

# Profile of foreign body ingestion and outcomes of endoscopic management in pediatric population

Avinash Bhat Balekuduru, Bhuvan Shetty, Amit Dutta<sup>1</sup>, Satyaprakash Bonthala Subbaraj

Department of Gastroenterology, M. S. Ramaiah Memorial Hospitals, Bengaluru, Karnataka, <sup>1</sup>Department of Gastroenterology, Christian Medical College, Vellore, Tamil Nadu, India

## Abstract

**Background:** Foreign body (FB) ingestion is a frequent gastrointestinal emergency in pediatric population. Improvement in endoscopic techniques and equipment enables nonsurgical management in most situations. Recent data from India on pediatric FB ingestion have been lacking. **Aim:** The aim of this study was to assess the profile and outcome after endoscopic management of patients <18 years of age presenting with FB ingestion. **Patients and Methods:** Records of all the children with FB ingestion who had undergone endoscopic removal at our institution during 5 years (2011–2016) were assessed retrospectively. The nature of FB ingested, and success and complication of endoscopic therapy were analyzed. **Results:** There were 150 pediatric endoscopies during the study period. Of this, 120 (80%) were for removal of ingested FB. Most common (MC) FB was coin (69%). The retrieved FBs were 83 coins, 13 batteries, 5 pins, 4 clips, 2 each of anklets, keys, marbles, and seeds, one each of spoon, blade, spanner, peanut, toe ring, and a pencil. One had trichobezoar. Esophagus was the MC site of location of FB (85/120). FB removal was successful by flexible endoscopy in 97.1%. Four (0.03%) cases were referred for rigid endoscopic/surgical removal by otolaryngologists/pediatric surgeon. Except for one child developed bronchopneumonia, there was no morbidity or mortality in the study. **Conclusion:** Endoscopic removal of FB is a safe procedure with excellent outcomes in a specialized gastroenterology unit.

## Key words

Endoscopic removal, foreign bodies, pediatric endoscopy

## Introduction

Foreign body (FB) ingestions are a frequent reason for emergency endoscopy in pediatric population. Children <5 years of age account for about three-fourth of all FB ingestions.<sup>[1]</sup> As opposed to adults, 98% of FB ingestions in children are accidental and involve common objects found in the home environment, such as coins, toys, jewelry, magnets, and batteries.<sup>[2]</sup> Children may present with overt symptoms


including, but not limited to, stridor, pain, drooling, fussiness, chest pain, abdominal pain, fever, refusal to feed, wheezing, and respiratory distress.<sup>[3,4]</sup> Occasionally, they may not have any symptom.

Ingested FBs may pass spontaneously with time, or patients could experience complications such as obstruction, ulcers, and perforations.<sup>[5,6]</sup> Majority of FBs will likely pass without the need for intervention or endoscopic removal.<sup>[7]</sup> Only 10%–20% of cases require intervention and <1% require surgery. The mortality due to FB ingestion is extremely rare.<sup>[8]</sup> Flexible endoscopic removal has success rate of over 95% in removal of upper GI foreign bodies.<sup>[9]</sup> The aim of the current study was

### Address for correspondence:

Dr. Avinash Bhat Balekuduru, Department of Gastroenterology, M. S. Ramaiah Memorial Hospitals, Bengaluru - 560 054, Karnataka, India.  
E-mail: avinashbalekuduru@gmail.com

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to analyze the type, location, and endoscopic management outcomes of FBs ingestion in pediatric population seen at our center.

## Patients and Methods

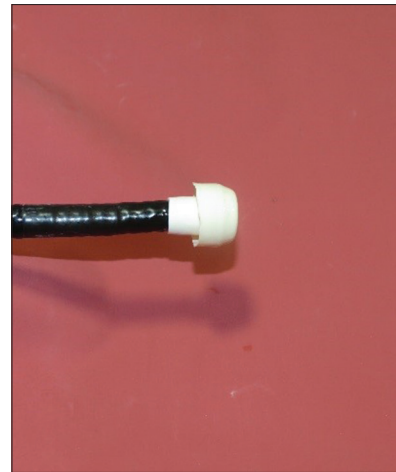
Patients who underwent endoscopic FB removal at the Department of Gastroenterology in M. S. Ramaiah Hospitals, Bangalore, between January 2011 and January 2016 were included in this retrospective study. This study was approved by the Institutional Ethics Committee. Written informed consent before endoscopic interventions was taken from guardians. Age, location of FB impaction, clinical symptoms, endoscopic method for removal, and complications were collected after review of medical charts using uniform structured data form and analyzed. The clinical and laboratory data are presented as mean value with standard deviation or median with range for continuous variables and as proportions for categorical variables. Plain neck, chest, and abdominal radiographs were taken to localize the site of radiopaque FBs and for signs of esophageal perforation such as mediastinal, subdiaphragmatic, or subcutaneous air. General anesthesia was used in all children for airway protection and relaxation of upper esophageal sphincter (UES). Emergency endoscopy was done in children who had ingested sharp FBs, disc batteries, had dysphagia, and in patients who could not manage their secretions. Nonprogression of FB in 1 day by radiograph or failure of reassurance to caretakers was also an indication for endoscopic removal. For sharp FBs, a transparent protective distal hood or a modified condom was used to avoid mucosal injury. Latex male condom was cut in the middle and placed at the distal end of the scope [Figures 1 and 2] in retracted form which wrapped around the FB at gastroesophageal junction [Figure 3] during withdrawal of endoscope. This novel technique can reduce the cost of the hood and prevent mucosal injury during sharp FB retrieval.

### Equipments used

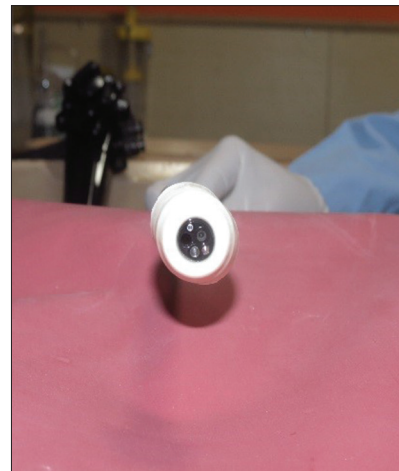
Flexible single-accessory channel endoscopy (GIF-Q 150/H 180-Olympus, Tokyo, Japan) was used for the procedures. Flexible endoscopy was done in all patients. Rigid esophagoscopy was used for proximal foreign bodies impacted at the level of the UES, especially batteries in collaboration with otolaryngologist. Otolaryngologists used Jackson grasping forceps (JGF) constructed entirely of stainless steel. The JGF jaws are shaped to provide a secure grip on the object to be removed. They are strong, durable, and sustain any degree of traction. Rat-tooth/alligator forceps, polypectomy snares, polyp graspers, Dormia baskets, retrieval nets, and hood/overtubes were used as necessary for the removal of FBs from upper gastrointestinal (GI) tract.

## Results

There were 140 patients below the age of 18 years who had a diagnosis of FB ingestion during the study period. Of



**Figure 1:** Distal end of endoscope fitted with condom cut as a hood



**Figure 2:** Tip of the endoscope with the condom hood retracted



**Figure 3:** At gastroesophageal junction, the hood flips covering the sharp foreign body preventing injury to esophagus

these, 20 patients did not undergo endoscopy as there were contraindications for the procedure, or the FB had passed beyond upper GI tract or consent could not be obtained. All these patients subsequently spontaneously passed out the FB.

The remaining 120 underwent endoscopy which constituted about 86% of all the emergency upper GI endoscopy done in this age group during the study period. In contrast to 120 pediatric patients, there were only 36 adults who were seen with FB ingestion (dentures in 25, food impaction in 10, and bangle in 1).

The median age of 120 patients who underwent endoscopy was 8 years (range: 3–18 years). About 70% patients did not have any symptom related to FB ingestion. Crying with drooling of saliva was noted in esophageal impaction of FB (70%). Children between 10 and 18 years presented with dysphagia (61%) and throat pain (27.3%) to the emergency department after ingestion of FB.

On endoscopy, the most common site of location of FB was esophagus (70%,  $n = 85$ ). Five were noted in duodenum and the rest were noted in stomach. One patient had trichobezoar in stomach extending up to distal duodenum. Most patients in this study were below 10 years of age ( $n = 78$ ) and the ingested FB was coin in about 90% of these patients [Table 1]. Rest of the patients had ingested battery except for one patient who had swallowed a clip. While coin and battery were the common ingested FB in patients above 10 years of age, there was a large diversity of FB ingested as shown in Table 1. Recurrent FB ingestion was not noted in the study.

The endoscopic procedure was carried out under general anesthesia after obtaining informed consent. Successful endoscopic retrieval of FB was possible in 97.1% of cases. Coins were removed by either Roth net [Figures 4 and 5] or Dormia basket or forceps. Batteries were removed using FB

retrieval forceps or Roth net [Figure 6 and 7]. Esophageal tear/ulcer was noted in 5% cases postprocedure. No mortality due to FB impaction was noted. Four patients required surgical removal of FB due to impaction of Button Battery

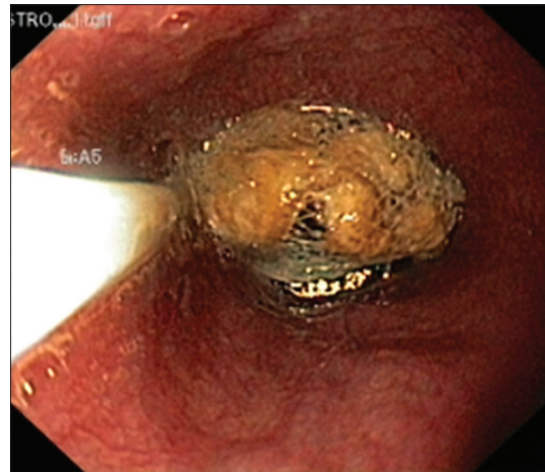


Figure 4: Endoscopic removal of coin using roth net forceps

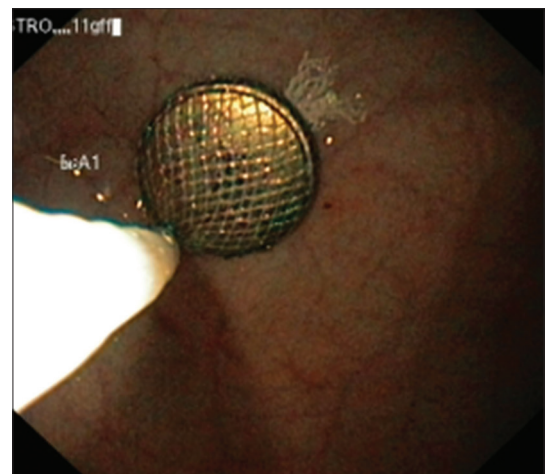


Figure 5: Endoscopic removal of coin using roth net forceps

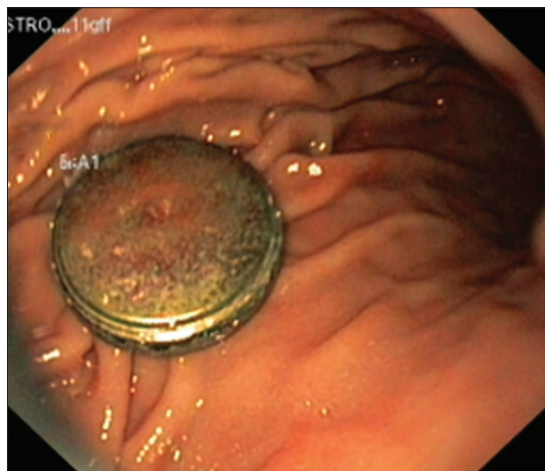


Figure 6: Endoscopic image of button battery in stomach

**Table 1: Type of foreign body with the endoscopic removal accessory used in the two age groups**

Type of foreign body (endoscopic accessory used)	<10 years	>10 years	Total
Coins (Roth net forceps/FBRF/Dormia basket)	70	13	83
Batteries (FBRF/Roth net)	7	6	13
Pins (FBRF)		5	5
Clips (FBRF)	1	3	4
Anklets (snare forceps) [Figure 8]		2	2
Marbles (Roth net forceps)		2	2
Seeds (Roth net forceps)		2	2
Keys (snare forceps)		2	2
Blade (hood + FBRF)		1	1
Spanner (FBRF)		1	1
Walnut (snare forceps) [Figure 9 and 10]		1	1
Fish bone (hood + FBRF) [Figure 11 and 12]		1	1
Spoon (FBRF)		1	1
Pencil (snare forceps)		1	1
Trichobezoar (surgery) [Figure 13 and 14]		1	1

FBRF=Foreign body retrieval forceps

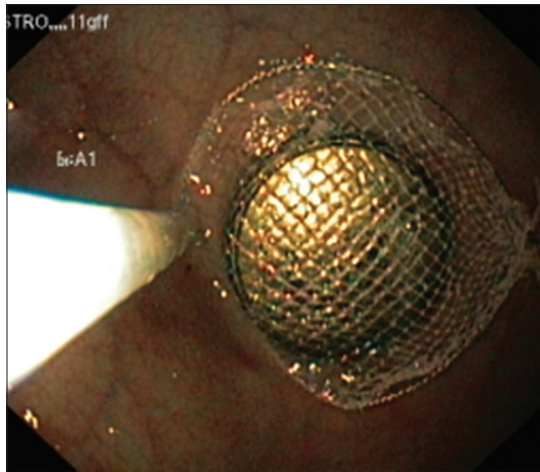


Figure 7: Endoscopic removal of battery using roth net forceps

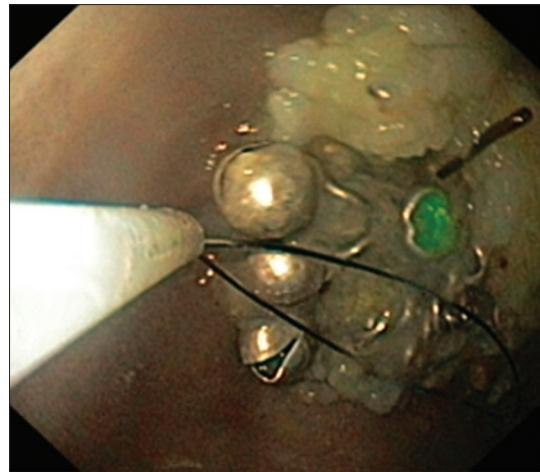


Figure 8: Endoscopic image of anklet and removal using snare forceps

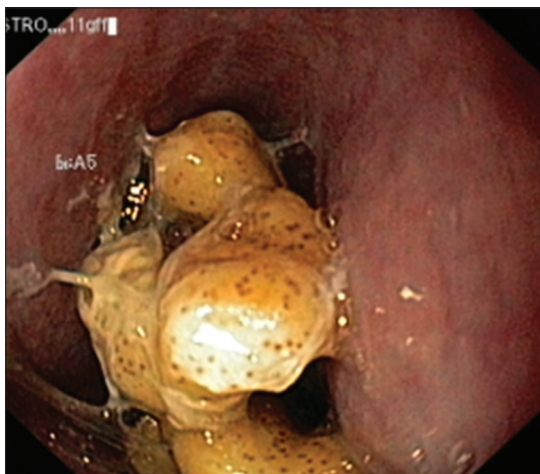


Figure 9: Endoscopic image of esophageal walnut



Figure 10: Endoscopic removal of walnut using snare forceps



Figure 11: Endoscopic image of fish bone stuck in esophagus

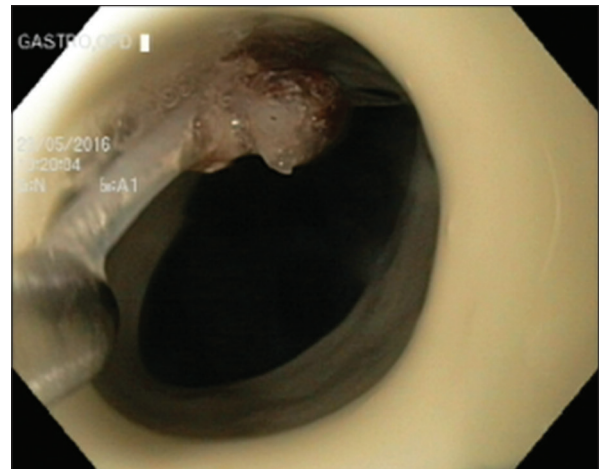


Figure 12: Endoscopic removal using condom hood and foreign body retrieval forceps

(BB) at the UES and the grasp of the endoscopic FB retrieval forceps was not sufficient. The batteries at UES with failed endoscopic attempt were removed using rigid endoscopy and use of JGF.

## Discussion

Esophageal FB requires prompt removal within 24 h. The length of the FB >6 cm is unlikely to pass through the



**Figure 13:** Endoscopic image of trichobezoar in stomach

duodenum and ileocecal valve and diameter of FB >2.5 cm unlikely to pass through the pylorus should be removed though in the stomach.<sup>[10,11]</sup> Esophageal FB almost always warrant early endoscopic removal as these patients are symptomatic and there is also risk of ulceration/perforation if the FB is left for long. Some gastric FBs will pass spontaneously if small in size. However, large FB which may not be able to traverse the pylorus, sharp items, and button battery needs endoscopic removal. There is not much data on timing of endoscopic intervention but early removal may be better as peristalsis may push the FB into intestine.<sup>[12]</sup>

In our study, Coins were the most common (MC) ingested objects among children. A 10-year study from the United States reported coins as the MC FB noted among >250,000 ingestions and 20 deaths.<sup>[13]</sup> Drooling/chest pain/stridor/zinc toxicity with massive ingestion of pennies has been described.<sup>[14]</sup> We were able to remove all the coins endoscopically using Roth net or forceps except for 15 cases where the coin passed out spontaneously.

Esophageal BBs have emerged as the most critical indication for emergent endoscopy in children. Increased diameter of BB and a change to lithium cells (better shelf life and higher voltage) result in increased likelihood of esophageal impaction. The mechanism of BB injury is related to hydroxide radicals, results in a caustic injury instead of an electrical-thermal injury.

Emergency removal is necessary for prevention of complications. Stone retrieval basket or Roth net is most often successful as there is less chance of leak.<sup>[8]</sup> In our study, either sharp FB/disk battery/impacted FB in esophagus, endoscopy was performed within 6 h of presentation.

In the cohort >8600 BB ingestions from national capital poison center, there was a major effect in 73 patients (0.8%), with death in 13 patients (0.15%).<sup>[15]</sup> Most of the impacted BBs were in esophagus. Batteries impacted, especially in the upper esophagus/at the UES posed a clinical challenge. This finding is consistent with previous studies.<sup>[10,16-18]</sup> Cross consultation with



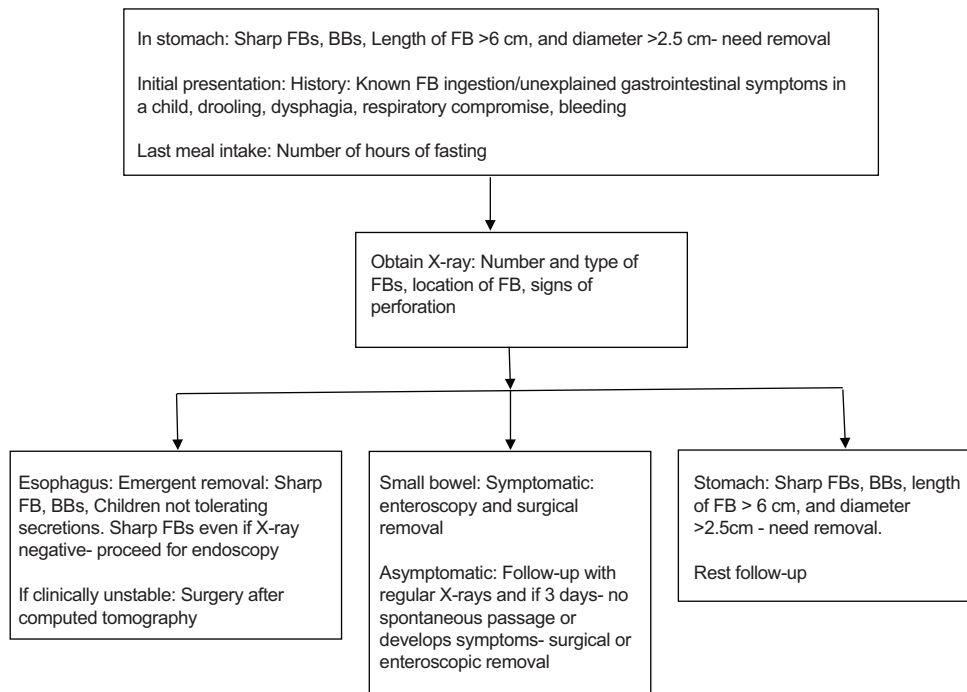
**Figure 14:** Post operative specimen of trichobezoar

otolaryngologists for rigid esophagoscopy and removal should be done due to better control of accessories. Flexible endoscopy failed to remove big BB stuck in UES and edge not visible on forward view. Rigid endoscopy utilizes a nonflexible-channeled device that is introduced into the esophagus under general anesthesia. It is better for impacted BBs in the proximal esophagus/hypopharynx/cricopharynx.<sup>[18]</sup> The technique requires considerable skill and may cause complications such as esophageal abrasion and perforation.<sup>[19,20]</sup>

Repeat endoscopy is also indicated after the removal of sharp FBs for assessment of mucosal damage. Many sharp-pointed objects are not radiographically visible, but endoscopy should still follow a radiologic examination with negative findings. Sharp-pointed objects lodged in the esophagus are a medical emergency. Sharp-pointed objects in the stomach will pass spontaneously, but the risk of a complication caused by a sharp-pointed object is as high as 35%, and therefore, endoscopic removal is preferred.<sup>[8]</sup> One patient had esophageal mucosal tear, but this improved with conservative management. Other patients had minor ulcer at the site of impaction.

Many sharp objects follow Jackson's axiom: "advancing points puncture, trailing do not,"<sup>[21]</sup> and often pass the GI tract uneventfully.<sup>[22]</sup> Spontaneous passage of nail without any intervention was noted in five patients. Patients were admitted and explained to watch for abdominal pain, GI bleed, or fever. Radiographs were done on daily basis to monitor the progress of the nails. None required surgery and nails passed out by the 3<sup>rd</sup> day of ingestion in all of them.

Endoscopic accessories were chosen depending on the trial on a prototype of the ingested FB. Rat-tooth forceps (56%), Roth net (34%), and polypectomy snares (8%) were commonly used. The success rate in retrieval of FB depends lot on several factors including the experience of operator and assistant, accessories available, anesthesia facilities, and following an algorithmic approach [Figure 15]. A compilation of FBs over 5 years is as shown in Figure 16.



**Figure 15:** Diagnostic and therapeutic algorithm for foreign body ingestion in pediatric and adolescent population



**Figure 16:** Picture depicting the collection of foreign BODIES in children and adults

## Conclusion

FB ingestion is a frequent emergency in pediatric gastroenterology. Successful endoscopic retrieval is possible if intervened early. Majority of the cases are accidental and priority has to be given in educating the patients/parents to be careful with coins, sharps, batteries, and corrosives.

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## Conflicts of interest

There are no conflicts of interest.

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