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RESEARCH PAPER

Comparison of clinical effects of epidural levobupivacaine morphine *versus* bupivacaine morphine in dogs undergoing elective pelvic limb surgery

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Abstract

Objective To evaluate the efficacy, in terms of the amount of rescue analgesia required, and the clinical usefulness of epidural injection of morphine with bupivacaine or levobupivacaine for elective pelvic limb surgery in dogs during a 24-hour perioperative period.

Study design Prospective, blinded, randomized clinical study.

Animals A group of 26 dogs weighing 31.7 ± 14.2 (mean ± standard deviation) kg and aged 54 ± 36 months.

Methods All dogs were premedicated with methadone intravenously (0.2 mg kg^{-1}) and anaesthesia induced with diazepam (0.2 mg kg^{-1}) and propofol intravenously to effect. After induction of anaesthesia, dogs randomly received a lumbosacral epidural injection of morphine 0.1 mg kg^{-1} with either levobupivacaine 0.5% (1 mg kg^{-1}; group LevoBM) or bupivacaine 0.5% (1 mg kg^{-1}; group BM). Cardiovascular, respiratory and temperature values were recorded during the intra- and postoperative period. A visual analogue scale, subjective pain scale, sedation scale and the short form of the Glasgow pain scale were assessed every 6 hours after epidural injection during 24 hours. The ability to stand and walk, neurological deficits and other side effects were assessed at the same time points. The amount of rescue analgesia (sufentanil intraoperatively and methadone postoperatively) was recorded.

Results No statistically significant differences were found between groups for any of the recorded data, with the exception of the incidence of spontaneous urination and postoperative rescue analgesia requirement. In group LevoBM four dogs spontaneously urinated at recovery while none of the dogs in group BM did ($p = 0.03$) and seven dogs of group LevoBM required postoperative rescue analgesia *versus* none of the dogs in the BM group ($p = 0.005$).

Conclusions and clinical relevance Epidural LevoBM is a suitable alternative to BM in healthy dogs during elective pelvic limb surgery. Epidural BM produced more urinary retention but better pain control compared to the same concentration and dose of LevoBM in dogs.

Keywords bupivacaine, dogs, epidural, pelvic limb surgery, levobupivacaine.

Introduction

Lumbosacral epidural anaesthesia is a common regional anaesthetic technique for management of dogs undergoing pelvic limb surgery. In the human and veterinary literature, it is well documented that

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lumbosacral epidural anaesthesia is able to alleviate pain in the pelvic limbs (Hendrix et al. 1996; Torske & Dyson 2000; Dyson 2008). It has been argued that epidural anaesthesia provides better postoperative analgesia than parenteral opioids in humans (Block et al. 2003). Correct pain management reduces the recovery time, decreases the risk for secondary infections and surgical complications and results in a faster return to normal activities (Yeager et al. 1987).

Bupivacaine and levobupivacaine are local anaesthetics that, when dosed at lower concentrations, provide differential sensory and motor neural blockade (Camorcia et al. 2007) which is the blocking of pain and temperature sensations (A-δ, C fibres) while preserving motor function (A-α fibres). Bupivacaine has a chiral centre and therefore exists as a 50:50 mixture of two enantiomers [(S(−) and R(+)], both of which have similar potency and duration of action (Foster & Markham 2000). Bupivacaine is commonly used in clinical practice because it has a long duration of action and a concentration of 0.5% of bupivacaine results in an adequate sensory and motor blockade for surgical procedures in companion animals (Torske & Dyson 2000).

Levobupivacaine is the S(−)-enantiomer of bupivacaine and has comparable anaesthetic properties. Experimental and human studies have shown that levobupivacaine is less cardiotoxic than bupivacaine (De Rossi et al. 2011) but with higher protein binding (97% *versus* 95%). This means that < 3% of levobupivacaine is free in the plasma and available to act on other tissues, possibly causing less unwanted side effects (McLeod & Burke 2001).

The synergism of action of local anaesthetics and opioids has been widely investigated and reported in literature (Torske & Dyson 2000; Kona-Boun et al. 2006; Leone et al. 2008; Abelson et al. 2011) and the analgesia is generally superior to that induced by each class injected alone. The addition of opioids improves the quality of pain relief without affecting the degree of motor blockade (Leone et al. 2008) and increases the duration. Bupivacaine—morphine is one of the most commonly used epidural drug combinations in small animal practice (Odette & Smith 2013).

Although one study has compared the epidural effects of bupivacaine and levobupivacaine in conscious experimental dogs (Gomez de Segura et al. 2009), the effects of epidural levobupivacaine and morphine *versus* those of epidural bupivacaine and morphine have not been well studied.

The primary aim of this study was to evaluate the analgesia requirements and side effects of two epidural anaesthesia protocols in dogs undergoing elective pelvic limb surgery intraoperatively and for 24 hours postoperatively.

Material and methods

Animals

This study was conducted after institutional approval for animal experimentation (*Commission d'éthique animale; 1237*) and after obtaining informed consent from the animals' owners.

A power analysis was performed with G power software (Faul et al. 2007) considering that values will be compared between both groups at each of the five time points ($n = 10$ classes). The power of the study was over 80% to detect an effect size of 0.37 (two-way ANOVA model) or 0.35 (chi-square test) in the scores with $\alpha = 0.05$. By convention, these effect sizes are considered between medium and large effect. Therefore 13 animals were recruited per group.

Dogs undergoing elective tibial plateau advancement in the Veterinary Hospital of the University of Liège, Belgium were recruited for this prospective clinical study. No breed, sex, size, weight or age restrictions were imposed. A physical examination, complete blood cell count and serum biochemical analysis was performed on potential recruits. Dogs were excluded for presence of dermatitis in the area of the L7 to S1 intervertebral space, pelvic deformity, obesity (which precluded the palpation of the anatomical landmarks), aggression (which rendered them unable to participate in postoperative pain scoring) or low platelet count. All dogs were required to remain in the hospital for at least 24 hours after surgery.

Study protocol

The dogs were randomly allocated to one of the two groups by an external clinician using the Microsoft Excel (Microsoft Operations Ltd, Dublin, Ireland) random function. Anaesthetists, surgeons and both pain evaluators were unaware of group allocation. The treatment consisted of either 1 mg kg^{-1} bupivacaine (Marcaine; AstraZeneca, Belgium) and 0.1 mg kg^{-1} of preservative-free morphine sulphate 1% (Morphine HCL Sterop; Sterop, Belgium) (group BM) or 1 mg kg^{-1} levobupivacaine 0.5% (Chirocaine; AbbVie, Belgium) and 0.1 mg kg^{-1} morphine sulphate (group LevoBM).

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