Cricopharyngeal Dysphagia in Dogs: The Lateral Approach for Surgical Management

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ABSTRACT: Cricopharyngeal dysphagia occurs in dogs when there is achalasia or asynchrony of the cricopharyngeal muscle. Differentiation of other causes of dysphagia and preoperative stabilization of the patient are essential for a successful outcome. Cricopharyngeal myectomy or myotomy using a lateral or ventral approach is the preferred treatment.

The swallowing process may be divided into oropharyngeal, esophageal, and gastro-esophageal phases. The oropharyngeal phase of swallowing may be further subdivided into oral, pharyngeal, and cricopharyngeal phases. Impairment of any part of the oropharyngeal phase of swallowing may result in dysphagia. In the oral phase of swallowing, prehension and formation of a food bolus (which is moved to the tongue base) occur. Oral dysphagia is characterized by decreased tongue movements and difficulty in bolus accumulation. During the pharyngeal phase of swallowing, the bolus is delivered to the caudal pharynx by coordinated contraction of the pharyngeal muscles. Pharyngeal dysphagia is characterized by interrupted movement of the bolus from the oropharynx to the hypopharynx and by impaired initiation of the involuntary portion of the swallowing reflex. During the cricopharyngeal phase of swallowing, the thyropharyngeal muscle contracts while the cricopharyngeal muscle relaxes, allowing passage of the bolus from the pharynx to the esophagus. At other times, and as soon as the bolus is completely transported into the esophagus, the cricopharyngeal muscle constricts continuously, thereby closing the proximal esophagus to prevent entrance of air into the esophagus during respiration and to prevent gastroesophageal reflux into the pharynx.

Cricopharyngeal dysphagia (CPD) is an upper esophageal sphincter abnormality that occurs with inadequate relaxation of the cricopharyngeal muscle (achalasia) or failure of synchronization between pharyngeal contraction and cricopharyngeal relaxation (asynchrony) during swallowing. Esophageal dysphagia occurs when there is difficulty transporting the bolus through the esophageal body. Gastro-esophageal dysphagia results when there is a problem transporting the bolus through the caudal esophageal sphincter.

CPD is uncommon in dogs, and its underlying...
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Case Report

A 1-year-old castrated English cocker spaniel weighing 24.2 lb (11 kg) was referred to the Veterinary Medical Teaching Hospital, University of Missouri–Columbia, with a history of chronic coughing and regurgitation after eating. The dog had a low body condition score (i.e., 2 of 9). The complete blood count and serum biochemistry profile results included slight neutrophilia and lymphocytosis. The result of a serologic examination for *Ehrlichia canis* infection was positive. A neurologic examination disclosed no abnormalities. An acetylcholine antibody titer was within normal limits. Thoracic radiography detected a bronchial and interstitial pattern that was most evident in the left caudal lung lobe. Barium swallow videofluoroscopy showed normal movement of the barium from the oral cavity to the pharynx. Attempts to propel the bolus into the esophagus were unsuccessful because the upper esophageal sphincter was not adequately relaxed. A diagnosis of CPD was made, and the dog was prescribed doxycycline (50 mg PO bid for 3 weeks) and discharged from the hospital.

Seven days later, the dog was readmitted to the hospital to undergo surgery for CPD. Results of a clinical examination of the oral cavity and larynx, with the patient under light anesthesia, were normal. Results of an intraoperative electromyographic examination of the left pelvic limb and pharyngeal muscles were within normal limits. A percutaneous endoscopic gastrostomy tube was placed on the left side, and the dog underwent left lateral cricopharyngeal myectomy as already described. The resected cricopharyngeal muscle was submitted for histopathologic examination. The specimen was stained with hematoxylin–eosin, modified trichrome, periodic acid–Schiff, ATPase at pH levels of 9.8 and 4.3, esterase, nicotinamide adenine dinucleotide–tetrazolium reductase, acid phosphatase, alkaline phosphatase, oil red O, and staphylococcal protein A conjugated with horseradish peroxidase. The results of histopathology showed moderate variability in myofiber size, with scattered, round atrophic fibers. Abundant endomyosial, perimysial, and adipose connective tissues were seen. Necrotic fibers were also present, and intramuscular nerve branches moderately depleted of myelinated fibers were seen. The dog recovered uneventfully from anesthesia and started enteral feeding via the gastrostomy tube.

The dog was offered ice cubes 12 days after surgery and had canned food and water 14 days after surgery without showing signs of regurgitation. Forty-five days after surgery, the owner reported that the dog was eating canned and dry food normally, without regurgitation or coughing.

Surgical Anatomy

The cranial esophagus is dorsal to the larynx and left of the midline. The upper esophageal sphincter is formed by the thyropharyngeal and cricopharyngeal muscles. The thyropharyngeal muscles originate from the lateral surface of the thyroid cartilage lamina and course dorsally and cranially over the dorsal border of the thyroid lamina and insert on the median dorsal surface of the pharynx in a bilaterally symmetric fashion. The cricopharyngeal muscle originates from the lateral
surface of the cricoid cartilage and spreads over the dor-
sal surface of the esophagus across the midline and ends
by narrowing its belly to the contralateral aspect of the
cricoid cartilage. The borders of the cricopharyngeal and
thyropharyngeal muscles are obscured as the fibers
blend together. In contrast to what has been
reported, recent studies in normal puppies and adult
dogs have shown that the cricopharyngeal muscle is
unpaired (i.e., single). The cricopharyngeal muscle is
innervated by the glossopharyngeal nerve and the pha-
ryngeal branch of the vagus nerve. The cricopharyn-
geal muscle receives its blood supply primarily from
branches of the cranial thyroid artery.

SURGICAL MANAGEMENT
Preoperative Considerations and Care
Preoperative stabilization of dehydrated and debili-
tated patients is mandatory for a successful outcome and
includes administration of intravenous fluids and
electrolytes as well as antimicrobials to prevent aspira-
tion pneumonia. To obtain optimal nutritional status, a
percutaneous endoscopic gastrostomy tube should be
placed in dogs with persistent dysphagia. Electromyo-
graphy of the pharyngeal and laryngeal muscles is useful
in excluding other abnormalities associated with the
pharyngeal phase of swallowing or laryngeal paralysis
that may adversely affect the outcome. Preoperative
electromyographic recordings in four Bouvier des Flan-
dres with muscular dystrophy undergoing surgery for
CPD showed incoordination in the pharyngeal phase of
swallowing in addition to CPD. Aspiration pneumonia
and/or bronchitis has been reported in 46% of the 45
dogs that underwent surgery for CPD. Laryn-
geal paralysis and masticatory myositis have also been
reported preoperatively in dogs with CPD.

Surgical Technique
Cricopharyngeal myotomy or myectomy, alone or
combined with thyropharyngeal myotomy or myectomy,
is the definitive treatment of dogs with CPD to relieve
clinical signs and facilitate swallowing. During cricopharyngeal myotomy, the muscle is tran-
sected along the dorsal midline to the esophageal mus-
cularis. Cricopharyngeal myectomy involves partial
excision of the cricopharyngeal muscle after elevating
the muscle fibers from the esophageal muscularis.
Cricopharyngeal surgery may be performed using the
standard ventral midline approach. A lateral
approach has recently been described for myotomy or
myectomy of the cricopharyngeal muscle. This
approach is similar to that used for cricoarytenoid laryn-
goplasty in dogs with laryngeal paralysis.

Of the 45 dogs receiving surgical treatment of
CPD, 53% had cricopharyngeal myotomy, 25%
had cricopharyngeal myectomy, 9% had cricopharyngeal
and thyropharyngeal myotomy, and 13% had cricopha-
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ryngal and thyropharyngeal myectomy. Of dogs undergoing myotomy or myectomy of both muscles, three had partial myotomy and four had partial myectomy. The ventral midline approach was performed in 82% of the dogs, and the lateral approach in 18%.

In the lateral approach, the dog is placed in lateral recumbency, and a rolled towel is placed under its neck to elevate the cricopharynx toward the surgeon (Figure 1). An orogastric tube is preplaced to aid identification of the esophagus. The head is stabilized on the table by placing adhesive tape on the nose. An 8- to 10-cm left lateral incision is made dorsal to the larynx and ventral to the jugular vein starting at the cranial aspect of the cricoid cartilage (Figure 1). The platysma muscle and subcutaneous tissue are incised. With the use of Gelpi retractors, the sternocleidomastoid muscle and jugular vein are retracted dorsally and the sternohyoideus muscle is retracted ventrally to allow identification of the thyroid cartilage (Figures 2 and 3). The loose connective tissue around the thyroid cartilage is dissected free to expose the thyropharyngeal muscle, the cricopharyngeal muscle caudal to it, and the esophagus (Figure 4). The thyroid gland may become visible between the trachea and the sternohyoideus muscle. The cricopharyngeal muscle is dissected free laterally and dorsally down to the midline (Figure 5). Small branches of the cranial thyroid artery are ligated or electrocoagulated to control bleeding. Perforation of the esophageal wall is avoided. A 2- to 2.5-cm portion of the cricopharyngeal muscle is removed and placed in 10% buffered neutral formalin for histopathologic examination. Connective tissue is apposed with a continuous pattern of 3-0 absorbable suture. Skin closure may be accomplished with a continuous intradermal pattern using 3-0 absorbable suture, or the skin may be closed with nylon suture or staples.

Postoperative Care and Complications

The day after surgery, patients should be fed canned or blenderized food for the first 2 days and gradually returned to a normal diet over the next 3 to 4 days.

Figure 3. The thyroid cartilage is identified (grasped with forceps).

Figure 4. The thyropharyngeal muscle (grasped with forceps) and cricopharyngeal muscle (CP) can be easily identified by dissection of the loose connective tissue around the thyroid cartilage.

Figure 5. Cricopharyngeal myectomy by dissection of the muscle laterally and dorsally to the midline. The cricopharyngeal muscle has been incised dorsally and is grasped with hemostats to facilitate further dissection and final incision (dotted line) laterally.
Tube gastrostomy should be considered in patients that fail to maintain their body weight after surgery and that have persistent dysphagia.\textsuperscript{21} Fluid therapy and antimicrobials may be continued in the presence of aspiration pneumonia.\textsuperscript{28} Postoperative complications following cricopharyngeal myotomy or myectomy may include laryngeal paralysis, fibrosis, esophageal wall perforation, recurrence of dysphagia, and pharyngocutaneous fistula.\textsuperscript{29} Persistent or recurrent dysphagia and aspiration pneumonia were the most common short- and long-term postoperative complications reported in 23 of the 45 dogs that underwent surgery for CPD.\textsuperscript{8,9,14,18,21} The management of aspiration pneumonia may include administration of intravenous fluids and/or antimicrobials, positive-pressure ventilation via tracheostomy tube or oxygen support via nasal tube, nebulization, and coupage.\textsuperscript{21} Aspiration pneumonia has been diagnosed in 12 dogs, 10 of which died or were euthanized as a result of the complication 12 hours to 4 years after surgery; two dogs survived.\textsuperscript{8,9,18,21} Aspiration pneumonia may be difficult to manage effectively in the presence of esophageal hypomotility and megaesophagus.\textsuperscript{21} In a study\textsuperscript{9} of 24 Bouvier des Flandres with dysphagia associated with muscular dystrophy, four had surgery for CPD and three died 2 days after surgery because of aspiration pneumonia. The concurrent presence of pharyngeal dysphagia in those three dogs may have been responsible for the unfavorable outcome. One dog experienced dysphagia attributed to fibrosis and contracture after undergoing cricopharyngeal myotomy for CPD. The dog underwent endoscopic bougienage without much success and was euthanized.\textsuperscript{14} Thus some authors\textsuperscript{3,5,18} support performing myectomy rather than myotomy to ensure complete removal of the muscle fibers and prevent the previously described complication. However, others\textsuperscript{5} favor myotomy as long as muscle fibers are all recognized and transected. Two dogs have had revision of previous CPD surgery because of partial or transient resolution of dysphagia. One dog underwent cricopharyngeal, thyropharyngeal, and hypopharyngeal...
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Key Points

- Diagnosis of cricopharyngeal dysphagia is made with positive-contrast videofluoroscopy.
- Cricopharyngeal myectomy via a lateral approach provides more rapid and easier access than does a ventral approach for surgical management of cricopharyngeal dysphagia.
- Accurate preoperative differentiation of cricopharyngeal dysphagia from pharyngeal dysphagia and esophageal hypomotility may decrease the possibility of surgical failure and aspiration pneumonia.

OUTCOME

Of the 45 dogs that had surgery for CPD, 49% showed complete resolution of clinical signs of dysphagia; follow-up was available for 38 dogs and ranged from 12 hours to 8 years.1,6,8–10,14–21 The outcome and follow-up of 45 dogs are presented in Table 1. Myotomy achieved complete resolution of clinical signs in 12 dogs and myectomy in 11 dogs. However, the type of surgical procedure (myotomy versus myectomy) has reportedly not had an effect on the outcome,21 nor has surgeon experience (diplomates versus residents).21

CONCLUSION

Surgery is the preferred treatment of dogs with CPD, and several techniques to resolve clinical signs of dysphagia have been discussed in the literature. A lateral approach has been described for myotomy26 and myectomy20,21 of the cricopharyngeal muscle. With the lateral approach, identification of the cricopharyngeal muscle is straightforward and the procedure is quicker and easier compared with the ventral approach, in which rotation of the larynx by 180° and placement of stay sutures to maintain rotation are necessary to identify the cricopharyngeal muscle. In addition, with the lateral approach, access to the dorsal midline of the muscle can be easily achieved and the muscle can be laterally and dorsally undermined and excised without difficulty if the esophageal wall is not traumatized. Five dogs with CPD that had cricopharyngeal muscle myectomy through the lateral approach had complete resolution of clinical signs for 2 to 8 years after surgery.10 Before surgery, CPD should be accurately differentiated from other causes of dysphagia (e.g., oral or pharyngeal-phase dysphagia and esophageal hypomotility) to eliminate the possibility of surgical failure and to decrease the chance of aspiration pneumonia.8,9,21 Preoperative stabilization of the patient and enteral feeding with a percutaneous endoscopic gastrostomy tube are essential for a favorable outcome.

REFERENCES


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1. Achalasia refers to
   a. failure of the cricopharyngeal muscle to relax.
   b. asynchrony of the cricopharyngeal and thyropharyngeal muscles.
   c. failure of the cricopharyngeal muscle to contract.
   d. failure of the thyropharyngeal muscle to relax.

2. CPD is an abnormality of the
   a. upper esophageal sphincter.
   b. lower esophageal sphincter.
   c. upper pharyngeal sphincter.
   d. esophageal muscle.

3. Which is an unpaired muscle?
   a. sternohyoideus
   b. thyropharyngeus
   c. sternocephalicus
   d. cricopharyngeus

4. Which breed has been identified as having a genetic component to CPD?
   a. Labrador retriever
   b. boxer
   c. golden retriever
   d. standard poodle
5. Which statement regarding diagnosis of CPD is incorrect?
   a. A diagnosis of CPD can be confirmed by positive-contrast videofluoroscopy.
   b. Positive-contrast videofluoroscopy is not a reliable method of differentiating CPD from other causes of dysphagia.
   c. Electromyography of pharyngeal muscles may aid in differentiating CPD from other abnormalities associated with pharyngeal dysphagia.
   d. Electromyography of the laryngeal muscles in dogs with CPD is useful in excluding laryngeal paralysis, which may adversely affect patient outcome.

6. The cricopharyngeal muscle originates from the
   a. lateral surface of the thyroid cartilage.
   b. lateral surface of the cricoid cartilage.
   c. medial surface of the thyroid cartilage.
   d. medial surface of the cricoid cartilage.

7. Which complication has not been reported in dogs after surgery for CPD?
   a. aspiration pneumonia
   b. persistent dysphagia
   c. incisional seroma
   d. megaesophagus

8. Which statement regarding surgical treatment of CPD is incorrect?
   a. Cricopharyngeal myectomy via a lateral approach has been reported.
   b. Cricopharyngeal myectomy involves resection of the esophageal mucosa.
   c. During cricopharyngeal myotomy, the muscle is transected along the dorsal midline to the esophageal muscularis.
   d. Thyropharyngeal myotomy has been reported in conjunction with cricopharyngeal myotomy.

9. Which statement regarding surgical treatment of CPD is correct?
   a. Cricopharyngeal myotomy is more effective than cricopharyngeal myectomy.
   b. Surgeon experience has not been associated with patient outcome following surgery.
   c. Success after surgery is better with Bouvier de Flandres than with cocker spaniels.
   d. In dogs, long-term success after surgery is better with males than with females.

10. During the lateral approach for cricopharyngeal myectomy or myotomy, which muscle is retracted dorsally for exposure?
    a. sternocephalicus
    b. sternohyoideus
    c. sternothyroideus
    d. thyropharyngeus