INTRATHECAL SLOW INFUSION OF ISOBARIC BUPIVACAINE IN LOW-DOSE FOR OVARIOHYSTERECTOMY IN DOGS

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Abstract

The aim of this study was to determine the effects of the catheter-aided intrathecal slow injection of low-dose bupivacaine for ovariohysterectomy in 20 non-pregnant dogs. A Tuohy cannula and a spinal catheter were used for infusion. The distance between the lumbosacral-thoracolumbar spaces, was measured under sedation 24 h prior to the operation. The catheter inserted into the subarachnoid region through the lumbosacral space, was advanced into the thoracolumbar space and fixed to the region. One day later, 0.5% bupivacaine was administered via the catheter into the thoracolumbar region at a dose of 1 ml/10 kg and rate of 1 ml/min; afterwards, ovariohysterectomy was performed. Blood pressure, heart rate, respiratory rate, and rectal temperature were recorded prior to anaesthesia, and 10, 20, 30, 45 and 60 min following anaesthesia. Anaesthesia was seen to last for 1.5-3 h. No adverse effects with regard to systolic and diastolic blood pressure, heart and respiratory rates during anaesthesia were observed. With this method, a reliable, fast-acting and desirable anaesthesia was achieved. In conclusion, in cases where general anaesthesia might be dangerous, spinal anaesthesia with a catheter could provide a risk-free option.

Key words: dog, bupivacaine, spinal anaesthesia, ovariohysterectomy.

Spinal and epidural anaesthesia are techniques, aimed at blocking nerves in the subarachnoid space. Due to the accumulation and systemic absorption in the epidural adipose tissue, the epidural dose is many times higher than intrathecal dose (8, 15, 16). Since in the subarachnoid region nerves are not covered with duramater, nerve blockage is very rapid in intrathecal injections. Therefore, spinal anaesthesia requires lower dosage for local anaesthetic and systemic effects and neurotoxicity risk is low (3, 4, 10).

While spinal and epidural anaesthesia can be used alone, combined anaesthesia techniques are also available (2, 6, 16). The anaesthesia and muscle relaxation enables various surgical procedures to be performed in the hind quarter extremities, perineum, and abdominal region (15, 16). In individuals with various organ and system diseases, particularly paediatric and geriatric patients, where general anaesthesia would constitute a risk, spinal anaesthesia provides a reliable, cheaper, and convenient alternative (15 - 17).

While various local anaesthetics are currently used for this purpose, isobaric (0.5%) bupivacaine is a widely preferred agent in spinal and epidural anaesthesia (6, 12, 14, 16). Studies are also present, in which opioid agents have been used in combination with local anaesthetics (1, 2, 4, 15).

Since total spinal anaesthesia may lead to complications, in particular bradycardia and hypotension, the catheter technique, where small amounts of anaesthetic agent are used, are more advantageous (1, 2, 5, 11, 13, 14, 16). In gynaecological operations in humans, especially caesarean section and ovariohysterectomy, the much safer anaesthetic options of spinal and epidural anaesthesia both for mother and foetus have been used extensively in recent years (5, 6, 8, 14).

The aim of this study was to determine intraoperative and haemodynamic effects of intrathecal slow injection of low dose bupivacaine via catheter in dogs undergoing ovariohysterectomy.

Material and Methods

Animals. For the prevention of uncontrolled breeding, 20 adult bitches of various breeds, living as strays in urban areas, were used. Lack of pregnancy was confirmed via ultrasound examination.

Catheter application. Feed was withheld for 24 h before the operation, and the animals were sedated using 2.2 mg/kg of xylazine HCl administered intramuscularly. Following clipping and disinfection of the lumbosacral region, each animal was placed in a ventral recumbence on the operation table. The distance
between the lumbosacral and thoracolumbar spaces was measured and recorded. Prior to intrathecal injection, local anaesthesia was induced in subcutaneous tissues and interarcual ligaments, using 3 ml of 2% lignocaine (Jetokain 2%, Amp. Adeka).

For spinal anaesthesia, a Tuohy cannula 88 mm/3½, 1.3 mm in diameter (18 G) and 0.85 x 0.45 x 1000 mm (20 G) spinal catheter (Espocan®+Docking System+Perifix® Soft Tip, BRAUN) were used. Following sedation, the cannula was inserted into the subarachnoid space in the lumbosacral region, with the bevelled edge facing cranially. The control syringe containing 2 ml of isotonic NaCl was attached to the cannula and the position of the cannula within the spinal space was confirmed by the fluid backflow. The cannula was removed and the catheter advanced into the thoracolumbar space, taking into account the distance between the skin and the subarachnoid space, as well as the lumbosacral-thoracolumbar space. The catheter was fixed to the area with surgical tape and radiographic checks were made to confirm correct positioning of the catheter. The animals were fitted with Elizabethan collars and caged.

Intrathecal injection. One day later, the animals were surgically prepared and 0.5% bupivacain (Marcaine 0.5%, Astra Zeneca PLC, U.K.) was administered to the thoracolumbar region (T13-L1), through the previously applied catheter at a dose of 1 ml/10 kg and rate of 1 ml/min.

Surgical procedure. Following spinal injection, the animal was placed on an operation table in a right lateral recumbence. Subsequently, laparotomy and ovariohysterectomy was performed by a 5 cm skin incision in the left paralumbar fossa, with blunt dissection of the underlying tissues.

Clinical and haemodynamic measurements. Blood pressure, heart rate, respiratory rate, and rectal temperature were recorded for each animal before anaesthesia (0 min) and 10, 20, 30, 45, and 60 min after anaesthesia. Areas influenced with anaesthesia following subarachnoid injection were assessed with needle pricks.

After the operation, the spinal catheter was removed from the area. The animals were held in the same position until the effects of anaesthesia wore off, and this period was recorded for each animal. Necessary post-operative medical treatment (antimicrobials and analgesic agents) was administered. The animals were released 10 d later.

Statistical analysis. Data obtained in the intraoperative period was statistically analysed using the Anova method in the SPSS programme.

Results

Animals used in the study were adult animals of various breed and ages. The body weight ranged from 10 to 25 kg (mean 17.1±3.8kg). The amount of total anaesthetic agent used was therefore between 1 and 2.5 ml.

At the end of intrathecal infusion, there was no response to sterile needle pricks in any of the animals, and surgery was begun usually within 5 min.

No pain was observed in any of the animals during laparotomy or ovariohysterectomy, and there was a good degree of muscle relaxation. Surgical procedures were completed within 40-45 min. However, efficient anaesthesia in the animals was seen to continue for 1.5-3 h. Therefore, none of the animals required an additional dose of bupivacaine. No neurological or clinical disturbances were observed in any of the animals either at the end of anaesthesia or during the recovery period.

Changes seen in rectal temperature, heart and respiratory rates, and blood pressure during anaesthesia are shown in Table 1. There was no statistical difference between heart rates before anaesthesia and 10, 20, 30, 45, and 60 min after anaesthesia (P>0.05). Similarly, no statistical difference was observed between the systolic and diastolic blood pressures before and at 10, 20, 30, 45, and 60 min after anaesthesia (P>0.05).

Table 1

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Heart rate/min</td>
<td>72.4±9.1</td>
</tr>
<tr>
<td>Respiratory rate/min</td>
<td>19.8±5.5</td>
</tr>
<tr>
<td>Body temperature (°C)</td>
<td>38.6±0.7</td>
</tr>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>127.8±4.7</td>
</tr>
<tr>
<td>Diastolic blood pressure (mmHg)</td>
<td>76.0±16.4</td>
</tr>
</tbody>
</table>

Differences between initial values and those obtained during the anaesthetic period were found to be statistically insignificant (P>0.05) in all parameters.
Discussion

This study has demonstrated that a catheter administered subarachnoid slow injection of 0.5% bupivacaine at a dose of 1ml/10kg; accomplished an ideal and uncomplicated anaesthesia for paralumbar laparotomy and ovariohysterectomy in dogs.

The property of the selected local anaesthetic affects the speed, duration, and depth of spinal anaesthesia as well as possible complications (15, 16). Bupivacaine is an agent providing the quickest effects at low doses, and is used in hypobaric, isobaric, and hyperbaric formulations (3, 4, 10, 12). Comparative studies have also established the undesirable effects of bupivacaine on the cardiac and respiratory system, as well as its lower toxicity than local anesthetics such as lidocaine, tetracaine, ropivacaine, and mepivacaine (6, 16). The 0.5% hyperbaric (heavy) formulation is most extensively used. In the present study, the 0.5% isobaric (plain) bupivacaine formulation was selected and no undesired effect was observed. It has been reported that bupivacaine provides a longer lasting (2-3 h) anaesthesia than other agents (3, 6, 11, 15). The duration of anaesthesia in this study was between 1.5 and 3 h. Animals were kept in the same position until they recovered from anaesthesia, therefore preventing possible adverse effects occurring (respiratory arrest, death due to motor paralysis, accidental situations etc).

It has been demonstrated in many studies that, in cases of total spinal or epidural anaesthesia performed without a catheter, various undesirable effects such as bradycardia, hypotension, and respiratory distress occur. These effects change, depending on the property, volume and administration speed of the local anaesthetic (1, 11, 14-16).

In spinal and epidural anaesthesia, systolic and diastolic blood pressure has been reported to be primarily influenced, leading to subsequent bradycardia (1, 5, 9). In the present study, it was found that the drop in the systolic blood pressure at the 10th and 20th min (P<0.05) compared to the initial value, once again came close to the initial value at the 30th, 45th, and 60th min. However, diastolic blood pressure was seen to be insignificantly lower than the initial value (P>0.05) only at 10th and 60th min. Similarly, heart rate also exhibited insignificant variations within the normal range.

In order to balance blood pressure changes due to anaesthesia, vasoconstrictors are administered locally or systematically during anaesthesia, to slow down the absorption of local anaesthetic from the subarachnoid space (5, 9, 15). The blood pressure is also balanced by giving crystalloid fluids before and during anaesthesia (15, 16). One sided spinal anaesthesia has been used in practice to maintain the amount of anaesthetic agent at a minimum level (7). Since our main purpose in this study was to determine the effects of low-dose local anaesthetic on blood pressure, the patients were given neither fluid infusion nor any vasoconstrictor agents. Nevertheless, anaesthesia was well tolerated.

Particularly in total spinal anaesthesia, it has been demonstrated that respiratory arrest, occurring due to the concentration of the anaesthetic used, its volume, the segment in which anaesthesia was administered, injection speed, and position of the patient, creates an important problem, and that, when necessary, patients should be intubated and oxygen support be given (1, 11). In this study, cranial spreading of the anaesthetic solution was prevented by placing the animals in a suitable position, and no adverse effects on respiration were observed.

It has been demonstrated that haemodynamic, neurological, and respiratory problems occurring after single shot injections can be controlled by using a catheter (15). The advantages of this technique, which enables the observation of adverse effects that can occur in the patient during the slow infusion of low-dose local anaesthetic to the region, have also been determined in this study. In addition, the breakdown of nervous tissue that may occur due to local anaesthetic infiltration into nerve tissue during direct subarachnoid injection, as well as accidental cases (2, 4, 7, 10) such as vein puncture, can be prevented with this procedure. In situations where the operation lasts longer, maintenance doses can be administered. It can also be left in situ for days, and various agents may be given post-operatively (15). However, it must be stressed that the use of a catheter requires specialised experience. In the authors’ opinion, the clinician should clear any doubts using radiological aids.

It has been reported that spinal anaesthesia is established within 2 min following injection; however, in epidural anaesthesia approximately 15 min is required (15, 16). In the study presented here, the administration of local anaesthetic took 1-2.5 min. After this, patients were placed in a suitable position, and the surgical procedure commenced. This took approximately 5 min. Surgery begun immediately after this stage, and insufficient anaesthesia was not seen in any of the patients.

In the recovery period from spinal and epidural anaesthesia, adverse effects related to respiration (apnoea) or digestion (vomiting) (1, 6, 11, 16, 17) were not observed.

With this procedure, a reliable, speed, and desirable anaesthesia was achieved without the need for pre-loading with respiratory and oxygen support. It suggests that spinal anaesthesia performed via a catheter, which is an easy procedure with no need to employ specialised equipment, may be a practical option, particularly in the presence of systemic disorders, which could render general anaesthesia dangerous for the patient. This also provides a low-cost option.

References