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Complications of surgical sterilization by ovariohysterectomy in female dogs: A systematic review

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Abstract

Ovariohysterectomy in female dogs is a frequent surgical procedure for sterilization. However, there might be short-term and long-term complications that are necessary to know. This systematic review aims to identify complications of ovariohysterectomy in dogs, analyzing the methodological quality of the studies that provide data. 40 studies published in Spanish, English, and Portuguese were identified through an electronic search in Pub Med, Medwell Journals, Scielo, Science Direct, and Google Academic. Six descriptive studies on the complications of canine ovariohysterectomy were selected. Studies on complications with non-comparable methodologies were excluded. Heterogeneity was observed in the characteristics and quality of the studies. The majority used convenience sampling, in which the number of participants varied between 72 and 1880. The analysis units were purebred and crossbred canine females from 6 to 108 months of age. The follow-up period of patients for the assessment of complications varied from one week to ten years. The proportion of complications ranged from 0.1 to 74%. The main events reported in the studies occur in short term periods, such as anesthetic complications, bleeding, and wound inflammation. In the long term, there is urinary incontinence, pyometra, and obesity. It is concluded that the scientific evidence available on complications in dogs sterilized by ovariohysterectomy is not enough to support decision-making in the clinical practice with respect to the topic addressed.

Keywords: contraception, observational study, dogs, consequences.

Complicaciones por esterilización quirúrgica mediante ovariohisterectomía en perras: revisión sistemática

Resumen

La ovariohisterectomía en perras es un procedimiento quirúrgico de esterilización frecuente. Sin embargo, se pueden presentar complicaciones a corto y largo plazo que son necesarias conocer. Esta revisión sistemática tiene como objetivo identificar las complicaciones por ovariohisterectomía en perras, analizando la calidad metodológica de los estudios que aportan estos datos. Se identificaron 40 estudios publicados en español, inglés y portugués mediante búsqueda electrónica en PubMed, Medwell Journals, SciELO, Science Direct y Google Académico. Se seleccionaron seis estudios descriptivos de complicaciones por ovariohisterectomía en perras. Se excluyeron los estudios sobre complicaciones con metodologías no comparables. Se apreció heterogeneidad en las características y calidad de los estudios. La mayoría utilizó muestreo por conveniencia, en el que el número de participantes varió entre los estudios desde 72 a 1880. Las unidades de análisis fueron hembras caninas de seis a 108 meses de razas puras y cruces.

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El periodo de seguimiento de los pacientes para la valoración de complicaciones varió desde una semana hasta diez años. La proporción de complicaciones se situó entre 0,1 y 74 %. Los principales eventos reportados son los que se presentan a corto plazo como las complicaciones anestésicas, hemorragias e inflamación de la herida; a largo plazo está la incontinencia urinaria, piómetra y obesidad. Se concluye que la evidencia científica disponible sobre complicaciones en perras esterilizadas mediante ovariohisterectomía no es suficiente como respaldo para la toma de decisiones en la práctica clínica de esta especie respecto al tema abordado.

Palabras clave: anticoncepción, estudio observacional, perros, secuelas.

Complicações por esterilização cirúrgica mediante ovário-histerectomia em cadelas: revisão sistemática

Resumo

A ovário-histerectomia em cadelas é um procedimento cirúrgico de esterilização frequente. No entanto, é necessário saber que podem ocorrer complicações a curto e longo prazo. Esta revisão sistemática tem como objetivo identificar as complicações por ovário-histerectomia em cadelas, analisando a qualidade metodológica dos estudos que fornecem estes dados. Foram identificados 40 estudos publicados em espanhol, inglês e português mediante busca eletrônica em Pub Med, Medwell Journals, Scielo, Science Direct e Google Academic. Foram selecionados seis estudos descritivos de complicações por ovário-histerectomia em cadelas. Foram excluídos os estudos sobre complicações com metodologias não comparáveis. Foi observada heterogeneidade nas características e qualidade dos estudos. A maioria utilizou amostragem por conveniência, onde o número de participantes apresentou variação de estudos entre 72 a 1880. As unidades de análises foram fêmeas caninas de seis a 108 meses de raças e cruzamentos puros. O período de seguimento dos pacientes para a valoração de complicações variou desde uma semana até dez anos. A proporção de complicações se situou entre 0,1 e 74 %. Os principais eventos relatados são os que se apresentam a curto prazo como as complicações anestésicas, hemorragias e inflamação da ferida; a longo prazo está a incontinência urinária, piometra e obesidade. Se conclui que a evidência científica disponível sobre complicações em cadelas esterilizadas mediante ovário histerectomia não é suficiente como respaldo para a tomada de decisões na prática clínica desta espécie com relação ao tema abordado.

Palavras-chave: anticoncepção, estudo observacional, cachorros, sequelas.

Introduction

The control of dog populations is a practice carried out on a global scale by means of different methods that have been classified in general as surgical (sterilization) and non-surgical (immunosterilization, hormonal control, isolation, intrauterine device) (1). Canine ovariohysterectomy (OVH) is one of the most frequently used surgical procedures in the case of companion animals (2). It is recommended by many animal welfare organizations to control dog populations, and is recognized by the World Health Organization (WHO) as a means of population control for dogs, as part of rabies control programs in endemic areas (3). It may be one of the most publicized or widely known methods in general, but, at the same time, there is great misinformation and stigmatization about it (4).

Technically called ovariectomy (extraction of ovaries) or OVH (extraction of uterus and ovaries), this surgical procedure must be performed by a veterinarian using general anesthesia (5,6). There are two ways to approach OVH in female dogs: through the medial and the lateral line. The latter is the most widely used approach in Colombia (1). In the country, OVH is the most frequently used method to control dog populations, but its costs are disadvantageous, since the price of surgery in an average clinic is more or less the equivalent of twelve days of legal minimum wage, which makes it difficult for the public to access this type of procedures (1).

OVH might present the same complications as any surgical procedure involving celiotomy: anesthetic problems, hemorrhages, incisional hernia, delayed healing, abscesses, infections, and death (7,8). Short-term complications include hemorrhage of the ovarian or uterine pedicle, bloody vulvar discharge, onset of pseudocyesis, dehiscence or infection of the incision, and, very rarely, peritonitis or evisceration (7,8). Long-term complications might include ovarian or uterine granulomas with or without fistulization, recurrent estrus, vaginal bleeding, urinary incontinence, ovarian remnant syndrome, as well as intestinal and peritoneal adhesions (9).

According to reports, the incidence of surgical complications of canine OVH varies between 6.1 and 27.0%, without correlation with the age of the animal, the skills of the surgeon, or the presence of a reproductive disease (7). Intra-abdominal hemorrhage (10) is the main cause of death after OVH; intraoperative hemorrhage occurs more frequently when dogs are sterilized while they are in heat, due to the influence of estrogen (8).

This study aims to analyze the quality of scientific publications on the subject, as well as to integrate in an objective and systematic way the findings of the studies that examine complications of OVH in female dogs, in order to determine whether available scientific evidence is enough to support decision-making in the clinical practice of small species.

Materials and methods

Design

A systematic review of descriptive or observational studies with a retrospective and prospective analysis of OVH complications in canine females, published in indexed scientific journals.

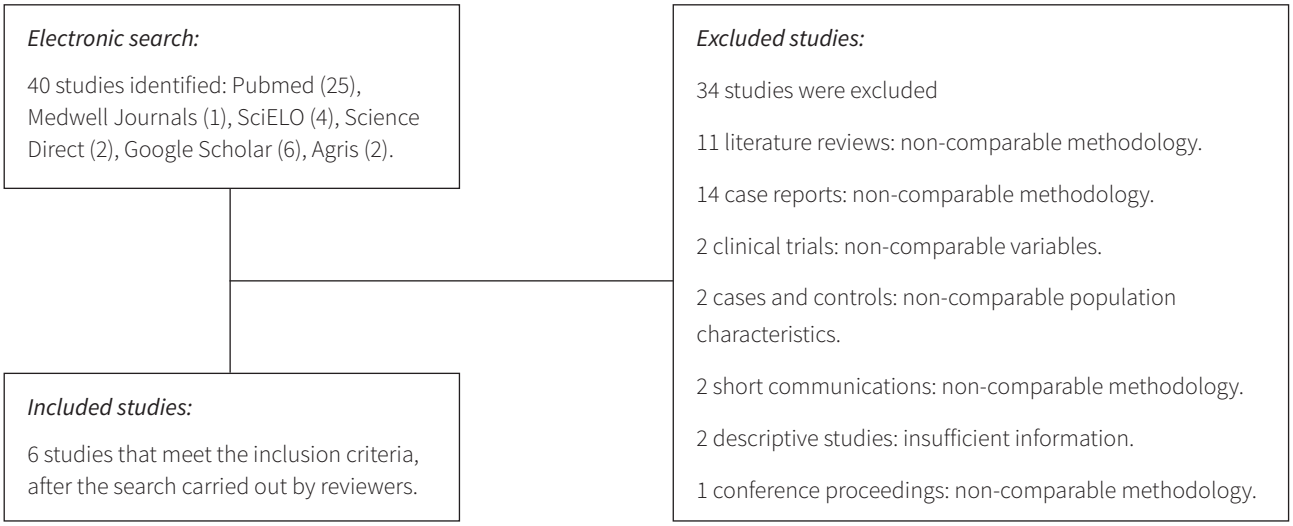
Search strategy

The search was performed between January and December 2015, without limiting the year of publication. The inclusion criteria considered language, which was limited to Spanish, English, and Portuguese in the electronic databases PubMed, Medwell Journals, SciELO, Science Direct, Agris, and Google Scholar. The descriptors used were: *complications, bitches, ovariohysterectomy, splayed, neutering.* The search was limited to articles that referred to complications in canines anywhere in the text. Additionally, an inverse search was carried out based on the bibliographic references included in the selected studies. Although an attempt was made to identify unpublished studies by evaluating research reports, national and international conference proceedings, as well as by consulting experts on the subject, it was not possible to find articles that would meet the inclusion criteria.

Article selection

All studies referring to OVH complications in female dogs were included, regardless of the type of study design or language (Spanish, English, and Portuguese). Two authors separately identified the studies according to the search strategy and established inclusion criteria. The two searches were then compared and an agreement was reached in case of discrepancies; finally, six studies were selected. The selection and exclusion process is described in Figure 1.

Figure 1. Bibliographic search of articles for review



Methodological assessment

Given that they are mainly descriptive studies, the articles were evaluated in terms of their methodological quality and relevance to the subject under study. To the effect, the evaluation protocol of the Strengthening the Reporting of Observational Studies in Epidemiology Initiative (Strobe) was used, which is composed of 22 criteria (11). Due to controversies regarding the validity of assigning quality values in systematic reviews of observational studies, the weight of each methodological criterion was not quantified. Evaluation variables were qualitative and dichotomous, with yes or no qualifications, according to the presence or absence of the criterion studied.

The methodological quality assessment was carried out independently by two authors. Discrepancies regarding qualifications were sorted out in order to reach an agreement. The first criterion of the methodological assessment verified title and abstract; the second, the reasons and scientific basis of the research; the third, objectives; 4 to 11, methodology; 12, statistical methods; 13 to 17, results; 18 to 21, discussion, and 22, other information.

Synthesis of data

The data reported on complications of OVH as a surgical sterilization method in the evaluated studies were expressed as percentages in maximum and minimum ranges. The present study is considered to be without risk as established in Resolution 8430 of October 4, 1993 (12). It counts with the ethical approval of the Institutional Committee for the Care and Use of Animals (Cicua) at the CES University, Medellín, through Act 14 of June 30, 2015.

Results

Methodological assessment

Tables 1 and 2 present study characteristics and the results of the methodological assessment of the six articles selected.

Table 1. Characteristics of the studies included in the review:
Complications of surgical sterilization by canine ovariohysterectomy

Article	Author/Year	Place	Date of Study	Sample	Study Type	Observation Period of Complications
Complications of elective ovariohysterectomies in the dog and cat at a teaching institution: clinical review of 853 cases.	J. L. Berzon, 1979	New York	1975-1978	853	Descriptive Prospective	14-34 months
Bilateral flank ovariectomy in the dog- surgical technique and sequelae in 72 animals.	L. A. Janssens, 1991	Belgium	–	72	Descriptive Prospective	5-10 years (Records-Owner questionnaires)
Evaluation of postoperative complications following elective surgeries of dogs and cats at private practices using computer records	F. Pollari, 1996	Ontario (Canada)	February 1993-March 1994	1581	Descriptive Prospective (5-13 months)	3 weeks (Records)
Complications observed during and after ovariohysterectomy of 142 bitches at a veterinary teaching hospital	R. Burrow, 2005	Liverpool (England)	January 2002-August 2004	142	Descriptive Prospective	10-14 days (Records)
Enterologic and Gynaecologic Complications of Ovariohysterectomy in the Bitch	J. F. Akinrinmade, 2012	Ibadan (Nigeria)	1990-2010	493	Descriptive Retrospective	1-24 weeks (Records-Owner questionnaires)
Complications of ovariohysterectomy procedures performed in 1880 dogs	L. Muraro, 2014	Veneto (Italy)	January 2010-December 2011	1880	Descriptive Retrospective	4 weeks (Records)

Table 2. Methodological assessment of the six studies included in the review: Complications of surgical sterilization by canine ovariohysterectomy

Criteria of methodological quality	Study and year					
	Berzon 1971	Janssens 1991	Pollari 1996	Burrow 2005	Akinrinmade 2012	Muraro 2014
1a. It indicates the study design in the title or abstract	+	+	+	+	+	+
1b. It provides an informative and balanced synopsis in the abstract of what has been done and what has been found	–	+	+	+	+	+
2. It explains the reasons and scientific basis of the research	+	+	+	+	+	+
3. It indicates specific objectives	+	+	+	+	+	+
4. It presents the key elements of the study design at the beginning of the study	+	+	+	+	+	+
5. It describes the relevant framework, places, and dates	+	+	+	–	+	+
6. It provides eligibility criteria, and sources and methods of participant selection	+	–	+	–	+	+
7. It clearly defines all the variables	–	+	+	+	+	+
8. For each variable of interest, it indicates data sources and the details of evaluation methods	–	+	+	+	+	+
9. It specifies all the measures taken to face possible sources of bias	–	–	+	–	–	–
10. It explains how sample size was determined	+	–	+	–	–	+
11. It explains how quantitative variables were treated in the analysis	–	–	–	+	–	–
12. It specifies all statistical methods	–	–	–	+	+	+
13. It indicates the number of participants in each phase of the study	–	–	+	–	+	+
14a. It describes the characteristics of the participants in the study	–	–	–	+	–	–
14b. It indicates the number of participants with missing data in each variable of interest	0	0	0	0	–	–
15. It indicates the number of event results or provides summary measures	+	+	+	+	+	+
16a. It provides unadjusted and, if applicable, adjusted estimates for confounding factors	0	0	0	0	0	+
16b. When categorizing continuous variables, it describes the limits of the intervals	0	0	0	+	0	0
17. It describes other analyzes performed	0	–	–	+	–	+
18. It summarizes the main results of the study objectives	+	+	+	+	+	+
19. It discusses the limitations of the study	–	–	–	–	–	–
20. It provides a prudent global interpretation of the results	–	–	+	+	+	+
21. It discusses the possibility of generalizing the results	–	–	–	–	–	+
22. It specifies the funding and role of the sponsors of the study, and whether it comes from the previous study on which the article is based	–	–	–	–	–	–

+ = yes, – = no, 0 = not applicable

The selected studies were published between 1979 and 2014, with reports from North America, Africa, and Europe, which were mostly prospective. There were only two retrospective studies. The follow-up control was not very detailed in general, and the studies do not refer at all to the objective of masking the follow-up evaluator.

Most of the articles used a convenience population sampling in their methodology. The sample size ranged from 72 (13) to 1880 (14) animals, with observation periods ranging from one week (15) to 10 years (13). The method used to collect information was mainly descriptive cross-sectional, through the review of medical records or owner questionnaires from four to nine years after the surgery. Regarding data analysis, the majority of information was insufficient and, in some cases, there were failures in its presentation or interpretation.

Studied population

Study subjects were canine females between 6 and 108 months, of different pure and cross breeds. With the exception of Pollari (16), studies report the weight of patients between 1.3 and 55.0 kg. The surgical technique for OVH in the studies was the medial approach, with one exception (13), in which ovariectomy was performed using the bilateral approach. In two of the studies, the surgical procedure was carried out by senior veterinary medicine students supervised by expert surgeons (7,17).

Complications during and after ovariohysterectomy

All the reviewed studies aim to obtain qualitative data, thus complications during and after the OVH procedure are reported in absolute or relative values. Only one study (7) used linear regression and correlation tests to evaluate surgery time, anesthesia, and the onset of complications. The main surgical complications reported in the studies (Tables 3 and 4) are anesthetic complications (6-41%) and intraoperative hemorrhage (2-79%). On the other hand, self-inflicted trauma (13-74%) and obesity (60%) are the most frequent postoperative complications.

Table 3. Complications of surgical sterilization by canine ovariohysterectomy in the six included studies

	Author/Percentage of complications					
	Berzon	Janssens	Pollari F	Burrow R	Akinrinmade J	Muraro L
Surgical complications				20.60		
Anesthetic complications	6-41					
Intraoperative hemorrhage	2-79			6.40		
Hemorrhage of the ovarian artery				6.40		1.12
Hemorrhage of the surgical incision				0.70		0.48
Hemorrhage in an unidentified location				2.10		
Postoperative complications			4-35	14.10	10.70	6.38*
Postoperative pyrexia	7-20					
Postoperative vaginal bleeding	2				4.20*	
Postoperative hematuria	1			2.80		
Self-inflicted trauma	13-74					
Wound dehiscence-incisional hernia	0.3-2				1.40*	0.21
Seroma	5-25	26				2.45
Wound infection	2-20		1-3			
Delayed healing or incisional inflammation	5-25			3.50-5	1.80*	1.22
Juvenile Vulva	0.3-3					
Temporary urinary incontinence	0.3					
Urinary incontinence		18				1.91
Pyometra	1					
Recurring estrus	1				1.80*	
Pseudopregnancy				0.70	1.60*	
Non-absorbable ligature					0.60*	
Ovarian remnant syndrome					2.80*	0.11
Weight gain		60				
Excessive hair loss		26				
Aggression toward other dogs		22				
Sedentary behavior		29				
Diarrhea				0.70	1.20*	
Tracheitis				0.70		
Pancreatitis				0.70		
Enterological complications**					2.2*	

* Data obtained by authors from the results provided by primary research.

** Enterological complications: chronic vomiting, diarrhea, anorexia, weight loss, pyrexia, extensive intestinal adhesion, adhesion between intestine and ovarian stump, adhesion between bladder and cervical stump, adhesion between intestine and abdominal wall, presence of abdominal masses, adhesion between bowel, colon and uterine stump.

Table 4. Consolidated percentage of complications of ovariohysterectomy

Complication	Percentage (range)	Reference
Anesthetic complications	6-41	17
Hemorrhage of the ovarian artery	1.12-6.40	7,14
Hemorrhage of the surgical incision	0.48-0.70	7,14
Postoperative complications	4-35	7,14,15,16
Juvenile vulva	0.30-3	17
Temporary urinary incontinence	0.30	17
Urinary incontinence	1.91-18	13,14
Pyometra	1	17
Recurring estrus	1-1.80 *	15,17
Postoperative vaginal bleeding	2-4.2 *	15,17
Self-inflicted trauma	13-74	17
Postoperative pyrexia	7-2	17
Postoperative hematuria	2.80	7,17
Intraoperative Hemorrhage	2-79	17
Wound dehiscence-incisional hernia	0.3-2	14,15,17
Seroma	2.45-26	13,14,17
Wound infection	1-20	16,17
Delayed healing or incisional inflammation	1.22-25	7,14,15,17
Weight gain	60	13
Excessive hair loss	26	13
Aggression toward other dogs	22	13
Sedentary behavior	29	13
Tracheitis	0.7	7
Diarrhea	0.70-1.2*	7,15
Pancreatitis	0.70	7
Pseudopregnancy	0.70-1.60*	7,15
Enterological complications	2.20*	15
Non-absorbable ligature	0.60*	15
Ovarian remnant syndrome	0.11-2.80*	14,15

* Data obtained by authors from the results provided by primary research.

Discussion

The small number of articles found on complications in canine females sterilized by OVH in different contexts and countries evidences the need to perform a "diagnostic analysis" on this subject. Epidemiological studies on complications of sterilization by OVH in canine females included in this review have methodological limitations that should be taken into account.

The present study found many discrepancies in the compliance with the evaluated methodological quality criteria. The research presented by Pollari et al. (16), Burrow, Batchelor and Cripps (7), and Muraro and White (14) were the most complete studies according to methodological assessment. However, Burrow, Batchelor and Cripps (7) did not describe the relevant framework, places, and dates, nor eligibility criteria, sources, and methods for participant selection.

Only Pollari et al. (16) specified the measures adopted to address possible sources of bias; Burrow, Batchelor and Cripps (7) described the way of using quantitative variables in the analysis and participant characteristics in the study, while Muraro and White (14) discussed the possibility of generalizing the results, which is explained according to the way in which the population under study was selected.

None of the evaluated articles discusses study limitations or possible conflict of interests; thus the absence of information in the articles evidences a publication bias and hinders the analysis process.

Considering that data collection in the studies of Akinrinmade and Eyarefe (15) and Janssens and Janssens (13) was carried out by means of questionnaires addressed to the owners 24 weeks up to nine years after the procedure, the real numbers can be underestimated. In addition, no intervals were included in the follow-up period to guarantee the validity of the information obtained. Follow-up control in general was not very detailed, and the studies do not refer at all to the objective of masking the follow-up evaluator.

On the other hand, the studies of Akinrinmade and Eyarefe (15) and Muraro and White (14) are based on retrospective records, which makes them weaker, since they may have a potential information bias. These studies only provide a sample profile and their validity is limited. In order for a study to have external validity, there must be a probabilistic sampling of subjects with certain characteristics of a target population. The extrapolation of the results of the study population to other equivalent populations requires compliance with the principle of representativeness of its population (18).

The complications reported in the studies are varied in the short and long term, and in some cases, with very wide intervals, such as intraoperative bleeding (2-79%), self-inflicted trauma (13-74%), and anesthetic complications (6-41%), which need to be analyzed in light of the particular and clinical characteristics of the patients, to determine possible association factors. Additionally, in some cases, they are described in a general way as surgical and postoperative complications (4-35%), without further specification.

It is interesting that the studies report on conditions such as excessive hair loss and aggression toward other dogs as complications (14), without considering that these clinical signs may have a multicausal etiology, which is why they are not necessarily attributable to OVH.

Regarding data analysis, the majority of information was insufficient and, in some cases, there were failures in its presentation or interpretation. In two studies, the procedure was carried out by senior veterinary students, a particular features that must be considered when interpreting the results, since complications associated with OVH are often the result of an inappropriate technique used when performing the procedure, and they are easily preventable with attention to good surgical technique (2).

Conclusion

There exists a great heterogeneity regarding the characteristics and methodological quality of the studies that report on complications in female dogs subjected to surgical sterilization by OVH. The present research confirms the need for studies with more complete information that emphasize descriptive quantitative data; prospective epidemiological studies in the general population that provide data adjusted for age, race, and weight; as well as detailed studies on environmental risk factors. The available scientific evidence is not sufficient to support decision-making in the clinical practice of dogs with respect to the subject evaluated. In addition, there is no evidence of effect since they are descriptive studies.

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