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Review Articles

Foreign Body Ingestion in Children: Urgency of Management

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Abstract

The majority of foreign body ingestions occur in children between the ages of six months and three years. Most cases are brought to medical attention by their parents because the ingestion was witnessed or reported to them. Commonly ingested objects include coins, button batteries, toys, toy parts, magnets, safety pins, screws, marbles, bones, and food boluses. Many of the children are asymptomatic or have transient symptoms at the time of the ingestion. A careful history and physical examination are the keystones in diagnosing an esophageal foreign body and to the prevention of its complications. Imaging can be used to confirm the findings and to localize the site of the foreign body. Clinical management focuses on identifying and treating the cases at risk for complications, which depends on the location and type of foreign body. Timing of removal depends on nature of ingested object and signs & symptoms of the airway/intestinal obstruction. Flexible endoscopy for most foreign body extractions is preferred.

Key words: *Children, Foreign bodies, Management.*

Introduction

The majority of foreign body ingestions occur in children between the ages of six months and three years. Most cases are brought to medical attention by their parents because the ingestion was witnessed or reported to them. Many of the children are asymptomatic or have transient symptoms at the time of the ingestion. Clinical management focuses on identifying and treating the cases at risk for complications, which depends on the location and type of foreign body.

More than 50% of cases are children aged 5 years or less, and most are boys. The ingestion of the foreign body is not generally voluntary, except for neurologically impaired or psychiatric patients and youngest siblings.

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Epidemiology and Pathophysiology

The majority of foreign body ingestions occur in children between the ages of six months and three years[1]. Ingestion of multiple foreign objects and repeated episodes are uncommon occurrences and usually occur in children with developmental delay or behavioral problems[2]. Fortunately, most foreign bodies that reach the gastrointestinal tract pass spontaneously. Only 10 to 20 percent require endoscopic removal, and less than 1 percent require surgical intervention[3].

Common foreign bodies — Commonly ingested objects include coins, button batteries, toys, toy parts, magnets, safety pins, screws, marbles, bones, and food boluses[4].

Coins – Coins are by far the most common foreign body ingested by children[5].

Button batteries – The number of ingestions of disk or button batteries has increased with expanded use of button batteries in household and recreational products. Serious sequelae (eg, esophageal burn, perforation, or fistula) occurs in about 3 percent of all button battery ingestions. In addition to direct pressure necrosis, contact of the flat esophageal wall

with both poles of the battery conducts electricity, resulting in liquefaction necrosis and perforation of the esophagus. Retained batteries also can cause problems through leakage of caustic material (generally batteries contain a heavy metal like mercury, silver, lithium, and a strong hydroxide of sodium or potassium)[6]

Sharp objects – The most common sharp-pointed objects ingested by children are straight pins, needles, straightened paper clips and fish bones; these represent 10 to 15 percent of swallowed objects[4]. Sharp objects have a high risk of perforation (15 to 35 percent). When lodged in the hypopharynx, they can cause a retropharyngeal abscess. Ingested toothpicks and bones are likely to perforate[7] .

Food impaction-In children presenting with a food impaction, there is a higher incidence of underlying esophageal pathology (strictures, achalasia, web or ring, or esophageal motility disorders) as compared with children with other esophageal foreign bodies[8]. Reflux esophagitis and eosinophilic esophagitis also predispose to food impaction.

Magnets – With the increasing use of small magnets in toys and household items, ingestion of magnets has become a serious health hazard in children. Many of the children with complications from multiple magnet ingestion had underlying conditions such as developmental delay or autism[9,10].

Superabsorbent polymers – Toys and household products made of superabsorbent polymers present a risk for bowel obstruction if ingested. These objects can expand 30 to 60 times in volume when hydrated[4].

Anatomical Considerations

The vast majority of foreign bodies pass through the entire gastrointestinal tract without any problem. Indeed, only 10 to 20% will become impacted. The most frequent localization of impaction is the cervical esophagus. However, it can also occur in the medial and distal parts of the esophagus. When foreign bodies have passed through the esophagus, 95% will be spontaneously eliminated in 4 to 6 days, sometimes longer (3–4 weeks). If they pass through the esophagus, they can become lodged in the pylorus, genu inferius of the duode-num, or ileocecal valve or on acquired or congenital stenosis. Children presenting with food bolus impaction are particularly likely to have underlying esophageal pathology directly responsible for the impaction[4].

Clinical Manifestations

Most children with esophageal foreign bodies are brought to medical attention by their parents because the ingestion was witnessed or reported to them [11]. In these settings, they often are asymptomatic. When symptoms do occur, they are often related to the location of the foreign body:

Esophagus – Patients with an esophageal foreign body may be asymptomatic, or may present with refusal to eat, dysphagia, drooling, or respiratory symptoms including wheezing, stridor, or choking. Older children may be able to localize the sensation of something stuck in the neck or lower chest, suggesting irritation in the upper or lower esophagus, respectively. Longstanding esophageal foreign bodies may cause weight loss or recurrent aspiration pneumonia, due to decreased caloric intake and poor handling of oral secretions, respectively[12]. They also can damage the mucosa and lead to strictures, or erode the esophageal wall, creating a fistula with the trachea or other nearby structures. Sharp objects may perforate the esophagus, resulting in neck swelling, crepitus, or pneumomediastinum[1].

Stomach and intestines – Objects that reach the stomach are typically asymptomatic, unless they are large enough to cause gastric outlet obstruction, which could present with vomiting and/or feeding refusal[13]. In true gastric outlet obstruction, symptoms include marked, non-bilious vomiting and gastric distension

Evaluation

A careful history and physical examination are the keystones in diagnosing an esophageal foreign body and to the prevention of its complications. Imaging can be used to confirm the findings and to localize the site of the foreign body. The diagnostic steps and treatment depend on the patient's symptoms, the shape and location of the foreign body, whether it is radio-opaque, or whether it has magnetic properties[12].

History and physical examination

Airway and breathing should always be examined first.

- Examination of the neck may reveal swelling, erythema, or crepitus, suggesting that an esophageal perforation has occurred, and surgical consultation is mandatory[14].
- The chest examination may reveal inspiratory stridor or expiratory wheezing, suggesting a lodged esophageal foreign body with tracheal compression.
- The abdominal examination may show evidence of small bowel obstruction or perforation, in which case immediate surgical consultation and abdominal imaging should be obtained.
- A handheld metal detector has been employed with variable success in locating coins, and can detect materials that are metallic but not radio-opaque, such as aluminum. This instrument is less reliable in detecting metallic objects other than coins, limiting its use[15].

Imaging —

- For all patients with suspected foreign body ingestion, the initial diagnostic test should be biplane radiographs (anteroposterior and lateral) of the neck, chest, and abdomen[16]. It may be difficult to differentiate between a disk battery and a coin on a radiograph. This distinction is most important when the foreign body is in the esophagus, since batteries require immediate removal whereas coins may or may not. Radiographic features that can help distinguish between the two are discussed separately. If the plain radiograph does not reveal any foreign body or abnormalities, further evaluation depends on the characteristics of the patient and the suspected foreign body:
- If the patient is symptomatic, **or** if the suspected foreign body has any dangerous characteristics (large [>2 cm width], long [>5 cm length], or sharp), **or** if the type of foreign body is not definitively known by the caretakers, computed tomography (CT) is the next diagnostic procedure[17]. Alternatively, magnetic resonance imaging (MRI) can be used for evaluation of radiolucent foreign bodies, but is contraindicated if any metallic foreign body is present.
- Imaging with CT or MRI is not necessary if the patient is entirely asymptomatic **and** if the caretakers are certain about the type of foreign body that was ingested **and** that the object has benign characteristics (small [<2 cm], not sharp or long, and not a magnet or battery). In this case, it is reasonable to discharge the patient after a period of observation in a health care setting, if the patient remains entirely asymptomatic and is able to eat and drink normally.
- Ultrasonography has been used to identify the location and nature of foreign bodies in the esophagus or stomach if appropriate expertise is available[18].

Approach To Management

Management approach (timing of removal) depends on nature of ingested object and signs & symptoms of the airway/intestoinal obstruction (table 1).

Urgent intervention — Urgent intervention (ie, removal of the foreign body via endoscopy or other technique) is indicated if any of the following warning signs are present:

1. When the ingested object is sharp, long (>5 cm), or a superabsorbent polymer, and is in the esophagus or stomach.
2. When the ingested object is a high-powered magnet or magnets.
3. When a disk battery is in the esophagus (and in some cases in the stomach).
4. When the patient shows signs of airway compromise.
5. When there is evidence of near-complete esophageal obstruction (eg, patient cannot swallow secretions).
6. When there are signs or symptoms suggesting inflammation or intestinal obstruction (fever, abdominal pain, or vomiting)[1].

Table-I

Timing of paediatric foreign body ingestion and endoscopic intervention [12].

Type	Location	Symptom	Timing
Button battery	Esophagus	Yes or no	Emergent
	Gastric/SB	Yes	Emergent
		No	Urgent(if age<5, BB20mm)Elective (if not moving on Xray)
Magnet	Esophagus	Yes	Emergent
		No	Urgent
	Gastric/SB	Yes	Emergent
		No	Urgent
Sharp	Esophagus	Yes	Emergent (if not managing secretions, otherwise urgent)
		No	Urgent
	Gastric/SB	Yes	Emergent (if signs of perforation, then with surgery)
		No	Urgent
Food impaction	Esophagus	Yes	Emergent (if not managing secretions, otherwise urgent)
		No	Urgent
Coin	Esophagus	Yes	Emergent (if not managing secretions, otherwise urgent)
		No	Urgent
	Gastric/SB	Yes	Urgent
		No	Elective
Long object	Esophagus	Yes or no	Urgent
	Gastric/SB	Yes or no	Urgent
Absorptive object	Esophagus	Yes	Emergent (if not managing secretions, otherwise urgent)
		No	Urgent
	Gastric/SB	Yes or no	Urgent

* BB button battery; SB small bowel.

Expectant management — For blunt foreign bodies without the above characteristics that are lodged in the esophagus in an asymptomatic patient, observation for 12 to 24 hours is reasonable because spontaneous passage often occurs. Objects lodged for more than 24 hours or for an unknown duration should be removed promptly. After this period, complications such as transmural erosion, perforation, and fistulae are more likely to occur.

Approaches For Specific Types Of Foreign Bodies

Coins — A small percentage of the ingested coins become lodged in the esophagus, and these can cause serious complications, including aspiration, if not removed. Approximately two-thirds of ingested coins are in the stomach at the time of initial radiographic evaluation[19]. The radiograph should be carefully examined for features that distinguish between a coin and battery, discussed separately. If a coin is visualized in the esophagus and the patient is asymptomatic, the child can be observed for up to 24 hours after ingestion of the coin. In such patients, 20 to 30 percent of coins will pass into the stomach spontaneously during the observation period (two-thirds of these during the first eight hours). Spontaneous passage is more common in older children and when coins are located in the distal third of the esophagus.

The esophageal coin should be removed promptly if the patient is symptomatic or if the time of ingestion is not known. If the child is asymptomatic and the coin does not pass spontaneously by 24 hours after ingestion, it should be removed.

Because coins lack sharp edges and the metal is not toxic, coins that reach the stomach can be managed expectantly, and most will pass out uneventfully within one to two weeks. For these patients, most providers check the location of the

coin with a plain radiograph about once a week. If the coin has not passed beyond the stomach by four weeks, endoscopic removal is recommended. If the child develops any signs or symptoms of obstruction, abdominal pain, vomiting, or fever, then the patient is promptly reevaluated with radiographs and the coin is removed endoscopically

Batteries — When batteries become lodged in the esophagus, they represent a medical emergency. Necrosis of the esophagus may occur due to liquefaction from the electrical current, and may lead to ulceration within a few hours of ingestion, and perforation as early as eight hours after ingestion[20]. Longer term retention may lead to pressure necrosis and/or leakage of caustic material, with resultant tissue damage including perforation.

Magnets — High-powered magnets composed of neodymium (also known as rare earth magnets) are now common components of household appliances and some toys. They represent a serious health hazard if ingested, due to risks for gastrointestinal perforation. Two or more strong magnets, especially if ingested at different times, may attract across layers of bowel leading to pressure necrosis, fistula, volvulus, perforation, infection, or obstruction; this may result in serious consequences including intestinal resection. Endoscopic removal should be considered if the magnet is accessible (ie, in the esophagus or stomach), especially if the child is at risk for further ingestions. Alternatively, it is reasonable to manage these cases conservatively, with the following precautions:

- Serial radiographs should be performed to confirm that the magnet progresses through the gastrointestinal tract and to confirm that multiple magnets are not present. To reduce the risk of misinterpreting the radiograph, both AP and lateral radiographs should be performed initially, and all subsequent radiographs should be closely examined for any indication that multiple magnets might be present.
- The child should be kept away from any magnetic or metallic materials (including metallic buttons or buckles in clothing), until the magnet has passed out of the gastrointestinal tract.
- Ingestion of a single magnet with another metallic object should be managed using the protocol for multiple magnet ingestion.

Techniques

Various methods have been used to remove esophageal foreign bodies. They include rigid and flexible endoscopy, bougienage, Foley catheterization of the esophagus, and the penny pincher technique.

Flexible endoscopy — Flexible endoscopy is preferred in most circumstances because the foreign body can be directly visualized and manipulated, and the surrounding gastrointestinal tract can be examined for potential complications [1,5,7,14,94,110]. This procedure is performed under conscious sedation or general anesthesia, depending upon the patient's age, ability to cooperate, and the type and number of objects to be removed. The endoscopist should have a complete array of equipment to grasp the foreign object, such as a rat-tooth and alligator forceps, polyp snare, retrieval net, and helical baskets. A foreign body protector hood is the preferred method of protecting the esophagus if the object is sharp or pointed[21].

Rigid endoscopy — Rigid endoscopy utilizes a non-flexible channeled device that is introduced into the esophagus under general anesthesia. It is most useful for impacted sharp objects that are located in the proximal esophagus, at the level of the hypopharynx and cricopharyngeus muscle. The technique requires considerable skill and may cause complications such as esophageal abrasion and perforation[22].

Magill forceps — Magill forceps can be used to extract foreign bodies impacted in the oropharynx or upper esophagus. In some cases, an object impacted in the upper esophageal sphincter is visible at the time of tracheal intubation and can be directly removed with the Magill forceps without the need for intubation. However, in most cases, an endotracheal tube is placed to protect the airway, and a laryngoscope is used to gently open the esophagus and visualize the foreign body[23].

Foley catheter — For this technique, a deflated Foley catheter is passed beyond the foreign body. The balloon is then inflated using a radio-opaque contrast dye, and the catheter is slowly drawn back under fluoroscopic guidance, to remove the foreign body through the mouth. The technique can be successful with proximal esophageal foreign bodies when performed by an experienced operator. It does not permit visualization of the esophagus and carries

the risk of esophageal perforation if the balloon is inflated below a stricture. In addition, this approach may cause aspiration of the foreign body if it is inadvertently dragged into the trachea. For these reasons, many providers do not recommend this technique if endoscopy is available.

Penny pincher technique — The penny pincher technique involves insertion of a grasping forceps through a nasogastric tube, under fluoroscopic guidance and usually without anesthesia or endotracheal intubation. This approach is an improvement over the Foley catheter method because it permits direct control of the object, reducing the risk of dropping it into the airway. However, it also does not allow inspection of the esophagus and should only be used for objects that can be firmly grasped and controlled by the forceps[24]. A variety of techniques are used to extract foreign bodies from the esophagus or stomach. flexible endoscopy for most foreign body extractions is preferred because the technique can be adapted to a variety of foreign bodies in the esophagus, stomach, or proximal duodenum, and allows direct assessment of the mucosa for injury. Rigid endoscopy or retrieval with Magill forceps are useful techniques for objects in the hypopharynx or proximal esophagus.

Objects that have passed beyond the proximal duodenum are not accessible to the endoscope, and most will pass without complications. The progress of radio-opaque objects down the gastrointestinal tract should be monitored with serial radiographs.

Conclusions

The most common foreign bodies in children are blunt. Sharp foreign bodies are frequently associated with serious complications like - retropharyngeal abscess due to delay in presentation. So foreign body must be removed at the earliest. Flexible endoscopy for most foreign body extractions is preferred

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