

The Canine Gastrointestinal Tract: Esophagus

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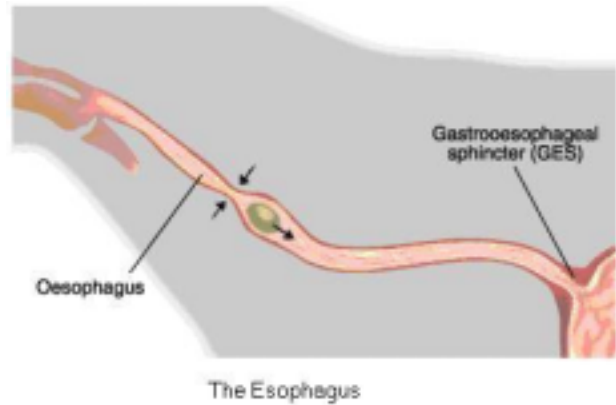
KEY POINTS

- **Esophageal disease often causes regurgitation, which needs to be differentiated from retching and true vomiting.**
- **There are a number of different esophageal diseases; they can be acquired or congenital.**
- **The primary treatment depends on the type of disorder present and often involves surgery and aggressive drug therapy. However, appropriate dietary management is also important.**
- **Dietary management is crucial in many patients presenting with protein-calorie malnutrition due to chronically reduced food intake with regurgitation; these malnourished patients need a highly energy- and nutrient-dense diet, such as one designed for critical care patients.**
- **Other conditions, such as megaesophagus, benefit from changing food types and feeding regimens; it is important to assess which type of food (liquid, wet, or dry) will best suit the individual patient, and animals are best fed “little and often,” offering the food from a height.**
- **A low fat diet may be advantageous in patients with gastric reflux, as fat levels influence gastro-esophageal sphincter pressure and stomach emptying.**

Esophageal diseases often cause regurgitation, which must be carefully differentiated from pharyngeal retching or true vomiting. If both the stomach and esophagus are involved in the disease process, the differentiation between regurgitation and vomiting may be more difficult. The primary treatment of many esophageal disorders involves surgery or aggressive drug therapy. However, appropriate dietary management is also important, allowing an adequate intake of calories in animals that often present with protein-calorie malnutrition.

Anatomy

Food formed into a bolus by the tongue is transferred by swallowing to the esophagus, a comparatively short, muscular tube leading from the mouth to the stomach. No digestive enzymes are secreted here, but esophageal cells do produce mucus to lubricate food in the process of peristalsis. Peristalsis can be described as automatic wave-like contractions and relaxations that propel food along the digestive tract, stimulated by the presence of food. It only takes a few seconds to transport food from the mouth to the stomach.



The esophagus consists of several distinct layers:

- **Mucosa**
- **Submucosa** with mucous glands
- **Muscularis** and loose connective tissue

There is no serosa in the esophagus, which means poor retention of sutures after surgery. The canine muscularis consists of two intertwining layers of striated muscle, a unique situation that does not occur in either humans or cats. The muscularis appears as longitudinal folds with barium contrast radiography.

The upper esophageal sphincter or cricopharyngeal sphincter is composed of the cricopharyngeal and thyropharyngeal muscles. Relaxation of the sphincter is coordinated with swallowing. The sphincter prevents aerophagia and reflux of food from the esophagus into the pharynx during swallowing.

The lower esophageal sphincter or gastroesophageal sphincter (GES) is not a true sphincter but a "distal high pressure zone" (i.e., an inner layer of gastric smooth muscle with outer esophageal striated muscle in the dog and contributions from the diaphragm and intraabdominal pressure).

Function

The esophagus is stimulated by stretch receptors, which induce primary peristaltic waves to propel food toward the stomach. If the ingesta stops momentarily at the thoracic inlet, heart base, or distal high pressure zone, a secondary peristaltic wave is initiated via afferent and efferent impulses in the vagus nerve and propels the ingesta into the stomach. The gastroesophageal sphincter relaxes as the bolus approaches and then contracts again to prevent any gastroesophageal reflux.

Clinical Disorders

Esophageal disorders may be acquired or congenital. The most common disorders include:

- Esophageal foreign body
- Megaesophagus
- Vascular ring anomaly
- Gastroesophageal reflux
- Esophagitis
- Esophageal stricture

Less common conditions include:

- Hiatal hernia
- Esophageal diverticulum
- Periesophageal masses
- Esophageal neoplasia

Gastroesophageal intussusception is a rare disorder, which presents in a similar way to the more common hiatal hernia.

Esophageal Foreign Body

These are most commonly seen in terriers, particularly West Highland White Terriers, and mostly in young animals. Many of the foreign bodies are bones. Foreign bodies usually lodge at the thoracic inlet over the heart base or in the distal esophagus. In cases of partial obstructions, the animal may be able to keep fluids down but not solid foods.

An emergency situation may arise due to pressure necrosis of the esophagus with the development of chronic strictures or erosions.

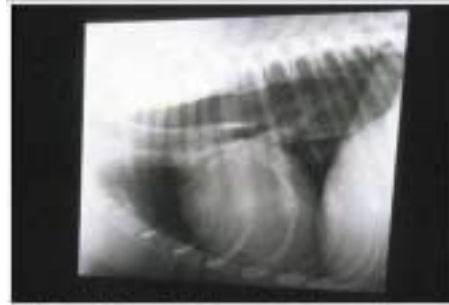
Chronic cases show a proximal dilation of the esophagus, with or without bronchoesophageal fistulae; however, most cases are acute. Aspiration pneumonia may develop as a complication.



Esophageal Foreign Body - Bone
(Source K. Hurley)

Megaesophagus

This is a common cause of regurgitation in the dog, and both congenital and acquired forms may be seen. The esophagus becomes dilated and hypomotile. However, the gastroesophageal sphincter still relaxes normally, which is different to achalasia in humans, where the gastroesophageal sphincter fails to dilate.



Lateral Thoracic Radiograph of a Megaesophagus
(Source P. Watson)

Affected dogs may have concurrent esophagitis due to the prolonged contact between the fermenting ingesta and the esophageal wall.

Congenital Form

An increased incidence has been reported in Irish Setters, Great Danes, German Shepherd Dogs, Labrador Retrievers, Chinese Shar-Peis, and Newfoundlands. A hereditary component has been discussed but has only been shown in Miniature Schnauzers and Wirehaired Fox Terriers. The underlying cause is unclear, but there appears to be a defect in the vagal afferent pathway.

Acquired Form

This is most commonly idiopathic or secondary to neuropathies and/or myopathies and metabolic disease (e.g., myasthenia gravis). Other reported causes are toxicities, such as botulism and lead poisoning, brainstem disease (including distemper virus), some peripheral polyneuropathies, acquired sensory neuropathies, and Addison's disease.

Megaesophagus may also occur secondary to any prolonged partial or complete obstruction (e.g., with chronic foreign body, vascular ring anomaly, or neoplasia). Regardless of its cause, acquired megaesophagus may be reversible in the early stages. However, when the dilation is either severe and/or chronic, nerves within the myenteric plexus may be permanently damaged and the dilation and hypomotility may become irreversible.

Vascular Ring Anomaly

This disorder is relatively common in dogs, with a higher incidence among large breeds such as German Shepherd Dogs and Irish Setters. A familial predisposition has been suspected.

There are a number of possible vascular ring anomalies (VRAs) caused by defects in the normal development of arteries from the six pairs of fetal aortic arches. However, clinical problems arise only if the anomaly causes a constriction of the esophagus over the heart base. Approximately 95% of all reported cases are due to a persistent right aortic arch, leading to esophageal constriction as the ligamentum arteriosum crosses to the left sided main pulmonary artery.

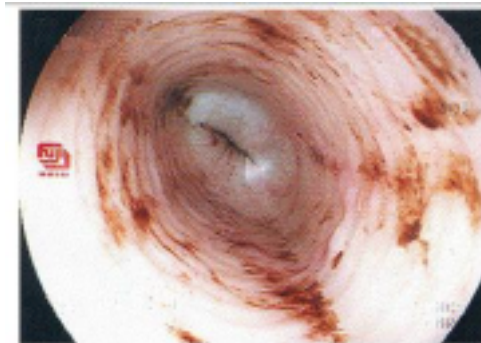


Lateral Thoracic Radiograph of a VRA
(Source P. Watson)

Vascular ring anomalies cause chronic partial obstruction over the heart base, leading to the development of megaesophagus cranial to the obstruction. This can lead to a chronic megaesophagus. It is important to diagnose and treat these cases early, before significant permanent esophageal damage occurs. Vascular ring anomalies tend to cause local fibrosis of the esophagus with possible permanent stricture formation, which itself may also need treatment.

Gastroesophageal Reflux

Gastroesophageal reflux may be caused by temporary or permanent gastroesophageal sphincter (GES) incompetence and may result in esophagitis. The severity of the inflammation depends on the frequency of the reflux, the length of contact time, and composition of refluxed material. Acid alone, for example, is less damaging than combinations of acid with pepsin, trypsin, and bile salts.



Gastroesophageal Reflux
(Source K. Hurley)

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This disorder is normally secondary to chronic vomiting, hiatal hernias, gastric motility disorders, or masses in the region of the GES. It may also occur overnight during sleep, leading to early morning salivation and regurgitation.

Clinically, the most significant cause is probably general anesthesia. Significant reflux may occur in patients in spite of good anesthetic technique. General anesthesia predisposes patients to reflux, because anesthetic and sedative drugs tend to reduce GES pressure, esophageal

peristalsis, and the production of saliva, which would normally neutralize refluxed acid in the esophagus.

Esophagitis

This is usually secondary to:

- Chronic gastritis
- Vomiting
- Gastroesophageal reflux
- Ingestion of foreign body
- Hiatal hernia
- Esophageal neoplasia
- Megaesophagus



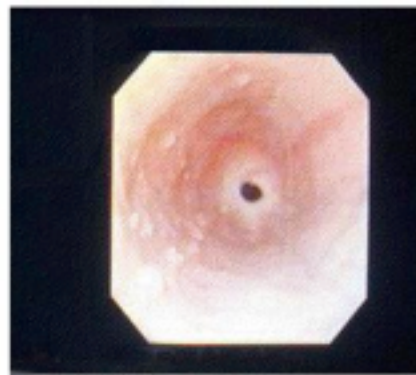
Esophagitis
(Source K. Hurley)

Esophagitis involves inflammation of the mucosa, with or without inflammation of the submucosa and muscularis.

Esophageal Stricture

This condition describes the fibrosis and narrowing of the esophagus in one or more places. The condition may be congenital, but it is usually acquired, for example, secondary to:

- Esophagitis
- Foreign body
- Esophageal trauma or surgery
- Vascular ring anomaly
- Chronic extramural or intramural mass or obstruction



Esophageal Stricture
(Source K. Hurley)

Strictures can occur as late as 14 days after gastroesophageal reflux due to general anesthesia, although patients may show some clinical signs prior to stricture formation.

Hiatal Hernia

Hiatal hernias can be either congenital or acquired. The most common form is the "sliding hiatal hernia," whereby the gastroesophageal sphincter is displaced into the terminal esophagus along with a variable part of the stomach. "Rolling (paraesophageal) hiatal hernias," which are very rare in small animals, involve the gastroesophageal sphincter staying in position but the gastric fundus rolling into the esophagus. Occasionally, there may be a combination of both types of hernia.



Lateral and Dorsoventral Thoracic Radiograph of a Hiatal Hernia (Source P. Watson)

Congenital hiatal hernias, often observed in Chinese Shar-Peis, English Bulldogs, and Chow Chows, are caused by an incomplete closure of the diaphragmatic hiatus. Acquired hiatal hernias are secondary to increased intraabdominal pressure with chronic vomiting.

Esophageal Diverticulum

This is a very uncommon disorder, which can be congenital or acquired. The congenital condition is most commonly seen in Bulldogs and Shar-Peis.

Acquired diverticula can be divided into:

- **Pulsion (false) diverticulum** - This is an outpouching of the mucosa through a tear in the muscularis, which is believed to be due to pressure within the esophagus (e.g., due to an obstruction or regional peristaltic abnormalities); the tear is usually just proximal to the diaphragm.
- **Traction (true) diverticulum** - This involves all layers of the esophageal wall and is believed to be caused by traction from an external, adhered fibrous band secondary to inflammation outside the esophagus in the airways, lungs, lymph nodes, or pericardium.

Periesophageal Masses

Periesophageal masses are uncommon in the dog. When seen, they usually only lead to partial obstruction, so that foods, but not fluids, are regurgitated. This may be seen in conjunction with aspiration pneumonia and the development of megaesophagus forming cranial to the mass due to chronic obstruction.

The most common manifestations of this condition include:

- The **cervical esophagus** with thyroid or laryngeal carcinomas, salivary gland tumors, metastases of tonsillar carcinomas, and others
- The **thoracic esophagus** with cranial mediastinal lymphomas or thymomas, large lung tumors, heart base tumors, or abscesses or granulomas

Esophageal Neoplasia

This disorder is very rare in dogs, except in areas where *Spirocerca* is endemic, such as East Africa and the southeastern United States. *Spirocerca* induces sarcomas. Otherwise, the most common esophageal tumors are metastases (e.g., from thyroid carcinomas). Primary tumors include squamous cell carcinoma or leiomyomas, which may involve the esophageal-gastric junction, and sarcomas.

Gastroesophageal Intussusception

This is a rare disorder, although intermittent gastroesophageal intussusception may be seen in dogs secondary to chronic vomiting, similar to acquired hiatal hernias. These cases respond to treatment of the underlying cause and conservative therapy. Most cases are quite severe with marked intussusception causing vomiting, respiratory signs, shock, and death in 95% of cases. This is often secondary to esophageal motility disorders such as megaesophagus. If the problem is diagnosed early enough, gastropexy may be a means of treatment.

Diagnosis

It is very important to differentiate vomiting, regurgitation and retching from one another for diagnostic purposes. Dog owners often describe regurgitation as "vomiting," and a careful evaluation of the history is therefore required. Furthermore, owners often confuse vomiting and expectoration (the expulsion of material from the respiratory tract), particularly as animals sometimes vomit after a prolonged bout of coughing or may cough with aspiration pneumonia caused by regurgitation.

It may be necessary to feed a test meal and observe the patient's reaction.

Laboratory Tests

Animals with esophageal foreign bodies or prolonged regurgitation should always have routine laboratory tests for electrolyte balance, hydration, and acid-base status prior to general anesthesia.

Pharyngeal Retching

Food and saliva are brought back up immediately after intake. The animal will demonstrate an observed difficulty and maybe even pain and distress on attempted swallowing. Due to problems with swallowing, the patient may be anorectic or cachectic. Aspiration of food with resultant pneumonia and coughing is common. In severe cases, liquids may even be ejected via the animal's nose and will be seen as nasal discharge.

Regurgitation

Regurgitation is a more passive process than vomiting. In order to regurgitate, the animal will lower its head, with no visible abdominal effort. A tube of undigested food and white (not bile-stained) saliva will be ejected. This can be seen soon after feeding, particularly in cases of concurrent esophagitis, or several hours after food intake, whereby the ingesta has been stored in the dilated esophagus, and regurgitation is triggered by increased intrathoracic pressure.

Expelled ingesta are often bright in color and the animal may try to eat them again. It is important to note that regurgitation is passive, in that no reflex is involved. Aspiration pneumonia is a common complication.

Vomiting

True vomiting is an active process involving muscular contractions. Vomiting is usually preceded by nausea, seen as agitation, salivation, and repeated swallowing. The ejection of vomitus is very forceful. The vomit may consist of partially digested foods, fluid (often bile stained), and/or hematemesis. Aspiration pneumonia is unusual, unless there is concurrent esophageal disease.

The differentiation of vomiting and regurgitation may be difficult in cases of regurgitation with concurrent esophagitis, as the latter causes dysphagia, salivation, and apparent nausea. Similarly, it may be difficult to distinguish the above described in cases of concurrent gastric and esophageal disease.

The pH in the ejected material can help to further distinguish the process (using a urine dipstick). Material with a pH ≥ 7 is likely to be from the esophagus, whereas that with a pH ≤ 5 is probably of gastric origin.

Management

Surgery is the mainstay of management in vascular ring anomalies (VRAs), although chronic cases of VRA with severe secondary esophageal changes may not improve with surgery. Strictures may be managed with bougienage by passing a cylindrical instrument into the esophagus to dilate constricted areas. Further indications for surgical management are congenital hiatal hernias, esophageal diverticula, and tumors. If the endoscopic removal of foreign bodies proves unsuccessful, thoracotomy may be necessary. In all cases, there should be careful postoperative dietary management.

Dietary management plays an important role in the management of megaesophagus in addition to treating any underlying cause, such as Addison's disease or myasthenia gravis. Drugs that increase gastrointestinal motility should not be used in the treatment of megaesophagus, as they can increase the gastroesophageal sphincter tone, which further inhibits the passage of ingesta into the stomach.

Mild cases of esophagitis can be treated with antiinflammatory drugs in paste form. More severe cases need aggressive medical management with mucosal protectants, acid secretory inhibitors, and prokinetics to increase GES tone. Drugs with local effect are best applied in paste form, as tablets will pass straight into the stomach.

All early signs of postoperative reflux esophagitis need to be treated immediately in order to prevent stricture formation; concurrent dietary management is also important. Aggressive antibiotic treatment is indicated in all cases of aspiration pneumonia.

Dietary Management

Animals with esophageal disease often present with protein-calorie malnutrition. This develops as a result of chronically reduced intake due to regurgitation and concurrent hypermetabolism due to aspiration pneumonia. Dietary considerations are therefore very similar as for critically ill patients and focus on supplying sufficient energy with the appropriate levels of protein, fat, and carbohydrate and the supplementation of other beneficial nutrients.

Additionally, there are a number of measures to consider:

- **Feed small amounts of high energy foods often** to prevent protein-calorie malnutrition.
- Patients with megaesophagus are best fed small amounts often **from a height**, such as a chair, and should also drink water from a height; additionally their front legs should be raised after feeding and exercise should be postponed until food has settled.

- Patients with megaesophagus should **consistently receive the type of food that they manage best**; some patients respond best to soft foods which slip down easily, whereas others are best fed dry foods which stretch the esophagus and stimulate any remaining activity. This needs to be adjusted individually.
- Generally, most esophageal diseases *other than megaesophagus* respond best to a **liquid or gruel diet**.
- Placing a **gastrostomy feeding tube** should be considered in seriously malnourished patients and in patients with chronic regurgitation; however, gastrostomy tubes are **contraindicated** with concurrent vomiting or gastric disease.
- **Nasoesophageal tubes should not be used in esophageal disease**, as they can cause abrasions of the esophagus, delay the healing process, and increase the risk of stricture formation.
- **In diseases with gastric reflux**, such as reflux esophagitis or hiatal hernia, **a low fat diet may be advantageous**, as high fat levels may encourage reflux by reducing gastroesophageal pressure and delaying stomach emptying.

Summary

Esophageal disease often results in a reduced nutrient assimilation, as the food cannot pass into the stomach for digestion. Dogs with chronic esophageal disease therefore often develop protein-calorie malnutrition and need to receive a highly energy- and nutrient-dense diet designed for critical care patients. Problems are further compounded if aspiration pneumonia develops, resulting in hypermetabolism.

Feeding a diet in liquid or gruel form from a height or via a gastrostomy tube helps to ensure that food passes into the stomach and can be digested and absorbed in a normal way. The use of nasoesophageal or nasogastric feeding tubes is contraindicated in esophageal disease, because these tubes increase gastroesophageal reflux, mechanically oppose esophageal healing, and predispose to stricture formation. In some specific esophageal conditions in which gastric reflux is a problem, a low fat food is indicated as reduced fat levels increase gastroesophageal sphincter pressure and speed gastric emptying.