Veterinary Anaesthesia and Analgesia 2018, **xxx**, 1–9 https://doi.org/10.1016/j.vaa.2017.08.014

RESEARCH PAPER

Comparison of the effects of alfaxalone and propofol with acepromazine, butorphanol and/or doxapram on laryngeal motion and quality of examination in dogs

Denise I Radkey[a], **Robert J Hardie**[b] & **Lesley J Smith**[b]

[a]University of Wisconsin Veterinary Care, Section of Anesthesia and Pain Management, School of Veterinary Medicine, University of Wisconsin, Madison, WI, USA

[b]Department of Surgical Sciences, School of Veterinary Medicine, University of Wisconsin, Madison, WI, USA

Correspondence: Lesley J Smith, Department of Surgical Sciences, 2015 Linden Drive, University of Wisconsin School of Veterinary Medicine, Madison, WI 53706, USA. E-mail: lesley.smith@wisc.edu

Abstract

Objective To compare the effects of alfaxalone and propofol, with and without acepromazine and butorphanol followed by doxapram, on laryngeal motion and quality of laryngeal examination in dogs.

Study design Randomized, crossover, blinded study.

Animals Ten female Beagle dogs, aged 11–13 months and weighing 7.2–8.6 kg.

Methods The dogs were administered four intravenous (IV) treatments: alfaxalone (ALF), alfaxalone + acepromazine and butorphanol (ALF–AB), propofol (PRO) and propofol + AB (PRO–AB). AB doses were standardized. Dogs were anesthetized 5 minutes later by administration of alfaxalone or propofol IV to effect. Arytenoid motion during maximal inspiration and expiration was captured on video before and after IV doxapram (0.25 mg kg^{-1}). The change in rima glottidis surface area (RGSA) was calculated to measure arytenoid motion. An investigator blinded to the treatment scored laryngeal examination quality.

Results A 20% increase in RGSA was the minimal arytenoid motion that was detectable. RGSA was significantly less in ALF before doxapram compared with all other treatments. A <20% increase in RGSA was measured in eight of 10 dogs in PRO and in all dogs in ALF before doxapram. After doxapram, RGSA was significantly increased for PRO and ALF; however, 20% of dogs in PRO and 50% of dogs in ALF still had <20% increase in RGSA. A <20% increase in RGSA was measured in five of 10 dogs in PRO–AB and ALF–AB before doxapram. All dogs in PRO–AB and ALF–AB with <20% increase in RGSA before doxapram had ≥20% increase in RGSA after doxapram. Examination quality was significantly better in PRO–AB and ALF–AB.

Conclusions and clinical relevance The use of acepromazine and butorphanol improved the quality of laryngeal examination. Any negative impact on arytenoid motion caused by these premedications was overcome with doxapram. Using either propofol or alfaxalone alone is not recommended for the evaluation of arytenoid motion.

Keywords acepromazine, alfaxalone, butorphanol, canine, laryngeal function, propofol.

Introduction

Laryngeal paralysis is a common respiratory abnormality in older large breed dogs (Gaber et al. 1985; White 1989; Broome et al. 2000; Rudorf et al. 2001). One method for the diagnosis of laryngeal paralysis is direct observation of the lack of arytenoid motion during deep inspiration and expiration.

The ideal anesthetic protocol for laryngeal examination would result in an adequate anesthetic depth to allow jaw relaxation sufficient enough to position a laryngoscope for the examination of the larynx while

Please cite this article in press as: Radkey DI, Hardie RJ, Smith LJ Comparison of the effects of alfaxalone and propofol with acepromazine, butorphanol and/or doxapram on laryngeal motion and quality of examination in dogs, Veterinary Anaesthesia and Analgesia (2018), https://doi.org/10.1016/j.vaa.2017.08.014

maintaining intact laryngeal reflexes. It is crucial that the anesthetic agent does not inhibit arytenoid motion to avoid a false positive diagnosis of laryngeal paralysis. A challenge in administering anesthesia for a laryngeal examination is that even light anesthesia may result in apnea or shallow inspirations, confounding an accurate diagnosis. When the plane of anesthesia lightens and deep inspirations have returned, the dog is often too awake to allow laryngoscopy.

Several anesthetic protocols have been examined for their effect on arytenoid motion in dogs without (Gross et al. 2002; Jackson et al. 2004) and with doxapram (McKeirnan et al. 2014). While the methodologies differ, thiopental was suggested as the drug of choice for laryngeal examination (Jackson et al. 2004). Thiopental is not available in the USA; therefore, propofol is the most commonly administered drug for laryngeal examination.

Alfaxalone, recently available in the USA, is an injectable anesthetic with effects similar to those of propofol (Ambros et al. 2008). Alfaxalone results in similar induction quality but a less desirable recovery than propofol when administered to unpremedicated dogs (Maney et al. 2013). Alfaxalone administered to premedicated cats provided a good quality laryngeal examination with normal arytenoid motion (Nelissen et al. 2012). In that study, the normalized glottal gap area was not different between alfaxalone, propofol or ketamine–diazepam. However, no arytenoid motion was observed in some cats anesthetized with ketamine–diazepam or propofol despite chest excursions and obvious breathing, whereas all cats administered alfaxalone displayed arytenoid motion throughout the examination (Nelissen et al. 2012).

A direct comparison of alfaxalone and propofol for laryngeal examination in dogs was recently published (Smalle et al. 2017); however, arytenoid motion was not evaluated via laryngoscopy, but rather by direct observation. The objectives of this study were to evaluate arytenoid motion, the quality of laryngeal examination and the effect of doxapram on arytenoid motion in normal dogs anesthetized with either alfaxalone or propofol, with or without premedication with acepromazine and butorphanol. We hypothesized that alfaxalone would provide a similar quality of laryngeal examination and have an equivalent effect on arytenoid motion compared with propofol, that these specific premedications would improve the quality of the laryngeal examination, and that doxapram administration would increase arytenoid motion in all anesthetic treatments.

Methods

Animals

A group of 10 young adult purpose-bred female Beagle dogs were studied. A power calculation revealed that nine dogs per treatment would allow $\alpha = 0.05$ and $\beta = 0.2$, with 80% power, to show a 50% difference in rima glottidis surface area (RGSA) between treatments. Dogs weighed 7.2–8.6 kg and were aged 11–13 months. Normal health status was assessed by physical examination and measured packed cell volume (PCV) and total protein (TP) within normal reference ranges. The dogs were obtained from a commercial facility, and the study was approved by the Institutional Animal Care and Use Committee of Ridglan Laboratories, Inc. (Ridglan Laboratories, Inc., WI, USA) where the study was performed.

Study design and experimental protocol

The 10 dogs were assigned to four anesthetic treatments in a randomly assigned crossover design (Research Randomizer; www.researchrandomizer.com). The four treatments included: alfaxalone + saline (treatment ALF), alfaxalone + acepromazine and butorphanol (treatment ALF–AB), propofol + saline (treatment PRO) and propofol + acepromazine and butorphanol (treatment PRO–AB). A minimum of 7 days elapsed between treatments.

The dogs were housed in the facility where the study was performed; therefore, no acclimation time was required. Food, but not water, was withheld for 12 hours before each study day. Prior to the start of each treatment, a 20 gauge catheter was placed in a cephalic vein. Oxygen saturation of hemoglobin (SpO_2) was estimated with a pulse oximetry probe placed on the pinna (Vetcorder; Sentier Health Connect LLC, WI, USA). Heart rate (HR) was measured by palpation of the femoral artery, and respiratory rate (f_R) was measured by observing thoracic excursions. Each variable was recorded before administration of any treatment and after laryngoscopy was completed.

In ALF–AB and PRO–AB, acepromazine (0.03 mg kg^{-1}; acepromazine maleate; VetOne, ID, USA) and butorphanol (0.2 mg kg^{-1}; Torbugesic; Fort Dodge Animal Health, NY, USA) were administered intravenously (IV), and in ALF and PRO, 0.3 mL saline (0.9% NaCl; Hospira Inc., IL, USA) was administered IV. After 5 minutes, either propofol (0.5 mg kg^{-1}; Diprivan; Fresenius Kabi, IL, USA) or

Please cite this article in press as: Radkey DI, Hardie RJ, Smith LJ Comparison of the effects of alfaxalone and propofol with acepromazine, butorphanol and/or doxapram on laryngeal motion and quality of examination in dogs, Veterinary Anaesthesia and Analgesia (2018), https://doi.org/10.1016/j.vaa.2017.08.014