GI foreign body management

With rapid diagnosis and aggressive care, GI foreign bodies can be successfully and safely removed through surgery.

Gastrointestinal foreign bodies are challenging and difficult cases to manage. Treatment depends on the type of foreign body and its location, along with the degree of obstruction and length of time it has been blocking the gastrointestinal (GI) tract. Timely diagnosis and surgical removal of obstructions may prevent the need for resection and anastomosis.

Medical resolution of GI foreign bodies is atypical and requires vigilant monitoring and a radiographic or ultrasonographic series to follow the object’s progress through the GI tract. Endoscopy may be successful for removing esophageal, stomach and upper duodenal foreign bodies.

Surgery offers the best outcome in most GI foreign body cases. However, one of the hardest decisions that a clinician makes is recommending surgery for a patient—even if it is exploratory. There is no such thing as a negative exploratory, thus the need for biopsies.

In this article, we will discuss surgical techniques for removing foreign bodies in the stomach and intestines (Figure 1, page 35). Surgical removal of esophageal foreign bodies requires a different approach and is beyond the scope of this article.

Stabilizing patients

Patients may be quite ill and debilitated when presented to the hospital and they may require stabilization before nonsurgical or surgical intervention.

Patient dehydration should be corrected with a crystalloid fluid such as lactated Ringer’s solution or Normosol. A diagnostic workup can be performed while you are stabilizing the patient. Metabolic and electrolyte imbalances are common with gastrointestinal diseases and should be identified and corrected. Hypokalemia and dehydration are common in vomiting patients. Hypoglycemia may be present in young Pets (less than 6 months old) with prolonged anorexia and vomiting. A dextrose bolus, dextrose-containing fluids or additional dextrose should be added to the intravenous fluids of these patients.¹

Not all patients with gastrointestinal foreign bodies will be vomiting on presentation, but they may have a history of sig-
nificant vomiting. Antiemetic therapy may be instituted with injectable prochlorperazaine (Table 1, page 36). Vomiting patients may also have significant esophagitis, which can be treated with injectable H₂-antagonists such as cimetidine or famotidine, as well as a cytoprotectant in the form of sucralfate, which should be given an hour after other medications (Table 1, page 36). Metoclopramide may be used but is generally avoided in suspected GI foreign body cases because it can cause serious problems resulting from its prokinetic effects on outflow obstructions or linear foreign bodies. Ondansetron is a newer antiemetic available for protracted vomiting, but it may be cost-prohibitive. If the Pet has significant hypoalbuminemia, healing may be impaired and plasma transfusion is indicated.

If the gastric or intestinal lumen will be entered, perioperative antimicrobial agents effective against oral contaminants (e.g., ampicillin, amoxicillin, clindamycin or cephalosporins) should be initiated before surgery. I prefer intravenous administration of antimicrobial agents instead of intramuscular or subcutaneous routes because hydration may limit absorption and high blood levels can be achieved more quickly. Because of the acidity of the stomach, normal proximal gastrointestinal flora are fewer in number. The bacterial load increases as you progress distally in the tract, so different or combination antimicrobials (e.g., second- and third-generation cephalosporins in addition to aminoglycosides or metronidazole if you are performing colonic surgery) may be indicated (Table 2, page 36).

Although anesthetic protocols vary, the abdominal protocol that we use in our hospitals is very safe and effective for our patients. Stabilized patients are sedated with a combination of butorphanol and diazepam, induced with propofol and maintained with sevoflurane (Table 3, page 38). Dextrose-containing intravenous fluids are used in young patients because of limited and rapidly depleted hepatic glycogen stores.1,2 All of our patients are monitored intraoperatively with pulse oximetry and electrocardiography.
Gastrotomy

Gastrotomy is performed for gastric foreign body removal if endoscopy is unavailable or unsuccessful. To begin, make a ventral midline abdominal incision from the xiphoid to the pubis. Before entering the intestinal lumen, explore the entire abdominal cavity and take biopsies of organs such as the liver, spleen or pancreas if necessary. It is beneficial to follow the same process every time you explore an abdomen (Table 4, page 39). With experience, the process can take less than five minutes. Using gentle manipulation, examine the entire gastrointestinal tract for additional foreign bodies and general health. Then isolate the stomach from the other abdominal organs and “pack off” the organ with moistened sterile laparotomy sponges. Use a sterile warm electrolyte solution of 0.9 percent saline to moisten the sponges. This solution can also be used to keep the intestines moist during surgery.

After isolating the stomach, place stay sutures to assist with positioning to prevent accidental gastric content overflow from the incision. Make a stab incision in a less vascular area of the ventral stomach between the greater and lesser curvatures, avoiding the pylorus (Figure 2, page 40).Enlarge the incision with Metzenbaum scissors to allow foreign body removal and evaluation of the lumen. Some patients may have a large amount of gastric fluid or ingesta, and suctioning may be needed to aspirate the material. After you have removed the foreign body, examine the

<table>
<thead>
<tr>
<th>Table 1: Medical Therapy for Patients with Vomiting and Esophagitis</th>
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<tbody>
<tr>
<td><strong>Drug</strong></td>
</tr>
<tr>
<td>Cimetidine</td>
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<tr>
<td>Famotidine</td>
</tr>
<tr>
<td>Prochlorperazine</td>
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<tr>
<td>Metoclopramide</td>
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<tr>
<td></td>
</tr>
<tr>
<td>Chlorpromazine</td>
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<td>Sucralfate</td>
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<th>Table 2: Effective Antibiotics for Gastrointestinal Surgical Patients</th>
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<tbody>
<tr>
<td><strong>Drug</strong></td>
</tr>
<tr>
<td>Ampicillin sodium</td>
</tr>
<tr>
<td>Cefazolin</td>
</tr>
<tr>
<td>Gentamicin</td>
</tr>
<tr>
<td>Amikacin</td>
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<tr>
<td>Metronidazole</td>
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mucosa for additional foreign bodies, ulceration and neoplasia. At this time you may elect to perform a biopsy if you note mucosal abnormalities.

Close the stomach in two layers using a monofilament absorbable suture with 2-0 or 3-0 material. I prefer PDS-II suture; however, other options are available (Table 5, page 42). Sutures should be 3 mm apart, and I recommend at least a 4-mm bite of gastric wall. The first layer is a Cushing pattern incorporating the submucosa, muscularis and serosal layers. The submucosa contains collagen and is the holding layer of the suture line; therefore, it is important to include this layer in your closure.

Oversew with a second Cushing or Lembert pattern incorporating the muscularis and serosal layers. This reduces the chance of leakage, incisional dehiscence and peritonitis. Flush the incision with a sterile electrolyte solution. At this point, I remove the laparotomy sponges and change to a new pair of sterile surgical gloves. To close the abdomen, I use a new set of surgical instruments that I have previously segregated out from the original surgical pack. Flush the abdomen again and perform routine linea alba closure. The external rectus sheath is the holding layer and the most important layer for abdomen closure. Take 5-mm bites of each side, and do not include the rectus abdominis muscle in the closure. Incorporation of the internal rectus sheath is unnecessary and may increase adhesion formation.

Enterotomy

Foreign bodies often lodge in the intestinal tract as well. Surgical removal through enterotomy is similar to that of gastrotomy, but there are important differences: single layer closure, omental or serosal patches, and resection options. As previously discussed, bacterial flora increase in type and number from proximal to distal points in the GI tract. Complete obstructions may cause bowel loop dilation and compromised tissue, which may require bowel resection and anastomosis. First we will discuss a simple enterotomy and then intestinal resection and anastomosis.

Again, make a ventral midline abdominal incision from the xiphoid to the pubis and perform complete exploration of the abdomen. Once you have isolated the foreign body, exteriorize the bowel loop and pack it off with moistened laparotomy sponges. Assessing bowel viability helps you determine if a simple enterotomy is indicated or if resection is necessary. To evaluate

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**Table 3: Anesthetic Protocol for Stabilized Patients Undergoing Abdominal Surgery**

1. Premedicate:
   - Diazepam (0.2 mg/kg to 10 mg maximum IM)
   - Butorphanol (0.2-0.4 mg/kg to 5 mg maximum IM [dog] or SQ [cat])
2. Wait 30 minutes
3. Induce using propofol to effect 2.2 to 8.8 mg/kg IV
4. Maintain using sevoflurane 1% to 4% inhaled

Surgical removal through enterotomy is similar to that of gastrotomy, but there are important differences: single layer closure, omental or serosal patches, and resection.
| 1. | Skin, subcutaneous tissue and linea alba |
| 2. | Falciform ligament and fat |
| 3. | Abdominal aorta and its major branches |
| 4. | Caudal vena cava |
| 5. | Portal vein |
| 6. | Kidneys |
| 7. | Liver lobes |
| 8. | Gallbladder |
| 9. | Pancreas |
| 10. | Diaphragm |
| 11. | Abdominal esophagus |
| 12. | Stomach |
| 13. | Small bowel |
| 14. | Cecum |
| 15. | Colon |
| 16. | Lymph nodes |
| 17. | Omentum, peritoneal mesentery |
| 18. | Urinary bladder |
| 19. | Female |
| 20. | Male |
| 21. | Adrenal glands |
| 22. | Spleen |

1. Skin, subcutaneous tissue and linea alba
2. Falciform ligament and fat
   Remove with scissors from both sides of the incision; no ligation is usually necessary
3. Abdominal aorta and its major branches
4. Caudal vena cava
5. Portal vein
6. Kidneys
   Artery—frequently multiple
   Vein—frequently multiple
   Ureter (note its location at bladder neck [dorsolateral] and its path along psoas muscles)
7. Liver lobes
8. Gallbladder
9. Pancreas
   Handle gently because rough handling can induce pancreatitis
   Left and right limbs
10. Diaphragm
    Left and right crura
    Aortic hiatus
    Esophageal hiatus
    Caval foramen
    Costal arch
11. Abdominal esophagus
12. Stomach
    Cardia
    Fundus
    Body
    Pylorus—Note close relationship of common bile duct and pancreatic ducts arterial supply gastrohepatic ligament
13. Small bowel
    Note blood supply to each area
14. Cecum
    Note size and consistency, feel illeoceccolic junction
15. Colon
    Ascending, transverse and descending portions
16. Lymph nodes
    Mesenteric
    Sublumbar
17. Omentum, peritoneal mesentery
    Greater omentum
    Lesser omentum
    Mesoduodenum—used to displace and pack off cranial portions of abdomen from the right to the left
    Mesocolon—used to displace and pack off caudal aspect of abdominal contents from the left to the right
18. Urinary bladder
    Ureter entrance on dorsal trigone area (must be avoided with prostatectomy or cystotomy)
    Apex and trigone
    Lateral ligaments
19. Female
    Ovary, ovarian bursa, proper ovarian ligament
    Uterine body
    Cervix
    Round ligament
    Broad ligament
    Suspensory ligament (broken down to mobilize ovary during ovariohysterectomy)
20. Male
    Prostate
    Ductus deferens (and relation to ureters)
21. Adrenal glands
    Phrenicoabdominal arteries and their position in relation to ureters
22. Spleen
    Usually will be very large and turgid as a result of barbiturate anesthesia

*Credit: Howard B. Seim III, DVM, ACVS, Abdominal Exploratory: biopsy, biopsy, biopsy. Conference notes
capillary refill time, blanch the intestines with your fingertips. If color does not return within two seconds, the vasculature is compromised and that section may need to be removed. Blue- to black-colored intestine should be resected. Subjective assessment parameters include color, texture, peristalsis, arterial pulsation and bleeding on incision. Unfortunately, none of these factors are a guaranteed indicator that the bowel will heal postoperatively.

Gently milk the intestinal contents 4 to 5 cm to either side of the intended incision and have a surgical assistant use a scissor-hold with her fingers to minimize leakage from the site. If available, Doyen clamps can be used to perform the scissor-hold.

Make a longitudinal incision distal to the foreign body in healthy tissue on the antimesenteric border and extend it parallel to the long axis of the bowel (Figure 3A, page 42). You may also make a perpendicular incision (transverse) on the antimesenteric border. Next, milk the foreign body through the incision—a relatively large foreign body can be delivered through a relatively small enterotomy site. As always, handle tissue gently to avoid unnecessary trauma. After you have removed the foreign body, examine the mucosa for additional foreign bodies, ulceration or neoplasia. Take biopsies if needed.

Flush the area with warmed sterile saline, which also may allow better visualization of the site. Mucosa will tend to evert.
after the incision is made. Because of this eversion, take care to include all layers of the intestine for closure, especially the submucosa. Again, the submucosa is the holding layer of the suture line, so it is important to include this layer in your closure. Create a single layer of full-thickness appositional sutures 3 to 4 mm apart and 3 to 4 mm from the cut edge of the intestine to close the incision (Figure 3B, page 42). Monofilament 3-0 or 4-0 absorbable suture is the preferred material. I prefer PDS-II suture for its strength and ease in handling.

If the incision is long or the intestinal lumen is small, you may need to close it transversely. Swaged-on taper needles minimize trauma and leakage. Sutures should be tight enough to seal the intestine but not blanch the tissue and cause ischemia of the incisional margins. A simple interrupted or continuous suture pattern can be used.

Observe the bowel for peristaltic motion and return of color. I place omentum over the sutured site to provide blood supply and

Swaged-on taper needles minimize trauma and leakage. Sutures should be tight enough to seal the intestine but not blanch the tissue and cause ischemia of the incisional margins.
Create a single layer of full-thickness appositional sutures 3 to 4 mm apart and 3 to 4 mm from the cut edge of the intestine to close the incision with a simple continuous (shown) or a simple interrupted suture pattern.

**Table 5: Selected Absorbable Suture Materials**

- Synthetic monofilament
- PDS II (polydioxanone)
- Monocryl (poliglecaprone 25)
- Maxon (polyglyconate)

Milk the foreign body through the incision—a relatively large foreign body can be delivered through a relatively small enterotomy site. A surgical assistant can perform a scissor-hold with her fingers to minimize leakage from the site. Alternatively, Doyen clamps can be used to perform the scissor-hold.
help prevent peritonitis.4 A pedicle of greater omentum may be wrapped around the incision line and tacked to the serosa with two simple interrupted sutures. Serosal patch grafts may also be used in significantly compromised or contaminated areas. Serosal patching involves placing an antimesenteric border of small intestine over the incision and securing it with two sutures. This also helps supply support, a fibrin seal, resistance to leakage, and blood supply to the damaged area.2

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Once a decision for resection is made, pack off the affected bowel loop, milk the intestinal contents and clamp or hold the tissue as previously described. Double ligate the arcadial mesenteric blood vessels supplying the bowel section to be removed.
Linear foreign body removal can require multiple enterotomy sites. However, a single enterotomy catheter technique can be used to avoid multiple incisions in the bowel. Although this technique is beyond the scope of this article, I have used this procedure to remove a cassette tape, and it worked very well.

After flushing the incision site and suturing the bowel, remove the laparotomy sponges and change to a new pair of sterile surgical gloves and surgical instruments. Flush the abdomen again and perform routine linea alba closure as described previously for gastrotomy. Perform subcutaneous closure with absorbable suture material in a continuous pattern. Close skin routinely.

**Resection and anastomosis**

Significant intestinal tissue damage may require resection and anastomosis. Once you have decided to perform resection, pack off the affected bowel loop, milk the contents to either side and clamp or hold the tissue as previously described.

### Table 6: Analgesics Used for Patients Undergoing Abdominal Surgery

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage</th>
<th>Route</th>
<th>Frequency</th>
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<tbody>
<tr>
<td>Butorphanol</td>
<td>0.2-0.4 mg/kg</td>
<td>IV, SQ</td>
<td>Every 2-6 hrs</td>
</tr>
<tr>
<td>Ketoprofen</td>
<td>1 mg/kg</td>
<td>IM, SQ, PO</td>
<td>s.i.d.</td>
</tr>
<tr>
<td>Etodolac</td>
<td>10-15 mg/kg</td>
<td>PO</td>
<td>s.i.d. (dog)</td>
</tr>
<tr>
<td>Carprofen</td>
<td>4 mg/kg once, 2.2 mg/kg</td>
<td>PO, IV, SQ, IM</td>
<td>b.i.d. (dog)</td>
</tr>
</tbody>
</table>

**Figure 5**: Surgical closure following anastomosis using a simple continuous pattern.  
**Figure 6**: Surgical closure following anastomosis using a simple interrupted pattern.
Double ligate the arcadial mesenteric blood vessels supplying the bowel section to be removed (Figure 4, page 43). Double ligate the terminal arcadial vessels supplying the bowel section to be removed as well. Take care to avoid ligating vessels supplying the bowel that is to remain. Transect the bowel obliquely so that the antimesenteric border is shorter than the mesenteric border, usually about a 60-degree angle. Suture the healthy bowel ends starting at the mesenteric border with one knot. Place another knot at the antimesenteric border. Place simple interrupted sutures on both sides 2 to 3 mm apart with a 3-mm bite in the submucosa using 3-0 or 4-0 synthetic monofilament suture. Place all suture knots extraluminally. I prefer simple interrupted sutures, but continuous pattern closure can also be used (Figure 5 and 6, page 44). Close the rent created in the mesentery with several sutures to prevent bowel loop or organ entrapment. Inspect the bowel for peristaltic motion, color and leakage as previously discussed. Place an omental patch over the site to help speed healing. Flush the incision site. Remove the laparotomy sponges, change to a new pair of sterile surgical gloves and surgical instruments, flush the abdomen and close the abdomen as described previously.

Postoperative care
After the surgery is completed, monitor patients closely for vomiting during recovery. Continue supportive fluids and evaluate a daily complete blood count with differential, electrolytes and serum chemistries, along with twice daily vital signs. Use analgesics for pain management starting with injectable agents followed by oral therapy. Multimodal therapy is advised; I use butorphanol or morphine sulfate narcotic therapy, as well as NSAID therapy while the patient is hospitalized. Patients are discharged with oral NSAIDs, either etodolac

Complications of gastrointestinal surgery include shock, leakage, ileus, hemorrhage, perforation, peritonitis, stenosis, short bowel syndrome, recurrence, dehiscence and death.
Food and water should be given 4 to 12 hours postoperatively if the patient is not vomiting. I encourage eating to stimulate peristalsis and reduce the likelihood of ileus or adhesions. Plus, protein intake assists in healing. Start with diets that are bland and highly digestible such as Prescription Diet i/d (Hill’s Pet Nutrition) or Royal Canin Veterinary Diet Low Fat, giving a small meal three or four times daily. A normal diet can be started two to three days after surgery. Continue the antibiotic therapy for five to seven days after surgery.2

**Expected outcomes**

Complications of gastrointestinal surgery include shock, leakage, ileus, hemorrhage, perforation, peritonitis, stenosis, short bowel syndrome, recurrence, dehiscence and death. Small intestine dehiscence rates are 7 percent to 16 percent with significant mortality rates.7 Give all clients detailed discharge instructions and discuss the Pet’s care with them in person, telling them to call you at the first sign of problems.7 Persistent vomiting, fever and leukocytosis in the presence of abdominal tenderness may indicate peritonitis resulting from enterotomy leakage.8 Abdominocentesis and lavage should be performed in these cases. If toxic neutrophils with engulfed bacteria or free peritoneal bacteria are present, early re-exploration of the abdomen is warranted and further resection and reanastomosis may be required.7 The most common time frame for leakage or dehiscence is within two to seven days after surgery.

Clients need to monitor the Pet for vomiting and lethargy; bowel movements should resume within 24 hours once vomiting has ceased and the Pet is able to eat. Any vomiting should be immediately reported to the hospital. Anorexia, fever and lethargy also necessitate an examination. The veterinary team should explain to clients the importance of monitoring their Pet during the first week and to call the hospital immediately if there are any problems.

Once the Pet has recovered from surgery, the veterinary team can recommend behavior-modification classes and safeguarding the Pet’s environment to help prevent the problem from recurring (see Protecting Pets from edible dangers, page 12). With rapid diagnosis and aggressive care, success rates are high when treating Pets with gastrointestinal foreign bodies.

**References**


**Todd A. Nash, DVM**, received his veterinary degree from The Ohio State University College of Veterinary Medicine in 1990. He has practiced general and emergency medicine throughout the United States. He joined Banfield in 2001 and is currently the chief of staff at the original Banfield in Portland, Ore., where he lives with his wife, Lisa, a dog, Shelby, a cat, Bob, and their new baby, Marley.