RESEARCH PAPER

Dexmedetomidine–methadone–ketamine *versus* dexmedetomidine–methadone–alfaxalone for cats undergoing ovariectomy

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Abstract

Objective To compare the duration, quality of anaesthesia and analgesia, and quality of recovery of dexmedetomidine and methadone combined with either ketamine or alfaxalone.

Study design Randomized, prospective clinical trial.

Animals A group of 44 healthy client-owned cats presenting for ovariectomy.

Methods Cats were randomly assigned to one of the two treatment groups: DAM ($n = 22$), which was administered intramuscularly (IM) dexmedetomidine (15 μg kg^{-1}), methadone (0.3 mg kg^{-1}) and alfaxalone (3 mg kg^{-1}), and DKM ($n = 22$), which was administered IM dexmedetomidine (15 μg kg^{-1}), methadone (0.3 mg kg^{-1}) and ketamine (3 mg kg^{-1}). During anaesthesia, heart rate, respiratory rate and systolic arterial pressure were measured every 5 minutes. Cats that moved or had poor muscle relaxation were administered an additional 1 mg kg^{-1} of either alfaxalone (DAM) or ketamine (DKM) intravenously (IV). In cases of increased autonomic responses to surgical stimulation, fentanyl (2 μg kg^{-1}) was administered IV. At the end of the surgery, atipamezole (75 μg kg^{-1}) was administered IM, and the times to both sternal recumbency and active interaction were recorded. Quality of recovery was evaluated with a simple descriptive scale. The UNESP-Botucatu multidimensional composite pain scale and a visual analogue scale were used to evaluate postoperative analgesia at the return of active interaction and 1, 2 and 3 hours later.

Results The additional anaesthesia and rescue fentanyl requirements were similar between groups. The quality of recovery was better in the DAM group than in the DKM group [simple descriptive scale scores: 0 (0–1) and 1 (0–3), respectively; $p = 0.002$]. Postoperative pain scores decreased progressively over time in both groups, with no significant differences ($p = 0.08$) between them.

Conclusions and clinical relevance Both protocols provided comparable quality of anaesthesia and analgesia and were suitable for cats undergoing ovariectomy. In combination with methadone and dexmedetomidine, alfaxalone and ketamine showed comfortable and reliable recoveries.

Keywords alfaxalone, cats, ketamine, methadone, ovariectomy.

Introduction

Ovariectomy is one of the most common reasons for anaesthesia in young female cats in Europe. Owing to the fractious nature of some cats and the limited anaesthesia equipment availability of many small veterinary clinics, an intramuscular (IM) anaesthetic protocol offers distinct advantages. However, the anaesthetic drugs should be safe and well absorbed by the IM route, and provide reliable unconsciousness, muscle relaxation and analgesia.

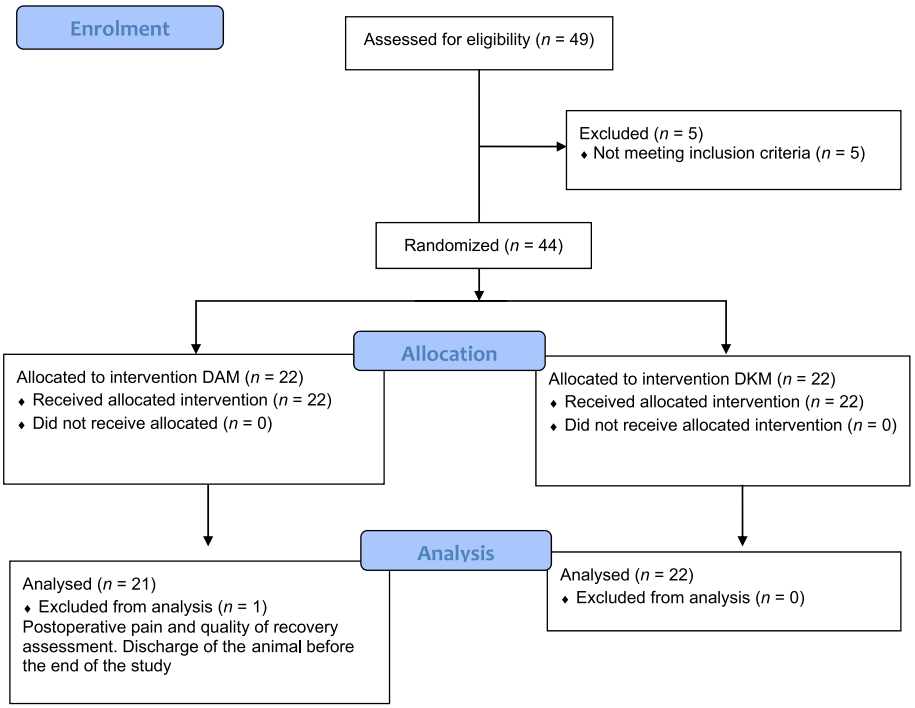

Figure 1 Consort flow diagram. DAM, dexmedetomidine, methadone and alfaxalone; DKM, dexmedetomidine, methadone and ketamine.

In cats, alpha-2 agonists are commonly used anaesthetic agents because they provide reliable sedation and short-term analgesia (Cullen 1996; Murrell & Hellebrekers 2005; Nagore et al. 2013). Furthermore, opioid and alpha-2 agonist combinations have a synergistic analgesic effect (Meert & De Kock 1994; Slingsby et al. 2015) and provide deeper sedation compared with the effect of either agent alone (Girard et al. 2010).

Ketamine is often used in combination with opioids and alpha-2 agonists because it is inexpensive and offers the advantage of producing predictable dissociative and analgesic effects (Harrison et al. 2011; Ko et al. 2011; Carbone 2012). However, repeated dosing of ketamine during anaesthesia has been associated with drug accumulation and delayed recovery in cats (Baggot & Blake 1976; Liu et al. 2006). Furthermore, ketamine stimulates the cardiovascular system [increases heart rate (HR), blood pressure and cardiac output] because of central stimulation of the sympathetic system. This leads to an increase in myocardial work that increases the myocardial oxygen demand leading to impaired cardiovascular function in cats with underlying cardiac disease (Clutton 2007). This effect potentially endangers fractious cats in which preanaesthetic examination is not feasible.

Alfaxalone is a neurosteroid anaesthetic available in Europe in a cyclodextrin-based formulation (Alfaxan; Jurox, Australia). It has excellent cardiovascular stability (Muir et al. 2009) and fast clearance from the body, making it suitable for repeated dosing during anaesthesia (Whittem et al. 2008). Consequently, alfaxalone offers some advantages over ketamine when it is used as part of a balanced anaesthetic protocol. Alfaxalone has been used at different dosages to induce anaesthesia intravenously (IV) (Pinelas et al. 2014) and IM (Grubb et al. 2013). Alfaxalone may have analgesic properties, resulting from its blockade of T-type $Ca2^{+}$ channels and potentiation of $GABA_A$ ligand-gated channels (Pathirathna et al. 2005). However, a beneficial analgesic benefit has not been observed clinically (Winter et al. 2003; Murison & Martinez Taboada 2010).

The aim of this study was to compare the anaesthetic, cardiorespiratory, analgesic and recovery quality effects of ketamine or alfaxalone in combination with an alpha-2 agonist (dexmedetomidine) and an opioid (methadone), in cats undergoing ovariectomy.

