should be discussed with a specialist.

\textit{Esophageal abnormalities:} Children with previous esophageal surgery or other abnormalities are at increased risk of esophageal foreign body lodgment.\textsuperscript{23} If a foreign body becomes lodged, it is usually advisable to discuss removal with a physician knowledgeable about the patient’s anatomy and management issues. It is worth noting that Foley catheter removal in patients with underlying esophageal abnormalities who are otherwise good candidates for this procedure is typically successful; a success rate of 83\% has been reported from one center.\textsuperscript{11}

\textit{Symptoms:} The majority of children with esophageal foreign bodies have associated signs or symptoms, such as foreign body sensation, drooling, or gagging.\textsuperscript{16} However, asymptomatic children with esophageal foreign bodies have been repeatedly described.\textsuperscript{16,24,25} Some of these foreign bodies have been long standing; these children may have grown accustomed to the presence of the foreign body. Others, however, have ingested their foreign body quite recently. It has been suggested, based on very limited data, that asymptomatic children with acute
esophageal foreign body impaction may have a more benign natural history than those with discernible symptoms. \textsuperscript{26} At any rate, these children are more likely to tolerate a period of watchful waiting to allow for spontaneous passage of their foreign bodies. Children with severe symptoms, such as inability to swallow secretions or marked discomfort, should probably be more urgently managed.

\textit{Location of the foreign body:} Esophageal foreign bodies tend to be located in one of three typical locations. About 70\% are located in the upper esophagus, seen on a chest radiograph as between the clavicles. About 10\% are in the middle esophagus, seen on a chest radiograph at the level of aortic arch or the carina, while about 20\% are at the lower esophageal sphincter, just above the stomach bubble on a chest radiograph.\textsuperscript{16,24,18} Foreign bodies that lodge at other, non-typical locations often do so at the site of underlying esophageal pathology. In a child without a history of esophageal pathology, this may be the tip-off to a problem. In general, children with foreign bodies at unusual sites in the esophagus should likely undergo endoscopy, especially if there is no history of esophageal pathology. This will allow inspection of the area by the endoscopist, as well as removal of the foreign body.

The location within the esophagus also heavily influences the probability of success of the watchful waiting approach. While most esophageal coins lodged in the lower esophagus in otherwise normal children will pass spontaneously into the stomach, fewer than one-third will spontaneously pass from the upper or middle esophagus.\textsuperscript{9,15,18} Thus, some physicians will opt for active removal of blunt objects in the upper or middle esophagus, while choosing watchful waiting for similar objects in the lower esophagus.

\textit{Family preferences:} When treatment options are discussed with a parent or caretaker, some will have strong opinions about removal methods that may not match your own. This may be due to fears, incomplete understanding, other value systems, or outside pressures. In particular, when families prefer endoscopy over another method, I tend to accede to their requests, even if I believe watchful waiting or another removal method may be more appropriate.

\textit{Circumstances of the ingestion:} Esophageal foreign bodies may be the result of child abuse, and have contributed to the death of a child.\textsuperscript{27} Alternatively, foreign body ingestion could be the result of under-supervision, especially if recurrent. As always when dealing with children, it is important to keep the possibility of abuse or neglect in mind, and making the appropriate referrals to protective authorities when it is indicated.
Foreign body issues:

Nature of the foreign body: Fairly small, relatively smooth foreign bodies are the most amenable to non-endoscopic removal methods; indeed, many will pass into the stomach spontaneously in the first 24 hours after their ingestion. Foreign bodies that are very large (defined by some as > 6.5 cm in any dimension), however, even if they do pass into the stomach, might not pass further, although it is not uncommon for even surprisingly large objects to traverse the entire gastrointestinal tract without difficulty. Thus, endoscopy is typically selected for removal of large objects from the esophagus, to minimize the risk of their inadvertent passage into the stomach and a potential second procedure later. Potentially toxic foreign bodies, such as many medications, should probably also be removed endoscopically, to avoid inadvertent passage into the stomach and the associated potential toxicity. Button batteries, even those that are “dead”, usually create an electric current in the moist esophagus sufficient to damage the mucosa in a matter of a few hours. These should be removed without delay, usually endoscopically, so that the mucosa may be inspected for injury. Very sharp esophageal objects, or those with sharp points, present a risk of causing esophageal injury during their removal, and should also be removed endoscopically. Some very small objects will adhere to the moist esophageal mucosa; although these may become dislodged if the patient is fed, endoscopy should probably be selected if a removal procedure is required.

Likelihood of multiple foreign bodies: Although the large majority of children with an esophageal foreign body have only one impacted object, an occasional child will have multiple esophageal foreign bodies. These may be in different areas or even adherent to each other. Radiographs performed in different planes, such as AP and lateral chest radiographs, help identify such children. Children with multiple esophageal foreign bodies present a special problem. If any of the objects is best removed with endoscopy, there is no role for removal of some of the objects via another method. Spontaneous passage of all of them is unlikely. Although multiple smooth foreign bodies may be carefully removed with bougienage or a Foley catheter, many practitioners would opt for endoscopy. In fact, many only perform bougienage or Foley catheter removals on patients with witnessed, single smooth foreign body ingestions, to minimize the risk of encountering unexpected potentially sharp second foreign bodies that may be radiolucent, such as a sharp piece of plastic. Although unexpected second esophageal foreign bodies are occasionally encountered when performing removal procedures on children meeting those criteria, they are rarely problematic.
Local practice and resource issues:

Although children may meet all the usual criteria for bougienage or Foley catheter removal, these techniques should only be used by those familiar with the procedures and their complications. Since airway compromise is an important potential complication, familiarity with management of pediatric airway emergencies is crucial. The potential for esophageal injury suggests the importance of having made previous backup arrangements with such specialists as otolaryngologists and cardiothoracic surgeons. In general, administrative support, such as a credentialing process, for these procedures should be sought well before they are performed.

Formal comparison of methods:

Prospective trials comparing the various methods of esophageal foreign body removal are notably absent from the peer-reviewed literature. Instead, there are numerous case series describing experiences with each method, usually focused on removal of esophageal coins. These generally conclude with a recommendation in favor of use of the described method. This suggests that each removal strategy, when used in appropriately selected patients, is safe and effective.

In two recent studies, authors rigorously combined results from published case series, along with cost/charge data from their home medical centers, to compare expected costs of the various methods of removal of esophageal coins. The specific methods of the two studies differed, but their principal conclusions were consistent. Both found that, in appropriate patients, non-endoscopic removal methods (Foley catheter or bougienage methods) led to considerable cost savings over endoscopy. All methods had low complication rates. Watchful waiting for spontaneous passage into the stomach was superior to all, assuming a spontaneous passage rate of at least 23%: this is clearly met for coins in the lower esophagus, and may apply to other foreign bodies and esophageal locations as well. These studies have important limitations, most notably publication bias in the data obtained reported in the case series and an inability to measure non-financial costs. They do, however, suggest that use of non-endoscopic removal methods in selected patients, with endoscopy used for failed procedures, may be superior to endoscopy as a primary removal strategy. They also provide important preliminary data and appropriate justification for investigators planning prospective studies.

Potentially more useful but as yet unpublished are analyses of a three-step strategy for those children meeting pre-determined criteria: watchful waiting for spontaneous passage for some well-defined period, perhaps twelve to twenty-four hours, followed by bougienage or Foley
catheter removal, with endoscopy for those whose removal procedure is unsuccessful. Such an approach has the potential to maximize cost-effectiveness while minimizing invasiveness.\textsuperscript{32}

Other novel approaches, such as technologic advances, may make current removal methods less relevant. For example, successful, safe, and rapid upper esophageal coin removal using a rubber catheter-covered grasping endoscopic forceps, dubbed a “penny pincher,” with fluoroscopic guidance was recently described.\textsuperscript{33}

**Follow-up**

Esophageal foreign bodies in children are not typically associated with esophageal pathology. Thus, routine follow-up esophagrams or other studies are not usually indicated. One obvious advantage of endoscopy is that it allows visualization of the esophagus, which may identify the unusual child with unsuspected, significant underlying pathology. As discussed above, children who have had foreign bodies lodged in atypical esophageal locations in the absence of known esophageal abnormalities should probably undergo evaluation for esophageal pathology. Children with recurrent esophageal foreign bodies should also undergo evaluation, especially if foreign bodies become lodged at the same location in the esophagus. Psychological evaluation may also be indicated.\textsuperscript{34} Children with esophageal foreign bodies in addition to other signs or symptoms suggesting other pathology, such as hoarseness or chronic cough, should probably also be referred for evaluation.

Children whose foreign bodies have advanced into the stomach may still suffer complications, although the large majority of such foreign bodies will pass through the remainder of the gastrointestinal tract without difficulty. Those with pre-existing gastrointestinal abnormalities are at highest risk, and should be discussed with a specialist. All others (and their parents) should be instructed to return for re-evaluation should the patient develop vomiting, abdominal pain, fever, bleeding, or other symptoms suggesting such complications as intestinal obstruction or peritonitis. Of some interest is what to do with the child who has a quarter or another relatively large object in the stomach. The utility of stool screening or routine follow-up radiographs or metal detector scans of such “high-risk” children has not been formally investigated. Although most will pass them without complication, some children will retain the object long enough to raise concerns it will never pass, usually several weeks or longer. If a retained gastric foreign body is recognized, it seems likely that eventually the child will develop a stomach ache, which may or may not be related to the presence of the foreign body, and be referred for a removal procedure.
Conclusions and Recommendations

Esophageal foreign bodies should be removed, or allowed to pass from, the esophagus well before complications arise. Removal within a 24-48 hour time period following ingestion is probably safe. Incidentally-found esophageal foreign bodies should be promptly removed via endoscopy. Endoscopic esophageal foreign body removal is the national standard, against which all other strategies for management should be measured. It is the removal method of choice for nearly all esophageal foreign bodies with any sort of complication. However, many esophageal foreign bodies of childhood occur without complications. Research to date, albeit with several limitations, suggests that, for healthy children with acutely swallowed, uncomplicated, smooth esophageal foreign bodies, the Foley catheter and bougienage removal methods are safe and effective, and offer large cost savings over endoscopy. Watchful waiting for spontaneous passage of a foreign body is clearly very effective and probably the method of choice for managing healthy children with coins acutely lodged in the distal esophagus; it is less clearly superior in other scenarios.

A great deal of research is still needed. The most obvious and potentially valuable is a prospective trial comparing cost-effectiveness of the principal strategies of removal of esophageal foreign bodies. Use of observation for spontaneous passage as a management strategy could be improved by determining optimal waiting times, the extent to which food and drink make spontaneous passage likelier versus delaying a removal procedure, and its role in management of asymptomatic esophageal foreign bodies. A prospective comparison of follow-up strategies may help improve post-removal care as well.
References

12 Harned RK, Strain JD, Hay TC, Douglas MR. Esophageal foreign bodies: safety and efficacy of Foley catheter extraction of coins. AJR 1997;168:443-446.