Anesthesia in an English Bulldog

Jennifer E. Carter, DVM, DACVAA, CVPP
University of Melbourne

Hugo, a 7-year-old neutered male English bulldog, is presented for dental cleaning with possible extraction because of a suspected mandibular tooth root abscess. Hugo had been eating and drinking normally until 5 days ago, when his owner noticed he was less interested in his food and was drooling excessively.

At one year of age, Hugo was neutered and underwent soft palate resection, sacculectomy, and alarplasty of the nares. He has a 7-year history of snoring. He is up-to-date on core vaccinations. His 80-year-old owner does not leash walk him, and Hugo has access to a fenced yard for short times only for urination and defecation.

On physical examination, BCS is 7/9. Hugo is panting loudly and is excited but friendly. Although his excitement makes auscultation of the heart and lungs difficult, no obvious murmurs are evident. No other abnormalities are noted. Preoperative CBC results demonstrate a moderate neutrophilia (14.5×10^3/uL; range, 3-12 $\times 10^3$/uL) with no left shift. Serum chemistry profile results are unremarkable.

WHAT ARE THE APPROPRIATE NEXT STEPS?

OPTION 1

To perform dental treatment using balanced anesthesia and analgesia with drugs and techniques tailored to Hugo and the procedure (***Table 1***), go to page 74.

OPTION 2

To perform dental treatment using balanced anesthesia and analgesia according to the practice's standard operating procedure (***Table 2***), in an effort to reduce risk for error by using familiar drugs and protocols, go to page 77.

TABLE 1

DRUGS & TECHNIQUES TAILORED TO HUGO

Purpose	Drug/Technique
Premedication	Methadone (0.3 mg/kg IM) Acepromazine (0.02 mg/kg IM) Oxygen via facemask for 3 minutes before induction
Induction	Propofol (IV to effect)
Maintenance	Isoflurane
Operative	Local anesthetic dental blocks as needed Dexamethasone sodium phosphate (0.15 mg/kg IV)
Postoperative	Buprenorphine (0.03 mg/kg IV)

TABLE 2

PRACTICE'S STANDARD OPERATING PROCEDURE

Purpose	Drug/Technique
Premedication	Dexmedetomidine (0.008 mg/kg IM) Hydromorphone (0.1 mg/kg IM)
Induction	Propofol (IV to effect)
Maintenance	Isoflurane
Operative	Local anesthetic dental blocks as needed
Postoperative	Carprofen (4.4 mg/kg SC)

OPTION 1

Perform dental treatment using balanced anesthesia with drugs and techniques tailored to Hugo and the procedure.

Case Progression

Methadone (0.3 mg/kg IM) and acepromazine (0.02 mg/kg IM) are administered, and Hugo is monitored by a veterinary nurse while the drugs take effect. A catheter is placed, and oxygen is delivered via facemask for 3 minutes before administration of propofol (IV to effect) to allow endotracheal intubation. Using a laryngoscope, placement of an 8-mm endotracheal tube is attempted; however, the tube is too large, so a 7-mm endotracheal tube is placed. During intubation, the soft palate is markedly elongated and obstructs the laryngeal opening. Oxygen is administered with isoflurane for anesthetic maintenance; when the patient reaches a stable anesthetic plane, owner permission is granted to trim the soft palate during the dental procedure. Periprocedural antibiotics were administered and care was taken to protect the palatoplasty site during the dental extraction to minimize risk for bacteremia. Dexamethasone sodium phosphate (0.15 mg/kg IV) is administered to reduce the risk for postoperative airway obstruction from inflamed tissues. The remainder of the anesthetic period is unremarkable. Hugo, under careful observation, is allowed to recover with the endotracheal tube in place until he begins to swallow vigorously. Buprenorphine (0.03 mg/kg IV) is administered for postoperative analgesia.

Clinical Considerations

To create a balanced anesthetic plan, Hugo's unique physical characteristics, his breed, and the procedure to be performed were all considered. Brachycephalic breeds are predisposed to brachycephalic syndrome, characterized by an elongated soft palate, stenotic nares, and everted laryngeal saccules. Dogs with brachycephalic syndrome often have hypoplastic tracheas and pharyngeal and laryngeal collapse.[1-5] In a retrospective study of 90 dogs with brachycephalic airway obstructive syndrome, 61% were English bulldogs; 94% of study dogs had elongated soft palates.[1]

Brachycephalic dogs have high negative airway pressure in the upper airway tract, which can cause the tissues of the soft palate to become stretched and contribute to upper airway obstruction.[6] Hugo underwent soft palate resection 6 years prior, but his history of persistent snoring suggests that his soft palate continues to obstruct his upper airway. He is able to compensate for the obstruction when awake but not after sedation or induction because of relaxation of the pharyngeal and laryngeal muscles. In a retrospective study of 73 dogs, clinical signs returned to some degree in all dogs that underwent surgical correction for brachycephalic syndrome.[2]

Premedication agents that cause excessive sedation must be avoided in patients with brachycephalic syndrome to avoid worsening airway obstruction. Premedication drug effects on respiratory drive and normal respiratory function must also be considered. Opioid agents can cause hypoventilation by shifting the ventilatory response curve of the medullary chemoreceptors to the right, making them less sensitive to CO_2 increases.[7] Methadone is an ideal premedication for Hugo because it is a full μ-opioid agonist that provides appropriate analgesia for dental extraction but, unlike other opioids, is unlikely to cause vomiting when administered IM. Acepromazine, which can reduce respiratory rate, is also an appropriate premedication choice because it does not cause significant changes in arterial CO_2 or O_2 partial pressures.[8,9]

Brachycephalic dogs generally have higher vagal tone and may experience bradycardia during anesthetic procedures.[10] Anticholinergic drugs (eg, atropine, glycopyrrolate) are often used in premedication protocols to prevent opioid-induced bradycardia; however, these drugs should be avoided in premedication combinations for

brachycephalic patients. Anticholinergic drugs reduce the watery component of saliva but not the thick mucus, which can worsen airway obstruction. Once the airway is secured, anticholinergic drugs can be used if needed to treat bradycardia. Atropine has a relatively short duration of action; therefore, thickened saliva should not be a concern in the postoperative period.

Patients should be monitored continuously for worsening airway obstruction after sedative administration. Preoxygenation with 100% oxygen for 3 minutes has been demonstrated to increase the time to desaturation by nearly 5 times in patients experiencing postinduction apnea.[11] Providing preoxygenation to brachycephalic patients is prudent when securing an airway rapidly may be difficult. The ability to gain rapid control of the airway via intubation is critical during induction. Propofol enables a controlled induction and, when given to effect, results in minimal cardiopulmonary depression. Alfaxalone also can be used, as it provides induction comparable to that of propofol with similar dose-dependent cardiopulmonary effects.

A laryngoscope facilitates endotracheal intubation in brachycephalic patients. Dogs with brachycephalic syndrome typically have an elongated (and often hyperplastic) soft palate; a hyperplastic tongue and pharyngeal tissue also are frequently present. These conditions combined can make visualization of the arytenoid cartilages challenging. The laryngoscope is used to depress the tongue and, if necessary, the epiglottis to improve visualization. In severe cases, an endoscope may be needed to facilitate endotracheal intubation. A hypoplastic trachea can make it difficult to determine the appropriate endotracheal tube size. Before starting intubation, tubes of multiple sizes should be available, and the veterinarian or veterinary nurse should attempt to place the largest diameter tube possible.

Brachycephalic patients should not be extubated until they clearly demonstrate airway control by swallowing vigorously. Surgical-site swelling can obstruct airflow and worsen breathing in brachycephalic patients; anti-inflammatory doses of steroids are often used to minimize swelling. Even after extubation, brachycephalic patients should be monitored closely for signs of respiratory difficulty. Continuous use of a pulse oximeter during the recovery period is ideal, but the pulse oximeter should be removed if it causes patient stress. Brachycephalic patients may require reintubation or tracheostomy if they are unable to ventilate adequately.

Many patients with brachycephalic syndrome continue to require oxygen supplementation following surgical correction. This can be provided via oxygen cages, facemasks, and nasal oxygen cannulas. In a retrospective study comparing use of nasotracheal tubes with other methods of postoperative supplementation in 20 dogs (19 of which had undergone palatoplasty), the authors reported that the nasotracheal tube was easy to place and suggested that it could reduce the incidence of respiratory distress postoperatively as compared with other methods of oxygenation.[12]

Outcome

Postoperatively, Hugo is moved to an oxygen cage in ICU and receives buprenorphine (0.03 mg/kg IV). Four hours after extubation, pulse oximetry shows an oxygenation of 96% while breathing room air, and supplemental oxygen is discontinued. Hugo is discharged from the hospital the following day, and a one-week follow-up appointment is scheduled to assess his breathing and discuss a weight-loss plan.

Implications

Tailored premedication choices, patient monitoring after administration of premedications, and preoxygenation helped minimize Hugo's risk for respiratory emergencies perioperatively. Using a laryngoscope for intubation facilitated placement of the endotracheal tube and allowed observation of the elongated soft palate. The veterinarian was able to contact the client and obtain permission to trim the soft palate in the same surgical session. Successful dental cleaning and extraction of the abscessed tooth, along with soft palate resection, resulted in an improved quality of life for the patient.

OPTION 2

Perform dental treatment using balanced anesthesia according to the practice's standard operating procedure, in an effort to reduce risk for error by using familiar drugs and protocols.

Case Progression

Dexmedetomidine (0.008 mg/kg IM) and hydromorphone (0.1 mg/kg IM) are administered, and Hugo is placed in a quiet cage unobserved while the drugs take effect. After 10 minutes, a veterinary nurse notices Hugo struggling to breathe. Exaggerated paradoxical chest wall movements are noted, and the mucous membranes appear cyanotic. Hugo is rushed to the dental area for endotracheal intubation. The practice does not routinely use a laryngoscope for intubation and one is not immediately available. The veterinarian attempts intubation with an 8-mm endotracheal tube but is unable to visualize the laryngeal opening because of a markedly hypertrophied and elongated soft palate and hypertrophied pharyngeal tissues. Despite these complications, the veterinarian continues the procedure without contacting the owner. Oxygen is provided via facemask, and a laryngoscope is located a few minutes later. Intubation is attempted again using the same 8-mm endotracheal tube, but the tube is too large. Hugo is successfully intubated using a 7-mm endotracheal tube, and intermittent positive pressure breaths are provided. His mucous membrane color improves, and the dental procedure commences as planned with no further issues.

Hugo is allowed to recover with the endotracheal tube in place and oxygen flowing until he swallows. On extubation, his respiratory effort is increased and mucous membranes are muddy. Oxygen is administered via facemask, but Hugo struggles to breathe. Propofol (IV to effect) is administered, and an endotracheal tube is placed. Thoracic auscultation discloses bilateral crackles. Thoracic radiographs show pulmonary edema. The owner is informed that Hugo has signs of noncardiogenic postobstructive pulmonary edema and may require ventilation while the edema resolves and that Hugo's soft palate is elongated and a second surgery may be required to shorten it; however, because of Hugo's current respiratory compromise, his anesthetic risk is increased and his respiratory signs may worsen after surgery.

Clinical Considerations

All clinicians should be familiar with the pharmacology of the drugs they prescribe and the pathophysiology of the conditions they treat. Some consider it safer to use familiar drugs over unfamiliar agents. This practice assumes the clinician clearly understands the limitations and contraindications of the more familiar drugs. Some clinicians believe that α-2 agonists such as dexmedetomidine are a good choice for premedication in brachycephalic patients because these drugs have a dose-dependent duration of action and are reversible. Others warn that α-2 agonists can cause markedly more profound sedation as compared with acepromazine.

In Hugo's case, use of dexmedetomidine may have contributed to his airway obstruction. Both acepromazine and dexmedetomidine can cause relaxation of the pharyngeal musculature and, during deep sedation, result in airway obstruction. These drugs should be administered to brachycephalic patients in lower doses to decrease the potential for excessive sedation. Continuous monitoring of all patients following premedication administration is always prudent but is essential for brachycephalic dogs. Prompt identification and treatment of respiratory distress can reduce the risk for further complications.

Use of a laryngoscope is essential during endotracheal intubation of brachycephalic patients because it facilitates appropriate visualization of the larynx for intubation. Various endotracheal tube sizes should be available during intubation, as hypo-

plastic trachea is common in brachycephalic dogs and makes predetermination of tube size difficult.

Timely communication between the veterinary team and the pet owner is an essential component of veterinary care. During surgical procedures, in particular, the veterinary team should remain in close contact with the owner in case of unexpected events or findings. In Hugo's case, after noting the elongated soft palate and associated respiratory issues, the owner was not contacted before the procedure was continued. Contacting the owner could have better prepared him for Hugo's unfavorable outcome.

Postoperative administration of dexamethasone sodium phosphate (0.15 mg/kg IV) might have improved Hugo's outcome; however, it likely would not have prevented the development of pulmonary edema. Leaving the endotracheal tube in place until Hugo could swallow vigorously was appropriate because of his brachycephalic conformation; however, disconnecting the oxygen and evaluating his oxygenation using pulse oximetry could have enabled earlier detection of pulmonary edema.

Outcome

After discussing Hugo's prognosis and treatment options, the owner elects euthanasia because of the uncertain prognosis and concerns about treatment costs.

Implications

The patient's breed, history of previous surgical corrections, BCS, and history of snoring all suggested the presence of brachycephalic syndrome; therefore, the risk for airway obstruction should have been recognized earlier.

In addition, the patient should not have been left unattended in a cage to wait for the premedication drugs to take effect. If Hugo had been monitored continuously, his respiratory distress might have been discovered earlier, leading to prompt treatment of his airway obstruction and preventing the development of postobstructive pulmonary edema. Having a laryngoscope and different sizes of endotracheal tubes readily available during intubation would have helped the veterinary team more quickly obtain a secure airway.

The owner should have been contacted immediately after Hugo was intubated and his vital signs were stable to determine if the owner wished to continue. This conversation most likely would not have altered the eventual outcome, but it would have given Hugo's owner the opportunity to decline the dental procedure and decrease the bill amount.

References

1. Fasanella FJ, Shivley JM, Wardlaw JL, Givaruangsawat S. Brachycephalic airway obstructive syndrome in dogs: 90 cases (1991-2008). *J Am Vet Med Assoc*. 2010;237(9):1048-1051.
2. Torrez CV, Hunt GB. Results of surgical correction of abnormalities associated with brachycephalic airway obstruction syndrome in dogs in Australia. *J Small Anim Pract*. 2006;47(3):150-154.
3. Wykes PM. Brachycephalic airway obstructive syndrome. *Probl Vet Med*. 1991;3(2):188-197.
4. Lorinson D, Bright RM, White RAS. Brachycephalic airway obstructive syndrome—a review of 118 cases. *Canine Pract*. 1997;22(5-6):18-21.
5. Harvey CE. Upper airway obstruction surgery 2: soft palate resection in brachycephalic dogs. *J Am Anim Hosp Assoc*. 1982;18:538-544.
6. Van der Touw T, O'Neill N, Brancatisano A, Amis T, Wheatley J, Engel LA. Respiratory-related activity of soft palate muscles; augmentation by negative upper airway pressure. *J Appl Physiol*. 1994;76(1):424-432.
7. KuKanich B, Wiese AJ. Opioids. In: Grimm KA, Lamont LA, Tranquilli WJ, Greene SA, Robertson SA, eds. *Veterinary Anesthesia and Analgesia: The Fifth Edition of Lumb and Jones*. Ames, IA: John Wiley & Sons; 2015:207-226.
8. Turner DM, Ilkiw JE, Rose RJ, Warren JM. Respiratory and cardiovascular effects of five drugs used as sedatives in the dog. *Aust Vet J*. 1974;50(6):260-265.
9. Farver TB, Haskins SC, Patz JD. Cardiopulmonary effects of acepromazine and of the subsequent administration of ketamine in the dog. *Am J Res Vet*. 1986;47(3):631-635.
10. Doxey S, Boswood A. Differences between breeds of dog in a measure of heart rate variability. *Vet Rec*. 2004;154(23):713-717.
11. McNally EM, Robertson SA, Pablo LS. Comparison of time to desaturation between preoxygenated and nonpreoxygenated dogs following sedation with acepromazine maleate and morphine and induction of anesthesia with propofol. *Am J Vet Res*. 2009;70(11):1333-1338.
12. Senn D, Sigrist N, Forterre F, Howard J, Spreng D. Retrospective evaluation of postoperative nasotracheal tubes for oxygen supplementation in dogs following surgery for brachycephalic syndrome: 36 cases (2003-2007). *J Vet Emerg Crit Care (San Antonio)*. 2011;21(3):261-267.