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RESEARCH PAPER

Comparison of the effects of propofol or alfaxalone for anaesthesia induction and maintenance on respiration in cats

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Abstract

Objective To compare the effects of propofol and alfaxalone on respiration in cats.

Study design Randomized, 'blinded', prospective clinical trial.

Animals Twenty cats undergoing ovariohysterectomy.

Methods After premedication with medetomidine 0.01 mg kg^{-1} intramuscularly and meloxicam 0.3 mg kg^{-1} subcutaneously, the cats were assigned randomly into two groups: group A (n = 10) were administered alfaxalone 5 mg kg^{-1} $minute^{-1}$ followed by 10 mg kg^{-1} $hour^{-1}$ intravenously (IV) and group P (n = 10) were administered propofol 6 mg kg^{-1} $minute^{-1}$ followed by 12 mg kg^{-1} $hour^{-1}$ IV for induction and maintenance of anaesthesia, respectively. After endotracheal intubation, the tube was connected to a non-rebreathing system delivering 100% oxygen. The anaesthetic maintenance drug rate was adjusted (± 0.5 mg kg^{-1} $hour^{-1}$) every 5 minutes according to a scoring sheet based on physiologic variables and clinical signs. If apnoea > 30 seconds, end-tidal carbon dioxide ($P_E'CO_2$) > 7.3 kPa (55 mmHg) or arterial haemoglobin oxygen saturation (SpO_2) < 90% occurred, manual ventilation was provided. Methadone was administered postoperatively. Data were analyzed using independent-samples t-tests, Fisher's exact test, linear mixed-effects models and binomial test.

Results Manual ventilation was required in two and eight of the cats in group A and P, respectively (p = 0.02). Two cats in both groups showed apnoea. $P_E'CO_2$ > 7.3 kPa was recorded in zero *versus* four and SpO_2 < 90% in zero *versus* six cats in groups A and P respectively. Induction and maintenance dose rates (mean ± SD) were 11.6 ± 0.3 mg kg^{-1} and 10.7 ± 0.8 mg kg^{-1} $hour^{-1}$ for alfaxalone and 11.7 ± 2.7 mg kg^{-1} and 12.4 ± 0.5 mg kg^{-1} $hour^{-1}$ for propofol.

Conclusion and clinical relevance Alfaxalone had less adverse influence on respiration than propofol in cats premedicated with medetomidine. Alfaxalone might be better than propofol for induction and maintenance of anaesthesia when artificial ventilation cannot be provided.

Keywords continuous rate infusion, feline, respiration, total intravenous anaesthesia, ventilation.

Introduction

Total intravenous anaesthesia (TIVA) is an alternative to inhalation anaesthesia for maintenance of

general anaesthesia. One advantage of TIVA, by using continuous rate infusion (CRI), is a more stable plasma level of the anaesthetic compared to repeated boli. This may result in a constant level of anaesthesia by adjusting the infusion rate of the injectable anaesthetic to the perceived level of anaesthesia, compared to the oscillating effect of repeated boli administration (White 1983).

Alfaxalone and propofol, two injectable anaesthetics, are suitable for CRI because they have a rapid onset, short duration of action, fast redistribution and short elimination half-life (Morgan & Legge 1989; Whittem et al. 2008). Depth of anaesthesia can be adjusted quickly by changing the rate of infusion, in contrast to other injectable anaesthetics such as ketamine.

Alfaxalone and propofol have both been used for induction and maintenance of anaesthesia in cats (Andress et al. 1995; Liehmann et al. 2006; Muir et al. 2009; Beths et al. 2014), but no direct comparison of the two drugs can be found in the literature. The main difference between these agents seems to be the effect on respiration. While respiratory depression and apnoea have been identified during propofol anaesthesia (Liehmann et al. 2006) cats did not exhibit apnoea or a decrease in arterial haemoglobin oxygen saturation (SpO_2) < 90% during induction and maintenance of anaesthesia using alfaxalone (Schwarz et al. 2014).

The primary reason for the present study was our clinical observation that cats appeared to show less apnoea when alfaxalone was used for induction and maintenance of anaesthesia compared to propofol.

The hypothesis of this study was that cats anaesthetized with a CRI of alfaxalone would develop less apnoea (>30 seconds), hypercapnia (>7.3 kPa; 55 mmHg) or hypoxemia (SpO_2 < 90%) and require less ventilatory support compared to cats anaesthetized with a CRI of propofol.

Materials and methods

The present study was approved by the Committee for Animal Experimentation of the Canton Zurich, Switzerland (Nr. 164/ November 9th 2011).

Animals

Twenty female cats scheduled for elective ovariohysterectomy were enrolled in the study with informed owner consent. All cats underwent a clinical examination and were deemed to be in good health. Exclusion criteria were age <5 months, American Society of Anesthesiologists (ASA) classification > II, obvious pregnancy or lactation.

Preanaesthetic preparation and anaesthesia

Cats were housed in the hospital for 24 hours prior to anaesthesia. Food was withheld overnight, but water was available until premedication was administered.

Premedication consisted of medetomidine 0.01 mg kg^{-1} intramuscularly (IM) (Dorbene; Graeub AG, Switzerland) and meloxicam 0.3 mg kg^{-1} subcutaneously (SC) (Metacam; Boehringer Ingelheim, Switzerland). Fifteen minutes after premedication, a 22 gauge catheter (Terumo Surflo; Provet AG, Switzerland) was placed in the left or right cephalic vein and a lactated Ringer's infusion (Ringer-Lactate; Fresenius Kabi AG, Switzerland) was started at a constant rate of 10 mL kg^{-1} $hour^{-1}$. Cefazoline 22 mg kg^{-1} (Kefzol; Teva Pharma AG, Switzerland) was administered intravenously (IV). Before induction, sedation was scored using a numeric rating scale with 0) able to stand and walk; 1) able to lie sternal; 2) able to lift the head; 3) able to raise the head when hands clapping; 4) not able to lift the head, unresponsive, lies quietly.

After rating the sedation, cats were allocated to one of two anaesthetic techniques in a randomised fashion using a computer program (R 3.0.1; GNU Software Foundation, Switzerland). Anaesthesia was induced 25 minutes after premedication.

Group A received a CRI of alfaxalone 5 mg kg^{-1} $minute^{-1}$ (Alfaxan; Vétoquinol AG, Switzerland) for induction until intubation criteria described below were reached. The maintenance dose of alfaxalone was 10 mg kg^{-1} $hour^{-1}$. Similarly, group P received propofol 6 mg kg^{-1} $minute^{-1}$ for induction (Propofol 1%; Fresenius Kabi AG) followed by 12 mg kg^{-1} $hour^{-1}$ for maintenance. Both drugs were administered IV using a syringe driver (Syramed μSP6000; Arcomed, Switzerland).

During induction, depth of anaesthesia was assessed in all cats using a modified predescribed intubation score (Martinez Taboada & Murison 2010. Once the eye had rotated ventromedially, the palpebral reflex and jaw tone were checked and if absent lidocaine (Lidocain 20 mg mL^{-1}; Kantonsapotheke, Switzerland) was sprayed on the larynx (2 mg $spray^{-1}$, one or two sprays at the back of the throat). Thereafter, an attempt to

