

This too shall pass: A study of ingested sharp foreign bodies

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BACKGROUND:	Gastrointestinal foreign body (GFB) ingestion is a common problem and often results in surgical consultation. Current literature is limited to case reports and fails to provide data regarding the management of sharp GFB ingestion. We hypothesized that patients who ingest sharp objects rarely have perforation or obstruction requiring surgical intervention.
METHODS:	Patients presenting with GFBs from January 2005 to December 2015 at a level 1 trauma center with an acute care surgery program were retrospectively reviewed. Exclusion criteria were leaving without being seen, noningested GFB, unknown or blunt GFB, or if the GFB was not found on imaging. Data collected included patient demographics, length of stay, imaging, and interventions that were performed.
RESULTS:	During the study period, there were 1,164 patients with 1,245 hospital visits for GFBs; 995 visits were excluded, resulting in 169 sharp GFB ingestion patients with 192 visits included in our study. The average age was 31. Sixty-five percent were men, and 41% were incarcerated. The average length of stay was 3 days, which was longer in patients with psychiatric holds and consultations. Of the 169 patients, 116 (69%) had no intervention and did not return for complications. Fifty-five endoscopies were performed with GFB removal in 30 cases. Seven patients (4%) underwent surgery, five of which had peritonitis. When evaluating the total study cohort, 134 (79%) of the patients had no procedure or a negative procedure. Patients requiring surgery had significantly larger objects (6 ± 3 cm) than those who had endoscopy (3 ± 2 cm) or no procedure (2 ± 1 cm).
CONCLUSION:	Surgical intervention occurred in only seven (4%) patients with sharp GFB ingestions, and 79% of the patients required no intervention. Barring an acute abdomen or esophageal sharp GFBs, patients can be discharged with return precautions, admitted for necessary psychiatric care, or returned to custody for patients seeking secondary gain. Upper gastrointestinal larger GFBs should be removed endoscopically when possible. (<i>J Trauma Acute Care Surg.</i> 2017;82: 150–155. Copyright © 2016 Wolters Kluwer Health, Inc. All rights reserved.)
LEVEL OF EVIDENCE:	Therapeutic/care management study, level V.
KEY WORDS:	Sharp; ingestion; endoscopy; swallowed; gastrointestinal foreign body.

The ingestion of blunt foreign objects has been extensively discussed in the literature. Most (80–90%) ingested gastrointestinal foreign bodies (GFBs) that traverse the gastroesophageal junction will pass through the gastrointestinal (GI) tract without complication. The risk of perforation is 1% for all types of ingested GFBs.^{1–4} Despite these reported low rates of perforation, reported surgical intervention rates range from 1% to 14%.^{5,6}

The majority of studies have focused on blunt GFBs and their management. Literature on the management of sharp GFBs is limited to case reports and case series, which demonstrate rates of surgical intervention ranging from 15% to 35% and complications as high as 35%.^{2,6–8} Existing sharp GFB literature describes a variety of swallowed sharp objects including fish bones, straightened paper clips, toothpicks, needles, dental bridgework, and razor blades. Sharp GFB ingestions are most common among the psychiatric, incarcerated, pediatric, alcoholic, and diminished capacity populations.^{5,9–11}

The ingestion of sharp objects is a relatively common occurrence that frequently leads to surgical consultation. No consensus or guidelines for treatment exist, resulting in highly variable rates of endoscopic and surgical intervention. Moreover, there is a lack of data regarding the rate of complication secondary to sharp GFB ingestions. The purpose of this study is to determine the frequency of complications with sharp GFB ingestion and how often surgical or endoscopic intervention was necessary in attempt to provide practice recommendations. We hypothesized that patients who ingest sharp objects rarely have perforation or obstruction requiring surgical intervention.

PATIENTS AND METHODS

A retrospective study was performed at Community Regional Medical Center (CRMC), Fresno, CA, an American College of Surgeons verified level 1 trauma center with an acute care surgery program. All patients with an ICD-9 diagnosis code of foreign body in the GI tract (935.0–938.0) seen in the emergency department from January 2005 to December 2015 were analyzed. Patients were excluded if they left the emergency department before being examined, ingested an unknown or blunt GFB, had a noningested GFB, if the method of foreign body entry into the GI tract was unknown, or if the object was not found on imaging.

Data collected included demographics, visit type (initial or follow-up), object ingested, location of foreign body in the

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GI tract, radiologic findings, procedure details if applicable, pathology associated with the GFB, psychiatric consults, and hospital length of stay. Object size was obtained from either operative reports or radiology reports, or was measured on radiographic studies.

Interventions were considered therapeutic if the GFB had caused mucosal injury, perforation, or obstruction, or if the sharp GFB was removed from the GI tract. Interventions were defined as nontherapeutic if the GFB was not found, and there were no associated injuries in need of repair.

Categorical data are presented as percentages, and continuous data are presented as mean ± standard deviation. Statistics were performed using two-tailed independent *t* tests and Mann-Whitney *U* tests with significance attributed to a *p* value less than 0.05. This study was approved by the Community Regional Medical Center/UCSF Fresno Institutional Review Board.

RESULTS

During the study period, there were 1,164 patients with 1,245 hospital visits for GFBs. Two hundred ninety-two of these encounters were excluded because the type of GFB was unknown, was not ingested, the method of entry into the GI tract could not be determined, or there was negative or no radiographic imaging was available. Of the 953 ingested GFB encounters, 761 were for blunt GFBs, and 192 were for sharp GFBs. There were 169 patients accounting for the 192 visits; 23 were follow-up visits for the same ingestion. Of the 169 patients, 14 (8%) were seen multiple times for different ingestions. The sharp objects ingested are listed in Table 1.

Ages ranged from 0 to 97 years (mean = 31 ± 17 years) and 16% were under the age of 15 years. The majority of patients were men (65%), and 41% were incarcerated. The median length of stay was 2 (1–3) days, but was longer in the 52 patients with psychiatric holds or consultations (3 [2–6] days) than those without (1 [1–2]; *p* < 0.001).

TABLE 1. The Cumulative Numbers of Ingested Sharp Gastrointestinal Foreign Bodies Among the Study Population

Sharp Gastrointestinal Foreign Body	Number Ingested
Razor blades	105
Pens/pencils	19
Tack/thumbtack/pushpin	14
Screws/nails	14
Needles	11
Bobby pin/hair clip/hairpin/barrette	10
Dental tools (screwdriver, wire, bur, etc.)	7
Earrings	6
Staples	6
Glass (broken crack-pipe/broken bulbs)	5
Sharp bones/fish bones	5
Paper clips	3
Safety pins	5
Other (fishing hook, toothpick, crab shell, piece of antenna, tweezers, etc.)	17

A single patient may have ingested multiple objects.

Of the 169 patients who ingested sharp GFBs, no intervention was performed in 116 (69%) patients, and none of these patients returned with complications. The remaining 53 patients had an endoscopy, underwent surgery, or both during their initial visit.

Imaging

The sharp GFB was identified on plain radiograph in 161 patients; 39 of these also had a CT scan either before or after their initial plain radiograph. In six patients, the object was not identified on radiograph but was found on CT. The remaining two patients were referred in after failed esophagogastroduodenoscopies (EGDs) at outside facilities.

Follow-up imaging was performed in 89 patients during their hospitalization. In 25, the GFB had passed. In 34 patients, the GFB had moved from prior its location. In three patients, it was unclear whether or not the GFB moved. In eight patients, the follow-up imaging confirmed GFB removal after intervention, and in 19 patients, the GFB had not moved at all.

Of the 23 patients who returned for follow-up visits after their GFB ingestion, 20 had follow-up imaging. All GFBs had moved and 10 had passed. None of the patients required intervention on the follow-up visit.

Endoscopy

Forty-seven patients (25%) underwent endoscopy. Of these, 34 patients underwent EGD, six patients underwent colonoscopy, one patient had three colonoscopies, four patients had both an EGD and a colonoscopy, one had both an EGD and a rigid esophagoscopy, and one underwent two EGDs and an exploratory laparotomy. A total of 55 endoscopies were performed, all of which were performed by gastroenterologists, with the exception of the rigid esophagoscopy performed by an otolaryngologist. Ten patients underwent endoscopy for GFBs that did not move on repeat imaging; the GFB was retrieved in six of these, and four were in the esophagus. Patients in whom the object had not moved on repeat imaging were more likely to undergo endoscopic intervention than those with movement of the object (*p* = 0.015).

The ingested sharp GFB was not found in 25 (45%) of the endoscopies. Of the 30 cases in which the sharp GFB was found, 25 patients had no reported injury. In the five patients with noted injuries associated with the sharp GFB, findings were described as mucosal ulceration, erosion, embedding of the sharp object into the mucosa, lacerations, necrotic debris, and adherent clots. Eight patients had GFBs removed from the esophagus, two of which were found to have esophageal trauma due to the GFB. Two patients had pens/pencils removed from the stomach and had mucosal injuries suggestive of possible impending perforation. None of the patients who underwent endoscopy

TABLE 2. The Results of All the Endoscopies Performed Among the Study Population

Procedure	N	GFB Removed	Pathology
EGD + esophagoscopy	42	26 (62%)	5 (12%)
Colonoscopy	13	4 (31%)	0

A single patient may have had multiple endoscopies.

had perforation or bleeding associated with the GFB ingestion (Table 2).

In the subset of 17 patients with esophageal GFBs seen on imaging, 10 underwent EGD, eight of which had the GFB removed. The remainder did not undergo or had a negative endoscopy.

Surgery

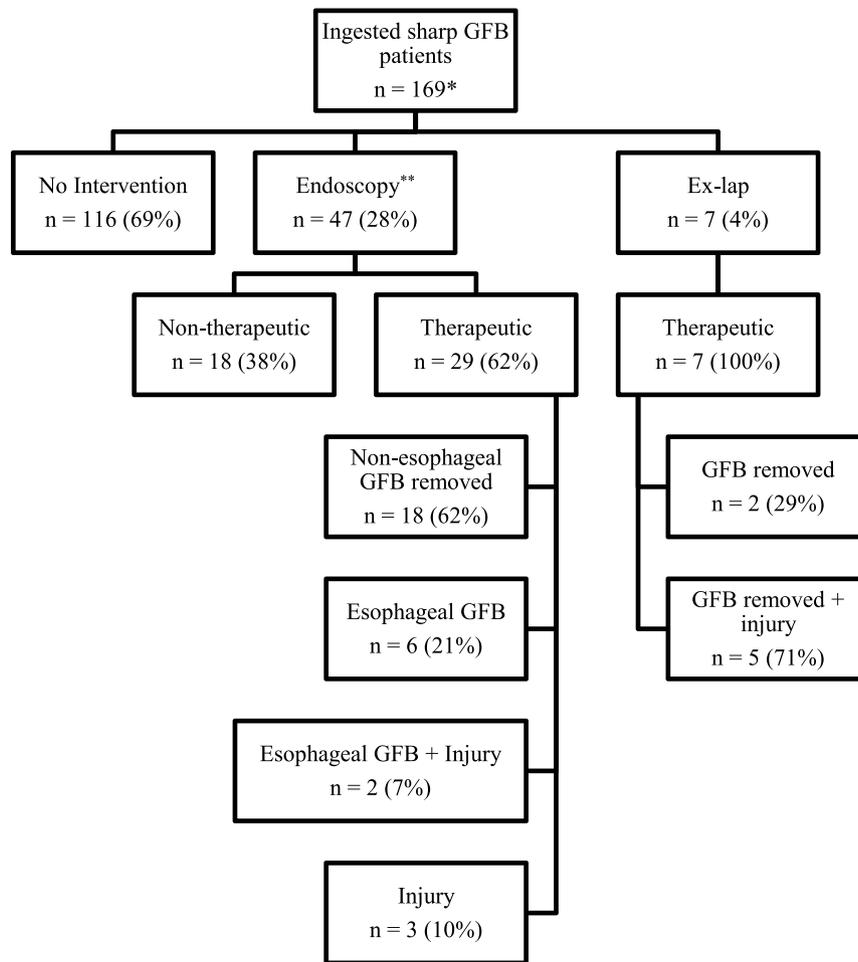
Seven patients (4%) underwent exploratory laparotomy. Surgery was clearly indicated in five patients with peritonitis. The other two patients had increasing abdominal pain with no significant injury found at laparotomy; however, the foreign bodies were removed through created enterotomies. No deaths occurred.

Of the five patients with peritonitis, one had safety pin removal with an adjacent area of jejunal wall thickening and possible pinhole perforation. Another had multiple fistulas and perforations from ingestion of many sharp and blunt GFBs, including 14 pencils. Another had perforation of the anterior gastric antrum from razor blade ingestion. Another was a

patient with prior Roux-en-Y gastric bypass who was found to have a necrotic gastrojejunal anastomosis; with a razor blade found distal to the anastomosis that was removed. The last patient had perforation and purulent drainage from a sewing needle ingested 1 month prior; the needle was removed and the perforation repaired.

Of the two patients who had the object removed via exploratory laparotomy without bowel abnormalities or injuries noted, one had a thumbtack removed through a cecal colotomy. Intraoperative fluoroscopy was required to locate the sharp GFB. His white blood cell count was 5.9 before the operation, and his vital signs were normal. The other patient had three razor blades removed, one from the cecum, one from the duodenum, and one from the jejunum. Identification of the duodenal razor blade required an intraoperative x-ray. No bowel injuries or abnormalities were found. Her white blood cell count was 13.5 before surgery.

When evaluating the total study cohort, 134 (79%) of the patients had no procedure or a negative procedure. Of



* One patient had endoscopy and ex-lap and has been included in both categories

** 7 patients had multiple endoscopies; therefore 55 endoscopies were performed

Figure 1. Interventions and their therapeutic value. Interventions were considered therapeutic if the GFB had caused mucosal injury, perforation, or obstruction, or if the sharp GFB was removed from the gastrointestinal tract. Interventions were defined as nontherapeutic if the GFB was neither found, and there were no associated injuries in need of repair.

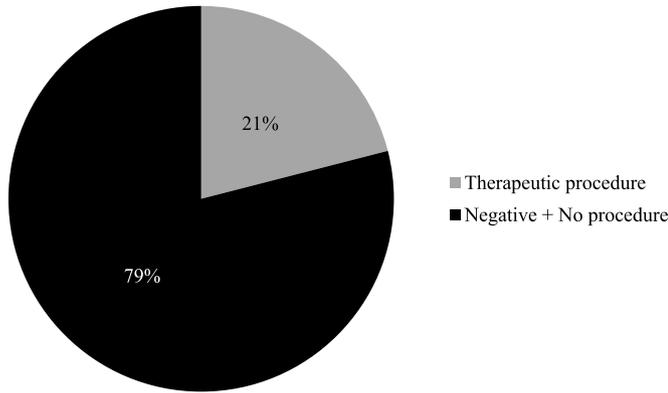


Figure 2. Proportion of therapeutic interventions. Therapeutic interventions: the object was removed or surgery/endoscopy was performed in the presence of perforation, obstruction or fistulas.

the therapeutic procedures, only 10 patients (6%) had injuries that would suggest that the procedure was undoubtedly needed (Fig. 1).

Foreign Body Size

Data on the size of the sharp GFB were available in the radiology or operative reports, or were measured on radiographic studies in 128 patients. The average size of the ingested sharp

GFBs was 2.8 cm. The patients requiring surgery (6 ± 3 cm) had significantly larger objects than those that had endoscopy (3 ± 2 cm, $p = 0.007$), and those that had no procedure (2 ± 1 cm, $p < 0.001$). There was no statistically significant difference in the size between those that underwent endoscopy and those that had no procedure (Fig. 2).

DISCUSSION

There is a lack of agreement in the literature regarding the management of ingested sharp GFBs. The reported rates of operative intervention range from 15% to 35% for ingested sharp GFBs,² whereas our operative intervention rate was 4%. Articles reporting higher intervention rates cite “impending perforation” as an indication, which may explain the discrepancy.^{12,13} In one retrospective study on the management of GFB ingestions, only one of nine patients undergoing surgery had an acute abdomen.⁶ Despite our relatively high threshold for surgical intervention, two (29%) of the seven operations were laparotomies in which the objects were removed, but there were no injuries or obstructions found.

In our series of sharp GFB ingestions, 69% had no intervention, and none of these patients returned for complications. Fifty-five endoscopies were performed; 45% were negative. The remaining were considered therapeutic due to removal of the GFB; however, significant associated mucosal injuries were only

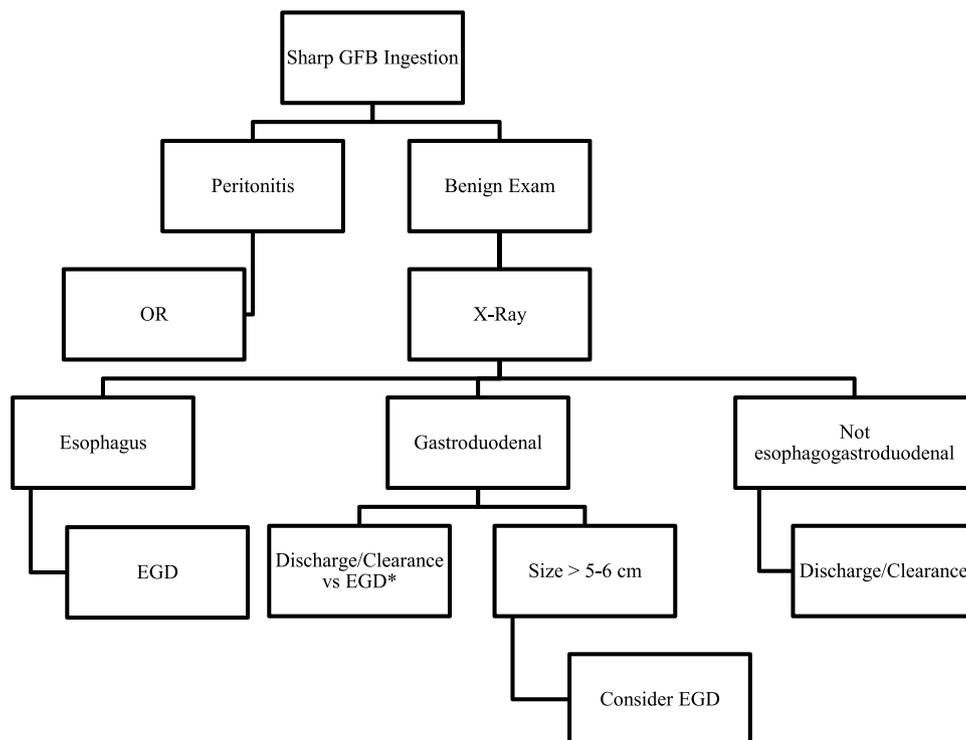


Figure 3. Ingested sharp GFB treatment algorithm. Proposed sharp GFB treatment algorithm based on our results and our review of the literature. *Although the vast majority of patients had no intervention and had no complication, because this is a retrospective study, we cannot know the true therapeutic value of the 17 EGDs (8% of total visits) in which the object is removed, but no abnormal findings were found.

identified in 5. Seven (4%) patients underwent surgery, and only five (3%) patients had injuries that required surgical repair. Combining our patients with no intervention and those with non-therapeutic procedures, 79% of visits required no intervention (Fig. 1). These data suggest that most sharp GFBs will pass through the GI tract without complication or need for intervention.

Follow-up imaging was not beneficial upon discharge. Nearly half of patients in this study did not have follow-up imaging, and none returned with any complications. None of the patients who were discharged and returned for follow-up imaging required any intervention. However, patients in whom the object had not moved on repeat imaging were more likely to undergo endoscopic intervention than those with movement of the object ($p = 0.015$).

The treatment of sharp GFBs impacted in the esophagus was not specifically examined in this study. In the absence of pneumomediastinum, it is recommended that esophageal sharp GFBs be removed endoscopically to avoid the morbidity and mortality associated with esophageal perforation.^{9,14,15} In our study, less than half of the patients with esophageal sharp GFBs had the object removed, and there were no complications in any patients with sharp esophageal GFBs.

Although most GFBs (sharp or blunt) that pass through the gastroesophageal junction are likely to pass through the GI tract uneventfully, size does matter. Gastrointestinal foreign bodies that are larger in size/length (>6 cm) may have difficulty passing the duodenal sweep and may eventually cause mucosal injury and perforation based on studies.^{7,16,17} In our study, patients who swallowed sharp GFBs greater than 6 cm were more likely to undergo exploratory laparotomy than endoscopic intervention or no intervention.

Some sources suggest that sharp gastroduodenal objects reachable via upper endoscopy should also be removed to prevent possible small or large bowel injury as the object passes through the digestive tract.^{11,18,19} However, success rates can be low with high complication rates. Although none of the patients in our study had complications secondary to endoscopy, a study conducted at the University of Wisconsin noted a modest success rate (48%) and a 6% risk of complication, where three patients had esophageal tears and one required a laparotomy to remove an endoscope snared to a comb that could not be removed.⁶ The success rate of endoscopy for GFB ingestion was 55% in our study, consistent with literature ranging from 48% to 90%.^{6,7,10} The overall utility of endoscopy is unclear; most sharp GFBs do not cause injury or obstruction and endoscopic retrieval does not seem necessary in all cases.

The average length of stay in this study was found to be 3 days. The increased length of stay appeared to be associated with the need for psychiatric consultation. Because many sharp GFB ingestion patients are incarcerated, institutionalized, or have psychiatric diagnoses and high recidivism rates, admitting patients after sharp GFB ingestion could potentially lead to further ingestions for the purpose of malingering or secondary gain. In an era of high health care costs and strained resources, eliminating unnecessary admissions can reduce the burden on the system. As opposed to admitting psychiatric patients for medical observation, these patients can be medically cleared more quickly to begin receiving needed psychiatric treatment. Those incarcerated can be returned to custody, barring peritonitis or need for a psychiatric hold.

Based on our results and the above review of the literature, we have developed an algorithm for the management of ingested sharp GFBs (Fig. 3). Patients without peritonitis on examination can be discharged with expectant management and anticipatory guidance.

Our study is limited by its retrospective/observational design. It is possible that sharp GFB ingestion patients that were discharged with anticipatory guidance had follow-up care elsewhere. This is unlikely, as CRMC is the safety net hospital for the region and has contractual agreements with the jail and psychiatric facilities. It is also possible that our number of sharp GFB ingestion patients is low, because 36 patients were excluded due to negative imaging. These patients were excluded due to the possibility that they misrepresented the ingestion for secondary gain or psychiatric reasons. However, it is also possible that ingested objects either were not radiopaque (e.g., glass) or had already passed. If this is the case, the true endoscopic and surgical intervention rates would be even lower than we report because none of them required any intervention. Thus, the percentage of patients that did not require intervention is likely higher than we report.

In conclusion, surgical intervention occurred in only seven (4%) patients with sharp GFB ingestions, and most patients (79%) required no intervention. Barring an acute abdomen or esophageal sharp GFBs, patients can be discharged or returned to custody with return precautions or admitted for necessary psychiatric care. Upper GI larger sharp objects should be removed endoscopically when possible.

AUTHORSHIP

K.R.Z. contributed to data collection, data analysis, and article preparation. J.W.D. contributed to study design, data interpretation, and article review. E.E.A. contributed to data analysis and article review. R.C.D. contributed to study design, data collection, data analysis, article review. J.E.G. contributed to data analysis and article review.

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DISCLOSURE

The authors declare no conflicts of interest.

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