Veterinary
Anaesthesia and Analgesia
Formerly the Journal of Veterinary Anaesthesia

Veterinary Anaesthesia and Analgesia, 2015 doi:10.1111/vaa.12259

SHORT COMMUNICATION

Effects of intramuscular dexmedetomidine in combination with ketamine or alfaxalone in swine

Martín Santos, Blanca T Bertrán de Lis & Francisco J Tendillo
Medical and Surgical Research Unit, Instituto de Investigación Sanitaria Puerta de Hierro-Majadahonda, Madrid, Spain

Correspondence: Martín Santos, Medical and Surgical Research Unit, Instituto de Investigación Sanitaria Puerta de Hierro-Majadahonda, Manuel de Falla 1, 28222 Madrid, Spain. E-mail: martin.santos@salud.madrid.org

Abstract

Objective To evaluate and compare the use of intramuscular (IM) premedication with dexmedetomidine in combination with ketamine or alfaxalone in pigs.

Study design Prospective, randomized, 'blinded' trial.

Animals Fourteen healthy 2-month-old Landrace × Large White pigs weighing 21.5 ± 0.6 kg.

Methods Animals were distributed randomly into two groups: group KD ($n = 7$) was given 10 mg kg^{-1} IM ketamine + 10 μg kg^{-1} IM dexmedetomidine; and group AD ($n = 7$) was given 5 mg kg^{-1} IM alfaxalone + 10 μg kg^{-1} IM dexmedetomidine mixed in the same syringe. Pain on injection, degree of sedation and quality of induction were scored. The time from induction of anaesthesia to recumbency was recorded. Once pigs were recumbent, reflexes were evaluated. Pulse and respiratory rates, end-tidal carbon dioxide and arterial oxygen saturation were recorded at 5 and 10 minutes after drug administration. Data were compared using a two-way ANOVA or a *t*-test for unpaired data as relevant. Data are presented as the mean ± standard deviation (range).

Results Two animals in both groups showed slight pain on drug injection. The time to lateral recumbency in group KD [187 ± 34 seconds (153–230)] was similar to group AD [206 ± 36 seconds (150–248)]. In group AD, sedation was deeper, and the quality of anaesthetic induction was smoother. When moved for anaesthesia, five pigs in group KD vocalized. There were no differences between groups in pulse rates, arterial oxygen saturation and end-tidal carbon dioxide; however, the respiratory rate at 10 minutes was significantly higher in group KD than in group AD.

Conclusions and clinical relevance IM dexmedetomidine in combination with ketamine in pigs induced moderate to deep sedation and fair to smooth induction of anaesthesia. When dexmedetomidine was combined with alfaxalone, sedation was deeper, and induction was of a better quality.

Keywords alfaxalone, dexmedetomidine, ketamine, pig, premedication.

Introduction

Physical restraint is often difficult to apply to swine. The induction of anaesthesia by the intramuscular (IM) route offers several advantages. Ketamine and alfaxalone have been used as a major component for chemical restraint in pigs because they can be given by the IM route and induce rapid onset of action (Thurmon et al. 1972; Green et al. 1981; Santos González et al. 2013). However, when used alone ketamine leads to muscle tremors, extensor rigidity and panting (Thurmon et al. 1972; Green et al. 1981) and alfaxalone can cause muscular twitching (Keates 2003; Santos González et al. 2013). In order to improve muscle relaxation, ketamine is often

combined with α-2 adrenoceptor agonists and this has become a popular anaesthetic drug combination for IM use in swine (Sakaguchi et al. 1995).

Dexmedetomidine is a potent and selective agonist of α-2-adrenoceptors in the central and peripheral nervous system. It has been combined in different species with ketamine (Barletta et al. 2011; Ko et al. 2011) and alfaxalone (Grubb et al. 2013; Herbert et al. 2013); however, the effects of these combinations have not, to our knowledge, been described in swine.

The purpose of this study was to evaluate and compare the use of IM premedication with dexmedetomidine in combination with alfaxalone or ketamine in pigs prior to induction of anaesthesia.

Materials and methods

Fourteen healthy 2-month-old Landrace × Large White female pigs, weighing 21.5 ± 0.6 kg, were included in this 'blinded', randomized controlled trial. A computer generated random numbers table was used to assign treatments. Animals were handled according to European and national regulations on the protection of experimental animals (Directive 2010/63/UE and RD 53/2013) and the study was approved by the ethic committee for animal research, IIS Puerta de Hierro-Majadahonda, Spain.

Prior to the day of the study, pigs were deprived of food, but not of water, overnight. Pigs were distributed randomly into two groups: animals in group KD (n = 7) were given 10 mg kg^{-1} ketamine (Imalgene 50 mg mL^{-1}; Merial, Spain) combined with 10 μg kg^{-1} dexmedetomidine (Dexdomitor; Esteve, Spain) IM. Animals in group AD (n = 7) were given 5 mg kg^{-1} alfaxalone (Alfaxan; Vetoquinol, Spain) combined with 10 μg kg^{-1} dexmedetomidine IM. The ketamine or alfaxalone and dexmedetomidine were mixed in the same syringe, and the total volume of injectate (for both groups) was standardized at 12 mL by dilution in 0.9% sodium chloride. All drugs were administered IM by injection into the lumbar muscle. In order to assess pain on injection, the needle was attached to a line extension and preplaced into the muscle. After confirming the absence of any discomfort as a result of the needle, the drugs were administered via a line extension over a period of 30 seconds.

Two independent evaluators, unaware of the treatment, evaluated the pain on injection, the quality of induction, the degree of sedation and recumbency, as well as the effects of the drugs on each pig. Pain on injection was scored using a scale modified from that of Michou et al. (2012): no pain; mild pain (movement of tail and turning of head towards injection side); moderate pain (attempting to remove needle by scratching the wall); and severe pain (vocalization and major movement requiring manual restraint). The quality of anaesthetic induction was evaluated using a scale modified from that of Covey-Crump & Murison (2008): smooth (no sign of excitement, quick lateral recumbency and good muscle relaxation); fair (slight excitement with or without a growl, muscle twitching or movement of the limbs); poor (marked excitement with or without a growl, muscle twitching, paddling of the limbs and head movements); and very poor (severe excitement and vocalization). The degree of sedation was assessed 10 minutes after administration of drugs by scoring the pigs' apparent degree of unawareness of their surroundings using a scale modified from that of Covey-Crump & Murison (2008): no effect; mild sedation (quiet, reluctant to move but reacts to noise stimulus); moderate sedation (unable to move but reacts to noise or physical stimulus); and deep sedation (central depression accompanied by drowsiness, does not react to noise or physical stimulus).

The time to lateral recumbency was recorded, and mandibular, palpebral and corneal reflexes were evaluated at 5 and 10 minutes after drug injection. The pulse rate (PR) and haemoglobin oxygen saturation (SpO_2) were monitored continuously by pulse oximetry (5250 Respiratory Gas Monitor; Ohmeda-BOC, Spain) using a probe placed on the pig's tail once the animal became recumbent. End-tidal carbon dioxide ($PE'CO_2$) and the respiratory rate (f_R) were monitored via a facemask connected to a quantitative mainstream capnometer (EMMA Emergency Capnometer; Phasein AB, Sweden). The respiratory rate was assessed by counting thoracic respiratory movements. These three physiological variables were recorded at 5 and 10 minutes after drug administration.

During the study, the pigs were not stimulated other than for the purpose of monitoring physiological variables, assessing the level of sedation and evaluating reflexes.

Ten minutes after injecting the drug combinations, the animals were transported to the surgery room. Then, intubation was attempted in animals that had lost the mandibular reflex. Anaesthesia was induced or deepened by the administration of sevoflurane via a facemask. Subsequently, endotra-

