Veterinary
Anaesthesia and Analgesia
Formerly the Journal of Veterinary Anaesthesia

Veterinary Anaesthesia and Analgesia, 2014, **41**, 480–490 doi:10.1111/vaa.12144

RESEARCH PAPER

Minimum infusion rate of alfaxalone for total intravenous anaesthesia after sedation with acepromazine or medetomidine in cats undergoing ovariohysterectomy

Andrea Schwarz*, Karin Kalchofner*, Julia Palm†, Stephanie Picek*, Sonja Hartnack‡ & Regula Bettschart-Wolfensberger*

*Equine Department, Vetsuisse Faculty, Section Anaesthesiology, University of Zurich, Zurich, Switzerland

†Section of Small Animal Reproduction, Clinic of Reproductive Medicine, Vetsuisse Faculty, University of Zurich, Zurich, Switzerland

‡Section of Epidemiology, Vetsuisse Faculty, University of Zurich, Zurich, Switzerland

Correspondence: Andrea Schwarz, Equine Department, Section Anaesthesiology, Vetsuisse Faculty, University of Zurich, Winterthurerstrasse 260, 8057 Zurich, Switzerland. E-mail: aschwarz@vetclinics.uzh.ch

Abstract

Objective To determine the induction doses, then minimum infusion rates of alfaxalone for total intravenous anaesthesia (TIVA), and subsequent, cardiopulmonary effects, recovery characteristics and alfaxalone plasma concentrations in cats undergoing ovariohysterectomy after premedication with butorphanol-acepromazine or butorphanol-medetomidine.

Study design Prospective randomized blinded clinical study.

Animals Twenty-eight healthy cats.

Methods Cats undergoing ovariohysterectomy were assigned into two groups: together with butorphanol [0.2 mg kg^{-1} intramuscularly (IM)], group AA (n = 14) received acepromazine (0.1 mg kg^{-1} IM) and group MA (n = 14) medetomidine (20 μg kg^{-1} IM). Anaesthesia was induced with alfaxalone to effect [0.2 mg kg^{-1} intravenously (IV) every 20 seconds], initially maintained with 8 mg kg^{-1} $hour^{-1}$ alfaxalone IV and infusion adjusted (±0.5 mg kg^{-1} $hour^{-1}$) every five minutes according to alterations in heart rate (HR), respiratory rate (f_R), Doppler blood pressure (DBP) and presence of palpebral reflex. Additional alfaxalone boli were administered IV if cats moved/swallowed (0.5 mg kg^{-1}) or if f_R >40 breaths $minute^{-1}$ (0.25 mg kg^{-1}). Venous blood samples were obtained to determine plasma alfaxalone concentrations. Meloxicam (0.2 mg kg^{-1} IV) was administered postoperatively. Data were analysed using linear mixed models, Chi-squared, Fishers exact and t-tests.

Results Alfaxalone anaesthesia induction dose (mean ± SD), was lower in group MA (1.87 ± 0.5; group AA: 2.57 ± 0.41 mg kg^{-1}). No cats became apnoeic. Intraoperative bolus requirements and TIVA rates (group AA: 11.62 ± 1.37, group MA: 10.76 ± 0.96 mg kg^{-1} $hour^{-1}$) did not differ significantly between groups. Plasma concentrations ranged between 0.69 and 10.76 μg mL^{-1}. In group MA, f_R, end-tidal carbon dioxide, temperature and DBP were significantly higher and HR lower.

Conclusion and clinical relevance Alfaxalone TIVA in cats after medetomidine or acepromazine sedation provided suitable anaesthesia with no need for ventilatory support. After these premedications, the authors recommend initial alfaxalone TIVA rates of 10 mg kg^{-1} $hour^{-1}$.

Keywords acepromazine, alfaxalone, cat, medetomidine, total intravenous anaesthesia.

Introduction

Total intravenous anaesthesia (TIVA) has become a clinically accepted technique in veterinary practice, primarily due to the introduction of new short-acting and minimally cumulative anaesthetic agents. Propofol is a suitable anaesthetic agent for TIVA in most animals but in cats prolonged propofol infusions can result in delayed recoveries (Pascoe et al. 2006) and signs of generalized malaise after repetitive use on consecutive days (Andress et al. 1995). Alfaxalone, a synthetic neurosteroid solubilized in 2-hydroxypropyl β-cyclodextrin, has been licensed under the name Alfaxan as an injectable anaesthetic agent for induction and maintenance of general anaesthesia in dogs and cats. Following intravenous (IV) administration in cats, alfaxalone has a rapid onset of action, fast redistribution and a short terminal half-life of 45 minutes. At clinically relevant doses in the feline patient, minimal cardiovascular and respiratory depression occurs and even after multiple bolus administration, alfaxalone does not accumulate (Whittem et al. 2008; Muir et al. 2009). The use of repetitive alfaxalone boli has been shown to be suitable for short-term anaesthesia in cats undergoing minor surgical procedures (Bösing et al. 2012). Incremental bolus administration is likely to result in higher peak plasma concentrations and greater cardiopulmonary effects; the use of a continuous rate infusion (CRI) might result in more stable plasma concentrations and better haemodynamic stability. In dogs, alfaxalone CRI maintains good haemodynamic function, although respiratory depression has been reported (Ambros et al. 2008; Herbert et al. 2013; Suarez et al. 2012). In an experimental model that used different noxious stimuli, alfaxalone anaesthesia in unsedated cats was maintained with repetitive bolus administration (Whittem et al. 2008); these authors suggested an alfaxalone TIVA dose rate of 7–8 mg kg^{-1} $hour^{-1}$ for maintenance in unsedated cats.

The aim of this study was to determine the minimum anaesthesia induction dose and infusion rate of alfaxalone that would inhibit a response to surgical stimulation in cats undergoing ovariohysterectomy, after sedation with either medetomidine/butorphanol or acepromazine/butorphanol. Furthermore, cardiopulmonary effects, recovery events and plasma concentrations of alfaxalone were determined.

Materials and methods

This study was approved by the Committee for Animal Experimentation of the Canton Zurich, Switzerland (Nr. 219/2010).

Animals and treatment groups

Twenty-eight client-owned cats presented for elective ovariohysterectomy at the Small Animal Hospital, University of Zurich, Switzerland were included. Informed owner consent was obtained for each cat. All cats were physically examined. Inclusion criteria were American Society of Anesthesiologists status I (ASA I), aged >6 months, body weight >2 kg and a biochemical/haematologic profile within the hospital's reference ranges. Animals were fasted for eight hours before surgery, with free access to water up to the time of premedication. Two IV catheters were placed in each cat before premedication (Terumo Surflo IV 22 gauge × 25 mm; Provet AG, Switzerland), one in each cephalic vein. Cats were allocated by block randomisation into two groups. Group AA (n = 14) received acepromazine 0.1 mg kg^{-1} (Prequillan; Arovet AG, Switzerland) IM and group MA (n = 14) medetomidine 20 μg kg^{-1} IM (Domitor; Pfizer AG, Switzerland) for sedation. Butorphanol (Morphasol; Dr. E. Graeub AG, Switzerland) 0.2 mg kg^{-1} was administered IM together with either medetomidine or acepromazine to all cats.

Anaesthetic induction

Anaesthesia was performed by one experienced anaesthetist (AS) who was unaware of treatment groups in all cats. Thirty minutes after premedication, anaesthesia was induced in both groups with alfaxalone (Alfaxan; Vetoquinol, Germany), with a dose of 0.2 mg kg^{-1} injected as a rapid bolus IV, repeated every 20 seconds until endotracheal intubation was possible. When the palpebral reflex (PB) and jaw tone had diminished, the larynx was desensitized with lidocaine spray (Lidocain HCL 20 mg mL^{-1} Nasenspray für Katzen; Kantonsapotheke Zürich, Switzerland). Intubation attempts with a cuffed endotracheal tube were started immediately thereafter and discontinued if coughing or swallowing occurred. The total dose of

