Veterinary
Anaesthesia and Analgesia
Formerly the Journal of Veterinary Anaesthesia

Veterinary Anaesthesia and Analgesia, 2012 doi:10.1111/j.1467-2995.2012.00747.x

RESEARCH PAPER

An evaluation of anaesthetic induction in healthy dogs using rapid intravenous injection of propofol or alfaxalone

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Abstract

Objective To evaluate quality of anaesthetic induction and cardiorespiratory effects following rapid intravenous (IV) injection of propofol or alfaxalone.

Study design Prospective, randomised, blinded clinical study.

Animals Sixty healthy dogs (ASA I/II) anaesthetized for elective surgery or diagnostic procedures.

Methods Premedication was intramuscular acepromazine (0.03 mg kg^{-1}) and meperidine (pethidine) (3 mg kg^{-1}). For anaesthetic induction dogs received either 3 mg kg^{-1} propofol (Group P) or 1.5 mg kg^{-1} alfaxalone (Group A) by rapid IV injection. Heart rate (HR), respiratory rate (f_R) and oscillometric arterial pressures were recorded prior to induction, at endotracheal intubation and at 3 and 5 minutes post-intubation. The occurrence of post-induction apnoea or hypotension was recorded. Pre-induction sedation and aspects of induction quality were scored using 4 point scales. Data were analysed using Chi-squared tests, two sample *t*-tests and general linear model mixed effect ANOVA ($p < 0.05$).

Results There were no significant differences between groups with respect to sex, age, body weight, f_R, post-induction apnoea, arterial pressures, hypotension, SpO_2, sedation score or quality of induction scores. Groups behaved differently over time with respect to HR. On induction HR decreased in Group P (-2 ± 28 beats $minute^{-1}$) but increased in Group A (14 ± 33 beats $minute^{-1}$) the difference being significant ($p = 0.047$). However HR change following premedication also differed between groups ($p = 0.006$). Arterial pressures decreased significantly over time in both groups and transient hypotension occurred in eight dogs (five in Group P, three in Group A). Post-induction apnoea occurred in 31 dogs (17 in Group P, 14 in Group A). Additional drug was required to achieve endotracheal intubation in two dogs.

Conclusions and Clinical relevance Rapid IV injection of propofol or alfaxalone provided suitable conditions for endotracheal intubation in healthy dogs but post-induction apnoea was observed commonly.

Keywords alfaxalone, anaesthesia induction, dogs, propofol, rapid induction technique.

Introduction

Manufacturers recommend slow administration of injectable intravenous (IV) anaesthetics, over 10–40 seconds for propofol and over 60 seconds for alfaxalone (NOAH Compendium of Animal Medicines). However there are occasions when it

may be desirable to increase the speed of injection to achieve rapid anaesthetic induction and endotracheal intubation [rapid sequence induction (RSI)]. Rapid control of the airway is recommended in dyspnoeic patients, especially those with potential upper respiratory tract obstruction or a ruptured diaphragm. It should also be considered where there is an increased risk of pulmonary aspiration of gastric contents, such as patients that have a full stomach, are heavily pregnant or have abnormal oesophageal function.

Propofol commonly is administered to induce anaesthesia in dogs. It is a short acting IV anaesthetic agent that causes rapid loss of consciousness 20–40 seconds after administration. Adverse cardiovascular and respiratory side effects have been reported, including hypotension, hypoventilation and apnoea (Smith et al. 1993). The decrease in arterial blood pressure is believed to result from the combined effects of impaired myocardial contractility and a decrease in systemic vascular resistance (Goodchild & Serrao 1989). Hypoventilation and apnoea are mediated centrally via depression of central inspiratory drive and the ventilatory response to carbon dioxide (Kashiwagi et al. 2004). There is evidence that the incidence and severity of these adverse effects are increased when propofol is administered as a rapid bolus (Stokes & Hutton 1991) and this may be of concern if propofol is to be used to achieve rapid anaesthetic induction and endotracheal intubation in dogs. Propofol use may also be associated with excitatory side effects such as paddling, muscle twitching or opisthotonus (Davies 1991).

Alfaxalone is a synthetic neuroactive steroid that interacts with the gamma aminobutyric acid (GABA) receptor to produce anaesthesia and muscle relaxation. Recently, a new formulation of alfaxalone solubilised in 2-hydroxypropyl-beta-cyclodextrin has received marketing authorization for use in dogs and cats. Studies conducted in dogs have demonstrated dose dependent anaesthetic properties (Ferré et al. 2006) and dose dependent cardiovascular and respiratory effects (Muir et al. 2008), with supraclinical doses causing increased heart rate, hypotension and hypoventilation. Quality of induction and recovery were reported to be good to excellent (Muir et al. 2008). The use of alfaxalone as part of a rapid induction technique has not been described and it is unclear whether a more rapid rate of IV injection might increase the frequency and severity of adverse effects.

The aim of this study was to evaluate anaesthetic induction in healthy dogs using rapid intravenous administration of either propofol or alfaxalone, as might be performed clinically to achieve rapid endotracheal intubation. The quality of induction and the occurrence of cardiovascular and respiratory side effects were investigated to determine whether either agent might be suitable for use as part of a rapid induction technique in dogs.

Materials and methods

Approval to perform the study was obtained from the Ethics Committee of the Faculty of Veterinary Medicine, University of Glasgow. Owners signed a non-specific consent form permitting the collection and use of clinical data for research purposes.

Animals

Sixty client-owned dogs classified as ASA physical status I or II and scheduled to undergo elective surgery or diagnostic procedures under general anaesthesia were enrolled in the study. The dogs were of various breeds, aged between 6 months and 8 years old and weighed between 10 and 50 kg. Exclusion criteria included extremes of body condition, evidence of cardiopulmonary or airway dysfunction on clinical examination and ongoing treatment with drugs known to have sedative effects such as opioids or anticonvulsants.

Anaesthetic technique

Prior to anaesthesia dogs were fasted for 12 hours but access to water was allowed *ad libitum*. Preanaesthetic medication comprised 0.03 mg kg^{-1} acepromazine (ACP Injection 2 mg mL^{-1}; Novartis Animal Health Ltd, UK) and 3 mg kg^{-1} meperidine (Pethidine 50 mg mL^{-1} solution for injection; Dechra Veterinary Products, UK), combined in the same syringe and injected into the dorsal cervical muscles. After approximately 30 minutes a cannula was placed into a cephalic vein and the degree of sedation was assessed and assigned a score from 0 to 3 (Appendix 1; Murison 2001).

Dogs were allocated to one of two induction protocols using computer generated random numbers. For dogs in Group P anaesthesia was induced by rapid IV injection of 3 mg kg^{-1} of a microemulsion form of propofol (no longer available, Propo-Clear; Pfizer Ltd, UK). In Group A anaesthesia was

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