

Systematic review of different surgical contraception techniques in queens

Revisión sistemática de las diferentes técnicas quirúrgicas de contracepción en gatas

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ABSTRACT

In the veterinary clinic, contraceptive surgery is the most commonly performed surgery in female cats. However, it is not established which surgical technique is the most appropriate. In order to reduce postoperative pain, recovery time, surgery time and technical ease for the surgeon, different surgical techniques and variations of these techniques have been described. This has created the dilemma of performing ovariectomy versus oophorectomy; type of approach: midline, lateral or laparoscopic; and method of ovarian pedicle ligation: harmonic scalpel, plastic and titanium clips, bipolar electrocautery unit, pedicle knot and traditional ligation. With this in mind, with the objective of establishing which is the most adequate contraceptive surgery in female cats and supported by evidence-based medicine, a systematic review was carried out. Using Google Scholar, Web of Science, PubMed and SciELO search engines, with the following variables to be evaluated: pain, time and technical difficulty. It was found that there is little evidence to establish the superiority of any surgical technique over another and that the choice of surgical technique should be made based on the patient, the surgeon's skills and the availability of materials.

Keywords: Contraception, cats, ovariectomy, ovariectomy, surgical approaches.

RESUMEN

En la clínica veterinaria, la cirugía contraceptiva es la más practicada en gatas. Sin embargo, no está establecido cuál técnica quirúrgica es la más adecuada. Con la finalidad disminuir el dolor posoperatorio, tiempo de recuperación, tiempo de cirugía y facilidad técnica para el cirujano, se han descrito diferentes técnicas quirúrgicas y variaciones de las mismas. Esto ha creado el dilema sobre la realización de ovariectomía contra la ooforectomía; tipo de abordaje: línea media, lateral o laparoscópico; y método de ligadura del pedículo ovárico: bisturí harmónico, clips de plástico y titanio, electrocauterio bipolar, nudo pedicular y ligadura tradicional. Teniendo esto en cuenta, con el objetivo de establecer cuál es la cirugía contraceptiva más adecuada en gatas y apoyados en la medicina basada en evidencias, se realizó una revisión sistemática. Utilizando los buscadores Google Académico, Web of Science, PubMed y SciELO, con las siguientes variables a evaluar: dolor, tiempo y dificultad técnica. Se encontró que existe poca evidencia para establecer la superioridad de alguna técnica quirúrgica sobre otra y que la elección de la técnica quirúrgica debe de ser realizada en base al paciente, habilidades del cirujano y la disponibilidad de materiales.

Palabras claves: contracepción, gatas, ovariectomía, ovariectomía, abordajes quirúrgicos.

INTRODUCTION

Surgical contraceptive procedures are the first option to prevent reproduction in female cats worldwide. Two fundamental factors have been established to justify reproductive control in cats. The first is the very importance of controlling the overpopulation of this species; and the second is the prevention of some diseases of the reproductive tract and mammary gland ([Overley *et al.*, 2005](#)). Over time, two surgical techniques have been described for contraception in female cats, ovariohysterectomy (OVH) which is defined as the complete removal of the reproductive tract and ovarioectomy (OV) which consists of the exclusive removal of the ovaries ([Howe 2006](#); [Pereira *et al.*, 2018](#)). Both techniques are equally effective in controlling the population of the species and in reducing the possibility of the presence of mammary gland tumors when practiced at early ages ([Frasson, 2018](#)).

Contraceptive surgery accounts for a high percentage of procedures performed in female cats. With the idea of reducing the pain, difficulty, time and cost of these surgeries, variants have been developed in the last decades ([Griffin *et al.*, 2016](#)). The main variants occur in the type of ligation used on the ovarian pedicles. The different types are ligation using one or two forceps, single use of suture ligation, hemostatic clips, monopolar, bipolar or ultrasound-based electrosurgical equipment ([Boursier *et al.*, 2018](#); [Guedes *et al.*, 2017](#); [Miller *et al.*, 2016](#)). Basically, there are two approaches to perform both OVH and OV in female cats: the midline approach also known as celiotomy and the lateral or flank approach. In the United States, most veterinarians prefer the celiotomy approach, whereas in Europe the lateral technique is preferred ([Bushby and White, 2019](#); [Cuddy, 2016](#)). Recently, laparoscopy has been taken up as a viable alternative. This minimally invasive technique allows a better view of the structures, as well as a decrease in postoperative risks and pain, also shortening surgery and patient recovery times ([Da Conceição *et al.*, 2018](#); [Howe, 2006](#); [Phypers, 2017](#)).

Therefore, there are several surgical techniques in cat contraception, with each surgeon describing the advantages and benefits of the hemostatic approaches or methods. However, it has not been concretely established which is the most appropriate in this species, since in the scientific literature there is scarce information on which technique causes less pain, requires less time or is technically easier to perform. For this reason, in order to identify the advantages and disadvantages of these surgical techniques, a systematic review was carried out to evaluate their benefit and to show which of them is safer, faster and less painful for the cat.

MATERIAL AND METHODS

For this work, the published literature was reviewed in the scientific search engines Google Scholar, PubMed and Web of Science, and the following search criteria were used: spay, cats, ovariohistectomy, ovarioectomy, contraception, surgery, techniques, and laparotomy in English, Spanish and Portuguese.

Studies from 2006 to 2020, in which a surgical technique of contraception in cats was described, were included. Studies that evaluated the risks, benefits and indications of the particular surgical technique were analyzed, with emphasis on those that discussed and compared with some other technique. Literature reviews and clinical case reports of different surgical techniques of contraception in female cats were also included.

All included studies were categorized according to the classification of scientific evidence established by [Sackett and Wennberg \(1997\)](#). This classification has five levels of stratification, which have been endorsed by the Canadian Task Force on Preventive Health Care who were the first to determine the levels of evidence that a scientific study offers ([Manterola et al., 2014](#)).

Once the articles were classified, those grouped in levels III to I were analyzed for the discussion section. The variables to be discussed in this manuscript are: surgery time, pain both Trans and Post-surgical, technical difficulty of the surgery and learning time or technical difficulty of each one.

RESULTS AND DISCUSSION

The original result of the search was 6760 publications. After discarding all studies performed in another species, book chapters or publications where the surgical technique was not evaluated and based on the classification of scientific evidence, 31 investigations were obtained, distributed in the five existing categories according to [Manterola et al. \(2014\)](#).

Table 1. Representation of evidence pyramid levels and the grouping of studies at each level

| Level | |
|-----------|--|
| Level I | <ul style="list-style-type: none"> • Howe LM. (2006). Surgical methods of contraception and sterilization. Theriogenology. • Sakals SA et al., (2018). Evaluation of laparoscopically assisted ovariectomy technique in cats. Veterinary surgery. • Swaffield MJ, Molloy SL, Lipscomb VJ. (2020). Prospective comparison of perioperative wound and pain score parameters in cats undergoing flank vs midline ovariectomy. Journal of Feline Medicine and Surgery |
| Level II | <ul style="list-style-type: none"> • Coe RL et al., (2007). Comparison of flank and midline approaches to the ovariohysterectomy of cats. Vet Record. • Nimwegen A., Kirpensteijn J. (2007). Laparoscopic ovariectomy in cats: Comparison of laser and bipolar electrocoagulation. Journal of feline medicine and surgery. • Coisman JG et al., (2013). Comparison of surgical variables in cats undergoing single-incision laparoscopic ovariectomy using a LigaSure or extracorporeal suture versus open ovariectomy. Veterinary surgery • Santos Ferreira G et al., (2013). Ovariectomia laparoscópica em cadelas e gatas. Revista brasileira medicina veterinaria • Kiani FA et al., (2014). Comparative study on midline and flank approaches for ovariohysterectomy in cats. Journal of Agriculture and Food Technology. • Porters N et al., (2014). Prepubertal gonadectomy in cats: different surgical techniques and comparison with gonadectomy at traditional age. Veterinary Record. • Case JB et al., (2015). Comparison of surgical variables and pain in cats undergoing ovariohysterectomy, laparoscopic-assisted ovariohysterectomy, and laparoscopic ovariectomy. Journal of the American animal hospital association. • Dias do Pardo T et al., (2015). Nylon clamps and mononylon for ovariohysterectomy in cats. Enciclopedia Biosfera. • Gauthier, O. et al., (2015) Assessment of postoperative pain in cats after ovariectomy by laparoscopy, median celiotomy, or flank laparotomy. Veterinary Surgery • Roberts ML et al., (2015). Effect of age and surgical approach on perioperative wound complication following ovariohysterectomy in shelter-housed cats in Australia. Journal of feline medicine and surgery open reports. • Miller KP et al., (2016). Pedicle ties provide a rapid and safe method for feline ovariohysterectomy. Journal of Feline Medicine and Surgery • Freeman LJ et al., (2017). Evaluation of learning curves for ovariohysterectomy of dogs and cats and castration of dogs. JAVMA. |
| Level III | <ul style="list-style-type: none"> • Burrow R et al., (2006). Prospective evaluation of postoperative pain in cats undergoing ovariohysterectomy by mindline or flank approach. Vet Record. • Grint N et al., (2006) Assessment of the influence of surgical technique on postoperative pain and wound tenderness in cats following ovariohysterectomy. Journal of feline medicine and surgery. • Ferreira MP et al., (2011). Laparoscopic Ovariohysterectomy in Domestic Cats: Two Portals Technique. Acta Scientiae Veterinari. • Pecere Oliveira J et al., (2014). Pain assessment in cats undergoing ovariohysterectomy by midline or lateral celiotomy through use of a previously validated multidimensional composite pain scale. Acta Cirurgica Brasileira • Tavares DC et al., (2016). Video-assisted ovariohysterectomy in domestic cats (<i>Felis catus</i>, Linnaeus, 1758) using two access portals. Acta Cirurgica Brasileira. • Da Costa D et al., (2017). LESS ovariohysterectomy in cats using a new homemade multiport. Ciencia Rural. • Moutinho da Conceicao ME et al., (2017). Description and Executability of a Novel Pre-tied Mini Ligature (Miniloop) in Laparoscopic Ovariectomy in Cats. Acta Scientiae Veterinariae. • Brousier JF et al., (2018). Effectiveness of a bipolar vessel sealant device for ovariohysterectomy in cats with pyometra. Journal of Feline medicine and Surgery. |
| Level IV | <ul style="list-style-type: none"> • Ball RL et al., (2010). Ovarian remnant syndrome in dogs and cats: 21 cases (2000-2007). JAVMA. • Fransson BA., Ragle CA. (2011). Lift laparoscopy in dogs and cats: 12 cases (2008-2009). JAVMA • Lawall T et al., (2017). Minilaparoscopic ovariohysterectomy in healthy cats. Ciencia rural. • Minto BW et al., (2017). Spay hook minimally invasive ovariohysterectomy in cats. Retrospective study of 276 cases. Investigação. |
| Level V | <ul style="list-style-type: none"> • McKenzie B. (2010). Evaluating the benefits and risk of neutering dogs and cats. CAB reviews: Perspectives in agriculture, veterinary science, nutrition and natural resources • De Tora M y McCarthy RJ. (2011). Ovariohysterectomy versus ovariectomy for elective sterilization of female dogs and cats: is removal of the uterus necessary? JAVMA. • Sparkes A. (2011). Neutering cats- Assessing attitudes and challenging conventions. Journal of feline medicine and surgery. • Howe LM. (2015). Current perspectives on the optimal age to spay/castrate dogs and cats. Veterinary Medicine: research and reports. • Griffin B et al., (2016). The Association of Shelter Veterinarians' 2016 Veterinary Medical Care Guidelines for Spay-Neuter Programs. JAVMA. • Yates D y Goetz U. (2016). Flank or midline ovariohysterectomy in the cat? Companion Animal. |

Different surgical techniques of contraception in cats, their approach and hemostasis.

In female cats it is described that both OVH and OV are equally beneficial as elective contraceptive surgical techniques, but the incision length is considered to be decreased in OV because exposure of the body of the uterus is not necessary ([DeTora and McCarthy, 2011](#); [Muraro and White, 2014](#); [Peeters and Kirpensteijn, 2011](#)). However, the surgery time is usually the same and the signs of pain measured by Glasgow scale are the same in both procedures ([Peeters and Kirpensteijn, 2011](#)).

In cases where uterine disease is present, OVH should always be performed. These two surgical techniques can be performed by midline approach or lateral technique ([Bushby and White, 2019](#); [Stavisky and Brennan, 2020](#)).

Midline approach

The midline or celiotomy approach is the one traditionally taught in universities. Although technically the word celiotomy refers to the incision that spans from the xiphoid cartilage to the pubis, to perform OVH in female cats, it is incised two centimeters caudal to the umbilical scar and extends in the direction of the pubis ([Frasson, 2018](#)). Upon entering the abdominal cavity, the ovaries are located with the help of an ovariome or using the index finger. To further free the ovary, the suspensory ligament is digitally torn, which is inserted caudal and ventral to the last rib ([Hill and Smeak, 2010](#); [McGrath et al., 2004](#); [Yates and Goetz, 2015](#)). Once the ovary is exteriorized, hemostasis is performed on the ovarian pedicle, for which there are several techniques (described elsewhere).

Lateral approach

The lateral approach is used for both OVH and OV and is apparently simpler than the celiotomy approach. This approach was initially indicated in cats with overdeveloped mammary glands or in feral cats in which postoperative care and observation is a management complication ([McGrath et al., 2004](#); [Reece, 2018](#)). The anatomy of the cat should be taken into account and consider that the left ovary is caudal to the kidney, slightly ventral to the third and fourth lumbar vertebrae. In this technique the animal is placed in lateral decubitus either left or right. Subsequently, between 1 and 5 cm caudal to the last rib and below the lumbar transverse processes, a 1 to 4 cm long skin incision is made in a dorsoventral direction. The subcutaneous tissue is incised and blunt dissection is performed, as well as in the muscular fascia formed by the external oblique, internal oblique and transversus abdominis muscles. When the latter muscle is incised, the abdominal cavity is penetrated through the peritoneum. Immediately the left or right ovary is located, the ovarian pedicle is clamped with hemostatic forceps and ligation is performed. Before cutting the pedicle, the opposite ovary is located, for which, the uterine bifurcation is located ([Howe 2006](#); [McGrath et al., 2004](#); [Yates Goetz, 2015](#)), the suspensory ligament and ovary are expired and externalized through the incision in

the same way as in the ventral midline approach ([Kiani et al., 2014](#)), to perform the same procedure as in the first ovary. Finally, muscle fascia is closed encompassing all three muscles in one plane, followed by a subcuticular suture and skin ([Howe 2006](#); [Silva-Molano et al., 2007](#)).

Ovarian pedicle hemostasis

A fundamental part of contraceptive surgery in small species is hemostasis of the ovarian pedicle, since it is the step in which most surgical complications occur, as its failure leads to hemorrhage ([Adin, 2011](#); [Bohling, 2020](#); [Pollari et al., 1996](#); [Voorwald et al., 2013](#)). Moreover, it is one of the most difficult steps to perform properly, even by inexperienced surgeons ([Bushby and White, 2019](#); [Miller et al., 2016](#)).

In female cats, the ovarian pedicle can be ligated aided with two forceps. When using two forceps to perform the ligation, these should be accompanied by 1 or 2 turns to the ligation that circle the pedicle or a transfixion ligation below the first forceps ([Frasson, 2018](#); [Hill and Smeak, 2010](#)). It can also be done with the aid of a single clamp over the ovarian pedicle, which is recommended in cases where the reproductive tract is small, friable or fragile and will not withstand the trauma caused by the two clamps ([Mayhew and Brown, 2007](#)). The use of a double ligature circulating the pedicle is sufficient in these cats and only in case the cat is pregnant or in estrus, it would be necessary to place a transfixion ligature ([Frasson, 2018](#)).

Another way to perform hemostasis is by using the pedicle knot, which consists of ligating the ovarian pedicle on itself. This procedure is performed similarly to the spermatic cord during orchiectomy of male cats ([Howe, 2006](#); [Miller et al., 2016](#)). Apparently the main advantage of performing the pedicle knot is that it allows the ligation to be performed in less time, compared to the placement of two ligatures on the same structure ([Porters et al., 2014](#)), which allows this maneuver to be performed in a shorter time, with decreased use of suture material and thus leaving less or no foreign material in the patient ([Bushby and White, 2019](#); [Miller et al., 2016](#)).

Similarly, it is described that a single ligation encompassing the uterine horn and pedicle produces safe and rapid hemostasis in female cats ([Begum and Bhuvaneshwari, 2018](#)). The introduction of new hemostatic techniques, such as bipolar electro-surgical unit, has also been implemented in contraceptive surgery in female cats. This device has been shown to be effective in producing hemostasis in OVH in female cats ([Watts, 2018](#)).

Discussion of surgery time

Although it may be thought that surgery time is not an important factor, it should be taken into account as a significant parameter when it comes to performing massive surgeries for the control of reproduction in female cats.

Comparison of surgery time in open techniques

In a study they compared the techniques of OVH and OV in female cats. Both surgeries were performed by midline and by an experienced surgeon. Authors found that the time invested in performing OV, was significantly less than OVH ([Pereira et al., 2018](#)). In another study, they compared the surgery times invested with open techniques. These authors describe that performing OVH in pre-pubertal female cats is significantly faster than when practiced in female cats older than 8 months ([Porters et al., 2014](#)). In addition, these same authors found that surgery time was shorter when monopolar electrocoagulation was used, followed by staple application, pedicle lacing (pedicle knot) and ligation.

On the other hand, in another investigation they found that the use of ovarian pedicle knot resulted in a shorter time (5 minutes) compared to the suture knot technique (7 minutes); this time was measured only for ovarian pedicle hemostasis ([Miller et al., 2016](#)).

In a comparison study of midline and lateral flank approach, lateral flank procedures were found to have an average time of 23 minutes, which was considerably less than that recorded for midline approach (31 minutes) ([Kiani et al., 2014](#)). However, these results contrast with those described by other researchers, who found no statistically significant differences in surgical time between these two approaches ([Swaffield et al., 2020](#)). On the other hand, it is described that the time during skin incision and entry into the peritoneum is longer in the lateral flank approach, while the location of the uterus takes longer in the midline approach ([Coe et al., 2006](#)).

In a retrospective study, the use of a bipolar device was shown to be safe and effective for performing celiotomy OV in female cats. Although they demonstrated that surgery time with this technique was shorter in female dogs, this did not occur in female cats ([Watts, 2018](#)).

Finally, it is defined that the surgical technique in which less time is invested to perform OVH in female cats, is the so-called "minimally invasive with ovariotome". This consists of a mini-approach through the midline, in which surgeons use the ovariotome to locate the ovarian pedicles. The average time with this technique was 11.4 minutes ([Minto et al., 2017](#)). These results were corroborated in another study, where they conclude that the use of the ovariotome for a mini-incision is less invasive and propose it as an option to incorporate routinely in veterinary contraceptive techniques, as it presents several advantages against traditional celiotomy ([Lawall et al., 2017](#)).

Comparison of laparoscopic vs. open surgery time

During the literature review, it was found that surgery time varies significantly when comparing these two types of surgical techniques. For example, [Sakals et al. \(2018\)](#), compared laparotomy versus laparoscopic surgery. They describe that the open OVH procedure was faster, as this was performed in an average time of 19.1 minutes, compared to laparoscopic techniques, where they spent 27.7 to 33.2 minutes. The OVH by laparoscopy was performed with the use of a vessel sealing device and suture ligatures respectively, where no significant difference in time was obtained, although the procedure performed with the vessel sealing device was faster. However, they mention that greater laparoscopic experience considerably reduces surgical times. This is especially true for assisted OV, which may be the best option among laparoscopic surgeries. In another study, a greater difference is described, since in open OVH they invested 21 minutes on average against 51.6 minutes for laparoscopy ([Case et al., 2015](#)).

In another investigation, surgery times were statistically similar in laparoscopic surgeries with a single port and those using LigaSure® with open surgeries. They also found that extracorporeal knot ligation in single-port laparoscopy is technically more difficult and time-consuming ([Coisman et al., 2014](#)).

Comparison of the time between laparoscopic surgeries

There have been studies comparing surgery time between laparoscopic contraceptive procedures in female cats. For example, one study compared the use of hemostasis by bipolar electrocoagulation versus laser pedicle resection in OV. In this study, hemostasis was performed and one of the pedicles was cut with a laser device and the contralateral one with a bipolar device. These researchers found that with the laser device the surgical time was statistically greater than with the bipolar device; the greatest difference in surgical time occurred at the time of resection of the ovary, since with the laser device it took (4:09 ± 2:50 minutes), versus (2:23 ± 1:01) with bipolar electrocoagulation. In addition, they mention that the approach to the right ovary was a little more difficult, but it did not interfere with the difficulty of the surgery ([van Nimwegen and Kirpensteijn, 2007](#)). In another study where they only performed laparoscopic OV with extracorporeal knot, they had an average time of 44.8 minutes, which according to the authors is similar to other studies where the bipolar system was used ([Conceição et al., 2017](#)). In a similar study, researchers found that the use of a bipolar hemostatic device significantly reduces surgery time in laparoscopic OVH in female cats, this when compared against a monopolar mechanism ([Howe, 2006](#)). There is another research where they found that with a single-port laparoscopic home device the surgery time was 14.54 minutes on average ([da Costa et al., 2017](#)).

Pain comparison

Pain management during and after surgery is one of the most important points to consider when performing contraceptive surgical techniques in female cats ([Murugesan et al., 2020](#)). For example, there is an accepted lack of scientific evidence as to whether the lateral or midline approach is less painful ([Merritt and Collinson, 2020](#)). Likewise, it has not been established whether OVH or OV causes greater pain in female cats ([Peeters and Kirpensteijn, 2011](#)). It is also common to consider that laparoscopic techniques tend to cause less pain than traditional surgery ([Gauthier et al., 2015](#)).

Comparison of pain caused with open techniques

In the evaluation of the literature, research was found comparing the pain produced by a traditional midline approach with the lateral flank approach. A significant difference in postoperative pain between both surgical techniques has been described, since it has been demonstrated that there is greater pain when the lateral flank approach was used ([Burrow et al., 2005](#)). Likewise, there is research that reports evidence of greater pain on palpation in cats with lateral flank wounds compared to midline wounds ([Coe et al., 2006](#)).

These results contrast with those described by other authors. For example, [Gauthier et al. \(2015\)](#), found no significant differences in pain caused by celiotomy or lateral surgeries. In addition, two other studies mention that, although there was greater inflammation and secretions in cats with lateral approach, there was no statistically significant difference in terms of postoperative pain ([Coe et al., 2006](#)). In another study they found very interesting results in terms of pain produced with the lateral approach versus celiotomy in female cats undergoing OV. It was found that one hour after surgery and at discharge time the cats with the lateral approach had more pain. However, they observed that the midline OVH cats had more swelling at discharge, as well as at 3 and 10 days post-surgery. Interestingly, cats with the lateral approach had less pain at days 3 and 10 post-surgery ([Swaffield et al., 2020](#)).

Comparison of pain caused by open versus laparoscopic techniques

During the literature review, an article was found describing that female cats spayed laparoscopically showed similar pain scales as those that were spayed by open midline technique ([Case et al., 2015](#)). On the other hand, [Sakals et al. \(2018\)](#), no differences were found in pain measurements with visual analog scales in cats with open versus laparoscopic surgery. In this investigation, they compared laparoscopic-assisted surgery using a bipolar device, traditional ligation-assisted and open surgery.

These results differ considerably with those presented by other authors, who demonstrate that laparoscopic OVH is less painful, especially with the use of the harmonic scalpel. It was shown that cats with traditional OVH presented higher cortisol

concentration in postsurgical blood and their pain scales were higher (Guedes *et al.*, 2017). This is supported by another study where they performed OVH in female cats by laparoscopy and demonstrated that it is less painful than that performed by midline or flank (Gauthier *et al.*, 2015).

Comparison of pain caused by laparoscopic techniques

There is little literature comparing pain with different laparoscopic techniques for OVH or OV in female cats. In one article they found no difference in pain caused by the use of ligatures versus a bipolar device in laparoscopically assisted OVH (Sakals *et al.*, 2018). Contrary to what was described in another investigation, in which they found that cats submitted to OV in which they ligated by extracorporeal knot presented more pain than those in which they used LigaSure® (Case *et al.*, 2015).

Learning time or technical difficulty of each technique

Learning time for open techniques

This is the area in which less scientific literature was found, however, two investigations could be analyzed: In a study in which final year veterinary students took part, a favorable evolution and development of confidence was found during the performance of surgery in a period of three weeks (Freeman *et al.*, 2017). In another investigation in which a survey of perceived difficulty of two approaches (lateral flank and midline) for performing OVH in female cats was conducted, veterinary students determined that on a scale of 0 to 100, the lateral flank approach was more complicated with a score of 48, versus 41 points for the midline approach (Coe *et al.*, 2006).

Finally, no studies were found that discuss the learning time of open versus laparoscopic techniques or comparing laparoscopic techniques.

CONCLUSIONS

In the systematic review carried out in this work, we found that there is little scientific literature with sufficient evidence to clarify the most appropriate surgical contraceptive technique in female cats. It is not adequately established which one causes less pain, is faster or less difficult. However, important criteria can be formed on some points.

In female cats, OVH and OV have been described as an alternative to contraceptive surgery. Currently there is no scientific evidence to suggest that one technique is superior to the other and both can be performed by a midline, lateral flank or laparoscopic approach. Oophorectomy is a rarely used alternative but its advantages (shorter surgery time, smaller incisions and avoidance of possible uterine complications) outweigh its disadvantages.

Surgery time is similar in the two open approaches (lateral and laparotomy). However, miniceliotomy with ovariectomy proved to be the faster technique. The ovarian pedicle ligation procedure is the slowest step; the time for this is reduced with the use of a pedicle knot. The use of a bipolar electrocoagulation system was not shown to reduce the time in open surgeries in female cats, contrary to what occurred in female dogs. Laparoscopic surgery is slower and requires a longer learning curve, however, with practice and the use of special devices (LigaSure®) the times are very similar to those obtained with open surgery. In addition, with this technique the use of bipolar electro-surgical unit and harmonic scalpel by ultrasonic coagulation does reduce surgery time.

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