Canine Bronchoesophageal Fistulas: Case Report and Literature Review

Abstract: A bronchoesophageal fistula (BEF) is defined as a communication between the esophagus and one or more bronchi. BEFs are commonly associated with esophageal diverticula, which are circumscribed outpouchings of the esophageal wall. This article presents the report of a case seen at Louisiana State University Veterinary Teaching Hospital and Clinics in 2006 and reviews the pathogenesis, diagnosis, and treatment of esophageal diverticula and BEFs. The BEF in the case presented was of a very rare form, involving only the accessory lung lobe bronchus.

Case Presentation

History
An 11½-month-old, 1-kg, intact female Yorkshire terrier was evaluated by the referring veterinarian for a mild, progressive cough of 2 weeks’ duration. The dog was housed with several other Yorkshire terriers of similar age that reportedly had no similar clinical signs. The patient's routine vaccinations were current. Radiography conducted by the referring veterinarian showed evidence of pneumonia. After an unsuccessful treatment attempt with amoxicillin–clavulanic acid and enrofloxacin, a transtracheal wash was performed and Pseudomonas aeruginosa was cultured. Based on sensitivity results, the patient was treated with enrofloxacin and nebulized gentamycin for 1 month. The patient did not respond to this treatment and was referred to Louisiana State University Veterinary Teaching Hospital and Clinics (LSU-VTH&C) at 14 months of age for further evaluation.

Diagnosis
At presentation to LSU-VTH&C, the patient was depressed but responsive. The dog was underweight (1.0 kg) and had a chronic cough with occasional production of light yellow mucus, a temperature of 102.8˚F, a heart rate of 160 bpm, and a respiratory rate of 46 breaths/min. Mildly increased lung sounds could be auscultated on the right side of the dog’s chest. All other physical examination parameters revealed no obvious abnormalities. After careful questioning of the owner, no clear cause of the cough was evident. A list of diagnostic differentials for a progressive, unresponsive, chronic, occasionally productive cough is presented in BOX 1. A complete blood count revealed a left shift with 8.5 × 10^3/μL neutrophils (reference range: 3 × 10^3/μL to 11.5 × 10^3/μL), 0.8 × 10^3/μL bands (reference range: 0 to 0.3 × 10^3/μL), and 2.3 × 10^3/μL monocytes (reference range: 0.1 × 10^3/μL to 1.4 × 10^3/μL). Basophilic cytoplasm of neutrophils was evident during leukocyte morphology examination. The serum chemistry profile revealed no significant abnormalities.

On survey thoracic radiographs, severe distention of the stomach and small intestines could be seen, along with a mildly dilated caudal esophagus with a well-delineated left lateral contour and an amorphous, poorly marginated alveolar pattern in the region of the accessory lung lobe in the ventrodorsal view (FIGURES 1 AND 2). The following day, the patient was anesthetized and airway endoscopy was performed to elucidate the presence and extent of pulmonary lesions. Endoscopic examination revealed frothy whitish fluid associated with the entrance to the lobar bronchus of the accessory lung lobe (FIGURE 3). Cytologic evaluation

At a Glance

Case Presentation
Page E1
Bronchoesophageal Fistulas
Page E3
Esophageal Diverticula
Page E8

“Dr. Gaschen discloses that he has received financial support from Nestlé Purina PetCare and Pfizer Animal Health.
Canine Bronchoesophageal Fistulas

The cytologic diagnosis was septic neutrophilic inflammation. A Pasteurella sp and more than three other bacteria were isolated from the bronchial fluid. Empirical antibiotic treatment with ceftazidime (25 mg/kg IV) was initiated pending sensitivity tests. During recovery from anesthesia, the cough appeared to worsen and become productive, especially immediately after feeding. Esophagoscopy performed on the following day showed an inflamed distal esophageal diverticulum and an open lower esophageal sphincter (FIGURE 3).

Two explanations were considered: (1) the esophageal diverticulum was trapping food particles, resulting in regurgitation and subsequent aspiration pneumonia or (2) it was directly communicating with the respiratory system. Ideally, an esophageal contrast study would have been performed to demonstrate the presence of communication between the diverticulum and the respiratory system. However, due to monetary constraints and failure of medical management, the owners elected euthanasia without further diagnostics.

Necropsy revealed a 2.5 × 1 cm, oblong diverticulum at the distal segment of the esophagus (FIGURE 4). Firmly adhered to the outer surface of the diverticulum was a diffusely dark red right accessory lung lobe. A transmural perforation in the diverticulum communicated with the adhered lung lobe. Histologic sections of the esophagus and adherent lung at the level of perforation revealed a fistula lined by two types of epithelium, with an abrupt transition from a selective bronchial wash revealed mostly degenerate neutrophils, with a few macrophages and small mature lymphocytes. Bacterial cocci were seen within neutrophils. Additionally, Simonsiella spp were present, suggesting contamination of the lower airway with material from the pharynx. The cytologic diagnosis was septic neutrophilic inflammation. A Pasteurella sp and more than three other bacteria were isolated from the bronchial fluid. Empirical antibiotic treatment with ceftazidime (25 mg/kg IV) was initiated pending sensitivity tests. During recovery from anesthesia, the cough appeared to worsen and become productive, especially immediately after feeding. Esophagoscopy performed on the following day showed an inflamed distal esophageal diverticulum and an open lower esophageal sphincter (FIGURE 3).

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QuickNotes
A BEF should always be considered when an esophageal diverticulum is imaged or eating/drinking is associated with coughing.

![RIGHT LATERAL THORACIC RADIOGRAPH SHOWING AN ILL-DEFINED ALVEOLAR SOFT TISSUE OPACITY THAT SILHOUETTES WITH THE CAUDAL VENA CAVA, AFFECTING THE ACCESSORY LUNG LOBE (ARROW).](image)
Canine Bronchoesophageal Fistulas

Bronchoesophageal Fistulas

An esophageal fistula is an abnormal communication between the esophageal lumen and surrounding structures, most commonly the respiratory system. Fistulas resulting in esophagoaortic, tracheoesophageal, or bronchoesophageal communications are uncommon despite the intimate relationship between the esophagus and the aorta, trachea, and bronchi. The most commonly reported esophageal fistula in dogs is the BEF. All reports of dogs with BEFs have involved small breeds, with miniature poodles and terriers being overrepresented (TABLE 1).

Pathophysiology

Congenital and acquired BEFs have been described, with the latter being far more common. In humans, congenital BEFs have been associated with an uncoordinated separation of the esophagus from the respiratory tract during embryologic development, resulting in a persistent attachment between the two. Alternatively, BEFs could result from an intrauterine infection causing the embryonic bronchus and esophagus to adhere. Acquired BEFs are most commonly sequelae of esophageal perforation due to foreign bodies, chronic irritation, or, less frequently, pulmonary abscesses. The most frequently reported cause of acquired BEF is trauma caused by a retained esophageal foreign body, usually a bone. Foreign bodies may also penetrate the esophageal wall and establish a fistula with the trachea, pulmonary parenchyma, or skin. The greater incidence of esophageal fistulas with bronchi versus other sites has been attributed

QuickNotes

Because of its chronic nature, insidious onset, and nonspecific clinical signs, a BEF may go undiagnosed.

Endoscopic views of the bronchus of the accessory lung lobe.

A localized, ill-defined alveolar pattern in the region of the accessory lung lobe (arrow).

Superimposition with the spine makes the abnormality difficult to see in the ventrodorsal view.

An inflamed distal esophageal diverticulum (arrows). Distally, the lower esophageal sphincter is open.

A whitish, frothy fluid (arrow) exudes from the bronchus. The other bronchi appear unaffected.

From stratified squamous epithelium to cuboidal respiratory epithelium (FIGURE 5). The right lung lobe had thick fibrous pleura and suppurative pneumonia with a refractile fragment of foreign material. A diagnosis of esophageal diverticulum with bronchoesophageal fistula (BEF) was made.
Canine Bronchoesophageal Fistulas

**FIGURE 4**
The distal esophageal diverticulum (arrow). Note the gastric rugal folds (G), left lung lobes (L), and esophagus (E) to the right. The right lung lobes (R) are difficult to see due to adhesions with the diverticulum.

**FIGURE 5**
Cross-sections of the diverticulum revealed a communication with the accessory lung lobe. The stratified squamous epithelial lining of the communication (arrowhead) abruptly changes to columnar and cuboidal epithelium (arrow).

Most authors recommend performing an esophageal contrast study when a BEF is suspected or an esophageal diverticulum is identified by other diagnostic procedures.

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to the fact that most obstructions of the thoracic esophagus occur caudal to the heart. 2,8

It is believed that the pathogenesis of foreign body–induced BEF begins with esophageal wall necrosis and perforation, followed by leakage of esophageal contents into adjacent tissues. 7 The necrotic reaction progresses, and an esophageal traction diverticulum results from the inflammatory reaction between the esophagus and bronchi. 8 It is also possible that an esophageal diverticulum, either congenital or acquired, may be present before the acquired BEF forms. 8 Healing of the foreign body–induced lesion eventually leads to development of a communicating tract and continuous airway contamination with esophageal contents. 7 Little published information regarding the length of time required for BEF formation exists; however, some authors speculate that fistula formation may occur within several days after foreign body–induced esophageal damage. 2,8

BEFs allow ingested material to pass into the bronchi and lungs and may allow passage of pulmonary secretions into the digestive tract. 9 Most canine BEFs due to esophageal foreign bodies connect the esophagus with either the right caudal lung lobe bronchus or the middle lung lobe bronchus. 8 The right caudal lung lobe bronchus is reportedly the most frequently involved bronchus (TABLE 1). Other causes of BEF formation include trauma, neoplasia, bronchial foreign bodies, and peri-esophageal inflammation. 2,10 BEFs are rare in dogs and cats but should always be considered when an esophageal diverticulum is found or eating/drinking is associated with coughing. Because of their chronic nature, insidious onset, and nonspecific clinical signs, BEFs may go undiagnosed. 2,8 Human patients have reportedly reached adulthood before the condition was recognized. 5

**Diagnosis**

History of an esophageal foreign body and a confirmed diverticulum are present in most cases of acquired BEF in dogs. 7 The physical examination may reveal coughing, dyspnea, respiratory crackles over affected lung regions, hemoptysis, 12 anorexia, depression, weight loss, regurgitation, and dysphagia. Coughing associated with drinking liquids, a sign frequently associated with BEFs, may take several days to develop. 2 Coughing associated with eating or drinking strongly suggests a communication between the esophagus and tracheobronchial tree. Other reported complications include pyothorax, septicemia, and abdominal distention secondary to dyspnea and aerophagia. 2 Excessive production of mucus shed via the nose and mouth may be an important early sign of the defect. 15 Death may result from drowning subsequent to accumulation of secretions or from pneumonia due to aspi-
**Table 1: Reported Clinical and Diagnostic Findings With Bronchoesophageal Fistulas**

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (yrs)</th>
<th>Breed</th>
<th>Sex</th>
<th>Clinical Signs</th>
<th>Pulmonary Radiographic Changes</th>
<th>Fistula Connection</th>
<th>Foreign Body</th>
<th>Esophageal Diverticulum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (2009)</td>
<td>1</td>
<td>Yorkshire terrier</td>
<td>F/I</td>
<td>Cough after eating and drinking, dyspnea, weight loss, pyrexia</td>
<td>Yes</td>
<td>Accessory lung lobe</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>2 (2003)</td>
<td>0.8</td>
<td>Chihuahua</td>
<td>M/I</td>
<td>Regurgitation</td>
<td>No</td>
<td>Right caudal tertiary bronchus</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3 (1995)</td>
<td>7</td>
<td>Maltese</td>
<td>F/S</td>
<td>Anorexia, dysphagia, productive cough, pyrexia, weight loss</td>
<td>Yes</td>
<td>Right caudal main stem bronchus</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>4 (1995)</td>
<td>3</td>
<td>Fox terrier</td>
<td>F/S</td>
<td>Depression, cough after drinking</td>
<td>No</td>
<td>Right caudal and middle lung lobes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>5 (1991)</td>
<td>1</td>
<td>Cairn terrier</td>
<td>M/?</td>
<td>Cough after eating and drinking</td>
<td>Yes</td>
<td>Right caudal lung lobe</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>6 (2011)</td>
<td>1.2</td>
<td>Miniature poodle</td>
<td>M/?</td>
<td>Cough after drinking, weight loss</td>
<td>Yes</td>
<td>Right caudal lung lobe</td>
<td>N/A</td>
<td>No</td>
</tr>
<tr>
<td>7 (1986)</td>
<td>6</td>
<td>Yorkshire terrier</td>
<td>M/?</td>
<td>Cough after drinking, weight loss, depression, emaciation, dyspnea</td>
<td>Yes</td>
<td>Right cranial and middle lung lobes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>8 (1984)</td>
<td>7</td>
<td>Peekapoo</td>
<td>F/?</td>
<td>Cough after drinking</td>
<td>Yes, with pleural effusion</td>
<td>Right middle bronchus</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>9 (1984)</td>
<td>2</td>
<td>Poodle–terrier cross</td>
<td>F/S</td>
<td>Cough after drinking and exercise, lethargy, anorexia</td>
<td>Yes</td>
<td>Right main stem bronchus</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>10 (1984)</td>
<td>0.5</td>
<td>Lhasa apso</td>
<td>F/?</td>
<td>Regurgitation</td>
<td>No</td>
<td>Right caudal and middle lung lobes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>11 (1982)</td>
<td>5</td>
<td>Miniature poodle</td>
<td>F/S</td>
<td>Cough after drinking, retching/gagging, dysphagia</td>
<td>Yes</td>
<td>Accessory bronchus</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>12 (1978)</td>
<td>6</td>
<td>Parson Russell terrier</td>
<td>M/?</td>
<td>Regurgitation, retching, gulping, dyspnea, pyrexia, anorexia</td>
<td>Yes</td>
<td>Right caudal lung lobe</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>13 (1978)</td>
<td>2</td>
<td>Cairn terrier</td>
<td>F/?</td>
<td>Retching, cough</td>
<td>Yes</td>
<td>Right caudal lung lobe</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>14 (1978)</td>
<td>5</td>
<td>Miniature dachshund</td>
<td>F/?</td>
<td>Anorexia, listlessness, cough, regurgitation</td>
<td>N/A</td>
<td>Right caudal lung lobe</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>15 (1978)</td>
<td>4</td>
<td>Cairn terrier</td>
<td>F</td>
<td>Anorexia, cough, dyspnea</td>
<td>Yes, with pleural effusion</td>
<td>Right caudal lung lobe</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>16 (1974)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Gagging, anorexia, pyrexia</td>
<td>N/A</td>
<td>Right middle and/or caudal lung lobe</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>17 (1974)</td>
<td>2</td>
<td>Terrier cross</td>
<td>F/S</td>
<td>Weight loss, cough, dyspnea, pyrexia, depression, hypertrophic osteopathy</td>
<td>No</td>
<td>Left caudal lung lobe</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>18 (1973)</td>
<td>3.5</td>
<td>Miniature poodle</td>
<td>F/I</td>
<td>Cough after eating and drinking, listlessness, weakness, anorexia, dyspnea, pyrexia, oculonasal discharge</td>
<td>Yes</td>
<td>Right caudal lung lobe bronchus</td>
<td>N/A</td>
<td>Yes</td>
</tr>
</tbody>
</table>

I = intact, N/A = not available, S = spayed

Canine Bronchoesophageal Fistulas

ration of gastric and esophageal contents.\textsuperscript{13} Large fistulas directed caudally or ventrally from the esophagus produce a more consistent cough than small fistulas directed cranially or dorsally,\textsuperscript{8} most likely as the result of gravity.\textsuperscript{8} Systemic signs in dogs are associated with mediastinitis,\textsuperscript{4,7} aspiration pneumonia,\textsuperscript{7} or bronchopneumonia.\textsuperscript{4} Respiratory signs may be relatively mild, resulting in a marked delay in the diagnosis of a congenital lesion.\textsuperscript{10} In humans, coughing associated with swallowing liquids may be brought on by a change of posture, such as lying on the back or side.\textsuperscript{14} In some cases, dysphagia may be the predominant sign.\textsuperscript{10} A complete blood count may reveal inflammatory changes associated with chronic pneumonia.

Survey thoracic radiography may reveal radiopaque foreign bodies in the esophagus or bronchus, pulmonary consolidation, pleural fluid accumulation,\textsuperscript{4} or localized interstitial, alveolar, or bronchial lung patterns.\textsuperscript{8,12} Pleural fluid may accumulate secondary to localized pulmonary infection or as an extension of the inflammatory reaction around the fistula.\textsuperscript{8} A BEF should be suspected in a young animal with recurrent aspiration pneumonia; a focal, recurrent lung opacity\textsuperscript{10}; or localized pneumonia associated with coughing after eating or (especially) drinking.\textsuperscript{9} With the exception of the case presented here, characteristic lung patterns typically involve disease localized to the right caudal and/or middle lobes\textsuperscript{16} (FIGURE 6). In the case in this report, disease was localized to the accessory lobe, another possible site of aspiration pneumonia.

Contrast esophagography\textsuperscript{7,11} endoscopy,\textsuperscript{6,11} or histopathology\textsuperscript{9} is required for definitive diagnosis of communication between the esophagus and the airway, with contrast esophagography considered the gold standard. Most authors recommend performing an esophageal contrast study when a BEF is suspected or when an esophageal diverticulum is identified by other diagnostic procedures. Even if clinical signs are not associated with swallowing,
Canine Bronchoesophageal Fistulas

A barium esophageal contrast study should be part of evaluating chronic pulmonary disease of unknown etiology (Figures 7 and 8). Iodinated contrast agents should be avoided because they are hyperosmolar and result in pulmonary edema. Oral iodinated contrast agents are also more irritating to bronchi and might elicit a cough, which would result in poor opacification of the fistula and/or bronchi. Barium solution is preferred if communication with the bronchi is suspected because of its low cost and its nonreactivity in airways. A thin mixture of barium should be used (20% to 30% weight/volume) because it fills small fistulas more efficiently than thick barium mixed with food. However, small fistulas may be more difficult to demonstrate. Fluoroscopy with some form of video recording is helpful in diagnosing small fistulas or fistulas directed cranially or dorsally from the esophagus. In these cases, the contrast medium may only momentarily fill the bronchi. Multiple recumbent positions may be required to facilitate gravitation of the contrast medium into or through the fistula. Fluoroscopy is also helpful in differentiating a fistula from aspiration when contrast medium is used. In humans, repeated esophageal contrast studies may not uniformly reveal the fistula even when it is strongly suspected.

Esophagoscopy and bronchoscopy can be attempted, but both require general anesthesia, which may be a problem in dogs with compromised respiratory function. Moreover, endoscopy may not allow clear identification of the origin of the fistulous tract. Bronchoscopy may allow visualization of the diseased lung lobe(s) and enables sample collection from affected areas for cytology and culture. The presence of Simonsiella spp is only significant if oral contamination of the catheter or fluid is avoided during transtracheal aspiration, as was seen in the case presented. Predictably, bacteria cultured from fluid obtained via transtracheal or bronchoalveolar lavage reflect their oral and esophageal sources. Bacteroides fragilis, Actinomyces spp, Enterococcus cloacae, Escherichia coli, Staphylococcus intermedius, and nonhemolytic and α-hemolytic streptococci have been reported.

If the patient succumbs to complications or is euthanized, the diagnosis of a BEF may be confirmed based on gross and histopathologic examination. In human medicine, the following criteria are generally accepted and used to confirm the congenital origin of a BEF: (1) absence of past or present surrounding inflammation; (2) lack of adherent lymph nodes; and (3) presence of a definite mucosa and muscularis mucosa within the fistula.

Treatment

Treatment consists of surgical correction of the fistulous tract. Anesthesia may present a challenge because the fistula makes ventilation difficult, and inhaled anesthetic escapes into the esophagus, which can result in tracheobronchial flooding with gastric contents. In human patients, this complication has been prevented by preoperative gastrostomy or endobronchial intubation. A dog with a BEF between the esophagus and right caudal lobar bronchus underwent intubation of the left main stem bronchus under fluoroscopic guidance to avoid loss of anesthetic gases and ventilatory problems when the fistula was being dissected. Intubation of the left main stem bronchus also resulted in collapse of the right lung lobes, facilitating surgical dissection. Lobectomy may be necessary if extensive pulmonary lesions such as consolidation, abscessation, bronchopneumonia, fistula recurrence, and foreign material contained within the airways are present. Postoperatively, an
Esophageal Diverticula

An esophageal diverticulum is defined as a circumscribed outpouching of the esophageal wall that may be congenital or acquired. Congenital diverticula result from abnormal embryologic development of the esophagus. Acquired diverticula are classified as either traction or pulsion diverticula. Traction diverticula result from periesophageal inflammation and fibrosis where contraction of fibrotic adhesions to adjacent organs causes eversion and outpouching of the esophageal wall. These adhesions lead to loss of normal esophageal motility and focal dilation. Pulsion diverticula result from increased esophageal luminal pressure due to a foreign body, mass, stricture, or vascular ring anomaly, all of which cause local compromise of the esophageal wall. Diverticula generally appear in the pharyngoesophageal, midthoracic, or caudal thoracic areas of the esophagus. The accumulation of ingesta (impaction) within diverticula leads to esophagitis, mechanical obstruction (seen with large diverticula), and disturbed esophageal motility.

Clinical signs associated with large esophageal diverticula may include regurgitation, gagging, gulping, retching, distress or gasping after eating, odynophagia, emaciation, thoracic and/or abdominal pain, hypersalivation, and respiratory distress. Postprandial regurgitation results from mechanical obstruction and motility disturbances, while respiratory distress occurs with rupture of the diverticula into the mediastinum, aspiration pneumonia, or fistula formation. Abnormal lung sounds may be auscultated if aspiration pneumonia has developed. Peridiverticulitis can result in BEFs or adhesions to adjacent lung lobes. Small diverticula may not be associated with clinical signs.

Laboratory findings may include an inflammatory leukogram associated with aspiration pneumonia, while cytology may reveal pyothorax associated with rupture. Survey thoracic radiography, contrast radiography, and endoscopy can all be helpful in diagnosing esophageal diverticula. Radiographs should be taken with the neck in an extended position to diminish “normal” esophageal redundancy in young and brachycephalic breeds. Plain radiographs should be evaluated for the presence of a focal, soft tissue, or heterogenous opac-
ity representing the impacted diverticulum; signs of aspiration pneumonia; or esophageal dilation. An esophagram usually demonstrates a deviation or outpouching of the esophageal lumen that fills partly or completely with contrast material. In the case presented, esophagoscopy was useful to diagnose the inflamed, saclike outpouching of the esophageal lumen. However, clinicians must be careful not to perforate the weaker or thinner diverticular wall with the endoscope.

Small diverticula may be managed medically by feeding a soft, bland diet with the endoscope. Large diverticula, especially those associated with progressive or intractable clinical signs, require excision and reconstruction of the esophageal wall. The lack of esophageal serosa and omentum for support makes esophageal surgery technically demanding, and surgical complications from repair of an esophageal diverticulum are common. Surgical closure without tension is required because of the constant peristaltic motion and extrinsic movements of the head, neck, heart, and lungs. Also, the blood supply of the esophagus is easily compromised, leading to local ischemia and necrosis. Techniques using gastrointestinal anastomosis and thoracoabdominal stapling instruments to surgically excise diverticula have been described. Peridiverticular adhesions or a BEF may require a partial or complete lung lobectomy. Most severe cases warrant a guarded prognosis because of the complications associated with esophageal surgery, such as stricture formation and segmental hypomotility. The prognosis is good if the diverticulum is uncomplicated by lung adhesions, abscesses, or BEFs.

**Conclusion**

BEF is a rare cause of chronic cough in dogs and is usually related to an esophageal foreign body and diverticulum. Clinical signs can be nonspecific but may include a history of coughing after eating or drinking. The most reliable method for confirming the presence of a BEF is positive-contrast esophagography; however, endoscopy, necropsy, and postmortem histopathology can assist the clinician in making the diagnosis. Surgical repair is the treatment of choice. When no secondary complications are present and the patient is stable preoperatively, the prognosis is good.

**Acknowledgment:** The authors thank Caroline Geigy, Dr. med. vet., for her valuable contribution in managing the case presented.

**References**

1. Which diagnostic test is usually not required to diagnose esophageal diverticula?
   a. survey thoracic radiography  
   b. esophagram  
   c. biopsy  
   d. endoscopy

2. What are the classic signalment and historical signs in a dog with BEF?
   a. small dog, retching, anorexia, lethargy  
   b. small dog, coughing after eating and/or drinking  
   c. large dog, difficulty eating, regurgitation  
   d. large dog, vomiting, dyspnea

3. Which of the following is the most common etiology of BEF?
   a. foreign body and pulsion diverticula  
   b. foreign body and traction diverticula  
   c. congenital malformation with pulsion diverticula  
   d. congenital malformation with traction diverticula

4. Which of the following has not been associated with BEF?
   a. esophageal diverticula  
   b. pleural effusion  
   c. peritoneal effusion  
   d. pneumonia

5. Which of the following is not a clinical sign usually associated with BEF?
   a. coughing  
   b. retching  
   c. anorexia  
   d. diarrhea

6. What characteristics make a BEF challenging to diagnose?
   a. chronic nature, insidious onset, non-specific clinical signs  
   b. rarity  
   c. multitude of differentials  
   d. all of the above

7. With which lung lobe(s) does/do BEFs most commonly communicate?
   a. left caudal  
   b. right cranial, middle  
   c. accessory lung lobe  
   d. right caudal, middle

8. Which test is the gold standard to confirm the presence of a BEF?
   a. contrast esophagography  
   b. fluoroscopy  
   c. endoscopic visualization  
   d. bronchoalveolar lavage

9. Thoracic radiography of dogs with BEF usually does not reveal
   a. esophageal diverticula.  
   b. diffuse pulmonary disease.  
   c. an alveolar pattern.  
   d. a mediastinal mass.

10. The treatment of choice for BEF is
    a. surgical correction.  
    b. antibiotics.  
    c. antiulcer medications.  
    d. upright feedings.