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Intermittent At-Home Suctioning of Esophageal Content for Prevention of Recurrent Aspiration Pneumonia in 4 Dogs with Megaesophagus

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Background: Megaesophagus carries a poor to guarded prognosis due to death from aspiration pneumonia. Options for medical management of regurgitation are limited to strategic oral or gastrostomy tube feeding.

Objectives: To describe the use and efficacy of intermittent esophageal suctioning to prevent regurgitation and associated episodes of aspiration pneumonia in dogs with megaesophagus.

Animals: Four dogs with acquired idiopathic megaesophagus and recurrent aspiration pneumonia.

Methods: Retrospective review of medical records of dogs with megaesophagus in which intermittent suctioning of esophageal content was employed for management of recurrent aspiration pneumonia.

Results: Intermittent suctioning of the esophagus was initiated in 4 dogs after failure of strict gastrostomy tube feeding failed to prevent regurgitation and repeated episodes of aspiration pneumonia. Suctioning was accomplished by esophagostomy tube in 3 dogs and per os in 1 dog. After initiation of esophageal suctioning, dogs survived for a median of 13.5 additional months (range, 10–30 months) during which time 2 dogs had no additional episodes of aspiration pneumonia and 2 dogs had infrequent episodes of pneumonia, but aspiration was suspected to be a contributing factor in their death. Complications included clogging of the esophagostomy tube, esophagostomy site infections, and esophagitis.

Conclusions and Clinical Importance: Use of intermittent esophageal suctioning in dogs with megaesophagus that continue to regurgitate despite gastrostomy tube feedings can reduce or abolish clinical episodes of aspiration pneumonia.

Key words: Esophagostomy; Regurgitation.

Megaesophagus is a functional disorder in which there is decreased peristalsis and diffuse dilation of the esophagus. Treatment is generally limited to supportive care unless esophageal dysfunction resolves or a primary cause can be corrected. Acquired idiopathic megaesophagus carries a poor to guarded prognosis. The median survival time from hospital admission (or diagnosis) to death or euthanasia ranges from 1 to 3 months[1–3] with an overall case fatality rate of 74%.[1] Regurgitation is the most common clinical sign observed in dogs with megaesophagus and aspiration pneumonia is the most common cause of death.[1,4] Dogs with megaesophagus and concurrent radiographic evidence of aspiration pneumonia have a 7.69 fold increased risk of dying before discharge from the hospital and are 2.2 times as likely to die at any given time point as compared to dogs without aspiration pneumonia.[2]

Abbreviations:

CBC	complete blood cell count
MRSA	methicillin-resistant *Staphylococcus aureus*
MRSP	methicillin-resistant *Staphylococcus pseudointermedius*
ESBL	extended spectrum beta lactamase

Traditional treatment options to prevent regurgitation include feeding in a cranially elevated position and experimenting with different consistencies of food until an optimal formulation is identified. In dogs that continue to regurgitate despite these measures, a gastrostomy feeding tube can be placed to bypass the esophagus.[5,6] Despite provision of all water and nutritional needs through a gastrostomy tube, many dogs with megaesophagus continue to regurgitate and undergo repeated episodes of aspiration pneumonia.

The purpose of this study is to describe the management and long term outcome of 4 dogs with generalized megaesophagus in which intermittent suctioning of esophageal content was employed in an effort to prevent recurrent aspiration pneumonia.

Materials and Methods

The electronic database of medical records at the North Carolina State University Veterinary Hospital was searched for all dogs diagnosed with generalized megaesophagus and recurrent aspiration pneumonia between 2006 and 2014. Four cases for which

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medical management using both a gastrostomy feeding tube and intermittent esophageal suctioning were identified and retrospectively reviewed. Information extracted from the medical records included signalment, body weight, clinical signs and their duration, physical examination and clinical laboratory findings, and diagnostic testing for underlying cause(s) of megaesophagus. Also recorded were the durations of time and number of episodes of aspiration pneumonia occurring prior to and after initiation of elevated feeding, after initiation of gastrostomy tube feeding, and following institution of intermittent suctioning of esophageal content. The type of esophagostomy tube, means of placement, frequency of use and volume of esophageal contents recovered, complications associated with esophagostomy tube maintenance, and patient outcome were also recorded. Where summarized, data were described as median and range unless otherwise stipulated.

Results

Signalment and Case Histories

Dogs ranged in age from 5 to 11 years (median 8.5 years) and included two Golden retrievers and two Rottweilers. Two were spayed females and two were castrated males. Their body weights ranged from 27.6 to 40.2 kg (median 32.5 kg). Three dogs had a history of recurrent regurgitation ranging in duration from 6 weeks to 16 months prior to presentation. The remaining dog had a single episode of vomiting and diarrhea on the day of admission. Prior to referral, medical management of regurgitation was reported in two dogs and included a change in diet consistency (2 dogs) and elevated feeding (1 dog). Two dogs with recurrent regurgitation had a single episode of aspiration pneumonia, based on historical information.

Diagnostic Evaluation

In each dog, thoracic radiographic findings were consistent with the presence of generalized megaesophagus. One dog had concurrent radiographic evidence of aspiration pneumonia. At the time of referral, diagnostic testing to evaluate for secondary causes of megaesophagus was performed at the discretion of the attending clinician. This testing included a complete blood cell count (CBC), serum biochemistry profile, and nicotinic acetylcholine receptor antibody titer in all dogs. A complete urinalysis and measurement of serum concentrations of thyroid hormones and cortisol were performed in two dogs. No secondary causes of megaesophagus were identified by these tests.

Initial Case Management

Recommendations for treatment of all four dogs included a change in diet consistency and elevated feeding. Following discharge from the hospital, all dogs were diagnosed clinically and radiographically with one or more episodes of aspiration pneumonia (range 1–7 episodes) over a period of time ranging from 3 days to 19 months. At this time, each dog underwent anesthesia for percutaneous endoscopic or surgical placement of a permanent gastrostomy feeding tube. In dog 4, an esophagostomy tube was placed under the same anesthetic episode as the gastrostomy feeding tube. Dogs were discharged from the hospital with instructions to administer all food and water through the gastrostomy tube. Despite discontinuation of oral nutrition and water intake, dog 1 was diagnosed with aspiration pneumonia 3 times in the subsequent 5 months, dog 2 was diagnosed with aspiration pneumonia 3 times in the subsequent 3 months, and dog 3 never showed radiographic resolution of pneumonia over the following 3 months, with progressive worsening of the lung pattern on 5 separate occasions. Dog 4 was diagnosed with aspiration pneumonia once over the following 10 months.

Esophagostomy Tube Placement

In an effort to prevent additional episodes of aspiration pneumonia, dogs 2 and 3 underwent anesthesia for surgical placement of a permanent percutaneous esophagostomy tube through which accumulated esophageal contents could be intermittently removed by suction and discarded. Clinical experience with dogs 2 and 3 led to the initial simultaneous placement of an esophagostomy and gastrostomy tube in dog 4. Placement of an esophagostomy tube was recommended in dog 1; however, this procedure was declined. In this dog, intermittent esophageal suctioning through the oral cavity was initiated.

The esophagostomy tube chosen for placement was either a 20 Fr × 55 cm silicone esophagostomy feeding tube with 10 cm of side holes[a] (dogs 2 and 3) or a 30 Fr × 55 cm silicone esophagostomy feeding tube with 12 cm of side holes[a] (dog 4). For tube placement, dogs were positioned in right lateral recumbency and a curved grasping forceps was passed from the oral cavity into the proximal esophagus. The tip of the forceps was used to push the cervical esophagus laterally toward the skin in a position ventral to the wing of the atlas, dorsal to the jugular vein and caudal to the larynx. A stab incision was made through the skin and esophagus overlying the tip of the forceps. The tip of the esophagostomy tube was grasped with the forceps, pulled through the skin and out the mouth, and then redirected down the esophagus. A finger trap suture was used to secure the tube and anchored through the skin. A cervical bandage was placed to further secure the tube. Following tube placement, thoracic radiography or endoscopy was used to confirm that the aborad end of the esophagostomy tube resided in the distal third of the thoracic esophagus.

In dog 1, esophageal suction through the oral cavity was accomplished by propping the mandible open using a roll of tape. An 18 Fr suction tube was then inserted through the center of the tape roll and passed to the level of the distal esophagus. Aspiration of the esophageal content was first initiated on an outpatient basis and later performed by the owner at home using a personal homecare suction device[b] at a vacuum pressure of 40–60 mmHg. The suction was turned on only after the tube was in place and turned off immediately prior to removal of the tube from the esophagus. It was

estimated to take 5–7 minutes to complete aspiration of the esophageal content.

Intermittent Suctioning of Esophageal Content

The owners of all dogs aspirated and discarded the esophageal contents of their dog 2–4 times per day and at times when their dog appeared uncomfortable, nauseous, or was observed to salivate excessively. The volumes recovered from each aspiration ranged from 0 to 700 mL. When aspirated immediately after gastrostomy tube feeding, esophageal content was reported to be greater in volume and consisted mostly of saliva and clear fluid. All dogs were fed and provided water exclusively through their gastrostomy tube. Oral administration of water was not allowed except in small volumes sufficient to moisten the oral cavity. In one dog, oral intake of 200–500 mL of water was allowed 2–3 times a day with simultaneous removal of water from the esophagus through the esophagostomy tube.

After institution of esophageal suctioning, owners reported only rare episodes of regurgitation. Two dogs (dogs 2 and 3) were not diagnosed with any additional episodes of aspiration pneumonia. These two dogs were euthanized 13 and 14 months after placement of the esophagostomy tube for reasons unrelated to aspiration pneumonia. Two dogs (dogs 1 and 4) were each diagnosed with 2 additional episodes of aspiration pneumonia. Dog 1 was diagnosed with oliguric renal failure and euthanized 34 months after initiation of intermittent esophageal suctioning. In this dog, aspiration pneumonia was diagnosed radiographically just prior to death. Dog 4 had clinical signs of respiratory distress and aspiration pneumonia was suspected at the time he died at home 10 months after placement of the esophagostomy tube.

Complications

The most common complication of indwelling esophagostomy for suction of esophageal content was obstruction of the tube by hair, plant material, thickened/dried saliva and other debris that was ingested by the dogs. Obstruction of the tube occurred twice in dog 4, seven times in dog 2, and in dog 3 the owner reported a need to unclog the tube approximately every 4–8 weeks. Approaches used to remove obstructing debris from the esophagostomy tube included flushing with a carbonated beverage, passage of endoscopic biopsy forceps blindly into the tube to remove debris from the distal end of the tube, or temporary insertion of an 8 French red rubber catheter alongside the esophagostomy tube prior to removing the tube for de-clogging and then use of the red rubber catheter as a guide for reinsertion of the clean esophagostomy tube. In dog 2, failure of these approaches to adequately remove obstructing debris necessitated general anesthesia to replace the esophagostomy tube on 3 occasions. Dog 2 also required general anesthesia on 3 additional occasions for endoscopic retrieval of ingested portions of the gastrostomy tube and dietary indiscretion involving consumption of 0.5 pounds of paper towels, chewed up papers, small pieces of plastic, organic material, and large quantities of hair. In attempt to prevent obstruction of the tube and also decrease viscosity of the accumulated saliva, owners were advised to flush the esophagostomy tube with 10–30 mL of warm water anywhere from every other day to three times a day. Owners were also advised to thwart their dog from consumption of foreign material by providing a non-edible chew product, or placing an E-collar or basket-type muzzle.

All three dogs with indwelling esophagostomy tubes developed multiple episodes of inflammation, discharge, reflux of esophageal content, or loss of stay-sutures associated with the esophagostomy site. Two dogs had documented bacterial infections at the esophagostomy site involving an extended-spectrum beta lactamase (ESBL) producing *Escherichia coli* (dog 4) and a methicillin-resistant *Staphylococcus aureus* (MRSA) and *Staphylococcus pseudointermedius* (MRSP) (dog 2). In dog 2, the MRSA and MRSP infection were complicated by a co-existing diagnosis of cutaneous lymphoma.

One dog (dog 3) experienced four separate episodes of hospitalization for lethargy and fever accompanied by blood-tinged to overtly hemorrhagic and foul-smelling esophageal contents. During each episode, results of a CBC revealed a left-shifted leukogram with normal to low total neutrophil count and slight to moderately toxic bands ranging from 1,534 to 2,485 cells per microliter. Results of aerobic bacterial culture of the esophageal effusion, performed at the time of the second episode, revealed growth of an ESBL-producing *E. coli*, *Pseudomonas aeruginosa*, and a Group G *Streptococcus*. The dog was treated on each occasion with intravenous fluids and antibiotics consisting of a combination penicillin/β-lactamase inhibitor, a fluoroquinolone, and metronidazole. Treatment of presumed esophagitis consisted of administration of warmed saline, sucralfate, a mouthwash solution consisting of a mixture of diphenhydramine, lidocaine, aluminum hydroxide, and magnesium hydroxide[c], or barium solution through the esophagostomy tube. The first three episodes resolved within 24–72 hours; however failure to respond at the time of the fourth episode prompted the owner to elect euthanasia. On post-mortem examination, there was a thick paper towel foreign body closely associated with and partially enveloping the esophagostomy tube within the mid thoracic esophagus. The esophageal segment extending from the caudal cervical through the thoracic portion was moderate to severely distended and flaccid with a severely thinned mural thickness. The esophageal mucosal epithelium was completely absent and replaced by a thick tract of loose granulation tissue containing scattered necrotic debris, fibrin, and varying numbers of degenerative and non-degenerative neutrophils, macrophages, lymphocytes and plasma cells (Fig 1). Occasionally the inflammation and fibrosis extended deep to the muscularis mucosae into the tunic muscularis, and surrounded vessels within this layer.

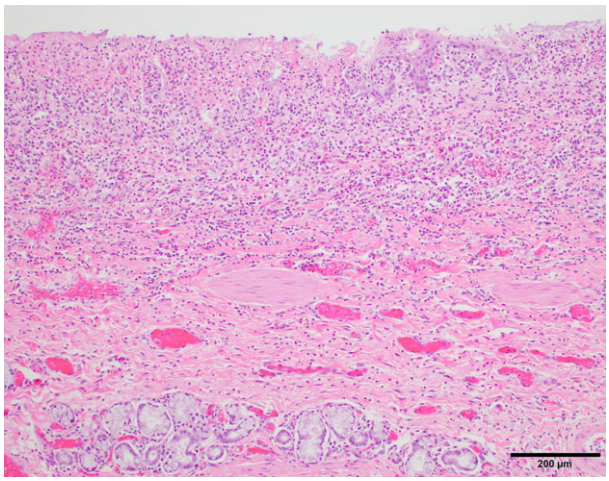

Fig 1. Histopathologic appearance of the esophagus of dog 3, 100× magnification. The esophageal stratified squamous epithelium is nearly completely absent and replaced by a thick tract of loose fibrosis and granulation tissue with admixed fibrin and necrotic debris. There is also infiltration of abundant inflammatory cells, including neutrophils, macrophages, lymphocytes and plasma cells, which variably extend into deeper tissues, such as submucosal glands. Scale bar represents 200 µm.

Discussion

In the group of dogs reported in this case series, regurgitation and multiple episodes of hospitalization for treatment of aspiration pneumonia continued to occur despite implementation of traditional strategies for management of megaesophagus. Based on similarity in appearance of the regurgitated material to saliva, we suspected that these dogs continued to regurgitate and aspirate secondary to accumulation of salivary secretions in the esophagus. The decision to implement esophageal suctioning (orally in 1 dog and via esophagostomy tube in 3 dogs) was made based on the frequency of aspiration events and significant concern for increased risk of death. Placement of a wide-lumen, multiple side-hole, percutaneous esophagostomy tube was chosen for use as the suction device based on ease of placement and use of such tubes for the purpose of assisted feeding. After initiation of intermittent esophageal suctioning, these dogs survived for a median of 13.5 additional months (range, 10–30 months). During this time regurgitation events were rare and 2 dogs had no reported episodes of aspiration pneumonia. The other 2 dogs had infrequent episodes of pneumonia but aspiration was suspected to be a complicating factor in their death or euthanasia.

The concurrent use of a gastrostomy tube for providing water and enteral nutrition and an esophagostomy tube for esophageal suctioning may not be feasible or desirable for the majority of owners of dogs with megaesophagus. Nevertheless, there are many owners, like those of the dogs in this case series, who would be willing to invest the time and money in a management method that may decrease morbidity, prolong survival, and improve quality of life of their dog. In one dog, placement of the esophagostomy tube allowed for oral intake of water (with immediate suctioning of saliva and water from the esophagus), which was considered important by the owner for the dog's mental health.

Maintenance of the esophagostomy tube in these dogs presented several unique challenges related to its use as a suction device. The most common complication was obstruction of the tube by desiccated salivary secretions and hair or other foreign material that was ingested by these dogs. In addition to deterring dogs from dietary indiscretion, daily flushing of the tube with warm water and preemptive removal of material lodged in the tube lumen using endoscopic biopsy forceps is likely to minimize, but not entirely prevent, these obstruction events. In patients not suffering from concurrent dysphagia, allowing the dog to drink water during simultaneous suctioning of the esophagus can be considered a beneficial way to hydrate the oral cavity and contents of the esophagus. Most owners suctioned their dogs' esophagus 2–4 times a day. Timing of suctioning after each gastrostomy tube feeding may yield the most esophageal content based on one owner's observation that greater volumes were recovered at that time.

One dog in this study was ultimately euthanized because of recurrent severe systemic inflammation and fever that was associated with marked, chronic ulcerative esophagitis. Indwelling silicone esophagostomy feeding tubes that do not cross the lower esophageal sphincter do not appear to cause significant esophagitis in dogs when studied over a period of 21 days.[7] Whether use of the esophagostomy tube as a suction device was contributory to this lesion is unclear. It is also possible that the pathogenic bacteria recovered by aerobic culture of the esophageal contents or presence of a foreign body in the esophagus of this dog contributed to the injury. Had hemorrhagic fluid not been suctioned from the esophagus, the clinical signs could easily have been mistaken for a radiographically occult episode of aspiration pneumonia. Severe esophagitis should be considered as a differential diagnosis in dogs with megaesophagus that develop systemic inflammation and fever in the absence of radiographic evidence of aspiration pneumonia.

In conjunction with use of a gastrostomy tube, this case series supports that intermittent suctioning of the esophagus can prevent regurgitation, decrease the incidence of aspiration pneumonia, and prolong the life of dogs with megaesophagus. Using a percutaneous esophagostomy tube, suctioning of the esophagus can be performed by owners at home and should be considered as an option for management of dogs with recurrent aspiration pneumonia. Possible complications include obstruction of the esophagostomy tube, cutaneous infection at the tube insertion site, and severe esophagitis.

Acknowledgments

Conflict of Interest Declaration: Authors declare no conflict of interest.

Off-label Antimicrobial Declaration: Authors declare no off-label use of antimicrobials.

Footnotes

[a] MILA International Inc., Erlanger, KY
[b] Vacutec® EV Aspirator, Graham-Field Health Products, Atlanta, GA
[c] FIRST® – Mouthwash BLM, CutisPharma Inc, Wilmington, MA

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Supporting Information

Additional Supporting Information may be found online in the supporting information tab for this article:

Fig S1. Treatment time intervals (months) from onset of clinical signs to end-of-life in 4 dogs diagnosed with generalized megaesophagus, regurgitation, and recurrent episodes of aspiration pneumonia. Time of initiation of upright (elevated feeding) (U), gastrostomy tube placement (G), and initiation of intermittent esophageal suctioning (E) in relation to episodes of aspiration pneumonia (black arrowheads) are shown. Red stars indicate the time at which each dog was referred to the North Carolina State University Veterinary Hospital.

Fig S2A. Gross appearance of the esophageal mucosa of dog 3. (A) Upon opening the esophagus, the esophageal tube was enveloped by an ingested paper towel with associated stray hairs. The mucosa was diffusely covered by a thin, shiny, dark gray material.

Fig S2B. (B) The foreign body was cleared and mucosa rinsed to reveal a tan to pink mottled mucosa that varied from shiny to dull with numerous small erosions to ulcerations. Many areas of the mucosa had a reddened appearance. Diffusely, the mural thickness of the esophagus was moderately to occasionally severely thinned.