Article

Ovariohysterectomy requires more post-operative analgesia than orchiectomy in dogs and cats

Carolina Quarterone, Stelio Pacca Loureiro Luna, Nadia Crosignani, Flávia Augusta de Oliveira, Carlize Lopes, Alfredo Feio da Maia Lima, Antonio Jose de Araújo Aguiar

Abstract — The requirement for post-operative analgesia after ovariohysterectomy (OH) *versus* orchiectomy in dogs and cats was compared. Twelve male and 12 female cats and 12 male and 12 female dogs received meloxicam, 0.1 mg/kg body weight, PO, 2 h before surgery. Eleven female cats and 3 female dogs received rescue analgesia ($P = 0.002$). No male of either species required rescue analgesia. The number of cats receiving rescue analgesia was greater in females than in males ($P < 0.0001$). One should not rely solely on preoperative short-acting opioid and preemptive use of NSAIDs to control postoperative pain following OH, in dogs or cats. Postoperative pain after OH should be assessed for at least 2 h for cats and 4 h for dogs, using species-specific validated tools, to ensure proper postoperative pain diagnosis and management. Male dogs and cats subjected to orchiectomy required less postoperative analgesia intervention than female dogs and cats submitted to OH.

Résumé — L'ovariohystérectomie nécessite d'avantage d'antalgiques post-opératoires que l'orchiectomie chez les chiens et les chats. Dans cette étude, nous avons comparé le besoin en antalgiques post-opératoires après l'OH versus l'orchiectomie chez les chiens et les chats. Douze mâles et 12 femelles, chats et chiens, ont reçu 0,1 mg/kg de Méloxicam par voie orale, 2h avant chirurgie. Onze chattes et trois chiennes ont eu besoin d'antalgiques de secours ($P = 0{,}002$). Aucun mâle de l'une ou l'autre espèce n'en a eu besoin. Chez les chats, les besoins en antalgiques de secours étaient plus élevés chez les femelles que les mâles ($P < 0{,}0001$). Il est donc primordial de ne pas se fier uniquement aux opioïdes à action courte préopératoire, et à l'utilisation préventive des AINS, pour contrôler la douleur post-opératoire après OH, tant chez le chien que chez le chat. L'évaluation de la douleur post-opératoire après l'OH devrait être suivie pendant au moins 2 heures pour les chats, et 4 heures pour les chiens, en utilisant des outils validés et spécifiques pour chaque espèce, afin d'assurer un diagnostic et une prise en charge post-opératoire appropriés à la douleur. Chez les chiens et les chats, les mâles soumis à l'orchiectomie ont nécessité moins d'intervention d'antalgiques post-opératoires que les femelles soumissent à l'OH.

(Traduit par les auteurs)

Can Vet J 2017;58:1191–1194

Introduction

Ovariohysterectomy (OH) and orchiectomy are the most common surgical procedures in dogs and cats and are used as clinical models for studies assessing pain (1,2). Studies investigating the attitudes of veterinarians indicate that cats receive lower pain scores for surgery than do dogs (3–7). The treatment of pain in cats has been historically neglected (3–7) and although this scenario is changing (7), for the time being, the use of analgesics in cats is still lower than that in dogs (4–7). The main reasons for this situation are the difficulty in recognizing and treating pain in cats (8) and the use of adapted and non-validated scales in some studies (9).

Given that male dogs and cats receive less analgesia than females, that cats receive less analgesia and are given lower pain scores for surgery than dogs (3,6), and that several studies have used only non-steroidal anti-inflammatory drugs (NSAIDs) for postoperative analgesia in dogs and cats submitted to castration and ovariohysterectomy (10–12), it is important to compare the postoperative requirement of analgesia in dogs and cats after castration and OH (13,14).

Department of Anesthesiology, Maringá University Center — UniCesumar, Maringá-PR, 87050900, Brazil (Quarterone); Department of Veterinary Surgery and Anesthesiology (Luna, Lima, Aguiar), Faculty of Veterinary Medicine and Animal Science, UNESP — Univ Estadual Paulista, Botucatu-SP, 18618970, Brazil; Department of Anesthesiology, Faculty of Medicine, UNESP — Univ Estadual Paulista, Botucatu-SP, Brazil (Crosignani); Goias Federal University — Veterinary Hospital, Jataí — GO, Brazil (de Oliveira); Department of Clinical and Surgical Practices, Catarinense Federal Institute, Araquari-SC, Brazil (Lopes).

Address all correspondence to Dr. Carolina Quarterone; e-mail: carolquarterone9@gmail.com

Based on the hypothesis that OH causes greater expression of pain than orchiectomy, this study had the objective of comparing the requirement for post-operative analgesia after OH *versus* orchiectomy in dogs and cats.

Materials and methods

This study was approved by the Institution's Ethics Committee on Animal Experimentation under protocols 124 and 125/2013 and all procedures were performed with the owner's consent.

Animals

The study included 12 male dogs [weight: 6.5 to 40.5 kg; mean: 20.3 ± 12.2 kg standard deviation (SD) and age: 11 to 480 mo; mean: 20.8 ± 13.7 mo], 12 female dogs (weight: 5.8 to 29 kg; mean: 14.8 ± 8.6 kg and age: 12 to 84 mo; mean: 44 ± 23.6 mo), 12 male cats (weight: 2.3 to 5.5 kg; mean: 3.91 ± 0.96 kg and age: 6 to 24 mo; mean: 12 ± 4.32 mo) and 12 female cats (weight: 1.9 to 3.3 kg; mean: 2.58 ± 0.41 kg and age: 6 to 12 mo; mean 8 ± 2.54 mo). The dogs and cats were of various breeds. The animals were considered healthy based on clinical, physical, and laboratory tests including those for a complete blood (cell) count (red blood cells and white blood cells), total plasma protein, liver parameters (aspartate aminotransferase, alanine aminotransferase, and alkaline phosphatase assays), and kidney function (urea and creatinine measurements).

Prior to the start of the study, the animals were allowed to adapt to the environment and to the observer for 24 h; food and water were withheld for 12 h and 4 h, respectively, before surgery.

Experimental design

Two hours before surgery, the animals received meloxicam (Maxicam; Ourofino Agronegocio LTDA; Cravinhos SP, Brazil) 0.1 mg/kg body weight (BW), PO. One hour later all animals received acepromazine (Acepram 0.2%; Vetnil Indústria e Comércio de Produtos Veterinários LTDA, Louveira SP, Brazil), 0.05 mg/kg BW, IM. After 15 min, the right or left cephalic vein was cannulated using a 20- or 22-gauge (G) over-the-needle catheter for administration of lactated Ringer's solution (Ringer lactato; Halexistar Indústria Farmacêutica LTDA, Rodovia BR 153 Km 03, Goiania, GO, Brazil) at 5 mL/kg BW/h during anesthesia. Anesthesia was then induced with propofol (Propovan; Cristália Produtos Químicos e Farmacêuticos LTDA, Itapira SP, Brazil), 5 mg/kg BW, IV, to effect. After orotracheal intubation with a cuffed tube, anesthesia was maintained with isoflurane (Isoforine; Cristália Produtos Químicos e Farmacêuticos LTDA) in oxygen. The Ayre T-piece breathing system was used for animals weighing < 5 kg at 500 mL/kg BW per min fresh gas flow, and a rebreathing system was used for animals > 5 kg BW at 30 mL/kg per min fresh gas flow. For intraoperative analgesia, fentanyl (Fentanest; Cristália Produtos Químicos e Farmacêuticos LTDA) 2 μg/kg BW, IV was administered IV for 1 min, starting 2 min before skin incision.

The animals were placed in dorsal decubitus position on a thermal mattress for surgery. Before and during surgery, the following variables were assessed and maintained within normal ranges: heart rate (PM60 Vet Pulse oximeter; Mindray Medical International; Shenzhen; China), respiratory rate, indirect systolic pressure (Doppler ultrasound systems; Parks Medical Electronics, Aloha, Oregon, USA), oxygen saturation (PM60 Vet Pulse oximeter; Mindray Medical International), and rectal temperature (Incoterm; Mod. Flexterm, Porto Alegre RS, Brazil). The duration of surgery and of anesthesia were recorded.

Ovariohysterectomy was performed by a surgical technique using a Snook hook to expose the ovaries after a ventral retroumbilical abdominal incision of 2 cm, while orchiectomy was performed by pre-scrotal and scrotal methods in dogs and cats, respectively.

Post-operative evaluation

An experienced evaluator assessed pain before (baseline) and 1, 2, 4, 8, and 24 h post-surgery after extubation of the trachea, by the UNESP-Botucatu Multidimensional Composite Pain Scale (UBMCPS) for cats (8) and by the Modified Glasgow Pain Scale (MGPS) for dogs (15). Rescue analgesia was applied upon reaching a score of 33% of the total MGPS for dogs (score ≥ 3.3) and 27% of the UBMCPS for cats (score ≥ 8). For this purpose, morphine (Dimorf; Cristália Produtos Químicos e Farmacêuticos LTDA) was used at doses of 0.3 and 0.5 mg/kg BW, IM, in cats and dogs, respectively. The animals were assessed 30 min after the rescue; this protocol was repeated if necessary.

Sedation was assessed by the sedation score in both species as previously described (16–18), in which 0 = an awake state and 21 = a deeply sedated state. After the last assessment of pain, the animals were treated with meloxicam (orally), the study was terminated, and the animals were released to the owners' care.

Statistical analysis

Data were analyzed using the Shapiro-Wilk test. For the weight, age, and duration of surgery, the *t*-test for independent samples was used. Fisher's exact test was used to compare the number of rescue analgesia treatments among groups. All tests were analyzed at the 5% significance level using the statistical software packages (SAS version 9.3; SAS Institute, Cary, North Carolina, USA; Sigmastat 3.5; Systat Software, San Jose, California, USA; Graphpad Prism 7; GraphPad Software, La Jolla, California, USA).

Results

The surgery lasted on average 2.67 ± 0.98, 7.42 ± 2.07, 3.9 ± 1, and 7.42 ± 2.2 min for the male cats, female cats, male dogs, and female dogs, respectively. The duration of surgery for females was longer than that for males in both species ($P < 0.0001$). Female dogs were older than male dogs ($P = 0.008$) and male cats were older than female cats ($P = 0.01$). There was no difference in temperature between genders at the end of surgery (female dogs 37.03 ± 0.51°C, male dogs 36.9 ± 0.69°C, female cats 36.4 ± 0.45°C and male cats 36.9 ± 0.96°C).

Sedation scores were higher compared with the baseline at 1 h post-operation in cats and dogs and the scores were higher at 1 and 2 h for female dogs compared with male dogs.

A total of 11 female cats and 3 female dogs received rescue analgesia ($P = 0.002$). These consisted of 3 female cats at 1 h post-surgery and 8 female cats at 2 h post-surgery and 3 female dogs at 2 h post-surgery. One dog and 1 cat required additional rescue analgesia 30 min after the rescue at 2 h post-surgery. No male of either species required rescue analgesia. The number of rescue analgesias was greater in female ($n = 11$) than in male cats ($n = 0$) ($P < 0.0001$).

Discussion

The results confirmed the hypothesis that OH produces higher expression of pain, and that female dogs and cats express more pain after OH than males do after orchiectomy. Although ovaries and testes have the same innervation, i.e., the genitourinary nerve originates from the L3–L4 segment (19), OH is a more invasive procedure which involves laparotomy. In contrast to a previous study (20), no male of either species required rescue analgesia, most likely due to the use of different pain scales. Otherwise, as in the present study, behavior score was about 30% greater after OH compared to castration in cats (21). We speculate that the factors that most intensified the pain scores for females were the duration and trauma of surgery, the opening and manipulation of the abdominal cavity, the pulling of the ovarian pedicle, and the peritoneal incision, but this warrants further research.

The authors recognize that any evaluation to quantify pain is subjective and although it is difficult to compare genders which might have different behaviors, the present study used a current instrument (MGPS) to assess pain in dogs and a validated scale (UBMCPS) to assess pain in cats, which take into consideration species-specific behaviors, to improve reliability of the data (15,22) and minimize the failure of analgesia in these species. The MGPS and UBMCPS have been commonly used to guide rescue analgesia (1,2,23). In previous studies, the differences between male and female cats subjected to surgical sterilization were not so evident, most likely due to the use of adapted and non-validated scales to assess pain in cats (9,21,24).

Current guidelines recommend trans-operative local anesthesia and the use of NSAIDs for postoperative analgesia after OH (13). In this study, local anesthesia was not used and this was possibly at least one of the reasons why female dogs and cats required supplemental postoperative analgesia. Pre-emptive use of local anesthesia, as recommended by the guidelines, apparently reduces post-operative pain and is important for controlling pain after OH in both cats and dogs, even when the procedure is rapid and performed by an experienced surgeon. It is also important that follow-up pain assessment and potential analgesic requirements be anticipated for any surgical procedure.

The only source of post-operative analgesia was the NSAID, unless there was a need for rescue analgesia. Fentanyl was chosen as a short acting trans-operative opioid, to avoid residual post-operative analgesia. The time to effect of fentanyl is apparently short, as thermal threshold was increased 1 minute after administration of fentanyl, 2 μg/kg BW per min, in neonatal dogs (25). Therefore, by the time the ovarian pedicle was clamped, the analgesic effect of fentanyl was apparently present (26) and by the time post-operative pain was assessed, the effect of fentanyl had abated compared to longer acting opioids (25,26).

Animals receiving rescue analgesia were removed from the data analysis. Because 11 female cats received rescue analgesia, there was an insufficient number of animals available for statistical analysis of postoperative pain scores and results were evaluated on the basis of requirement of rescue analgesia and not on differences in pain scores.

A smaller dose of morphine was used for post-operative analgesia in cats compared to dogs, because previous studies reported that the pharmacokinetics of 0.2 mg/kg BW of morphine in cats (27) was similar to that in dogs (0.5 mg/kg BW) (28,29). The elimination of morphine metabolites in cats is more prolonged than in dogs; therefore, it is usually recommended that smaller doses and longer intervals of administration of morphine be used in cats (13).

One limitation of the present study was that the surgery was rapid and performed by an experienced surgeon, which might have contributed to the low post-operative pain scores. However, when comparing the duration of the surgical procedure, the surgeon's experience, and the size of the incision, only the latter influenced the pain scores in response to palpation of the surgical wound in female dogs subjected to OH (1).

Veterinarians generally assign higher pain scores and provide more analgesic treatment to dogs undergoing surgery than they do to cats (3–5,14,30). Despite evidence of great concern and improvements in the attitudes toward assessing and treating pain in animals (6,30), greater attention should be given to analgesia in cats.

This study showed that one should not rely solely on preoperative short-acting opioid and pre-emptive use of NSAIDs to control postoperative pain following OH in dogs and cats. Postoperative pain assessment after OH should be performed beyond the 1-hour period and during the period of hospitalization for at least 2 h for cats and 4 h for dogs, using species-specific validated tools, to ensure proper postoperative pain diagnosis and management.

In conclusion, male dogs and cats subjected to orchiectomy required less post-operative analgesia intervention than female dogs and cats submitted to OH.

Acknowledgments

We acknowledge grants from CAPES and from FAPESP (São Paulo Research Foundation) 2010/08967-0. CVJ

References

1. Wagner AE, Worland GA, Glawe JC, Hellyer PW. Multicenter, randomized controlled trial of pain-related behaviors following routine neutering in dogs. J Am Vet Med Assoc 2008;233:109–115.
2. Teixeira LR, Luna SPL, Taffarel MO, et al. Comparison of intrarectal ozone, ozone administered in acupoints and meloxicam for postoperative analgesia in bitches undergoing ovariohysterectomy. Vet J 2013; 197:794–799.
3. Dohoo SE, Dohoo IR. Postoperative use of analgesics in dogs and cats by Canadian veterinarians. Can Vet J 1996;37:546–551.
4. Hunt JR, Knowles TG, Lascelles BD, Murrell JC. Prescription of perioperative analgesics by UK small animal veterinary surgeons in 2013. Vet Rec 2015;176:493.
5. Lascelles BDX, Capner CA, Waterman-Pearson AE. Current British veterinary attitudes to perioperative analgesia for cats and small mammals. Vet Rec 1999;145:601–604.

6. Lorena SERS, Luna SPL, Lascelles BDX, Corrente JE. Current attitudes regarding the use of perioperative analgesics in dogs and cats by Brazilian veterinarians. Vet Anaesth and Analg 2014;41:82–89.
7. Farnworth M, Adams N, Keown A, Waran N, Stafford K. Veterinary provision of analgesia for domestic cats *(Felis catus)* undergoing gonadectomy: A comparison of samples from New Zealand, Australia and the United Kingdom. N Z Vet J 2014;62:117–122.
8. Brondani JT, Luna SP, Padovani CR. Refinement and initial validation of a multidimensional composite scale for use in assessing acute postoperative pain in cats. Am J Vet Res 2011;72:174–183.
9. Al-Gizawiy MM, Rude EP. Comparison of preoperative carprofen and postoperative butorphanol as postsurgical analgesics in cats undergoing ovariohysterectomy. Vet Anaesth Analg 2004;31:164–174.
10. Benito-de-la-Víbora J, Lascelles BD, García-Fernández P, Freire M, Gómez de Segura IA. Efficacy of tolfenamic acid and meloxicam in the control of postoperative pain following ovariohysterectomy in the cat. Vet Anaesth Analg 2008;35:501–510.
11. Shih AC, Robertson S, Isaza N, Pablo L, Davies W. Comparison between analgesic effects of buprenorphine, carprofen, and buprenorphine with carprofen for canine ovariohysterectomy. Vet Anaesth Analg 2008;35:69–79.
12. Morgaz J, Navarrete R, Muñoz-Rascón P, et al. Postoperative analgesic effects of dexketoprofen, buprenorphine and tramadol in dogs undergoing ovariohysterectomy. Res Vet Sci 2013;95:278–282.
13. Mathews K, Kronen PW, Lascelles D, et al. Guidelines for recognition, assessment and treatment of pain. J Small Anim Pract 2014;55:E10–68.
14. Williams VM, Lascelles BD, Robson MC. Current attitudes to, and use of, peri-operative analgesia in dogs and cats by veterinarians in New Zealand. N Z Vet J 2005;53:193–202.
15. Murrell JC, Psatha EP, Scott EM, Reid J, Hellebrekers LJ. Application of a modified form of the Glasgow pain scale in a veterinary teaching centre in the Netherlands. Vet Rec 2008;162:405–410.
16. Vainio O, Vaha-Vahe T, Palmu L. Sedative and analgesic effects of medetomidine in dogs. J Vet Pharmacol Ther 1989;12:225–231.
17. Kuusela E, Raekallio M, Vaisanen M, Mykkanen K, Ropponen H, Vainio O. Comparison of medetomidine and dexmedetomidine as premedicants in dogs undergoing propofol-isoflurane anesthesia. Am J Vet Res 2001;62:1073–1080.
18. Ramoo S, Bradbury LA, Anderson GA, Abraham LA. Sedation of hyperthyroid cats with subcutaneous administration of a combination of alfaxalone and butorphanol. Aust Vet J 2013;91:131–136.
19. Bailey CS, Kitchell RL, Haghighi SS, Johnson RD. Spinal nerve root origins of the cutaneous nerves of the canine pelvic limb. Am J Vet Res 1988;49:115–119.
20. Hunt JR, Grint NJ, Taylor PM, Murrell JC. Sedative and analgesic effects of buprenorphine, combined with either acepromazine or dexmedetomidine, for premedication prior to elective surgery in cats and dogs. Vet Anaesth Anal 2013;40:297–307.
21. Vaisanen MA, Tuomikoski SK, Vainio OM. Behavioral alterations and severity of pain in cats recovering at home following elective ovariohysterectomy or castration. J Am Vet Med Assoc 2007;231:236–242.
22. Brondani JT, Mama KR, Luna SP, et al. Validation of the English version of the UNESP-Botucatu multidimensional composite pain scale for assessing postoperative pain in cats. BMC Vet Res 2013;9:143.
23. Warne LN, Beths T, Carter JE, Whittem T, Bauquier SH. Evaluation of the influence of atipamezole on the postoperative analgesic effect of buprenorphine in cats undergoing a surgical ovariohysterectomy. Vet Anaesth Analg 2016;43:424–428.
24. Cagnardi P, Villa R, Zonca A, et al. Pharmacokinetics, intraoperative effect and postoperative analgesia of tramadol in cats. Res in Vet Sci 2011;90:503–509.
25. Luks AM, Zwass MS, Brown RC, Lau M, Chari G, Fisher DM. Opioid-induced analgesia in neonatal dogs: Pharmacodynamic differences between morphine and fentanyl. J Pharmacol Exp Ther 1998;284:136–141.
26. Wegner K, Horais KA, Tozier NA, Rathbun ML, Shtaerman Y, Yaksh TL. Development of a canine nociceptive thermal escape model. J Neurosci Methods 2008;168:88–97.
27. Taylor PM, Robertson SA, Dixon MJ, et al. Morphine, pethidine and buprenorphine disposition in the cat. J Vet Pharmacol Ther 2001; 24:391–398.
28. KuKanich B, Lascelles BD, Papich MG. Pharmacokinetics of morphine and plasma concentrations of morphine-6-glucuronide following morphine administration to dogs. J Vet Pharmacol Ther 2005;28:371–376.
29. Dohoo S, Tasker RA, Donald A. Pharmacokinetics of parenteral and oral sustained-release morphine sulphate in dogs. J Vet Pharmacol Ther 1994;17:426–433.
30. Kongara K, Squance HE, Topham IA, Bridges JP. Attitudes and perceptions of veterinary paraprofessionals in New Zealand to postoperative pain in dogs and cats. NZ Vet J 2016;6:112–116.