Vol. 17, No. 3, Autumn, 2021, 14-23 **Original Article**
DOI: 10.22055/IVJ.2021.253465.2313
DOR: 20.1001.1.17356873.1400.17.3.2.7
Journal Homepage: http://www.ivj.ir/

Comparison of analgesic and cardiopulmonary effects in epidural injection of lidocaine, bupivacaine and dexmedetomidine following ovariohysterectomy in the dog

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Received: 19.10.2020 Accepted: 22.01.2021

Abstract

Epidural anesthesia has been widely used as an adjuvant anesthetic technique in dogs due to its perioperative analgesia and reduction of general anesthetics requirements. This study aimed to compare the postoperative analgesia and cardiopulmonary changes following epidural injections of lidocaine, bupivacaine and dexmedetomidine after ovariohysterectomy in dogs. Fifteen healthy adult female dogs of mixed breed with an average weight of 12.76 ± 1.41 kg were randomly divided into three groups (lidocaine 2.5 mg/kg, bupivacaine 1 mg/kg and dexmedetomidine 10 µg/kg body weight, with a final volume of 0.36 mL/kg). Heart rate, respiratory rate, mean arterial pressure and rectal temperature were assessed by vital signs monitoring before epidural injection and during surgery time and hourly up to 6 hours after the end of the surgery. Pain assessment was done by SDS, VAS and UMPS methods hourly, immediately after surgery for up to 6 hours. Heart rate at 2 and 3 hours after surgery was lower in the dexmedetomidine group compared to the other two groups. Comparison of respiratory rate in the three groups showed that the respiratory rate in dogs in the dexmedetomidine group at 1, 3, 4 and 5 hours was lower than in the bupivacaine group. There were no significant differences between the three groups in the first 2 hours after surgery in terms of pain assessment by mentioned methods. In the UMPS method, at 4 and 5 hours after surgery, bupivacaine and dexmedetomidine had better analgesia compared to lidocaine. At 6 hours, dexmedetomidine had better analgesia than bupivacaine. Based on the results, it was concluded that dexmedetomidine has a better analgesic effect than other drugs.

Key words: Lidocaine, Bupivacaine, Dexmedetomidine, Epidural, Dog, Ovariohysterectomy

Introduction

The control of pain in the perioperative period is important to hasten recovery and maintain comfort during surgery (Bonnet & Marret 2005, Wagner *et al.*, 2008). Among different anesthetic techniques, epidural and intrathecal anesthesia are efficient analgesic procedure for retro-umbilical surgeries, (Luis *et al.*, 2007). Spinal and epidural anesthesia techniques produce analgesic effects by blocking nerves in the

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subarachnoid space. The volume of medication is very important for effective epidural anesthesia. Due to the accumulation and systemic absorption of drugs in the epidural adipose tissue using routine volume of lidocaine, 0.25 mL/kg body weight (BW), is not effective when performing ovariohysterectomy. This is because the origin of ovarian innervation, which drives from the third and fourth lumbar nerves, (Chien & Shen 1991, Karsli *et al.*, 2003) is cranial to the area of the lidocaine blockade, which usually does not extend beyond the fourth or fifth lumbar vertebrae (Pohl *et al.*, 2012). The epidural administration of bupivacaine decreases arterial blood pressure by decreasing cardiac output (CO) and/or systemic vascular resistance (SVR). However, the pathophysiology of hypotension due to the epidural administration of bupivacaine seems to depend on its spinal cord level in conjunction with the extent of sympathetic blockade (Dias *et al.*, 2018, Missant *et al.*, 2010) and on the presence of other drugs such as inhalant anesthetics (Borghi *et al.*, 2002, Shamshery *et al.*, 2016). The sympathetic blockade from epidural local anesthetics at the lumbar spine level causes vasodilation and a decrease in SVR, while the decrease in CO due to decrease in heart rate and contractility is only seen when the local anesthetics migrate to higher thoracic levels (T1 –T5) and block the cardiac accelerator nerves, (Veering 2003)

The epidural administration of alpha-2 adrenergic agonists is an analgesic alternative to opioids, presenting the advantages of absence of pruritus and development of tolerance and dependence (Pohl *et al.*, 2012). The anti-nociceptive effects derived from its administration are primarily due to stimulation of alpha-2 adrenoceptors in the spinal cord. The interaction with these receptors results in noradrenaline release, hyperpolarizing the dorsal horn neurons and inhibiting substance P, (Lemke 2004). Besides, C fibers are preferentially blocked as are A-delta fibers, but to a lesser extent; xylazine seems to provide a more specific block (Valverde 2010). The analgesia provided by the administration of alpha-2 adrenergic agonists has been confirmed in various species, such as humans, dogs, horses, and cattle (Soares *et al.*, 2004).

The aim of this study was to compare analgesic and cardiorespiratory effects of lidocaine, bupivacaine and dexmedetomidine as an epidural injection after ovariohysterectomy in bitches.

Materials and Methods

Fifteen healthy adult female dogs of mixed breed dogs were selected for ovariohysterectomy with a mean weight of 12.76±1.41 kg. For animal health assessment, paraclinical (CBC, TP) and physical examination were performed for each dog at least two weeks prior to surgery. All procedures were done following ethical guidelines for care and use of laboratory animals and were approved by the Experimental Animals Committee of Shahid Chamran University of Ahvaz, Iran (Code: EE/99.3.02.36079/scu.ac.ir).

The dogs were randomly divided into three groups (n=5). The first group received 2% lidocaine (LIGNODIC 2%, Caspian Tamin Co., Iran) 2.5 mg/kg BW (LID) and the second group, 0.5% bupivacaine (MARCAINE SPINAL 0.5 %, AstraZeneca, Ireland) 0.5 mg/kg BW (BUP) and the third group dexmedetomidine (MEDONEX 200, Exir Co., Iran) 10 µg/kg BW (DEX). In all groups, the drug was diluted with 0.9% saline solution to a final volume of 0.36 mL/kg and then injected epidurally into the lumbosacral space. The dogs were transferred to the operating room 30 minutes prior to the sedation to acclimatize to the environment. Then, 30 minutes before epidural injection, acepromazine 0.1 mg/kg was administered intramuscularly. After 20 minutes, two 20G angiocatheters were applied to both cephalic veins, one for induction of anesthesia and the other one for fluid therapy using isotonic saline solution 10 ml/kg/hour. Blood samples were collected from jugular vein to measure glucose (colorimetric glucose oxidase method, Pars Azmoun Company, BT-1500 biochemical analyzer made in Italy) and cortisol (ELISA Competitive Enzyme Immunoassay, Monobind Company, USA) levels before epidural injection and then at 30, 60, 120 and 180 minutes after epidural injection. The dogs were placed on sternal recumbency on the table and according to the predetermined treatment group the drugs were injected. The research was planned based on a blind study. At first, the right and left cranial dorsal iliac spines were palpated to determine the exact location of the injection and the spinal needle (20G) was inserted through the skin at the midline in the depression just caudal to L7. Injection into the lumbosacral space and assessment of perineal reflex performed for confirmation of loss of reflex that indicating the correct injection site. To evaluate the perineal reflex, the skin was pinched with hemostatic forceps in ratchet 2 and anesthesia was confirmed by not seeing the anal reflex. The loss of resistance method was used to determine the correct location of the needle. After the epidural injection, the animal was kept in the sternal recumbency position for more than 15 minutes. Then anesthesia was induced using ketamine 10 mg/kg BW and diazepam 0.2 mg/kg BW and maintained with 1.5% isoflurane (Baxter, USA) and 100% oxygen at a flow rate of 50 mL/kg/min (Mann *et al.*, 1992). Ovariohysterectomies were performed by median laparotomy (Fossum 2019). Cefazolin 25 mg/kg was used intravenously before surgery as a prophylactic antibiotic. All surgeries were performed by an experienced surgeon. Heart rate, rectal temperature and non-invasive mean arterial pressure were measured by vital signs monitor (VITAPIA7000KV, TRISMED Co., Ltd, Republic of Korea) assessed hourly, immediately after surgery for up to 6 hours. Respiratory rates were counted by the person watching the reservoir bag at the times stated earlier. After the end of surgery, postoperative pain assessment was performed hourly, immediately after surgery for up to 6 hours using three methods: University of Melbourne Pain Scale (UMPS), Simple Description Scales (SDS) and Visual Analogue Scale (VSD) (Saberi Afshar *et al.*, 2017). If the patients' scores were greater than 7 according to the UMPS criteria or they seemed painful to the observer, they were given meloxicam intravenously at a dose of 0.2 mg/kg.

SPSS 16.0 was used for testing the statistical significance of data (SPSS inc., USA). The quantitative variables were analyzed within and among groups by using analysis of variance (ANOVA) for repeated measures and the post hoc Tukey method were applied. For all measurements, mean ± standard deviation or maximum-minimum were determined. For all comparisons, $p<0.05$ was considered statistically significant.

Results

After the operation, no complications were seen at the incision site and the dogs recovered. No significant difference was observed in age, weight, duration of surgery and incision length between three groups (Table 1).

Table 1. Mean ± Standard deviation of age, weight, incision length and duration of surgery. Bupivacaine at a dose of 1 mg/kg (BUP), dexmedetomidine (DEX) at a dose of 10 µg/kg and lidocaine (LID) at a dose of dose 2.5 mg/kg

Parameter / Group	Age (month) (a)	Weight (kg) (b)	incision length (cm) (c)	surgery duration (min) (d)
LID	20.20±5.54	11.90±1.14	5.40±1.51	31.4±1.34
BUP	19.40± 3.13	12.94±1.61	58.1±5	39.2±7.85
DEX	19.20±5.01	13.46±2.69	5.4±1.14	31.6±9.06

lidocaine (LID), bupivacaine (BUP), dexmedetomidine (DEX)

Heart rate at 2 and 3 hours after surgery was lower in the DEX group compared to the other two groups which was statistically significant (p<0.05). Also, the heart rate in the Dex group at 5 and 6 hours was lower than the lidocaine group (Table 2). In comparison between the three groups, the respiratory rates in the DEX group was significantly (p<0.05) lower at 1, 3, 4 and 5 hours than the BUP group (Table 2). Also, in the BUP group after 2 hours there was an increase in respiratory rate compared to baseline, which was statistically significant (p<0.05). Only slight changes in temperature and MAP were seen in all groups (Table 2).

There were no significant differences between the three groups in the first 2 hours after surgery in terms of pain assessment by SDS, VAS and UMPS methods (Table 3). In SDS method at 3, 4, 5 and 6 hours after surgery, the score of DEX group was lower than BUP group, which was statistically significant (P<0.05). Also, BUP at 4 hours after surgery is significantly different from LID group and the BUP group score was lower (P<0.05). In VAS method at 3, 4 and 5 hours after surgery, the score of DEX group was lower than that of lidocaine group, which was statistically significant (P<0.05). Also, at 5 and 6 hours after surgery, the score of BUP group was higher than DEX group. In the UMPS method, at 3, 4 and 5 hours after surgery, the BUP and DEX groups scored lower than the LID group. Also, at 6 hours after surgery, the DEX group score was lower than the BUP (P<0.05).

In statistical comparison of plasma glucose levels, no significant difference was observed between the 3 groups at any time, except that at 120 minutes the glucose level in the BUP group was higher than the LID group. Despite the increase in plasma glucose levels in all three groups, only 60 minutes after epidural injection, a significant difference was observed with basal glucose levels in groups BUP and DEX and 30 minutes after epidural injection significant difference was observed in LID group. (p<0.05).

In statistical evaluation and comparison of plasma cortisol levels, there was a significant difference between groups DEX and LID in 30, 60 and 120 minutes and cortisol levels were higher in group LID (p<0.05). In comparison between plasma cortisol levels between groups BUP and LID, cortisol levels were higher in group BUP after epidural injection at 120 and 180 minutes (p<0.05) (Table 4).

Table 2. Mean ± Standard deviation of heart rate, respiratory rate, rectal temperature and mean arterial blood pressure at different times. Bupivacaine at a dose of 1 mg/kg (BUP), dexmedetomidine (DEX) at a dose of 10 µg/kg and lidocaine (LID) dose 2.5 mg/kg.

Vital sign	Time / Group	Before surgery (a)*	One hour after surgery (b)	Two hours after surgery (c)	Three hours after surgery (d)	Four hours after surgery (e)	Five hours after surgery (f)	Six hours after surgery (g)
Heart rate (beats/ minute)	LID (A)**	100 ± 6	101 ± 14	104 ± 16 C	112 ± 16 C	107± 17	105± 14 C	111 ± 18 BC
	BUP (B)	91 ± 9 eg	94± 10 e	97 ± 12 C	99 ± 17 C	102 ± 10 ab	98 ±10	100± 10 A
	DEX (C)	84 ± 14 cd	84 ± 12 cd	64 ± 12 ABabefg	64 ± 11 ABabefg	85 ± 16 cdf	78± 17 Acde	88 ± 12 Ad
Respiratory rate (breaths/ minute)	LID	22 ± 6 g	21 ± 4 C	21 ± 5	22 ± 4 C	19 ± 2	19 ± 3	20 ± 5
	BUP	23 ± 60	26 ± 8 C	27 ± 9 D	21 ± 9 Cc	25 ± 7 C	25 ± 7 C	25 ± 8
	DEX	15 ± 2	15 ± 2AB	16 ± 5	15 ± 1 AB	15 ± 3 B	15 ± 2 B	16 ± 2
Rectal temperature (°C)	LID	38 ± 1	37 ± 0.8	37.1 ± 0.7	36.9 ± 1.1	37.1 ± 0.7	39.6 ± 5.2	37.1 ± 0.6
	BUP	37.6 ± 0.2	37.5 ±0.1	37.5 ± 0.2	37.3 ± 0.4	37.5 ± 0.1	37.5 ± 0.4	37.4 ± 0.9
	DEX	38.2 ± 1.3	37.5± 0.1	37.5 ± 0.2	37.3 ±1	37.3 ± 1.1	37.3 ± 0.9	37.4 ± 0.9
MAP (mmHg)	LID	103.4±17.7	118.2±31	104.2±16.7	103.6± 16.8	99.8 ± 41.3	95.6 ± 16.3	92.8± 17.7
	BUP	117.6±17.7	123.2±20	118.2±22.5	115.2± 21.1	111.6 ± 5.9	111.6 ±5.9	111.6± 6.0
	DEX	102.8±18.5 dg	133±22.6	122.4±27.1	121.4±15.7 a	111.6 ±5.9	111.6 ± 5.9	111.6 ± 6 a

-lidocaine (LID) bupivacaine (BUP) dexmedetomidine (DEX)
*Different small letters in each row indicated a significant difference between times in each group (P<0.05).
**Different capital letters in each column indicated a significant difference between groups in each time (P<0.05).

Table 3: Mean (minimum-maximum) pain assessment using the simple description scale (SDS), visual analogue scale (VAS) and university of Melbourne pain scale (UMPS) methods at different times. Bupivacaine at a dose of 1 mg / kg, dexmedetomidine at a dose of 10 µg / kg and lidocaine dose 2.5 mg/kg

Pain Assessment Scale	Time / Group	one hour after surgery (a)	two hours after surgery (b)	three hours after surgery (c)	four hours after surgery (d)	five hours after surgery (e)	six hours after surgery (f)
SDS	LID (A)**	0(0-0) def	1(1-1) ef	1(1-1) Cef	2(1-2) BCa	2(1-2) Cabc	2(2-2) abc
	BUP (B)**	0(0-1) ef	0(0-1) ef	0(0-2) f	0(0-1) Af	1(2-1) Cab	2(1-2) abcd
	DEX (C)**	0(0-0) f	0(0-0) f	0(0-0) Af	0(0-0 Af	0(1-0) ABf	1(1-1) A abcd
VAS	LID	1(1-1) cdef	1(1-2) cdef	2(2-3) BCabf	2(2-3) Cabf	3(3-4) Cab	4(3-4) abcd
	BUP	0(0-1) def	0(0-2) ef	1(0-2) Af	2(0-2) af	2(1-4) Cabf	5(3-5) Cabcde
	DEX	0(0-0) df	0(0-0) cdf	0(0-1) Ae	1(1-0) Aabf	1(1-1) ABcf	3(2-4) Babde
UMPS	LID	2(1-2) cdef	3(2-5) def	4(5-3) BCaef	5(5-7) BCabef	7(6-7) BCabcd	7(7-7) abcd
	BUP	1(0-1) cdef	1(1-4) f	1(1-4) Aadf	2(2-4) Aacf	3(3-7) Aa	8(3-8) Cabcd
	DEX	1(2-1) cdef	2(2-1) def	2(2-1) Aaf	2(3-2) Aabef	2(2-3) Aabdf	6(6-8) Babcde

-lidocaine (LID) bupivacaine (BUP) dexmedetomidine (DEX)
*Different small letters in each row indicated a significant difference between times in each group (P <0.05).
**Different capital letters in each column indicated a significant difference between groups in each time (P <0.05).

Table 4. Mean ± Standard deviation of plasma concentrations of glucose and cortisol at different times. Bupivacaine 1 mg/kg (BUP), dexmedetomidine (DEX) 10 µg/kg and lidocaine (LID) 2.5 mg/kg

Biochemistory parameter	Time / Group	Before surgery (a)*	30 min after epidural injection (b)	60 min after epidural injection (c)	120 min after epidural injection (d)	180 min after epidural injection (e)
Glucose (mg/dl)	LID(A)**	77.6 ±2.9 bcd	100.2 ± 3.4 acde	87.6 ± 1.5 abde	85 ± 1.2 Babce	80.4 ±1.5 bcd
	BUP(B)	84.2 ± 5.1 c	88 ±5.2 c	102 ± 4 abe	92.6 ± 7 Ace	89.4 ± 6.8 cd
	DEX(C)	78.6 ±2.7 c	94.2 ±5.8 ce	93.4 ±3.5 abe	87.2 ± 2.5	82.2 ± 1.3 c
Cortisol (µg/dl)	LID(A)	2.2 ±0.2 bcde	8.64 ±0.7 Cacde	11.18 ±0.8 Cabd	14.4 ± 0.4 Cabce	12.1 ± 0.6 Babd
	BUP(B)	2.06 ± 0.1	8.1 ± 0.8	11.2 ±0.8	15.3 ±0.5 C	14.6 ±0.5 AC
	DEX(C)	2.4 ±0.2 bcde	7.5 ±1.5 Aacde	10.5 ± 1.9 Aabd	13.7 ±1.9 ABabce	12.1 ±2.1 Babd

-lidocaine (LID) bupivacaine (BUP) dexmedetomidine (DEX)
*Different small letters in each row indicated a significant difference between times in each group (P <0.05).
**Different capital letters in each column indicated a significant difference between groups in each time (P <0.05).

Discussion

Epidural administration of local anesthetics can be effective for a variety of surgical procedures such as cesarean section (Luna *et al.*, 2004), orthopedic procedures in the hind limb, and soft tissue surgeries (Hendrix *et al.*, 1996, Hewitt *et al.*, 2007). In some papers, potential advantages and disadvantages of each class of drugs and their combinations used for epidural anesthesia and analgesia in dogs were reported (Torske & Dyson, 2000, Valverde 2008). These drugs include local anesthetics, opioids, alpha 2 agonist or combination of these drugs. Lidocaine is an amide type local anesthetic that can be administered into the lumbosacral epidural space to produce a rapid desensitization with good muscle relaxation (Cruz *et al.*, 1997). Bupivacaine is another amide type local anesthetic with a prolonged duration of effect compared with lidocaine (Lawal and Adetunji, 2009). Alpha 2 agonist are potent sedatives and analgesics that bind to noradrenergic receptors of the spinal cord, inhibiting the central transmission of the afferent nociceptive impulses, by pre- and postsynaptic membrane hyperpolarization and inhibition of norepinephrine and substance P release (Vesal *et al.*, 1996, Branson *et al.*, 1993).

Different doses have been used in different studies and the selected doses in the present study have been effective for ovariohysterectomy in bitches according to the study of others (Pohl *et al.*, 2012, Odette & Smith 2013, Shah *et al.*, 2017).

In the study of heart rate between the three groups, only in the DEX group, there was a significant decrease at 2 and 3 hours after surgery. However, in the other groups, although the heart rate increased, the difference was not statistically significant. Another study found a decrease in heart rate after taking dexmedetomidine epidurally up to 60 minutes after surgery (Pohl *et al.*, 2012). Hemodynamic effects of dexmedetomidine, which include transient hypertension, bradycardia, and hypotension, result from the drug's peripheral vasoconstrictive and sympatholytic properties (Weerink *et al.*, 2017). In comparison between the three groups, the respiratory rates in the DEX group was significantly ($p<0.05$) lower at 1, 3, 4 and 5 hours than the BUP group. The literature mentions that alpha-2 adrenergic agonists cause a decrease in respiratory rate;

however, alveolar ventilation is maintained due to an increase in tidal volume (Pohl *et al.,* 2012). Hypotension is an undesirable effect of epidural anesthesia and is caused by rostral spread of the local anesthetic with subsequent sympathetic blockade. The degree of sympathetic blockade depends on the site of injection, dose of local anesthetic and the preexisting state of the circulation. In veterinary medicine, because the blockade is performed in the lumbosacral space of the animal, the occurrence of high sympathetic blockade is rare and transitory (Almeida *et al.*, 2007). In the present study, changes in blood pressure were within the normal range and excessive reduction was not seen. The rectal temperature in all three groups decreased, but this decrease was in the range of physiology due to anesthesia. Decrease in temperature during surgery is a physiological effect of using anesthetic drugs. These anesthetic agents depressed the central nervous system and decreased muscle activity, (Seliškar *et al.*, 2007) which results in hypothermia (Andreoni & Hughes, 2009).

In the present study, postoperative analgesia was evaluated by three methods SDS, VAS and UMPS. Each measurement method for pain is based on different criteria and each has the ability to detect pain to some extent. For example, the SDS as the simplest of the three scales usually consists of four or five expressions used to describe various values of pain intensity, e.g. no pain, mild, moderate, or severe pain. Each expression is assigned a number, which becomes the pain score for that animal (Leonardi *et al.,* 2006). The UMPS method is a scale based on specific behavioral and physiological responses and includes multiple descriptors in six categories of parameters or behaviors related to pain (Matičić *et al.,* 2010). Therefore, different methods of pain assessment were used so that we can have a better understanding of pain after using different drugs. Using three different methods to assess pain, minor differences in pain sensation between different groups are better recognized. In all three methods, there was no difference between groups in the first 2 hours of postoperative analgesia but after 3 hours BUP and DEX had better analgesia than LID.

The addition of 0.05% dexmedetomidine (4 μg/kg) to 0.5% bupivacaine (1 mg/kg) provided adequate analgesia; however, prolonged duration of motor blockade was a clinical concern following pelvic orthopedic surgeries in dogs (Odette & Smith, 2013). Time to first urination was earlier but pain scores worsened at 1 h following surgery when compared with dogs receiving epidural bupivacaine-morphine for similar procedures (Odette & Smith, 2013).

Epidural administered bupivacaine and dexmedetomidine have different mechanisms of action to provide analgesia. Bupivacaine is a local anesthetic that acts on the cell membrane sodium channels by inhibiting recovery after repolarization thereby inhibiting transmission of noxious stimuli. Dexmedetomidine is classified as an alpha-2 adrenergic agonist. Analgesia is mediated by this drug at the level of the dorsal horn of the spinal cord through G protein modulated activity on trans-membrane ion channels, and at the level of the brainstem through alteration of norepinephrine release, (Giovannitti *et al.*, 2015) Others have hypothesized that epidural dexmedetomidine provides analgesia through its modulatory effects on the nociceptive pathway by altering ion conductance centrally at the locus coeruleus and by inhibition of substance P release in the dorsal root neuron, (Odette & Smith 2013).

Hyperglycemia may be attributed to the traumatic stress or increased muscular activity and sympathetic stimulation caused by restraining the animals resulting into increased secretion of adrenocortical hormones (Sethi *et al.,* 2017). Hyperglycemia has been suggested as a usual response to stress due to the rise in adrenocortical hormones. These hormones stimulate gluconeogenesis and also reduce consumption of glucose by cells, and result in increased blood glucose concentration (Shah *et al.,* 2018). Hyperglycemia was seen in the present study but no significant difference was observed between the groups. Comparison of plasma cortisol levels in the LID group compared to the DEX group may indicate that dogs in the LID group experienced more pain.

In conclusion, this study demonstrates that dexmedetomidine and bupivacaine provide adequate analgesia in dogs undergoing ovariohysterectomy. However, these drugs can provide analgesia in dogs for up to a few hours after surgery. After that, other analgesics such as NSAIDs or opioids should be used.

Acknowledgements

The authors express their gratitude to the Research Council of Shahid Chamran University of Ahvaz for its financial support.

Conflict of interest

The authors declare that there is no conflict of interest.

Funding

This research was supported by the Vice Chancellor for Research of Shahid Chamran University of Ahvaz.

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Received: 19.10.2020
Accepted: 22.01.2021

DOI: 10.22055/IVJ.2021.253465.2313
DOR: 20.1001.1.17356873.1400.17.3.2.7

مقایسه اثرات قلبی ریوی و بی‌دردی حاصل از تزریق اپیدورال داروهای لیدوکائین، بوپیواکائین ودکس‌مدتومدین به دنبال جراحی برداشت رحم و تخمدان در سگ

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دریافت: ۱۳۹۹/۰۷/۲۸ پذیرش: ۱۳۹۹/۱۱/۰۳

چکیده

بی‌حسی اپیدورال به دلیل بی‌دردی حین عمل و کاهش نیاز به بیهوشی عمومی به طور گسترده‌ای به عنوان یک روش بی‌حسی کمکی در سگ‌ها مورد استفاده قرار گرفته است. هدف از این مطالعه مقایسه‌ی بی‌دردی بعد از عمل و تغییرات قلبی ریوی پس از تزریق اپیدورال لیدوکائین، بوپیواکائین و دکس‌مدتومیدین پس از عمل برداشت رحم و تخمدان در سگ‌ها بود. برای این منظور، ۱۵ قلاده سگ بالغ سالم، از نژاد مخلوط با وزن متوسط ۱/۴۱ ± ۱۲/۷۶ کیلوگرم به طور تصادفی به سه گروه (لیدوکائین ۲/۵ میلی‌گرم/کیلوگرم، بوپیواکائین ۱ میلی‌گرم/کیلوگرم و دکسمدتومیدین ۱۰ میکروگرم/کیلوگرم وزن بدن با حجم نهایی ۰/۳۶ میلی‌لیتر/کیلوگرم) تقسیم شدند. ضربان قلب، تعداد تنفس، فشار متوسط شریانی و درجه حرارت مقعدی قبل از تزریق اپیدورال و در طی زمان جراحی و تا ۶ ساعت بعد از پایان جراحی ارزیابی شد. پس از عمل درد تا ۶ ساعت ارزیابی شد. ضربان قلب در ۲ و ۳ ساعت پس از عمل در گروه دکسمدتومیدین در مقایسه با دو گروه دیگر کم‌تر بود. با مقایسه‌ی تعداد تنفس در هر سه گروه، تعداد تنفس در گروه دکسمدتومیدین در ساعت‌های ۱، ۳، ۴ و ۵ کم‌تر از گروه بوپیواکائین بود. ارزیابی درد با استفاده از روش‌های SDS، VAS و UMPS انجام شد. از نظر ارزیابی درد با استفاده از روش‌های SDS، VAS و UMPS در ۲ ساعت اول پس از جراحی تفاوت معنی‌داری بین سه گروه وجود نداشت. با روش UMPS در ۴ و ۵ ساعت پس از جراحی، بوپیواکائین و دکسمدتومیدین در مقایسه با لیدوکائین بی‌دردی بهتری داشتند. در ساعت ۶، دکسمدتومیدین ضددردی بهتر نسبت به بوپیواکائین داشت. بر اساس نتایج، دکسمدتومیدین اثر ضددردی بهتر نسبت به سایر داروها داشته باشد.

کلمات کلیدی: لیدوکائین، بوپی‌واکائین، دکس‌مدتومیدین، اپیدورال، سگ، اوریوهیسترکتومی

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