EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 5
Issue: 7
486-493
Year: 2018

FOREIGN BODY INGESTION AMONG CHILDREN: DIAGNOSIS, TREATMENT AND COMPLICATIONS

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Article Received on 11/05/2018 **Article Revised on 02/06/2018** **Article Accepted on 24/06/2018**

ABSTRACT

Background: Foreign-body ingestion is a gastrointestinal emergency, often requiring presentation to an emergency department for urgent evaluation and treatment. **Methods:** A retrospective chart review of children between 6 months and 14 years of age who presented to Makassed General Hospital for suspected foreign body ingestion. Demographic data collected from medical chart included age, gender, type and location of foreign body, management, associated upper gastrointestinal disease, and outcome (complications, success rate and mortalities). **Results:** Over a 10-year period, a total of 403 patients presented to our hospital for suspected foreign body ingestion. The mean age of children was 5.4 (±1.8) years (range: 6 months-14 years). There was a slight male predominance (male/female ratio was 1:1.16). The most common presenting symptom was foreign body sensation and pain (31%) in children >5 years. The duration of symptoms was longer in patients presented with history of food impaction (median 33.9 h vs. 8 h) (P < 0.0001). Physical examination did not reveal any abnormality in most patients. The most common localization of the foreign bodies shown in plain X-ray was in the esophagus (33.9%). X-ray was normal in 6.3% of the patients. The age of patient did not determine the localization of FB on admission (P = 0.436). Endoscopic removal was attempted in 46.1% and was successful in 96.4% of patients in which the most common (47.1%) of retained foreign bodies was coins. The majority of foreign bodies were located in the upper esophagus (62%). Management of foreign bodies differs according to the localization, type of foreign bodies and the severity of symptoms in children. The duration of hospitalization was longer in patients with delayed admission (P value < 0.0001). **Conclusion:** Foreign bodies' ingestion in children suggests that, selectively, most children can be observed at home and the decision between endoscopic intervention and observation on an outpatient basis depend on the type, location and duration of the ingested foreign bodies. It is a main responsibility of the parent to minimize exposure to potentially harmful agents and the pediatric physicians to provide education to families regarding the types of household objects that carry potential risk to children.

KEYWORDS: Foreign body, Endoscope, Emergency Department.

INTRODUCTION

Pediatric foreign body (FB) ingestion is a common problem throughout the world requiring presentation to an emergency department (ED) for urgent evaluation. The type of ingested FB, the anatomical location of the FB, and the time to medical presentation are all factors that determine how the child will be treated.[1]

Children make up 80% of the patients that seek medical care after ingesting foreign bodies with the peak incidence of occurrence being between 6 months and 3 years of age.[2] As opposed to adults, 98% of foreign body ingestions (FBIs) in children are accidental and involve common objects found in the home environment, such as coins, toys, jewelry, magnets, and batteries[2,3], with males showing a slight predominance.[4] Most children who swallow a foreign body are otherwise healthy; some have underlying conditions that may predispose them to having retained swallowed objects. These conditions include structural abnormalities (strictures, rings, fundoplication), inflammatory conditions (reflux esophagitis, eosinophilic esophagitis), and motor dysfunction (achalasia).[5-7] These children can present with a variety of gastrointestinal (GI), respiratory, or nonspecific symptoms including choking, drooling, poor feeding, fever, wheezing, vomiting, dysphagia, odynophagia, chest, throat, or even neck pain.[5-8]

In 80% to 90%, a FB passes spontaneously through the upper gastrointestinal (UGI) but sometimes it lodges in the esophagus and needs to be removed to avoid dangerous complications such as: obstruction or perforation of the UGI, bleeding, ulcerations, or

fistulas.[5] Foreign bodies with smooth edges usually do not pose significant problems, but a sharp foreign object that is not retrieved at the earliest possible time may penetrate the wall of a viscous and cause complications and the same applies for button-type batteries.[9] Up to 40% of foreign body ingestions in children pass asymptomatic.[10]

For the purpose of initial diagnosis, radiographs can confirm the location, size, shape, and number of ingested foreign bodies and can help to exclude aspirated objects. Radiographs identify most foreign bodies, especially if the object is likely to be radio-opaque.[11,12]

10% to 20% of ingested foreign bodies necessitate endoscopic removal, whereas only 1% of them will finally need surgical intervention.[13] The best method of removing impacted foreign body remains controversial. Rigid endoscopic removal of foreign body is safe and effective, but often requires general anesthesia.[14] The flexible fibroptic endoscopic removal, which can be done under local anesthesia in outpatient department, has gained great popularity over the past decade.

There are at present no data from Lebanon about foreign body ingestion in children.

The objectives of the present study are to: (1) analyze our experience in foreign body ingestion among children presenting at Makassed General tertiary care center over the last 10 years, (2) highlight the problem of foreign body ingestion among children in terms of commonly ingested objects, and (3) identify the link between location of impaction, associated symptoms, complications, spontaneous passage, methods and timing of removal.

MATERIALS AND METHODS

The medical records of all 403 patients who were referred to Makassed General Hospital for suspected foreign body ingestion between September 2004 and February 2014 were evaluated retrospectively. This study was approved by the Makassed General hospital Institutional Review Board. Patient with ingestion of caustic material were excluded from the study. Demographic data collected from the medical chart included age, gender, type and location of FB, management, associated upper gastrointestinal disease, and outcome (complications, success rate and mortalities) were registered and analyzed.

A full history, clinical examination and appropriate radiographs of the neck, chest or abdomen were undertaken on every child with suspected foreign body ingestion in the emergency department before admission.

All patients were managed according to a strict management protocol recommended in the hospital as shown in algorithm 1. The timing of endoscopy was based on clinical judgment. If the patient was symptomatic and/or the foreign body was considered unsafe, they were admitted for observation and an upper flexible or rigid endoscopy was carried out under general anesthesia by a gastroenterologist and/or otolaryngologist. Symptomatic esophageal foreign bodies were performed as "urgent" cases to ensure removal within 6 to 8 hours of presentation; asymptomatic esophageal FBs were observed up to 24 hours. Button batteries and sharp objects were removed emergently within less than 2 hours of presentation. Gastric and duodenal FBs that were sharp, large (3-5 cm in length), or symptomatic (abdominal pain or vomiting) were removed as "emergent" cases within 1 to 2 hours of presentation. All other gastric and duodenal FBs were allowed to pass spontaneously; the patient was monitored as an outpatient and followed by radiographs 7 days after ingestion if the foreign bodies were not observed to pass in the stool. If the foreign body was retained for 4 weeks, endoscopic removal was attempted.

Post removal of foreign body physical assessment was performed. Providing there were no complications and oral intake had resumed, the patient was discharged home the same day.

Statistical Analysis

Descriptive analysis of the data was performed and Chi square test was used to test the association between categorical variables. Data were presented as mean (standard deviation) or number (%). SPSS 19.0 was used for all analyses and significance level was set at 0.05.

RESULTS

During the study period, a total of 403 children were referred to our emergency department at Makassed General Hospital for suspected ingestion of foreign bodies.

The male to female ratio was 217:186 (1:1.6), and the mean age was 5.4 (±1.8) years, (range: 6 months to14 years) with the peak incidence of occurrence being between 3 and 4 years of age with 24.3% followed by 2 to 3 years (16.4%), below 2 years (17.3%), 4 to 5 years (13.2%), 5 to 6 years (13.4%), and the least age for foreign body ingestion was above the age of 7 years (7.2%) (Table 1). The ingestion of foreign body was witnessed or strongly suspected by one of the family members in 376 cases (93.3%).

No symptom was encountered in 38% of patients. The main presenting symptoms were vomiting (27.3%), cough (19.1%), drooling (17.4%), gagging (14.6%), sensation (31%), pain (31%), food refusal (16.1%) and respiratory distress in 3.5% of patient (Table 2).

The most common symptom was foreign body sensation and pain affecting about 31% of patients. Foreign body sensation and pain (throat, chest or abdomen) were more common in older children (age above 5 years), than in

younger children (age less than 5 years) with statistically significant P value < 0.0001.

The mean duration of symptoms prior to presentation was 5.5 hours. Two hundred and sixty six patients (66%) presented to the emergency department within 6 hours after FB ingestion, 110 (27%) between 6 and 24 hours and 27 (6.6%) after more than 24 hours (figure 1). The duration of symptoms was longer in patients presented with history of food impaction (median 33.9 hours) whereas it was shorter in patients with history of long, rounded and sharp object ingestion (median 8 hours) with statistically significant P value < 0.0001 (Figure 2).

Physical examination did not reveal any abnormality in most patients.

An underlying upper gastrointestinal tract disorder was identified in 17 patients (4.2%), of whom 9 had a stricture following esophageal atresia repair in the neonatal period, 2 had a stricture related to eosinophilic esophagitis, 2 had a history of pyloric stenosis operation, 2 had duodenal atresia and 2 had eosinophilic esophagitis. The underlying gastrointestinal tract disorder was more common in children with food bolus impaction identified in 12 patients (75%) than in children with other foreign bodies with statistically significant P value < 0.0001.

Radiological examinations showed that the majority of foreign bodies were located in the esophagus in 33.9% (n = 132) of the patients, in the stomach of 32.9% (n = 128) patients, in the duodenum of 15.1% (n =59) patients, and in the intestinal segments in 11% (n = 43) patients. X-ray was normal in 6.9 % (n = 27) of the patients.

There was no statistically significant correlation between the age of patient and the localization of foreign body at the admission (P value = 0.436).

The modes of management and the results of treatment were summarized in Figure 3.

Endoscopic removal was attempted in 186 patients (46.1%), 178 patient were admitted at initial presentation and 8 (2%) after a 48- to 72-hours observation period at home; 44.1 % underwent upper endoscopic examination within 48 hours, and 8 children returned to the hospital for endoscopic removal of a foreign located in the stomach with severe symptoms. Foreign body was extracted successfully in 96.4% (n =179) of patients by using laryngoscope and Magill forceps (n = 12, 6.4%), rigid endoscope with foreign body forceps (n =104, 56%) and flexible endoscope with foreign body forceps (n =70, 37.6%). Extraction failed in 7 cases because the foreign bodies dislodged into the stomach and parents were asked to observe for spontaneous passage.

The management of foreign bodies differs according to the localization and the type of foreign body in children. Of the 132 patients admitted to the hospital with foreign body located in the esophagus, 125 patients (94.6 %) had the FB removed by endoscopy. Since most foreign bodies were located distal to the esophagus in the stomach and beyond, 176 patients (92.6%) were treated conservatively with statistically significant P value <0.0001 (Table 3).

Also, the management of foreign body was affected by the type of objects, 93.8% of food impaction and 70% of sharp objects ingestion were removed immediately. On the other hand, only 45.6% of rounded objects were removed by endoscopy and the majority were located in the upper esophagus with statistically significant P value < 0.0001 (Table 4).

The summary of the nature of ingested foreign bodies was given in Table 5.

The type of ingested FB varied widely. The majority of the foreign bodies swallowed were coins (n=190, 47.1%); followed by sharp objects (n=60, 14.9%) including pins/needles (n =56, 13.8%) and long objects (n=38, 9.4%). Other ingested objects were magnets (n=17, 4.2%), disc-batteries (n = 22, 5.5%), food bolus (n = 16, 4.2%) plastic objects (n = 6), pieces of toy (n = 2), pen covers (n = 2), buttons (n = 8), and balls (n = 7). The diameter ranged from 0.1 to 5 cm, the most common size of an ingested foreign body being less than 3 cm.

The localization of foreign body was affected by the type of ingested foreign body at admission, the most common location of sharp objects (pin/needle) (n=29, 56.9%) and long objects such as batteries (n=8, 47.1%) was the stomach, while coins (n=64, 33.9%) and bones (n=5, 50%) were in the upper esophagus whereas food impaction (n=7, 40%) was in the lower esophagus with statistically significant P value < 0.0001.

A significant percentage 60.9% with size 3-5 cm required an invasive procedure to extract. Of those, 73.4% (n=94) were located in the stomach. Regarding long objects of more than 5 cm, all (100%) were removed and mainly were impacted in the esophagus with statistically significant P value < 0.0001.

The ingested foreign body was not observed in the stools of 27 patients (6.6%), since it was not witnessed by the parents, and 8 patients (2%) returned to the hospital for endoscopic removal after a 48- to 72-hours-observation period at home and a positive X-ray investigation prior to the procedure.

No major complications, such as esophageal abscess, perforation or bleeding were recorded. The rate of complications was 0.9%. Two cases showed mucosal erosion after the removal of impacted coin and sharp objects. Furthermore, no mortalities due to foreign body ingestion or removal had been reported throughout the study.

The duration of hospitalization was longer in patients with delayed admission. It was 2 ± 0.5 days in patients admitted within the first day of ingestion, 3.8 ± 4.7 days in cases admitted within second to third day of ingestion with statistically significant P value < 0.0001.

Table. 1: Patients' demographic data.

Data	Value
Number of patients	403
Gender	
Male	217(53.8%)
Female	186(46.2%)
Age (years)	5.4(1.8)
< 1	11(2.7%)
1-2	59(14.6%)
2-3	66(16.4%)
3-4	98(24.3%)
4-5	53(13.2%)
5-6	54(13.4%)
6-7	33(8.2%)
>7	29(7.2%)
Region	
Beirut	325(80.6%)
North	11(2.7%)
South	23(5.7%)
Bekaa	25(6.2%)
Mountain	19(4.7%)

Table. 2: Symptoms of patients with suspected of foreign body ingestion.

Data	Frequency
Asymptomatic patients	153(38.0%)
Symptoms at admission	
Gagging	59(14.6%)
Drooling	70(17.4%)
Coughing	77(19.1%)
Vomiting	110(27.3%)
Bloody saliva	2(0.5%)
Food refusal	65(16.1%)
Foreign body sensation	124(30.8%)
Respiratory Distress	14(3.5%)
Pain	125(31.0%)

Table. 3: Correlation between site of foreign body impaction and removal technique.

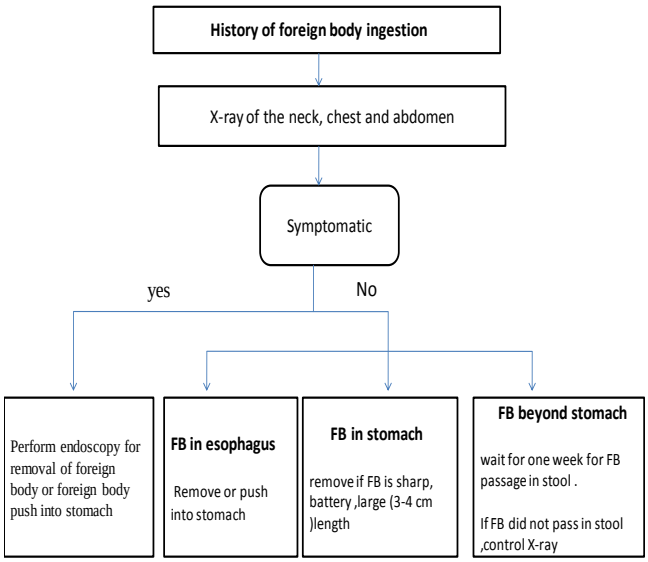
Site of impaction	Endoscopy	Conservative	P-value
Larynx	12(6.4%)	8(3.7%)	<0.0001
Esophagus			
Upper	80 (43.0%)	2 (0.9 %)	
Middle	29 (15.6%)	1 (0.4%)	
Lower	16 (8.6%)	4 (1.8%)	
Distal to esophagus			
Stomach	49 (26.3 %)	79 (36.4%)	
Intestine	0(0%)	43(19.8%)	
Colon	0 (0%)	39 (17.9%)	

Table. 4: Correlation between nature of foreign body and removal technique.

	Endoscopy	Conservative	P-value
Nature of the object			<0.0001
Long slender	18 (9.8%)	20 (10.1%)	
rounded	98 (53.6%)	117 (59.1%)	
Sharp	42 (23.0%)	18 (9.1%)	
Food	15 (8.2%)	1 (0.5%)	
Unspecific	10 (5.5%)	42 (21.2%)	

Table. 5: Nature of the ingested foreign body.

Data	Value
Long	38 (9.4%)
Round	25 (6.2%)
Sharp	60 (14.9%)
Food	16 (4.0%)
Unspecific	35 (8.7%)
Coin	190(47.1%)
Magnet	17 (4.2%)
Disk battery	22 (5.5%)



Algorithm. 1: Management of foreign body ingestion.

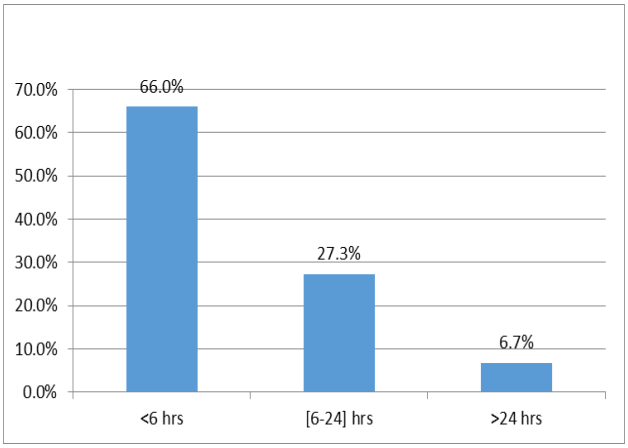


Figure 1: Duration of symptoms before presentation.

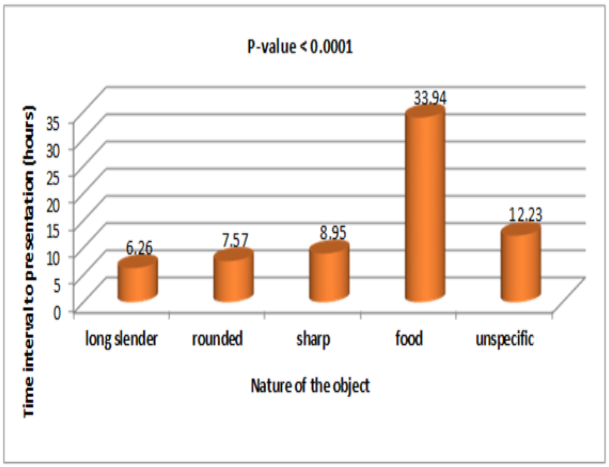


Figure. 2: Nature of the foreign body with respect to time to presentation.

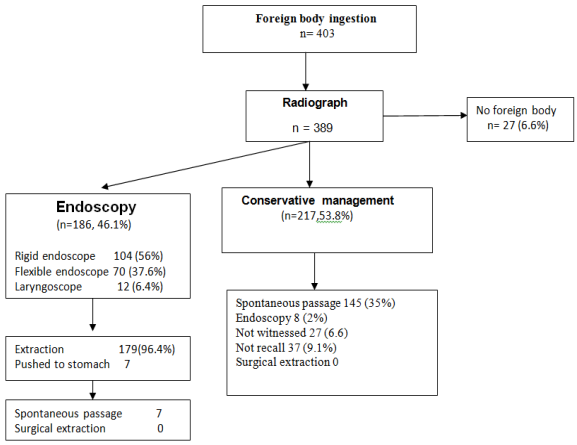


Figure. 3: Modes of management and results of treatment in children with foreign body ingestion.

DISCUSSION

Foreign-body ingestion is a GI emergency, often requiring presentation to an emergency department for urgent evaluation and procedural intervention. The nature of objects, the anatomical site and the severity of symptoms, are all factors often challenging the clinical perception of the physician in developing a successful treatment plan. We reviewed our experience with ingestions of FBs in children presenting to the emergency department.

The demographics of children with FB ingestion in our study were similar to those previously reported, that is, an average age of 5.4 years and a slight male predominance.[4,15,16] Coins were by far the most common FB found in the esophagus (47.1%) and this is similar to the experience with various studies throughout the world.[4,11,17]

The symptoms of FB ingestion vary with the location, size of the foreign body and with the age of patients. In our study, the most common symptom was the sensation and pain affecting about 31% of patients. More vague symptoms including vomiting, drooling and food refusal are common including 27%, 18% and 16% respectively and this is similar to the experience with various studies throughout the world.[4,7]

Approximately half of cases were asymptomatic and physical examination did not reveal any abnormality of patients in our study. The mean duration of symptoms prior to presentation was 5.5 hrs; most of the patients (66%) were referred to the hospital within the first 6 h of having swallowed the foreign body, 27.3% within 24 hours and 6.7% after more than 24 hours. The duration of symptoms was longer in patients presented with history of food impaction (median 34 h) whereas it was shorter in patients with history of long, rounded and sharp object ingestion (median 8 h).

Most foreign bodies requires an invasive procedure to extract were located in the esophagus (94.6%), which is expected as more distally located FBs were left unless they were symptomatic, large, multiple magnets or sharp. Most esophageal FBs (62%) were located in the upper esophagus at the thoracic inlet; the remaining foreign bodies were equally distributed between the mid-esophagus (aortic arch) and lower esophagus (lower esophageal sphincter). Our study which is in harmony with many other reports which showed that foreign bodies are more commonly impacted in the upper esophagus in children.[8,12,15,18] Management of foreign bodies differs according to the localization, type of FB and the severity of symptoms in children.

Common factors related to esophageal FB impaction include structural abnormalities, inflammatory conditions and motor dysfunction. Previous studies have reported underlying structural abnormalities in 4% to 14% of children with esophageal foreign body.[19] In our series, underlying esophageal pathology was present in 4.2% of all children with esophageal foreign bodies. More commonly recognized predisposing condition for esophageal FB is eosinophilic esophagitis, make necessary to do esophageal biopsy at initial endoscopy and appropriate follow-up.[20]

The discussion of management is described below according to localization and type of FBs.

Coins

Coins are frequently ingested by children and are the most common foreign object to be retained in the esophagus. Management of coin ingestion depends on the location of the coin and if the patient is symptomatic. Our strategy involves to immediately remove all coins lodged in the esophagus, during 24 hours of presentation, the 24-hour observation period for asymptomatic patients is not adopted, this is related to increased family anxiety and repeated radiological examination with the consequent exposure to radiation. The decision of removal depends on the age, gender, coin location and if the patient is symptomatic. If the coin is located in the stomach, it does not require immediate endoscopic

intervention because it will most likely pass on its own. Spontaneous passage of an esophageal coin is more likely to occur in older children, males and when it is located distally in the esophagus.[22] Endoscopy is the standard technique for foreign body removal; there are other techniques that are discussed in the literature, such as the Foley and bougienage techniques as well as the magnet probe that can be performed quickly, less expensive and without sedation.[4]

In the literature the reported success rate of endoscopy is 76-98.5%, with morbidity rate 0-0.5%.[21] The endoscopic intervention was successful in 96.4% of our cases and failed in only 7 cases, Successful removal was greater from the esophagus (99%) than from more distal locations (70%). The intravenous administration of glucagon is not recommended for use in coin ingestion and the success rates are similar to those of spontaneous passage range from 12 to 50%.[23]

Long objects

Long objects such as hair-grips and pencils ingestion can become impacted in the esophagus, the pylorus, the duodenal C loop, and the ileocecal valve, leading to several complications, such as pressure necrosis, obstruction, and perforation.[8] In younger children, objects larger than 1 cm by 3 cm should be removed endoscopicaly.[24] In a 10-year review of pediatric foreign body ingestion (mean patient age 3.9 years), endoscopic removal was performed 248 times; 81% of objects removed were coins and at least 94% in total were smaller objects.[25] In contrast, the adult's patients with intentional ingestion and psychiatric disorders are more likely to ingest longer objects.[26,27] In our series of 403 ingestions, 55 patients (13.6%) revealed long object ingestion, none of them had any established co-morbid psychiatric diagnosis. A significant percentage (60.9 %) with size 3-5 cm requires an invasive procedure to extract were located, which is expected as the long objects of more than 5 cm 100% had been removed. In the remaining cases, the FBs were passed spontaneously without complications.

Sharp Objects

Objects with sharp edges or point include pins, needles, nails, fish and chicken bones and toothpicks. There is a higher risk of complications after ingesting sharp objects than with other foreign bodies, including risk of perforation anywhere along the GI tract. Sharp objects in the esophagus should be removed immediately.[34] Most sharp objects in the stomach or duodenum pass through the GI tract uneventfully; because these objects still carry a high risk of complications, they should be removed endoscopically if possible. The incidence rates of sharp objects ingestion in our study is 14.8%, which is similar to those previously reported from European and Asian centers (Incidence rates between 11% and 13%).[11] In our series, 70% of sharp objects ingestion were removed immediately by flexible endoscopy before they pass into the duodenum while the others passed through the GI tract uneventfully without complications.

Food impactions

Food impactions in the esophagus are more common in adults but can also occur in children. An immediate endoscopic removal should be performed within 24 hours if the patient is symptomatic or had signs of obstruction.[35] Children with food impaction have an increased incidence of esophageal pathology. In our series, underlying esophageal pathology was present in 4.2% of all children with esophageal FBs; structural abnormalities accounted for 3.7% and inflammatory conditions in 0.5%. We found that underlying esophageal pathology was more common in children with food bolus impaction than in children with other FBs. These findings coincide with a previous study that showed anatomic esophageal abnormalities in 20% of food bolus impactions compared with 2.6% of other FBs.[19] When viewed separately, food bolus impactions often occur in association with underlying esophageal pathology (20%–85%).[2,3,20,21] Carbonated drinks resolve esophageal food impaction by releasing carbon dioxide gas which further distends the esophagus and facilitate the passage of the liquefied bolus into the stomach.[28]

Magnets

Magnets are another common household item that children have easy access to because they can be found in toys and jewelry. All patients should be referred to the emergency department because neck, chest, and abdominal x-ray was recommended to determine whether there is single or multiple magnet ingestion and to determine the location. Ingestion of a single magnet could be considered similar to swallowing any smooth small object such as a coin. Single magnet is typically less dangerous once it passes into the stomach. Ingestion of multiple magnets is particularly dangerous, because they can attract each other across bowel walls, resulting in possible tissue necrosis, formation of fistula, and obstruction or intestinal perforation.[29]

If multiple magnets are noted in the stomach or esophagus, they should be removed promptly by endoscopy. If the ingestion was greater than 12 hours before removal, or beyond the stomach and the patient is symptomatic a pediatric surgeon should be involved as well. If the magnets do not progress or if the patient becomes symptomatic, the magnets should be removed immediately.[30]

Button batteries

The ingestion of disc (also called button) batteries became more frequent in recent years, after the increasing accessibility of electronic toys and devices to children Early intervention is indicated for patients who have swallowed button or disc batteries because of the potential for voltage burns and direct corrosive effects. Burns can occur as early as four hours after ingestion.[22]

Disc batteries in the esophagus should be removed immediately within 2 hours to prevent risk of tissue injury.[22] If the disc battery has already passed beyond the esophagus and the patient is asymptomatic, the patient can be monitored as an outpatient and followed by x-rays if not observed to pass in the stool, 4 days after ingestion if the child concerned is younger than 6 years or after 10-14 days if the child is older.[5,31] The battery should be removed from the stomach or beyond if the patient develops GI symptoms, or if a child younger than 6 years ingests a battery 15 mm or larger and it remains in the stomach for 4 days or more.[32]

Delayed intervention was considered in 1 child (0.24%) with a disc battery lodged in the lower esophagus. In this case, the button battery had caused esophageal necrosis with ulceration. The patient presented after 48 hours from ingestion, the upper endoscopic examination revealed area of necrosis and the battery was removed without complication.

Complications reported in our study are related to foreign body impaction. Pediatric retrospective studies have reported complication rates related to foreign body ingestion in the range of 13% to 20% which in our study were associated with sharp and impacted foreign bodies.[1,33]

CONCLUSION

Foreign body ingestion remains a serious problem in the Lebanese population. Foreign body ingestion in children suggests that, selectively, most children can be observed at home. At presentation, an initial X-ray should be performed, and the decision between endoscopic intervention and observation on an outpatient basis depend on the type, location and duration of the ingested foreign body. It is a main responsibility of the parent to minimize exposure to potentially harmful agents and the pediatric physicians to provide education to families regarding the types of household objects that carry potential risk to children.

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