Chapter 11

# Gastrointestinal emergencies

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## Obstructive pharyngeal sialocele

Salivary mucocele (or sialocele) is the most common disease affecting the salivary glands in dogs, whereas it is rarely reported in cats.[1–4] It refers to a collection of saliva that has leaked from a damaged salivary gland or duct into the subcutaneous tissue. Sialoceles can be cervical, sublingual (ranula), or zygomatic depending on the salivary gland involved.[1,2] Pharyngeal sialoceles are uncommon but could result in a severe clinical presentation due to a swelling formed in the caudal dorsal or lateral pharynx just rostral to the level of the epiglottis, with a high risk of airway obstruction.[1,5] It has been described that most affected animals do not have concurrent ranulas and cervical sialoceles;[6] however, a recent study reported ipsilateral cervical sialoceles in 43% of dogs with ranulas.[5] Pharyngeal sialoceles most commonly originate from the sublingual and mandibular salivary gland–duct complex.[5,6] After the animal has been stabilized, marsupialization and/or sublingual and mandibular sialoadenectomy are necessary for treatment of pharyngeal sialocele.[5,6]

### Clinical presentation and diagnosis

Miniature Poodles and male dogs appear to be overrepresented in cases of sialoceles. Common clinical signs include labored breathing, stridor, cough, and exercise intolerance.[5,6] Concurrent ranulas or ipsilateral cervical sialoceles are possible in affected animals.[5] The diagnosis of sialoceles is typically based on clinical signs, such as a mass containing viscous, honey-colored, clear or blood-tinged fluid. Cytology often reveals inflammatory cells, and a periodic acid–Schiff (PAS) examination of the fluid can help confirm the presence of saliva. Additional diagnostic tests such as radiography, ultrasonography, computed tomography, and bacteriology can assist in confirming the presence of a sialocele and in ruling out other local diseases (Fig. 11.1).[1]

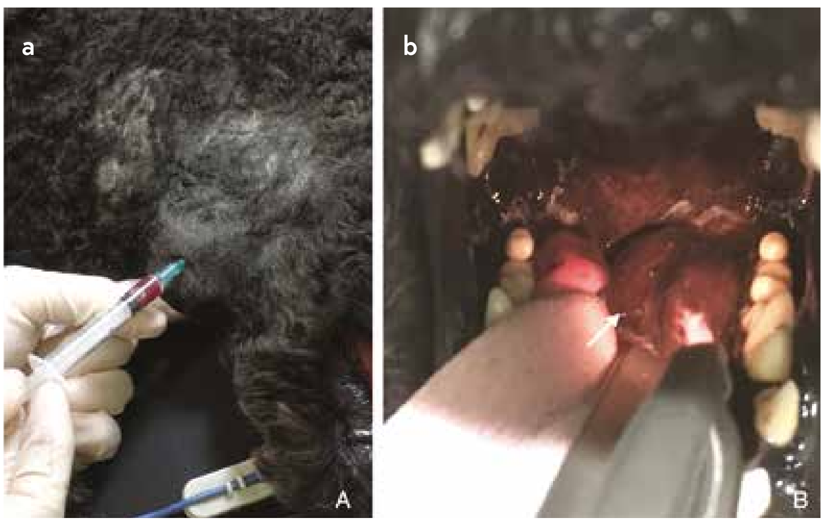
### Treatment

Since pharyngeal sialoceles can result in acute airway obstruction, patients presenting with respiratory distress require immediate drainage, endotracheal intubation, or emergency temporary tracheostomy. After initial stabilization, marsupialization or sialoadenectomy must be performed.

#### Surgical technique

Emergency treatment with the patient under general anesthesia:

1. Intubation, oral examination, and rapid sialocele decompression using:
   - Fluid aspiration with a large-diameter needle and syringe (Video 11.1).
   - Intraoral stab incision of the pharyngeal sialocele wall with a number 11 scalpel blade.




Video 11.1. Oral endoscopic examination and rapid decompression of an obstructive pharyngeal sialocele using aspiration with a large-diameter needle and syringe. Video courtesy of Matteo Gobbetti.

**Figure 11.1** An 8-year-old Poodle with (a) a cervical sialocele and (b) a concomitant pharyngeal sialocele. Upon oral examination, airway obstruction due to the pharyngeal sialocele can be seen (white arrow).

   - Grasping the sialocele with Allis tissue forceps and incising/excising it with Metzenbaum scissors (Video 11.2).
2. Emergency temporary tracheostomy (see Chapter 21).

After stabilization of the patient:

1. Marsupialization:
   a. The sialocele wall is incised and the accumulated fluid removed using suction.
   b. The redundant tissue from the sialocele is resected.
   c. Multiple simple interrupted sutures (3-0 to 4-0 absorbable monofilament) are placed between the remnant wall of the sialocele and the oral mucosa (Fig. 11.2).
2. Sublingual and mandibular sialoadenectomy (ventral approach) (Videos 11.3 and 11.4):
   a. The patient is positioned in dorsal recumbency and a large area is aseptically prepared, from the midcervical region to the most rostral portion of the ventral mandible.

Video 11.2. Patient with respiratory distress. Oral endoscopic examination and identification of an obstructive pharyngeal sialocele. Decompression was performed by excision of the redundant tissue while grasping the sialocele. Video courtesy of Matteo Gobbetti.

Video 11.3. Sublingual and mandibular sialoadenectomy using a tunneling technique. Video courtesy of Matteo Gobbetti.

Video 11.4. Sublingual and mandibular sialoadenectomy using a tunneling technique in a toy-breed dog.

   b. A skin incision is made on the affected side, starting 4–5 cm caudal to the mandibular ramus and extending rostrally toward the mandibular symphysis. Bilateral gland removal requires a midline incision.
   c. The large inflammatory pseudocapsule can be bluntly dissected or incised to provide drainage. It can be partially or totally excised.
   d. After incising the platysma muscle, the external jugular bifurcation should be identified. The mandibular gland is located at or just cranial to this bifurcation.
   e. The capsule of the gland is exposed via blunt dissection and incised. The gland–duct complex (mandibular–sublingual) is then bluntly dissected.

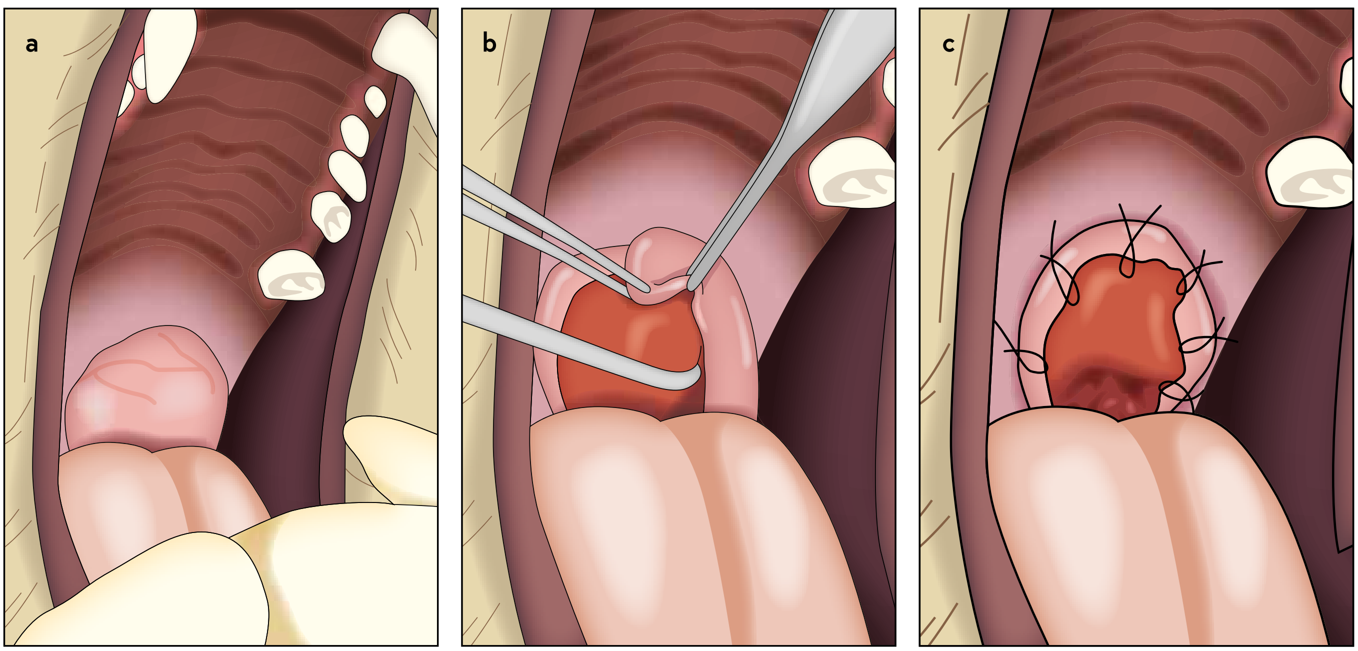



Figure 11.2 Pharyngeal sialocele marsupialization. (a) Airway obstruction due to the pharyngeal sialocele is present on oral examination. (b) Grasping the sialocele with tissue forceps and incising/excising it with Metzenbaum scissors. (c) Multiple simple interrupted sutures are placed between the remnant wall of the sialocele and the oral mucosa.

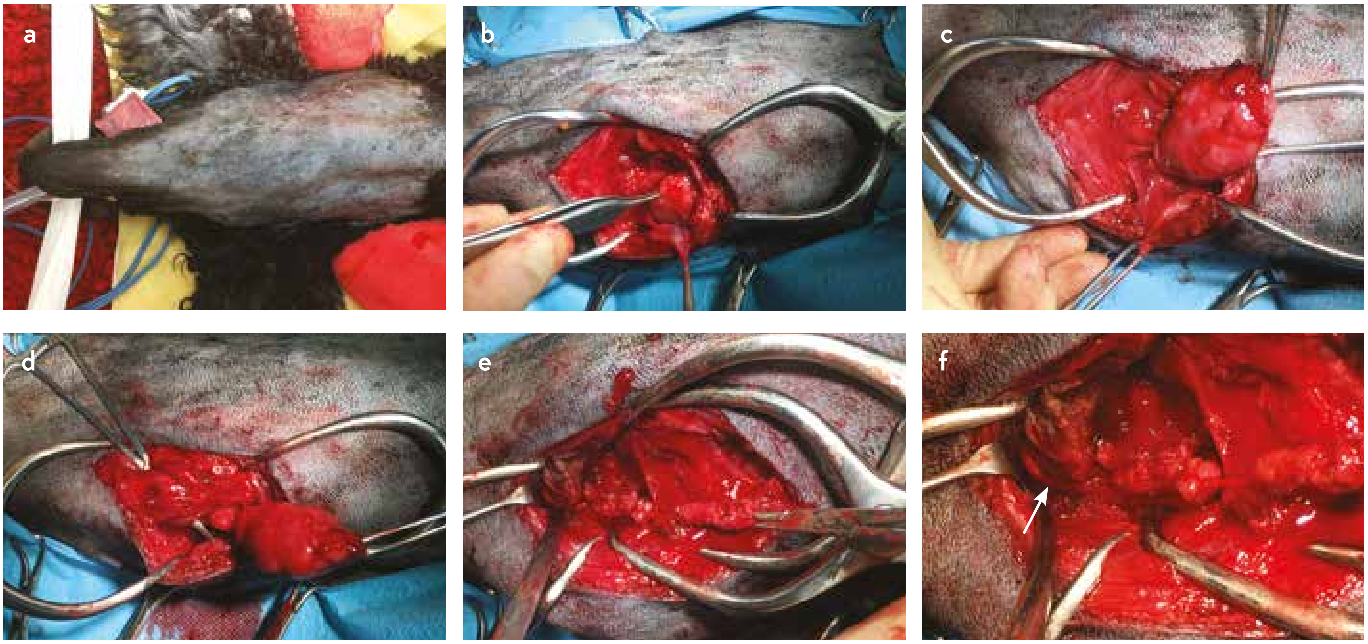



Figure 11.3 Sublingual and mandibular sialoadenectomy with tunneling technique. (a) Ventral approach. (b,c) Blunt dissection of the gland complex. (d) A hemostat is placed under the digastricus muscle, from rostral to caudal, and the duct is clamped just rostral to the large glandular complex. (e) The mandibular and main sublingual glands are excised, and the remaining duct (with hemostat) is passed under the digastricus muscle from caudal to rostral. (f) Dissection of the remaining sublingual gland is continued rostral to the level of the lingual nerve (white arrow), where the duct is ligated and resected. Cranial is to the left of the images.

f. Dissection with tunneling of the digastricus muscle is preferable (Fig. 11.3). After blunt dissection of the gland–duct complex, a mosquito forceps is placed under the digastricus muscle, from rostral to caudal, and the duct is clamped with mosquito forceps just rostral to the large glandular complex. The mandibular and main sublingual glands are excised and the remaining duct pulled under the digastricus muscle (tunneling) with the previously placed mosquito forceps. Dissection of the remaining sublingual gland is continued rostrally to the level of the lingual nerve, where the duct is ligated and resected.
g. Alternatively, dissection without tunneling of the digastricus muscle can be performed (Fig. 11.4). Caudal traction is applied to the gland–duct complex, and the duct and gland are dissected under the digastricus muscle. Rostral traction is applied to the digastricus muscle with a handle retractor (Army-Navy or Senn–Miller retractor), and the salivary duct is ligated (with 2-0 or 3-0 absorbable monofilament suture) as close to the lingual nerve as possible.
h. The mylohyoideus muscle can be incised for better exposure of the rostral glandular tissue.
i. The surgical incision is routinely closed.
j. The decision to use a drain (as well as the type of drain) and postoperative bandage management are at the discretion of the individual surgeon.
k. Following removal of the mandibular and sublingual salivary glands, the patient is positioned in sternal recumbency for final oral examination. If not performed earlier or if still present, redundant pharyngeal tissue can be excised with Metzenbaum scissors. Based on the surgeon's preference, marsupialization may be performed.

## Postoperative management

An oral examination should be performed after surgery to evaluate the patency of the airway/larynx. The respiratory rate and pattern should be monitored during hospitalization. Standard wound care includes suture removal after 10–12 days and management of drains/bandages if present.[1]

## Outcome

Surgical treatment is successful in most dogs. Marsupialization has good results, but recurrence is possible. To minimize this risk, removal of the mandibular and sublingual gland–duct complex is recommended.[1,5,6] Two different approaches for sialoadenectomy have been described (ventral paramedian and lateral), with a recent article suggesting that the ventral paramedian approach for mandibular and sublingual sialoadenectomy is associated with a lower risk of recurrence but a higher risk of wound-related complications compared to the lateral approach.[3]

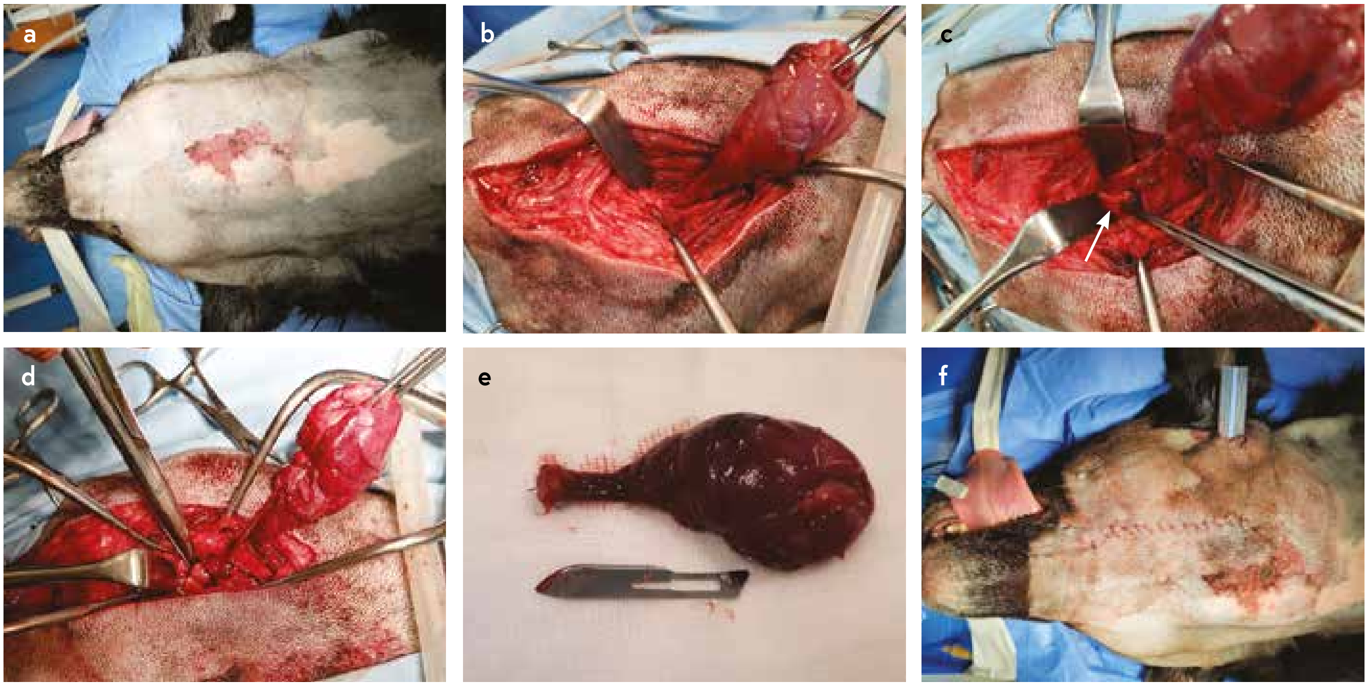



Figure 11.4 Sublingual and mandibular sialoadenectomy without tunneling technique. (a) Ventral approach. (b) Blunt dissection of the gland–duct complex. (c) Using handle retractors, rostral traction is applied to the digastricus muscle for identification of the lingual nerve (white arrow). (d) The salivary duct is ligated as rostral as possible, close to lingual nerve. (e) Sublingual and mandibular gland–duct complex after excision. (f) Skin closure and passive drain placement. Cranial is to the left of the images.

## Penetrating injuries to the pharynx

Penetrating oropharyngeal injuries associated with carrying, chewing, or retrieving sticks occur frequently in dogs.[7–9] Although wooden sticks are the main cause, fishhooks, needles, bones, and grass awns have also been reported. Medium- to large-breed dogs appear to be affected most often.[7,8] Affected animals present with either acute (<7 days) or chronic (>7 days) disease, which can result in potentially serious events.[7] In one case series, only 12% of dogs were brought to a veterinarian with acute injury, while 82% of dogs presented with chronic disease (clinical signs for 8 days to 11 months).[8]

### Clinical presentation and diagnosis

It is useful to divide the patients into acute (<7 days) and chronic (>7 days) as proposed by White and Lane in 1988,[7] because the clinical approach is different. In case of acute penetrating injury, dogs typically exhibit signs of dysphagia, depression, pain on neck flexion, subcutaneous emphysema, oral pain, and drooling of saliva and blood.[7–9] Chronically affected dogs often present with cervical or facial swelling, abscess formation, and discharging sinus tracts in the head and neck. Common sites of penetration include the lateral and dorsal pharyngeal walls, sublingual region, and esophagus. Esophageal penetration has a guarded prognosis for recovery.[7–9]

Radiography and/or computed tomography of the cervical area and thorax are recommended for the initial diagnostic workup. Ultrasound can also be used, especially helpful to identify small foreign material. After induction of anesthesia, inspection of the oropharynx using a laryngoscope and/or endoscope as well as palpation of the neck can help detect abnormalities. Tracheal and esophageal endoscopy is suggested in cases of cervical swelling or radiographic/computed tomographic signs of gas or tissue reaction within the cervical region.[7–9]

### Treatment

The type of treatment depends on the chronicity of the lesion. For acute injuries, oral exploration and retrieval of the foreign body through the entry wound are frequently possible (Fig. 11.5).[9] A recent study described successful retrieval of stick foreign bodies in the oropharynx of dogs using rigid endoscopy, with all animals undergoing endoscopic assessment within 2 days of injury.[10] However, cervical surgical exploration is recommended in acute cases if there is radiographic evidence of tissue emphysema.[9] In chronic cases, the wound may not be obvious on transoral pharyngeal examination, and surgical exploration of the retropharyngeal space is warranted through a ventral midline approach (Fig. 11.6).[8,9]

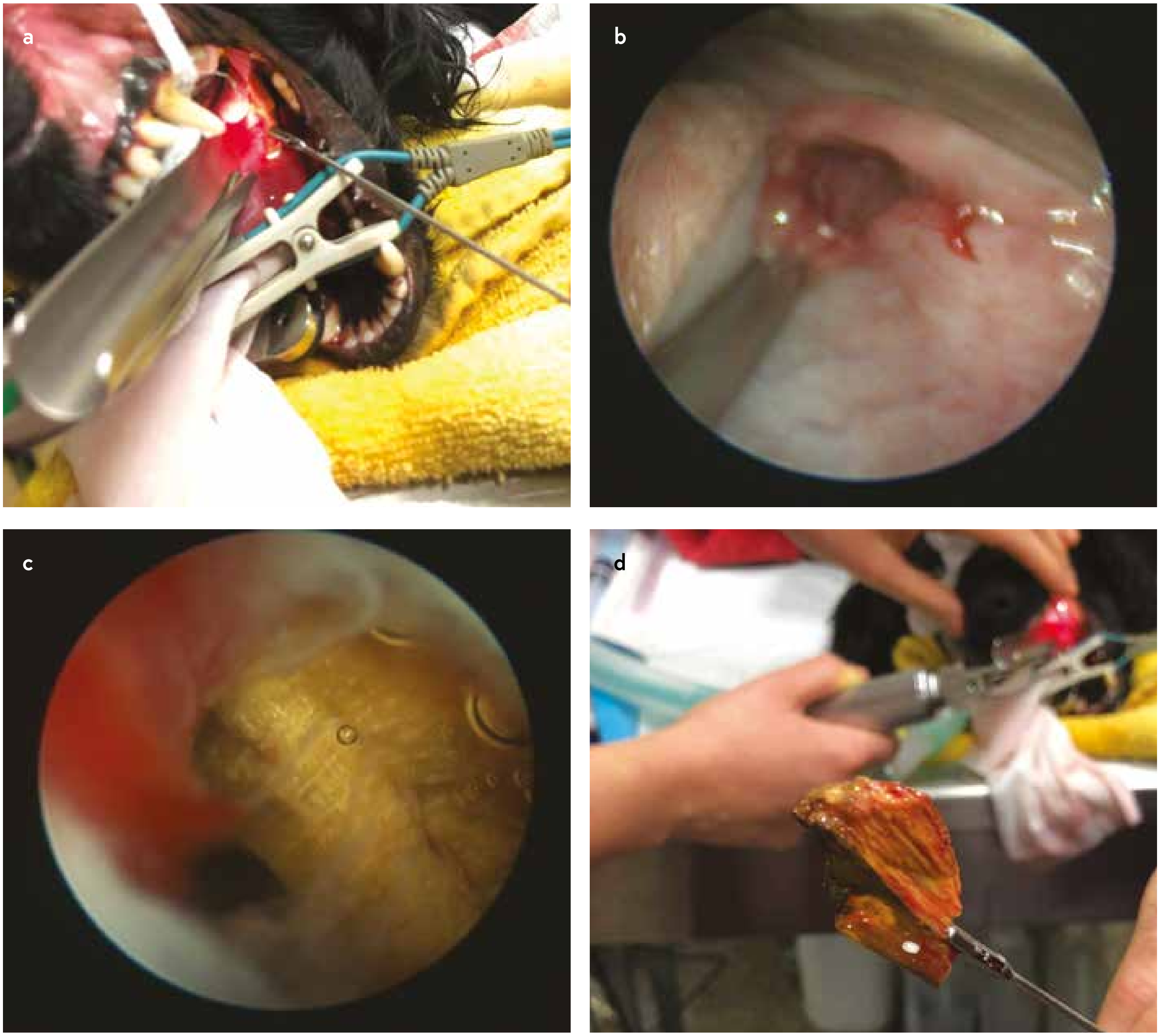



Figure 11.5 Acute stick injury. (a–c) Oral exploration and video-assisted (rigid endoscopy) foreign body removal through the oropharyngeal entry point. (d) Foreign body (wood) after extraction.

## Surgical technique

### Acute penetrating injury (Figs. 11.7 and 11.8)

1. Oropharyngeal exploration is performed with a laryngoscope or rigid endoscope.
2. Ventral median cervical surgical exploration is recommended in dogs with acute penetrating injuries of the oropharynx or esophagus if there is radiographic evidence of tissue emphysema.[9]
3. The wound is explored, the foreign body removed, and debridement and lavage performed.
4. After appropriate debridement, the intraoral wound can be closed or left to heal by second intention. The decision to primarily close the wound depends on lesion chronicity, tissue viability, and anticipated drainage. If the esophagus is damaged, primary reconstruction is recommended.
5. In case of esophageal injury, a feeding tube should be placed (gastrostomy or nasogastric tube).

### Chronic penetrating injury (Fig. 11.9)

1. A ventral median cervical approach is made.
2. The retropharyngeal space is explored. Attention should be paid to the recurrent laryngeal nerves, which run close and parallel to the trachea.
3. Nonviable tissue is debrided. The area should be

Figure 11.6 Chronic stick injuries. (a–c) First case, with a large, nonmobile, painful swelling on the ventral cervical neck. Computed tomography scan showing a large, chronic, fluid-filled cavity close to the larynx. Ventral approach to the neck, surgical exploration, debridement, and passive drain placement. (d–g) Second case, with a subcutaneous fistula. Computed tomography scan, physical and surgical exploration, and excised tissue after debridement.

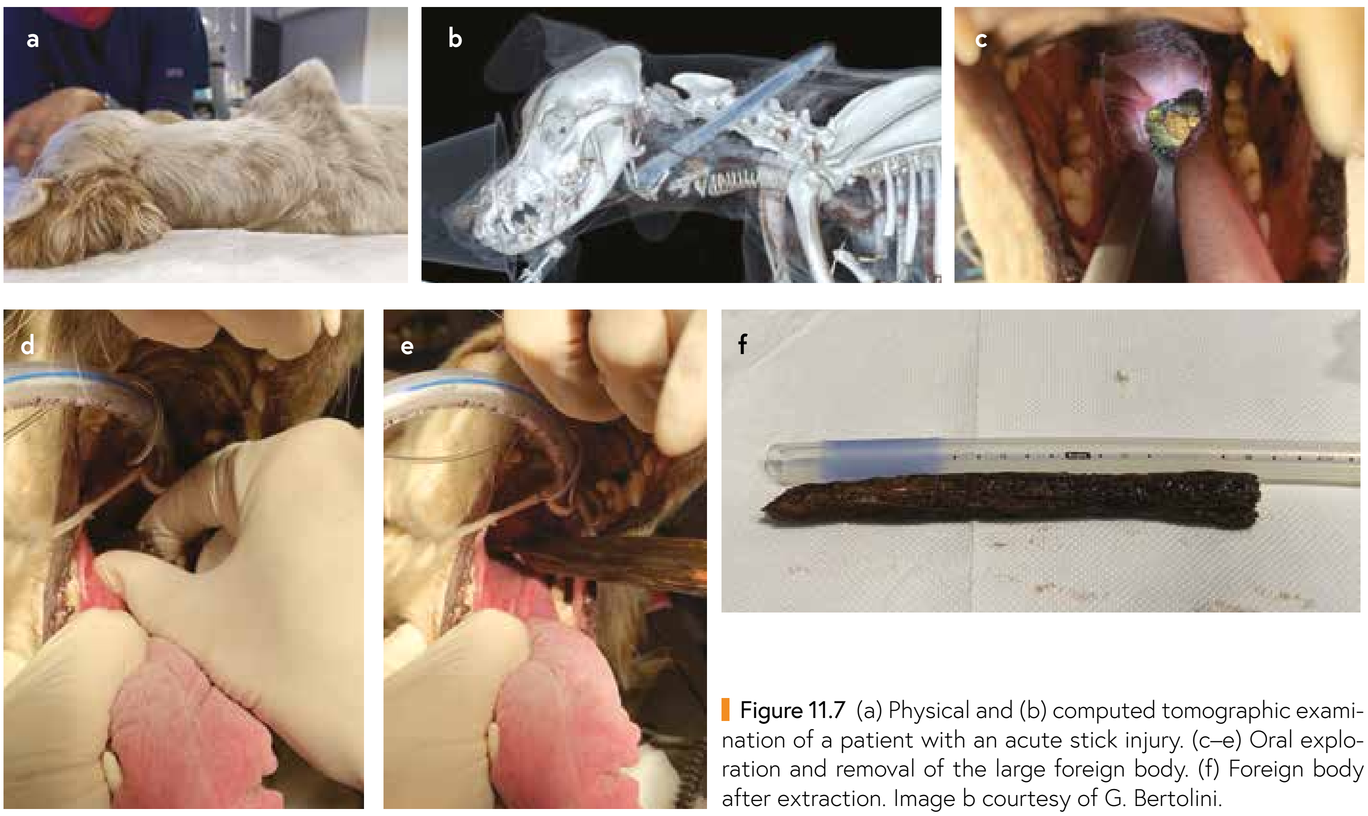


Figure 11.7 (a) Physical and (b) computed tomographic examination of a patient with an acute stick injury. (c–e) Oral exploration and removal of the large foreign body. (f) Foreign body after extraction. Image b courtesy of G. Bertolini.


Figure 11.8 Acute stick injury treated via a combined (a) oral and (b,c) ventral neck approach for removal of multiple foreign bodies.

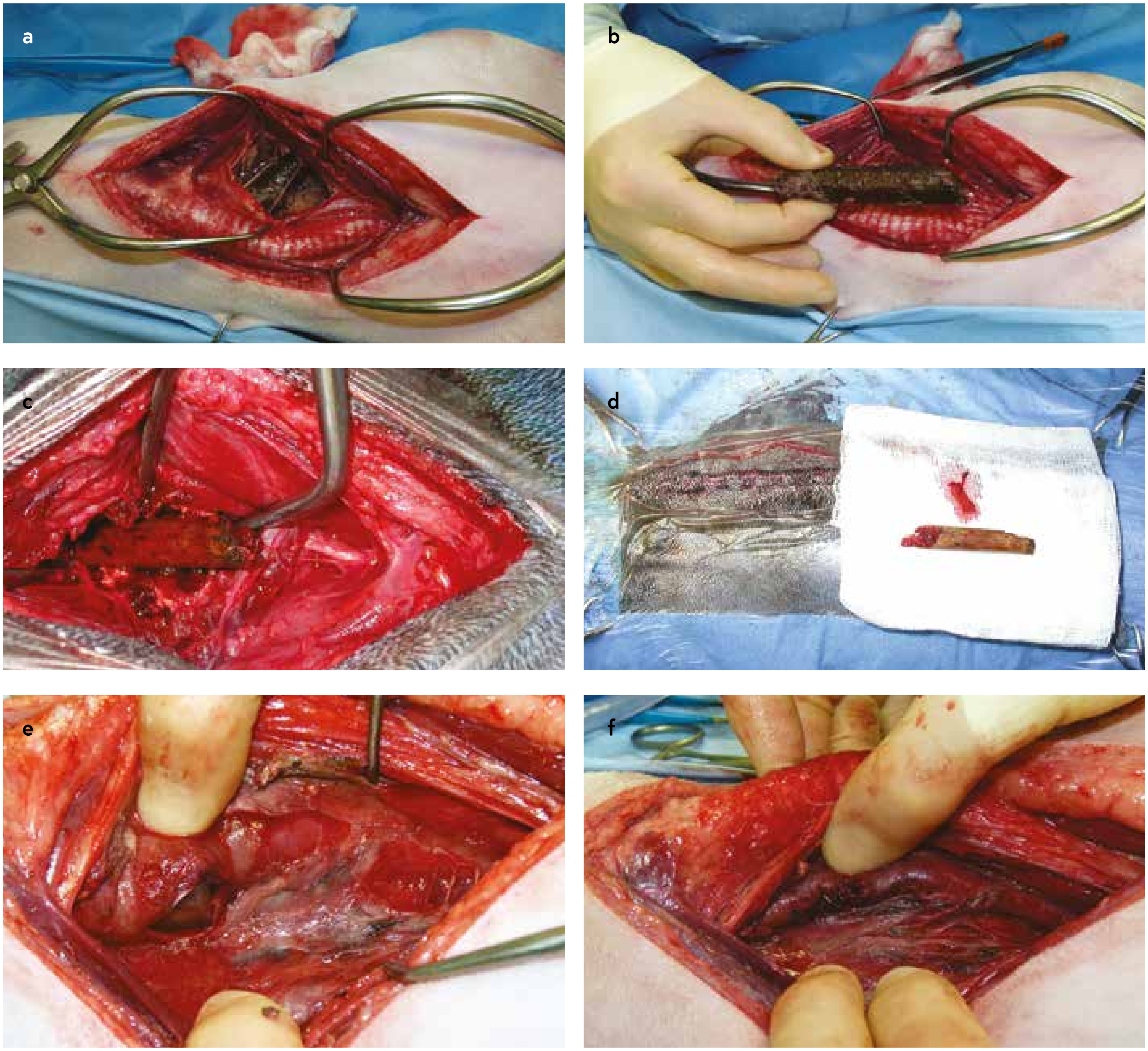



Figure 11.9 (a,b and c,d) Two cases with ventral neck exploration for chronic foreign body removal. (e,f) Ventral approach to the neck for foreign body removal and esophageal suturing in another case of stick injury with esophageal perforation.

explored for any foreign body. Tissue and/or fluid should be sampled for cytology and culture.

4. The surgical site is copiously lavaged and a drain (active or passive) is placed.
5. Empirical administration of broad-spectrum antibiotics is recommended until culture and sensitivity testing results are available.
6. In case of penetrating esophageal injury, debridement and esophageal wall reconstruction is necessary (see below).

### Postoperative management

Minimal postoperative care is required after uncomplicated surgery. The drain should be kept in place based on the daily fluid production. Standard wound care is delivered, and the sutures are removed after 10–12 days.

### Outcome

Acute penetrating injuries of the oropharyngeal region, when treated appropriately, have a better prognosis than acute penetrating esophageal injuries.[9] Aggressive surgical debridement of all sinus tracts and retrieval of foreign material does not eliminate the possibility of recurrence. The recurrence rates in chronic cases are similar regardless of whether foreign material was encountered (45%) or not (43%) during surgery.[8]

## Esophageal foreign body or trauma

Obstruction of the esophagus by a foreign body should be considered an emergency because the longer an object remains in the esophagus, the higher the risk of aspiration and esophageal wall injury through pressure necrosis.[11] The most common types of foreign bodies found in the esophagus are bones and plastic items.[12] In dogs and cats, fishhooks account for only 0% to 17% of cases.[11,12] Several techniques have been described to remove esophageal foreign bodies, such as endoscopy, fluoroscopy, and surgery.[12,13] When endoscopic retrieval is unsuccessful, a perforation is present, or if endoscopic removal carries a high risk of perforation, surgery via esophagotomy or gastrotomy is recommended.[12–14]

### Clinical presentation and diagnosis

The clinical signs of esophageal foreign body can include gagging, retching, regurgitation, vomiting, dyspnea, pain, lethargy, and inappetence. Terrier breeds, such as the English Bull Terrier and the West Highland White Terrier, are overrepresented among the affected population.[11,15] Esophageal foreign bodies most commonly lodge at the level of the thoracic inlet, the heart base, and the distal esophagus due to extraluminal structures preventing esophageal dilation at these locations.[16]

Cervical and thoracic radiographs can identify most esophageal foreign bodies and may reveal radiographic indicators of esophageal perforation such as pneumomediastinum, pneumothorax, periesophageal fluid collection, and mediastinal widening (Fig. 11.10). Endoscopic examination allows direct visualization of the foreign body and permits assessment of the esophageal mucosa for signs of esophagitis, ulceration, necrosis, or perforation. Computed tomography can be also used to confirm the presence of an esophageal foreign body but has limitation in identifying periesophageal fluid and extraluminal air, which are suggestive of esophageal perforation.[17]

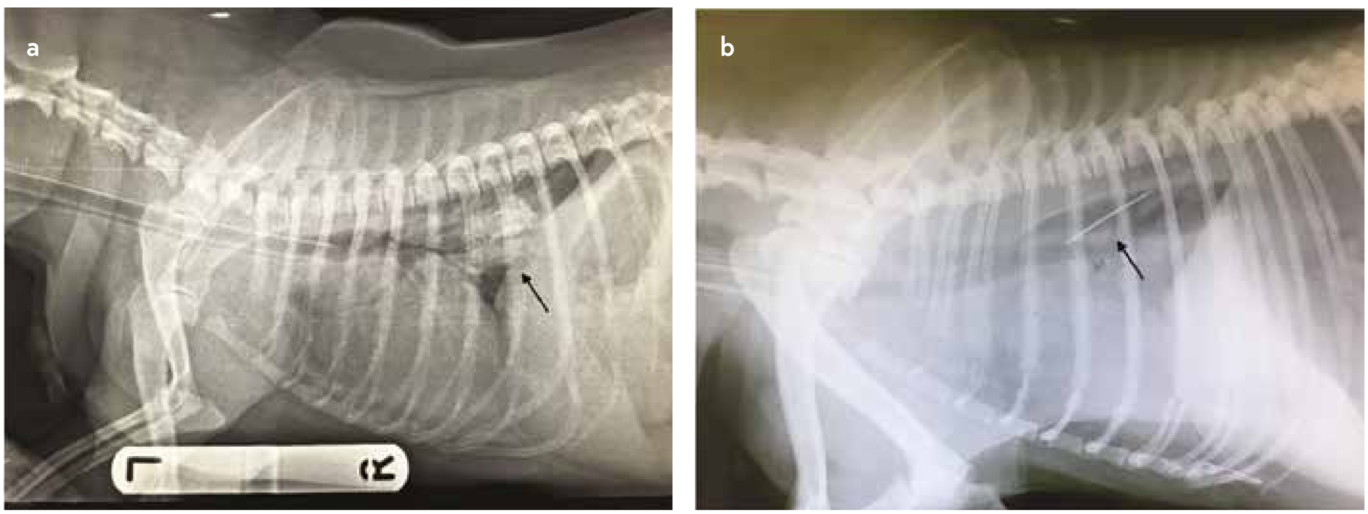



Figure 11.10 Lateral thoracic radiographs of two different esophageal foreign bodies, (a) pork bone and (b) needle, lodged in the caudal thoracic esophagus (black arrow).

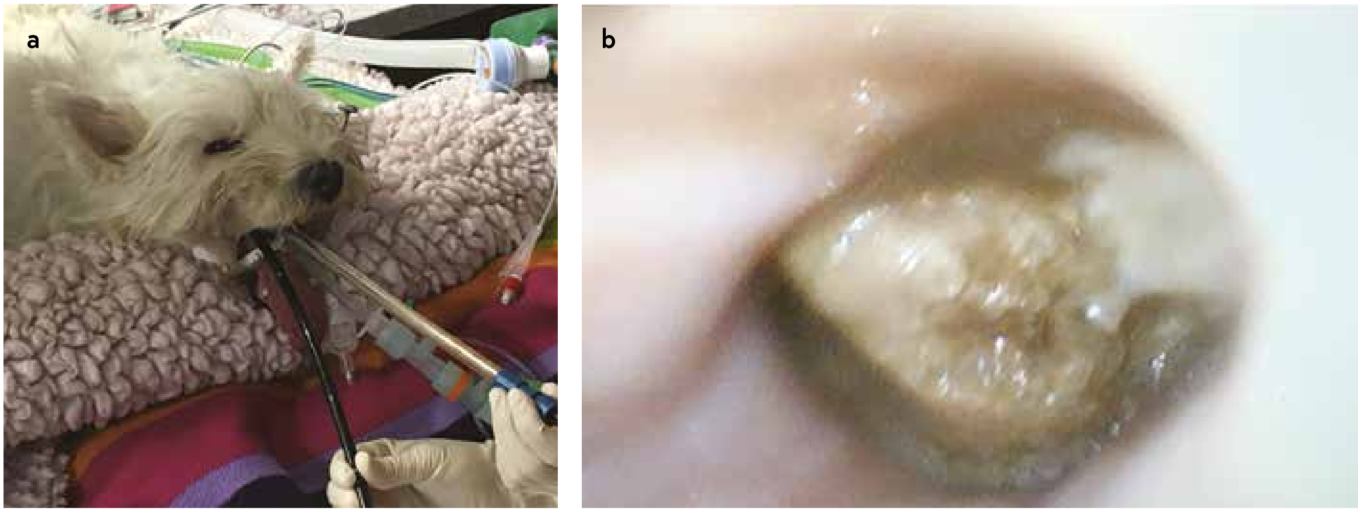



Figure 11.11 Endoscopic treatment of an esophageal foreign body.

## Treatment

The treatment of choice for removal of an esophageal foreign body is esophagoscopy (Fig. 11.11), with reported success rates ranging from 68% to 97%.[12,18] Fluoroscopy is another minimally invasive technique that can be used, with a reported success rate of 83%;[19] however, it is only suitable when the foreign body is radiopaque and the necessary equipment is available. The aim of these techniques is either to retrieve the foreign body through the mouth or to advance it into the stomach. The latter can be followed by a gastrotomy (see below) in case the foreign body is not degradable by the gastric fluids.

Surgical management is indicated when minimally invasive methods are unsuccessful or unavailable, or when there is evidence of full-thickness esophageal perforation. This can be evident before, during, or after foreign body removal. Esophageal foreign bodies that remain lodged for more than 72 hours are more likely to be associated with esophageal perforation.[20] Small perforations of the cervical esophagus can sometimes be managed conservatively with local drainage and withholding food and water for 72 hours,[21] while larger perforations of the cervical and intrathoracic esophagus should be surgically managed. The optimal management of dogs with esophageal perforation is still debated, but the size of the perforation is a factor to consider. One study described good survival in 10 dogs with minimal esophageal fishhook perforation treated conservatively,[20] and other experimental studies described that lesions <12 mm could heal spontaneously.[18,22,23] However, because little consensus exists regarding the optimal management of dogs with esophageal perforation secondary to an esophageal foreign body, and considering the potentially life-threatening consequences, large perforations of the cervical and intrathoracic esophagus should be surgically managed.

### Surgical technique

#### Cervical approach (Fig. 11.12; Video 11.5)

1. The patient is placed in dorsal recumbency with the neck resting on a rolled towel, and a ventral midline approach to the neck is performed. A skin incision is made extending from the manubrium to the larynx.
2. The incision is deepened by blunt midline separation of the paired bellies of the mastoid part of the sternocephalic muscle and the underlying sternohyoid muscle.
3. Lateral retraction of these muscles with Gelpi retractors exposes the trachea and esophagus. The trachea, along with the recurrent laryngeal nerves, is retracted to the right.
4. A cranial partial sternotomy can be performed to improve caudal exposure if necessary (see Chapter 4).
5. Soft plastic tubing (e.g., a large orogastric tube) may be advanced through the mouth to aid in the intraoperative identification of the esophagus. Laparotomy sponges are used to isolate the esophagus.

Video 11.5. Cervical approach for esophageal foreign body removal.

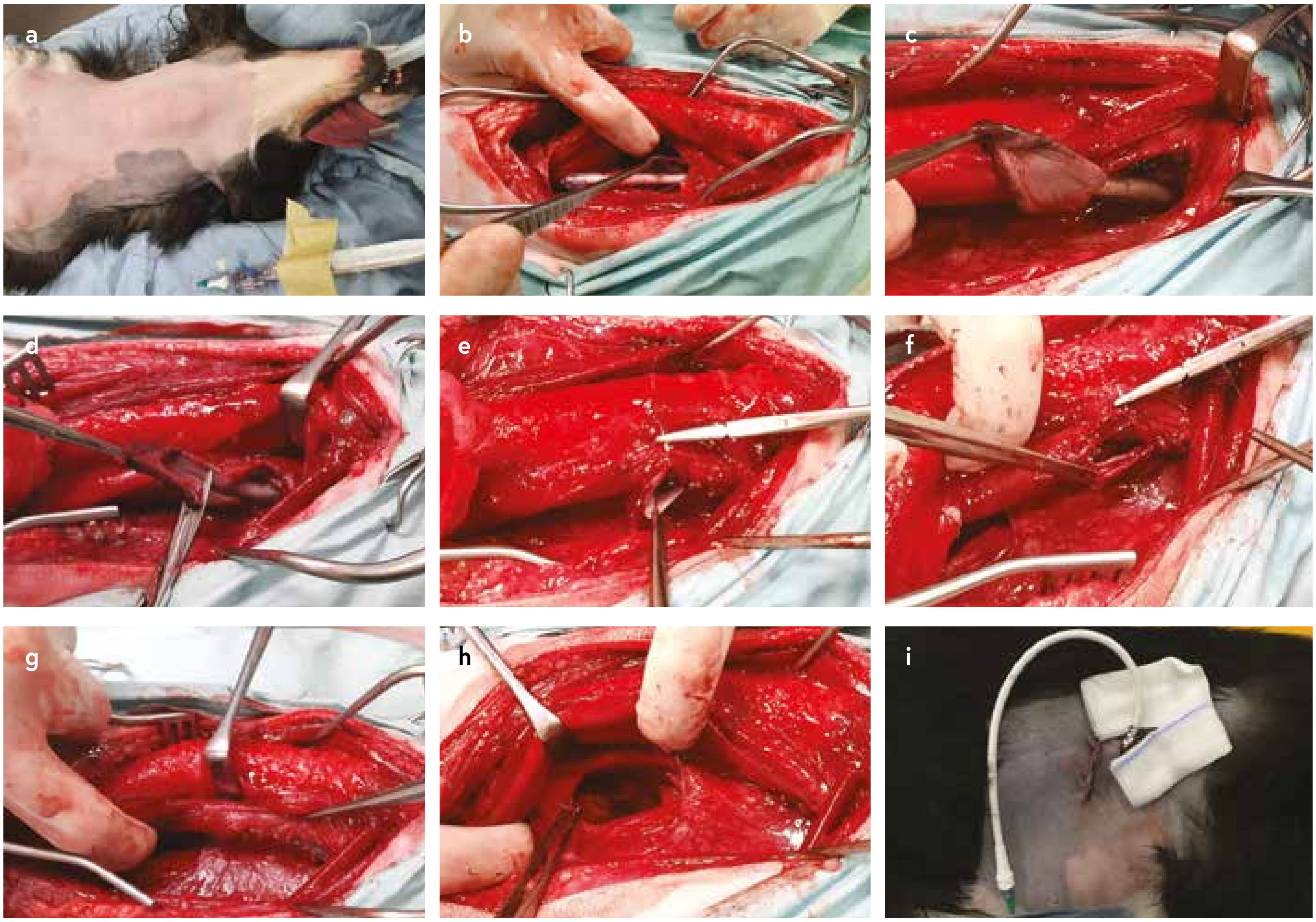



**Figure 11.12** Cervical approach in a case of penetrating esophageal injury due to a foreign body (stick) with laceration of the cervical portion of the esophagus. (a–c) Ventral midline approach to the neck and identification of the esophageal laceration. An esophageal probe helps to identify the lesion. (d) Lesion debridement. (e–g) Two-layer closure of the esophageal wall. (h) Exploration, debridement, and closure of the muscular neck wounds. (i) Gastrostomy tube placement.

### Transthoracic approach (Video 11.6)

1. A left-sided intercostal thoracotomy (see Chapter 4) is the preferred method to provide access to the esophagus overlying the heart base and caudal thoracic esophagus. The decision of which intercostal space to use is determined by the location of the foreign body on preoperative imaging.
2. Laparotomy sponges are used to isolate the esophagus and retract the lung lobes.

### Esophagotomy (Fig. 11.13)

1. The intrathoracic esophagus is elevated using stay sutures or umbilical tape, taking care to avoid damaging the ventral and dorsal vagal trunks.
2. A longitudinal incision is made in the less inflamed area of the esophagus.
3. The foreign body is carefully removed from the esophageal lumen, and the mucosa is carefully inspected for perforations.

Video 11.6. Transthoracic approach for esophageal foreign body removal. Cranial and caudal left-sided intercostal thoracotomy.

4. Any perforation should be debrided before repair. Right-sided intrathoracic perforations can be approached through the esophagotomy incision or by rotating the esophagus with stay sutures.
5. Before repair is started, the mucosal–submucosal limit of the perforation should be visible.
6. Esophageal closure is performed using a simple interrupted suture pattern in two layers. Alternatively, a double-layer technique can be used: the mucosal–submucosal layer is closed with the knots positioned intraluminally, while the muscularis–adventitial layer is closed with extraluminal knots (3-0 or 4-0 slowly

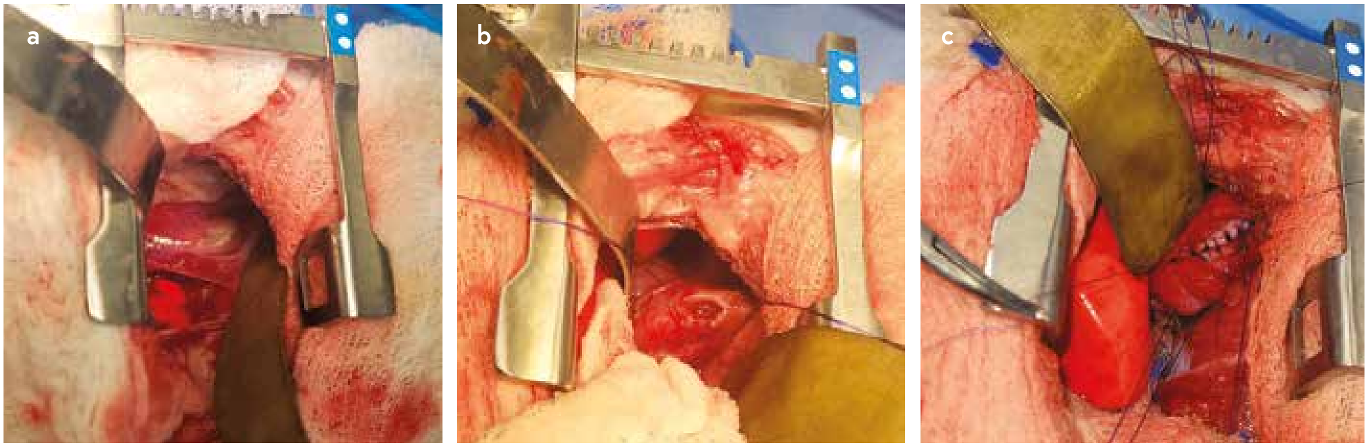



Figure 11.13 (a) Transthoracic esophageal approach via left-sided intercostal thoracotomy. (b) The intrathoracic esophagus is elevated using stay sutures and the esophagus is longitudinally incised in the less inflamed area. (c) The foreign body is carefully removed and the esophageal wall is closed in two layers with simple interrupted sutures. Images courtesy of Adrien Aertsens.

absorbable monofilament suture). Suture bites are placed 2–3 mm apart and 3 mm away from the incision/defect edges. Continuous suture patterns using a double-layer technique have also been reported.

7. A saline leak test can be performed after suturing:
   a. The esophagus is atraumatically clamped proximal and distal to the surgical site.
   b. Sterile saline is injected into the lumen with a needle (e.g., 22 gauge) and syringe (e.g., 10 mL) to gently distend the esophagus.
   c. Additional sutures are placed to close any defect detected.
8. Small defects of approximately one-fourth of circumference can be primarily repaired, while larger esophageal defects are best treated via primary repair buttressed with a patch. Sternothyroid and longus colli muscle flaps can be used for a cervical esophagus patch, whereas diaphragm and intercostal muscle flaps can be used for a thoracic esophagus patch.
9. Omentalization can be performed by advancing the omentum through a diaphragmatic incision or through a paracostal approach and a subcutaneous tunnel into the thoracotomy site. The omentum is sutured around the esophagotomy site using simple interrupted absorbable monofilament sutures.
10. To avoid stricture/necrosis of the omentum and to reduce the risk of herniation, the diaphragmatic or paracostal incision is partially closed with simple interrupted sutures.
11. The thoracic cavity is copiously lavaged and a thoracostomy tube should be placed before routine closure. A gastrostomy or nasogastric feeding tube should be inserted (see Chapter 5).
12. A drain can be placed in the cervical area.

Gastrotomy for extraction of caudal esophageal foreign bodies (Fig. 11.14)[14]

1. A standard cranial midline celiotomy is performed to expose the stomach (see Chapter 3).
2. The stomach is retracted using 2–4 full-thickness stay sutures.
3. An incision is made on the ventral surface of the stomach, midway between the lesser and greater curvatures in the area with the least vascularity. The length of the incision along the gastric axis should be wide enough to allow one hand to be introduced.
4. Ribbon retractors are introduced into the stomach to improve visibility of the cardiac region by carefully retracting the walls of the stomach. Forceps are then introduced into the stomach and passed into the distal esophagus to grasp the foreign body.
5. Firmly lodged foreign bodies should not be forced, as attempts to extract sharp bones, for example, could perforate or lacerate the esophageal wall. In such cases, bone rongeurs and bone cutters can be used to fragment the foreign body. The distal part of the esophagus, which may be partly seen through the gastrotomy incision, is inspected and digitally palpated.
6. The stomach and abdomen are closed routinely (see gastrotomy section).

## Postoperative management

Patients usually require multimodal analgesia and monitoring. Analgesia may include opioids (e.g., morphine, methadone). Fentanyl in constant-rate infusion can be used for severe pain management. Local anesthetic agents (e.g., bupivacaine or ropivacaine) can be used to block intercostal nerves. Nonsteroidal anti-inflammatory drugs (e.g., meloxicam) may be indicated in selected patients. To prevent esophagitis and gastroesophageal

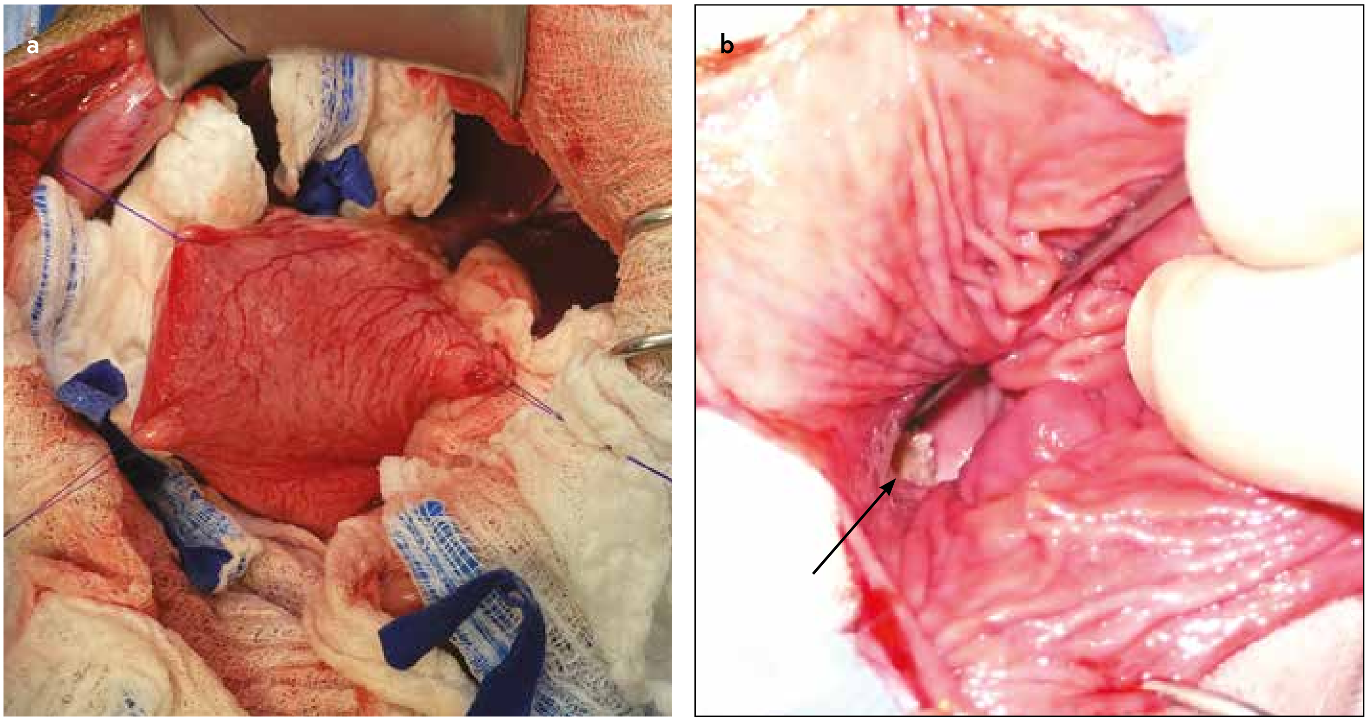


Figure 11.14 Extraction of a caudal esophageal foreign body through a gastrotomy approach. (a) Stomach retraction using stay sutures. (b) Identification of the foreign body (black arrow) in the distal esophagus after gastrotomy. Images courtesy of Adrien Aertsens and *Journal of Small Animal Practice* (2016) 57, 354–359.

reflux, omeprazole and sucralfate are used postoperatively. Broad-spectrum antibiotics (e.g., cefuroxime 15–20 mg/kg every 8–12 h) are indicated due to the high risk of aspiration pneumonia in these patients.

Vital signs including heart rate, blood pressure, respiratory pattern, and temperature should be checked for the first 24–48 hours. Pulse oximetry measurement, blood gas analysis, and thoracic imaging can be performed if indicated. Thoracostomy drains are normally maintained for 12–24 hours. Gastrostomy tubes may be helpful for administration of postoperative nutrition and medications but should be monitored and maintained for a minimum of 10 days. If a nasogastric tube has been placed instead, it should be kept in place for 5–8 days (Fig. 11.15).

## Outcome

The prognosis after foreign body removal is generally excellent, except in cases of thoracic esophageal perforation. Early complications may include esophagitis, ischemic necrosis, dehiscence, leakage, and infection. Late complications include esophageal strictures and tracheo- or bronchoesophageal fistulae. The survival-to-discharge rate following surgery for the treatment of esophageal foreign bodies reportedly ranges from 50% to 93%.[12,14,16,23] Recent studies have demonstrated a high survival-to-discharge rate in dogs undergoing surgery for the treatment of esophageal foreign bodies, although esophageal perforation is significantly associated with a lower survival-to-discharge rate. Only 6.1% of esophagotomy incisions dehisced, and most of the dogs that survived had good long-term follow-up with few long-term complications.[18] However, these studies often combined various methods of esophageal foreign body removal, making it difficult to differentiate outcomes following minimally invasive versus surgical removal or to provide detailed information on a significant number of surgical cases.

# Gastrointestinal foreign body

In veterinary medicine, the most common indication for a laparotomy is the removal of foreign bodies from the gastrointestinal (GI) tract. GI foreign bodies occur more commonly in dogs compared to cats due to their behavior of ingesting objects. Gastric foreign bodies account for 16% to 50% of all GI foreign bodies. In dogs, the larger esophageal size compared to the intestine or pyloric outflow tract results in the ability to swallow relatively large objects that then lead to obstruction.

## Clinical presentation and diagnosis

### Gastric foreign body

The clinical signs of gastric foreign bodies include vomiting, regurgitation (secondary to esophagitis caused by

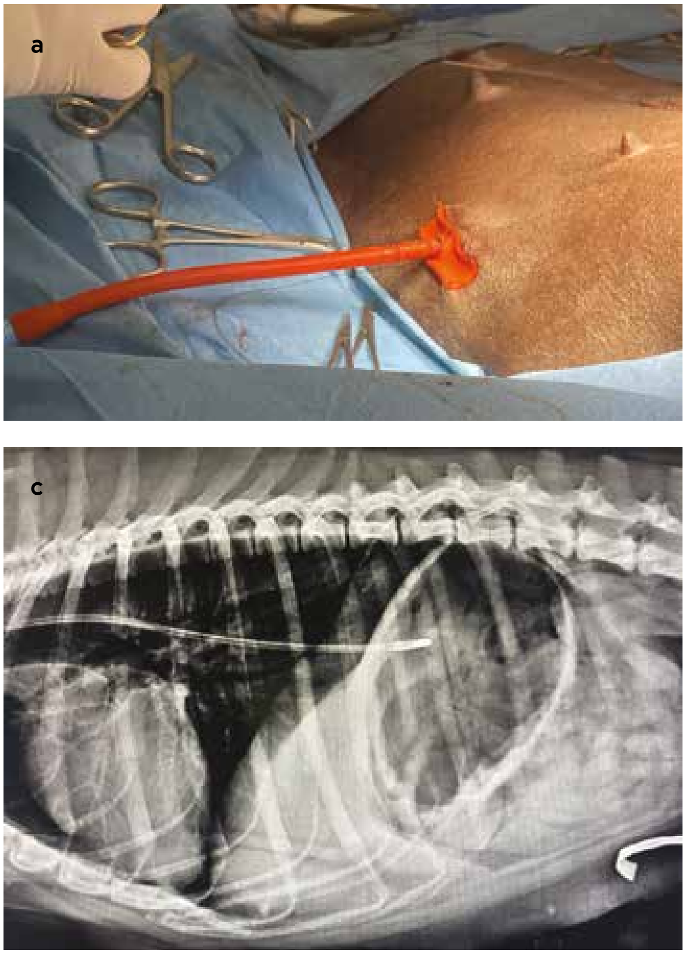




**Figure 11.15** (a) Gastrostomy and (b,c) nasogastric feeding tubes.

vomiting), and abdominal pain. Abdominal distension may be noticed in patients that suffer pyloric outflow obstruction. Blood work (hematology, serum biochemistry, electrolytes) may reveal electrolyte and acid–base imbalances, with hypochloremia being the most common abnormality due to vomiting.

The initial diagnostic modality recommended is abdominal radiography. In one study, plain abdominal radiographs (Fig. 11.16) enabled visualization of 95% of gastric foreign bodies; in only two cases the foreign bodies were not observed (a piece of wood and organic material).[24] Contrast radiography can be beneficial in differentiating a foreign body from an intraluminal mass. The use of water-soluble iodinated contrast agents is recommended because they can be easily removed from the abdominal cavity in the presence of a ruptured GI tract. The disadvantage is that they provide poorer contrast compared to barium. The presence of free abdominal air in the abdominal cavity should prompt an emergency exploratory laparotomy due to the presence of a perforated viscus. Ultrasonography can aid in the diagnosis of GI foreign bodies, particularly when there is uncertainty about the presence of GI obstruction on radiography. If free abdominal fluid is visualized, an abdominocentesis with biochemical analysis and cytology of the fluid should be performed to look for signs of septic peritonitis (i.e., intracellular bacteria) (see Chapter 16).

**Figure 11.16** Plain lateral abdominal radiograph of a dog revealing the presence of a gastric foreign body.

## Intestinal foreign body

The clinical signs of an intestinal obstruction caused by foreign bodies can vary depending on the location, duration, and degree of the obstruction. The most common signs include vomiting, anorexia, lethargy, and abdominal pain. Palpation of the abdomen may reveal the presence of the foreign body. Abdominal radiography can help identify the object, particularly if it is radiopaque. However, more often, signs of mechanical obstruction such as multiple distended, gas- or fluid-filled small intestinal loops are visualized. In case of partial obstruction, these signs may be less severe. Comparing the intestinal diameter to the vertebral height can aid in differentiating between a mechanical/obstructive and functional intestinal ileus. If the ratio between the maximum dilated intestine and the narrowest point of L5 is greater than 2.0, a mechanical obstruction is highly likely and further diagnostics or exploratory laparotomy may be indicated.[25] Contrast radiography can be used but can be time-consuming. Ultrasonography is quicker but operator dependent, and the presence of gas in the intestines may limit the visualization of structures. In a study comparing ultrasound and radiography for identifying GI foreign bodies in 11 dogs and 5 cats, ultrasound identified all 16 foreign bodies, while radiography only identified 9.[26] Comparing the ability of ultrasound and radiography to identify GI foreign bodies, ultrasound revealed a bright interference associated with strong distal acoustic shadowing for all the foreign bodies.

**Figure 11.17** Oral examination in a cat showing a linear foreign body trapped around the base of the tongue (white arrow).

## Linear foreign body

Linear foreign bodies are more common in cats compared to dogs and include threads, stockings, strings, and carpet. They can cause a specific form of intestinal obstruction. Typically, the linear foreign body becomes anchored in a particular part of the GI tract, most commonly the base of the tongue (cats) or the pylorus (dogs). The peristaltic movements of the intestine cause the linear material to move aborally, resulting in the small intestine bunching up like an accordion. Continued peristaltic movements can lead to the linear material perforating the mesenteric side of the intestine, leading to septic peritonitis. The most common clinical signs are vomiting, anorexia, and lethargy. Linear foreign bodies usually cause partial obstruction; therefore, the clinical signs may not be as severe as with complete obstruction. In approximately 50% of cats, the linear foreign body can be identified attached to the tongue during clinical examination (Fig. 11.17). Abdominal palpation may reveal clumping of the intestines and abdominal pain.
Diagnosis can be aided by plain abdominal radiography, which shows a plicated small intestine in the cranial midabdomen. Gas pockets may be seen instead of the normal curvilinear columns. The use of contrast radiography can reveal more clearly the pleating of the intestines and, in some cases, the foreign material may appear radiolucent. On ultrasound, linear foreign bodies present as bright linear interfaces associated with shadowing, and the affected bowel segment appears plicated. Intestinal distension is normally less pronounced than with larger foreign bodies.

# Treatment

## Gastric foreign body

When dealing with gastric foreign bodies, it is important to consider their size and duration. This can help in decision-making, such as attempting endoscopy for retrieval. If the foreign body is too large for endoscopic removal or if it has been present for an extended period, surgical intervention should be considered. Prompt removal of the foreign body is crucial to prevent migration into the small intestine, which can lead to obstruction and devitalization of the intestine. The preferred surgical treatment for gastric foreign bodies is gastrotomy.

### Surgical technique: Gastrotomy (Figs. 11.18–11.23)

1. A midline celiotomy approach is made (see Chapter 3).
2. Moistened laparotomy swabs are used to isolate the stomach from the rest of the abdomen, reducing the risk of peritoneal contamination.
3. Thorough palpation of the stomach is important to locate and assess the foreign body.

4. To provide retraction and decrease the risk of contamination, two stay sutures are placed in the stomach at either side of the gastrotomy incision, passing the needle through the submucosa to prevent tearing of the tissues (Fig. 11.18).

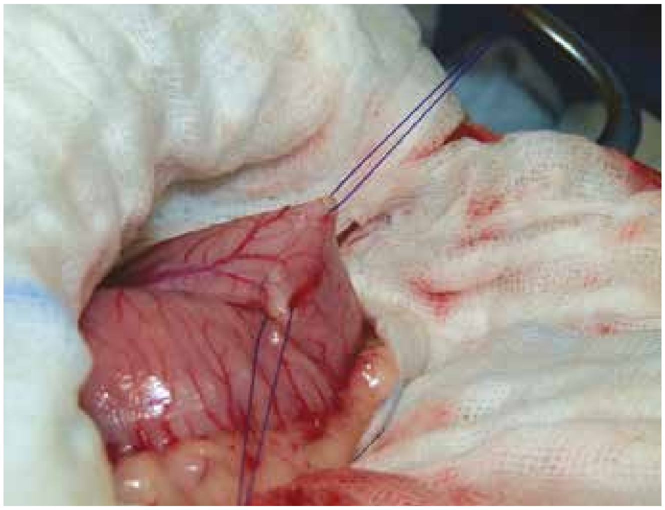


**Figure 11.18** Isolation of the stomach from the abdominal cavity using moistened laparotomy swabs. Placement of two stay sutures on either side of the incision to minimize gastric fluid spillage.

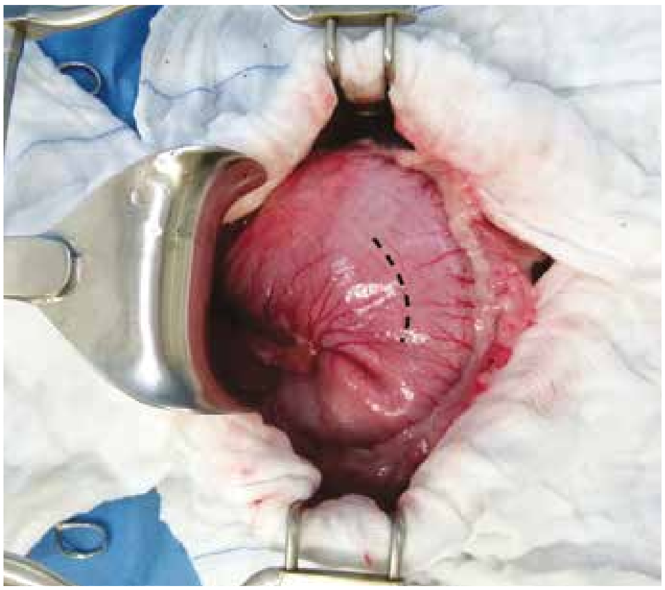


**Figure 11.19** Ventral incision of the gastric body.

Video 11.7. Gastrotomy for gastric foreign body removal. After isolating the stomach and placing two stay sutures, the ventral aspect of the gastric body is incised to extract the foreign bodies.

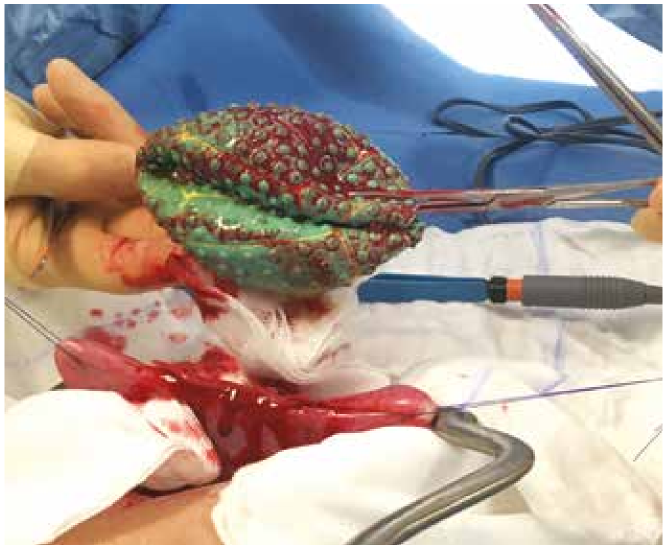


**Figure 11.20** Retrieval of a plastic ball from the stomach.

5. An incision is performed with a number 11 scalpel blade in the ventral aspect of the gastric body, parallel to the long axis of the stomach and midway between the greater and lesser curvatures, in an area without mayor blood supply (Fig. 11.19; Video 11.7). In case of a linear foreign body, the incision may be made over the pyloric region.
6. The length of the incision depends on the size of the foreign material, but it should be kept as small as possible.
7. The foreign material is removed using instruments such as DeBakey forceps or Allis tissue forceps (Fig. 11.20).
8. The suture pattern for stomach closure varies depending on the surgeon's preference. Typically, a two-layer closure is performed, with a simple continuous pattern involving all layers (Fig. 11.21) followed by a simple continuous pattern or inverting pattern (Connell or Cushing) incorporating the serosa and muscularis layers (4-0 or 3-0 slowly absorbable monofilament suture) (Fig. 11.22; Video 11.8).
9. Once the stomach is closed, a segment of omentum is placed over the suture site (Video 11.9).
10. In case of contamination of the abdomen, copious abdominal lavage is indicated.
11. The abdominal wall is closed routinely.

## Intestinal foreign body

Intestinal foreign bodies require careful evaluation and surgical intervention. An exploratory laparotomy should be performed, with special attention to examining the entire GI tract, as there may be multiple foreign bodies or a perforated segment of intestine oral to the foreign material. Once identified, the segment is assessed for viability. Enterotomy is performed on a viable intestinal

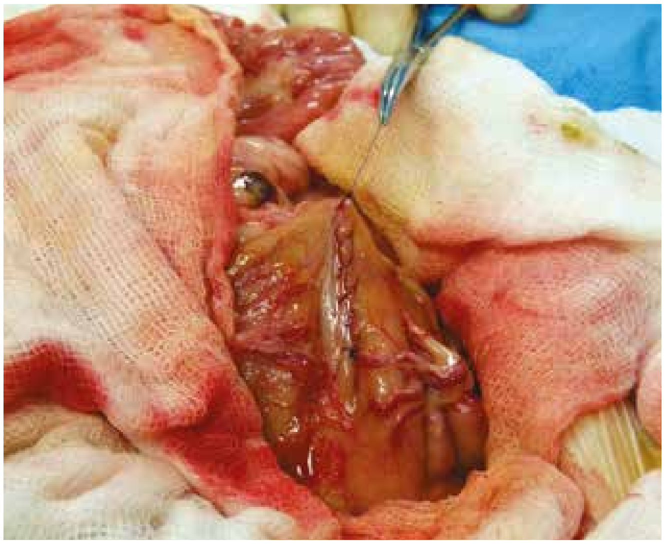


Figure 11.21 Simple continuous suture pattern incorporating all stomach layers.

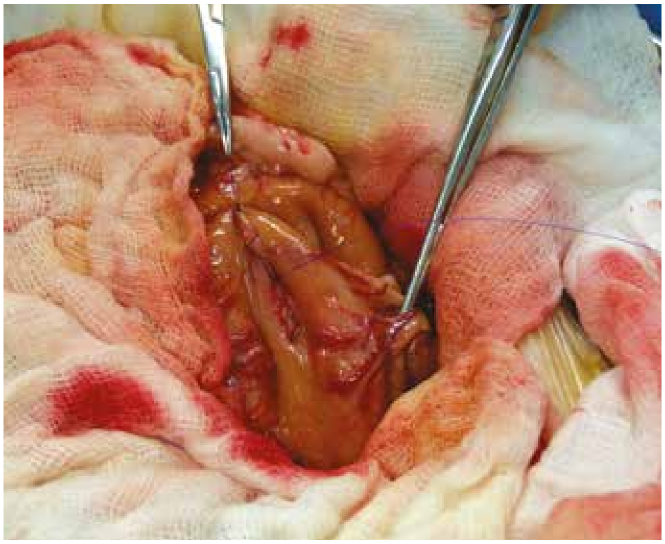


Figure 11.22 Inverting continuous suture pattern incorporating the gastric serosa and muscularis layers.

Video 11.8. Stomach closure via simple continuous suture in two layers: the first layer incorporates the mucosa and submucosa, while the second incorporates the muscularis and serosa.

Video 11.9. Use of omentum to cover the gastric incision.

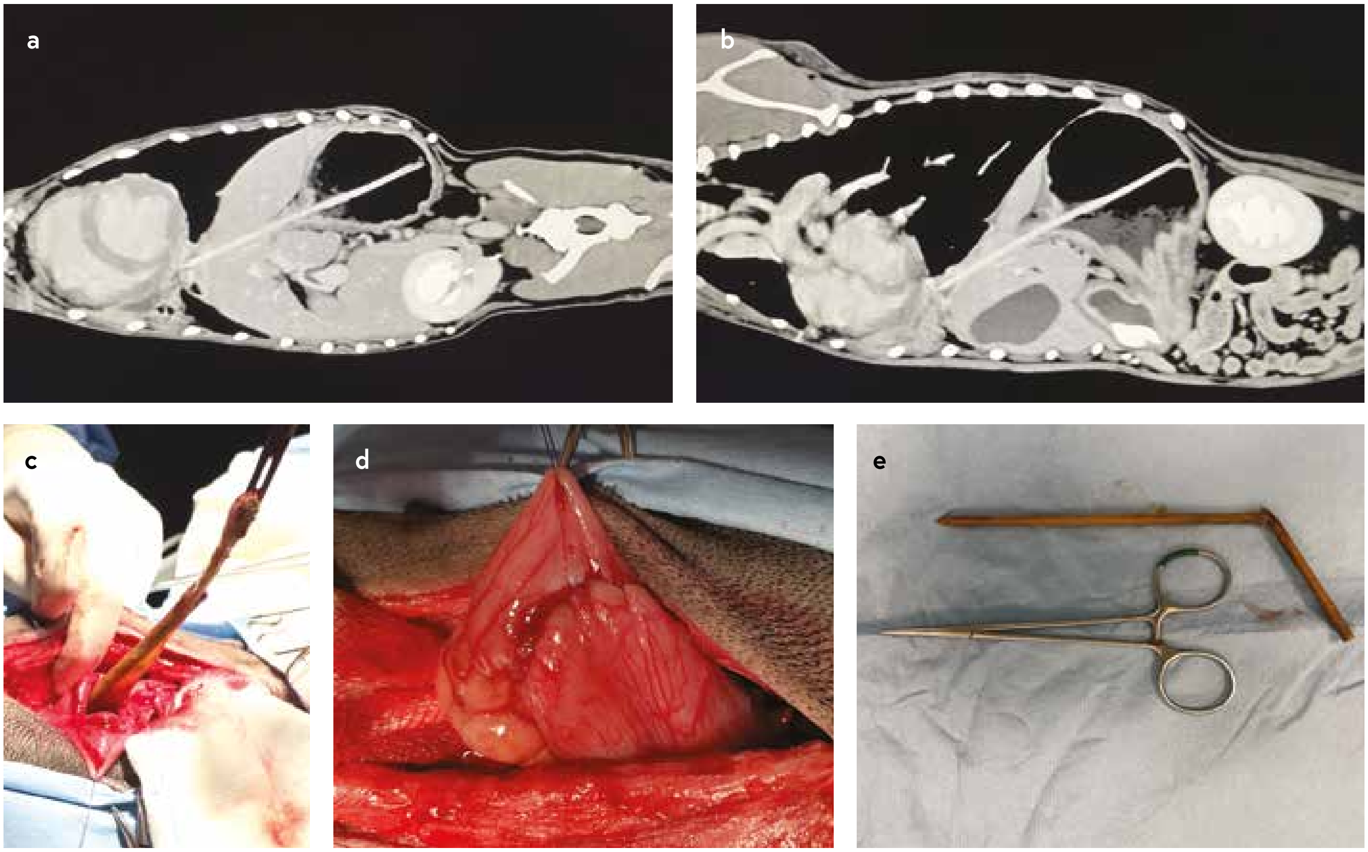


Figure 11.23 (a,b) Computed tomography scans showing a kebab skewer in the stomach. (c) Gastrotomy surgery for foreign body removal. (d) Closure of the stomach in two layers. (e) Foreign body after extraction.

portion aboral to the foreign body, while enterectomy should be performed on nonviable segments. In case of doubt, it may be worthwhile to remove the foreign material and assess the intestinal segment for a few minutes. In some cases, the intestine can appear nonviable due to the pressure from the foreign body; however, once the foreign body is removed and blood flow is restored, the appearance of the intestinal segment starts improving. If this is not the case, then an enterectomy should be performed.

### Surgical technique: Enterotomy

1. A midline celiotomy approach is made (see Chapter 3).
2. The digestive tract is thoroughly examined, from the abdominal portion of the esophagus to the colon.
3. The foreign body or bodies are identified, and the presence of necrosis or perforation of the affected intestinal segment is assessed (Fig. 11.24).
4. The segment of intestine is isolated by placing moistened laparotomy swabs around it (Fig. 11.25).
5. A longitudinal incision is made on the antimesenteric border of the intestine, slightly aboral to the foreign body, as this area of the intestine has not been damaged by the passage of the object (Fig. 11.26; Video 11.10). The length of the incision should be sufficient to extract the foreign body without damaging the intestinal wall (Fig. 11.27; Video 11.11).
6. After foreign body removal, the incision is closed using a single-layer simple interrupted or continuous appositional suture pattern (3-0 or 4-0 absorbable monofilament; e.g., polydioxanone). Suture bites should be about 3–4 mm wide and are placed 3–4 mm apart, depending on intestinal thickness and diameter. It is very important to include the submucosal layer, as it provides the greatest strength to the closure (Fig. 11.28; Videos 11.12 and 11.13).
7. Omentum is wrapped around the enterotomy site (Fig. 11.29; Video 11.14).

**Figure 11.24** Identification of an intestinal foreign body.

**Figure 11.25** Isolation of the affected intestinal loop from the abdominal cavity using moistened laparotomy swabs.

### Surgical technique: Enterectomy

1. A midline celiotomy approach is made (see Chapter 3).
2. The segment of intestine to be resected is identified and evaluated to determine its viability. Subjective criteria for evaluating intestinal viability include intestinal wall thickness, intestinal color, and the presence of peristalsis (pinch test) and vascular pulsation (see "Intussusception" section below).

**Figure 11.26** Antimesenteric incision made aboral to the foreign body.

Video 11.10. Enterotomy. An incision is made on the antimesenteric border, aboral to the foreign material.

Figure 11.27 Retrieval of the foreign body.

Video 11.11. Intestinal foreign body removal.

Figure 11.28 Closure of the enterotomy using simple interrupted appositional sutures.

Video 11.12. Enterotomy closure using simple interrupted appositional sutures.

Video 11.13. Examination of the enterotomy closure with DeBakey forceps to assess if more sutures are required.

Figure 11.29 Omentalization of the enterotomy.

Video 11.14. Placement of omentum covering the enterotomy site.

3. Moistened laparotomy swabs are used to isolate the segment.
4. If the segment has sufficient mobility, it should be brought out from the abdominal cavity to reduce possible contamination.
5. The length of intestine to be resected is determined:
   - Necrotic tissue: A minimum margin of 1–2 cm of healthy tissue (Video 11.15).
   - Intestinal tumors: Margin of 5–7 cm oral and aboral (Fig. 11.30).
   - Once decided on the margins to remove, the incision of the intestine to be sutured should be close to the main vessel irrigating the section of intestine; this will improve perfusion to the anastomosis.
6. The vessels supplying the bowel segment to be removed are double ligated with a 2-0 to 3-0 monofilament suture and resected, including the con-

Video 11.15. Assessment of multiple intestinal perforations in a dog shot with a pellet gun.

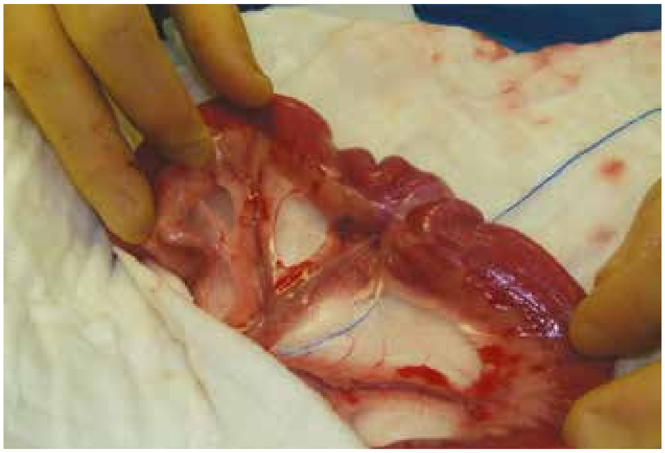


Figure 11.30 Resection of a segment of intestine with a 5 cm margin oral and aboral due to an intestinal carcinoma.

Figure 11.32 Ligation of the arcuate vessels.

Figure 11.31 Double ligation and resection of the vessels supplying the bowel segment.

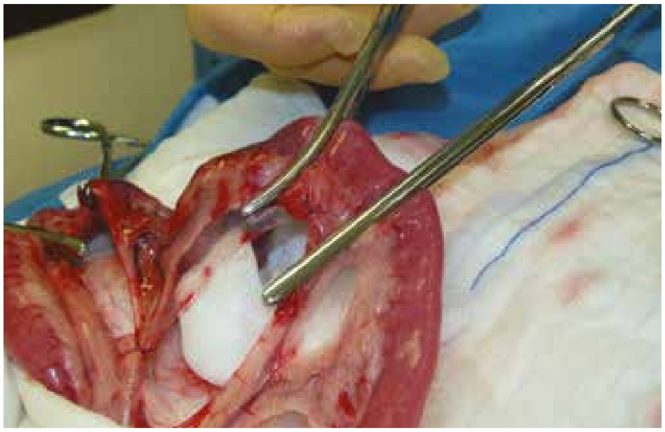


Figure 11.33 Placement of an atraumatic and a traumatic clamp on the edges of the intestine to be sutured and resected, respectively.

necting arcades in the mesenteric border of the intestine (Fig. 11.31). It is important to ligate the arcuate vessels located at the mesenteric border (Fig. 11.32).

7. Atraumatic clamps (e.g., Doyen forceps) or the assistant's fingers are placed on the edge of the intestine to be sutured and traumatic or atraumatic clamps on the edges to be resected (Fig. 11.33).
8. The bowel segment is cut at the level of the atraumatic forceps with a number 11 scalpel blade, leaving at least a 1 cm margin to facilitate suturing (Fig. 11.34; Video 11.16).

Video 11.16. Intestinal resection, ensuring no contamination and leaving enough bowel edge for suturing.

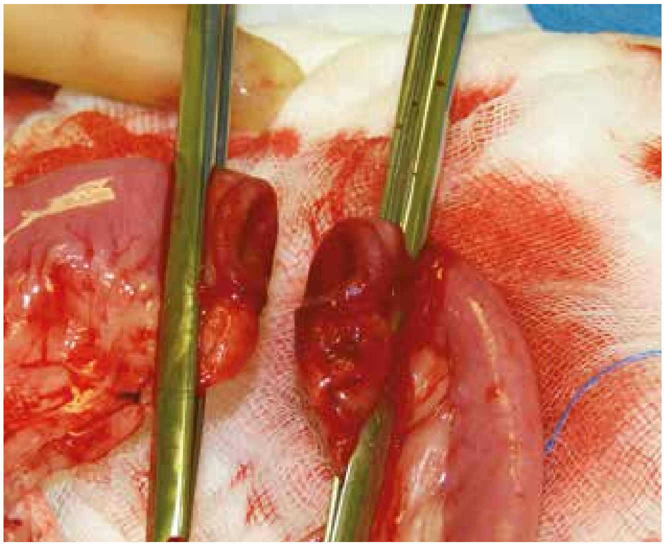


Figure 11.34 Transection of the intestinal segment at the level of the atraumatic forceps, leaving a minimum of 1 cm margin for suture placement.

Suture end-to-end anastomosis:

1. Suturing begins at the mesenteric edge to ensure correct placement of the sutures, as this area has a higher risk of dehiscence due to the presence of mesenteric fat (Fig. 11.35; Video 11.17).
2. Once the first sutures have been placed, anastomosis is continued toward the antimesenteric edge, especially if there is disparity between lumen sizes (Box 11.1). If there is no disparity, a suture can be placed at the antimesenteric edge, followed by the remaining sutures (Figs. 11.36 and 11.37).
3. A simple interrupted appositional suture pattern, with 3-0 or 4-0 long-lasting absorbable monofilament, is used. It is important to include the submucosal layer of the intestine, as it provides the greatest strength. A single layer of interrupted sutures decreases the risk of stricture and leakage of intestinal contents and results in faster wound healing. The needle is inserted about 3–5 mm from the edge of the incision, and sutures are placed every 3–5 mm, depending on intestinal thickness and diameter. The chosen suture should have a good tensile strength for at least 2 weeks, which is when anastomotic strength is close to normal. Examples of suture materials include glycomer 631, polyglyconate, and polydioxanone.
4. Other techniques, such as anastomosis using a continuous suture pattern or a modified Gambee technique, have been described.
5. After suturing, the anastomosis site can be checked:
   - Pushing DeBakey forceps between each suture (Video 11.18).
   - Saline leak test: Injecting saline into the intestine to see if there is any fluid leakage. The application of leak testing in surgery does not predict the likelihood of incisional dehiscence or failure; however, appropriate use of this technique may benefit novice surgeons in intestinal suturing techniques, such as suture number and spacing.[27]

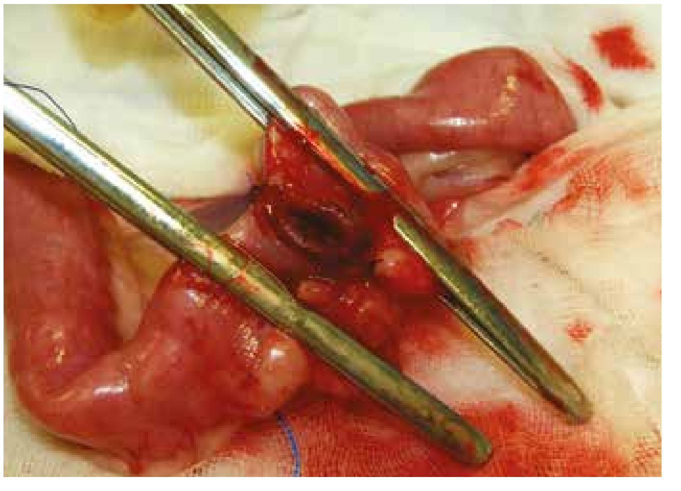


**Figure 11.36** Placement of sutures at the antimesenteric border if no disparity exists between the bowel lumen sizes.

**Figure 11.35** Initial sutures placed at the mesenteric side to reduce the risk of dehiscence.

**Figure 11.37** Suture placement is continued until a technically correct anastomosis is achieved.

Video 11.17. Placement of the first 2-3 sutures at the mesenteric side of the intestine.

Video 11.18. Assessment of enterectomy closure with DeBakey forceps.

a. The bowel is atraumatically clamped 1–2 cm proximal and distal to the surgical site.
b. Sterile saline is injected into the lumen with a needle (e.g., 22 gauge) and syringe (e.g., 10 mL) to gently distend the bowel.
c. Additional sutures are placed to close any defect detected.

6. Finally, the mesentery is sutured using 3-0 or 4-0 absorbable monofilament (e.g., polydioxanone or poliglecaprone) in a simple continuous or interrupted pattern (Fig. 11.38; Video 11.19).
7. Prior to closing the abdominal cavity, omentum is placed over the anastomosis (Video 11.20).

## Box 11.1. Techniques in case of disparity between bowel lumen sizes

- The sutures in the wider lumen may be spaced further apart than those in the narrower lumen.
- The edge of the bowel segment with the narrower lumen can be cut at an angle from the mesenteric border toward the antimesenteric side to increase its surface area (Fig. 11.39).
- The antimesenteric border of the narrower lumen can be spatulated (Fig. 11.40).
- The wider lumen can be partially sutured to reduce its diameter.
- A stapling technique can be used (Fig. 11.41).

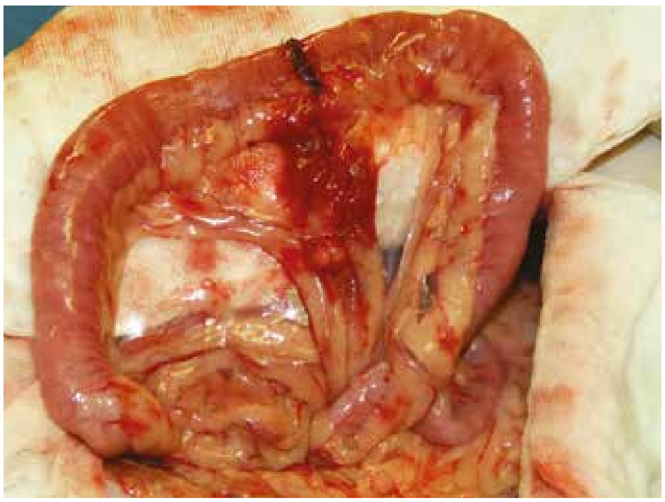


**Figure 11.38** Suturing of the mesentery to decrease the risk of intestinal entrapment.

Video 11.19. Suturing of the mesentery using a simple continuous pattern.

Video 11.20. Placement of omentum over the anastomosis site.

Stapled functional end-to-end anastomosis (Fig. 11.42): Several types of anastomoses can be performed with the use of GI stapling systems. When staples, typically made of titanium, are fired, they bend into a B conformation, which improves blood flow to the incision. Two commonly used stapling systems are the GIA (gastrointestinal anastomosis) and the TA (thoracoabdominal) systems (Video 11.21). Five staple heights are available, indicated by the color of the cartridge (grey, white, blue, gold, and green) (see Chapter 6). For GI surgery, the blue and green cartridges are typically used in the intestine and the stomach (usually thicker), respectively. In the blue cartridge, the open staple height is 3.5 mm and 3.8 mm for the TA and GIA systems, respectively, and the closed staple height is 1.5 mm. In the green cartridge, the open staple height is 4.8 mm for both the TA and GIA systems, and the closed staple height is 2.0 mm. Regarding staple length, the GIA system comes in three lengths: 60 mm, 80 mm, and 100 mm, while the TA system sizes are 30 mm, 45 mm, 60 mm, and 90 mm. Another stapling system that could be used for functional end-to-end anastomosis in small dogs (<10 kg) and cats is the Endo GIA stapler with purple cartridges (length 60 mm or 45 mm; medium-thick Tri-Staple 3 mm/3.5 mm/4 mm from inside to outside line).

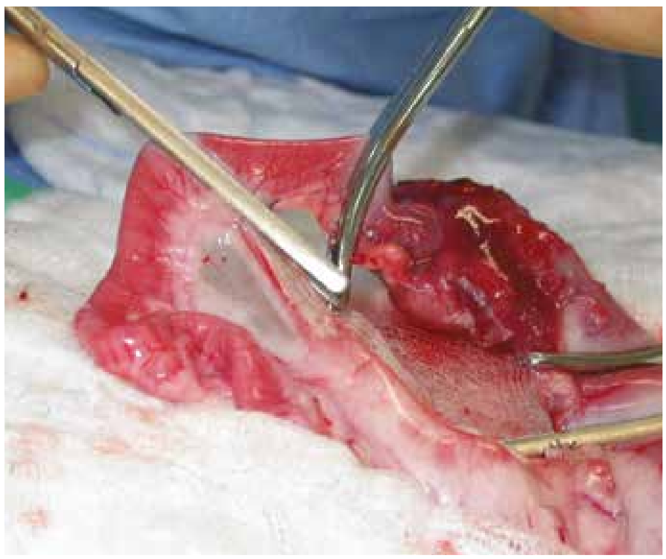


**Figure 11.39** Angling the edge of the intestinal segment with the narrower lumen if a disparity exists between the two lumen sizes.

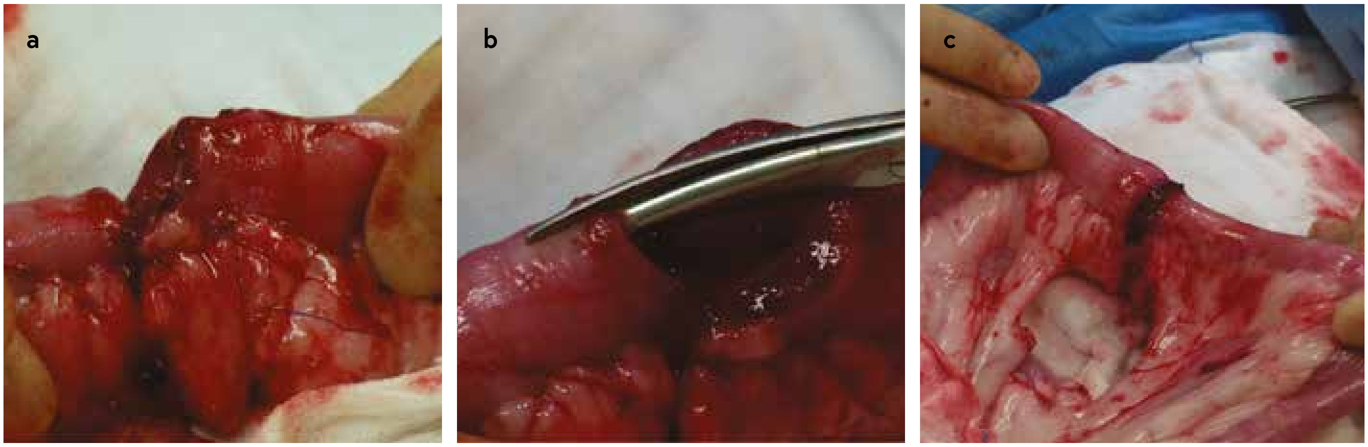



Figure 11.40 Spatulation of the antimesenteric side in case of lumen size disparity.

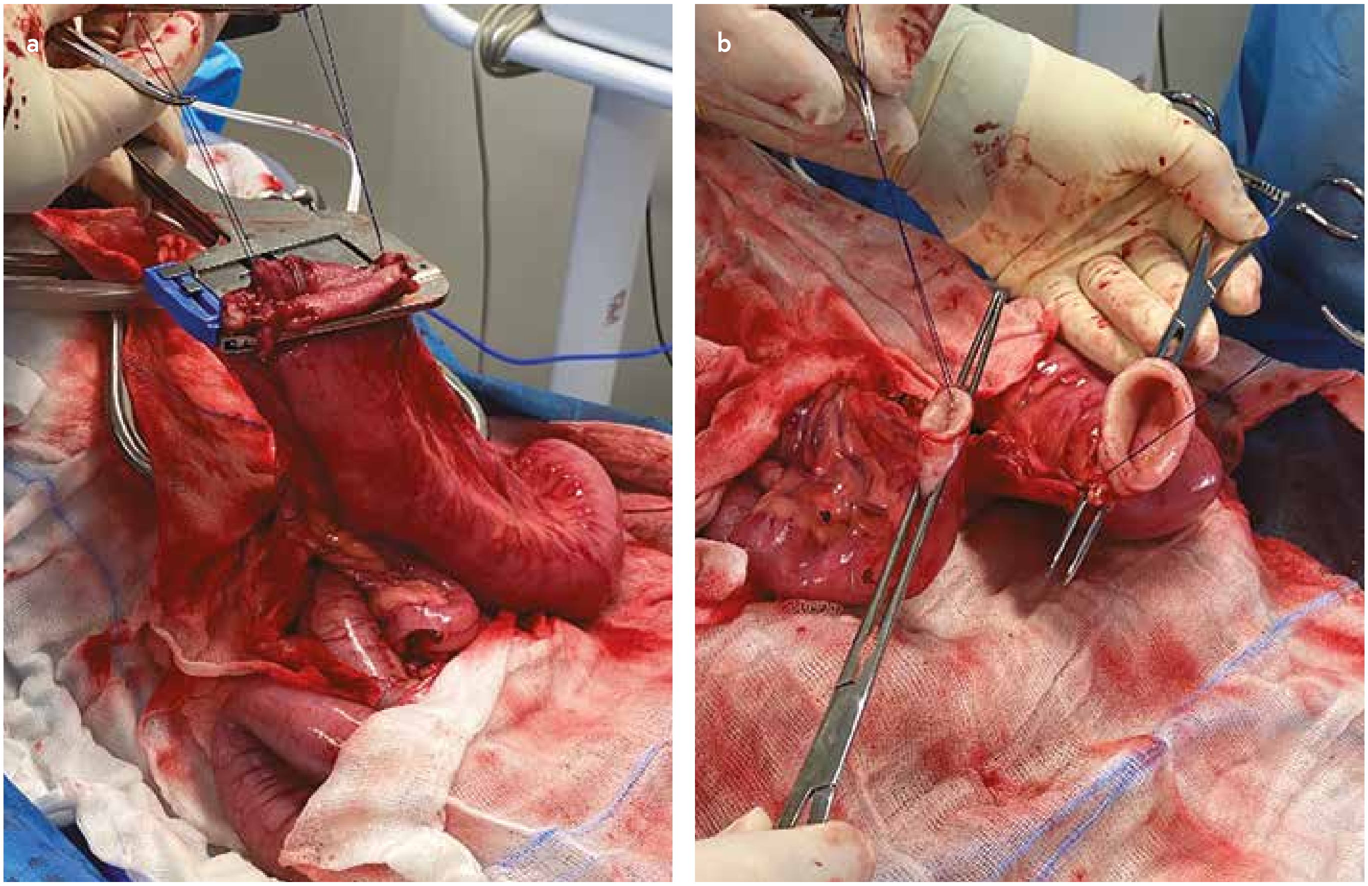



Figure 11.41 Use of stapling devices for cases with a large disparity between bowel lumen sizes.

Video 11.21. Use of two stapling systems, GIA (gastrointestinal anastomosis) and TA (thoracoabdominal), for performing a stapled anastomosis.

1. After performing the intestinal resection, the GIA stapling system is separated into its two arms. The arms are introduced into each bowel loop and closed, with the staple line facing the antimesenteric walls (Fig. 11.43; Video 11.22).

**Figure 11.42** Functional end-to-end intestinal anastomosis performed with the use of staples.

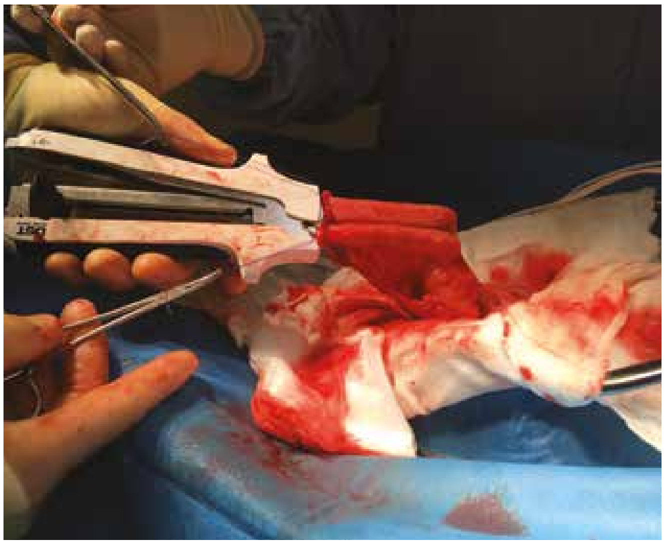


**Figure 11.43** Introduction of the arms of the GIA stapling device into each intestinal loop.

Video 11.22. The arms of the GIA stapling device are inserted into each bowel loop and locked, with the staples on the antimesenteric side.

2. Once the GIA system is fired, it releases four staggered staple lines and cuts the intestine longitudinally, creating a lumen between the two intestinal loops. The length of the lumen depends on the length of the GIA arms.
3. The arms of the GIA system are removed, and the cut edges of the intestinal segments are then closed with a TA stapling system (Fig. 11.44; Video 11.23).

**Figure 11.44** Closure of the cut edges of the intestinal segments using a TA stapling system.

Video 11.23. Closure of the cut edges of the intestinal segments using a TA stapling device.

4. The TA system produces an eversion of the intestinal edges. An inverting suture pattern can be performed over the staple line to reduce the risk of adhesion and leakage of intestinal contents (Video 11.24).[28]
5. Two interrupted sutures are placed at the distal junction of the two intestinal loops to decrease tension and reduce the risk of dehiscence along the staple line (Fig. 11.45; Video 11.25).[29]

The advantages of stapling systems compared to sutures are:

- They promote primary healing in the early postoperative period. In the inflammatory phase of healing, the force exerted by sutures decreases until the proliferative phase begins. In contrast, with stapling systems, there is a linear increase in the force exerted by the staples.
- They provide a greater burst strength in the early postoperative period.
- Staple anastomosis is faster to perform, reducing anesthetic time.

Video 11.24. Use of an inverting suture pattern over the staple line.

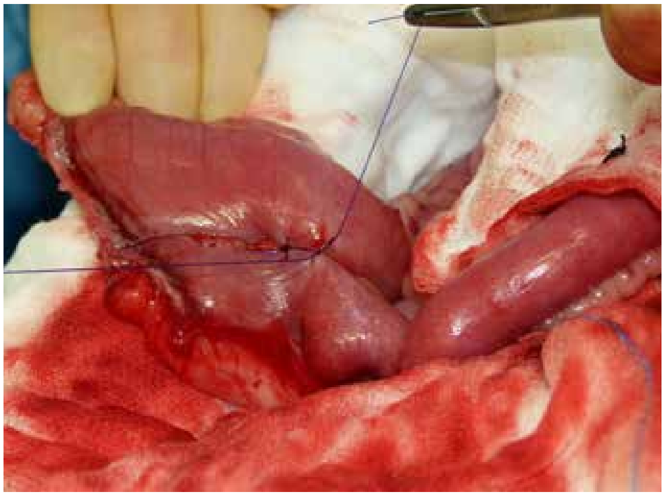


Figure 11.45 Placement of one or two interrupted sutures in the crotch of the anastomosis.

Video 11.25. Placement of two interrupted sutures at the distal junction of the two intestinal loops.

- There is less tissue handling.
- They can be used if there is a disparity in the intestinal lumen sizes.
- Stapled anastomosis is generally more reliable.

In case of septic peritonitis, the risk of anastomosis dehiscence is 35%–38%, while in patients without septic peritonitis the risk is 6%–9%. In patients with peritonitis, the risk of dehiscence of an anastomosis with sutures and with staples is 13%–28.9% and 5%–9.7%, respectively. Therefore, in the presence of septic peritonitis, a stapled anastomosis is likely a better choice.[30,31]

## Colonic foreign body

Colonic foreign bodies are usually incidental findings with no clinical signs, and they typically do not require any treatment. However, if a colonic foreign body is causing clinical signs, it can be retrieved using endoscopy or, in case of a sharp object localized in the distal colon, with careful manual manipulation. Surgery should only be attempted if unavoidable.

## Linear foreign body

In cats that present immediately after ingesting linear foreign material and show no signs of obstruction or peritonitis, conservative treatment can involve cutting the piece of string attached to the tongue. In 9 out of 19 cats (47%), the string passed through the intestine in 1–3 days; however, the remaining 10 cats required surgery due to deterioration of their condition, and one-third of them had perforation.[32] In dogs, linear foreign material is usually lodged in the pylorus, making surgical treatment necessary. These foreign bodies can affect a large segment of intestine, and if a significant portion needs to be resected, short-bowel syndrome should be considered. Due to the risk of perforation and subsequent septic peritonitis associated with linear foreign bodies, surgical treatment is recommended.

Surgical technique:

1. If the linear foreign body is attached to the tongue, it should be cut before performing abdominal surgery.
2. A midline celiotomy approach is made (see Chapter 3).
3. The plicated intestine is isolated from the abdominal cavity (Fig. 11.46).
4. An enterotomy is performed midway along the site of the plicated intestine on the antimesenteric side.
5. The string is identified, grasped with two hemostats, and then cut in the middle.
6. If the linear foreign body is attached to the pylorus, a gastrotomy at the level of the pylorus is performed. The material is identified and gently pulled from the stomach (Fig. 11.47).
7. Multiple enterotomies may be necessary to safely remove the foreign body. If the piece of string moves and comes out after applying gentle traction, it can be removed; otherwise, another enterotomy must be performed until the string can be safely removed without causing perforation of the intestine (Figs. 11.48 and 11.49).

Figure 11.46 Isolation of the plicated section of intestine from the abdominal cavity.


Figure 11.47 (a) Linear foreign body trapped in the pylorus of a dog. (b) A pyloric incision is performed and the linear material removed. (c) Pyloric incision sutured.

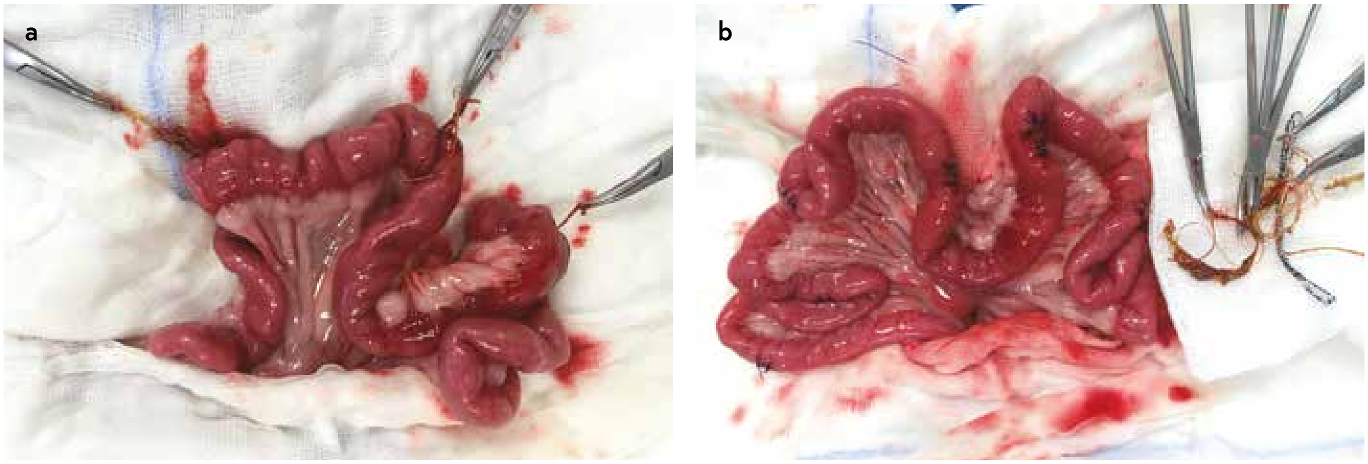



Figure 11.48 Removal of a linear foreign body through multiple enterotomies to avoid damaging the intestine.

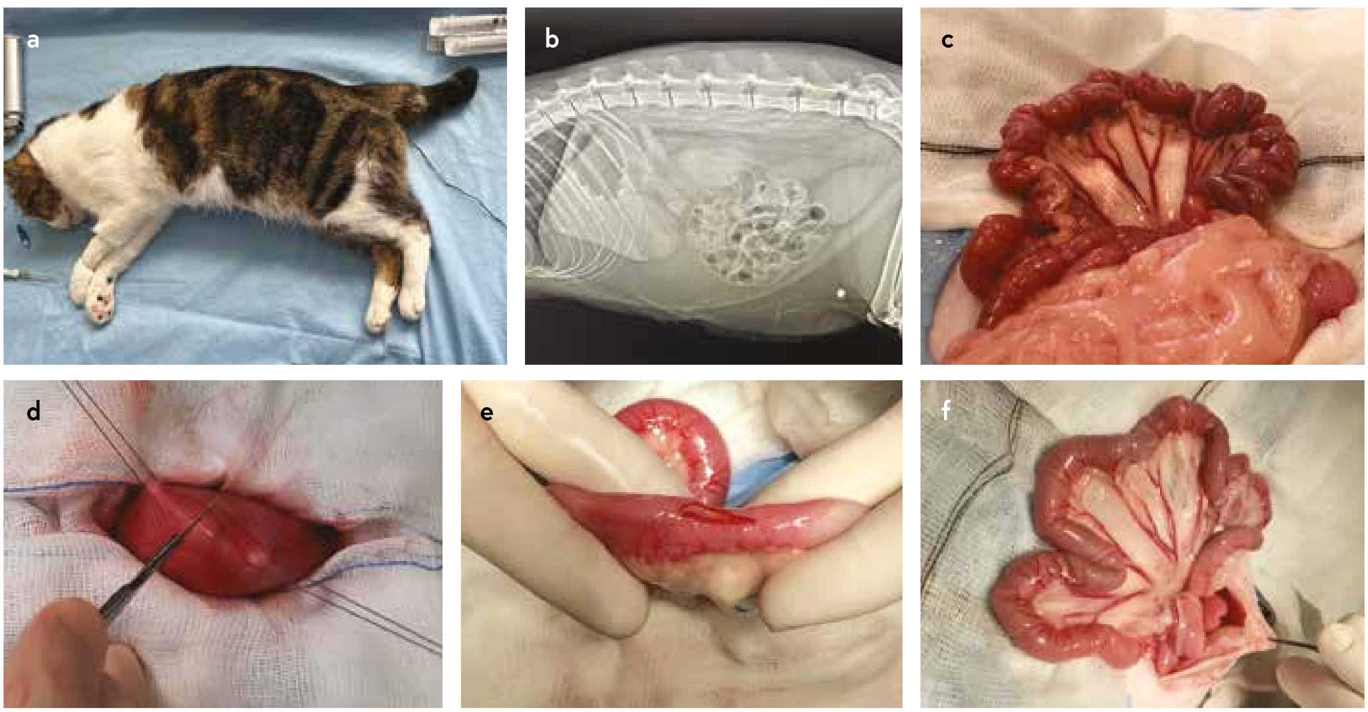



Figure 11.49 Linear foreign body in a cat. (a) The patient presented with kyphosis, and a linear foreign body was visible from the anus. (b) Radiography revealed intestinal plication. (c) Intraoperative image of small intestinal plication secondary to the foreign body. (d,e) Gastrotomy and enterotomy to release the anchor point of the foreign body. (f) Resolution of intestinal plication is observed.

8. After removing the piece of string, the mesenteric side of the intestine is evaluated for perforations.
9. If no perforations are found, the enterotomy incisions can be sutured (see "Enterotomy" section above).
10. If perforations are present, a section of intestine will need to be resected and anastomosed (see "Enterectomy" section above).
11. The abdomen is copiously lavaged and closed routinely.

### Postoperative management

After surgery, correction of fluid, electrolytes, and acid–base disturbances should be continued. If peritonitis was present, it should be treated with antibiotics and an abdominal closed-suction drain placed (see Chapter 16). If the patient is not vomiting, water and food can be offered 12 hours after anesthetic recovery. Appropriate analgesia should be provided.

### Outcome

The prognosis after surgical retrieval of gastric foreign bodies is excellent. For intestinal foreign bodies, the prognosis is generally good, although it can become more complicated if there is necrotic tissue or septic peritonitis. The prognosis for cats with linear foreign bodies is good, with perforations being rare but increasing the risk of mortality if present. The prognosis for dogs with linear foreign bodies is guarded, as the likelihood of perforation and death is higher than in cats. Intestinal resection and anastomosis are required in more than 40% of dogs. Septic peritonitis following small intestinal surgery has been reported to occur in 7%–16% of cases, and factors such as the presence of peritonitis, intestinal foreign bodies, hypoalbuminemia, use of blood products, and delayed enteral feeding have been identified as possible predictors of GI leakage.[30]

## Intussusception

Intestinal intussusception is a relatively common GI disorder in dogs and cats. It is characterized by the telescoping and invagination of one segment of the intestine (intussusceptum) into the lumen of an adjacent segment of intestine (intussuscipiens).[33] Intussusception is believed to be caused by changes in intestinal motility, often triggered by other conditions such as inflammation, infection (bacterial, parasitic, viral), neoplasia, foreign body, and surgery. The most frequently reported types of intussusception are ileocolic in dogs[33–35] and jejunojejunal in cats.[36] Imaging may be required to confirm the diagnosis. Appropriate emergency stabilization and surgical intervention are typically necessary.

### Clinical presentation and diagnosis

The most common clinical signs of intussusception include anorexia, lethargy, vomiting, bloody diarrhea, and abdominal pain.[33–35] The severity and type of clinical signs partially depend on patient factors, the duration of the intussusception, and whether the obstruction is complete or incomplete.[33–35] Common physical examination findings associated with intussusception include dehydration, abdominal pain, hypothermia (in cats), presence of an abdominal mass, intestinal thickening, or distension.[34,36] While radiography may be a good initial screening test for GI disease, it is not a reliable method for diagnosing intussusception.[33] Ultrasound is the preferred diagnostic imaging modality due to its high specificity (97.8%), sensitivity (100%), and accuracy (98.4%).[37] Ultrasonographic findings typically include concentric rings in the transverse section (Fig. 11.50), forming a target-like structure consisting of a hyperechoic or anechoic center surrounded by multiple hyper- and hypoechoic concentric rings. Finally, careful attention should be paid to find or rule out the possible cause of intussusception to improve the success of treatment and avoid recurrence.

### Treatment

Although some intussusceptions may resolve spontaneously, or after analgesic premedication and general anesthesia, definitive treatment generally involves surgery. Following appropriate patient stabilization, an abdominal exploratory laparotomy is warranted. The surgical technique is dictated by intraoperative findings and includes manual reduction or en bloc resection and anastomosis of the intussusception.

**Figure 11.50** Ultrasound image of an intestinal intussusception showing concentric rings in the transverse section.

## Surgical treatment

1. A midline celiotomy approach is made (see Chapter 3).
2. Complete assessment of the GI tract should be performed. In some cases, spontaneous resolution of intussusception is possible.
3. After identifying the intussusception, manual reduction with very gentle traction on the intussusceptum is attempted (Fig. 11.51; Video 11.26).
4. Resection and anastomosis are recommended when portions of the intestine are likely to be necrotic, nonviable, or not reducible (see "Enterectomy" section above) (Fig. 11.52; Video 11.27). Subjective criteria for evaluating intestinal viability include intestinal wall thickness, intestinal color (Fig. 11.53), and the presence of peristalsis (pinch test) and vascular pulsation.
5. In selected cases, an enteroplication technique may be performed to reduce the incidence of future recurrences. However, it should be considered that a study investigating the complications and recurrence rates in 35 dogs with intussusception found no significant differences in the rate of recurrence between patients who did or did not undergo en-

**Figure 11.51** Intraoperative image of an intestinal intussusception in a dog, showing the intussusceptum (white arrow) and the intussuscipiens (black arrow).

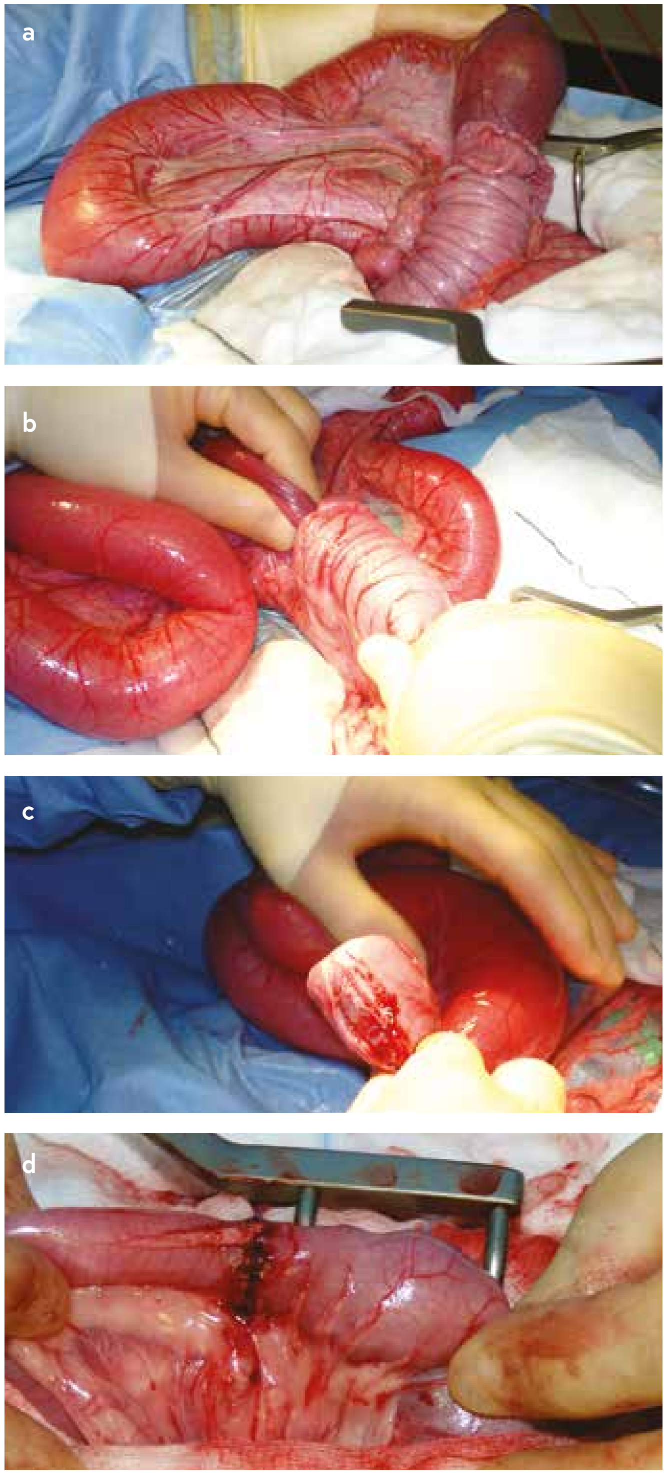



**Figure 11.52** (a) Intestinal intussusception in a dog. (b) Manual reduction. (c) Intestinal antimesenteric edge laceration. (d) Enterectomy.

Video 11.26. Manual reduction of an intestinal intussusception.

Video 11.27. Resection and functional end-to-end anastomosis with Endo GIA of a nonreducible intestinal intussusception in a cat.

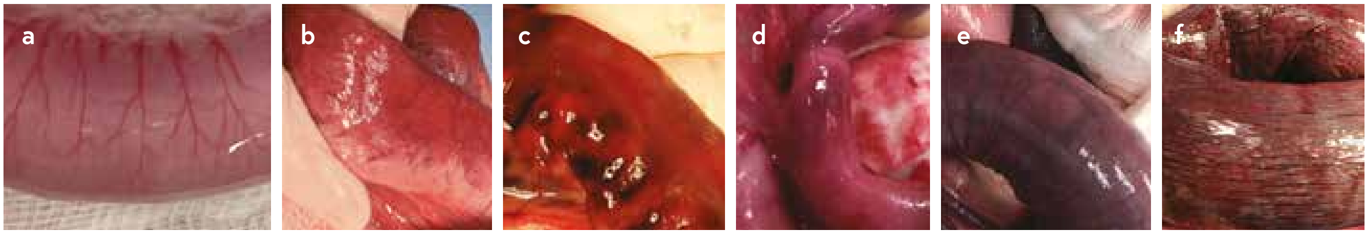



Figure 11.53 Assessment of intestinal viability based on color, ranging from (a) normal viable to (f) nonviable necrotic.

Figure 11.54 Enteroplication of the small intestine.

teroplication. Moreover, life-threatening complications related to enteroplication, such as strangulation and obstruction, were observed.[38,39]

a. The small intestine is arranged in gentle loops side by side from the duodenocolic ligament to the level of the ileum.
b. Adjacent loops of intestine are sutured together midway between the mesenteric and antimesenteric borders with simple interrupted sutures, engaging the submucosa (Fig. 11.54).

6. For ileocolic intussusception associated with cecal inversion, the following treatment techniques are possible:
   - Manual reduction.
   - Resection and anastomosis of necrotic, nonviable, or not reducible sections (see "Enterectomy" section above).
   - Antimesenteric colotomy to facilitate reduction of the intestine and cecum, followed by typhlectomy of the necrotic/nonviable cecum using a stapler or blade incision and suturing of the colon (Fig. 11.55).
7. Histopathologic examination of the resected intestinal section should be performed.

## Postoperative management

After surgery, correction of fluid, electrolyte, and acid–base disturbances should be continued. If peritonitis is present, it should be treated with antibiotics and an abdominal closed-suction drain can be placed (see Chapter 16). If the patient is not vomiting, water and food can be offered 12 hours after anesthetic recovery.

## Outcome

The prognosis for animals that have undergone uncomplicated reduction or resection of small intestinal intussusception is good.[34] Recurrence rates range from 3% to 27%.[38,39] Recurrence is usually noted within 3 days of surgery but has been reported up to 3 weeks after surgery.[33] It appears that recurrence may be more frequent in patients undergoing manual reduction rather than resection and anastomosis, but no other specific risk factors for recurrence have been identified.[39] Enteroplication may decrease recurrence rates, but it can be associated with serious complications.[38,39]

# Gastric dilatation–volvulus

Gastric dilatation–volvulus (GDV) is a life-threatening disease in dogs that occurs most commonly in large-breed, deep-chested animals. It involves the trapping of air within the lumen of the stomach, which rotates on its axis, resulting in a rapid increase of intraluminal pressure, gastric malpositioning, compression of the diaphragm and caudal vena cava, and impaired respiratory and cardiovascular function. The exact sequence of events—whether the stomach rotates first or distension develops first—remains uncertain, and there is supportive evidence for both theories.[40–43] Although various risk factors have been studied, the etiology and pathophysiology of GDV are not completely understood. Specific risk factors identified in dogs include purebred large or giant breed, high thoracic depth:width ratio, history of GDV in a first-degree relative, feeding few meals per day, rapid eating, aggressive or fearful temperament, small food particle size, increased hepatogastric ligament length, and exercise or stress after a meal.[40–44]

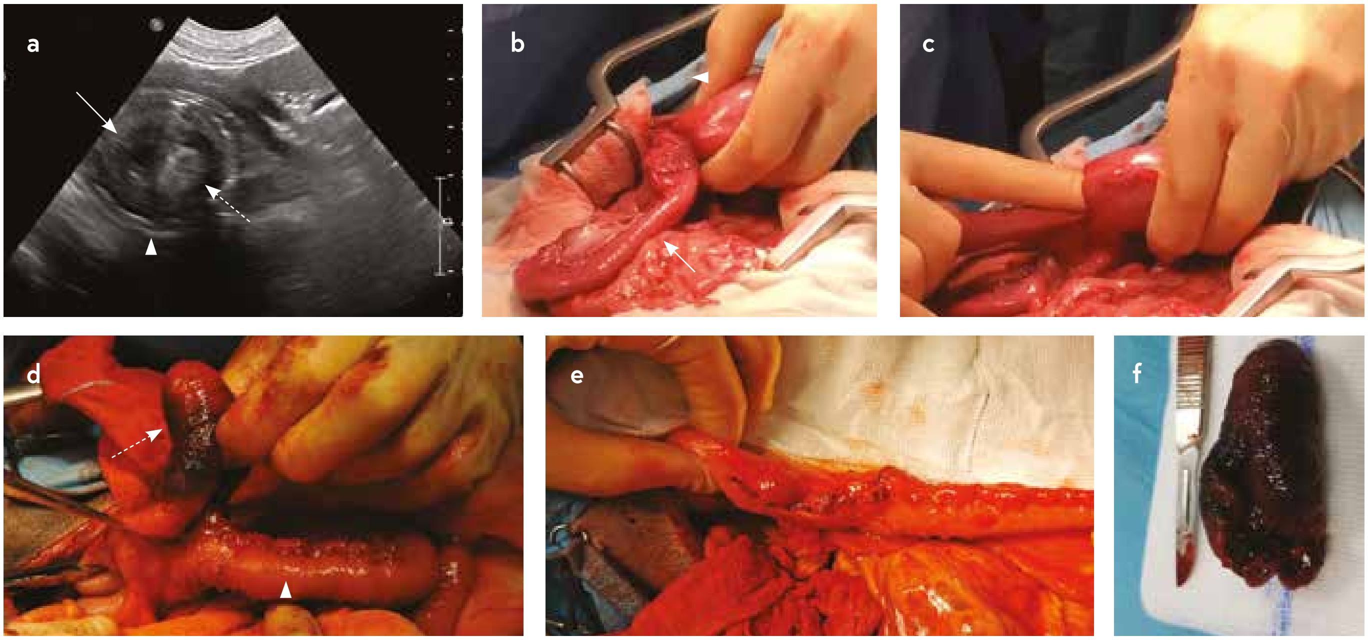



Figure 11.55 (a) Ultrasound image in transverse section showing cecal inversion and ileocolic intussusception (colon, white arrowhead; ileal intussusceptum, white arrow; inverted cecum, dashed white arrow). (b) Inverted cecum in association with ileocolic intussusception (colon, white arrowhead; ileum, white arrow). (c) Manual reduction failed to resolve the intussusception. (d) Antimesenteric proximal colotomy for reduction of the intussusception. Note the inverted necrotic cecum (dashed white arrow). The ileum was healthy, with minimal serosal inflammation (white arrowhead). (e) After typhlectomy, the colon was sutured using a simple interrupted pattern. (f) Necrotic cecum after excision.

The pathophysiology of GDV is complex and involves multiple organ systems. Gastric distension leads to increased abdominal pressure and decreased venous return, resulting in cardiogenic shock. Pressure on the diaphragm hampers inspiration, leading to decreased oxygen delivery. Portal hypertension causes venous stasis, mucosal damage, bacterial translocation through the GI tract, and decreased clearance of bacteria and endotoxins. Increased intragastric pressure reduces blood flow in the gastric wall, leading to gastric wall necrosis. After repositioning the stomach and restoring blood blow, reperfusion injury can occur.[40–44]

## Clinical presentation and diagnosis

Dogs with GDV commonly present with clinical signs of gastric distension, nonproductive retching, hypersalivation, restlessness, anxiousness, and stretching. Sign severity depends on the duration of the condition and the stage of shock at the time of presentation. Physical examination findings vary based on disease severity and shock stage. Radiographs with the dog in right lateral recumbency are usually used to confirm the diagnosis. Pylorus malpositioning, with gas entrapped, can be visualized as a typical double bubble or reverse C appearance (Fig. 11.56). Laboratory findings are primarily related to hypotension and its effects. Hemoconcentration, a stress leukogram, and thrombocytopenia may be observed. Hepatocellular damage can lead to increased alanine aminotransferase (ALT) and total bilirubin levels. Azotemia with elevated blood urea nitrogen (BUN) and creatinine levels may be present. Electrolyte disturbances and coagu-

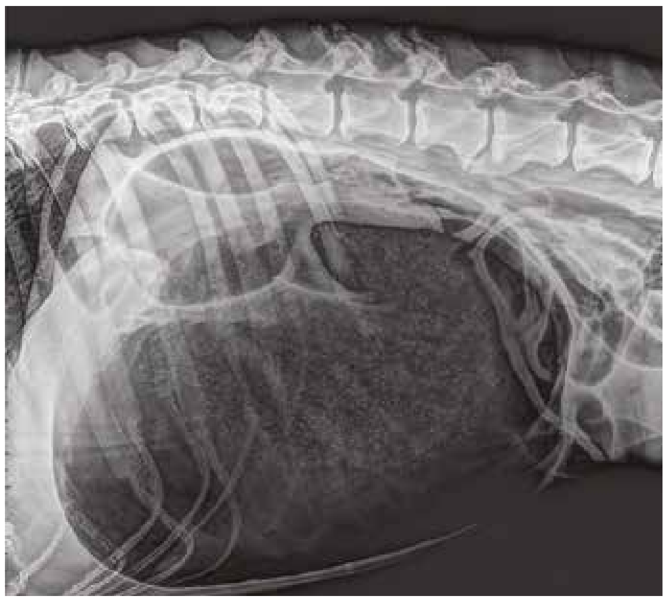


Figure 11.56 Right lateral abdominal radiograph showing gastric dilatation–volvulus. Note the characteristic double bubble or reverse C appearance caused by dorsal displacement of the pylorus.

lation abnormalities can vary among patients. Plasma lactate levels are usually increased in patients with GDV and can potentially serve as a prognostic indicator. Electrocardiographic abnormalities (cardiac ventricular arrhythmias) have been reported in 40%–70% of dogs with GDV.[40–44]

## Treatment

Medical management of GDV is aimed at stabilizing the patient before surgery and should be initiated simultaneously with diagnostics. Treatment focuses on restoring perfusion through fluid therapy and on providing analgesia. Venous access is established through at least two large-bore catheters in either the cephalic or jugular veins to facilitate rapid fluid resuscitation. Intravascular volume expansion and maintenance are achieved using a crystalloid solution (e.g., sodium chloride or lactated Ringer's solution at a rate of 45–90 mL/kg/h) combined with a colloid (e.g., hypertonic saline 7% at a dose of 4–5 mL/kg over 5–15 minutes, or hydroxyethyl starch at a dose of 10–20 mL/kg). Systemic parameters such as blood pressure and heart rate should be monitored to assess the response to fluid therapy. Oxygen supplementation is provided using flow-by methods, and the electrocardiogram is monitored for cardiac arrythmias, which can be treated accordingly.[40–44] Broad-spectrum antibiotics and intravenous analgesia, such as methadone, are administered.

Gastric decompression is performed after initiating fluid resuscitation using either orogastric intubation or percutaneous placement of an over-the-needle catheter or trocar into the gas-distended stomach. Most animals tolerate orogastric intubation; however, general anesthesia and endotracheal intubation is strongly recommended to reduce the risk of aspiration pneumonia during gastric decompression. A large-diameter tube with end and side holes is premeasured from the nose to the last rib. The tube is lubricated and passed through the mouth, and the dog is stimulated to swallow the tube into the esophagus. The tube should not be advanced beyond the premeasured and marked point. If passing the tube through the rotated caudal esophageal sphincter is not possible, decompression can be achieved by percutaneous placement of a large-bore needle or catheter (14–16 gauge) caudal to the ribs in the most distended and tympanic area.[41]

The overlying skin should be shaved, cleaned, and disinfected before the procedure.

Once the patient is stabilized, anesthesia is induced for surgical correction of the malpositioned stomach followed by gastropexy. Generally, surgery is initiated as soon as possible; however, a recent study suggested that surgery can be delayed with adequate supportive therapy in selected cases.[45]

### Surgical technique

1. A cranial midline celiotomy is performed (see Chapter 3).
2. Identification of the malpositioned and rotated stomach is facilitated by the presence of omentum covering the ventral surface (Fig. 11.57).
3. Prior to derotation, it is essential to achieve full gastric decompression. A nonsterile assistant can pass an orogastric tube through the patient's mouth, and the surgeon can manipulate the tube as it passes from the esophagus into the cardia. This maneuver allows for the emptying of fluid and food from the stomach, facilitating the derotation process.
4. Derotation is performed by locating and retracting the pylorus toward the right side of the abdomen while simultaneously pushing the stomach body dorsally with the other hand. Palpation of the gastroesophageal junction aids in determining whether the stomach is completely derotated. The orogastric tube can also assist in identifying the gastroesophageal junction.
5. Following derotation, a thorough abdominal examination should be performed to identify any additional abnormalities and allow adequate time for reperfusion of the stomach and spleen. Assessment of gastric and splenic viability is crucial and involves visual and tactile inspection. The dorsal side of the stomach wall should also be inspected. Subjective

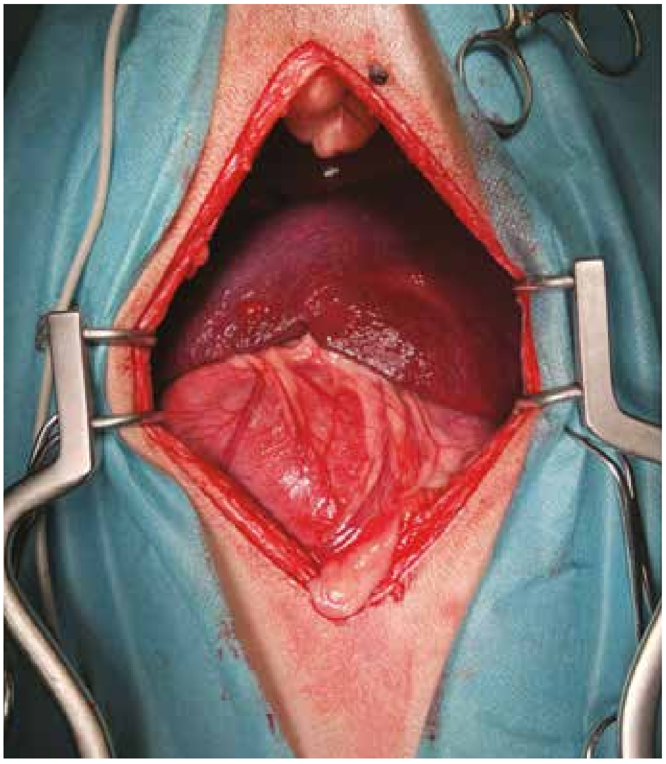


**Figure 11.57** Intraoperative image of a rotated stomach covered by omentum. Image courtesy of Krista van Blokland-Post.

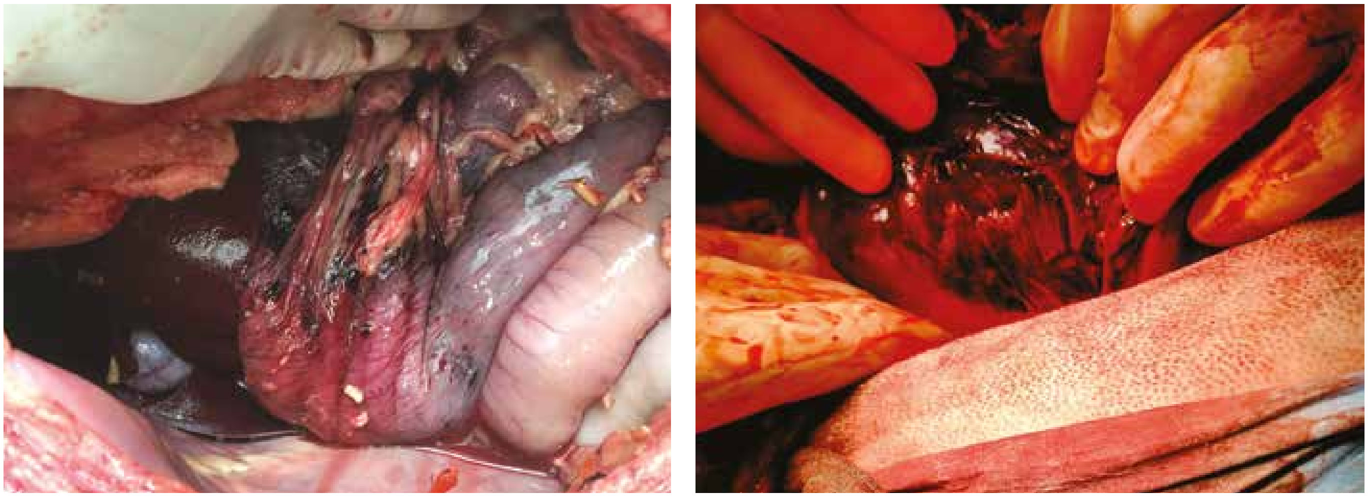


Figure 11.58 Intraoperative images showing gastric necrosis in a patient with gastric dilatation–volvulus. Images courtesy of Lucinda van Stee.

criteria for evaluating stomach viability include gastric wall thickness, serosal surface color, evidence of serosal capillary perfusion, and the presence of peristalsis. Devitalized stomach wall appears thin, gray, or green and should be resected until bleeding occurs (Fig. 11.58).

6. If thrombosis is detected in the splenic vessels, splenectomy may be necessary.
7. Partial gastrectomy may be warranted. The stomach is isolated with moistened swabs to prevent leakage and stay sutures are placed around the proposed resection site. Vessels to the affected area are ligated. The affected tissue is sharply excised with scissors or a scalpel blade, ensuring that the edges bleed actively. The defect is closed using two layers of 2-0 or 3-0 absorbable sutures or a stapling device.
8. Another technique involves invaginating the affected portion of the stomach by folding inward the affected area and suturing healthy tissue over it using two layers of a simple continuous or inverting suture pattern (2-0 or 3-0 absorbable monofilament; e.g., polydioxanone). Although this technique is easier and quicker, it may result in significant melena up to 2 weeks following the procedure.
9. A gastropexy should be performed to create a permanent adhesion between the pyloric antrum and the right abdominal wall. Several gastropexy techniques have been described, including incisional gastropexy, belt-loop gastropexy, modified belt-loop gastropexy, circumcostal gastropexy, modified circumcostal gastropexy, incorporating gastropexy, tube gastropexy, and gastrocolopexy (see below). To ensure a durable adhesion, the muscularis of the stomach must be in contact with the muscles of the abdominal wall. The authors prefer incisional gastropexy due to its simplicity and efficiency.
10. Routine closure of the abdomen is performed.

## Surgical technique: Gastropexy

### *Incisional gastropexy (Video 11.28)*[43,44,46]

1. A 4–5 cm seromuscular incision is made in the antrum between the vasculature of the greater and lesser curvatures, without penetrating the gastric lumen (Fig. 11.59).

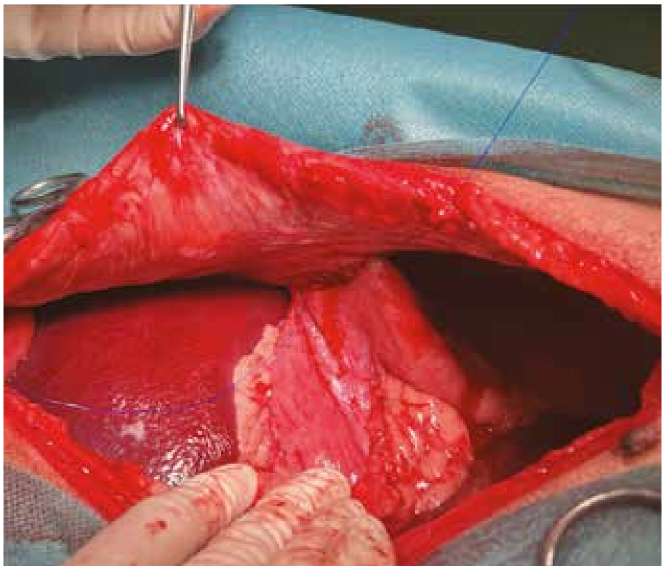


Figure 11.59 Incisional gastropexy between the pyloric antrum and right abdominal wall. Image courtesy of Krista van Blokland-Post.

Video 11.28. Incisional gastropexy.

2. The stomach is manually apposed against the right abdominal wall to estimate the anatomical position of the stomach.
3. A second incision (in a craniocaudal or ventrodorsal direction, as the surgeon prefers) is created on the right abdominal wall at the appropriate site through the peritoneum and transversus abdominis muscle, staying 2–4 cm caudal to the last rib to prevent pneumothorax. The abdominal wall can be lifted with towel clamps or Allis tissue forceps to facilitate appropriate dorsal placement of the incision.
4. The incisions are approximated with two continuous suture lines of 2-0 or 0 absorbable or nonabsorbable monofilament. To aid visualization, the dorsal suture line is closed first (Fig. 11.60).

### *Belt-loop gastropexy*[43,44,46]

1. A seromuscular flap is created in the antrum region by making two parallel 4 cm long incisions 3 cm apart, connecting them in the most cranial aspect.
2. The flap is undermined from the underlying mucosal layer.
3. Two 5 cm long incisions are created in the abdominal wall through the peritoneum and transversus abdominis muscle, 3 cm apart.
4. A tunnel is made between these incisions by undermining the tissue in between.
5. A stay suture is placed in the free end of the flap, and the flap is passed through the tunnel.
6. The flap is sutured back to the site where it was elevated using 2-0 or 3-0 monofilament suture in a simple interrupted or continuous pattern.

### *Modified belt-loop gastropexy (Fig. 11.61; Video 11.29)*[47]

1. Two parallel incisions (4–5 cm long and 2 cm apart) are made through the peritoneum and transversus abdominis muscle on the right abdominal wall, 2 cm caudal to the costal arch and 5 cm from the linea alba. The incisions should be oriented obliquely ventrodorsally and craniocaudally.
2. A tunnel is created between these incisions by undermining the tissue in between.
3. After passing Allis tissue forceps through the tunnel from caudal to cranial, a seromuscular fold of the antral wall is grasped.
4. The forceps with the fold are pulled back through the tunnel, and the fold is sutured to both the greater curvature of the stomach and the cut edge of the abdominal wall with 0 or 2-0 nonabsorbable mono-

Video 11.29. Modified belt-loop gastropexy. Video courtesy of Luca Formaggini.

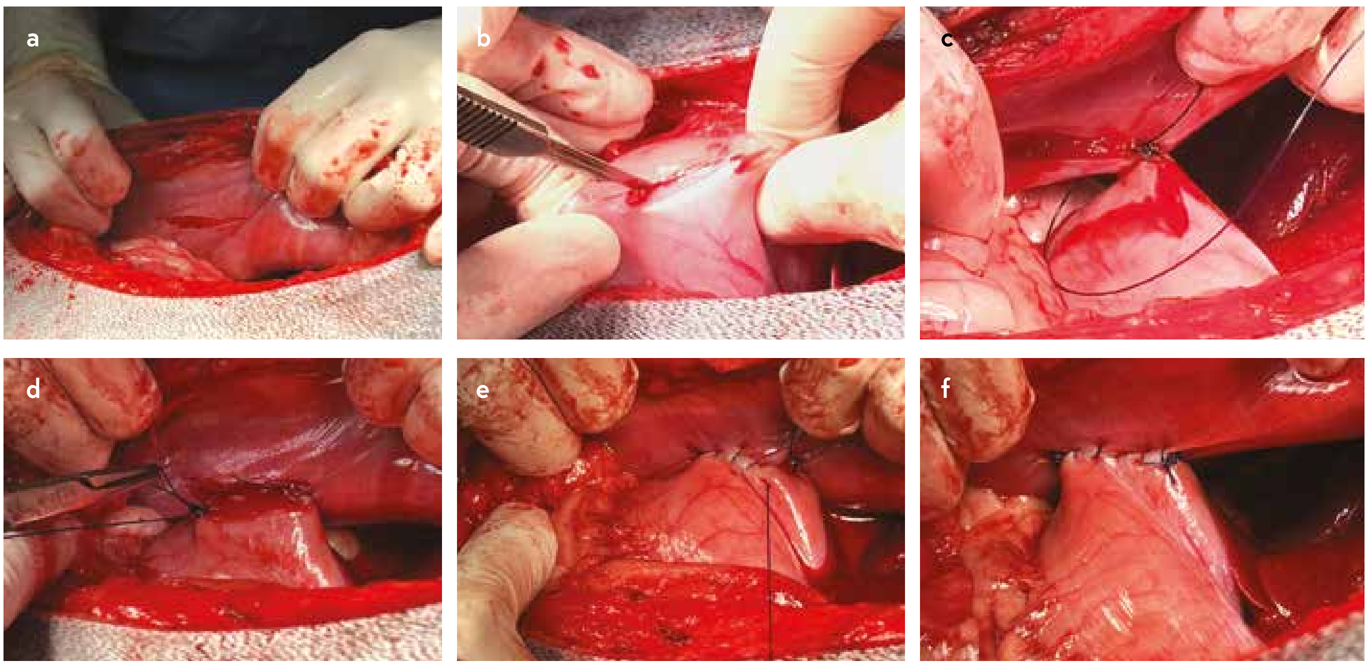



**Figure 11.60** Incisional gastropexy. (a) Creation of a 4–5 cm incision in the right abdominal wall, 2–3 cm caudal to the last rib. (b) Creation of a seromuscular incision in the pyloric antrum. (c–f) The incisions are apposed with two continuous suture lines using absorbable or nonabsorbable material.

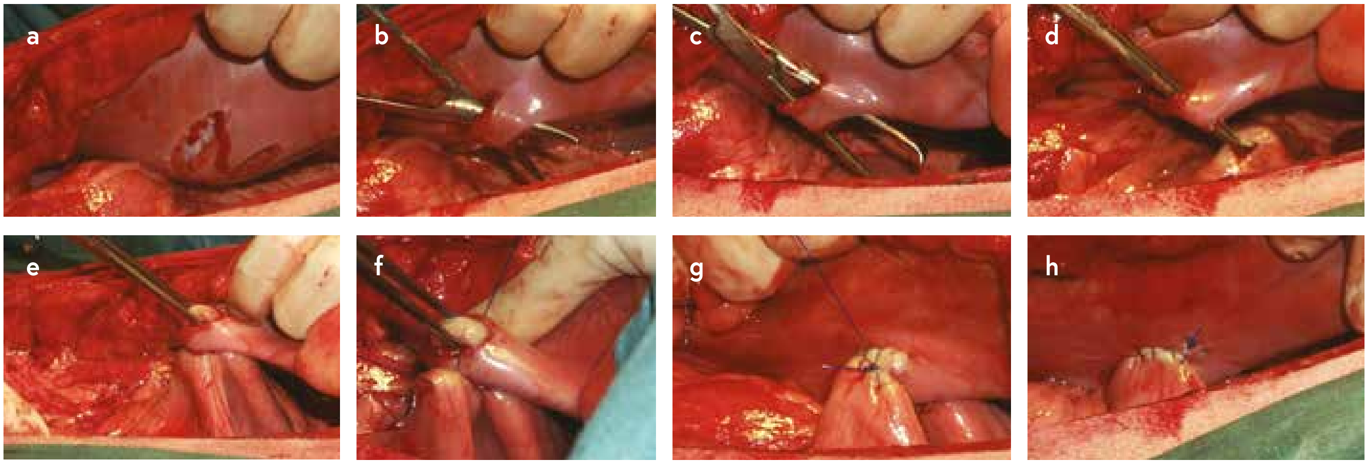



Figure 11.61 Modified belt-loop gastropexy. (a) Creation of two parallel incisions on the right abdominal wall. (b) Creation of a tunnel between the incisions. (c,d) Passage of Allis tissue forceps through the tunnel to grasp a seromuscular fold of the pyloric antrum. (e–h) Pulling back of the forceps and fold through the tunnel and suturing of the fold to the greater curvature of the stomach and the cut edge of abdominal wall in a continuous pattern. Images courtesy of Luca Formaggini and *Journal of the American Animal Hospital Association* 2018; 54(5):239–245.

filament material in a continuous pattern from caudal to cranial. Each bite should include the serosa and muscularis of the stomach, the serosa and muscularis of the fold, the fascia and muscular tissue of the transversus abdominis muscle, and the peritoneum.

### *Circumcostal gastropexy*[43,48] *and modified circumcostal gastropexy*[49]

1. A seromuscular flap of stomach wall is created as described before. The modified technique involves the use of a seromuscular fold of the antral wall (Fig. 11.62).[49]
2. A 5–6 cm incision is made over the 11th or 12th rib on the right side, at the level of the costochondral junction.
3. The tissue around the rib is bluntly dissected, staying in close contact to the rib. Care should be taken to avoid creation of a pneumothorax or rib fracture.
4. A stay suture is placed in the free end of the flap or fold of the antral wall (modified technique) and the flap is passed from cranial to caudal through the tunnel around the rib.
5. The flap is sutured back to the site where it was elevated in a simple interrupted or continuous pat-

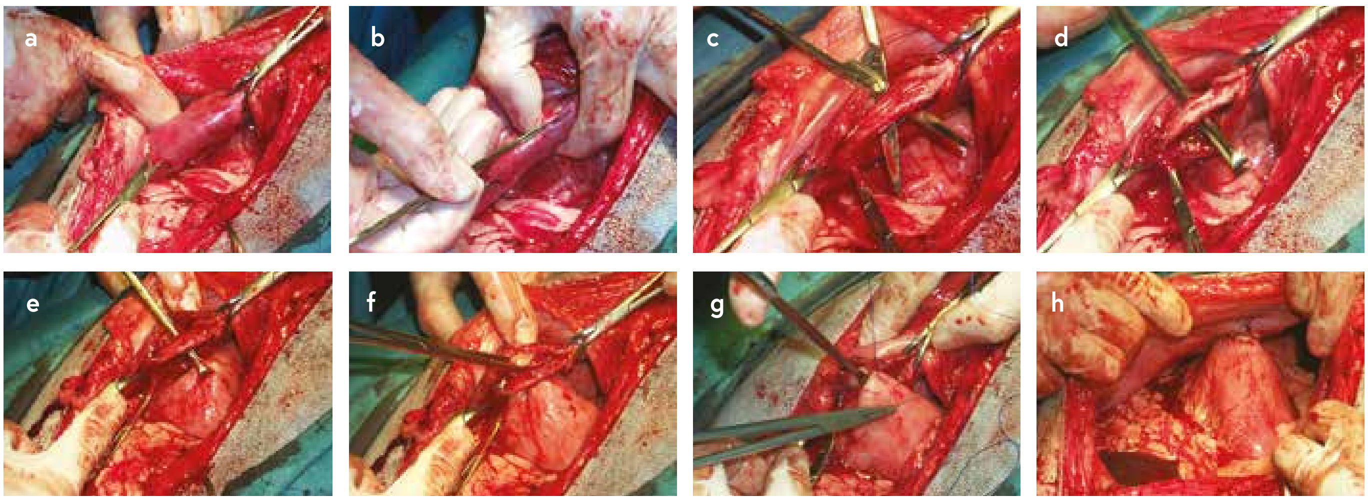



Figure 11.62 Modified circumcostal gastropexy. (a) Isolation and visualization of the last palpable rib. (b) Incision over the isolated rib using a scalpel blade. (c) Creation of a 3 cm wide tunnel under the rib by sharp dissection with a scalpel or scissors. (d) Passage of Allis tissue forceps from lateral to medial through the tunnel under the rib. (e) Grasping of a 3 cm wide fold of stomach in the region of the pyloric antrum using the forceps. (f) Pulling of the fold through the tunnel and wrap around the rib. (g,h) After creating three or four incisions (each 1 cm) through the serosa and muscularis on each side of the fold, the suture is passed through the stomach, the gastric fold, and the abdominal wall. Images courtesy of Luca Formaggini.

tern using 2-0 or 3-0 monofilament. If the modified technique is used, multiple sutures are applied involving the serosa and muscularis of the stomach, the serosa and muscularis of the fold, the fascia and muscular tissue of the transversus abdominis muscle, and the peritoneum.

### *Incorporating gastropexy*[43,50]

Upon abdominal closure, approximately 5 cm of gastric wall of the pyloric antrum should be included in the cranial linea alba closure, with absorbable suture material (2-0 or 3-0 monofilament). This technique is not recommended if other techniques are available due to the high risk of complications (adhesion formation and risk of gastric entry in future surgeries).

### *Gastrocolopexy*[43,48]

The transverse colon is brought in apposition with the greater curvature of the stomach. This technique is less recommended due to the possible risk of recurrence.

1. The greater omentum is tucked dorsolateral to the transverse colon.
2. The surfaces of the stomach and colon are scarified at the proposed pexy site with a number 11 scalpel blade.
3. 10–15 cm of stomach wall is sutured to the colon wall with interrupted polypropylene sutures, spaced approximately 0.5 cm apart, including the serosal and muscular layers only.

### *Tube gastropexy*[51]

1. A skin stab incision is created 3–4 cm caudal to the last rib and lateral to the ventral midline.
2. Using mosquito forceps, the tip of a tube (de Pezzer mushroom-tipped catheter or Foley catheter, 24 or 26 gauge) is passed into the abdominal cavity through the incision.
3. A purse-string suture is preplaced in the pyloric antrum (2-0 absorbable material). A stab incision is made into the stomach through the purse-string suture, and the catheter tip is placed into the lumen. The purse-string suture is tied tightly around the catheter; if using a Foley catheter, the bulb is inflated with saline.
4. Multiple absorbable monofilament pexy sutures (4–5 simple interrupted sutures) are preplaced and tightened around the gastric and abdominal wall incisions.
5. The pexy site is omentalized.
6. The mushroom tip or balloon is drawn up to the stomach wall, and the tube is secured on the outside of the skin with a finger-trap suture (see Chapter 5).
7. The gastropexy tube should remain in place for 10–14 days. The tube is removed by traction and the stoma left to heal by secondary intention.

## Postoperative management

After surgery, fluid therapy should be continued to maintain the hydration status and correct any remaining electrolyte imbalances. If the dog recovers well, fluid therapy can be discontinued after 24 hours.[46] Continuous electrocardiography is used to monitor the development of arrhythmias, as ventricular arrhythmias can occur up to 72 hours after surgery. If needed, arrhythmias are treated medically with lidocaine or procainamide. Arterial blood pressure should be monitored, especially in patients with septic shock before surgery or in cases that required gastrectomy, and supported with inotropes to maintain mean arterial pressure above 60 mmHg.[43,44,52]

Parameters such as pulse rate and quality, respiratory rate, temperature, mucous membrane color, capillary refill time, and evidence of abdominal distension should be closely monitored to detect complications at an early stage.[46,52,53]

Postoperative analgesia should be provided with opioids, such as morphine, buprenorphine, methadone, or fentanyl. Additionally, constant-rate infusions of lidocaine or ketamine can be used for adjunctive analgesia. Nonsteroidal anti-inflammatory drugs should be avoided to prevent GI and renal side effects,[50] but they can be prescribed for further postoperative analgesia after discharge once the dog has fully recovered from surgery and remains stable.[46] Feeding can be resumed 12–24 hours postoperatively. Histamine ($H_2$) receptor blockers and sucralfate can be used in case of gastric mucosal damage or partial gastrectomy.[40,43,46,52]

## Outcome

Complications reported after GDV surgery include prolonged hypotension, cardiac arrhythmias, ileus or abnormal gastric motility, vomiting and aspiration pneumonia, peritonitis, sepsis, and disseminated intravascular coagulation, and additional treatment or reoperation may be necessary.[43,44,46,53]

Mortality rates of GDV are around 10%–20%, and approximately 80% of the surgically treated cases survive to discharge.[40,43,54] Negative prognostic factors include hyperlactatemia, the need for splenectomy or partial gastrectomy, gastric perforation and sepsis, increased duration of clinical signs before hospital admission, hypotension, and arrhythmias.[40,43,53] Recurrence rates are similar between surgical techniques, with approximately 8% for incisional gastropexy,[55] 9% for circumcostal gastropexy, and 20% for gastrocolopexy.[48]

# Rectal prolapse

Rectal prolapse can be partial or complete. In the former, also known as anal prolapse, only the anal mucosa protrudes through the anal orifice. In the latter, a cylindrical mass comprising all layers of the rectum circumferentially protrudes through the anal orifice.[56] Spontaneous resolution is unlikely due to swelling caused by edema formation. There is a higher incidence of rectal prolapse in younger animals, particularly in those with underlying GI disease such as parasites. Prolapse commonly occurs secondary to tenesmus, which may be due to underlying GI or urogenital disease or as a result of surgery.[56,57]

## Clinical presentation and diagnosis

Patients with partial rectal prolapse exhibit red and swollen mucosa protruding from the anus after defecation. Animals with complete rectal prolapse present with an elongated, cylindrical mass protruding from the anus (Fig. 11.63). Initially, the protruding tissue appears swollen and red, but laceration, hemorrhage, necrosis, and ulceration can occur due to trauma and/or self-mutilation. To differentiate rectal prolapse from prolapse of an intussusception of the colon or small intestine, a finger or blunt instrument can be gently passed between the prolapse and the anus. In the case of rectal prolapse, the instrument cannot be passed because the prolapsed tissues converge with the mucocutaneous junction of the anus. Conversely, in cases of intussusception, the instrument can easily be passed 5–7 cm between the rectal wall and the prolapsed tissue (Fig. 11.64).[56,57] The diagnosis of rectal prolapse is relatively straightforward, but identifying the underlying cause can be more challenging. However, it is essential to investigate underlying diseases to achieve a permanent cure and reduce the likelihood of recurrence.

## Treatment

In addition to possible diagnostic workup and treatment of the underlying cause, the prolapsed tissue should be treated as an emergency. Manual reduction is often achievable when vital rectal tissue is present. However, if the tissue is necrotic or devitalized, rectal resection and anastomosis are required.

### Surgical technique: Manual reduction

1. General or epidural anesthesia is required for this procedure.
2. The mucosal surface is cleaned with a warm isotonic solution.
3. The protruding mass is lubricated, and gentle pressure is applied for reduction.
4. After reduction, an appropriately sized test tube or syringe case is temporarily placed in the anal orifice, and a 3-0 or 2-0 nonabsorbable monofilament pure-string suture is inserted at the mucocutaneous junction to narrow the anal orifice (Fig. 11.65).
5. The purse-string suture is tightened sufficiently to prevent mucosal prolapse while still allowing soft feces to pass through the slightly narrowed orifice.
6. The suture is left in place for 3–5 days. The patient is fed a low-residue diet and given laxatives such as lactulose.
7. In the case of recurrence, colopexy can be performed (Fig. 11.66) (see Chapter 15).[58,59]


**Figure 11.63** (a) Complete rectal prolapse in a dog, presenting as an elongated, cylindrical mass protruding from the anus. (b,c) Rectal prolapse in another case, with hemorrhage, necrosis, and ulceration.

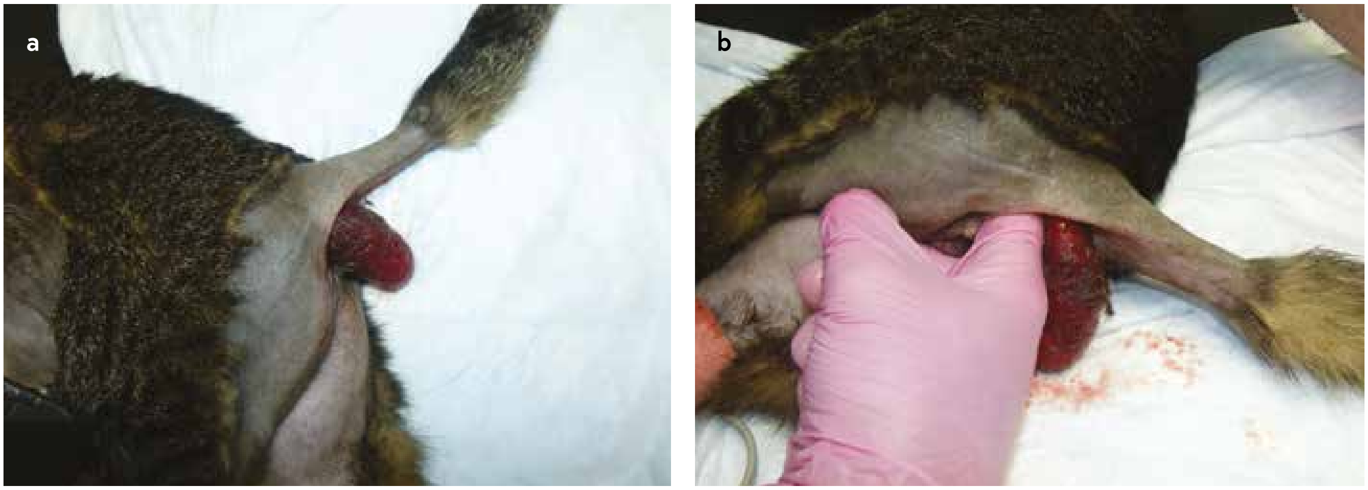


Figure 11.64 Prolapsed intestinal intussusception. Unlike in the case of rectal prolapse, a finger or the blunt end of an instrument can easily be passed between the prolapsed intussusception and the anus.

Figure 11.65 Application of a purse-string suture after manual reduction of rectal prolapse. (a) Initial 1 cm bites at the mucocutaneous junction, remaining medial to the anal sac duct opening. (b,c) Subsequent bites around the circumference of the anus, tightening the purse-string suture around an appropriately sized test tube or syringe case to reduce the anal opening to approximately one-third of its original diameter.

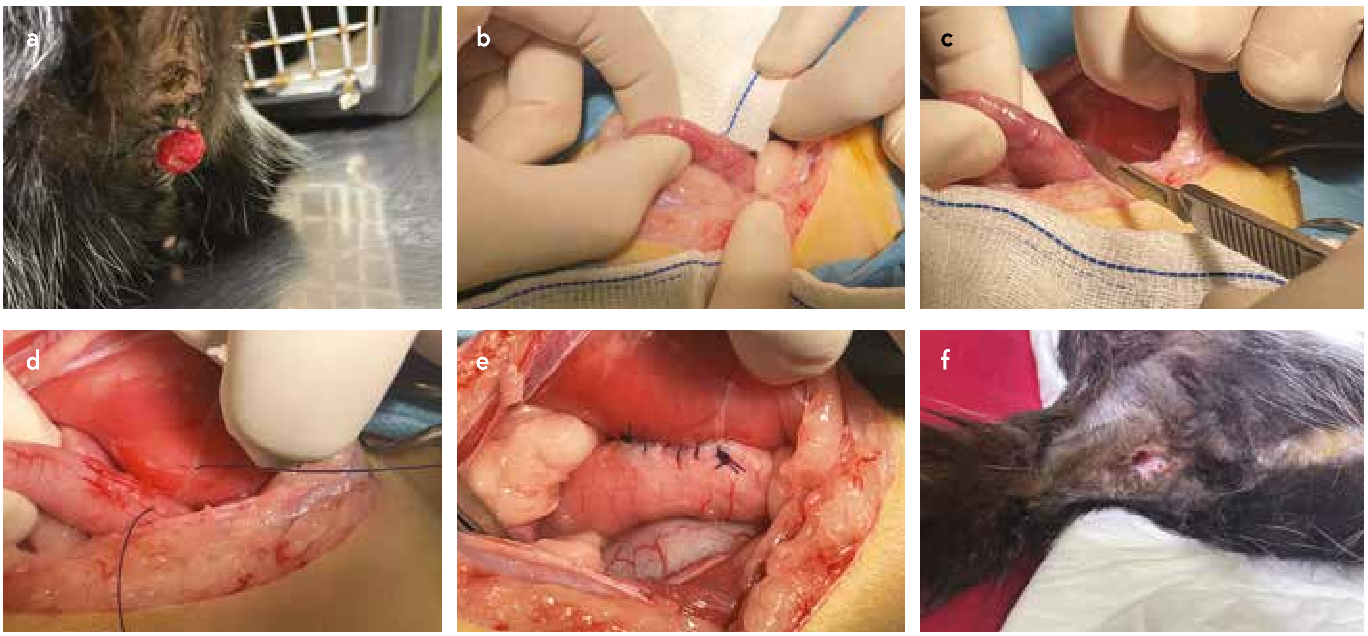


Figure 11.66 Manual reduction and colopexy in a case of recurrent rectal prolapse.

### Surgical technique: Rectal resection and anastomosis (Fig. 11.67)

1. General and epidural anesthesia are required for this procedure, as well as perioperative antibiotic therapy.
2. The patient is placed in sternal recumbency, with the pelvic limbs over a padded end of the surgery table and the tail secured in a forward position. The perineal area is surgically prepared and draped.
3. To aid suture placement and prevent contamination, a sponge or test tube can be placed into the rectum.
4. Four full-thickness stay sutures are placed in healthy tissue, spaced 90 degrees apart. These sutures should include both layers of the prolapse.
5. One-third to one-half of the prolapsed tissue is resected 1–2 cm from the anus, caudal to the stay sutures.
6. A single layer of full-thickness simple interrupted sutures, using 4-0 or 3-0 absorbable monofilament material, is used to create an anastomosis. The cut edges are sewn together, taking wide bites to ensure the submucosa is contained within the suture.
7. The remaining tissue is cut and sewn in sections.
8. The stay sutures are removed, and the everted rectum is manually reduced.

## Postoperative management

To reduce tenesmus and prevent recurrence after purse-string suture removal, periodic application of a local anesthetic to the rectal tissue has been suggested to prevent further straining. Other treatments to reduce tenesmus and prevent recurrence include anticholinergic-antispasmodic drugs such as dicyclomine and retention enemas with an anti-inflammatory drug such as hydrocortisone or mesalamine (dogs only).[56]

## Outcome

The prognosis for rectal prolapse is generally favorable with manual reduction, with or without colopexy. Complications of rectal amputation and anastomosis include incontinence, dehiscence, recurrence of the prolapse, and anorectal stricture (particularly in cats).[56,60]

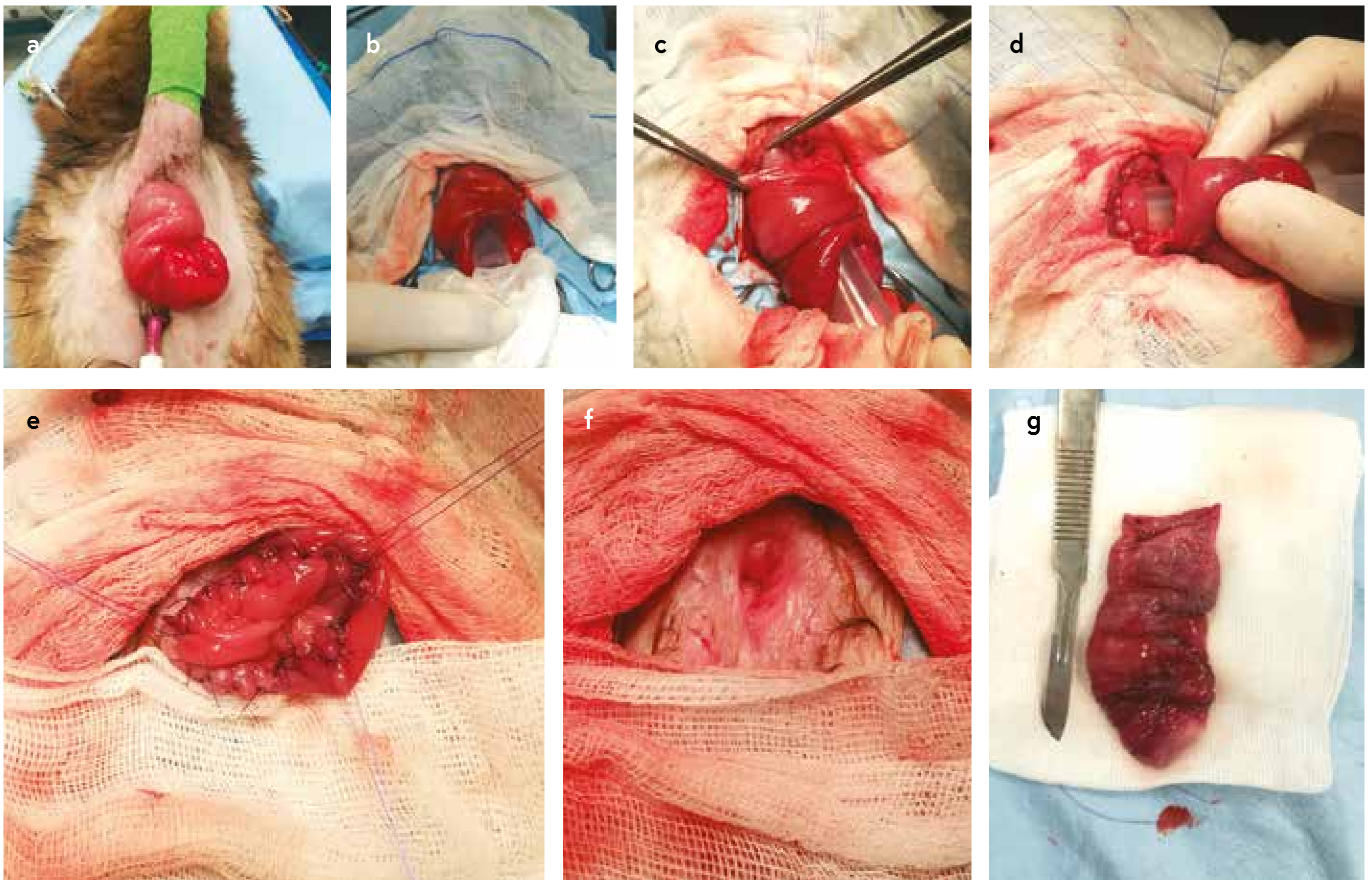



Figure 11.67 Rectal prolapse in an adult cat. (a) Preoperative appearance. (b) Placement of a test tube inside the anus to assist with suturing. Placement of full-thickness stay sutures in healthy tissue, spaced 90 degrees apart, encompassing both layers of the prolapse. (c–e) Resection and anastomosis with a single layer of full-thickness simple interrupted sutures. (f) Final appearance after resection and anastomosis. (g) Prolapsed rectal tissue following excision.

**KEEP IN MIND**

- Clinical signs vary depending on the location and degree of obstruction caused by a foreign body.
- Ultrasonography is a valuable imaging modality for detecting foreign bodies.
- Exploratory laparotomy is the most common treatment for removing foreign bodies and assessing intestinal viability.
- Proficiency in performing enterotomy and enterectomy is essential when dealing with gastrointestinal foreign bodies.
- After removing a linear foreign body, it is important to assess the affected mesenteric site for signs of perforation.
- Gastric dilatation–volvulus negative prognostic factors include hyperlactatemia, the need for splenectomy or partial gastrectomy, gastric perforation and sepsis, increased duration of clinical signs before hospital admission, hypotension, and arrhythmias.
- In case of rectal prolapse with necrotic or devitalized tissue present, rectal resection and anastomosis is required.
- It is essential to investigate underlying diseases to achieve a permanent cure and reduce the risk of recurrence when treating rectal prolapse.

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