

## Foreign Bodies in the Upper Digestive Tract. General Concepts

**Julio Camarena\***

Gastroenterology Service, Francisco Moscoso Puello Hospital. Santo Domingo, Dominican Republic

\***Corresponding Author:** Julio Camarena, Gastroenterology Service, Francisco Moscoso Puello Hospital. Santo Domingo, Dominican Republic.

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### Abstract

The intake of a foreign body (FB) is a relatively frequent, occasionally serious but exceptionally fatal event [1]. The severity and complications they generate in the digestive tract will depend on certain characteristics, such as the size, shape, content, and conditions related to the patient; in addition to the place in the digestive tract where it was impacted, the time elapsed and finally the ability of the endoscopist to extract it.

The objective of this review is to offer an overview of the subject, through practical tools that allow to successfully address the extraction of FBs impacted in the upper digestive tract.



**Figure a**

**Keywords:** Foreign Bodies; Upper Digestive Tract; Morbidity; Endoscopic

### Introduction

The intake of an FB occurs under very different conditions. In infants, it is more frequent in males under 6 years of age, usually accidentally, due to carelessness or curiosity to put everything into their mouths. Within the variety of ingested objects, we find coins, buttons, safety pins, small toys, pencils, and puzzle pieces. Currently flat batteries have taken great interest in recent years due to their frequency and high risk of morbidity [2].

In adults, 80% of accidentally ingested FB that manages to reach the stomach, are expelled spontaneously, often without causing

symptoms to the patient. Of this group, 20% will need endoscopic extraction and only 1% a surgical intervention.

In cases of intentionally ingested FB, the evolution is presented differently. Rapid endoscopic removal will be needed in 63 to 76% and surgical intervention in 12 to 16% of cases. According to a published series, 852 cases of intentionally ingested FB showed no mortality in adults; instead, there was 1 death among 2,206 cases of children [2].

Ingestion of FB of a non-food nature generally occurs voluntarily in adults belonging to certain risk groups or under special

conditions (deprived of liberty, mentally deficient and psychiatric). Illicit activities provide cases of great technical difficulty due to the risk of complications, such as those where we find razors, bags of cocaine, valuables such as jewelry, among others<sup>2</sup>. In these cases, there is a high risk of severity, surgical intervention, morbidity, and mortality.

In adults we can outline three large groups of accidental intakes of FB. First, food (chicken bones, fish bones and pieces of unchewed meat). A second group includes the fragments of teeth, toothbrushes, toothpicks, or wooden chopsticks; and finally, a third group corresponds to items related to various activities such as pins, head skewers, screws, nails, and earrings [3].

### Clinical manifestations

The first clinical manifestation after the passage of an FB through the aero-digestive tract could be an access of cough of sudden onset, as a protective reflex of the airways. The patient may manifest the sensation of choking, dyspnea, acute respiratory distress, and abnormal breath sounds. If the object is large enough to completely obstruct the airways and if these are not freed and resuscitation maneuvers are not performed quickly, the person may die from asphyxiation.

The passage of an FB into the digestive tract occurs asymptotically in most cases. If it stops in the esophagus, clinical manifestations such as hypersalivation, vomiting, dysphagia-odynophagia or retro sternal pain frequently appear. The existence of pain and crepitus on palpation of the neck, abdominal pain, and eventually peritoneal signs, make us think of an esophageal perforation, in some segment of the gastric cavity or in the small intestine.

In the medical history it is important to determine the time elapsed after the intake of the FB, the amount, and its characteristics, as well as the presence of food or medicines that may modify the digestive peristalsis or hinder the identification and extraction.

### Diagnosis

An FB in the upper digestive tract should be suspected when stated by the patient himself, or his family, in cases of minors. It is investigated in cases of acute dysphagia, changes in eating habits in infants, as well as the preference for a liquid diet, rejecting solid foods. In addition, the presence of breath sounds or changes in a child's voice pitch without an obvious explanation.

A simple chest and abdomen x-ray should be performed systematically in two planes: frontal and lateral, including the neck, especially if the discomfort is referred to the upper part of the chest. X-rays make it easy to detect radiopaque foreign bodies, but not transparent plastic, wooden or radio transparent objects.

Video endoscopy is performed in all cases where the ingestion of an FB is suspected and in the face of persistent esophageal symptoms even with the negativity of radiological studies [2]. This can confirm its presence and precise location, detect any pre-existing lesion or disease on the digestive mucosa that obstructs the passage, the lesions produced by the FB on the mucosa and finally, it is the ideal procedure for extraction under direct vision.

The FB passing into the esophagus may be stopped in one of its three zones of physiological narrowing, located in the upper third below the cricopharyngeal muscle, in the aortic arch and a few centimeters above the diaphragm.

Clogging elsewhere should lead to suspicion of a pre-existing esophageal disease such as peptic stenosis, neoplastic or eosinophilic esophagitis. Once in the stomach, 90 or 95% of the FB passes without producing gastrointestinal symptoms and can be eliminated by feces without posing a risk to the patient.

### Indications of endoscopic extraction of ES in the gastrointestinal tract

There are FB that can transit the digestive tract without causing inconvenience and be eliminated by feces spontaneously. These are those of small size, rounded shape, non-cutting, and whose content is not toxic.

Endoscopic extraction [3] is recommended in the following cases

- All those located in the esophagus.

Those located in the stomach and duodenum

- If they are sharp or pointed.
- If they are more than 4 cm in length.
- If they are more than 2 cm wide.
- If they contain caustic substances.

If they are stuck

- After 3 weeks in the stomach.
- After a week in the duodenum.

### When to extract FB?

Choosing a right the time and place to extract an FB represents an important decision. Those that obstruct the airways and esophagus represent an emergency, such as the pointed, flat batteries and those that are accompanied by symptoms. Non-obstructive, round-shaped or located in the gastric cavity can wait and be removed afterwards. Those who have more than 48 hours in the stomach, of small size and who do not produce symptoms, are not an emergency. A patient at risk of complications should be hospitalized until the extraction is performed. It is useful and timely to integrate an interdisciplinary team that includes surgeons, anesthesiologists, and otolaryngologists.

Before starting the extraction, a specific strategy should be established that considers the age of the patient, the context, the comorbidities, the time of the last intake, as well as the shape and size of the FB. Likewise, an object like the one ingested must be present to be tested with the available extraction devices and choose the one that offers the greatest firmness, security and stability when extracting the FB in the opposite direction by sphincters and anatomical structures. Having recent radiological information is key, especially if a long time has passed since ingestion, due to the risk of migration due to peristalsis in the distal direction beyond the reach of our instruments [4].

The place where the endoscopic procedure is performed should be the one that offers the greatest safety for the patient and has instruments for respiratory support and pulmonary ventilation. It can be an operating room or even in the endoscopy unit, depending on our physical conditions. In cases of infants and preschoolers, endoscopy should be performed in the operating room with sedation and endotracheal intubation. During the procedure it is highly advisable to have a trained anesthesiologist and a team of experienced technical assistants, together with the endoscopist.

The patient and family members should be informed of the options, risks, and strategy we are going to follow, and their informed consent should be obtained.

Foreign body (earring) in gastric cavity, a 3-year-old girl. Extraction by endoscopy, under general anesthesia.

### Devices for endoscopic removal of a FB

There is a wide range of devices on the market that help perform FB extraction with the least damage to digestive structures.



Figure b

These can be protective devices: such as those on tubes, caps and baskets [5]; and those that allow to hold it, such as special tweezers (mouse, crocodile, tripod, bipod, etc.). The choice in each type will depend on the characteristics and location of the FB in the digestive tract, in addition to the risks and difficulties of its extraction. It is advisable to have all endoscopic devices for extraction and protection at the place and time of endoscopy [4].

### When not to extract FB?

Letting an FB progress in the digestive tract until it is expelled in the feces is a decision that requires individualizing each case. If there is that possibility without the risk of getting stuck in a sphincter or some area of narrowness, we must indicate a normal diet rich in fiber and plenty of water. Progression through the digestive tract should be documented by radiological imaging. Finally, it is necessary to sift the feces to locate it and check its output [6].

It is imperative to know the exact size and characteristics of the FB, age of the patient, history of previous lesions of the digestive tract, intake of food or drugs that modify the peristalsis. In cases of sharp FB, the use of laxatives is prohibited because of the risk of perforation by increasing intestinal motility.

### Complications

FB lodged in the upper digestive tract can lead to complications due to the characteristics of its shape and content, the time elapsed after ingestion, the place where it got stuck, the age and comorbidities of the patient [7].

A complete physical examination and x-ray or tomography imaging methods help to diagnose complications early and to define a safe strategy for endoscopic or surgical extraction.

Before attempting endoscopic extraction, it is necessary to identify signs of perforation, tears of the digestive wall (especially in the esophagus and duodenum), subcutaneous emphysema, abscesses, or an acute abdomen. Pain, subcutaneous crackles, and fever are frequent symptoms of a perforation [4].

X-rays of the thorax and abdomen are important for identifying signs of perforation, such as subdiaphragmatic, mediastinal, or subcutaneous.

Pointed, sharp, irregular, large, toxic content or dental prostheses located in the esophagus that require difficult extraction and the use of different instruments, make up the cases where mucous tears, hemorrhages and perforations are observed. If these complications are not noticed quickly, they can evolve to conditions of high morbidity and mortality such as abscesses, mediastinitis, aero-digestive fistulas and fibrosis [8].

Finally, after a laborious, long, and difficult extraction, we must keep the patient under observation for 12 or 24 hours. Often, an endoscopic or imaging review is necessary, especially if we have the doubt of a complication.

### Types of FB

The form and content of the FB determines the possibility of impacting the digestive tract, the evolution, complications, and conditions of its extraction.

### Pointed objects

These constitute a serious risk of perforation, which occurs in almost 33% of cases. Chicken bones, fish bones, pins and toothpicks are particularly dangerous. Perforation is observed in the oropharynx, esophagus, the loop in the 'C' of the duodenum, the Treitz ligament, the terminal ileum, the ileocecal valve, and the sigmoid colon.

Animal studies have shown that the intestine can dilate in response to mucosal contact and a pointed object. This relaxation, combined with the axial flow in the light, tends to rotate pointed objects by placing the tip in a proximal direction, which would decrease in some cases the risk of perforation [3].

As a general guideline, in infants and preschoolers pass spontaneously pointed objects less than 2.5 cm in length. Adolescents and adults can tolerate the passage of objects up to 5 cm long.

### Round objects

In a general sense, round objects are the least dangerous, if they pass directly into the upper esophagus. There is a high risk of dyspnea and death from asphyxiation if they go into the upper airways if they are not removed quickly.

If their size does not exceed 3 to 4 cm long, they travel through the digestive tract and are eliminated spontaneously in the feces. Imaging studies can tell us the exact place where it has stopped, such as the natural strictures and narrowings of the esophagus, pylorus and ileo-cecal valve. The impossibility of removing them by endoscopy indicates surgical intervention [3].

### Coins

Because of their size and shape, coins can obstruct the airways and digestive tracts, causing choking or dysphagia, respectively. They are common in infants and preschoolers. They are easily identified by x-rays.

Small coins with a diameter of less than 2 cm could pass through the pylorus, transit the small intestine to reach the colon and be expelled in the feces. The presence of abdominal distension and colic-like pain would indicate a possible impaction in the ileus-cecal valve, so it is necessary to perform x-rays every 24 to 48 hours to be able to decide on an eventual surgical intervention.

As a rule, all coins that impact the esophagus, that remain 24 hours in the stomach and those with a diameter greater than 3 cm should be extracted. They can be removed with endoscopic instruments such as mouse bite type tweezers, since they usually have an overhead edge. A polyp basket can also be useful for extraction [7].

Its endoscopic extraction should be performed in conditions of maximum safety, with the assistance of anesthesia and endotracheal intubation, and preferably in the operating room. In this way, they are prevented from passing into the airways when passing through the upper esophageal sphincter.

### Flat batteries

These coin-like batteries, although relatively small, are a very serious emerging problem. They are frequently used in toys and everyday objects in the home [9].

Depending on the chemical composition, the batteries are made

up of four main components: Mercury, Silver, Manganese or Lithium oxide, all dissolved in a solution of Potassium or Sodium hydroxide at 20 - 45%.

After contact with the digestive mucosa, a degradation of the metal structure of the battery with output of its alkaline content occurs, which produces direct chemical lesions due to corrosion, necrosis, and low voltage electrical burn [9-11].

In a contact time of 1 hour the mucosa may have erythema, congestion, and necrosis. A perforation of the wall of the digestive tract is observed within the next 4 hours. Finally, these lesions can evolve to the creation of trachea-esophageal and enteral fistulas, perforations of the wall, and a stenosis could be established between 3 to 14 days. Although mortality is low, delayed diagnosis is a factor in complications and fatal injuries [4].



**Figure c**

Intestinal perforation due to the ingestion of a flat battery 20 hours earlier in a 6-year-old child.

A simple x-ray of the abdomen can differentiate a flat battery from a coin by the presence of a concentric opaque radius halo typical of batteries, in addition to its location.

Batteries should be removed urgently if they are within reach of the endoscope. Mouse bite tweezers and polyp baskets are very useful. If they have progressed to the small intestine and there are no signs of perforation, a laxative would help speed up the bowel movement and be recovered in the colon.

### Magnets

The ingestion of pieces of magnets, frequent in children, produces an attraction between the intestinal loops with the possibility of creating fistulas and perforations. Its removal should be immediate, in some cases with the help of enteroscopes. In cases of

documenting the existence of a single small, magnetized piece, its spontaneous exit can be allowed, if the age of the patient allows it [12].

### Meat and food

The impact of meat on the esophagus is generally observed in adolescents and older adults, the latter with teeth problems or esophageal stenosis [6].

Sausages, meats with "clods" and bones can often obstruct the esophagus. The place of impact is the lower third of the esophagus, especially if there are stenosis of organic or peptic origin.

When the patient has few symptoms, a few hours can be waited to allow gastric emptying of food and establish the most appropriate strategy for its extraction. A chest x-ray that includes the neck in anteroposterior and lateral incidence is very useful to identify the place and presence of bones. We may then need mild sedation until a tracheal intubation is performed in the operating room with the support of an anesthesiologist if it is required.

A pushing maneuver can be used to bring the meat FB stuck to the stomach and allow its digestion. In case of larger pieces or presence of esophageal stenosis, it is necessary to remove through the mouth. For the latter, adapted instruments are used to be able to grasp the meat as a whole, without destroying it into pieces, and facilitate its extraction. A protective tube envelope is very useful if we decide to extract by pieces and reduces the risk of injuring the upper digestive tract.

After removing the meat, the esophageal mucosa should be checked to rule out underlying obstructive or inflammatory lesions and those produced by the instruments used in the extraction [3].

The presence of bones hinders their mobilization, and they add a risk of perforation. The bones must be removed axially, either fastened with mouse bite tweezers or by polypectomy loops so as not to produce further damage. The areas of greater resistance such as tendons or aponeurosis, represent safe areas to insert bipod tweezers of great apprehension capacity and greater tensile force. Proteolytic enzymes should not be administered with the aim of reducing the size by dissolution or digestion, as it would increase the risk of enzymatic aggression to the injured esophageal wall.

Fishbones are very common in adults. They are usually located in the proximal segments of the hypopharynx, larynx, esophagus

and exceptionally in the stomach, so initially it is the otolaryngologists should try to remove them before an endoscopist.

Many times, during endoscopy only a whitish spot is noticed in the mucosa, which corresponds to the proximal -not sharp- end of the fishbone. The persistence for a few days of a fishbone in the digestive wall can favor the development of small abscesses, localized pain, dysphonia, and high dysphagia-odynophagia. In many cases the discomfort in the throat can be secondary to a small wound produced by the passage of the sharp tip of the fishbone along with the food bolus, so it is frequent that during the endoscopy we cannot find it.

### Dental prosthesis

The passage of dental prosthesis into the digestive tract occurs when eating or sleeping. There is a great risk of impact or lesion of the esophagus by the metal “hooks” that they usually have.

These are of variable size and often pink in color, which could make it difficult to identify, especially when there is food in the gastric cavity.

They are usually located in the esophagus, producing dysphagia to solids, neck pain and in severe cases subcutaneous crackling when they have perforated the esophageal wall. Its extraction is associated with great morbidity, requiring diverse instruments and great skill. Its removal is not without complications such as tears of the wall when mobilizing the prosthesis, stenosis and in some cases, a temporary tracheostomy.

### Bezoars

A bezoar is a compact accumulation of undigested material that cannot leave the stomach. They are of different compositions: hairs, vegetables, medicines, etc. They can occur at any age -often in patients with behavioral disorders- with abnormal gastric emptying and after gastric surgeries. Most are asymptomatic, others produce dyspepsia, abdominal pain, bloating, anorexia, early satiety, and weight loss. Imaging methods makes the doctors suspect the diagnosis, and endoscopy confirms it.

Depending on their composition, some can be dissolved by chemicals; others need removal by endoscopy, indicated in patients who have large, non-dissolving bezoars and with significant symptoms. To allow their expulsion or extraction, bezoars can be

broken by fragmentation with tweezers, wire loop, water jet, coagulation with argon plasma or even laser. When they cannot be fragmented or removed, a surgical gastrostomy is necessary [3].

### Iatrogenic foreign bodies

We refer as iatrogenic FB to objects introduced into the upper digestive tract during a medical procedure with a diagnostic or therapeutic goal, which could then be removed endoscopically.

### Intragastric balloons

They are spherical biocompatible silicone devices temporarily introduced into the gastric cavity as a method to reduce intake. They have a diameter of approximately 11 cm and a volume of 500 to 700 ml. of solution.

Its introduction is relatively easy, but the extraction can be complicated, and some models of balloons need special instruments such as “bipod” tweezers and puncture-aspiration needles, specially designed for that purpose, in addition to skills and experience of the endoscopist. They should be removed between 6 to 12 months after placement; in cases of non-tolerance; deflation of the balloon, in cases of an emergency due to abdominal trauma; surgeries, pregnancies or any event that requires it.

Its extraction is more difficult due to the presence of food remains in the gastric cavity, the deterioration of the walls of the balloon, and the use of an inadequate technique during its extraction. In many cases the instruments cannot hold with sufficient force for extraction through the cardia and esophagus and can break into pieces injuring the esophageal mucosa [4]. If it stays in the stomach much longer than set by the manufacturer, it can deflate and be expelled in the stool.

### Esophageal-pyloric prostheses

Digestive stents are used to treat multiple non-surgical esophago-gastric conditions, especially in neoplastic processes, with symptoms of digestive obstruction demonstrating efficacy as a palliative treatment by reducing symptoms, reducing morbidity, allowing oral intake and finally, avoiding malnutrition in patients [13].

The migration of the prosthesis is more frequent with self-expanding prostheses, since in them only the proximal portion is the one that is anchored, not so the distal end that remains free in the

gastric cavity. The recovery of a migrated prosthesis is not always easy, so it is often abandoned in the gastric cavity and a new prosthesis is placed where the previous one used to be.

Distal migration of esophageal stents is frequent, especially “covers”. The presence of dysphagia-aphagia-odynophagia, in a patient with an esophageal prosthesis makes suspect this complication, which we must confirm with radiological studies; and then by endoscopy perform its relocation, if this is done early. The growth of the tumor lesion or the clinical condition of the patient makes it difficult to mobilize. Most of these prostheses have a thread at their proximal end that helps us reduce their diameter, remove it, or simply reposition it. A hemostatic clip would help keep it in the proper position.

### Endoscopic capsule

It is a non-reusable device with a size of 25 x 11 mm in diameter, which has a built-in miniature color video camera and a light source that transmits images to sensors located on the abdominal wall; and there to a Holter type registrar. The main utility of capsule endoscopy is the study of the small intestine, although new uses in the study of the esophagus, stomach and colon are being published.

The main complication of capsule endoscopy is its retention in the small intestine, defined as its permanence of the device in the gastrointestinal tract for more than 2 weeks<sup>18</sup>. The retention rate is 1-5% depending on whether the indication is the study of a hemorrhage of dark origin or if it is a suspicion of Crohn’s disease. No case of retention has been described in normal subjects [14-16].

Usually, the retention of the capsule does not produce symptoms, but in case it occurs, its removal is indicated endoscopically or preferably surgically. If you are in an accessible location, a double balloon enteroscope can help with its removal.

### Bags of cocaine

These are cases that, in general, are under the responsibility of the judicial authorities. Normally the diagnosis is established by radiological images; endoscopy is a means of confirming its presence.

The material of cocaine bags is normally latex. These are ingested by mouth and then expelled in the stool. Endoscopic removal should not be attempted due to the risk of rupture and spillage of the contents in the gastric cavity, with fatal consequences [2]. It should be expected to be removed by “natural” means or surgical extraction if there is a risk of rupture.

### Conclusion

An FB in the digestive tract is a major challenge for the endoscopist. It is a procedure that must be well planned and performed with the greatest safety for the patient.

Deciding which FB should be removed by endoscopy, by surgery, and which can continue along the digestive tract represents the first challenge the endoscopist must determine.

Removing a FB from the digestive tract requires knowledge of the anatomy of the aero-digestive cavities. It also requires having the necessary endoscopic instruments, the special skills, as well as the ability to respond to the diversity of eventualities and complications.

We must assess the risks and benefits of extraction and minimize the possible sequelae. Additionally, have recent radiological information before the patient undergoes the extraction procedure. Have at hand the necessary instruments and have all the necessary resources such as anesthesia with tracheal endo intubation in cases of children and non-cooperative patients. Inform the patient and family members about the risks, possible options and strategy to be followed and finally, obtain their informed consent.

In cases of locations not accessible with instruments, complication, or inexperience, it is recommended to refer to a higher care center or a surgeon.

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