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Introduction

Brachycephalic breeds are usually distinguished from others by their shortened skull which results from an early anklyosis of the cartilages in this region. Different breeds are usually recognized as brachycephalic: Boston terrier, English and French bulldog, pugs, Pekinese, Shih-tzu and cavalier King Charles. Clinical signs of upper respiratory syndrome in the brachycephalic dog (BD) usually include snoring, inspiratory dyspnea, exercise intolerance and stridor, cyanosis or even syncopal episodes in more severe cases. These problems are usually aggravated by stress, exercise or heat. Labored breathing is accompanied by overdistalation of the chest since a higher negative pressure tends to suck the abdomen into the thoracic cavity. The condition usually worsens with age. Vomiting or saliva regurgitation are also frequently encountered.

Peculiarities of brachycephalic dogs.

Several anatomic abnormalities can be found in the brachycephalic dogs. The cartilaginous skeleton of the external nares is usually shorter, thicker and medially displaced, secondarily obstructing the nostrils. The size, shape and position of the conchae are modified, leading to potential intra-nasal stenosis. The soft palate, which normally extends to the top of the epiglottis, can extend up to 1 to 2 cm beyond. On a radiographic examination or CT one can readily see that, in many cases, the soft palate is not only overlong but also over-thick. A hyperplastic tongue is also frequently encountered. In many BDs, laryngeal ventricles can be seen protruding into the laryngeal lumen. Finally, the trachea of some brachycephalic dogs (mainly English Bulldogs) is hypoplastic, which further decreases the air flow. These anatomical anomalies are responsible for a multifocal obstruction of the upper-airways that have secondary functional consequences on laryngeal function.

Pathophysiologic consequences

Given their narrowed nostrils and nasal passages, brachycephalic dogs must produce higher negative pressure to breathe properly. This pressure can be clinically observed on the nostrils and also on the larynx. The cuneiform and corniculate cartilages are drawn into the glottal opening following increased inspiratory efforts causing laryngeal collapse. In these cases an inspiratory stridor and even suffocation can be observed. In such patients the laryngeal ventricles are usually everted into the laryngeal lumen.

Other findings

Many owners describe signs of regurgitation or vomiting when their BD becomes excited or suffers from respiratory distress. In these instances, signs of respiratory distress are usually relieved when the dog vomits or regurgitates large packs of ‘foam’. In one study on 73 brachycephalic dogs suffering from upper airway syndrome, respiratory and digestive signs were graded as minimal (grade 1), moderate (grade 2), or severe (grade 3) according to their frequency and severity. A correlation between gastric and respiratory signs severity was demonstrated (p=0.059).

Diagnosis

Diagnosis is based on breed, age and clinical signs. Radiographic, CT, or MRI examinations are used to assess the length and thickness of the soft palate, as well as other mucosal hyperplasia or nasal anomalies. Thoracic radiographs can be recommended in order to diagnose a stenotic trachea, aspiration pneumonia and secondary right-sided heart failure. Endoscopy should be conducted as a basic diagnostic work-up: after removal of the endotracheal tube, the motion of the arytenoid cartilages and position of the ventricles are evaluated. In some specific breeds, antegrade and retrograde rhinoscopy are recommended to evaluate the presence of abnormal conchae. During the same procedure, upper gastro-intestinal endoscopy is usually recommended if digestive signs are present.

Macroscopic and endoscopic findings

Stenotic nares and soft palate hyperplasia are the two most common anomalies, present in 50-85% and 96-100% of cases, respectively. Everted ventricles and moderate to severe laryngeal collapse are presented in 50-64% of patients. Some authors specifically studied digestive disorders in BDs suffering from upper airway compromise. In this study, seventy-one out of 73 dogs (97.2%) presented esophageal, gastric or duodenal anomalies. Gastro-oesophageal reflux associated with regurgitation and vomiting can contribute to upper oesophageal, pharyngeal and laryngeal inflammation. These phenomena have been documented experimentally in animals and clinically in infants and can further contribute to upper respiratory problems. In turn, respiratory distress could stimulate the autonomous sympathetic nervous system which would slow gastric motility and increase the gastric emptying time. The close relation between
respiratory and digestive problems is sustained by the fact that most of these animals ‘vomit’ large packs of saliva when excited or stressed or in respiratory distress.

**Treatment**

According to the pathophysiology of the syndrome, early relief of the proximally located obstruction should be attempted because it is postulated that this early correction could prevent or even reverse ventricular eversion or laryngeal collapse. In one study, the influence of upper airway surgical treatment on gastro-intestinal signs improvement has also been studied. After surgical treatment of upper airways, and despite discontinuation of medical treatment in more than 80% of the cases, a clear improvement of upper gastro-intestinal tract disease was observed. In the cases where a control gastro-esophageal endoscopy could be obtained 6 months after upper airway surgery, a complete resolution of the gastro-esophageal endoscopic and histopathologic signs was seen all of the time. These findings support the previous hypothesis of a common pathophysiologic pathway for upper respiratory and upper gastro-esophageal disease in brachycephalic dogs.

**Surgical treatment**

Several techniques of rhinoplasty have been developed. They all aim to open the lateral wings of the nostrils. Removing this part actually increases the diameter of the nostrils and contributes to improvement of the nasal flow. Current techniques for treatment of an elongated soft palate involve section of the overlong part. A new technique, the ‘folded flap palatoplasty’ (see Figures 1-3 below) has been developed in order to address both the pharyngeal and the laryngeal obstruction. This technique achieves a marked reduction of the soft palate thickness, thereby relieving the nasopharynx and oropharynx from obstruction. An endoscopic laser removal of abnormal caudal conchae has been proposed and actually relieves the intra-nasal obstruction, should it be present. Since it is postulated that laryngeal collapse and ventricular eversion are more likely secondary events due to increase respiratory depression, relief of proximal obstruction should alleviate signs of laryngeal collapse. In cases where clinical signs are not improved after rhinoplasty and palatoplasty, lateralization of one of the arytenoïd cartilages can be attempted if the cartilages are stiff enough. Laser removal of the ventricles, as well as laser ‘laryngoplasty’, seem to carry promising results in patients with flaccid larynx. A concurrent medical treatment of gastro-esophageal signs should be proposed as it has been shown to improve the overall prognosis.

**References**