Comparison of Lidocaine-Distilled Water and Lidocaine-Mgso4 Mixture in Epidural Anesthesia of Dog

Saifollah Dehghani ∗1 MSc
Amin Bigham Sadegh2 DVSc

1Department of Clinical Sciences, Faculty of Veterinary Medicine, Shiraz University, Shiraz, Iran
2Department of Clinical Sciences, Faculty of Veterinary Medicine, University of Shahrekord, Shahrekord, Iran.

Abstract

Objective- To compare the lidocaine-MgSO4 combination with lidocaine-Distilled water in the epidural of indigenous awake dogs.

Design- Prospective experimental study.

Animals- Five young (12±2 months) female indigenous dogs weighting (10.74 ± 0.44 kg).

Procedures- Epidural anesthesia was produced in all dogs with 2% lidocaine (1ml/4.5 kg body weight) with 1 ml distilled water and two weeks later repeated by lidocaine (1ml/4.5 kg) with 1 ml of 10% MgSO4.  Time to recumbency, onset time, duration of analgesia and cranial spread of analgesia and standing time were recorded. Heart rate, Respiratory rate and body temperature were recorded at 0 minute prior to epidural administration of each treatment as a base line values and at 5, 10, 15, 30, 60 and 75 minutes afterwards. Statistical analysis included paired student t-test and ANOVA (Spss, soft ware of windows). p<0.05 was considered as significant level.

Results- Significant difference (p<0.05) was noted for onset of analgesia between Lidocaine-Distilled water (2.04 ± 0.14 min) and Lidocaine-MgSO4 (4.70 ± 0.20 min). Lidocaine-MgSO4 produced analgesia of significantly longer duration (185 ± 5.13 min) than that of Lidocaine - Distilled water (49 ± 4.5 min). Lidocaine-Distilled water produced recumbency at 1.48 ± 0.106 min after epidural administration but Lidocaine-MgSO4 did not produce any recumbency throughout the study. Time to standing after epidural injection of Lidocaine-Distilled water was 49.8 ± 1.56 min.

Conclusion and clinical relevance The combination of Lidocaine-MgSO4 produced analgesia longer than Lidocaine-Distilled water. Long lasting obstetrical and surgical procedures could commence relatively soon after epidural injection of Lidocaine-MgSO4 and could be completed without re-administration of anesthetic agent.

Key words: MgSO4, lidocaine, canine, epidural anesthesia.

∗Corresponding Author:
Saifollah Dehghani Najvani
Department of Clinical Sciences, Faculty of Veterinary Medicine, Shiraz University, Shiraz, Iran.
E-mail: sdehghan04@yahoo.com

IJVS Vol.: 2 No.: 3 Year: 2007
Introduction

The administration of local anaesthetic into epidural space is an established technique of producing regional anaesthesia in Veterinary Medicine. Furthermore, epidural administration of local anesthetics, opioids and alpha2-adrenergic agonists is an effective method of controlling postoperative pain, particularly after surgery involving the hind limb, pelvic or perineal region in dogs. The most frequently used epidural anesthetics are lidocaine; mepivacaine, bupivacaine, and procaine. With the exception of bupivacaine, this group of agents provides analgesia of relatively short duration and may necessitate re-administration of the agent to allow completion of the procedure. Also, local anesthetic agents indiscriminately block motor, sensory and sympathetic fibers causing ataxia, hind limb weakness, and occasionally recumbency. Epidural and intrathecal administration of agents with greater duration of action may be more appropriate for procedures requiring long duration of analgesia. These agents include opioids and alpha-2 agonist. Epidural use of ketamine has been reported in horse, cattle, and dogs with short duration of analgesia without recumbency or ataxia. Recently magnesium sulfate, which blocks N-Methyl-D-Aspartate (NMDA) receptors, similar to ketamine, was used in intrathecal anesthesia in rat. As magnesium blocks the NMDA receptors and ions channels, it can prevent central sensitization caused by peripheral nociceptive stimulation. Magnesium also has antinociceptive effects in animal and human models of pain. These effects are primarily based on the inhibition of calcium influx into the cell and antagonism of NMDA receptors. The purpose of this study was to investigate the effects of epidural injection of Lidocaine-MgSO4 mixture in dogs, to assay onset time, duration time, and monitor its effect on the heart rate, respiratory rate and body temperature.

Materials and Methods

Five young (12±2 months) female indigenous dogs weighting (10.74 ± 0.44 kg) were used in this study. The lumbosacral area of each dog was clipped and scrubbed with povidone iodine (10%). Lidocaine was infiltrated subcutaneously over the lumbosacral joint space. An 18-gauge, 3.5-cm long needle was inserted into the epidural space with the bevel pointed forward. Proper placement of the needle was determined by loss of resistance and by ease of injection of a small volume (2-3 ml) of air. The selection of the dogs for this study, were based on excluding paediatric, geriatric, obese and pregnant animals. In addition, the treated dogs were supported in sternal recumbency for a few minutes immediately following drug injection to obviate posture-related unilateral block. Each dog received each of two treatments at two weeks intervals in the cross over design. All medications were administered over approximately 30 seconds in each dog. In treatment group 1ml of 10% MgSO4 (Nasr Fariman, Iran) was added to 1ml/4.5 kg body weight 2% lidocaine without epinephrine (Lidocaine HCL, Pasteur, Iran). And in control group 1ml distilled water was added to 2% lidocaine (1ml/4.5 kg body weight) without epinephrine. pH values was determined as 5.7 for lidocaine–MgSO4 and 6.7 for lidocaine–distilled water by digital pH meter,( NEL, Model 821, Ingold Electrod U457, Turkey ). There was no sedimentation in the lidocaine - MgSO4 mixture. All drugs were administered over approximately 30 seconds in each dog. Time to onset [time interval (min) between epidural injections of drug to loss of pain response inflicted by a hemostat], duration [time interval (min) between loss and reappearance of pain response inflicted by a hemostat] and cranial extension of analgesia were recorded. Analgesia was defined as lack of a response to pin prick and hemostat pressure (closed to the first
ratchet) applied first in the perineal area and then moved cranially toward the thoracic region until a response (movement associated with pin prick or hemostat pressure) was observed. Responses were measured each minute until no reaction occurred and then at 5 minutes intervals until a response occurred. The dogs were evaluated throughout the study for presence of recumbency and standing time. Heart rate, respiratory rate and body temperature were recorded for each animal prior to administration of each treatment protocol at 0 minute (base line value) and at 5, 10, 15, 30, 60, and 75 minutes after administration.

Statistical Analysis

Student’s t–test was used for analysis of paired data between two groups (onset time and analgesia duration data) and ANOVA test was used for comparison of paired data with base line values (heart rate, respiratory rate and body temperature data). p<0.05 was considered as significant level (Spss, software of windows).

Results

Epidural analgesia was produced in all dogs following administration of lidocaine-distilled water and lidocaine-MgSO4. Following the administration of lidocaine-distilled water, recumbency occurred (1.48 ± 0.10 min) but no recumbency observed following epidural administration of Lidocaine-MgSO4. Time to onset of analgesia was significantly longer in lidocaine-MgSO4 (4.70±0.20 min) in comparison to lidocaine-distilled water (2.04±0.14 min). Lidocaine-MgSO4 produced significantly (p<0.05) longer duration of analgesia (185±5.13 min) than that produced by lidocaine-distilled water (49±4.5 min), standing time was 49.8 ±1.56 minutes in the control group (Table1). Cutaneous analgesia ranged from coccyx vertebral to approximately L1 in the control and experimental groups. The cutaneous analgesia included the perineal region and was similar in spread on both sides of the spine to level of L1 in both control and experimental groups.

Table 1: Anesthetic indices (mean ± SEM) epidurally administered lidocaine–distilled water and lidocaine-MgSO4 in 5 dogs (min).

<table>
<thead>
<tr>
<th>Indices</th>
<th>lidocaine – distilled water (min)</th>
<th>lidocaine - MgSO4 (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to recumbency</td>
<td>1.48 ± 0.10</td>
<td>-------</td>
</tr>
<tr>
<td>Onset of analgesia</td>
<td>2 ± 0.14</td>
<td>4.7 ± 0.2 a</td>
</tr>
<tr>
<td>Duration of analgesia</td>
<td>49 ± 4.5</td>
<td>185 ± 5.13b</td>
</tr>
<tr>
<td>Time to stand</td>
<td>49.8 ± 1.56</td>
<td>-------</td>
</tr>
</tbody>
</table>

Statistical analysis revealed that there were no differences in heart rate, respiratory rate and body temperature in comparison to the base line value in the control and experimental groups during the study (Table 2).
Table 2: Heart rates (beats/min), respiratory rate (breath/min) and rectal temperature (°C) of 5 dogs under epidural anesthetic with lidocaine–distilled water and lidocaine-MgSO4

<table>
<thead>
<tr>
<th>Indices</th>
<th>Control (Heart rate)</th>
<th>Control (Respiratory rate)</th>
<th>Control (Rectal temperature)</th>
<th>Experiment (Heart rate)</th>
<th>Experiment (Respiratory rate)</th>
<th>Experiment (Rectal temperature)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time interval(min)</td>
<td>0</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Heart rate</td>
<td>102.4 ± 10.8</td>
<td>89.8 ± 7.5</td>
<td>90 ± 7.1</td>
<td>88.8 ± 7.05</td>
<td>102.4 ± 12.05</td>
<td>114 ± 9.2</td>
</tr>
<tr>
<td>Respiratory rate</td>
<td>25.4 ± 0.74</td>
<td>24 ± 0.70</td>
<td>21.4 ± 0.74</td>
<td>22.8 ± 0.66</td>
<td>25.2 ± 0.8</td>
<td>23.8 ± 1.6</td>
</tr>
<tr>
<td>Rectal temperature</td>
<td>39.3 ± 0.1</td>
<td>39.4 ± 0.1</td>
<td>39.4 ± 0.2</td>
<td>39.2 ± 0.2</td>
<td>39.48 ± 0.03</td>
<td>39.18 ± 0.09</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indices</th>
<th>30</th>
<th>60</th>
<th>75</th>
<th>30</th>
<th>60</th>
<th>75</th>
<th>30</th>
<th>60</th>
<th>75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate</td>
<td>87.4 ± 6.01</td>
<td>93.2 ± 8.4</td>
<td>100 ± 10.2</td>
<td>111 ± 9.59</td>
<td>107.2 ± 10.36</td>
<td>104.6 ± 12.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory rate</td>
<td>19.6 ± 0.74</td>
<td>22.6 ± 0.67</td>
<td>25.2 ± 0.58</td>
<td>22 ± 0.63</td>
<td>24 ± 0.63</td>
<td>23.8 ± 1.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rectal temperature</td>
<td>39.1 ± 0.16</td>
<td>39.1 ± 0.1</td>
<td>39.2 ± 0.1</td>
<td>38.8 ± 0.09</td>
<td>39.1 ± 0.08</td>
<td>39.1 ± 0.1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussion

The spread of anesthetic solution within the epidural space is known to be influence by a number of factors including age, obesity, pregnancy and body position. In clinical practice, dogs would normally be sedated as indicated to facilitate epidural puncture. The use of a sedative drug was deliberately omitted in this study in order to avoid the possible confounding effects of a sedative agent on the physiological variables that were measured. It was, however, recognized that failure of block might result if the needle tip was dislodged from the epidural space in a struggling awake dog following epidural puncture. The likelihood of this complication occurring was lessened by the application of firm manual restraint by an assistant. From the humane viewpoint, lidocaine solution was infiltrated into the injection site to minimize pain of epidural puncture.

MgSO4 such as ketamine has been used in the rat epidural analgesia. MgSO4 such as ketamine is a non competitive NMDA receptors antagonist. Injection of ketamine for perineal analgesia in the dogs, horses and cattle has been reported in the literature. Pain stimulation can causes release of Aspartate and Glutamate neurotransmitters that bind to N-Methyl Amino acids receptors and cause calcium, sodium ions inflow and potassium out flow.
that results pain stimulation sensation in the CNS. Magnesium sulfate blocks calcium influx and non competitively antagonize NMDA excitatory receptors that cause prevention of central sensitization produced by peripheral nociceptive stimulation. Mizutani et al had reported prolongation of pain recognition after systemic administration of MgSO4 in human however Thurnau et al reported that MgSO4 could not cross the blood brain barrier following systemic administration. Prolonged duration of intrathecal analgesia following administration of fentanyl – magnesium combination has been reported in rat. Recently Marzouk et al and Haagi-Mohammadi et al had used fentanyl-Mgso4 and lidocain-MgSO4 in spinal anaesthesia in the human being, respectively showing significantly prolonged duration of analgesia. Their results support the prolonged duration of analgesia observed in our study after epidural injection of lidocaine–MgSO4 (109.2 ± 5.2 min ) in comparison to control group (75.8 ± 1.42 min ). Catteral et al, have correlated the delayed in the beginning of anaesthesia due to lowered non ionized form which is cellular permeable form. Recumbency is expected following epidural administration of lidocaine because local anesthetics block both sensory and motor fibers. Recumbency was observed after epidural administration of lidocaine- distilled water in this study but no recumbency was observed following the lidocaine-MgSO4 administration. Marzouk et al also used MgSO4–fentanyl intratechally in the human being and did not report any motor nerve affection. Probably lidocaine-MgSO4 with unknown mechanism had less effect on motor nerve fibers in comparison to lidocaine-distilled water.

There were no significant differences in the heart rate, respiratory rate and body temperature between control and experimental group in comparison to base line value throughout the study. Haaji-Mohammadi et al did not observe any respiratory or cardiovascular side effects after intratechal injection of lidocaine- MgSO4 in the human being. Further research is necessary to determine the various dose of MgSO4 in epidural administration and its histopathological effects on neuron fibers in epidural space.

References


چکیده:
مقایسه اثر لیدوکائین- آب مقرطر و لیدوکائین- سولفات منیزیم
در بی حس ایپیدورال سگ

دکتر سیف‌الدین همایونی ۱، دکتر امین بهمن صادقی ۲

گروه علوم درمانگاهی، دانشکده دامپزشکی، دانشگاه شیراز، ایران.
گروه علوم درمانگاهی، دانشکده دامپزشکی، دانشگاه شیراز، شهر کرد، ایران.

هدف: بیحسی ایپیدورال به‌میانجی از روشهای بیحسی ناحیه‌ای در دامپزشکی مطرح می‌باشد. در مطالعات متعددی از داروها و ترکیبات مختلف برای ایجاد بیحسی ایپیدورال استفاده شده است تا تولید بیحسی را افزایش دهد. هدف از انجام این مطالعه مقایسه اثر لیدوکائین- آب مقرطر لیدوکائین- سولفات منیزیم در بی حس ایپیدورال سگ‌های بومی هوشماری می‌باشد.

طرح: مطالعه تجريبي.

چیتالات: در این مطالعه ۵ فلاده سگ ماده بومی (۱۱±۴) ماهه به وزن (۱۲۲±۴) کیلوگرم مورد استفاده قرار گرفت.

روش: بیحسی ایپیدورال در تمامی سگ‌ها با لیدوکائین ۲٪ نسبت به ابتدا آن‌ها گرفت و ۲ هفته بعد با ترکیب لیدوکائین ۲٪ و ۱ میلی لیتر سولفات منیزیم ۱۰٪ تکرار شد. زمان زمانی که، شروع بیحسی، طول بین حس و کشش بیحسی به طرف قدم مورد ارزیابی و تبیت می‌شد. تعداد ضربان قلب، تعداد تنفس و دمای بدن در زمان تحقیق از تجربیات ایپیدورال بیانور اطلاعات یافته و در زمان‌های ۱۰، ۱۵، ۲۰، ۲۵ دقیقه بعد از تجویز هر دارو تبیت شده و مورد مقایسه قرار گرفت. تجزیه و تحلیل آماری با نرم‌افزار SPSS ویندوز انجام گرفت.

نتایج: نتایج نشان دادند که شرکت بیشتری به شکل معنی‌داری در استفاده از ترکیب لیدوکائین-سولفات منیزیم (۲۰۰/۰۷۴ دقیقه) بیشتر از گروه کنترل (۱۴/۳۴۴ دقیقه) بوده است. طول ایجاد بیحسی در ترکیب لیدوکائین-سولفات منیزیم (۱۲/۸۵ دقیقه) به شکل معنی‌داری بیشتر از ترکیب لیدوکائین-آب مقرطر (۴۴/۴۴ دقیقه) بوده است.

نتیجه گیری: چنین به نظر می‌رسد که ترکیب لیدوکائین-سولفات منیزیم بی‌بیانیتری بوده و به‌طور نسبت به ترکیب لیدوکائین-آب مقرطر ایجاد بیحسی‌برنگی‌هایی متشکل از دو طولای مدت جراحی، مامایی و ایجاد بی‌بیانی‌های طولانی مدت بعدها در جراحی از این ترکیب بهبودی شکل می‌باشد. انتظار می‌رود که برای از کارکردی این ترکیب مطالعات سازمانی بپردازند.

کلید واژگان: سولفات منیزیم، لیدوکائین، بیحسی ایپیدورال، سگ

IJVS Vol.: 2 No.: 3 Year: 2007