

OPEN

What Do Saudi Children Ingest?

A 10-Year Retrospective Analysis of Ingested Foreign Bodies From a Tertiary Care Center

Ahmed H. Ibrahim, MD,* Abdurahman Andijani, MD,* Muhammed Abdulshakour, MD,* Sulwan Algain, MD,* Asma Abu Thamrah, MD,* Mariam M. Ali, MD,* Haifa Marwah, MD,* Anwaar Aldaher, MD,* Salman Bashir, MSc,† Badr Alsaleem, MD,‡ Ali Asery, MD,‡ and Abdurahman Al-Hussaini, MD,§||

Objectives: Few studies investigated the correlation between foreign body (FB) ingestion and occurrence of complications. The local literature is limited to case reports and small case series on esophageal FBs. We conducted this study to identify the high-risk factors predisposing to complications among Saudi children ingesting FBs.

Methods: The medical records of 436 children (boys, 59.6%; mean age, 4.4 ± 2.7 years) presenting to the emergency department (ED) between 2007 and 2016 were retrospectively reviewed. Relative risk analysis of clinical variables was performed between 2 groups: The first group constituted children without FB-related complications ($n = 389$), and the second group included those with major complications ($n = 14$). Major complication was defined as any event associated with significant morbidity such as esophageal stricture, esophageal perforation, esophageal fistula, and intestinal perforation or fistula formation.

Results: Most of the 436 cases presented between ages 2 and 4 years (35.1%). Coin was the most commonly ingested FB (22.9%) followed by button battery (19.5%). Most of the ingested FBs passed spontaneously without intervention (69%). Upper endoscopy was performed in 121 cases (27.7%). By multivariate analysis, the variables that were significantly associated with major complications included the following: very young age group (0–2 years; odds ratio [OR], 11.5), button battery (OR, 4), FB impacted at upper esophagus (OR, 8.7), and longer time duration to visit the ED (OR, 14.7).

Conclusion: Button battery impaction at upper esophagus in very young children and delayed presentation to the ED were the most significant risk factors of FB-related complications.

Key Words: complications, foreign body ingestion, risk factors, Saudi Arabia

(*Pediatr Emer Care* 2021;37: e1044–e1050)

Foreign body (FB) ingestion is a common emergency case in pediatric gastroenterology. Fortunately, 80% to 90% of the ingested FBs pass spontaneously down the gastrointestinal tract (GIT), and the mortality associated with FB ingestion is <1%.¹ The remaining 10% to 20% require endoscopic intervention, and 1% requires surgical removal.¹ The morbidity from FB ingestions

depends on several factors: the type of FB ingested, duration since ingestion, and the site of impaction along the GIT.² The reported morbidities included the following: bleeding, ulceration, esophageal or GIT perforation, mediastinitis, peritonitis, abscess, or fistula formation.²

Several types of ingested FBs that varied according to the culture and feeding habits of the population studied had been reported; however, coins constitute the most commonly ingested FBs worldwide. Previously published reports on FB ingestions have focused on certain epidemiologic features of FB ingestions like demographics, site of impaction, type of the swallowed FB, and methods of intervention.^{3–9} Few studies investigated the correlation between FBs and occurrence of complications.^{10–12} The local literature is limited to case reports¹³ and small case series on esophageal FBs.¹⁴

Several questions related to FB ingestions in Saudi Arabia remain to be answered: What do Saudi children ingest? What are the epidemiologic features and clinical profile of FB ingestions? How frequent intervention is needed to retrieve FBs in GIT? What is the fate of FBs in GIT? These unanswered questions prompted us to conduct this large study over a 10-year period. Furthermore, we investigated the high-risk factors predisposing to complications in an attempt to identify opportunities to prevent or improve prognosis of FB ingestion.

METHODS

Study Setting and Design

The study was a retrospective hospital-based study that was conducted in the Children's Specialized Hospital at King Fahad Medical City, a tertiary care center in Riyadh, the capital city of Saudi Arabia, over the period from 2007 to 2016.

Study Population

We searched the hospital's picture archiving and communication system using “foreign body,” “coin,” battery,” “hair clip,” or “nail” in pediatric age group as key words, during the period from 2007 to end of June 2016. Children between the first day of life and 14 years of age who presented to the pediatric emergency department (ED) with a history of ingested FB, witnessed by one of the family members, and/or visualized in the esophagus or GIT on a plain x-ray were included. We excluded cases with FBs inhaled into the chest, FBs present in other sites other than the GIT, and suspected cases of FB ingestion when imaging and/or endoscopy revealed no evidence of FB in GIT and parents do not observe FB in stool.

Data Collection

The following data were retrospectively recorded from hospital electronic medical records and endoscopy reports of the included study subjects: age, sex, type and location of FB, time taken by parents to visit ED, duration of impaction,

From the *Children's Specialized Hospital, King Fahad Medical City; †Department of Biostatistics, Research Services Administration, Research Center, King Fahad Medical City; ‡Division of Pediatric Gastroenterology, Children's Specialized Hospital, King Fahad Medical City; §College of Medicine, Alfaisal University; and ||Prince Abdullah Bin Khalid Celiac Disease Research Chair, King Saud University, Riyadh, Kingdom of Saudi Arabia.

Disclosure: The authors declare no conflict of interest.

Reprints: Abdurahman Al-Hussaini, MD, King Fahad Medical City, Riyadh, Kingdom of Saudi Arabia (e-mail: aa_alhussaini@yahoo.com).

Copyright © 2019 The Author(s). Published by Wolters Kluwer Health, Inc.

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

ISSN: 0749-5161

underlying gastrointestinal (GI) pathology, details of method of intervention, endoscopic findings, and complications. All patients who were reassured and discharged from pediatric ED without intervention were contacted by telephone to ensure spontaneous passage and detect any complication.

Hospital Protocol in Management of Ingested FBs

All children who present to the ED at King Fahad Medical City with a witnessed or suspected FB ingestion undergo plain anteroposterior and lateral view x-rays of the neck, chest, and abdomen. The indication and timing of endoscopic removal in our hospital depend on the type and location of FB and clinical condition of the child. We have adopted a protocol of “wait and see” before considering endoscopic removal if a blunt object (<2 cm wide and <5 cm long) was in the stomach (up to 2 weeks), if a coin is impacted in distal esophagus in an asymptomatic child (up to 18–24 hours), and if a button battery in the stomach fails to move distally after more 24 hours. We have considered emergent endoscopy (as soon as operating room is available) if there is a button battery or sharp object impacted in the esophagus. We have done urgent endoscopy (after a minimum of 6-hour fasting) in a symptomatic child with blunt object (or food bolus) impacted in the esophagus, a sharp or long pointed FB in the stomach or duodenum, and if ≥ 2 magnets ingested and at least 1 is in the stomach or duodenum. All children with blunt FBs located in the small or large bowel at the time of presentation are reassured that they will pass spontaneously. The parents are instructed before leaving ED to closely inspect stool for FB and to come back to ED if the child develops GI symptoms. During this observation period, we monitor the FB in GIT via serial x-rays (every 3–4 days); failure of the FB to move distally as evident on serial x-rays or development of GI symptoms is a reason for surgical consultation.

Intervention

Flexible upper endoscopy (Olympus company) performed by pediatric gastroenterologists is the mainstay method of intervention in our hospital for retrieval of FB in GIT. At our center, pediatric otolaryngologists first try retrieval of an FB (using rigid esophagoscope) impacted at supraclavicular level as shown on chest x-ray (located just below upper esophageal sphincter [UES]), and anesthesiologists first try to remove an FB impacted at

UES with the tip of FB projecting above the UES using McGill forceps.

Endoscopic removal in our center is performed under general anesthesia in the operating room with a protected airway. The accessories that we use to remove the foreign bodies include grasping forceps, rat tooth forceps, tripod forceps, retrieval basket, Roth net, and snares. We used to ask for pediatric surgeon backup in difficult cases and when there is a significant period elapsed between FB impaction in the esophagus and endoscopic intervention. After removal of FB, we routinely inspect the site of impaction and take biopsies if the esophageal mucosa looks abnormal. Postoperatively, we request chest and neck x-ray for difficult or failed cases and cases with complications. Patients with no complications were mostly discharged within 24 hours, whereas difficult cases associated with significant esophageal injury were observed for up to 3 to 5 days before discharge.

Definitions

–Complications: A major complication of FB ingestion was defined as any event associated with significant morbidity such as esophageal stricture, esophageal perforation, esophageal fistula, aspiration pneumonia, intestinal perforation, enteric fistula formation, and peritonitis. A minor complication was defined as a local injury at the site of FB impaction such as erosion and ulcer.

–The anatomic locations for esophageal FB impaction: For describing the site of FB impaction in the esophagus, radiologically the esophagus was divided into proximal (cervical to T2 level), mid (T3–T6), and lower (T7 to thoracolumbar junction) esophagus.

Statistical Analysis

All categorical variables, including sex, age, FB type, sign and symptoms of FB, and others, were presented as numbers and percentages. The clinical data of the 3 groups were evaluated. One group consisted of children who did not have complications from FBs ingestion, another group included those with major complications, and a third group constituted patients with minor complications. The relative risk analysis was performed for the risk factors. We used the χ^2 or Fisher exact test to determine the significant relationship among categorical variables. Multiple

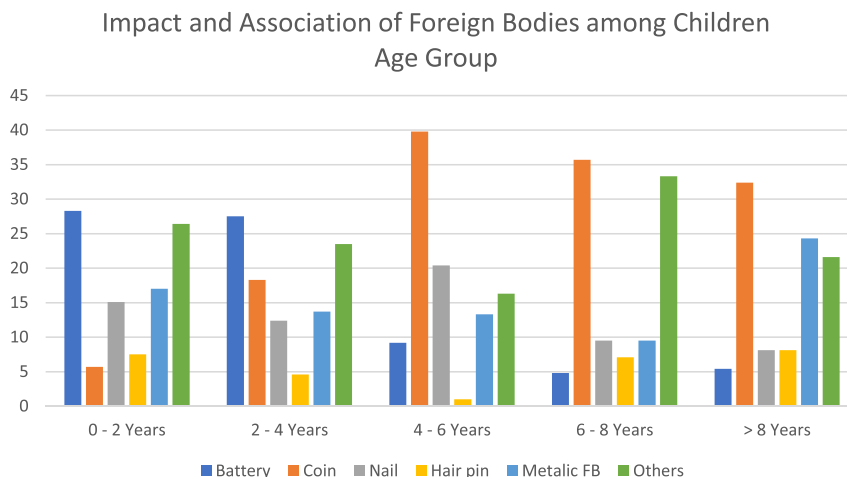


FIGURE 1. Impact and association of foreign bodies among children.

logistic regression was performed to determine the significant predictors/risk factors associated with complications. Statistical significance was indicated at a *P* value of <0.05. All data were entered and analyzed through statistical package SPSS version 22.

RESULTS

General Characteristics

A total of 436 cases of GIT FBs were identified during the study period (boys, 260 [59.6%]). The mean age was 4.4 ± 2.7 years. We divided the age at presentation into 5 categories: Most patients were between 2 and 4 years of age (35.1%), followed by the 0- to 2-year (24.3%) and the 4- to 6-year age groups (22.5). Coin was the most commonly ingested FB among Saudi children (22.9%), followed by battery (19.5%), nail (14.2%), and hair pin (5%). Other metallic FBs and uncategorized FB (eg, bone, SIM card, plastic, and others) contributed to 14.9% and 23.4%, respectively. Figure 1 shows the frequency and type of FB ingested stratified according to age; button battery was the most frequent FB ingested among young children (<4 years), and coin was more frequent among older children (Table 1).

Location of FB Impaction

Most of the FBs were located in the stomach (31.4%) at first presentation to the ED, followed by the esophagus (25.6%) and small bowel/colon (18.4%). In the remaining 24.6% of the cases, the location of the FB could not be definitely identified neither by imaging nor by endoscopy. The esophageal FBs (*n* = 112) were largely impacted at the upper esophagus (63.4%), lower esophagus (25.9%), and middle esophagus (10.7%).

Clinical Presentation

Most patients were asymptomatic (332 [76.1%]). The symptomatic patients (*n* = 104 [23.9%]) largely manifested esophageal-related symptoms and respiratory symptoms (Table 1). The data on the time taken for parents to seek medical advice at our ED were available for 175 patients only (40%). Of 175 patients, 111 presented within 12 hours from ingestion (63.4%), 12 (7%) presented within 12 to 24 hours, and the remaining 30% presented after 24 hours.

Intervention and Outcome

Most of the ingested FBs passed spontaneously without intervention (*n* = 300 [69%]). Upper endoscopy was performed in 121 cases (27.7%). Successful FB removal was accomplished in 119 cases (98.3%). Two FBs (button battery and stone impacted at the upper esophagus) could not be removed endoscopically. Both patients needed ENT and surgical intervention, respectively. Six cases (1.4%) required surgical intervention (magnets in 2 cases, metallic FBs in 2 cases, button battery in 1, and hair pin in 1), 4 FBs were removed by an anesthetist using McGill forceps, and 5 cases needed ENT assistance. Thirty-eight coins of 100 were trapped in the esophagus and needed endoscopic removal (38%), whereas the remaining 62% passed spontaneously. Major complications occurred in 14 cases (3.2%; Table 2). None of these complications were related to the intervention used. Minor complications occurred in 31 cases (7.1%): 14 were due to button batteries, 2, metallic FB; 6, coins; 4, hair pin; 1, nail; 2, food bolus; and 1, unspecified FB. There was no morbidity associated with the endoscopic procedures. There was no mortality associated with FBs ingestion in our center over the past 10 years.

TABLE 1. Demographic and Clinical Characteristics of the 436 FB Cases

Variables	No. (%)
Age group, y	
0–2	106 (24.3)
2–4	153 (35.1)
4–6	98 (22.5)
6–8	42 (9.6)
>8	37 (8.5)
Sex	
Male	260 (59.6)
Female	176 (40.4)
Type of FB	
Coin	100 (22.9)
Battery	100 (22.9)
Metallic FB	65 (14.9)
Nail	62 (14.2)
Hair pin	22 (5.0)
Food bolus	12 (2.3)
Others	90 (20.6)
Site of the Ingested FB	
Upper esophagus	71 (16.3)
Middle esophagus	12 (2.8)
Lower esophagus	29 (6.7)
Stomach	137 (31.4)
Small Intestine/colon	80 (18.4)
Unidentified FB	107 (24.6)
Symptomatic	104 (23.9)
Asymptomatic	332 (76.1)
Vomiting	51 (11.7)
Drooling	27 (6.2)
Dysphagia/choking	33 (7.6)
Abdominal pain	18 (4.1)
Respiratory symptoms (chest pain, SOB, cough)	28 (6.4)
Duration of FB ingestion until visiting the ED, h	
0–12	111 (25.5)
12–24	12 (2.8)
> 24	52 (11.9)
Unknown	261 (59.9)
Duration from ER visit until endoscopic removal (total 121 endoscopy procedures), h	
0–6	32 (26.5)
6–12	40 (33)
12–24	19 (15.7)
>24	5 (4.1)
Data not available	25 (20.6)
Treatment method	
Spontaneous passage	300 (69)
Endoscopy	121 (27.7)
Pediatric surgery	6 (1.3)
ENT surgeon	5 (1.1)
Anesthetist by McGill forceps	4 (0.9)
Major complications	14 (3.2)
Minor complications	31 (7.1)
No complications	389 (89.7)

TABLE 2. Details of the FB Cases Associated With Major Complications

Cases	Age, y	Sex	Type of FB	Time to Visit ED, h	Site of Impaction	Clinical Presentation	Major Complication	Intervention Required
1	0.4	F	Battery	>24	Upper esophagus	Vomiting, drooling	TEF, esophageal stricture	Endoscopy
2	1	F	Battery	12–24	Upper esophagus	Fever, vomiting	TEF, bilateral vocal folds palsy	Surgery
3	1	M	Battery	>24	Upper esophagus	Vomiting, dysphagia,	Esophageal stricture	Endoscopy
4	2	F	Battery	0–12	Upper esophagus	Vomiting, drooling	Esophageal stricture	Endoscopy
5	6	F	Battery	12–24	Lower esophagus	Dysphagia	Esophageal stricture	Endoscopy
6	1	F	Magnets	>24	Small intestine	Vomiting, abdominal pain, and distension	Perforation, enterocolonic fistula, bowel resection	Surgery
7	5	F	Magnets	>24	Small intestine	Mild abdominal pain	Perforation, gastroenteric fistula, bowel resection	Surgery
8	1	M	Hair Pin	>24	Small intestine	Vomiting	Bowel perforation	Surgery
9	1	F	Bone	12–24	Upper esophagus	bloody vomiting	Laceration at UES, aspiration pneumonia needing ventilation	ENT
10	1	F	Metallic clip	>24	Ascending colon	Vomiting, irritable	Colonic perforation	Surgery
11	1	M	Metallic FB	12–24	Upper esophagus	Cough and SOB	TEF	Endoscopy
12	1	F	Metallic earring	0–12	Stomach	Data not available	Lacerating injuries at antrum, duodenum, and esophagus	Endoscopy
13	10	F	Metallic earring	>24	Upper esophagus	Vomiting	Esophageal perforation	Endoscopy
14	11	M	Metallic FB	>24	Descending colon	Vomiting, abdominal pain	Perforation in colon splenic flexure—appendectomy	Surgery

TEF indicates tracheoesophageal fistula.

Associated Underlying GI Pathology

Fifteen patients had underlying esophageal pathology (3.5%) that predisposed to FB impaction; these included 12 patients with eosinophilic esophagitis (EOE; FB was food bolus in 9 cases, glass piece, hair pin, and coin, 1 each) and 3 patients with postesophageal atresia repair and anastomotic stricture (FB was food bolus in all). The characteristic endoscopic appearance of the esophageal mucosa in EOE cases prompted the endoscopist to obtain biopsies to confirm the diagnosis (15 eosinophils/high-power field, at different levels of the esophagus).

Risk Factors Associated With Complications

By multivariate analysis, the variables that were significantly associated with major complications included the following: very young age group (0–2 years; odds ratio [OR], 11.5; $P < 0.0001$), button battery (OR, 4; $P = 0.005$), FB impacted at the upper esophagus (OR, 8.7; $P < 0.001$), and longer time duration to visit ED (OR, 14.7; $P < 0.001$). Among mucosal injury, ulcer was the only risk factor of complication (Table 3). These variables were also significantly associated with minor complications (Table 4).

DISCUSSION

Our report indicates that FB ingestion is a common health problem among Saudi children. Our data show many similarities to data from different countries throughout the world: slight male predominance, most patients were young (60% <4 years), most

ingested coins (23%), and most ingested FBs passed spontaneously (69%). Other important finding was the significant association between button battery impaction at the upper esophagus in very young children and development of major complications.

Endoscopy has been the mainstay of intervention for FB retrieval in our center and proved its effectiveness and safety. We reported a 98.3% success rate of endoscopic removal of FBs, which is higher than the success rate in several previous reports that scored 85% to 92% success rate.^{6,7,10} There was no morbidity or mortality associated with the endoscopic retrieval of FBs in our center over the past 10 years in contrast to 5% complication rate related to endoscopic procedures reported by others.¹⁵ The rate of major complications related to FB ingestion in our study cohort (3.2%) is very low as compared with 5.7% to 10% complication rate reported previously.^{1,16,17} We have used to do all therapeutic endoscopic procedures under general anesthesia, which might have helped to relax the UES and made the removal of large objects easy. In addition, most FBs in our cohort were retrieved within the first 12 hours after presenting to the ED (30% within the first 6 hours), and only 7% of FBs were removed after 24 hours, which facilitated the removal of FBs before minor or major complications occur.

Previous reports showed that morbidity from FB ingestions depends on 3 main factors: the type of FB ingested, duration since ingestion, and the site of impaction along the GIT.^{1–11} Our study confirmed that these 3 factors are very important in the decision-making process when an FB is encountered in the GIT. We have

TABLE 3. Correlation Between Foreign Bodies and Occurrence of Major Complications

Variable	Major Complications (n = 16)	No Complications (n = 389)	OR (95% CI)
Sex			
Male	4 (25.0%)	237 (60.9%)	0.21 (0.068–0.675)
Female	12 (75.0%)	152 (9.1%)	
Age group, y			
0–2	12 (75.0%)	80 (20.6%)	11.59 (3.64–36.89)
2–4	0 (0.0%)	140 (36.0%)	0.06 (0.003–0.935)
4–6	2 (12.5%)	95 (24.4%)	0.44 (0.099–1.981)
6–8	0 (0.0%)	40 (10.3%)	0.27 (0.016–4.638)
>8	2 (12.5%)	34 (8.7%)	1.49 (0.325–6.839)
Type of FB			
Battery	7 (43.8%)	64 (16.5%)	3.95 (1.419–10.991)
Coin	0 (0.0%)	95 (24.4%)	0.1 (0.006–1.63)
Nail	0 (0.0%)	61 (15.7%)	0.17 (0.01–2.842)
Hair pin	1 (6.3%)	17 (4.4%)	1.46 (0.182–11.698)
Metallic	5 (31.3%)	57 (14.7%)	2.65 (0.887–7.905)
FB	3 (18.8%)	95 (24.4%)	0.71 (0.199–2.56)
Others			
Site of the ingested FB at presentation			
Upper esophagus	9 (56.3%)	50 (12.9%)	8.72 (3.108–24.452)
Middle esophagus	0 (0.0%)	8 (2.1%)	1.49 (0.082–27.065)
Lower esophagus	1 (6.3%)	23 (5.9%)	1.06 (0.134–8.388)
Stomach	1 (6.3%)	127 (32.6%)	0.14 (0.018–1.053)
Small intestine	4 (25.0%)	110 (28.3%)	0.85 (0.267–2.678)
Colon/rectum	1 (6.3%)	71 (18.3%)	0.3 (0.039–2.298)
Duration of FB ingestion until visiting the ED, h			
0–12	3 (18.8%)	94 (24.2%)	0.72 (0.202–2.596)
12–24	3 (18.8%)	6 (1.5%)	14.73 (3.313–65.499)
>24	8 (50.0%)	36 (9.3%)	9.81 (3.472–27.694)

CI indicates confidence interval.

shown that button battery impacted at the upper esophagus in very young children carries very high risk for development of major and minor complications. Furthermore, a delay in removing a high-risk FB from GIT increases the risk of complications. Not witnessing FB ingestion by parents is an important reason for delay in seeking medical advice.¹⁴ Therefore, physicians should have low threshold to consider FB ingestion in the differential diagnosis of unexplained wheezing, stridor, or dysphagia in young children presenting to the ED.

There is agreement among authorities that emergent removal of FB is mandatory for an FB impacted in the esophagus in a symptomatic child and for button battery in the esophagus even if asymptomatic.² Of 14 cases with major complications in our study cohort, the esophagus was the site of FB impaction in 8 cases (57%, 5 were button battery and 3 were sharp objects), which reinforces the recommendation of emergent removal of button battery or sharp objects trapped in the esophagus. Although most cases of button battery ingestion end uneventfully (batteries <12–14 mm in diameter almost never lodge in the esophagus of young children), button batteries that get impacted in the esophagus can result in serious complications within few hours of impaction and even death via direct current injury and corrosive chemical material leaking out of the battery.¹⁸ Button batteries

greater than 20 mm in diameter were the ones responsible for almost all of the severe button-related injuries previously reported.^{18,19} These data suggest that manufacturers should produce smaller batteries in place of the large batteries to avoid most of these complications.

Guidelines from gastroenterology authorities also recommend urgent removal of any sharp object and long objects (>5 cm) in the stomach; however, the policy concerning certain blunt objects like coin in the esophagus in an asymptomatic child or a button battery in the stomach is less consistent. We did not observe any minor or major complication related to coin ingestion, although rarely major complications due to prolonged impaction of coin in the esophagus were reported.²⁰ Prospective¹² and retrospective studies²¹ reported an overall spontaneous passage rate of esophageal coins into the stomach of 30% and up to 67% of coins lodged in the distal esophagus. Based on these observations and the favorable outcome of coin ingestion in our study, our practice has been to observe an asymptomatic esophageal coin for a 16- to 24-hour period, thus obviating the need for unnecessary endoscopy and anesthesia in the first 24 hours after ingestion. In general, button batteries that traverse the esophagus to the stomach usually pass spontaneously without complications. However, batteries remaining in the stomach >48 hours have high chance to

TABLE 4. Correlation Between Foreign Bodies and Occurrence of Minor Complications

	Minor Complications (n = 31)	No Complications (n = 389)	OR (95% CI)
Sex			
Male	19 (61.3%)	237 (60.9%)	1.02 (0.479–2.152)
Female	12 (38.7%)	152 (39.1%)	
Age group, y			
0–2	14 (45.2%)	80 (20.6%)	3.18 (1.504–6.726)
2–4	13 (41.9%)	140 (36.0%)	1.28 (0.611–2.7)
4–6	1 (3.2%)	95 (24.4%)	0.1 (0.014–0.767)
6–8	2 (6.5%)	40 (10.3%)	0.6 (0.138–2.617)
>8	1 (3.2%)	34 (8.7%)	0.35 (0.046–2.632)
Type of FB			
Battery	14 (45.2%)	64 (16.5%)	4.18 (1.963–8.911)
Coin	5 (16.1%)	95 (24.4%)	0.6 (0.222–1.593)
Nail	1 (3.2%)	61 (15.7%)	0.18 (0.024–1.339)
Hair pin	4 (12.9%)	17 (4.4%)	3.24 (1.019–10.312)
Metallic FB	3 (9.7%)	57 (14.7%)	0.62 (0.184–2.121)
Others	4 (12.9%)	95 (24.4%)	0.46 (0.156–1.344)
Site of the ingested FB			
Upper esophagus	12 (38.7%)	50 (12.9%)	4.28 (1.96–9.354)
Middle esophagus	4 (12.9%)	8 (2.1%)	7.06 (1.997–24.927)
Lower esophagus	5 (16.1%)	23 (5.9%)	3.06 (1.075–8.708)
Stomach	9 (29.0%)	127 (32.6%)	0.84 (0.378–1.886)
Small intestine	1 (3.2%)	110 (28.3%)	0.08 (0.011–0.628)
Colon/rectum	0 (0.0%)	71 (18.3%)	0.07 (0.004–1.215)
Duration of FB ingestion until visiting the ED, h			
0–12	14 (45.2%)	94 (24.2%)	2.58 (1.228–5.441)
12–24	3 (9.7%)	6 (1.5%)	6.84 (1.624–28.811)
>24	8 (25.8%)	36 (9.3%)	3.41 (1.422–8.178)

CI indicates confidence interval.

leak its corrosive chemicals under gastric acid effect and therefore should be removed within 24 to 48 hours after ingestion or earlier if GI symptoms develop.

The incidence of magnet ingestion has increased during the past several years.²² Although we had 2 cases of magnet ingestion in the past 10 years, both had catastrophic consequences with intestinal fistulas, perforation, and obstruction. A single swallowed magnet can be managed conservatively. However, it is prudent to obtain multiple anteroposterior and lateral x-ray views of the abdomen because it is possible for 2 magnets to stuck together, overlap on a single view, and be misdiagnosed as a single magnet.¹³ Presence of more than one magnet in the GIT or a magnet coingested with another metallic object is a true emergency that carries very high risk of complications because the loops of the intestine can be squeezed between them resulting in bowel ischemia, necrosis, and perforation. In May 2012, a task force consisting of members in the North American Society of Pediatric Gastroenterology, Hepatology, and Nutrition has developed an algorithm that delineates the roles of the pediatric gastroenterologists and surgeons in the management of these challenging cases.²²

We have observed that children presenting with food impaction always have underlying esophageal pathology (15/121 patients who underwent endoscopy [12.4%]); 12 patients had EOE and 3 patients had postesophageal atresia repair and anastomotic stricture. Six the 12 EOE patients had variable

length esophageal caliber narrowing that necessitated both medical therapy and dilation, as we have previously reported.²³ Previous studies have reported underlying esophageal pathology in 4% to 14% of children with esophageal FB.^{24,25} Food impaction is a common symptom in EOE patients even in the absence of esophageal narrowing.²⁶ These data have 2 important practical implications: First, it is important to obtain esophageal biopsy on retrieval of food bolus impacted in the esophagus; second, endoscopist should be cautious not to push the food bolus down to the stomach as a first attempt because such technique could increase the risk of perforation. Instead, endoscopist needs to remove the food bolus en bloc by using a grasping device (eg, retrieval net). When extraction of the food bolus is unsuccessful, reduction of the food bolus size by piecemeal removal is followed by gentle pressure on the center of the remaining food bolus to advance it to the stomach.

This study has some limitations. Our data collection was based on a retrospective chart review with its inherent limitations of recall and case ascertainment bias. Also, the data collectors were not blind to the purpose of the study.

In conclusion, there is a need for public and health care professionals' awareness campaigns for education about the hazards of FB ingestions. Most FB ingestions have benign course and spontaneously pass the GIT. Button battery impaction at the upper esophagus in very young children, magnet ingestion, and delayed

presentation to the ED are the most significant risk factors of complications.

REFERENCES

- Eisen GM, Baron TH, Dominitz JA, et al. Guideline for the management of ingested foreign bodies. *Gastrointest Endosc.* 2002;55:802–806.
- ASGE Standards of Practice Committee, Ikenberry SO, Jue TL, Anderson MA, et al. Management of ingested foreign bodies and food impactions. *Gastrointest Endosc.* 2011;73:1085–1091.
- Popel J, El-Hakim H, El-Matary W, et al. Esophageal foreign body extraction in children: flexible versus rigid endoscopy. *Surg Endosc.* 2011;25:919–922.
- Antoniou D, Christopoulos-Geroulanos G. Management of Foreign body ingestion and food bolus impaction in children: a retrospective analysis of 675 cases. *Turk J Pediatr.* 2011;53:381–387.
- Alvaro A, Hauser B, Vandenplas Y, et al. Management of ingested FBs in childhood and review of the literature. *Euro J Pediatr.* 2001;160:468–472.
- Orji FT, Akpek JO, Okolugbo NE, et al. Management of esophageal foreign bodies: experience in a developing country. *World J Surg.* 2012;36:1083–1088.
- Li ZS, Sun ZX, Zou DW, et al. Endoscopic management of foreign bodies in the upper-GI tract: experience with 1088 cases in China. *Gastrointest Endosc.* 2006;64:485–492.
- Lin CH, Chen AC, Tsai JD, et al. Endoscopic removal of foreign bodies in children. *Kaohsiung J Med Sci.* 2007;23:447–452.
- Denney W, Ahmad N, Dillard B, et al. Children will eat the strangest things: a 10-year retrospective analysis of foreign body and caustic ingestions from a single academic center. *Pediatr Emerg Care.* 2012;28:731–734.
- Park YK, Kim KO, Yang JH, et al. Factors associated with development of complications after endoscopic foreign body removal. *Saudi J Gastroenterol.* 2013;19:230–234.
- Tokar B, Cevik AA, Ilhan H, et al. Ingested gastrointestinal foreign bodies: predisposing factors for complications in children having surgical or endoscopic removal. *Pediatr Surg Int.* 2007;23:135–139.
- Waltzman ML, Baskin M, Wypij D, et al. A randomized clinical trial of the management of esophageal coins in children. *Pediatrics.* 2005;116:614–619.
- Ahmed AM, Hassab MH, Al-Hussaini AA, et al. Magnetic toy ingestion leading to jejunocecal fistula in a child. *Saudi Med J.* 2010;31:442–444.
- Altokhais TI, Al-Saleem A, Gado A, et al. Esophageal foreign bodies in children: emphasis on complicated cases. *Asian J Surg.* 2017;40:362–366.
- Berggreen PJ, Harrison E, Sanowski RA, et al. Techniques and complications of esophageal foreign body extraction in children and adults. *Gastrointest Endosc.* 1993;39:626–630.
- Saki N, Nikakhlagh S, Safai F, et al. Esophageal foreign bodies in children. *Pak J Med Sci.* 2007;23:854–856.
- Gregori D, Scarinzi C, Morra B, et al. ESFBI Study Group. Ingested foreign bodies causing complications and requiring hospitalization in European children: results from ESFBI study. *Pediatr Int.* 2010;52:26–32.
- Samad L, Ali M, Ramzi H, et al. Button battery ingestion: hazards of esophageal impaction. *J Pediatr Surg.* 1999;34:1527–1531.
- Litovitz T, Schmitz BF. Ingestion of cylindrical and button batteries: an analysis of 2382 cases. *Pediatrics.* 1992;89:747–757.
- Healy GB, et al. Aerodigestive tract foreign bodies. In: Fallis JC, Filler RM, Lemoine G, eds. *Pediatric Thoracic Surgery*. New York: Elsevier; 1991: 192–200.
- Waltzman ML. Management of esophageal coins. *Curr Opin Pediatr.* 2006;18:571–574.
- Hussain SZ, Bousvaros A, Gilger M, et al. Management of ingested magnets in children. *J Pediatr Gastroenterol Nutr.* 2012;55:239–242.
- Al-Hussaini A. Savary dilation is safe and effective treatment for esophageal narrowing related to pediatric eosinophilic esophagitis. *J Pediatr Gastroenterol Nutr.* 2016;63:474–480.
- Crysdale WS, Sendi KS, Yoo J, et al. Esophageal foreign bodies in children. 15-year review of 484 cases. *Ann Otol Rhinol Laryngol.* 1991;100:320–324.
- Louie JP, Alpern ER, Windreich RM, et al. Witnessed and unwitnessed esophageal foreign bodies in children. *Pediatr Emerg Care.* 2005;21:582–585.
- Al-Hussaini A, Semaan T, El Hag I, et al. Eosinophilic esophagitis in a developing country: is it different from developed countries? *Gastroenterol Res Pract.* 2013;2013:526037. Article ID 526037.