Article published online: 2023-07-07

Endoscopic Management of Pediatric Foreign Body Ingestions and Food Bolus Impactions: A Retrospective Study from a Tertiary Care Center

Syed Shafiq[1] Harshad Devarbhavi[1]

[1] Department of Gastroenterology, St. John's Medical College Hospital, Bengaluru, Karnataka, India

J Digest Endosc 2023;14:68–73.

Address for correspondence Syed Shafiq, MD, DM, Department of Gastroenterology, St. John's Medical College Hospital, Sarjapur Road, Bengaluru-560034, Karnataka, India (e-mail: syed.dr.s@gmail.com).

Abstract

Background Foreign body (FB) ingestion is a common pediatric problem with the majority of these occurring in children younger than 3 years. Management varies depending on the age of the patient, ingested object(s), its location along the digestive tract, and the available expertise. We aim to report our experience with endoscopic management of FB ingestions in children (<18 years).

Materials and Methods We retrospectively reviewed and analyzed endoscopic and medical records from our hospital database of all pediatric patients (<18 years) who presented with FB ingestion between January 2011 and December 2021.

Results Our analysis included a total of 368 patients. FB ingestions and/or food bolus impactions were noted in 242 and 11 children, respectively while 115 (31.25%) had spontaneously passed off FB from the digestive tract. Most common FB was coin (28.5%) followed by animal bones (26.2%). Endoscopic management of FBs and food bolus impaction was successful in 247 children (97.63%), while endoscopic FB retrieval failed in 6 children including 1 with fish bone and 5 with button batteries. A total of 9 out of 11 children with food bolus impaction had underlying esophageal pathology, the commonest being corrosive stricture ($n = 7$). No mortality related to endoscopic intervention was reported.

Conclusions Endoscopic retrieval of ingested FBs and food bolus impaction in children is a safe and effective approach when performed by experienced endoscopists and is associated with a high success rate and a lower incidence of complications with reduced hospital stay.

Keywords
- button battery
- coin
- fish bone
- food bolus
- foreign body
- stricture

Introduction

Foreign body (FB) ingestions constitute approximately 4% of all emergency endoscopies performed.[1,2] The majority of FB ingestions occur in children because of their curiosity to explore objects orally, with peak incidence occurring between the ages of 6 months and 3 years. While the majority of the ingested FBs tend to pass off spontaneously through the digestive tract, approximately 10 to 20% of FBs require endoscopic intervention with an estimated 1% needing surgery for their extraction and/or to mitigate complications.[3–6] Impacted FBs, especially button batteries (BBs) in the esophagus, given its proximity to vital structures in the mediastinum, may result in serious complications including death if not intervened expeditiously. Western literature shows that ingested FBs account for approximately 1,500 deaths

article published online
July 7, 2023

DOI https://doi.org/10.1055/s-0043-1771009.
ISSN 0976-5042.

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

annually, although similar data are lacking from the Indian subcontinent.[7] While most adults with FB ingestion present with a multitude of symptoms including dysphagia, odynophagia, retrosternal pain, FB sensation, retching, and/or vomiting, most children given their limited vocabulary present with nonspecific symptoms such excessive crying, sialorrhea, vomiting, fever, etc., thus causing a delay in diagnosis and resulting in complications.[5,8–10]

The aim of this study was to report our experience in endoscopic management of ingested FBs and/or food bolus impactions of the digestive tract in children (<18 years).

Materials and Methods

We retrospectively evaluated the medical and endoscopic records of 368 children who were referred to St. John's Medical College Hospital, Bengaluru, for suspected history of FB ingestion and/or food bolus impaction between January 2011 and December 2021. Of these, 115 patients had spontaneous expulsion of FBs by the time they arrived at the emergency department (ED) or were subjected to endoscopic procedure. Of the remaining 253 patients, 242 underwent endoscopy for FBs in the digestive tract and 11 patients for food bolus impactions. All patients had a thorough and quick physical examination to evaluate for evidence of luminal obstruction and other complications, especially perforation (cervical swelling and/or crepitus in case of oropharyngeal/proximal esophageal perforation, or fever and peritonitis in case of intestinal perforation). Plain X-rays of the neck, chest, and/or abdomen were obtained for all patients upon their presentation to the ED in accordance with current recommendations and practice guidelines to assess the presence, location, size, configuration, and number of ingested objects.[3,4] Patients with FBs impacted in the esophagus, those with stridor and/or breathing difficulty, and children with sharp FBs (including pin, nails, and razor) in the upper digestive tract were treated as emergency and underwent endoscopy within 2 hours of their arrival to the ED irrespective of their fasting status. Those with asymptomatic FBs in the stomach and esophageal food bolus impactions were classified as urgent to semi-urgent procedures and subjected to endoscopy within 6 to 8 hours of their ED presentation.[11,12]

All patients underwent endoscopic procedure under general anesthesia by a trained anesthetist, with close monitoring of vital signs such as blood pressure, heart rate, and oxygen saturation during the entire procedure. All endoscopic procedures were performed using flexible endoscopes; either Olympus GIF-Q150 or GIF-180 was used for esophagogastroduodenoscopy, while Olympus CF-180 was used in a sole patient with documented metallic nail in the transverse colon. A variety of accessories including FB rat tooth forceps, biopsy forceps, Roth net, FB retrieval baskets, snares, and magnet were used depending on the nature of the FB and the ease and competency of the endoscopist(s). Transparent caps, hoods, and/or over-tubes were employed when needed during retrieval of sharp FBs to protect the digestive tract during their endoscopic retrieval. Patients with documented BB ingestion irrespective of its location in the digestive tract underwent esophagogastroduodenoscopy to document any injury related to its transit along the upper digestive tract.[13,14] The on-call pediatrician or pediatric surgeon was in attendance for all the endoscopic procedures. Postprocedure, all the patients were observed and monitored closely in the hospital until discharge. Patients with impacted esophageal FBs including BBs were kept nil by mouth for 24 to 48 hours, received thin barium study to rule out any perforation, and were started on oral feeds only after barium study was reported as normal. Patients were discharged from the hospital once they tolerated oral feeds without incident.

Of note, our experience with endoscopic management of BBs has been published recently.[13]

Demographic, clinical, and endoscopic data were collected and analyzed with regard to age, gender, type and location of FBs, symptoms after FB ingestion, anesthetic methods, associated upper gastrointestinal (GI) tract diseases, accessory devices utilized, and complications related to the FB impaction. Descriptive statistics including mean, median, and standard deviation were used to analyze the data. Institutional ethical committee clearance was obtained for the study.

Results

Of the total 368 patients, endoscopic intervention was required in 242 patients with FB ingestions and 11 with food bolus impactions ($n = 253$). In the remaining 115 patients (31.25%), the FB had passed off beyond the reach of the upper GI scope spontaneously from the digestive tract by the time the patient arrived at the ED (or endoscopy was undertaken). The mean age of our study population was 2.8 years (range: 3 months–17 years), with 67% ($n = 169$) being less than 3 years of age.

The mean age of patient, sex, and type and location of FBs are depicted in ►**Table 1**.

Coins were the most common FBs followed by BBs. Although the most common site of FB location was the stomach (64.97%); given its narrow diameter, the esophagus was the most common site of FB impaction. Only one patient underwent colonoscopy for extraction of a metallic nail from the transverse colon as the nail would not move or change its position even after 3 days of monitoring in the hospital (►**Fig. 1**). The average "door to endoscopy time" in those with esophageal BBs was 1.3 and 6.2 hours in those with other FBs (including BBs) beyond the gastroesophageal junction.

While a majority of our patient had no symptoms ($n = 200$); in the remainder of the study population, the most common symptoms (either alone or in combination) were dysphagia noted in 20 patients followed by odynophagia in 12, sialorrhea in 8, retrosternal chest discomfort in 8, and dyspnea and cough in 5 patients.

A total of 11 patients presented with a history of food bolus impaction, of which 9 had an underlying esophageal pathology, with corrosive stricture being the most common ($n = 7$) followed by anastomotic stricture at the site of

Table 1 Demographic data of the patients with foreign body ingestion

Total number of patients with foreign body ingestion and/or food bolus impaction	$N = 253$	Percentage
Male-to-female ratio	57:43	
Mean age (range)	2.8 y (3 mo–17 y)	
Type of ingested foreign body	($N = 242$)	100
1. Coins	62	28.5
a. Esophagus	20	
b. Stomach	38	
2. Duodenum	4	
3. Animal bones	57	26.2
i. Fish bones	21	
a. Esophagus	14	
b. Stomach	6	
c. Duodenum	1	
ii. Chicken bones	18	
a. Esophagus	13	
b. Stomach	5	
iii. Mutton bones	18	
a. Esophagus	12	
iv. Stomach	6	
4. Button Battery	56	25.8
a. Esophagus	24	
5. Stomach	32	
6. Other metallic foreign bodies	34	15.6
i. Hair pin	12	
a. Esophagus	3	
b. Stomach	6	
c. Duodenum	3	
ii. Safety pin	10	
a. Esophagus	2	
b. Stomach	6	
c. Duodenum	2	
iii. Unclassified metallic objects	3	
a. Esophagus	2	
b. Stomach	1	
iv. Keys	5	
a. Esophagus	2	
b. Stomach	3	
v. Springs		
a. Esophagus	2	
vi. Razor	2	
a. Esophagus	1	
vii. Nail	1	
viii. Colon	1	
7. Jewelry	5	2.3
i. Rings	4	
a. Esophagus	2	
b. Stomach	2	
ii. Pendant	1	
iii. Stomach	1	
8. Miscellaneous	3	1.38
i. Displaced tracheostomy tube	1	
a. Esophagus	1	
ii. Toothpick	1	
a. Esophagus	1	
iii. Pen drive	1	
iv. Stomach	1	
Type of food bolus impaction	$N = 11$	100
1. Vegetable/fruit seeds	6	54.5
2. Meat/chicken bolus	4	36.4
3. Medicinal tablets	1	9.1

previous tracheoesophageal fistula surgery ($n = 2$), while 2 patients had no obvious cause for impaction.

Food bolus impactions were treated by either "push technique" wherein the food bolus was pushed into the stomach carefully under endoscopic guidance or retrieved piecemeal using either a snare or Roth net (►**Fig. 2**).

Endoscopic management of FB and food bolus impactions was successful in 247 (97.63%) children but failed in 6 including 5 with BBs and 1 with fish bone ingestion who developed retropharyngeal abscess, all of whom underwent surgical intervention. Two of the five children who failed BB extraction had esophageal perforation with resultant peritonitis needing surgical intervention.[13] No complications related to the endoscopic procedure or general anesthesia were observed in our study.

Discussion

FB ingestions and food bolus impactions are relatively common in endoscopy practice and can result in significant morbidity and mortality if not treated promptly. Fortunately, approximately 80 to 90% of ingested FBs pass off spontaneously through the digestive tract.[8,15,16] Large objects (>1 cm

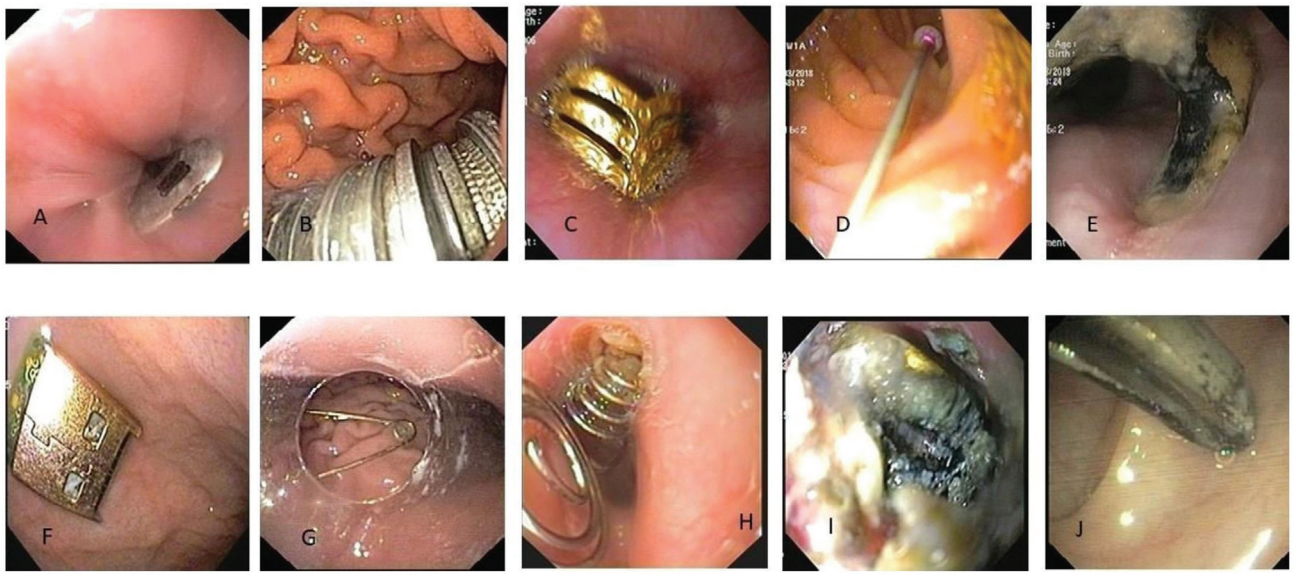

Fig. 1 Various foreign bodies retrieved from the gastrointestinal tract. (**A**) Razor in the upper esophagus. (**B**) Stack of coins in the stomach. (**C**) Gold ring in the lower esophagus. (**D**) Hair pin in the second part of the duodenum. (**E**) Dentures in the mid-esophagus. (**F**) Pen drive in the stomach. (**G**) Open safety pin is being removed with hood attached to the endoscopy. (**H**) Spring in the upper esophagus. (**I**) Corroded button battery in the postcricoid region. (**J**) Nail in the transverse colon.

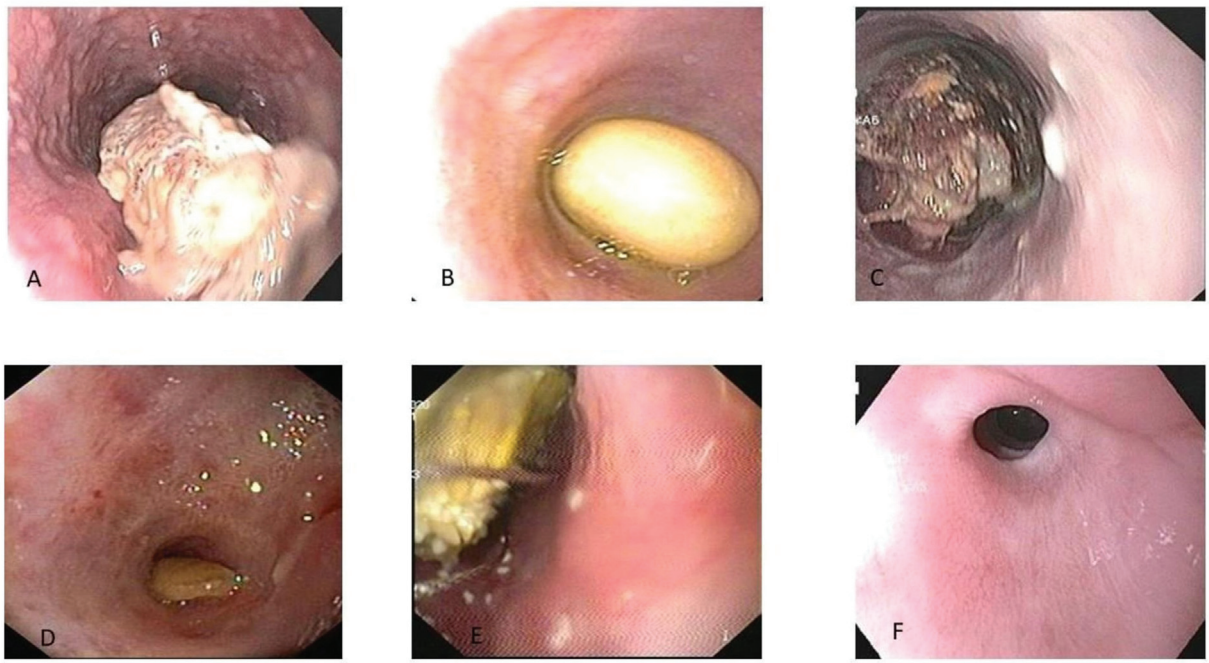

Fig. 2 Food bolus impaction in our study population. (**A**) Chicken bolus in the mid-esophagus. (**B**) Jackfruit seed in the lower esophagus. (**C**) Meat bolus in the mid-esophagus. (**D**) Medicinal tablet impacted at the site of corrosive stricture of the esophagus. (**E**) Meat bolus being removed piecemeal using a snare. (**F**) Corrosive mid-esophageal stricture.

in diameter) may get lodged anywhere along the GI tract; however, the esophagus, due to its inherent low motility and anatomical narrowing, is a common site of FB and food bolus impactions.[2] True FB ingestion is mostly encountered in pediatric populations, with 75% of cases occurring in children younger than 10 years; BBs, coins, and metallic pins are the common culprits.[1] In our present study, FB and food bolus impactions were found in 242 and 11 patients, respectively, out of 368 patients (68.75%), which differs from western studies that reported FBs in the range of 80%.[2,17–21] This inconsistency could be related to delay in referral from the outlying hospitals for endoscopic procedure resulting in a high likelihood of spontaneous passage of FB through the digestive tract with time. Of the total 253

patients with FB ingestion in our study, 67% were aged less than 3 years. Endoscopic intervention was successful in 97.63% ($n = 247$) of our patients but failed in 6 patients, which is comparable to other studies.[21,22] Patients in whom endoscopic retrieval was unsuccessful included five children with impacted BBs and one child with fish bone who developed retropharyngeal abscess needing surgical drainage and intravenous antibiotics. While the stomach was the most common site of FB, the most common site of FB and food bolus impactions was the esophagus given its narrow lumen.

The need for and timing of an endoscopic intervention are dependent on multiple factors; these include patient age and clinical condition, the location and characteristics of the ingested FB, time since ingestion, the technical capabilities of the endoscopist, and availability of endoscopic accessories and on-call anesthetists.[23] Patients unable to effectively manage their secretions secondary to complete esophageal obstruction from the ingested FB and/or those with sharp objects or BB require emergent endoscopic intervention, preferably within 2 hours, and at the least within 6 hours.[3] Both North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN) and European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) recommend performing emergent (<2 hours) endoscopic removal of BBs impacted in the esophagus regardless of the patient's symptoms.[11,12] This protocol was followed in our patients and all those with impacted esophageal BBs were taken up for endoscopy within 2 hours of their arrival to the ED. Also, emergency endoscopic retrieval was undertaken in those presenting with symptoms of complete esophageal obstruction or dyspnea and those with sharp pointed objects in the upper digestive tract in accordance with other studies.[3,21] Patients with BBs and other FBs (except sharp objects) in the stomach were subjected to endoscopy on an average of 6.2 hours from the time of their arrival to the ED (range: 2–8 hours).

Our study included a total of 11 children with food bolus impaction, with vegetable and fruit seeds being the commonest culprits followed by animal meat. Corrosive stricture was noted in seven of these patients and another two had anastomotic stricture developing after surgery for tracheoesophageal fistula. All these patients underwent stricture dilatation once the FB was extracted. Studies have demonstrated that around 75 to 100% of adult patients with food bolus impaction have an underlying esophageal pathology, with the most common abnormalities being hiatus hernia, eosinophilic esophagitis, strictures, surgery, and esophageal motility disorders, similar studies are lacking in pediatric patients.[24–27] Endoscopic "push technique," which has been advocated by several authors as the primary endoscopic method to treat esophageal food bolus impaction, was successful in the remaining eight patients in our study, while others underwent piecemeal extraction using either a snare or Roth net.[28,29]

Although radiographic evaluation is not always required, plain radiographic evaluation of the neck, chest, and abdomen is recommended to assess the presence, number, location, size, and shape of the radiopaque FB. X-rays can also provide useful information regarding possible aspiration, presence of free mediastinal or peritoneal air, or subcutaneous emphysema.[30]

The major limitation of our study is the retrospective nature of the study, and being a single-center study, the findings of our study cannot be generalized. There was no follow-up in the majority of our subjects after the initial endoscopy as most of them were referred from other outlying hospitals.

In general, any FB along the esophagus should be considered for extraction on an emergency/urgent basis. Any sharp objects, multiple magnets, and BBs in the stomach should be removed expeditiously to avoid complications, while blunt objects such as coins in the stomach and duodenum in an asymptomatic patient warrant a "wait and watch" approach and such patients need to be closely monitored radiologically and clinically till expulsion of the FB is confirmed.

Conclusion

In conclusion, FB ingestion and impacted food boluses in the digestive tract are a common pediatric problem needing endoscopic intervention. At presentation, a quick history and physical examination along with plain X-rays of the chest and abdomen should be performed to assess the type and location of the ingested FBs. While a proportion of digestive tract FBs are expelled without incidence, flexible endoscopic retrieval under general anesthesia is safe and effective in those presenting with obstructive symptoms when performed by a skilled endoscopist with a high success rate.

Funding
None.

Conflict of Interest
None declared.

References

1 Bronstein AC, Spyker DA, Cantilena LR Jr, Green JL, Rumack BH, Heard SEAmerican Association of Poison Control Centers. 2007 annual report of the American association of poison control centers' national poison data system (NPDS): 25th annual report. Clin Toxicol (Phila) 2008;46(10):927–1057
2 Mosca S, Manes G, Martino R, et al. Endoscopic management of foreign bodies in the upper gastrointestinal tract: report on a series of 414 adult patients. Endoscopy 2001;33(08):692–696
3 Birk M, Bauerfeind P, Deprez PH, et al. Removal of foreign bodies in the upper gastrointestinal tract in adults: European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guideline. Endoscopy 2016;48(05):489–496
4 Ikenberry SO, Jue TL, Anderson MA, et al; ASGE Standards of Practice Committee. Management of ingested foreign bodies and food impactions. Gastrointest Endosc 2011;73(06):1085–1091
5 Pfau PR. Removal and management of esophageal foreign bodies. Tech Gastrointest Endosc 2014;16:32–39
6 Becq A, Camus M, Dray X. Foreign body ingestion: dos and don'ts. Frontline Gastroenterol 2020;12(07):664–670
7 Schwartz GF, Polsky HS. Ingested foreign bodies of the gastrointestinal tract. Am Surg 1976;42(04):236–238

8 Sugawa C, Ono H, Taleb M, Lucas CE. Endoscopic management of foreign bodies in the upper gastrointestinal tract: a review. World J Gastrointest Endosc 2014;6(10):475–481
9 Chiu YH, Hou SK, Chen SC, et al. Diagnosis and endoscopic management of upper gastrointestinal foreign bodies. Am J Med Sci 2012;343(03):192–195
10 Zhang S, Cui Y, Gong X, Gu F, Chen M, Zhong B. Endoscopic management of foreign bodies in the upper gastrointestinal tract in South China: a retrospective study of 561 cases. Dig Dis Sci 2010;55(05):1305–1312
11 Kramer RE, Lerner DG, Lin T, et al; North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition Endoscopy Committee. Management of ingested foreign bodies in children: a clinical report of the NASPGHAN Endoscopy Committee. J Pediatr Gastroenterol Nutr 2015;60(04):562–574
12 Tringali A, Thomson M, Dumonceau JM, et al. Pediatric gastrointestinal endoscopy: European Society of Gastrointestinal Endoscopy (ESGE) and European Society for Paediatric Gastroenterology Hepatology and Nutrition (ESPGHAN) Guideline Executive summary. Endoscopy 2017;49(01):83–91
13 Shafiq S, Devarbhavi H, Balaji G, Patil M. Button battery ingestion in children: Experience from a tertiary center on 56 patients. Indian J Gastroenterol 2021;40(05):463–469
14 Palta R, Sahota A, Bemarki A, Salama P, Simpson N, Laine L. Foreign-body ingestion: characteristics and outcomes in a lower socioeconomic population with predominantly intentional ingestion. Gastrointest Endosc 2009;69(3, Pt 1):426–433
15 Lin HH, Lee SC, Chu HC, Chang WK, Chao YC, Hsieh TY. Emergency endoscopic management of dietary foreign bodies in the esophagus. Am J Emerg Med 2007;25(06):662–665
16 Little DC, Shah SR, St Peter SD, et al. Esophageal foreign bodies in the pediatric population: our first 500 cases. J Pediatr Surg 2006; 41(05):914–918
17 Ciriza C, García L, Suárez P, et al. What predictive parameters best indicate the need for emergent gastrointestinal endoscopy after foreign body ingestion? J Clin Gastroenterol 2000;31(01):23–28
18 Arana A, Hauser B, Hachimi-Idrissi S, Vandenplas Y. Management of ingested foreign bodies in childhood and review of the literature. Eur J Pediatr 2001;160(08):468–472
19 O'Sullivan ST, Reardon CM, McGreal GT, Hehir DJ, Kirwan WO, Brady MP. Deliberate ingestion of foreign bodies by institutionalised psychiatric hospital patients and prison inmates. Ir J Med Sci 1996;165(04):294–296
20 Katsinelos P, Kountouras J, Paroutoglou G, Zavos C, Mimidis K, Chatzimavroudis G. Endoscopic techniques and management of foreign body ingestion and food bolus impaction in the upper gastrointestinal tract: a retrospective analysis of 139 cases. J Clin Gastroenterol 2006;40(09):784–789
21 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(04):381–387
22 Eisen GM, Baron TH, Dominitz JA, et al; American Society for Gastrointestinal Endoscopy. Guideline for the management of ingested foreign bodies. Gastrointest Endosc 2002;55(07): 802–806
23 Longstreth GF, Longstreth KJ, Yao JF. Esophageal food impaction: epidemiology and therapy. A retrospective, observational study. Gastrointest Endosc 2001;53(02):193–198
24 Lacy PD, Donnelly MJ, McGrath JP, Byrne PJ, Hennessy TP, Timon CV. Acute food bolus impaction: aetiology and management. J Laryngol Otol 1997;111(12):1158–1161
25 Sebastián Domingo JJ, De Diego Lorenzo A, Santos Castro L, Castellanos Franco D, Menchén P. Endoscopic management of foreign bodies in the digestive tract. Rev Esp Enferm Dig 1990;77 (04):259–262
26 Kirchner GI, Zuber-Jerger I, Endlicher E, et al. Causes of bolus impaction in the esophagus. Surg Endosc 2011;25(10):3170–3174
27 Weinstock LB, Shatz BA, Thyssen SE. Esophageal food bolus obstruction: evaluation of extraction and modified push techniques in 75 cases. Endoscopy 1999;31(06):421–425
28 Vicari JJ, Johanson JF, Frakes JT. Outcomes of acute esophageal food impaction: success of the push technique. Gastrointest Endosc 2001;53(02):178–181
29 Schaefer TJ, Trocinski D. Esophageal Foreign Body. Treasure Island, FL: StatPearls Publishing; 2021
30 Caravati EM, Bennett DL, McElwee NE. Pediatric coin ingestion. A prospective study on the utility of routine roentgenograms. Am J Dis Child 1989;143(05):549–551