Esophageal Food Impaction and Foreign Object Ingestion in Gastrointestinal Tract: A Review of Clinical and Endoscopic Management

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Abstract: Foreign bodies in the digestive tract represent a frequent pathology for the emergency service. Foreign bodies are represented by impacted food bolus or voluntarily and involuntarily swallowed objects. Involuntary swallowing of objects occurs most frequently in children, especially between six months and three years of age. Food impaction is mostly encountered among adults with different pathologies. For the removal of swallowed foreign bodies, digestive endoscopy is the gold standard method, being successful in over 95% of cases without significant complications. For the endoscopic management of foreign bodies, it is crucial to be aware of the indications, devices, techniques and patient preparation in order to achieve successful and safe removal from the digestive tract. Recommendations in this article are based on a review of the literature and extensive personal experience.

Keywords: foreign bodies; food impaction; endoscopy; upper gastrointestinal tract

1. Introduction

Two of the most common endoscopic emergencies are esophageal food impaction (EFI) and foreign object ingestion (FOI) [1]. Most swallowed foreign bodies (80–90%) pass spontaneously, but endoscopic removal is required in about 10–20% of cases, and less than 1% require surgery to remove the foreign body or treat complications [2,3]. Depending on the type of foreign body swallowed, its location and the patient's health status, there is a risk that the patient will quickly become unstable [4].

According to the type of foreign bodies swallowed, they are divided into two categories: esophageal food impaction (EFI) and true foreign object ingestion (FOI). In addition, there are iatrogenic foreign bodies such as impacted endoscopic capsules, enteric, biliary or esophageal migrated stents. According to the patient profile, the ingestion can be voluntary (for example, among prisoners, patients with psychiatric diseases) or accidental (for example, patients with underlying gastrointestinal stenosis) [4].

The diversity of foreign bodies makes every case presented to the emergency department a challenge, even for the most experienced endoscopists [4]. Foreign bodies represent a condition that must be approached by a multidisciplinary team. Therefore, it is important to have available an otolaryngologist, a gastroenterologist and a general surgeon and/or a thoracic surgeon. Most frequently, patients arrive at the emergency room with an impacted food bolus at the esophageal level, with an estimated incidence of between 16 and 100,000 people/year [5,6]. However, there are 30% of the patients who suspect the presence of a foreign body, but with a negative endoscopy. Food impaction

(>75%) occurs mainly in adults and most of these have an underlying esophageal motility disorder and/or esophageal lumen pathology (benign or malignant): stricture, ring, bars, diverticula, anastomoses and neoplasias [6]. Ingestion of foreign bodies is common in children, with a peak between 6 months and 3 years [7]. Accidental ingestion of foreign bodies usually occurs in patients who wear dental appliances or have an altered mental status, whereas intentional ingestion of true foreign bodies occurs in patients with various psychiatric disorders, developmentally delayed patients, prisoners and drug dealers [6,8]. If esophageal obstruction results, it is most often in the proximal portion of a normal esophagus; in contrast, food impaction occurs primarily in adults and tends to take place in the distal esophagus because of esophageal pathology, usually a Schatzki's ring or a peptic stricture [5].

Endoscopy of the upper and lower digestive tract is the gold standard for diagnostic and therapeutic purposes for foreign bodies that have entered the gastrointestinal tract, with a failure rate of less than 5% of cases [9]. Foreign bodies cross the digestive tract and can cause obstruction or perforation; in addition, sharp objects at any point of impaction may cause perforation before extraction [7]. Esophageal perforation can be avoided when foreign bodies are pulled into the scope (overtube) before extraction [7,10]. The elective location of foreign bodies is at the level of the anatomical strictures of the esophagus; foreign bodies may also have a place at the level of congenital stenoses or post-caustic stenoses, as well as at the level of some regions with extrinsic compression [11].

The aim of this review is to highlight the challenges gastroenterologists face when they have to treat a foreign body in the digestive tract, but also the diagnostic algorithms and endoscopic treatment according to the latest international guidelines. In addition, we approach the management of specific foreign bodies in the digestive tract.

2. Diagnosis

The ingestion of esophageal foreign bodies is an emergency situation and requires timely management because of the potentially life threatening complications that ingestions pose [12]. Table 1 lists the main types of esophageal foreign bodies. The diagnosis can be outlined through a targeted anamnesis [9]. In conscious and cooperative adults, the history will often provide details about the type of object ingestion and the time since ingestion [6]. Often, children are not able to present an anamnesis and then a sudden refusal to eat, excessive salivation or respiratory symptoms (coughing or wheezing) will raise the suspicion of a swallowed foreign body [9]. The patient may present with sudden dysphagia while eating, often accompanied by anterior chest pain or odynophagia and inability to swallow saliva [9]. A good history should provide information about dysphagia–odynophagia, foreign body retention, gastroesophageal reflux disease (GERD), known structural and functional pathologies of the esophagus as well as what foods the patient has ingested and how much time has elapsed between the ingestion of food and their presentation to the emergency room [3]. The physical examination should begin with stabilizing the patient and rapidly detecting foreign body complications, so ventilation, airway compromise and risk of aspiration should be evaluated as a priority [13]. Fever, tachycardia, neck edema and subcutaneous crackles on palpation are suggestive signs of esophageal perforation [13].

Even if the object has passed through the esophagus, patients may have a foreign body sensation in the esophagus that manifests as dysphagia and may simulate a persistent foreign object impaction [12].

X-ray evaluation is indicated for all patients in whom an esophageal foreign body is suspected [9]. Lateral and anteroposterior x-rays of the neck, along with chest and abdomen x-rays, can be conducted to elicit a radiopaque foreign body [12]. Impacted foods, including fish or chicken bones, are radiolucent and often difficult to visualize on radiographs, yet radiologic evaluation is important to diagnose complications [13]. The endoscopist must take into account that the presence of fish bones and other objects cannot be ruled out by

radiographs and must not perform an investigation with oral contrast medium because of the possibility of aspiration [6].

Table 1. Classification of swallowed foreign bodies/objects, according to ESGE Clinical Guideline 2016 [2].

Category (Sort)	Example
Blunt bodies	Round bodies: coins, buttons, batteries and magnets
Cutting objects	Thin objects: needles, toothpicks, pins, razor blades, crushed glass, partial dental plaque
Impacted food (bolus)	With or without bones
Long objects	Turnscrew, toothbrush, fork, pen or pencil
Others	Packets of illegal drugs

If the physician suspects perforation of a digestive organ after clinical examination and emergency radiographs, a CT examination is recommended [2]. The cardinal symptom of esophageal perforation is chest pain, usually radiating posteriorly and to the left shoulder, sometimes accompanied by vomiting and dyspnea [4]. The triad: chest pain, vomiting and subcutaneous emphysema, is known as Mackler's triad [14]. Patients may also present with dysphagia, dysphonia or epigastric pain [14]. Using CT, the location, shape and size of the foreign body and connective tissue can be identified, which helps the physician determine endoscopic management [2]. The CT provides excellent anatomical information and can detect complications such as the formation of abscesses, mediastinitis or fistulas [15].

3. Management

The European Society for Gastrointestinal Endoscopy recommends immediate (<2 h, maximum 6 h after ingestion) therapeutic endoscopy for foreign bodies causing complete obstruction, sharp objects and batteries or magnets [2]. Urgent endoscopy (<24 h) should also be performed for other esophageal foreign bodies without complete obstruction [2].

Endoscopy of the upper digestive tract is very sensitive in detecting foreign bodies and has the advantage that therapeutic maneuvers can be performed [16]. In addition, endoscopy may reveal pre-existing esophageal pathology leading to obstruction and any mucosal damage [17]. The timing of endoscopic intervention is based on the perceived risks of aspiration and perforation [2]. In most cases, conscious sedation is sufficient for the endoscopic procedure (low dose midazolam) [18]. However, in complex cases where endoscopy takes a long time, it is necessary to perform general anesthesia to ensure the comfort of the patient and the physician [19]. Cases with upper esophageal obstruction may require orotracheal intubation or the use of a supratube to avoid mucosal injury [20]. In patients who do not have signs of complete obstruction, endoscopy may be delayed because the spontaneous passage of the food bolus may occur [21,22]. However, endoscopic intervention should not be delayed for more than 24 h after presentation because of the increased risk of complications, and preferably should be performed within 12 h [19]. In patients with severe distress, who are unable to control secretions, the endoscopy should be performed in the first 6–12 h. The sooner the esophageal obstruction is removed, the less risk there is of injuring the mucosa [2,13].

The risk of complications decreases if the object has passed into the stomach. Therefore, observation is acceptable and endoscopic intervention may be unnecessary, except for sharp and pointed objects. Sharp objects should be immediately removed whenever their location is above the ligament of Treitz. Long objects (>5 cm) or wide objects (>2 cm) should be endoscopically removed from the stomach if they have not passed in 3–5 days.

It is important for the gastroenterologist to be well trained (minimum 2500 endoscopies performed) and to know the appropriate instruments and techniques according to each situation [9,23]. Gastroenterologists need to be familiar with and trained in a wide range of

foreign body removal instruments [16]. A flexible endoscope is the gold standard diagnostic and therapeutic method for the obstruction of food and other foreign bodies, which has been successful in studies in over 90% of cases [24]. Standard flexible gastroscopes (9.8 mm outer diameter with a 2.8 mm diameter channel) are widely accepted and effective for adult patients [25]. The instruments used to extract foreign bodies from the digestive tract are varied and are used according to the type of foreign body: polypectomy snare, alligator forceps, Savary plug, tripod forceps, Dormia basket, recovery net, clear latex cap and overtube [26]. Recently, balloon enteroscopy (single and double) has been used to remove foreign bodies that cannot be removed with the standard flexible endoscope [4,27]. Grappling tongs with two to five teeth are used for lifting soft objects, but cannot be used for larger and hard foreign objects [2].

The Dormia basket is used to catch round objects, and nets or recovery bags are used for a more secure catch for some foreign bodies (coins, batteries) and the removal of food boluses; in addition, polypectomy traps are widely available and inexpensive [28]. Depending on the object to be removed, the endoscopist selects the type of instrument to use to extract the foreign body (Table 2) [2]. For small objects (needles, razor blades), alligator or rat forceps can be used; for soft objects, the endoscopist uses the Dormia basket, the polypectomy snare or the recovery net (Figure 1a,b) [6].

Table 2. Overview of retrieval devices, according to ESGE Clinical Guideline 2016 [2].

Foreign Body	Endoscopic Retrieval Devices
Blunt bodies	Polypectomy snare, Dormia basket, retrieval net, grasping forceps
Cutting objects	Grasping forceps, polypectomy snare, Dormia basket, retrieval net, clear latex cap, overtube
Long objects	Polypectomy snare, Dormia basket
Impacted food (bolus)	Polypectomy snare, grasping forceps, retrieval forceps, Dormia basket
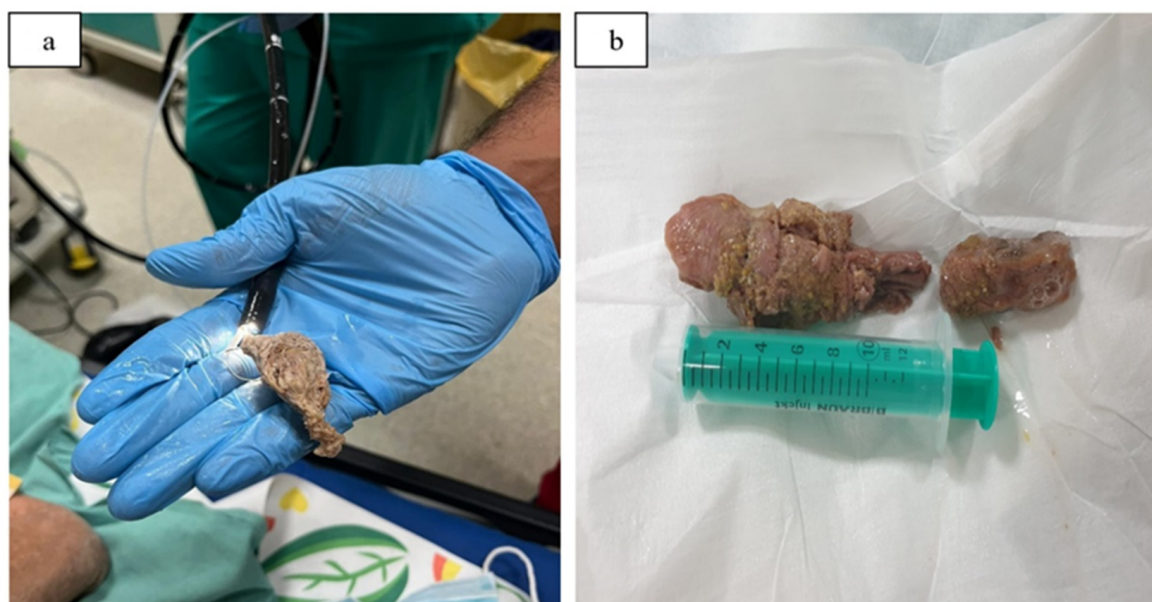
Figure 1. (**a**,**b**) Esophageal food impaction, extraction with polypectomy snares. From the Emergency Clinical Hospital Bucharest collection.

A Foley urinary catheter has been used sporadically in children who have swallowed various objects [29]. When the foreign object is located in the stomach, to protect the esophageal mucosa, a overtube is used through which the object will be extracted [26].

Several non-endoscopic therapeutic approaches have been investigated. Glucagon, administered in doses of 0.5–2.0 mg, can cause relaxation of the esophageal smooth muscle and lower esophageal sphincter, allowing the passage of the foreign body or food [30].

Most authors advocate administration of 1 mg glucagon before endoscopy (Chart 1), and if the foreign body does not advance, administration can be repeated after 30 min [31]. Successful therapy with glucagon ranges from 12% to 58%. Side effects of glucagon comprise nausea, vomiting and abdominal distension. Carbonated beverages such as Coca-Cola or Pepsi can be used to cleanse the esophagus with little risk to the patient [32]. These effervescent agents release carbon dioxide gas to distend the lumen and also to push the foreign body from the esophagus into the stomach. However, aspiration and perforation have been reported as possible complications. There are numerous diseases of the esophagus that favor obstruction (Table 3), such as peptic strictures, eosinophilic esophagitis or esophageal motility disorders (achalasia) or surgical interventions (Nissen fundoplication, esophagectomy, bariatric surgery) [4]. Although it is an underestimated condition, eosinophilic esophagitis is thought to be one of the main causes of food impaction. Mucosal biopsies should be obtained after bolus removal in order to establish diagnosis and therefore prevent reimpaction.
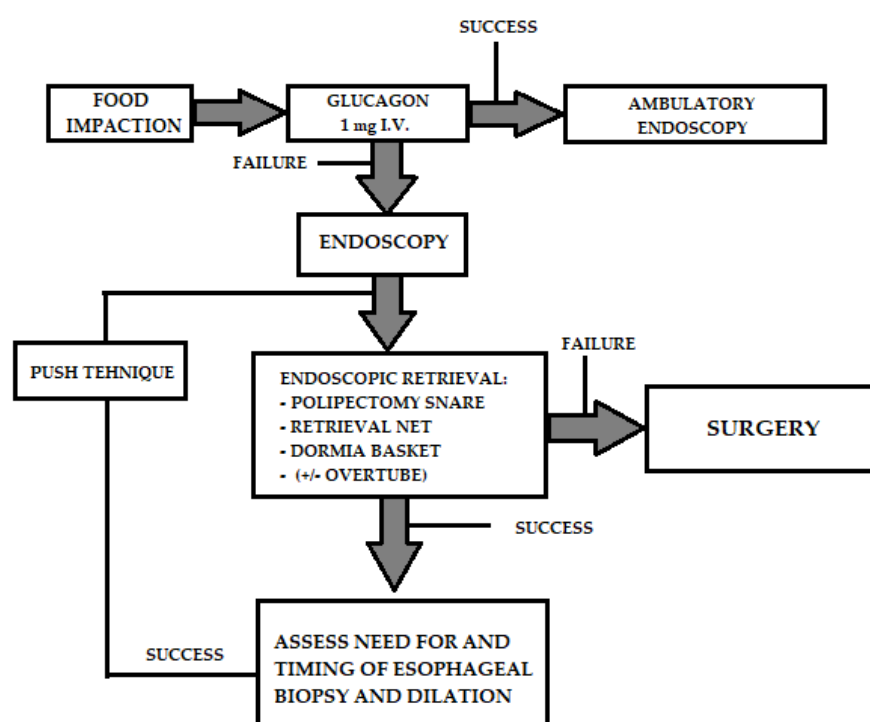
Chart 1. Therapeutic algorithm for food impaction in the esophagus. Glucagon can be administered intravenously before endoscopy to relax the esophagus and accelerate spontaneous mobilization of the impacted food. If this fails, endoscopy is performed and the foreign body is mobilized or extracted.

Table 3. Pathology of the esophagus that can cause the retention of foreign bodies, by Fung et al. [4].

Examples of Underlying Disorders Implied in Esophageal Obstruction	
Eosinophilic esophagitis	Schatzki ring
Peptic stricture	Radiation-induced stricture
Esophageal neoplasia	Diverticulum
Achalasia and other spastic dysmotility	Post-surgical (fundoplication)

Nifedipine and nitroglycerin are not recommended for esophageal obstruction due to side effects and lack of efficacy [33]. Radiological methods under fluoroscopy have been described for treatment, using Foley probes and suction probes to extract the objects [34]. The most frequently described device is the Foley catheter which is passed distal to the foreign object, inflated at the tip and then withdrawn into the oropharynx along with the object. The procedure is performed under fluoroscopic guidance. However, radiological

methods are not commonly preferred, unless flexible endoscopy is unavailable, because the object cannot be controlled, especially at the hypopharynx and the pharyngoesophageal sphincter [34,35]. Complications may include aspiration, perforation, laryngeal spasm, epistaxis and even death of the patient [6]. The timing for endoscopy have been summarized in Table 4. To protect the airway, older guidelines and manuals often recommended anesthesia and orotracheal intubation [23]. In the experience of the Bucharest Emergency Hospital, orotracheal intubation to protect the airway is not necessary in most cases, and sedation can be easily provided with midazolam [23].

Table 4. Timing for endoscopy [2].

Object Type	Location	Timing
Batteries	Esophagus	Immediate (<2 h)
	Stomach/small intestine	Urgent
Magnets	Esophagus	Urgent
	Stomach/small intestine	Urgent
Cutting objects	Esophagus	Immediate (<2 h)
	Stomach/small intestine	Urgent
Blunt and small foreign body < 2.5 cm size	Esophagus	Urgent
	Stomach/small intestine	Non-urgent
Blunt and medium-sized foreign body > 2.5 cm size	Esophagus	Urgent
	Stomach/small intestine	Non-urgent
Large object > 5 cm	Esophagus	Urgent
	Stomach/small intestine	Urgent
Impacted food (bolus)	Esophagus	Immediate (urgent if obstruction is not complete)

4. Specific Foreign Bodies

4.1. Food Bolus Impaction

Most often, meat becomes stuck in the esophagus (steakhouse syndrome) [36]. After esophageal obstruction by food, patients tend to swallow extra food to push the food bolus into the stomach [36]. The obstruction of the esophagus by food can be pushed toward the stomach with the endoscope or extracted with various tools at the working channel of the endoscope [37]. Another method of relieving the esophagus is to push the food bolus out of the esophagus into the stomach using Savary–Gilliard plugs [13].

The Savary guide is inserted through the food bolus and under radiological screening it reaches the stomach; then, it is dilated with Savary spark plugs from the smallest to the largest spark plug [38]. If there is resistance when pushing or the presence of the alimentary bolus with bone is suspected, the alimentary bolus is extracted piece by piece either with the basket probe, with the polypectomy snare or with the Alligator forceps [21]. Biopsies may be required after extraction of the food bolus to determine underlying esophageal pathology [5]. If there are no significant mucosal lesions, it is useful to perform dilatation with Savary plugs in the same session to reduce the risk of recurrence [39]. If the mucosa of the esophagus is affected and signs of inflammation are present, a further session is performed to dilate the esophagus with Savary plugs, ensuring treatment with proton pump inhibitors until then [13].

4.2. Sharp-Pointed Object

Sharp or pointed foreign bodies must be extracted as a priority before passing through the stomach, as there is a high risk of them perforating the intestine [22]. Swallowing sharp foreign bodies such as bones (Figure 2), toothpicks and dental apparatus or plaque (Figure 3) can be dangerous as they can affect the airway, perforate or penetrate the intestine, form aortic or tracheal fistulas or cause cardiac tamponade [9]. The most common objects that can cause organ perforation are fish or chicken bones, but also toothpicks and plastic cutlery [40]. Fish bones usually remain in the mouth, larynx and pharynx, but also in the upper esophagus [41]. For non-penetrating bones, extraction with alligator

clips is easiest. Penetrating bones that cannot be extracted endoscopically are extracted surgically [41]. Swallowed drug blisters can damage the esophagus and can be removed with a recovery net [42].
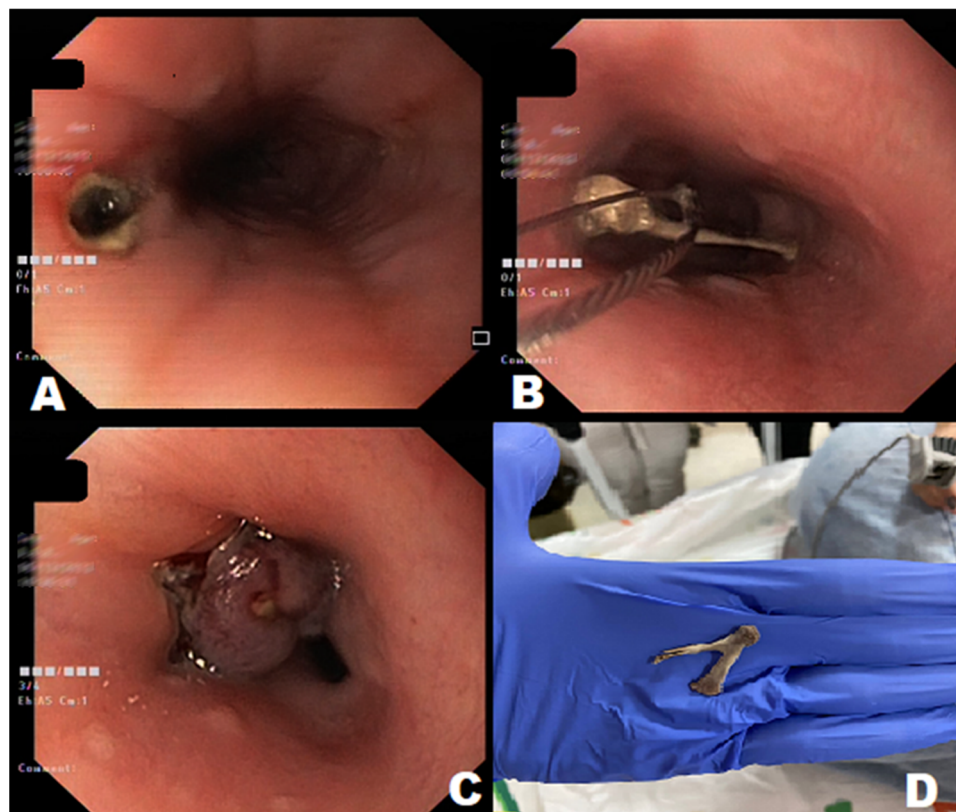
Figure 2. (**A**) Esophagus fistula after perforation with chicken bone. (**B**) Chicken bone, endoscopic extraction with polypectomy snare. (**C**) Endoscopic treatment of Esophageal Fistula with Padlock Clip fixation system. (**D**) Chicken bone after extraction. Emergency Clinical Hospital Bucharest collection.
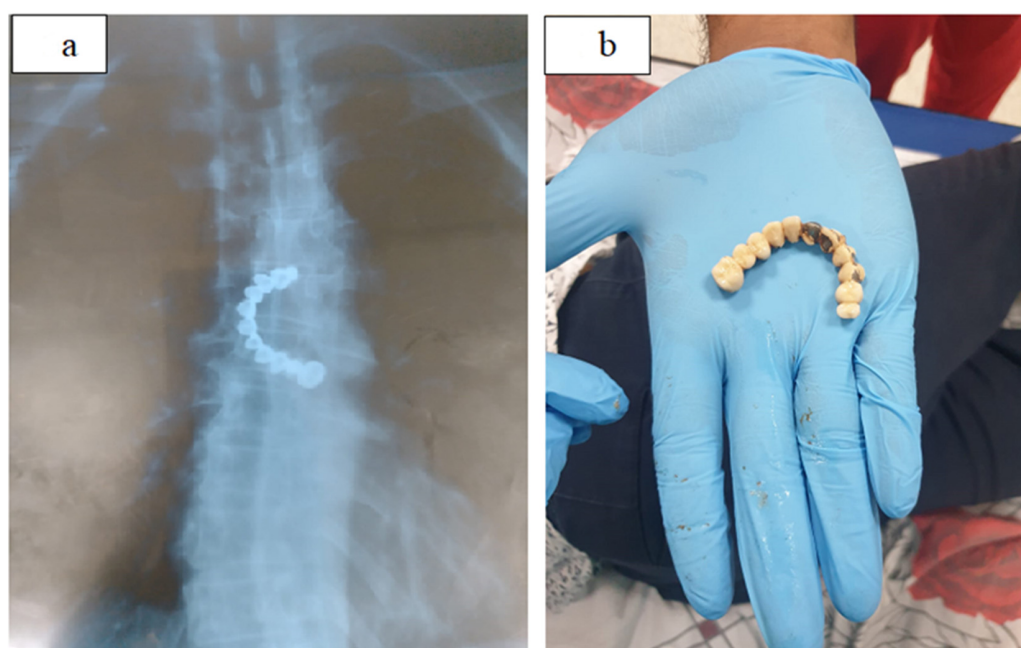
Figure 3. (**a**,**b**). Dental plaque in esophagus, extraction with polypectomy snares. Emergency Clinical Hospital Bucharest collection.

Even if the presence of a foreign body is not evident on the radiograph, but the history suggests the presence of a foreign body, the physician will need to perform a diagnostic endoscopy [43]. If signs and symptoms of perforation occur or ingested sharps do not progress within 72 h of ingestion, surgery is required [44]. Serial radiographs will be taken of the patient to document safe progress through the digestive tract and the patient will be instructed to report any change in health: abdominal pain, fever and chills, vomiting and gastrointestinal bleeding manifested by hematemesis, hematochezia or melena [43].

4.3. Blunt Objects: Coins, Batteries, and Magnets

Watches, hearing aids or other small devices contain a button or small disc batteries. Contact between the two poles of the batteries with the mucosa may cause corrosive injury, necrosis and perforation [9]. The endoscopist may use a retrieval snare or stone extraction basket for the extraction [28]. The voluntary or involuntary ingestion of magnets is a delicate problem which can cause serious damage to the gastrointestinal tract [45]. Ingested magnets cause necrosis and may lead to possible perforation and fistula formation or even intestinal obstruction [46]. Therefore, anterior–posterior and lateral radiographs are important and must be performed as soon as possible [6]. The upper digestive endoscopy must also be performed as soon as possible and the removal of the magnets can be performed with recovery nets or Dormia basket [9]. Last but not least, control radiographs are taken after the endoscopy to exclude any remaining foreign bodies [47]. Disc batteries are a particular problem because they may contain an alkaline solution that can cause liquefaction necrosis shortly after ingestion, leading to perforation or the formation of a fistula [48].

4.4. Long Object

Long objects (longer than 5 cm) such as toothbrushes, spoons and pens are most likely to become stuck in the duodenum and should be removed [9]. This can generally be accomplished with a polypectomy snare. A polypectomy trap is used for removal and an overtube may be used to protect the esophagus and respiratory tract. Urgent endoscopy should be performed as soon as possible and surgery is required in case of perforation [43]. Renee Palta et al. presented, in a study conducted on 262 cases of voluntary ingestion of foreign bodies, that 90% of cases could be resolved endoscopically and 10% required surgery for their removal [49]. Furthermore, the foreign bodies were located in the gastric region in 80% of the cases [49].

4.5. Illegal Drug Packages

Narcotics are often introduced into the body orally or anally in the form of packets (often made of rubber or other material) and usually contain cocaine, amphetamines and heroin [50]. The drug traffickers swallow the drugs mainly to protect themselves from prosecution, and the quantity of the drug can be lethal [51]. Despite appearances, they should not be extracted endoscopically as the risk of perforation is high and accidental release with consequent drug overdose can be rapidly fatal [52]. If symptoms such as psychomotor agitation, tachycardia, palpation, hyperthermia and dilated pupils occur, a possible penetration of the drug into the body should be suspected as a result of breaking the narcotic packages [52]. This allows them to be visualized endoscopically so that the diagnosis is certain. In the small ones, their removal is facilitated by a purgative, and in the large ones by surgical interventions depending on the location: gastrostomy, enterotomy or colotomy [53]. Observation with a liquid diet and serial radiographs is recommended. Pharmaceutical agents that increase gastrointestinal motility (metoclopramide and erythromycin) have been described as useful in the treatment of drug-pack swallowers [54]. Mandava et al. describe in their study that up to 45% of those who take packages containing narcotics require various surgical procedures to remove them [54].

4.6. Small Bowel Foreign Objects

Once an ingested object has transited the esophagus and stomach, it continues its journey through the duodenum, jejunum, ileum, colon and rectum, depending on its size, before being excreted [4]. This does not always happen, either because of the size and shape of the foreign body or because of an underlying pathology such as the intestinal strictures that occur in Crohn's disease or after radiotherapy [55].

In these cases, whilst the data presented in the literature are limited, a small number of cases can be resolved endoscopically and the rest result in surgery [56]. However, with the advancements of device-assisted enteroscopy, endoscopists have the possibility of safely and efficiently removing foreign bodies by using balloon enteroscopes with dedicated accessories such as baskets, hoods and forceps.

4.7. Colorectal Foreign Objects

Foreign bodies found in the colorectal area may result either from the anterograde passage of ingested objects or from their introduction (retrograde) directly into the rectum [57]. The latter is usually the result of psychiatric illness, sexual practices or the introduction of illicit drugs to be transported [4]. Most of them can be removed non-surgically, by manual extraction, if they are blunt and palpable on rectal examination. X-ray examinations should be a priori performed to accurately describe the location, orientation and type/configuration of the object. The symptomatology in patients with a colorectal foreign body varies from rectal tenesmus, abdominal pain and rectal bleeding and the complications that may occur are determined by perforation, peritonitis or bowel obstruction [58]. To avoid injury to the doctor, the foreign body should not be removed manually until the presence of a sharp or pointed object is excluded [4]. Foreign bodies located at the level of the sigmoid often require surgical intervention compared to those at the level of the rectum [59]. Intrarectal foreign bodies can be removed with moderate sedation, but bulky foreign bodies: vibrators, bottles or deodorants (Figure 4), require general anesthesia and surgical intervention [59]. Surgery is additionally indicated in the presence of abscesses, peritonitis, perforation and obstruction.

Figure 4. Intrarectal foreign body (deodorant) on x-ray. From the Emergency Clinical Hospital Bucharest collection.

5. Endoscopic Procedure-Related Complications

The percentage of complications in endoscopic procedures to remove foreign bodies is less than 2% [21]. The most serious and medicolegally important consequence is the death of the patient on the endoscopy table. Another feared complication is perforation. The patient may be treated endoscopically (padlock clip fixation system or with an expandable stent) or require emergency surgical intervention [60]. The risk of aspiration depends on the patient's level of consciousness, analgesia, type of foreign body and the duration of obstruction [61]. Uncooperative patients, foreign bodies and their extraction, sharp and pointed objects (Figure 5), prolonged time from obstruction to removal of the foreign body and stenotic pathology of the esophagus are factors that increase the risk of complications during endoscopic intervention [62].
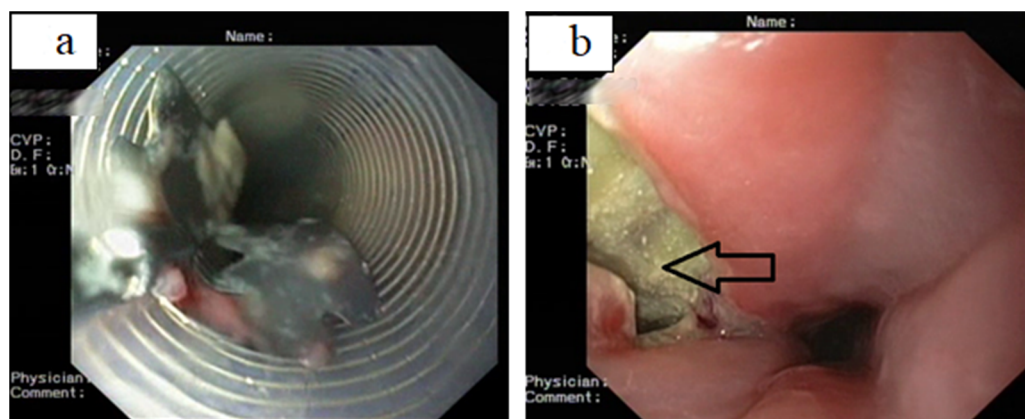
Figure 5. (**a**,**b**) Foreign body (blade) extracted with alligator forceps through the overtube; Esophageal mucosa tear after extraction (arrow). From the Emergency Clinical Hospital Bucharest collection.

6. Conclusions

Foreign object ingestion represents a frequently encountered endoscopic emergency, each case bringing its own particularities and challenges. Endoscopists must be trained to remove foreign bodies and know the methods, instruments and possible complications. Flexible therapeutic endoscopy is the treatment of choice being a reliable procedure in the hands of skilled endoscopists, holding a high success rate, low morbidity rate and no mortality.

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