6.1.5. UPDATE ON BRACHYCEPHALIC OBSTRUCTIVE AIRWAY SYNDROME

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BOAS – FREQUENTLY ASKED QUESTIONS:

1. What other anatomic abnormalities can contribute to obstructive airway disease other than stenotic nares, elongated soft palate, and everted laryngeal saccules?
2. Why are thoracic radiographs indicated in animals with upper airway disease?
3. Are there differences in outcomes between different brachycephalic breeds?
4. How early should you surgically address stenotic nares?
5. How early should you surgically address an elongated soft palate?
6. What is the best method to surgically address an elongated soft palate?
7. What are the surgical options once a dog has stage 2 or stage 3 laryngeal collapse?

Brachycephalic obstructive airway syndrome refers to upper airway obstruction attributable to a combination of anatomic abnormalities seen in brachycephalic dogs. Concurrent tracheal hypoplasia, everted tonsils, nasopharyngeal turbinates, and other abnormalities often contribute to respiratory distress. Brachycephalic animals typically have a compressed face with poorly developed nares and a distorted nasopharynx. The head shape is the result of an inherited developmental defect in the bones of the base of the skull. These bones grow to a normal width but have a reduced length. The soft tissues of the head are not proportionately reduced and often appear redundant.

Stenotic nares are congenital malformations of the nasal cartilages that result in medial collapse and partial occlusion of the external nares. Airflow into the nasal cavity is restricted and greater inspiratory effort is necessary, causing mild to severe dyspnea. Resistance to airflow through the nasal cavity in normal dogs is 76% to 80% of total resistance, depending on the volume of airflow. As more and more negative pressure is exerted to breathe, intratracheal and intrapharyngeal pressures can become high enough to cause surrounding tissues to collapse.

Elongated soft palate is the most common component of brachycephalic syndrome and is frequently diagnosed in brachycephalic dogs. The elongated soft palate is pulled caudally during inspiration, obstructing the dorsal aspect of the glottis. It is sometimes drawn between the corniculate processes of the arytenoid cartilages which increases
inspiratory effort and causes more turbulent airflow. The laryngeal mucosa becomes inflamed and edematous, further narrowing the airway. The tip of the soft palate is blown into the nasopharynx during expiration. Affected dogs may have trouble swallowing because normal occlusion of the airway during deglutition compromises ventilation. Dysfunctional swallowing may produce aspiration pneumonia. Some affected animals with concurrent gastrointestinal problems (e.g., esophagitis, hiatal hernia) have improved following surgical treatment of the brachycephalic syndrome.

Laryngeal saccule eversion is diagnosed less often than elongated soft palate or stenotic nares, but has been in reported in over half of dogs with brachycephalic syndrome. It is uncommon to have everted laryngeal saccules as the only abnormality in brachycephalic dogs. Eversion of the laryngeal saccules is considered the first stage of laryngeal collapse. Increased airflow resistance and increased negative pressure generated to move air past obstructed areas (stenotic nares, dorsal glottis) pull the saccules from their crypts, causing them to swell. Once everted, the saccules are continuously irritated by turbulent airflow and become increasingly edematous. The saccules obstruct the ventral aspect of the glottis and further inhibit airflow. It may be difficult for an inexperienced examiner to differentiate everted laryngeal saccules from the vocal folds because of their proximity. Everted saccules partially or completely obscure the vocal folds and may be unilateral or bilateral.

In addition to components already described, everted tonsils, aryepiglottic collapse, corniculate collapse, tonsil eversion, redundant pharyngeal folds, nasopharyngeal collapse, macroglossia, nasopharyngeal turbinates, and laryngeal collapse may contribute to the severity of respiratory distress. Recently laryngeal collapse as a primary disease has been reported in English bull terriers, Norwich terriers, and other small breed dogs.

**DIAGNOSTICS**

Thoracic radiographs should be evaluated to detect underlying cardiopulmonary abnormalities (e.g., cardiomegaly, pulmonary edema, pneumonia) or other concurrent conditions (e.g., hypoplastic trachea, hiatal hernia, heart base tumor). Lateral cervical radiographs allow evaluation of the nasopharynx, the soft palate, the larynx, and the entire length of the trachea. An elongated soft palate may appear thickened and elongated. Nasopharyngeal, laryngeal, and tracheal masses may be identified.

Laryngeal examination can be broken down into structural and functional parts. Structural examination is most often indicated in brachycephalic breeds to assess the length of the soft palate, presence of everted tonsils or everted laryngeal saccules, and degree of laryngeal collapse. A normal soft palate should just touch the tip of the epiglottis. To appropriately assess soft palate length, the tongue should be in a normal position. An elongated soft palate typically extends past the tip of the epiglottis by at least several millimetres. Everted laryngeal saccules are protrusions of the mucosa diverticula rostral to the vocal folds. The saccules obstruct the ventral aspect of the glottis and further inhibit airflow. It may be difficult for an inexperienced examiner to
differentiate everted laryngeal saccules from the vocal folds because of the proximity. However, in most studies regarding brachycephalic airway syndrome, everted laryngeal saccules are present in 50-60% of affected dogs. Laryngeal collapse is caused by loss of cartilage rigidity that allows medial deviation of the laryngeal cartilages. There are three stages of severity to laryngeal collapse. Stage 1 is the eversion of the laryngeal saccules into the glottis. During stage 2, the cuneiform processes of the arytenoid cartilages lose rigidity and collapse into the laryngeal lumen. In addition, the aryepiglottic folds collapse ventromedially. The most advanced phase of laryngeal collapse is stage 3 in which the corniculate process of each arytenoid cartilage fatigues and then collapses toward midline, resulting in complete laryngeal collapse.

SURGICAL TREATMENT: STENOTIC NARES

Brachycephalic breeds may have a congenital malformation of the nasal cartilages resulting in medial collapse and restriction of airflow into the nasal cavity. Stenotic nares are easily correctable. Various surgical techniques are used, and all have the same result: permanent enlargement of the external nares. Techniques include wedge resection, nares amputation (Trader’s technique), and alapexy. For wedge resection, a #11 scalpel blade, Baker’s biopsy punch or laser can be used to make deep and even cuts in the wing of the nostril. There is no difference in outcome between a horizontal or vertical wedge resection. Haemorrhage is expected, but bleeding is managed by digital pressure and then controlled once sutures are in place. Absorbable 4-0 multifilament or monofilament suture in a simple interrupted pattern is used to appose cut surfaces.

SURGICAL TREATMENT: ELONGATED SOFT PALATE

Soft palate resection is a relatively simple procedure. The most important aspect of the surgery is to make sure that the palate is not made too short. The consequences of a short soft palate are nasal regurgitation and rhinitis. The procedure is typically performed by placing stay sutures on either side of the palate at the level of planned resection. Technique descriptions describe resecting the soft palate at the level of the cranial commissure of the tonsilar crypt, although most surgeons use the mid to caudal body of the tonsil as a landmark. Metzenbaum scissors are used to transect approximately one-third to one-half the width of the palate. A simple continuous pattern with 4-0 (1.5 metric) monofilament or multifilament absorbable suture is used to oppose the nasal and oral mucosa over the exposed palatine muscle. Removal of the rest of the palate is performed and the suture line is continued to the opposite side. Hemorrhage and swelling are usually minimal, but premedication with dexamethasone (0.25 – 0.5 mg/kg, IV) is often routine.

Soft palate resection may also be performed using surgical laser or Ligasure. Surgical time is significantly shorter with these modalities; however, clinical outcomes are similar with those receiving traditional resection.

A folded-flap palatoplasty has been described for dogs that have excessive length and excessive thickness of the soft palate. In this technique the soft palate is thinned by excision of a portion of the oropharyngeal mucosa, underlying soft tissues and part of
the levator veli palatini muscle. The palate is made shorter by bringing the caudal edge of the palate rostrally, folding it onto itself until the caudal nasopharyngeal opening is readily visible transorally.

SURGICAL TREATMENT: EVERTED LARYNGEAL SACCULES AND LARYNGEAL COLLAPSE

Resection of the everted laryngeal saccules is relatively simple, however whether resection of the saccules is needed in dogs with brachycephalic syndrome can be debated. Since complications are resection are possible (e.g., laryngeal swelling, laryngeal webbing, regrowth), it has been recommended that saccules be removed only when believed to contribute significantly to obstruction.

Resection of the everted laryngeal saccules is relatively simple. Each saccule is grasped with Allis tissue forceps and then sharply transected with Metzenbaum scissors. Suturing is not necessary. The difficulty of this technique lies in getting good visualization of the larynx and glottis. Often these dogs have redundant pharyngeal tissue that swells rapidly with minimal handling. The presence of an endotracheal tube can also make visualization difficult.

Laryngeal collapse is the end-stage component of brachycephalic obstructive airway syndrome. Weakened laryngeal cartilages become displaced medially, severely obstructing the airway. Options for treatment at this stage are limited. First, all other underlying conditions (steno tic nares, elongated soft palate, everted laryngeal saccules) are addressed. Unilateral arytenoid lateralization has recently been reported to have reasonable long-term outcomes, but this technique should be used with caution as the opposite cartilage may continue to collapse medially. Bilateral arytenoid lateralization techniques are considered unacceptable due to the high risk for aspiration pneumonia. Partial arytenoidectomy procedures have also been associated with a high rate of complications and perioperative mortality. Permanent tracheostomy is the recommended treatment for stage 3 laryngeal collapse, although many owners consider this an unacceptable option.

PROGNOSIS

Surgical correction of brachycephalic airway syndrome will alleviate signs of respiratory distress and improve quality of life in most dogs. The degree of improvement is usually dependent on how severely the dog is affected preoperatively. Dogs corrected for stenotic nares and elongated soft palate had a better postoperative response than dogs with elongated soft palate alone. The most recent large retrospective study describes a good to excellent long-term outcome in 94%. English bulldogs have been found to have a worse response to surgery when compared to all other breed combined and are far more likely to develop aspiration pneumonia postoperatively. Without surgery, prognosis for dogs with elongated soft palate and everted laryngeal saccules is guarded, as respiratory signs and laryngeal collapse will progress over time.
REFERENCES


