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Methods of local blockade with lidocaine in cats submitted to laparoscopic ovariectomy. Comparação de três métodos de bloqueio local com lidocaína em gatas submetidas a ovariectomia laparoscópica.

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Abstract

The aim of this work was to compare three techniques of local blockade, as part of a multimodal protocol in cats submitted to videoassisted ovariectomy (OVH). This study included 38 cats, assigned to four groups (control; incisional block, intraperitoneal block and block of the ovarian arteriovenous complex). Pain was assessed using Analogue Visual Scale, Pain Scale of the UNESP and Composite Multimodal Pains Scale-Feline, prior and after surgery. Anesthetic and analgesic protocols provided adequate post-surgical analgesia in most cats. It is concluded that the intraperitoneal administration of lidocaine may be a useful technique to reduce trans-surgical pain, while the use of incisional infiltration with this medication improves early postoperative pain in videosurgeries.
Keywords: Multimodal analgesia. Pain. Surgery.

Resumo

O objetivo deste trabalho foi comparar três técnicas de bloqueio local, como parte de um protocolo multimodal, em gatos submetidos a ovariectomia (OVE) videoassistida. Este estudo incluiu 38 gatos, divididos em quatro grupos (controle; bloqueio incisional, bloqueio intraperitoneal e bloqueio do complexo arteriovenoso ovariano). A dor foi avaliada por meio da Escala Visual Analógica, Escala de Dor da UNESP e Escala de Dores Multimodal Composto-Felina, antes e após a cirurgia. Os protocolos anestésicos e analgésicos proporcionaram analgesia pós-cirúrgica adequada na maioria dos gatos. A administração intraperitoneal de lidocaína pode ser uma técnica útil para reduzir a dor trans-cirúrgica, enquanto o uso de infiltração incisional com este medicamento melhora a dor pós-operatória precoce em laparoscopias.
Palavras-chave: Analgesia multimodal. Dor. Cirurgia.

Introduction

Pain is an experience of distress associated with real or potential tissue damage with sensory, emotional, cognitive, and social components (BELL, 2018, p. 55; WILLIAMS; CRAIG 2016, p. 2420). In the veterinary context, acute pain can become an unwanted consequence, which compromises the well-being and recovery of patients, as well as the relationship between practitioner and client (EPSTEIN et al., 2015, p. 68; ROBERTSON, 2018, p. 440). In cats, pain recognition is an evident challenge for evaluators and has been described as a cause of suboptimal analgesia in this species (BATESON, 1991, p. 828; HOLDEN et al., 2014, p. 616).

Multimodal analgesia points to quality postoperative recovery associated with low perioperative pain scores, with local and regional blocks and other adjunct therapies (REID et al., 2017, p. 449). Local anesthetics inhibit membrane depolarization, nerve excitation, and conduction, which disrupt electrical impulses of nerves or sensory tracts. They are low-cost drugs, with safe dose margins and low adverse effects (STEAGALL et al., 2019, p. 22). Intraperitoneal and/or incisional administration has demonstrated a reduction in analgesia requirements and immediate post-surgical pain scores in human patients (DUFFIELD et al., 2018, p. 1215; KAHOKEHR et al, 2011, p. 31) and canines (CAMPAGNOL et al., 2012, p. 428; LAMBERTINI et al., 2018, p. 867) undergoing abdominal surgeries. As for the feline species, there is little evidence on the use of local anesthetics, more specifically in laparoscopic procedures, based on the use of bupivacaine with or without epinephrine (BENITO, 2016a, 2016b, 2018) and lidocaine (ZILBERSTEIN et al., 2008), the most widely used local anesthetic.

It is essential to compare the analgesic effect of lidocaine in the peritoneum, blockade of ovarian pedicles and incisional infiltrative block, as part of a multimodal protocol, in cats submitted to elective laparoscopic ovariectomy, in order to identify the most appropriate method for use in multimodal therapy, as well as its limitations in cats.

Materials and methods

Experimental design

This experimental, prospective, controlled, random and blind study was carried out at the University Veterinary Hospital of UFSM (HVU - UFSM), Rio Grande Do Sul, Brazil. The study was approved by the Ethics Committee on the Use of Animals of the same institution (protocol 5671220818). Written informed consent was obtained from the owners before the inclusion of the animals.

Animals

It was included 38 healthy cats, of various breeds, aged between six and 50 months of age, weighing between 2 and 5 kg, from the hospital routine, referred for elective laparoscopic ovariectomy. The cats were considered healthy from the physical, clinical and laboratory examination, composed of: heart rate (HR), respiratory rate (RR), capillary filling time (CRT), rectal temperature, in addition to blood count, platelet count, total plasma proteins (TPP) and serum creatinine, albumin, alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (FA), urea and fructose.

Exclusion criteria included aggressiveness, underlying diseases and use of analgesics or anti-inflammatory drugs during the evaluation period.

Experimental Groups

Cats were familiarized to the observers, cages and tools to evaluate sedation and pain for 48 hours prior to surgical procedures. Cats were randomly assigned into four groups, one control group and three who received different anesthetic block treatments:

1. Control group (CG): 10 cats, intravenous fentanyl hydrochloride (2 μg/kg) in bolus every 15 minutes of transoperative surgery.
2. Incisional group (ING): 10 cats, incisional infiltrative block with lidocaine (2 mg/kg), five minutes before the incision, distributing the total volume between the portal access sites.
3. Intraperitoneal group (IPG): nine cats that received lidocaine (2 mg/kg), diluted into 5 ml of saline solution, instilled in the peritoneum, immediately after placement of the first portal, by Hasson modified technique (minilaparotomy), five minutes before pneumoperitoneum stabilization.
4. Ovarian arteriovenous complex group (CAVOG): nine cats who received ovarian pedicle block with lidocaine (2 mg/kg), divided for each pedicle, administered through transparietal injection after fixation of the ovary in the abdominal wall, five minutes before the onset of hemostasis of each pedicle.

Anesthetic Procedure

Animals were submitted to solid and water fasting of eight and two hours, respectively, prior to surgery. Cats were premedicated with the combination of dexmedetomidine (Dexdomitor® Zoetis, SP, Brazil) (10 μg/kg) and tramadol (Tramadon®, Cristália, SP, Brazil) (2 mg/kg), applied intramuscularly (IM). They had blood samples collected to evaluate hemogasometric parameters (pH, PO_2, PCO_2, HCO^{-3}, -BE) and electrolytes (Na^+, K^+ and Ca^{++}) and glucose levels, before induction and at the end of the procedure. Anesthetic induction was performed with propofol (Propovan®, Cristália, SP, Brazil) (3 mg/kg), administered intravenously (IV).

Orotracheal intubation was promoted, while anesthetic maintenance was performed with isoflurane (Isoforine®, Cristália, SP, Brazil), vaporized in 100% oxygen, in an open anesthesia system (Baraka), always performed by the same anesthesiologist. Ringer with Lactate (Equiplex®, Goiania, GO, Brazil) (3 ml/kg/h, IV) was used during the surgical procedure. The antimicrobial chemoprophylaxis was performed with cephalotin (BioChimico®, Itatiaia, RJ, Brazil) (30 mg/kg, IV).

During the transoperative period, the animals were continuously monitored through multiparametric monitoring (ALFAMED, Vita 400, MG, Brazil). The HR, RR, systolic (SAP), mean (MAP) and diastolic arterial pressures (DAP) by noninvasive method, as well as electrocardiogram (ECG), esophageal temperature (T °C esof), peripheral oxyhemoglobin saturation (SpO_2) and expired fraction of carbondioxide ($EtCO_2$) were monitored. The need for analgesic supplementation was identified by the verification of increased MAP, HR and/or RR in 15% above baseline values (PEREIRA et al., 2018, p. 2), without alteration of the anesthetic plan.

The transoperative analgesic rescue was standardized with the application of fentanyl (Fentanest®, Cristalia, SP, Brazil) (2 μg/kg), IV. Prior to the end of the surgery, the animals received atipamezole (Antisedan®, Zoetis, SP, Brazil), corresponding to half the volume of dexmedetomidine used for premedication, for total reversal of the effects of dexmedetomidine.

After the end of the surgical procedure, animals received sodium dipyrone (Febrax®, LemaInjex, Vespasiano, MG, Brazil) (12.5 mg/kg), IV. In-home post-surgical pain management was promoted using meloxicam (0.1mg/kg), orally, every 24 hours, for two days. This treatment was started after the postoperative pain evaluation period.

Surgical Procedure

All surgical procedures were performed by the same surgeons. A standardized surgical protocol was used, and the duration of all procedures was recorded. The first portal (6 mm) was positioned, through the open technique, in the umbilical scar region, with an incision of approximately 0.6 cm, with scalpel on the skin, subcutaneous tissue and midline.

Pneumoperitoneum with medicinal CO_2 was initiated at a speed of 1.5 L/min and with a maximum pressure of 8 mmHg for cavity inspection, with the aid of a rigid endoscope of about 4,5 mm and 27° of angulation. Under laparoscopic visualization, the second 6-mm portal was positioned, in the midline in the pre-pubic region.

The lateralization of the patients was promoted by the rotation of the trunk to locate the ovaries. Subsequently, the uterine horn was elevated to the muscle wall, with laparoscopic Kelly forceps. For fixation, a polypropylene thread 3-0 (Shalon, Goiania, GO, Brazil) transparietal suture was done.

Hemostasis of the uterine vessels and a small segment of uterus, near the ovary, was obtained by cauterization with a 5-mm bipolar forceps (PowerBlade Linea), followed by the section of this structure with 5 mm Metzenbaum scissors. Finally, the suspending ligament of the ovary was cauterized and sectioned, allowing the removal of the organ through the second portal. Both ovaries were managed in the same way.

The wounds were sutured in three planes using polyglactin 910 3-0 (Shalon, Goiánia, GO, Brazil). In the abdominal musculature and subcutaneous was used cross-mattress pattern. For dermorraphy was used simple interrupted pattern with monofilament nylon 4-0.

Pain Assessment

Pain was analyzed subjectively and objectively by three experienced evaluators and unaware of the anesthetic treatments used. The Visual Analog Scale (VAS), UNESPS (BRONDANI et al., 2011) and CMPS-F (REID et al., 2018) were used at the moments: T0 (prior to surgery), one, two, three and six hours after extubation (T1, T2, T3 and T6, respectively).

Animals that reached ≥ 5 cm on the VAS scale (5/10), ≥ 8 (8/30) points on the UNESPS scale or score ≥ 5 (5/20) in the CMPS-F, by at least two of the evaluators, received analgesic rescue with methadone (0.1 mg/kg, IM), followed by pain reassessment with all scales, after 30 min until normalization of the parameters, according to these scales.

Statistical Analysis

Statistical analysis was performed using a statistical software (IBM SPSS Statistics 21). Significance was defined as $p \leq 0.05$ (two-tailed). The results were presented as mean ± standard deviation (SD). A Shapiro-Wilk normality test was performed to determine the distribution of the data. From there, the numerical variables were contrasted: age, weight, HR, RR, SAP, MAP, DAP, $EtCO_2$, SpO_2, Esophageal T ºC, glycemia, pain scores (VAS, UNESPS and CMPS-F), surgical times and hemogasometric and electrolyte parameters, with the treatment groups, at different measurement moments. This was accomplished by means of the test – ANOVA and by the tukey test of repeated measurements for paired samples, using the Bonferroni confidence interval adjustment, when the samples presented normal distribution. Friedman's test was used for nonparametric analysis in the case where this condition was not met.

Results

Thirty-eight healthy cats with no defined breed were included. Body weight (mean ± SD: 2.8 ± 0.64 kg) and age (17.55 ± 9.8 months) were not different between groups (p = 0.483). Surgical times were significantly higher in IPG (41 ± 10 minutes) and CAVOG (44 ± 10 minutes), when compared to CG (30 ± 04 minutes) and ING (32 ± 04 minutes) (p=0.001) (Table 1).

Table 1 - Demographic data and surgical time of the animals of the different groups. (Mean ± SD)

	Groups				
	CG[(a)] (*n* = 10)	ING[(b)] (*n* = 10)	IPG[(c)] (*n* = 9)	CAVOG[(d)] (*n* = 9)	*P* value*
Age (months)	16.3 ± 10.3	17.1 ± 7.6	18.2 ± 8.6	18.7 ± 13.6	≥0.05
Weight (Kg)	2.6 ± 0.46	2.9 ± 0.63	3 ± 0.83	2.7 ± 0.62	≥0.05
Surgical Time (min)	0:30 ± 0:04	0:32 ± 0:04	0:41 ± 0:10	0:44 ± 0:09	<0.05 (c *vs* d)

CG[(a)], control group; ING[(b)], incisional group; IPG[(c)], intraperitoneal group; CAVOG[(d)], ovarian arteriovenous complex group.

* ANOVA – Tukey's HSD Post Hoc Test.

Physiological parameters

HR did not differ in the comparison between the experimental groups (p=0.101); but in the different measurement times, where an increase was observed during the hemostasis of the first (141.14 ± 3.8 bpm) and the second ovary (132.6 ± 4.05 bpm) (p=0.000). The RR did not present significant variations between the groups or in the different measurement times. Similarly, SAP, MAP and DAP were not different in the comparison between the four experimental groups. However, MAP was significantly higher in hemostasis of the first (74.53 ± 17.80 mmHg; p=0.05) and second ovary (83.8 ± 13.43 mmHg; p=0.01), compared to the end of the surgical procedure (63.4 ± 22.15 mmHg) in all groups. On the other hand, DAP presented different values during hemostasis of the second ovary (60.28 ± 17.8 mmHg), when contrasted with the final moment of surgery (49.5 ± 147.39 mmHg) (p=0.006), being significantly lower in the latter in all groups (Table 2).

Table 2 - Trans-surgical physiological parameters of cats submitted to ovariectomy (OVE) by experimental group. (Mean ± SD)

		Measurement Times				
		5 min[a]	OV1[b]	OV2[c]	FM[d]	P Value *
HR	CG	125 ± 17	136 ± 21	138 ± 33	109 ± 18	<0.05 (b, c *vs* d)
	ING	108 ± 19	152 ± 30	132 ± 12	115 ± 13	<0.05 (b *vs* a, d)
	IPG	120 ± 26	130 ± 20	119 ± 22	124 ± 27	≥0.05
	CAVOG	132 ± 21	146 ± 20	140 ± 26	127 ± 10	≥0.05
P Value*		≥0.05	≥0.05	≥0.05	≥0.05	
RR	CG	19 ± 8	20± 7	16 ± 7	14 ± 8	≥0.05
	ING	22 ± 9	20 ± 10	20 ± 7	16 ± 9	≥0.05
	IPG	20 ± 8	16 ± 5	17 ± 5	17 ± 8	≥0.05
	CAVOG	22 ± 12	19 ± 5	17 ± 4	16 ± 4	≥0.05
P Value*		≥0.05	≥0.05	≥0.05	≥0.05	
MAP	CG	70 ± 11	77 ± 22	69 ± 19	64 ±22	≥0.05
	ING	79 ± 14	76 ± 14	73 ± 16	61 ± 14	≥0.05
	IPG	85 ± 16	71 ± 18	83 ± 13	63 ± 22	<0.05 (c *vs* d)
	CAVOG	78 ± 26	73 ± 17	70 ± 14	62 ± 7	≥0.05
P Value*		≥0.05	≥0.05	≥0.05	≥0.05	

HR, heart rate; RR, respiratory rate; MAP, mean blood pressure; CG, control group; ING, incisional group; IPG, intraperitoneal group; CAVOG, ovarian arteriovenous complex group; 5 min, 5 minutes from the procedure; OV1, cauterization of the first ovary; OV2, cauterization of the second ovary; FM, final moment of the procedure. Significant difference (p< 0.05).

Both SpO_2, $EtCO_2$ and esophageal T °C showed no considerable differences between the four experimental groups. Regarding hemogasometric and electrolyte parameters, at the beginning and end of the surgical procedure, no statistical differences were found between the groups. Protocol of action in situations of bradycardia was not used in any of the animals included in this study.

Pain assessment

Results referring to pain scores by VAS, showed a statistical difference between moment T0 (0.08 ± 0.2) and T1 (0.3 ± 0.5) (p=0.040) in all groups. In T3, pain scores achieved in the IPG (0.74 ± 0.98) were significantly higher than the CAVOG (0.03 ± 0.11) (p=0.041). Similarly, scores reached in the second hour of evaluation (T2) in IPG cats were higher than in cats belonging to the CAVOG, by CMPS-F (p=0.045) and by UNESPS (p=0.357). Through UNESPS, mean scores were significantly higher in the first (1.46 ± 2.15) and second hour after extubation (1.7 ± 2.4), when compared to baseline values (p=0.025 and p=0.027, respectively). Moreover, significantly higher values were observed in T2 in contrast to T6 (p=0.005), a fact supported by CMPS-F (p=0.017) (Figure 1).

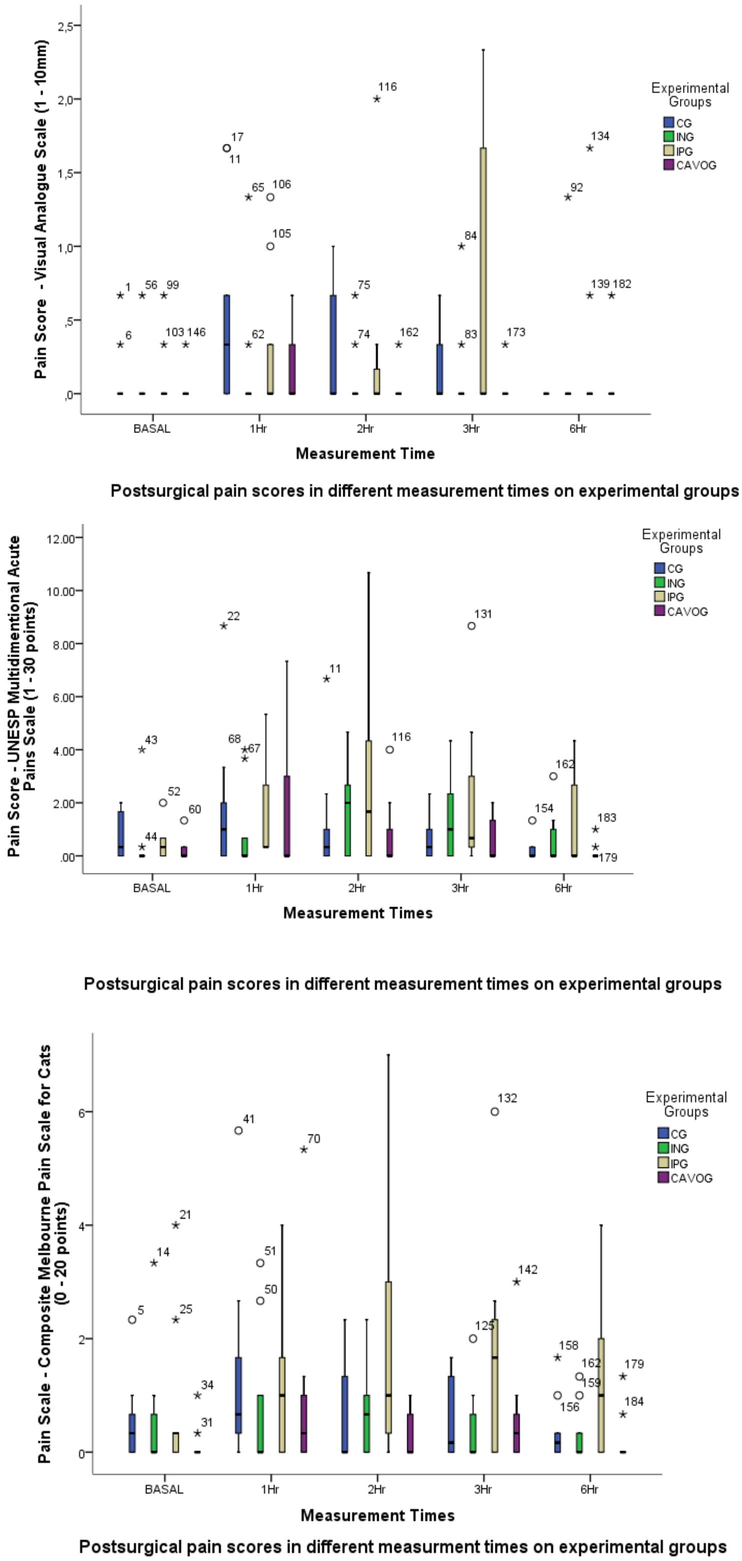

Figure 1 - Box diagrams showing median, interquartile range, minimum and maximum pain scores according to the scales used in the study from up to down: Visual Analog Scale, Multidimensional Acute Pain Scale for Cats from EUNESP and Composite Multimodal Pains Scale-Feline CMPS-F, in different experimental groups.

In 15.8% (6/38) of the cats, it was necessary to perform analgesic rescue during surgery due to increased HR, MAP and/or RR, of which 66% belonged to the ING, 17% belonged to the IPG and 17% to CAVOG. Regarding the post-surgical analgesic rescue, 13.5% (5/38) of the cats achieved the intervention score, in at least one of the scales used, receiving methadone at a dose of 0.1 mg/kg, as analgesic rescue therapy. Of these, 7.89% (3/38) belonged to the IPG, 2.63% (1/38) to CAVOG and 2.63% (1/38) to CG. The difference observed regarding analgesic rescue between the treatment groups lacks statistical significance ($\chi2$ Pearson = 4.581; p=0.287). During the application of anesthetic and post-surgical techniques, no complications were reported, as well as clinical signs of intoxication associated with the dose used, respectively. A single methadone administration was required in the five cats that required analgesic intervention. They returned to baseline values in the evaluations after the intervention, and a second intervention was not necessary. Both UNESPS and CMPS-F accused the need for analgesic rescue jointly in three of the five cats that needed analgesic rescue, while VAS proved inefficient in detecting postoperative pain.

Discussion

In this study, the anesthetic blocking techniques used promoted values of physiological parameters and pain assessment scores similar and comparable to the control group. There were no short-term complications throughout the evaluation period. The usefulness of lidocaine, as part of a multimodal anesthetic protocol, is highlighted for the reduction of trans-surgical autonomous nociceptive stimulus, through intraperitoneal blockade techniques and ovarian arteriovenous complex. It is also emphasized the blockade of conscious pain in the postoperative period, with the technique of incisional block. These pathways showed a special difference in the parameters, such as HR and the absence of analgesic rescue, through the intraperitoneal, ovarian arteriovenous complex and incisional routes, respectively (Figure 2).

The animals were pre-medicated with dexmedetomidine (SLINGSBY et al., 2010, p. 166; MCSWEENEY et al., 2012, p. 411) based on its ability to reverse of its analgesic and sedative effects, with the use of atipamezole; while fentanyl was chosen, as the opioid for trans-surgical analgesic rescue, due to its short half-life and minimal analgesic residue, thus avoiding interference in postoperative pain evaluation (BRADBROOK; CLARK, 2018, p. 63).

Although the physiological parameters were not statistically different between the groups, cats belonging to the IPG presented the lower HR values during the moments of greater painful stimulus, related to the traction and cauterization of the ovarian pedicles. Monitoring of cardiopulmonary variables is recommended in cats submitted to long-term laparoscopic procedures (SHIH et al., 2015 p. 03). The number of analgesic rescues in this group was similar to CAVOG, and lower than those received by animals of the ING. This is a response of the ascending afferent block promoted by the techniques, which interferes with the conduction of the ionic channels of the ovarian nerves, that receives sympathetic fibers of the caudal intermesenteric and mesenteric plexus and parasympathetic fibers of the vagus nerve (ZILBERSTEIN et al., 2008, p. 214).

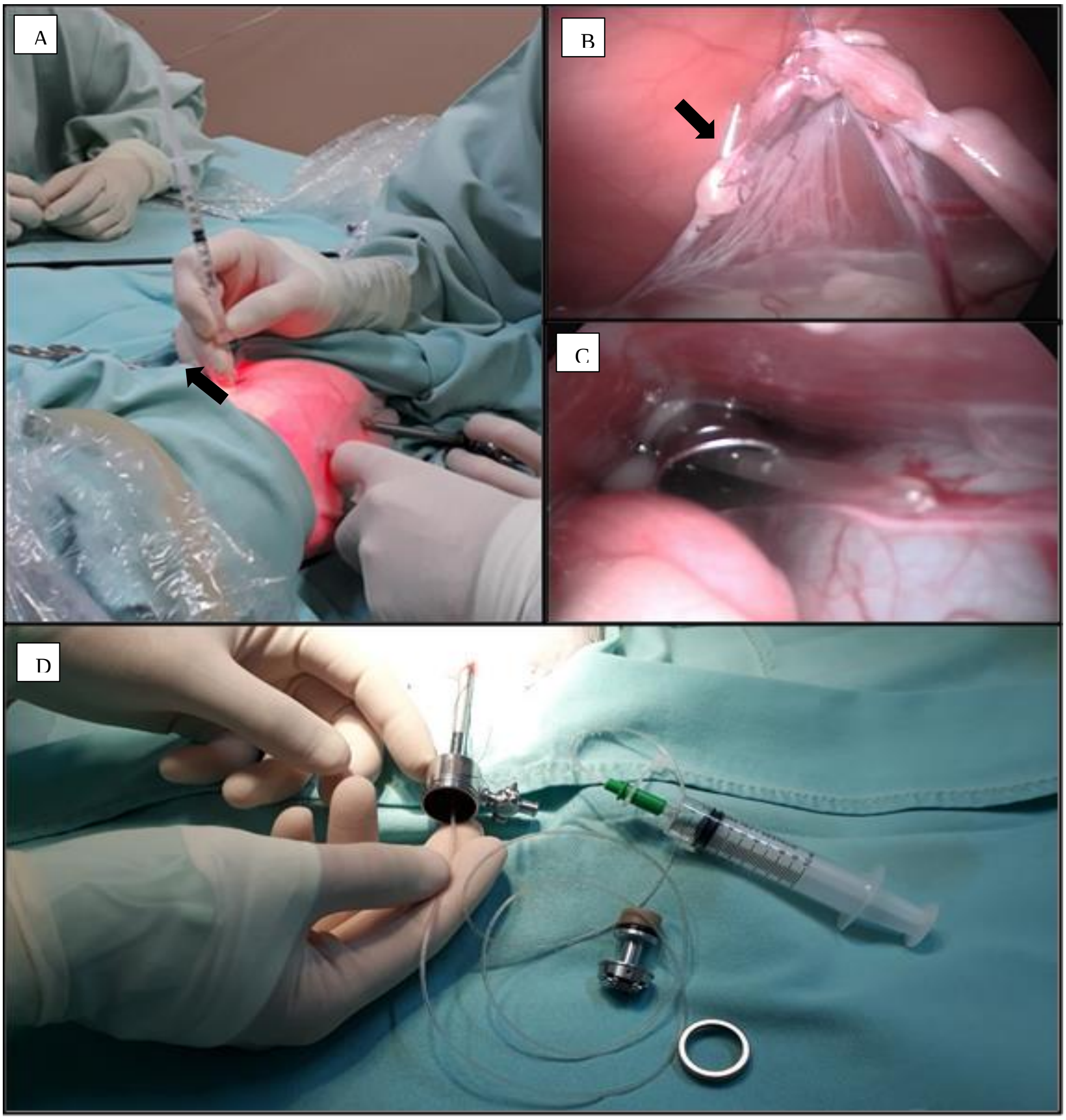

Figure 2 - Example of local infiltration techniques for surgical analgesia. Use of lidocaine to infiltrate the ovarian pedicle with a 24 G catheter (arrow) coupled to a 1 ml syringe, external (A) and internal view (B). (C) Use of intraperitoneal block with lidocaine with No. 8 nasogastric catheter and 10 ml syringe. Internal (C) and (D) external view of the catheter used to instillation of intraperitoneal anesthetic (Source: the authors)

As laparoscopic techniques substantially reduce tissue injury (COISMAN et al., 2014, p. 38; VAN NIMWEGEN; KIRPENSTEIJN, 2007, p. 397), it is accepted that pneumoperitoneum is one of the main factors leading to sympathetic stimulation, generating increases in HR and RR (ÖZDEMIR et al., 2016, p. 2058). In this sense, intraperitoneal blockage allowed relevant decrease of the stimulus generated by distension of the abdominal cavity and the intrinsic irritant effect of CO2. Several studies point out the considerable advantages that this technique brings, in the context of laparoscopic surgeries, in humans, promoting low postoperative pain scores, decreased use of opioids in anesthetic protocols and better quality of recovery (DUFFIELD et al., 2018, p. 1213; MACFATER et al., 2018, p. 3113).

In dogs, the use and advantages attributed to the intraperitoneal blockade technique with local anesthetics have already been documented, promoting lower pain scores than those achieved in placebo groups, but without reaching levels of statistical significance, similar to our present study (CARPENTER et al., 2004, p. 48; LAMBERTINI et al., 2018, p. 867). In a study conducted in felines submitted to OVH, it was proved that the use of IP anesthesia administered in combination with buprenorphine result in similar pain scores and need for rescue analgesia when compared to buprenorphine and meloxicam, and in lower pain scores than buprenorphine alone (BENITO et al., 2016a, p. 911). This evidence an important role of local anesthetic in the multimodal analgesia protocol, as observed in this study.

Although the IPG presented positive attributes during the transoperative period, the response to pain was not similar during the evaluation after the surgical procedure, since this was the group that received the highest number of analgesic rescues after surgery (60%). It is noteworthy that it also reached statistically higher pain scores than CAVOG in the second hour after extubation (T2), through CMPS-F (p=0.045) and in the third hour of evaluation (T3) through VAS (p=0.041).

As already mentioned, the anesthetic mechanism seems to be linked to the creation of transient chemical block of the afferent vagal pathways (SHAH et al., 2018, p. 81). However, once intraperitoneal bolus is administered, levels of local anesthetic can be found in plasma in two to four minutes (KAHOKHER et al., 2011, p. 34). In addition, it exists the fact that in felines, lidocaine has an intermediate duration of action, approximately 60 to 90 minutes (THOMASY et al., 2005, p. 1164), in addition to a larger absorption surface. Thus, it is expected that the anesthetic effect of the technique, is less consistent in the post-surgical period, and only indicated for short-term analgesia, as suggested by WILSON et al., (2004, p. 108).

The trends observed in physiological parameters, as well as the need for supplementary analgesia during the surgical procedure of cats belonging to CAVOG, were statistically similar to those found in IPG. Furthermore, the number of analgesic rescues in the post-surgical period was lower than the IPG and similar to the CG, and this technique could be considered appropriate in a multimodal analgesia protocol of laparoscopic procedures in cats. According to the authors' knowledge, there is no evidence in the literature of the use of peritoneal lidocaine instillation in laparoscopic procedures in felines, nor of its comparison with other analgesic techniques. No complications have been reported during or after the surgical procedure.

Carpenter et al (2004, p. 51) conducted a comparative study of the analgesic and anesthetic effect of lidocaine versus bupivacaine intraperitoneally in dogs. In this study, was observed intermedium efficacy with the use of lidocaine, still without statistical significance, when evaluated by subjective pain scales. Although not superior to the efficacy of bupivacaine, the authors indicated the use of lidocaine in reproductive system surgical procedures.

Considering that the highest index of transoperative analgesic rescue, occurred in the ING, it can be assumed that this treatment was not efficient enough to maintain physiological parameters in the moments correlated with greater autonomic stimulation, that is, the step of hemostasis of ovarian pedicles. The same can be associated with the absence of direct (CAVOG) or indirect (IPG) blockage of the nociceptive stimulus in the nerve fibers of the ovaries and even the distension of the abdominal wall and visceral ischemia associated with pneumoperitoneum. The results of this study are comparable to those found by Vicente and Bergström, (2018, p. 925), which investigated the differences in the analgesic effect of lidocaine or the association of lidocaine with bupivacaine in the incision of cats submitted to OVH, where 43% and 44% of the animals, from the respective groups, required additional doses of propofol, due to increases in physiological parameters in the preoperative period, interpreted as autonomic stimulus.

In this study, no animal belonging to the ING received analgesic rescue in the post-surgery, considering this fact of clinical relevance, although no level of statistical significance was reached among the different treatment groups (p=0.205). Eoh et al (2018, p. 3) developed a retrospective study in humans, evaluating the analgesic effect of incisional blockade at the access point of portals in laparoscopic surgeries during the postoperative period. When comparing with the negative control group, where no analgesic treatment was administered at the incision, they demonstrated the usefulness of the blockade when faced with significantly lower pain scores in the group treated with incisional lidocaine.

In view of the time of action of lidocaine, this effect cannot be exclusively explained by the presence of local anesthetic in the tissue since pain reduction was evident beyond this time. However, the greater efficacy of pain relief, of a local infiltration of lidocaine, could be attributed to inhibition of central sensitization and hyperalgesia (KAHOKEHR et al., 2011, p. 34) since the administration of the anesthetic agent occurred prior to the surgical procedure. Lidocaine infiltration in local tissues has as advantages the efficacy in the resolution of early postoperative pain, its simplicity to use, its safe and low cost, which is important especially in cases where the value of the procedure is a concern (EOH et al., 2018, p. 4; MICHALOLIAKOU et al., 1996, p. 50).

The administration of methadone, as analgesic rescue, promoted satisfactory analgesia in all animals. The anesthetic and analgesic protocols provided adequate analgesia in the post-surgical period of the cats, and there were no short-term complications during the evaluation period of the study. However, this study presented some limitations, such as the number of individuals included in the experiment. It is deemed that a larger sample number would allow greater statistical reliability. In addition, plasma levels of the anesthetic agent were not measured in order to be associated with the level of analgesia promoted and the duration of the effect.

In conclusion, our study has demonstrated that intraperitoneal administration of lidocaine is a useful technique to reduce trans-surgical pain, while the use of incisional infiltration with this medication improves early postoperative pain in cat laparoscopies. No relevant limitations were found in the use of the anesthetic techniques evaluated.

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References

BATESON, P. Assessment of pain in animals. **Animal Behavior**, v. 42, n. 5, p. 827-839, 1991.

BELL, A. The neurobiology of acute pain. **The Veterinary Journal**, 237, p. 55-62, 2018.

BENITO, J.; MONTEIRO, B. P.; BEAUDRY, F.; LAVOIE, A. M.; LASCELLES, B. D. X.; STEAGALL, P. V. Pharmacokinetics of bupivacaine after intraperitoneal administration to cats undergoing ovariohysterectomy. **American Journal of Veterinary Research**, v. 77, n. 6, p. 641-645, 2016b.

BENITO, J.; MONTEIRO, B.; BEAUDRY, F.; STEAGALL, P. Efficacy and pharmacokinetics of bupivacaine with epinephrine or dexmedetomidine after intraperitoneal administration in cats undergoing ovariohysterectomy. **Canadian Journal of Veterinary Research**, v. 82, n. 2, p. 124-130, 2018.

BENITO, J.; MONTEIRO, B.; LAVOIE, A. M.; BEAUCHAMP, G.; LASCELLES, B. D. X.; STEAGALL, P. V. Analgesic efficacy of intraperitoneal administration of bupivacaine in cats. **Journal of Feline Medicine and Surgery**, v. 18, n. 11, p. 906-912, 2016a.

BRADBROOK, C.; CLARK, L. State of the art analgesia - Recent developments pharmacological approaches to acute pain management in dogs and cats: part 2. **The Veterinary Journal**, 236, p. 62-67, 2018.

BRONDANI, J. T.; LUNA, S. P. L.; PADOVANI, C. R. Refinement and initial validation of a multidimensional composite scale for use in assessing acute postoperative pain in cats. **American Journal of Veterinary Research**, v. 72, n. 2, p. 174-183, 2011.

CAMPAGNOL, D.; TEIXEIRA-NETO, F. J.; MONTEIRO, E. R.; RESTITUTTI, F.; MINTO, B. W. Effect of intraperitoneal or incisional bupivacaine on pain and the analgesic requirement after ovariohysterectomy in dogs. **Veterinary Anaesthesia and Analgesia**, v. 39, n. 4, p. 426-430, 2012.

CARPENTER, R. E.; WILSON, D. V.; EVANS, A. T. Evaluation of intraperitoneal and incisional lidocaine or bupivacaine for analgesia following ovariohysterectomy in the dog. **Veterinary Anaesthesia and Analgesia**, v. 31, n. 1, p. 46-52, 2004.

COISMAN, J. G.; CASE, J. B.; SHIH, A.; HARRISON, K.; ISAZA, N.; ELLISON, G. Comparison of surgical variables in cats undergoing single-incision laparoscopic ovariectomy using a LigaSure or extracorporeal suture versus open ovariectomy. **Veterinary Surgery**, v. 43, n. 1, p. 38-44, 2014.

DUFFIELD, J. A.; THOMAS, M. L.; MOORE, J. W.; HUNTER, R. A.; WOOD, C.; GENTILI, S.; LEWIS, M. Intraperitoneal local anesthetic instillation and postoperative infusion improves functional recovery following colectomy: a randomized controlled trial. **Diseases of the Colon & Rectum**, v. 61, n. 10, 1205-1216, 2018.

EOH, K. J.; LEE, J. Y.; NAM, E. J.; KIM, S.; KIM, Y. T.; KIM, S. W. Periumbilical infiltration of lidocaine with epinephrine for postoperative pain reduction in single-port laparoscopic adnexal surgery. **Journal of Obstetrics and Gynecology**, v. 0, n. 0, p. 1-5, 2018.

EPSTEIN, M.; RODAN, I.; GRIFFENHAGEN, G.; KADRLIK, J.; PETTY, M.; ROBERTSON, S.; SIMPSON, W. Pain management guidelines for dogs and cats. **Journal of the American Animal Hospital Association**, v. 51, n. 2, p. 67-84, 2015.

HOLDEN, E.; CALVO, G.; COLLINS, M.; BELL, A.; REID, J.; SCOTT, E. M.; NOLAN, A. M. Evaluation of facial expression in acute pain in cats. **Journal of Small Animal Practice**, v. 55, n. 12, p. 615-621, 2014.

KAHOKEHR, A.; SAMMOUR, T.; SRINIVASA, S.; HILL, A. G. Systematic review and meta-analysis of intraperitoneal local anaesthetic for pain reduction after laparoscopic gastric procedures. **BJS Society**, v. 98, n. 1, p. 29-36, 2011.

LAMBERTINI, C.; KLUGE, K.; LANZA-PEREA, M.; BRUHL-DAY, R.; GUERRERO, K. S. K. Comparison of intraperitoneal ropivacaine and bupivacaine for postoperative analgesia in dogs undergoing ovariohysterectomy. **Veterinary Anaesthesia and Analgesia**, v. 45, n. 6, p. 865-870, 2018.

MACFATER, W. S.; XIA, W.; BARAZANCHI, A.; SU’A, B.; SVIRSKIS, D.; HILL, A. G. Intravenous local anaesthetic compared with intraperitoneal local anaesthetic in abdominal surgery: a systematic review. **World Journal of Surgery**, v. 42, n. 10, p. 3112-3119, 2018.

MCSWEENEY, P. M.; MARTIN, D. D.; RAMSEY, D. S.; MCKUSICK, B. C. Clinical efficacy and safety of dexmedetomidine used as a preanesthetic prior to general anesthesia in cats. **Journal of the American Veterinary Medical Association**, v. 240, n. 4, p. 404-412, 2012.

MICHALOLIAKOU, C.; CHUNG, F.; SHARMA, S. Preoperative multimodal analgesia facilitates recovery after ambulatory laparoscopic cholecystectomy. **Anesthesia & Analgesia**, v. 82, n. 1, p. 44, 1996.

ÖZDEMIR VAN BRUNSCHOT, D. M. D.; VAN LAARHOVEN, K. C. J. H. M.; SCHEFFER, G. J.; POUWELS, S.; WEVER, K. E.; WARLÉ, M. C. What is the evidence for the use of low-pressure pneumoperitoneum? a systematic review. **Surgical Endoscopy**, v. 30, n. 5, 2049-2065, 2016.

PEREIRA, M. A. A.; GONÇALVES, L. A.; EVANGELISTA, M. C.; THURLER, R. S.; CAMPOS, K. D.; FORMENTON, M. R.; PATRICIO, G. C. F.; MATERA, J. M.; AMBRÓSIO, A. M.; FANTONI, D. T. Postoperative pain and short-term complications after two elective sterilization techniques: ovariohysterectomy or ovariectomy in cats. **BMC Veterinary Research**, v. 14, n. 35, p. 1-7, 2018.

REID, J.; NOLAN, A. M.; SCOTT, E. M. Measuring pain in dogs and cats using structured behavioural observation. **The Veterinary Journal**, 236, p. 72-79, 2018.

REID, J.; SCOTT, E. M.; CALVO, G.; NOLAN, A. M. Definitive Glasgow acute pain scale for cats: validation and intervention level. **Veterinary Record**, v. 180, n. 18, p. 449-449, 2017.

ROBERTSON, S. How do we know they hurt? Assessing acute pain in cats. **In Practice**, v. 40, n. 10, 440-448, 2018.

SHAH, J.; VOTTA-VELIS, E. G.; BORGEAT, A. New local anesthetics. **Best Practice & Research Clinical Anaesthesiology**, v. 32, n. 2, p. 179-185, 2018.

SHIH, A. C.; CASE, J. B.; COISMAN, J. G.; ISAZA, N. M.; AMORA-JUNIOR, D.; MAISENBACHER, H. W. Cardiopulmonary effects of laparoscopic ovariectomy of variable duration in cats. **Veterinary Surgery**, v. 44, n. S1, p. 2-6, 2015.

SLINGSBY, L. S.; MURRELL, J. C.; TAYLOR, P. M. Combination of dexmedetomidine with buprenorphine enhances the antinociceptive effect to a thermal stimulus in the cat compared with either agent alone. **Veterinary Anaesthesia and Analgesia**, v. 37, n. 2, p. 162-170, 2010.

STEAGALL, P. V. M.; BENITO, J.; MONTEIRO, B.; LASCELLES, D.; KRONEN, P. W.; MURRELL, J. C.; ROBERTSON, S.; WRIGHT, B.; YAMASHITA, K. Intraperitoneal and incisional analgesia in small animals: simple, cost-effective techniques. **Journal of Small Animal Practice**, v. 61, n. 1, p. 19-23, 2019.

THOMASY, S. M.; PYPENDOP, B. H.; ILKIW, J. E.; STANLEY, S. D. Pharmacokinetics of lidocaine and its active metabolite, monoethylglycinexylidide, after intravenous administration of lidocaine to awake and isoflurane-anesthetized cats. **American Journal of Veterinary Research**, v. 66, n. 7, p. 1162-1166, 2005.

VAN NIMWEGEN, S. A.; KIRPENSTEIJN, J. Laparoscopic ovariectomy in cats: comparison of laser and bipolar electrocoagulation. **Journal of Feline Medicine and Surgery**, v. 9, n. 5, p. 397-403, 2007.

VICENTE, D.; BERGSTRÖM, A. Evaluation of intraoperative analgesia provided by incisional lidocaine and bupivacaine in cats undergoing ovariohysterectomy. **Journal of Feline Medicine and Surgery**, v. 20, n. 10, p. 922-927, 2018.

WILLIAMS, A. C. de C.; CRAIG, K. D. Updating the definition of pain. **Pain**, v. 157, n. 11, p. 2420, 2016.

WILSON, D. V.; BARNES, K. S.; HAUPTMAN, J. G. Pharmacokinetics of combined intraperitoneal and incisional lidocaine in the dog following ovariohysterectomy. **Journal of Veterinary Pharmacology and Therapeutics**, v. 27, n. 2, p. 105-109, 2004.

ZILBERSTEIN, L. F.; MOENS, Y. P.; LETERRIER, E. The effect of local anaesthesia on anaesthetic requirements for feline ovariectomy. **The Veterinary Journal**, v. 178, n. 2, p. 214-218, 2008.

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