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# Swallowed Foreign Bodies in Children: Diagnosis and Methods of treatment

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## 1. Abstract

### 1.1. Backgrounds

Children continue to swallow foreign bodies, some of which are bizarre and can be life threatening but coins continue to be the most common. This review presents our experience with 85 swallowed foreign bodies outlining aspects of diagnosis and management.

### 1.2. Patients and Methods

The medical records of all children with the diagnosis of swallowed foreign body were retrospectively reviewed for age at diagnosis, type of swallowed foreign body, diagnosis and management.

### 1.3. Results

During a 12-year period, from June 2009-July 2020, a total of 85 children with swallowed foreign bodies were treated. Their age ranged from 8 months to 13 years (mean 5.8 years). There were 55 males and 30 females. All were healthy except two who had repair of esophageal atresia with tracheoesophageal fistula. A variety of foreign bodies were swallowed. This included button batteries in 3 and swallowed magnets in 8 but coins were the commonest swallowed objects. All were managed conservatively except those with esophageal foreign bodies where a policy of emergency removal was adopted. Five required surgical removal including one in the esophagus and 4 required laparotomies to remove complicated swallowed foreign bodies. The 8 swallowed magnets were removed endoscopically in 2, surgically in 2 and laparoscopically in 4.

### 1.4. Conclusions

A variety of objects can be swallowed by children but coins continue to be the commonest. A policy of wait and follow-up is safe to treat the majority of swallowed foreign bodies except esophageal foreign bodies, and multiple magnets. Esophageal foreign bodies should be removed to avoid the risk of perforation. Multiple swallowed magnets require surgical removal and this can also be done laparoscopically.

## 2. Introduction

Children are known to ingest inadvertently or intentionally a variety of foreign bodies. Swallowed foreign bodies are common among children and a variety of foreign bodies such as coins, pins, screws, button batteries, magnets or toy parts have been reported to be ingested by children [1-5]. Sometimes bizarre foreign bodies have been ingested by children [6,7]. The greatest incidence of swallowed foreign bodies is among children aged 6 months to 4 years [1]. Fortunately, the majority of ingested foreign bodies pass spontaneously without health consequences or damage to the gastrointestinal tract [1-10]. This however is not the case always and some foreign bodies can cause complications including bleeding, gastrointestinal tract perforation and/or intestinal obstruction. Although coins are the commonest foreign bodies to be swallowed by children, a variety of other objects can be swallowed some of them may cause serious life-threatening complications such as button batteries and magnets [3, 4, 5, 11, 12 and 13]. The presentation and management of swallowed foreign bodies is variable depending on the type, site and size of the foreign body. This study is a review of our experience of swallowed foreign bodies in children with emphasis on aspects of diagnosis and management.

## 3. Patients and Methods

The medical records of all children with the diagnosis of swallowed foreign bodies were retrospectively reviewed for age at diagnosis, type of swallowed foreign body, diagnosis and management.

### 3.1. Results

During a 12-year period, from June 2009-July 2020, a total of 85 children with swallowed foreign bodies were treated. Their age ranged from 8 months to 13 years (mean 5.8 years). There were 55 males and 30 females. All were healthy without preexisting esophageal disease except two who had repair of esophageal atresia with tracheoesophageal fistula. The diagnosis of swallowed radiopaque foreign bodies was confirmed by a cervical, chest and abdominal x-ray to confirm the number and site of swallowed foreign body. These x-rays were repeated prior to endoscopic or surgical removal of radiopaque foreign bodies. For those patients in whom the foreign body had passed to the stomach or distally, follow-up plain abdominal x-rays were performed to assess the progress of the foreign body and its passage in the feces. The frequency of these x-rays is variable but in general these x-rays are ordered every 48 hours and then weekly if these foreign bodies are not causing problems. The parents were also instructed to inspect the stools for the spontaneous passage of the foreign. A variety of foreign bodies were swallowed but coins were the commonest objects (Figures 1a, 1b, 2). Forty-six (54%) of the swallowed foreign bodies were coins. The size of these coins was also variable. This was an important factor as large coins got stuck in the esophagus while small coins passed to the stomach. Large coins (15 patients) were removed from the esophagus using a rigid or flexible esophagoscope. In two of them a Foley's catheter was used to remove the coin from the upper part of the esophagus. One patient was referred to our hospital after four days of a swallowed coin got stuck in the upper third of the esophagus. This was removed endoscopically but with difficulty as it was deeply stuck and about to perforate the esophagus. These coins usually get stuck in the upper third of the esophagus just distal to the cricophayngeous muscle. The remaining 31 were small coins and all of them passed spontaneously in the stools. One girl presented with a neglected swallowed plastic sharp button that got stuck in the upper esophagus and caused esophageal perforation (Figures 3a and 3b). This was diagnosed using barium swallow and CT-scan and removed surgically. The perforation in the esophagus healed conservatively. In two patients, the swallowed foreign bodies were diagnosed intraoperatively. One of them presented with bile-stained vomiting and features of duodenal obstruction. He had a contrast study which showed intra-luminal duodenal obstruction (Figure 4). Intra-operatively, he was found to have a gelatinous type of sweets that did not dissolve and got stuck to each other causing acute duodenal obstruction. The other child presented with acute small bowel intestinal obstruction and intra-operatively, he was found to have a pacifier that he swallowed and caused acute intestinal obstruction (Figures 5a and 5b). Two patients presented with dysphagia and vomiting and were found to have seeds and pieces of meat that caused obstruction at the site of esophageal stricture following repair of esophageal atresia and tracheoesophageal fistula. These were removed endoscopically. Two of our patients swallowed a small bulb that was stuck in the esophagus (Figures 6a and 6b). In one of them this was removed endoscopically while the other one he vomited it out. Another patient swallowed a metal dog toy that passed spontaneously. Two girls swallowed a gold ring that was removed endoscopically from the esophagus in one and from the stomach in the other (Figures 7a and 7b). A boy swallowed a piece of a blade used to cut carpets and this was also removed endoscopically from the stomach. One of our patients was referred to our hospital after seven days of swallowing a nail that was stuck in the wall of the duodenum. Two endoscopies failed to dislodge the nail and this was removed surgically through a laparotomy. Intraoperatively, the nail penetrated part of the duodenal wall but did not cause perforation. Three of our patients swallowed button batteries. One was large and got stuck in the esophagus and this was removed endoscopically. The other 2 swallowed a small button battery which has already passed into the small intestines at the time of presentation. These were treated conservatively and on follow up passed spontaneously with stools. Of the 77 swallowed foreign bodies and excluding those with swallowed magnets, 29 (38.2%) required either endoscopic or surgical removal while the remaining 48 passed spontaneously. One of them vomited the swallowed foreign body which was a small bulb (Tables 1 and 2). Eight of our patients swallowed several magnets that resulted in complications including small bowel perforation and intestinal obstruction necessitating an emergency laparotomy and intestinal resection in some of them as shown in table 3. In 2 of our patients the magnets were removed endoscopically. Two required laparotomies to remove the magnets including removing 25 cm of small intestine in one and closure of two perforations in the small intestines (Figures 8a, 8b, 8c and 8d). In 4 of them, the magnets were removed laparoscopically and in one this required resection of a small part of the small intestines. Postoperatively all did well and there was no mortality.

**Table 1.**

| FOREIGN BODY | NO. | LOCATION | OUTCOME |
|---|---|---|---|
| LARGE COINS | 15 | ESOPHAGUS | ENDOSCOPIC REMOVAL |
| GOLDEN RING | 2 | ESOPHAGUS AND STOMACH | ENDOSCOPIC REMOVAL |
| PIECE OF BLADE | 1 | STOMACH | ENDOSCOPIC REMOVAL |
| LARGE BUTTON BUTTERY | 1 | ESOPHAGUS | ENDOSCOPIC REMOVAL |
| PIECE OF BONE | 1 | ESOPHAGUS | ENDOSCOPIC REMOVAL |
| LARGE PLANT SEED | 1 | ESOPHAGUS | ENDOSCOPIC REMOVAL |
| PLATIC BUTTON | 1 | ESOPHAGUS | SURGICAL REMOVAL |
| GELATINOUS SWEETS | 1 | DUODENUM | SURGICAL REMOVAL |

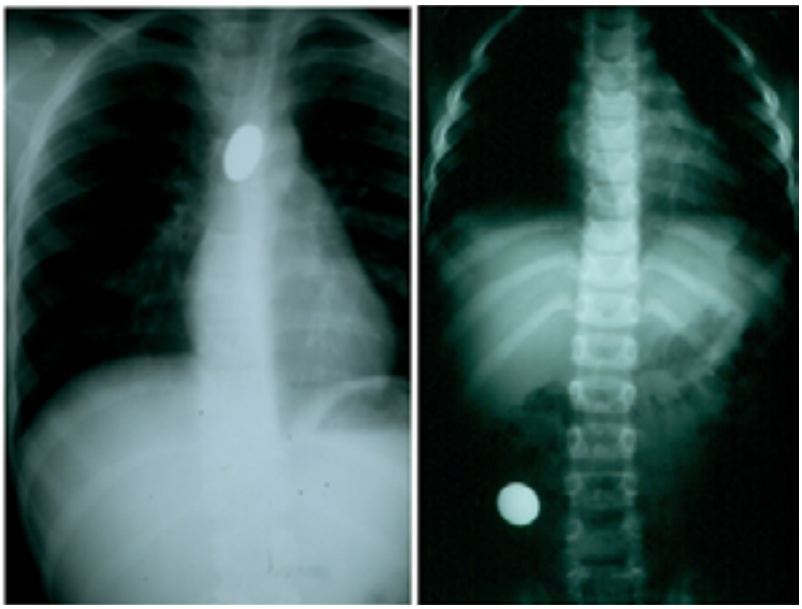
| | | | |
|---|---|---|---|
| METALLIC NAIL | 1 | DUODENUM | SURGICAL REMOVAL |
| METALLIC NECKLACE | 1 | JEJUNUM | SURGICAL REMOVAL |
| METALLIC WIRE | 1 | ESOPHAGUS | ENDOSCOPIC REMOVAL |
| A PACIFIER | 1 | JEJUNUM | SURGICAL REMOVAL |
| SEEDS AND PIECES OF MEAT | 2 | ESOPHAGUS | ENDOSCOPIC REMOVAL |
| TOTAL | 29 | | |

**Table 2**

| FOREIGN BODY | NO | OUTCOME |
|---|---|---|
| SMALL COINS | 31 | PASSED IN STOOL |
| METALLIC NAIL | 6 | PASSED IN STOOL |
| SMALL BUTTON BATTERY | 2 | PASSED IN STOOL |
| METALLIC SCREW | 3 | PASSED IN STOOL |
| SEWING NEEDLE | 1 | PASSED IN STOOL |
| METALLIC DOG TOY | 1 | PASSED IN STOOL |
| PART OF A ZIPPER | 1 | PASSED IN STOOL |
| METALLIC PIN | 1 | PASSED IN STOOL |
| STABLER WIRE | 1 | PASSED IN STOOL |
| SMALL ELECTRIC BULBE | 1 | VOMITTED |
| TOTAL | 48 | |

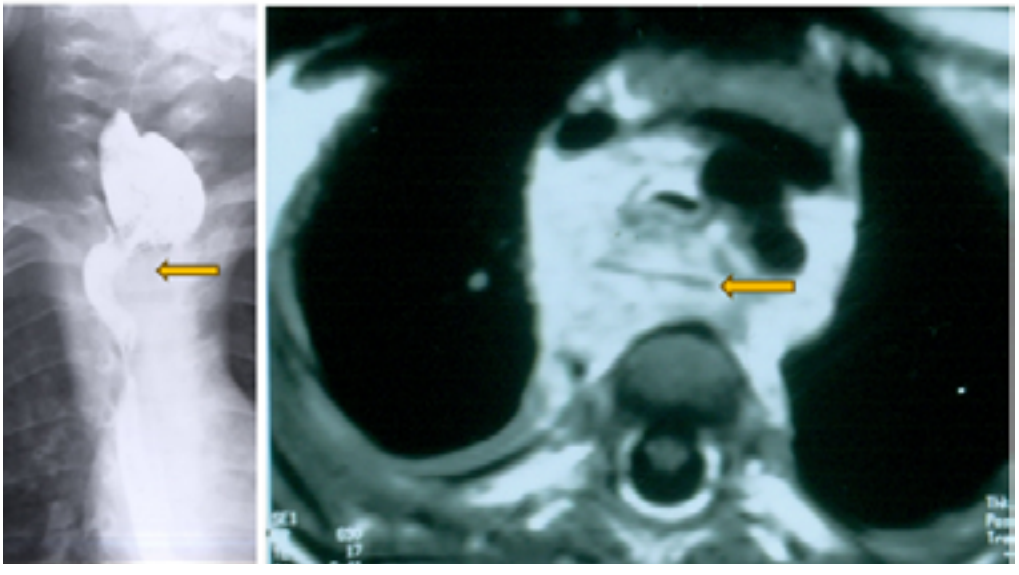
**Table 3**

| FOREIGN BODY | NO | OUTCOME |
|---|---|---|
| 2-YEAR-OLD FEMALE WITH MULTIPLE MAGNETS | 1 | REMOVED SURGICALLY WITH RESECTION OF 25 CM OF JEJUNUM |
| 7-YEAR-OLD MALEWITH 1 ABDOMINAL, 2 ESOPHAGEAL AND I IN LEFT BROCHUS MAGNETS | 1 | 1 PASSED IN STOOL |
| | | 2 REMOVED EDOSCOPICALLY FROM UPPER ESOPHAGUS |
| | | 1 REMOVED BRONCHOSCOPICALLY |
| 2-YEAR-OLD MALE WITH MULTIPLE MAGNETS | 1 | REMOVED LAPAROSCOPICALLY WITH RESECTION OF SMALL PART OF SMALL INTESTINES |
| 10-YEAR-OLD FEMALE WITH 2 MAGNETS | 1 | REMOVED LAPAROSCOPICALLY |
| 8-YEAR-OLD MALE WITH MULTIPLE MAGNETS | 1 | REMOVED LAPAROSCOPICALLY |
| 2-YEAR-OLD MALE WITH 3 MAGNETS | 1 | REMOVED SURGICALLY |
| | | 2 PERFORATIONS CLOSED |
| 13-YEAR-OLD MALE WITH 2 MAGNETS | 1 | LAPAROSCOPICALLY MOBILIZED |
| | | 1 REMOVED ENDOSCOPICALLY |
| | | 1 ALLOWED TO PASS IN STOOL |
| 2-YEAR-OLD MALE WITH 3 MAGNETS IN STOMACH | 1 | REMOVED ENDOSCOPICALLY |
| TOTAL | 8 | |



**Figures 1a and 1b**: Plain x-ray showing swallowed coin in the esophagus and in the abdomen. The first was removed endoscopicaly while the second one passed spontaneously in the stools.

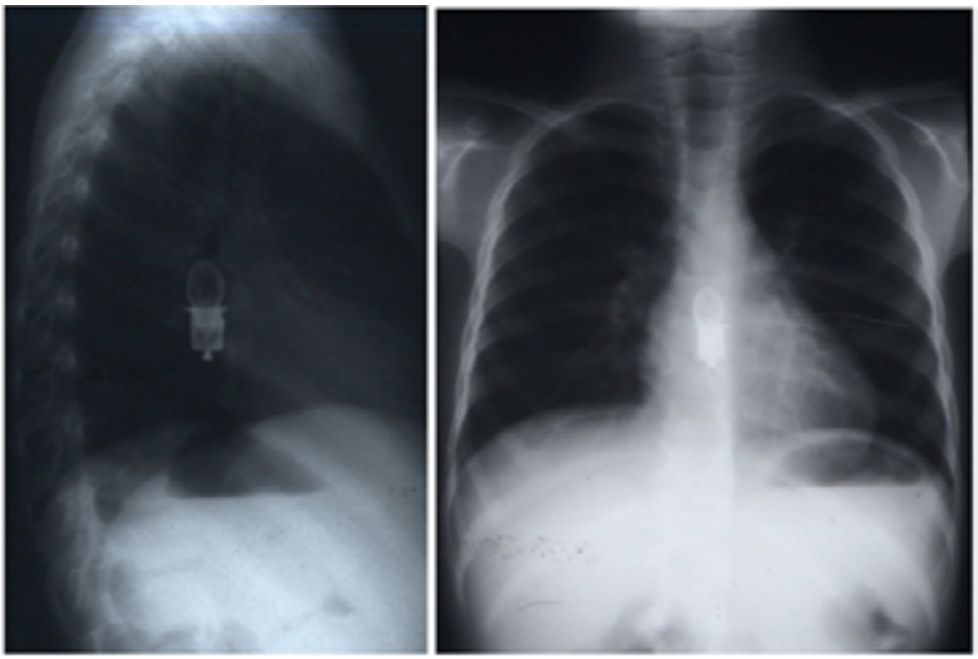
**Figure 2**: A photograph showing a variety of swallowed foreign bodies including coins, a small bulb, a needle, a piece of bone, a piece of blade and a bended meatal wire.



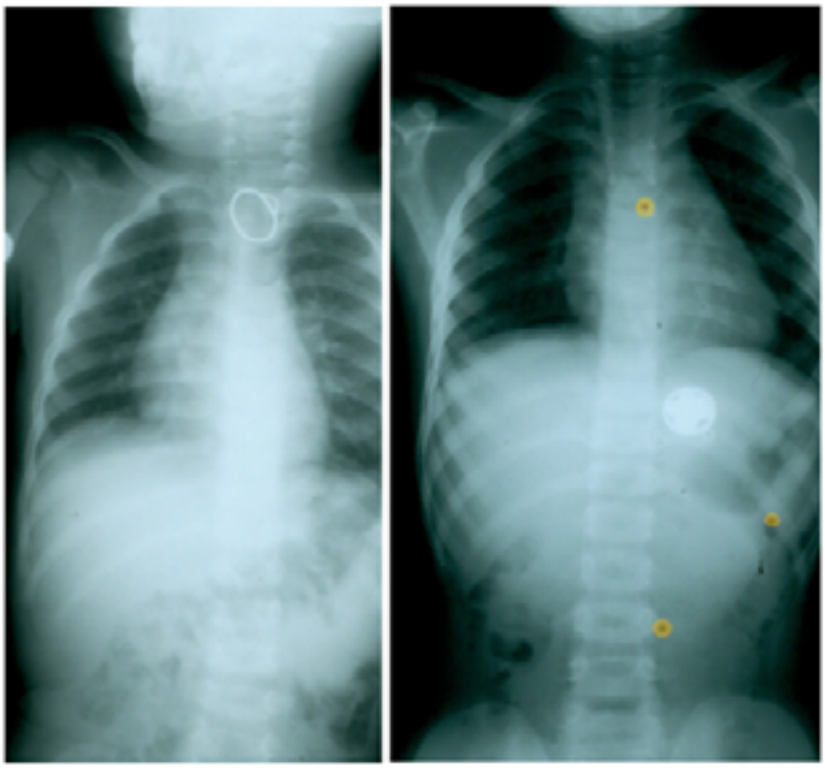
**Figures 3a and 3b**: Barium swallow and CT scan showing eaophageal perforation seconday to a swallowed plastic button.

**Figure 4**: Barium meal showing intraluminal obstruction by a wallowed foreign body (Gelatinous sweets).

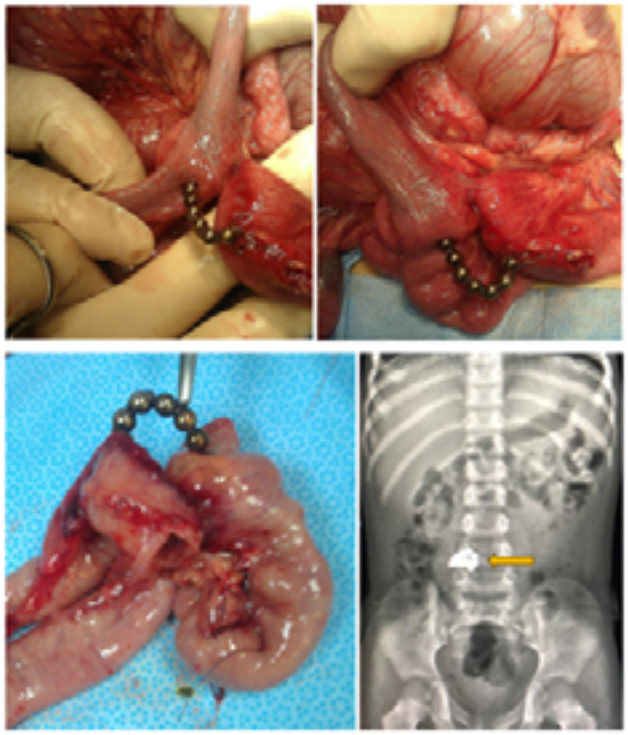
**Figures 5a and 5b**: Intraoperative photograph showing intestinal obstruction by a swallowed pacifier.



**Figures 6a and 6b**: Chest x-rays showing swallowed small bulbs.



**Figures 7a and 7b**: Chest x-rays showing swallowed gold rings, one in the esophagus and the other one in the stomach.



**Figures 8a, 8b, 8c and 8d**: Intraoperative photographs and abdominal x-ray showing swallowed magnets that caused intestinal obstruction and fistula formation. These were removed surgically including resection of about 25 cm of small intestines.

## 4. Discussion

Children are known to ingest a variety of foreign bodies. One reason for this is that children tend to put things in their mouth leading to inadvertently or intentionally swallowing these foreign objects. It is important to educate parents about this and the danger of leaving foreign small objects in the hands of their children which can lead to swallowing different objects by their children which sometimes can be life threatening [7,10,11). Parents should avoid giving their children small toys and objects to play with. A variety of foreign bodies are ingested by children but coins continue to be the commonest swallowed foreign bodies [1-5]. This was the case in our series. Forty-six (54%) of the swallowed foreign bodies were coins. Swallowed coins can be large or small in size. Large coins tend to be stuck in the esophagus and need to be removed endoscopically while small coins will pass the esophagus and commonly will pass spontaneously with stools. Button (disk) batteries are important and increasingly swallowed foreign bodies by children. Button

batteries can pass through the gastrointestinal tract without adverse effects but may become lodged at any part of the gastrointestinal tract causing ulceration, necrosis and perforation [5,13,14,15,16,17]. The management of button batteries depends on their size and location in the gastrointestinal tract. Button batteries that are stuck in the esophagus needs to be removed as an emergency. This can be done endoscopically as neglected button batteries stuck in the esophagus can cause serious complications and there are reports of tracheoesophageal fistula and intestinal perforation as a complication of ingested button batteries [14, 15]. Button batteries in the stomach or intestines on the other hand do not need to be removed immediately, as they generally pass through the gastrointestinal tract without adverse effects but they need to be monitored closely. Swallowed button batteries once passed the esophagus should be followed up closely and retained button batteries in the stomach or at a fixed spot in the intestines calls for their removal. It is our policy to remove button batteries that are retained in the stomach for 2-3 days or those that do not pass out from the intestines in 2-3 days. This can be done endoscopically for the ones in the stomach or surgically for the ones in the intestines [16]. There are different types of button batteries, but mercury ones are the most common and most dangerous as they may cause mercury salt poisoning [17]. Children are known to ingest a variety of foreign bodies and sometimes bazar foreign bodies but fortunately the majority of them pass spontaneously without complications. This however is not the case always and sometimes these swallowed foreign bodies can lead to complications including intestinal obstruction, intestinal perforation or bleeding. This is specially so if the objects are large or sharp [18-21]. Children who swallow foreign bodies are usually asymptomatic and they are brought to the hospital either because they admit swallowing a foreign body or because the parents saw the child swallow the foreign body but sometimes, they are brought to the hospital because of swallowed foreign bodies related complications. Fortunately, the majority of swallowed foreign bodies will pass safely with feces but sometimes complications develop commonly from esophageal impaction and intestinal obstruction or perforation. The most common site for foreign bodies to become stuck in the esophagus is at the thoracic inlet and the cricopharyngeal muscle. It is estimated that about 70% of swallowed foreign bodies lodge at this site. About 15% of swallowed foreign bodies become stuck at the mid esophagus and the remaining 15% get stuck at the gastroesophageal junction. It is important to locate the site and type of esophageal foreign bodies prior to any intervention and it is our policy to do a plain x-ray of the chest and abdomen just prior to any intervention as the position of the foreign body can change any time. Blunt esophageal foreign bodies can be removed by using a Foley catheter, passing it beyond the swallowed foreign body, inflating the balloon slightly and pulling it out with the foreign body or the foreign body may be pushed down into the stomach with a bougie [22-26]. The bougienage method should not be performed on children with known lower gastrointestinal abnormalities or distal esophageal stenosis as this may further complicate the procedure. The use of Magill forceps and/or a Foley catheter, has been shown to be safe and effective in children with upper esophageal foreign bodies [27]. Kelly et al advocated the use of Foley catheter to extract coins lodged in the upper third of the esophagus and bougienage of coins lodged in the distal two thirds of the esophagus [1]. We have used this technique in 2 of our patients without any adverse effects. Children with preexisting esophageal abnormalities such as congenital esophageal stenosis or stricture following repair of esophageal atresia with or without tracheoesophageal fistula are likely to have foreign body stuck at the site of the pathology and these foreign bodies should be removed under vision using a rigid or flexible esophagoscopy. Two of our patients had seeds and pieces of meat stuck at the site of previous repair of esophageal atresia and tracheoesophageal fistula and these were removed endoscopically. Endoscopy (esophagoscopy) is by far the most commonly used method to remove esophageal foreign bodies and is usually the procedure of choice. Once a swallowed foreign body reaches the stomach of a child, it is likely to pass spontaneously and less likely to lead to complications. These can be removed from the stomach endoscopically but we prefer leaving them to pass spontaneously. Controversy continues regarding swallowed sharp or pointed foreign bodies as there is a risk of gastrointestinal perforation and bleeding [18,19]. It was suggested that such objects should be removed endoscopically from the stomach and if passed beyond the stomach, they should be followed and monitored closely. In our series, we adopted a policy of endoscopically removing sharp swallowed foreign bodies from the stomach but we closely monitor and follow-up those with swallowed sharp objects once they passed the stomach. This is irrespective of the size of the swallowed object and in all our patients the swallowed sharp foreign bodies passed without complications except one with a nail that was stuck in the wall of the duodenum. This was removed surgically after failed two endoscopic trial to remove it. Ingestion of magnets which was once rare is becoming a common problem among children and teens and these are known to be associated with serious complications that result from intestinal obstruction, pressure necrosis and bowel perforation [3,4]. This is attributed to the widespread use of magnets in toys which makes them easily accessible to children specially toys where the magnetic parts could be detached easily. Add to this the use of magnets as body art and to mimic piercings of the tongue, lip, and nose and the wide spread use of small, round (about 3 to 6 mm in size) magnets marketed as “stress relief” (high-powered neodymium magnets) desk toys for adults. These are generally sold in sets of 100 or more which makes it difficult for parents to recognize if a few magnets have gone missing. An important point which needs to be stressed is that children who swallow magnets are afraid to tell their parents and only to present later to the hospital with complications related to the swallowed magnets. The North American Society for Pediatric Gastroenterology, Hepatology and Nutrition in their survey

reported that 50.4 percent of swallowed magnets are in patients between the ages of 1 and 6 years, while 33.6 percent are seen in children 6 to 12 years old [22,23,24]. Some of these magnets are small and powerful and if more than one magnet is swallowed, they end up in different parts of the gastrointestinal tract. The strong magnetic force of these magnets leads to attraction between them and they pull toward each other leading to pressure against the intestinal walls with subsequent intestinal obstruction, pressure necrosis, perforation, and fistula formation. Magnets pose a real danger to children and parents should be aware of this. Early recognition and surgical intervention can prevent significant morbidity and mortality [25-32). A single swallowed magnet will likely pass through the gastrointestinal tract without any complications. However, if two or more magnets have been swallowed, attraction between them will lead to serious complications. This was the case in our patients who swallowed magnets necessitating an emergency laparotomy because of intestinal obstruction and perforation and some of them required resection of part of the small intestine. Rapid evaluation of children with swallowed magnets is critical and to avoid complications these magnets must be identified and if more than one magnet swallowed emergency surgical intervention is recommended. It is important that physicians caring for these patients are made aware of the serious consequences of magnets ingestion and that they are distinct from most other types of foreign body ingestion. Two or more swallowed magnets should not be left to pass spontaneously like other swallowed foreign bodies. If the magnets are discovered early and are in the stomach, they can be removed endoscopically as in one of our patients. It was interesting that in one of our patients, three magnets were swallowed simultaneously, two of them went into the esophagus but the third one went into the trachea. They were held together but once the esophageal ones were removed endoscopically, the third one slipped into the left bronchus and was removed via a bronchoscope. The simultaneous ingestion of more than one magnet may lead to their attraction and adherence to each other in the stomach and can pass spontaneously or better they can be removed endoscopically. Once multiple swallowed magnets pass beyond the stomach early surgical intervention is indicated to prevent serious life-threatening complications such as intestinal obstruction and intestinal perforation [29-33]. These are removed via the classic laparotomy. The recent advances in minimal invasive surgery had made it possible to remove these magnets laparoscopically [34,35]. In 4 of our patients the swallowed magnets were removed laparoscopically. This is so even in the presence of intestinal perforation or obstruction as was shown in our patients. In conclusion, a variety of objects can be swallowed by children but coins continue to be the commonest. Swallowed foreign bodies can lead to serious complications and sometimes to mortality. Wait and follow-up is a safe policy to treat the majority of swallowed foreign bodies except foreign bodies stuck in the esophagus, and swallowed multiple magnets. Esophageal foreign bodies should be removed to avoid the risk of perforation. Swallowed magnets are a health hazard to children and delay in diagnosis and treatment can lead to serious complications. The policy of wait and see in the management of swallowed magnets should be avoided. Physicians caring for these patients should be aware of this and early referral to a specialized center is important and if more than one magnet were ingested, early surgical intervention is indicated to prevent serious life-threatening complications. Our series is limited to conclude from but laparoscopic removal of swallowed magnets is feasible and safe in children.

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