Upper Airway Obstruction in Cats: Diagnosis and Treatment*

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ABSTRACT: Clinical signs of upper airway obstruction provide valuable information regarding the degree of airway compromise and the anatomic compartment involved but are not specific to any disease process. The purpose of the diagnostic workup is to determine the extent and nature of the condition. The extent of the physical examination depends on the degree of upper airway obstruction, and complete evaluation may need to be postponed until the patient is anesthetized. However, rapid assessment of respiratory impairment is crucial because it allows appropriate triage of patients. In cats with mild upper airway obstruction, radiographs of the thoracic and cervical areas may be obtained with the patient either awake or under sedation. A complete oral and laryngeal examination should be performed with the patient under anesthesia. Additional tests may also be indicated. Manipulation of the upper airway in a compromised patient is likely to exacerbate signs; therefore, diagnostic tests and corrective surgery should be scheduled under the same anesthetic episode. This article describes the corrective surgical techniques for obstructive airway diseases. Although these techniques may be technically demanding, they do not require specialized equipment and, depending on the nature of the disease, often provide good results.

Clinical signs of upper airway obstruction are variable and not specific to any disease process. Signs may help to localize disease, but a thorough diagnostic approach is needed to diagnose the condition. The severity of signs will depend on the degree of functional obstruction and will dictate the initial therapeutic approach. On presentation, triage should be conducted immediately so that patient care can be prioritized accordingly. Cats with severe upper airway obstruction should be anesthetized and intubated as quickly as possible. Placement of a cricothyrotomy tube or emergency tracheostomy should be limited to patients that cannot be intubated and that require bypass of the larynx.

Diagnostic evaluation should be performed after respiratory function has im-

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proved. The physiologic response to a stress-induced increase in oxygen requirements involves an acceleration of the respiratory rate. This will exacerbate any preexisting compromise of the upper airway and may quickly result in a life-threatening situation. For that reason, handling of patients with compromised airways should be minimized, and most diagnostic tests should be performed while the patient is under anesthesia. Routine hematology and blood chemistry should be performed before anesthesia if the patient can safely tolerate blood sampling. Alternatively, analyses may be postponed until the cat has been sedated or anesthetized. Because examination and intubation of the upper airway may exacerbate the obstruction and complicate recovery, diagnostic evaluation should be scheduled when treatment of the condition may be achieved under the same anesthetic episode. If this is not possible, clinicians should be prepared to place a temporary tracheostomy tube.

**DIAGNOSIS**

**Physical Examination**

The purpose of the initial examination is to assess the degree of airway compromise. This can be done from a distance by observing the attitude, posture, breathing pattern, respiratory rate, and color of mucous membranes. A gentle physical examination and auscultation may then be performed. Oxygen therapy should be provided during examination, if required. Any step of the examination that causes stress should be postponed until the cat is anesthetized and intubated.

Various tube types and sizes (including urinary catheters) should be prepared to allow intubation of a narrowed airway. At this point, intravenous administration of an ultra-short-acting corticosteroid (e.g., 0.25 mg/kg of dexamethasone sodium phosphate) is recommended to minimize edema. Ideally, laryngeal anatomy and function should be evaluated before intubation. This examination can be performed with the patient under light anesthesia, with simultaneous observation of the respiratory cycle. After intubation, the soft palate should be evaluated for any ventral deviation that may be associated with nasopharyngeal masses. Nasopharyngeal polyps present as unilateral or bilateral gray or pink masses with a smooth or nodular surface (Figure 1). Although they often measure 1 to 2 cm in diameter when diagnosed, polyps may reach up to 5 × 2 cm. A laryngoscope placed at the base of the tongue facilitates inspection of the pharynx and larynx for any mass, inflammation, or foreign body. Gentle retraction of the soft palate with a spay hook or stay sutures provides exposure of the caudal nasopharynx. Otoscopic examination is important in cats with nasopharyngeal diseases and/or signs of auricular disease. Auricular discharge and rupture of the tympanic membrane may be associated with otitis media. Otoscopic polyps are sometimes seen through a bulging tympanic membrane (Figure 2). Cannulation of the nose with a 6-Fr nasogastric tube should be attempted in cats with suspected nasal or nasopharyngeal obstruction. In cats with nasopharyngeal stenosis, a cannula can be advanced through the nasal passages but stops before

Figure 1—Intraoperative view of the nasopharynx of an 8-year-old cat with bilateral nasopharyngeal polyps and nasopharyngeal foreign body. A ventral midline approach through the soft palate was used.

Figure 2A

Figure 2—Otoscopic examination of a cat. (A) Normal transparent appearance of the tympanic membrane. (B) A nasopharyngeal polyp in the middle ear. The mass can be seen behind the tympanic membrane.
reaching the laryngopharynx on both sides. Cannulation of the nasal passages allows caudal displacement of nasopharyngeal masses and, used in combination with cranial retraction of the soft palate, improves their visualization. If no abnormality is found on clinical and radiographic examination, further diagnostic tests (e.g., endoscopic examination of the subepiglottic area and nasopharynx) should be considered.

Radiography

Thoracic radiographs are part of the routine evaluation of patients with respiratory disease. Indeed, localization of respiratory signs is not always accurate. Symptoms of primary lower respiratory tract disease may be masked if patients suffer concurrent upper airway obstruction. One ventrodorsal and two lateral projections should be evaluated for metastases in cats suspected of having laryngeal neoplasia. Evaluation of the entire respiratory tract is warranted to establish a treatment plan and prognosis.

Cervical radiographs are also indicated. Radiodense foreign bodies (e.g., needles, pellets) are occasionally found in cats. Radiographic signs of laryngeal neoplasia are variable. Feline laryngeal tumors may appear as a generalized thickening of the larynx rather than a distinct mass lesion. Tumors are best visualized by laryngoscopy. Conversely, radiographs are useful in localizing mass lesions causing extramural compression of the larynx. Soft tissue radiopacities are suggestive of tumors or abscesses of the larynx and adjacent structures. Soft tissue swelling, subcutaneous emphysema, and displacement of the tracheolaryngeal cartilages may be found in animals with laryngeal trauma. In these cases, radiographs are also helpful in assessing the status of the spine.

Whereas cervical and thoracic radiographs may be obtained using sedation in some patients, skull radiography is always performed while the patient is anesthetized in order to ensure proper positioning. Skull radiography is warranted in cats with nasal or nasopharyngeal disease, with or without auricular signs. Nasopharyngeal polyps are best visualized on the lateral projection as a soft tissue density in the nasopharynx, displacing the soft palate ventrally (Figure 3). The best radiographic view to evaluate middle-ear disease is the open-mouth view. Additional views include oblique views of the bullae and a ventrodorsal projection to assess the external canal and petrous temporal bone. Soft tissue opacity within the bulla and thickening of the wall suggest middle-ear involvement. However, radiographic changes are inconsistent, especially early in the disease course, and false-negative radiographic diagnosis of otitis media has been reported in up to 25% of the cases. Computed tomography of the skull may be considered in the absence of radiographic signs of middle-ear disease. Radiographic signs of nasopharyngeal stenosis are inconsistent. A dorsal deviation of the soft palate may occasionally be seen (Figure 4).

Endoscopy

Endoscopic examination of the nasopharynx requires retroflexion of a flexible endoscope over the soft palate, thereby allowing visualization of the entire nasopharynx and choanae as well as the most caudal portion of the nasal cavities. By the time of presentation, nasopharyngeal polyps tend to have reached such a significant size that endoscopic evaluation is rarely needed for diagnosis. However, endoscopy is crucial for the diagnosis of nasopharyngeal stenosis, radiolucent foreign bodies, abscesses, and neoplasia. In nasopharyngeal stenosis, adhesions are occasionally located at the junction of the nasopharynx and laryngopharynx, preventing retroflexion of an endoscope over the soft palate. Cranial retraction of the soft palate allows direct visualization of the area.

The same flexible endoscope may be used to evaluate subepiglottic disorders. Foreign bodies are occasionally found caudal to the larynx and may be retrieved endo-
scopically. Tracheoscopy will also improve visualization of subepiglottic tumors and facilitate biopsy.

**Histopathology**

Histologically, nasopharyngeal polyps consist of a core of well-vascularized fibrous connective tissue covered by stratified squamous or columnar epithelium. Inflammatory cells are especially prominent in the submucosa. However, a presumptive diagnosis of nasopharyngeal polyp can usually be made on the basis of signalment, history, and the appearance of the mass. Preoperative biopsy is, therefore, not essential. Instead, I recommend immediate surgical treatment and histopathology of the excised tissue. Similarly, the gross appearance of nasopharyngeal stenosis and abscesses is characteristic.

Making a diagnosis of laryngeal masses requires histopathology. Granulomatous laryngitis must be differentiated from neoplasia because the prognoses differ significantly. The inflammatory disorder clinically resembles neoplasia but histopathologic findings consist of a mixed inflammatory cell infiltrate involving macrophages, lymphocytes, and plasma cells. Ulceration of the epithelium is a common finding in humans and has also been described in cats.

Histopathologic examination of frozen sections is helpful in the management of laryngeal masses. The test's accuracy was 93% in a study comparing the diagnoses based on evaluation of frozen sections compared with tissue prepared using conventional methods. Establishing an intraoperative diagnosis provides a rational basis for decisions regarding therapeutic options or euthanasia.

**Other Tests**

Cytologic examination of laryngeal masses may be attempted if frozen sections are not available. Inflammation may, however, be difficult to differentiate from neoplasia. Before recovery from anesthesia, a temporary tracheostomy should be considered to palliate the obstruction until a definitive diagnosis can be made. Cytology is more useful in the diagnosis of fungal infections, where organisms may be seen in the specimen.

Results of bacterial cultures should be interpreted in combination with other diagnostic tests. Although bacterial infections may be clinically significant, they often are secondary to upper airway obstruction.

Ultrasonography is often used to evaluate patients that present with cervical masses, to define the character of the mass as well as the organ involved. Ultrasonography may be easier than is radiography to perform on sedated patients and may provide useful preoperative information. Assessing the degree of vascularization and invasiveness of cervical masses will help in planning surgical
treatment and in anticipating complications. The ultrasonographic appearance of a laryngeal cyst has recently been reported in a cat. Ultrasonographic evaluation performed without sedation provided a preoperative diagnosis. Alternatively, cysts may be diagnosed by fine-needle aspiration during laryngoscopic examination. Surgical treatment may be performed under the same anesthetic episode.

Computed tomography helps delineate the extent of nasal and nasopharyngeal tumors and may be used to evaluate middle-ear disease in cats with nasopharyngeal polyps. Electromyography and muscle biopsies are not needed to diagnose laryngeal paralysis. They may, however, be indicated to evaluate other muscle groups in cats with suspected generalized neuropathy.

**TREATMENT**

**Nasopharyngeal Polyps**

The timing of surgery and the techniques used will depend on clinical presentation and the extent of disease. A ventral bulla osteotomy is indicated when evidence of middle-ear disease is found. This may be performed first to remove all attachments of the polyp. The septum dividing the bulla into a small ventromedial and a large dorsolateral compartment must be removed. Care should be taken when curetting the promontory to avoid damage to sympathetic fibers and subsequent postoperative Horner's syndrome. Cultures can be obtained from the bulla during surgery, and excised tissue can be submitted for histopathology. Secondary bacterial infection should be anticipated and a broad-spectrum antibiotic administered intravenously (e.g., cephazolin, 20 mg/kg). When a bacterium is isolated, postoperative antibiotherapy should be adjusted according to sensitivity and continued for 3 weeks. A Penrose drain or a modified butterfly catheter connected to a vacutainer tube may be placed before closure of the surgical site to provide drainage and minimize postoperative swelling. Primary closure has been found to be as successful as is passive drainage after total ear canal ablation and lateral bulla osteotomy in dogs. Although no similar study has been performed in cats with ventral bulla osteotomy, primary closure is an acceptable option.

If a bulla osteotomy is not indicated, traction avulsion is used to remove polyps from the ear canal and/or nasopharynx. A ventral midline approach through the soft palate may be required if the nasopharyngeal polyp cannot be retracted caudally (Figure 1).

**Nasopharyngeal Stenosis**

Nasopharyngeal stenosis can be treated by resecting the membrane covering the internal nares; however, web...
bating may recur, especially if primary closure cannot be achieved and a mucosal defect is left to heal by second intention. Recurrence after bougienage has also been described. In humans, various techniques have been designed to try to prevent this common complication after resection of stenotic webs; surgical laser, mucosal flaps, and airway stents have been used with variable success. The use of a braided stainless-steel stent did not resolve clinical signs in a cat with recurrent nasopharyngeal stenosis. This complication should be prevented by reconstructing the mucosal surface of the nasopharynx following excision of the stenosis. If primary closure cannot be accomplished, a nasopharyngeal advancement flap can be used. The mucosa and submucosa of the dorsal laryngopharynx should be gently elevated (Figure 5). The flap should be advanced and sutured to the cranial edge of the dorsal nasopharyngeal defect (Figure 6). Primary closure of the soft palate can then be achieved in a routine manner.

Granulomatous Laryngitis

From the limited data available, combined medical and surgical treatment may be warranted to treat obstructive inflammatory laryngeal disease in dogs and cats. Because no evidence for bacterial infection has been found, the need for antibiotic treatment in granulomatous laryngitis is questionable. Antibiotic and corticosteroid treatment alone provide only slight and temporary improvement. Surgical excision of the proliferative laryngeal tissue by partial laryngectomy has been reported, but intermittent or long-term administration of prednisolone may be required to control clinical signs after surgery. Permanent tracheostomy may be considered as a last resort. In contrast to laryngeal neoplasia, the long-term prognosis following treatment of proliferative inflammatory laryngitis is good.

Laryngeal Neoplasia

Because laryngeal tumors in cats are rare and may not be resectable by the time of presentation, information regarding surgical treatment is often scarce. Total laryngectomy and permanent tracheostomy are techniques used in humans that have had limited use in veterinary medicine. Laryngeal lymphoma may have a better prognosis than squamous cell carcinoma and adenocarcinoma because it may respond to chemotherapy and radiation therapy. However, I am not aware of any study reporting treatment protocols and survival times in cats with laryngeal neoplasms.

Even if the laryngeal neoplasm cannot be resected, a permanent tracheostomy with or without adjunctive treatment may be considered as palliative therapy for upper airway obstruction. The technique for permanent tracheostomy in cats is similar to that in dogs. However, I would recommend the use of a rectangle rather than an oval tracheostomy because the mucosa in cats is more delicate and difficult to elevate from the tracheal rings than that in dogs. Because laryngeal tumors may extend into the trachea, the tracheostomy site should be positioned as distal as possible. An H-shaped incision should be made over four tracheal rings to create two full-thickness tracheal flaps at both the cranial and caudal ends of the incision (Figure 7). The tracheal flaps should be raised, and a rectangle of skin and subcutaneous tissue can be excised. The amount of tissue resected must be determined on an individual basis to allow tension-free closure without obstruction by redundant skin. Two longitudinal skin flaps should be elevated laterally to the tracheostomy site. The width of these flaps should approximate the thickness of the subcutaneous tissue and trachea. The tracheal flaps are sutured to the skin to seal the cranial and caudal borders of the tracheostomy. Finally, the longitudinal skin flaps should be...
brought in apposition with the incised mucosa at the level of the tracheal lumen.

**Laryngeal Paralysis**

Cats with cervical swelling resulting from trauma, surgery, or neoplasia of adjacent structures may present with neurapraxia of the recurrent laryngeal nerve. In these cases, laryngeal paralysis can be temporary and supportive treatment may be considered. Oxygen therapy and temporary tracheostomy in combination with an anti-inflammatory dose of short-acting corticosteroids (e.g., dexamethasone sodium phosphate, 0.25 mg/kg twice/day) are often required. This treatment should be discontinued (within a week) after the swelling has decreased or if the tracheostomy tube becomes nonfunctional. Cats tend to produce more mucus than do dogs and I have found maintenance of tracheostomy tubes beyond 3 days difficult. If palliative treatment becomes impractical before laryngeal function is recovered, definitive repair is recommended.

The three surgical procedures most commonly described for the treatment of laryngeal paralysis in dogs include castellated laryngofissure, ventriculocordectomy and partial arytenoidectomy, and unilateral or bilateral arytenoid lateralization. Castellated laryngofissure is technically demanding in dogs, and would be even more so in cats, in which the thyroid cartilage may be too small to create an adequate central cartilaginous flap. Partial laryngectomy and vocal fold removal by an oral approach has been used successfully in a few cats with laryngeal paralysis. Although relatively simple, this technique requires placement of a temporary tracheostomy tube; complications, including postoperative edema, aspiration, and laryngeal stenosis, are well recognized in dogs.

Although unilateral arytenoid lateralization is technically more demanding, I prefer the procedure described by Lahue for treating cats with permanent laryngeal paralysis. Unilateral arytenoid lateralization has previously been described in cats. Mobilization of the arytenoid cartilages seems subjectively easier in cats than in dogs, possibly because cats lack an interarytenoid cartilage. Transection of the interarytenoid ligament is not warranted. Two 3-0 polypropylene sutures should be placed through the dorso-caudal edge of the cricoid. Alternatively, sutures may be placed through the caudal cornu of the thyroid cartilage. In canine cadaver larynges, however, cricoarytenoid lateralization techniques provided a greater increase in the size of the glottic opening than did thyroid lateralization techniques. Each suture passes under the caudal laryngeal nerve and through the cricoarytenoid articular surface or the muscular process of the arytenoid cartilage.
sutures are tied, moving the arytenoid cartilage caudally and laterally. Based on the few reported cases as well as my own experience, results have been excellent.40,41

Other Diseases

Nasopharyngeal foreign bodies can be removed using cranial retraction of the soft palate or endoscopy. If a nasopharyngeal abscess is present, a ventral midline approach through the soft palate is required to allow removal of any foreign body, debridement, and lavage. A ventral bulla osteotomy is indicated if the abscess is an extension of otitis media. Excised tissue is submitted for histopathology and bacteriology. Postoperative antibiotherapy is prescribed for 3 weeks after surgery, based on the sensitivity of the organism isolated.

Treatment of nasopharyngeal cryptococcosis includes...
immediate physical dislodgment or debulking of the lesion(s), followed by long-term systemic antifungal therapy. Cryptococcal granuloma can be flushed from the nasopharynx by inserting a cannula in each ventral nasal meatus and injecting sterile saline under pressure. Gentle palpation of the mass through the soft palate facilitates caudal mobilization. If the lesion(s) cannot be flushed, a ventral midline approach through the soft palate allows surgical debulking. Antifungal therapy is prescribed for a minimum of 6 months, based on sensitivity results. Of the five cats described by Malik and coworkers, four were cured, based on resolution of clinical signs and declining latex cryptococcal antigen agglutination titers. One cat, in which the nasopharyngeal mass had not been removed, died of upper airway obstruction.

Brachycephalic syndrome rarely warrants surgical treatment in cats, probably because of their sedentary nature. The surgical correction of stenotic nares involves resection of a wedge of epithelium and nasal cartilage and is similar to the procedure described in dogs. Excellent responses have been reported in cats.

Episodes of spontaneous laryngospasm may be interrupted by injecting 1 to 2 ml of water into the cat’s mouth to dislodge secretions accumulated in the larynx and provoke a swallowing reflex, thus interrupting the spasm. A short-term course of an antiinflammatory dose of prednisone may also be prescribed, if needed, to treat the associated pharyngitis.

Laryngeal and branchial cysts are best treated by complete surgical excision. An intraoral approach or a ventral laryngofissure may be used to reach and excise laryngeal cysts. The branchial cyst reported in a cat was described as a large, cystic mass located in the cervical region, displacing the larynx and trachea. A ventral midline cervical approach provided enough exposure for dissection and removal of the mass. Prognosis after excision of laryngeal and branchial cysts is excellent.

The treatment and prognosis associated with extramural compression of the upper airway depend on the nature and location of the disease. The cat with retropharyngeal plexiform vasculopathy was cured after excision of the affected lymph node.

CONCLUSION
An initial evaluation of cats with upper airway obstruction should be used to assess the degree of respiratory impairment and allow appropriate triage. A good understanding of the epidemiology and pathophysiology of upper respiratory obstructive disease in cats allows clinicians to establish and prioritize a list of differentials. However, the selection, timing, and sequence of diagnostic tests also depend on the severity of airway compromise and the personality of the cat.
After the nature, location, and extent of the disease have been identified, treatment options and prognosis can be discussed. When possible, diagnostic tests and corrective surgery should be performed during the same anesthetic episode to facilitate recovery. Some diseases (i.e., nasopharyngeal stenosis, abscesses and cryptococcosis, laryngeal cysts, granulomatous laryngitis) are unusual but carry a good to excellent prognosis if recognized early and treated appropriately. When surgery is indicated, successful outcome will depend on appropriate surgical technique as well as anticipation of potential complications and postoperative monitoring.

REFERENCES


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