RESEARCH PAPER

Comparison between the effects of postanesthetic xylazine and dexmedetomidine on characteristics of recovery from sevoflurane anesthesia in horses

Alonso GP Guedes[a,b], Caitlin C Tearney[c], Alessia Cenani[c], Fabio Aristizabal[a] & Jorge Nieto[a]

[a]Department of Surgical and Radiological Sciences, School of Veterinary Medicine, University of California Davis, Davis, CA, USA

[b]Department of Veterinary Clinical Sciences, College of Veterinary Medicine, University of Minnesota, MN, USA

[c]Veterinary Medical Teaching Hospital, School of Veterinary Medicine, University of California Davis, Davis, CA, USA

Correspondence: Alonso GP Guedes, Department of Veterinary Clinical Sciences, College of Veterinary Medicine, University of Minnesota, 1352 Boyd Avenue, St Paul, MN 55108, USA. Email: guede003@umn.edu

Abstract

Objective To compare postanesthetic xylazine and dexmedetomidine on recovery characteristics from sevoflurane anesthesia in horses.

Study design Randomized, crossover study.

Animals Six geldings, mean ± standard deviation (SD) (range), 17 ± 4 (11–24) years and 527 ± 80 (420–660) kg.

Methods Horses were anesthetized with sevoflurane for 60 minutes under standardized conditions for a regional limb perfusion study. In recovery, horses were administered either xylazine (200 μg kg^{-1}) or dexmedetomidine (0.875 μg kg^{-1}) intravenously. Recoveries were unassisted and were video-recorded for later evaluation of recovery events and quality by two individuals unaware of treatment allocation. Recovery quality was assessed using a 100 mm visual analog scale (VAS) (0 = poor recovery, 100 = excellent recovery), the Edinburgh Scoring System (ESS) (0–100; 100 = excellent recovery) and the mean attempt interval (MAI) (longer = better). Data are mean ± SD.

Results All recovery quality assessments (xylazine and dexmedetomidine, respectively: VAS: 71 ± 21 mm, 84 ± 13 mm; ESS: 65 ± 22, 67 ± 30; MAI: 52 ± 24 minutes, 60 ± 32 minutes) and events (first limb movement: 37 ± 8 minutes, 42 ± 10 minutes; first attempt to lift head: 44 ± 12 minutes, 48 ± 9 minutes; first attempt to sternal posture: 57 ± 28 minutes, 50 ± 7 minutes; number of head bangs: 2.0 ± 3.0, 0.5 ± 0.5; time to first attempt to stand: 72 ± 6 minutes, 78 ± 13 minutes; time to standing: 79 ± 14 minutes, 84 ± 13 minutes) did not differ significantly between treatments ($p > 0.05$).

Conclusions and clinical relevance Recovery characteristics did not differ significantly between postanesthetic xylazine and dexmedetomidine following 1 hour of sevoflurane anesthesia in horses in this study. Further evaluations in more horses and in younger horses are required to confirm these results.

Keywords α_2-adrenergic agonist, complications, inhalation, sedation.

Introduction

Recovery is one of the most crucial and least controllable periods in equine anesthesia and a substantial proportion of life-threatening injuries occur during this period (Hubbell 1999; Johnston et al. 2002; Bidwell et al. 2007; Clark-Price 2013; Dugdale et al. 2016). Recovery events and quality may be influenced by numerous factors, including invasiveness of surgery, duration of anesthesia, anesthetic

dose, adjunct anesthetic or sedative drugs, repeated anesthetic events, time in sternal recumbency, length of recovery period, number or prematurity of attempts to stand, and individual factors such as behavior, temperament and body mass (Eger & Johnson 1987; Whitehair et al. 1993; Young & Taylor 1993; Eger et al. 1998; Matthews et al. 1998; Hubbell 1999; Santos et al. 2003; Leece et al. 2008; Creighton et al. 2012; Valverde et al. 2013; Dugdale et al. 2016). In general, less invasive procedures, inhalant anesthetics with lower blood solubility, anesthesia of shorter duration, and a longer recovery period with fewer attempts to stand are associated with improved recoveries from inhalation anesthesia.

Horses recovering from inhalation anesthesia can be disoriented, agitated and uncoordinated, and may take multiple attempts to stand and remain standing. Postanesthetic administration of an α_2-adrenergic receptor agonist (α_2-agonist) has been used in attempts to limit some of these problems and to improve recovery quality (Hubbell 1999; Clark-Price 2013). Xylazine is one of the most commonly used α_2-agonists for this purpose (Clark-Price 2013). Although several studies have compared the effects of α_2-agonists in horses recovering from isoflurane anesthesia (Santos et al. 2003; Bauquier & Kona-Boun 2011; Woodhouse et al. 2013), the present authors were unable to find any reports comparing different α_2-agonists in horses recovering from sevoflurane or desflurane anesthesia. Postanesthetic sedation with xylazine seems to prolong but not improve recoveries from sevoflurane or desflurane anesthesia (Matthews et al. 1998; Aarnes et al. 2014). Whether a benefit might be observed with a more selective and shorter-acting α_2-agonist remains to be demonstrated.

Compared with xylazine, dexmedetomidine is a more selective α_2-agonist with a substantially shorter plasma elimination half-life (8 *versus* 49 minutes) and faster clearance rate (79 *versus* 21 mL kg^{-1} $minute^{-1}$) in horses (Garcia-Villar et al. 1981; Rezende et al. 2015). In ponies aged 4–5 years and 19–23 years, the plasma elimination half-life of dexmedetomidine is 20 minutes and 29 minutes, respectively (Bettschart-Wolfensberger et al. 2005), whereas that of xylazine is 75 minutes (Dyer et al. 1987). Studies using dexmedetomidine infusions during isoflurane or sevoflurane anesthesia in horses or ponies with or without an additional postanesthetic dose reported good qualities of recovery (Marcilla et al. 2010, 2012; Gozalo-Marcilla et al. 2013a, 2013b). Medetomidine is a racemic mixture that contains dexmedetomidine as the active enantiomer (Kuusela et al. 2000). In a comparison of recovery characteristics after isoflurane anesthesia in horses, the effects of a medetomidine infusion administered during anesthesia were judged to be superior to those of a bolus of xylazine delivered at the end of anesthesia (Creighton et al. 2012). However, it is not known whether recovery from inhalation anesthesia is better after the administration of dexmedetomidine compared with other α_2-agonists.

The present study aimed to quantify and compare the effects of postanesthetic administration of xylazine and dexmedetomidine, respectively, on recovery characteristics in horses anesthetized with sevoflurane. It was hypothesized that timed recovery events would be shorter and recovery quality would be better with dexmedetomidine compared with xylazine.

Materials and methods

Animals

Six university-owned geldings (five Thoroughbreds, one Westphalian), with a mean ± standard deviation (SD) age of 17 ± 4 years (individual ages: 11, 16, 16, 17, 18 and 24 years) and mean ± SD (range) weight of 527 ± 80 (420–660) kg were used. Horses were deemed to be clinically healthy based on history and physical examination. Food was withheld for approximately 12 hours prior to anesthesia and water was available *ad libitum*. The University of California Davis Institutional Animal Care and Use Committee reviewed and approved the study protocols.

Anesthesia and monitoring

This experiment was undertaken simultaneously with another research study evaluating two tourniquet times for intravenous (IV) regional limb perfusion with the antibiotic amikacin. The limb perfusion was performed in the dependent thoracic limb with the horse in alternate lateral recumbency for each occasion. The limb was not exanguinated before the tourniquet was applied; the maximum tourniquet time was 30 minutes and the study was completed within 40 minutes. No other drugs were administered and no injury resulted from the limb perfusion study.

Horses were anesthetized twice with an interval of 4 weeks between studies. A 14 gauge, 13.3 cm catheter (Becton Dickinson Infusion Therapy Systems, Inc., UT, USA) was aseptically placed in a jugular vein and dexmedetomidine (3.5 μg kg^{-1}; Orion

