Journal of Equine Veterinary Science 34 (2014) 793–798

Contents lists available at ScienceDirect

Journal of Equine Veterinary Science

journal homepage: www.j-evs.com

Original Research

Intraoperative Analgesic Effect of Intrafunicular Lidocaine Injection During Orchiectomy in Isoflurane-Anesthetized Martina Franca Donkeys

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ARTICLE INFO

Article history:
Received 6 November 2013
Received in revised form 2 February 2014
Accepted 12 February 2014
Available online 18 February 2014

Keywords:
Lidocaine
Pain
General anesthesia
Orchiectomy
Donkey

ABSTRACT

This study aimed to evaluate the analgesic effect of intrafunicular lidocaine during orchiectomy in isoflurane-anesthetized donkeys. For this purpose, 10 adult healthy donkeys were chosen from Martina Franca donkey population. Each donkey underwent two surgical procedures of monolateral orchiectomy under general anesthesia. Starting isoflurane vaporizer setting was 1.5% to maintain a light plane of anesthesia. Regional anesthesia was performed by injecting 10 mL of 2% lidocaine plus adrenalin or an equivalent volume of saline solution into the spermatic cord. According to what was injected into the funiculus before the surgical procedure, each donkey was once assigned to the group L (lidocaine) and once to the group S (saline). End-tidal isoflurane and standard physiological parameters were measured. Compared with groups, monolateral orchiectomy increased mean heart rate in group S; during surgical procedure, the end-tidal isoflurane was significantly lower in group L. No differences were found regarding mean arterial blood pressure, respiratory rate, recovery quality, and metabolic parameters between groups during procedures. In isoflurane-anesthetized donkeys, intrafunicular injection of lidocaine before castration appears to decrease intraoperative nociception and significantly reduces the concentration of the volatile agent to obtain a sufficient surgical anesthesia.

1. Introduction

Castration is the most frequently performed surgical procedure in equids; it can be accomplished under sedation or general anesthesia. Prevention or reduction of nociception is considered beneficial during general anesthesia to minimize the amount of the inhalation agents [1]. These agents provide poor analgesia and may induce dose-dependent cardiopulmonary depression [2]. Traditional approaches to provide analgesia include the systemic administration of nonsteroidal anti-inflammatory drugs, α_2-adrenergic agonists, opioids, and local anesthetics.

The use of local and regional analgesic techniques in horses is increasing during standing procedures and in association with general anesthesia to reduce central sensitization [3-6]. Local and regional analgesia reduce the requirements for postoperative analgesia [3], minimize stress, allow a rapid and safe recovery, and facilitate the surgical procedure decreasing cremaster muscle tension [6].

In veterinary literature, many reports describe the use of lidocaine during orchiectomy in dogs, cats, piglets, calves, and lambs [7-12].

During the last decade, the use of lidocaine has regained popularity within equine inhalation anesthesia, with the aim of reducing volatile agents concentrations,

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http://dx.doi.org/10.1016/j.jevs.2014.02.002

improving cardiopulmonary function, and guaranteeing analgesia [13]. Several reports have recently addressed the anesthetic-sparing effects of local anesthetics administered IV. IV lidocaine, followed by constant rate infusion (CRI), has been shown to decrease isoflurane requirements by 25% in horses and halothane requirements by 15%–20% in ponies [14,15]. However, intraoperative CRI of lidocaine affects the degree of ataxia and may decrease the quality of recovery [16].

Because donkeys are physiologically and pharmacologically different from horses, awareness of species-specific features of anesthesia and analgesia are very important. These differences must be taken into account when formulating an individual anesthetic or analgesic protocol [17-19]. Several studies and review articles were published by Matthews [19-23] about the use of anesthetics and analgesics in donkeys and mules.

To the authors knowledge, the intrafunicular (IF) use of lidocaine during castration under general anesthesia has not been investigated in donkeys. The aim of this study was therefore to evaluate the analgesic effects of IF lidocaine during primary castration with an inguinal approach [24] in adult Martina Franca donkeys. Effects on recovery quality were also assessed.

2. Materials and Methods

The animals enrolled in the study were part of a research project designed to evaluate the reproductive physiology in donkey stallions (unpublished data). The project was approved by the Committee on Animal Research and Ethics of the Universities of Chieti-Pescara and Teramo (http://www.unich.it/unichieti/appmanager/federati/CEISA), Protocol #45/2013/CEISA/COM, approval date July 16, 2013. Ten adult Martina Franca donkey stallions, owned by the University of Teramo, homogenous for age and body weight, were included in the study. The donkeys underwent two surgical procedures of monolateral orchiectomy under general anesthesia, 1 month apart, for reasons connected to the study on reproductive physiology. The left testicle was randomly chosen to be removed during the first procedure; the right testicle was removed during the second.

Only healthy donkey stallions with eutopic testicles were included in the study. Based on clinical examination, all animals were classified as American Society of Anesthesiologists physical status grade I. Food but not water was withheld for 12–18 hours; before anesthetic induction, a 14 gauge × 160 mm jugular catheter was inserted using aseptic technique; one hour before surgery, each donkey received antibiotic perioperative prophylaxis with sodium ampicillin (20 mg/kg IV; Vetamplius 10 g; Fatro, Bologna, Italy) and gentamicin sulfate (6.6 mg/kg IV; Aagent 10%; Fatro, Bologna, Italy).

Premedication was achieved with acepromazine (30 μg/kg intramuscular- IM; Prequillan; Fatro, Bologna, Italy) 30–60 minutes before induction of general anesthesia after placing the jugular catheter. All donkeys were sedated with medetomidine hydrochloride (9 μg/kg IV; Medetor 1 mg/mL; CP-Pharma-Handelsges, Burgdorf, Germany) administered over a 2-minute period. Five to 10 minutes later, when the level of sedation was considered adequate, anesthesia was induced with a combination of ketamine hydrochloride (2.2 mg/kg IV; Ketavet 100; Intervet Productions, Aprilia (LT), Italy) and diazepam (20 μg/kg IV; Valium 5 mg/mL; Roche, Milano, Italy). Once recumbent, the trachea was intubated with an appropriately sized cuffed endotracheal tube, and the donkeys were hoisted onto a surgical table in dorsal recumbency with shoulder supports; the hind limbs were allowed to adopt a flexed position with moderate abduction. After intubation, the animals were immediately connected to a large animal anesthetic circle breathing system (VML Anesthesia Machine; MDS Matrx, New York) under spontaneous ventilation. A 30-L reservoir bag was filled with isoflurane (Isoflo; Abbott Animal Health, Berkshire, UK) 2% starting vaporizer setting, in oxygen and/or air with an inspired oxygen fraction (FiO_2) of 50%. When the donkeys were connected to the large animal anesthetic circuit, the initial end-tidal isoflurane (F'_EISO) predetermined concentration was 1.50–1.55. The total fresh gas flow was 20 mL/kg/min for 20 minutes followed by 10 mL/kg/min for the remaining time. During anesthesia, the F'_EISO was reduced as much as possible by the anesthetist, according to the assessment of clinical and physiological parameters, to maintain a light anesthetic plane.

Adequacy of anesthesia was judged by standard recognized criteria of anesthetic depth. Clinical signs including movement, the position of the eye, the degree of depression of the protective reflexes of the eye (palpebral and corneal reflexes), the rate and depth of breathing, and the animal's response to surgical stimulation were evaluated. Indicators of a "light" plane of anesthesia were lateral nystagmus, tearing, unstimulated closure of the eyelids, shivering, and tightening of muscles in the neck and shoulders. Adequately, anesthetized donkeys were generally relaxed, did not respond to surgical stimulation, and had eyes that are ventromedially or centrally located with reduced reflex responses. A brisk palpebral reflex and/or sporadic spontaneous blinking were considered normal. In case of nystagmus, ketamine was administered at the dose of 0.1 mg/kg IV. In case of movement, thiopental sodium (0.5–1 mg/kg IV; Pentothal sodium; Intervet Productions) was administered. Isoflurane concentration was increased after ketamine or thiopental administration. After induction of general anesthesia, 10 minutes before skin incision, regional IF anesthesia was performed by inserting a 21 gauge × 50 mm needle percutaneously into the spermatic cord, as close as possible to the external inguinal ring. Ten milliliters of 2% lidocaine HCl (Lidocaina 2%; Esteve Veterinaria, Milano, Italy) plus epinephrine (10 μg/mL; Adrenalina; SALF Laboratorio Farmacologico, Cenate Sotto (BG), Italy) or an equivalent volume of saline solution were injected in a fan-shaped manner taking care to not perforate the funicular vessels; avoidance of intravenous injection was checked by aspiration before injection. The choice of whether to use lidocaine or saline during the first anesthesia was randomly made by an operator not involved directly in the research project. According to what was injected into the funiculus before the surgical procedure, each donkey was once assigned to the group L (lidocaine) and once to the group S (saline). Both anesthetist and