

An atlas of gastrointestinal endoscopy in dogs and cats

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KEY POINTS

- Endoscopic examination is a valuable tool in the investigation of gastrointestinal disorders.
- A knowledge of the normal appearance of the various luminal surfaces, and the underlying anatomy, is essential.
- Generally endoscopy requires general anesthesia.
- Many gastrointestinal lesions have a polymorphic appearance – biopsy is mandatory for definitive diagnosis.
- Endoscopic examination has limitations; in particular it is not indicated in the investigation of motility disorders.

INTRODUCTION

Fiberoptic endoscopy is a noninvasive technique for evaluating the lumen and mucosa of the gastrointestinal tract. It is a fundamental method for investigation of the digestive tract, and is important in the diagnosis and prognosis of a variety of gastrointestinal disorders (1, 2). This article presents an atlas of the normal endoscopic appearance of the canine and feline gastrointestinal tracts. Certain pathological conditions are also described.

THE ENDOSCOPIC PROCEDURE

The process of endoscopic examination must follow a precisely organized sequence, so that no area is left unexplored. It must be remembered that the mucosal linings of the gastrointestinal tract are fragile, and the clinician must resist the temptation to 'push' past resistance. As the endoscope progresses through the various portions of the upper digestive tract, it is important to follow the general direction of their long axes (**Figures 1 to 13**) while at the same time using the flexible tip to inspect the entire surface. Thus, the entire mucosa of the stomach can be examined by a combination of forward movement, lateral inspection, and, finally, rotation and retroflexion of the head of the endoscope (the J maneuver).

Before endoscopic examination, the dog or cat must be fasted for 24 hours to allow ingesta to pass from the stomach and upper intestine, and in preparation for a general anesthetic. If a colonoscopy is anticipated, a 24 to 48 hour fast is desirable, supplemented by multiple enemas or oral administration of a hyperosmotic, cathartic solution. The standard procedure for an upper digestive tract endoscopy is to examine the animal in left lateral recumbency – this releases the pylorus and pyloroduodenal angle from the weight of the viscera. Generally, the operator will make a quick preliminary inspection of the esophagus and stomach, perhaps with moderate insufflation, before passing through the pylorus to examine the duodenum. Detailed examination of the stomach, and any biopsy sampling, is performed as the endoscope is withdrawn.

A colonoscopy is also performed on an animal in left lateral recumbency, to avoid accumulation of liquid within the transverse colon and ease the passage of the endoscope beyond the splenic flexure of the colon. The endoscope may be lubricated (with an inert gel) prior to the colonoscopy, and moderate insufflation may be necessary to separate the walls of the colon. Passage to the transverse colon (2–4 cm in length in cats, 5–8 cm in dogs) is performed by directing the tip upwards around the splenic flexure. The hepatic flexure is traversed at the end of the transverse colon to reach the ascending colon. It is usual to find some liquid and fecal matter in the ascending colon, even in an animal that has been adequately prepared. It may be possible to irrigate and aspirate these residues to obtain a satisfactory view of the ileocolonic sphincter and the cecal opening. Further exploration, to the level of the terminal ileum, may be possible in medium-sized and large dogs.

A thorough endoscopic examination of the upper or lower gastrointestinal tract should take about 30 to 45 minutes. Biopsy specimens should always be obtained, even if gross irregularities are inapparent, since microscopic changes may be evident and support a diagnosis.

NORMAL ENDOSCOPIC APPEARANCE

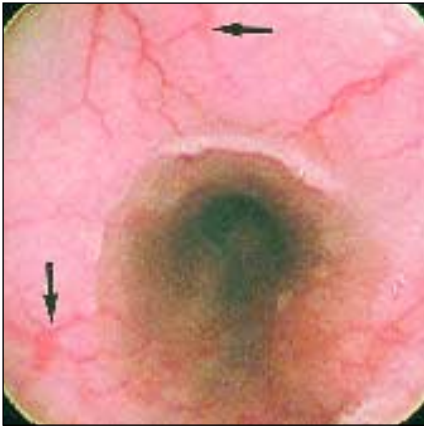


Figure 1 (Cat) The cervical esophagus is usually collapsed unless a bolus of food is passing. Insufflation reveals a smooth tubular organ, pale pink in color, with longitudinal folds plainly evident. In the cat it is usual to see small intraepithelial venules (arrows).



Figure 2 (Cat) The distal esophagus is darker in color. In cats, but not dogs, it displays surface striations, both longitudinal and circumferential (arrow) in a herringbone pattern.



Figure 3 (Dog) The gastroesophageal sphincter is slightly offset from the main long axis of the body of the esophagus.



Figure 4 (Dog) The esophagogastric transition zone represents the demarcation between the stratified squamous epithelium of the esophagus and the gastric mucosa. It is easily seen but the exact anatomical position varies, not being visible in some subjects until the moment the endoscope enters the cardia.



Figure 5 (Dog) The gastric mucosa is thrown into folds (larger on the greater curvature than on the lesser), although insufflation may be necessary to visualize these adequately.



Figure 6 (Dog) The pyloric antrum is slightly off-center and appears as a funnel-shaped, smooth-walled area of constriction terminating at the pylorus, just out of vision in this picture.

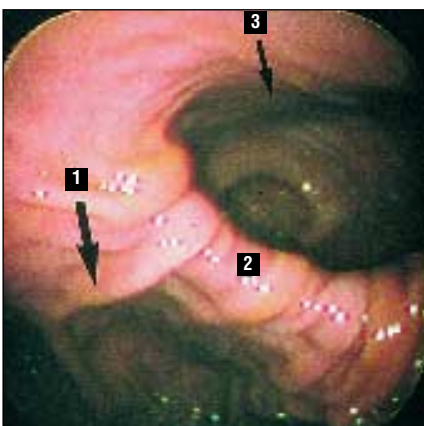


Figure 7 (Dog) The lesser curvature of the stomach is visualized here by the J maneuver (retroversion): body of the stomach (1); the angularis (2); and the pyloric antrum (3).



Figure 8 (Dog) The cardiac region, illustrated here, is visualized by the J maneuver.



Figure 9 (Dog) The pylorus is easily identified (arrow), although in some instances the presence of gastric secretions or mucosal hypertrophy may make it difficult to locate.



Figure 10 (Dog) The proximal duodenum is usually an orange-red color with a characteristic velvety appearance, reflecting the presence of the villi. In the body of the duodenum, the Peyer's patches appear as pale ovoid depressions, each a few millimeters in length. There are two curves to negotiate – the first (seen here) reflects the duodenum passing over the greater curvature of the stomach. The second curve marks the junction with the jejunum. The degree to which the jejunum can be explored will depend on the diameter of the endoscope and the size of the dog.



Figure 11 The luminal wall of the normal colon is smooth and pale. Submucosal blood vessels may be seen and there may be occasional, small lymphoid follicles.
Courtesy of Dr. Kevin Monce.



Figure 12 (Dog) The ileocecal junction appears as a rounded papilla on the mucosa when visualized by colonoscopy. It often appears congested. It is sometimes possible to pass through this sphincter and enter the terminal ileum. Alternatively, it is possible to perform blind ileal biopsy, via the papilla. The entrance to the cecum is slightly off-center, relative to the ileocolonic junction. The body of the cecum is often folded back on itself and frequently contains ingesta. Irrigation and insufflation are necessary if the mucosa is to be examined.



Figure 13 (Dog) Endoscopic examination of the colon is best achieved when the endoscope is gently withdrawn, centering on the colonic lumen. The normal mucosa is pale, glistening in nature and pink in colour. Submucosal blood vessels and lymphoid patches may be seen. Hyperaemia of the colonic mucosa must be interpreted with caution as it may reflect the pre-operative enema, or even the passage of the endoscope.

ENDOSCOPIC ASPECTS OF GASTROINTESTINAL DISEASE

Endoscopy is useful in the diagnosis of some, but by no means all, gastrointestinal diseases (**Table 1**). Indeed, endoscopy is contraindicated in some conditions. For example, general anesthesia and endoscopy in cases of megaesophagus may increase the risk of gastroesophageal reflux.

Esophageal disorders

The principal indications for endoscopic examination of the esophagus are dysphagia and regurgitation (**Table 1**) (3). Generally, functional disorders of the esophagus are better investigated by radiographic examination, with or without contrast studies. The esophagus is a highly distensible organ, but in dogs (rather than cats), and particularly in the terrier breeds, foreign body obstruction is not uncommon.

Esophageal foreign bodies result in ulcerative esophagitis and

Table 1
Gastrointestinal disorders in which endoscopy is useful for diagnosis, and those in which it is unhelpful

Helpful	Unhelpful
<i>Esophagus</i>	
Esophagitis	Esophageal motility disorders
Foreign body obstruction	Megaesophagus
Stricture	
Neoplasia	
Hiatal hernia	
Gastroesophageal intussusception	
<i>Stomach</i>	
Acute and chronic gastritis	Gastric motility disorders
Gastric ulceration	
Foreign body	
Neoplasia	
Pyloric stenosis	
Hypertrophic gastropathies	
<i>Small intestine</i>	
Chronic inflammatory disorders	Functional disorders
Ulceration	Inaccessible lesions in the jejunum and proximal ileum
Lymphangiectasia	
Foreign body	
Neoplasia	
Small intestinal bacterial overgrowth	
<i>Colon</i>	
Colitis	Functional disorders
Neoplasia	
Ileocolic intussusception	
Cecal eversion	
Colorectal diverticulitis	



Figure 14 Large cartilaginous foreign body at the distal esophageal sphincter of a dog.



Figure 15 Ulcerative esophagitis following migration of a foreign body in a dog.

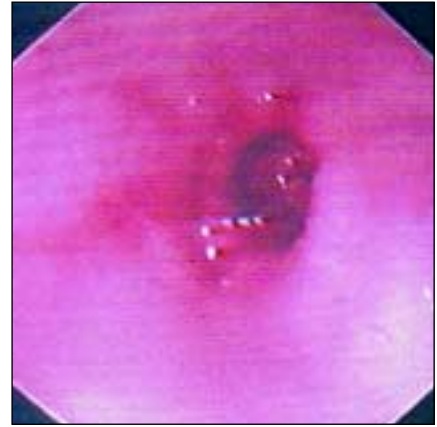
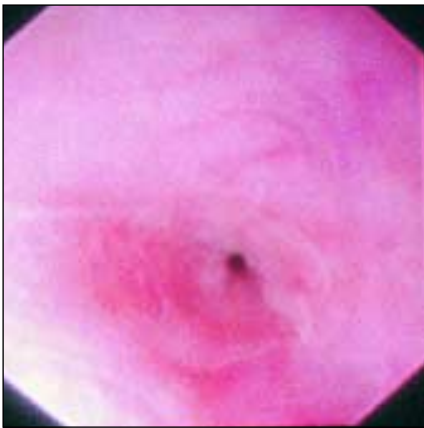


Figure 16 Erythematous esophagitis, particularly noticeable on the top of the mural folds.



Figures 17 and 18 Esophageal stricture in the cervical esophagus of a cat (Figure 17). This was successfully dilated using a balloon catheter introduced via the endoscope (Figure 18).

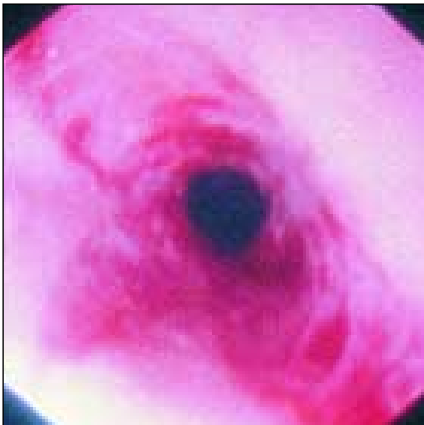


Figure 19 Hiatal hernia in a Boxer which presented with hypersalivation and frequent regurgitation. Endoscopic diagnosis is achieved by noting gastric mucosa sliding across the esophageal hiatus of the diaphragm, although the visualization requires the J maneuver (retroversion).

must be treated as a matter of urgency. There are three common sites of obstruction:

- At the thoracic inlet.
- Over the base of the heart.
- At the distal esophageal sphincter between the base of the heart and the diaphragm (**Figure 14**).

The foreign body can be removed with endoscopic forceps in many animals, provided the object is small and localized in the cervical or cranial thoracic region, and the risks of perforation are low (4).

Esophagitis follows inflammation resulting from various insults, both acute and chronic. Persistent esophageal foreign bodies, ingestion of caustic substances, persistent vomiting or gastroesophageal reflux are examples of the most common causes of

esophagitis. A stricture (intramural obstruction) may follow severe inflammation, such as that caused by a foreign body (**Figure 15**). Peptic esophagitis and reflux esophagitis are far less obvious on endoscopy and vary in severity. Erythema or erosions may be seen, particularly in the distal esophagus (**Figure 16**). In severe cases, the erosions may progress to ulceration and stenosis may result (4).

An esophageal stricture may result if deep inflammation follows oesophagitis. Strictures associated with tumors are uncommon in dogs and cats. The most common cause of esophageal stricture in dogs and cats is reflux esophagitis. This may be associated with prolonged episodes of vomiting or may occur following general anesthesia. In addition, excessively frequent gastroesophageal reflux may result in stricture. This excessively frequent reflux may be associated with periesophageal disorders in the distal esophageal sphincter region, certain neuromuscular or endocrine disorders, hiatal hernia, pyloric obstruction, or a reduction in pressure of the distal esophageal sphincter when certain preanesthetic drugs are used.

Strictures following reflux esophagitis generally occur in the form of a regular, concentric narrowing of the lumen, although they may also present as diffuse or strip-like areas of erosion. These strictures may sometimes be alleviated by successive inflation of balloon catheters introduced via the operating channel of the endoscope (**Figures 17 and 18**) (1, 4).

Strictures following ingestion of caustic substances are often extensive and carry a very guarded prognosis – the severity of the lesion, the risk of perforation, and the fact that the animal is often in shock combine to make most attempts at treatment unsuccessful.

Other disorders of the oesophagus include hiatus hernia (**Figure 19**), fistula (**Figure 20**), and neoplasia (**Figure 21**).





Figure 20 Esophageal fistula noted when an esophageal foreign body was removed endoscopically.



Figure 21 An esophageal tumour. In this case the tumor was a fibrosarcoma and was associated with infection by *Spirocerca lupi*.

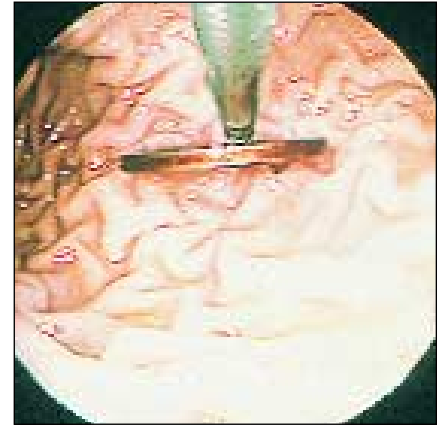


Figure 22 Gastric foreign body. In this instance a coin is clearly visible. Courtesy of Dr. Kevin Monce.



Figure 23 Typical appearance of reflux gastritis with a radial pattern of erosions on the antral folds.

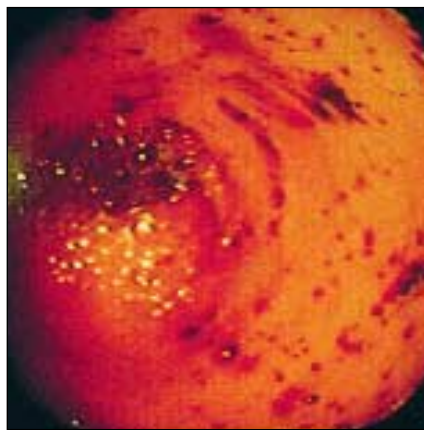


Figure 24 Hemorrhagic gastropathy observed in a dog with hepatic insufficiency following leptospirosis.

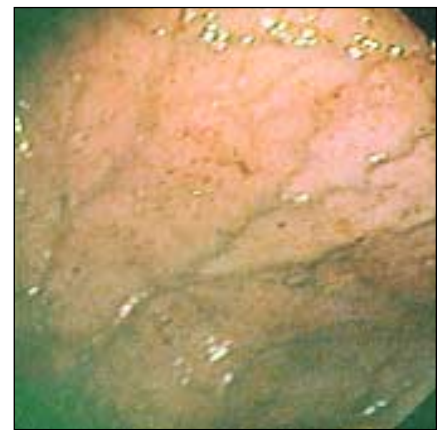


Figure 25 Atrophic gastropathy is apparent in an eight-year-old Boxer. Note mucosal pallor, prominent submucosal blood vessels, and atrophy of the mucosal folds.



Figure 26 Nodular gastritis. Histologically, these nodules may be lymphocytic or may demonstrate interstitial follicular inflammation.

Esophageal infection with the parasite *Spirocerca lupi* may result in esophageal fibrosarcoma (4).

Gastric disorders

The principal indications for gastric endoscopy are chronic vomiting, hematemesis, melena, or chronic anemia as a consequence of gastrointestinal bleeding (Table 1) (2, 5).

Acute gastritis is a vague clinical entity associated with loss of integrity of the gastric mucosa. Various etiological agents may be associated with acute gastritis – for example, ingestion of a foreign

body (Figure 22) or caustic materials and infectious disease. Reflux gastritis is usually chronic, but occasionally it may present as an acute syndrome. It follows retrograde movement of irritant biliary and pancreatic secretions which may disrupt the mucosa to cause erosions, particularly on the top of the mucosal folds in the antrum (Figure 23). Metabolic disorders and hepatic diseases may result in ischemia of the gastric mucosa (Figure 24). The ischemia is visualized as multiple hemorrhagic mucosal erosions.

Chronic gastritis may cause vomiting, weight loss and anorexia. Endoscopic examination and endoscope-guided biopsy have revealed three basic patterns of chronic gastritis (6):

- Atrophic type, characterized by abnormally pale mucosae, visible submucosal blood vessels and atrophy of the fundic folds (Figure 25).
- Nodular type, characterized by a papular or nodular reaction, often around the pylorus (Figure 26).
- Hyperplastic or, more rarely, granulomatous type, characterized by diffuse or localized hypertrophy of the antral or antero-pyloric mucosa – chronic hypertrophic pyloric gastropathy (CHPG) or antral pyloric hypertrophy syndrome (APHS) (Figure 27) (7, 8).

Pyloric obstruction is a relatively common disorder and results from congenital or acquired stenosis, or blockage of the pyloric lumen by a foreign body. CHPG is most common in older, small breed

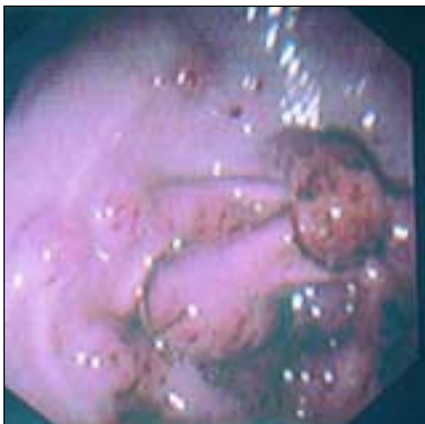


Figure 27 Focal hypertrophic gastropathy in a 12-year-old Spaniel presenting with weight loss and chronic vomiting. Histologically, there was glandular hyperplasia.



Figure 28 Chronic pyloric hypertrophic gastropathy in a 12-year-old Shitzu dog. Note the hyperplastic mucosal folds.



Figure 29 Pyloric polyps. These benign lesions occurred in an 11-year-old dog and resulted in chronic vomiting.

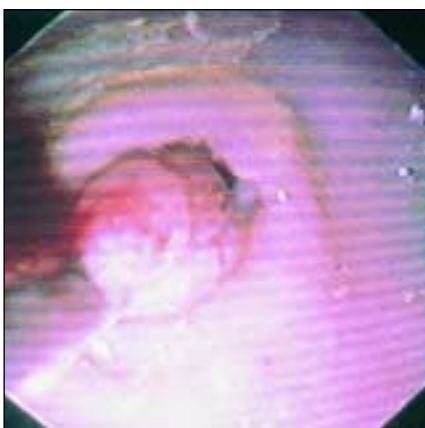


Figure 30 Pyloric carcinoma. Histopathological examination of biopsy samples is necessary if this condition is to be differentiated from CHPG and benign polyp formation.



Figure 31 Congenital pyloric stenosis in a six-month-old French Bulldog with chronic vomiting.

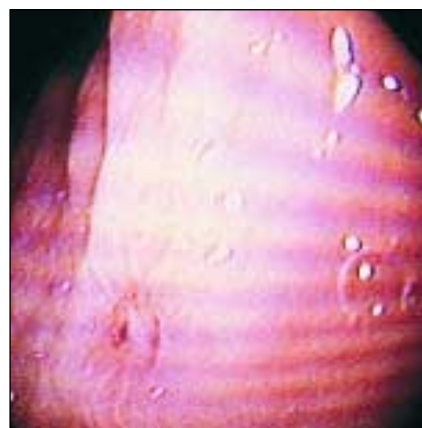


Figure 32 Gastric ulceration in the stomach of a cat.

dogs. It is characterized by the appearance of a diffuse or localized hypertrophy of the anteropyloric mucosa which causes delayed gastric emptying. The clinical signs include chronic vomiting and weight loss. Although it may be possible to visualize almost pathognomonic hypertrophy in the pyloric region (**Figure 28**), it must be differentiated from neoplasia by biopsy (**Figures 29 and 30**) (7, 8). Congenital pyloric stenosis appears most commonly in Boxers, French Bulldogs, and Boston Terriers, and has an endoscopic appearance that is similar to CHPG (**Figure 31**) (7).

Gastric ulceration (**Figure 32**) appears to be much more common than was supposed before the widespread use of endoscopy as an investigative tool allowed clinicians to examine the gastric mucosa directly (5). Gastric ulcers, like ulcers elsewhere, are rarely primary. They may reflect a variety of etiologies, such as systemic illness or the use of ulcerogenic drugs (particularly nonsteroidal antiinflammatory agents). Ulcers that occur as a consequence of these drugs are often small, are concentrated in the antropylic area and appear as linear or lenticular erosions with adjacent, often multiple, superficial bleeding points (1).

Gastric tumors may be either benign or malignant. Many benign gastric tumors are discovered serendipitously at endoscopy. Benign, adenomatous polyps may occur in the antrum and may cause pyloric stenosis. In contrast, leiomyomas, typically found in older dogs, appear as ulcerated masses, frequently in the fundus and occasionally at the gastroesophageal junction (9). Malignant gastric neoplasia in dogs is usually a carcinoma or adenocarcinoma,

whereas lymphoma is the most common tumor type in cats. Endoscopically, these gastric neoplasms are pleomorphic (**Figures 33, 34 and 35**) (10–12).

Small intestinal disorders

The principal indications for endoscopy of the proximal intestinal tract are chronic vomiting, small intestinal-type diarrhea, and putative malabsorption syndromes (**Table 1**). The use of endoscopic catheters to collect duodenal chyme for quantitative bacteriological culture is essential for definitive diagnosis of small intestinal bacterial overgrowth. Endoscopic examination of the intestinal tract may reveal evidence of hyperemia or ulceration, but it is not easy to correlate these signs with disease. In many cases with histopathologically confirmed disease, the endoscopic appearance is normal. There are no pathognomonic presentations of intestinal disease, and in most cases histopathological examination of biopsy material is necessary to make a diagnosis (13, 14).

Intestinal (duodenal) ulceration is rare in animals. When it does occur (**Figure 36**), it is generally associated with chronic inflammatory bowel disease (**Figure 37**) or neoplasia, and is often situated close to the pylorus. Intestinal ulcers may perforate, resulting in acute abdominal crisis.

Lymphangiectasia presents endoscopically with a multi-focal, pale, papular, almost granular appearance (**Figure 38**). The mucosa may sometimes have a mucoid appearance due to exudation of lymph (1).





Figure 33 Ulcerated gastric neoplasia (poorly differentiated carcinoma) in a seven-year-old Shetland Sheepdog.



Figure 34 Infiltrative gastric neoplasia in a five-year-old dog. This adenocarcinoma was highly malignant but was not ulcerated.



Figure 35 Lymphoma of the fundic region in a 10-year-old cat with a history of vomiting, anorexia and weight loss. The fundic mucosa is grossly thickened.



Figure 36 Ulceration of the proximal duodenum in an eight-year-old Pointer with weight loss, melena, and anemia. Histopathological examination demonstrated lymphocytic-plasmacytic enteritis and villus atrophy.

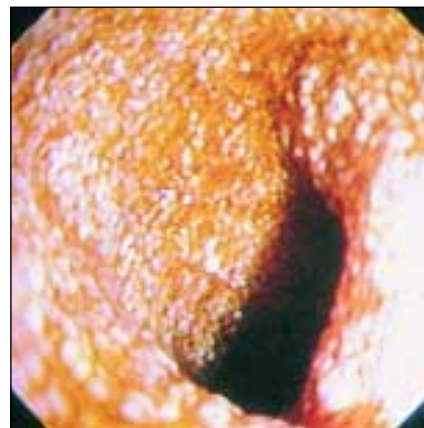


Figure 38 Lymphangiectasia in the small intestine of a six-month-old Poodle with a thoracic effusion, ascites, and panhypoproteinemia (27 g/l, normal 52–82 g/l).



Figure 37 Lymphocytic plasmacytic enteritis is a chronic inflammatory disease. In this illustration, prominent lymphoid follicles are apparent. Courtesy of Dr. Kevin Monce.

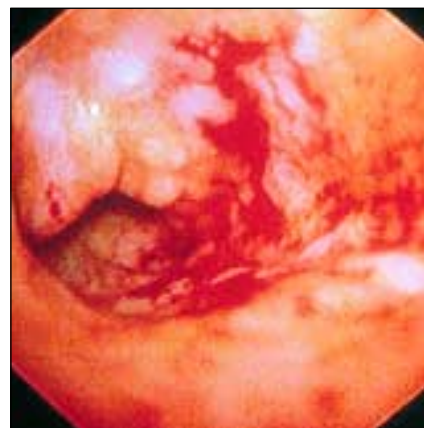


Figure 39 Colitis. There is ulceration and pseudopolyp formation in the colon of this two-year-old Boxer with a history of hemorrhagic, large bowel diarrhea and tenesmus.

Intestinal tumors are not readily diagnosed by endoscopy, although occasionally a friable, hemorrhagic mass may be seen. Most commonly a thickening or swelling is noticed and histopathological examination of biopsy samples is necessary to make the diagnosis.

Large intestinal and colorectal disorders

Colonoscopy is necessary if the distal intestinal tract is to be visualized. The principal indications are large bowel diarrhea, tenesmus, and hematochezia (Table 1). As with the investigation of gastric and small intestinal disorders, it may prove difficult to correlate histopathological evidence of disease with endoscopic appearance, and the clinician must be prepared to take serial biopsy samples from the area under investigation (15).

Colitis may result in discontinuous lesions interspersed between areas of endoscopically normal mucosa, although it is most often

diffuse (Figure 39). Lesions may be superficial or extend deep into the submucosa. Healing of these deeper lesions generates fibrosis, which may result in pleomorphic pseudopolyp formation or rarely in stenosis. Chronic inflammation may result in thickened, excessively folded, friable mucosa. Histological classification of representative lesions, and of apparently normal mucosa, is mandatory (16).

Ileocolic intussusception is not uncommon, particularly in young animals with intestinal motility disorders accompanying diarrhea. It appears endoscopically as a smooth, intraluminal mass (Figure 40).

Whip worm infection is associated with *Trichuris vulpis*, a parasite with a widespread distribution. However, the routine use of gastrointestinal endoparasiticides removes these parasites and thus clinical disease is regional. Trichuriasis is associated with tenesmus, hematochezia, and the presence of colonic inflammation of varying degrees of severity (Figure 41) (15).



Figure 40
Ileocolic intussusception in a three-month-old Doberman Pinscher with acute parvovirus enteritis. The smooth intraluminal mass is clearly visible.

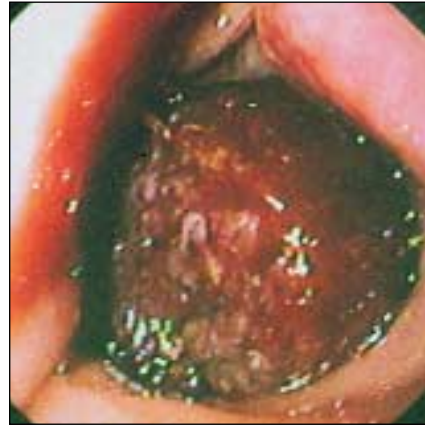


Figure 42
Large, friable benign tumor in the rectum of an elderly Poodle with hematochezia and tenesmus.



Figure 41
Severe trichuriasis.



Figure 43
Large stenotic malignant neoplasm in the colon of an elderly cat presenting with tenesmus and vomiting.

Colonic and rectal neoplasia may be benign or malignant. The most common manifestation is benign polyp formation, which has a pleomorphic presentation (**Figure 42**). These polyps may protrude through the rectum and cause tenesmus and bleeding. Malignant tumours also have a pleomorphic presentation, dependent to some

extent on the underlying type and size. Stenosis may result if they are large (**Figure 43**) (17, 18).

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