ORIGINAL ARTICLE

Flexible Endoscopic Management of Foreign Body Ingestion in Children: A Ten-Year Single-Center Retrospective Study in the Philippines

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ABSTRACT

Background and Objective. Foreign body (FB) ingestion is a common pediatric concern in the Philippines, but local studies on flexible endoscopic management are lacking. This study aimed to describe the clinical profile and outcomes of children referred for flexible endoscopic management and identify factors associated with poor outcomes.

Methods. This retrospective cohort study included 145 patients aged <18 years admitted to the Philippine General Hospital for FB ingestion from 2014 to 2024. Data on clinical features and outcomes were analyzed, and odds ratios (OR) were calculated to identify associations with poor outcomes, defined as complications or mortality.

Results. Most FB ingestions (96.55%) were accidental, with coins as the most common FB (56.55%). Patients were admitted an average of 40.42 hours post-ingestion and referred for endoscopy within 9.28 hours. Flexible endoscopy was performed in 44.83% of cases, with a 98.46% success rate and an average procedure time of 32.25 minutes. Spontaneous passage occurred in 50.34% of cases. Poor outcomes were linked to age <1 year (OR: 7.49, p = 0.0291), delayed extraction (>48 hours; OR: 15.43, p = 0.0181), and prolonged procedures (>30 minutes; OR: 12, p = 0.0318). Good outcomes were associated with unremarkable physical exams (OR: 0.078; p = 0.0018), early admission (≤24 hours; OR: 0.1208, p = 0.0140), and timely endoscopic referral (≤24 hours; OR: 0.0314, p = 0.0187).

Conclusion. Flexible endoscopy is effective and safe for FB extraction in children. Early admission and timely intervention significantly improve outcomes, while delays and prolonged procedures increase the risk of complications.

Keywords: foreign-body, endoscopy, child, retrospective study

INTRODUCTION

Foreign body ingestion (FBI) among children is a common presenting problem in the emergency department (ED) causing serious complications if not treated appropriately. Most cases are accidental[1] and have varying outcomes, some of which can be life-threatening[2]. The variety of factors in pediatric FBI which affect patient presentation makes immediate evaluation complicated since these cannot be generalized and risk assessment may not be feasible without further investigation and diagnostics. Although some present with no symptoms, ED consults are generally based on witnessed or reported ingestion and, if symptomatic, are commonly associated with various features including the type of material ingested and its location in the gastrointestinal tract. Among those with symptoms, the most common complaints include abdominal pain and vomiting,[3-6] with majority of ingested foreign bodies being coins,[3-7] most of which were lodged in the esophagus[3].

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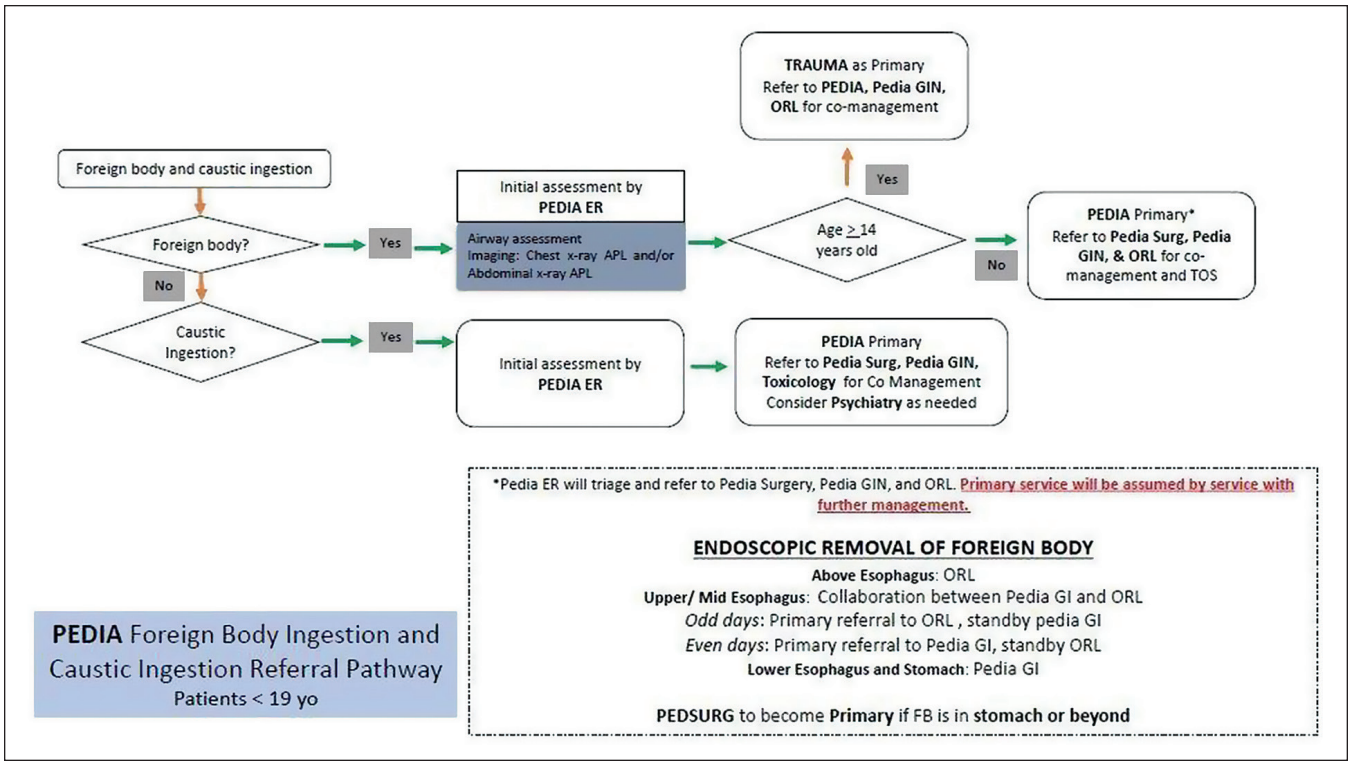

Figure 1. Management algorithm in the Philippine General Hospital (PGH) on foreign body ingestion in pediatric patients.
Image courtesy of the PGH Division of Pediatric Emergency Medicine.

Flexible endoscopic extraction is a practical non-invasive intervention which is a viable option in managing FBI in children. Although it entails the need for anesthesia and sedation, and exposes the patient to procedure-related risks, serious morbidities from endoscopic management are uncommon.[8] In those with significant complications, comorbidities such as abnormal gastrointestinal motility or previous surgery were documented to be important patient risk factors.[9]

In low-income source and developing countries where equipment and skilled professionals are not always available, there is a need to identify patient and foreign body characteristics associated with poor outcomes requiring urgent procedures in order to streamline management. In the Philippines, there have been recorded 1,041 cases of FBI in children since 2006.[10] A local single center study documented that the majority of FBI cases involved patients from the pediatric age group, almost all of whom were successfully managed with rigid esophagoscopy with little complications.[11] However, there are limited observational studies on the outcomes of flexible endoscopic management of FBI, particularly in centers where this procedure can be done in accordance to existing guidelines. In the Philippine General Hospital (PGH), a government tertiary medical center, children with FBI are referred alternately to the Department of Otorhinolaryngology or the Division of Pediatric Gastroenterology, Hepatology and Nutrition, with the former doing only rigid and the latter only flexible endoscopic management (Figure 1). However, there is currently a lack of local studies focusing on the adherence to, and outcomes of, following the latest guidelines on flexible endoscopy and FBI. This prompts the need for more investigations looking at these factors together with the possible link between patient features and nature of foreign body ingested requiring immediate intervention, as management should always be guided by the risk of complications.

This study aimed to determine the clinical profile and outcomes of pediatric patients who were referred for flexible endoscopic extraction of ingested foreign bodies, and to identify possible associations between their clinical features and outcomes. The study was guided by the following hypotheses: that flexible endoscopic extraction is a safe procedure for the removal of ingested foreign bodies in children, and that timely intervention significantly reduces the risk of complications.

METHODS

This is a retrospective cohort study based on review of medical records of pediatric patients presenting with foreign body (FB) in PGH and referred to the Division of Pediatric Gastroenterology, Hepatology and Nutrition for flexible endoscopic management from April 1, 2014 to March 30, 2024. The aim was to determine the clinical profile and outcomes of pediatric patients who were referred for flexible

endoscopic extraction of ingested FB and to identify possible associations between clinical features and outcome of these patients. The inclusion criteria encompass all pediatric patients age 18 years old and below presenting with FBI in PGH and referred to the Division of Pediatric Gastroenterology, Hepatology and Nutrition for endoscopic management. Patients who were initially referred for rigid endoscopic extraction of ingested foreign body without referral for possible flexible endoscopic management were excluded.

The primary outcomes of interest in this study were the presence or absence of complications, in-hospital mortality, length of hospital stay, time from discharge to follow-up, and whether the foreign body passed spontaneously. The main exposure was referral for possible flexible endoscopic extraction of the ingested foreign body. Predictor variables included patient demographic characteristics, associated clinical conditions and comorbidities, presenting signs and symptoms, significant physical examination findings, and the nature of the ingested foreign body (type, size, radiographic location). Temporal variables such as time from ingestion to hospital admission, time to referral to the pediatric gastroenterology service, time to procedure, length of procedure, and overall hospital stay were also analyzed. Although no formal diagnostic criteria were applied, all included patients had confirmed or strongly suspected foreign body ingestion and were referred for possible flexible endoscopic management, based on established institutional protocols. A sample size calculation was conducted prior to data collection using a standard formula for finite populations. With an estimated population size of 41,280 Emergency Department admissions over the past 10 years, a confidence level of 95%, and a margin of error of 5%, the computed minimum required sample size was 381 participants. To satisfy this number, the study involved total enumeration sampling of all patients with FBI who were referred within the designated study period.

The medical records of all patients who satisfied the inclusion criteria were reviewed. Patients with incomplete medical records were excluded from the study. All relevant data included in the ten-year interval were collected and tabulated using a Microsoft Excel File. Data processing and analysis were performed using R and R Studio. Categorical data were summarized using frequencies and proportions, and continuous data were summarized using mean and standard deviation values. Analysis of variance and chi-square test or Fisher's exact test of homogeneity were used to compare clinical information across groups. All tests of association were planned a priori, guided by the study objectives and informed by existing literature on pediatric foreign body ingestion. Variables selected for association testing with clinical outcomes included demographic characteristics, comorbidities, presenting symptoms, physical examination findings, nature and location of the ingested foreign body, and timing-related factors (e.g., time from ingestion to admission, referral, and procedure; length of procedure; length of hospital stay). No post-hoc or exploratory analyses were performed beyond the prespecified statistical comparisons. Odds ratios were computed to determine possible association between clinical outcomes and clinical features. The level of significance was set to 5%.

This study was submitted for review to the University of the Philippines Manila Research Ethics Board (UPMREB). In addition, the investigators underwent Good Clinical Practice (GCP) training-workshop prior to the start of the study. A waiver of informed consent was requested from the UPMREB panel since the study is a secondary analysis of data from available medical records.

RESULTS

Clinical Features

A total of 170 patients satisfied the inclusion criteria, the complete medical records of 145 of whom were available (Figure 2). Among them, the mean age was 5.23 years (SD 3.86), with similar prevalence in those age 1 to 3, 4 to 5, and 6 to 12 years old. 59.3% were male (Table 1).

80.69% of the patients did not have any underlying co-morbidity, while the most common type of co-morbidity was neurodevelopmental in 10 (6.9%.) patients. These included autism spectrum disorder (n=3), Down syndrome (n=2), global developmental delay (n=1), language disorder (n=1), cerebral palsy (n=1), Chiari II malformation (n=1), and chronic infarct of the right thalamus (n=1). Three patients (2.07%) were also diagnosed with asymptomatic COVID-19 on routine testing upon admission which delayed the extraction procedure as these cases were done last in order to contain the infection.

Upon ingestion, 38.62% were asymptomatic while the most common symptom complaint was vomiting at 35.86%, followed by drooling (9.66%), dysphagia (8.97%), and foreign body sensation (8.97%).

On physical examination, most of the patients had unremarkable findings (88.28%) despite the varying nature, size, and location of the ingested FB. Four patients had abdominal tenderness, two with abnormal breath sounds (crackles) with no respiratory distress. One patient (0.69%) who ingested glass shards presented with bleeding oral mucosa but was otherwise stable with unremarkable course.

Foreign Body Ingested

Coins were the most common FB ingested (56.55%) followed by button batteries (13.79%), blunt objects (11.72%), and pointed objects (9.66%) (Table 2). The most common type of coin was one-peso coin, with both old and new types measuring 20-25 mm, comprising 35.17% of all ingestions. One patient, a 9-year-old girl, ingested a twenty-peso coin measuring 30 mm which was lodged in the esophagus and was extracted successfully and safely using flexible endoscopy despite its size. Four patients ingested open safety pins, with one having the FB lodged in the stomach and was successfully extracted via flexible endoscopy, while two patients had

Table 1. Demographic and Clinical Features of Patients Referred for Flexible Endoscopic Management of Foreign Body Ingestion

	All patients (n=145), n, (%)	Discharged with no complications (n=138), n,%	With complications (n=6), n,%	Mortality (n=1), n,%	*p* value
Sex					1
Male	86 (59.3)	81 (58.69)	4 (66.67)	1 (100)	
Female	59 (40.7)	57 (41.3)	2 (33.33)	0	
Age group (years)					**0.001526**
<1	9 (6.21)	7 (5.07)	2 (33.33)	0	
1 to 3	42 (28.97)	39 (28.26)	3 (50)	0	
4 to 5	42 (28.97)	42 (30.43)	0	0	
6 to 12	42 (28.97)	42 (30.43)	0	0	
13 to 18	10 (6.9)	8 (5.8)	1 (16.67)	1 (100)	
Comorbidities					0.06987
None	117 (80.69)	113 (81.88)	4 (66.67)	0	
Neurodevelopmental	10 (6.9)	9 (6.52)	0	1 (100)	
Infectious	5 (3.45)	5 (3.62)	0	0	
Gastrointestinal	3 (2.07)	2 (1.45)	1 (16.67)	0	
Metabolic	3 (2.07)	2 (1.45)	0	0	
Malnutrition	2 (1.38)	1 (0.72)	1 (16.67)	0	
Psychiatric	2 (1.38)	2 (1.45)	0	0	
Caustic ingestion	1 (0.69)	1 (0.72)	0	0	
Pulmonary	1 (0.69)	1 (0.72)	0	0	
Renal	1 (0.69)	1 (0.72)	0	0	
Physical examination					**0.002133**
Unremarkable	128 (88.28)	125	3 (50)	0	
Abnormal breath sounds	2 (1.38)	1 (0.72)	1 (16.67)	0	
Abdominal distention	1 (0.69)	0	1 (16.67)	0	
Abdominal tenderness	4 (2.76)	3 (2.17)	1 (16.67)	0	
Drooling	1 (0.69)	1 (0.72)	0	0	
Hoarseness	1 (0.69)	1 (0.72)	0	0	
Lower GI bleed	1 (0.69)	1 (0.72)	0	0	
Oral mucosa wounds	1 (0.69)	1 (0.72)	0	0	
Respiratory distress	1 (0.69)	0	0	1 (100)	
Stunting	1 (0.69)	1 (0.72)	0	0	
Tachycardia	1 (0.69)	2 (1.45)	0	0	
Tenderness on neck area	1 (0.69)	1 (0.72)	0	0	
Whistling sound	1 (0.69)	1 (0.72)	0	0	

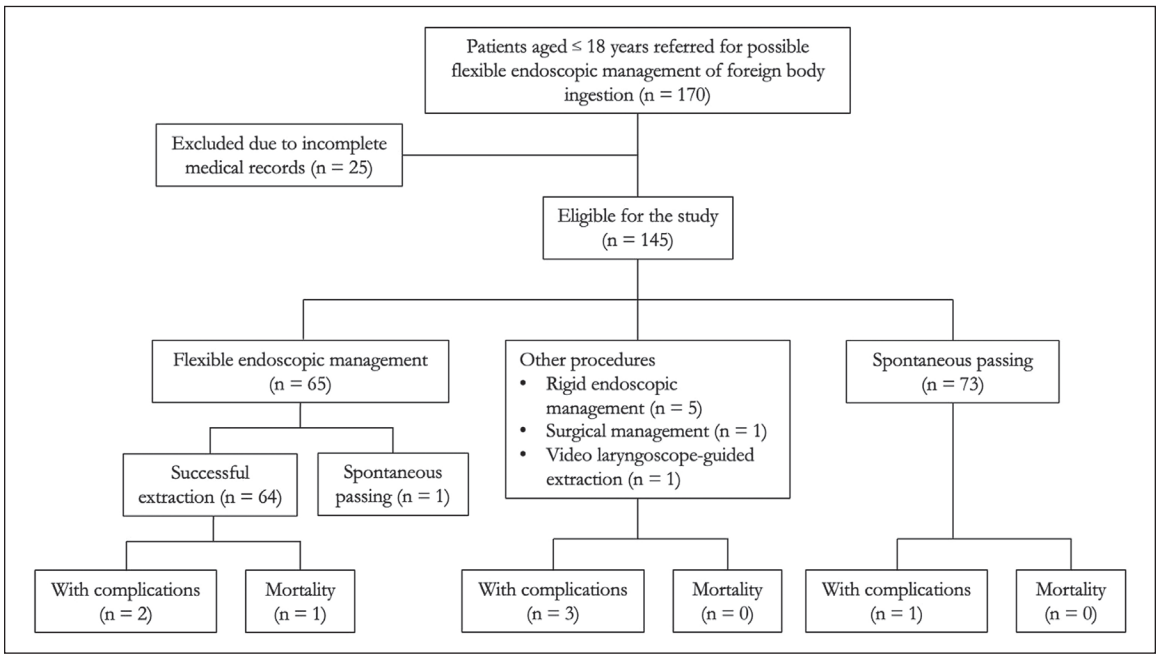

Figure 2. Study flow diagram of the distribution of management and clinical outcomes of foreign body ingestion.

Table 2. Foreign Body Features of Patients Referred for Flexible Endoscopic Management of Foreign Body Ingestion

	All patients (n=145), n, (%)	Discharged with no complications (n=138), n,%	With complications (n=6), n,%	Mortality (n=1), n,%	*P* value
Mode of ingestion					0.222
Accidental	140 (96.55)	134 (97.1)	5 (83.33)	1 (100)	
Non-accidental	5 (3.45)	4 (2.9)	1 (16.67)	0	
Site of ingestion					1
Home	132 (91.03)	125 (90.58)	6 (100)	1 (100)	
School	2 (1.38)	2 (1.45)	0	0	
Hospital (inpatient)	2 (1.38)	2 (1.45)	0	0	
Others	9 (6.21)	9 (6.52)	0	0	
Type of ingested FB					0.106
Blunt object	17 (11.72)	15 (10.87)	2 (33.33)	0	
Button battery	20 (13.79)	19 (13.77)	1 (16.67)	0	
Coin	82 (56.55)	80 (57.97)	1 (16.67)	1 (100)	
Food impaction	1 (0.69)	1 (0.72)	0	0	
Magnet	5 (3.45)	5 (3.62)	0	0	
Plastic foil wrap	1 (0.69)	1 (0.72)	0	0	
Pointed object	14 (9.66)	13 (9.42)	1 (16.67)	0	
Ring	1 (0.69)	1 (0.72)	0	0	
Seeds	1 (0.69)	0	1 (16.67)	0	
False teeth	3 (2.07)	3 (2.17)	0	0	
Radiographic location of FB					0.3208
Upper esophagus	44 (30.34)	41 (29.71)	3 (50)	0	
Mid-esophagus	5 (3.45)	4 (2.9)	0	1 (100)	
Distal esophagus	9 (6.21)	9 (6.52)	0	0	
GEJ	1 (0.69)	1 (0.72)	0	0	
Stomach	39 (26.9)	38 (27.54)	1 (16.67)	0	
Small or large intestines	35 (24.14)	34 (24.64)	1 (16.67)	0	
Unknown/radioluscent	8 (5.52)	8 (5.8)	0	0	
Approximate size (mm)					0.1633
<20	31 (21.38)	28 (20.29)	3 (50)	0	
20 to 25	79 (54.48)	76 (55.07)	2 (33.33)	0	
26 to 30	25 (17.24)	24 (17.39)	0	1 (100)	
>30	6 (4.14)	6 (4.35)	0	0	
Specific procedure done					**0.02234**
EL with extraction	1 (0.69)	0	1 (16.67)	0	
Flexible endoscopy only	2 (1.38)	2 (1.45)	0	0	
Flexible endoscopy with extraction	60 (41.38)	57 (41.3)	2 (33.33)	1 (100)	
Rigid endoscopy with extraction	2 (1.34)	2 (1.34)	0	0	
Rigid esophagoscopy only	3 (2.07)	2 (1.45)	1 (16.67)	0	
Rigid followed by flexible endoscopy with extraction	2 (1.38)	1 (0.72)	1 (16.67)	0	
Flexible followed by rigid bronchoscopy with extraction	1 (0.69)	1 (0.72)	0	0	
Video laryngoscope-guided extraction	1 (0.69)	1 (0.72)	0	0	
None	73 (50.34)	72 (51.45)	1 (16.67)	0	

spontaneous passing of the FB in stools. One patient, a 5-month-old infant, underwent exploratory laparotomy due to intestinal perforation. One patient ingested *Sandoricum koetjape* or Santol seeds which was lodged in the stomach and first portion of the duodenum, requiring two flexible endoscopic procedures for extraction.

Most ingestions occurred at home (91.72%), followed by outdoors while playing (5.52%). Two patients (1.38%) ingested FB while at school and another two (1.38%) had ingestions while in the hospital, initially admitted for surgery of internal hemorrhoids in one and another for cyanotic heart disease. Both accidentally ingested teeth which eventually lodged in the esophagus and were successfully removed with flexible endoscopic extraction.

Accidental ingestions comprise 96.6% of the all FBI cases. Five cases (3.4%) were deliberate ingestions in adolescent patients, two of which were diagnosed with Bipolar I disorders who attempted suicide. Of note, one patient ingested multiple box cutter blades, one of which was lodged in the upper esophagus and was successfully extracted via flexible endoscopy using a rat tooth forceps and an overtube device (Figure 3). The rest of the blades were passed in stools after treatment with polyethylene glycol. Although there was minimal mucosal injury in the esophagus, there were no noted significant untoward events during the procedure. Other foreign body deliberately ingested were razor blade and X-ray lead marker, all of which had spontaneous passage and unremarkable course.

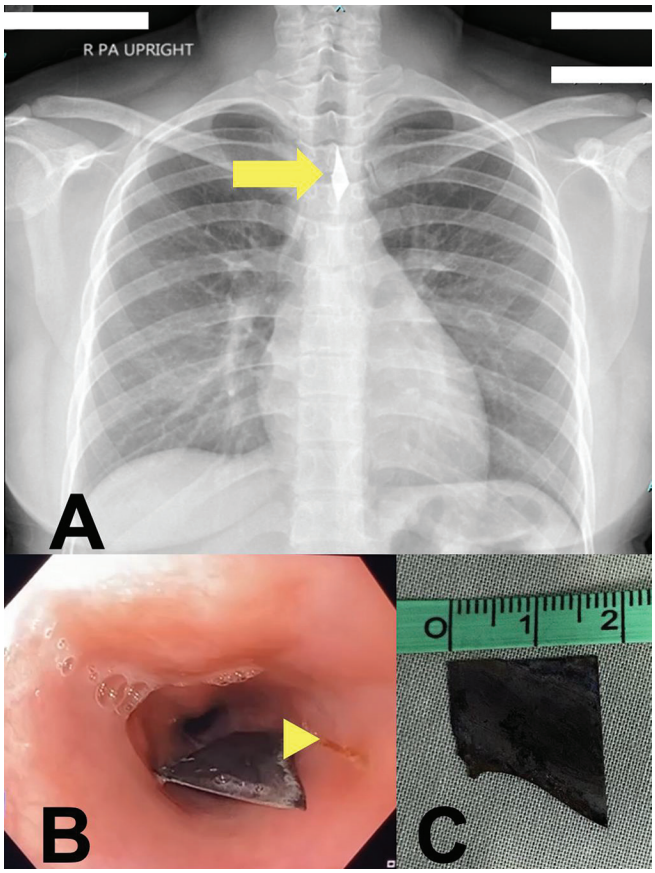

Figure 3. Box cutter blade ingestion by an adolescent female. The blade was lodged in the esophagus **(A)** *[yellow arrow]* and upon endoscopy, there was minimal mucosal injury with no apparent bleeding **(B)** *[yellow arrow head]*. The blade was successfully extracted via flexible endoscopy **(C)**.

On radiographic examination, majority of FB were lodged in the upper esophagus (30.34%), followed by the stomach (26.9%), and intestines (24.14%) (Table 2). The anatomical location of the esophageal foreign bodies was classified based on radiographic imaging and/or endoscopic findings. The esophagus was divided into three segments: upper third (from the cricopharyngeus to the level of the thoracic inlet), middle third (between the thoracic inlet and mid-thoracic vertebrae), and distal third (from the mid-thoracic vertebrae to the gastroesophageal junction). Classification into these categories was determined according to the position of the foreign body on radiographs or as noted during endoscopic retrieval. Majority of the FB had sizes ranging from 20-25 mm while only six (4.24%) were >30 mm which were lollipop stick, sewing pin, LEGO brick, false teeth, AA battery, and a key. Only one patient showed signs of complication on X-ray; an infant who developed pneumoperitoneum from intestinal perforation in one of the open safety pin ingestions who eventually underwent exploratory laparotomy and extraction.

Foreign Body Extraction

Seventy-two (49.66%) underwent procedures for extraction due to either the FB being lodged in the esophagus or being stuck in the stomach for more than two weeks (Table 2). Sixty-five (44.83%) patients, or 89.04% of those who underwent procedures, underwent flexible endoscopic management with a 98.46% success rate. In the sole case where flexible endoscopy was not successful, FB extraction was planned for a one-peso coin (measuring 23 mm) because of previous radiographic location in the upper esophagus but was noted endoscopically to have moved beyond the pylorus; hence, extraction was deferred and the FB was passed in stools after five days with no complications.

The average time between ingestion and procedure was 79.77 hours (SF 148.41), and between admission and procedure was 69.04 hours (SD 307.7), with delays mainly due to institutional logistical limitations, such as scheduling constraints for anesthesia services necessary for the procedures. The average length of procedure was 32.25 hours (SD 23.61). (Appendix A). Of the 65 patients who underwent flexible endoscopic extraction of FB, 61 (93.85%) underwent general endotracheal anesthesia, with no untoward events. Only four (6.15%) had intravenous anesthesia, with age ranging from 5 to 15 years old, with the reason for which intravenous sedation was chosen was not documented. (Appendix B)

Majority of the flexible endoscopic procedures involved the use of a standard gastroscope (96.92%); one used flexible bronchoscope and another one used transnasal gastroscope due to the unavailability of standard gastroscopes during the time of procedure. Of the 65, rat tooth forceps was the most common endoscopy accessory used (n=56, 86.15%). Only two cases (3.08%) used overtube for extraction of sharp FB, while transparent cap was only used in one case. (Appendix B)

On endoscopy, majority of the FB were located in the upper esophagus (53.85%). The most common endoscopic finding was mucosal injury attributed to the FB (11.94%) and none were attributed to the procedure. In one patient, the FB was not found endoscopically and was presumed to have passed beyond the pylorus, and was eventually passed in the stool, as evidenced by an unremarkable repeat abdominal radiograph.

Outcome

Out of the 145 patients, 73 (50.34%) experienced spontaneous passage of the ingested foreign body after an average of 8.55 days (SD 12.24) while being treated with polyethylene glycol. These cases included 69 coins, as well as one each of a box cutter blade, razor blade, X-ray lead marker, and paper clip. In contrast, 65 patients (44.83%) underwent flexible endoscopic extraction, of which 64 cases (98.47%) were successfully completed without major complications. All patients who are clinically well with no complications were discharged and were followed up on outpatient basis.

No complications were attributed to the procedure, with an average hospital stay of 4.62 days (SD 15.21) (Table 3).

Most patients were discharged without complications (95.17%). Six (4.14%) had complications while admitted, three (2.07%) of whom underwent flexible endoscopic management. These included a 15-year-old male with severe acute malnutrition who ingested multiple seeds who eventually presented with signs of gut obstruction in which two flexible endoscopic extraction procedures were done in order to retrieve most of the seeds. Another one was a 1-year-old female who ingested a coin and during routine monitoring of electrolytes while admitted developed multiple electrolyte imbalance which promptly resolved after treatment. The last one was a 2-year-old female who ingested button battery and developed adverse drug reaction to cefuroxime and clindamycin after antibiotic treatment was initiated due to endoscopic findings of mucosal injury and minimal bleeding. Among those who did not undergo flexible endoscopic management, the three (2.07%) who developed complications were: a 1-year-old male who ingested plastic coin who developed nosocomial pneumonia after a prolonged hospital stay due to several surgical procedures including rectal biopsy due to suspicion of Hirschsprung's disease; a 4-month-old male who ingested paper clip and was documented to have atelectasis after extraction with rigid esophagoscopy; and a 5-month-old male who ingested an open safety pin who had intestinal perforation and underwent exploratory laparotomy and closure of the intestinal perforation. Except for the last case, all of these patients had spontaneous passage of the FB in stools.

One (0.69%) patient died from sepsis complications related to underlying pneumonia. This patient was a 16-year-old male with Down syndrome and had an incidental finding of coin lodged in the esophagus while being worked up for pneumonia. He underwent successful extraction of the FB via flexible endoscopy. However, during the course of his hospital stay, he developed sepsis and eventually succumbed to septic shock.

Table 3. Clinical Outcomes of Patients Referred for Flexible Endoscopic Management of Foreign Body Ingestion

Outcome	n (%)	Mean (SD)
With complications	6 (4.14)	
Intestinal perforation	1 (0.69)	
Partial gut obstruction	1 (0.69)	
Atelectasis	1 (0.69)	
Adverse drug reaction	1 (0.69)	
Nosocomial pneumonia	1 (0.69)	
Multiple electrolyte imbalance	1 (0.69)	
Mortality	1 (0.69)	
Length of hospital stay (days)		4.62 (15.21)
Length of time from discharge to follow-up		14.76 (23.77)
Spontaneous passage of foreign body*		8.55 (12.24)

**In patients who did not undergo any procedure*

Factors Associated with Outcome

Poor outcome

Upon calculation of crude odds ratio (OR) for poor outcome, as in those with complications or mortality, it was noted that male sex (OR: 1.7593), age <1 year (OR: 7.4857), neurodevelopmental comorbidity (OR: 2.3889), abdominal tenderness (OR: 7.5), intentional ingestion (OR: 5.5833), pointed foreign body (OR: 1.6026), and FB located at upper esophagus on radiograph (OR: 1.7744) were associated with increased risk of having poor outcomes (Table 4). However,

Table 4. Comparison of Demographic, Clinical, Foreign Body Features, and Management of Patients by Outcomes (n = 145)

	Good Outcome	Poor Outcome	OR (95% CI)	*p* value
Male sex	57/138 (41.3%)	2/7 (28.57%)	1.7593 (0.3297 - 9.3876)	0.5085
Age <1 year	7/138 (5.07%)	2/7 (28.57%)	7.4857 (1.2281 - 45.6292)	**0.0291**
Neurodevelopmental co-morbidity	9/138 (6.52%)	1 (14.29%)	2.3889 (0.2589 - 22.0453)	0.4425
Vomiting	50/138 (36.23%)	2 (28.57%)	0.7040 (0.1317 - 3.7630)	0.6815
Abdominal tenderness	3/138 (2.17%)	1 (14.29%)	7.5000 (0.6760 - 83.2063)	0.1008
Non-accidental ingestion	4/138 (2.9)	1 (14.29%)	5.5833 (0.5384 - 57.9041)	0.1496
Pointed object	13/138 (9.42)	1 (14.29%)	1.6026 (0.1789 - 14.3585)	0.6734
Upper esophagus as location of FB	41/138 (29.71)	3 (42.86)	1.7744 (0.3801 - 8.2839)	0.4657
>25 mm FB	30/138 (21.74%)	1 (14.29%)	0.6000 (0.0695 - 5.1785)	0.6423
Unremarkable PE findings	125/128 (97.65%)	3/128 (2.34%)	0.078 (0.0157 – 0.3872)	**0.0018**
Flexible endoscopy with extraction	57/67 (85.07%)	3/6 (50%)	0.2807 (0.0516 - 1.5269)	0.1415
≤24 hours from ingestion to admission	106/138 (76.81%)	2/7 (28.57%)	0.1208 (0.0224 - 0.6524)	**0.0140**
≤24 hours from ingestion to referral	94/138 (68.12%)	0/7	0.0314 (0.0018 - 0.5620)	**0.0187**
>48 hours from ingestion to procedure	14/68 (20.59%)	4/5 (80%)	15.4286 (1.5958 to 149.1631)	**0.0181**
Length of procedure >30 minutes	15/60 (25%)	4/5 (80%)	12.0000 (1.2423 - 115.9118)	**0.0318**

CI – confidence interval, EL – exploratory laparotomy, FB – foreign body, GEJ – gastroesophageal junction, GI – gastrointestinal, OR – odds ratio

among these, only having age <1 year was statistically significant (p value = 0.0291). Endoscopic management beyond 48 hours (OR: 15.4286, p value = 0.0181) and duration of procedure for > 30 minutes (OR: 12, p value: 0.0318) also significantly increased the odds of poor outcomes.

Good outcome

Those with no complications and had an uneventful FB extraction or spontaneous foreign body passage were classified as having good outcome. This was significantly associated with unremarkable physical examination on initial consult, (OR: 0.078; *p* value = 0.0018), admission ≤24 hours after ingestion (OR: 0.1208, p value = 0.0140), and referred for extraction ≤24 hours from ingestion (OR: 0.0314, p value = 0.0187).

DISCUSSION

In this retrospective cohort study, we reviewed 145 cases referred for possible endoscopic management of FBI, 75 of which required endoscopic removal over a 10-year period. Coins were the most commonly ingested object, particularly among children under 5 years old. The esophagus was the most frequent site of foreign body impaction. Most patients presented within 24 hours of ingestion, and flexible endoscopy successfully removed the foreign body in nearly all cases, with a low complication rate and no procedure-related mortality. Delayed presentation and ingestion of multiple or sharp objects were associated with increased procedural difficulty and risk of mucosal injury.

The results of the study are consistent with the observation that FBI is a common concern in the pediatric population. The widespread prevalence of FBI has made it a focus of multiple studies worldwide, with investigations delving into its clinical presentation, management outcomes, and the demographic characteristics of affected children. In the present study, we showed for the first time that to achieve a good outcome for these patients, they need to be referred immediately to a pediatric gastroenterologist within 24 hours post-ingestion to assess if extraction using flexible endoscopy is warranted, and if deemed indicated, extraction has to be done within 48 hours and the ideal length of procedure should also be <30 minutes.

A systematic review of 17 publications involving 5,559 children revealed a variety of trends across different centers, noting differences in the types of ingested objects, the presenting symptoms in the emergency department, the anatomical locations involved, the therapeutic management employed, and the observed complications.[12] From these findings, several associations were noted, including the link between the type of foreign body ingested and the presenting symptoms, as well as that between the location of the foreign object and the frequency of spontaneous passing.

In our present study, the majority of affected children were under 12 years old, with a mean age of 5.23 years. This is consistent with the pattern noted globally, where children under 5 years are most at risk. In the U.S., for instance, 75% of ingestions occur in children younger than 5 years,[13] and foreign body ingestion accounts for 6.87% of all cases,[2] making it one of the top five most common exposures in this age group. The predominance of younger children in these studies highlights the need for vigilance, particularly at home where most ingestions occurred.

Our data also confirmed that coins, particularly one-peso coins, are the most commonly ingested foreign bodies (56.55%). This mirrors findings from other studies, where coins accounted for 46-88% of all pediatric FBI cases[14-22] and this may be attributed to their accessibility to children, often found in their daily environment. Other materials ingested, though less frequent, include fish bones,[23] pins,[24] and even culturally specific objects like Turkish blue beads,[25] reflecting geographical and cultural differences in the types of ingested materials. Notably, there was an increase in button battery ingestions during the COVID-19 pandemic[26] and this may possibly be due to increased time spent at home during the quarantine period, with most cases of FBI being domestic in nature[22].

The size of the ingested foreign bodies, particularly coins, is a critical factor influencing the risk of esophageal impaction and associated complications. In our study, the most commonly retrieved foreign bodies measured between 20–25 mm in diameter. This is significantly larger than the reported average esophageal diameter of children. In a study involving patients aged 18 years and below who underwent radiographic esophageal contrast imaging, the esophageal diameter of children weighing approximately 17 kg (roughly the body weight of a healthy 5-year-old Filipino child) was found to be only 9–10.8 mm.[27] This notable discrepancy between esophageal size and foreign body diameter underscores the urgency of timely endoscopic removal to prevent obstruction, mucosal injury, or perforation.

Clinically, the majority of patients in our study were asymptomatic, regardless of the nature and location of the ingested foreign body. This is consistent with those reported in literature where symptoms range from being asymptomatic to more severe presentations like choking or respiratory distress. Among those who ingested coins, vomiting (35.86%) was the most commonly reported symptoms, a finding echoed in several other studies[14,15,18,20-22,24,28-30] with reported vomiting prevalence as high as 31%[15]. As there was no standardized charting system or checklist used during the study period, certain clinical variables—especially subjective symptoms and physical examination findings—may not have been uniformly documented. Only data explicitly recorded by pediatric gastroenterology fellows were included in the analysis to limit interobserver variability, as all fellows were trained under the same institutional program with consistent clinical protocols. However, it is acknowledged that a missing documentation of a finding does not necessarily equate to its clinical absence, and thus, the true denominator for some

variables may be lower than the total study population. This inherent limitation in retrospective chart reviews is recognized and considered in the interpretation of findings.

Radiographic findings in our study showed that the upper esophagus was the most common anatomical site for foreign body lodgment (30.34%), followed by the stomach (26.9%) and intestines (24.14%). This too aligns with published data, where the esophagus (15-71%),[20-22,24,25,31] and the stomach (11-60%)[15,20-22,24,25] were the most common sites. Among those in whom the foreign body was stuck in the esophagus, 50-76% underwent endoscopic management, including flexible endoscopy.[15,17-19,24,31] Radiographic imaging plays a pivotal role in the initial assessment of foreign body ingestion. According to the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition (NASPGHAN) guidelines, plain radiographs are particularly recommended for suspected ingestions involving button batteries, magnets, coins, sharp or pointed objects, and other radiopaque materials.[32] Imaging not only helps identify the type and number of foreign bodies ingested but also determines their anatomical location, which directly impacts the urgency and type of intervention. This is especially relevant in our setting, where both otorhinolaryngologists and pediatric gastroenterologists may be involved in management. Rigid endoscopy, typically performed by otorhinolaryngologists, is limited to proximal esophageal retrieval, whereas flexible endoscopy allows access to more distal regions of the gastrointestinal tract. As such, radiographic findings are critical in guiding the referral and procedural strategy. In the study, all coins that were radiologically found to be lodged in the stomach beyond two weeks and required endoscopic extraction measured at least 23 mm in diameter, corresponding to the size of the Philippine one-peso coin. This is notably smaller than the >25 mm threshold recommended by international guidelines as the cutoff for foreign bodies unlikely to pass through the pylorus spontaneously.[32] The findings suggest that the anatomical and physiological differences among populations, including possibly smaller pyloric dimensions in Filipino children, may warrant reconsideration of this size threshold in local clinical practice.

Flexible endoscopy was the primary therapeutic intervention in our study, used in 89.04% of cases, with a high success rate of 98.46%. This finding is consistent with a growing body of evidence that supports flexible endoscopy as a safe and effective approach for managing pediatric FBI. Studies have shown that flexible endoscopy offers advantages over rigid endoscopy, such as shorter procedure times and lower complication rates. In particular, Popel et al. reported that, although both were equally safe and effective, more flexible endoscopic management was done compared to rigid endoscopy (64% vs 35%) in coins lodged in the esophagus, with flexible endoscopy having shorter procedure duration (10.50 ± 12.2 minutes vs 16.49 ± 21.1 minutes, $p = 0.04$).[18] Among those with foreign bodies noted in the esophagus but no endoscopic intervention was done, spontaneous passage was reported mostly in those involving the lower third of the esophagus,[21] while those with foreign bodies documented to be in the stomach and the intestines have generally higher spontaneous passage rates compared to other anatomic locations[21,25,31,33]. While the study focused on patients referred for flexible endoscopic extraction, not all underwent the procedure. Some were managed conservatively or underwent alternate procedures such as rigid endoscopy due to clinical judgment or changes in foreign body location. These were included for completeness and comparison, as the referral for flexible endoscopy implies that the patients initially met criteria for the procedure.

Serious complications related to FBI are rare in the pediatric age group in published literature with related mortality only being reported in one case: an eight-year-old girl with intellectual disability who had chicken bone lodged in the esophagus which required an operation for removal. She presented with a five-day history of fever and respiratory distress and the foreign body was successfully removed; however, she eventually succumbed to sepsis.[15] Other reported complications include mucosal abnormalities and intestinal perforation.[19,20] Although the time of ER consult may affect the severity of complications, as in the lone case of the reported mortality, waiting until the following morning from the time of ingestion was shown to have had minimal impact on complications or success rate.[34] In our study, the only case of mortality succumbed to septic shock as a complication of pneumonia. The cause of death was not related to FBI, and the flexible endoscopic extraction of the FB ingested was successful. This shows that based on the past 10 years in our institution, flexible endoscopic management of FBI could be done safely and effectively.

The management of pediatric FBI varies based on several factors, including the type and location of the foreign body, the time of ingestion, and the clinical status of the child. In general, impaction in the esophagus warrants removal, with the timing of endoscopy—whether elective, urgent, or emergent— depending on different factors such as clinical status, time of last oral intake, type of foreign body ingested, and location within the gastrointestinal tract. Guidelines from organizations such as NASPGHAN and the European Society for Pediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) provide evidence-based recommendations for clinicians.[32,35] Different recommendations were outlined based on the type of ingested materials involved (button batteries, magnets, pointed objects, food impaction, coins and other blunt objects, and superabsorbent objects), with algorithms directing management offering practical models on how to approach pediatric FBI using different modalities, including flexible endoscopy. These guidelines are particularly useful for deciding when to resort to endoscopic removal, especially for high-risk objects like button batteries and magnets, which can cause severe damage if not managed quickly. Although helpful in clinical practice, these guidelines were restricted by the limited available prospective data to

guide their development, causing decision making for therapeutic management a complex process requiring integration of a number of factors that clinicians have to consider. Furthermore, the use of these guidelines in low-resource settings remains a challenge; their applicability in these areas is yet to be studied, especially in settings where necessary equipment and trained professionals are lacking. Our study was conducted in a setting where access to endoscopic equipment and trained personnel was available, albeit limited, allowing for successful management of most cases. However, in many low-resource areas, such access may be limited, and clinicians may need to rely on more conservative management strategies or seek out alternative referral systems. The development of guidelines tailored for such settings is an area that warrants further exploration and more relevant studies are needed in terms of looking at factors that are associated with decreased risks for poor outcomes.

In our study, there was low rate of serious complications (4.14%), which is comparable to the findings of other studies. Serious complications, such as mucosal injuries or perforations, were rare, and mortality was only reported in one case. This underscores the fact that pediatric FBI generally has a favorable prognosis, especially when managed promptly. An important finding of our study with regard to risk of poor outcome is related to the timing involved in FBI management. Our analysis revealed that admission as well as early consultation and referral to a pediatric gastroenterologist within 24 hours after ingestion significantly reduced the risk. Additionally, our study ascertains the importance of early and swift intervention; it revealed that procedures done beyond 48 hours post-ingestion and those lasting longer than 30 minutes were associated with poor outcomes. This finding is particularly important for pediatric gastroenterologists, as delayed intervention and prolonged procedures can increase the likelihood of complications. Together, these findings highlight the critical role of early admission and referral, timely intervention, and efficient procedure management to optimize patient outcomes.

Based on the study, the following recommendations are proposed to enhance pediatric FBI management: all cases should be admitted to the emergency room within 24 hours for early evaluation, particularly for high-risk objects like button batteries or magnets, to prevent complications from delayed intervention. Referral for flexible endoscopic management is advised, as it is a safe, efficient, and low-risk method for foreign body removal. Patients should be assessed by a pediatric gastroenterologist or fellow-in-training within 24 hours of ingestion to ensure expert decision-making based on object type, location, and symptoms. A thorough physical examination is crucial to identify symptoms of gastrointestinal damage and prioritize urgent care. Flexible endoscopic extraction should be performed within 48 hours of ingestion to reduce complications like mucosal injury or perforation, and the procedure should ideally be completed within 30 minutes to minimize patient discomfort and procedural risks. This study also highlights the occurrence of cases where endoscopy was performed but no foreign body was ultimately retrieved, suggesting possible spontaneous passage prior to the procedure. Such cases underscore the importance of clearly defined indications for endoscopy to avoid unnecessary exposure to anesthesia and the inherent risks of an invasive procedure. Establishing and adhering to specific criteria for intervention—especially in clinically stable patients or when the ingested object is presumed to be low-risk—may help minimize avoidable procedures while maintaining patient safety. This reinforces the value of thorough clinical evaluation and judicious use of imaging and observation in appropriate scenarios. The findings that coins stuck in the stomach measured less than the international cutoff of 25 mm for spontaneous passage beyond the pylorus suggest that the anatomical and physiological differences among populations, including possibly smaller pyloric dimensions in Filipino children, may warrant reconsideration of this size threshold in local clinical practice. Further studies focusing on regional anthropometric data may be valuable in developing population-specific recommendations to better guide clinical decision-making and avoid unnecessary delays in intervention.

This study has several limitations inherent to its retrospective design. Selection bias may be present, although we attempted to mitigate this by including all eligible pediatric patients who were referred for possible endoscopic foreign body removal during the study period through comprehensive and consecutive record review. In addition, information bias may have occurred due to missing or incomplete documentation; however, only cases with sufficient and detailed records across key time points were included. While we analyzed associations between foreign body type and clinical outcomes, potential confounding factors (e.g., comorbidities, symptom onset timing, procedural factors) could not be fully controlled due to limitations in available data. Finally, the findings represent a single-center experience and this, together with a relatively small sample size which was less than the computed sample size of 381, restricts further interpretation of association and may limit generalizability to other settings.

CONCLUSION

Pediatric FBI remains a significant concern due to its prevalence and varied presentations. This study described the clinical profile, management, and outcomes of pediatric patients with FBI in a tertiary referral center. Coins were the most commonly ingested foreign bodies with most cases not having any serious complications. While many cases were managed conservatively, a substantial number required endoscopic intervention. The findings support existing evidence that early recognition and timely management, particularly with flexible endoscopy, are crucial for favorable outcomes. Delays in intervention were often due to logistical

factors, underscoring the need for system-level improvements. The continued development and refinement of clinical guidelines, along with efforts to address the challenges faced in low-resource settings, are key to improving the management of pediatric FBI. These results may help inform local protocol development and optimize patient outcomes in similar contexts.

Statement of Authorship

Both authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

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APPENDICES

Appendix A. Temporal Features of Admission, Referral, and Procedures of Patients Referred for Flexible Endoscopic Management of Foreign Body Ingestion

Features	Mean (SD)
Time between ingestion and admission (hours)†	40.42 (94.74)
Time between ingestion and referral	49.08 (95.02)
Time between admission and referral†	9.28 (9.76)
Time between ingestion and procedure	79.77 (148.41)
Time between admission and procedure	69.04 (307.7)
Length of procedure	32.25 (23.61)

† *Two patients were already admitted when referred for flexible endoscopic management of foreign body ingestion (n = 143).*

Appendix B. Flexible Endoscopy Features of 65 Pediatric Patients who Underwent Flexible Endoscopic Extraction of Foreign Body

Features	n (%)
Endoscope used	
Standard gastroscope	63 (96.92)
Flexible bronchoscope	1 (1.54)
Trans-nasal gastroscope	1 (1.54)
Endoscopy accessory used for foreign body retrieval	
Rat tooth forceps	56 (86.15)
Alligator jaw forceps	2 (3.08)
Biopsy forceps, snare	1 (1.54)
Extraction forceps	1 (1.54)
Mixed tooth (retrieval forceps)	1 (1.54)
Net	1 (1.54)
Pharyngeal foreign body extraction forceps	1 (1.54)
Retrieval forceps	1 (1.54)
Takahashi forceps	1 (1.54)
Overtube	2 (3.08)
Transparent Cap	1 (1.54)
Foreign body visualized on endoscopy	64 (98.46)
Location of foreign body on endoscopy	
Upper esophagus	35 (53.85)
Stomach	10 (15.38)
Distal esophagus	8 (12.31)
Mid esophagus	7 (10.77)
Beyond the pylorus	3 (4.62)
Pyriform sinus	1 (1.54)
Not visualized	1 (1.54)
Type of anesthesia	
General anesthesia	61 (93.85)
Intravenous	4 (6.15)