

Tracheal collapse in dogs: to ring or to stent?

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Alistair Gibson examines the contentious issue of whether to perform surgery, or to stent following a tracheal collapse

Tracheal collapse is a progressive, chronic, debilitating disease that occurs predominantly in middle-aged to older toy and miniature breed dogs. Yorkshire Terriers, Pomeranians, Poodles and Chihuahuas are the breeds most commonly affected. Although the average age of dogs with tracheal collapse is six to eight years, it is frequently diagnosed in dogs with respiratory problems between one and five years of age. The aetiology of tracheal collapse is unknown. Most cases are of the acquired type, which usually occurs in middle-aged to older dogs, although congenital cases have been reported in young dogs (Ettinger 1989).

The most obvious clinical manifestation of this condition is the presence of a classic dry, hacking, 'goose-honk' cough. However, moist and productive cough, or the complete absence of cough should not necessarily preclude a diagnosis of collapsed trachea. The cough may be mild initially, but often becomes severe, paroxysmal or incessant as the disease progresses. A degree of exercise intolerance may be present and is usually proportional to the severity of the collapse and the activity of the dog. Severe disease may cause dyspnoea at rest, cyanosis and even collapse. Obesity is a commonly reported finding in canine tracheal collapse patients with a reported incidence of up to 67% (White *et al.* 1994).

Gagging may be noted, especially after eating or drinking, and this may be related to laryngeal paralysis. Inspiratory dyspnoea or stridor is also commonly seen, especially during eating, drinking, excitement or pulling on a neck leash. Stridor is often seen in conjunction with cervical tracheal collapse. Occasionally, expiratory dyspnoea may be clinically apparent in animals with pure intra-thoracic or tracheobronchial collapse.

DIAGNOSIS

Palpation of the cervical trachea may reveal a flaccid and flattened trachea and will often elicit a cough. The

degree and severity of the collapse is best determined by radiography and tracheoscopy. Radiographs of the sedated patient, during both inspiration and expiration, will show whether the collapse is in the cervical or thoracic trachea, or both. Cervical tracheal collapse tends to occur during inspiration, whereas intra-thoracic collapse is usually seen during expiration. Fluoroscopy, if available, is a very useful adjunct to plain radiography as it allows evaluation of the dynamic movement of the trachea and bronchi through all the phases of respiration. Tracheoscopy often provides a more accurate picture of the disease than radiography. A benefit of endoscopy is the ability to evaluate the entire airway to include laryngeal function, the trachea and to help ascertain whether bronchial collapse is present, as this latter complication is not readily treatable using standard techniques.

GRADING SYSTEM

A grading system for tracheal collapse, based on endoscopic appearance of the airway, is described below (**Figure 1**):

- Grade I: Normal tracheal cartilage anatomy with a slightly pendulous trachealis muscle impinging into the tracheal lumen with up to 25% loss of luminal diameter.
- Grade II: Trachealis becomes wide and more pendulous with mild flattening of tracheal cartilages: lumen is reduced by up to 50%.
- Grade III: Severe flattening of tracheal cartilages (edges are clinically palpable); dorsal tracheal membrane is almost in contact with the opposite tracheal wall; and, lumen diameter is reduced by 75%.
- Grade IV Total tracheal collapse: trachealis muscle lies on the tracheal floor; the cartilage rings are completely flattened; and, the lumen is obliterated.

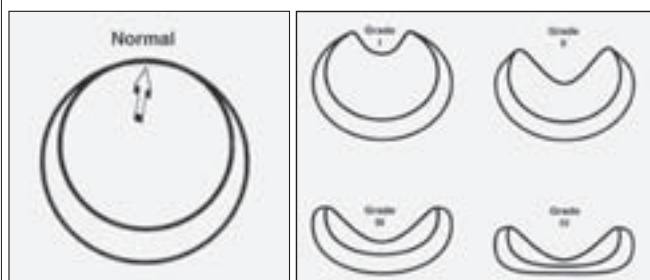


Figure 1: The grading system for tracheal collapse.

MEDICAL MANAGEMENT

Medical treatment is indicated for those patients with mild clinical signs and those animals with less than 50% collapse (Grade I). Medical therapy for dogs with tracheal collapse is symptomatic and palliative, not curative. Typically, dogs are treated with a combination of antitussives, bronchodilators, corticosteroid anti-inflammatories, antibiotics and sedatives. It is rare for patients to receive all of the therapies listed above, and treatment is tailored to the requirements of the individual. Controlling obesity, improving the ventilation and air quality in the patient's environment, and using a chest harness in place of a neck collar and lead, have all been reported as proving beneficial to tracheal collapse patients and may, in fact, play the most important role in the success or failure of long-term management.

Whilst medical management can result in long-term



Figure 2: An example of a severe (Grade IV) tracheal collapse.

SURGICAL MANAGEMENT

Surgery is recommended for those dogs showing moderate to severe clinical signs, a 50% or greater reduction of the tracheal lumen, or a condition refractory to medical treatment (Ettinger 1989). Relative contra-indications to surgery include laryngeal paralysis, concurrent cardiac disease, bronchial collapse and chronic pulmonary disease. Numerous techniques have been described for surgical correction of tracheal collapse. One of the earliest methods described was dorsal membrane placcation. This technique involves shortening the gap between the free ends of the tracheal rings by placing a horizontal mattress suture through the dorsal membrane, thus effectively improving

palliation and control of clinical signs, many cases prove refractory to medical care, while others progress to the point where surgical intervention becomes necessary (Figure 2).

the luminal conformation.

Although the use of an external plastic splint to support the trachea at the site of collapse was initially described as long ago as 1964, the first truly practical application of an external prosthesis for the treatment of tracheal collapse, in which individual C-shaped polypropylene prosthetic rings were employed, was published in 1976. Surgical placement of prosthetic rings, either constructed from syringe barrels or bought commercially, have been used for many years and often prove to be effective, especially in dogs less than six years of age. A modification of the external ring technique includes a polypropylene or polyvinylchloride spiral ring which attempts to provide a continuous support of the trachea. Placing rings on the thoracic trachea is difficult and all of the external devices require some interruption of tracheal blood supply and dissection of the recurrent laryngeal nerve.

These techniques have a reported 75% overall success rate in one report of 90 dogs for reducing clinical signs, however there is a significant associated morbidity (Buback *et al.* 1996). In the same study, 5% of animals died peri-operatively, 11% developed laryngeal paralysis from the surgery, 19% required permanent tracheostomies (half within 24 hours), and 23% died of respiratory problems with a median survival of 25 months. In addition, only 11% of the dogs in this study had intra-thoracic collapse (all dogs had some degree of extra-thoracic collapse) and the authors advised against this technique in patients with intra-thoracic tracheal collapse as the resulting morbidity was unacceptably high.

TRACHEAL STENTING

The combination of surgical risk and the inability to adequately treat intra-thoracic tracheal collapse has led to the evaluation of minimally invasive surgical techniques to address this problem and, in particular, the use of intraluminal tracheal stents. The majority of stents commercially available at present are made of nitinol, a nickel-titanium alloy which is extremely flexible and possesses physical properties that closely resemble tracheal cartilage.

Correct choice of size of stent is critical to the success of this technique. In order to choose an appropriately-sized stent, it is important to determine the length of collapse and the diameter of the trachea. Simple radiography is not adequate to identify the length of collapse as different areas of collapse will be apparent during different phases of respiration. For this reason, this measurement is made in a conscious animal using real-time fluoroscopy. An attempt is made to induce coughing during this procedure, as this will often reveal more extensive collapse than will be seen during relaxed breathing. Choosing a stent of correct diameter is probably the most vital aspect of the technique as a whole and it is imperative that the stent diameter is not chosen based upon resting survey radiographs as this will typically lead to the stent being under-sized, resulting in possible stent migration. Accurate measurement is achieved using a special radio-opaque oesophageal catheter (in conjunction with a soft-tipped guide wire), which reduces the risk of radiographic

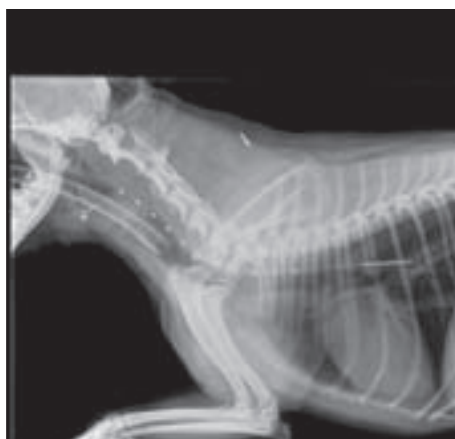


Figure 3: Oesophageal sizing catheter *in situ*.

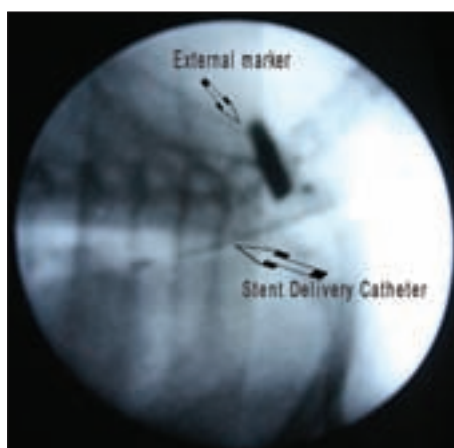


Figure 4: An example of stent placement under fluoroscopic guidance.



Figure 5: An example of a fully-deployed stent.

magnification (Figure 3). The radiograph is taken under positive pressure ventilation to ensure the trachea is maximally dilated. Once an appropriately-sized stent has been chosen, the stent is then placed under fluoroscopic guidance through the largest ET tube the patient can accept (Figure 4). The radio-opaque stent is easily visualised under fluoroscopy, even when constrained within the delivery system. Once the distal end of the stent has been positioned, stent deployment can proceed and, once this has been achieved, the delivery system is then removed. Radiographs are taken to

confirm that the stent is positioned correctly and that it is fully expanded (Figure 5). The patient is recovered immediately and closely monitored for several hours post-operatively in an intensive care setting. Patients are routinely discharged from the hospital one to two days post-stenting with a three to six week tapering dose of prednisolone, continued antitussive

therapy and a two-week course of broad spectrum antibiotics. Owners are warned to expect an initial dry cough that should improve over the following three to four weeks. Aggressive medical management of post-stenting coughing is imperative for a good long-term outcome, as coughing predisposes to the possibility of stent fracture and to the formation of granulation tissue around the implant. The majority of patients will require life-long medication following stenting.

CONCLUSIONS

Neither surgery nor stenting are cures for tracheal collapse and neither has been shown to slow the progression of the disease. Before considering any form of surgical intervention, it is essential that aggressive medical management has been attempted and has failed at providing a 'reasonable quality of life' for the patient. The decision as to whether to perform surgery versus stenting is a complicated and debatable one. Decisions must be made on an individual basis, but some basic guidelines can be used. If significant intra-thoracic collapse is present, then surgery is either unlikely to resolve the problem or may be associated with excessive morbidity and therefore an intra-luminal stent should be considered. If only cervical collapse is present, then surgical rings may be considered although in aged or otherwise compromised patients stenting may still be preferable. It is equally important when considering intra-tracheal stenting, that owners are fully apprised of the limitations of this technique, that it is not curative and that the possibility for post-interventional complications still exists. However, for severe cases involving significant intra-thoracic collapse, stent implantation offers a minimally invasive, effective, easy and brief procedure that can significantly improve the quality of life of these patients.

For further details on this technique please contact info@heartvet.co.uk

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