

NYLON CLAMPS AND MONONYLON FOR OVARIOHYSTERECTOMY IN CATS

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ABSTRACT

Ovariohysterectomy is the most performed surgery in small animals, with the purpose of birth control, avoiding pseudocyesis as also treating female reproductive tract affections. Several surgery techniques have been described. Beyond the traditional midline approach to the abdomen, the flank and many laparoscopic approaches may be performed. Twenty-four healthy, mongrel and adult cats took part of the study. They were randomly distributed in four groups of six animals, this way: GI – midline approach and ligature with nylon thread; GII – midline approach and ligature with nylon clamp; GIII – flank approach and ligature with nylon thread and GIV – flank approach and ligature with nylon clamp. The times of diuresis, ovariohysterectomy and closure were timed. Clinic evaluations were done at the day of the surgery and at 7 and 28 days after it. The results revealed that the midline approach was significantly faster than the flank approach. The ligature time of the pedicles and uterus body, as the total surgery time were statistically shorter for the groups that used the nylon clamp. We also observed a higher incidence of edema in the groups of midline approach at the seventh day after surgery, however at the twenty-eighth day after surgery, all the wounds healed equally. We concluded that the nylon clamps were secure to be use in cats' ovariohysterectomies. Also, the flank approach takes more time to be performed than the midline one. The incidence of edema is considerable higher in the groups of midline access.

KEYWORDS: clamps, celiotomy, surgery, feline, OSH

BRAÇADEIRA DE POLIAMIDA E FIO DE NÁILON NA OVÁRIO-HISTERECTOMIA EM GATAS

RESUMO

A ovário-histerectomia representa um dos procedimentos mais realizados pela clínica de pequenos animais, tendo por finalidade o controle da natalidade, prevenção de cio e pseudogestação, como também, tratar afecções do trato reprodutor feminino. Foram descritas muitas variações de técnicas de ovário-

histerectomia, incluindo, além da tradicional abordagem pela linha média, abordagem pelo flanco e diversas abordagens laparoscópicas. Participaram, no presente estudo, 24 gatas híidas, sem raça definida, adultas, atendidos no Hospital Veterinário da Universidade federal de Goiás. As gatas foram distribuídas aleatoriamente em quatro grupos de seis animais para a realização do procedimento cirúrgico, da seguinte forma: Grupo I - acesso pela linha média e ligadura com fio de náilon; Grupo II - acesso pela linha média e ligadura com braçadeira de náilon; Grupo III - acesso pelo flanco e ligadura com fio de náilon e Grupo IV - acesso pelo flanco e ligadura com braçadeira de náilon. Durante os procedimentos foram cronometrados os tempos de diérese, da ovário-histerectomia em si e de síntese. Avaliações clínicas foram feitas aos sete e 28 dias após a cirurgia. Avaliações ultrassonográficas foram realizadas em quatro tempos: antes da cirurgia, imediatamente após, aos sete e aos 28 dias, com intuito de verificar possíveis alterações relativas aos materiais empregados. Os resultados mostraram que o acesso pela linha média foi significativamente mais rápido que pelo flanco. O tempo de ligadura dos pedículos e corpo uterino, assim como o tempo total da cirurgia, foram estatisticamente inferiores nos grupos onde a braçadeira foi empregada. Observou-se maior incidência de edema no grupo de animais onde o acesso foi pela linha média aos sete dias, entretanto aos 28 dias todas as incisões já haviam cicatrizado. As conclusões indicam que as braçadeiras constituem dispositivos seguros, que podem ser utilizados na OHE em gatas. O acesso pelo flanco é, significativamente, mais demorado que pela linha média. Ainda, a incidência de edema foi consideravelmente maior nos grupos em que o acesso à cavidade foi feito pela linha média.

PALAVRAS-CHAVE: braçadeiras, celiotomia, cirurgia, felino, OHE

INTRODUCTION

In Brazil, due to the absence of effective public policies of population control, thousands of dogs and cats are born every day causing overcrowding that prints significant adverse impacts on the social, economic, and health fields. So, in an attempt to control the amount of animals, especially in urban areas, many animals are captured, imprisoned and euthanized. Mindful about the inefficacy of this measure, some urban centers worldwide have adopted surgical sterilization as a form of euthanasia consorting prevention, little socially acceptable, and the optimization of financial resources allocated for this purpose (FARIA et al., 2005).

According to ROBERTSON (2008), it is estimated that there are over 200 million worldwide pet cats. In the United States, China and many European countries, the number of cats exceeds that of dogs, greatly increasing the need for methods of birth control. In this sense, ovariohysterectomy is one of the most commonly performed procedures in small animals, in order to control the population, beyond the estrus and pseudopregnancy prevention (OLIVEIRA, 2007; SCHIOCHET et al., 2007; TROMPOWSKY et al., 2007) and, in some countries, in addition, the method aims to reduce the number of animals that are euthanized by enabling a subsequent adoption (NELSON & COUTO, 1998). Furthermore, the ovariohysterectomy constitutes the procedure of choice for therapy of diseases of the reproductive tract (CASTRO et al. 2004; MALM et al., 2004 and TROMPOWSKY et al. 2007).

FINGLAND (1996), HEDLUND (2005) and STONE (2007) consider other reasons for performing ovariohysterectomy including preventing mammary tumors or

congenital anomalies; prevention or treatment of pyometra, metritis, cancers (ovarian, uterine or vaginal), cysts, trauma, uterine torsion, uterine prolapse, vaginal prolapse, vaginal hyperplasia and the control of some endocrine abnormalities (diabetes mellitus and epilepsy) and skin diseases (eg, generalized demodicosis). In cats, there are few potential complications related to ovariohysterectomy described in the veterinary literature, and such complications occur most commonly in animals of the canine species (KUAN et al., 2010).

The usual age for castration of dogs and cats is around six months, immediately before the first estrus. There are reports that in some shelters from animal protection societies, pups (both dogs and cats) were castrated between eight and 12 weeks of age, with no reports of adverse effects. However, after pretty early ovariohysterectomy, there may be greater potential for hypoplasia of the vagina and vulva, coursing with perivulvar dermatitis. Another potential side effect is the persistence of juvenile behavior, especially unwelcome in some breeds of dogs (STONE, 2007).

There are many variations of ovariohysterectomy techniques described including, besides the traditional approach by midline, the flank approach and various laparoscopic ones (HEDLUND, 2005). The flank access to the abdominal cavity is more commonly used in cats due to the anatomical considerations. The cats have a body shape that makes the approach to the abdomen relatively easier. The thin and flexible abdominal muscles of the flank region facilitate the dissection and as a result, there is minimal bleeding, when compared with those dogs that have the abdominal wall muscles thicker. Accessing the contra lateral ovary in cats is relatively easy because the abdominal width is more narrow, particularly compared to the dogs (KRZACZYNSKI, 1974; MCGRATH et al. 2004).

Hemostasis is an important moment during any surgical procedure. Methods to control surgical bleeding can be performed in small vessels, by clamping, twisting and pinching or by electro coagulation. For medium and large caliber vessels there's always the possibility to use transfixation ligatures, coagulation or even diathermy (ROVERE et al., 2007).

The ligatures have been held for more than 4,000 years, through the use of various materials ranging from linen, silk and intestines of sheep to the current synthetic materials. Nylon adjustable clamps can be used for permanent hemostasis, with good occlusion of the vascular pedicles and with great advantages such as low cost and by not requiring any specific device for the application and fixation (ROVERE et al., 2007).

The nylon clamps are a viable alternative to vascular occlusion, which provides safe and effective definitive hemostasis, considerable reduction of surgical time and leading to the reduction of the operating costs (CASTRO et al., 2004; SILVA et al., 2004; SILVA et al., 2006, MIRANDA et al., 2006; ROVERE et al. 2007; RABELO et al. 2008; SILVA et al., 2009). Although these aspects are relevant in the feasibility of population control programs, it seems that the use of the method requires further studies to substantiate its applicability.

The choice of feline species for this study is due to the substantial increase in the population in the recent years and, consequently, its importance for the animal surgery routine. The nylon clamps can be excellent alternative to ligation of the arteriovenous ovarian complex during ovariohysterectomies in cats, providing safety and low cost to the process. The surgical approach may represent an important role

in the total time of surgery, so there's the need to compare the traditional access (midline) to other one (flank) which, ally to safer and faster forms of ligature. The aim of the study was to evaluate the use of nylon clamps as to provide hemostasis during the ligation of the ovarian arteriovenous complex during the ovariohysterectomy in cats, subjected to two different surgical approaches.

MATERIAL AND METHODS

This study was carried out at the Veterinary and Animal Sciences Federal University of Goiás (FUG)-Brazil in the period from July to September of 2011 after submission and approval by the Ethics and Research committee of the FUG, protocol number 45/2011.

Animals

Twenty-four mongrel adult cats, weighing between 2 kg and 5 kg were selected for the study after the normal healthiness verified, through clinical and laboratory tests conducted at the Veterinary Hospital of the Federal University of Goiás

Experimental Groups

The cats were randomly assigned to four groups of six animals for surgical procedures in four steps, with an interval of seven days between each. The team involved in the procedures was always the same, without changing any components. All procedures and post-operative data were similar between groups, with varying access and surgical ligation of the ovarian pedicles and uterine stumps, as follows:

- Group I (GI): Abdominal access trough the midline and ligatures with monofilament nylon
- Group II (GII): Abdominal access the trough the midline and ligatures with nylon clamp
- Group (GIII): Abdominal access trough the flank and ligatures with monofilament nylon
- Group IV (GIV): Abdominal access trough the flank and ligatures with nylon clamp

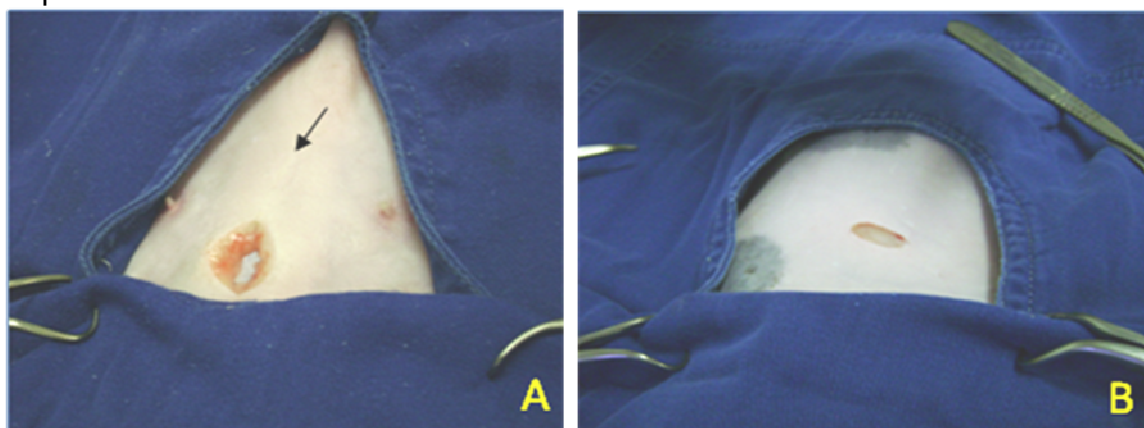


FIGURE1 – Drapes prepared to carry out two accesses for ovariohysterectomy in cats: (A) ventral midline incision, approximately 3 cm caudal to the navel (arrow); (B) right flank incision.

Clamps

For the study, ribbon type colorless nylon (polyamide) clamps were used. The dimensions were of 2.5 mmx100mm and they were sterilized in packs of four units through autoclaving system (COSTA NETO et al., 2009).

Preoperative and Anesthetic

Laboratory tests were made to confirm the health status of the animals. They included blood count, serum levels of creatinine, alanine aminotransferase (ALT) and total proteins, three days before each surgical procedure. Hydric and feeding fasting of six and 12 hours, respectively, were instituted for all of the animals in the experiment.

On the surgery day, the animals were weighed and subsequently underwent premedication, which was composed by the combination of 10 mg/kg of ketamine 0,3 mg/kg of midazolam and 5mg/kg of meperidine, all in the same syringe. The shaving was performed 15 minutes after administration of premedication. In cats from groups I and II the trichotomy extended ventrally, from the xiphoid to the pubis, and about five centimeters laterally to each mammary chain. In groups III and IV the trichotomy also extended to the region of the right flank.

After shaving, the cephalic vein was punctured through the use of flexible venous catheter 24G and 5 mL/kg/h of ringer lactate were administrated. For induction, 3-5 mg/kg of propofol were administrated intravenously. When the laryngotracheal reflection loss occurred, the animals were intubated with an endotracheal tube appropriate to the anatomic conformation of each one. The maintenance of the anesthesia was performed with isoflurane vaporized with 100% oxygen in an open circuit.

After adequate anesthesia surgical plan, the animals from groups I and II were positioned in dorsal recumbence, while the animals from groups III and IV were placed in the left lateral recumbence.

The previous antisepsis was performed with 2% gluconate of chlorhexidine in three applications. After the final antisepsis, with three consecutive applications of 2% gluconate of chlorhexidine and the last one with 70% alcohol, the drapes were placed.

Drug therapy consisted of 8mg/kg of sodium cefovecin, administered as a single dose via SC; 0,2 mg/kg of meloxicam and 2mg/kg of tramadol hydrochloride, all intravenously. The surgical wound was cleaned with NaCl 0.9% solution and rifamycin spray was sprayed. Finally, the wound was covered with sterile gauze and hold to the skin with tape.

Surgical times

During the procedures the dieresis (access to the cavity and identification of structures), ovariohysterectomy (the surgical procedures and hemostasis maneuvers, when necessary) and synthesis (from the laparotomy up to the last skin stitch) times were timed. So that, in the end, it was possible to estimate the steps of the procedure taken, as well as the total time. The dieresis and synthesis times were determined for the comparison between groups that differed from the surgical access (midline or flank). So the animals from GI and GII and the animals from GIII and GIV were grouped into two major experimental groups, with 12 animals on each. The time of OHE was timed with the aim of comparing the material used for vessel ligation

(nylon or nylon clamp) and, therefore, the animals of GI and GIII and animals in groups GII and GIV were grouped into two large experimental groups who had 12 samples.

At the end, all of the times were added together to determine the total time average for each surgery group (GI, GII, GIII, and GIV) and a subsequent comparison would help to determine which technique would be faster.

Postoperative

The medical prescriptions were based on 0,1 mg/kg of Meloxicam orally, every 24 hours, for three days. There was no need to administer antibiotics during the postoperative period, since the effect of the antibiotic used in the peri-operative lasted for 14 days. Rifamycin was indicated after the wound cleaning, twice a day, until the removal of the stitches, that occurred at the seventh day elapsed surgery. It was recommended constant use of Elizabethan collar, until the stitches were removed.

Clinical evaluation

Clinical assessments were made on the day of surgery (before and after the procedure), at seventh and at the 28th days postoperatively. We evaluated the following physiological parameters: heart rate, respiratory rate, mucous membrane color, capillary refill time and rectal temperature. A questionnaire about the behavior of the animal, feeding, drinking and elimination of feces and urine was given.

The surgical wounds were evaluated at three time points: immediately after surgery (D0), seven days after surgery (D7) and 28 days (D28). The animals were divided into two groups regarding the type of access to the abdominal cavity (midline or flank). The evaluation was based on incision size (in cm) and on the appearance of the lesion. The wound evaluations, about the appearance, included: presence or absence of wound secretion, presence or absence of edema and the presence or absence of dehiscence.

Statistical Analysis

To evaluate the surgical times between groups, the ANOVA was performed, complemented by the Multiple Comparisons Tukey Test, setting up 5% ($p < 0.05$) as level of rejection of the null hypothesis, and the values of greater significance were marked with an asterisk (SCHIOCHET, 2006). The determination of the total time of surgery, comparing the four groups was performed by the analysis of variance also complemented by Kruskal-Wallis. The Fisher's exact test and the Odds ratio were used to compare the healing quality of the surgical wounds.

RESULTS

Synthesis and dieresis times

The synthesis and the dieresis times were timed and their means and standard deviations represented are, in minutes, in Table 1.

TABLE 1 – Means of the dieresis and synthesis times of cats undergoing ovariohysterectomy, by two different approaches (ventral midline - GI and GII or flank - GIII and GIV).

Group	Dieresis time (min)		Synthesis time (min)	
	Mean	SD	Mean	SD
Midline (GI e GII)	1,88*	0,42	8,02*	1,05
Flanc (GIII e GIV)	3,61*	0,84	9,27*	1,4

* indicates, by applying the Tukey test, significant differences between groups, with $p < 0.05$.

It was observed that there was a significant difference for the dieresis time mean between the midline and flank groups, demonstrating that the flank dieresis was statistically longer than the midline one. Similarly, the observation of the table for the synthesis time, indicated that there was a significant difference between the groups, showing that the group submitted to the midline access had a mean time faster than the group that underwent flank access.

Material for pedicle and uterine body ligation

We evaluated two different materials for the arteriovenous ovarian complex and uterine body ligations of 24 cats, which were divided into two groups. The results are shown in Table 2.

TABLE 2 – Mean times of ovariohysterectomy using two different materials for the arteriovenous ovarian complex and uterine body ligation (monofilament nylon - GI and GIII or nylon clamp - GII and GIV)

Group	Ovariohysterectomy time (min)	
	Média	SD
Nylon (GI e GIII)	13,71*	2,69
Nylon clamp (GII e GIV)	9,87*	2,78

* indicates, by applying the Tukey test, significant differences between groups, with $p < 0.01$.

The statistical analysis indicated that surgical procedures employing clamps were significantly performed in a shorter time when compared to those ones that employed nylon. There was no noticeable difficulty in positioning the clamps or even to move the braking system. Also, there was no need to apply more than one clamp for each ligature. One clamp broke during the positioning, but it was promptly replaced without further damage to the animal and without causing bleeding.

No significant bleeding occurred in any of the animals and there was requirement to perform any emergency hemostatic maneuvers. The amount of blood lost in the procedures was seen as normal, when compared to other procedures already performed previously in other animals, by the same surgeon.

Apparently, the autoclaving caused no conformational damage to the clamp system and promoted sufficient sterilization to prevent the trans and postoperative infection. However, no resistance tests were performed in the clamps.

Total time of surgery

The total time of surgery was obtained by summing the dieresis, the ovariohysterectomy itself and the synthesis times. Means are listed in Table 3.

TABLE 3 – Mean of total time of surgery (including dieresis, ovariohysterectomy and synthesis) of 24 cats submitted to surgical procedures accessed by midline or flank and whose ligatures materials included monofilamentar nylon or nylon clamp.

Group	Total surgery Time (min)	
	Mean	SD
GI (midline and nylon)	25,42 ^a	3,58
GII (midline and nylon clamp)	20,85 ^b	2,76
GIII (flank and nylon)	25,14 ^a	2,43
GIV (flank and nylon clamp)	20,22 ^b	2,38

Same letters do not differ significantly by Kruskal-Wallis test, $p < 0.05$.

Statistical analysis showed a significant difference among GI-GII, GI-GIV, GIII-GII and GIII-GIV. However there was no significant difference between GI –GIII and GII-GIV. Thus, the results indicated that the total time of surgery that used the clamps nylon as ligation material for arteriovenous ovarian complex and uterine body was lower than the total time of surgery that used monofilamentar nylon for the same purpose. Another observation made was that access to the abdominal cavity did not influence the total time of surgery.

Surgical wound evaluation

All wounds were evaluated about the incision size, measured through the use of a caliper. The mean sizes of the incisions are disposed in Table 4.

TABLE 4 – Mean sizes of surgical wounds and incisions, in cm, on the day of surgery and at seven and 28 days after surgery.

Incision size (cm)	Day 0		Day 7		Day 28	
	Mean	SD	Mean	SD	Mean	SD
Midline (GI e GII)	2,6	0,46	2,3	0,43	2,3	0,32
Flanc (GIII e GIV)	2,5	0,42	2,1	0,43	2,2	0,42

Analysis of variance complemented by the Test for multiple comparisons of Tukey.

According to the statistical test recommended, there were no significant differences between the experimental groups, in any of the days when the wounds were evaluated.

Another evaluation of the surgical wounds occurred by the occurrence of secretion presence or absence, edema or suture dehiscence, whole or in part. Table 5 shows the distribution of the occurrences of secretion seven days after the surgery,

between the groups. We observed the same occurrence between the groups so that, according to the statistical tests, there were no differences between groups.

TABLE 5 – Secretion incidence on the wounds of 24 cats submitted to ovariohysterectomy, through flank or midline approaches.

Groups	Presence of secretion	
	Present	Abscent
Midline	1 (8,3%)	11 (91,6%)
Flanc	1 (8,3%)	11 (91,6%)

Fisher Exact Test

The occurrence of edema was observed and characterized as present or absent. Table 6 shows the numerical values and percentage of this change occurrence.

TABLE 6 – Edema incidence on the wounds of 24 cats submitted to ovariohysterectomy, through flank or midline approaches.

Groups	Edema		(p) Fisher	Odds Ratio	(p) Odds
	Present	Abscent			
Midline	11 (91,6%)*	1 (8,3%)*	0,0001	121	0,002
Flanc	1 (8,3%)*	11 (91,6%)*			

Fisher Exact Test and Odds Ratio

Edema occurred in 11 of the 12 animals from the midline access, whereas this change was seen in only one animal whose access was for the flank. The Fischer Exact Test indicated significant ($p > 0.01$) differences between the two groups. The odds ratio indicated that the probability of this change in the midline group access animals was 121 times higher than the probability of the same change in the flank access group.

The last change observed, related to the surgical wound, was the occurrence of partial or complete dehiscence of the suture. Table 7 presents numerical of values and percentages of such change.

TABLE 7 - Incidence of surgical wound dehiscence of 24 cats submitted to ovariohysterectomy, through midline or flank access.

Groups	Suture dehiscence		(p) Fisher	Odds Ratio	(p) Odds
	Present	Abscent			
Linha média	2 (16,6%)	10 (83,3%)	1	2,2	1
Flanco	1 (8,3%)	11 (91,6%)			

Fisher Exact Test and Odds Ratio

Two animals from midline group and one from the flank the by this postoperative change however, according to statistics held, there was no significant

differences between the groups. In the three cases of dehiscence, the owners confirmed that the animals remained for some time without the Elizabethan collar.

Clinical Evaluation of the animals

The animals were all clinically assessed at every return to the hospital. The tests included: heart rate, respiratory rate, mucous membrane color, capillary refill time and rectal temperature. All animals showed up fine, without any parameters changes. Even those ones who presented suture dehiscence remained within the normal physiologic parameters.

According to some owners, one animal from group GI, two animals from GII and one from GIV demonstrated restlessness within three days after the surgery but, at the removal of the stitches, all of them had normalized behavior.

Two animals from GII and one from GIII presented hyporexia during some days (2-5 days), however, at the return, they feeding normally.

DISCUSSION

Significant differences were observed in the times of diuresis and synthesis, indicating that the flank access takes longer to complete. COE et al. (2006) compared the time taken to access the abdominal cavity by midline or flank in cats undergoing elective ovariohysterectomy and found that the time from incision to the opening of the peritoneum was significantly higher in the flank, on the other hand, the uterus localization was significantly faster in the flank group, when compared to the midline one. MCGRATH et al. (2004) stated that in the flank incision, the ipsilateral ovary is located immediately below the point of incision, which facilitates its location, reducing the final surgical time.

The time of the ovariohysterectomy, sponsored by ligation of the uterine body and ovarian arteriovenous complexes and section, was significantly reduced in the group of animals that were the nylon clamp was used as a means of hemostasis. According to several authors, the nylon clamps appear to be promising devices for ovarian-hysterectomies and other surgeries that require vascular secure ligatures, reducing the operative time and proving to be inert inside the body (SORBELO et al., 1999 ; CASTRO et al., 2004; SILVA et al., 2004, CARRILLO et al., 2005; MIRANDA, et al., 2006; RABELO et al. 2008; SILVA et al., 2009).

Another important feature related to clamps is the low cost of the material. ROVERE et al. (2007) found that the nylon clamps are easy to use, induce minimal tissue reaction and have low cost. Still, they are safe forms of vascular pedicles ligatures larger than 3 mm in surgical interventions of the veterinary practice.

The main drawback mentioned regarding the use of nylon suture material is the poor malleability and poor knot security. So that, it should be avoided in blood vessels ligatures (BOOTHE, 1998; ROVERE et al. 2007). However, as noted by SORBELO et al. (1999) and RABELO et al. (2008), the irreversibility provided by the self-locking system of the nylon clamps promotes the progressive closure, preventing the structures' escape and securing the necessary hemostasis for the procedure safety. During the execution of the surgical procedures, there were no difficulties found to insert the stem clamp around the ovarian pedicle, through the rupture of the medial portion of the large ligament of the uterus, corroborating COSTA NETO et al. (2009)

statement, that admitted that its linear format and flexibility avoided the use of gripping instruments, which are often required surgical procedures.

It was observed that, for the clamp stem during the surgical procedure, it was necessary to use specific scissors to perform a more precise cutting. COSTA NETO et al. (2009) suggested scissors for cutting wires would be ideal. Also, they recommended that the cut should be made transversely to the longitudinal axis of the stem, immediately after its self-locking system.

We observed a reduction of the total time of surgical procedures in which clamps were used for hemostasis and ligation of the uterine body and ovarian pedicles. MALM et al. (2005), in a stress study, performed analysis of plasma cortisol in bitches undergoing ovariohysterectomies and found the elevation of cortisol (a pain indicator hormone) in proportion to the increase in the surgical time, which reiterates the necessity to search for techniques that reduce the surgical time, contributing to the animals' welfare.

The surgical wounds were evaluated about the size, presence of secretions, edema and suture dehiscence. The only statistically significant change was the higher incidence of edema at the site of midline incisions. KRZACZYNSKY (1974), DORN (1975), MCGRATH et al. (2004) and ADIN (2011) reported a better healing of the incisions performed at the flank, when compared to the midline ones. They relate a lower incidence of dehiscence, caused by the lack of pressure by the weight of the viscera. However, studies about the occurrence of edema at incision sites still should be conducted.

There were three cases of suture dehiscence were reported, two in the midline group and one in the flank group, but only one case of evisceration was found in an animal subjected to the midline incision. According to MCGRATH et al. (2004) and ADIN (2011), the main advantage described in relation to the lateral flank approach is a decreased incidence of evisceration, in case of dehiscence in the postoperative period. Also, according to ADIN (2011), another advantage is the possibility of observing the surgical wound at long range due to its location on the sidewall. These advantages are especially important when dealing with populations of homeless or wild animals. Opportunities to examine these animals after the procedure are very limited so, the exam, even performed distance from the animal, becomes essential. The flank incision allows visual access to the wound, without the need to deal with the animal, in contrast to what happens when the approach is performed by the midline.

MCGRATH et al. (2004) pointed out some disadvantages of the flank incision, which include: limited exposure of the contra lateral horn, especially in case of possible surgical complications, a certain degree of difficulty in locating the incisional scar and also the possibility of discoloration of hair in the region that went through the shaving process. Although mentioned, none of these changes was observed in the animals subjected to the flank approach.

Hemorrhages are classified as the most common complications that may happen during or after an ovariohysterectomy, (BURROW et al., 2005; WHITEHEAD, 2006; ADIN, 2011; PEETERS & KIRPENSTEIJN, 2011). According to the same authors the intra operative hemorrhage is commonly associated with the rupture of the right ovarian pedicle while trying to reach the suspensory ligament. This occurrence has been attributed to rough handling of delicate tissues caused, mainly, by inexperienced surgeons. In the present study, intra operative hemorrhage did not

constitute a complication, because it was not observed in any animal. The amount of blood lost during the procedures was considered small and no additional hemostasis maneuver was necessary. However, it was not possible to quantify the blood loss during the procedures performed. This quantification could provide more accurate data, in order to help choosing the best approach technique and even the best ligature materials for ovariohysterectomies.

The clinical evaluation results of the animals indicated that physiological parameters were not changed and fell within the reference values for the species, described as follows: heart rate, mucous membrane color for GAY & RADOSTITS (2002), respiratory by MCGORUM et al. (2002) and temperature by HOUSTON & RADOSTITS (2002). For this reason, it was not necessary to perform other exams in the postoperative period.

CONCLUSIONS

With the results obtained in this study, we conclude that both nylon clamps as monofilament nylon are devices that demonstrate safety, since we found no significant bleeding during or after the surgical procedures in cats undergoing elective ovariohysterectomies.

The times of diuresis and synthesis were significantly reduced in the groups undergoing ovariohysterectomies midline compared access flank.

The use of nylon clamps reduced the time of elective ovariohysterectomies performed in healthy cats, however the approach to the abdominal cavity did not affect the total time of the procedure.

REFERENCES

ADIN, C. A. Complications of ovariohysterectomy and orchiectomy in Companion Animals. **Veterinary Clinic of Small Animals**, Philadelphia, v. 41, p.1023-1039, 2011.

BOOTHE, H., W. Selecting Suture Materials for Small Animal Surgery. **Compendium of Continuous Education Practice**, New York, v. 20, p. 355-358, 1998.

BURROW, R.; BATCHELOR, D.; CRIPPS, P. Complications observed during and after ovariohysterectomy of 142 bitches at a veterinary teaching hospital. **Veterinary Record**, London, v. 157, n. 26, p. 829–33, 2005.

CARRILLO, J. M.; SOPENA, J. J.; RUBIO, M. Experimental study of the use of nylon-band in the resolution of rabbit oblique fractures. In: 8TH **WSAVA Congress; 37TH AVEPA Congress**, Sevilla, Spain, 2002, 259p.

CASTRO, R.D.; PACHALY, J.R.; MONTIANI– FERREIRA, F. Técnica alternativa para ligaduras vascular em massa na ováriohisterectomia em cadelas: relato

preliminar. **Arquivos de Ciências Veterinárias e Zoologia–UNIPAR**, Casacavel, v.7, n.2, p.44, 2004.

COE, R. J.; GRINT, N. J.; TIVERS, M. S.; HOTSTON MOORE, A.; HOLT P. E. Comparison of flank and midline approaches to the ovariohysterectomy of cats. **Veterinary Records**, London, v. 13, p. 464-467, 2006.

COSTA NETO, J. M.; TEIXEIRA, E. M.; FERREIRA FILHO, E. M.; TORÍBIO, J. M. M. L.; ALMEIDA FILHO, C. H. R.; MORAES, V. J. Braçadeiras de náilon para hemostasia preventiva na ovário-histerectomia em gatas. **Revista Brasileira de Saúde e Produção Animal**, Salvador, v. 10, n. 3, p.615-624, jul/set 2009.

DORN, A. S. Ovariohysterectomy by the flank approach. **Veterinary Medicine & Small Animal Clinician**, Bonner Springs, v. 70, n. 5, p.569–573, 1975.

FARIA, M. C.; ALMEIDA, F. M.; SERRÃO, M. L.; ALMEIDA, N. C.; LABARTHE, N. Use of cyanoacrylate in skin closure for ovariohysterectomy in a population control programme, **Journal of Feline Medicine and Surgery**. New South Wales, n. 7, p. 71-75, 2005.

FINGLAND, F. G. Ovário-histerectomia. In: BOJRAB, M. J. **Técnicas atuais em cirurgias de pequenos animais**. 3 ed. São Paulo: Roca, p. 375-381.1996.

GAY, C. C.; RADOSTITS, O. M. Exame clínico do sistema cardiovascular. In: RADOSTITS, O. M.; MATHEW, I. G.; HOUSTON, D. M. **Exame clínico e diagnóstico em veterinária**. 1. ed. Rio de Janeiro: Guanabara Koogan, Cap. 14, p. 191-226.2002.

HEDLUND, C. S.; Cirurgias dos sistemas reprodutivo e genital. In FOSSUM, T. W.; **Cirurgia de Pequenos Animais**. 2. ed. São Paulo: Roca, Cap. 28, p. 610-617. 2005.

HOUSTON, D. M.; RADOSTITS, O. M. O exame clínico. In: RADOSTITS, O. M.; MATHEW, I. G.; HOUSTON, D. M. **Exame clínico e diagnóstico em veterinária**. 1. ed. Rio de Janeiro: Guanabara Koogan, Cap. 14, p. 81.2002.

KRZACZYNSKI J: The flank approach to feline ovariohysterectomy (an alternate technique). **Veterinary Medicine & Small Animal Clinician**, Bonner Springs, v.69, n.5, p. 572–574, 1974.

KUAN, S. Y.; TICEHURST, K.; HOFFMAN, K. L.; CROSBY, D.; BARRS, V. R.; Intestinal strangulation after elective ovariohysterctomy, **Journal of Feline Medicine and Surgery**, New South Wales , v. 12, p. 325-329, 2010.

MALM, C.; SAVASSI-ROCHA, P.R.; GHELLER, V.A.; OLIVEIRA, H.P.; LAMOUNIER, A.R.; FOLTYNECK, V. Ovário-histerectomia: estudo experimental comparativo entre as abordagens laparoscópicas e aberta na espécie canina. Intra-

operatório-I. **Arquivo Brasileiro de Medicina Veterinária e Zootecnia**, Belo Horizonte, v.56, n.4, 2005.

MCGORUM., B. C.; DIXON, P. M.; RADOSTITS, O. M.; ABBOTT, J. A. Exame clínico do trato respiratório. In: RADOSTITS, O. M.; MATHEW, I. G.; HOUSTON, D. M. **Exame clínico e diagnóstico em veterinária**. 1. ed. Rio de Janeiro: Guanabara Koogan, 2002. Cap. 16, p. 234.

MCGRATH, H.; HARDIE, R. J.; DAVIS, E. Lateral flank approach for ovariohysterectomy in small animals. **Compendium of Continuous Education Small Animal Practice**, New York, v. 26, p. 922–930, 2004.

MIRANDA, A. F.; SILVA, L. A. F.; TAVARES, G. A.; AMARAL, A. V.C.; MIRANDA, H. G. Braçadeiras de náilon: resistência à tração em testes físicos e seu emprego como cerclagem no fêmur de cães. **Ciência Animal Brasileira**, Goiânia, v.7, n.3, p, 299-307, jul/set. 2006.

NELSON, R.W.; COUTO. C.G. Distúrbios do ciclo estral. In: **Medicina interna de pequenos animais**, 2. ed. Rio de Janeiro: Guanabara Koogan, p. 659-675.1998.

OLIVEIRA, K. S. Síndrome do ovário remanescente. **Acta Scientiae Veterinarie**, Porto Alegre, v. 35, supl. 2, p, 273-274, 2007.

PEETERS. M. E.; KIRPENSTEIJN, J. Comparison of surgical variables and short-term postoperative complications in healthy dogs undergoing ovariohysterectomy or ovariectomy. **Journal of the American Veterinary Medical Association**, Schaumburg, v. 238, n.2, p. 189 -194, 2011.

RABELO, R. E.; SILVA, L. A. F.; SANT'ANA, F. J. F.; SILVA, M. A. M.;MOURA, M. I.; FRANCO, L. G.; OLIVEIRA, C. R. Use of polyamide tierap for ovariectomy in standing mares. **Acta Science Veterinarie**, Porto Alegre, v.36, n.2.p.119-125, 2008.

ROBERTSON, S. A. Managing pain in feline patients. **Veterinary Clinic of Small Animals**, Philadelphia, v. 38, p. 1267-1290, 2008.

ROVERE, R.; BERTONE, P.; BAGNIS, G.; COCCO, R.; LUJÁN, O.; SERENO, M.; WHEELER, J. Observación de la reacción tisular del precinto comercial de poliamida empleado como método de ligadura en pedículo renal y uterino en conejos. **Archivos de Medicina Veterinaria**, Buenos Aires, v. 39, n. 2, p. 167-172, 2007.

SCHIOCHET, BECK, C. A. C.; STEDILE, R.; FERREIRA, M. P.; CONTESINI. E.; ALIEVI, M. M.; SANTOS. E. B. J.; BREISTSAMETER, I. Ovariectomia laparoscópica em uma gata com ovários remanescentes. **Acta Scientiae Veterinarie**, Porto Alegre, v. 35, supl. 2, p, 245-248, 2007.

SCHIOCHET, F. **Ovário-salpingo-histerectomia laparoscópica em felino hígdos**. 2006. 78f. Dissertação (Mestrado em Ciências veterinárias) – Faculdade de Veterinária, Universidade Federal do Rio Grande do Sul, Porto Alegre.

SILVA, L. A. F.; ARAÚJO, G. R. S.; MIRANDA, A. H.; RABELO, R. E.; GARCIA, A. M.; SILVA, O. C.; ARAÚJO, I. F.; MACEDO, S. P.; SOUSA, J. N.; FIORAVANTI, M. C.; OLIVEIRA, K. S.; AMARAL, A. V. C.; SILVA, E. B. Ovariohisterectomia em cadelas: uso da braçadeira de náilon da hemostasia preventiva. **Ciência Animal Brasileira**, Goiânia, v. 5, suplemento, p. 100-102, 2004.

SILVA, L. A. F.; COSTA, A. C.; SOARES, L. K.; BORGES, N. C.; FERREIRA, J. L.; CARDOSO, L. L. Orquiectomia em bovinos empregando braçadeiras de náilon na hemostasia preventiva: efeito da estação do ano, método e contenção cirúrgica. **Ciência Animal Brasileira**, Goiânia, v. 10, n. 1, p.261-270, jan./mar, 2009.

SILVA, L. A. F.; FRANÇA, R. O.; VIEIRA, D.; SOUSA, V. R.; FRANCO, L. G.; MOURA, M. I.; SILVA, M. A. M.; TRINDADE, B. R.; COSTA, G. L.; BERNARDES, K. M. emprego da braçadeira de náilon na orquiectomia em equinos. **Acta Scientiae veterinariae**, Porto Alegre, v. 34, p. 261-266, 2006.

SORBELLO, A. A.; GIUDUGLI, J. N.; ANDRETTO, R. Nova alternativa para ligaduras em cirurgias videoendoscópicas ou convencionais, com emprego de fitas de nylon em estudo experimental. **Revista Brasileira de Coloproctologia**, Rio de Janeiro, v. 19, n. 1, p. 24-26, 1999.

STONE, E. A.; Sistema reprodutivo. In: SLATTER, D. **Manual de cirurgia de pequenos animais**. 3. ed. São Paulo: Manole, Cap. 93, p. 1487-1502. 2007.

TROMPOWSKY, A. C. M. V.; PLIEGO, C. M.; FERREIRA, M. L. G.; NUNES, V. A.; SANTOS, M. C. S. Relato de quatro casos de hidronefrose secundária a ovário-salpingohisterectomia (OSH) em cadelas. **Acta Scientiae Veterinariae**, Porto Alegre. v.35 (supl 2), p.344-345, 2007.

WHITEHEAD, M. Ovariohysterectomy versus ovariectomy. **Veterinary Record**, London, v.159, n. 21, p.723-724, 2006.