

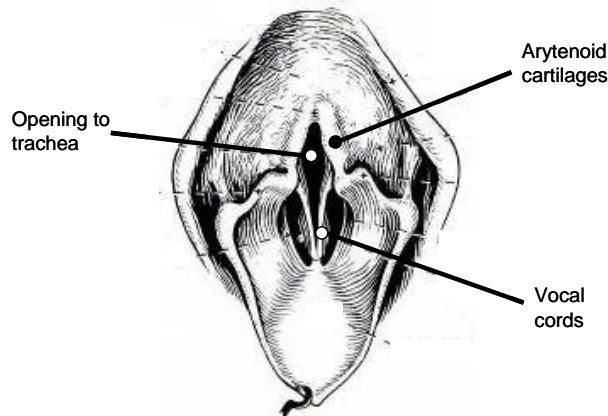
Laryngeal Paralysis: A Serious and Noisy Condition



“What is it and how will it affect my pet?”

Laryngeal paralysis is a condition recognized mostly in older dogs that can develop slowly over a year or more until it reaches a stage that causes significant breathing problems or emergencies. Some cases of laryngeal paralysis are in younger animals, occasionally puppies, rarely cats, and develop rapidly to the point of emergency. This condition is usually seen in larger dogs (over 50#), but smaller dogs can be affected by laryngeal paralysis or a more complex condition called Laryngeal Collapse.

The opening to the trachea (“wind pipe”) normally is pulled open on two sides (the arytenoid cartilages; see Figure 1.) when breathing in, and then these cartilages relax when breathing out. With laryngeal paralysis, the muscles that normally pull these open do not function properly. When an affected dog breathes in, the cartilages don’t pull open—rather, they are sucked into the opening, or in severe cases sucked shut. Early in the condition, this creates increased noise when they breathe (called “stridor”); later, it can completely obstruct their airway, and they can suffocate.



The Larynx, as viewed from the mouth
(Drawing from *Miller's Anatomy*)

The early signs of laryngeal paralysis can be quite subtle. It may be a slight harshness in their panting, and they may pant a lot or in odd situations (i.e. when cool and calm). Very early it might be a simple voice change. Later, people report that they see their pet working harder to breathe; their facial expression is a bit anxious, eyes are prominent, and their chest is vigorously expanding. The pet may also look like he/she is “smiling” when they pant, with their lips pulled way back and tongue hanging out.

Because animals use their breathing as a means to cool themselves naturally, laryngeal paralysis patients are more prone to overheating under conditions that would not make a normal dog hot. This may be a simple walk outside on a sunny day or vigorous play on a cool day.

When the paralysis is quite pronounced, it is very obvious that the animal is really working to breathe. The noise they create with each breath is harsh and easy to hear. Their tongue may be a darker red or purple in color; they do not want to be touched or restrained. They are in “respiratory distress” and need medical assistance. Ironically, the airway compromise gets worse when they breathe harder, similar to asthma. Fast moving air will suck the airway shut, while slow moving air will pass more easily. But the feeling of “air hunger” is a powerful drive, and will make an animal try to breathe harder, the airflow will speed up, and a viscous cycle begins.

Additionally, some dogs will trigger their own crisis by simply barking. The vocal cords are in the larynx; when the dog tries to bark, they contract other neck muscles and narrow their airway. When they take their next breath deeply, the vicious cycle begins too.

Medical care during a breathing crisis often entails oxygen therapy, external cooling, sedation to take the anxiety of “air hunger” away, and possibly intubation and artificial respiration for a short period to increase their oxygen and decrease their CO₂ rapidly. With this brief but effective therapy, most patients will rest comfortably and return rapidly to their pre-crisis state. Unfortunately, most patients that have reached a crisis point will continue to suffer these breathing episodes because their airway is ineffective.

If your pet has a confirmed or tentative diagnosis of laryngeal paralysis, you will be faced with some decision making.

- 1) Should we perform diagnostic tests to find a cause for the laryngeal paralysis?
- 2) Should we perform diagnostic tests to identify medical problems that might create problems during anesthesia or might be unrelated but cause health problems later?
- 3) Should we surgically correct this condition?

An Underlying Cause “*Should we look for a cause? Or just treat the problem?*”

Laryngeal paralysis is a result of poor nerve function of the Recurrent Laryngeal Nerve or poor contraction of the Cricothyroideus Dorsalis Muscle. There are two of each of these serving the right and left sides of the larynx. Anything that damages these structures can result in laryngeal paralysis to one or both sides. Anything that damages these nerves “upstream” (brain or spinal cord location) can result in laryngeal paralysis. Sometimes it is very obvious what damaged the nerves or muscles, as with neck trauma or surgery; other times it is not so clear because the damage is microscopic or related to changes in individual muscle/nerve cell performance. Often, we are unable to identify any cause at all, and we call it “idiopathic”. A very common and large subset of idiopathic laryngeal paralysis cases is older labrador retrievers, golden retrievers, and springer spaniels; a newer, commonly used term for this is Geriatric Onset Laryngeal Paralysis Polyneuropathy (GOLPP). In the majority of patients, by the time the paralysis and airway compromise are detected, the nerve or muscle damage is probably irreversible and will not change with removal of the underlying cause.

So the question is: *If we diagnose this condition and we are thinking about surgically correcting the airway problem, should we go looking for the underlying cause of the paralysis even if we cannot change the paralysis by doing so?* Below are arguments for & against the diagnostic pursuit of an underlying cause.

No, do not do these tests

- It would be spending money for results that may not alter future plans.
- Given patient description, the odds support a cause that no one has identified yet anyway (i.e. idiopathic).
- Prefer to save and spend money on things that are absolutely necessary (i.e. surgery, complications, etc.)
- Family is OK with reasonable risk taking.

Yes, look for the cause

- Family prefers to know about underlying cause/disease that might influence prognosis.
- This will identify conditions that definitely might need to be addressed.
- Full information may optimize surgical decision-making and odds of success.
- Family prefers all the information for informed decision.

With some patients, the idiopathic “cause” is very likely and with other patients a “real” cause may be found. Discuss these pro/con issues with your primary care veterinarian and a veterinary surgeon to help fully understand the diagnostic test decisions. Some tests are low costs and low risk to your pet; others involve more time and investment. Given your pet’s situation, some tests might be more strongly indicated and others less so. It is important to remember that your decision-making on the other two key questions can proceed with or without the pursuit of an underlying cause.

Association with Other Problems *“If we are going to treat this, what pre-operative tests should be performed to improve outcome?”*

The decision to treat laryngeal paralysis opens the door for even more decisions regarding pre-operative screening. Screening tests look for issues that may complicate anesthesia, they may identify medical problems that will complicate post-operative recovery, and they may uncover pre-existing but unrelated conditions that may affect the quality and duration of your pet’s life. Theoretically this list of possible tests is quite lengthy and can become impractical; where you draw the line depends on many factors unique to your family and your pet. You are the best one to make these decisions in consultation with your primary care veterinarian and surgeon.

Anesthesia is unique in patients with a compromised airway. Knowing the status of the heart and lungs and oxygen-carrying components of the blood will allow finer adjustments to anesthetic protocols and tailoring to your pet’s specific needs.

Appropriate uncomplicated post-anesthetic recovery is dependent upon the patient clearing anesthetic drugs from their system; knowing that the kidneys and liver are functioning properly is very important.

Preventing post-operative aspiration pneumonia is key to an uncomplicated recovery. Often, before surgery, we can detect esophagus problems that lead to regurgitation and aspiration pneumonia, and take additional steps to prevent it (*simple medications that reduce regurgitation*) or choose different surgical procedures more appropriate to the patient.

In the most common type of patient we see with laryngeal paralysis (i.e. large breed (retriever-type dogs; older age (8-11yrs)), the condition is part of a **"trifecta" of problems**, all related to bad nerve function (polyneuropathy). The larynx muscles are weak/paralysed, the esophageal muscles are weak and flabby, and the muscles of the rearlimbs are weak and become shrunken or atrophied. This trifecta is well recognized and now documented in the veterinary medical literature, although we still do not have a cure-type treatment for any of them. We support the airway with surgery, we can nudge the stomach a bit with medication to compensate for a flabby esophagus, and we can minimally help rearleg weakness with consistent exercise, physical therapy, and anti-oxidant supplements (i.e. high dose fish oil/omega-3s and Vitamin E).

Discovering other unrelated medical problems may be important to your family when deciding how to proceed with treatment. Some medical problems are easy to treat when caught early; these screening tests may catch unrelated problems early. Some medical problems are more life-threatening than the laryngeal paralysis; the priority for treatment may need to be re-adjusted. And some medical problems may significantly shorten your pet’s expected life-span; having this information may change your decisions regarding the laryngeal paralysis treatment.

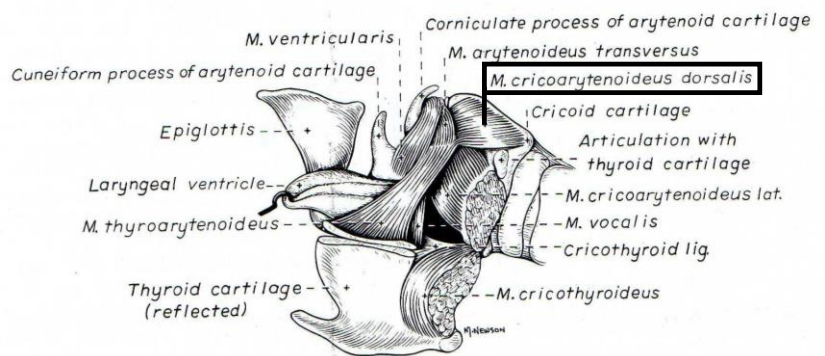
Generally speaking, more information can be a help or a hindrance. Depending on your approach to life, you may prefer to “not know” or “know it all”. And perhaps there is a middle-ground that can be customized to your primary concerns. Talk with your primary care veterinarian and your surgeon about these factors and seek their assistance in your decision-making regarding pre-operative screening tests.

Re-establishing Airflow “Can we treat this problem?”

Laryngeal paralysis is a problem of anatomy. The anatomy is interfering with the airflow necessary for breathing. Ironically, the larynx is also responsible for protecting the airway and lungs from fluids and food that should only go down the esophagus into the stomach. So, the correction is simply to move or remove the interfering anatomy without causing any new problems with airway protection.

Many different approaches have been used to surgically treat laryngeal paralysis. Over the years and through the monitoring of many post-operative patients, one technique has remained at the top of the list of procedures with good success and few complications, the Unilateral Cricoarytenoid Lateralization or “Tieback”. As with all things in medicine and elsewhere, we are always looking to improve upon the past, so new variations or new techniques will likely come along with similar or better success in the future.

The theory of the Tieback is simple. Put in a prosthetic muscle! Well, actually it is a suture that is connected to the two same structures as the paralyzed muscle. The Cricoarytenoideus Dorsalis Muscle normally pulls the arytenoid cartilage open when an animal inhales. It runs from the Cricoid cartilage to the Arytenoid cartilage; we place a suture between these two cartilages and permanently pull the arytenoid cartilage open on one side of the larynx. To minimize the chance of fluids or food entering the airway, we only pull open one side enough to prevent airway compromise and future breathing crises.



Laryngeal anatomy, as viewed from the side

(Drawing from Miller's Anatomy)

In the hands of an experienced surgeon, this is typically a relatively straight-forward, minimally invasive surgical procedure. The incision is only 3-4 inches on one side of the neck and well-planned pain management can reduce or eliminate post-operative pain directly associated with surgery. Restrictions following surgery are few; no neck collar/leash indefinitely, minimize barking for 6 weeks, elevate feeding station indefinitely, and use caution if swimming is essential.

Minor post-op complications include:

- incision infection (rare) or seroma (occasional);
- loss of voice (usually already gone with laryngeal paralysis);
- coughing during/following eating and drinking (usually tapers off over time).

Major post-op complications include:

- break-down of suture/cartilage connection that results in pre-surgical breathing status requiring re-operation;
- aspiration of regurgitated stomach contents into the lungs resulting in mild to severe pneumonia.

Patients must be carefully selected for the Tieback procedure. Other conditions mimicking laryngeal paralysis (such as laryngeal collapse or laryngeal tumors) will not benefit from this particular surgery. The presence of coexisting problems, most importantly poor esophageal function, may increase the likelihood of severe post-operative complications; different procedures or additional safe-guards may be appropriate for these patients. Make sure to thoroughly discuss your pet's full health status with the surgeon during the planning stages.

Conversations with the families of pets with laryngeal paralysis and a Tieback correction reveal an overwhelming positive response. Statements like, "If I knew Maddy only had 6 months to live, I would do this procedure all over again; she is a new dog with a new lease on life." are very common. Families also notice that the "slowing down" that their older dog has been experiencing has completely gone away; it was all related to the airway compromise. No surgical procedure can offer a 100% guarantee for such resounding success, but the Tieback does yield strongly positive results the clear majority of the time.

Other surgical treatments options include:

- 1) Arytenoidectomy (partial laryngectomy): usually performed via the open mouth.
- 2) Vocal cordectomy ("debark"): can be performed via the open mouth or through incision in neck.
- 3) Permanent tracheostomy: specific indication is for patients who have known regurgitation (usually associated with esophageal disease).

Talk with your primary care veterinarian and pursue a consult with a veterinary surgeon to fully explore your options. Treatment can and will be tailored to your pet, your family needs and the medical situation.

A Slow and Subtle Onset *"When do we surgically treat?"*

Families often describe their pet as "getting older and slowing down" and accept this as simply an age-related situation. In dogs with geriatric-onset laryngeal paralysis, this slowing down is possibly related to poor airflow into their lungs through a compromised larynx. Many families report that their pet is "young again" after the airway problem is corrected.

The question is: *If we can diagnose this condition early in its development, should we prophylactically address it with surgical correction at a time when the pet is simply "slowing down" or should we wait until the condition has created a major deterioration or crisis in breathing?* Below are arguments for & against "prophylactic" surgery for early cases.

Yes, treat early

- Lower costs now *versus* much higher costs later
Elective surgery with short hospitalization *versus* ER fees, family emotional distress during crisis, longer hospital stay, time away from work
- Improve pet's quality of life by not letting it deteriorate.
- Reduce the chance of an untimely and scary death due to suffocation.
- Prevent the cardiovascular stress and the development of complications caused by airway compromise.
- The diagnostic workup may catch other conditions in an early stage too.

No, treat when major breathing compromise

- Early treatment is spending money when there may not ever be a breathing crisis.

- There is an inherent risk of anesthesia, and do not want to assume that unless crisis stage.
- Procedure may fail and require a repeat.
- Procedure may make pet worse.
- The diagnostic work up may find bad disease that we prefer not to know about.
- After the procedure, the neck cannot be used for restraint (i.e. no collar/leash, only harness).

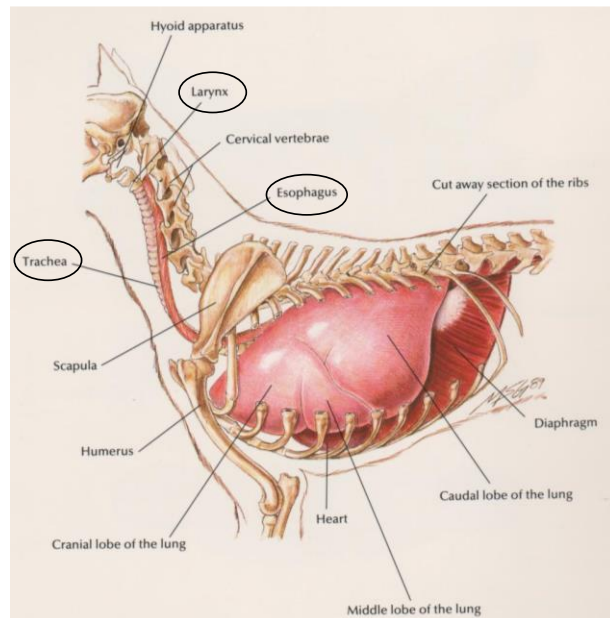
There is no “right” answer for every patient, every family and every situation. If your pet may have laryngeal paralysis in the early stages, consider the above risks and benefits, discuss the case with your veterinarian, and consider a consult with a veterinary surgeon to discuss the details of a surgical correction. The appearance of the larynx on a sedated exam is not the best gauge for surgical timing; it will diagnose a failing larynx, but not how severely it is effecting your pet.

A good gauge you can use to find that sweet spot for surgical timing (not too early, not too late) is to watch your pet in their daily activities. If they are able and willing to run and play, to investigate their surroundings with their nose sniffing a lot then they are not concerned about breathing. Once it reaches a stage when they have to stop and “think” about breathing, when daily activities take a backseat, then quality of life is going down. Somewhere in between these two places is the sweet spot. You will come to the correct and comfortable decision for you and yours.

Creating Other Problems “What complications are related to this condition?”

In addition to the breathing issues that laryngeal paralysis patients face, other problems related or unrelated to surgical correction may arise. The majority of complications do relate to the fact that the larynx is no longer serving its important function as guardian of the gateway to the lungs. Minor problems can also develop after surgery that are directly related to surgical manipulation of tissues near the larynx (and are unique to each different surgical technique.)

The most significant potential complication in patients with laryngeal paralysis is the aspiration (i.e. breathing in) of liquids into the trachea and lungs. The liquids that can create problems are primarily those that come up from the stomach (either during regurgitation or vomiting; these are different things, make sure you know and can report accurately), but water is a concern too (typically during swimming, not simply drinking). It is relatively uncommon for food to be aspirated during eating, but dogs who are very fast eaters (like many Labrador Retrievers!) can choke on food particles if they stuff too much food into the back of their throat. It is typically only the stomach contents, when aspirated, that develop into pneumonitis (i.e. inflammation of the lungs) and may progress to pneumonia (i.e. lung infection).



Close relationship between airway and esophagus
(Drawing from Hill's Atlas of Veterinary Clinical Anatomy)

THINGS TO LOOK FOR RELATED TO

ESOPHAGEAL DYSFUNCTION

- Apparent burping w/ rapid swallowing and smacking lips; excessive licking
- “Burping up” liquids when walking around (no active vomiting motion)
- Regurgitating undigested food in large amounts (no active vomiting motion)
- Restless sleep pattern; awakens and pants or paces (suggesting true “heartburn” symptoms)

Aspiration pneumonia can be life threatening and can come on slowly or very rapidly. It happens more commonly in laryngeal paralysis patients after surgical correction (of any variety), and the high-risk times are immediately post-operatively (when sedated with various anesthetic medications) or when a post-surgical patient has vomiting or regurgitation episodes later in life. Therapy for aspiration pneumonitis/pneumonia ranges from outpatient antibiotics and chest physiotherapy to in-patient intensive care.

Patients with pre-existing esophageal dysfunction (from a “flabby” esophagus to full-blown megaesophagus disease)

are at higher risk for aspiration pneumonitis/pneumonia because they are likely to have “silent” regurgitation of stomach contents. This burping up of liquids (i.e. heartburn or GERD in people) is easily managed and re-swallowed in normal dogs, but patients with laryngeal paralysis cannot protect their airway from this insult. A thorough consideration of your pet’s gastrointestinal performance (historical observations and diagnostic testing) is key to recognizing the likelihood of the aspiration complications. **Starting all patients before or regardless of surgery on life-time medications that help reduce the esophageal problems is valuable and recommended.** Pro-motility medications and antacid medications are the prophylactic treatments of choice; please discuss with your primary care veterinary team.

Other complications with laryngeal paralysis patients are centered around post-operative concerns and are directly related to the type of surgical correction that is used.

- **“Oral” procedures** (those that involved operation via the mouth) can result in scarring of the airway and reduced breathing performance or recurrence of serious compromise.
- The **“tieback”** procedure can result in a wound healing problem called a seroma. This is a fairly mild complication that is usually self-limiting and requires no treatment. Occasionally it can get large and healing is improved with simple drainage. A tieback site can breakdown in the immediate post-operative period or over 1-2 years; generally this is related to the laryngeal cartilage being weak and unable to hold the sutures used in the procedure. It is possible to re-do a tieback on the same side, but often it is preferred to operate the opposite side.
- The other surgical techniques often require a **temporary tracheostomy**. While this is not a complication, per se, it is another wound site that must be monitored. It generally heals well and rapidly.

The final issue is not necessarily a complication but relates to corrective options if esophageal disease is apparent or aspiration has already occurred. Because of the higher risk of aspiration with surgical corrections that “open up” the larynx, it is generally recommended to pursue a **Permanent Tracheostomy** as the surgical correction of choice for these patients.

The benefit of this procedure is that it does not increase the likelihood of aspiration (because no alteration is made to the larynx itself), and if a patient does aspirate, the majority of the liquid will drain out via the tracheostomy before reaching the lungs (i.e. no pneumonia). These patients require a bit more dedication to wound management and care over their lifetimes than other patients. The stoma (i.e. skin opening into the trachea) must be clipped of fur routinely and minor cleaning of crusts and mucus must happen daily. These patients cannot be allowed to swim; their airway into their lungs is exposed on their neck, and they can easily

drown. Their breathing with a tracheostomy is free and clear, and dogs can resume normal activity levels after healing is complete.

While laryngeal paralysis and its post-operative complications can be quite severe, the majority of families living through this with their pets are happy with the quality of life that is restored with surgery. It is less and less common for aspiration pneumonia to be fatal, and patients can make a full recovery even in severe cases. The majority of patients do not suffer these complications and go on to live well with the ease of breathing restored. Each patient must be considered individually though; talk through these potential complications with your primary care veterinarian and surgeon and select the most appropriate management plan for your pet.

It is important that you have proper expectations about this procedure; your experience and your pet's outcome will benefit greatly. Please discuss this information with your veterinarian when working through the decision-making process regarding **Laryngeal Paralysis**.

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