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## Removal of Gastrointestinal Foreign Bodies

Josep M. Bordas<sup>a</sup> · Josep Llach<sup>a</sup> · Miguel Muñoz-Navas<sup>b</sup>

<sup>a</sup>Endoscopy S., Gastroenterology Department, Institut de Malalties Digestives, Hospital Clinic, Barcelona, and <sup>b</sup>Gastroenterology Department, Clínica Universitaria de Navarra, Pamplona, Spain

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### Abstract

More than 80–95% of the ingested foreign bodies pass spontaneously through the gastrointestinal (GI) tract without or with few complications; it is considered that 10–20% require medical intervention. In the great majority of the cases, endoscopy solves the problem and in around 1% of the cases surgery is required for exploration and extraction. Although foreign body ingestion can induce severe complications and even death, in recent years, deaths caused by foreign bodies have rarely been reported. The greatest incidence of foreign body ingestion occurs in children, psychiatric patients and prisoners and, in general, foreign bodies are found in previously healthy patients. It is mandatory to spend some time to acquire an accurate history followed by front and profile x-rays. The most common foreign bodies are ingested foreign bodies. The risks are related to sharp and long objects, button batteries and magnets. A number of rectal foreign bodies may be retained inside the rectum or sigmoid. When endoscopy fails, surgery is mandatory. Nowadays some medical therapies may introduce foreign bodies in the digestive tract that must be retrieved. After retrieval, 24-hour admission should be only considered when complications or possible complications are suspected or when surgery is considered. All patients with foreign bodies are admitted to hospital after surgery if required. It is very important to recognize a significant complication induced by a foreign body even before any active medical intervention or after retrieval, since it is known that early treatment greatly influences the outcome.

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Foreign bodies are a recurrent problem and a challenge in gastrointestinal (GI) endoscopy. Ingested foreign bodies are the most frequent foreign bodies in the digestive tract. However, rectal introduction may also be considered and nowadays another source of digestive foreign bodies may be due to GI medical therapy or the migration of foreign medical objects from other parts of the body.

This subject has had a great impact in medical journals and for many years nearly 200 papers on foreign bodies have been published every year in journals submitted for peer review. Most are case reports and only a few are retrospective series.

The greatest incidence of foreign body ingestion occurs in children, psychiatric patients and prisoners and, in general, swallowed or rectal foreign bodies are found in previously healthy patients [1, 2]. The management of this situation sometimes involves risks of which both the patient and relatives must be aware. After assessing that a foreign body is present and ruling out the presence

**Table 1.** Foreign body work-up

1. History	In some patients the presence of a foreign body is only suspected In children this situation is more frequent
2. Physical examination	Presence, location, shape and relationship with surrounding organs
3. Assessing suspected diagnosis	X-ray study (front and lateral study) other imaging studies
4. Diagnosis	Presence, location, shape and relationship with surrounding organs
5. Plan foreign body extraction	Observation, endoscopic treatment, surgery
6. Searching for endoscopic material, personnel	Location, nature and shape of the foreign body determine the method for retrieval When an endoscopic method is decided, adequate sedation facilities, scope and ancillary devices must be selected and ready to use before starting the treatment It is also convenient to try the best method in hanging similar objects when possible
7. To prevent solution for the side effects (admission and surgical facilities)	Surgery department should be contacted in difficult cases
8. Explanation of the procedure and informed consent	It is mandatory to inform the patient of the usual risk involved with the location, nature and shape of the foreign body
9. Endoscopic procedure	Sometimes endoscopy is used as a diagnostic tool mainly in the hypopharynx and in esophageal foreign bodies
10. Post-procedure care	Decision as to hospital admission

**Table 2.** Material for foreign body retrieval

Endoscopic devices	
Flexible scopes	Rigid scopes
<i>Ancillary devices</i>	Magill forceps
Endoscopic scissors	Standard forceps
Dormia basket (different sizes)	
Lithotripter	
Retrieval net	
Atraumatic grasping forceps	
Special forceps	
Alligator	
Rat-tooth	
Rubber-covered forceps	
Polypectomy snares	
Magnetic catheter	
Forcep hooks	
<i>Special ancillary devices</i>	
Overtube	
Soft rubber funnel hood attached to the tip of the scope	
Finger part of a latex hand globe attached to the tip of the scope	
TTS balloon dilators	

of severe side effects needing more invasive management, endoscopy can be applied in the great majority of patients experiencing symptoms in the upper GI tract and in those with potentially dangerous foreign bodies.

### **Procedural Aspects** (table 1)

It is mandatory to spend some time to acquire an accurate history followed by some basic instrumental diagnostic procedures. Front and profile x-rays are sometimes very useful, mainly when the suspected foreign body can be visualized by this method. Nonetheless, in these cases the x-ray reading must be accurate since, in some cases, the images of the foreign body may be difficult to assess. Nonetheless, even in negative readings, these documents may be useful in relation to any legal problem [3].

The aim of the x-ray examination is: (1) to confirm the presence of a foreign body [4]; (2) to know the size and shape; (3) to diagnose a preexisting perforation; (4) to know its location and avoid unexpected perforation, and (5) to have some idea of the method and possible risk involved in extraction.

After evaluating the foreign body or having a high suspicion of its presence, the following are necessary: (1) to obtain written informed consent; (2) to establish the work-up plan, and (3) prepare the adequate material/personnel (tables 2, 3).

### **Patient Preparation**

Only a few scientific societies have published guidelines on this subject. These documents are important because they are the procedural basis and inform the society on the difficulties and risks involved [5]. It is necessary to decide if foreign body retrieval maneuvers should start immediately or if it would be convenient to wait for the stomach to be empty or the colon prepared.

Patients with esophageal foreign bodies can be explored by endoscopy immediately if appropriate. The endoscopy of patients with stomach and intestinal foreign bodies may wait for the cavity to be empty which facilitates the search and diminishes the risk of aspiration. The colon needs adequate cleansing (prograde in non-obstructive cases) if perforation has been ruled out and endoscopy is considered the procedure of choice.

### **Treatment for Specific Foreign Bodies**

#### *Ingested Foreign Bodies* (table 3)

##### *Impacted Food Bolus*

Most ingested foreign bodies occur in children with a maximal incidence between 6 months and 3 years of age. In adults, patients with an increased risk are those wearing dental prostheses because of the lesser sensitivity during swallowing, overall if they do not wear their glasses for eating. These circumstances facilitate the ingestion of bone, some hard food pieces or shellfish such as cockles. Other medical situations that facilitate food impaction in the esophagus are

**Table 3.** Foreign body treatment

Decision			
Observation without admission	Minimal invasive treatment (retrieval, destruction dissolution/digestion, dislodge)	Admission for observation	Surgery
For small blunt foreign body in stomach	Flexible endoscopes are used in most cases Rigid endoscopes can be used for objects in a hypopharyngeal location	Complications or possible complications are suspected	Must be considered
In 90% of cases, foreign bodies reach stomach	Different ancillary devices can be used but the most frequently used are: <ul style="list-style-type: none"> <li>- Rat-tooth grasping forceps</li> <li>- Atraumatic three-arm forceps</li> <li>- Dormia basket</li> <li>- Polypectomy snare</li> <li>- Retrieval net</li> <li>- Magnetic retriever</li> <li>- Overtube</li> <li>- Soft rubber protector hood attached to the endoscope tip</li> </ul> <p>These devices facilitate retrieval of some sharp objects</p>	Some complex foreign bodies Foreign body in which previous endoscopic retrieval failed	<ul style="list-style-type: none"> <li>- In free abdominal perforation</li> <li>- When vascular involvement is suspected</li> <li>- Complex foreign bodies with high risk of perforation during retrieval maneuvers</li> </ul>

esophageal motor disturbances (achalasia, sclerodermia, diffuse spasm) strictures (Schatzki's ring, peptic strictures, tumors and membranes) and diverticulae.

Most of the patients with food impaction require endoscopic (95%) or surgical intervention. The most important information in this group of patients who need endoscopic (95%) or surgical intervention in a high percentage of cases is to obtain knowledge on the type of foreign body by: (1) clinical history to determine whether a fish or meat bone may be included in the ingested foreign body; (2) the second most important information is the length of time from the ingestion to the appearance of symptoms; (3) the clinical manifestations are also important, and (4) exploration and data obtained by x-ray examination are convenient and in some cases are necessary.

These data allow a decision to be made in selecting the best treatment: observation, endoscopy or surgery. When there is high probability that no bone is included in the impacted bolus, minimal invasive treatment using flexible endoscopy is usually the best procedure. Unchewed meat or large meat fragments may be removed using different types of grasping forceps, snare or Dormia basket (fig. 1), after dislodging. When the foreign body is soft in absence of bone or sharp objects, endoscopy provides knowledge on the nature of the foreign body. Agglomerated food debris usually needs patience to progressively disaggregate retained food allowing the debris to be broken down little by little. This action reduces the size of the foreign body allowing the main part of the retained bolus to pass through the cardia/stricture to the stomach. This action usually

**Table 4.** Digestive tract foreign bodies

Upper GI tract	Food	<ul style="list-style-type: none"> <li>- Bone</li> <li>- Fish bone</li> <li>- Pieces of meat or other (hard/solid) consistent food</li> <li>- Pills</li> <li>- Almonds and other consistent fruits or seeds</li> </ul>
	Foreign bodies with poisoning risk	<ul style="list-style-type: none"> <li>- Batteries</li> <li>- Mercury thermometers</li> <li>- Metals</li> </ul>
	Magnets	
	Unclassified objects with risk of perforation	<ul style="list-style-type: none"> <li>- Nails</li> <li>- Glass fragments</li> <li>- Toys and objects with sharp and potentially cutting edges</li> <li>- Dental prostheses</li> <li>- Tooth stick</li> </ul>
	Unclassified objects without risk of perforation	<ul style="list-style-type: none"> <li>- Coins and toys</li> <li>- Hair</li> <li>- Toothbrush/spoons/springs and other metallic devices</li> </ul>
	Medical devices	<ul style="list-style-type: none"> <li>- Prostheses</li> <li>- Lost material</li> </ul>
	Other	<ul style="list-style-type: none"> <li>- Large biliary stones</li> </ul>
Biliary tract		<ul style="list-style-type: none"> <li>- Prostheses (plastic and expandable), guidewire fragments</li> </ul>
Small bowel		<ul style="list-style-type: none"> <li>- Prostheses</li> <li>- Migrated gastric balloons</li> <li>- Magnets</li> </ul>
Colon	Non-medical devices	<ul style="list-style-type: none"> <li>- Migrated from upper GI tract</li> <li>- Cylinders and round objects</li> </ul>
	Medical devices	<ul style="list-style-type: none"> <li>- Prostheses (stenosis treatment)</li> <li>- Lost material</li> </ul>

requires multiple passages of the endoscope and the use of atraumatic grasping forceps. In these cases the overtube is useful. The use of the retrieval basket or devices used to hook the varices to perform elastic band ligation can facilitate the retrieval of retained material.

In most of the cases, esophageal stricture or Schatzki ring induces the impaction. Intubation is rarely considered and success of foreign body retrieval is achieved in nearly 100% of the cases with scarce need for surgery or development of side effects [6, 7]. In some cases, mainly when hard foreign bodies are present, glucagon or other spasmolytics are an important help.

#### *Other Foreign Bodies Retained in the Hypopharynx and the Esophagus*

Meat bones and shellfish may be seen using an adequate radiologic technique. Fish bones are difficult to assess by radiology and endoscopy may be considered the best diagnostic method in

**Fig. 1.** The main flexible endoscopic tools used for retrieval of foreign bodies.

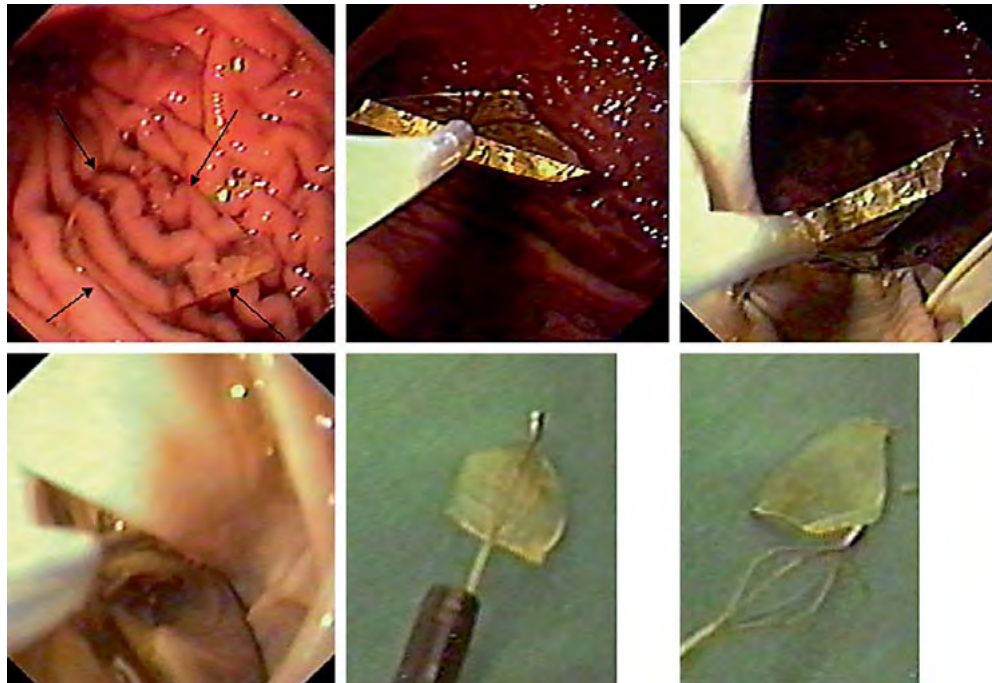


1

**Fig. 2. a, b.** A soft rubber hood which is automatically reversed when the endoscope is pulled back onto the cardia.



2



**Fig. 3.** Sharp foreign body (glass fragment) retrieved with the use of latex glove attached to the endoscope tip. Glass fragment in the great curve of the stomach. The foreign body is caught by Dormia basket and retrieved into the latex glove attached to the tip of the endoscope. The glove hood protects the esophageal wall during retrieval. The glass fragment firmly caught in the Dormia basket. The foreign body obtained was 2.5 × 3.2 cm.

these patients. Bone retrieval should be carried out with caution to avoid perforation and tears. A spasmolytic may facilitate the maneuvers. Grasping forceps are the best endoscopic ancillary device used and the policy for removal requires the best position and direction of these tools to be obtained. Sometimes the overtube or latex protector hood is useful (fig. 2). It is mandatory to carefully explore the esophagus immediately after foreign body removal, in order to avoid perforation and assess what may have precipitated the event.

#### *Sharp and Long Objects*

Sharp and pointed objects lodged in the esophagus represent a medical emergency. Independently of whether the foreign body is retained in the esophagus or the stomach, the system to grasp this type of foreign body is similar and must be performed in association with stomach and esophagus wall protection. The overtube and the latex protector hood (fig. 2, 3) attached to the end of endoscope are very efficient ancillary devices in protecting the esophageal and the pharyngeal walls [8, 9]. Safety and efficacy in retrieval depends mainly on the size and the shape of the object. The final treatment decision is sometimes made during endoscopy and is related to the inability to grasp, impossibility to mobilize or the high risk involved in retrieving the ingested foreign body.

#### *Coins and Button Batteries*

Coins usually pass through the GI tract. Progress control is usually easy with the use of x-ray. In most cases in adults, these foreign bodies pass through the digestive tract. When they remain in the esophagus or in the stomach, endoscopic maneuvers are needed. The main problem with coins is to obtain adequate apprehension, although the rat-tooth grasping forceps is usually adequate. In other cases, overtube or the Roth basket is the best method. Batteries may induce a chemical risk and must therefore be retrieved as soon as possible. Regular cylinder-shaped batteries can usually be retrieved using polypectomy snares. Button batteries must be retrieved using a net.

#### *Magnets*

When only one magnet is present in the digestive tract the action depends on the size and shape. All objects <2.5 cm in size pass through the pylorus and observation is considered the best treatment. If more than one magnet is present in the digestive tract, retrieval maneuvers are needed. If left in the gut the magnets may be attracted to each other and induce gut perforation. When such foreign bodies are in the stomach the method for retrieval is similar as that for other types of foreign bodies. When they are in the gut, balloon enteroscopy or surgery may be considered [10, 11].

#### *Bezoars*

Bezoars are foreign material which are compacted and retained in the stomach and sometimes in the upper part of the duodenum, e.g. vegetable fiber (phytobezoar) or ingested hair (trichobezoar). Delayed emptying or partial gastrectomy facilitates phytobezoar. The best treatment is enzymatic dissolution, but sometimes endoscopy facilitates the disaggregation and retrieval using the overtube because of the need for multiple passages of the endoscope [12].

Trichobezoar usually needs surgery. Sometimes the phytobezoar is hard and rupture can be achieved with the lithotripter basket or with polypectomy snares. If digestion or fragmentation is difficult or fails, laparoscopic surgery is the treatment option [13, 14].

## *Rectal Foreign Bodies*

Some foreign bodies reach the colon after passing through the stomach and small intestine and remain in the cecum. Colonoscopy can be used for retrieval using standard devices, mainly polypectomy snare forceps, retrieval net or Dormia basket. A number of rectal foreign bodies are related to sexual play and may be retained inside the rectum or sigmoid colon and sometimes even proximal migration is observed. Most of these objects are cylindrical or long and are difficult to be efficiently grasped, managed and retrieved. The work-up includes x-ray planes to rule out perforation and establish the position of the foreign body before any manipulation. Often only small objects may be grasped and retrieved. Large or impacted objects usually need surgery because of the risk of perforation and the great difficulties in retrieval [15–18].

## *Medical Foreign Bodies*

Cholelithiasis may induce direct pass of the biliary stones to the duodenal bulb or to proximal duodenum. Large stones may induce obstruction (biliary ileus and Bouveret syndrome). The main problem in these cases is to adequately grasp the stone with the lithotriptor Dormia basket. To crush the stone or to retrieve it from the duodenum to the stomach is the first main aim, which may not always be accomplished. Afterwards, fragmentation and retrieval is usually a minor problem. When endoscopy fails, surgery is mandatory.

## *Foreign Bodies-Related Medical Therapy*

Nowadays some medical therapies may introduce foreign bodies in the digestive tract and must be retrieved after a period of time. Mainly esophageal enteral and biliary plastic or metallic expandable prosthesis are now used for stricture dilation or for closing leaks and fistulas.

(1) Plastic biliary prostheses are easily retrieved using polypectomy snares. The distal tip or lateral flap of the plastic tube is taken by the snare. Sometimes the use of grasping forceps is necessary for mobilization, when the distal prostheses tip remains closely in contact with the mucosa in front of the papilla. Proximal migrated plastic biliary prostheses may be held using the Dormia basket in the majority of cases [19]. In some cases, prostheses cannulation by dilation or stone retrieval balloon or by biopsy forceps allow the problem to be solved, inflating the balloon or opening the forceps. In other cases we can use the Soehendra stent retriever [19] or an ultrathin endoscope introduced in the biliary tract through the papilla, which will allow to use different pediatrics accessories. The choice of a retrieval technique depends on several factors including biliary ductal dilation, depth of stent migration, distal stent impaction and biliary stricture distal to the migrated stent. The placement of an additional stent alongside an irretrievable stent is a satisfactory alternative to retrieval [19]. Biliary totally or partially covered expandable prostheses may be retrieved using polypectomy snare or rat-tooth grasping forceps. If there is some difficulty in mobilizing the prostheses, the introduction of a biliary dilation balloon into the prostheses makes mobilization and retrieval easier [20].

(2) Temporary esophageal expandable prostheses are mainly used for treating leaks or fistulas and to manage difficult strictures. Partial or total cover prostheses are used and retrieval

is convenient 2–4 weeks after introduction. Now most of the prostheses have a retrieval system using grasping forceps. The mechanism is a loop in both tips of the prostheses which may be easily grasped by rat-tooth forceps allowing closure of the proximal part of the expandable prostheses and facilitating the retrieval maneuvers. Although this mechanism is useful immediately just after the introduction, some weeks later the loop often breaks during the retrieval maneuvers. In these cases, rat-tooth forceps allow patient detachment of the proximal part of the prostheses from the esophageal wall and the prostheses can be held and removed by rat-tooth forceps attached to the proximal edge of the prostheses. Even after detaching the proximal part of the prostheses, mesh mobilization is sometimes difficult. One solution is to introduce the scope, grasping the caudal edge of the mesh with the foreign body forceps in an attempt to mobilize the prostheses in the caudal direction by introducing the scope. Mobilization in the caudal direction then makes it easier to retrieve the prostheses holding it from the cephalic edge. The use of polypectomy devices can also be used, but it is usually difficult to adequately snare the proximal part of the prostheses. If these maneuvers fail, the prostheses can reportedly be retrieved from the distal part holding it by foreign body forceps, inverting the mesh. Radiology facilitates the retrieval maneuvers.

Other tricks have been described for retrieval of partial cover prostheses when the uncovered part remains firmly included in the digestive wall. The most common mechanism is new prostheses introduction into that which needs to be retrieved. After 4–7 days the new prostheses pressure induces necrosis to the imbibed part of the old prostheses. Immediately after new mesh retrieval, the old one can be more easily mobilized.

There is a new device for retrieving metallic expandable covered mesh designed to manage acute esophageal variceal hemorrhage (SX-Ella Stent Danis). The stent has a proximal loop thus elongating and narrowing the mesh, meanwhile an overtube may be synchronically advanced in the esophagus and the stent may be progressively and easily introduced in the overtube [21]. This maneuver can also be used by retrieving other expandable stents.

Distally migrated expandable stents are usually retrieved with a polypectomy snare but can also be retrieved with the use of a dilation balloon introduced into the expanded prostheses making it easier to reposition the mesh in the distal esophagus and grasp the proximal part with other retrieval tools. Some authors have used a mechanical lithotripsy device [22], or some endoloops to collapse the metallic stent [23, 24]. It is very helpful to have a soft rubber protector hood attached to the distal part of the endoscope (fig. 2) or to use an overtube in order to ease the passing of the grasped stent through the cardiac sphincter, the esophagus and the pharynx [24].

In the digestive tract some objects used during surgery may induce external pressure to the digestive wall and finally migrate into the lumen [25, 26]. Most of these foreign bodies require surgery for retrieval because of their size and relationship with the surrounding structures. In these cases, CT scan facilitates establishment of the size, shape and situation of the foreign body for making a decision regarding the best treatment.

### *Body Packing*

The introduction of packed illicit drugs into the digestive tract is well known (swallowed or inserted into the rectum). Radiology is the method to detect their presence being characterized by an induced radiolucent halo or 'double condom' sign. These foreign bodies can sometimes be

retrieved, but the risk of acute intoxication must be considered and even if complications are not present, surgical treatment is often applied [27–29].

### *Admission Decision*

All patients with foreign bodies are admitted to hospital after surgery if required. In other cases, 24-hour admission should be only considered when: (1) complications or possible complications are suspected; (2) if retrieval of multiple or complex foreign bodies has been difficult, and (3) when retrieval is not possible and a new attempt or surgery is considered.

## **Results**

Although foreign body ingestion may be considered as a banal accident, it can induce severe complications and even death. In recent years, deaths caused by foreign bodies have rarely been reported, with related mortality being considered extremely low [30]. Although more than 80–95% of the ingested foreign bodies pass spontaneously through the GI tract without or with few complications [31–33], it is considered that 10–20% require medical intervention. In the great majority of the cases, GI or OHN (OTL) endoscopy solve the problem and in around 1% of the cases surgery is required for exploration and extraction [34]. However, in the Palta study [35] reporting the experience obtained in an urban county hospital during 7 years and including 262 cases with 92% intentional foreign body ingestion, surgery was needed in 11% of the cases. In this group of patients needing surgery, foreign objects beyond the pylorus was more frequent and was treated with a significant great delay from ingestion to clinical presentation. In the Chaves prospective study [34], the efficacy in retrieval of foreign bodies was 99%. Another retrospective study reported a success rate of 96% [36]. Other studies have reported success rates from 83 to 98% with flexible endoscopes. In the Bergreen study [36], the use of flexible endoscopes described a success rate of 96%, being 100% with the rigid scope, although the difference was not significant. Nevertheless, these data suggest that the use of rigid scopes should be considered the second option when the flexible scope fails on deciding the need for endoscopic treatment. A study conducted by Ciriza et al. [37] indicated that dysphagia is the best parameter for emergency GI endoscopy.

## **Complications**

Severe complications due to retrieval are uncommon [38]. The most frequent complication is perforation related to the extraction of esophageal foreign bodies. Other complications are bleeding, aspiration and sedation-related side effects. It must be taken in account that some severe complications occur before any active medical intervention, mainly due to perforation. In this situation it is convenient to consider surgery. Progressive pain, fever dysphagia, gagging, vomiting or sensation of choking to induce oral secretion, complex foreign bodies and the time elapsed from the ingestion and clinical manifestations are the clinical data for this potentially severe condition. The complication rate varies when the total number of patients with foreign bodies ingestion requiring medical care or all those endoscopically treated is considered. In the

Chaves study [34] the complication rate was 38%, but only 9% occurred during the removal procedure (laceration, perforation and hematoma). The remaining complications were related to direct injury in the esophagus (27%) and injury of the stomach wall (2%) by the foreign body before removal was attempted. In the literature the total incidence of complications due to foreign bodies in the upper GI tract varies from 15 to 42%. In the Palta study [35] the total complication rate was 6% but these complications were detected before endoscopy in 10 out of 262 cases (4%).

It is very important to recognize a significant complication related to foreign body or after retrieval early since it is known that early treatment greatly influences the outcome [39]. If a complication is suspected, an x-ray can show air around the esophageal lumen. The clinical signs of complication are crackling post-procedure, progressive chest or abdominal pain, fever, tachycardia and shortness of breath. In this situation, front and lateral x-ray planes and radiography may show the presence of extraluminal air and the use of a hydrosoluble contrast study may facilitate the localization of perforation when the existing CT scan is a very sensitive method to assess extraluminal inflammation or perforation. In these cases the diagnostic work-up must be associated with surgical consultation.

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Josep M. Bordas, MD, PhD  
 GI Endoscopy, Gastroenterology Department  
 Institut de Malalties Digestives, Hospital Clinic  
 C/Villarroel, 170, ES-08022 Barcelona (Spain)  
 Tel. +34 93 227 55 23, Fax +34 93 227 98 50, E-Mail [jbordas@adam.es](mailto:jbordas@adam.es)