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Original Article

Management of Foreign Body Ingestion in Children: A Single-center Experience

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ABSTRACT

Objective: Foreign body (FB) ingestion is frequently encountered in childhood, and although the clinical results are often benign, it has high morbidity and mortality rates. Although guidelines for managing these children are available, there are still controversial aspects of the treatment recommendations. This study aimed to evaluate the treatment options for children who swallow FBs.

Methods: The study included 439 patients admitted with FB ingestion. Demographic and clinical features, type, size and localization of FB, treatment approach, and the timing of endoscopy were retrospectively scanned from hospital records.

Results: Most patients were male (58.3%) and 69.7% of the patients were aged <5 years. The most common symptom (42.3%) was nausea and vomiting and 82.5% of the patients were asymptomatic. The most common localization was the intestines (59.7%). While 84.1% of swallowed FBs came out with a spontaneous passage without complications, the endoscopic removal procedure was successful at the rate of 91.8%. The most frequently swallowed FB was coins (39.6%). Spontaneous elimination rates were higher for small coins and endoscopic removal rates were higher for large coins ($p<0.001$). The rate of emergency endoscopy was significantly higher in cases who swallowed a 2.6 cm coin ($p<0.001$). It was found that all sharp/pointed objects located in the intestine on admission came out spontaneously without complications. Sharp/pointed objects and button batteries located in areas accessible by esophagogastroduodenoscopy were more frequently removed using the endoscopic technique ($p<0.001$). In the cases with the ingestion of a single magnet or superabsorbent FB (giant growing toys), the FB came out with spontaneous passage without any adverse clinical outcome.

Conclusion: It can be suggested that this study of a large sample, showing the management of FBs without complications, will be of guidance in clarifying controversial aspects of the treatment.

Keywords: Foreign body ingestion, children, endoscopic removal, superabsorbent polymers

INTRODUCTION

Foreign body (FB) ingestion is one of the most common problems in childhood and usually occurs by accidental ingestion, starting from 6 months of age, when infants start exploring the objects around them by placing them in the mouth and this can continue up to 5 years of age.[1,2] The type of ingested FB may differ depending on social and sociocultural conditions.[3] Approximately 80-90% of ingested FB progress spontaneously in the gastrointestinal tract.[4] However, complications such as perforation, aortoenteric/enteroenteric fistula, and mediastinitis are important causes of morbidity and mortality and may develop depending on the type and localization of the FB.[5] Appropriate management can prevent complications and unnecessary invasive procedures. Although guidelines for managing these children are available, there are controversial suggestions regarding the treatment decision, and the experience and preference of the physician is also critical.[6] The decision to wait for the spontaneous passage of the swallowed FB or remove it endoscopically requires the evaluation of many

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conditions including the child's age, weight, presence of symptoms, and the characteristics of the swallowed FB.[4] Further reports must clarify the controversial issues regarding the treatment approaches. This study aimed to evaluate the choice of treatment approaches in children who have ingested foreign bodies.

MATERIALS AND METHODS

This single-centre, retrospective cohort study was conducted in the Clinic of Paediatric Gastroenterology, Necmettin Erbakan University Faculty of Medicine. The patients included were aged 0-18 years, and presented at hospital because of FB ingestion between 2019 and 2022. Patients were excluded from the study if they were not evaluated in the Paediatric Gastroenterology clinic, were treated in the otolaryngology or thoracic surgery clinics due to the localization of the object at the cricopharyngeal muscle level, had FB localization outside the gastrointestinal tract, or if the clinical/imaging findings were not available. No laxative or glucagon was used in any patient in the study group.

Age, gender, admission symptoms, type and size of the FB, radiological and endoscopic localization, type and duration of removal, the time from admission to esophagogastroduodenoscopy application were retrospectively scanned from the hospital records.

The swallowed FBs were classified into 7 groups including coins, batteries, magnets, sharp/pointed objects, deformable toys (balloon, play-dough), blunt objects that are not large/long and others (food bolus, large/long objects, superabsorbent objects). Endoscopy timing was classified as emergent, urgent, or elective according to the timing of endoscopy reported by The North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN).[5] According to this classification, if esophagogastroduedonoscopy was applied after 2 h regardless of the fasting duration, it was defined as emergent, and if applied in the first 24 h after waiting for a period of fasting, it was defined as urgent. If esophagogastroduedonoscopy was applied after the first 24 h, it was defined as elective.

Ethical approval for the study was obtained from the Ethics Committee of Necmettin Erbakan University (decision number: 2022/3788). No informed consent was obtained due to the retrospective study design. The parents or primary caregivers approved the usage of the children's data for scientific research when they were admitted to the unit.

Statistical Analysis

Statistical analyses of the data were performed using SPSS 20.0 (IBM Inc, Chicago, IL, USA) program. Descriptive statistics were presented as frequency (percentage) for categorical data and mean ± standard deviation or median (interquartile range) for numerical data, as appropriate. Chi-square analysis with Monte Carlo correction was used to determine the relationships between categorical data. The Mann-Whitney U test and Kruskal-Wallis test were used to compare numerical data. When the differences were significant in multiple comparisons, critical difference pairwise comparison results were obtained. A value of $p<0.05$ was considered statistically significant.

RESULTS

Demographic Data

The study included 439 patients admitted to the hospital approximately 2019-2022 and diagnosed with FB ingestion. Most patients were male (58.3%) and 69.7% (n=306) were aged <5 years. The demographic characteristics, symptoms, ingested FBs and localizations of the FBs are shown in Table 1. The distribution of ingested FBs according to age groups are shown in Table 2.

Clinical Features

A direct radiograph was taken of all patients on admission. Of the foreign bodies, 388 (88.4%) were radiopaque and could be detected on direct radiography; 8 (15.7%) of the radiolucent FBs (n=51) could be localized endoscopically, 3 (5.9%) could not be

Table 1. Demographic and clinical characteristics

Characteristics	Categories	Mean ± SD
Age	Month	52.08±38.65
		n (%)
Gender	Male	256 (58.3)
	Female	183 (41.7)
Symptom	Asymptomatic	361 (82.2)
	Nousea/vomiting	33 (7.5)
	Difficulty swallowing/ salivation	19 (4.3)
	Abdominal pain	18 (4.1)
	Cough	5 (1.1)
	Respiratory distress	3 (0.7)
Foreign body	Coin	174 (39.6)
	Sharp/pointed object	68 (15.5)
	Battery	58 (13.2)
	Blunt object (not large/ long)	55 (12.5)
	Transformable toys	36 (8.2)
	Magnet	30 (6.8)
	Others*	18 (4.1)
Localization	Intestines	262 (59.7)
	Stomach	118 (26.9)
	Could not be localized	43 (9.8)
	Esophagus	12 (2.7)
	Duodenum	3 (0.7)
	Liver	1 (0.2)

*Others: Food impaction, superabsorbent object and large/long objects.
SD: Standard deviation

Table 2. Distribution of ingested foreign bodies according to age groups

	Age group n (%)				
Foreign body	**0-2 years**	**2-5 years**	**5-10 years**	**>10 years**	**p-value**
Coin	23 (23)	102 (49.5)	49 (47.1)		0.225
Sharp/pointed object	21 (21)	20 (9.7)	7 (6.7)	20 (69)	
Battery	23 (23)	28 (13.6)	4 (3.8)	3 (10.3)	
Blunt object (not large/long)	18 (18)	20 (9.7)	14 (13.5)	3 (10.3)	
Transformable toys	5 (5)	18 (8.7)	13 (12.5)		
Magnet	7 (7)	12 (5.8)	10 (9.6)	1 (3.4)	
Others	3 (3)	6 (2.9)	7 (6.7)	2 (6.9)	

The relation between the age groups and foreign object classifications was performed by chi-square test with Monte Carlo exact method

Table 3. Symptoms and endoscopy timing classification

Symptom	**Emergent n (%)**	**Urgent n (%)**	**Elective n (%)**	**Not performed n (%)**	**p-value**
Asymptomatic		16 (51.6)	22 (88)	323 (88.3)	<0.001*
Difficulty swallowing/salivation	11 (64.7)[a,b,c]	2 (6.5)[a]	1 (4)[b]	5 (1.4)[c]	
Nausea and vomiting	3 (17.6)	12 (38.7)[a,b]	1 (4)[a]	17 (4.6)[b]	
Abdominal pain	3 (17.6)	1 (3.2)	1 (4)	13 (3.6)	
Cough				5 (1.4)	
Respiratory distress				3 (0.8)	

*Significant at 0.05 level according to chi-square test.

[a,b,c]: Same superscript letters in each row denote the significant pairwise comparison of columns

detected with endoscopy, and remaining 78.4% did not undergo endoscopic intervention.

Esophagogastroduodenoscopy was performed in 73 (16.6%) patients. The FB could be removed in 67 (91.8%) patients with esophagogastroduodenoscopy, and could not be detected in 6 (8.2%) patients; these FBs were removed with spontaneous passage during follow-up. A total of 369 (84.1%) ingested foreign bodies were removed with spontaneous passage, 67 (15.3%) with esophagogastroduodenoscopy and 3 (0.7%) required surgical intervention (staples, a needle localized in the liver parenchyma, and penetrating multi-magnets). Esophagogastroduodenoscopy was performed in 17 patients (23.3%) emergently in 31 patients (42.5%) urgently, and in 25 patients (34.2%) electively. The timing of endoscopy differed significantly according to the localization of the FB. The time to endoscopy was significantly longer when the FB was detected in the stomach [median (Q1-Q3) 8 (6-58)], compared to esophageal localization [median (Q1-Q3) 1 (1-2)] (p<0.001). The time to endoscopy in asymptomatic cases [median (Q1-Q3) 11 (6-79,5)] was found to be significantly longer compared to symptomatic cases [median (Q1-Q3) 2 (1-7,25)] (p<0.001). The rates of elective endoscopy and spontaneous exit without endoscopy were higher in asymptomatic cases, whereas the emergent and urgent endoscopy rates were higher in symptomatic cases. In patients with symptoms of dysphagia/salivation and abdominal pain, endoscopy was performed immediately, while in those with symptoms of nausea/vomiting, the endoscopy was performed after a longer fasting period (p<0.001) (Table 3).

Ingested Foreign Body and Management

Coin

When the patients who ingested coins were evaluated it was found that the most frequently ingested coins were of 2.1 cm diameter (43.1%). The largest coin was 2.6 cm in diameter and was ingested by 12.6% of cases. The smallest coin was of 1.7 cm diameter and the patients who ingested these coins were mostly asymptomatic, whereas the patients who ingested the largest coins were found to be symptomatic (p=0.003). The rate of spontaneous passage was found to be higher for small coins, while the rate of endoscopic removal was higher for large coins (p<0.001). The rate of emergency endoscopy was significantly higher in cases who had swallowed a 2.6 cm coin (p<0.001) (Table 4). The patients with FB localized in the esophagus were symptomatic and emergency endoscopy was performed. In patients with FB localized in the stomach, only 1 (6.2%) FB was removed with spontaneous passage, and the remaining (93.8%) bodies did not progress during the follow-up period so were removed by elective endoscopy. All the coins with a diameter of 2.4 cm removed using the endoscopic technique, were localized in the stomach and were removed electively because they did not progress to the distal part of the stomach during clinical follow-up. Of the patients who swallowed a 2.1 cm diameter coin, 1 emergent (4-month-old infant who developed respiratory distress) and 1 urgent endoscopy (11-month-old infant, symptomatic) were performed.

Table 4. Comparison of the frequency, localization, symptoms, removal type, and the timing of endoscopy according to coin diameter

	Diameter					
	2.6 cm n (%)	**2.4 cm n (%)**	**2.1 cm n (%)**	**1.8 cm n (%)**	**1.7 cm n (%)**	**p-value**
Frequency	22 (12.6)	35 (20.1)	75 (43.1)	28 (16.1)	14 (8.1)	
Localization						
Esophagus	5(22.7)[a]		1 (1.3)[a]			<0.001*
Stomach	16(72.7)[a,b,c]	11 (31.4)[a]	19 (25.3)[b]	10 (35.7)	3 (21.4)[c]	
Intestines	1 (4.6)[a,b,c,d]	24 (68.6)[a]	55 (73.3)[b]	18 (64.3)[c]	11 (78.6)[d]	
Symptom						
Asymptomatic	15 (68.2)[a,b]	29 (82.9)	62 (82.7)	27 (96.4)[a]	14 (100)[b]	0.003*
Symptomatic	7 (31.8)[a]	6 (17.1)	13 (17.3)	1 (3.6)[a]		
Removal type						
Spontaneous	2 (9.1)[a,b,c,d]	30 (85.7)[a]	70 (93.4)[b]	27 (96.4)[c]	14 (100)[d]	<0.001*
Endoscopically	20 (90.9)[a,b,c]	5 (14.3)[a]	5 (6.6)[b]	1 (3.6)[c]		
Timing of endoscopy						
Emergent	5 (22.7)		1 (1.3)			<0.001*
Urgent			1 (1.3)			
Elective	15 (68.2)[a,b]	5 (14.3)	3 (4)[a]	1 (3.6)[b]		
Not performed	2 (9.1)[a,b,c,d]	30 (85.7)[a]	70 (93.4)[b]	27 (96.4)[c]	14 (100)[d]	

*Significant at 0.05 level according to chi-square test.

[a,b,c,d]: Same superscript letters in each row denote the significant pairwise comparison of columns

Table 5. The types and distribution of sharp pointed objects according to clinical charactreristics and treatment approach

	Foreign body						
	Pin	**Needle**	**Safety pin**	**Nail**	**Stapler**	**Toothpick**	**Other**
Frequency	27 (39.7)	3 (4.4)	10 (14.7)	19 (27.9)	2 (2.9)	3 (4.4)	4 (6)
Localization							
Esophagus						2 (66.7)	1 (25)
Stomach	4 (14.8)		4 (40)	2 (10.5)	2 (100)		
Duodenum	1 (3.7)					1 (33.3)	1 (25)
Intestines	22 (81.5)	2 (66.7)	6 (60)	17 (89.5)			1 (25)
Liver		1 (33.3)					
Not localized							1 (25)
Symptom							
Asymptomatic	21 (77.8)	2 (66.7)	10 (100)	18 (94.7)	2 (100)		1 (25)
Symptomatic	6 (22.2)	1 (33.3)		1 (5.3)		3 (100)	3 (75)
Removal type							
Spontaneous	22 (81.5)	2 (66.7)	6 (60)	18 (94.7)	1 (50)		2 (50)
Endoscopically	5 (18.5)		4 (40)	1 (5.3)		3 (100)	2 (50)
Surgery		1 (33.3)			1(50)		
Endoscopy timing							
Emergent	1 (3.7)					2 (66.7)	1 (25)
Urgent	4 (14.8)		5 (50)	1 (5.3)		1 (33.3)	2 (50)
Not performed	22 (81.5)	3 (100)	5 (50)	18 (94.7)	2 (100)		1 (25)

Others: Broken porcelain dish piece, drawing pin, clohtspin spring, dental laser tip

Table 6. Comparison of the frequency, localization, symptoms, removal type, and the timing of endoscopy according to battery diameters

	Size (diameter)					
	5 mm	**5-10 mm**	**10-15 mm**	**15-20 mm**	**20-25 mm**	**p-value**
Frequency	30 (53.6)	13 (23.2)	8 (14.3)	3 (5.4)	2 (3.6)	
Localization						
Esophagus			1 (12.5)			0.151
Stomach	8 (26.7)	4 (30.8)	4 (50)	1 (33.3)	2 (100)	
Intestines	22 (73.3)	9 (69.2)	3 (37.5)	2 (66.7)		
Symptom						
Asymptomatic	30 (100)[a,b]	10 (76.9)	3 (37.5)[a]	2 (66.7)[b]	2 (100)	0.013*
Symptomatic		3 (23.1)	5 (62.5)	1 (33.3)		
Removal type						
Spontaneous	30 (100)[a]	10 (76.9)[a]	3 (37.5)	2 (66.7)		<0.001*
Endoscopically		3 (23.1)[a,b]	5 (62.5)	1 (33.3)[a]	2 (100)[b]	
Endoscopy timing						
Emergent			3 (37.5)	1 (33.3)		<0.001*
Urgent		3 (23.1)[a,b]	2 (25)[c,d]		2 (100)[a,b,c,d]	
Not performed	30 (100)	10 (76.9)	3 (37.5)	2 (66.7)		

*Significant at 0.05 level according to chi-square test.

[a,b,c,d]: Same superscript letters in each row denote the significant pairwise comparison of columns

Sharp objects

When the types of sharp objects were compared no statistically significant differences were found in terms of symptoms, localization, exit pattern, and timing of endoscopy. However, in the patients with the FB localized in the intestine on admission, the FBs were removed through spontaneous passage without any intervention. Emergency or urgent endoscopy was performed in 17 patients (25%) (Table 5).

Button battery

When the patients who swallowed a button battery were examined, the most commonly ingested battery was 5 mm in size, in more than half of the patients (53.7%). There was no significant relationship between battery size and localization, but the rate of large diameter batteries removed by endoscopy was significantly higher ($p<0.001$). All 5 mm diameter batteries were removed through spontaneous passage. In 4 patients who had ingested 5-10 mm diameter batteries, the battery was localized in the stomach, and in 3 symptomatic patients, the battery was removed with urgent endoscopy. All the patients who ingested 10-15 mm and 15-20 mm batteries were symptomatic and the batteries were detected in the esophagus and stomach and were removed with endoscopy. Two patients who ingested a 20-25 mm battery were asymptomatic; the FBs were localized in the stomach and were removed with urgent endoscopy (Table 6).

Magnet

Of the 30 patients who ingested magnets, 4 (13.3%) had ingested multiple magnets and 26 had ingested a single magnet. All the magnets were <15 mm and in the patients with a single magnet it was removed spontaneously. In 2 patients who ingested multiple magnets, the FB was removed from the stomach with emergency endoscopy, in 2 patients the magnet was localized in the intestine and in one, it was surgically removed because the magnet was not removed spontaneously. There was no statistically significant difference in localization, removal pattern or removal times.

Food impaction

One of the 3 patients with food bolus was diagnosed with eosinophilic esophagitis after endoscopic removal of the food bolus localized in the esophagus. The other 2 were patients with a history of pyloric stenosis due to corrosive exposure, and the food bolus was removed endoscopically.

Superabsorbent foreign bodies

Superabsorbent foreign objects were those that could reach a maximum diameter of 10-20 mm when immersed in water. These were ingested by 13 (3%) patients and all were removed through spontaneous passage. Two patients who ingested a long FB (lollipop stick, pen) were asymptomatic; the FBs were removed from the stomach.

DISCUSSION

The results of this study showed that ingested FBs were frequently removed spontaneously without any problems, and the success of the endoscopy procedure was high.

Of the patients in this study, 69.7% were under the age of 5 and the rate of male gender was higher. These findings were parallel to the literature.[7,8] This young age has been associated with the inability of infants to distinguish edible objects and that they will put everything they hold into their mouths starting from the age of 6 months and it has been reported that gender was unimportant in this pathology.[9]

At the time of admission, 82.5% of the patients were asymptomatic. In symptomatic patients, the most common symptoms (42.3%) were nausea/vomiting. In previous studies, several conditions including vomiting, abdominal pain, and hypersalivation were reported as the most common symptoms.[10-12]

Direct radiography has been reported to be diagnostic in 64-96% of cases.[13] In this study, FB could be localized by direct radiography in 88.4% of the cases. The remaining cases had a history of swallowing a radiolucent FB. The NASPGHAN guidelines recommend endoscopic evaluation or the use of imaging methods such as computed tomography in cases of suspected radiolucent FB ingestion, if accompanied by clinical findings.[5] The current study patients who ingested radiolucent FBs and were asymptomatic were only followed up, and the FBs were subsequently removed with spontaneous passage without complications. Esophagogastroduodenoscopy was performed in all symptomatic cases. In this series, radiolucent FBs were removed endoscopically in only 8 cases (1.8%). Endoscopic evaluation can be recommended in symptomatic cases of radiolucent FB ingestion.

In this study, the intestines were the most common localization. In previous studies, different regions of the gastrointestinal tract, such as the esophagus and intestine have been reported to be the most common localization.[7,8,14,15] This variability may be due to different characteristics of the patients and the ingested object. In this study, FBs were followed up in 84.1% of the cases, according to the "wait-observe" method and the objects were removed spontaneously without complications. In patients who underwent endoscopy, the success of the procedure was 91.8%. In the remaining patients, the FB could not be removed endoscopically because it had progressed to the distal of the duodenum, and during follow-up, it was removed with spontaneous passage. In the literature, the success of endoscopic procedures varies ranging between 31.1% reported by Diaconescu et al.[13] and 98% reported by Pokharel et al.[16]

In this study, urgent esophagogastroduodenoscopy was determined to be most frequently performed and the timing of endoscopy differed significantly according to the localization of the FB and the presence of symptoms. The time to endoscopy was significantly longer when the FB was localized in the stomach compared to the esophagus. Similarly, the time to endoscopy in asymptomatic cases was significantly longer than in symptomatic cases. Additionally, spontaneous removal and elective endoscopy rates were higher in asymptomatic cases, while emergent and urgent endoscopy rates were higher in symptomatic cases. NASPGHAN recommends emergency endoscopy in patients with FBs located in the esophagus and in any localization if the patient is symptomatic.[5] The current study findings are consistent with these recommendations.

Consistent with the literature, the most frequently ingested FB in this study was coin (39.6%).[11-13] The type of ingested FB may vary according to sociocultural differences. In some studies conducted in Turkey 10 years ago, different results were seen. Yalçin et al.[3], examined 112 cases of FB ingestion and reported that the most frequently swallowed FB was safety pin. Aydoğdu et al.[8] reported that safety pins were swallowed more frequently by infants, and that pins were swallowed more frequently by girls older than 10 years, and this was due to cultural and belief differences. Dereci et al.[7], reported that the most frequently ingested FB was a coin. Gezer et al.[17] also reported that a coin was the most frequently ingested FB in a case series of 1,000 children who had swallowed FBs. There can be considered as several reasons for this change. Rather than pinning good luck charms of blue beads to the clothes of infants nowadays they tend to be pinned to their beds. Additionally, magnets produced for attaching headscarves have replaced pins recently.

In a study evaluating children who swallowed coins over 10 years, Chen et al.[18] reported that of 252,338 children admitted to the emergency service with the complaint of ingesting coins, 20 died. The risk varies according to patient characteristics and the size of the coin. In Turkey, coin sizes vary between 1.7-2.6 cm. The most commonly ingested coin in the current study was 50 kurus (2.1 cm). The patients who ingested small coins were more often asymptomatic and most of the coins were removed with spontaneous passage. Patients who ingested large diameter coins were more symptomatic and the rate of endoscopic removal was higher. All coins localized in the esophagus with a diameter of 2.6 cm were removed by emergency endoscopy. In a 23-month-old infant who swallowed 1 TL (2.6 cm), endoscopy could not be performed because the coin was localized in the intestine on admission, and was removed with spontaneous passage. However, NASPGHAN recommends performing endoscopy in children, due to the low probability of a FB larger than 2.5 cm being able to pass through the pylorus.[5] If a large diameter coin has passed the pylorus and cannot be reached using the endoscopic technique in children, the "wait-observe" approach with close follow-up for the surgical requirement seems to be an inevitable practice in centres where enteroscopy cannot be performed.

The "wait-observe" approach was performed for all coins of 2.4 cm diameter (n=11) that were localized in the stomach on admission. However, the coins of 2.4 cm diameter could not pass the pylorus in 5 of 11 patients and were removed by elective endoscopic technique. Since the diameter of 50 kurus is 2.4 cm, which is very close to the 2.5 cm limit in terms of the possibility of spontaneous passage, it can be suggested that the "wait-observe"

approach should be applied in the same way as for patients who ingested 1 TL.

In this study, the second most frequently swallowed FB was sharp/pointed objects. In the literature, it has been reported that most sharp/pointed FBs are removed spontaneously without any complications and those that cannot be removed spontaneously most commonly got stuck in the upper esophageal lumen.[19,20] In this study, it was determined that sharp/pointed objects were eliminated spontaneously without any problems if they were in the intestine, and those localized in areas accessible by esophagogastroduodenoscope were largely removed endoscopically. NASPGHAN recommends endoscopic removal of esophageal sharp/pointed FBs, and removal of those that have advanced to the stomach in asymptomatic cases, if the object does not progress after 3 days of follow-up.[5] However, in the current study population, endoscopic removal was often preferred when sharp/pointed objects were located in areas that could be reached by esophagogastroduodenoscopy. The reason why our practices differ from the recommendations in the guidelines and literature is that especially since sharp/pointed objects cause more anxiety in families and they cannot take the risks that may develop if the object is not removed spontaneously and therefore, they prefer endoscopic removal.

Button batteries are among the most worrisome ingested FBs due to the risk of morbidity and mortality reported recently.[21] In this study, more than half of the patients swallowed a 5 mm size button battery and all of these batteries were spontaneously removed. In most patients, button battery of 5 mm diameter was localized in the intestine on admission. All the patients with a 5 mm diameter button battery in the stomach were asymptomatic. In these patients, elective endoscopic removal was planned following the fasting period, but the procedure was not performed because the object was seen to be localized in the intestines on direct X-ray performed just before the endoscopy. The rate of endoscopic removal was found to be significantly higher in large diameter batteries. It was determined that all button batteries larger than 10 mm located in the esophagus and stomach were removed endoscopically. In one patient the battery was localized in the esophagus and it was removed by emergency endoscopy. It has been accepted that button batteries localized in the esophagus indicate emergent endoscopic intervention, but the approach to batteries in the stomach is controversial. Contrary to previous recommendations, NASPGHAN has recommended that gastric button batteries should be removed by endoscopy and follow-up should be considered only in the presence of criteria including small battery, a short time since swallowing, older and asymptomatic patients. Even under these conditions, NASPGHAN left the decision of endoscopy to the expert opinion in terms of evaluating the possibility of esophageal damage.[5] In a case series by Leinwand et al.[21], it was reported that in one patient who swallowed button battery, elective endoscopy was planned to remove the button battery localized in the stomach and patient died from major artery injury. In this study, all button batteries larger than 10 mm that were accessible by esophagogastroduodenoscopy were removed endoscopically without complications. There is clear information for emergent endoscopic removal of esophageal button battery. However, gastric button batteries remain a matter of debate. Considering this extensive case series all of which were resolved without complications, it can be recommended that after a period of fasting if the battery remains in the stomach and has not advanced radiographically, endoscopy should be planned regardless of size and the battery should be removed.

In the study, it was found that 6.8% of the patients swallowed magnets. Abbas et al.[22] reported an alarming 8.5-fold increase in magnet swallowing cases in the United States. In studies conducted in Turkey, the frequency of ingesting magnet has been low enough to cause these cases to be classified as "other".[3,14,17] In this study, the reason for the high incidence of magnet ingestion is the same as the decrease in needle ingestion cases. This study was conducted in the region where the wearing of headscarves and many headscarf-related accessories are most common in Turkey. Recently, magnets have been produced to be used instead of pins to fix the headscarf, and these are quite common in this region. This has reduced needle ingestion, but introduced a new risk of magnet ingestion. It was determined that all ingested magnets were smaller than 15 mm, and 86.7% of the patients ingested a single magnet and the magnets were removed spontaneously. Endoscopic removal was performed in 6.6% of patients who ingested multiple magnets and the magnets were localized in the stomach. In the remaining patients, the magnet was localized in the intestines and only 1 patient-required surgery. These results were consistent with the NASPGHAN guideline recommendations.[5] It can be suggested that magnets should be removed endoscopically when they are located in areas that can be reached by esophagogastroduodenoscopy.

Food impaction is rarer in children than in the adult population. In the cases reported in literature, the impaction is frequently located in the esophagus and are secondary to pathologies such as eosinophilic esophagitis and achalasia.[23] In this study, food impaction was located in the esophagus in 1 case with eosinophilic esophagitis. In 2 cases, pyloric stenosis developed due to corrosive substance ingestion, and gastric food impaction was detected. To the best of our knowledge, these are the first gastric food impaction cases reported in the literature.

Superabsorbent polymers are beads of various sizes that can enlarge when immersed in water. Since there are few case reports stating that they expand after swallowing and cause obstruction in the gastrointestinal tract and there is no study reporting otherwise, NASPGHAN recommends endoscopy in the presence of suspected ingestion and if the foreign object cannot be detected with endoscopy, follow-up for signs of ileus is recommended.[5] Case series reported after the publication of the guideline have reported better results. Mehmetoğlu[24] and Cairns et al.[25] reported that none of the patients who ingested superabsorbent polymers required intervention or surgery. In this study, endoscopy was performed in only 1 of the 13 patients as the time between ingestion and admission was short although the

object was found to have progressed. In the other 12 patients, the beads were ingested after they had been kept in water for a long time, and the diameter after enlargement was <20 mm. None of the 12 patients developed signs of intestinal obstruction. It can be suggested that since these objects with slippery surface progress rapidly, the probability of detecting these objects with endoscopy is low, especially in patients admitted long after the ingestion. If possible, evaluation of the size after soaking may be helpful in patient management.

Study Limitations

Important limitations of this study were that it was a retrospective and single-center study. Since the type and frequency of swallowed objects may show regional differences, it is impossible to generalize the results to the national level. Nevertheless, the sample size can be considered large enough to evaluate the treatment approaches to FBs that are frequently ingested in our region.

CONCLUSION

In this large sample, it was seen that ingested FBs are frequently removed spontaneously, large-scale coins do not proceed with the "wait-observe" method and require elective endoscopy, endoscopic removal is often preferred when sharp/pointed objects and button batteries are located in areas that can be reached by esophagogastroduodenoscopy, and superabsorbent polymers are removed spontaneously. These results were similar to the findings of other recent studies. To clarify the controversial aspects in the current guidelines for treating children who have ingested FBs, and to evaluate treatment options, there is need for further prospective studies.

Ethics

Ethics Committee Approval: Ethical approval for the study was obtained from the Ethics Committee of Necmettin Erbakan University (decision number: 2022/3788).

Informed Consent: Retrospective study.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: A.Y., Ö.Y., Concept: A.Y., Ö.Y., Design: A.Y., Ö.Y., Data Collection or Processing: A.Y., Ö.Y., Analysis or Interpretation: A.Y., Literature Search: A.Y., Ö.Y., Writing: A.Y.

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