



Abstract

This anesthetic case study outlines the rationale behind and describes the successful use of butorphanol as a premedicant and as an intraoperative analgesic in a dog undergoing unilateral arytenoid lateralization. Given the antiemetic, sedative, and analgesic effects of butorphanol, it may be the opioid of choice in certain veterinary surgeries (especially those where anxiolysis, sedation, antiemesis, and moderate analgesia are beneficial).



ANESTHESIA/ANALGESIA

Anesthetic Case Management of a Dog Undergoing Arytenoid Lateralization

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Laryngeal paralysis is a commonly encountered upper respiratory disease in dogs. Decreased functionality of the arytenoid cartilage leads to a partial obstruction of the airway. As a result, respiration becomes more difficult. Common clinical signs include increased respiratory noise and effort, panting, gagging, exercise intolerance, altered vocalization sounds, and/or heat intolerance. The disease process can be congenital or acquired but is most commonly seen in older, large-breed dogs secondary to generalized peripheral polyneuropathy.¹ In these instances, patients may also suffer from hind-end weakness and difficulty swallowing.

Surgical correction (unilateral arytenoid lateralization) of laryngeal paralysis is frequently indicated and carries a good prognosis (median survival time of 3 to 5 years after surgical correction).¹

SIGNALMENT, PRESENTATION, AND HISTORY

This report outlines the case of an 8-year-old male castrated Newfoundland dog that was referred to a private veterinary specialty center for suspected laryngeal paralysis.

Take-Home Points

- Butorphanol can be used successfully as a premedicant in dogs due to its antiemetic and sedative properties.
- Butorphanol can be administered to dogs prior to functional airway examination.
- Butorphanol can provide mild to moderate analgesia, especially if utilized as part of a multimodal analgesic protocol.
- Butorphanol can be utilized as a constant-rate infusion to provide analgesia for medium- to long-duration procedures.
- Butorphanol may be administered prior to, or concurrently with, μ -opioid agonists without adversely impacting the degree of analgesia.



Upon presentation, the patient was in stable condition with the following vital signs:

- **Mentation:** Bright, alert, and responsive
- **Heart rate (HR):** 75 beats per minute (bpm; reference range, 60 to 140 bpm)
- **Respiratory rate (RR):** 36 breaths/min (reference range, 15 to 30 breaths/min)
- **Temperature:** 101.8 °F (38.8 °C; reference range, 101 °F to 102.5 °F [38.3 °C to 39.2 °C])
- **Mucous membrane color:** Pink
- **Capillary refill time:** < 2 seconds
- **Body weight:** 128 lb (58 kg)
- **Body condition score:** 5/9

The owners reported a progressive, 5-month history of difficulty breathing, voice change, and increased upper airway noise (stridor), which was exacerbated by exercise. The owners were not currently administering any medications. Physical examination revealed no abnormalities except for the presence of stridor and effort. No paraparesis or pelvic limb weakness was appreciated, and the owners did not report any challenges with swallowing.

A review of the medical record revealed a prior diagnosis of left cruciate insufficiency, which was surgically repaired 2 years prior via tibial plateau leveling osteotomy. The anesthetic record from that surgery was not available for review.

Following consultation, the owners elected to pursue preoperative diagnostics (hematologic screening, thoracic radiography, and a functional airway exam) followed by arytenoid lateralization, if indicated.

TREATMENT AND OUTCOME

The patient was administered gabapentin (7 mg/kg PO), trazodone (3 mg/kg PO), and maropitant (2 mg/kg PO). After 90 minutes, an 18-gauge IV catheter was placed in the right cephalic vein. Ondansetron was administered at 0.2 mg/kg IV over 5 minutes. A complete blood count and a serum biochemical profile were unremarkable. Three-view thoracic radiographs were likewise unremarkable.

Following the aforementioned diagnostics, the patient was transported to the surgical preparation area and placed in sternal recumbency. Butorphanol (0.2 mg/kg IV) and dexmedetomidine (1 µg/kg IV) were administered. Flow-by oxygen with a loose-fitting face mask was provided at 3 L/min for 5 minutes. Propofol

(1 mg/kg IV) was titrated to effect to facilitate a functional airway exam. Doxapram was available for respiratory system stimulation but was not utilized.

Airway examination confirmed bilateral laryngeal paralysis and bilaterally erythematous cuneiform and corniculate processes. An additional 2 mg/kg of propofol was titrated to effect to facilitate intubation with a 57-French endotracheal tube (ETT). The patient was connected to an adult rebreathing circuit with a 4-L reservoir bag. Isoflurane 1.25% (vaporizer setting) was administered in 100% oxygen using an initial oxygen flow rate of 4 L/min (69 mL/kg/min).

Physiologic monitoring equipment was established and the patient's vital signs were as follows:

- **Peripheral oxygen saturation (SpO₂):** 99% (reference range, > 95%)
- **HR:** 100 bpm
- **Noninvasive oscillometric blood pressure (NIBP):** 98/50 (66) mm Hg (hypotension defined as mean arterial pressure < 60 mm Hg)
- **Sinus rhythm:** Normal
- **End-tidal carbon dioxide (ETCO₂):** 52 mm Hg (reference range, 35 to 55 mm Hg during spontaneous respiration)
- **RR:** 9 breaths/min
- **Rectal temperature:** 101 °F (38.3 °C)

The owners were contacted and informed about the completed diagnostics, and the decision to pursue arytenoid lateralization was confirmed. The patient was placed in right lateral recumbency for surgical preparation of the left cervical region. An additional dose of butorphanol (0.1 mg/kg IV) was administered (20 minutes after the initial dose), followed by a constant-rate infusion (CRI) of 0.1 mg/kg/hr. Meloxicam at 0.1 mg/kg was administered subcutaneously. The patient's vital signs were as follows:

- **SpO₂:** 100%
- **HR:** 90 bpm
- **NIBP:** 99/52 (68) mm Hg
- **ETCO₂:** 44 mm Hg
- **RR:** 12 breaths/min

The patient was transported to the operating theater. Physiologic monitoring equipment was re-established and showed:

- **SpO₂:** 100%
- **HR:** 100 bpm
- **NIBP:** 122/72 (88) mm Hg
- **ETCO₂:** 46 mmHg



- **RR:** 15 breaths/min
- **Rectal temperature:** 101.2 °F (38.4 °C)

IV fluid therapy was initiated using lactated Ringer's solution at 5 mL/kg/hr. Ketamine (0.25 mg/kg IV) was administered, followed by a CRI of 0.6 mg/kg/hr. The initial surgical incision was made. Anesthetic depth was deemed appropriate (absent palpebral reflex, minimal jaw tone, ventromedial eye position). Isoflurane was reduced to 1% (vaporizer setting), and the oxygen flow rate was reduced to 1.2 L/min (21 mL/kg/min).

Thirty-five minutes after initial surgical incision, isoflurane was discontinued, the ETT cuff was deflated, and the ETT was rotated 360 degrees to check for laryngeal suture entrapment. Once the ETT was freely movable, the cuff was slowly reinflated until cessation of leak occurred at 15 cm H₂O and isoflurane 1% (vaporizer setting) resumed. The patient's vital signs were as follows:

- **SpO₂:** 98%
- **HR:** 92 bpm
- **NIBP:** 120/74 (90) mm Hg
- **ETCO₂:** 48 mm Hg
- **RR:** 14 breaths/min
- **Rectal temperature:** 101.2 °F (38.4 °C)

Bupivacaine (1 mg/kg SC) was instilled during incision closure. Total surgical time was 68 minutes. Isoflurane was discontinued and the patient was rotated into sternal recumbency. The ETT was temporarily removed and oral examination confirmed satisfactory arytenoid lateralization. The patient was reintubated and allowed to breathe 100% oxygen for 5 minutes. Total anesthetic time was 105 minutes.

The patient was transported to the recovery ward and placed in sternal recumbency. Vital signs were:

- **Mentation:** Sedate
- **SpO₂:** 97%
- **HR:** 75 bpm
- **NIBP:** 132/67 (88) mm Hg
- **RR:** 15 breaths/min
- **Rectal temperature:** 100.8 °F (38.2 °C)

IV fluid therapy and the ketamine CRI were discontinued. The butorphanol CRI continued to run at 0.1 mg/kg/hr. The ETT was deflated and removed 17 minutes after isoflurane was discontinued (no regurgitation was noted in/on the ETT or in the oral cavity). The incision was iced for the next 15 minutes. The postoperative treatment plan included a

butorphanol CRI (0.1 mg/kg/hr) for the next 2 hours, gabapentin (7 mg/kg PO q8h), trazodone (3 mg/kg PO q8h), meloxicam (0.1 mg/kg PO q24h) 24 hours after subcutaneous dose, cold therapy every 6 hours, the avoidance of neck leads and Elizabethan collars due to surgical incision location, the provision of small amounts of water (to minimize the risk of aspiration), and the controlled feeding of wet food formed into meatballs (to minimize the risk of aspiration). Acepromazine (0.01 mg/kg IV) was to be administered in the event of anxiety/stress and methadone (0.1 mg/kg IV) was to be administered in the event of elevated Colorado State University pain scores (> 2 out of 4). Neither of these medications were indicated postoperatively, and the patient was discharged 20 hours later without incident.

DISCUSSION

Anesthetic management of patients undergoing arytenoid lateralization is relatively straightforward but presents a few unique risks. Preoperatively, the disease process results in a partial upper airway obstruction, which can be exacerbated by stress. Therefore, care should be taken to minimize perioperative fear, anxiety, and stress through the utilization of anxiolytics, sedatives, and environmental considerations (e.g., quiet wards, privacy curtains, gentle handling). Likewise, oxygen supplementation and an emergency intubation kit should be available perioperatively in the event of a respiratory crisis. Prior to induction, a functional airway exam may be required to confirm the diagnosis of laryngeal paralysis, which necessitates the careful selection of premedicants to maintain laryngeal function/motion.

Following surgical correction, these patients are at an increased risk of aspiration pneumonia because one side of the rima glottidis is permanently open.² Therefore, care should be taken to minimize the incidence of perioperative regurgitation and postoperative nausea and vomiting. Water and food intake can be altered (e.g., smaller volumes of water, altered food bowl designs, controlled feeding) to further decrease the risk of aspiration. Finally, although arytenoid lateralization is generally thought to be less painful than more invasive surgical procedures (e.g., thoracotomy, laparotomy, fracture repair), the provision of adequate multimodal analgesia is warranted.

Given these specific anesthetic goals, the utilization of butorphanol in the perioperative period seems logical.



Butorphanol is a mixed opioid agonist-antagonist (κ and μ , respectively). It is used pervasively throughout veterinary medicine as an antitussive, as a mild sedative, and as an analgesic for mild to moderate pain. Given its minimal effect on laryngeal motion,³ along with its antiemetic^{4,5} and sedative properties,⁶ butorphanol may be used successfully as a premedicant in dogs undergoing arytenoid lateralization.

Some anesthetists avoid using butorphanol when moderate to severe pain is expected. While butorphanol is generally thought to be a less effective analgesic than the μ -opioid agonists (hydromorphone, methadone, fentanyl), this relative deficiency might be clinically insignificant when multimodal analgesic regimens (e.g., locoregional blocks, nonsteroidal anti-inflammatory drugs, *N*-methyl-D-aspartate antagonists, α_2 -agonists) are utilized.⁵ Butorphanol's perceived lack of analgesia may also be due to an inadequate dosing schedule⁷ or from the drug's relatively short duration of action. If duration of action is a concern, a CRI can be utilized with good effect.⁸ Finally, many clinicians avoid using butorphanol for fear that its antagonist properties preclude the concurrent or future use of μ -opioid agonists. This argument seems to be theoretical in nature and is not supported either in practice or in the literature.⁹⁻¹¹

SUMMARY

This anesthetic case study outlines the rationale for and describes the successful use of butorphanol as a premedicant and as an intraoperative analgesic in a canine patient undergoing unilateral arytenoid lateralization. Given the antiemetic, sedative, and analgesic effects of butorphanol, it may be the opioid of choice in certain veterinary surgeries (especially those

where anxiolysis, sedation, antiemesis, and moderate analgesia are beneficial).

Author's Note

The role of butorphanol in veterinary anesthesia and analgesia is both a widely debated and a highly polarizing topic. Some veterinary professionals love the drug, while others eschew it. Some use the drug as a solo analgesic, while others consider it ineffective for even mildly painful procedures. Some routinely use the drug in combination with other opioids, while others view this practice as medically inappropriate. Given these conflicting opinions (along with the associated literature), it can be difficult to know when and how to use butorphanol appropriately. The author's purpose in writing this case study is to demonstrate that butorphanol can be utilized effectively *as part of a multimodal anesthetic and analgesic plan*. Readers are encouraged to refer to the reference section for a more thorough discussion of the nuances of butorphanol. **TVN**

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