

## ANALYSIS OF USE OF ANTIMICROBIALS IN ELECTIVE OVARIOHISTERECTOMY OF BITCHES

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### ABSTRACT

The main use of the antimicrobials is therapeutic, but inappropriate use contributes for selection of resistant bacteria. One of the main ways to prevent postoperative infections is antimicrobial prophylaxis. The aim of this study was conduct a literature review on the administration protocol of antimicrobials in elective ovariohysterectomy of bitches in Brazil. It was made a research in Brazilian bibliography about elective ovariohysterectomy in bitches from 2002. The use of antimicrobials and occurrence of postoperative infections (PI) were collected. Due to the various protocols reported in the analyzed literature (twenty-one studies) it was observed that there are no defined protocols on the use of antimicrobials in elective surgeries of dogs in Brazil. The protocol more effective in preventing PI is the administration of antimicrobials just preoperatively, but was the less frequent. The antimicrobial administration in the postoperative period was the protocol most frequent, however, is not beneficial to control infection. Such approaches favor the emergence of resistant bacterial strains. The antimicrobial most used was enrofloxacin, but this drug is not effective in preventing PI in dogs. The veterinarians also are responsible by increase of the microbial resistance, and meetings of veterinary surgeons are necessary for define protocols about antimicrobial prophylaxis in surgical procedures.

**KEYWORDS:** antibiotic, canine, elective surgery, microbial resistance.

### ANALISE DO USO DE ANTIMICROBIANOS EM OVARIOHISTERECTOMIA ELETIVA DE CADELAS

#### RESUMO

O principal uso de antimicrobianos tem finalidade terapêutica, mas a utilização inadequada contribui para a seleção de bactérias resistentes. Uma das principais maneiras de prevenir infecções pós operatórias é a utilização de antibióticos profilaticamente. O objetivo deste estudo foi realizar uma revisão na literatura disponível sobre o protocolo de administração de antimicrobianos em

ovariohisterectomias eletivas no Brasil. Para isto, foi feita uma pesquisa na bibliografia brasileira sobre ovariohisterectomias em cadelas desde o ano de 2002. O uso de antibióticos e a ocorrência de infecções pós operatórias (IPO) foram registradas. Devido aos diversos protocolos detectados na literatura analisada (21 estudos), observou-se que não há protocolos definidos a respeito do uso de antimicrobianos em cirurgias eletivas de cães no Brasil. O protocolo mais efetivo na prevenção de IPO é a administração de antimicrobianos no pré operatório, no entanto foi o menos frequente nos estudos analisados. A administração de antimicrobianos no pós operatório foi o protocolo mais frequente, porém tal protocolo não é benéfico para controlar IPO. Tais condutas favorecem a emergência de cepas de bactérias resistentes. O antimicrobiano mais utilizado foi a enrofloxacin, mas tal fármaco não é efetivo na prevenção de IPO em cães. Os médicos veterinários também são responsáveis pelo aumento da resistência microbiana e reuniões de cirurgiões veterinários são necessárias para se definir protocolos de profilaxia antimicrobiana em procedimentos cirúrgicos.

**PALAVRAS-CHAVE:** antibiótico, canino, cirurgia eletiva, resistência microbiana.

## INTRODUCTION

Antimicrobials are used in the agriculture, aquaculture, prevention of diseases, food industry, and as promoters of the growth in the animal husbandry, but the main use is in the therapeutic area, both in human medicine like in veterinary medicine. However, inappropriate use of antimicrobials contributes for selection of resistant bacteria (PRESCOTT et al., 2002).

A global view of microbial resistance in dogs is incipient because there is no systematic research in the area with the use of standard methodology for evaluating the resistance. Probably microbial resistance in dogs is a problem less severe when compared to humans, because dogs are less exposed to antimicrobial use, time of use is usually short and sporadic, stay in hospitals is not common and animals with chronic disease and immunosuppressed are not routinely treated, but euthanized (PRESCOTT et al., 2002). However, there are reports of bacterial resistance to antimicrobials in Veterinary Medicine, including Brazil (SANTOS et al., 2010; ISHII et al., 2011).

The surgical site infection, a process by which a microorganism enters, establishes itself and multiplies in the surgical incision, has been identified as one of the most important sites of infection, and may to cause postoperative complications in surgical patients (DUNNING, 2007), therefore combat postoperative infections (PI) is imperative not only to reduce costs, but mainly to decrease morbidity and mortality in surgical patients (FERRAZ et al., 2001). One of the main ways to prevent PI is to use of antimicrobial prophylaxis in surgical procedure (ADIN, 2011). Thus, antimicrobial prophylaxis may be defined as administration of an antimicrobial agent before contamination or infection of a surgical site (DUNNING, 2007). However, the prophylactic use of antimicrobials without adopting other conducts may become ineffective and potentially cause microbial resistance (FERRAZ et al., 2001; DUNNING, 2007; FOSSUM & WILLARD, 2007).

In many situations, the use of prophylactic antimicrobials associated with general measures for prevention of surgical infection is effective when done rationally (FERRAZ et al., 2001; FOSSUM & WILLARD, 2007). However, the inappropriate prescribing of antimicrobial prophylaxis to patients favors the selection of resistant bacterial strains. Therefore, parameters such as the type of surgical procedure,

potential contamination of the microorganism, underlying diseases, as well as the choice of drug should be observed for that antimicrobials used in surgery are effective to prevent infections (CROCO & NAKAGAWA, 2008).

Considering the importance of antimicrobial use and emergence of resistance of pathogenic bacteria observed by inadvertent prescription of antimicrobials for postoperative prophylaxis in surgical procedures performed by veterinarians (BRAGA, 2008), the aim of this study was to survey the Brazilian literature on the protocol of administration of antimicrobials in elective ovariohysterectomy (OH) of bitches.

### MATERIAL AND METHODS

We performed a bibliographic research about scientific articles, monographs, dissertations and thesis that reported performing elective ovariohysterectomy in bitches in Brazil from 2002. The publications were analyzed and information about the use of antimicrobial agents and occurrence of postoperative infections were collected and arranged in tables (Tables 1, 2 and 3).

**TABLE 1:** Antimicrobial prophylaxis protocol in elective ovariohysterectomy of bitches during preoperative in Brazilian bibliography.

| Serial number | Antimicrobial/Dose/Via                  | PI*             | Authors                |
|---------------|---|-----------------|------------------------|
| 1             | Cephalothin 30 mg/kg IV <sup>1</sup>    | NC <sup>2</sup> | CALDEIRA et al., 2006  |
| 2             | Cephalothin 30 mg/kg IV                 | Absent          | RODRIGUES et al., 2012 |
| 3             | Penicillin 40.000 UI/kg IM <sup>3</sup> | Absent          | QUESSADA et al., 2009  |
| 4             | Ampicillin 22 mg/kg IV                  | Absent          | ATAIDE et al., 2010    |
| 5             | Ampicillin 20 mg/kg IV                  | Absent          | SOUZA, 2011            |
| 6             | Ampicillin 22 mg/kg IV                  | Absent          | TORRES, 2011           |
| 7             | Cephalothin 30 mg/kg O <sup>4</sup>     | NC              | GUEDES, 2012           |

\*PI: Postoperative infection; <sup>1</sup>Intravenous; <sup>2</sup>Not cited; <sup>3</sup>Intramuscular; <sup>4</sup>Oral

**TABLE 2:** Antimicrobial prophylaxis protocol in elective ovariohysterectomy of bitches during postoperative in Brazilian bibliography.

| Serial number | Antimicrobial/Dose/Via/<br>Dosage in PO* (days)                      | PI**   | Authors                 |
|---------------|--|--------|-------------------------|
| 1             | Enrofloxacin 5 mg/kg/ NC <sup>1</sup> /7                             | NC     | CASSU et al., 2008      |
| 2             | Enrofloxacin 5 mg/kg/ SC <sup>2</sup> / Single Dose                  | NC     | PEREIRA & MARQUES, 2009 |
| 3             | Enrofloxacin 5 mg/kg/NC/7  | NC     | VILELLA et al., 2009    |
| 4             | Penicillin + streptomycin 40.000 UI/kg/IM <sup>3</sup> / Single Dose | Absent | LIMA et al., 2010       |
| 5             | Enrofloxacin 5 mg/kg/NC/10   | NC     | PAOLLOZZI et al., 2011  |
| 6             | Penicillin 40.000 UI/kg/IM/ 3 (72/72 h)                              | Absent | SILVA et al., 2011      |
| 7             | Enrofloxacin 5 mg/kg/SC/Single Dose                                  | NC     | TAFFAREL et al., 2012   |
| 8             | Cephalexin 30 mg/kg/O <sup>4</sup> /6                                | Absent | SILVA et al., 2012      |

\*PO: Postoperative; \*\*PI: Postoperative infection; <sup>1</sup>Not cited; <sup>2</sup>Subcutaneous; <sup>3</sup>Intramuscular; <sup>4</sup>Oral

**TABLE 3:** Antimicrobial prophylaxis protocol in elective ovariohysterectomy of bitches during preoperative, trans and postoperative in Brazilian bibliography.

| Serial number | Antimicrobial/Dose/Via/ Dosage in PO* (days)  | Surgicalperiod                      | PI**            | Authors                   |
|---------------|---|-------------------------------------|-----------------|---------------------------|
| 1             | Enrofloxacin 5 mg/kg/IM <sup>1</sup> (preoperative), O <sup>2</sup> (postoperative)/6 | Preoperative and postoperative      | Present         | COSTA NETO et al., 2006 ) |
| 2             | Enrofloxacin mg/kg/IM/5   | 5 Preoperative and postoperative    | Absent          | GONÇALVES, 2007           |
| 3             | Enrofloxacin mg/kg/SC <sup>3</sup> / 7 -10  | 5 Preoperative and postoperative    | NC <sup>4</sup> | ALBUQUERQUE, 2008         |
| 4             | Ampicillin mg/kg/IV <sup>5</sup> Enrofloxacin 5 mg/kg SC/4                            | 20 Preoperative and postoperative   | NC              | TAMANHO et al., 2010      |
| 5             | Cephalotin 30 mg/kg/IV Ceftiofur 2 mg/kg SC Single Dose                               | Preoperative and postoperative      | Present         | MALM et al., 2005         |
| 6             | Enrofloxacin 5 mg/kg/IM (transoperative) (postoperative)/7                            | NC Transoperative and postoperative | Absent          | BUDZIAK, 2010             |

\*PO: Postoperative; \*\*PI: Postoperative infection; <sup>1</sup>Intramuscular; <sup>2</sup>Oral; <sup>3</sup>Subcutaneous; <sup>4</sup>Not cited; <sup>5</sup>Intravenous

## RESULTS AND DISCUSSION

We evaluated 21 Brazilian studies, with indication for antimicrobial use to prevent PI in elective OH in bitches (Tables 1, 2 and 3). By analysis of the articles, it was observed that antimicrobials are administered preoperatively, transoperatively and postoperatively (Tables 1, 2 and 3). In seven studies (33.33%) antimicrobials were administered only preoperatively (Table 1), in eight publications only in the postoperatively (38.09%) (Table 2), in five studies in the preoperative and postoperative (23.80%) (Table 3), and only in one study (4.76%) was administered in transoperative, but associated to postoperative (Table 3). With this result, it is observed that in Brazil in Veterinary Medicine there is no consensus on the use of antimicrobials in elective surgeries, demonstrating that there is no defined protocols, however, routine and protocols are necessary for having reduction of surgical site infection and resistance microbial (GAGLIARDI et al., 2009). It should be noted that in elective OH no are indicated prophylactic antimicrobials (DUNNING, 2007; ADIN, 2011).

Even if the objective of the study is not related to the onset of infections, the occurrence of PI should be reported, since that the publication of the results of the surgical procedures, and the divulgation of ratio infection/surgeon/anesthetist is one factor that helps to diminish the appearance of PI (FERRAZ et al., 2001). However, in nine publications (40.90%) (Tables 1, 2 and 3) the authors did not mention if occurred whether or not infections, demonstrating a disregard on the subject. Among authors that report infections, despite the use of antimicrobials were recorded cases

of PI (Table 3), including studies with antimicrobial use in postoperative (MALM et al., 2005; COSTA NETO et al., 2006).

Of the articles analyzed (21) it was detected that in 13 of them (57.14%), antimicrobials were administered preoperatively (Tables 1 and 3) but only seven authors (33.33%) administered just preoperatively, and five others (23.80%) administered in two stages (preoperative and postoperative). The protocol recommended in the literature as the most effective in preventing PI in elective surgeries is the administration of antibiotics only preoperatively (EUGSTER et al., 2004; DUNNING et al., 2007; GAGLIARDI et al., 2009), but was the less frequent in the analyzed studies (seven; 33.33 %) (Table 1). The administration of antibiotics unnecessarily favors the emergence of resistant bacterial strains (CROCO & NAKAGAWA, 2008) and increases the costs of the surgical procedure (FERRAZ et al., 2001). It is important to note that in five studies (out of seven) in which the antimicrobials were administered just preoperatively (Table 1) there were no infections, demonstrating that this protocol was effective for preventing PI in elective OH of bitches.

In most studies the antimicrobials were administered postoperatively (13; 61.90%) (Tables 2 and 3), demonstrating a conduct wholly inadequate once that antimicrobial administered three to six hours after bacterial contamination are not beneficial to control the infection (DUNNING, 2007). The optimal timing of administration of prophylactic antimicrobials in surgical procedures is the preoperative (EUGSTER et al., 2004; DUNNING et al., 2007; FOSSUM & WILARD, 2007; GAGLIARDI et al., 2009) because the prophylactic antimicrobial must be present at time of potential contamination of the surgical site to prevent the growth of pathogenic contaminants (FOSSUM & WILARD, 2007). The conduct observed in this study favors the emergence of resistant strains of microorganisms (FERRAZ et al., 2001; DUNNING, 2007; FOSSUM & WILARD, 2007; CROCO & NAKAGAWA, 2008) and increases the cost of the surgical procedure (FERRAZ et al., 2001). Importantly, the use of prophylactic antimicrobials with the objective to reduce PI may lead to neglect in the aseptic techniques (FOSSUM & WILARD, 2007), which may take to a rise of PI. There may be considerable reduction in the rate of PI with implementation of simple measures such as accurate diagnosis of infections, hygiene, control of associated infection, time reduced of preoperative; trichotomy, antisepsis and asepsis, accurate surgical technique, disclosure of infection rates of the professionals involved (surgeon and anesthetist) and strict control of antimicrobials (FERRAZ et al., 2001).

Among the studies analyzed, noted that the antimicrobial most used to avoid PI was enrofloxacin (42.85%), found in nine studies (Tables 2 and 3). The enrofloxacin is an antimicrobial agent suitable for various clinical situations (ISHII et al., 2011), but is not an effective drug to prevent postoperative infection in dogs (SILVA et al., 2009). Due to this indiscriminate use, resistance to this antimicrobial has been found in a Brazilian veterinary teaching hospital (ISHII ET al., 2011). Furthermore, enrofloxacin should be administered for five days, and the period of administration should only be increased in cases of serious or chronic diseases (VANCUTSEM et al., 1990), which is not the case of elective surgery in dogs. However, the more frequent posology of enrofloxacin in this study was seven days, and some authors used up to 10 days in postoperatively (Table 3). This type of conduct aggravates the emergence of resistant microorganisms, making it difficult to combat and prevention of hospital infections (BRAGA, 2008; CROCO &

NAKAGAWA, 2008).

The most important risk factors for the occurrence of postoperative infection in small animals are surgeries on animals with poor clinic condition (EUGSTER et al., 2004), prolonged duration of surgery, especially if they exceed ninety minutes (EUGSTER et al., 2004; ADIN, 2011), large numbers of people in the operating room, contaminated or dirty surgery, long hospital stay (EUGSTER et al., 2004), incorrect administration of antibiotic prophylaxis (EUGSTER et al., 2004; BRAGA, 2008) and interference of the patient in surgical wound (BRAGA et al., 2008). All the patients submitted to elective OH are in favorable clinic situation (MALM et al., 2005; RODRIGUES et al., 2012; ATAÍDE et al., 2010; SILVA et al., 2011), the surgical time varies between nine to 73.6 minutes, depending on the technique used (MALM et al., 2005; RODRIGUES et al., 2008; PEREIRA & MARQUES, 2009; VILELLA et al., 2009; SILVA et al., 2011; TAFFAREL et al., 2012), surgery is clean (DUNNING, 2007; MATTOS JR. et al., 2010), the hospitalization time is minimal (COSTA NETO et al., 2006; QUESSADA et al., 2009), and the Elizabethan collar is routine (GONÇALVES, 2007; BUDZIAK, 2010; SANTOS et al., 2010) therefore does not justify the use of antimicrobial prophylaxis in elective ovariohysterectomy of bitches. However, if conditions are adverse, and it was not possible to assess the health status of the animals as in massal castration, it is recommended to administer prophylactic antibiotics, but this should be done preoperatively to be effective in controlling PI (EUGSTER et al., 2004; DUNNING, 2007; FOSSUM & WILARD, 2007; GAGLIARDI et al., 2009). It is noted that in seven publications (31.81%) antimicrobials were used in postoperatively only (Table 2), attitude totally ineffective in controlling PI because the antimicrobials administered postoperatively are not beneficial to control infection (DUNNING, 2007). This conduct aggravates the situation in relation to the emergence of resistant microorganisms (FERRAZ et al., 2001; DUNNING, 2007; FOSSUM & WILARD, 2007; CROCO & NAKAGAWA, 2008) and increases the cost of surgery (FERRAZ et al., 2001).

The antimicrobials most indicated for prophylaxis of surgical infection in elective surgeries are antibiotics of the beta-lactam group as cefazolin (DUNNING, 2007) and cephalosporin (ADIN, 2011), which were used in 14 studies (63.63%), although not always adequately because these drugs should be used preoperatively to be effective in controlling PI. However, in five studies (22.72%), beta lactam antibiotics were administered preoperatively and postoperatively (Tables 2 and 3), leading to the estimate that 40 to 80% antimicrobial use in animals is unnecessary or highly questionable (BEOVIC, 2006)

The use of the Elizabethan collar greatly contributes to the prevention of PI because it avoids interference of the patient in surgical wound, which is a major cause of postoperative infection in animals (BRAGA, 2008). However, it was observed that the collar is not always used (SILVA et al., 2011).

## **CONCLUSION**

The veterinarians also are responsible by increase of the microbial resistance. Therefore, national meetings of veterinary surgeons are necessary for define protocols about antimicrobial prophylaxis for surgical procedures to decrease this problem.

## REFERENCES

ADIN, C.A. Complications of Ovariohysterectomy and Orchiectomy in Companion Animals. **Veterinary Clinics of North American: Small animal Practice**, v. 41, n.5, p. 1023–1039, 2011. Available at: <<http://www.sciencedirect.com/science/article/pii/S0195561611000957>>. Accessed on 2 Dec. 2012.

ALBUQUERQUE, V.B. **Ropivacaína isolada ou associada à morfina, butorfanol ou tramadol pela via peridural em cadelas para realização de ovariosalpingohisterectomia**. 2008.99f. Dissertação (Mestrado em Ciência Animal) – Faculdade de Odontologia, Universidade Estadual Paulista, Araçatuba, Available at: <[http://www.athena.biblioteca.unesp.br/exlibris/bd/bfo/33004021075P8/2008/albuquerque\\_vb\\_me\\_araca.pdf](http://www.athena.biblioteca.unesp.br/exlibris/bd/bfo/33004021075P8/2008/albuquerque_vb_me_araca.pdf)>. Accessed on 2 Dec. 2012

ATAÍDE, M. W.; BRUN, M. V.; BARCELLOS, L. J.G.; BORTOLUZZI, M.; FERANTI, J. P. S.; SANTOS, F. R.; TOMAZZONI, F.; BRAMBATTI, G.; ZÍLIO, P. P.; O. R. O, G.; SARTORI, L. W.; MONTEIRO, A. R.V.; ZANELLA, R. Ovariosalpingohisterectomia vídeo-assistida ou convencional em cadelas com o uso de ligasure atlas. **Ciência Rural**, v. 40, n. 9, p. 1974-1979, 2010. Available at: <[http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0103-84782010000900019](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-84782010000900019)>. Accessed on 20 Dec. 2012

BEOVIC, B. The issue of antimicrobial resistance in human medicine. **International Journal of Food Microbiology**, v. 112, n. 3, p. 280-287. 2006. Available at: <<http://www.sciencedirect.com/science/article/pii/S0168160506002856>>. Accessed on 20 Dec. 2012

BRAGA, D.P. **Incidência e fatores de risco associados à infecção do sítio cirúrgico na clínica de cães e gatos do Hospital Veterinário da Universidade Federal de Viçosa**. 2008. 121 f. Dissertação (Mestrado em Medicina Veterinária) Universidade Federal de Viçosa, Viçosa. Available at: <[http://www.tede.ufv.br/tesesimplificado/tde\\_arquivos/8/TDE-2009-12-18T071538Z-2118/Publico/texto%20completo.pdf](http://www.tede.ufv.br/tesesimplificado/tde_arquivos/8/TDE-2009-12-18T071538Z-2118/Publico/texto%20completo.pdf)>. Accessed on 20 Nov. 2012.

BUDZIAK, C. **Avaliação dos perfis clínico e laboratorial de cães de abrigo submetidos à ovariohisterectomia e orquiectomia**. 2010. 94 f. Dissertação (Mestrado em Ciência Animal). Pontifícia Universidade Católica do Paraná, São José dos Pinhais. Available at: <[http://www.biblioteca.pucpr.br/tede/tde\\_arquivos/18/TDE-2011-07-04T171543Z-1609/Publico/Carine.pdf](http://www.biblioteca.pucpr.br/tede/tde_arquivos/18/TDE-2011-07-04T171543Z-1609/Publico/Carine.pdf)>. Accessed on 20 Nov. 2012.

CALDEIRA, F.M.C.; OLIVEIRA, H.P.; MELO, E.G.; MARTINS, C.; VIEIRA, M.S.; SILVA, C.N. Cortisol sérico e glicemia em cadelas tratadas com tramadol e submetidas à ovário-histerectomia. **Ciência Rural**, v.36, n.1, 2006. Available at: <[http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0103-84782006000100023](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-84782006000100023)>. Accessed on 2 Nov. 2012.

CASSU, R.N.; STEVANIN, H.; KANASHIRO, C.; MENEZES, L.M.B.; LAPOSY, C.B. Anestesia epidural com lidocaína isolada e associada ao fentanil para realização de

ováriosalpingo-histerectomia em cadelas. **Arquivo Brasileiro de Medicina Veterinária e Zootecnia**, v. 60, n.4, p. 825-831, 2008. Available at: <<http://www.scielo.br/pdf/abmvz/v60n4/08.pdf>>. Accessed on 22 Nov. 2012

COSTA NETO J. M., T. R. G., BARAÚNA A. L. I., GORDILHO FILHO A. O., BARAÚNA L. C. Ovariosalpingohisterectomia laparoscópica em cadelas. **Veterinaria Notícias**, v. 12, n. 1, p. 79-86, 2006. Available at: <<http://www.vetnot.famev.ufu.br/viewarticle.php?id=45>>. Accessed on 22 Feb. 2013

CROCO, E. L.; NAKAGAWA, C. Uso de antibioticoprofilaxia em cirurgia. **Revista da Faculdade de Ciências Médicas de Sorocaba**, v. 10, n. 3, p. 30-37, 2008. Available at: <<http://revistas.pucsp.br/index.php/RFCMS/article/view/1010/661>>. Accessed on 22 Feb. 2013.

DUNNING, D. Infecção da ferida cirúrgica e uso de antimicrobianos. In: SLATTER, D. **Manual de cirurgia de pequenos animais**. São Paulo: Manole, 2007, p. 113-122.V.1

EUGSTER, S.; SCHAWALDER, P., GASCHEN, F. AND BOERLIN, P. A Prospective Study of Postoperative Surgical Site Infections in Dogs and Cats. **Veterinary Surgery**, v.33, n. 5, p.542-550, 2004. Available at: <<http://onlinelibrary.wiley.com/doi/10.1111/j.1532-950X.2004.04076.x/abstract;jsessionid=21911C0D808C887CCBD259AD96742317.d02t02?deniedAccessCustomisedMessage=&userIsAuthenticated=false>>. Accessed on 21 March 2013.

FERRAZ, E. M.; FERRAZ, A. A. B.; BACELAR, T.S.; D'ALBUQUERQUE, H.S.T.; VASCONCELOS, M. D. M. M.; LEÃO, C. S. Controle de infecção em cirurgia geral - resultado de um estudo prospectivo de 23 anos e 42.274 cirurgias. **Revista do Colégio Brasileiro de Cirurgiões**, v. 28, n.1, p.17-26, 2001. Available at: <<http://www.scielo.br/pdf/rcbc/v28n1/04.pdf>>. Accessed on 21 March 2013.

FOSSUM, T. W.; WILARD, M. D. Infecções cirúrgicas e seleção dos antibióticos. In: FOSSUM, T. W. (Ed) **Cirurgia de pequenos animais**. 3ª.ed. (tradução). Rio de Janeiro: Elsevier, 2007. p. 79-89.

GAGLIARDI, A. R.; ESKICIOGLU, C.; MCKENZIE M, FENECH D.; NATHENS A.; MCLEOD R. Identifying opportunities for quality improvement in surgical site infection prevention. **American Journal of Infection Control**, v. 37, p. 398-402, 2009. Available at: <<http://www.sciencedirect.com/science/article/pii/S0196655308009012>>. Accessed on 25 Oct. 2012.

GONÇALVES, A. C. O. **Estudo comparativo entre a laparotomia mediana ventral e lateral direita para ovariosalpingohisterectomia em cadelas adultas**. 2007. 58 f. Monografia (Graduação em Medicina Veterinária). Universidade Federal da Bahia, Salvador. Available at: <[http://www.cirurgia.vet.ufba.br/arquivos/docs/monografias/2007\\_GoncalvesACO.pdf](http://www.cirurgia.vet.ufba.br/arquivos/docs/monografias/2007_GoncalvesACO.pdf)>

>. Accessed on 25 Oct. 2012.

GUEDES, R. L. **Eletrocirurgia e cliques de titânio para hemostasia em pedículos ovarianos durante ovariectomias vídeo assistida com dois portais em cadelas.** 2102. 51f. Dissertação (Mestrado em Medicina Veterinária). Universidade Federal de Santa Maria. Santa Maria. Available at: <<http://coralx.ufsm.br/ppgm/DISSERTA%C7%D5ES/2012/ROG%C9RIOLUIZARI%20GUEDES%20-%20DISSERTA%C7%C3O.pdf>>. Accessed on 27 April 2013.

ISHII, J.B.; FREITAS, J.C.; ARIAS, M.V.B. Resistência de bactérias isoladas de cães e gatos no Hospital Veterinário da Universidade Estadual de Londrina (2008-2009). **Pesquisa Veterinária Brasileira**, v. 31, n.6, p. 533-537, 2011. Available at: <<http://www.scielo.br/pdf/pvb/v31n6/a13v31n6.pdf>>. Accessed on 27 April 2013.

LIMA, A. F. M.; LUNA, S. P. L.; RODRIGUES, M. M. P.; QUITZAN, J. G. Avaliação histológica e videolaparoscópica e ligaduras dos pedículos ovarianos realizados com mononáilon agulhado ou abraçadeiras auto-estáticas de náilon em cadelas submetidas à ovariosalpingohisterectomia pela técnica do gancho. **Ars Veterinaria**, v.26, n.2, p.66-70, 2010. Available at: <<http://www.arsveterinaria.org.br/index.php/ars/article/view/268/226>>. Accessed on 13 Aug. 2013.

MALM, M. C.; SAVASSI-ROCHA, P.R.; GHELLER, V.A.; OLIVEIRA, H.P.; LAMOUNIER, A.R.; FOLTYNEK, V. Ovário-histerectomia: estudo experimental comparativo entre as abordagens laparoscópica e aberta na espécie canina. II- Evolução clínica pós-operatória. **Arquivo Brasileiro de Medicina Veterinária e Zootecnia**, v. 57, suppl.2, p.167-172, 2005. Available at: <[http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0102-09352005000800006](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0102-09352005000800006)>. Accessed on 11 Aug. 2013.

MATTOS JR, E.; ITO, K.C.; CONTI-PATARA, A.; CARVALHO, H.S.; CALDEIRA, J.A.; REINOLDES, A.; CORTOPASSI, S.R.G. Estudo comparativo dos parâmetros cardiorrespiratórios e tempo de recuperação em cadelas submetidas a ovariosalpingohisterectomia e anestesiadas com halotano, isoflurano ou sevoflurano. **Brazilian Journal of Veterinary Research and Animal Science**, v. 47, n. 5, p. 403-412, 2010. Available at: <<http://www.revistasusp.sibi.usp.br/pdf/bjvras/v47n5/a10v47n5.pdf>>. Accessed on 11 Aug. 2013.

PAOLOZZI, R.J.; CASSU, R.N.; CRUZ, F.S.F.; PARRILHA, L.R. Diferentes doses de tramadol em cães: ações analgésicas, sedativas e sobre o sistema cardiorrespiratório. **Ciência Rural**, v.41, n.8, 2011. Available at: <[http://www.scielo.br/scielo.php?pid=S0103-84782011000800019&script=sci\\_arttext](http://www.scielo.br/scielo.php?pid=S0103-84782011000800019&script=sci_arttext)> Accessed on 13 Aug. 2013.

PEREIRA, D.A.; MARQUES, J.A. Uso de morfina, xilazina e meloxicam para o controle da dor pós-operatória em cadelas submetidas à ovariosalpingohisterectomia. **Arquivo Brasileiro de Medicina Veterinária e Zootecnia**. v.61, n.2,

p.353-361, 2009. Available at: <<http://www.scielo.br/pdf/abmvz/v61n2/a11v61n2.pdf>>. Accessed on 20 Dec

PRESCOTT, JOHN F.; HANNA, W.J. BRAD; REID-SMITH, RICHARD; DROST, KELLI. Antimicrobial drug use and resistance in dogs. **Canadian Veterinary Journal**, v. 43, n.2, p. 107–116, 2002. Available at: <<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC339174/>> Accessed on 20 Dec

QUESSADA, A.M.; SOUSA, A.A.R.COSTA, A.P.R.; SOUSA, A.A.S.; ROCHA, R.R.C. Comparação de técnicas de ovariosalpingohisterectomia em cadelas. **Acta Scientiae Veterinariae**, v.37, n.3, p. 253-258, 2009. Available at: <[http://www.sumarios.org/sites/default/files/pdfs/pub\\_839.pdf](http://www.sumarios.org/sites/default/files/pdfs/pub_839.pdf)> Accessed on 08 July 2013.

RODRIGUES, M.C.; COELHO, M.C.O.C.; QUESSADA, A.M.; LIMA, D.A.S.; SOUSA, J.M.; CARVALHO, C.C.D. Ovariosalpingohisterectomia em cadelas: comparação entre a técnica de tração uterina por via vaginal associada à celiotomia pelo flanco e abordagem ventral mediana. **Revista Portuguesa de Ciências Veterinárias**. v.111, n. 583-584, p. 165-172, 2012. Available at: <[http://www.fmv.utl.pt/spcv/PDF/pdf12\\_2012/165-172.pdf](http://www.fmv.utl.pt/spcv/PDF/pdf12_2012/165-172.pdf)>. Accessed on 16 Sep. 2013.

SANTOS, L., SCALCO NETO, J., RIZZO, N., BASTIANI, P., RODRIGUES, L., BARCELLOS, H., BRUN, M. Contaminação ambiental em um hospital veterinário e perfil de susceptibilidade a antimicrobianos das bactérias isoladas. **Ciência Animal Brasileira**. v. 11, n. 2, p. 384-389, 2010. Available at: <<http://www.revistas.ufg.br/index.php/vet/article/view/2988/6844>>. Accessed on 08 July 2013.

SILVA, M.A.M.; BATISTA, P.A.C.S.; POGIANNI, F.M.; SILVA, M.L.; MUNERATO, M.S.; FLORES, F.N.; BORGES, P.A.; RIBEIRO, A.P.; NUNES, N.; TONIOLLO, G.H. Ovário-histerectomia vídeo-assistida com único portal em cadelas: estudo retrospectivo de 20 casos. **Ciência Rural**, v.41, n.2, 2011. Available at: <<http://www.scielo.br/pdf/cr/2011nahead/a871cr4012.pdf>>. Accessed on 08 July 2013.

SILVA, M.A.M.; TONIOLLO, G.H.; CARDOSO, K.C.F.; QUARTERONER, C.; BRUN, M.V. Pure-transvaginal natural orifice transluminal endoscopic surgery (NOTES) ovariohysterectomy in bitches: a preliminar feasibility study. **Ciência Rural online**. 2012. Available at: <<http://www.scielo.br/pdf/cr/2012nahead/a20612cr5944.pdf>>. Accessed on 20 Dec. 2012.

SOUZA, FERNANDO WIECHETECK DE. **Ovário-histerectomia em cadelas por celiotomia (“técnica convencional”), miniceliotomia (“técnica do gancho”) ou por videocirurgia (via NOTES vaginal híbrida)**. 2011. 58 f. Dissertação. (Mestrado. Franca, Universidade de Franca. Available at: <[http://www.mestradoveterinaria.unifran.br/dissertacoes/2011/Fernando\\_Wiecheteck\\_de\\_Souza.pdf](http://www.mestradoveterinaria.unifran.br/dissertacoes/2011/Fernando_Wiecheteck_de_Souza.pdf)>. Accessed on 20 Dec 2012.

TAFFAREL, M.O.; SALGADO, A.E.P.; MELO FILHO, E.V.; TEIXEIRA, L.R.; FRACALOSI, L.D.C.; LUZ, M.R.; FREITAS, P.M.C. Efeitos da eletroacupuntura, aquapuntura e farmacopuntura em cadelas anestesiadas com isofluorano e submetidas à ovário-histerectomia. **Arquivo Brasileiro de Medicina Veterinária e Zootecnia**, v.64, n.1, p.23-31, 2012. Available at: <<http://www.scielo.br/pdf/abmvz/v64n1/a04v64n1.pdf>>. Accessed on 29 Dec. 2012.

TAMANHO, R. B.; OLESKOVICZ, N.; MORAES, A. N.; FLÔRES, F. N.; DALLABRIDA, A. L.; CARNEIRO, D. R. R.; PACHECO, A. D.; ROSA, A. C. Anestesia epidural cranial com lidocaína e morfina para campanhas de castração em cães. **Ciência Rural**, 2009. Available at: <<[http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0102-09352009000200011&lng=en&nrm=iso](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0102-09352009000200011&lng=en&nrm=iso)>. ISSN 0102-0935. <http://dx.doi.org/10.1590/S0102-09352009000200011>>. Accessed on 31 Jan. 2013.

TORRES, V.N. **Ovariosalpingohisterectomia video cirúrgica em cadelas comparação entre os acessos com dois e três portais**. Dissertação de mestrado. Universidade Federal do Rio Grande do Sul, Faculdade de Veterinária, Programa de pós graduação em ciências veterinárias. 2011. 46p. Available at: <<https://www.repositorioceeme.ufrgs.br/bitstream/handle/10183/49691/000851069.pdf?sequence=1>>. Accessed on 31 Jan. 2013.

VANCUTSEM, P.M.; BABISH, J.G.; SCHWARK, W.S. The fluorquinolone antimicrobials: structure, antimicrobial activity, pharmacokinetics, clinical use in domestic animals and toxicity. **The Cornell Veterinarian**, v. 80, n.2, p.173-186, 1990. Available at: <<http://www.ncbi.nlm.nih.gov/pubmed/2180631>>. Accessed on 02 Feb. 2013.

VILELLA, G.T.A.; CASSU, R.N.; PEREIRA, L. MANNIGEL, R.C. Avaliação da recuperação pós operatória em cães com o uso complementar de arnica Montana CH12. **Veterinária e zootecnia**, v. 16, n.1, p.108-116, 2009. Available at: <[http://www.fmvz.unesp.br/revista/volumes/vol16\\_n1/VZ16\\_1\(2009\)\\_108-116.pdf](http://www.fmvz.unesp.br/revista/volumes/vol16_n1/VZ16_1(2009)_108-116.pdf)>. Accessed on 02 Feb. 2013.