



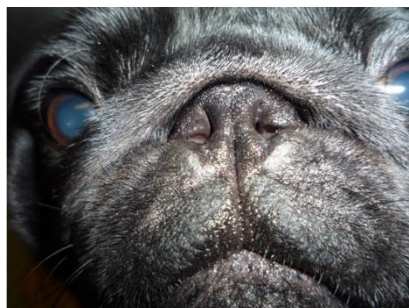
# **The Brachycephalic patient**

## **Mini Series**

**Session Two: Brachycephalic obstructive  
airway syndrome: surgical correction**

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## **The Brachycephalic obstructive airway syndrome – anaesthesia considerations and surgery**

Anaesthesia of brachycephalic dogs' presents challenges before, during and after any surgical, dental or diagnostic procedure. In this session, we will cover anaesthesia considerations for any procedure and specifically for airway surgery and discuss details of surgical management of the airway.

### **Physiology of the brachycephalic patient**

#### **Respiratory drive**

Normal respiratory drive originates in the respiratory centres in the pons with stimulation from chemoreceptors in the medulla oblongata, which respond very sensitively to changes in arterial CO<sub>2</sub> and pH levels of the cerebrospinal fluid. Peripheral chemoreceptors in the aortic body and carotid body also contribute to stimulation of the respiratory centres, however typically they would not be activated and the fine respiratory control is almost exclusively via the central chemoreceptors. In patients who retain CO<sub>2</sub> due to pulmonary disease such as emphysema or chronic bronchitis, humans with obstructive sleep apnoea and dogs with brachycephalic obstructive airway syndrome (BOAS) the stimulation of respiratory drive changes. The peripheral chemoreceptors assume a vital importance because the central chemoreceptors become unresponsive to the constant stimulus of CO<sub>2</sub> and the peripheral chemoreceptors assume the function of driving respiration (the hypoxic drive). These patients will only breathe when arterial PO<sub>2</sub> is low enough to trigger the peripheral chemoreceptors. It is essential to understand this physiological alteration as when a BOAS dog is intubated and receives 100% oxygen they will commonly become apnoeic because O<sub>2</sub> levels do not fall low enough to stimulate respiration. It is of course important they do not become hypoxic but it must be understood that manual or mechanical ventilation may be needed intraoperatively. In order to initiate return of spontaneous ventilation careful evaluation of end tidal CO<sub>2</sub> and oxygen saturation are needed and some permissive hypercapnia may be necessary to stimulate return of spontaneous ventilation.

Brachycephalic dogs have a lower arterial blood oxygen concentration, higher blood carbon dioxide concentrations and are hypertensive compared to mesocephalic dog breeds.

#### **High vagal tone**

Brachycephalic dogs have a high vagal tone which can cause bradycardia. Whilst routine premedication with anticholinergics is not advocated, as this can lead to salivary secretions and airway secretions decreasing but actually becoming thicker, it is important that anticholinergics are readily prepared to administer if there is significant bradycardia. The threshold for treatment will depend on general patient evaluation and blood pressure, however a heart rate lower than 50 beats per minute would be a trigger point for administration of an anticholinergic.

#### **Non-cardiogenic pulmonary oedema**

The balance of interstitial fluid in the pulmonary parenchyma is affected by osmotic pressure, arterial and venous blood pressure and airway pressure. Dogs with severe upper airway resistance and therefore negative airway pressure during inspiration can develop accumulation of fluid within the alveoli (non-cardiogenic pulmonary oedema) as there is an imbalance in the factors that control

fluid distribution. This may be exacerbated by a hyperadrenergic state. Development of pulmonary oedema can occur during a respiratory crisis and be a cause of sudden death.

### **Heat stress**

Their conformation means that they have a decreased capacity to lose heat through panting. Also the action of panting may worsen the dynamic upper airway obstruction in these patients.

### **Gastrointestinal disease**

A high prevalence of gastrointestinal signs, predominantly regurgitation, is seen in dogs with BOAS. Histopathological evidence of chronic gastritis and endoscopic evidence of oesophagitis was demonstrated in 97% of dogs with BOAS, even when the owners had not obviously been aware of gastrointestinal tract signs (Poncet et al 2005). The severity of the gastrointestinal and respiratory signs are positively correlated.

The high incidence of gastrooesophageal reflux is believed to be associated with the high negative intrathoracic pressure which are generated trying to overcome the upper respiratory tract obstruction.

### **Tips for a safe anaesthetic**

- Ensure the environment is calm. Minimise stress and restraint. Have a cool and calm environment.
- Routine pretreatment with oral omeprazole (1 mg/kg at least 4 hours before induction) is recommended in all brachycephalic patients undergoing general anaesthesia
- Routine administration of maropitant preoperatively counteract nausea induced by opiates.
- Brachycephalic patients require additional time for their management and monitoring to be carried out safely.
- Sedation improves ventilation by increasing the large and small airway diameter via relaxation of striated and smooth muscle and reduces ventilation/perfusion mismatch.
- Note that excessive sedation will induce recumbency and reduce pharyngeal muscle tone which can make upper respiratory tract obstruction worse. Flushing mouth and oesophagus with warm saline or water if regurgitation occurs.
- No routine use of anticholinergics

Preoxygenation aims to denitrogenate the functional capacity of the lung and reduce the chances of cellular hypoxia, which occurs as induction drugs are delivered. This is of particular importance in brachycephalic breeds as they have lower than normal arterial oxygen concentrations and therefore may be prone to more rapid and dangerous desaturation during a period of apnoea at induction.

When airway surgery is performed, a decision needs to be made regarding administration of either Dexamethasone or NSAIDS. This decision may be made following airway examination or following recovery from anaesthesia. For example: if there is evidence of mucosal swelling and inflammation evident when the airway is first examined then it is appropriate to administer dexamethasone (0.1 to 0.2 mg/kg IV) to reduce mucosal inflammation and swelling. Alternatively, if there is minimal airway swelling noted on initial evaluation, non steroidal anti-inflammatory medication may be administered as it probably has a greater analgesic effect than afforded by dexamethasone and can

be continued post-operatively following discharge. I often wait to assess the dog's recovery from anaesthesia and surgery to determine if I am happy to administer a Nonsteroidal anti-inflammatory medication, therefore relatively precluding administration of dexamethasone should signs of further upper airway swelling occur.

Brachycephalic breeds have prominent exposed eyes and are very prone to corneal ulceration. Use lubrication must be used when any sedative agent is administered, but particularly when under general anaesthetic. Copious sterile lubrication gel is effective at protecting the eye under anaesthesia. Administration of tear replacements (Celluvisc) is continued post-operatively every 4 hours.

### *Endotracheal intubation*

Necessary equipment:

- Laryngoscope
- Good light source
- Suction catheter
- Range of cuffed ET tubes.
- Rigid stylet
- Rigid urinary catheter for delivery of oxygen or to act as stylet

Perform an oropharyngeal and laryngeal examination in all BOAS dogs at routine general anaesthesia. Which may be useful to guide owners and also will help to identify dogs that are at higher risk of developing problems during the recovery period.

Ventilation can be affected by obesity, patient positioning,

Analgesia based upon pain scoring rather than routine administration at regular intervals. This provides better more tailored analgesia and avoids the possibly unnecessary side effects of hyperventilation with methadone or possible nausea and vomiting with morphine, for example.

Patient positioning during anaesthetic recovery. Until they are able to maintain an open airway for themselves it is important to position them to optimise the patency of their airway. This can be achieved by positioning in sternal recumbency with the neck extended and tongue pulled out

### **BOAS Surgery**

The patient will be evaluated and a decision made about all the components of corrective airway surgery that are required. Typically the partial staphylectomy will be performed first. This then allows better access to the larynx if a laryngeal procedure is required, for example for laryngeal saccullectomy or less frequently a partial cuneiformectomy. The rhinoplasty is performed after the intraoral stage of the procedure; this then allows sometime after which the larynx and palate can again be checked for bleeding before anaesthetic recovery. If it is warranted to place a temporary tracheostomy tube then this is done at the end of the procedure as safer airway management can be achieved when the patient is intubated.

## **Partial staphylectomy**

Appropriate assessment of the length of the palate is important. The caudal border of the tonsillar crypt or just meeting the tip of the epiglottis are guidelines that are used. Remember however that the issue is dynamic and that the caudal border of the soft palate will be drawn into the rima glottidis during inspiration. In English Bull dogs and many French bull dogs the palate is not only long but very thick and, in order to achieve the best improvement in airflow in these dogs, using the mid level of the tonsillar crypt as a landmark and performing the staphylectomy as an inverted U is effective. The technique that is described in detail below uses stay sutures and staphylectomy without a clamp in place, however the use of a soft palate clamp is another option covered in the presentation. A folded flap palatoplasty is also described to not only shorten but also the thin the palate.

### *Steps for partial staphylectomy:*

- Patient in sternal recumbency with the mouth held in an open position.
- Identify the appropriate landmark for the level of resection of the soft palate.
- Grasp the free edge of the palate in the midline with Allis tissue forceps allowing the palate to be pulled rostrally.
- Place stay sutures at the lateral extent of the staphylectomy incision on both sides, just adjacent to the tonsillar crypt. This is the site that is most likely to bleed and use of the stay sutures allows this to be avoided. Tension applied between the Allis tissue forcep and a stay suture or between both stay sutures allows accurate tissue apposition and minimises any bleeding.
- Ensure the tube is cuffed. Generally placement of a throat pack is not necessary and can interfere with assessment and suturing but some surgeons may choose to do this.
- Perform the staphylectomy using Metzebaum scissors passing from lateral to medial passing the tips more rostrally to create an inverted U.
- Repair the palate with simple interrupted sutures of absorbable suture material ensuring to engage both the nasal and the oral mucosa. Simple continuous suturing is also an option but can make accurate apposition of the palate slightly more challenging. Use of a swaged on suture material with a small radius or curvature of the needle helps to allow passage of the needle within the tight confines of the oral cavity without traumatising the palate, pharyngeal tissue or the tongue.

### Common mistakes:

Failing to notice the most lateral extent of the palatine wound when suturing. This can lead to persistent bleeding from the cut edge of the palate and an additional suture should be placed if this is noted.

Failure to engage the nasal mucosal surface when placing sutures.

### Another option:

Use of a tonsillectomy clamp is also described to perform the staphylectomy. The clamp is placed over the free edge of the soft palate which is drawn rostrally. The palate is then resected whilst the clamp remains closed. A simple continuous suture is then placed through the cut free edge of the soft palate encircling the jaws of the tonsillectomy clamp. The suture has to be placed in a loose manner such that the clamp can be withdrawn and the continuous suture then rapidly tightened and tied. The advantage of this technique is that there is complete control of haemorrhage from the cut edge of the palate. If using this technique it helps to use a monofilament suture material (e.g. polygelcaprone) as the reduced resistance facilitates the suture being tied.

### **Rhinoplasty**

The rhinoplasty can be performed from a young age and can significantly delay the development of secondary BOAS changes.

The patient is positioned in sternal recumbency with the nasal planum perpendicular to the table or slightly raised by positioning with sandbags. A modified horizontal or vertical wedge can be used. What is very important is that the resection includes a partial ala-vestibulectomy, therefore creating modification to the opening of the naris deeper than just the nasal planum. Closure is performed using 1.5 metric monofilament suture in a simple interrupted suture; generally 3 or 4 sutures are required per naris.

Common mistakes:

Performing the rhinoplasty too superficially that there is not significant improvement in the opening of the airway.

It can be challenging to create absolute symmetry of the nostrils when performing rhinoplasty and it is worthwhile advising the clients that this could be something they note post-operatively. Whilst it is not of importance to the improvement in airway function, from some clients the cosmetic appearance of their pet is paramount.

### **Laryngeal sacculotomy**

Laryngeal sacculotomy is performed with the patient extubated, by grasping the protruding sacculae with Allis tissue forceps and using fine scissors to cut the base of the laryngeal sacculae therefore allowing removal. Specialist fine instruments can make this procedure safer and more precise. Care must be taken to remove all of the sacculae, otherwise there is a risk of webbing occurring, where a scar forms bridging the rima glottidis. It can be a difficult balance of decisions when considering whether or not to opt for laryngeal sacculotomy when BOAS surgery is being performed for the first time. Almost invariably, partial staphylectomy and rhinoplasty are indicated, however whilst the majority of dogs will have concurrent eversion of laryngeal sacculae and it has been demonstrated on follow up studies that correction of the primary components of BOAS are not sufficient to allow resolution of the eversion and mucosal oedema of the laryngeal sacculae (Canatore et al, 2012), there are greater complications when performing laryngeal sacculotomy (Hughes et al, 2018), including necessity for temporary tracheostomy. Many clinicians may opt not to pursue laryngeal sacculotomy as a first line treatment, however it must be assessed on a case by case basis.

## **Other surgical techniques**

Recent publications report a modern multilevel surgery to be performed for BOAS, which if necessary include rhinoplasty and palatoplasty in addition to laryngeal procedures of laryngeal sacculotomy and partial cuneiformectomy, if indicated, in addition to laser assisted ethmoturbinectomy, again if indicated. Objective assessment of these dogs with whole body plesythmography to determine a BOAS index, has demonstrated that the BOAS index improves more with this more thorough multilevel surgery than with traditional techniques (Lui et al., 2017). It was worth noting that despite this improvement the operated dogs remained clinically affected with BOAS. Whilst BOAS surgery may be able to help it is not a solution for this canine welfare problem and of course we need to keep ensuring we can change the future breeding practices.

## **Post-operative monitoring**

Careful post-operative monitoring is essential following BOAS surgery. Whilst the airway should be more open following corrective surgery there is the risk of anaesthesia recovery, risks from airway swelling, bleeding and secretions and increased risk of aspiration pneumonia from perioperative regurgitation. The patient must be kept cool and calm and continuous monitoring is essential for the first few hours following recovery from surgery; subsequently overnight care is essential for appropriate care of these patients.

## **Temporary tracheostomy**

The use of a temporary tracheostomy following recovery from BOAS surgery may be opted for electively or may become indicated if there is evidence of marked upper respiratory tract obstruction at some point during recovery. Also, if the patient were to suffer from significant aspiration pneumonia that necessitates mechanical ventilation a temporary tracheostomy tube would also be elected. The rate of need for post-operative intervention and placement of a temporary tracheostomy varies between institutions but is on average around 5%.

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