Tracheal Collapse:
Updates on Diagnostics, Medical Management, and Intraluminal Stenting
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Tracheal collapse is a progressive, and potentially life-threatening condition occurring most frequently in middle aged to older toy breed dogs such as Yorkshire Terriers and Pomeranians. The diagnosis of tracheal collapse is made with a thorough physical exam and imaging, such as radiographs, fluoroscopy and endoscopy. Many patients respond well to medical management although some patients will become refractory to medications over time. Surgical management of tracheal collapse includes extraluminal prosthesis and tracheal stents. Overall the long-term prognosis for dogs with tracheal collapse is good to guarded.

Etiology and pathophysiology
In tracheal collapse, the cartilaginous rings that make up and support the trachea undergo a degenerative process leading to collapse of various segments of the trachea during respiration. The cartilaginous rings in affected dogs are generally hypoplastic, fibrodystrophic, hypocellular, and lack chondroitin sulfate, glycosaminoglycan and glycoproteins, and calcium.

Tracheal collapse is graded according to a scheme ranging from Grade I to Grade IV. A Grade I collapse is defined as a redundant dorsal tracheal membrane, while a Grade IV collapse is a complete collapse of the tracheal cartilage. The collapse can involve the extrathoracic trachea, intrathoracic trachea, or both. It is very important for the clinician to know whether the collapse is extra or intrathoracic because the treatment options vary greatly between these two areas. In general if the trachea is collapsing on inhalation, the collapse is extrathoracic, and if it is collapsing on exhalation it is intrathoracic. Definitive diagnosis of the area of involvement and the extent of collapse can be made with fluoroscopy and endoscopy. Bronchi can also collapse, either independent or in conjunction with the trachea. It is vital for clinicians to diagnose bronchial collapse, as it will affect the treatment options and long-term prognosis for patients.

Clinical signs and diagnostics
Tracheal collapse most commonly affects middle aged to older toy and small breed dogs. Yorkshire terriers are overrepresented, as are miniature Poodles, Chihuahuas and Pomeranians. Many patients are overweight.

Clinical signs in dogs with tracheal collapse include coughing, which can range from a mild, intermittent cough early in the disease process to a more characteristic “goose honking” cough, which is frequently described by clients. Patients may cough continuously as the collapse progresses. Clinical signs such as dyspnea, exercise intolerance, and cyanosis can be seen in animals with severe collapse.

Workup of tracheal collapse patients involves various imaging and laboratory tests. Routine blood work, including a complete blood count, serum chemistry panel, and a urinalysis are performed to help rule out other underlying disease processes and to ensure that the animal is a good anesthetic candidate. Two-view radiographs of the chest are performed. Tracheal collapse can sometimes be documented on plain radiographs. These radiographs also allow the clinician to assess the heart, pulmonary vasculature and pulmonary parenchyma, and other bony and soft tissue structures to ensure that there is no underlying cardiac or pulmonary disease contributing to the clinical signs seen. Not seeing tracheal collapse on a routine chest radiograph does not rule out the disease; fluoroscopy or endoscopy is generally needed to rule in or out tracheal collapse.

Fluoroscopy is routinely performed on animals suspected of having tracheal collapse. This involves placing the animal in lateral recumbency and visualizing the animal’s trachea and mainstem bronchi as it is breathing and, ideally, coughing. The severity and extent of tracheal collapse can be evaluated fairly well on fluoroscopy, which does not require sedation or general anesthesia. The radiologist performing the fluoroscopy will often attempt to elicit a cough by massaging the trachea because tracheal collapse is best seen during forceful expiration or inspiration such as occurs during coughing. It is very important to visualize and evaluate the mainstem bronchi, as mainstem bronchi collapse changes both the treatment options and prognosis for the patient. Endoscopy can be performed to evaluate the trachea for the grade and extent of tracheal collapse and for any other abnormalities including bronchial collapse. Patients have to be anesthetized for endoscopy. Patients with severe clinical signs may have significant problems recovering from anesthesia unless surgery is performed, so patients should not be anesthetized for endoscopy unless a definitive treatment plan has been determined and discussed with the owner.

Therapy
Medical management is often successful early in the disease process when clinical signs are mild. Approximately 70% of dogs initially respond to medical management. However, the condition is normally progressive, with many patients eventually becoming refractory to medical management. Medical management for emergency treatment includes oxygen supplementation, fluid therapy,
and active cooling if the animal is hyperthermic. Administration of anxiolytics and sedatives such as butorphanol (0.2-0.4 mg/kg) and acepromazine (0.01-0.05 mg/kg) is vital.

### Emergency management of laryngeal paralysis

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage</th>
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<tr>
<td>Butorphanol</td>
<td>0.2-0.4 mg/kg</td>
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<tr>
<td>Acepromazine</td>
<td>0.01-0.05 mg/kg (to start)</td>
</tr>
<tr>
<td>Dexamethasone SP</td>
<td>0.14 mg/kg</td>
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<tr>
<td>Oxygen therapy</td>
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The mainstay of long-term medical management is cough suppressants such as hydrocodone and butorphanol. Dosages and specific medications should be adjusted and tailored to each individual patient. Sedatives, non-steroidal anti-inflammatory agents, or corticosteroids (prednisone) can also be used, if necessary. As mentioned earlier, most dogs respond very well to medical management, and if a patient does not seem to respond well he/she may need a different cough suppressant or different medication schedule. Some clinicians advocate using bronchodilators, although their benefit has not been proven. Lifestyle changes should focus on weight loss, restricted exercise, and providing the pet with a cool, shaded, and ideally air-conditioned environment. Neck leashes should be avoided and animals should be walked, using a harness, during the cooler hours of the day, such as at dusk and dawn.

The most commonly performed surgical therapies for tracheal collapse include extraluminal ring prostheses and intraluminal stenting. The surgical method chosen depends on the patient, the grade of collapse, where specifically the collapse is occurring, and finally, the experience and comfort level of the surgeon in charge of the case. For extrathoracic collapse, extra-or intraluminal stenting are viable options. However, it has been shown that extraluminal stenting has an unacceptably high morbidity and mortality rate if used for patients with intrathoracic tracheal collapse.

The management of extrathoracic and especially intrathoracic tracheal collapse has been revolutionized in the last decade with the advent of commercially available, veterinary specific intraluminal stents. Intraluminal stents are introduced orally and expand in the lumen of the trachea. The stents that are currently used are made from a very sophisticated material called nitinol. This material is a compound of nickel and titanium and is classified as a shape memory alloy. Some of nitinol’s unique properties include shape memory and superelasticity, which makes it very durable and fatigue resistant. There are numerous types of stents available, including self-expanding nitinol tracheal stents made exclusively for veterinary applications. The first reported use of a nitinol stent for management of tracheal collapse in a dog was in 2002.

Patients presenting for possible stenting of their tracheal collapse are evaluated using the diagnostics described above and medical management is instituted. Stenting is not recommended unless clinical signs cannot be controlled with medical management. Some dogs will have collapse of the mainstem bronchi. These patients are not considered candidates for stenting, as there are currently no stents available for the mainstem bronchi. These patients have a guarded prognosis because their disease can only be managed medically, and many will continue coughing for the rest of their lives.

Once a surgeon has determined that a patient needs a stent, and is a good candidate for stenting, the procedure can be performed. The size of the stent is determined based on measurements of the trachea diameter and affected area on thoracic radiographs. The stent is deployed under fluoroscopic or endoscopic guidance, with the patient under general anesthesia. The stent is inserted through the mouth and opens to full size when released into the trachea. Radiographs are performed after the stent is placed to ensure proper stent positioning.

Animals are recovered from anesthesia in the intensive care unit, and spend 1-2 nights there, under constant observation. Most animals are discharged the day after surgery and go home on medications such as cough suppressants and steroids, which are given for a finite period of time (2-4 weeks depending on clinical signs).
**Prognostic points**

Reported complications after stent placement include bacterial tracheitis, excessive granulation tissue formation, stent migration, stent fracture, and further tracheal collapse. Additionally, the presence of the stent may negatively affect the animal’s ability to clear mucous and inhaled debris, although the clinical significance of this is unknown at this time.

The placement of a tracheal stent is a palliative treatment for collapsing trachea. Stenting the trachea will not permanently fix the underlying problem, but serves to improve the pet’s quality of life for the short term. It is possible that the stent may fail or complications associated with the stent may be seen again in the future. At that time, further treatment will be necessary.

Animals are generally rechecked one and three months after stent placement. At one month, chest radiographs are performed to ensure that the stent has not migrated or fractured. At three months, radiographs will be repeated and endoscopy is sometimes performed. After this time routine rechecks are not performed. However, animals may be rechecked at any time if they are having a worsening of clinical signs, or if there appears to be a problem with the stent.

**Summary**

Tracheal collapse is a chronic, progressive airway disease most commonly seen in toy and small breed dogs. Accurate and complete physical examination and diagnosis of the area of collapse allows the clinician to make medical or surgical treatment recommendations to the client. Intraluminal stenting is a treatment option for both intra and extrathoracic tracheal collapse and has a fair to good outcome in dogs with end-stage tracheal collapse.

**References**


