

## Laryngeal Paralysis

Barbara Kirby, DVM, MS, DACVS, DECVS

The high heat and humidity of summer weather is gone but veterinarians and owners must continue to be on the lookout for cases of laryngeal paralysis (LP). There is no evidence of a seasonal primary reason for laryngeal paralysis. This article reviews the pathophysiology, diagnosis, and treatment of laryngeal paralysis in dogs and cats. Laryngeal paralysis is a common disease of older large and giant breed dogs. In dogs, the diagnosis is relatively straight-forward. In cats, the condition is rare and the diagnosis is a lot more challenging. In both dogs and cats, unilateral arytenoid lateralization (“tie-back”) is the treatment of choice.



**Figure 1a.** Direct laryngoscopy by fiberoptic endoscope for purpose of photography of a cat with bilateral laryngeal paralysis. Note the very narrow, slit-like opening of the laryngeal airway.



**Figure 1b.** Direct laryngoscopic appearance of the cat in the Figure 1a immediately after left arytenoids lateralization. Note the large increase in rima glottidis area.

### *Laryngeal Anatomy and Normal Function*

The cranial opening of the larynx is formed by the corniculate processes of the arytenoid cartilages dorsally, the cuneiform processes of the arytenoid cartilages and aryepiglottic folds laterally, and the epiglottis and vocal folds ventrally. The **rima glottidis** is the narrowest part of the laryngeal airway. It is normally an elongated diamond in shape. The larynx has 3 functions:

1. **Respiration:** During *inspiration*, the arytenoids actively abduct, increasing the size of the rima glottidis, resulting in decreased airway resistance. During *expiration*, the arytenoids passively return to the resting position. During *fast exercise*, arytenoid abduction is sustained during both inspiration and expiration to maximize airflow and minimize airway resistance.
2. **Deglutition:** Reflex closure of the larynx during swallowing prevents aspiration of food and fluid into the airway.
3. **Vocalization:** Voice production is related to movement of air over the vocal and vestibular folds, plus changes in length and thickness of the vocal folds produced by contraction of laryngeal muscles.

### *Pathophysiology of Laryngeal Paralysis*

Laryngeal dysfunction in LP is responsible for its common clinical signs:

1. **Respiratory dysfunction:**

·decreased resting rima glottidis size leads to increased airflow resistance and turbulence resulting in **audible laryngeal stridor**.

·loss of laryngeal abduction on inspiration and loss of sustained laryngeal abduction with exercise leads to **upper airway obstruction worsening with exercise**.

·upper airway obstruction leads to laryngeal edema and dynamic laryngeal collapse

·noncardiogenic pulmonary edema can occur with any type of upper airway obstruction

**2. Swallowing dysfunction:**

·loss of laryngeal adduction reduces airway protection and leads to **aspiration pneumonia**

**3. Altered vocalization:**

·change in voice or **hoarse bark** is common in dogs with LP

·**absence of purring** is common in cats with LP

Laryngeal paralysis can be either congenital or acquired. Congenital LP is reported in English and Staffordshire bull terriers, Bouvier des Flandres, Siberian husky and husky-mixes, and in Dalmatians. The mode of inheritance is unknown in all except the Bouvier (autosomal dominant inheritance). Acquired LP in dogs is most often idiopathic. Breeds predisposed to acquired LP include Saint Bernard, Labrador retriever, Golden retriever, Newfoundland, Afghan hound, Standard poodle, white-coated German shepherd, and many others. Dogs with idiopathic LP are usually middle-aged to elderly. Male dogs are slightly more commonly affected than females. Non-idiopathic LP may be the result of iatrogenic trauma to recurrent laryngeal nerve(s) during cervical surgeries such as thyroidectomy; trauma to the neck from dog fights or penetrating wound or foreign body; generalized neuropathy or myopathy; central or peripheral lesions of the vagus, recurrent laryngeal, or caudal laryngeal nerves; intrathoracic or extrathoracic neoplastic masses compressing the recurrent laryngeal nerves; or more rarely, hypoadrenocorticism, organophosphate poisoning, or any central nervous system or posterior brain stem disease.

In cats, LP is idiopathic in about 50%. Non-idiopathic causes of feline LP include polyneuropathies and various neoplastic diseases including lymphosarcoma affecting the vagus or laryngeal nerves. There is no reported age, breed, or sex predilection in cats.

### *Clinical Signs*

Clinical signs in both dogs and cats can be quite variable. Signs are usually gradual in onset and gradually progressive, but animals with LP are often presented with acute, severe respiratory distress. Clinical signs are often exacerbated by hot weather, exercise or excitement, or the stress of examination. Common clinical signs include:

#### **Canine LP**

laryngeal stridor  
inspiratory dyspnea  
cough  
exercise intolerance  
collapse  
voice change, hoarse bark  
cyanosis  
choking, gagging

#### **Feline LP**

laryngeal stridor  
inspiratory dyspnea  
absence of purring  
change in meow

### *Diagnostic work-up*

The usual diagnostic work-up includes CBC, chemistry profile, VD and lateral thoracic radiographs, and lateral cervical (soft tissue technique) radiographs. These tests together with careful physical examination will generally rule out the non-idiopathic causes of LP. Careful assessment of good quality radiographs is critical. In one study, 70% of dogs with confirmed LP had abnormal thoracic radiographs, including 20% with megaesophagus and 15% with aspiration pneumonia. Other things to check for on chest films include cardiogenic or noncardiogenic pulmonary edema, mediastinal or thoracic inlet masses, and pulmonary metastases. Lateral cervical films may reveal cervical masses, tracheal collapse or deviation, or intraluminal laryngeal or tracheal masses. The normal larynx is slightly larger than the proximal cervical trachea and is air-filled. Loss of the normal air density in the larynx may indicate laryngeal mass or laryngeal edema. Dystrophic mineralization of the laryngeal cartilages is a common age-related change in dogs and is not clinically significant.

### *Definitive Diagnosis of Laryngeal Paralysis*

Definitive diagnosis is by direct laryngoscopy under a light plane of general anesthesia (eg. IV Propofol). Animals with LP have an abnormally narrow rima glottidis at rest and absence of abduction of one or both sides of the larynx during inspiration. They often have forced passive movement of the vocal folds during expiration which mimics active abduction. There is sometimes fluttering or quivering of the arytenoids and/or vocal folds. The laryngeal mucosa is usually edematous and sometimes erythematous. Occasionally, small ulcers or vesicles may be observed on the laryngeal mucosa. The diagnosis of LP in cats is significantly more challenging, due to typical feline laryngospasm.

### *Treatment of Laryngeal Paralysis*

Urgent treatment for severe respiratory distress includes a cool, non-stressful environment and sedation. Morphine (0.05-0.1mg/kg IM) is the preferred sedative because it effectively alleviates the anxiety and air-hunger of acute upper airway obstruction. Morphine can be combined with a low dose of acepromazine (0.01-0.02 mg/kg IM) to reduce anxiety. Rarely, the administration of morphine will worsen the respiratory crisis. Emergency general anesthesia (IV propofol) and endotracheal intubation plus specific surgery or temporary tracheostomy is sometimes required.

Surgical treatment of choice for LP is unilateral arytenoid lateralization. Arytenoid lateralization permanently fixes the arytenoid cartilage and vocal fold on one side (usually the left side for right-handed surgeons) in abduction, enlarging the airway. Bilateral arytenoid lateralization is possible, but associated with a higher complication rate than the unilateral procedure. Partial laryngectomy (*per os* ventriculocordectomy) is associated with a high incidence of postoperative complications including development of laryngeal scar tissue (laryngeal webbing) and development of laryngeal collapse. Partial laryngectomy is not recommended.

Permanent tracheostomy bypasses the upper airway obstruction in LP, but is usually not considered the treatment of choice. Permanent tracheostomy is recommended for cases of laryngeal collapse. Laryngeal collapse is most often seen in brachycephalic breeds with long-standing upper airway abnormalities (stenotic nares, elongated soft palate, everted laryngeal saccules, hypoplastic trachea, tracheal collapse). Fortunately, LP is exceedingly rare in these breeds.

### *Complications*

Postoperative complications are reported in about 1/3 of dogs treated surgically for LP using various techniques. Minor wound complications are common. The most common serious complication is aspiration pneumonia, which can be fatal. Recurrence of clinical signs can occur with failure of either the sutures or the cartilage used in the tie-back procedure.

### *Outcome*

For most animals treated with unilateral arytenoid lateralization for laryngeal paralysis, the outcome is favorable. Many owners report their elderly pet “has a new lease on life” and is “more than 100% improved”. Median survival in one large retrospective study was >1,000 days, with most animals dying of unrelated causes.

### *Clinical Research*

Results of a randomized prospective clinical trial in laryngeal paralysis has recently been published in **Veterinary Surgery** (Demetriou JL, Kirby BM. The effect of two modifications of unilateral arytenoid lateralization on rima glottidis in dogs. *Vet Surg* 32(1):62-68, 2003.) This was the first study to evaluate the clinical outcome and percentage increase in rima glottidis area achieved in live anesthetized dogs clinically affected with bilateral laryngeal paralysis. When comparing two different surgical techniques (cricoarytenoid lateralization versus cricothyroarytenoid lateralization), we found no significant difference in mean percentage increase in rima glottidis area between the two groups. In both groups, the percentage increase in rima glottidis area of approximately 240 +/- 44% was significantly greater than previously reported for unilateral arytenoid lateralization in cadaver studies.



Figure 2a. Direct laryngoscopy in a 12 year old Labrador retriever with bilateral laryngeal paralysis. The soft palate is being elevated by tongue depressor. The epiglottis is being depressed by the laryngoscope blade. Note the narrow rima glottidis and laryngeal mucosal edema.



Figure 2b. Direct laryngoscopy for the same dog immediately after left arytenoid lateralization. Note the large increase in area of the rima glottidis.

**TO: Referring Veterinary Hospitals**

**FROM: Rebecca Kirby, DVM**

**DATE: December 1, 2004**

**REGARDING: Dr. Barbara Kirby**

I am proud to officially introduce you to our newest surgeon, Dr. Barbara M. Kirby (no, we aren't related...). Dr. Kirby has vast experience in soft tissue and orthopedic small animal procedures. She has written many articles and contributed to text books. She has mentored many surgery residents in both the United States and in Scotland. I am enclosing for your information and distribution her informational brochure. I am sure that you and your clients will have a great experience working with her.

Dr. Kirby provided the majority of the oncology service while she was on faculty at the University of Edinburgh. She is working with Dr. Thamm to provide a continuation of chemotherapy and rechecks for Dr. Thamm's on-going oncology patients now that he is gone.

We are also enclosing for your information the next installment in the continuing education series provided by the surgery department. Dr. Kirby and her past resident have done research on laryngeal paralysis. She has written the enclosed text for your information. It was with great pride that she accepted the award for best resident clinical research paper published in **Veterinary Surgery** in 2003 on behalf of her resident, Dr. Jacquelyn Demetriou, at the annual scientific meeting of the American College of Veterinary Surgeons in Washington DC last year.

Our surgeons are happy to consult with you by phone with questions about suspected cases of laryngeal paralysis or any other surgical conditions. Please feel free to phone for advice, estimates, or to schedule appointments for your clients. They are also happy to review radiographs pertaining to surgical cases. Radiographs can be dropped off or mailed to **Animal Emergency Center**. Please let us know if you would like Dr. King and/or Kirby to come by (with lunch!) to meet you and your staff. They look forward to meeting you and working together to provide the best possible surgical care for your clients and their pets.